

Goodrive350A-HR Series Hot-Redundancy VFD

User Manual



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V1.0	July 2026	First release.

Preface

Thanks for using the GD350A-HR series hot-redundancy variable-frequency drive (VFD).

If not otherwise specified in this manual, the VFD always indicates Goodrive350A-HR series VFD, which is designed for hot-redundancy applications. It integrates synchronous motor drive and asynchronous motor drive functions, incorporates torque control, speed control, and position control, and delivers excellent control performance. Using the most advanced vector control technology in the world and the latest digital processor dedicated for motor control, the VFD has strengthened the reliability and environment adaptability and adapted customized and industrial design to improve the functions, make the application more flexible, and optimize the performance.

In order to meet diversified customer demands, the VFD provides abundant expansion cards including PLC card, PG card, communication card and I/O expansion card to achieve various functions as needed. Each VFD can be installed with three expansion cards at most.

The PLC card adopts the mainstream development environment for customers to carry out secondary development easily, fulfilling varied customized needs and reducing customer cost.

The PG card supports a variety of encoders including incremental encoders and resolver-type encoders. In addition, it also supports pulse reference and frequency-division output. The PG card adopts digital filter technology to improve EMC performance and to realize stable transmission of the encoder signal over a long distance. It is equipped with the encoder disconnection detection function to prevent system faults from escalating.

The VFD supports multiple kinds of popular communication modes to realize complicated system solutions. It can be connected to the internet with the optional wireless communication card, by which you can monitor the VFD state anywhere any time through mobile APP.

The VFD uses high power density design. Some power ranges carry built-in DC reactor and braking unit to save installation space. Through overall EMC design, it can satisfy the low noise and low electromagnetic interference requirements to cope with challenging grid, temperature, humidity and dust conditions, thus greatly improving product reliability.

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 for equipment installation, commissioning, operation, and maintenance, and be capable of preventing emergencies.

1.3 Warning symbols

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

Sign	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 sensitive	The PCBA may be damaged if related requirements are not followed.	
 Hot	Hot surface	Do not touch. The VFD pedestal may become hot.	
 5 min	Electric shock	As high voltage may still be present in the DC bus capacitors after power-off, to prevent electric shock, please wait at least 5 minutes (or 15/25 minutes, depending on the warning label on the machine) before performing any operation.	 5 min
 Read manual	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 voltage is less than 36V. The minimum waiting time is listed in the following. <table border="1"> <thead> <tr> <th>VFD model</th><th>Minimum waiting time</th></tr> </thead> <tbody> <tr> <td>1R5G/2R2P-110G/132P</td><td>5 minutes</td></tr> <tr> <td>132G/160P-315G/355P</td><td>15 minutes</td></tr> <tr> <td>355G/400P and higher</td><td>25 minutes</td></tr> </tbody> </table>	VFD model	Minimum waiting time	1R5G/2R2P-110G/132P	5 minutes	132G/160P-315G/355P	15 minutes	355G/400P and higher	25 minutes
VFD model	Minimum waiting time								
1R5G/2R2P-110G/132P	5 minutes								
132G/160P-315G/355P	15 minutes								
355G/400P and higher	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.
- The installation site must be away from children and other public places.
- Use the VFD in proper environments. (For details, see section 4.2.1 Installation environment.)
- 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 10Ω. 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 control terminals form extra-low voltage (ELV) circuits. Therefore, you need to prevent the control terminals from connecting to accessible terminals of other devices when there is no isolation protection mechanism configured. ✧ The VFD may start up by itself when P01.21 is set to 1 (restart after power off). Do not get close to the VFD and motor. ✧ 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 synchronous motor, in addition to the above requirements, 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 on 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 8 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 inside 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 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 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 a VFD with a higher power rating should be used.
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 is 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 ambient 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 product 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 current-carrying capacity requirements of all components (including the 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. |

2.7 Safety standard related data

IEC/EN 61508 (Class A system)							ISO 13849**			
SIL	PFH	HFT	SFF	λ_{du}	λ_{dd}	PTI*	PL	CCF	DC	Category
2	8.73×10^{-10}	1	71.23%	1.79×10^{-9}	0	1 year	d	57	60%	3

* PTI: Proof test interval

** Depends on the classification defined on the EN ISO 13849-1.

3 Product overview

3.1 What this chapter contains

This chapter introduces the basic principles, product specifications, nameplate, model designation code, product ratings, and structural diagram.

3.2 Basic principles

The VFD is used to control asynchronous AC induction motors and permanent-magnet synchronous motors. The following lists the main circuit diagrams of different VFD models. The rectifier converts 3PH AC voltage into DC voltage, the capacitor bank of intermediate circuit stabilizes the DC voltage, and then the inverter converts DC voltage into AC voltage that can be used by an AC motor. When the circuit voltage exceeds the maximum limit value, the braking transistor connects the external braking resistor to the intermediate DC circuit to dissipate the regenerative energy.

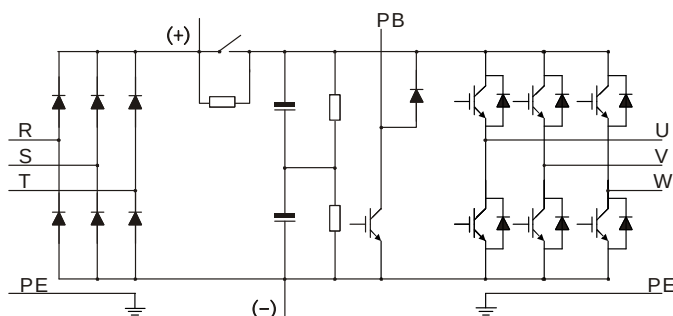


Figure 3-1 Main circuit diagram for 7R5G/011P and lower VFD models

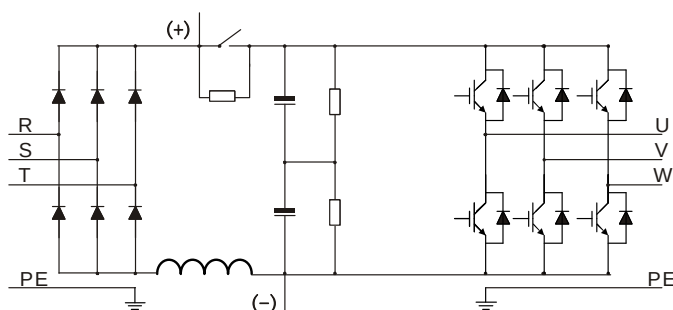


Figure 3-2 Main circuit diagram for 055G/075P–110G/132P VFD models

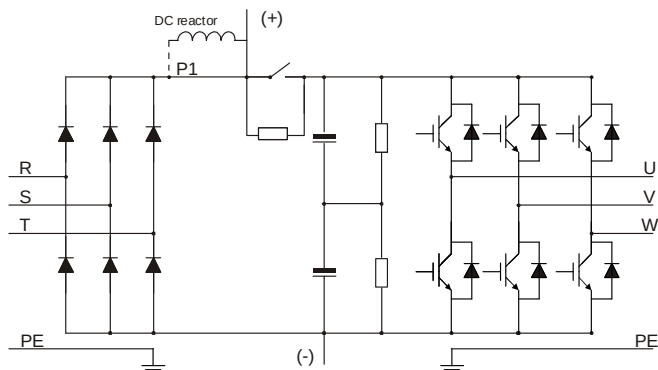


Figure 3-3 Main circuit diagram for 132G/160P–315G/355P VFD models

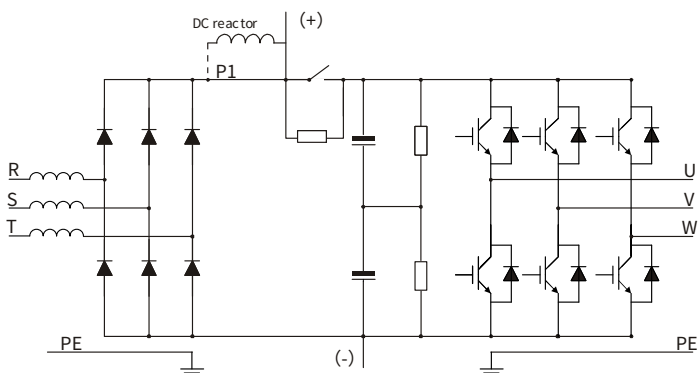


Figure 3-4 Main circuit diagram for 355G/400P and higher VFD models

Note:

- The 132G/160P and higher VFD models can be connected to external DC reactors. Before connection, remove the copper bar between P1 and (+). The 075G/090P and higher VFD models can be connected to external braking unit. DC reactors and braking units are optional parts.
- The VFDs of 055G/075P–110G/132P (inclusive) models are equipped with built-in DC reactors.
- The 7R5G/011P and lower VFD models are equipped with a built-in braking unit. The 055G/075P model can be optionally equipped with a built-in braking unit or an external braking unit. All models equipped with a built-in braking unit can be connected to an external braking resistor. Braking resistors are optional accessories.

3.3 Product specifications

Function description		Specifications
Power input	Input voltage (V)	AC 3PH 380 V(-15%) – 440 V(+10%)
	Input current (A)	See section 3.6 Product ratings.
	Input frequency (Hz)	50 Hz or 60 Hz; Allowed range: 47–63 Hz
Power output	Output voltage (V)	0–Input voltage
	Output current (A)	See section 3.6 Product ratings.
	Output power (kW)	See section 3.6 Product ratings.
	Output frequency (Hz)	0–400 Hz
Technical control performance	Control mode	Space vector PWM (SVPWM), sensorless vector control (SVC), and feedback vector control (FVC) mode
	Motor type	Asynchronous motor (AM) and permanent magnet synchronous motor (SM)
	Speed ratio	For AM, 1:200 (SVC); for SM, 1:20 (SVC); 1:1000 (FVC)
	Speed control accuracy	±0.2% (SVC), ±0.02% (FVC)
	Speed fluctuation	±0.3% (SVC)
	Torque response	<20ms (SVC), <10ms (FVC)
	Torque control accuracy	10% (SVC), 5% (FVC)
	Starting torque	For AMs: 0.25Hz/150% (SVC) For SMs: 2.5Hz/150% (SVC) 0Hz/200% (FVC)
	Overload capacity	G-type model: 150% of the rated current for 1 min, 180% of the rated current for 10 s, and 200% of the rated current for 1 s P-type model: 120% of the rated current for 1 min, 150% of the rated current for 10 s, and 180% of the rated current for 1 s
Running control performance	Frequency setting method	Settings can be implemented through digital, analog, pulse frequency, multi-step speed run, simple PLC, PID, and communication. Settings can be combined and the setting channels can be switched.
	Automatic voltage regulation	The output voltage can be kept constant although the grid voltage changes.
	Fault protection	More than 30 protection functions, such as protection against overcurrent, overvoltage, undervoltage, overtemperature, phase loss, and overload
	Speed tracking restart function	Used to implement impact-free smooth startup for rotating motors Note: This function is available for models of 7R5G/011P and above.

Function description		Specifications
Peripheral interface	Terminal analog input resolution	No more than 20 mV
	Terminal digital input resolution	No more than 2 ms
	Analog input	Two inputs; AI1: 0–10 V/0–20 mA; AI2: -10–+10 V
	Analog output	One output; AO1: 0–10 V/0–20 mA
	Digital input	Four regular inputs. Max. frequency: 1 kHz; internal impedance: 3.3 kΩ Two high-speed inputs; max. frequency: 50 kHz; supporting quadrature encoder input; with speed measurement function
	Digital output	One high-speed pulse output; max. frequency: 50 kHz 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: 3 A/AC 250 V, 1 A/DC 30 V
	Expansion interfaces	SLOT1, SLOT2, and SLOT3 Supporting PG cards, PLC cards, communication cards, I/O cards, fiber-optic master/slave control cards and so on
Others	Installation method	Supports wall mounting, floor mounting, and flange mounting.
	Temperature of running environment	-10°C – 50°C. Derating is required when the ambient temperature exceeds 40°C.
	Ingress protection (IP) rating	IP20
	Pollution degree	Degree 2
	Cooling method	Forced air cooling
	Braking unit	Built-in for 7R5G/011P and lower models; built-in or external braking unit optional for 055G/075P; external braking unit optional for other models
	EMC filter	Conducted emissions of all models meet the requirements of C3 in the IEC/EN 61800-3 standard. Optional external filters can be used to meet IEC/EN 61800-3 C2. Note: The EMC specifications required in the appendix of this manual must be observed. The motor and motor cables must comply with the technical requirements specified in the appendix of this manual.

3.4 Product nameplate

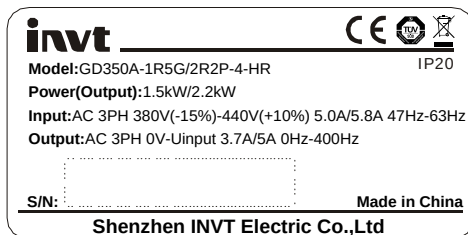


Figure 3-5 Product nameplate

Note: The preceding shows a standard product nameplate example. The nameplate has markings such as "CE", "TUV", and "IP20" depending on the actual certification result.

3.5 Model designation code

A model designation code contains product information. You can find the model designation code on the VFD nameplate.

GD350A-1R5G/2R2P-4-HR-L3-S

① ② ③ ④ ⑤ ⑥

Figure 3-6 Model description

Field	Sign	Description	Example
Product series abbreviation	①	Product series abbreviation	GD350A: Goodrive350A high-performance multifunction VFD
Rated power	②	Power range + load type	1R5: 1.5 kW G: Constant torque load P: Variable torque load
Voltage class	③	Voltage class	4: AC 3PH 380 V(-15%) – 440 V(+10%)
Product type	④	Product type	HR: Hot-redundancy series
Reactor	⑤	Reactor configuration	Empty: Without output reactors L3: With built-in output reactor (Customized)
Product version	⑥	Product version	Default: Standard version S: Book-type design (customized)

Note:

- The braking unit has been built in the 7R5G/011P and lower VFD models as a standard configuration.
- The braking unit is not a standard configuration for the 055G/075P VFD models (but you can choose to purchase the built-in braking unit, and then the VFD model has a suffix "B", for example, GD350A-055G/075P-4-HR-B).

3.6 Product ratings

VFD model	Constant torque			Variable torque		
	Output power (kW)	Input current (A)	Output current (A)	Output power (kW)	Input current (A)	Output current (A)
GD350A-1R5G/2R2P-4-HR	1.5	5.0	3.7	2.2	5.8	5
GD350A-7R5G/011P-4-HR	7.5	25	18.5	11	30	23
GD350A-055G/075P-4-HR	55	128	115	75	139	150
GD350A-075G/090P-4-HR	75	139	150	90	168	170
GD350A-090G/110P-4-HR	90	168	180	110	201	215
GD350A-110G/132P-4-HR	110	201	215	132	265	260
GD350A-132G/160P-4-HR	132	265	260	160	310	305
GD350A-160G/185P-4-HR	160	310	305	185	345	340
GD350A-185G/200P-4-HR	185	345	340	200	385	380
GD350A-200G/220P-4-HR	200	385	380	220	430	425
GD350A-220G/250P-4-HR	220	430	425	250	460	480
GD350A-250G/280P-4-HR	250	460	480	280	500	530
GD350A-280G/315P-4-HR	280	500	530	315	580	600
GD350A-315G/355P-4-HR	315	580	600	355	625	650
GD350A-355G/400P-4-HR	355	625	650	400	715	720
GD350A-400G/450P-4-HR	400	715	720	450	840	820
GD350A-450G/500P-4-HR	450	840	820	500	890	860
GD350A-500G-4-HR	500	890	860	/	/	/

Note:

- The VFD input current is measured in cases where the input voltage is 380V without additional reactors.
- The rated output current is the output current when the output voltage is 380V.
- Within the allowable input voltage range, the output current/power cannot exceed the rated output current/power.

3.7 Structural diagram

The VFD structure is shown in the following figure (taking the 055G/075P model as an example).

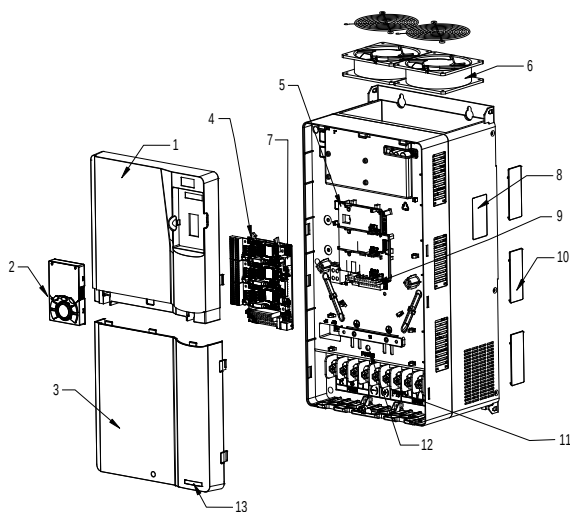


Figure 3-7 Product structure

No.	Name	Description
1	Upper cover	Protects internal components and parts.
2	Keypad	See section 5.4 Operation procedure.
3	Lower cover	Protects internal components and parts.
4	Expansion card	Optional. For details, see Appendix A Expansion card.
5	Baffle of control board	Protects the control board and is used to install an expansion card.
6	Cooling fan	For details, see chapter 8 Maintenance.
7	Keypad interface	Connects the keypad.
8	Nameplate	See section 3 Product overview.
9	Control terminals	See section 4 Installation guidelines.
10	Heat dissipation hole cover	Optional. After a cover with heat dissipation vents is added, the protection rating will increase, and the internal temperature of the VFD will also rise, requiring the VFD to be derated.
11	Main circuit terminals	See section 4 Installation guidelines.
12	POWER indicator	Power supply indicator
13	GD350A-HR product series label	See section 3.5 Model designation code.

4 Installation guidelines

4.1 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 section 1.4 Safety guidelines. 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.
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4.2 Mechanical installation

4.2.1 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 – +50.0°C ✧ When the ambient temperature exceeds 40°C, derate by 1% for every increase of 1°C. ✧ It is not recommended to use the VFD when the ambient temperature exceeds 50°C. ✧ In order 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 up 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.

Environment	Condition
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 ✧ Away from oil mist, corrosive gases, and combustible 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) ✧ Without radioactive substances and combustible objects ✧ Without hazardous gases and liquids ✧ Low-salt environment ✧ No direct sunlight
Altitude	✧ Lower than 1000 m ✧ When the altitude exceeds 1000 m, derate by 1% for every increase of 100 m. ✧ When the altitude is higher than 2000 m, configure an isolation transformer on the input end of the VFD. It is not recommended to use the product when the altitude exceeds 5000 m.
Vibration	The maximum vibration acceleration must not exceed 5.8 m/s ² (0.6 g).
Installation direction	Install the VFD vertically to ensure good heat dissipation performance.

Note:

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

4.2.2 Installation direction

The VFD can be installed on the wall or in a cabinet.

The VFD must be installed vertically. Check the installation position according to following requirements. For details about the outline dimensions, see Appendix C Dimension drawings.

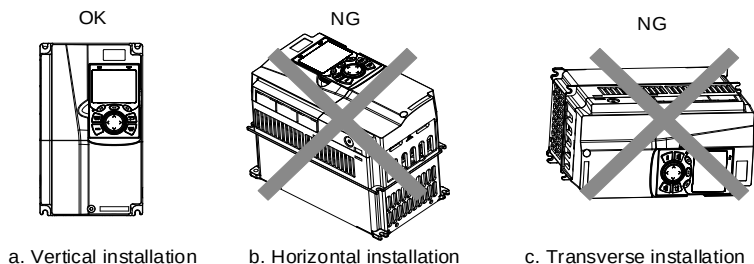


Figure 4-1 VFD installation direction

4.2.3 Installation method

There are three kinds of installation modes based on different VFD dimensions.

- Wall-mounting: applicable to 315G/355P and lower models.
- Flange-mounting: applicable to 200G/220P and lower models.
- Floor-mounting: applicable to 220G/250P–500G models.

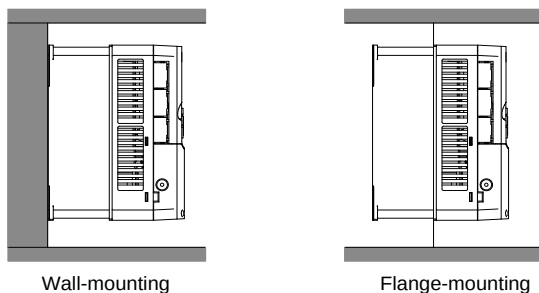


Figure 4-2 Installation method

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

Note:

- When the flange mounting method is used, the flange mounting plate (optional part) is required for the 1R5G/2R2P–110G/132P VFD models but not required for the 132G/160P–200G/220P VFD models.
- The 220G/250P–315G/355P VFD models support the installation base (optional part), which can house an input AC reactor (or DC reactor) and an output AC reactor.

4.2.4 Installing one VFD

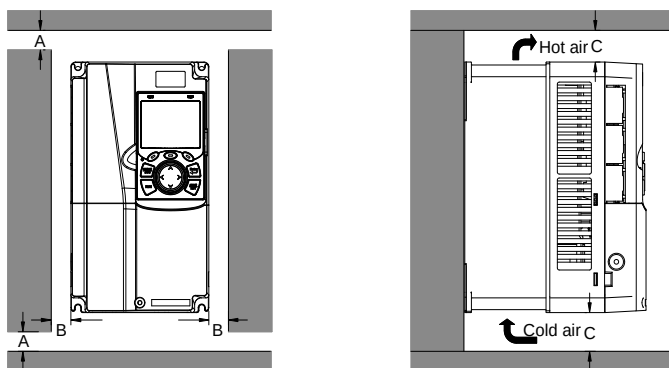


Figure 4-3 Single-unit installation

Note: For clearances A, B, and C, each must be 100mm at least.

4.2.5 Installing multiple VFDs

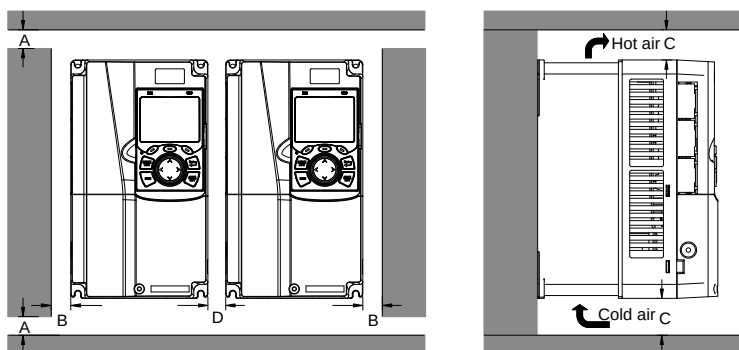


Figure 4-4 Parallel installation

Note:

- When you install VFDs in different sizes, align the top of each VFD before installation for the convenience of future maintenance.
- For clearances A, B, C and D, each must be 100 mm at least.

4.2.6 Vertical installation

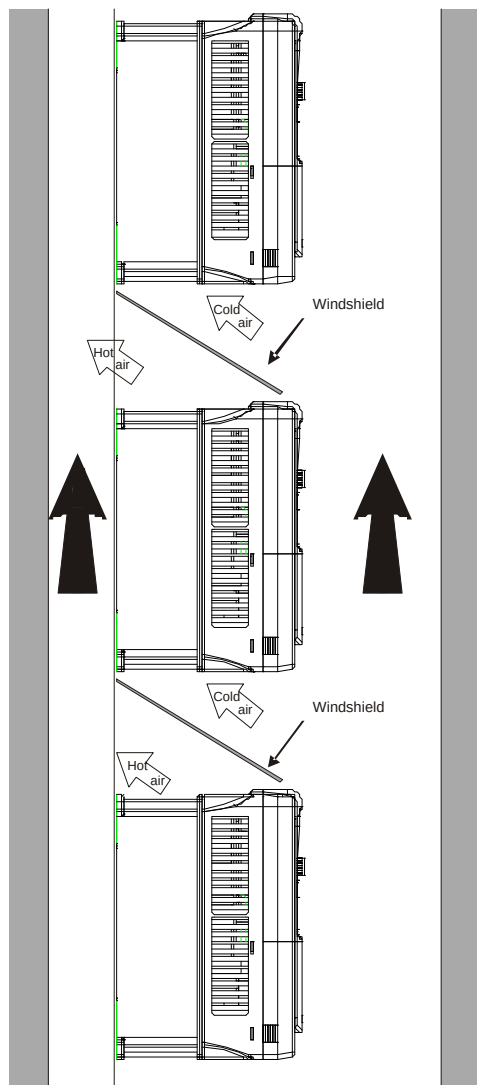


Figure 4-5 Vertical installation

Note: During vertical installation, you must install windshield, otherwise, the VFD will experience mutual interference, and the heat dissipation effect will be degraded.

4.2.7 Tilted installation

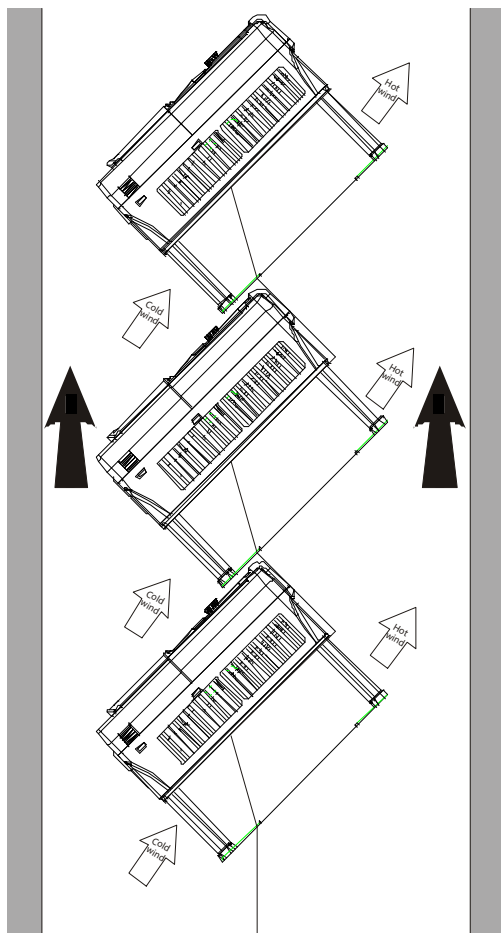


Figure 4-6 Tilted installation

Note: During tilted installation, it is a must to ensure the air inlet duct and air outlet duct are separated from each other to avoid mutual interference.

4.3 Standard wiring of the main circuit

4.3.1 Main circuit wiring diagram

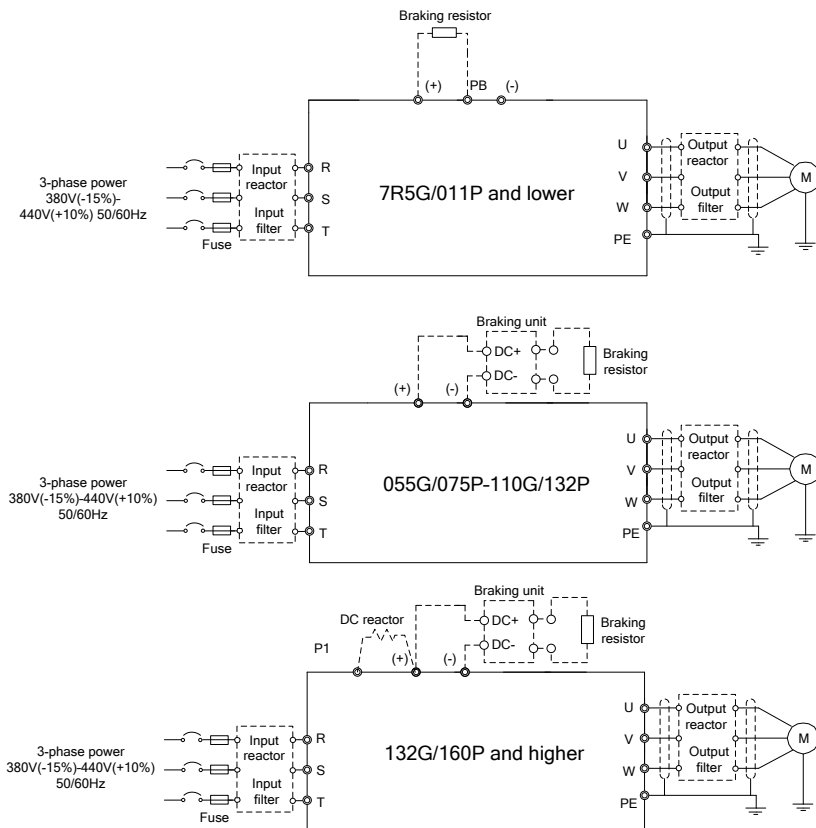


Figure 4-7 Main circuit wiring

Note:

- The fuse, DC reactor, braking unit, braking resistor, input reactor, input filter, output reactor and output filter are optional parts. For details, see Appendix D Peripheral options.
- P1 and (+) have been shorted together by default for the 132G/160P and higher VFD models. If you need to connect to an external DC reactor, take off the jumper of P1 and (+).
- Before connecting the braking resistor, remove the yellow warning label with PB, (+) and (-) from the terminal block; otherwise, poor contact may occur.
- The 055G/075P model can be configured with either a built-in braking unit or an external braking unit as an option.

4.3.2 Main circuit terminal diagram

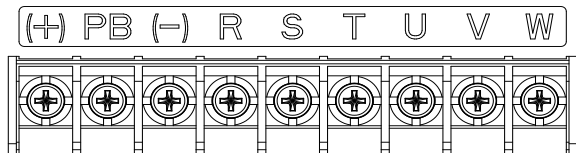


Figure 4-8 Main circuit terminals for the 7R5G/011P and lower VFD models

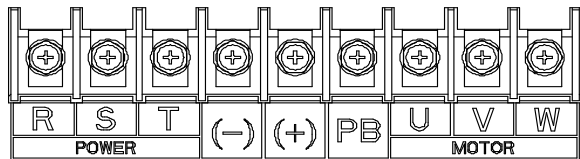


Figure 4-9 Main circuit terminals for the 055G/075P–110G/132P VFD models

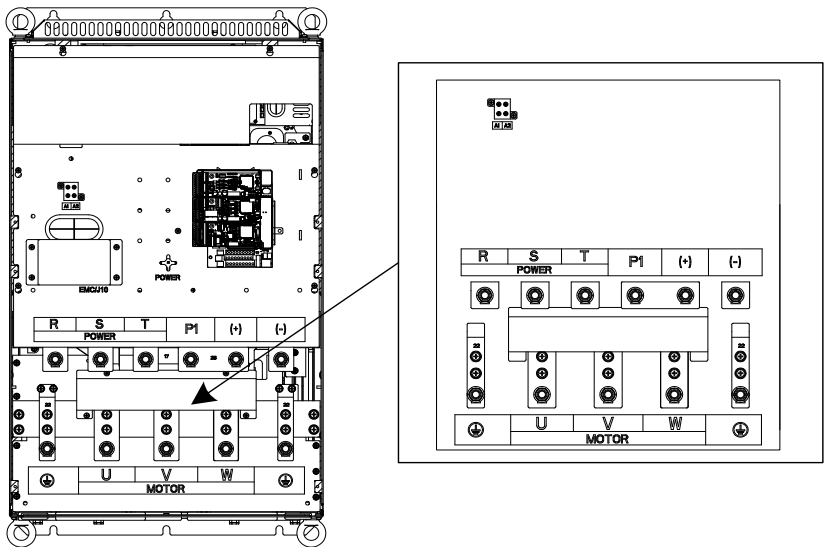


Figure 4-10 Main circuit terminals for the 132G/160P–200G/220P VFD models

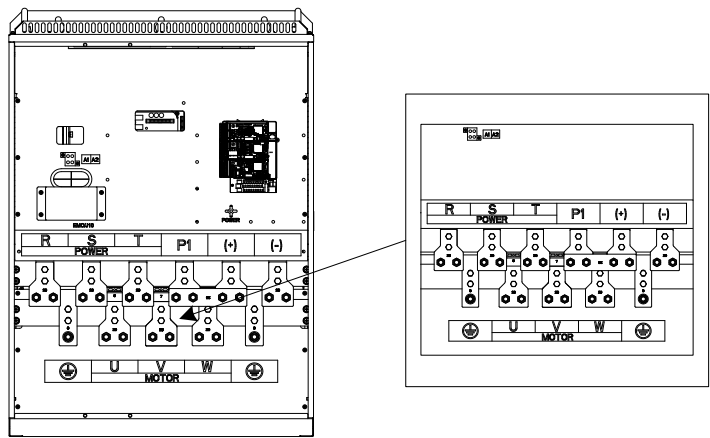


Figure 4-11 Main circuit terminals for the 220G/250P-315G/355P VFD models

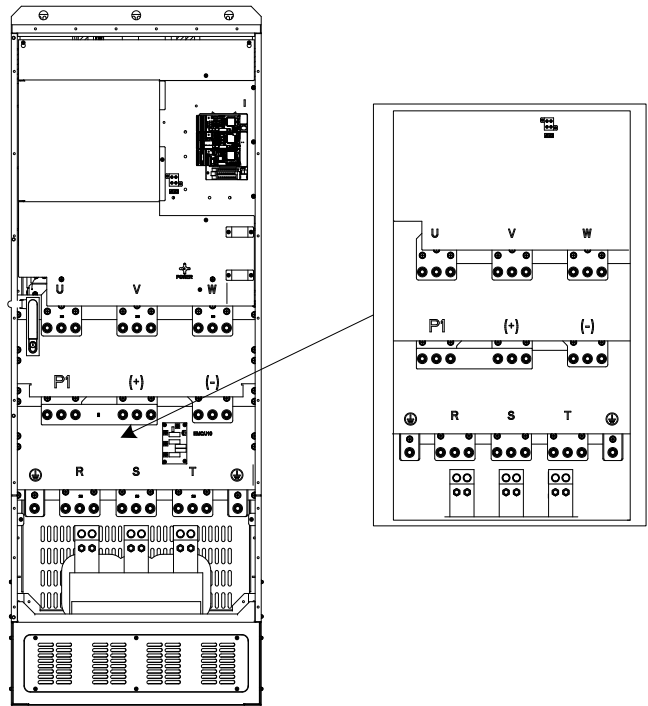


Figure 4-12 Main circuit terminals for the 355G/400P-500G VFD models

Terminal symbol	Name			Function description
	7R5G/011P and lower	055G/075P–110G/132P (inclusive)	132G/160P and higher	
R, S, T	Main circuit power input			3PH AC input terminals, connected to the grid
U, V, W	VFD outputs			3PH AC output terminals, connected to the motor usually
P1	Not available	Not available	DC reactor terminal 1	P1 and (+) connect to external DC reactor terminals. (+) and (-) connect to external braking unit terminals.
(+)	Braking resistor terminal 1	Braking unit terminal 1 Braking resistor terminal 1	DC reactor terminal 2 Braking unit terminal 1	
(-)	/	Braking unit terminal 2		
PB	Braking resistor terminal 2	Braking resistor terminal 2	Not available	PB and (+) connect to external braking resistor terminals.
PE	Grounding terminal for safe protection			Each machine must carry two PE terminals and proper grounding is required.

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.
- The braking resistor, braking unit, and DC reactor are all optional accessories.
- Route the motor cable, input power cable and control cable separately.
- "Not available" means this terminal is not for external connection.
- For models 055G/075P to 075G/090P, the PB terminal is only available when the 055G/075P model is configured with a built-in braking unit.

4.3.3 Wiring procedure for main circuit terminals

- Connect the grounding line of the input power cable to the grounding terminal (PE) of the VFD, and connect the 3PH input cable to R, S and T terminals and tighten up.
- Connect the ground wire of the motor cable to the PE terminal of the VFD, connect the motor 3PH cable to the U, V and W terminals, and tighten up.
- Connect optional components, such as the braking resistor and its cable, to the designated terminals.
- Fasten all the cables outside the VFD mechanically if allowed.

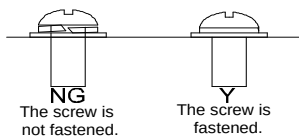


Figure 4-13 Screw installation

4.4 Standard wiring of the control circuit

4.4.1 Wiring diagram of basic control circuit

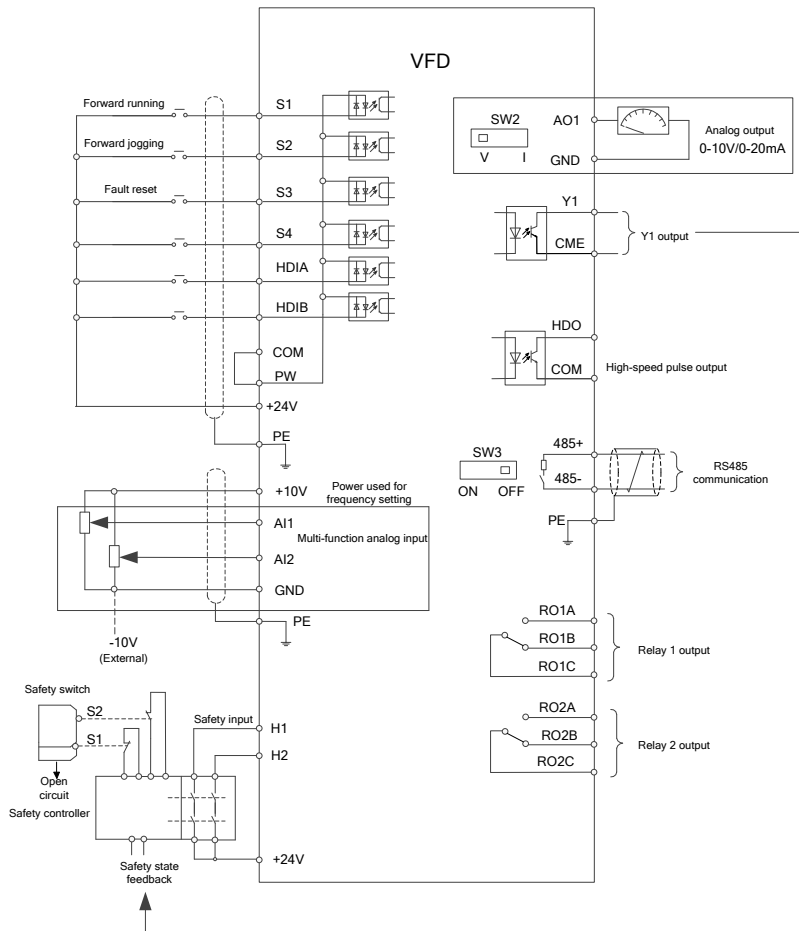


Figure 4-14 Control circuit wiring

Terminal name	Description	
+10V	Locally provided +10 V power supply	
AI1	Input range: For AI1, 0–10 V or 0–20 mA	
AI2	For AI2, -10 V–+10 V Input impedance: 20 k Ω for voltage input; 250 Ω for current input Whether voltage or current is used for input of AI1 is set through P05.50 Resolution: 5mV when 10 V corresponds to 50 Hz Deviation: $\pm 0.5\%$ at 25°C, when input is above 5 V/10 mA	
GND	+10 V reference ground	
AO1	Output range: 0–10 V or 0–20 mA Whether voltage or current is used for output is set through the DIP switch SW2 Deviation: $\pm 0.5\%$ when output exceeds 5 V or 10 mA at 25°C	
RO1A	RO1 output; RO1A: NO; RO1B: NC; RO1C: common Contact capacity: 3 A / AC250 V, 1 A /DC 30 V	
RO1B		
RO1C		
RO2A	RO2 output; RO2A: NO; RO2B: NC; RO2C: common Contact capacity: 3 A / AC250 V, 1 A /DC 30 V	
RO2B		
RO2C		
HDO	Switch capacity: 50 mA/30 V Output frequency range: 0–50 kHz Duty ratio: 50%	
CME	Common terminal of open collector output; shorted to COM by default	
Y1	Switch capacity: 50 mA/30 V Output frequency range: 0–1 kHz	
485+	RS485 communication/differential signal port. The standard 485 communication interface should use shielded twisted pair; the 120 Ω terminal matching resistor of RS485 communication is connected by toggle switch SW3.	
485-		
PE	Grounding terminal	
PW	External input terminal for digital input circuits Voltage range: 12–30 V	
24V	User power supply provided by the VFD. Max. output current: 200 mA	
COM	Common terminal of +24V	
S1	Digital input 1	- Internal impedance: 3.3 kΩ 12–30 V voltage input is acceptable. - Bi-direction input terminal, supporting both NPN and PNP - Max. input frequency: 1kHz - Programmable digital input terminals, the functions of which can be set through the related parameters
S2	Digital input 2	
S3	Digital input 3	
S4	Digital input 4	

Terminal name	Description	
HDIA	In addition to S1–S4 functions, the terminals can also act as high frequency pulse input channels.	
HDIB	Max. input frequency: 50kHz Duty ratio: 30%–70% Supports the input of a quadrature encoder with 24 V power supply; equipped with speed-measurement function	
+24V—H1	STO input 1	- Safe torque off (STO) redundant input, connected to the external NC contact. When the contact opens, STO acts and the VFD stops output. - The safety input signal cable uses the shielded cable and the length is controlled within 25 m. After wiring, perform the STO installation self-check according to Appendix E. - The H1 and H2 terminals are shorted to +24V by default. Remove the jumper from the terminals before using the STO function.
+24V—H2	STO input 2	

4.4.2 Input/output signal connection

Set NPN /PNP mode and internal/external power via U-shaped jumper. PNP internal mode is adopted by default.

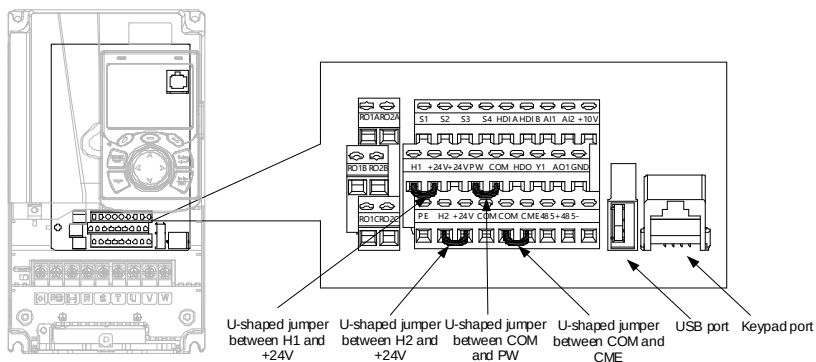


Figure 4-15 U-shaped jumper positions

Note: The USB port can be used to upgrade the software, and the keypad port can be used to connect an external keypad. The external keypad cannot be used when the local VFD keypad is used.

If the input signal comes from the NPN transistor, set the U-shaped jumper between +24V and PW based on the power used according to the following figure.

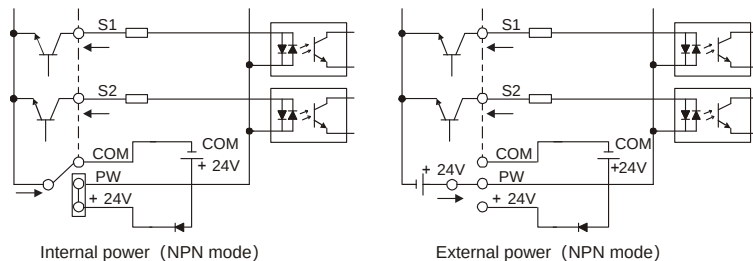


Figure 4-16 NPN mode

If the input signal comes from the PNP transistor, set the U-shaped jumper based on the power used according to the following figure.

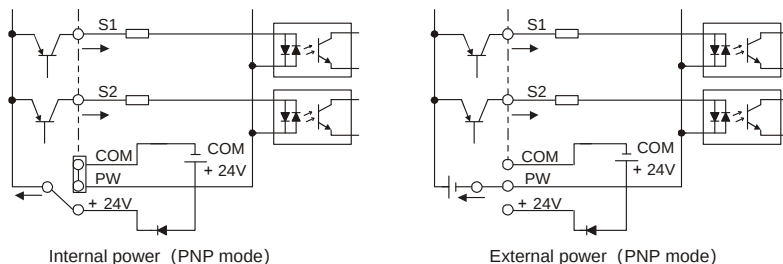


Figure 4-17 PNP mode

4.5 Wiring protection

4.5.1 Protecting the VFD and input power cable in case of short circuit

The VFD and input power cable can be protected in case of short circuit, avoiding thermal overload.

Carry out protective measures according to the following figure.

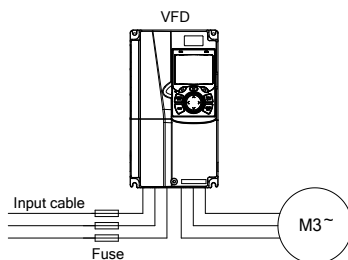


Figure 4-18 Fuse configuration

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

4.5.2 Protecting the motor and motor cable in case of short circuit

If the motor cable is selected based on VFD rated current, the VFD's internal protection can assist in protecting the motor and motor cable during a short circuit. Local electrical regulations must still be followed. No additional protective device is required.



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

4.5.3 Protecting the motor against thermal overload

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.

4.5.4 Bypass connection

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 to the VFD.

In some special scenarios, such as in soft startup, power-frequency running is directly performed after the 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 ends simultaneously.

5 Basic operation guidelines

5.1 What this chapter contains

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

5.2 Keypad

The VFD has been equipped with an LCD keypad as a standard configuration part. You can use the keypad to control the start and stop, read status data, and set parameters of the VFD.

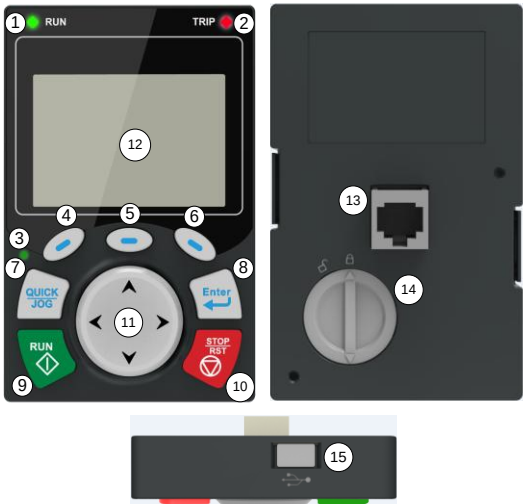


Figure 5-1 Keypad diagram

Note:

- The LCD keypad is equipped with a real-time clock, which can run properly after being installed with batteries even if the power line is disconnected. The clock battery (CR2032) must be purchased by the user.
- The LCD keypad has the parameter copying function.
- If you need to install the keypad externally (that is, on another position rather than on the VFD), you can use M3 screws to fix the keypad, or you can use the keypad installation bracket to install the keypad. When installing the keypad externally, use an extension cable with a standard RJ45 crystal head for connection.

Name		Description	
Status indicator	1		Run indicator Off: The VFD is stopped. Blinking: The VFD is in parameter autotuning. On: The VFD is running.

Name		Description	
	2		Fault indicator LED on: The VFD is in fault state. LED off: The VFD is in normal state. LED blinking: The VFD is in pre-alarm state.
	3		Short-cut key indicator, which displays different state under different functions, see definition of  key for details.
Keys	4		Function key The function of the function key varies with the menu. The function of function key is displayed in the footer.
	5		
	6		
	7		Short-cut key Re-definable. It is defined as JOG function by default, namely jogging. The function of short-cut key can be set by the ones place of P07.02, as shown in the following: 0: No function 1: Jogging (linked indicator ③ logic: steady on) 2: Reserved 3: FWD/REV switchover (linked indicator ③ logic: steady off) 4: Clear the  setting (linked indicator ③ logic: steady off) 5: Coast to stop (linked indicator ③ logic: steady off) 6: Switch command channels in sequence (linked indicator ③ logic: steady off) 7: Reserved Note: After restoring to default values, the default function of short-cut key is 1.
	8		Confirmation key The function of confirmation key varies with menus, such as confirming parameter setup, confirming parameter selection, and entering the next menu.
	9		Run key Under keypad operation mode, the running key is used for running operation or autotuning operation.
	10		Stop/Reset key Press it to stop the VFD that is running or autotuning. The function of this key is restricted by P07.04. In fault alarm state, this key can be used for reset in any control modes.
	11		Direction key UP:  DOWN:  LEFT:  RIGHT:  UP: The function of UP key varies with interfaces, such as shifting up the displayed item, shifting up the selected item, and changing digits. DOWN: The function of DOWN key varies with interfaces, such as shifting down the displayed item,

Name	Description			
				shifting down the selected item, changing digits. LEFT: The function of LEFT key varies with interfaces, such as switch over the monitoring interface, such as shifting the cursor leftward, exiting current menu and returning to previous menu. RIGHT: The function of RIGHT key varies with interfaces, such as switch over the monitoring interface, shifting the cursor rightward, enter the next menu etc.
Display area	12	LCD screen	Display panel	240×160 dot-matrix LCD; display three monitoring parameters or six sub-menu items simultaneously.
Other	13	RJ45 interface	RJ45 interface	RJ45 interface is used to connect to the VFD.
	14	Battery cover	Clock battery cover	Remove this cover when replacing or installing clock battery, and close the cover after battery is installed.
	15	USB interface	Mini USB terminal	Mini USB terminal is used to connect to the USB flash drive through an adapter.

The LCD has different display areas, which displays different contents under different interfaces. The following figure is the main interface of stop state.

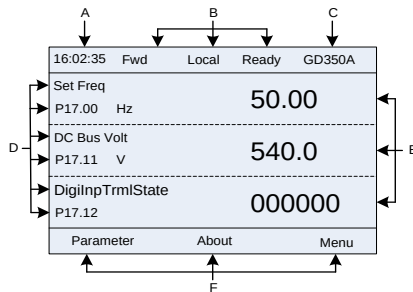


Figure 5-2 LCD main interface

Area	Name	Display
Header A	Real-time display area	Display the real-time; clock battery is not included; the time needs to be reset when powering on the VFD
Header B	VFD running state display area	Display the running state of the VFD: Displays the motor rotation direction: "Fwd" – Run forward during operation; Rev – Run reversely during operation; "Disrev" – Reverse running is forbidden Displays the VFD running command channel: "Local" – Keypad; "Trml" – Terminal; "Remote" - Communication

Area	Name	Display
		Display current running state of the VFD : "Ready" – The VFD is in stop state (no fault); "Run" – The VFD is in running state; "Jog" – The VFD is in jogging state; "Pre-alarm" – the VFD is under pre-alarm state during running; "Fault" – VFD fault occurred.
Header C	VFD model display area	VFD model display: "GD350A" – current VFD is GD350A series VFD.
Display D	Parameter names and function codes on the VFD homepage	Display a maximum of three parameter names and function codes on the homepage. The parameters displayed on the homepage can be managed.
Display E	Values of parameters on the VFD homepage	Display the values of parameters on the VFD homepage, which are updated in real time.
Footer F	Corresponding menu of function key (4), (5) and (6)	Corresponding menu of function key (4), (5) and (6). The corresponding menu of function key (4), (5) and (6) varies with interfaces, and the content displayed in this area also varies.

5.3 Keypad display

The VFD keypad can display the stopped-state parameters, running-state parameters, function parameter editing status, and fault alarm status.

5.3.1 Displaying stopped-state parameters

When the VFD is in stopped state, the keypad displays stopped-state parameters, and this interface is the main interface during power-on by default. Under stop state, parameters in various states can be displayed. Press  or  to shift the displayed parameter up or down.

16:02:35 Fwd Local Ready GD350A		16:02:35 Fwd Local Ready GD350A
Set Freq P17.00 Hz 50.00		DC Bus Volt P17.11 V 540.0
DC Bus Volt P17.11 V 540.0		DigilnTrmlState P17.12 000000
DigilnTrmlState P17.12 000000		DigiOutpTrmlState P17.13 0000
Parameter About Menu		Parameter About Menu

Figure 5-3 Stopped-state parameter display

Press  or  to switch between different display styles, including list display style and progress bar display style.

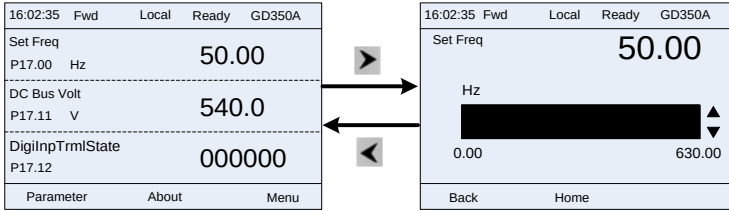


Figure 5-4 Stopped-state parameter display

The stopped-state parameter display list is user defined, and each state variable function code can be added to the list as needed. The state variable which has been added to the list can also be deleted or shifted.

5.3.2 Displaying running-state parameters

After receiving valid running command, the VFD will enter running state, and the keypad displays running state parameter with **RUN** indicator on the keypad turning on. Under running state, multiple types of state parameters can be displayed. Press or to shift up or down.

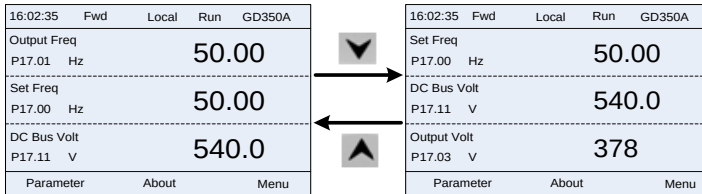


Figure 5-5 Running-state parameter display

Press or to switch between different display styles, including list display style and progress bar display style.

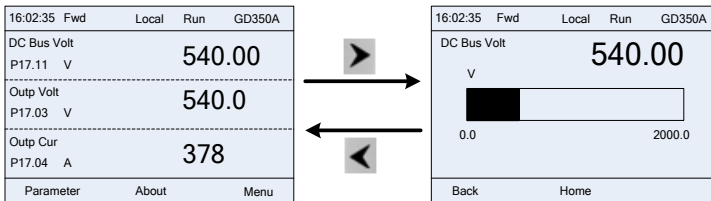


Figure 5-6 Running-state parameter display

Under running state, multiple kinds of state parameters can be displayed. The "parameter displayed in running state" list is user defined, and each state variable function code can be added to the list as needed. The state variable which has been added to the list can also be deleted or shifted.

5.3.3 Displaying fault alarms

The VFD enters fault alarm display state once fault signal is detected, and the keypad displays fault code and fault information with **TRIP** indicator on the keypad turning on. You can perform fault reset by using the **STOP/RST** key, control terminals, or communication commands.

If the fault persists, the fault code is continuously displayed.

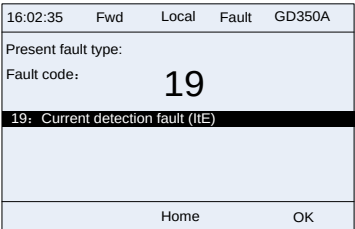


Figure 5-7 Fault alarm display

5.4 Operation procedure

You can operate the VFD through the keypad, including entering/exiting menus, selecting parameters, setting parameters, and modifying parameter lists.

5.4.1 Entering/Exiting menus

The following figure shows how to enter or exit the parameter menu step by step.

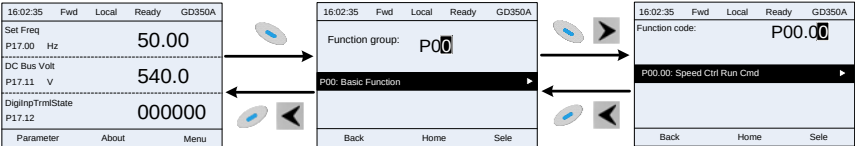


Figure 5-8 Example of entering/exiting the parameter menu

The following figure shows how to enter or exit different menus step by step.

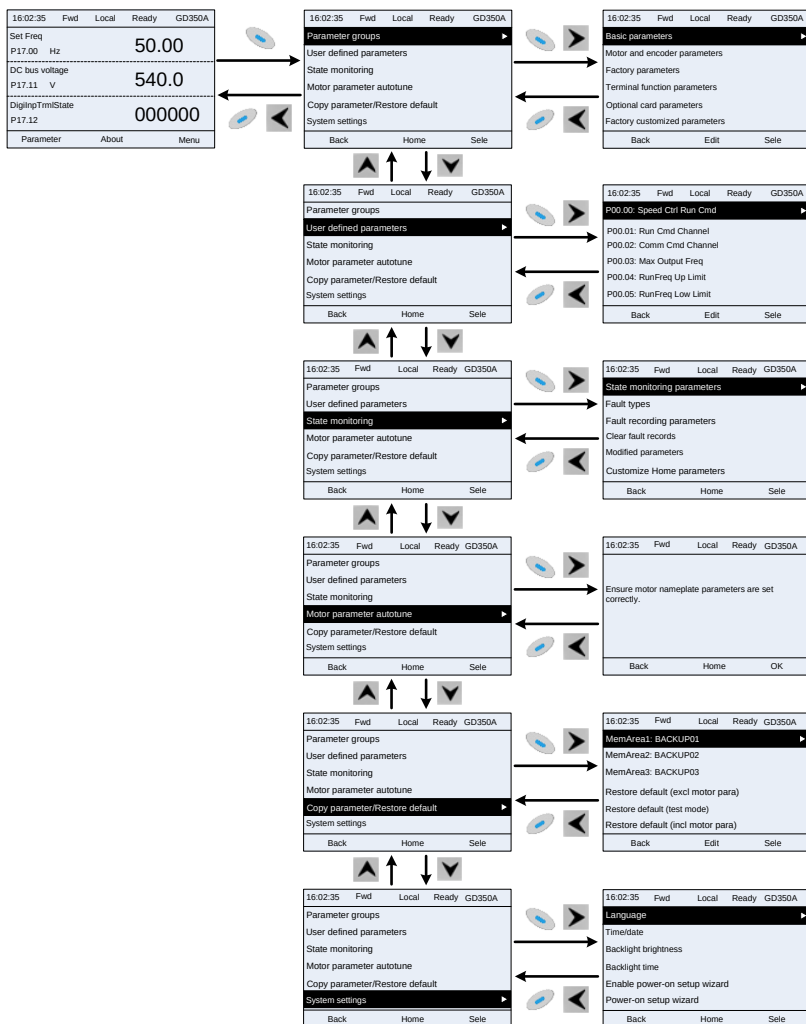


Figure 5-9 Example of entering/exiting the system menus

The keypad menu setup is shown as follows:

Level 1	Level 2	Level 3	Level 4
Grouping parameters	Basic parameter group setup	P00: Basic functions	P00.xx
		P01: Start and stop control	P01.xx
		P03: Motor 1 vector control	P03.xx
		P04: V/F control	P04.xx
		P07: HMI	P07.xx
		P08: Enhanced functions	P08.xx
		P09: PID control	P09.xx
		P10: Simple PLC and multi-step speed control	P10.xx
		P11: Protection parameters	P11.xx
		P13: SM control parameters	P13.xx
		P14: Serial communication	P14.xx
		P21: Position control	P21.xx
		P22: Spindle positioning	P22.xx
		P23: Motor 2 vector control	P23.xx
	Motor and encoder parameter setting	P02: Motor 1 parameters	P02.xx
		P12: Motor 2 parameters	P12.xx
		P20: Motor 1 encoder group	P20.xx
		P24: Motor 2 encoder group	P24.xx
	Control parameter group setup	P01: Start and stop control	P01.xx
		P13: SM control parameters	P13.xx
		P21: Position control	P21.xx
		P22: Spindle positioning	P22.xx
		P23: Motor 2 vector control	P23.xx
	Factory parameter setting	P99: Factory function group	xxxxxx
	Terminal function group setup	P05: Input terminal group	P05.xx
		P06: Output terminal group	P06.xx
		P98: AIAO calibration functions	xxxxxx
	Optional card parameter setting	P15: Functions of communication expansion card 1	P15.xx
		P16: Functions of communication expansion card 2	P16.xx
		P25: Expansion I/O card input functions	P25.xx

Level 1	Level 2	Level 3	Level 4
		P26: Expansion I/O card output functions	P26.xx
		P27: PLC card functions	P27.xx
		P28: Master/slave functions	P28.xx
		P90: Customized function group 1	P90.xx
	Factory-defined function prm setup	P91: Customized function group 2	P91.xx
		P92: Customized function group 3	P92.xx
		P93: Customized function group 4	P93.xx
User defined parameter setting	/	/	P00.00: Speed control mode P00.01: Running command channel Pxx.xx: Parameter setup xx
State monitor	Monitor state param	P07: Human-machine interface	P07.xx
		P17: Status viewing functions	P17.xx
		P18 group: Closed-loop vector state check functions	P18.xx
		P19: Status viewing functions of expansion card	P19.xx
	Fault type records	/	P07.27: Most recent fault type
			P07.28: Last fault type
			P07.29: 2nd-last fault type
			P07.30: 3rd-last fault type
			P07.31: 4th-last fault type
			P07.32: 5th-last fault type
	View fault parameter	/	P07.33: Running frequency at present fault
			P07.34: Ramp reference frequency at present fault
			P07.xx: xx state at the xx-th last fault
	Clear fault records	/	Sure to clear fault records?
	Modified param	/	Pxx.xx: Modified parameter

Level 1	Level 2	Level 3	Level 4
			1
			Pxx.xx: Modified parameter
			2
	Customize Home parameters	Stopped-state parameters	Pxx.xx: Modified parameter xx
		Running-state parameters	/
Motor parameter auto-tuning	/	Ensure motor nameplate parameters are set correctly.	Dynamic auto-tuning
			Complete parameter static auto-tuning
			Partial parameter static auto-tuning
Parameter backup/restore default value	/	Memory area 1: BACKUP01	Upload param from local to keypad
			Download all param from keypad
			Download non motor param from keypad
			Download motor param from keypad
		Memory area 2: BACKUP02	Upload param from local to keypad
			Download all param from keypad
			Download non motor param from keypad
			Download motor param from keypad
		Memory area 3: BACKUP03	Upload param from local to keypad
			Download all param from keypad
			Download non motor param from keypad
			Download motor param from keypad
		Restore default (excl. motor param)	Sure to restore defaults (excl motor para)?

Level 1	Level 2	Level 3	Level 4
System setup System-setting	/	/	Restore default (test mode)
			Sure to restore default (test mode)?
			Restore default (include motor prm)
			Sure to restore default (incl motor para)?
			Language
			Time/date
			Backlight brightness regulation
			Adjust backlight time
			Power-on guiding enable
			Power-on guiding settings
			Keypad burning selection
			Enable fault time
			Control board burning selection
			Up/down key sensitivity

5.4.2 Editing list

The parameters in the parameter list in stopped state can be added as needed (through the menu of user defined home parameters), and the list can also be edited such as "Place top", "Move up", "Move down", "Delete from the list", and "Restore default". The edit function is shown in the following.

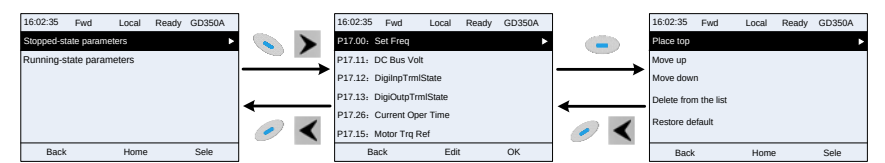


Figure 5-10 Editing list 1

Press key to enter edit interface, select the operation needed, and press key, key or key to confirm the edit operation and return to the previous menu (parameter list), the returned list is the list edited. If key or key is pressed in edit interface without selecting edit operation, it will return to the previous menu (parameter list remain unchanged).

Note: For the parameter objects in the list header, move-up operation will be invalid, and the same principle can be applied to the parameter objects in the list footer; after deleting a certain parameter, the parameter objects under it will be moved up automatically.

The items in the parameter list in running state can be added as needed (through the menu of user defined home parameters), and the list can also be edited such as "Place top", "Move up", "Move down", "Delete from the list", and "Restore default parameters". The edit function is shown in the

interface below.

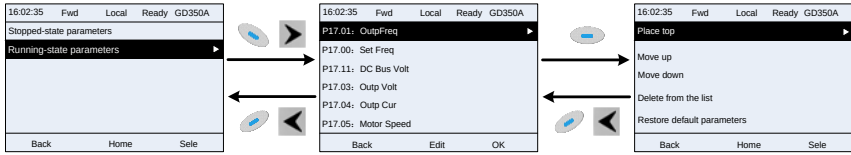


Figure 5-11 Editing list 2

The parameters of user defined parameter setting can be added, deleted or adjusted as needed, such as "Place top", "Move up", "Move down", "Delete from the list", and "Restore default parameters"; the adding function can be set in a certain function code in a function group. The edit function is shown in the figure below.

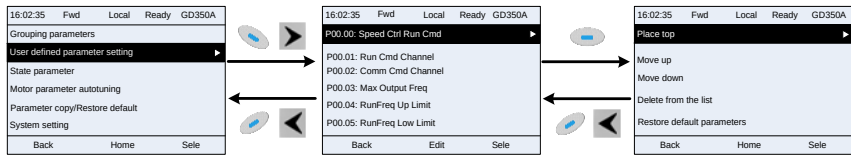


Figure 5-12 Editing list 3

5.4.3 Adding parameters to the parameter list displayed in stopped/running state

You can choose **Menu > State monitoring**, choose a submenu, and enter a specific function group and then a specific function code to add the parameter to the list of parameters displayed in stopped state or parameters displayed in running state.

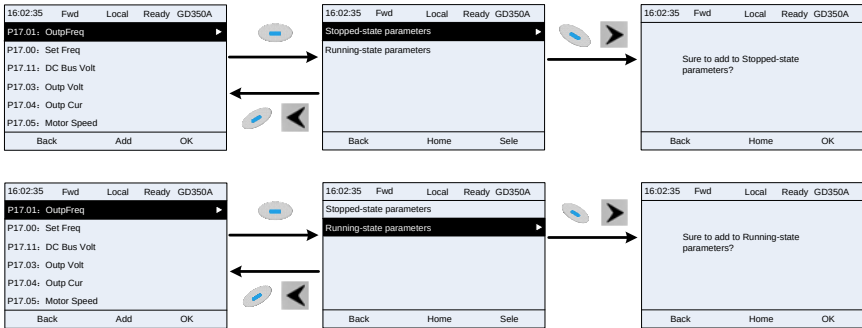


Figure 5-13 Example 1 of adding parameters

After selecting a specific function code, press key to enter parameter addition interface, and press key, key or key to confirm the addition operation. If this parameter is not included in the list of parameters displayed in stopped state or list of parameters displayed in running state, the parameter added will be at the end of the list; if the parameter is already in the list of parameters displayed in stopped state or list of parameters displayed in running state, the addition

operation will be invalid. If  key or  key is pressed without selecting addition operation in "Addition" interface, it will return to monitoring parameter list menu.

Part of the monitoring parameters in P07 HMI group can be added to the "parameter displayed in stop state" list or "parameter displayed in running state" list; all the parameters in groups P17, P18, P19, and P93 can be added to the "parameter displayed in stop state" list or "parameter displayed in running state" list.

Up to 16 monitoring parameters can be added to the list of parameters displayed in stopped state; and up to 32 monitoring parameters can be added to the list of parameters displayed in running state.

5.4.4 Add parameter to common parameter setup list

You can choose **Menu > Parameter groups**, choose a submenu, and enter a specific function group and then a specific function code to add the parameter to the user defined parameter list.

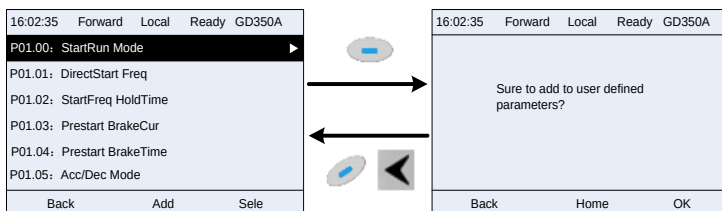


Figure 5-14 Example 2 of adding parameters

Press  key to enter addition interface, and press  key,  key or  key to confirm the addition operation. If this parameter is not included in the original user defined parameter list, the newly-added parameter will be at the end of the list; if this parameter is already in the user defined parameter list, the addition operation will be invalid. If  key or  key is pressed without selecting addition operation, it will return to parameter setup list menu.

All the function code groups under the submenu can be added to user defined parameter list. Up to 64 function codes can be added to the user defined parameter list.

5.4.5 Parameter selection edit interface

After accessing a specific function code under the **User defined parameters** menu, you can press the  key,  key or  key to enter the parameter edit interface. After entering the edit interface, the present value is highlighted. Press the  key and  key to edit the parameter value, and the corresponding parameter item of current value will be highlighted automatically. After the edit operation is completed, press  or  key to save the selected parameter and return to the previous menu; or press  key to maintain the value and return to the previous menu.

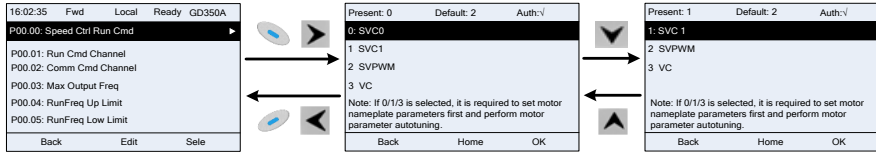


Figure 5-15 Parameter selection edit interface

In the interface, the "Auth" field on the top right indicates whether this parameter is editable or not.

" / " indicates the set value of this parameter can be modified under the present state.

"x" indicates the set value of this parameter cannot be modified under the present state.

"Present" indicates the present value.

"Default" indicates the default value of this parameter.

5.4.6 Parameter setup edit interface

You can choose **Menu > Parameter groups**, enter a specific function group and then a specific function code, and then press key, key or key to edit the parameter setting interface. After entering edit interface, set the parameter from low digit to high digit, and the digit under setting will be highlighted. Press key or key to increase or decrease the parameter value (this operation is valid until the parameter value exceeds the max. value or min. value); press or to shift the editing digit. After parameters are set, press or key to save the set parameters and return to the previous menu; press to maintain the original parameter value and return to the previous menu.

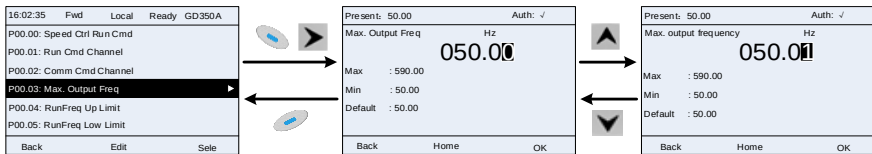


Figure 5-16 Parameter setup edit interface

In the parameter edit interface, the "Auth" field on the top right indicates whether this parameter can be modified or not.

" / " indicates the set value of this parameter can be modified under the present state.

"x" indicates the set value of this parameter cannot be modified under the present state.

"Present" indicates the present value.

"Default" indicates the default value of this parameter.

5.4.7 State monitoring interface

You can choose **Menu > State monitoring > State monitoring parameter**, enter a specific function group and then a specific function code, and press key, key or key to enter the state monitoring interface. After entering the state monitoring interface, the actual parameter value will be displayed in real time, this value is the actually detected value which cannot be modified.

In the state monitoring interface, you can press  key or  key to return to the previous menu.

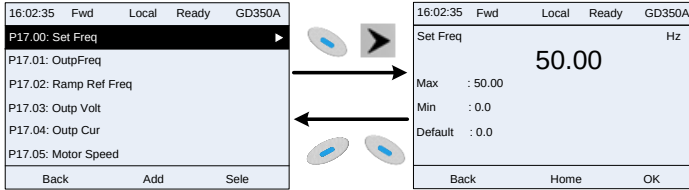


Figure 5-17 State monitoring interface

5.4.8 Motor parameter autotuning

You can choose **Menu > Motor parameter autotune** and press ,  key or  key to enter motor parameter autotuning interface. However, before entering the motor parameter autotuning interface, you must set the motor nameplate parameters correctly. After entering the interface, select a motor autotuning type to carry out motor parameter autotuning. In motor parameter autotuning interface, you can press  key or  key to return to the previous menu.

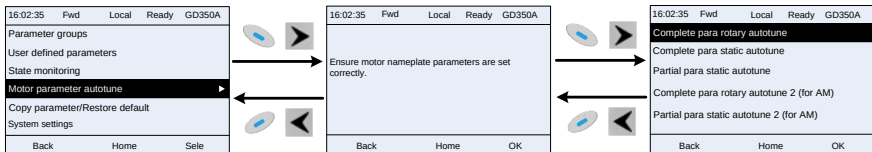


Figure 5-18 Parameter autotuning operation

After selecting a motor autotuning type, enter motor parameter autotuning interface, and press **RUN** key to start motor parameter autotuning. After autotuning is done, a message indicating that autotuning was successful will be displayed, and then it will return to the main interface of stop. During autotuning, you can press **STOP/RST** key to terminate autotuning; if a fault occurs during autotuning, the keypad will display a fault interface.

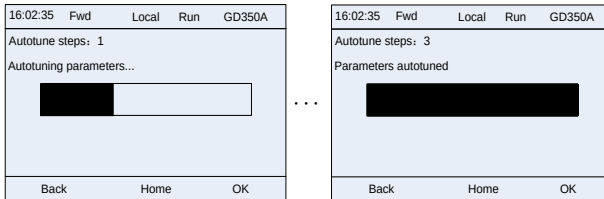


Figure 5-19 Parameter autotuning finished

5.4.9 Parameter backup

You can choose **Menu > Copy parameter/Restore default**, and press ,  key or  key to enter the function parameter backup interface and function parameter restoration interface to upload/download VFD parameters, or restore VFD parameters to default values. The keypad has three different storage areas for parameter backup, and each storage area can save the parameters of one VFD, which means the keypad can save parameters of three VFDs in total.

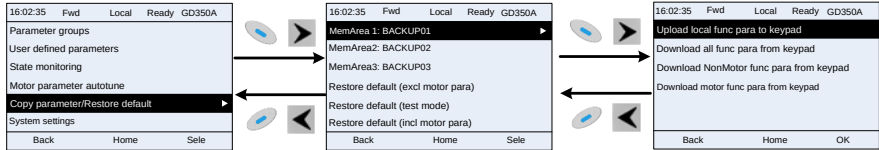


Figure 5-20 Parameter backup

5.4.10 System setup

You can choose **Menu > System settings**, and press key, key or key to enter system setting interface to set the keypad language, time/date, backlight brightness, backlight time and restore parameters.

Note: Clock battery is not included, and the keypad time/date needs to be reset after power off. If time-keeping after power off is needed, you should purchase the clock batteries separately.

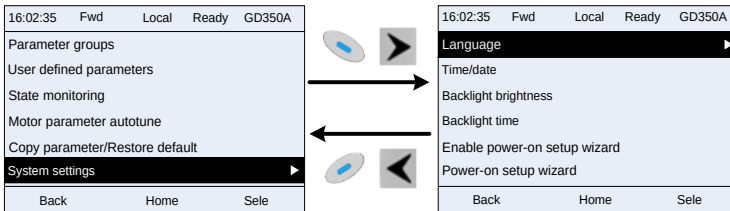
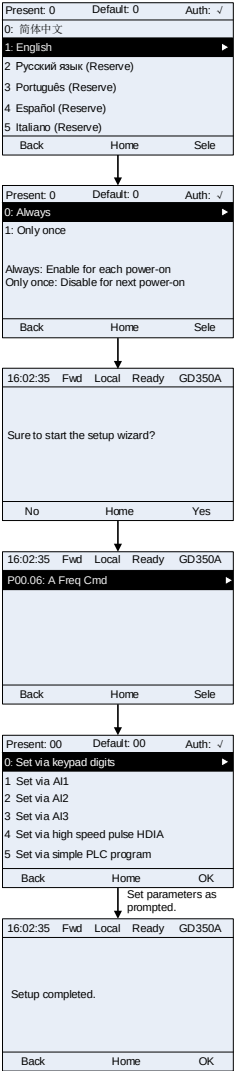


Figure 5-21 System setup

5.4.11 Power-on guiding settings

The keypad supports the power-on setup wizard function, mainly for the first power-on situation, instructing you to enter the setting menu, and gradually implementing basic functions such as basic parameter setting, direction judgment, mode setting and autotuning.

For first power-on, the keypad automatically enters the setup wizard interface. See the following.



5.5 Basic operation description

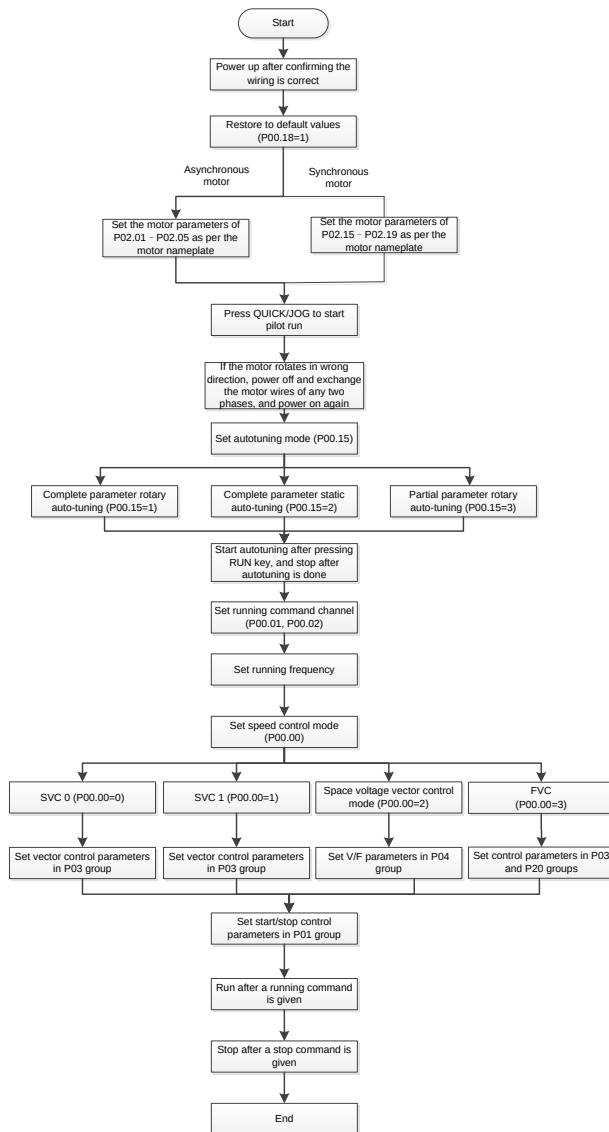
5.5.1 What this section describes

This section introduces the function modules inside the VFD.

	✧ Ensure that all terminals have been securely connected. ✧ Ensure that the motor power matches the VFD power.
--	--

5.5.2 Common commissioning procedure

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



Note: If a fault occurred, find out the fault cause and remove the fault according to chapter 7 Troubleshooting.

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

Channel of running commands P00.01	Multifunction terminal function 36 Switch the running command channel to keypad	Multifunction terminal function 37 Switch the running command channel to terminal	Multifunction terminal function 38 Switch the running 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.

Related parameter list:

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: FVC mode Note: Before using a vector control mode (0, 1, 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 running commands	0: Modbus/Modbus TCP communication 1: PROFIBUS/CANopen/DeviceNet communication 2: Ethernet communication 3: EtherCAT/PROFINET/EtherNet IP communication 4: PLC card 5: Wireless communication card	0
P00.15	Motor parameter autotuning	0: No operation 1: Dynamic autotuning; comprehensive motor parameter autotuning. It is recommended to use dynamic autotuning when high control accuracy is required. 2: Complete parameter static autotuning; used in scenarios where the motor cannot be disconnected from load.	0

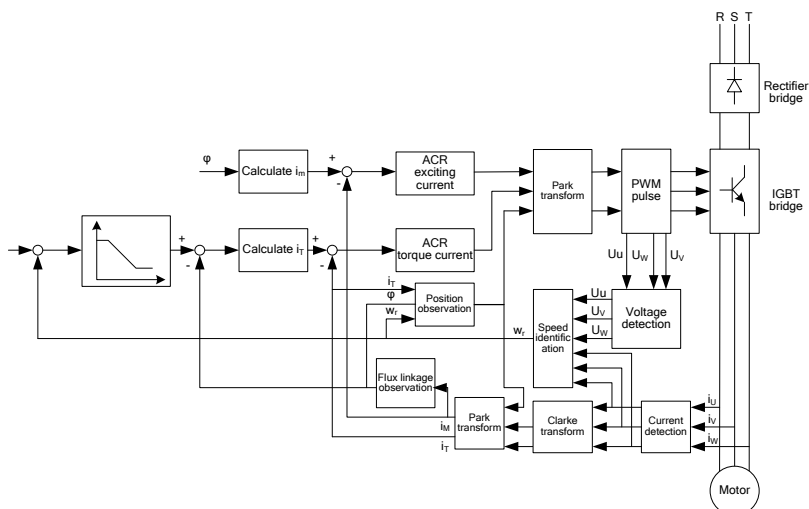
Function code	Name	Description	Default
		3: Partial parameter static autotuning; when the present motor is motor 1, only P02.06, P02.07, and P02.08 need to be autotuned; when the present motor is motor 2, only P12.06, P12.07, and P12.08 need to be autotuned. 4: Dynamic autotuning 2; similar to dynamic autotuning 1, but only valid for AMs 5: Partial parameter static autotuning 2; only valid for AMs	
P00.18	Function parameter restoration	0: No operation 1: Restore to default values (excluding motor parameters) 2: Clear fault records 3: Reserved 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. - Option 5 restores the parameters to those of the corresponding standard version. Non-professionals should use this option with caution.	0
P02.00	Motor 1 type	0: Asynchronous motor (AM) 1: Synchronous motor (SM)	0
P02.01	AM 1 rated power	0.1–3000.0 kW	Depends on model
P02.02	AM 1 rated frequency	0.01Hz–P00.03 (Max. output frequency)	50.00 Hz
P02.03	AM 1 rated speed	1–60000 rpm	Depends on model
P02.04	AM 1 rated voltage	0–1200 V	Depends on model

Function code	Name	Description	Default
P02.05	AM 1 rated current	0.8–6000.0 A	Depends on model
P02.15	Rated power of SM 1	0.1–3000.0 kW	Depends on model
P02.16	SM 1 rated frequency	0.01 Hz–P00.03 (Max. output frequency)	50.00 Hz
P02.17	SM 1 pole pair count	1–128	2
P02.18	SM 1 rated voltage	0–1200 V	Depends on model
P02.19	SM 1 rated current	0.8–6000.0 A	Depends on model
P05.01– P05.06	Function selection of multifunction digital input terminals (S1–S4, HDIA, and HDIB)	36: Switch the run command channel to keypad 37: Switch the run command channel to terminal 38: Switch the running command channel to communication	/
P07.02	Function of QUICK/JOG	Range: 0x00–0x27 Ones place: Function of QUICK/JOG 0: No function 1: Jog 2: Reserved 3: Switch between forward and reverse rotation 4: Clear the UP/DOWN setting 5: Coast to stop 6: Switch command channels in sequence 7: Reserved Tens place: Reserved	0x01

5.5.3 Vector control

AMs are high-order, nonlinear, strongly coupled, multivariable systems, which makes them difficult to control in practical applications. The vector control technology solves this situation as follows: measures and controls the stator current vector of the AM, and then decomposes the stator current vector into exciting current (current component that generates internal magnet field) and torque current (current component that generates torque) based on field orientation principle, and therefore controls the amplitude values and phase positions of the two components (namely, controls the stator current vector of the AM) to realize decoupled control on exciting current and torque current, thus achieving high-performance speed regulation of the AM.

As the vector control algorithm is complicated, exercise caution before modifying vector control function parameters.



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: FVC mode Note: Before using a vector control mode, enable the VFD to perform motor parameter autotuning first.	2
P00.15	Motor parameter autotuning	0: No operation 1: Dynamic autotuning; comprehensive motor parameter autotuning. It is recommended to use dynamic autotuning when high control accuracy is required. 2: Complete parameter static autotuning; used in scenarios where the motor cannot be disconnected from load.	0

Function code	Name	Description	Default
		3: Partial parameter static autotuning; when the present motor is motor 1, only P02.06, P02.07, and P02.08 need to be autotuned; when the present motor is motor 2, only P12.06, P12.07, and P12.08 need to be autotuned. 4: Dynamic autotuning 2; similar to dynamic autotuning 1, but only valid for AMs 5: Partial parameter static autotuning 2; only valid for AMs	
P02.00	Motor 1 type	0: Asynchronous motor (AM) 1: Synchronous motor (SM)	0
P03.00	Speed-loop proportional gain 1	0–200.0	20.0
P03.01	Speed-loop integral time 1	0.000–10.000 s	0.200 s
P03.02	Low switching-point frequency	0.00 Hz–P03.05	5.00 Hz
P03.03	Speed-loop proportional gain 2	0–200.0	20.0
P03.04	Speed-loop integral time 2	0.000–10.000 s	0.200 s
P03.05	High switching-point frequency	P03.02–P00.03 (Max. output frequency)	10.00Hz
P03.06	Speed-loop output filter	0–8 (corresponding to $0\text{--}2^8/10$ ms)	0
P03.07	Electromotive slip compensation coefficient of vector control	50%–200%	100%
P03.08	Braking slip compensation coefficient of vector control	50%–200%	100%
P03.09	Current-loop proportional coefficient P	0–65535	1000

Function code	Name	Description	Default
P03.10	Current-loop integral coefficient I	0–65535	1000
P03.11	Torque setting method	0–1: Keypad (P03.12) 2: AI1 3: AI2 4: AI3 5: Pulse frequency HDIA 6: Multi-step speed 7: Modbus/Modbus TCP communication 8: PROFIBUS/CANopen/DeviceNet communication 9: Ethernet communication 10: Pulse frequency HDIB 11: EtherCAT/PROFINET/EtherNet IP communication 12: PLC card Note: For these settings, 100% corresponds to the motor rated current.	1
P03.12	Torque set through keypad	-300.0%–300.0% (of the motor rated current)	20.0%
P03.13	Torque reference filter time	0.000–10.000 s	0.010 s
P03.14	Setting source of forward rotation upper-limit frequency in torque control	0: Keypad (P03.16) 1: AI1 2: AI2 3: AI3 4: Pulse frequency HDIA 5: Multi-step speed 6: Modbus/Modbus TCP communication 7: PROFIBUS/CANopen/DeviceNet communication 8: Ethernet communication 9: Pulse frequency HDIB 10: EtherCAT/PROFINET/EtherNet IP communication 11: PLC card 12: Reserved Note: 100% corresponds to the max. frequency.	0
P03.15	Setting source of reverse rotation upper-limit frequency in torque control	0: Keypad (P03.17) 1–11: Same as those for P03.14	0

Function code	Name	Description	Default
P03.16	Forward rotation upper-limit frequency set through keypad in torque control	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: Pulse frequency HDIA 5: Modbus/Modbus TCP communication 6: PROFIBUS/CANopen/DeviceNet communication 7: Ethernet communication 8: Pulse frequency HDIB 9: EtherCAT/PROFINET/EtherNet IP communication 10: PLC card 11: Reserved Note: 100% corresponds to the motor rated current.	0
P03.19	Setting source of braking torque upper limit	0: Keypad (P03.21) 1: AI1 2: AI2 3: AI3 4: Pulse frequency HDIA 5: Modbus/Modbus TCP communication 6: PROFIBUS/CANopen/DeviceNet communication 7: Ethernet communication 8: Pulse frequency HDIB 9: EtherCAT/PROFINET/EtherNet IP communication 10: PLC card 11: Reserved Note: 100% corresponds to the motor rated current.	0
P03.20	Motoring torque upper limit set through keypad	0.0–300.0% (of the motor rated current)	180.0%
P03.21	Braking torque upper limit set through keypad		180.0%

Function code	Name	Description	Default
P03.22	Flux weakening coefficient in constant power zone	0.1–2.0	0.3
P03.23	Min. flux weakening point in constant power zone	10%–100%	20%
P03.24	Max. voltage limit	0.0–120.0%	100.0%
P03.25	Pre-excitation time	0.000–10.000 s	0.300 s
P03.32	Torque control enable	0: Disable 1: Enable	0
P03.33	Flux weakening integral gain	0–8000	1200
P03.35	Control optimization setting	0x0000–0x1111 Ones place: Torque command selection 0: Torque reference 1: Torque current reference Tens place: Reserved 0: Reserved 1: Reserved Hundreds place: indicates whether to enable speed-loop integral separation 0: Disable 1: Enable Thousands place: Reserved 0: Reserved 1: Reserved	0x0000
P03.36	Speed-loop derivative gain	0.00–10.00 s	0.00 s
P03.37	High-frequency current-loop proportional coefficient	In the FVC mode (P00.00=3), when the frequency is lower than the current-loop high-frequency switching threshold (P03.39), the current-loop PI parameters are P03.09 and P03.10; and when the frequency is higher than the current-loop high-frequency switching threshold, the current-loop PI parameters are P03.37 and P03.38. Setting range of P03.37: 0–65535 Setting range of P03.38: 0–65535 Setting range of P03.39: 0.0–100.0% (of the max. frequency)	1000
P03.38	High-frequency current-loop integral coefficient		1000
P03.39	Current-loop high-frequency switching threshold		100.0%
P17.32	Flux linkage	0.0–200.0%	0.0%

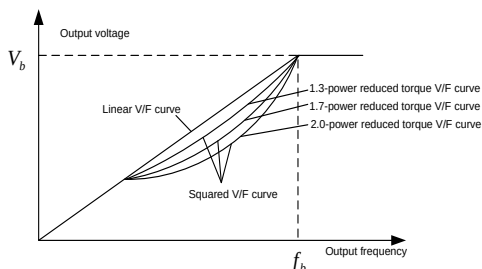
5.5.4 SVPWM

The VFD also carries built-in space voltage vector control function. The SVPWM mode can be used in cases where mediocre control precision is enough. In cases where a VFD needs to drive multiple motors, it is also recommended to adopt the SVPWM mode.

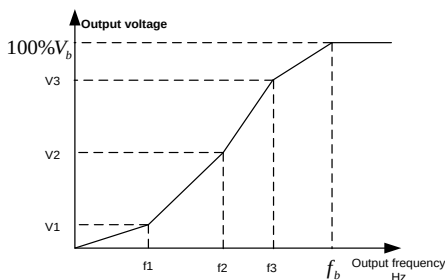
The VFD provides multiple kinds of V/f curve modes to meet different field needs. You can select corresponding V/f curve or set the V/f curve as needed.

Suggestions:

- 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.
- 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 VFD also provides multi-point V/f curves. You can change the V/f curves output by the VFD 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: $0 \leq f_1 \leq f_2 \leq f_3 \leq \text{Motor fundamental frequency}$, and, $0 \leq V_1 \leq V_2 \leq V_3 \leq \text{Motor rated voltage}$.



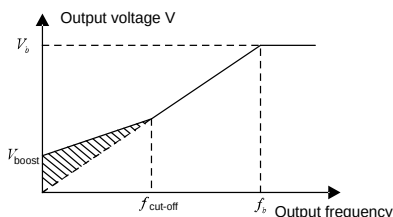
The VFD provides dedicated function codes for the SVPWM mode. You can improve the space voltage control performance by means of setting.

(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 VFD 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 VFD can search for the max. efficiency point to keep running 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

The SVPWM control mode belongs to an open-loop mode. Sudden motor load changes cause motor speed fluctuation. In cases where strict speed requirements must be met, you can set the slip compensation gain to compensate for the speed change caused by load fluctuation through VFD internal output adjustment.

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) × (Number of motor pole pairs)/60

(4) Oscillation suppression

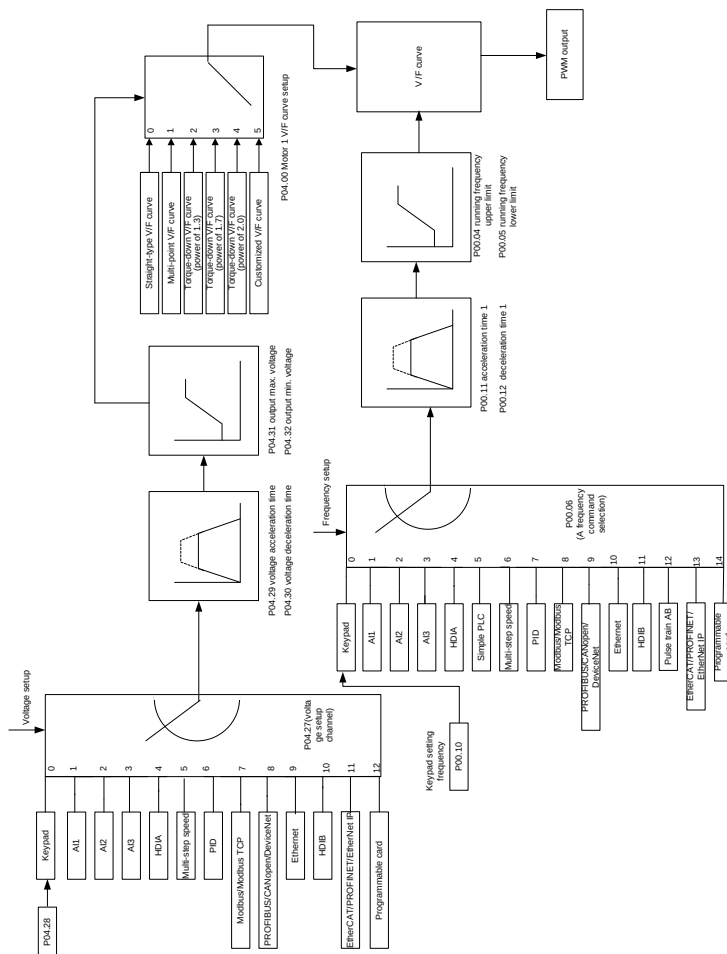
Motor oscillation often occurs in the SVPWM mode in large-power driving applications. To solve this problem, the VFD provides two oscillation factor function codes. You can set the function codes based on the oscillation occurrence frequency.

Note: A greater value indicates better control effect. However, if the value is too large, the VFD output current may be too large.

(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 VFD. 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.

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: FVC mode Note: Before using a vector control mode, enable the VFD to perform motor parameter autotuning first.	2
P00.03	Max. output frequency	Max(P00.04,10.00)–599.00Hz	50.00 Hz
P00.04	Running frequency upper limit	P00.05– P00.03	50.00 Hz
P00.05	Running frequency lower limit	0.00 Hz–P00.04	0.00 Hz
P00.11	ACC time 1	0.0–3600.0 s	Depends on model
P00.12	DEC time 1	0.0–3600.0 s	Depends on model
P02.00	Motor 1 type	0: Asynchronous motor (AM) 1: Synchronous motor (SM)	0
P02.02	Rated frequency of AM 1	0.01 Hz–P00.03 (Max. output frequency)	50.00 Hz
P02.04	AM 1 rated voltage	0–1200 V	Depends on model
P04.00	Motor 1 V/f curve setting	0: Straight-line 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	0.0%: (automatic); 0.1%–10.0%	0.0%
P04.02	Motor 1 torque boost cut-off	0.0%–50.0% (of the rated frequency of motor 1)	20.0%
P04.03	Motor 1 V/f frequency point 1	0.00 Hz–P04.05	0.00 Hz

Function code	Name	Description	Default
P04.04	Motor 1 V/f voltage point 1	0.0%–110.0%	0.0%
P04.05	Motor 1 V/f frequency point 2	P04.03–P04.07	0.00Hz
P04.06	Motor 1 V/f voltage point 2	0.0%–110.0%	0.0%
P04.07	Motor 1 V/f frequency point 3	P04.05–P02.02 or P04.05–P02.16	0.00Hz
P04.08	Motor 1 V/f voltage point 3	0.0%–110.0%	0.0%
P04.09	Motor 1 V/f slip compensation gain	0.0–200.0%	100.0%
P04.10	Motor 1 low-frequency oscillation suppression factor	0–100	10
P04.11	Motor 1 high-frequency oscillation suppression factor	0–100	10
P04.12	Motor 1 oscillation suppression threshold frequency	0.00Hz–P00.03 (Max. output frequency)	30.00Hz
P04.13	Motor 2 V/f curve setting	0: Straight-line 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	0.0%: (automatic); 0.1%–10.0%	0.0%
P04.15	Motor 2 torque boost cut-off	0.0%–50.0% (of the rated frequency of motor 2)	20.0%
P04.16	Motor 2 V/f frequency point 1	0.00Hz–P04.18	0.00Hz
P04.17	Motor 2 V/f voltage point 1	0.0%–110.0%	0.0%
P04.18	Motor 2 V/f frequency point 2	P04.16–P04.20	0.00Hz

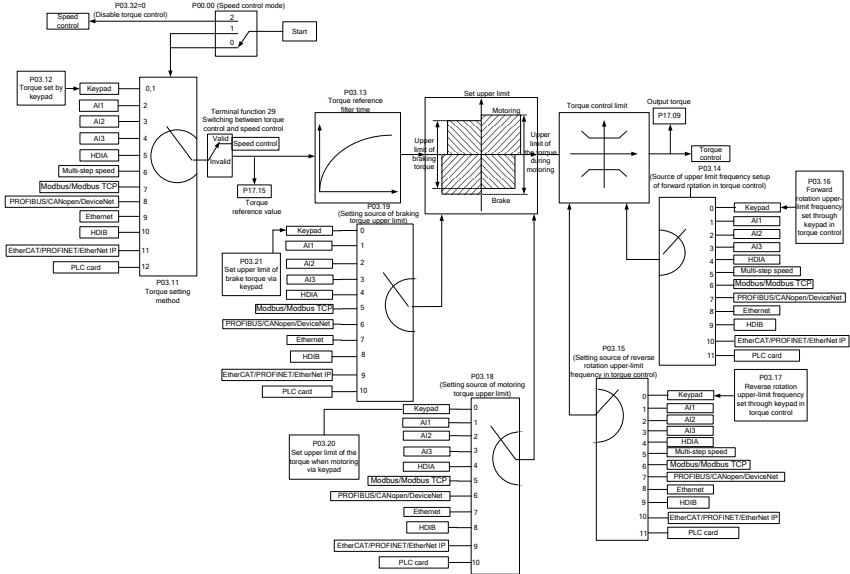
Function code	Name	Description	Default
P04.19	Motor 2 V/f voltage point 2	0.0%–110.0%	0.0%
P04.20	Motor 2 V/f frequency point 3	P04.18–P12.02 or P04.18–P12.16	0.00Hz
P04.21	Motor 2 V/f voltage point 3	0.0%–110.0%	0.0%
P04.22	Motor 2 V/f slip compensation gain	0.0–200.0%	100.0%
P04.23	Motor 2 low-frequency oscillation suppression factor	0–100	10
P04.24	Motor 2 high-frequency oscillation suppression factor	0–100	10
P04.25	Motor 2 oscillation suppression threshold frequency	0.00Hz–P00.03 (Max. output frequency)	30.00Hz
P04.26	Energy-save run	0: Disable 1: Automatic energy-saving run	0
P04.27	Voltage setting channel	0: Keypad; output voltage is determined by P04.28. 1: AI1 2: AI2 3: AI3 4: HDIA 5: Multi-step voltage setting 6: PID 7: Modbus/Modbus TCP communication 8: PROFIBUS/CANopen/DeviceNet communication 9: Ethernet communication 10: HDIB 11: EtherCAT/PROFINET/EtherNet IP communication 12: PLC card 13: Reserved	0
P04.28	Voltage set through keypad	0.0%–100.0% (of the motor rated voltage)	100.0%

Function code	Name	Description	Default
P04.29	Voltage increase time	0.0–3600.0 s	5.0 s
P04.30	Voltage decrease time	0.0–3600.0 s	5.0 s
P04.31	Max. output voltage	P04.32 –100.0% (of the motor rated voltage)	100.0%
P04.32	Min. output voltage	0.0%–P04.31 (of the motor rated voltage)	0.0%
P04.33	Flux weakening coefficient in constant power zone	1.00–1.30	1.00
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)	20.0%
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 higher 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 coefficient 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

Function code	Name	Description	Default
P04.40	Enabling IF mode for AM 1	0: Invalid 1: Enable	0
P04.41	Current setting in IF mode for AM 1	When IF control is adopted for AM 1, the function code is used to set the output current. The value is a percentage of the motor rated current. Setting range: 0.0–200.0%	120.0%
P04.42	Proportional coefficient in IF mode for AM 1	When IF control is adopted for AM 1, the function code is used to set the proportional coefficient of the output current closed-loop control. Setting range: 0–5000	350
P04.43	Integral coefficient in IF mode for AM 1	When IF control is adopted for AM 1, the function code is used to set the integral coefficient of the output current closed-loop control. Setting range: 0–5000	150
P04.44	Starting frequency point for switching off IF mode for AM 1	0.00Hz–P04.50	10.00Hz
P04.45	Enabling IF mode for AM 2	0: Invalid 1: Enable	0
P04.46	Current setting in IF mode for AM 2	When IF control is adopted for AM 2, the function code is used to set the output current. The value is a percentage of the motor rated current. Setting range: 0.0–200.0%	120.0%
P04.47	Proportional coefficient in IF mode for AM 2	When IF control is adopted for AM 2, the function code is used to set the proportional coefficient of output current closed-loop control. Setting range: 0–5000	350
P04.48	Integral coefficient in IF mode for AM 2	When IF control is adopted for AM 2, the function code is used to set the integral coefficient of output current closed-loop control. Setting range: 0–5000	150
P04.49	Starting frequency point for switching off IF mode for AM 2	0.00Hz–P04.51	10.00Hz
P04.50	End frequency point for switching off IF mode for AM 1	P04.44–P00.03	25.00Hz
P04.51	End frequency point for switching off IF mode for AM 2	P04.49– P00.03	25.00Hz

5.5.5 Torque control

The VFD supports torque control and speed control. Speed control aims to stabilize the speed to keep the set speed consistent with the actual running speed while the max. load-carrying capacity is restricted by the torque limit. Torque control aims to stabilize the torque to keep the set torque consistent with the actual output torque while the output frequency is restricted by the upper and lower limits.



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: FVC mode Note: Before using a vector control mode, enable the VFD to perform motor parameter autotuning first.	2
P03.32	Torque control enable	0: Disable 1: Enable	0
P03.11	Torque setting method	0–1: Keypad (P03.12) 2: AI1 3: AI2 4: AI3 5: Pulse frequency HDIA	0

Function code	Name	Description	Default
		6: Multi-step speed 7: Modbus/Modbus TCP communication 8: PROFIBUS/CANopen/DeviceNet communication 9: Ethernet communication 10: Pulse frequency HDIB 11: EtherCAT/PROFINET/EtherNet IP communication 12: PLC card Note: For these settings, 100% corresponds to the motor rated current.	
P03.12	Torque set through keypad	-300.0%–300.0% (of the motor rated current)	20.0%
P03.13	Torque reference filter time	0.000–10.000 s	0.010 s
P03.14	Setting source of forward rotation upper-limit frequency in torque control	0: Keypad (P03.16) 1: AI1 2: AI2 3: AI3 4: Pulse frequency HDIA 5: Multi-step speed 6: Modbus/Modbus TCP communication 7: PROFIBUS/CANopen/DeviceNet communication 8: Ethernet communication 9: Pulse frequency HDIB 10: EtherCAT/PROFINET/EtherNet IP communication 11: PLC card 12: Reserved Note: 100% corresponds to the max. frequency.	0
P03.15	Setting source of reverse rotation upper-limit frequency in torque control	0: Keypad (P03.17) 1: AI1 2: AI2 3: AI3 4: Pulse frequency HDIA 5: Multi-step speed 6: Modbus/Modbus TCP communication 7: PROFIBUS/CANopen/DeviceNet communication 8: Ethernet communication 9: Pulse frequency HDIB 10: EtherCAT/PROFINET/EtherNet IP communication 11: PLC card 12: Reserved Note: 100% corresponds to the max. frequency.	0

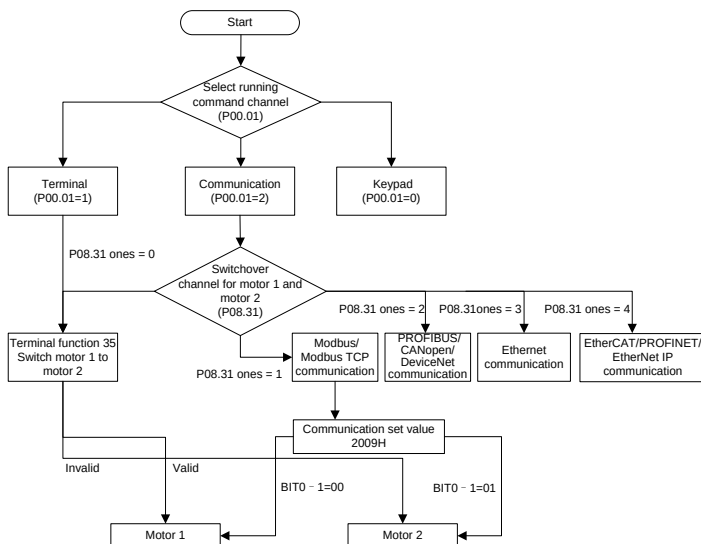
Function code	Name	Description	Default
P03.16	Forward rotation upper-limit frequency set through keypad in torque control	0.00Hz–P00.03 (Max. output frequency)	50.00Hz
P03.17	Reverse rotation upper-limit frequency set through keypad in torque control	0.00Hz–P00.03 (Max. output frequency)	50.00Hz
P03.18	Setting source of motoring torque upper limit	0: Keypad (P03.20) 1: AI1 2: AI2 3: AI3 4: Pulse frequency HDIA 5: Modbus/Modbus TCP communication 6: PROFIBUS/CANopen/DeviceNet communication 7: Ethernet communication 8: Pulse frequency HDIB 9: EtherCAT/PROFINET/EtherNet IP communication 10: PLC card 11: Reserved Note: 100% corresponds to the motor rated current.	0
P03.19	Setting source of braking torque upper limit	0: Keypad (P03.21) 1: AI1 2: AI2 3: AI3 4: Pulse frequency HDIA 5: Modbus/Modbus TCP communication 6: PROFIBUS/CANopen/DeviceNet communication 7: Ethernet communication 8: Pulse frequency HDIB 9: EtherCAT/PROFINET/EtherNet IP communication 10: PLC card 11: Reserved Note: 100% corresponds to the motor rated current.	0
P03.20	Motoring torque upper limit set through keypad	0.0–300.0% (of the motor rated current)	180.0%

Function code	Name	Description	Default
P03.21	Braking torque upper limit set through keypad	0.0–300.0% (of the motor rated current)	180.0%
P17.09	Output torque	-250.0–250.0%	0.0%
P17.15	Torque reference value	-300.0–300.0% (of the motor rated current)	0.0%

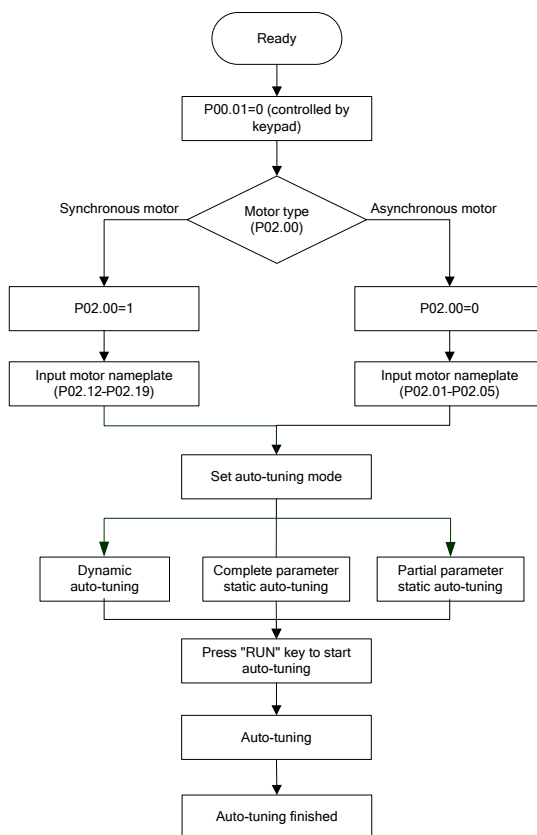
5.5.6 Motor parameters

	✧ 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 VFD may malfunction or 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 VFD can drive both AMs and SMs, 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 VFD 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.
- 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 addition, 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 addition, autotune P02.06–P02.10 for AMs and autotune P02.20–P02.22 for SMs. P02.23 (SM 1 back-EMF) can be obtained through calculation.

- 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 switch-over channel of motor 1 and motor 2 by setting the ones place of P08.31.

Related parameter list:

Function code	Name	Description	Default
P00.01	Channel of run commands	0: Keypad 1: Terminal 2: Communication	0
P00.15	Motor parameter autotuning	0: No operation 1: Dynamic autotuning; comprehensive motor parameter autotuning. It is recommended to use dynamic autotuning when high control accuracy is required. 2: Complete parameter static autotuning; used in scenarios where the motor cannot be disconnected from load. 3: Partial parameter static autotuning; when the present motor is motor 1, only P02.06, P02.07, and P02.08 need to be autotuned; when the present motor is motor 2, only P12.06, P12.07, and P12.08 need to be autotuned. 4: Dynamic autotuning 2; similar to dynamic autotuning 1, but only valid for AMs 5: Partial parameter static autotuning 2; only valid for AMs	0
P02.00	Motor 1 type	0: Asynchronous motor (AM) 1: Synchronous motor (SM)	0
P02.01	Rated power of AM 1	0.1–3000.0 kW	Depends on model
P02.02	Rated frequency of AM 1	0.01Hz–P00.03 (Max. output frequency)	50.00Hz
P02.03	AM 1 rated speed	1–60000rpm	Depends on model
P02.04	AM 1 rated voltage	0–1200V	Depends on model
P02.05	AM 1 rated current	0.8–6000.0A	Depends on model
P02.06	AM 1 stator resistance	0.001–65.535Ω	Depends on model

Function code	Name	Description	Default
P02.07	AM 1 rotor resistance	0.001–65.535Ω	Depends on model
P02.08	AM 1 leakage inductance	0.1–6553.5mH	Depends on model
P02.09	AM 1 mutual inductance	0.1–6553.5mH	Depends on model
P02.10	AM 1 no-load current	0.1–6553.5A	Depends on model
P02.15	Rated power of SM 1	0.1–3000.0 kW	Depends on model
P02.16	SM 1 rated frequency	0.01Hz–P00.03 (Max. output frequency)	50.00Hz
P02.17	SM 1 pole pair count	1–128	2
P02.18	SM 1 rated voltage	0–1200V	Depends on model
P02.19	SM 1 rated current	0.8–6000.0A	Depends on model
P02.20	SM 1 stator resistance	0.001–65.535Ω	Depends on model
P02.21	SM 1 direct-axis inductance	0.01–655.35mH	Depends on model
P02.22	SM 1 quadrature-axis inductance	0.01–655.35mH	Depends on model
P02.23	SM 1 back-EMF	0–10000	300
P05.01– P05.06	Function selection of multifunction digital input terminals (S1–S4, HDIA, and HDIB)	35: Switch from motor 1 to motor 2	/
P08.31	Switching between motor 1 and motor 2	0x00–0x14 Ones place: Switching channel selection 0: Terminal 1: Modbus/Modbus TCP communication 2: PROFIBUS/CANopen/DeviceNet communication 3: Ethernet communication 4: EtherCAT/PROFINET/ EtherNet IP communication Tens place: Enable switching during running 0: Disable 1: Enable	0x00

Function code	Name	Description	Default
P12.00	Motor 2 type	0: Asynchronous motor (AM) 1: Synchronous motor (SM)	0
P12.01	AM 2 rated power	0.1–3000.0 kW	Depends on model
P12.02	AM 2 rated frequency	0.01Hz–P00.03 (Max. output frequency)	50.00Hz
P12.03	AM 2 rated speed	1–60000rpm	Depends on model
P12.04	AM 2 rated voltage	0–1200V	Depends on model
P12.05	AM 2 rated current	0.8–6000.0A	Depends on model
P12.06	AM 2 stator resistance	0.001–65.535Ω	Depends on model
P12.07	AM 2 rotor resistance	0.001–65.535Ω	Depends on model
P12.08	AM 2 leakage inductance	0.1–6553.5mH	Depends on model
P12.09	AM 2 mutual inductance	0.1–6553.5mH	Depends on model
P12.10	AM 2 no-load current	0.1–6553.5A	Depends on model
P12.15	SM 2 rated power	0.1–3000.0 kW	Depends on model
P12.16	SM 2 rated frequency	0.01Hz–P00.03 (Max. output frequency)	50.00Hz
P12.17	SM 2 pole pair count	1–50	2
P12.18	SM 2 rated voltage	0–1200V	Depends on model
P12.19	SM 2 rated current	0.8–6000.0A	Depends on model
P12.20	SM 2 stator resistance	0.001–65.535Ω	Depends on model
P12.21	SM 2 direct-axis inductance	0.01–655.35mH	Depends on model
P12.22	SM 2 quadrature-axis inductance	0.01–655.35mH	Depends on model
P12.23	SM 2 back-EMF constant	0–10000	300

5.5.7 Start/stop control

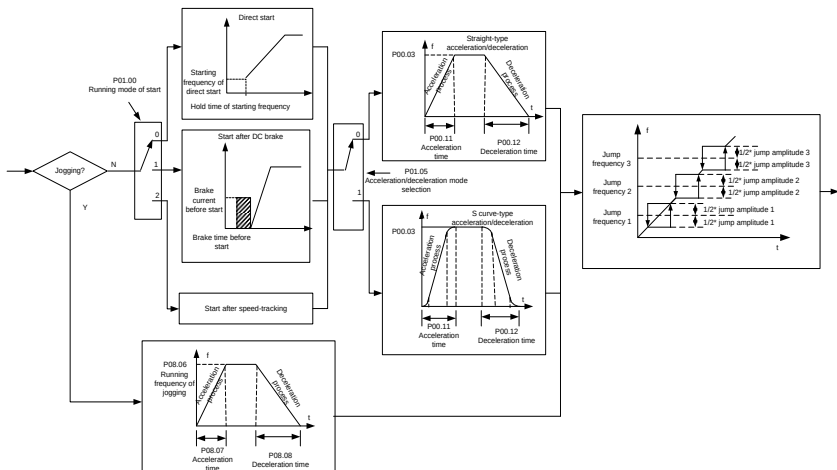
The start/stop control of the VFD involves three states: start after a running command is given at power-on; start after power-off restart is effective; start after automatic fault reset. The three start/stop control states are described in the following.

There are three start modes for the VFD, 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.

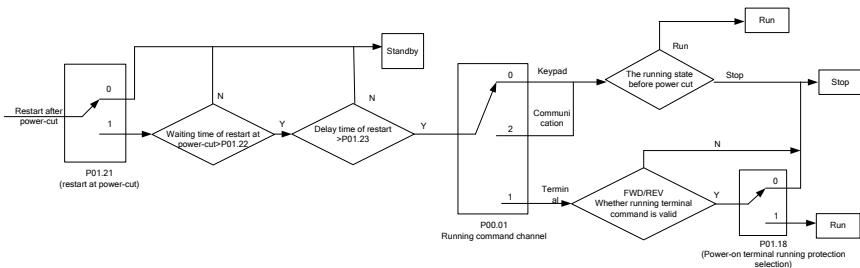
For large-inertia load, especially in cases where reversal may occur, you can choose to start after DC braking or start after speed tracking.

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

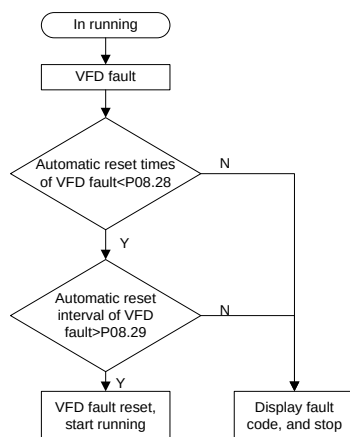
1. Logic diagram for start after a running command is given at power-on



2. Logic diagram for start after power-off restart is effective



3. Logic diagram for start after automatic fault reset



Related parameter list:

Function code	Name	Description	Default
P00.01	Channel of run commands	0: Keypad 1: Terminal 2: Communication	0
P00.11	ACC time 1	0.0–3600.0 s	Depends on model
P00.12	DEC time 1	0.0–3600.0 s	Depends on model
P01.00	Start mode	0: Direct start 1: Start after DC braking 2: Start after speed tracking	0
P01.01	Starting frequency of direct start	0.00–50.00 Hz	0.50Hz
P01.02	Starting frequency hold time	0.0–50.0 s	0.0 s
P01.03	Braking current before start	0.0–100.0%	0.0%
P01.04	DC braking time before start	0.00–50.00 s	0.00 s
P01.05	ACC/DEC mode	0: Linear 1: S curve Note: If mode 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

Function code	Name	Description	Default
P01.09	Starting frequency for braking at stop	0.00Hz–P00.03 (Max. output frequency)	0.00Hz
P01.10	Wait time before DC braking for stop	0.00–30.00 s	0.00 s
P01.11	DC braking current at stop	0.0–100.0% (percentage relative to the VFD rated output current)	0.0%
P01.12	DC braking time at stop	0.00–50.00 s	0.00 s
P01.13	FWD/REV run deadzone time	0.0–3600.0 s	0.0 s
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	0
P01.15	Stop speed	0.00–100.00 Hz	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-on	0: Terminal run command invalid at power-on 1: Terminal run command valid at power-on	0
P01.19	Action when running frequency falls below the lower limit (valid when frequency lower limit > 0)	0x00–0x12 Ones place: Action selection 0: Run at the frequency lower limit 1: Stop 2: Sleep Tens place: Stop mode 0: Coast to stop 1: Decelerate to stop	0x00
P01.20	Wake-up-from-sleep delay	0.0–3600.0 s (valid when the ones place of P01.19 is 2)	0.0 s
P01.21	Power-loss restart selection	0: Disable 1: Enable	0
P01.22	Wait time for restart after power-off	0.0–3600.0 s (valid only when P01.21=1)	1.0 s
P01.23	Start delay time	0.0–600.0 s	0.0 s
P01.24	Stop speed delay time	0.0–600.0 s	0.0 s

Function code	Name	Description	Default
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	0.0–60.0 s	2.0 s
P01.27	Time of starting segment of DEC S curve	0.0–50.0 s	0.1 s
P01.28	Time of ending segment of DEC S curve	0.0–50.0 s	0.1 s
P01.29	Short-circuit braking current	0.0–150.0% (percentage relative to the VFD rated output current)	0.0%
P01.30	Short-circuit braking hold time at start	0.00–50.00 s	0.00 s
P01.31	Short-circuit braking hold time at stop	0.00–50.00 s	0.00 s
P01.32	Pre-excitation time for jogging	0–10.000 s	0.000 s
P01.33	Starting frequency of braking for stop in jogging	0.00 Hz–P00.03	0.00 Hz
P01.34	Sleep entry delay time	0–3600.0 s	0.0 s
P05.01–P05.06	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	0.0–3600.0 s	Depends on model
P08.01	DEC time 2	0.0–3600.0 s	Depends on model
P08.02	ACC time 3	0.0–3600.0 s	Depends on model
P08.03	DEC time 3	0.0–3600.0 s	Depends on model

Function code	Name	Description	Default
P08.04	ACC time 4	0.0–3600.0 s	Depends on model
P08.05	DEC time 4	0.0–3600.0 s	Depends on model
P08.06	Running frequency of jog	0.00Hz–P00.03 (Max. output frequency)	5.00Hz
P08.07	ACC time for jog	0.0–3600.0 s	Depends on model
P08.08	DEC time for jog	0.0–3600.0 s	Depends on model
P08.19	Switching frequency of ACC/DEC time	0.00–P00.03 (Max. output frequency) 0.00Hz: No switchover Switches to ACC/DEC time 2 when the running frequency is greater than P08.19.	0
P08.21	Base frequency of ACC/DEC time	0: Max. output frequency 1: Set frequency 2: 100Hz Note: Valid for straight-line ACC/DEC only.	0
P08.28	Auto fault reset count	0–10	0
P08.29	Auto fault reset interval	0.1–3600.0 s	1.0 s

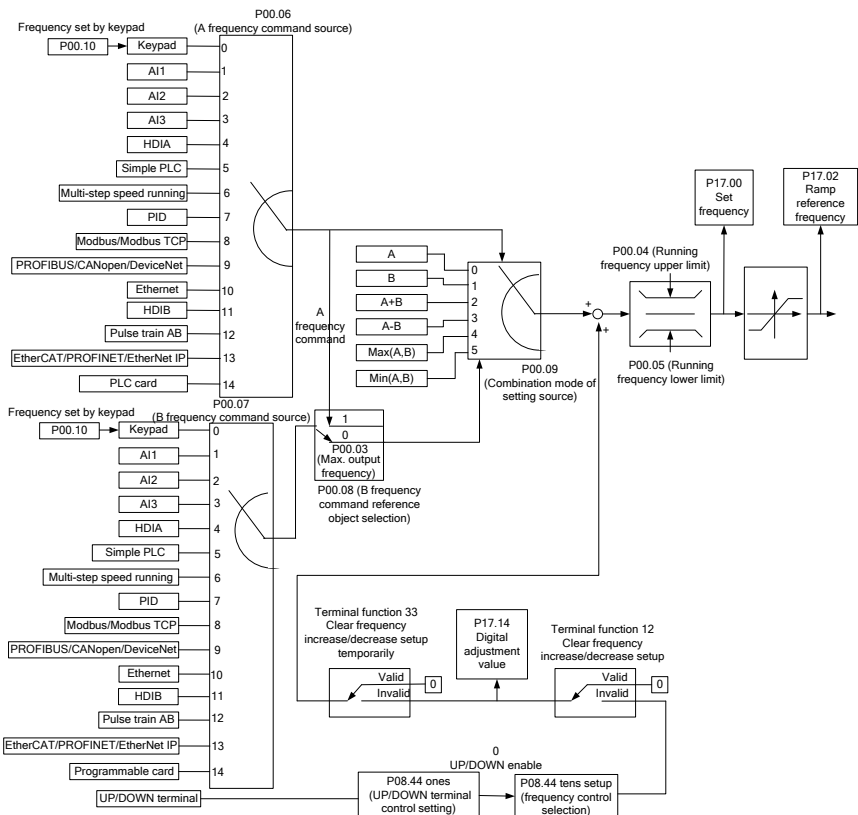
5.5.8 Frequency setting

The VFD supports multiple kinds of frequency reference modes, which can be categorized into two types: 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** switch input. By setting function codes, you can enable the corresponding reference mode and the impact made on the VFD frequency reference by this reference mode.

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

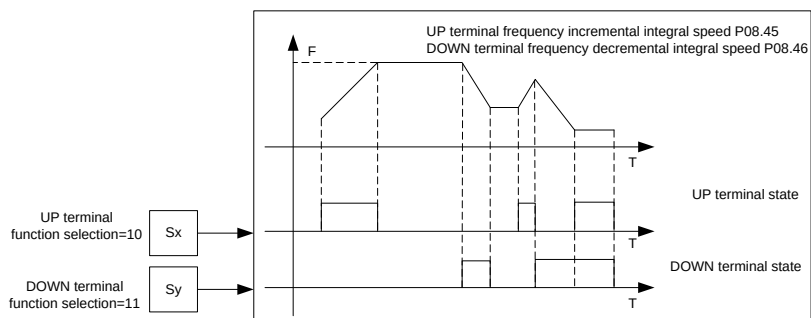


The VFD supports switchover between different reference channels, and the rules for channel switchover are shown as follows.

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 this multifunction terminal is invalid under present reference channel.

When setting the auxiliary frequency inside the VFD through multifunction terminals UP (10) and DOWN (11), you can increase/decrease the frequency quickly by setting P08.45 (UP terminal frequency increment rate) and P08.46 (DOWN terminal frequency decrement rate).



Related parameter list:

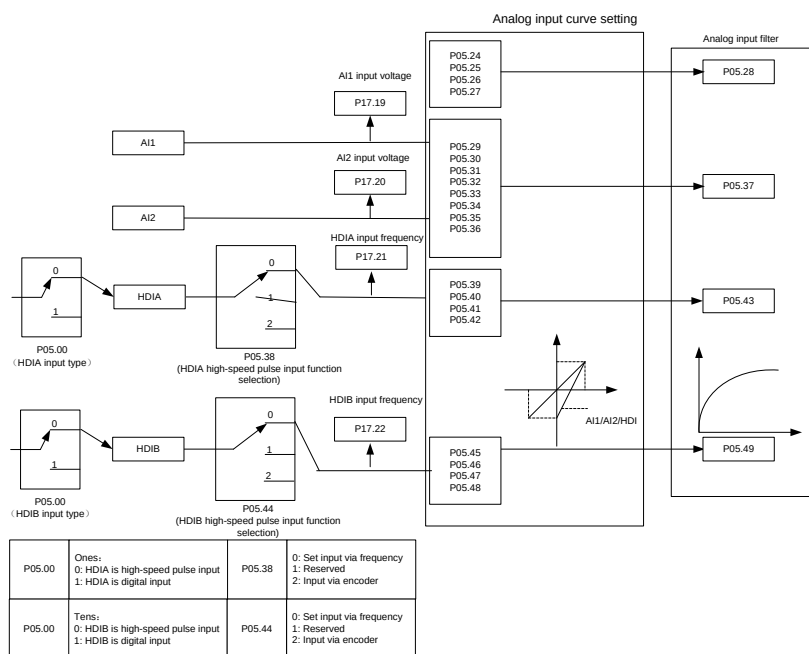
Function code	Name	Description	Default
P00.03	Max. output frequency	Max (P00.04, 10.00) – 590.00 Hz	50.00 Hz
P00.04	Running frequency upper limit	P00.05– P00.03	50.00 Hz
P00.05	Running frequency lower limit	0.00 Hz–P00.04	0.00 Hz
P00.06	A frequency command source	0: Keypad	0
P00.07	B frequency command source	1: AI1 2: AI2 3: AI3 4: High-speed pulse HDIA 5: Simple PLC program 6: Multi-step speed running 7: PID control 8: Modbus/Modbus TCP communication 9: PROFIBUS/CANopen/DeviceNet communication 10: Ethernet communication 11: High-speed pulse HDIB 12: Pulse train AB 13: EtherCAT/PROFINET/EtherNet IP communication 14: PLC card 15: Reserved	15
P00.08	Reference object of B frequency command	0: Max. output frequency 1: A frequency command	0

Function code	Name	Description	Default
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– P05.06	Function selection of multifunction digital input terminals (S1–S4, HDIA, and HDIB)	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	<u>UP/DOWN</u> terminal control setting	0x000–0x221 Ones place: Whether the setting made through <u>UP/DOWN</u> is valid. 0: The setting made through <u>UP/DOWN</u> is valid. 1: The setting made through <u>UP/DOWN</u> 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 increment rate	0.01–50.00Hz/s	0.50Hz/s
P08.46	DOWN terminal frequency decrement rate	0.01–50.00Hz/s	0.50Hz/s
P17.00	Set frequency	0.00Hz–P00.03 (Max. output frequency)	0.00Hz

Function code	Name	Description	Default
P17.02	Ramp reference frequency	0.00Hz–P00.03 (Max. output frequency)	0.00Hz
P17.14	Digital adjustment value	0.00Hz–P00.03	0.00Hz

5.5.9 Analog input

The VFD is equipped as standard with two analog input terminals—AI1 supports 0–10 V or 0–20 mA input, with the input type selectable through P05.50, while AI2 supports -10 V to +10 V input—and two high-speed pulse input terminals. Each input can be filtered independently. The corresponding reference curve can be configured by setting the reference values associated with the minimum and maximum input values.



Related parameter list:

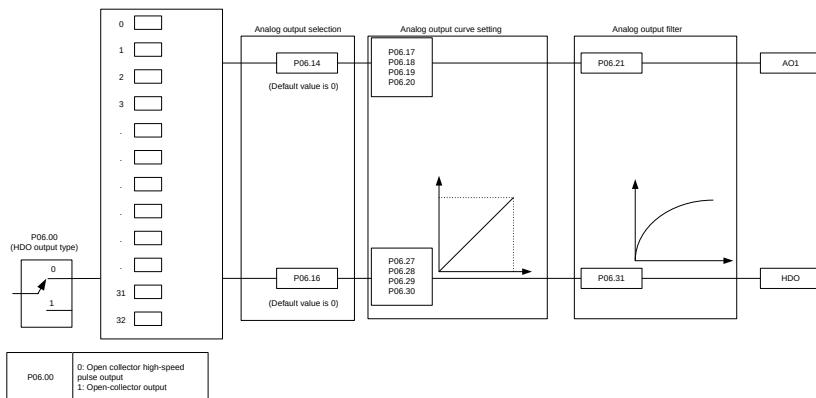
Function code	Name	Description	Default
P05.00	HDI input type	0x00–0x11 Ones place: HDIA input type 0: HDIA is high-speed pulse input 1: HDIA is digital input	0x00

Function code	Name	Description	Default
		Tens place: HDIB input type 0: HDIB is high-speed pulse input 1: HDIB is digital input	
P05.24	AI1 lower limit	0.00V–P05.26	0.00V
P05.25	Corresponding setting of AI1 lower limit	-300.0%–300.0%	0.0%
P05.26	AI1 upper limit	P05.24–10.00V	10.00V
P05.27	Corresponding setting of AI1 upper limit	-300.0%–300.0%	100.0%
P05.28	AI1 input filter time	0.000–10.000 s	0.030 s
P05.29	AI2 lower limit	-10.00V–P05.31	-10.00V
P05.30	Corresponding setting of AI2 lower limit	-300.0%–300.0%	-100.0%
P05.31	AI2 middle value 1	P05.29–P05.33	0.00V
P05.32	Corresponding setting of AI2 middle value 1	-300.0%–300.0%	0.0%
P05.33	AI2 middle value 2	P05.31–P05.35	0.00V
P05.34	Corresponding setting of AI2 middle value 2	-300.0%–300.0%	0.0%
P05.35	AI2 upper limit	P05.33–10.00V	10.00V
P05.36	Corresponding setting of AI2 upper limit	-300.0%–300.0%	100.0%
P05.37	AI2 input filter time	0.000 s–10.000 s	0.030 s
P05.38	HDIA high-speed pulse input function selection	0: Frequency setting input 1: Reserved 2: Input set through encoder, used together with HDIB	0
P05.39	HDIA lower limit frequency	0.000kHz–P05.41	0.000kHz
P05.40	Corresponding setting of HDIA lower limit frequency	-300.0%–300.0%	0.0%
P05.41	HDIA upper limit frequency	P05.39–50.000kHz	50.000kHz
P05.42	Corresponding setting of HDIA upper limit frequency	-300.0%–300.0%	100.0%
P05.43	HDIA frequency input filter time	0.000–10.000 s	0.030 s
P05.44	HDIB high-speed pulse input function selection	0: Frequency setting input 1: Reserved 2: Input set through encoder, used together with HDIA	0

Function code	Name	Description	Default
P05.45	HDIB lower limit frequency	0.000kHz–P05.47	0.000kHz
P05.46	Corresponding setting of HDIB lower limit frequency	-300.0%–300.0%	0.0%
P05.47	HDIB upper limit frequency	P05.45–50.000kHz	50.000kHz
P05.48	Corresponding setting of HDIB upper limit frequency	-300.0%–300.0%	100.0%
P05.49	HDIB frequency input filter time	0.000–10.000 s	0.030 s
P05.50	AI1 input signal type	0–1 0: Voltage 1: Current	0

5.5.10 Analog output

The VFD carries one analog output terminal (0–10 V/0–20 mA) and one high-speed pulse output terminal. 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.



AO output relationship description:

(By default, the minimum and maximum output values are mapped to 0.0% and 100.0% of the pulse or analog output, respectively. The actual output voltage or pulse frequency corresponds to the actual percentage, which can be set through function codes.)

Set value	Function	Description
0	Running frequency	0–Max. output frequency
1	Set frequency	0–Max. output frequency
2	Ramp reference frequency	0–Max. output frequency
3	Rotational speed	0–Synchronous speed corresponding to max. output frequency
4	Output current (relative to the VFD)	0–Twice the VFD rated current
5	Output current (relative to motor)	0–Twice the motor rated current
6	Output voltage	0–1.5 times the VFD rated voltage
7	Output power	0–Twice the motor rated power
8	Set torque value (bipolar)	0–Twice the motor rated current. A negative value corresponds to 0.0% by default.
9	Output torque (absolute value)	0– $\pm$ (Twice the motor rated torque)
10	AI1 input	0–10 V/0–20 mA
11	AI2 input	-10 V–10 V. A negative value corresponds to 0.0% by default.
12	AI3 input	0–10 V/0–20 mA
13	High-speed pulse HDIA input	0.00–50.00 kHz
14	Modbus/Modbus TCP communication setting value 1	0–1000
15	Modbus/Modbus TCP communication setting value 2	0–1000
16	PROFIBUS/CANopen/DeviceNet communication setting value 1	0–1000
17	PROFIBUS/CANopen/DeviceNet communication setting value 2	0–1000
18	Ethernet communication setting value 1	0–1000
19	Ethernet communication setting value 2	0–1000
20	High-speed pulse HDIB input	0.00–50.00 kHz
21	EtherCAT/PROFINET/EtherNet IP communication setting value 1	0–1000. A negative value corresponds to 0.0% by default.
22	Torque current (bipolar)	0–Three times the motor rated current. A negative value corresponds to 0.0% by default.
23	Exciting current	0–Three times the motor rated current. A negative value corresponds to 0.0% by default.
24	Set frequency (bipolar)	0–Max. output frequency. A negative value corresponds to 0.0% by default.
25	Ramp reference frequency (bipolar)	0–Max. output frequency. A negative value corresponds to 0.0% by default.

Set value	Function	Description
26	Rotational speed (bipolar)	0–Synchronous rotation speed corresponding to max. output frequency. A negative value corresponds to 0.0% by default.
27	EtherCAT/PROFINET/EtherNet IP communication setting value 2	0–1000
28	C_AO1 from the PLC card	0–1000
29	C_AO2 from the PLC card	0–1000
30	Rotational speed	0–Twice the motor rated synchronous rotation speed
31	Output torque (bipolar)	0–Twice the motor rated torque. A negative value corresponds to 0.0% by default.
32	AIAO detected temperature output	AO output temperature in the AIAO temperature detection.

Related parameter list:

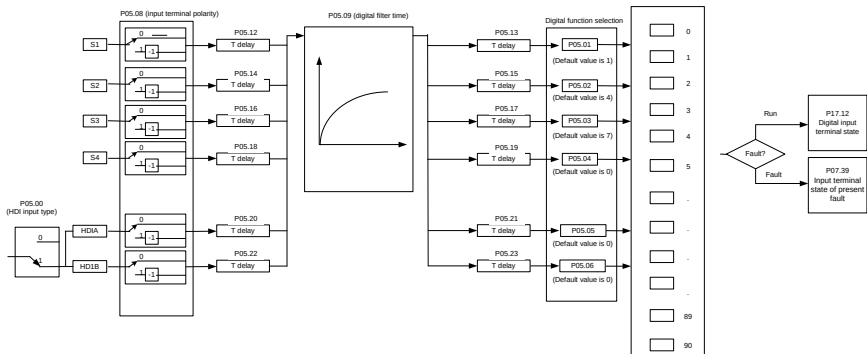
Function code	Name	Description	Default
P06.00	HDO output type	0: Open collector high-speed pulse output 1: Open collector output	0
P06.14	AO1 output	0: Running frequency (0–Max. output frequency)	0
P06.15	Reserved		0
P06.16	HDO high-speed pulse output	1: Set frequency (0–Max. output frequency) 2: Ramp reference frequency (0–Max. output 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%)	0

Function code	Name	Description	Default
		corresponds to twice the motor rated torque) 10: AI1 input (0–10 V/0–20 mA) 11: AI2 input (-10–10 V) 12: AI3 input (0–10 V/0–20 mA) 13: HDIA input value (0.00–50.00 kHz) 14: Modbus/Modbus TCP communication setting value 1 (0–1000) 15: Modbus/Modbus TCP communication setting value 2 (0–1000) 16: PROFIBUS/CANopen/DeviceNet communication setting value 1 (0–1000) 17: PROFIBUS/CANopen/DeviceNet communication setting value 2 (0–1000) 18: Ethernet communication setting value 1 (0–1000) 19: Ethernet communication setting value 2 (0–1000) 20: HDIB input value (0.00–50.00 kHz) 21: EtherCAT/PROFINET/ EtherNet IP setting value 1 (0–1000) 22: Torque current (bipolar, 100% corresponds to triple the motor rated current) 23: Exciting current (bipolar, 100% corresponds to triple the motor rated current) 24: Set frequency (bipolar, 0–Max. output frequency) 25: Ramp reference frequency (bipolar, 0–Max. output frequency) 26: Rotational speed (bipolar, 0–Speed corresponding to max. output) 27: EtherCAT/PROFINET/ EtherNet IP setting value 2 (0–1000) 28: C_AO1 from the PLC card (Set P27.00 to 1.0.) (0–1000) 29: C_AO2 from the PLC card (Set P27.00 to 1.0.) (0–1000) 30: Rotational speed of running (100% corresponds to the speed at twice the motor rated frequency)	

Function code	Name	Description	Default
		31: Output torque (Actual value, 100% corresponds to twice the motor rated torque) 32: AIAO detected temperature output 33–63: Reserved	
P06.17	AO1 output lower limit	-300.0%–P06.19	0.0%
P06.18	AO1 output corresponding to lower limit	0.00–10.00V	0.00V
P06.19	AO1 output upper limit	P06.17–300.0%	100.0%
P06.20	AO1 output corresponding to upper limit	0.00–10.00V	10.00V
P06.21	AO1 output filter time	0.000–10.000 s	0.000 s
P06.27	HDO output lower limit	-300.0%–P06.29	0.0%
P06.28	HDO output corresponding to lower limit	0.00–50.00 kHz	0.0kHz
P06.29	HDO output upper limit	P06.27–300.0%	100.0%
P06.30	HDO output corresponding to upper limit	0.00–50.00 kHz	50.00kHz
P06.31	HDO output filter time	0.000–10.000 s	0.000 s

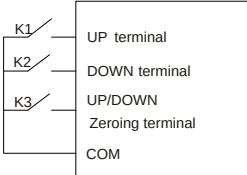
5.5.11 Digital input

The VFD comes standard with four programmable digital input terminals and two HDI input terminals. The function of all the digital input terminals can be programmed through function codes. HDI input terminal can be set to act as high-speed pulse input terminal or common digital input terminal; if it is set to act as high-speed pulse input terminal, you can also set HDIA or HDIB high-speed pulse input to serve as the frequency reference and encoder signal input.



This parameter is used to set the corresponding function of digital multi-function input terminals.

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

Set value	Function	Description
0	No function	The VFD does not act even if there is signal input. Set unused terminals to "no function" to avoid misaction.
1	Run forward (FWD)	Control the forward/reverse running of the VFD by external terminals.
2	Run reversely (REV)	
3	Three-wire running control	The terminal is used to determine the three-wire running control of the VFD. For details, see the description for P05.13.
4	FWD jog	For details about frequency of jogging running and ACC/DEC time of jogging running, see the description for P08.06, P08.07, and P08.08.
5	REV jog	
6	Coast to stop	The VFD blocks output, and the stop process of motor is not controlled by the VFD. This mode is applied in the scenarios with large-inertia loads and without stop time requirements. Its definition is the same as P01.08, and it is mainly used in remote control.
7	Fault reset	External fault reset function, same as the reset function of the STOP/RS1 key on the keypad. You can use this function to reset faults remotely.
8	Pause running	The VFD decelerates to stop, however, all the run parameters are in memory state, such as PLC parameter, wobbling frequency, and PID parameter. After this signal disappears, the VFD will revert to the state before stop.
9	External fault input	After receiving the external fault signal, the VFD reports the fault and stops.
10	Increase frequency setting (UP)	Used to change the frequency increase/decrease command when the frequency is given by external terminals. 
11	Decrease frequency setting (DOWN)	
12	Clear the frequency increase/decrease setting	

The terminal used to clear frequency-increase/decrease setting can clear the frequency value of auxiliary channel set by **UP/DOWN**, thus restoring the reference frequency to the frequency given by main reference frequency command channel.

Set value	Function	Description																				
13	Switch between A setting and B setting	The function is used to switch between the frequency setting channels.																				
14	Switch between combination setting and A setting	Function 13 can implement the switchover between A frequency reference channel and B frequency reference channel; function 14 can implement the switchover between the combination channel set by P00.09 and the A frequency reference channel; function 15 can implement the switchover between the combination channel set by P00.09 and the B frequency reference channel.																				
15	Switch between combination setting and B setting																					
16	Multi-step speed terminal 1																					
17	Multi-step speed terminal 2	A total of 16-step speeds can be set by combining digital states of these four terminals.																				
18	Multi-step speed terminal 3	Note: Multi-step speed 1 is the low-order bit, and multi-step speed 4 is the high-order bit.																				
19	Multi-step speed terminal 4		<table><tr><th>Multi-step speed 4</th><th>Multi-step speed 3</th><th>Multi-step speed 2</th><th>Multi-step speed 1</th></tr><tr><td>Bit3</td><td>Bit2</td><td>Bit1</td><td>Bit0</td></tr></table>	Multi-step speed 4	Multi-step speed 3	Multi-step speed 2	Multi-step speed 1	Bit3	Bit2	Bit1	Bit0											
Multi-step speed 4	Multi-step speed 3	Multi-step speed 2	Multi-step speed 1																			
Bit3	Bit2	Bit1	Bit0																			
20	Pause multi-step speed running	The multi-step speed selection terminals are disabled, and the current setpoint is retained																				
21	ACC/DEC time selection 1	The status of the two terminals can be combined to select four groups of ACC/DEC time.																				
22	ACC/DEC time selection 2		<table><tr><th>Terminal 1</th><th>Terminal 2</th><th>ACC/DEC time</th><th>Parameter</th></tr><tr><td>OFF</td><td>OFF</td><td>ACC/DEC time 1</td><td>P00.11/P00.12</td></tr><tr><td>ON</td><td>OFF</td><td>ACC/DEC time 2</td><td>P08.00/P08.01</td></tr><tr><td>OFF</td><td>ON</td><td>ACC/DEC time 3</td><td>P08.02/P08.03</td></tr><tr><td>ON</td><td>ON</td><td>ACC/DEC time 4</td><td>P08.04/P08.05</td></tr></table>	Terminal 1	Terminal 2	ACC/DEC time	Parameter	OFF	OFF	ACC/DEC time 1	P00.11/P00.12	ON	OFF	ACC/DEC time 2	P08.00/P08.01	OFF	ON	ACC/DEC time 3	P08.02/P08.03	ON	ON	ACC/DEC time 4
Terminal 1	Terminal 2	ACC/DEC time	Parameter																			
OFF	OFF	ACC/DEC time 1	P00.11/P00.12																			
ON	OFF	ACC/DEC time 2	P08.00/P08.01																			
OFF	ON	ACC/DEC time 3	P08.02/P08.03																			
ON	ON	ACC/DEC time 4	P08.04/P08.05																			
23	Simple PLC stop reset	Used to clear the previous PLC state memory information and restart the simple PLC process.																				
24	Pause simple PLC	When this function is activated during PLC operation, the program is paused and the VFD continues to run at the speed of the current step. After the function is deactivated, simple PLC operation resumes.																				
25	Pause PID control	PID is ineffective temporarily, and the VFD maintains current frequency output.																				
26	Pause wobbling frequency (stop at current frequency)	The VFD pauses at current output. After this function is canceled, it continues wobbling-frequency operation at current frequency.																				

Set value	Function	Description
27	Reset wobbling frequency (back to center frequency)	The set frequency of VFD is returned to the center frequency.
28	Reset the counter	The counter is cleared.
29	Switch between speed control and torque control	The VFD switches from torque control mode to speed control mode, or vice versa.
30	Disable ACC/DEC	Used to ensure the VFD is not impacted by external signals (except for stop command), and maintains the present output frequency.
31	Trigger the counter	Used to enable the counter to count pulses.
33	Clear the frequency increase/decrease setting temporarily	When the terminal is closed, the frequency value set by UP/DOWN can be cleared to restore the reference frequency to the frequency given by frequency command channel; when the terminal is opened, it restores to the frequency value after frequency increase/decrease setting.
34	DC braking	After the command becomes valid, the VFD will begin DC braking immediately.
35	Switch between motor 1 and motor 2	When the function is enabled, you can realize switchover control of two motors.
36	Switch the running command channel to keypad	When the function is enabled, the running command channel is switched to keypad. When the function is disabled, the running command channel is restored to the previous setting.
37	Switch the running command channel to terminal	When the function is enabled, the running command channel is switched to terminal. When the function is disabled, the running command channel is restored to the previous setting.
38	Switch the running command channel to communication	When the function is enabled, the running command channel is switched to communication. When the function is disabled, the running command channel is restored to the previous setting.
39	Pre-exciting command	When the function is enabled, motor pre-exciting is started until the function becomes invalid.
40	Clear power consumption quantity	When the function is enabled, the electricity consumption of the VFD is cleared.
41	Keep power consumption quantity	When the command is valid, the present operation of the VFD does not affect the electricity consumption data.
42	Switch the setting source of braking torque upper limit to keypad	The torque upper limit is set through the keypad when the command is valid.

Set value	Function	Description
43	Position reference point input	Only valid for S2, S3, and S4.
44	Disable spindle orientation	Spindle positioning is disabled.
45	Spindle zeroing / Local positioning zeroing	Trigger the spindle positioning function.
46	Spindle zeroing position selection 1	Spindle zeroing position 1 selected through terminal.
47	Spindle zeroing position selection 2	Spindle zeroing position 2 selected through terminal.
48	Spindle indexing selection 1	Spindle indexing value 1 selected through terminal.
49	Spindle indexing selection 2	Spindle indexing value 2 selected through terminal.
50	Spindle indexing selection 3	Spindle indexing value 3 selected through terminal.
51	Terminal for switching between position control and speed control	Switch between position control and speed control.
52	Disable pulse input	When the terminal is active, the pulse input is invalid.
53	Clear position deviation	Clears the input deviation of the position loop.
54	Switch position proportional gains	Switches the position proportional gains.
55	Cyclic digital positioning enable	Enables cyclic positioning in digital positioning mode.
56	Emergency stop	When the function is enabled, the motor decelerates to stop in emergency manner according to the time specified by P01.26.
57	Motor overtemperature fault input	When a motor overtemperature fault signal is input, the VFD stops the motor and reports a fault.
59	Switch to V/f control	When the function is enabled in stopped state, space voltage vector control is used.
60	Switch to FVC control	When the function is enabled in stopped state, FVC is used.
61	Switch PID polarities	Used to switch the PID output polarity. It is used together with P09.03.
62	Reserved	/
63	Enabling servo	When the thousands place of P21.00 is set to enable servo, the servo enabling terminal is valid, which controls the VFD to enter zero servo control. At this time, the start command is not needed.
64	FWD max. limit	Max frequency limit on forward rotation.

Set value	Function	Description
65	REV max limit	Max frequency limit on reverse rotation.
66	Clear encoder counting	Zero out the position counting value.
67	Pulse increase	If the terminal is valid when the function is selected, the pulse input is increased according to P21.27 (Pulse superposition speed).
68	Enable pulse superposition	When the pulse superimposition is enabled, pulse increase and pulse decrease are effective.
69	Pulse decrease	If the terminal is valid when the function is selected, the pulse input is decreased according to P21.27 (Pulse superposition speed).
70	Electronic gear selection	If the terminal is valid when the function is selected, the proportional numerator is switched to P21.30 (Numerator of the 2nd command ratio).
71	Switch to the master	When the function is enabled in stopped state, the unit switches to the master mode.
72	Switch to the slave	When the function is enabled in stopped state, the unit switches to the slave mode.
73	Rolling diameter reset	If the terminal is valid when the tension-specific function is used, the terminal resets the roll diameter.
74	Winding/unwinding switchover	If the terminal is valid when the tension-specific function is used, the terminal switches between the winding mode and unwinding mode.
75	Tension control pre-driving	If the terminal is valid when the tension-specific function is used, the VFD performs tension control pre-driving.
76	Disabling roll diameter calculation	If the terminal is valid when the tension-specific function is used, the VFD does not calculate the roll diameter.
77	Clearing alarm display	If the terminal is valid when the tension-specific function is used, tension alarm display is cleared.
78	Manual braking in tension control	If the terminal is valid when the tension-specific function is used, manual braking is allowed.
79	Forced material-break trigger	If the terminal is valid when the tension-specific function is used, the VFD triggers a forced material-break signal.
80	Initial roll diameter selection 1	If the terminal is valid when the tension-specific function is used, this function works in combination with Initial roll diameter selection 2 to select different initial roll diameters.
81	Initial roll diameter selection 2	If the terminal is valid when the tension-specific function is used, this function works in combination with Initial roll diameter selection 1 to select different initial roll diameters.

Set value	Function	Description
82	Fire override trigger	If the terminal is valid when the fire mode is enabled, the VFD triggers a fire control signal.
83	PID switchover in tension control	If the terminal is valid when the tension-specific function is used, the terminal switches from the first group of PID parameter to the second group. The first group is the default PID parameter group.
86	Carrier synchronization mode switches to standalone running (valid when stopped)	/
87	Carrier synchronization mode running signal	Carrier synchronization mode active signal.
88	Carrier synchronization mode run permissive signal	Signal indicating that the system allows carrier synchronization mode.
89	Carrier synchronization mode relay output running	The system allows the VFD to output to the motor.
90	Carrier synchronization relay open feedback signal	Relay feedback signal.

Related parameter list:

Function code	Name	Description	Default
P05.00	HDI input type	0x00–0x11 Ones place: HDIA input type 0: HDIA is high-speed pulse input 1: HDIA is digital input Tens place: HDIB input type 0: HDIB is high-speed pulse input 1: HDIB is digital input	0x00
P05.01	S1 function	0: No function	1
P05.02	S2 function	1: Forward run	4
P05.03	S3 function	2: Reverse run	7
P05.04	S4 function	3: Three-wire running control	0
P05.05	HDIA function	4: Forward jog	0
P05.06	HDIB function	5: Reverse jog 6: Coast to stop 7: Fault reset 8: Run pause	0

Function code	Name	Description	Default
		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 running command channel to communication	

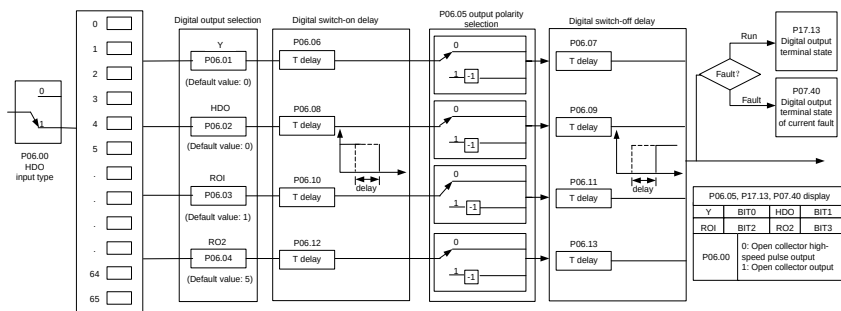
Function code	Name	Description	Default
		39: Pre-excitation command 40: Clear energy consumption 41: Keep energy consumption 42: Switch the setting source of torque upper limit to keypad 43: Position reference point input (only valid for S2, S3 and S4) 44: Spindle orientation inhibit 45: Spindle zeroing/local 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 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: Clear encoder counting 67: Pulse increment 68: Pulse superposition enable 69: Decrease pulses 70: Electronic gear selection 71: Switch to the master 72: Switch to the slave 73: Roll diameter reset 74: Winding/unwinding switchover 75: Tension control pre-driving	

Function code	Name	Description	Default
		76: Disable roll diameter calculation 77: Clear alarm display 78: Manual braking in tension control 79: Forced material-break trigger 80: Initial roll diameter selection 1 81: Initial roll diameter selection 2 82: Fire override trigger 83: Tension PID switchover 84–85: Reserved 86: Carrier synchronization mode switches to standalone running (valid when stopped) 87: Carrier synchronization mode running signal 88: Carrier synchronization mode run permissive signal 89: Carrier synchronization mode relay output running 90: Carrier synchronization relay open feedback signal 91–95: Reserved	
P05.08	Input terminal polarity	0x00–0x3F	0x00
P05.09	Digital input filter time	0.000–1.000 s	0.010 s
P05.10	Virtual terminal setting	0x00–0x3F (0: disable, 1: enable) Bit0: S1 virtual terminal Bit1: S2 virtual terminal Bit2: S3 virtual terminal Bit3: S4 virtual terminal Bit4: HDIA virtual terminal Bit5: HDIB virtual terminal	0x00
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	0.000–50.000 s	0.000 s
P05.13	S1 switch-off delay	0.000–50.000 s	0.000 s
P05.14	S2 switch-on delay	0.000–50.000 s	0.000 s
P05.15	S2 switch-off delay	0.000–50.000 s	0.000 s
P05.16	S3 switch-on delay	0.000–50.000 s	0.000 s

Function code	Name	Description	Default
P05.17	S3 switch-off delay	0.000–50.000 s	0.000 s
P05.18	S4 switch-on delay	0.000–50.000 s	0.000 s
P05.19	S4 switch-off delay	0.000–50.000 s	0.000 s
P05.20	HDIA switch-on delay	0.000–50.000 s	0.000 s
P05.21	HDIA switch-off delay	0.000–50.000 s	0.000 s
P05.22	HDIB switch-on delay	0.000–50.000 s	0.000 s
P05.23	HDIB switch-off delay	0.000–50.000 s	0.000 s
P07.39	Input terminal status at present fault	/	0x0000
P17.12	Digital input terminal status	/	0x00

5.5.12 Digital output

The VFD comes standard with two groups of relay output terminals, one open collector Y output terminal and one high-speed pulse output (HDO) terminal. All digital output terminal functions can be programmed via function codes. The HDO terminals select high-speed pulse output or digital output through function code setting.



The following table lists the function code options. A same output terminal function can be repeatedly selected.

Set value	Function	Description
0	Invalid	The output terminal does not have any function.
1	Running	The ON signal is output when there is frequency output during running.
2	Running forward	The ON signal is output when there is frequency output during forward running.
3	Running reversely	The ON signal is output when there is frequency output during reverse running.
4	Jogging	The ON signal is output when there is frequency output

Set value	Function	Description
		during jogging.
5	VFD fault	The ON signal is output when a VFD fault occurs.
6	Frequency level detection FDT1	Refer to the descriptions for P08.32 and P08.33.
7	Frequency level detection FDT2	Refer to the descriptions for P08.34 and P08.35.
8	Frequency reached	Refer to the description for P08.36.
9	Running in zero speed	The ON signal is output when the VFD output frequency and reference frequency are both zero.
10	Upper limit frequency reached	The ON signal is output when the running frequency reaches the upper limit.
11	Lower limit frequency reached	The ON signal is output when the running frequency reaches the lower limit frequency.
12	Ready for running	The ON signal is output when main circuit and control circuit powers are established, the protection functions do not act, and the VFD is ready to run.
13	Pre-exciting	The ON signal is output when the VFD is in pre-exciting.
14	Overload pre-alarm	The ON signal is output when the condition exceeds the specified threshold for the configured pre-alarm time; for details, see descriptions for P11.08–P11.10.
15	Underload pre-alarm	The ON signal is output after the alarm time elapsed based on the alarm threshold. For details, see the descriptions for P11.11–P11.12.
16	Simple PLC stage completed	When the present state of the simple PLC is completed, it outputs a signal.
17	Simple PLC cycle completed	When a single cycle of the simple PLC is completed, it outputs a signal.
23	Modbus/Modbus TCP communication virtual terminal output	A signal is output based on the value set through Modbus/Modbus TCP communication. When the value is 1, the ON signal is output; when the value is 0, the OFF signal is output.
24	PROFIBUS/CANopen/DeviceNet communication virtual terminal output	A signal is output based on the value set through PROFIBUS/CANopen communication. When the value is 1, the ON signal is output; when the value is 0, the OFF signal is output.
25	Ethernet communication virtual terminal output	A signal is output based on the value set through Ethernet communication. When the value is 1, the ON signal is output; when the value is 0, the OFF signal is output.
26	DC bus voltage established	When the bus voltage is higher than the inverter undervoltage, the output is valid.

Set value	Function	Description
27	Z pulse output	When the encoder Z pulse is reached, the output is valid, which becomes invalid 10 ms later.
28	In pulse superposition	When the pulse superposition terminal input function is valid, the output is valid.
29	STO action	When an STO fault occurs, the output is valid.
30	Positioning completed	When positioning is completed, the output is valid.
31	Spindle zeroing completed	When spindle zeroing is completed, the output is valid.
32	Spindle indexing completed	When spindle indexing is completed, the output is valid.
33	In speed limit	When the frequency is limited, the output is valid.
34	EtherCAT/PROFINET/EtherNet IP communication virtual terminal output	A signal is output based on the value set through PROFINET communication. When the value is 1, the ON signal is output; when the value is 0, the OFF signal is output.
35	Reserved	/
36	Speed/position control switchover completed	When the mode switchover is completed, the output is valid.
37	Any frequency reached	The frequency reaching signal is output when the ramp reference frequency is greater than the detected value of frequency reaching.
38–40	Reserved	/
41	Y1	Y1 from the PLC card
42	Y2	Y2 from the PLC card
43	HDO	HDO from the PLC card
44	RO1	RO1 from the PLC card
45	RO2	RO2 from the PLC card
46	RO3	RO3 from the PLC card
47	RO4	RO4 from the PLC card
48	EC PT100 detected OT alarm	Overtemperature (OT) alarm detected by the expansion card (EC) with PT100.
49	EC PT1000 detected OT alarm	Overtemperature (OT) alarm detected by the EC with PT1000.
50	AI/AO detected OT alarm	Overtemperature (OT) alarm detected by the temperature detection AI or AO terminal.
51	Stopped or running in zero speed	The VFD is stopped or running at zero speed.
52	Tension control disconnection	Disconnection is detected when the tension-specific function disconnection detection is enabled.
53	Specified roll diameter reached	The specified roll diameter is reached when the tension-specific function is enabled.

Set value	Function	Description
54	Max. roll diameter reached	The max. roll diameter is reached when the tension-specific function is enabled.
55	Min. roll diameter reached	The min. roll diameter is reached when the tension-specific function is enabled.
56	Fire mode enabled	The fire mode is enabled.
57	S1 terminal state	Select the S terminal input status for RO output.
58	S2 terminal state	
59	S3 terminal state	
60	S4 terminal status	
61	HDIA terminal state	Select the HDI terminal input status for RO output.
62	HDIB terminal state	
63–64	Reserved	/
65	Carrier synchronization relay output selection	Selects the relay output used to indicate that the system allows the VFD to output to the motor.

Related parameter list:

Function code	Name	Description	Default
P06.00	HDO output type	0: Open collector high-speed pulse output 1: Open collector output	0
P06.01	Y1 output	0: Invalid	0
P06.02	HDO output	1: Running	0
P06.03	RO1 output	2: Running forward	1
P06.04	RO2 output	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: Upper limit frequency reached 11: Frequency lower limit reached 12: Ready for running 13: Pre-exciting 14: Overload pre-alarm 15: Underload pre-alarm 16: Simple PLC stage completed	5

Function code	Name	Description	Default
		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/Modbus TCP communication virtual terminal output 24: PROFIBUS/CANopen/DeviceNet communication virtual terminal output 25: Ethernet communication virtual terminal output 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 limit reached in torque control 34: EtherCAT/PROFINET/EtherNet IP communication virtual terminal output 35: Reserved 36: Speed/position control switching completed 37: Any frequency reached 38–40: Reserved 41: Y1 from the PLC card (Set P27.00 to 1.) 42: Y2 from the PLC card (Set P27.00 to 1.) 43: HDO from the PLC card (Set P27.00 to 1.) 44: RO1 from the PLC card (Set P27.00 to 1.) 45: RO2 from the PLC card (Set P27.00 to 1.) 46: RO3 from the PLC card (Set P27.00 to 1.) 47: RO4 from PLC (Set P27.00 to 1.) 48: EC PT100 detected OT alarm 49: EC PT1000 detected OT alarm 50: AIAO detected OT alarm 51: Stopped or running in zero speed	

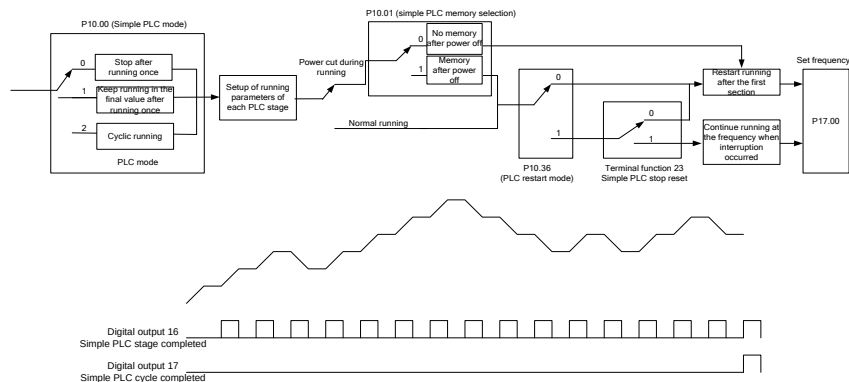
Function code	Name	Description	Default
		52: Tension control disconnection 53: Specified roll diameter reached 54: Max. roll diameter reached 55: Min. roll diameter reached 56: Fire mode enabled 57: S1 terminal state 58: S2 terminal state 59: S3 terminal state 60: S4 terminal state 61: HDIA terminal state 62: HDIB terminal state 63–64: Reserved 65: Carrier synchronization relay output selection	
P06.05	Output terminal polarity	0x00–0x0F	0x00
P06.06	Y1 switch-on delay	0.000–50.000 s	0.000 s
P06.07	Y1 switch-off delay	0.000–50.000 s	0.000 s
P06.08	HDO switch-on delay	0.000–50.000 s (valid when P06.00 is 1)	0.000 s
P06.09	HDO switch-off delay	0.000–50.000 s (valid when P06.00 is 1)	0.000 s
P06.10	RO1 switch-on delay	0.000–50.000 s	0.000 s
P06.11	RO1 switch-off delay	0.000–50.000 s	0.000 s
P06.12	RO2 switch-on delay	0.000–50.000 s	0.000 s
P06.13	RO2 switch-off delay	0.000–50.000 s	0.000 s
P07.40	Output terminal state at present fault		0x0000
P17.13	Digital output terminal status		0x00

5.5.13 Simple PLC

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

The VFD can realize 16-step speed control, and provide four groups of acceleration/deceleration time to choose from.

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



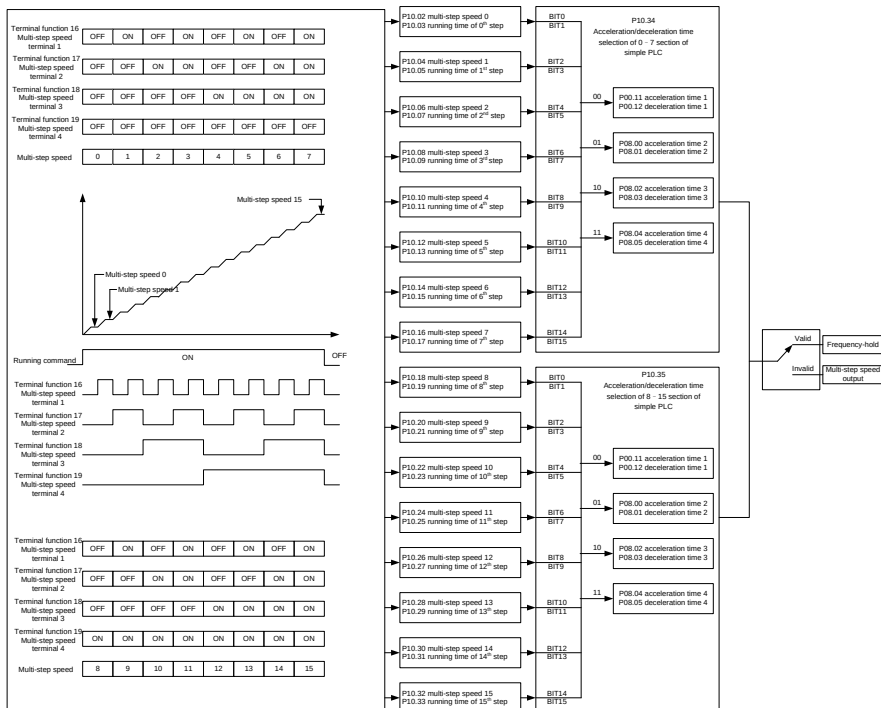
Related parameter list:

Function code	Name	Description	Default
P05.01–P05.06	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	-300.0–300.0%	0.0%
P10.03	Step 0 run time	0.0–6553.5 s (min)	0.0 s
P10.04	Multi-step speed 1	-300.0–300.0%	0.0%
P10.05	Step 1 run time	0.0–6553.5 s (min)	0.0 s
P10.06	Multi-step speed 2	-300.0–300.0%	0.0%
P10.07	Step 2 run time	0.0–6553.5 s (min)	0.0 s
P10.08	Multi-step speed 3	-300.0–300.0%	0.0%
P10.09	Step 3 run time	0.0–6553.5 s (min)	0.0 s
P10.10	Multi-step speed 4	-300.0–300.0%	0.0%
P10.11	Step 4 run time	0.0–6553.5 s (min)	0.0 s
P10.12	Multi-step speed 5	-300.0–300.0%	0.0%
P10.13	Step 5 run time	0.0–6553.5 s (min)	0.0 s
P10.14	Multi-step speed 6	-300.0–300.0%	0.0%

Function code	Name	Description	Default
P10.15	Step 6 run time	0.0–6553.5 s (min)	0.0 s
P10.16	Multi-step speed 7	-300.0–300.0%	0.0%
P10.17	Step 7 run time	0.0–6553.5 s (min)	0.0 s
P10.18	Multi-step speed 8	-300.0–300.0%	0.0%
P10.19	Step 8 run time	0.0–6553.5 s (min)	0.0 s
P10.20	Multi-step speed 9	-300.0–300.0%	0.0%
P10.21	Step 9 run time	0.0–6553.5 s (min)	0.0 s
P10.22	Multi-step speed 10	-300.0–300.0%	0.0%
P10.23	Step 10 run time	0.0–6553.5 s (min)	0.0 s
P10.24	Multi-step speed 11	-300.0–300.0%	0.0%
P10.25	Step 11 run time	0.0–6553.5 s (min)	0.0 s
P10.26	Multi-step speed 12	-300.0–300.0%	0.0%
P10.27	Step 12 run time	0.0–6553.5 s (min)	0.0 s
P10.28	Multi-step speed 13	-300.0–300.0%	0.0%
P10.29	Step 13 run time	0.0–6553.5 s (min)	0.0 s
P10.30	Multi-step speed 14	-300.0–300.0%	0.0%
P10.31	Step 14 run time	0.0–6553.5 s (min)	0.0 s
P10.32	Multi-step speed 15	-300.0–300.0%	0.0%
P10.33	Step 15 run time	0.0–6553.5 s (min)	0.0 s
P10.34	ACC/DEC time selection for simple PLC steps 0–7	0x0000–0xFFFF	0x0000
P10.35	ACC/DEC time selection for simple PLC steps 8–15	0x0000–0xFFFF	0x0000
P10.36	PLC restart mode	0: Restart from step 1 1: Resume from the paused step	0
P17.00	Set frequency	0.00Hz–P00.03 (Max. output frequency)	0.00Hz
P17.27	Present step of simple PLC	Used to display the present step of the simple PLC function.	0

5.5.14 Multi-step speed running

Set the parameters used in multi-step speed running. The VFD can set 16-step speeds, which are selectable by multi-step speed terminals 1–4, corresponding to multi-step speed 0 to multi-step speed 15.



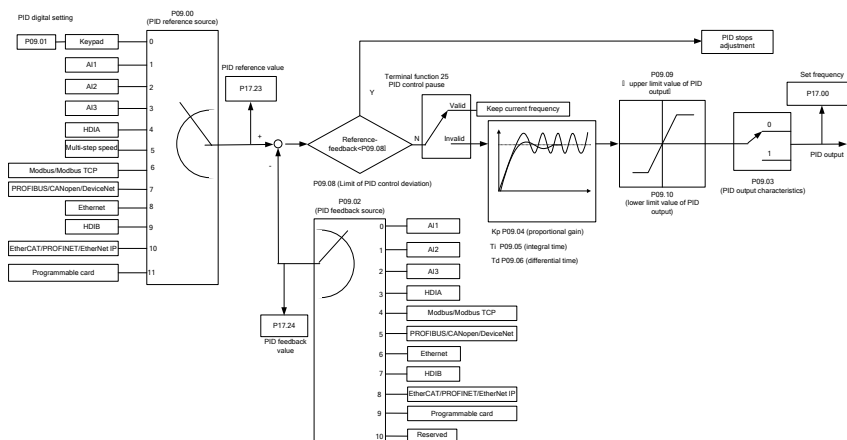
Related parameter list:

Function code	Name	Description	Default
P05.01–P05.06	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	-300.0~300.0%	0.0%
P10.03	Step 0 run time	0.0~6553.5 s (min)	0.0 s
P10.04	Multi-step speed 1	-300.0~300.0%	0.0%
P10.05	Step 1 run time	0.0~6553.5 s (min)	0.0 s

Function code	Name	Description	Default
P10.06	Multi-step speed 2	-300.0–300.0%	0.0%
P10.07	Step 2 run time	0.0–6553.5 s (min)	0.0 s
P10.08	Multi-step speed 3	-300.0–300.0%	0.0%
P10.09	Step 3 run time	0.0–6553.5 s (min)	0.0 s
P10.10	Multi-step speed 4	-300.0–300.0%	0.0%
P10.11	Step 4 run time	0.0–6553.5 s (min)	0.0 s
P10.12	Multi-step speed 5	-300.0–300.0%	0.0%
P10.13	Step 5 run time	0.0–6553.5 s (min)	0.0 s
P10.14	Multi-step speed 6	-300.0–300.0%	0.0%
P10.15	Step 6 run time	0.0–6553.5 s (min)	0.0 s
P10.16	Multi-step speed 7	-300.0–300.0%	0.0%
P10.17	Step 7 run time	0.0–6553.5 s (min)	0.0 s
P10.18	Multi-step speed 8	-300.0–300.0%	0.0%
P10.19	Step 8 run time	0.0–6553.5 s (min)	0.0 s
P10.20	Multi-step speed 9	-300.0–300.0%	0.0%
P10.21	Step 9 run time	0.0–6553.5 s (min)	0.0 s
P10.22	Multi-step speed 10	-300.0–300.0%	0.0%
P10.23	Step 10 run time	0.0–6553.5 s (min)	0.0 s
P10.24	Multi-step speed 11	-300.0–300.0%	0.0%
P10.25	Step 11 run time	0.0–6553.5 s (min)	0.0 s
P10.26	Multi-step speed 12	-300.0–300.0%	0.0%
P10.27	Step 12 run time	0.0–6553.5 s (min)	0.0 s
P10.28	Multi-step speed 13	-300.0–300.0%	0.0%
P10.29	Step 13 run time	0.0–6553.5 s (min)	0.0 s
P10.30	Multi-step speed 14	-300.0–300.0%	0.0%
P10.31	Step 14 run time	0.0–6553.5 s (min)	0.0 s
P10.32	Multi-step speed 15	-300.0–300.0%	0.0%
P10.33	Step 15 run time	0.0–6553.5 s (min)	0.0 s
P10.34	ACC/DEC time selection for simple PLC steps 0–7	0x0000–0xFFFF	0x0000
P10.35	ACC/DEC time selection for simple PLC steps 8–15	0x0000–0xFFFF	0x0000
P17.27	Present step of simple PLC	Used to display the present step of the simple PLC function.	0

5.5.15 PID control

PID control is a widely used method for process control. By performing proportional, integral, and derivative calculations on the deviation between the feedback signal of the controlled variable and the target reference, it adjusts the VFD's output frequency or voltage. This forms a negative feedback system that stabilizes the controlled variable at the target setpoint. It is suitable for process control such as flow control, pressure control, and temperature control. 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 an excessively large gain may cause oscillation. To solve this problem, set the integral time to a large value and the derivative 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 the deviation 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 (T_d): 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 P00.06 or P00.07 (Setting channel of A/B frequency command) is 7 or P04.27 (Voltage setting channel) is 6, the VFD is process PID controlled.

5.5.15.1 General procedures for PID parameter setup

Step 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 occurred. 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.

Step 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 the system oscillates, 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 .

Step 3 Determine derivative time T_d .

The derivative time T_d is generally set to 0.

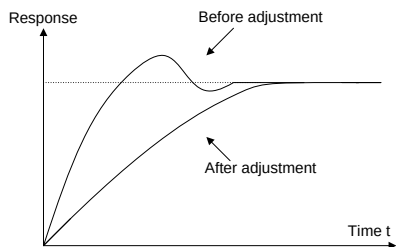
If you need to set T_d to another value, the setting method is similar to that for P and T_i , namely, set T_d to 30% of the value when there is no oscillation.

Step 4 Commission the system first without load and then under load, and then adjust PID parameters until fulfilling the requirement.

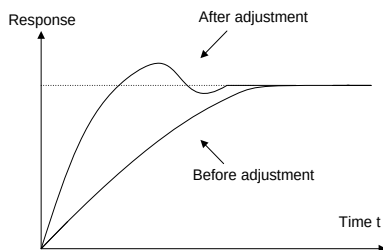
5.5.15.2 PID fine-tuning methods

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

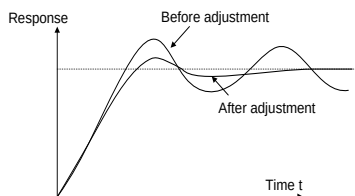
Control overshoot: When overshoot occurs, shorten the differential time (T_d) and prolong integral time (T_i).



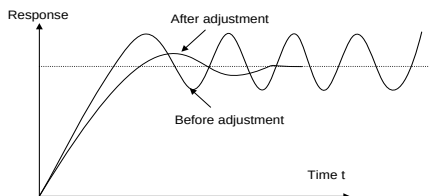
Stabilize the feedback value as fast as possible: When overshoot occurred, shorten integral time (T_i) and prolong differential time (T_d) to stabilize control as fast as possible.



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 short and approximately equal to the set 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:

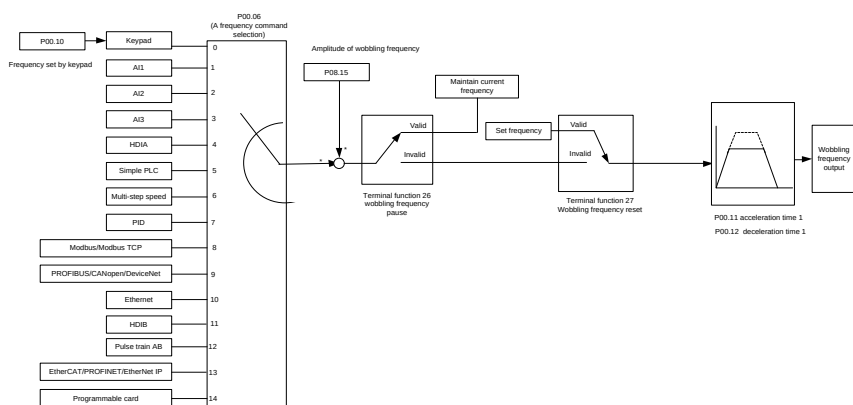
Function code	Name	Description	Default
P09.00	PID reference source	0: Setting through P09.01 1: AI1 2: AI2 3: AI3 4: High-speed pulse HDIA 5: Multi-step speed running 6: Modbus/Modbus TCP communication 7: PROFIBUS/CANopen/DeviceNet communication 8: Ethernet communication 9: High-speed pulse HDIB 10: EtherCAT/PROFINET/EtherNet IP communication 11: PLC card 12: Reserved	0
P09.01	PID digital setting	-100.0%–100.0%	0.0%
P09.02	PID feedback source	0: AI1 1: AI2 2: AI3 3: High-speed pulse HDIA 4: Modbus/Modbus TCP communication 5: PROFIBUS/CANopen/DeviceNet communication 6: Ethernet communication 7: High-speed pulse HDIB 8: EtherCAT/PROFINET/EtherNet IP communication 9: PLC card 10: Reserved	0
P09.03	PID output characteristic selection	0: PID output is positive. 1: PID output is negative.	0
P09.04	Proportional gain (Kp)	0.00–100.00	1.80
P09.05	Integral time (Ti)	0.00–10.00 s	0.90 s
P09.06	Derivative time (Td)	0.00–10.00 s	0.00 s
P09.07	Sampling cycle (T)	0.000–1.000 s	0.001 s

Function code	Name	Description	Default
P09.08	PID control deviation limit	0.0–100.0%	0.0%
P09.09	PID output upper limit	P09.10–100.0% (of max. frequency or voltage)	100.0%
P09.10	PID output lower limit	-100.0%–P09.09 (of max. frequency or voltage)	0.0%
P09.11	Feedback disconnection detection value	0.0–100.0%	0.0%
P09.12	Feedback disconnection detection time	0.0–3600.0 s	1.0 s
P09.13	PID control selection	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 is determined by P08.04.	0x0001
P09.14	Low frequency proportional gain (Kp)	0.00–100.00	1.00
P09.15	PID command ACC/DEC time	0.0–1000.0 s	0.0 s
P09.16	PID output filter time	0.000–10.000 s	0.000 s
P09.17	Reserved	/	/
P09.18	Low frequency integral time (Ti)	0.00–10.00 s	0.90 s
P09.19	Low frequency differential time (Td)	0.00–10.00 s	0.00 s

Function code	Name	Description	Default
P09.20	Low frequency point for PID parameter switching	0.00–P09.21	5.00Hz
P09.21	High frequency point for PID parameter switching	P09.20–P00.03	10.00Hz
P17.00	Set frequency	0.00Hz–P00.03 (Max. output frequency)	0.00Hz
P17.23	PID reference value	-100.0–100.0%	0.0%
P17.24	PID feedback value	-100.0–100.0%	0.0%

5.5.16 Wobble frequency operation

Wobbling frequency is mainly applied in the scenarios where transverse movement and winding functions are needed such as textile and chemical fiber industries. The typical working process is shown as follows.



Function code	Name	Description	Default
P00.03	Max. output frequency	Max (P00.04, 10.00) – 590.00 Hz	50.00Hz
P00.06	A frequency command source	0: Keypad 1: AI1 2: AI2 3: AI3 4: High-speed pulse HDIA 5: Simple PLC program 6: Multi-step speed running 7: PID control	0

Function code	Name	Description	Default
		8: Modbus/Modbus TCP communication 9: PROFIBUS/CANopen/DeviceNet communication 10: Ethernet communication 11: High-speed pulse HDIB 12: AB pulse train 13: EtherCAT/PROFINET/EtherNet IP communication 14: PLC card	
P00.11	ACC time 1	0.0–3600.0 s	Depends on model
P00.12	DEC time 1	0.0–3600.0 s	Depends on model
P05.01–P05.06	Digital input function selection	26: Pause wobbling frequency (stopped at the present frequency) 27: Reset wobbling frequency (returned to the center frequency)	/
P08.15	Wobble frequency amplitude percentage	0.0–100.0% (of the set frequency)	0.0%
P08.16	Amplitude of sudden jump frequency	0.0–50.0% (of the amplitude of wobble frequency)	0.0%
P08.17	Rise time of wobble frequency	0.1–3600.0 s	5.0 s
P08.18	Fall time of wobble frequency	0.1–3600.0 s	5.0 s

5.5.17 Local encoder input

The VFD supports a pulse-counting function by inputting the count pulse from HDI high-speed pulse port. When the actual count value is no less than the set value, a digital output terminal outputs a count-value-reached pulse signal, and the corresponding count value will be zeroed out.

Function code	Name	Description	Default
P05.00	HDI input type	0x00–0x11 Ones place: HDIA input type 0: HDIA is high-speed pulse input 1: HDIA is digital input Tens place: HDIB input type 0: HDIB is high-speed pulse input	0x00

Function code	Name	Description	Default
		1: HDIB is digital input	
P05.38	HDIA high-speed pulse input function selection	0: Frequency setting input 1: Reserved 2: Input set through encoder, used together with HDIB	0
P05.44	HDIB high-speed pulse input function selection	0: Frequency setting input 1: Reserved 2: Input set through encoder, used together with HDIA	0
P18.00	Measured encoder frequency	-999.9–3276.7 Hz	0.0Hz
P20.15	Speed measurement method	0: PG card 1: Locally measured through HDIA and HDIB. Only the 24 V incremental encoders are supported.	0

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

1. Commissioning procedure for closed-loop vector control on AMs

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

Perform rotary parameter autotuning or static parameter autotuning through the keypad. If the motor can be disconnected from 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 that the encoder is installed and set properly.

a) Determine the encoder direction and parameter settings.

Set P20.01 (encoder PPR), set P00.00=2 and P00.10=20.00Hz, and run the VFD. Then the motor rotates at 20.00 Hz. Check whether the speed measurement value of P18.00 is correct. If the value is negative, it indicates the encoder direction is reversed. In this case, set P20.02 to 1. If the speed measurement value deviates greatly, it indicates P20.01 is set improperly. 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.

b) Determine the Z pulse direction.

Set P00.10=20.00 Hz, and set P00.13 (Running direction) to forward and reverse in turn to check whether the difference in P18.02 is less than 5. Power off and swap phase A and phase B of the encoder. Then check the difference in P18.02 between forward rotation and reverse rotation. 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=3, and perform FVC control, and adjust P00.10 and speed loop and current loop PI parameters in group P03 to implement stable run in the entire range.

Step 6 Flux-weakening control

Set the flux-weakening regulator gain P03.26 to a value ranging from 0 to 8000, and check the flux-weakening control effect. You can adjust P03.22–P03.24 as needed.

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 (FVC mode), set P00.03, P00.04, and motor nameplate parameters in group P02.

Step 3 Set P20.01.

When the encoder is resolver-type encoder, set the encoder pulse count value to (resolver pole pair number $\times$ 1024), eg, if pole pair number is 4, set P20.01 to 4096.

Step 4 Verify whether 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 RUN key to run the VFD.

a) Rotary autotuning (P20.11=3)

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

During running, if the ENC10 or ENC1d fault occurs, set P20.02=1 and carry out autotuning again.

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

b) 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 implement stable run in the entire range. If oscillation occurs, reduce the value of P03.00, P03.03, P03.09 and P03.10. 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.

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 indexing 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 to run, and check the control effect and performance of the system.

Step 5 Set P21.00=0001 to set positioning mode to position control, namely pulse-string 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.

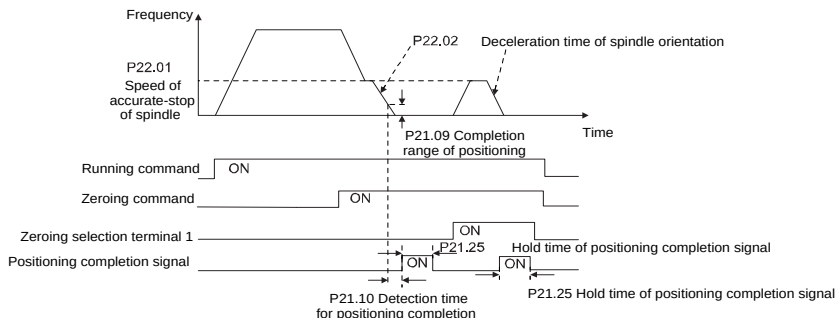
Step 7 When P21.08 (Position controller output limit) is set to 0, the position control will be invalid, and at this point, the pulse train acts as a frequency source, P21.13 (Position feedforward gain) should be set to 100%, the speed ACC/DEC time is determined by the pulse train ACC/DEC time, and the pulse train ACC/DEC time of the system can be adjusted. If the pulse train acts as the frequency source in speed control, you can also set P21.00 to 0000, and set the frequency source reference P00.06 or P00.07 to 12 (Pulse train AB), at this point, the acceleration/deceleration time is determined by the acceleration/deceleration time of the VFD, meanwhile, the parameters of the AB pulse train are still set through group P21. In speed mode, the filter time of pulse train AB 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.

4. Commissioning procedure for spindle orientation

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



Steps 1 to 4 are identical to the first four steps in the commissioning procedures for 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.

Steps 5 Set P22.00.bit0=1 to enable spindle positioning, set P22.00.bit1 to select spindle zero input. If the system adopts encoder for speed measurement, set P22.00.bit1 to 0 to select Z pulse input; if the system adopts photoelectric switch for speed measurement, set P22.00.bit1 to 1 to select photoelectric switch as zero input; set P22.00.bit2 to select zero search mode, set P22.00.bit3 to enable or disable zero calibration, and select zero calibration mode by setting P22.00.bit7.

Step 6 Spindle homing operation

- Select the positioning direction by setting P22.00.bit4.
- 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 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. In order to keep sufficient position-hold force and ensure that the system does not oscillate, 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 1)

Encoder Z pulse positioning supports the following spindle orientation methods:

- a) Encoder installed on the motor shaft: The motor shaft and the spindle are rigidly connected with a 1:1 ratio.
- b) 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 a proximity switch on the spindle.

- c) 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.

At this point, set P20.06 (Speed ratio between motor and encoder mounting shaft), and set P22.14 (Spindle drive ratio) to 1. As the encoder is not installed on the motor, the control performance of closed-loop vector will be affected.

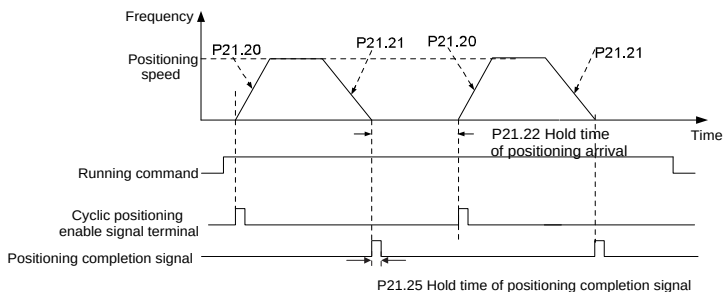
Proximity switch positioning supports the following spindle positioning modes:

- a) The encoder is installed on the spindle, and the motor shaft is connected to the spindle with a belt, the drive ratio is not necessarily 1:1.

At this point, it is required to set P22.14 (Spindle drive ratio).

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

Step 5 Set P21.00=0x0011 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

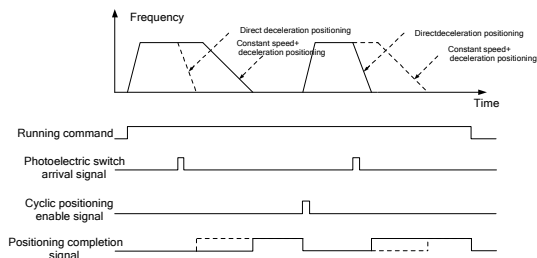
Set P21.16.bit1=0, and the motor will execute a single positioning action according to the settings in step (5) and maintain the position.

Step 7 Cyclic positioning operation

Set P21.16.bit1=1 to enable cyclic positioning. The cyclic positioning is divided into continuous mode and reciprocating mode. You can also carry out cyclic positioning through terminal function 55 (Cyclic digital positioning enable).

6. Commissioning procedure for photoelectric switch orientation positioning

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



Steps 1 to 4 are identical to the first four steps in the commissioning procedures for closed-loop vector control, which aim to fulfill the control requirements of closed-loop vector control.

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

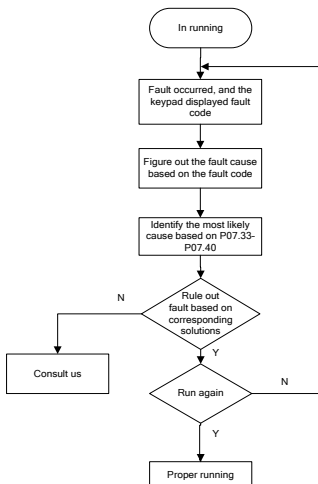
After positioning is done, the motor will stay in the current position. You can set cyclic positioning through input terminal function selection (55: enable cyclic digital positioning) in P05 group; when the terminal receives a cyclic positioning enable signal (pulse signal), the motor will continue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

5.5.19 Troubleshooting

The following provides fault handling information.



Related parameter list:

Function code	Name	Description	Default
P07.27	Most recent fault type	0: No fault	0
P07.28	Last fault type	1: Inverter unit U-phase protection (OUt1)	0
P07.29	2nd-last fault type	2: Inverter unit V-phase protection (OUt2)	0
P07.30	3rd-last fault type	3: Inverter unit W-phase protection (OUt3)	0
P07.31	4th-last fault type	4: Overcurrent during ACC (OC1)	0
P07.32	5th-last fault type	5: Overcurrent during DEC (OC2) 6: Overcurrent during constant speed running (OC3) 7: Overvoltage during ACC (OV1) 8: Overvoltage during DEC (OV2) 9: Overvoltage during constant speed running (OV3) 10: Bus undervoltage fault (UV) 11: Motor overload (OL1) 12: VFD overload (OL2) 13: Phase loss on input side (SPI) 14: Phase loss on output side (SPO) 15: Rectifier module overheating (OH1)	0

Function code	Name	Description	Default
		16: Inverter module overheating (OH2) 17: External fault (EF) 18: Modbus/Modbus TCP communication fault (CE) 19: Current detection fault (ItE) 20: Motor autotuning fault (tE) 21: EEPROM operation error (EEP) 22: PID feedback offline fault (PIDE) 23: Braking unit fault (bCE) 24: Running time reached (END) 25: Electronic overload (OL3) 26: Keypad communication error (PCE) 27: Parameter upload error (UPE) 28: Parameter download error (DNE) 29: PROFIBUS DP communication fault (E-DP) 30: Ethernet communication fault (E-NET) 31: CANopen communication fault (E-CAN) 32: To-ground short-circuit fault 1 (ETH1) 33: To-ground short-circuit fault 2 (ETH2) 34: Speed deviation fault (dEu) 35: Mal-adjustment fault (STo) 36: Underload fault (LL) 37: Encoder disconnection fault (ENC1o) 38: Encoder direction reversal fault (ENC1d) 39: Encoder Z-pulse disconnection fault (ENC1Z) 40: Safe torque off (STO) 41: Channel 1 safety circuit exception (STL1) 42: Channel 2 safety circuit exception (STL2) 43: Exception in both channels 1 and 2 (STL3) 44: Safety code FLASH CRC fault (CrCE) 45: PLC card customized fault 1 (P-E1) 46: PLC card customized fault 2 (P-E2) 47: PLC card customized fault 3 (P-E3) 48: PLC card customized fault 4 (P-E4) 49: PLC card customized fault 5 (P-E5) 50: PLC card customized fault 6 (P-E6) 51: PLC card customized fault 7 (P-E7)	

Function code	Name	Description	Default
		52: PLC card customized fault 8 (P-E8) 53: PLC card customized fault 9 (P-E9) 54: PLC card customized fault 10 (P-E10) 55: Duplicate expansion card type (E-Err) 56: Encoder UVW lost (ENCUV) 57: PROFINET communication timeout fault (E_PN) 58: CAN communication fault (SECAN) 59: Motor overtemperature fault (OT) 60: Failure to identify the card in slot 1 (F1-Er) 61: Failure to identify the card in slot 2 (F2-Er) 62: Failure to identify the card in slot 3 (F3-Er) 63: Communication timeout of the card in slot 1 (C1-Er) 64: Communication timeout of the card in slot 2 (C2-Er) 65: Communication timeout of the card in slot 3 (C3-Er) 66: EtherCAT communication fault (E-CAT) 67: BACnet communication fault (E-BAC) 68: DeviceNet communication fault (E-DEV) 69: CAN slave fault in master/slave synchronization (S-Err) 70: Expansion card PT100 overtemperature (OtE1) 71: Expansion card PT1000 overtemperature (OtE2) 72: EtherNet IP communication timeout fault (E-EIP) 73: No upgrade bootloader (E-PAO) 74: AI1 disconnection (E-AI1) 75: AI2 disconnection (E-AI2) 76: AI3 disconnection (E-AI3)	
P07.33	Running frequency at present fault	0.00Hz~P00.03	0.00Hz
P07.34	Ramp reference frequency at present fault	0.00Hz~P00.03	0.00Hz
P07.35	Output voltage at present	0~1200V	0V

Function code	Name	Description	Default
	fault		
P07.36	Output current at present fault	0.0–6300.0A	0.0A
P07.37	Bus voltage at present fault	0.0–2000.0V	0.0V
P07.38	Max. temperature at present fault	-20.0–120.0°C	0.0°C
P07.39	Input terminal status at present fault	0x0000–0xFFFF	0x0000
P07.40	Output terminal state at present fault	0x0000–0xFFFF	0x0000
P07.41	Running frequency at last fault	0.00Hz–P00.03	0.00Hz
P07.42	Ramp reference frequency at last fault	0.00Hz–P00.03	0.00Hz
P07.43	Output voltage at last fault	0–1200V	0V
P07.44	Output current at last fault	0.0–6300.0A	0.0A
P07.45	Bus voltage at last fault	0.0–2000.0V	0.0V
P07.46	Temperature at last fault	-20.0–120.0°C	0.0°C
P07.47	Input terminal state at last fault	0x0000–0xFFFF	0x0000
P07.48	Output terminal state at last fault	0x0000–0xFFFF	0x0000
P07.49	Running frequency at 2nd-last fault	0.00Hz–P00.03	0.00Hz
P07.50	Ramp reference frequency at 2nd-last fault	0.00Hz–P00.03	0.00Hz
P07.51	Output voltage at 2nd-last fault	0–1200V	0V
P07.52	Output current at 2nd-last fault	0.0–6300.0A	0.0A
P07.53	Bus voltage at 2nd-last fault	0.0–2000.0V	0.0V
P07.54	Temperature at 2nd-last fault	-20.0–120.0°C	0.0°C
P07.55	Input terminal state at 2nd-last fault	0x0000–0xFFFF	0x0000
P07.56	Output terminal state at	0x0000–0xFFFF	0x0000

Function code	Name	Description	Default
	2nd-last fault		

5.5.20 Hot-redundancy master/slave control

In high-reliability applications, to ensure uninterrupted load operation, the VFD redundancy solution allows flexible switching of slave VFD drives. Even if one VFD exits operation due to a fault, the remaining loads can continue operating normally. This function supports redundant operation, automatic switching, master/slave control, fault alarm, protective operation, and other functions. The existing redundant VFD system supports up to one master and four slaves for asynchronous motor V/F mode control. The hot-redundant control solution can be configured flexibly according to the requirements of the application scenario. Redundant master/slave operation requires the EC-PS501-24 power supply card, the EC-TX519 fiber-optic master/slave control communication card, and fiber-optic cable assemblies. Optional fiber-optic cables are available in various lengths, including 1 m, 2 m, 3 m, 5 m, and 10 m. For details about the EC-TX519 communication card, see section A.6.7 Fiber-optic master/slave control communication card (EC-TX519).

Note: Hot-redundancy master/slave control only supports asynchronous motor V/f mode. In networking mode, speed tracking and auto-tuning cannot be performed.

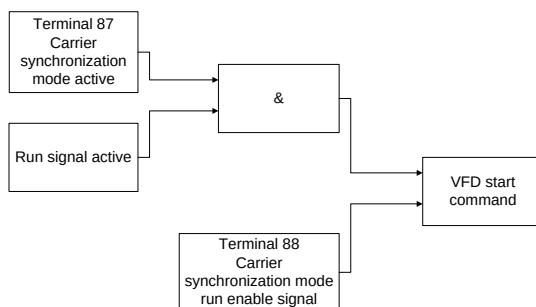


Figure 5-22 Run command logic

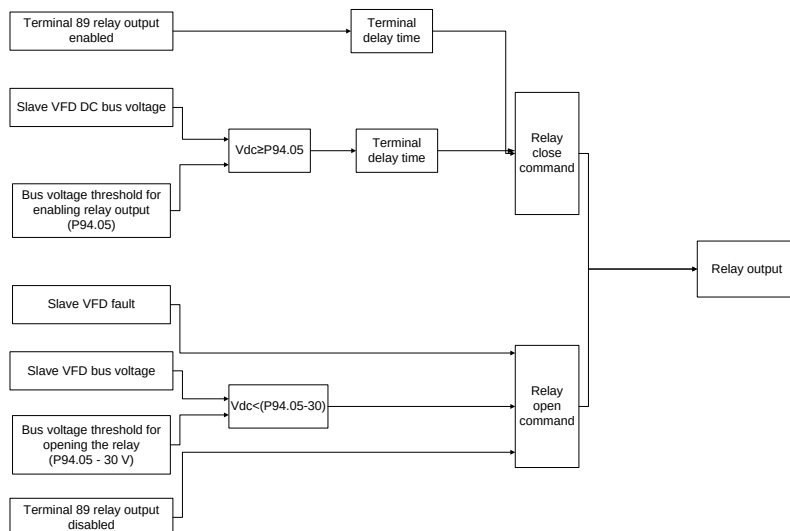


Figure 5-23 Relay output control logic

Master/slave basic parameter settings:

Function code	Name	Master	Slave 1	Slave 2	Description
P00.00	Speed control mode	2	2	2	/
P00.03	Max. output frequency	Set as required	Same as master	Same as master	/
P00.04	Running frequency upper limit	Set as required	Same as master	Same as master	/
P00.05	Running frequency lower limit	Set as required	Same as master	Same as master	/
P00.11	ACC time 1	Set as required	Same as master	Same as master	/
P00.12	DEC time 1	Set as required	Same as master	Same as master	/
P00.13	Running direction selection	Set as required	Same as master	Same as master	/
P00.14	Carrier frequency setting	Set as required	Same as master	Same as master	The maximum carrier frequency is 4 kHz.
P02.00	Motor 1 type	Set as required	Same as master	Same as master	/
P02.01	AM 1 rated power	Set as required	Same as master	Same as master	/

Function code	Name	Master	Slave 1	Slave 2	Description
P02.02	AM 1 rated frequency	Set as required	Same as master	Same as master	/
P02.03	AM 1 rated speed	Set as required	Same as master	Same as master	/
P02.04	AM 1 rated voltage	Set as required	Same as master	Same as master	/
P02.05	AM 1 rated current	Set as required	Same as master	Same as master	/
P02.06	AM 1 stator resistance	Set as required	Same as master	Same as master	/
P02.07	AM 1 rotor resistance	Set as required	Same as master	Same as master	/
P02.08	AM 1 leakage inductance	Set as required	Same as master	Same as master	/
P02.09	AM 1 mutual inductance	Set as required	Same as master	Same as master	/
P02.10	AM 1 no-load current	Set as required	Same as master	Same as master	/
P02.11	AM 1 core saturation coefficient 1	Set as required	Same as master	Same as master	/
P02.12	AM 1 core saturation coefficient 2	Set as required	Same as master	Same as master	/
P02.13	AM 1 core saturation coefficient 3	Set as required	Same as master	Same as master	/
P02.14	AM 1 core saturation coefficient 4	Set as required	Same as master	Same as master	/
P11.06	Automatic current limit threshold	Set as required	Set as required	Set as required	The current limit values of the two slave VFDs must be the same, and the master current limit value must be set to half of the slave value.
P94.00	Synchronous master/slave control selection	1	2	2	/
P94.01	Master response selection upon slave fault	0	0	0	/

Function code	Name	Master	Slave 1	Slave 2	Description
P94.02	Fiber-optic cable length	Set as required	Set as required	Set as required	/
P94.03	Output voltage compensation cycle	Set as required	Same as master	Same as master	/
P94.04	Slave operation priority upon master fault	Set as required	Same as master	Same as master	/
P94.05	Bus voltage threshold for enabling output	/	Set as required	Set as required	/
P94.06	Bus voltage delay time	/	Set as required	Set as required	/
P94.07	Synchronous master/slave fault delay count	Set as required	Same as master	Same as master	/
P94.08	Slave count	Set as required	/	/	/
P99.02	VFD model	Same as slave	Set according to the nameplate	Set according to the nameplate	The master VFD model must be set to the same model as the slave VFDs.

Related parameters are listed in the following.

Function code	Name	Description	Default
P05.01	S1 function	0–95	1
P05.02	S2 function	86: Carrier synchronization mode	4
P05.03	S3 function	switches to standalone running (valid when stopped)	7
P05.04	S4 function		0
P05.05	HDIA function	87: Carrier synchronization mode running signal	0
P05.06	HDIB function	88: Carrier synchronization mode run permissive signal 89: Carrier synchronization mode relay output running 90: Carrier synchronization relay open feedback signal	0
P06.01	Y1 output	0–65	0
P06.02	HDO output	65: Carrier synchronization relay output selection	0
P06.03	RO1 output		1

Function code	Name	Description	Default
P06.04	RO2 output		5
P07.27	Most recent fault type	0–85	0
P07.28	Last fault type	81: Carrier synchronization card slot error (E-cfr)	0
P07.29	2nd-last fault type		0
P07.30	3rd-last fault type	82: Synchronization signal loss (E-tsl)	0
P07.31	4th-last fault type	83: Carrier synchronization card communication timeout (E-cts)	0
P07.32	5th-last fault type	84: Carrier synchronization relay feedback fault (E-ros) 85: Carrier synchronization card master/slave fault (E-ctr)	0
P17.65	Carrier synchronization mode status word (valid for both master and slave)	0x0000–0xFFFF Ones place: Master/slave mode status 0: Carrier synchronization mode disabled 1: Master mode 2: Slave mode 3–15: Reserved Tens place: Synchronization signal valid status 0: Synchronization signal invalid 1: Synchronization signal valid 2–15: Reserved Hundreds place: Reserved 0–15: Reserved Thousands place: Reserved 0–15: Reserved	0x0000
P17.66	Slave 1 status word (valid for the master VFD)	0x0000–0xFFFF Ones place: Run signal command 0: Invalid	0x0000
P17.67	Slave 2 status word (valid for the master VFD)	1: Forward run 2: Reverse run 3: Stopped	0x0000
P17.68	Slave 3 status word (valid for the master VFD)	4: Faulty 5: POFF 6: Pre-exciting	0x0000
P17.69	Slave 4 status word (valid for the master VFD)	7–15: Reserved Tens place: Reserved 0–15: Reserved	0x0000

Function code	Name	Description	Default
		Hundreds place: Ready for running 0: Not ready to run 1: Ready for running 2–15: Reserved Thousands place: Reserved 0–15: Reserved	
P19.00	Slot 1 expansion card type	0–65535 30: Fiber-optic synchronization card	0
P19.01	Slot 2 expansion card type	Note: This expansion card is applicable only to SLOT1 for the 1R5G/2R2P model, and applicable only to SLOT2 for the 7R5G/011P and higher models.	
P94.00	Synchronous master/slave control selection	0x000–0x212 Ones place: Synchronous master/slave mode selection 0: Invalid 1: Master 2: Slave Tens place: Synchronous mode selection 0: Synchronous mode 0 1: Reserved Hundreds place: Slave start command source 0: Follow the master start command 1: Reserved 2: Reserved Note: Restart the VFD after setting P94.00.	0x000
P94.01	Master response selection upon slave fault	0x000–0x111 Ones place: Slave contactor not-open fault selection 0: No fault reported 1: Fault, stop Tens place: Slave non-contactor not-open fault selection 0: No fault reported 1: Fault, stop	0x000

Function code	Name	Description	Default
		Hundreds place: Slave operation selection when the master is faulty 0: Not allowed 1: Allowed to continue running	
P94.02	Fiber-optic cable length	1–10m	10m
P94.03	Output voltage compensation cycle	0–50	8
P94.04	Slave operation priority upon master fault	0x1111–0x4444 Ones place: Priority 0 0: Reserved 1: Slave 1 2: Slave 2 3: Slave 3 4: Slave 4 Tens place: Priority 1 0: Reserved 1: Slave 1 2: Slave 2 3: Slave 3 4: Slave 4 Hundreds place: Priority 2 0: Reserved 1: Slave 1 2: Slave 2 3: Slave 3 4: Slave 4 Thousands place: Priority 3 0: Reserved 1: Slave 1 2: Slave 2 3: Slave 3 4: Slave 4	0x4321
P94.05	Bus voltage threshold for enabling output	70.0–90.0%	80.0%
P94.06	Bus voltage delay time	0.000–50.000 s	0.5000 s
P94.07	Synchronous master/slave fault delay count	0–100	5
P94.08	Slave count	0–4	0

6 Function parameter list

6.1 What this chapter contains

This chapter lists all the function codes and corresponding description of each function code.

6.2 Function parameter list

The function parameters of the VFD are divided into groups by function. Among the function parameter groups, the P98 group is the analog input and output calibration group, while the P99 group 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 group P08.

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 VFD is in stopped or running state.

"◎" indicates that the value of the parameter cannot be modified when the VFD is in running state.

"●" indicates that the value of the parameter is detected and recorded, and cannot be modified.

(The VFD 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 VFD.) 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.

Group P00—Basic functions

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: SVPWM mode 3: FVC mode Note: Before using a vector control mode, 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 running commands	0: Modbus/Modbus TCP communication 1: PROFIBUS/CANopen/DeviceNet communication 2: Ethernet communication 3: EtherCAT/PROFINET/EtherNet IP communication 4: PLC card 5: Wireless communication card Note: Modbus TCP in option 0 and options 1, 2, 3, 4, and 5 are add-on functions and are available only when corresponding expansion cards are configured.	0	○
P00.03	Max. output frequency	The function code is used to set the max. output frequency of the VFD. 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	⊙

Function code	Name	Description	Default	Modify
P00.04	Running frequency upper limit	The upper limit of the running frequency is the upper limit of the output frequency of the VFD, 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	⊙
P00.05	Running frequency lower limit	The lower limit of the running frequency is the lower limit of the output frequency of the VFD, 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 2: AI2 3: AI3 4: High-speed pulse HDIA 5: Simple PLC program 6: Multi-step speed running 7: PID control 8: Modbus/Modbus TCP communication 9: PROFIBUS/CANopen/DeviceNet communication 10: Ethernet communication 11: High-speed pulse HDIB 12: Pulse train AB 13: EtherCAT/PROFINET/EtherNet IP communication 14: PLC card 15: Reserved	0	○
P00.07	B frequency command source		15	○
P00.08	Reference object of B frequency command	0: Max. output frequency 1: A frequency command	0	○

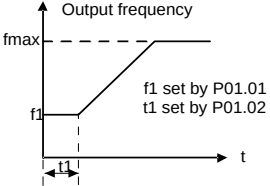
Function code	Name	Description	Default	Modify																
P00.09	Combination mode of setting source	0: A 1: B 2: (A+B) 3: (A-B) 4: Max(A, B) 5: Min(A, B)	0	○																
P00.10	Setting frequency through keypad	When A and B frequency commands select the keypad for setting, the value of the function code is the initial digital frequency setting value for the VFD. Setting range: 0.00Hz–P00.03 (Max. output frequency)	50.00Hz	○																
P00.11	ACC time 1	ACC time means the time needed if the VFD speeds up from 0Hz to the max. output frequency (P00.03). DEC time means the time needed if the VFD decelerates from the max. output frequency (P00.03) to 0Hz.	Depends on model	○																
P00.12	DEC time 1	The VFD has four groups of ACC/DEC time, which can be selected by P05. The factory default ACC/DEC time of the VFD is the first group. Setting range: 0.0–3600.0 s	Depends on model	○																
P00.13	Running direction selection	0: Run in the default direction 1: Run in the opposite direction 2: Disable reverse running	0	○																
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>1kHz</td><td>↑ High</td><td>↑ Low</td><td>↑ Low</td></tr><tr><td>10kHz</td><td></td><td></td><td></td></tr><tr><td>15kHz</td><td>↓ Low</td><td>↓ High</td><td>↓ High</td></tr></table> The relationship between models and carrier frequencies is as follows:	Carrier frequency	Electro magnetic noise	Noise and leakage current	Cooling level	1kHz	↑ High	↑ Low	↑ Low	10kHz				15kHz	↓ Low	↓ High	↓ High	Depends on model	○
Carrier frequency	Electro magnetic noise	Noise and leakage current	Cooling level																	
1kHz	↑ High	↑ Low	↑ Low																	
10kHz																				
15kHz	↓ Low	↓ High	↓ High																	

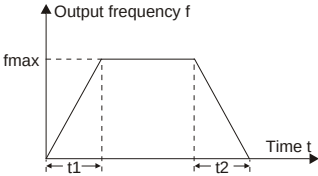
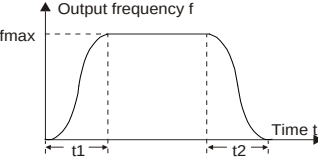
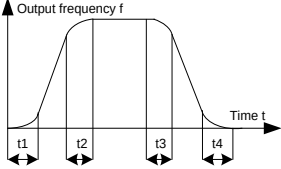
Function code	Name	Description		Default	Modify
		Model		Default carrier frequency	
		G type	1.5–7.5 kW	8 kHz	
			55 kW	4 kHz	
			75 kW and higher	2 kHz	
		P type	2.2 kW	4 kHz	
			55 kW and higher	2 kHz	
		Advantage of high carrier frequency: ideal current waveform, little current harmonic wave and motor noise. Disadvantage of high carrier frequency: increasing the switch loss, increasing VFD temperature and the impact to the output capacity. The VFD 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 carrier frequency may cause unstable operation at low frequency, decrease the torque, or even lead to oscillation. The carrier frequency has been properly set in the factory before the VFD is delivered. 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 increased of 1 kHz. Setting range: 1.0–15.0 kHz			
P00.15	Motor parameters Autotuning	0: No operation 1: Dynamic autotuning; comprehensive motor parameter autotuning. It is recommended to use dynamic autotuning when high control accuracy is required. 2: Complete parameter static autotuning; used in scenarios where the motor cannot be disconnected from load. 3: Partial parameter static autotuning; when the present motor is motor 1, only P02.06, P02.07, and P02.08 need to be autotuned; when the		0	©

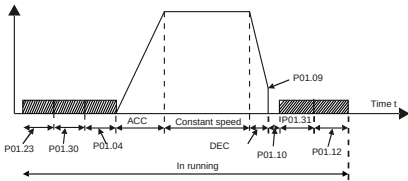
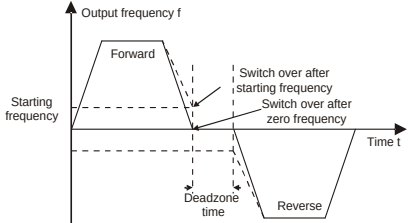
Function code	Name	Description	Default	Modify
		present motor is motor 2, only P12.06, P12.07, and P12.08 need to be autotuned. 4: Dynamic autotuning 2; similar to dynamic autotuning 1, but only valid for AMs 5: Partial parameter static autotuning 2; only valid for AMs		
P00.16	AVR function selection	0: Invalid 1: Valid during the whole process The auto-adjusting function of the VFD can eliminate the impact on the output voltage of the VFD because of the bus voltage fluctuation.	1	○
P00.17	VFD type	0: G type 1: P type	0	◎
P00.18	Function parameter restoration	1: Restore to default values (excluding motor parameters) 2: Clear fault records 3: Reserved 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. Option 5 restores the parameters to those of the corresponding standard version. Non-professionals should use this option with caution.	0	◎

Group P01—Start and stop control

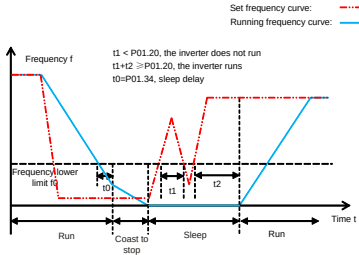
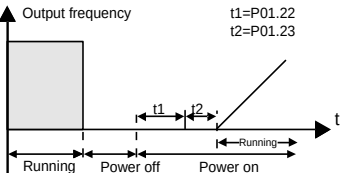
Function code	Name	Description	Default	Modify
P01.00	Start mode	0: Direct start 1: Start after DC braking 2: Start after speed tracking	0	◎
P01.01	Starting frequency	The function code indicates the initial frequency	0.50Hz	◎

Function code	Name	Description	Default	Modify
	of direct start	during VFD start. See P01.02 (Starting frequency hold time) for detailed information. Setting range: 0.00–50.00Hz		
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 VFD output frequency is the starting frequency. Then, the VFD runs from the starting frequency to the target frequency. If the target frequency (frequency command) is lower than the starting frequency, the VFD stops running and keeps in the standby state. The starting frequency is not limited by the frequency lower limit. Setting range: 0.0–50.0 s	0.0 s	⊙
P01.03	Braking current before start	The VFD 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 DC braking current indicates larger braking torque. The DC braking current before start is a percentage of the VFD rated output current. Setting range of P01.03: 0.0–100.0% Setting range of P01.04: 0.00–50.00 s	0.00 s	⊙
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	⊙

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	 Setting range: 0.0–50.0 s	0.1s	⊙
P01.08	Stop mode	0: Decelerate to stop. After a stop command takes effect, the VFD lowers output frequency based on the DEC mode and the defined DEC time; after the frequency drops to the stop speed (P01.15), the VFD stops. 1: Coast to stop. After a stop command takes effect, the VFD stops output immediately; and 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	0.00Hz	○

Function code	Name	Description	Default	Modify
P01.10	Wait time before DC braking for stop	braking for stop when running frequency reaches the starting frequency determined by P01.09.	0.00 s	○
P01.11	DC braking current at stop	Wait time before DC braking: The VFD blocks the output before starting DC braking. After this wait time, DC braking is started so as to prevent overcurrent caused by DC braking at high speed.	0.0%	○
P01.12	DC braking time at stop	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 VFD decelerates to stop within the specified time.  Setting range of P01.09: 0.00Hz–P00.03 (Max. output frequency) P01.10 setting range: 0.00–30.00 s Setting range of P01.11: 0.0–100.0% (of the rated VFD output current) P01.12 setting range: 0.0–50.0 s	0.00 s	○
P01.13	FWD/REV run deadzone time	This function code specifies the transition time of the switching in FWD/REV running switching mode specified by P01.14. See the figure.  Setting range: 0.0–3600.0 s	0.0 s	○

Function code	Name	Description	Default	Modify
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	0	⊙
P01.15	Stop speed	0.00–100.00 Hz	0.50 Hz	⊙
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	0.00–100.00 s	0.50 s	⊙
P01.18	Terminal run command protection at power-on	When the channel of running commands is terminal control, the system detects the state of the running terminal during power-on. 0: The terminal-based running command is invalid at power-on. Even the running command is considered as valid during power-on, the VFD does not run and it keeps the protection state until the running command is canceled and enabled again. 1: The terminal-based running command is valid at power-on. If the running command is considered as valid during power-on, the VFD is started automatically after the initialization. Note: Exercise caution before using this function. Otherwise, serious consequences may result.	0	○
P01.19	Action when running frequency falls below the lower limit (valid when frequency lower limit > 0)	The function code specifies the running state of the VFD when the set frequency is below the lower limit. Ones place: Action selection 0: Run at the frequency lower limit 1: Stop 2: Sleep Tens place: Stop mode 0: Coast to stop 1: Decelerate to stop The VFD stops as set in the tens place if the action selection is stop or sleep when the set frequency is lower than the lower limit. The VFD	0x00	⊙

Function code	Name	Description	Default	Modify
		resumes the running state automatically when the set frequency is above the lower limit again and this situation lasts for the time set by P01.20. Setting range: 0x00–0x12		
P01.20	Wake-up-from-sleep delay	The function code determines the wake-up-from-sleep delay time. When the running frequency of the VFD is lower than the lower limit, the VFD becomes standby. When the set frequency is higher than the lower limit once again and it lasts for the time set by P01.20, the VFD runs automatically.  Setting range: 0.0–3600.0 s (Valid when P01.19 ones place=2)	0.0 s	○
P01.21	Power-loss restart selection	The function code indicates whether the VFD automatically runs after re-power on. 0: Disable 1: Enable. If the restart condition is met, the VFD will run automatically after waiting the time defined by P01.22.	0	○
P01.22	Wait time for restart after power-off	The function code indicates the wait time before the automatic running of the VFD that is re-powered on.  Setting range: 0.0–3600.0 s (valid when	1.0 s	○

Function code	Name	Description	Default	Modify
		P01.21=1)		
P01.23	Start delay time	After a VFD running command is given, the VFD is in standby state and restarts with the delay defined by P01.23 to implement brake release. Setting range: 0.0–600.0 s	0.0 s	○
P01.24	Stop speed delay time	0.0–600.0 s	0.0 s	○
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	0.0–60.0 s	2.0 s	○
P01.27	Time of starting segment of DEC S curve	0.0–50.0 s	0.1 s	◎
P01.28	Time of ending segment of DEC S curve	0.0–50.0 s	0.1 s	◎
P01.29	Short-circuit braking current	When the VFD starts in direct start mode (P01.00=0), set P01.30 to a non-zero value to enter short-circuit braking. During stop, if the running frequency of VFD is lower than the starting frequency of brake for stop (P01.09), set P01.31 to a non-zero value to enter short-circuit braking for stop, and then carry out DC braking in the time set by P01.12. (Refer to the descriptions for P01.09–P01.12.) Setting range of P01.29: 0.0–150.0% (of the rated VFD output current) P01.30 setting range: 0.0–50.0 s P01.31 setting range: 0.0–50.0 s	0.0%	○
P01.30	Short-circuit braking hold time at start		0.00 s	○
P01.31	Short-circuit braking hold time at stop		0.00 s	○
P01.32	Pre-excitation time for jogging	0.000–10.000 s	0.300 s	○
P01.33	Starting frequency of braking for stop in jogging	0.00–P00.03	0.00 Hz	○
P01.34	Sleep entry delay time	0.0–3600.0 s	0.0 s	○

Group P02—Motor 1 parameters

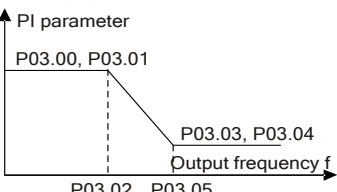
Function code	Name	Description	Default	Modify
P02.00	Motor 1 type	0: Asynchronous motor (AM) 1: Synchronous motor (SM)	0	⊙
P02.01	AM 1 rated power	0.1–3000.0 kW	Depends on model	⊙
P02.02	AM 1 rated frequency	0.01 Hz–P00.03 (Max. output frequency)	50.00 Hz	⊙
P02.03	AM 1 rated speed	1–60000 rpm	Depends on model	⊙
P02.04	AM 1 rated voltage	0–1200 V	Depends on model	⊙
P02.05	AM 1 rated current	0.8–6000.0 A	Depends on model	⊙
P02.06	AM 1 stator resistance	0.001–65.535 Ω	Depends on model	○
P02.07	AM 1 rotor resistance	0.001–65.535 Ω	Depends on model	○
P02.08	AM 1 leakage inductance	0.1–6553.5 mH	Depends on model	○
P02.09	AM 1 mutual inductance	0.1–6553.5 mH	Depends on model	○
P02.10	AM 1 no-load current	0.1–6553.5 A	Depends on model	○
P02.11	AM 1 core saturation coefficient 1	0.0–100.0%	80.0%	○
P02.12	AM 1 core saturation coefficient 2	0.0–100.0%	68.0%	○
P02.13	AM 1 core saturation coefficient 3	0.0–100.0%	57.0%	○
P02.14	AM 1 core saturation coefficient 4	0.0–100.0%	40.0%	○
P02.15	SM 1 rated power	0.1–3000.0 kW	Depends on model	⊙
P02.16	SM 1 rated frequency	0.01 Hz–P00.03 (Max. output frequency)	50.00 Hz	⊙
P02.17	SM 1 pole pair	1–128	2	⊙

Function code	Name	Description	Default	Modify
	count			
P02.18	SM 1 rated voltage	0–1200 V	Depends on model	⊙
P02.19	SM 1 rated current	0.8–6000.0 A	Depends on model	⊙
P02.20	SM 1 stator resistance	0.001–65.535 Ω	Depends on model	○
P02.21	SM 1 direct-axis inductance	0.01–655.35 mH	Depends on model	○
P02.22	SM 1 quadrature-axis inductance	0.01–655.35 mH	Depends on model	○
P02.23	SM 1 back-EMF	0–10000	300	○
P02.24	SM 1 initial pole position	0x0000–0xFFFF	0x0000	●
P02.25	SM 1 identification current	0%–50% (of the motor rated current)	10%	●
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	Overload protection coefficient of motor 1	Motor overload multiples $M = I_{out} / (I_n \cdot K)$ "I_n" is the rated motor current, "I_{out}" is the VFD output current, "K" is the motor overload protection coefficient. A smaller value of "K" indicates a bigger value of "M". When $M=116\%$, protection is performed after	100.0%	○

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%, protection is performed after motor overload lasts for 5 minutes; when M=200%, protection is performed after motor overload lasts for 60 seconds; and when $M \geq 400\%$, protection is performed 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 VFD. 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	0.000–30.000 kg·m ²	0.000	☐
P02.31–P02.32	Reserved	0–65535	0	☐

Group P03—Motor 1 vector control

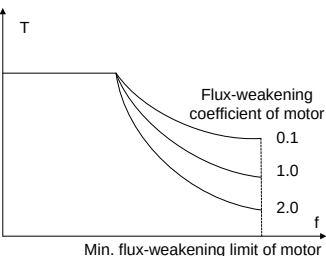
Function code	Name	Description	Default	Modify
P03.00	Speed-loop proportional gain 1	The parameters P03.00–P03.05 are applicable only to vector control mode. Below the switching	20.0	☐

Function code	Name	Description	Default	Modify
P03.01	Speed-loop integral time 1	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: 	0.200 s	☐
P03.02	Low switching-point frequency		5.00 Hz	☐
P03.03	Speed-loop proportional gain 2		20.0	☐
P03.04	Speed-loop integral time 2		0.200 s	☐
P03.05	High switching-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 P03.00: 0.0–200.0 Setting range of P03.01: 0.000–10.000 s Setting range of P03.02: 0.00 Hz–P03.05 Setting range of P03.03: 0.0–200.0 Setting range of P03.04: 0.000–10.000 s Setting range of P03.05: P03.02–P00.03 (Max. output frequency)	10.00Hz	☐
P03.06	Speed-loop output filter	0–8 (corresponding to 0–2 ⁸ /10 ms)	0	☐

Function code	Name	Description	Default	Modify
P03.07	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. Setting range: 50–200%	100%	○
P03.08	Vector control slip compensation coefficient (generating)		100%	○
P03.09	Current-loop proportional coefficient P	Note: - The two function codes impact the dynamic response speed and control accuracy of the system. Generally, you do not need to modify the two function codes. - Applicable to SVC mode 0 (P00.00=0), SVC mode 1 (P00.00=1), and FVC mode (P00.00=3). Setting range: 0–65535	1000	○
P03.10	Current-loop integral coefficient I		1000	○
P03.11	Torque setting method	0–1: Keypad (P03.12) 2: AI1 3: AI2 4: AI3 5: Pulse frequency HDIA 6: Multi-step speed 7: Modbus/Modbus TCP communication 8: PROFIBUS/CANopen/DeviceNet communication 9: Ethernet communication 10: Pulse frequency HDIB 11: EtherCAT/PROFINET/EtherNet IP communication 12: PLC card Note: 100% corresponds to the motor rated current.	0	○
P03.12	Torque set through keypad	-300.0%–300.0% (of the motor rated current)	20.0%	○
P03.13	Torque reference filter time	0.000–10.000 s	0.010 s	○
P03.14	Setting source of	0: Keypad (P03.16)	0	○

Function code	Name	Description	Default	Modify
	forward rotation upper-limit frequency in torque control	1: AI1 2: AI2 3: AI3 4: Pulse frequency HDIA 5: Multi-step speed 6: Modbus/Modbus TCP communication 7: PROFIBUS/CANopen/DeviceNet communication 8: Ethernet communication 9: Pulse frequency HDIB 10: EtherCAT/PROFINET/EtherNet IP communication 11: PLC card 12: Reserved Note: 100% corresponds to the max. frequency.		
P03.15	Setting source of reverse rotation upper-limit frequency in torque control	0: Keypad (P03.17) 1: AI1 2: AI2 3: AI3 4: Pulse frequency HDIA 5: Multi-step speed 6: Modbus/Modbus TCP communication 7: PROFIBUS/CANopen/DeviceNet communication 8: Ethernet communication 9: Pulse frequency HDIB 10: EtherCAT/PROFINET/EtherNet IP communication 11: PLC card 12: Reserved Note: For these settings, 100% corresponds to the max. frequency.	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 specifies the value when P03.14=0, while P03.17 specifies the value when P03.15=0.	50.00Hz	○

Function code	Name	Description	Default	Modify
P03.17	Reverse rotation upper-limit frequency set through keypad in torque control	Setting range: 0.00Hz–P00.03 (Max. output frequency)	50.00Hz	○
P03.18	Setting source of motoring torque upper limit	0: Keypad (P03.20) 1: AI1 2: AI2 3: AI3 4: Pulse frequency HDIA 5: Modbus/Modbus TCP communication 6: PROFIBUS/CANopen/DeviceNet communication 7: Ethernet communication 8: Pulse frequency HDIB 9: EtherCAT/PROFINET/EtherNet IP communication 10: PLC card 11: Reserved Note: 100% corresponds to the motor rated current.	0	○
P03.19	Setting source of braking torque upper limit	0: Keypad (P03.21) 1: AI1 2: AI2 3: AI3 4: Pulse frequency HDIA 5: Modbus/Modbus TCP communication 6: PROFIBUS/CANopen/DeviceNet communication 7: Ethernet communication 8: Pulse frequency HDIB 9: EtherCAT/PROFINET/EtherNet IP communication 10: PLC card 11: Reserved Note: 100% corresponds to the motor rated current.	0	○
P03.20	Motoring torque	Used to set torque limits.	180.0%	○

Function code	Name	Description	Default	Modify
	upper limit set through keypad	Setting range: 0.0–300.0% (of the motor rated current)		
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.  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. Setting range of P03.22: 0.1–2.0 Setting range of P03.23: 10%–100%	0.3	○
P03.23	Min. flux weakening point in constant power zone		20%	○
P03.24	Max. voltage limit	P03.24 sets the max. output voltage of the VFD, which is the percentage of 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 VFD starts up. A magnetic field is built up inside the motor to improve the torque performance during the start process. Setting range: 0.000–10.000 s	0.300 s	○
P03.26	Flux-weakening proportional gain	0–8000	1000	○
P03.27	Speed display selection in vector control	0: Display the actual value 1: Display the set value	0	○

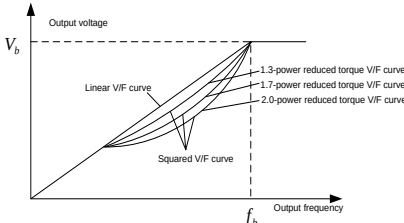
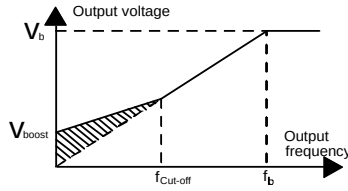
Function code	Name	Description	Default	Modify
P03.28	Static friction compensation coefficient	0.0–100.0%	0.0%	☐
P03.29	Static friction corresponding frequency point	0.50–P03.31	1.00Hz	☐
P03.30	High speed friction compensation coefficient	0.0–100.0%	0.0%	☐
P03.31	Corresponding frequency of high speed friction torque	P03.29–400.00Hz	50.00Hz	☐
P03.32	Torque control enable	0: Disable 1: Enable	0	☐
P03.33	Flux weakening integral gain	0–8000	1200	☐
P03.34	Flux-weakening control mode	0x000–0x112 Ones place: Control mode selection 0: Mode 0 1: Mode 1 2: Mode 2 Tens place: Compensation of inductance saturation coefficient 0: Compensation enabled 1: No compensation Hundreds place: Current loop feedforward compensation 0: Compensation enabled 1: No compensation	0x000	☐
P03.35	Control mode optimization selection	0x0000–0x1111 Ones place: Torque command selection 0: Torque reference 1: Torque current reference Tens place: Reserved 0: Reserved 1: Reserved Hundreds place: indicates whether to enable	0x0000	☐

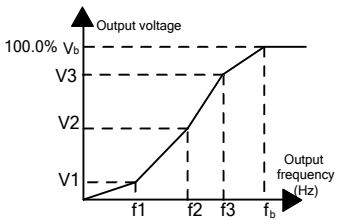
Function code	Name	Description	Default	Modify
		speed-loop integral separation 0: Disable 1: Enable Thousands place: Reserved 0: Reserved 1: Reserved		
P03.36	Speed-loop derivative gain	0.00–10.00 s	0.00 s	○
P03.37	High-frequency current-loop proportional coefficient	In the FVC mode (P00.00=3), when the frequency is lower than the current-loop high-frequency switching threshold (P03.39), the current-loop PI parameters are P03.09 and P03.10; and when the frequency is higher than the current-loop high-frequency switching threshold, the current-loop PI parameters are P03.37 and P03.38. Setting range of P03.37: 0–65535 Setting range of P03.38: 0–65535 Setting range of P03.39: 0.0–100.0% (of the max. frequency)	1000	○
P03.38	High-frequency current-loop integral coefficient		1000	○
P03.39	Current-loop high-frequency switching threshold		100.0%	○
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	Inertia compensation filter count, used to smooth inertia compensation torque. Setting range: 0–10	7	○
P03.43	Inertia identification torque	Due to friction force, it is required to set certain identification torque for the inertia identification to be performed properly. 0.0–100.0% (of the motor rated torque)	10.0%	○
P03.44	Enabling motor inertia identification	0: No operation 1: Enable	0	◎
P03.45	Current-loop	Automatic update will be performed after motor	0	○

Function code	Name	Description	Default	Modify
	proportional coefficient after autotuning	parameter autotuning. In the closed-loop vector control mode for SMs, you can set the value of this function code to P03.09. Range: 0–65535 Note: Set the value to 0 if motor parameter autotuning is not performed.		
P03.46	Current-loop integral coefficient after autotuning	Automatic update will be performed after motor parameter autotuning. In the closed-loop vector control mode for SMs, you can set the value of this function code to P03.10. Range: 0–65535 Note: Set the value to 0 if motor parameter autotuning is not performed.	0	○

Group P04—V/F control

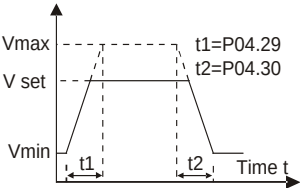
Function code	Name	Description	Default	Modify
P04.00	Motor 1 V/f curve setting	This function code defines the V/f curve of motor 1 to meet the needs of different loads. 0: Straight-line V/F curve, applicable to constant torque loads 1: Multi-point V/f curve 2: 1.3-power reduced-torque V/f curve 3: 1.7-power reduced-torque V/f curve 4: 2.0-power reduced-torque V/f curve Curves 2–4 are applicable to reduced-torque loads such as fans and 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 can be separated from F; and you can change the characteristics of the curve by adjusting F through the frequency setting channel specified by P00.06 or by adjusting V through the voltage setting channel specified by P04.27. Note: In the following figure, V_b is the motor rated voltage and f_b is the motor rated	0	◎

Function code	Name	Description	Default	Modify
		frequency. 		
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. P04.02 defines the percentage of cut-off frequency of manual torque boost to the rated 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 VFD uses automatic torque boost.	0.0%	○
P04.02	Motor 1 torque boost cut-off	Torque boost cut-off threshold: Below this frequency threshold, torque boost is valid; exceeding this threshold will invalidate torque boost.  Setting range of P04.01: 0.0%: Automatic, 0.1%–10.0% Setting range of P04.02: 0.0% –50.0%	20.0%	○

Function code	Name	Description	Default	Modify
P04.03	Motor 1 V/f frequency point 1	When P04.00=1 (Multi-point 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: $V1 < V2 < V3$, $f1 < f2 < f3$. Excessively 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		0.0%	☐
		 Setting range of P04.03: 0.00Hz–P04.05 Setting range of P04.04: 0.0%–110.0% (of the rated voltage of motor 1) Setting range of P04.05: P04.03 –P04.07 Setting range of P04.06: 0.0%–110.0% (of the rated voltage of motor 1) Setting range of P04.07: P04.05–P02.02 (AM 1 rated frequency) or P04.05– P02.16 (SM 1 rated frequency) Setting range of P04.08: 0.0%–110.0% (of the rated voltage of motor 1)		
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: $\Delta f = f_b - n \cdot p / 60$ where, f_b is the rated frequency of the motor, corresponding to function code P02.02. n is the rated rotating speed of the motor, corresponding to function code P02.03. p is the number of pole pairs of the motor. 100.0% corresponds to the rated slip frequency Δf of motor 1.	100.0%	☐

Function code	Name	Description	Default	Modify
		Setting range: 0.0–200.0%		
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 VFD overcurrent. You can adjust the function codes properly to eliminate such phenomenon.	10	○
P04.11	Motor 1 high-frequency oscillation suppression factor	Setting range of P04.10: 0–100	10	○
P04.12	Motor 1 oscillation suppression threshold frequency	Setting range of P04.11: 0–100 Setting range of P04.12: 0.00Hz–P00.03 (Max. output frequency)	30.00Hz	○
P04.13	Motor 2 V/f curve setting	This function code defines the V/f curve of motor 2 to meet the needs of different loads. 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) Note: Refer to the description for P04.00.	0	◎
P04.14	Motor 2 torque boost	Note: Refer to the descriptions for P04.01 and P04.02.	0.0%	○
P04.15	Motor 2 torque boost cut-off	Setting range of P04.14: 0.0%: Automatic; 0.1%–10.0% Setting range of P04.15: 0.0%–50.0% (of the rated frequency of motor 2)	20.0%	○
P04.16	Motor 2 V/f frequency point 1	Note: Refer to the descriptions for P04.03 and P04.08.	0.00 Hz	○
P04.17	Motor 2 V/f voltage point 1	Setting range of P04.16: 0.00 Hz–P04.18 Setting range of P04.17: 0.0%–110.0% (of the rated voltage of motor 2)	0.0%	○
P04.18	Motor 2 V/f frequency point 2	Setting range of P04.18: P04.16–P04.20	0.00 Hz	○
P04.19	Motor 2 V/f voltage point 2	Setting range of P04.19: 0.0%–110.0% (of the rated voltage of motor 2)	0.0%	○
P04.20	Motor 2 V/f frequency point 3	Setting range of P04.20: P04.18–P12.02 (of the rated frequency of AM 2) or P04.18–P12.16 (of the rated frequency of SM 2)	0.00 Hz	○
P04.21	Motor 2 V/f voltage	Setting range of P04.21: 0.0%–110.0% (of the	0.0%	○

Function code	Name	Description	Default	Modify
	point 3	rated voltage of motor 2)		
P04.22	Motor 2 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: $\Delta f = f_b - n \cdot p / 60$ where f_b is the rated frequency of motor 2, corresponding to function code P12.02. n is the rated rotating speed of the motor, corresponding to function code P12.03. p is the number of pole pairs of the motor. 100.0% corresponds to the rated slip frequency Δf of motor 2. Setting range: 0.0–200.0%	0.0%	○
P04.23	Motor 2 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 VFD overcurrent. You can adjust the function codes properly to eliminate such phenomenon.	10	○
P04.24	Motor 2 high-frequency oscillation suppression factor	Setting range of P04.23: 0–100	10	○
P04.25	Motor 2 oscillation suppression threshold frequency	Setting range of P04.24: 0–100 Setting range of P04.25: 0.00 Hz–P00.03 (Max. output frequency)	30.00 Hz	○
P04.26	Energy-save run	0: Disable 1: Automatic energy-saving run In light-load state, the motor can adjust the output voltage automatically to achieve energy saving.	0	◎
P04.27	Voltage setting channel	0: Keypad (specified by P04.28.) 1: AI1 2: AI2 3: AI3 4: HDIA 5: Multi-step voltage setting (The setting is determined by related parameters in group	0	○

Function code	Name	Description	Default	Modify
		P10.) 6: PID 7: Modbus/Modbus TCP communication 8: PROFIBUS/CANopen/DeviceNet communication 9: Ethernet communication 10: HDIB 11: EtherCAT/PROFINET/EtherNet IP communication 12: PLC card 13: Reserved		
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%	100.0%	○
P04.29	Voltage increase time	Voltage increase time means the time needed for the VFD to accelerate from min. output voltage to the max. output voltage.	5.0 s	○
P04.30	Voltage decrease time	Voltage decrease time means the time needed for the VFD to decelerate from the max. output voltage to min. output voltage. Setting range: 0.0–3600.0 s	5.0 s	○
P04.31	Max. output voltage	The function codes are used to set the upper and lower limits of output voltage. 	100.0%	⊙
P04.32	Min. output voltage		0.0%	⊙
		Setting range of P04.31: P04.32–100.0% (of the motor rated voltage) Setting range of P04.32: 0.0%–P04.31		
P04.33	Flux weakening coefficient in constant power zone	1.00–1.30	1.00	○
P04.34	SM V/f pull-in current 1	When the SM VF control mode is enabled, the function code is used to set the reactive current	20.0%	○

Function code	Name	Description	Default	Modify
		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)		
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 higher 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 coefficient 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	○
P04.40	Enabling IF mode for AM 1	0: Invalid 1: Enable	0	◎
P04.41	Current setting in IF mode for AM 1	When IF control is adopted for AM 1, the function code is used to set the output current. The value is expressed as a percentage of the motor rated current.	120.0%	○

Function code	Name	Description	Default	Modify
		Setting range: 0.0–200.0%		
P04.42	Proportional coefficient in IF mode for AM 1	When IF control is adopted for AM 1, the function code is used to set the proportional coefficient of the output current closed-loop control. Setting range: 0–5000	350	○
P04.43	Integral coefficient in IF mode for AM 1	When IF control is adopted for AM 1, the function code is used to set the integral coefficient of the output current closed-loop control. Setting range: 0–5000	150	○
P04.44	Starting frequency point for switching off IF mode for AM 1	0.00–P04.50	10.00Hz	○
P04.45	Enabling IF mode for AM 2	0: Invalid 1: Enable	0	◎
P04.46	Current setting in IF mode for AM 2	When IF control is adopted for AM 2, the function code is used to set the output current. The value is a percentage of the motor rated current. Setting range: 0.0–200.0%	120.0%	○
P04.47	Proportional coefficient in IF mode for AM 2	When IF control is adopted for AM 2, the function code is used to set the proportional coefficient of output current closed-loop control. Setting range: 0–5000	350	○
P04.48	Integral coefficient in IF mode for AM 2	When IF control is adopted for AM 2, the function code is used to set the integral coefficient of output current closed-loop control. Setting range: 0–5000	150	○
P04.49	Starting frequency point for switching off IF mode for AM 2	0.00–P04.51	10.00Hz	○
P04.50	End frequency point for switching off IF mode for AM 1	P04.44–P00.03	25.00Hz	○
P04.51	End frequency point for switching off IF mode for AM 2	P04.49–P00.03	25.00Hz	○

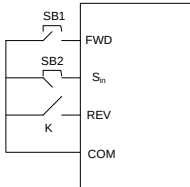
Group P05—Input terminal functions

Function code	Name	Description	Default	Modify
P05.00	HDI input type	0x00–0x11 Ones place: HDIA input type 0: HDIA is high-speed pulse input 1: HDIA is digital input Tens place: HDIB input type 0: HDIB is high-speed pulse input 1: HDIB is digital input	0x00	⊙
P05.01	S1 function	0: No function	1	⊙
P05.02	S2 function	1: Forward run	4	⊙
P05.03	S3 function	2: Reverse run	7	⊙
P05.04	S4 function	3: Three-wire running control	0	⊙
P05.05	HDIA function	4: Forward jog	0	⊙
P05.06	HDIB function	5: Reverse jog 6: Coast to stop 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	0	⊙

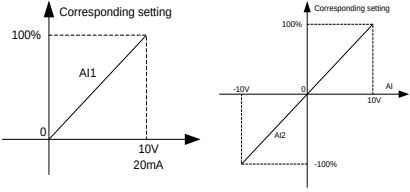
Function code	Name	Description	Default	Modify
		26: Wobble frequency pause 27: Wobble frequency reset 28: Counter reset 29: Switch between speed control and torque control 30: ACC/DEC disable 31: Counter trigger 32: Reserved 33: Clear the frequency increase/decrease setting temporarily 34: DC braking 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 running 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) 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		

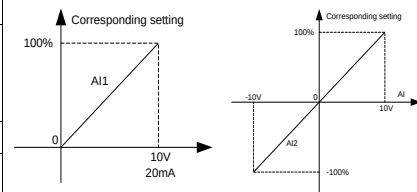
Function code	Name	Description	Default	Modify
		59: Switch to V/F control 60: Switch to FVC control 61: Switch PID polarities 62: Reserved 63: Enable servo 64: Forward limit 65: Reverse limit 66: Clear encoder counting 67: Pulse increment 68: Pulse superposition enable 69: Decrease pulses 70: Electronic gear selection 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: Forced material-break trigger 80: Initial roll diameter selection 1 81: Initial roll diameter selection 2 82: Fire override trigger 83: Tension PID switchover 84–85: Reserved 86: Carrier synchronization mode switches to standalone running (valid when stopped) 87: Carrier synchronization mode running signal 88: Carrier synchronization mode run permissive signal 89: Carrier synchronization mode relay output running 90: Carrier synchronization relay open feedback signal 91–95: Reserved		
P05.07	Reserved	/	/	/

Function code	Name	Description	Default	Modify																														
P05.08	Input terminal polarity	The function code is 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. 0x00–0x3F	0x00	○																														
P05.09	Digital input filter time	The function code is used to specify the sampling filter time of the S1–S4 and HDIA and HDIB terminals. In strong interference cases, increase the value to avoid maloperation. 0.000–1.000 s	0.010 s	○																														
P05.10	Virtual terminal setting	0x00–0x3F (0: disable, 1: enable) Bit0: S1 virtual terminal Bit1: S2 virtual terminal Bit2: S3 virtual terminal Bit3: S4 virtual terminal Bit4: HDIA virtual terminal Bit5: HDIB virtual terminal	0x00	◎																														
P05.11	Terminal control mode	The function code is used to set the terminal control mode. 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 FWD K2 REV COM <table><tr><td>FWD</td><td>REV</td><td>Running command</td></tr><tr><td>OFF</td><td>OFF</td><td>Stop</td></tr><tr><td>ON</td><td>OFF</td><td>Forward running</td></tr><tr><td>OFF</td><td>ON</td><td>Reverse running</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. K1 FWD K2 REV COM <table><tr><td>FWD</td><td>REV</td><td>Running command</td></tr><tr><td>OFF</td><td>OFF</td><td>Stop</td></tr><tr><td>ON</td><td>OFF</td><td>Forward running</td></tr><tr><td>OFF</td><td>ON</td><td>Stop</td></tr><tr><td>ON</td><td>ON</td><td>Reverse running</td></tr></table>	FWD	REV	Running command	OFF	OFF	Stop	ON	OFF	Forward running	OFF	ON	Reverse running	ON	ON	Hold	FWD	REV	Running command	OFF	OFF	Stop	ON	OFF	Forward running	OFF	ON	Stop	ON	ON	Reverse running	0	◎
FWD	REV	Running command																																
OFF	OFF	Stop																																
ON	OFF	Forward running																																
OFF	ON	Reverse running																																
ON	ON	Hold																																
FWD	REV	Running command																																
OFF	OFF	Stop																																
ON	OFF	Forward running																																
OFF	ON	Stop																																
ON	ON	Reverse running																																

Function code	Name	Description	Default	Modify																					
		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. During running, the S_{in} terminal needs to be closed, and when terminal FWD generates a rising edge signal, the VFD starts to run in the direction set by the state of terminal REV; the VFD needs to be stopped by disconnecting terminal S_{in}.  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 enabling terminal, and the running command is generated by FWD or REV, but the direction is controlled by both FWD and REV. During running, the S_{in} terminal needs to be closed, and terminal FWD or REV generates a rising edge signal to control the running and direction of the VFD; the VFD needs to be stopped by disconnecting terminal S_{in}.	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		
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																								

Function code	Name	Description	Default	Modify																				
		SB1 SB2 SB3 FWD S_{in} REV COM <table><tr><th>S_{in}</th><th>FWD</th><th>REV</th><th>Running direction</th></tr><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>ON→OFF</td><td></td><td></td><td>Decelerate to stop</td></tr></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 VFD stops due to a stop command given by another source, the VFD does not run again after the stop command disappears even if the control terminal FWD/REV is still valid. To make the VFD run, you need to trigger FWD/REV again, for example, PLC single-cycle stop, fixed-length stop, and valid STOP/RST stop during terminal control. (See P07.04.)	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. Si Electrical level Si Valid Invalid Valid Invalid Switch-on delay Switch-off delay	0.000 s	○																				
P05.13	S1 switch-off delay		0.000 s	○																				
P05.14	S2 switch-on delay		0.000 s	○																				
P05.15	S2 switch-off delay		0.000 s	○																				
P05.16	S3 switch-on delay		0.000 s	○																				
P05.17	S3 switch-off delay		0.000 s	○																				
P05.18	S4 switch-on delay		0.000 s	○																				

Function code	Name	Description	Default	Modify
P05.19	S4 switch-off delay	Setting range: 0.000–50.000 s	0.000 s	☐
P05.20	HDIA switch-on delay	Note: After a virtual terminal is enabled, the terminal status can be changed only by communication means. The communication address is 0x200A.	0.000 s	☐
P05.21	HDIA switch-off delay		0.000 s	☐
P05.22	HDIB switch-on delay		0.000 s	☐
P05.23	HDIB switch-off delay		0.000 s	☐
P05.24	AI1 lower limit		0.00 V	☐
P05.25	Corresponding setting of AI1 lower limit	The function codes define the relationship between the analog input voltage and its corresponding setting. When the analog input voltage outside the range between the lower and upper limits, the upper limit or lower limit is used.	0.0%	☐
P05.26	AI1 upper limit		10.00 V	☐
P05.27	Corresponding setting of AI1 upper limit	When the analog input is current input, 0mA–20mA current corresponds to 0V–10V voltage.	100.0%	☐
P05.28	AI1 input filter time	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:	0.030 s	☐
P05.29	AI2 lower limit		-10.00 V	☐
P05.30	Corresponding setting of AI2 lower limit		-100.0%	☐
P05.31	AI2 middle value 1		0.00 V	☐
P05.32	Corresponding setting of AI2 middle value 1		0.0%	☐
P05.33	AI2 middle value 2	 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.	0.00 V	☐
P05.34	Corresponding setting of AI2 middle value 2		0.0%	☐
P05.35	AI2 upper limit		10.00 V	☐
P05.36	Corresponding setting of AI2 upper limit		100.0%	☐
P05.37	AI2 input filter time		0.030 s	☐



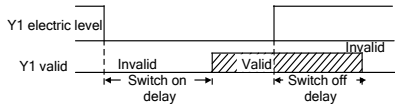
Function code	Name	Description	Default	Modify
		Setting range of P05.25: -300.0%~300.0% Setting range of P05.26: P05.24~10.00 V Setting range of P05.27: -300.0%~300.0% Setting range of P05.28: 0.000~10.000 s Setting range of P05.29: -10.00 V~P05.31 Setting range of P05.30: -300.0%~300.0% Setting range of P05.31: P05.29~P05.33 Setting range of P05.32: -300.0%~300.0% Setting range of P05.33: P05.31~P05.35 Setting range of P05.34: -300.0%~300.0% Setting range of P05.35: P05.33~10.00 V Setting range of P05.36: -300.0%~300.0% Setting range of P05.37: 0.000~10.000 s		
P05.38	HDIA high-speed pulse input function selection	0: Frequency setting input 1: Reserved 2: Input set through encoder, used together with HDIB	0	⊙
P05.39	HDIA lower limit frequency	0.000 kHz~P05.41	0.000 kHz	○
P05.40	Corresponding setting of HDIA lower limit frequency	-300.0%~300.0%	0.0%	○
P05.41	HDIA upper limit frequency	P05.39~50.000 kHz	50.000 kHz	○
P05.42	Corresponding setting of HDIA upper limit frequency	-300.0%~300.0%	100.0%	○
P05.43	HDIA frequency input filter time	0.000~10.000 s	0.030 s	○
P05.44	HDIB high-speed pulse input function selection	0: Frequency setting input 1: Reserved 2: Input set through encoder, used together with HDIA	0	⊙
P05.45	HDIB lower limit frequency	0.000 kHz~P05.47	0.000 kHz	○
P05.46	Corresponding setting of HDIB	-300.0%~300.0%	0.0%	○

Function code	Name	Description	Default	Modify
	lower limit frequency			
P05.47	HDIB upper limit frequency	P05.45–50.000 kHz	50.000 kHz	○
P05.48	Corresponding setting of HDIB upper limit frequency	-300.0%–300.0%	100.0%	○
P05.49	HDIB frequency input filter time	0.000–10.000 s	0.030 s	○
P05.50	AI1 input signal type selection	0: Voltage type 1: Current type Note: You can set the AI1 input signal type through the corresponding function code.	0	◎
P05.51– P05.52	Reserved	/	/	/

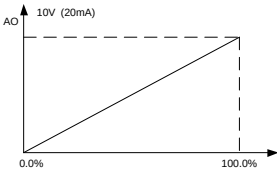
Group P06—Output terminals

Function code	Name	Description	Default	Modify
P06.00	HDO output type	0: Open collector high-speed pulse output. The max. frequency of pulse is 50.00kHz. For details about the related functions, see P06.27–P06.31. 1: Open collector output. For details about the related functions, see P06.02.	0	◎
P06.01	Y1 output	0: Invalid	0	○
P06.02	HDO output	1: Running	0	○
P06.03	RO1 output	2: Running forward	1	○
P06.04	RO2 output	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: Upper limit frequency reached 11: Frequency lower limit reached 12: Ready for running	5	○

Function code	Name	Description	Default	Modify
		13: Pre-exciting 14: Overload pre-alarm 15: Underload pre-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/Modbus TCP communication virtual terminal output 24: PROFIBUS/CANopen/DeviceNet communication virtual terminal output 25: Ethernet communication virtual terminal output 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 limit reached in torque control 34: EtherCAT/PROFINET/EtherNet IP communication virtual terminal output 35: Reserved 36: Speed/position control switching completed 37: Any frequency reached 38–40: Reserved 41: Y1 from the PLC card 42: Y2 from the PLC card 43: HDO from the PLC card 44: RO1 from the PLC card 45: RO2 from the PLC card 46: RO3 from the PLC card 47: RO4 from the PLC card 48: EC PT100 detected OT alarm		

Function code	Name	Description	Default	Modify								
		49: EC PT1000 detected OT alarm 50: AIAO detected OT alarm 51: Stopped or running in zero speed 52: Tension control disconnection 53: Specified roll diameter reached 54: Max. roll diameter reached 55: Min. roll diameter reached 56: Fire mode enabled 57: S1 terminal state 58: S2 terminal state 59: S3 terminal state 60: S4 terminal state 61: HDIA terminal state 62: HDIB terminal state 63–64: Reserved 65: Carrier synchronization relay output selection										
P06.05	Output terminal polarity	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>Bit3</td><td>Bit2</td><td>Bit1</td><td>Bit0</td></tr><tr><td>RO2</td><td>RO1</td><td>HDO</td><td>Y1</td></tr></table> Setting range: 0x00–0x0F	Bit3	Bit2	Bit1	Bit0	RO2	RO1	HDO	Y1	0x00	○
Bit3	Bit2	Bit1	Bit0									
RO2	RO1	HDO	Y1									
P06.06	Y1 switch-on delay		0.000 s	○								
P06.07	Y1 switch-off delay		0.000 s	○								
P06.08	HDO switch-on delay		0.000 s	○								
P06.09	HDO switch-off delay		0.000 s	○								
P06.10	RO1 switch-on delay		0.000 s	○								
P06.11	RO1 switch-off delay		0.000 s	○								
P06.12	RO2 switch-on delay		0.000 s	○								
P06.13	RO2 switch-off delay		0.000 s	○								
P06.14	AO1 output		0: Running frequency (100% corresponds to	0	○							

Function code	Name	Description	Default	Modify
	selection	max. output frequency)		
P06.15	Reserved	1: Set frequency (100% corresponds to max. output frequency) 2: Ramp reference frequency (100% corresponds to max. output 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 (0–10V/0–20mA) 11: AI2 input (-10–10V) 12: AI3 input (0–10V/0–20mA) 13: HDIA input value (0.00–50.00kHz) 14: Modbus/Modbus TCP communication setting value 1 (0–1000) 15: Modbus/Modbus TCP communication setting value 2 (0–1000) 16: PROFIBUS/CANopen/DeviceNet communication setting value 1 (0–1000) 17: PROFIBUS/CANopen/DeviceNet communication setting value 2 (0–1000) 18: Ethernet communication setting value 1 (0–1000) 19: Ethernet communication setting value 2 (0–1000) 20: HDIB input (0.00–50.00kHz) 21: EtherCAT/PROFINET/ EtherNet IP setting	0	○
P06.16	HDO high-speed pulse output		0	○

Function code	Name	Description	Default	Modify
		value 1 (0–1000) 22: Torque current (bipolar, 100% corresponds to triple the motor rated current) 23: Exciting current (bipolar, 100% corresponds to triple the motor rated current) 24: Set frequency (bipolar, 0–Max. output frequency) 25: Ramp reference frequency (bipolar, 0–Max. output frequency) 26: Rotational speed (bipolar, 0–Speed corresponding to max. output frequency) 27: EtherCAT/PROFINET/ EtherNet IP setting value 2 (0–1000) 28: AO1 from the PLC card (0–1000) 29: AO2 from the PLC card (0–1000) 30: Rotational speed (100% corresponds to the speed corresponding to twice the motor rated frequency) 31: Output torque (Actual value, 100% corresponds to twice the motor rated torque) 32: AIAO detected temperature output 33–63: Reserved		
P06.17	AO1 output lower limit	The function codes define the relationship between the output value and analog output.	0.0%	☐
P06.18	AO1 output corresponding to lower limit	When the output value exceeds the allowed range, the output uses the lower limit or upper limit.	0.00 V	☐
P06.19	AO1 output upper limit	When the analog output is current output, 1 mA equals 0.5 V.	100.0%	☐
P06.20	AO1 output corresponding to upper limit	In different cases, the corresponding analog output of 100% of the output value is different.	10.00 V	☐
P06.21	AO1 output filter time	 Setting range of P06.17: -300.0%–P06.19	0.000 s	☐

Function code	Name	Description	Default	Modify
		Setting range of P06.18: 0.00–10.00 V Setting range of P06.19: P06.17–300.0% Setting range of P06.20: 0.00–10.00 V Setting range of P06.21: 0.000–10.000 s		
P06.22	Reserved	/	/	/
P06.23	PTC constant-current source output current setting	0.000–20.000 mA	4.000 mA	○
P06.24	PTC resistance alarm threshold	0–60000 Ω	750 Ω	○
P06.25	PTC resistance alarm recovery threshold	0–60000 Ω	150 Ω	○
P06.26	Actual PTC resistance	0–60000 Ω	0 Ω	●
P06.27	HDO output lower limit	-300.0%–P06.29	0.0%	○
P06.28	HDO output corresponding to lower limit	0.00–50.00 kHz	0.00 kHz	○
P06.29	HDO output upper limit	P06.27–300.0%	100.0%	○
P06.30	HDO output corresponding to upper limit	0.00–50.00 kHz	50.00 kHz	○
P06.31	HDO output filter time	0.000–10.000 s	0.000 s	○
P06.32	Reserved	/	/	/
P06.33	Frequency reached detection value	0.00 Hz–P00.03	1.00 Hz	○
P06.34	Frequency reached detection time	0.0–3600.0 s	0.5 s	○

Group P07—HMI

Function code	Name	Description	Default	Modify
P07.00	User password	0–65535 When you set the function code to a non-zero number, password protection is enabled.	0	○

Function code	Name	Description	Default	Modify
		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 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 delete the user password. Exercise caution when using this function.		
P07.01	Reserved	/	/	/
P07.02	Function of QUICK/JOG key	Range: 0x00–0x27 Ones place: Function of QUICK/JOG 0: No function 1: Jog 2: Reserved 3: Switch between forward and reverse rotation 4: Clear the UP/DOWN setting 5: Coast to stop 6: Switch command channels in sequence 7: Reserved Tens place: Reserved	0x01	⊙
P07.03	Sequence of switching running-command channels by pressing QUICK	When P07.02=6, set the sequence of switching running command channels. 0: Keypad→Terminal→Communication 1: Keypad←→Terminal 2: Keypad←→Communication 3: Terminal←→Communication	0	○
P07.04	Stop function validity of STOP/RST	Used to specify the stop function validity of STOP/RST . For fault reset, STOP/RST is valid in any conditions.	0	○

Function code	Name	Description	Default	Modify
		0: Valid only for keypad control 1: Valid both for keypad and terminal control 2: Valid both for keypad and communication control 3: Valid for all control modes		
P07.05–P07.07	Reserved	/	/	/
P07.08	Frequency display coefficient	0.01–10.00 Display frequency = Running frequency × P07.08	1.00	○
P07.09	Rotation speed display coefficient	0.1–999.9% Mechanical rotation speed = 120 × (Displayed running frequency) × P07.09/(Number of motor poles)	100.0%	○
P07.10	Linear speed display coefficient	0.1–999.9% Linear speed = (Mechanical rotation speed) × P07.10	1.0%	○
P07.11	Rectifier bridge temperature	-20.0–120.0°C	0°C	●
P07.12	Inverter module temperature	-20.0–120.0°C	0°C	●
P07.13	Control board software version	1.00–655.35	Depends on version	●
P07.14	Local accumulative running time	0–65535h	0h	●
P07.15	VFD electricity consumption high word	Used to display the electricity consumption of the VFD. VFD electricity consumption = P07.15×1000 + P07.16	0 kWh	●
P07.16	VFD electricity consumption low word	Setting range of P07.15: 0–65535 kWh (×1000) Setting range of P07.16: 0.0–999.9 kWh	0.0 kWh	●
P07.17	VFD model	0x0000–0xFFFF1 Bit0–bit3: G type or P type 0x0: G type 0x1: P type Bit4–bit11: Chip type and manufacturer 0x00: DSP(TI)	Default: depends on model (0x0000)	●

Function code	Name	Description	Default	Modify
		0x01–0x20: Reserved 0x21: MCU(ST) 0x22–0xFF: Reserved Bit12–bit15: VFD series 0x0: GD350 0x1: GD350A 0x2: GD350-UL 0x3: GD350IP55 0x4–0xF: Reserved Note: Bit4–bit8 indicate the chip manufacturer (such as TI, ST), while bit9–bit11 indicate the chip type (such as DSP, MCU).		
P07.18	VFD rated power	0.4–3000.0 kW	Depends on version	●
P07.19	VFD rated voltage	50–1200V	Depends on version	●
P07.20	VFD rated current	0.1–6000.0A	Depends on version	●
P07.21	Factory bar code 1	0x0000–0xFFFF	Depends on version	●
P07.22	Factory bar code 2	0x0000–0xFFFF	Depends on version	●
P07.23	Factory bar code 3	0x0000–0xFFFF	Depends on version	●
P07.24	Factory bar code 4	0x0000–0xFFFF	Depends on version	●
P07.25	Factory bar code 5	0x0000–0xFFFF	Depends on version	●
P07.26	Factory bar code 6	0x0000–0xFFFF	Depends on version	●

Function code	Name	Description	Default	Modify
P07.27	Most recent fault type	0: No fault	0	●
P07.28	Last fault type	1: Inverter unit U-phase protection (OUT1)	0	●
P07.29	2nd-last fault type	2: Inverter unit V-phase protection (OUT2)	0	●
P07.30	3rd-last fault type	3: Inverter unit W-phase protection (OUT3)	0	●
P07.31	4th-last fault type	4: Overcurrent during ACC (OC1)	0	●
		5: Overcurrent during DEC (OC2)	0	●
		6: Overcurrent during constant speed running (OC3)		
		7: Overvoltage during ACC (OV1)		
		8: Overvoltage during DEC (OV2)		
		9: Overvoltage during constant speed running (OV3)		
		10: Bus undervoltage fault (UV)		
		11: Motor overload (OL1)		
		12: VFD overload (OL2)		
		13: Phase loss on input side (SPI)		
		14: Phase loss on output side (SPO)		
		15: Rectifier module overheating (OH1)		
		16: Inverter module overheating (OH2)		
		17: External fault (EF)		
		18: Modbus/Modbus TCP communication fault (CE)		
P07.32	5th-last fault type	19: Current detection fault (ItE)	0	●
		20: Motor autotuning fault (tE)		
		21: EEPROM operation error (EEP)		
		22: PID feedback offline fault (PIDE)		
		23: Braking unit fault (bCE)		
		24: Running time reached (END)		
		25: Electronic overload (OL3)		
		26: Keypad communication error (PCE)		
		27: Parameter upload error (UPE)		
		28: Parameter download error (DNE)		
		29: PROFIBUS communication fault (E-DP)		
		30: Ethernet communication fault (E-NET)		
		31: CANopen communication fault (E-CAN)		
		32: To-ground short-circuit fault 1 (ETH1)		
		33: To-ground short-circuit fault 2 (ETH2)		
		34: Speed deviation fault (dEu)		
		35: Mal-adjustment fault (STo)		

Function code	Name	Description	Default	Modify
		36: Underload fault (LL) 37: Encoder disconnection fault (ENC1o) 38: Encoder direction reversal fault (ENC1d) 39: Encoder Z-pulse disconnection fault (ENC1Z) 40: Safe torque off (STO) 41: Channel 1 safety circuit exception (STL1) 42: Channel 2 safety circuit exception (STL2) 43: Exception in both channels 1 and 2 (STL3) 44: Safety code FLASH CRC fault (CrCE) 45: PLC card customized fault 1 (P-E1) 46: PLC card customized fault 2 (P-E2) 47: PLC card customized fault 3 (P-E3) 48: PLC card customized fault 4 (P-E4) 49: PLC card customized fault 5 (P-E5) 50: PLC card customized fault 6 (P-E6) 51: PLC card customized fault 7 (P-E7) 52: PLC card customized fault 8 (P-E8) 53: PLC card customized fault 9 (P-E9) 54: PLC card customized fault 10 (P-E10) 55: Duplicate expansion card type (E-Err) 56: Encoder UVW lost (ENCUV) 57: PROFINET communication fault (E-PN) 58: CAN communication fault (SECAN) 59: Motor overtemperature fault (OT) 60: Failure to identify the card in slot 1 (F1-Er) 61: Failure to identify the card in slot 2 (F2-Er) 62: Failure to identify the card in slot 3 (F3-Er) 63: Communication timeout of the card in slot 1 (C1-Er) 64: Communication timeout of the card in slot 2 (C2-Er) 65: Communication timeout of the card in slot 3 (C3-Er) 66: EtherCAT communication fault (E-CAT) 67: BACnet communication fault (E-BAC) 68: DeviceNet communication fault (E-DEV) 69: CAN slave fault in master/slave synchronization (S-Err)		

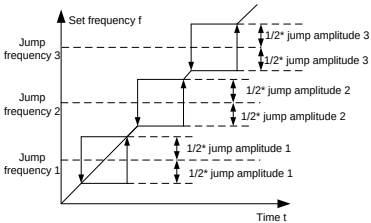
Function code	Name	Description	Default	Modify
		70: Expansion card PT100 overtemperature (OtE1) 71: Expansion card PT1000 overtemperature (OtE2) 72: EtherNet IP communication timeout fault (E-EIP) 73: No upgrade bootloader (E-PAO) 74: AI1 disconnection (E-AI1) 75: AI2 disconnection (E-AI2) 76: AI3 disconnection (E-AI3) 77–80: Reserved 81: Carrier synchronization card slot error (E-cfr) 82: Synchronization signal loss (E-tsl) 83: Carrier synchronization card communication timeout (E-cts) 84: Carrier synchronization relay feedback fault (E-ros) 85: Carrier synchronization card master/slave fault (E-ctr)		
P07.33	Running frequency at the most recent fault	0.00 Hz–P00.03	0.00 Hz	●
P07.34	Ramp reference frequency at the most recent fault	0.00 Hz–P00.03	0.00 Hz	●
P07.35	Output voltage at the most recent fault	0–1200 V	0 V	●
P07.36	Output current at the most recent fault	0.0–6300.0 A	0.0 A	●
P07.37	Bus voltage at the most recent fault	0.0–2000.0 V	0.0 V	●
P07.38	Max. temperature at the most recent fault	-20.0–120.0°C	0.0°C	●
P07.39	Input terminal status at the most	0x0000–0xFFFF	0x0000	●

Function code	Name	Description	Default	Modify
	recent fault			
P07.40	Output terminal state at the most recent fault	0x0000–0xFFFF	0x0000	●
P07.41	Running frequency at last fault	0.00 Hz–P00.03	0.00 Hz	●
P07.42	Ramp reference frequency at last fault	0.00 Hz–P00.03	0.00 Hz	●
P07.43	Output voltage at last fault	0–1200 V	0 V	●
P07.44	Output current at last fault	0.0–6300.0 A	0.0 A	●
P07.45	Bus voltage at last fault	0.0–2000.0 V	0.0 V	●
P07.46	Temperature at last fault	-20.0–120.0°C	0.0°C	●
P07.47	Input terminal state at last fault	0x0000–0xFFFF	0x0000	●
P07.48	Output terminal state at last fault	0x0000–0xFFFF	0x0000	●
P07.49	Running frequency at 2nd-last fault	0.00 Hz–P00.03	0.00 Hz	●
P07.50	Ramp reference frequency at 2nd-last fault	0.00 Hz–P00.03	0.00 Hz	●
P07.51	Output voltage at 2nd-last fault	0–1200 V	0 V	●
P07.52	Output current at 2nd-last fault	0.0–6300.0 A	0.0 A	●
P07.53	Bus voltage at 2nd-last fault	0.0–2000.0 V	0.0 V	●
P07.54	Temperature at 2nd-last fault	-20.0–120.0°C	0.0°C	●
P07.55	Input terminal state at 2nd-last fault	0x0000–0xFFFF	0x0000	●
P07.56	Output terminal	0x0000–0xFFFF	0x0000	●

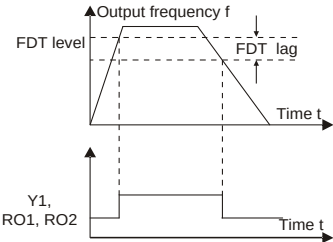
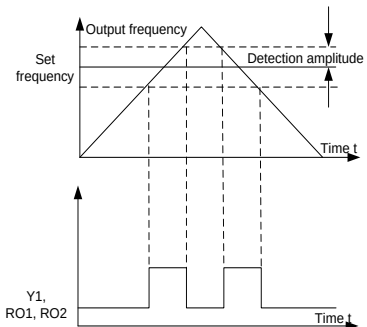
Function code	Name	Description	Default	Modify
	state at 2nd-last fault			

Group P08—Enhanced functions

Function code	Name	Description	Default	Modify
P08.00	ACC time 2	For details, see P00.11 and P00.12. The VFD has four groups of ACC/DEC time, which can be selected by P05. The factory default ACC/DEC time of the VFD is the first group. Setting range: 0.0–3600.0 s	Depends on model	☐
P08.01	DEC time 2		Depends on model	☐
P08.02	ACC time 3		Depends on model	☐
P08.03	DEC time 3		Depends on model	☐
P08.04	ACC time 4		Depends on model	☐
P08.05	DEC time 4		Depends on model	☐
P08.06	Running frequency of jog	The function code is used to define the reference frequency during jogging. Setting range: 0.00Hz–P00.03 (Max. output frequency)	5.00Hz	☐
P08.07	ACC time for jog	ACC time for jogging means the time needed for the VFD to accelerate from 0Hz to the max. output frequency (P00.03).	Depends on model	☐
P08.08	DEC time for jog	DEC time for jogging means the time needed for the VFD to decelerate from the max. output frequency (P00.03) to 0Hz. Setting range: 0.0–3600.0 s	Depends on model	☐
P08.09	Jump frequency 1	When the set frequency is within the range of jump frequency, the VFD runs at the boundary of jump frequency. The VFD can avoid mechanical resonance points by setting jump frequencies. The VFD 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		0.00Hz	☐

Function code	Name	Description	Default	Modify
		 Setting range: 0.00Hz–P00.03 (Max. output frequency)		
P08.15	Wobble frequency amplitude percentage	0.0–100.0% (of the set frequency)	0.0%	○
P08.16	Amplitude of sudden jump frequency	0.0–50.0% (of the amplitude of wobble frequency)	0.0%	○
P08.17	Rise time of wobble frequency	0.1–3600.0 s	5.0 s	○
P08.18	Fall time of wobble frequency	0.1–3600.0 s	5.0 s	○
P08.19	Switching frequency of ACC/DEC time	0.00–P00.03 (Max. output frequency) 0.00 Hz: No switchover If the running frequency is greater than P08.19, switch to ACC/DEC time 2.	0.00 Hz	○
P08.20	Droop control starting frequency point	0.00–50.00 Hz	2.00 Hz	○
P08.21	Reference frequency of ACC/DEC time	0: Max. output frequency 1: Set frequency 2: 100 Hz Note: Valid for straight ACC/DEC only.	0	◎
P08.22	Output torque calculation method	0: Based on torque current 1: Based on output power	0	○
P08.23	Number of decimal places of frequency	0: Two 1: One	0	○
P08.24	Number of decimal places of linear speed	0: No decimal point 1: One 2: Two	0	○

Function code	Name	Description	Default	Modify
		3: Three		
P08.25	Set counting value	P08.26–65535	0	○
P08.26	Designated counting value	0–P08.25	0	○
P08.27	Preset running time	0–65535 min	0 min	○
P08.28	Auto fault reset count	Auto fault reset count: When the VFD uses automatic fault reset, it is used to set the number of automatic fault reset times. When the number of continuous reset times exceeds the value, the VFD 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 occurs within 600 s after the VFD starts, the number of automatic fault reset times is cleared. Setting range of P08.28: 0–10 Setting range of P08.29: 0.1–3600.0 s	1.0 s	○
P08.30	Frequency decrease ratio in droop control	The output frequency of the VFD changes as the load changes. The function code is mainly used to balance the power when several motors drive the same load. Setting range: 0.00–50.00 Hz	0.00 Hz	○
P08.31	Channel for switching between motor 1 and motor 2	0x00–0x14 Ones place: Switching channel selection 0: Terminal 1: Modbus/Modbus TCP communication 2: PROFIBUS/CANopen/DeviceNet communication 3: Ethernet communication 4: EtherCAT/PROFINET/EtherNet IP communication Tens place: Enable switching during running 0: Disable 1: Enable	0x00	◎
P08.32	FDT1 electrical level detection value	When the output frequency exceeds the corresponding frequency of FDT electrical level, the multifunction digital output terminal	50.00 Hz	○

Function code	Name	Description	Default	Modify
P08.33	FDT1 lagging detection value	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 electrical level—FDT lagging detection value).	5.0%	☐
P08.34	FDT2 electrical level detection value		50.00 Hz	☐
P08.35	FDT2 lagging detection value	 Setting range of P08.32: 0.00Hz–P00.03 (Max. output frequency) Setting range of P08.33: 0.0–100.0% (FDT1 electrical level) Setting range of P08.34: 0.00Hz–P00.03 (Max. output frequency) Setting range of P08.35: 0.0–100.0% (FDT2 electrical 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: 0.00 Hz–P00.03 (Max. output frequency)	0.00 Hz	☐

Function code	Name	Description	Default	Modify
P08.37	Dynamic braking enable	0: Disable 1: Enable	1	○
P08.38	Dynamic braking threshold voltage	The function code is used to set the starting bus voltage of dynamic braking. Adjust this value properly to achieve effective braking for the load. The default value varies depending on the voltage class. Setting range: 200.0–2000.0 V	For 220V: 380.0 V For 380V: 700.0 V For 660V: 1120.0 V	○
P08.39	Cooling fan operating mode	0: Normal mode 1: The fan keeps running after power-on 2: Running mode 2	0	○
P08.40	PWM selection	0x0000–0x1121 Ones place: PWM mode selection 0: PWM mode 1, 3PH modulation and 2PH modulation 1: PWM mode 2, 3PH modulation 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 frequency Hundreds place: Deadzone compensation method 0: Compensation method 1 1: Compensation method 2 Thousands place: PWM loading mode selection 0: Interruptive loading 1: Normal loading	0x1101	◎
P08.41	Overmodulation selection	0x0000–0x1111 Ones place: Overmodulation enabling 0: Overmodulation disabled 1: Overmodulation enabled Tens place: Overmodulation mode 0: Light overmodulation 1: Deepened overmodulation Hundreds place: Carrier frequency limit 0: Limit enabled 1: No limit	0x1001	◎

Function code	Name	Description	Default	Modify
		Thousands place: Output voltage compensation 0: No compensation 1: Compensation enabled		
P08.42	Reserved	/	/	/
P08.43	Reserved	/	/	/
P08.44	UP/DOWN terminal control setting	0x000–0x221 Ones place: Whether the setting made through UP/DOWN is valid. 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 increment rate	0.01–50.00 Hz/s	0.50 Hz/s	○
P08.46	DOWN terminal frequency decrement rate	0.01–50.00 Hz/s	0.50 Hz/s	○
P08.47	Action selection at power-off during frequency setting	0x000–0x111 Ones place: Action selection at power failure during digital frequency adjustment. 0: Save the setting at power failure. 1: Clear the setting at power failure. Tens place: Action selection at power failure during frequency adjusting through Modbus communication 0: Save the setting at power failure. 1: Clear the setting at power failure. Hundreds place: Action selection at power-off	0x000	○

Function code	Name	Description	Default	Modify
		during frequency setting through DP communication 0: Save the setting at power failure. 1: Clear the setting at power failure.		
P08.48	Initial electricity consumption high word	Used to set the initial electricity consumption. Initial electricity consumption = P08.48 × 1000 + P08.49	0 kWh	○
P08.49	Initial electricity consumption low word	Setting range of P08.48: 0–59999 kWh (k) Setting range of P08.49: 0.0–999.9 kWh	0.0 kWh	○
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 VFD 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 VFD 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. Motor cooling is more effective. During flux braking, the stator current increases while the rotor current does not. Since the stator can be cooled much more effectively than the rotor, the motor dissipates heat more efficiently.	0	○
P08.51	VFD input power factor	This function code is used to adjust the current display value on the AC input side. 0.00–1.00	0.56	○
P08.52	STO lock selection	0: Lock upon STO alarm Lock upon STO alarm indicates resetting is	0	○

Function code	Name	Description	Default	Modify
		required after state restoration if STO occurs. 1: No lock upon STO alarm No lock upon STO alarm: Indicates that the STO alarm will automatically clear after state recovery from STO.		
P08.53	Upper limit frequency bias value in torque control	0.00 Hz–P00.03 (Max. output frequency) Note: Valid only for torque control.	0.00 Hz	○
P08.54	Upper limit frequency ACC/DEC selection in torque control	0: No ACC/DEC limit 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 inverter temperature drops to a certain level, the carrier frequency is restored to the set value. This function can reduce the VFD overheat alarm reporting chances.	0	○
P08.56	Min. carrier frequency	0.0–15.0 kHz	Depends on model	●
P08.57	Automatic carrier frequency reduction temperature threshold	40.0–85.0°C	70.0°C	○
P08.58	Carrier frequency reduction interval	0–30 min	10 min	○
P08.59	AI1 disconnection detection threshold	0–100%	0	○
P08.60	AI2 disconnection detection threshold	0–100%	0	○
P08.61	AI3 disconnection	0–100%	0	○

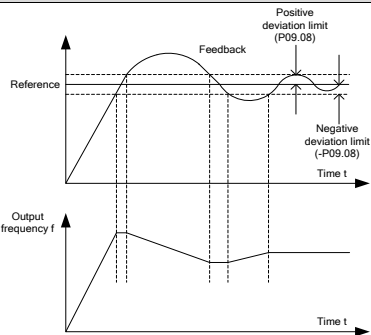
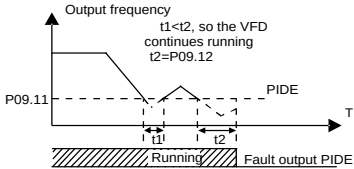
Function code	Name	Description	Default	Modify
	detection threshold			
P08.62	Output current filter time	0.000–10.000 s	0.000 s	☐
P08.63	Output torque filter count	0–8	8	☐

Group P09—PID control

Function code	Name	Description	Default	Modify
P09.00	PID reference source	When P00.06 or P00.07 (Setting channel of A/B frequency command) is 7 or P04.27 (Voltage setting channel) is 6, the VFD 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: High-speed pulse HDIA 5: Multi-step setting 6: Modbus/Modbus TCP communication 7: PROFIBUS/CANopen/DeviceNet communication 8: Ethernet communication 9: High-speed pulse HDIB 10: EtherCAT/PROFINET/EtherNet IP communication 11: PLC card 12: Reserved 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	☐
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.	0.0%	☐

Function code	Name	Description	Default	Modify
		Setting range: -100.0%~100.0%		
P09.02	PID feedback source	The function code is used to select the PID feedback channel. 0: AI1 1: AI2 2: AI3 3: High-speed pulse HDIA 4: Modbus/Modbus TCP communication 5: PROFIBUS/CANopen/DeviceNet communication 6: Ethernet communication 7: High-speed pulse HDIB 8: EtherCAT/PROFINET/EtherNet IP communication 9: PLC card 10: Reserved Note: The reference channel and feedback channel cannot be the same. 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 VFD will decrease to balance the PID. Example: PID control on tension during winding. 1: PID output is negative. When the feedback signal is greater than the PID reference value, the output frequency of the VFD will increase to balance the PID. Example: PID control on tension 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 deviation 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 and derivative	1.80	○

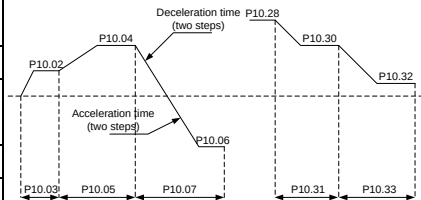
Function code	Name	Description	Default	Modify
		actions). Setting range: 0.00–100.00		
P09.05	Integral time (Ti)	The function code is used to determine the speed of the integral adjustment on the deviation of PID feedback and reference from the PID regulator. When the deviation of PID feedback and reference is 100%, the integral regulator works continuously during the time (ignoring proportional and derivative actions) to achieve the max. output frequency (P00.03) or the max. voltage (P04.31). Shorter integral time indicates stronger adjustment. Setting range: 0.00–10.00 s	0.90 s	○
P09.06	Differential time (Td)	The function code is 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 derivative regulator (ignoring proportional and integral function) is the max. output frequency (P00.03) or the max. voltage (P04.31). Longer derivative time indicates stronger adjustment. Setting range: 0.00–10.00 s	0.00 s	○
P09.07	Sampling cycle (T)	The function code is used to indicate the sampling cycle of feedback. The regulator calculates in each sampling cycle. A longer sampling cycle indicates slower response. Setting range: 0.001–1.000 s	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.	0.0%	○

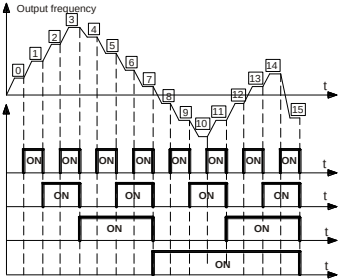
Function code	Name	Description	Default	Modify
		 Setting range: 0.0–100.0%		
P09.09	PID output upper limit	Used to set the upper and lower limits of PID regulator output values. 100.0% corresponds to the max. output frequency (P00.03) or max. voltage (P04.31). Setting range of P09.09: P09.10–100.0% Setting range of P09.10: -100.0%–P09.09	100.0%	○
P09.10	PID output lower limit		0.0%	○
P09.11	Feedback disconnection detection value	The function code is used to set the PID feedback offline detection value. When the feedback value is smaller than or equal to the feedback offline detection value, and the duration exceeds the value specified by P09.12, the VFD reports "PID feedback offline fault" and the keypad displays PIDE.  Setting range of P09.11: 0.0–100.0% Setting range of P09.12: 0.0–3600.0 s	0.0%	○
P09.12	Feedback offline detection time		1.0 s	○
P09.13	PID control selection	0x0000–0x1111 Ones place: 0: Continue integral control after the frequency reaches upper/lower limit 1: Stop integral control after the frequency	0x0001	○

Function code	Name	Description	Default	Modify
		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 is determined by P08.04		
P09.14	Low frequency proportional gain (Kp)	0.00–100.00 Low-frequency switching point: 5.00Hz, high-frequency switching point: 10.00Hz (P09.04 corresponds to high-frequency parameter), and the middle is the linear interpolation between these two points.	1.00	○
P09.15	PID command ACC/DEC time	0.0–1000.0 s	0.0 s	○
P09.16	PID output filter time	0.000–10.000 s	0.000 s	○
P09.17	Reserved	/	/	/
P09.18	Low frequency integral time (Ti)	0.00–10.00 s	0.90 s	○
P09.19	Low frequency derivative time (Td)	0.00–10.00 s	0.00 s	○
P09.20	Low frequency point for PID parameter switching	0.00–P09.21	5.00 Hz	○
P09.21	High frequency point for PID parameter switching	P09.20–P00.03	10.00 Hz	○
P09.22–P09.28	Reserved	/	/	/

Group P10—Simple PLC and multi-step speed control

Function code	Name	Description	Default	Modify
P10.00	Simple PLC mode	0: Stop after running once. The VFD stops automatically after running for one cycle, and it can be started only after receiving the running command. 1: Keep running in the final value after running for one cycle. The VFD keeps the running frequency and direction of the last section after a single cycle. 2: Cyclic running. The VFD enters the next cycle after completing one cycle until receiving the stop command.	0	○
P10.01	Simple PLC power-loss memory	0: Disable 1: Memorize at power failure. The PLC memorizes its running step and running frequency before power loss.	0	○
P10.02	Multi-step speed 0	Frequency setting range for steps from step 0 to step 15: -300.0–300.0%. 100.0% corresponds to the max. output frequency P00.03.	0.0%	○
P10.03	Step 0 run time		0.0 s (min)	○
P10.04	Multi-step speed 1	Running time setting range for steps from step 0 to step 15: 0.0–6553.5 s (min). The time unit is specified by P10.37.	0.0%	○
P10.05	Step 1 run time		0.0 s (min)	○
P10.06	Multi-step speed 2	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.	0.0%	○
P10.07	Step 2 run time		0.0 s (min)	○
P10.08	Multi-step speed 3		0.0%	○
P10.09	Step 3 run time	Note: The symbol of multi-step speed determines the running direction of simple PLC, and a negative value indicates reverse running.	0.0 s (min)	○
P10.10	Multi-step speed 4		0.0%	○
P10.11	Step 4 run time		0.0 s (min)	○
P10.12	Multi-step speed 5		0.0%	○
P10.13	Step 5 run time		0.0 s (min)	○
P10.14	Multi-step speed 6		0.0%	○
P10.15	Step 6 run time		0.0 s (min)	○



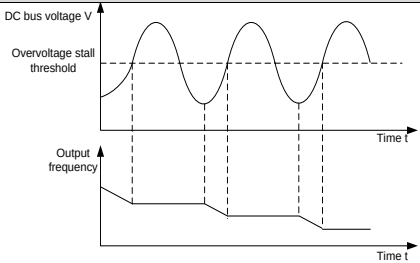
Function code	Name	Description	Default	Modify																																																						
P10.16	Multi-step speed 7	multi-step speed is within the range of f_{max}–f_{max}, and it can be set continuously. The start-up and stop of multi-step speed is determined by the function code P00.01. The VFD supports 16 speed steps, selected through the input combinations of multi-step terminals 1–4 (S terminals, whose functions are defined by P05.01–P05.06), corresponding to speed 0 to speed 15. 	0.0%	☐																																																						
P10.17	Step 7 run time		0.0 s (min)	☐																																																						
P10.18	Multi-step speed 8		0.0%	☐																																																						
P10.19	Step 8 run time		0.0 s (min)	☐																																																						
P10.20	Multi-step speed 9		0.0%	☐																																																						
P10.21	Step 9 run time		0.0 s (min)	☐																																																						
P10.22	Multi-step speed 10		0.0%	☐																																																						
P10.23	Step 10 run time		0.0 s (min)	☐																																																						
P10.24	Multi-step speed 11		0.0%	☐																																																						
P10.25	Step 11 run time		0.0 s (min)	☐																																																						
P10.26	Multi-step speed 12		0.0%	☐																																																						
P10.27	Step 12 run time		0.0 s (min)	☐																																																						
P10.28	Multi-step speed 13	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 (T indicates terminal). <table><tr><td>Terminal 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>Terminal 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>Terminal 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>Terminal 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>Terminal 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></table>	Terminal 1	OFF	ON	OFF	ON	OFF	ON	OFF	ON	Terminal 2	OFF	OFF	ON	ON	OFF	OFF	ON	ON	Terminal 3	OFF	OFF	OFF	OFF	ON	ON	ON	ON	Terminal 4	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	Step	0	1	2	3	4	5	6	7	Terminal 1	OFF	ON	OFF	ON	OFF	ON	OFF	ON	0.0%	☐
Terminal 1	OFF		ON	OFF	ON	OFF	ON	OFF	ON																																																	
Terminal 2	OFF		OFF	ON	ON	OFF	OFF	ON	ON																																																	
Terminal 3	OFF		OFF	OFF	OFF	ON	ON	ON	ON																																																	
Terminal 4	OFF		OFF	OFF	OFF	OFF	OFF	OFF	OFF																																																	
Step	0		1	2	3	4	5	6	7																																																	
Terminal 1	OFF		ON	OFF	ON	OFF	ON	OFF	ON																																																	
P10.29	Step 13 run time		0.0 s (min)	☐																																																						
P10.30	Multi-step speed 14		0.0%	☐																																																						
P10.31	Step 14 run time		0.0 s (min)	☐																																																						
P10.32	Multi-step speed 15		0.0%	☐																																																						
P10.33	Step 15 run time			0.0 s (min)	☐																																																					

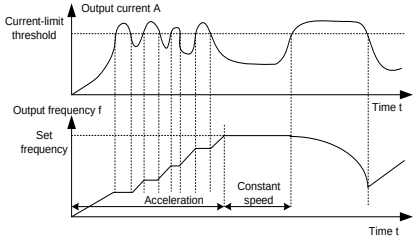
Function code	Name	Description										Default	Modify
		Terminal 2	OFF	OFF	ON	ON	OFF	OFF	ON	ON			
		Terminal 3	OFF	OFF	OFF	OFF	ON	ON	ON	ON			
		Terminal 4	ON	ON	ON	ON	ON	ON	ON	ON			
		Step	8	9	10	11	12	13	14	15			
P10.34	ACC/DEC time selection for simple PLC steps 0–7	The description is as follows:										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				
			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				
		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				
		Select corresponding acceleration/deceleration time, and then convert the 16-bit binary number into a hexadecimal number, 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										0x0000	○
P10.36	PLC restart mode	0: Restart from the step 0, namely if the VFD stops during running (caused by stop command, fault or power off), it will run from the first step after restart. 1: Continue running from the step frequency when interruption occurred, namely if the VFD										0	◎

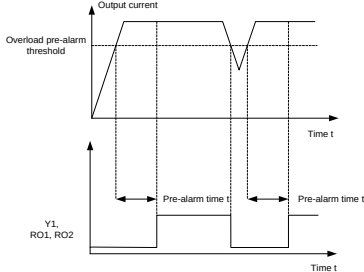
Function code	Name	Description	Default	Modify
		stops during running (caused by stop command or fault), it will record the running time of current step, and enters this step automatically after restart, then continue running at the frequency defined by this step in the remaining time.		
P10.37	Multi-step running time unit	0: seconds; the running time of each step is counted in seconds 1: minutes; the running time of each step is counted in minutes	0	⊙

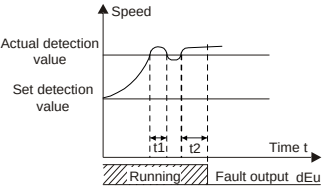
Group P11—Protection parameters

Function code	Name	Description	Default	Modify
P11.00	Phase loss protection	0x000–0x111 Ones place: 0: Disable software input phase loss protection. 1: Enable software input phase loss protection. Tens place: 0: Disable output phase loss protection. 1: Enable output phase loss protection. Hundreds place: 0: Disable hardware input phase loss protection. 1: Enable hardware input phase loss protection.	0x110	○
P11.01	Frequency decrease at sudden power loss	0: Disable 1: Enable	0	○
P11.02	Enabling dynamic braking in standby mode	0: Enable 1: Disable	0	⊙
P11.03	Overvoltage stall protection	0: Disable 1: Enable	1	○

Function code	Name	Description	Default	Modify
				
P11.04	Overvoltage stall protection voltage	120–150% (standard bus voltage) (380V)	136%	○
		120–150% (standard bus voltage) (220V)	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 VFD may trip due to overcurrent during acceleration. 0x00–0x11 Ones place: Current limit action selection 0: Invalid 1: Always valid Tens place: Hardware current limit overload alarm 0: Valid 1: Invalid	0x01	◎
P11.06	Automatic current limit threshold	The current-limit protection function detects output current during running, and compares it with the current-limit level specified by P11.06. If it exceeds the current-limit level, the VFD will run at stable frequency during accelerated running, or the VFD will run at decreased frequency during constant-speed running; if it exceeds the current-limit level continuously, the VFD output frequency will drop continuously until reaching the lower limit frequency. When the output current is detected to be lower than the current limit threshold again, it will continue accelerated running.	For the G type: 160.0% For the P type: 120.0%	◎
P11.07	Frequency drop rate during current limit		10.00 Hz/s	◎

Function code	Name	Description	Default	Modify
		 Setting range of P11.06: 50.0–200.0% (of the rated VFD output current) Setting range of P11.07: 0.00–50.00Hz/s		
P11.08	VFD/motor OL/UL alarm selection	0x0000–0x1134 Ones place: 0: Motor OL/UL alarm, relative to the motor rated current. 1: VFD OL/UL alarm, relative to VFD rated output current. 2: Motor output torque OL/UL alarm, relative to motor rated torque. 3: Motor OL/UL pre-alarm. The overload is relative to the motor rated current; while the underload is relative to the motor rated power. 4: VFD OL/UL pre-alarm. The overload is relative to the VFD rated current; while the underload is relative to the VFD rated power. Tens place: 0: The VFD continues to work for an OL/UL alarm. 1: The VFD continues to work for a UL alarm but stops running for an OL fault. 2: The VFD continues to work for an OL alarm but stops running for a UL fault. 3: The VFD stops running for an OL/UL alarm. Hundreds place: 0: Always detect 1: Detect during constant speed running. Thousands place: VFD overload current reference selection 0: Related to the current correction coefficient	0x0000	○

Function code	Name	Description	Default	Modify
		1: Not related to the current correction coefficient		
P11.09	Overload pre-alarm detection threshold	If the VFD or motor output current is larger than the overload pre-alarm detection level (P11.09), and the duration exceeds the overload alarm detection time (P11.10), an overload alarm signal is output.	For the G type: 150% For the P type: 120%	○
P11.10	Overload alarm detection time	 Setting range of P11.09: P11.11–200% (relative value determined by the ones place of P11.08) Setting range of P11.10: 0.1–3600.0 s	1.0 s	○
P11.11	Underload alarm detection level	Underload pre-alarm signal will be output if the output current of the VFD or motor is lower than underload pre-alarm detection level (P11.11), and the duration exceeds underload pre-alarm detection time (P11.12).	50%	○
P11.12	Underload pre-alarm detection time	Setting range of P11.11: 0–P11.09 (relative value determined by the ones place of P11.08) Setting range of P11.12: 0.1–3600.0 s	1.0 s	○
P11.13	Fault output terminal action upon fault occurring	Used to set the action of fault output terminals at undervoltage and fault reset. 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	0.0–50.0% Used to set the speed deviation detection value.	10.0%	○
P11.15	Speed deviation detection time	0.0–10.0 s (0.0 indicates no speed deviation protection)	2.0 s	○

Function code	Name	Description	Default	Modify
		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 $t2 = P11.15$ Setting range: 0.0–10.0 s		
P11.16	Automatic frequency-reduction during voltage drop	0–1 0: Invalid 1: Enable	0	☐
P11.17	Proportional coefficient of voltage regulator during undervoltage stall	Specifies the proportional coefficient of the bus voltage regulator during undervoltage stall. Setting range: 0–1000	100	☐
P11.18	Integral coefficient of voltage regulator during undervoltage stall	Specifies the integral coefficient of the bus voltage regulator during undervoltage stalling. Setting range: 0–1000	40	☐
P11.19	Proportional coefficient of current regulator during undervoltage stall	Specifies the proportional coefficient of the active current regulator during undervoltage stalling. Setting range: 0–1000	25	☐
P11.20	Integral coefficient of current regulator during undervoltage stall	Specifies the integral coefficient of the active current regulator during undervoltage stalling. Setting range: 0–2000	150	☐
P11.21	Proportional coefficient of voltage regulator during overvoltage stall	Specifies the proportional coefficient of the bus voltage regulator during overvoltage stalling. Setting range: 0–1000	60	☐
P11.22	Integral coefficient of voltage regulator	Specifies the integral coefficient of the bus voltage regulator during overvoltage stalling.	10	☐

Function code	Name	Description	Default	Modify
	during overvoltage stall	Setting range: 0–1000		
P11.23	Proportional coefficient of current regulator during overvoltage stall	Specifies the proportional coefficient of the active current regulator during overvoltage stalling. Setting range: 0–1000	60	○
P11.24	Integral coefficient of current regulator during overvoltage stall	Specifies the integral coefficient of the active current regulator during overvoltage stalling. Setting range: 0–2000	250	○
P11.25	Enabling VFD overload integral	0: Disable 1: Enable When this parameter is set to 0, the overload timing value is reset to zero after the VFD is stopped. In this case, the determination of VFD overload takes more time, and therefore the effective protection over the VFD is weakened. When this parameter is set to 1, the overload timing value is not reset, and the overload timing value is accumulative. In this case, the determination of VFD overload takes less time, and therefore the protection over the VFD can be performed more quickly.	0	◎
P11.26	Reserved	/	/	/
P11.27	V/f oscillation control method	0x00–0x11 Ones place: 0: Method 1 1: Method 2 Tens place: 0: Reserved 1: Reserved	0x00	◎
P11.28	SPO switch-on detection delay time	0.0–60.0 s Note: The SPO detection is started only after the VFD runs for the delay time P11.28 to avoid false alarms caused by the unstable frequency.	5.0 s	○
P11.29	SPO unbalance	0–10	6	○

Function code	Name	Description	Default	Modify
	factor			
P11.30	Reserved	/	/	/
P11.31	Fault level group 1	0x0000–0x3333	0x0000	○
P11.32	Fault level group 2	Thousands place/hundreds place/tens	0x0000	○
P11.33	Fault level group 3	place/ones place:	0x0000	○
P11.34	Fault level group 4	0: Report a fault	0x0000	○
P11.35	Fault level group 5	1: Report a fault after deceleration to stop	0x0000	○
P11.36	Fault level group 6	2: Alarm, with the action executed according to	0x0000	○
P11.37	Fault level group 7	P11.51	0x0000	○
P11.38	Fault level group 8	3: Mask the fault	0x0000	○
P11.39	Fault level group 9	Note: Different fault actions are taken for different fault severities.	0x0000	○
P11.40	Fault level group 10	The first 10 faults are not grouped by severity,	0x0000	○
P11.41	Fault level group 11	but each four of the subsequent faults are	0x0000	○
P11.42	Fault level group 12	grouped by severity in ascending order from	0x0000	○
P11.43	Fault level group 13	right to left in hexadecimal format, that is, from	0x0000	○
P11.44	Fault level group 14	the ones place to the thousands place (for	0x0000	○
P11.45	Fault level group 15	example, the ones place of fault severity group 1	0x0000	○
P11.46	Fault level group 16	corresponds to fault 11).	0x0000	○
P11.47	Fault level group 17	Group 1: Faults 11–14 (OL1, OL2, SPI, SPO)	0x0000	○
P11.48	Fault level group 18	Group 2: Faults 15–18 (OH1, OH2, EF, CE)	0x0000	○
P11.49	Fault level group 19	Group 3: Faults 19–22 (ITE, tE, EEP, PIDE)	0x0000	○
P11.50	Fault level group 20	Group 4: Faults 23–26 (bCE, END, OL3, PCE) Group 5: Faults 27–30 (UPE, DNE, E-DP, E-NET) Group 6: Faults 31–34 (E-CAN, ETH1, ETH2, dEu) Group 7: Faults 35–38 (STo, LL, ENC1o, ENC1d) Group 8: Faults 39–42 (ENC1Z, STO, STL1, STL2) Group 9: Faults 43–46 (STL3, CrCE, P-E1, P-E2) Group 10: Faults 47–50 (P-E3, P-E4, P-E5, P-E6) Group 11: Faults 51–54 (P-E7, P-E8, P-E9, P-E10) Group 12: Faults 55–58 (E-Err, ENCU, E-PN, SECAN)	0x0000	○

Function code	Name	Description	Default	Modify
		Group 13: Faults 59–62 (OT, F1-Er, F2-Er, F3-Er) Group 14: Faults 63–66 (C1-Er, C2-Er, C3-Er, E-CAT) Group 15: Faults 67–70 (E-BAC, E-DEV, S-Err, OtE1) Group 16: Faults 71–74 (OtE2, E-EIP, E-PAO, E-AI1) Group 17: Faults 75–78 (E-AI2, E-AI3, Reserved, Reserved) Group 18: Faults 79–82 (Reserved, Reserved, Reserved, Reserved) Group 19: Faults 83–86 (Reserved, Reserved, Reserved, Reserved) Group 20: Faults 87–90 (Reserved, Reserved, Reserved, Reserved)		
P11.51	Action for fault alarm	0: Run at the set frequency 1: Run at the output frequency at the time of failure 2: Run at the upper limit frequency 3: Run at the lower limit frequency 4: Run at fallback frequency upon exceptions	0	○
P11.52	Fallback frequency upon exceptions	0.00–630.00 Hz	0.00 Hz	○
P11.53	Fire mode function	0: Invalid 1: Fire mode 1 2: Fire mode 2 Note: When P11.53=0, the fire mode is invalid. In this case, the VFD runs in normal mode and stops when encountering a fault. When the fire mode function is valid, the VFD runs at the speed specified by P11.54. In fire mode 1, the VFD keeps running except when the VFD has been damaged. In fire mode 2, the VFD keeps running, but stops upon the following faults: OUT1, OUT2, OUT3, OC1, OC2, OC3, OV1, OV2, OV3, and SPO. Terminal control must be used for a fire mode. Note: After the fire mode is active for 5	0	◎

Function code	Name	Description	Default	Modify
		minutes, P11.55 is set to 1, and the warranty is no longer valid. Please use with caution.		
P11.54	Running frequency in fire mode	0.00 Hz–P00.03	50.00 Hz	○
P11.55	Fire mode flag	0–1 Note: If the fire mode has lasted 5 minutes, this flag is set to 1, and no warranty of repair is granted.	0	●
P11.56	Software input phase loss detection method	0: Detection based on the 100 Hz component obtained using a sine quadrature function 1: Detection based on the 100 Hz component obtained using a square-wave quadrature function	1	○
P11.57	Software input phase loss detection limit value	Sets the maximum peak-to-peak value of the 100 Hz component of the bus voltage fluctuation. 0.0–200.0 V	40.0 V	○
P11.58	Software input phase loss detection time	0.0–20.0 s	2.0 s	○
P11.59	Exciting current limit during flux weakening	0.0–100.0%	50.0%	○

Group P12—Motor 2 parameters

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	0.1–3000.0 kW	Depends on model	◎
P12.02	AM 2 rated frequency	0.01 Hz–P00.03 (Max. output frequency)	50.00 Hz	◎
P12.03	AM 2 rated speed	1–60000 rpm	Depends on model	◎
P12.04	AM 2 rated voltage	0–1200 V	Depends on model	◎
P12.05	AM 2 rated current	0.8–6000.0 A	Depends	◎

Function code	Name	Description	Default	Modify
			on model	
P12.06	AM 2 stator resistance	0.001–65.535 Ω	Depends on model	☐
P12.07	AM 2 rotor resistance	0.001–65.535 Ω	Depends on model	☐
P12.08	AM 2 leakage inductance	0.1–6553.5 mH	Depends on model	☐
P12.09	AM 2 mutual inductance	0.1–6553.5 mH	Depends on model	☐
P12.10	AM 2 no-load current	0.1–6553.5 A	Depends on model	☐
P12.11	AM 2 core saturation coefficient 1	0.0–100.0%	80%	☐
P12.12	AM 2 core saturation coefficient 2	0.0–100.0%	68%	☐
P12.13	AM 2 core saturation coefficient 3	0.0–100.0%	57%	☐
P12.14	AM 2 core saturation coefficient 4	0.0–100.0%	40%	☐
P12.15	SM 2 rated power	0.1–3000.0 kW	Depends on model	☒
P12.16	SM 2 rated frequency	0.01 Hz–P00.03 (Max. output frequency)	50.00 Hz	☒
P12.17	SM 2 pole pair count	1–128	2	☒
P12.18	SM 2 rated voltage	0–1200 V	Depends on model	☒
P12.19	SM 2 rated current	0.8–6000.0 A	Depends on model	☒
P12.20	SM 2 stator resistance	0.001–65.535 Ω	Depends on model	☐
P12.21	SM 2 direct-axis inductance	0.01–655.35 mH	Depends on model	☐

Function code	Name	Description	Default	Modify
P12.22	SM 2 quadrature-axis inductance	0.01–655.35 mH	Depends on model	○
P12.23	SM 2 back-EMF constant	0–10000	300	○
P12.24	Reserved	/	/	/
P12.25	Reserved	/	/	/
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 multiples $M = I_{out}/(I_n \cdot K)$ "In" is the rated motor current, "Iout" is the VFD output current, "K" is the motor overload protection coefficient. A smaller value of "K" indicates a bigger value of "M". When $M=116\%$, protection is performed after motor overload lasts for 1 hour; when $M=150\%$, protection is performed after motor overload lasts for 12 minutes; when $M=180\%$, protection is performed after motor overload lasts for 5 minutes; when $M=200\%$, protection is performed after motor overload lasts for 60 seconds; and when $M \geq 400\%$, protection is performed immediately.	100.0%	○

Function code	Name	Description	Default	Modify
		Setting range: 20.0%~150.0%		
P12.28	Motor 2 power display calibration coefficient	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	0.000~30.000 kg·m ²	0.000 kg·m ²	☐
P12.31~P12.32	Reserved	/	/	/

Group P13—SM control

Function code	Name	Description	Default	Modify
P13.00	SM injected-current decrease ratio	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 pole detection method	0: No detection 1: High-frequency current injection 2: Pulse superposition	0	☒

Function code	Name	Description	Default	Modify
P13.02	Pull-in current 1	Specifies the pole position orientation current. It 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	Specifies the pole position orientation current. It 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 switchover frequency	0.0~200.0% Note: The value is relative to the motor rated frequency.	20.0%	○
P13.05	High frequency superimposed frequency	200~1000 Hz	500 Hz	◎
P13.06	Pulse current setting	Used to set the pulse current threshold when the initial magnetic pole position is detected in the pulse mode. The value is a percentage of the motor rated current. Setting range: 0.0~300.0% (of the motor rated voltage)	100.0%	◎
P13.07	Reserved	0.0~400.0	0.0	○
P13.08	Control parameter 1	0x0000~0xFFFF	0x0000	○
P13.09	Frequency threshold of phase-lock loop switch-in	Used to set the frequency threshold for enabling the counter-electromotive force phase-locked loop in SVC 0. When the running frequency is lower than the value of the function code, the phase-locked loop is disabled; and when the running frequency is higher than that, the phase-locked loop is enabled. Setting range: 0.00~655.35 Hz	50.00 Hz	○
P13.10	Reserved	0.0~359.9	0.0	○
P13.11	Out-of-step detection time	Adjusts the response of the out-of-step prevention function. For a load with high inertia, increase this value; however, the response will	0.5 s	○

Function code	Name	Description	Default	Modify
		become slower. Setting range: 0.0–10.0 s		
P13.12	SM high-frequency compensation coefficient	When the motor runs at a speed higher than the rated speed, the parameter is valid. If the motor oscillates, adjust this parameter properly. Setting range: 0.0–100.0%	0.0%	○
P13.13	High-frequency pull-in current	0–300.0% (of the VFD rated output current)	20.0%	◎
P13.14– P13.19	Reserved	/	/	/

Group P14—Serial communication

Function code	Name	Description	Default	Modify
P14.00	Local communication address	Setting range: 1–247 When the master sets the slave address in a frame to 0, a broadcast address in a frame, all the slaves on the Modbus bus receive the frame but do 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 communication address of a slave cannot be set to 0.	1	○
P14.01	Communication baud rate setting	The function code is used to set the rate of data transmission between the host controller and the VFD. 0: 1200 bps 1: 2400 bps 2: 4800 bps 3: 9600 bps 4: 19200 bps 5: 38400 bps 6: 57600 bps 7: 115200 bps Note: The baud rate set on the VFD must be consistent with that on the host controller.	4	○

Function code	Name	Description	Default	Modify
		Otherwise, the communication fails. A greater baud rate indicates faster communication.		
P14.02	Data bit parity setting	The data format set on the VFD must be consistent with that on the host controller. Otherwise, the communication fails. 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	0–200 ms Indicates the communication response delay, that is, the interval from when the VFD 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 actual response delay is subject to the system processing time. If the response delay is longer than the system processing time, the system waits after data processing is completed and does not send response data to the host controller until the set response delay has elapsed.	5 ms	○
P14.04	RS485 communication timeout period	0.0 (invalid)–60.0 s 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 "Modbus/Modbus TCP communication fault" (CE) if the communication interval exceeds the value. In general, this parameter is set to disabled. When continuous communication is required, you can set the function code to monitor communication status.	0.0 s	○
P14.05	Transmission fault handling	0: Report an alarm and coast to stop 1: Keep running without reporting an alarm	0	○

Function code	Name	Description	Default	Modify
		2: Stop according to the stop mode without generating alarms (only in the communication-based control mode) 3: Stop according to the stop mode without generating alarms (in all control modes)		
P14.06	Modbus communication processing action selection	0x000–0x111 Ones place: 0: Respond to write operations 1: Do not respond to write operations Tens place: 0: Communication password protection is invalid. 1: Communication password protection is valid. Hundreds place: (valid for RS485 communication only) 0: P14.07 and P14.08 user-defined addresses are invalid. 1: P14.07 and P14.08 user-defined addresses are valid.	0x000	○
P14.07	User-defined running command address	0x0000–0xFFFF This parameter specifies the user-defined Modbus run command address.	0x2000	○
P14.08	User-defined frequency setting address	0x0000–0xFFFF This parameter specifies the user-defined Modbus frequency setting address.	0x2001	○
P14.09	Modbus TCP communication timeout time	0.0 (invalid)–60.0 s	0.0 s	○
P14.10	RS485 upgrade program enable	0: Disable 1: Enable	0	◎
P14.11	Bootloader software version	0.00–655.35	0.00	●
P14.12	Display of no upgrade bootloader fault	0: Display 1: Do not display	0	○
P14.13–	Reserved	/	/	/

Function code	Name	Description	Default	Modify
P14.47				
P14.48	Channel selection for mapping between PZDs and function codes	0x00–0x12 Ones place: Channel for mapping function codes to PZDs 0: Reserved 1: Group P15 2: Group P16 Tens place: Save function at power off 0: Disable 1: Enable	0x12	○
P14.49	Mapped function code for PZD2 receive	0x0000–0xFFFF	0x0000	○
P14.50	Mapped function code for PZD3 receive	0x0000–0xFFFF	0x0000	○
P14.51	Mapped function code for PZD4 receive	0x0000–0xFFFF	0x0000	○
P14.52	Mapped function code for PZD5 receive	0x0000–0xFFFF	0x0000	○
P14.53	Mapped function code for PZD6 receive	0x0000–0xFFFF	0x0000	○
P14.54	Mapped function code for PZD7 receive	0x0000–0xFFFF	0x0000	○
P14.55	Mapped function code for PZD8 receive	0x0000–0xFFFF	0x0000	○
P14.56	Mapped function code for PZD9 receive	0x0000–0xFFFF	0x0000	○
P14.57	Mapped function code for PZD10 receive	0x0000–0xFFFF	0x0000	○
P14.58	Mapped function code for PZD11 receive	0x0000–0xFFFF	0x0000	○
P14.59	Mapped function code for PZD12 receive	0x0000–0xFFFF	0x0000	○
P14.60	Mapped function code for PZD2 transmit	0x0000–0xFFFF	0x0000	○
P14.61	Mapped function code for PZD3 transmit	0x0000–0xFFFF	0x0000	○
P14.62	Mapped function code	0x0000–0xFFFF	0x0000	○

Function code	Name	Description	Default	Modify
	for PZD4 transmit			
P14.63	Mapped function code for PZD5 transmit	0x0000–0xFFFF	0x0000	○
P14.64	Mapped function code for PZD6 transmit	0x0000–0xFFFF	0x0000	○
P14.65	Mapped function code for PZD7 transmit	0x0000–0xFFFF	0x0000	○
P14.66	Mapped function code for PZD8 transmit	0x0000–0xFFFF	0x0000	○
P14.67	Mapped function code for PZD9 transmit	0x0000–0xFFFF	0x0000	○
P14.68	Mapped function code for PZD10 transmit	0x0000–0xFFFF	0x0000	○
P14.69	Mapped function code for PZD11 transmit	0x0000–0xFFFF	0x0000	○
P14.70	Mapped function code for PZD12 transmit	0x0000–0xFFFF	0x0000	○

Group P15—Functions of communication expansion card 1

Function code	Name	Description	Default	Modify
P15.00	Reserved	/	/	/
P15.01	Module address	0–127	2	⊙
P15.02	PZD2 receive	0: Invalid	0	○
P15.03	PZD3 receive	1: Set frequency (0–Fmax, unit: 0.01 Hz)	0	○
P15.04	Received PZD4	2: PID reference (-1000–1000, where 1000 corresponds to 100.0%)	0	○
P15.05	Received PZD5		0	○
P15.06	Received PZD6	3: PID feedback (-1000–1000, where 1000 corresponds to 100.0%)	0	○
P15.07	Received PZD7		0	○
P15.08	Received PZD8	4: Torque setpoint (-3000–+3000, where 1000 corresponds to 100.0% of the motor rated current)	0	○
P15.09	Received PZD9		0	○
P15.10	Received PZD10		0	○
P15.11	Received PZD11	5: Forward upper limit frequency setpoint (0–Fmax, unit: 0.01 Hz)	0	○
P15.12	Received PZD12	6: Reverse upper limit frequency setpoint (0–Fmax, unit: 0.01 Hz) 7: Motoring torque upper limit setpoint (0–3000,	0	○

Function code	Name	Description	Default	Modify
		where 1000 corresponds to 100.0% of the motor rated current) 8: Braking torque upper limit setpoint (0– 3000, where 1000 corresponds to 100.0% of the motor rated current) 9: Virtual input terminal command (range: 0x000–0x3FF, corresponding to S8/S7/S6/S5/HDIB/HDIA/S4/S3/S2/S1) 10: Virtual output terminal command (range: 0x00–0x0F, corresponding to RO2/RO1/HDO/Y1) 11: Voltage setting (special for V/F separation) (0–1000, where 1000 corresponds to 100% of the motor rated voltage) 12: AO1 output setting 1 (-1000–+1000, where 1000 corresponds to 100.0%) 13: AO2 output setting 2 (-1000–+1000, where 1000 corresponds to 100.0%) 14: Position reference high bit (signed) 15: Position reference low bit (unsigned) 16: Position feedback high bit (signed) 17: Position feedback low bit (unsigned) 18: Position feedback setting flag (position feedback can be set only after this flag is set to 1 and then to 0) 19: Function parameter mapping (PZD2–PZD12 correspond to P14.49–P14.59) 20–31: Reserved		
P15.13	PZD2 transmit	0: Invalid	0	○
P15.14	PZD3 transmit	1: Running frequency (×100, Hz)	0	○
P15.15	Sent PZD4	2: Set frequency (×100, Hz)	0	○
P15.16	Sent PZD5	3: Bus voltage (×10, V)	0	○
P15.17	Sent PZD6	4: Output voltage (×1, V)	0	○
P15.18	Sent PZD7	5: Output current (×10, A)	0	○
P15.19	Sent PZD8	6: Actual output torque (×10, %)	0	○
P15.20	Sent PZD9	7: Actual output power (×10, %)	0	○
P15.21	Sent PZD10	8: Rotation speed of running (×1, RPM)	0	○
P15.22	Sent PZD11	9: Linear speed of running (×1, m/s)	0	○

Function code	Name	Description	Default	Modify
P15.23	Sent PZD12	10: Ramp reference frequency 11: Fault code 12: AI1 input (×100, V) 13: AI2 input (×100, V) 14: AI3 input (×100, V) 15: HDIA frequency value (×100, kHz) 16: Terminal input state 17: Terminal output state 18: PID reference (×10, %) 19: PID feedback (×10, %) 20: Motor rated torque 21: Position reference high bit (signed) 22: Position reference low bit (unsigned) 23: Position feedback high bit (signed) 24: Position feedback low bit (unsigned) 25: Status word 26: HDIB frequency value (×1000, kHz) 27: PG card pulse feedback count high bit 28: PG card pulse feedback count low bit 29: PG card pulse reference count MSB 30: PG card pulse reference count LSB 31: Function parameter mapping (PZD2–PZD12 correspond to P14.60–P14.70)	0	○
P15.24	Reserved	/	/	/
P15.25	DP communication timeout period	0.0 (invalid)–60.0 s	5.0 s	○
P15.26	CANopen communication timeout time	0.0 (invalid)–60.0 s	5.0 s	○
P15.27	CANopen communication baud rate	0: 1000 kbps 1: 800 kbps 2: 500 kbps 3: 250 kbps 4: 125 kbps 5: 100 kbps 6: 50 kbps 7: 20 kbps	3	◎
P15.28	Master/slave CAN communication address	0–127	1	◎

Function code	Name	Description	Default	Modify
P15.29	Master/slave CAN communication baud rate	0: 50 kbps 1: 100 kbps 2: 125 kbps 3: 250 kbps 4: 500 kbps 5: 1 Mbps	2	☉
P15.30	Master/slave CAN communication timeout time	0.0 (invalid)–300.0 s	0.0 s	○
P15.31	DeviceNet communication timeout period (reserved)	0.0–60.0 s	5.0 s	○
P15.32–P15.42	Reserved	/	/	/

Group P16—Functions of communication expansion card 2

Function code	Name	Description	Default	Modify
P16.00–P16.01	Reserved	/	/	/
P16.02	Ethernet monitoring card IP address 1	0–255	192	☉
P16.03	Ethernet monitoring card IP address 2	0–255	168	☉
P16.04	Ethernet monitoring card IP address 3	0–255	0	☉
P16.05	Ethernet monitoring card IP address 4	0–255	1	☉
P16.06	Ethernet monitoring card subnet mask 1	0–255	255	☉
P16.07	Ethernet monitoring card subnet mask 2	0–255	255	☉
P16.08	Ethernet monitoring card subnet mask 3	0–255	255	☉
P16.09	Ethernet monitoring card subnet mask 4	0–255	0	☉
P16.10	Ethernet monitoring card gateway 1	0–255	192	☉
P16.11	Ethernet monitoring	0–255	168	☉

Function code	Name	Description	Default	Modify
	card gateway 2			
P16.12	Ethernet monitoring card gateway 3	0–255	0	⊙
P16.13	Ethernet monitoring card gateway 4	0–255	1	⊙
P16.14	Ethernet monitoring variable address 1	0x0000–0xFFFF	0x0000	○
P16.15	Ethernet card monitoring variable address 2	0x0000–0xFFFF	0x0000	○
P16.16	Ethernet card monitoring variable address 3	0x0000–0xFFFF	0x0000	○
P16.17	Ethernet card monitoring variable address 4	0x0000–0xFFFF	0x0000	○
P16.18– P16.23	Reserved	/	/	/
P16.24	Time to identify expansion card in slot 1	0.0–600.0 s The value 0.0 indicates that identification faults are not detected.	0.0 s	○
P16.25	Time to identify expansion card in slot 2		0.0 s	○
P16.26	Time to identify expansion card in slot 3		0.0 s	○
P16.27	Communication timeout period of expansion card in slot 1		0.0 s	○
P16.28	Communication timeout period of expansion card in slot 2		0.0 s	○
P16.29	Communication timeout period of expansion card in slot 3		0.0 s	○
P16.30	EtherCAT	0.0–60.0 s	5.0 s	○

Function code	Name	Description	Default	Modify
	communication timeout period (Reserved)			
P16.31	PROFINET communication timeout period	0.0–60.0 s	5.0 s	○
P16.32	PZD2 receive	0: Invalid	0	○
P16.33	PZD3 receive	1: Set frequency (0–Fmax, unit: 0.01 Hz)	0	○
P16.34	Received PZD4	2: PID reference (-1000–1000, where 1000 corresponds to 100.0%)	0	○
P16.35	Received PZD5	3: PID feedback (-1000–1000, where 1000 corresponds to 100.0%)	0	○
P16.36	Received PZD6	4: Torque setpoint (-3000–+3000, where 1000 corresponds to 100.0% of the motor rated current)	0	○
P16.37	PZD7 receive	5: Forward upper limit frequency setpoint (0–Fmax, unit: 0.01 Hz)	0	○
P16.38	PZD8 receive	6: Reverse upper limit frequency setpoint (0–Fmax, unit: 0.01 Hz)	0	○
P16.39	PZD9 receive	7: Motoring torque upper limit (0–3000, where 1000 corresponds to 100.0% of the motor rated current)	0	○
P16.40	Received PZD10	8: Braking torque upper limit (0–3000, where 1000 corresponds to 100.0% of the motor rated current)	0	○
P16.41	Received PZD11	9: Virtual input terminal command (range: 0x000–0x3FF, corresponding to S8/S7/S6/S5/HDIB/HDIA/S4/S3/S2/S1)	0	○
P16.42	Received PZD12	10: Virtual output terminal command (range: 0x00–0x0F, corresponding to RO2/RO1/HDO/Y1)	0	○
		11: Voltage setting (special for V/F separation) (0–1000, where 1000 corresponds to 100% of the motor rated voltage)		
		12: AO1 output setting 1 (-1000–+1000, where 1000 corresponds to 100.0%)		
		13: AO2 output setting 2 (-1000–+1000, where 1000 corresponds to 100.0%)		

Function code	Name	Description	Default	Modify
		14: Position reference high bit (signed) 15: Position reference low bit (unsigned) 16: Position feedback high bit (signed) 17: Position feedback low bit (unsigned) 18: Position feedback setting flag (position feedback can be set only after this flag is set to 1 and then to 0) 19: Function parameter mapping (PZD2–PZD12 correspond to P14.49–P14.59) 20–31: Reserved		
P16.43	PZD2 transmit	0: Invalid	0	○
P16.44	PZD3 transmit	1: Running frequency ($\times 100$, Hz)	0	○
P16.45	Sent PZD4	2: Set frequency ($\times 100$, Hz)	0	○
P16.46	Sent PZD5	3: Bus voltage ($\times 10$, V)	0	○
P16.47	Sent PZD6	4: Output voltage ($\times 1$, V)	0	○
P16.48	Sent PZD7	5: Output current ($\times 10$, A)	0	○
P16.49	Sent PZD8	6: Actual output torque ($\times 10$, %)	0	○
P16.50	Sent PZD9	7: Actual output power ($\times 10$, %)	0	○
P16.51	Sent PZD10	8: Running speed ($\times 1$, RPM)	0	○
P16.52	Sent PZD11	9: Linear speed of running ($\times 1$, m/s)	0	○
		10: Ramp reference frequency		
P16.53	Sent PZD12	11: Fault code 12: AI1 input ($\times 100$, V) 13: AI2 input ($\times 100$, V) 14: AI3 input ($\times 100$, V) 15: HDIA frequency value ($\times 100$, kHz) 16: Terminal input state 17: Terminal output state 18: PID reference ($\times 10$, %) 19: PID feedback ($\times 10$, %) 20: Motor rated torque 21: Position reference high bit (signed) 22: Position reference low bit (unsigned) 23: Position feedback high bit (signed) 24: Position feedback low bit (unsigned) 25: Status word 26: HDIB frequency value ($\times 1000$, kHz) 27: PG card pulse feedback count high bit 28: PG card pulse feedback count low bit	0	○

Function code	Name	Description	Default	Modify
		29: PG card pulse reference count MSB 30: PG card pulse reference count LSB 31: Function parameter mapping (PZD2–PZD12 correspond to P14.60–P14.70)		
P16.54	EtherNet IP communication timeout period	0.0–60.0 s	5.0 s	○
P16.55	EtherNet IP communication rate	0: Self-adaptive 1: 100 M full duplex 2: 100 M half duplex 3: 10 M full duplex 4: 10 M half duplex	0	◎
P16.56	Bluetooth pairing code	0–65535	0	●
P16.57	Bluetooth host type	Range: 0–65535 0: No host connection 1: Mobile App 2: Bluetooth box 3–65535: Reserved	0	●
P16.58	Industrial Ethernet communication card IP address 1	0–255	192	◎
P16.59	Industrial Ethernet communication card IP address 2	0–255	168	◎
P16.60	Industrial Ethernet communication card IP address 3	0–255	0	◎
P16.61	Industrial Ethernet communication card IP address 4	0–255	20	◎
P16.62	Industrial Ethernet communication card subnet mask 1	0–255	255	◎
P16.63	Industrial Ethernet communication card subnet mask 2	0–255	255	◎

Function code	Name	Description	Default	Modify
P16.64	Industrial Ethernet communication card subnet mask 3	0–255	255	⊙
P16.65	Industrial Ethernet communication card subnet mask 4	0–255	0	⊙
P16.66	Industrial Ethernet communication card gateway 1	0–255	192	⊙
P16.67	Industrial Ethernet communication card gateway 2	0–255	168	⊙
P16.68	Industrial Ethernet communication card gateway 3	0–255	0	⊙
P16.69	Industrial Ethernet communication card gateway 4	0–255	1	⊙

Group P17—Status viewing

Function code	Name	Description	Default	Modify
P17.00	Set frequency	Displays the present set frequency of the VFD. Range: 0.00 Hz–P00.03	0.00 Hz	●
P17.01	Output frequency	Displays the present output frequency of the VFD. Range: 0.00 Hz–P00.03	0.00 Hz	●
P17.02	Ramp reference frequency	Displays the present ramp reference frequency of the VFD. Range: 0.00 Hz–P00.03	0.00 Hz	●
P17.03	Output voltage	Displays the present output voltage of the VFD. Range: 0–1200 V	0 V	●
P17.04	Output current	Displays the valid value of present output current of the VFD. Range: 0.0–5000.0 A	0.0 A	●
P17.05	Motor speed	Displays the present motor rotation speed. Range: 0–65535 RPM	0 RPM	●

Function code	Name	Description	Default	Modify
P17.06	Torque current	Displays the present torque current of the VFD. Range: -3000.0–3000.0 A	0.0 A	●
P17.07	Exciting current	Displays the present exciting current of the VFD. Range: -3000.0–3000.0 A	0.0 A	●
P17.08	Motor power	Displays the present motor power. 100% 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% (relative to the rated motor power)	0.0%	●
P17.09	Motor output torque	Displays the present output torque of the VFD. 100% corresponds to the motor rated torque. 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: -250.0–250.0%	0.0%	●
P17.10	Estimated motor frequency	Displays the estimated motor rotor frequency under the open-loop vector condition. Range: 0.00 Hz–P00.03	0.00 Hz	●
P17.11	DC bus voltage	Displays the present DC bus voltage of the VFD. Range: 0.0–2000.0 V	0.0 V	●
P17.12	Digital input terminal status	Displays the present digital input terminal state of the VFD. 0x00–0x3F Corresponds to HDIB, HDIA, S4, S3, S2 and S1 respectively.	0x00	●
P17.13	Digital output terminal status	Displays the present digital output terminal state of the VFD. 0x00–0x0F The bits correspond to RO2, RO1, HDO, and Y1 respectively.	0x00	●
P17.14	Digital adjustment value	Displays the adjustment on the VFD through the <u>UP/DOWN</u> terminal. Range: 0.00 Hz–P00.03	0.00 Hz	●
P17.15	Torque reference value	Indicates the percentage of the rated torque of the present motor, displaying the torque reference.	0.0%	●

Function code	Name	Description	Default	Modify
		Range: -300.0%–300.0% (of the motor rated current)		
P17.16	Linear speed	0–65535	0	●
P17.17	Reserved	/	/	/
P17.18	Count value	0–65535	0	●
P17.19	AI1 input voltage	Displays the AI1 input signal. Range: 0.00–10.00 V	0.00 V	●
P17.20	AI2 input voltage	Displays the AI2 input signal. Range: -10.00 V–10.00 V	0.00 V	●
P17.21	HDIA input frequency	Display HDIA input frequency. Range: 0.000–50.000 kHz	0.000 kHz	●
P17.22	HDIB input frequency	Display HDIB input frequency. Range: 0.000–50.000 kHz	0.000 kHz	●
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 VFD. Range: 0–65535 min	0 min	●
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 as a percentage relative to the rated motor torque under the vector control mode. Range: -300.0%–300.0% (of the motor rated current)	0.0%	●
P17.29	Open-loop SM pole angle	Displays the initial identification angle of SM. Range: 0.0–360.0°	0.0°	●
P17.30	Phase compensation of SM	Displays the phase compensation of SM. Range: -180.0–180.0	0.0	●
P17.31	High-frequency superposition current of SM	0.0%–200.0% (of the motor rated current)	0.0%	●
P17.32	Motor flux linkage	0.0%–200.0%	0.0%	●

Function code	Name	Description	Default	Modify
P17.33	Exciting current reference	Displays the exciting current reference value under the vector control mode. Range: -3000.0–3000.0 A	0.0 A	●
P17.34	Torque current reference	Displays the torque current reference value under the vector control mode. Range: -3000.0–3000.0 A	0.0 A	●
P17.35	AC incoming current	Displays the valid value of incoming current on AC side. Range: 0.0–5000.0 A	0.0 A	●
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 N·m–3000.0 N·m	0.0 N·m	●
P17.37	Motor overload count value	0–65535	0	●
P17.38	Process PID output	-100.0%–100.0%	0.0%	●
P17.39	Function code with a parameter download error	0.00–99.00	0.00	●
P17.40	Motor control mode	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 1: Torque control 2: Position control Hundreds place: Motor number 0: Motor 1 1: Motor 2	0x000	●
P17.41	Motoring torque upper limit	0.0%–300.0% (of the motor rated current)	0.0%	●

Function code	Name	Description	Default	Modify
P17.42	Braking torque upper limit	0.0%–300.0% (of the motor rated current)	0.0%	●
P17.43	Forward rotation upper-limit frequency in torque control	0.00–P00.03	50.00 Hz	●
P17.44	Reverse rotation upper-limit frequency in torque control	0.00–P00.03	50.00 Hz	●
P17.45	Inertia compensation torque	-100.0%–100.0%	0.0%	●
P17.46	Friction compensation torque	-100.0%–100.0%	0.0%	●
P17.47	Number of pole pairs	0–65535	0	●
P17.48	VFD overload count value	0–65535	0	●
P17.49	A source frequency reference	0.00–P00.03	0.00 Hz	●
P17.50	B source frequency reference	0.00–P00.03	0.00 Hz	●
P17.51	PID proportional output	-100.0%–100.0%	0.0%	●
P17.52	PID integral output	-100.0%–100.0%	0.0%	●
P17.53	PID derivative output	-100.0%–100.0%	0.0%	●
P17.54	PID present proportional gain	0.00–100.00	0.00	●
P17.55	PID present integral time	0.00–10.00 s	0.00 s	●
P17.56	PID present derivative time	0.00–10.00 s	0.00 s	●
P17.57	Actual steps of multi-step speed	0–15	0	●
P17.58	100 Hz component peak-to-peak value	0.0–300.0 V Peak-to-peak value of bus voltage fluctuation at	0.0 V	●

Function code	Name	Description	Default	Modify
	(square-wave quadrature function detection)	100 Hz component, which is detected by using a square-wave orthogonal function.		
P17.59	100 Hz component peak-to-peak value (sine quadrature function detection)	0.0–300.0 V Peak-to-peak value of bus voltage fluctuation at 100 Hz component, which is detected by using a sine-wave quadrature function.	0.0 V	●
P17.60–P17.64	Reserved	/	/	/
P17.65	Carrier synchronization mode status word (valid for both master and slave)	0x0000–0xFFFF Ones place: Master/slave mode status 0: Carrier synchronization mode disabled 1: Master mode 2: Slave mode 3–15: Reserved Tens place: Synchronization signal valid status 0: Synchronization signal invalid 1: Synchronization signal valid 2–15: Reserved Hundreds place: Reserved 0–15: Reserved Thousands place: Reserved 0–15: Reserved	0x0000	●
P17.66	Slave 1 status word (valid for the master VFD)	Ones place: Run signal command 0: Invalid 1: Forward run	0x0000	●
P17.67	Slave 2 status word (valid for the master VFD)	2: Reverse run 3: Stopped 4: Faulty	0x0000	●
P17.68	Slave 3 status word (valid for the master VFD)	5: POFF 6: Pre-exciting 7–15: Reserved	0x0000	●
P17.69	Slave 4 status word (valid for the master VFD)	Tens place: Reserved Hundreds place: Ready for running 0: Not ready to run 1: Ready for running 2–15: Reserved	0x0000	●

Function code	Name	Description	Default	Modify
		Thousands place: Reserved		

Group P18—Status viewing in closed-loop control

Function code	Name	Description	Default	Modify
P18.00	Measured encoder frequency	The function code is used to indicate the actual-measured encoder frequency. The value of forward running is positive; the value of reverse running is negative. Range: -999.9–3276.7 Hz Note: P18.00 is only displayed in V/F and closed-loop modes. In open loop mode, it is not displayed.	0.0 Hz	●
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 value high word	High word of the position reference value. Cleared at stop. Range: 0–30000	0	●
P18.04	Position reference value low word	Low word of the position reference value. Cleared at stop. Range: 0–65535	0	●
P18.05	Position feedback value high word	High word of the position feedback value. Cleared at stop. Range: 0–30000	0	●
P18.06	Position feedback value low word	Low word of the position feedback value. Cleared at stop. Range: 0–65535	0	●
P18.07	Position deviation	The function code is used to indicate the deviation between the reference position and actual running position. Range: -32768–32767	0	●
P18.08	Position of position reference point	Z-pulse reference point position of spindle accurate stop. Range: 0–65535	0	●
P18.09	Spindle present position setting	Present position setting of spindle accurate stop. Range: 0–359.99	0.00	●

Function code	Name	Description	Default	Modify
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 an error of several pulses between the position of forward and reverse orientation, which can be eliminated by exchanging phase AB of encoder. 0: Forward 1: Reverse	0	●
P18.12	Encoder Z pulse angle	Range: 0.00–359.99	0.00	●
P18.13	Encoder Z pulse error times	Range: 0–65535	0	●
P18.14	PG card pulse feedback count high word	Encoder pulse count value. The count value increments continuously as long as the VFD is powered on. 0–65535	0	●
P18.15	PG card pulse feedback count low word	Encoder pulse count value. The count value increments continuously as long as the VFD is powered on. 0–65535	0	●
P18.16	Main control board measured value	-3276.8–3276.7 Hz	0.0 Hz	●
P18.17	Pulse command frequency	The 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: -3276.8–3276.7 Hz	0.00 Hz	●
P18.18	Pulse command feed-forward	The 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: -3276.8–3276.7 Hz	0.00 Hz	●
P18.19	Position regulator output	-327.68–327.67 Hz	0.00 Hz	●
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	0.00	●

Function code	Name	Description	Default	Modify
		encoder. Range: 0.00–359.99		
P18.22	Closed-loop SM pole angle	Present pole position. Range: 0.00–359.99	0.00	●
P18.23	Status word 2	0x0000–0xFFFF	0x0000	●
P18.24	High-order bit of PG card pulse reference count value	This function code indicates the pulse command (A2, B2) count value. The count value is accumulated only if the VFD is powered on. 0–65535	0	●
P18.25	Low-order bit of PG card pulse reference count value	This function code indicates the pulse command (A2, B2) count value. The count value is accumulated only if the VFD is powered on. 0–65535	0	●
P18.26	PG card speed measured value	-3276.8–3276.7 Hz	0.0 Hz	●
P18.27	Encoder UVW sector	0–7	0	●
P18.28	Encoder PPR display	0–65535	0	●
P18.29	SM angle compensation value	-180.0–180.0	0.0	●
P18.30	Reserved	/	/	/
P18.31	Z pulse value of pulse reference	0–65535	0	●
P18.32	Main control board measured speed in pulse reference mode	-3276.8–3276.7 Hz	0.0 Hz	●
P18.33	PG card measured speed in pulse reference mode	-3276.8–3276.7 Hz	0.0 Hz	●
P18.34	Present encoder filter width	0–63	0	●
P18.35	8k test duration	0–65535	0	●

Group P19—Expansion card status viewing

Function code	Name	Description	Default	Modify
P19.00	Slot 1 expansion card type	0–65535 0: No card	0	●
P19.01	Slot 2 expansion card type	1: PLC card 2: I/O card	0	●
P19.02	Slot 3 expansion card type	3: Incremental PG card 4: Incremental PG card with UVW 5: Ethernet communication card 6: DP communication card 7: Bluetooth card 8: Resolver PG card 9: CANopen communication card 10: Wi-Fi card 11: PROFINET communication card 12: Sin/Cos PG card without CD signal 13: Sin/Cos PG card with CD signal 14: Absolute encoder PG card 15: CAN master/slave communication card 16: Modbus TCP communication card 17: EtherCAT communication card 18: BACnet communication card 19: DeviceNet communication card 20: PT100/PT1000 temperature detection card 21: EtherNet IP card 22: MECHATROLINK communication card 23–29: Reserved 30: Fiber-optic synchronization card 31: Fault record card 32: SSI-PG card 31–65535: Reserved	0	●
P19.03	Slot 1 expansion card software version	0.00–655.35	0.00	●
P19.04	Slot 2 expansion card software version	0.00–655.35	0.00	●
P19.05	Slot 3 expansion	0.00–655.35	0.00	●

Function code	Name	Description	Default	Modify
	card software version			
P19.06	Terminal input status of I/O card	0x0000–0xFFFF	0x0000	●
P19.07	Terminal output state of I/O card	0x0000–0xFFFF	0x0000	●
P19.08	Reserved	/	/	/
P19.09	AI3 input voltage of I/O card	0.00–10.00 V	0.00 V	●
P19.10	EC PT100 detected temperature	-50.0–150.0°C	0.0°C	●
P19.11	EC PT100 detected digital value	0–4096	0	●
P19.12	EC PT1000 detected temperature	-50.0–150.0°C	0.0°C	●
P19.13	EC PT1000 detected digital value	0–4096	0	●
P19.14	Alarm display value	0: No alarm 1: EC PT100 detected OT alarm 2: EC PT1000 detected OT alarm 3: EC PT100 disconnection alarm 4: EC PT1000 disconnection alarm	0	●
P19.15	VFD control word	0–65535	0	●
P19.16	VFD status word	0–65535	0	●
P19.17	Ethernet monitoring variable 1	0–65535	0	●
P19.18	Ethernet monitoring variable 2	0–65535	0	●
P19.19	Ethernet monitoring variable 3	0–65535	0	●
P19.20	Ethernet monitoring variable 4	0–65535	0	●
P19.21	AIAO detected temperature	-20.0–200.0°C	0.0°C	●

Group P20—Encoder functions of motor 1

Function code	Name	Description	Default	Modify
P20.00	Encoder type display	0: Incremental encoder 1: Resolver 2: Sin/Cos encoder 3: EnDat absolute encoder	0	●
P20.01	Encoder pulse count	Number of pulses generated when the encoder revolves for one circle. Setting range: 0–16000	1024	◎
P20.02	Encoder direction	Ones place: AB direction 0: Forward 1: Reverse Tens place: Z pulse direction (Reserved) Hundreds place: CD/UVW pole signal direction 0: Forward 1: Reverse	0x000	◎
P20.03	Encoder disconnection fault detection time	0.0–10.0 s	2.0 s	○
P20.04	Encoder reversal fault detection time	0.0–100.0 s	0.8 s	○
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	Speed ratio between motor and encoder mounting shaft	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: 0.000–65.535	1.000	○
P20.07	Control parameters of SM	Bit0: Enable Z pulse calibration Bit1: Enable encoder angle calibration Bit2: Enable SVC speed measurement Bit3: Reserved Bit4: Reserved Bit5: Reserved Bit6: Enable the CD signal calibration Bit7: Reserved Bit8: Do not detect encoder faults during	0x0003	○

Function code	Name	Description	Default	Modify
		auto-tuning Bit9: Enable Z pulse detection optimization Bit10: Enable the initial Z pulse calibration optimization Bit12: Clear the Z pulse arrival signal after stop Bit13: Reserved Bit14: Detect Z pulse after one rotation Bit15: Reserved		
P20.08	Enable Z pulse offline detection	0x00–0x11 Ones place: Z pulse 0: No detection 1: Enable Tens place: UVW pulse (for synchronous motors) 0: No detection 1: Enable	0x10	○
P20.09	Initial angle of Z pulse	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 position autotuning	Range: 0–3 0: No operation 1: Rotary autotuning 2: Static autotuning 3: Rotary autotuning 2	0	◎
P20.12	Speed measurement optimization selection	0–2 0: No optimization 1: Optimization mode 1 2: Optimization mode 2	1	◎
P20.13	CD signal zero offset gain	0–65535	0	○
P20.14	Encoder type selection	Ones place: Incremental encoder 0: Without UVW 1: With UVW Tens place: Sin/Cos encoder 0: Without CD signal	0x00	◎

Function code	Name	Description	Default	Modify
		1: With CD signal		
P20.15	Speed measurement method	0: PG card 1: Locally measured through HDIA and HDIB. Only the 24 V incremental encoders are supported.	0	⊙
P20.16	Frequency division coefficient	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	0x0000–0xFFFF Bit 0: Indicates whether to enable encoder P-channel input filter 0: Disable 1: Enable Bit 1: Encoder P-channel input filter method 0: Self-adaptive filter 1: Use P20.18 as the filter parameter Bit 2: Indicates whether to enable encoder P-channel frequency-division output filter 0: Disable 1: Enable Bit 3: Indicates whether to enable filter for pulse reference F-channel frequency-division output 0: Disable 1: Enable Bit 4: Indicates whether to enable pulse reference F-channel filter 0: Disable 1: Enable Bit 5: Pulse reference F-channel filter method 0: Self-adaptive filter 1: Use P20.19 as the filter parameter Bit 6: Frequency-divided output source selection (valid only for incremental encoders) 0: Encoder signal 1: Pulse reference signal Bit 7–Bit 15: Reserved	0x0033	○
P20.18	Encoder P-channel filter width	0–63 The filter time is $P20.18 \times 0.25 \mu s$. The value 0 or	2	○

Function code	Name	Description	Default	Modify
		1 indicates 0.25 μ s.		
P20.19	Pulse reference F-channel filter width	0–63 The filter time is $P20.19 \times 0.25 \mu$ s. The value 0 or 1 indicates 0.25 μ s.	2	○
P20.20	Pulse reference F-channel pulse count	0–16000	1024	○
P20.21	Angle compensation enable	0–1	1	○
P20.22	Frequency point of speed measurement mode switchover	0.00–630.00 Hz Note: Valid only when P20.12=0.	1.00 Hz	○
P20.23	Angle compensation coefficient	-200.0–200.0%	100.0%	○
P20.24	Number of pole pairs in initial pole angle auto-tuning	1–128	2	◎

Group P21—Position control

Function code	Name	Description	Default	Modify
P21.00	Positioning mode selection	0x0000–0x7121 Ones place: Control mode selection (only for FVC mode) 0: Speed control 1: Position control Tens place: Position command source 0: Pulse train 1: Digital position 2: Photoelectric switch stop positioning Hundreds place: Position feedback source (reserved and fixed to P channel) 0: PG1 1: PG2 Thousands place: Servo mode (Reserved) 0: Disable servo, without position deviation	0x0000	○

Function code	Name	Description	Default	Modify
		1: Disable servo, with position deviation 2: Enable servo, without position deviation 3: Enable servo, with position deviation 4–7: Reserved		
P21.01	Pulse command mode	0x0000–0x3133 Ones place: Pulse mode 0: A/B quadrature pulse; A leads B 1: A is PULSE and B is 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 is 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 Bit0: Set pulse direction 0: Forward 1: Reverse Bit1: Set pulse direction by running direction 0: Disable, and Bit0 is valid 1: Enable Hundreds place: Frequency-multiplication selection for pulse + direction (reserved) 0: No frequency-multiplication 1: Frequency-multiplication Thousands place: Pulse control selection Bit0: Pulse filter selection 0: Inertia filter 1: Moving average filter Bit1: Overspeed control 0: No control 1: Control	0x0000	⊙
P21.02	Position-loop gain 1	The two position-loop gains are switched based	20.0	○
P21.03	Position-loop gain 2	on the switching mode set through P21.04. When the spindle accurate stop function is used, the gains are switched automatically, regardless of the setting of P21.04. P21.03 is used for	30.0	○

Function code	Name	Description	Default	Modify
		dynamic running, and P21.02 is used for maintaining the locked state. Setting range: 0.0–400.0		
P21.04	Position-loop gain switchover 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	Position gain switchover threshold in torque command	0.0–100.0% (of the motor rated torque)	10.0%	○
P21.06	Position gain switchover threshold in speed command	0.0–100.0% (of the motor rated speed)	10.0%	○
P21.07	Smooth filter coefficient during gain switchover	Smooth filter coefficient during position gain switchover Setting range: 0–15	5	○
P21.08	Position regulator output limit	Position regulator output limit value. When the output limit is 0, the position regulator is invalid, and no position control can be performed. However, speed control is valid. Setting range: 0.0–100.0% (of max. output frequency P0.03)	20.0%	○
P21.09	Positioning completion range	When the position deviation is less than P21.09, and the duration is greater than P21.10, a positioning completion signal is output. Setting range: 0–1000	10	○
P21.10	Detection time for positioning completion	0.0–1000.0 ms	10.0 ms	○

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	0.00–120.00% For pulse train reference only (position control)	100.00	○
P21.14	Position feedforward filter time constant	0.0–3200.0 ms For pulse train reference only (position control)	3.0 ms	○
P21.15	Position command filter time constant	The position feedforward filter time constant during pulse train positioning. 0.0–3200.0 ms	0.0 ms	◎
P21.16	Digital positioning mode selection	0x0000–0xFFFF Bit0: Positioning mode selection 0: Relative position 1: Absolute position (Origin mode. This function is reserved.) Bit 1: Cyclic positioning setting. You can enable positioning through a terminal (function 55) or choose automatic cyclic positioning. Terminals support only the enabling of continuous positioning, and automatic cyclic positioning can be set to cyclic positioning or reciprocating positioning through bit 2 of P21.16. 0: Terminal-based cyclic positioning 1: Automatic cyclic positioning Bit2: Cyclic mode 0: Continuous 1: Reciprocating (Only supported during automatic cyclic positioning) Bit 3: P21.17 based digital setting mode. You can select incremental or position type. The incremental type indicates that P21.17 positioning distance needs to be conducted again after each positioning is enabled. The position type indicates that the displacement is	0x0000	○

Function code	Name	Description	Default	Modify
		set through P21.17, and the system automatically moves to the new position when P21.17 changes. 0: Incremental 1: Position-based (not supported in continuous mode) Bit4: Home search mode. This function is reserved. 0: Search for the home position only once 1: Search for the home position at each run Bit 5: Home correction mode. This function is reserved. 0: Real-time correction 1: One-time correction Bit 6: Positioning completion signal setting. You can set the positioning completion signal in the pulse or electrical level form. The positioning completion signal is valid in the positioning completion signal holding time set in P21.25. 0: Valid in the positioning completion signal holding time (P21.25) 1: Always active Bit 7: First positioning setting. You can set whether the first positioning is performed when a running command is received. If no, the first positioning is performed only after the positioning enabling terminal or automatic cyclic positioning is enabled. 0: Invalid 1: Enable Bit 8: Positioning enabling signal setting (for terminal-based cyclic positioning). In the pulse form, after positioning is completed or in the first positioning, an edge transition of the positioning enable terminal needs to be detected for performing positioning. In the electrical level mode, after positioning is completed or in the first positioning, positioning is performed after it		

Function code	Name	Description	Default	Modify
		is detected that the positioning enabling terminal is switched on. 0: Pulse signal 1: Electrical level signal Bit 9: Position source 0: P21.17 1: PROFIBUS/CANopen communication Bit 10: Encoder pulse count retention after power loss 0: Not retained 1: Retained Bit11: Reserved Bit12: Positioning curve selection (Reserved) 0: Linear 1: S curve		
P21.17	Position set in digital mode	Used to set the position for digital positioning. Actual position= $P21.17 \times P21.11 / P21.12$ 0–65535	0	○
P21.18	Positioning speed setting selection	0: Setting of P21.19 1: AI1 2: AI2 3: AI3 4: High-speed pulse HDIA 5: High-speed pulse HDIB	0	○
P21.19	Positioning speed digital setting	0–100.0% (of the max. frequency)	20.0%	○
P21.20	Positioning ACC time	Used to set the ACC/DEC time in the positioning process.	3.00 s	○
P21.21	Positioning DEC time	Positioning ACC time means the time needed if the VFD speeds up from 0Hz to the max. output frequency (P00.03). Positioning DEC time means the time needed if the VFD decelerates from the max. output frequency (P00.03) to 0Hz. Setting range of P21.20: 0.01–300.00 s Setting range of P21.21: 0.01–300.00 s	3.00 s	○
P21.22	Hold time of positioning reached	The function code is used to set the holding time after the destination position is reached.	0.100 s	○

Function code	Name	Description	Default	Modify
		Setting range: 0.000–60.000 s		
P21.23	Home search speed	0.00–50.00 Hz	2.00 Hz	○
P21.24	Home position offset	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 completion signal of spindle accurate stop. Setting range: 0.000–60.000 s	0.200 s	○
P21.26	Pulse superposition value	P21.26: -9999–32767 P21.27: 0–3000.0 pulse/ms	0	○
P21.27	Pulse superposition speed	The function is valid in the pulse speed reference (P00.06=12) or pulse position mode (P21.00=1).	8.0 pulse/ms	○
P21.28	ACC/DEC time after pulse inhibition	1. Input terminal function 68 (Enable the pulse superimposition) 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. 2. Input terminal function 67 (pulse increase) 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. For example: P21.27=1.0 pulse/ms P05.05=67 When the S5 terminal input signal is 0.5 s, the actual superposed pulses = 500 pulses. 3. Input terminal function 69 (pulse decrease) 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	5.0 s	○

Function code	Name	Description	Default	Modify
		superposed on A2 and B2 of the pulse reference channel. Functions such as filtering and electronic gear are still valid for superposed pulses. 4. Output terminal function 28 (during 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 train when the speed reference source is set to the pulse train (P00.06=12 or P00.07=12). Setting range: 0–3200.0 ms	10.0 ms	○
P21.30	Numerator of the 2nd command ratio	1–65535	1000	○
P21.31	Pulse reference speed measuring method	0–2 0: Main control board 1: PG card 2: Hybrid	0	○
P21.32	Pulse reference feedforward source	0x0–0x1	0x0	◎
P21.33	Set value of clearing encoder count	0–65535	0	◎

Group P22—Spindle positioning

Function code	Name	Description	Default	Modify
P22.00	Spindle positioning mode selection	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	0x0000	○

Function code	Name	Description	Default	Modify
		1: S2/S3/S4 terminal input Bit2: Reference point search selection. Choose whether to search for the reference point for every run. 0: Search only once 1: Search every time Bit3: Enable reference point calibration 0: Disable 1: Enable Bit4: Positioning mode selection 1. Select the set direction or the nearest direction to perform spindle accurate stop. 0: Set direction positioning 1: Nearest direction positioning Bit5: Positioning mode selection 2. It is valid when bit4 is set to 0. 0: Forward positioning 1: Reverse positioning Bit6: Zeroing 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 calibration mode 0: Calibration on first time 1: Real-time calibration Bit8: Action selection after zeroing signal cancellation (electric level type) 0: Switch to speed mode 1: Position lock mode Bit9: Positioning completion signal selection 0: Electrical level signal 1: Pulse signal Bit10: Z pulse signal source		

Function code	Name	Description	Default	Modify
		0: Motor 1: Spindle Bit 11–Bit 15: Reserved		
P22.01	Speed of spindle orientation	Used to indicate the speed of searching for the accurate-stop start position during spindle accurate stop. After finding the accurate-stop start position, switch to position control mode for an accurate stop. Setting range: 0.00–100.00 Hz	10.00 Hz	○
P22.02	DEC time of spindle accurate stop	DEC time of spindle accurate stop. The DEC time of spindle accurate stop indicates the time needed for the VFD to decelerate from the max. output frequency (P00.03) to 0 Hz. Setting range: 0.1–100.0 s	3.0 s	○
P22.03	Spindle zero position 0	Four spindle homing positions can be selected through terminals configured with function numbers 46 and 47. Setting range: 0–65535	0	○
P22.04	Spindle zero position 1	Setting range: 0–65535	0	○
P22.05	Spindle zero position 2	Setting range: 0–65535	0	○
P22.06	Spindle zero position 3	Setting range: 0–65535	0	○
P22.07	Spindle indexing angle 1	You can select seven spindle scale-division angles by terminals (functions 48, 49, and 50). Setting range: 0.00–359.99	15.00	○
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	○

Function code	Name	Description	Default	Modify
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: 0.001–30.000	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 will be the sum of P22.03 and P22.15. Setting range: 0–39999	0	○
P22.16	Reserved	/	/	/
P22.17	Reserved	/	/	/
P22.18	Rigid tapping selection	Ones place: Enabling selection 0: Disable (However, the function can be enabled through a terminal assigned function No. 58.) 1: Enable (Internal enabling) Tens place: Analog input port selection 0: Invalid 1: AI1 2: AI2 3: AI3	0x00	◎
P22.19	Rigid tapping analog filter time	0.0–1000.0 ms	1.0 ms	○
P22.20	Max. frequency of rigid tapping	0.00–400.00 Hz	50.00 Hz	○
P22.21	Corresponding frequency of rigid tapping analog zero drift	0.00–10.00 Hz	0.00 Hz	○
P22.22–P22.24	Reserved	/	/	/

Group P23—Vector control of motor 2

Function code	Name	Description	Default	Modify
P23.00	Speed-loop proportional gain 1	The parameters P23.00–P23.05 are applicable only to vector control mode. Below the switching	20.0	○

Function code	Name	Description	Default	Modify
P23.01	Speed-loop integral time 1	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: 	0.200 s	☐
P23.02	Low switching-point frequency		5.00 Hz	☐
P23.03	Speed-loop proportional gain 2		20.0	☐
P23.04	Speed-loop integral time 2		0.200 s	☐
P23.05	High switching-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: 0.000–10.000 s Setting range of P23.02: 0.00 Hz–P23.05 Setting range of P23.03: 0.0–200.0 Setting range of P23.04: 0.000–10.000 s Setting range of P23.05: P23.02–P00.03 (Max. output frequency)	10.00 Hz	☐
P23.06	Speed-loop output filter	0–8 (corresponding to 0–2 ⁸ /10 ms)	0	☐
P23.07	Vector control slip compensation coefficient	Slip compensation coefficient is used to adjust the slip frequency of the vector control and improve the speed control accuracy of the	100%	☐

Function code	Name	Description	Default	Modify
	(motoring)	system. Adjusting the parameter properly can control the speed steady-state error.		
P23.08	Vector control slip compensation coefficient (generating)	Setting range: 50–200%	100%	○
P23.09	Current-loop proportional coefficient P	Note: - The two function codes impact the dynamic response speed and control accuracy of the system. Generally, you do not need to modify the two function codes. - Applicable to SVC mode 0 (P00.00=0), SVC mode 1 (P00.00=1), and FVC mode (P00.00=3). - The values of the two function codes are updated automatically after SM parameter autotuning is completed. Setting range: 0–65535	1000	○
P23.10	Current-loop integral coefficient I		1000	○
P23.11	Speed-loop derivative gain	0.00–10.00	0.00	○
P23.12	High-frequency current-loop proportional coefficient	In the FVC mode (P00.00=3), when the frequency is lower than the current-loop high-frequency switching threshold (P23.14), the current-loop PI parameters are P23.09 and P23.10; and when the frequency is higher than the current-loop high-frequency switching threshold, the current-loop PI parameters are P23.12 and P23.13.	1000	○
P23.13	Integral coefficient of high-frequency current loop		1000	○
P23.14	Current-loop high-frequency switching threshold		100.0%	○
P23.15–P23.19	Reserved	/	/	/

Group P24—Encoder functions of motor 2

Function code	Name	Description	Default	Modify
P24.00	Encoder type display	0: Incremental encoder 1: Resolver	0	●

Function code	Name	Description	Default	Modify
		2: Sin/Cos encoder 3: Endat absolute encoder		
P24.01	Encoder pulse count	Number of pulses generated when the encoder revolves for one circle. Setting range: 0–16000	1024	⊙
P24.02	Encoder direction	Ones place: AB direction 0: Forward 1: Reverse Tens place: Z pulse direction (Reserved) Hundreds place: CD/UVW pole signal direction 0: Forward 1: Reverse	0x000	⊙
P24.03	Encoder disconnection fault detection time	0.0–10.0 s	2.0 s	○
P24.04	Encoder reversal fault detection time	0.0–100.0 s	0.8 s	○
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	Speed ratio between motor and encoder mounting shaft	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: 0.000–65.535	1.000	○
P24.07	Control parameters of SM	Bit0: Enable Z pulse calibration Bit1: Enable encoder angle calibration Bit2: Enable SVC speed measurement Bit3: Reserved Bit4: Reserved Bit5: Reserved Bit6: Enable the CD signal calibration Bit7: Reserved Bit8: Do not detect encoder faults during auto-tuning Bit9: Enable Z pulse detection optimization Bit10: Enable the initial Z pulse calibration optimization	0x0003	○

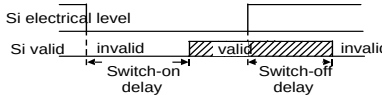
Function code	Name	Description	Default	Modify
		Bit11: Reserved Bit12: Clear the Z pulse arrival signal after stop Bit13: Reserved Bit14: Detect Z pulse after one rotation Bit15: Reserved		
P24.08	Enable Z pulse offline detection	0x00–0x11 Ones place: Z pulse 0: No detection 1: Enable Tens place: UVW pulse 0: No detection 1: Enable	0x10	○
P24.09	Initial angle of Z pulse	Relative electric angle of encoder Z pulse and motor pole position. Setting range: 0.00–359.99	0.00	○
P24.10	Pole initial angle	Relative electric angle of encoder position and motor pole position. Setting range: 0.00–359.99	0.00	○
P24.11	Initial pole position autotuning	0–3 0: No operation 1: Rotary autotuning (DC braking) 2: Static autotuning (suitable for resolver-type encoder, sin/cos with CD signal feedback) 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: No optimization 1: Optimization mode 1 2: Optimization mode 2	1	◎
P24.13	CD signal zero offset gain	0–65535	0	○
P24.14	Encoder type selection	Ones place: Incremental encoder 0: Without UVW	0x00	◎

Function code	Name	Description	Default	Modify
		1: With UVW Tens place: Sin/Cos encoder 0: Without CD signal 1: With CD signal		
P24.15	Speed measurement method	0: PG card 1: Locally measured through HDIA and HDIB. Only the 24 V incremental encoders are supported.	0	⊙
P24.16	Frequency division coefficient	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	0x0000–0xFFFF Bit 0: Indicates whether to enable encoder P-channel input filter 0: Disable 1: Enable Bit 1: Encoder P-channel input filter method 0: Self-adaptive filter 1: Use P24.18 as the filter parameter Bit 2: Indicates whether to enable encoder P-channel frequency-division output filter 0: Disable 1: Enable Bit 3: Indicates whether to enable filter for pulse reference F-channel frequency-division output 0: Disable 1: Enable Bit 4: Indicates whether to enable pulse reference F-channel filter 0: Disable 1: Enable Bit 5: Pulse reference F-channel filter method 0: Self-adaptive filter 1: Use P24.19 as the filter parameter Bit 6: Frequency-divided output source selection (only for incremental PG cards) 0: Encoder signal 1: Pulse reference signal	0x0033	○

Function code	Name	Description	Default	Modify
		Bit 7–Bit 15: Reserved		
P24.18	Encoder P-channel filter width	0–63 The filter time is $P24.18 \times 0.25 \mu s$. The value 0 or 1 indicates $0.25 \mu s$.	2	☐
P24.19	Pulse reference F-channel filter width	0–63 The filter time is $P24.19 \times 0.25 \mu s$. The value 0 or 1 indicates $0.25 \mu s$.	2	☐
P24.20	Pulse reference F-channel pulse count	0–16000	1024	☒
P24.21	Enabling SM angle compensation	0–1	0	☐
P24.22	Frequency point of speed measurement mode switchover	0.00–630.00 Hz	1.00 Hz	☐
P24.23	Angle compensation coefficient	-200.0–200.0%	100.0%	☐
P24.24	Number of pole pairs in initial pole angle auto-tuning	1–128	2	☒

Group P25—I/O card input functions

Function code	Name	Description	Default	Modify
P25.00	HDI3 input type selection	0: HDI3 is high-speed pulse input 1: HDI3 is digital input	0	☒
P25.01	S5 function	Same as P05	0	☒
P25.02	S6 function		0	☒
P25.03	S7 function		0	☒
P25.04	S8 function		0	☒
P25.05	S9 function		0	☒
P25.06	S10 function		0	☒
P25.07	HDI3 function		0	☒
P25.08	Expansion card input terminal polarity	0x00–0x7F	0x00	☐

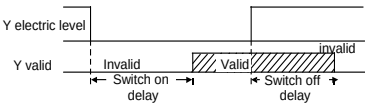
Function code	Name	Description	Default	Modify
P25.09	Expansion card virtual terminal setting	0x00–0x7F (0: Disable. 1: Enable) Bit 0: S5 virtual terminal Bit 1: S6 virtual terminal Bit 2: S7 virtual terminal Bit 3: S8 virtual terminal Bit 4: S9 virtual terminal Bit 5: S10 virtual terminal Bit 6: HDI3 virtual terminal	0x00	☉
P25.10	HDI3 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. Setting range: 0.000–50.000 s	0.000 s	○
P25.11	HDI3 switch-off delay		0.000 s	○
P25.12	S5 switch-on delay		0.000 s	○
P25.13	S5 switch-off delay		0.000 s	○
P25.14	S6 switch-on delay		0.000 s	○
P25.15	S6 switch-off delay		0.000 s	○
P25.16	S7 switch-on delay		0.000 s	○
P25.17	S7 switch-off delay		0.000 s	○
P25.18	S8 switch-on delay		0.000 s	○
P25.19	S8 switch-off delay		0.000 s	○
P25.20	S9 switch-on delay		0.000 s	○
P25.21	S9 switch-off delay		0.000 s	○
P25.22	S10 switch-on delay		0.000 s	○
P25.23	S10 switch-off delay		0.000 s	○
P25.24	AI3 lower limit	The function codes define the relationship between the analog input voltage and its corresponding setting. When the analog input voltage outside the range between the lower and upper limits, the upper limit or lower limit is used. When the analog input is a current input, 0 mA–20 mA current corresponds to 0 V–10 V voltage. In different applications, 100.0% of the analog setting corresponds to different nominal values. See the description in each application section	0.00 V	○
P25.25	Corresponding setting of AI3 lower limit		0.0%	○
P25.26	AI3 upper limit		10.00 V	○
P25.27	Corresponding setting of AI3 upper limit		100.0%	○
P25.28	AI3 input filter time		0.030 s	○
P25.29	AI4 lower limit		0.00 V	○
P25.30	Corresponding		0.0%	○

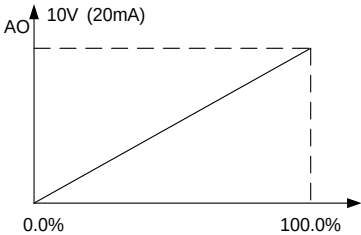
Function code	Name	Description	Default	Modify
	setting of AI4 lower limit	for details.		
P25.31	AI4 upper limit	The following figure illustrates the cases of several settings:	10.00 V	○
P25.32	Corresponding setting of AI4 upper limit		100.0%	○
P25.33	AI4 input filter time	Input filter time: to adjust the sensitivity of analog input. Increasing the value properly can enhance analog input anti-interference but may reduce the sensitivity of analog input. Note: AI3 and AI4 can support 0–10 V/0–20 mA input. When AI3 and AI4 select 0–20 mA input, the corresponding voltage of 20 mA is 10 V. Setting range of P25.24: 0.00 V–P25.26 Setting range of P25.25: -300.0%–300.0% Setting range of P25.26: P25.24–10.00 V Setting range of P25.27: -300.0%–300.0% Setting range of P25.28: 0.000 s–10.000 s Setting range of P25.29: 0.00 V–P25.31 Setting range of P25.30: -300.0%–300.0% Setting range of P25.31: P25.29–10.00 V Setting range of P25.32: -300.0%–300.0% Setting range of P25.33: 0.000 s–10.000 s	0.030 s	○
P25.34	HDI3 high-speed pulse input function selection	0: Frequency setting input 1: Count function	0	◎
P25.35	HDI3 lower limit frequency	0.000 kHz–P25.37	0.000 kHz	○
P25.36	Corresponding setting of HDI3 lower limit frequency	-300.0%–300.0%	0.0%	○
P25.37	HDI3 upper limit	P25.35–50.000 kHz	50.000	○

Function code	Name	Description	Default	Modify
	frequency		kHz	
P25.38	Corresponding setting of HDI3 upper limit frequency	-300.0%~300.0%	100.0%	○
P25.39	HDI3 frequency input filter time	0.000~10.000 s	0.030 s	○
P25.40	AI3 input signal type	0: Voltage type 1: Current type	0	○
P25.41	AI4 input signal type selection	Range: 0~1 0: Voltage type 1: Current type	0	○
P25.42~P25.45	Reserved	/	/	/

Group P26—I/O card output functions

Function code	Name	Description	Default	Modify
P26.00	HDO2 output type	0: Open collector high-speed pulse output 1: Open collector output	0	◎
P26.01	HDO2 output	Same as the description for P06.01	0	○
P26.02	Y2 output		0	○
P26.03	Y3 output selection		0	○
P26.04	RO3 output		0	○
P26.05	RO4 output		0	○
P26.06	RO5 output		0	○
P26.07	RO6 output		0	○
P26.08	RO7 output		0	○
P26.09	RO8 output		0	○
P26.10	RO9 output		0	○
P26.11	RO10 output		0	○
P26.12	Expansion card output terminal polarity selection	0x0000~0x1FFF Bit0: Y2 Bit1: Y3 Bit2: HDO2 Bit3: RO3 Bit4: RO4 Bit5: RO5 Bit6: RO6	0x0000	○

Function code	Name	Description	Default	Modify
		Bit7: RO7 Bit8: RO8 Bit9: RO9 Bit10: RO10 Bit11: RO11 Bit12: RO12		
P26.13	HDO2 switch-on delay	The function codes specify the delay time corresponding to the electrical level changes when the programmable output terminals switch on or switch off.  Setting range: 0.000–50.000 s Note: P26.13 and P26.14 are valid only when P26.00=1.	0.000 s	○
P26.14	HDO2 switch-off delay		0.000 s	○
P26.15	Y2 switch-on delay		0.000 s	○
P26.16	Y2 switch-off delay		0.000 s	○
P26.17	Y3 switch-on delay		0.000 s	○
P26.18	Y3 switch-off delay		0.000 s	○
P26.19	RO3 switch-on delay		0.000 s	○
P26.20	RO3 switch-off delay		0.000 s	○
P26.21	RO4 switch-on delay		0.000 s	○
P26.22	RO4 switch-off delay		0.000 s	○
P26.23	RO5 switch-on delay		0.000 s	○
P26.24	RO5 switch-off delay		0.000 s	○
P26.25	RO6 switch-on delay		0.000 s	○
P26.26	RO6 switch-off delay		0.000 s	○
P26.27	RO7 switch-on delay		0.000 s	○
P26.28	RO7 switch-off delay		0.000 s	○
P26.29	RO8 switch-on delay		0.000 s	○
P26.30	RO8 switch-off delay		0.000 s	○

Function code	Name	Description	Default	Modify
P26.31	RO9 switch-on delay		0.000 s	☐
P26.32	RO9 switch-off delay		0.000 s	☐
P26.33	RO10 switch-on delay		0.000 s	☐
P26.34	RO10 switch-off delay		0.000 s	☐
P26.35	AO2 output	Same as the description for P06.14	0	☐
P26.36	AO3 output		0	☐
P26.37	Reserved		0	☐
P26.38	AO2 output lower limit	The function codes define the relationship between the output value and analog output.	0.0%	☐
P26.39	AO2 output corresponding to lower limit	When the output value exceeds the allowed range, the output uses the lower limit or upper limit.	0.00 V	☐
P26.40	AO2 output upper limit	When the analog output is current output, 1mA equals 0.5V.	100.0%	☐
P26.41	AO2 output corresponding to upper limit	In different cases, the corresponding analog output of 100% of the output value is different.	10.00 V	☐
P26.42	AO2 output filter time		0.000 s	☐
P26.43	AO3 output lower limit		0.0%	☐
P26.44	AO3 output corresponding to lower limit		0.00 V	☐
P26.45	AO3 output upper limit		100.0%	☐
P26.46	AO3 output corresponding to upper limit	Setting range of P26.38: -300.0%–P26.40 Setting range of P26.39: 0.00–10.00 Setting range of P26.40: P26.38–100.0% Setting range of P26.41: 0.00–10.00 V Setting range of P26.42: 0.000–10.000 s Setting range of P26.43: -300.0%–P26.45 Setting range of P26.44: 0.00–10.00 V Setting range of P26.45: P26.43–300.0% Setting range of P26.46: 0.00–10.00 V Setting range of P26.47: 0.000–10.000 s	10.00 V	☐
P26.47	AO3 output filter time		0.000 s	☐

Function code	Name	Description	Default	Modify
P26.48– P26.52	Reserved	/	/	/

Group P27—PLC card functions

Function code	Name	Description	Default	Modify
P27.00	PLC card function enable	0–1 The function code is used to enable the PLC card function. This function is reserved.	0	⊙
P27.01	C_WrP1	0–65535 The function code is used for the VFD to write a value to WrP1 of the PLC card.	0	○
P27.02	C_WrP2	0–65535 The function code is used for the VFD to write a value to WrP2 of the PLC card.	0	○
P27.03	C_WrP3	0–65535 The function code is used for the VFD to write a value to WrP3 of the PLC card.	0	○
P27.04	C_WrP4	0–65535 The function code is used for the VFD to write a value to WrP4 of the PLC card.	0	○
P27.05	C_WrP5	0–65535 The function code is used for the VFD to write a value to WrP5 of the PLC card.	0	○
P27.06	C_WrP6	0–65535 The function code is used for the VFD to write a value to WrP6 of the PLC card.	0	○
P27.07	C_WrP7	0–65535 The function code is used for the VFD to write a value to WrP7 of the PLC card.	0	○
P27.08	C_WrP8	0–65535 The function code is used for the VFD to write a value to WrP8 of the PLC card.	0	○
P27.09	C_WrP9	-9999–32767 The function code is used for the VFD to write a value to WrP9 of the PLC card.	0	○
P27.10	C_WrP10	-9999–32767 The function code is used for the VFD to write a	0	○

Function code	Name	Description	Default	Modify
		value to WrP10 of the PLC card.		
P27.11	PLC card status	Used to display the status of the PLC card. 0: Stop 1: Run	0	●
P27.12	C_MoP1	0-65535 Used for the VFD to monitor/view the MoP1 value of the PLC card.	0	●
P27.13	C_MoP2	0-65535 Used for the VFD to monitor/view the MoP2 value of the PLC card.	0	●
P27.14	C_MoP3	0-65535 Used for the VFD to monitor/view the MoP3 value of the PLC card.	0	●
P27.15	C_MoP4	0-65535 Used for the VFD to monitor/view the MoP4 value of the PLC card.	0	●
P27.16	C_MoP5	0-65535 Used for the VFD to monitor/view the MoP5 value of the PLC card.	0	●
P27.17	C_MoP6	0-65535 Used for the VFD to monitor/view the MoP6 value of the PLC card.	0	●
P27.18	C_MoP7	0-65535 Used for the VFD to monitor/view the MoP7 value of the PLC card.	0	●
P27.19	C_MoP8	0-65535 Used for the VFD to monitor/view the MoP8 value of the PLC card.	0	●
P27.20	C_MoP9	-9999-32767 Used for the VFD to monitor/view the MoP9 value of the PLC card.	0	●
P27.21	C_MoP10	-9999-32767 Used for the VFD to monitor/view the MoP10 value of the PLC card.	0	●
P27.22	Digital input terminal state of PLC card	0x00-0x3F The function code is used to display the input terminal status on the PLC card. Bit5-bit0 indicate PS6-PS1.	0x00	●
P27.23	Digital output	0x0-0x3	0x0	●

Function code	Name	Description	Default	Modify
	terminal state of PLC card	The function code is used to display the output terminal status on the PLC card. Bit0 indicates PRO1, and bit1 indicates PRO2.		
P27.24	PLC card AI1	0-65535	0	●
P27.25	PLC card AO1	0-65535	0	●
P27.26	Length of data sent by PLC card and PZD communication object	0x00-0x28 Ones place: Quantity of data sent from the PLC card and VFD (that is, the amount of data sent by the PLC card, VFD transmission table 1, and VFD transmission table 2) 0: 0+24+60 1: 12+24+60 2: 24+24+60 3: 36+24+60 4: 48+24+60 5: 60+48+60 6: 72+24+60 7: 84+24+60 8: 96+96+96 Tens place: Card that communicates with the PLC card through PZD (valid only when the ones place of P27.26 is 5) 0: DP card 1: CANopen card 2: PN card Note: P27.26 can be changed at any time, but the change will only take effect after the VFD is powered on again.	0x03	○
P27.27	PLC card save function at power off	0: Disable 1: Enable	1	◎

Group P28—Master/slave control

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	0: CAN 1: Reserved	0	◎

Function code	Name	Description	Default	Modify
	data selection			
P28.02	Master/slave control mode	Ones place: Master/slave running mode selection 0: Master/slave mode 0 (The master and slave adopt speed control and maintain the power balance 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 starts in speed mode (Master/slave mode 0) and then switches to torque mode (Master/slave mode 1) at a certain frequency point.) Tens place: Slave start command source 0: Follow the master start command 1: Determined by P00.01 Hundreds place: Whether to enable master/slave to send/receive data 0: Enable 1: Disable	0x001	⊙
P28.03	Slave speed gain	0.0–500.0%	100.0%	○
P28.04	Slave torque gain	0.0–500.0%	100.0%	○
P28.05	Frequency point for switching between speed mode and torque mode in master/slave mode 2	0.00–10.00 Hz	5.00 Hz	○
P28.06	Slave count	0–15	1	⊙
P28.07– P28.08	Reserved	/	/	/
P28.09	CAN slave torque offset	-100.0–100.0%	0.0%	○
P28.10	EC PT100/PT1000 temperature detection enable	0x00–0x11 Ones place: PT100 temperature detection 0: Disable 1: Enable	0x00	⊙

Function code	Name	Description	Default	Modify
		Tens place: PT1000 temperature detection 0: Disable 1: Enable		
P28.11	EC PT100 detected OT protection threshold	0.0–150.0°C	120.0°C	○
P28.12	EC PT100 detected OT alarm threshold	0.0–150.0°C	100.0°C	○
P28.13	EC PT100 detected temperature calibration upper limit	50.0–150.0°C	120.0°C	○
P28.14	EC PT100 detected temperature calibration lower limit	-20.0–50.0°C	10.0°C	○
P28.15	EC PT100 calibration upper limit digital	0–4096	2950	○
P28.16	EC PT100 calibration lower limit digital	0–4096	1270	○
P28.17	EC PT1000 detected OT protection threshold	0.0–150.0°C	120.0°C	○
P28.18	EC PT1000 detected OT alarm threshold	0.0–150.0°C	100.0°C	○
P28.19	EC PT1000 detected temperature calibration upper limit	50.0–150.0°C	120.0°C	○
P28.20	EC PT1000 detected temperature calibration lower limit	-20.0–50.0°C	10.0°C	○

Function code	Name	Description	Default	Modify
P28.21	EC PT1000 calibration upper limit digital	0–4096	3100	○
P28.22	EC PT1000 calibration lower limit digital	0–4096	1100	○
P28.23	Detecting for PT100/PT1000 disconnection from EC	0x00–0x11 Ones place: PT100 disconnection detection 0: Disable 1: Enable Tens place: PT1000 disconnection detection 0: Disable 1: Enable	0x00	◎
P28.24	Enabling digital calibration in EC PT100/PT1000 temperature detection	0: Invalid 1: Enable PT100 lower limit digital calibration 2: Enable PT100 upper limit digital calibration 3: Enable PT1000 lower limit digital calibration 4: Enable PT1000 upper limit digital calibration	0	○
P28.25	Type of sensor for AIAO to detect motor temperature	0: No temperature sensor 1: PT100 2: PT1000 3: KTY84 4: PTC (resistance measurement only) Note: - Temperature is displayed through P19.21. - Supported only when AO1 is connected to AI1. - To measure temperature, switch the output of AO1 to current, and connect one end of the temperature resistor to AI1 and AO1, and the other end to GND.	0	◎
P28.26	AIAO detected motor OT protection threshold	0.0–200.0°C Note: When the motor temperature exceeds the threshold, the VFD reports an OT fault.	110.0°C	○
P28.27	AIAO detected motor OT alarm threshold	0.0–200.0°C Note: When the motor temperature exceeds the value, the DO terminal with function 50	90.0°C	○

Function code	Name	Description	Default	Modify
		(AIAO detected OT pre-alarm) outputs a valid signal.		

Group P35—Fault record card functions (supported by customized software)

Function code	Name	Description	Default	Modify
P35.00	RTC_Year	2022–9999	2024	⊙
P35.01	RTC_Month. RTC_Day	1.01–12.31	1.01	⊙
P35.02	RTC_Hour. RTC_Min	0.00–23.59	0.00	⊙
P35.03	RTC_Sec	0–59	0	⊙
P35.04	RTC reset enable	0–1	0	⊙
P35.05	Sampling channel 0	0–89	1	⊙
P35.06	Sampling channel 1	0: No function	2	⊙
P35.07	Sampling channel 2	1: Running frequency	3	⊙
P35.08	Sampling channel 3	2: Set frequency	4	⊙
P35.09	Sampling channel 4	3: Ramp reference frequency	5	⊙
P35.10	Sampling channel 5	4: Output current	6	⊙
P35.11	Sampling channel 6	5: Output torque	7	⊙
P35.12	Sampling channel 7	6: Output voltage	52	⊙
P35.13	Sampling channel 8	7: Bus voltage	53	⊙
P35.14	Sampling channel 9	8: Rotational speed 9: AI1 value 10: AI2 value 11: AI3 value 12: AO1 value 13: AO2 value 14: High-speed pulse HDIA 15: High-speed pulse HDIB 16: High-speed pulse HDO output 17: Terminal input state 18: Relay output status 19: DP communication receive CW PZD1 20: DP communication receive CW PZD2 21: DP communication receive CW PZD3 22: DP communication receive CW PZD4	54	⊙

Function code	Name	Description	Default	Modify
		23: DP communication receive CW PZD5 24: DP communication receive CW PZD6 25: DP communication receive CW PZD7 26: DP communication receive CW PZD8 27: DP communication receive CW PZD9 28: DP communication receive CW PZD10 29: DP communication receive CW PZD11 30: DP communication receive CW PZD12 31: DP communication transmit CW PZD1 32: DP communication transmit PZD2 display (16-bit unsigned) 33: DP communication transmit PZD3 display (16-bit unsigned) 34: DP communication transmit PZD4 display (16-bit unsigned) 35: DP communication transmit PZD5 display (16-bit unsigned) 36: DP communication transmit PZD6 display (16-bit unsigned) 37: DP communication transmit PZD7 display (16-bit unsigned) 38: DP communication transmit PZD8 display (16-bit unsigned) 39: DP communication transmit PZD9 display (16-bit unsigned) 40: DP communication transmit PZD10 display (16-bit unsigned) 41: DP communication transmit PZD11 display (16-bit unsigned) 42: DP communication transmit PZD12 display (16-bit unsigned) 43: VFD CW 44: Torque current feedback 45: Exciting current feedback 46: Linear speed 47: PID reference value 48: PID feedback value 49: Motor torque setting		

Function code	Name	Description	Default	Modify
		50: Motor ASR controller output 51: SM magnetic pole angle 52: U-phase current transient value 53: V-phase current transient value 54: W-phase current transient value 55: Self-test signal 1 56: Self-test signal 2 57: Test variable 1 58: Test variable 2 59: Test variable 3 60: Test variable 4 61: Function code set variable 1 62: Function code set variable 2 63: Function code set variable 3 64: Function code set variable 4 65–89: Reserved		
P35.15	Run record SD card save period	1–300	30	☉
P35.16	Reserved	/	/	/
P35.17	SD card state	0x0000–0x003F Bit0: When the system powers up, if the SD card is not inserted or the SD card is invalid, the value is 1. Bit1: SD card initialization successful, waiting for SD card operation Bit2: SD card reading failed Bit3: SD card writing failed Bit4: File opening failed Bit5: File creation failed	0x0000	●

Group P90—Tension control in speed mode

Function code	Name	Description	Default	Modify
P90.00	Tension control mode selection	0: Invalid 1: Tension speed control 2: Open-loop tension torque control 3: Closed-loop tension torque control Note: When 0 is selected, the function is	0	☉

Function code	Name	Description	Default	Modify
		disabled and the VFD performs general-purpose functions. When a non-zero value is selected, the tension control function is used.		
P90.01	Winding/unwinding mode	0: Winding 1: Unwinding Note: The motor forward rotation direction is the winding direction. When using the tension control mode, check whether the motor rotation direction is correct in the winding mode; if not, change the rotation direction by swapping two phase wires of the motor. After the rotation direction is corrected, the winding mode can be switched to the unwinding mode by setting P90.01 to 1 or changing the winding/unwinding switchover terminals.	0	○
P90.02	Reel mechanical transmission ratio	0.01–600.00 =Motor rotation speed/reel rotation speed=Reel diameter/motor shaft diameter	1.00	○
P90.03	Max. line speed	0.0–6000.0 m/min	1000.0 m/min	○
P90.04	Linear speed input source selection	0: Keypad 1: AI1 2: AI2 3: AI3 4: High-speed pulse HDI 5: Main traction encoder frequency-division input	0	◎
P90.05	Linear speed set through keypad	0.0–100.0%	20.0%	○
P90.06	Diameter of main traction	0.0–6000.0 mm	99.0 mm	○
P90.07	Main traction drive ratio	0.000–60.000	1.000	○
P90.08	Linear speed ACC time	0.00–600.00 s	0.00 s	○
P90.09	Linear speed DEC time	0.00–600.00 s	0.00 s	○
P90.10	Tension setting	0x00–0x14	0x00	◎

Function code	Name	Description	Default	Modify
	source selection	Ones place: Tension setting source selection 0: Keypad 1: AI1 2: AI2 3: AI3 4: High-speed pulse HDI Tens place: Multiplier selection of max. tension P90.12 0: 1× 1: 10×		
P90.11	Tension set through keypad	0.0–100.0%	10.0%	○
P90.12	Max. tension	0–60000 (N, tens place of P90.10=0) or 0–60000 (10 N, tens place of P90.10=1)	1000 N	○
P90.13	Roll diameter calculation method selection	0: No calculation 1: AI1 2: AI2 3: AI3 4: High-speed pulse HDI 5: Linear speed 6: Thickness (of wire) 7: Thickness (of strip)	0	◎
P90.14	Roll diameter calculation delay time	0.0–100.0 s	1.0 s	○
P90.15	Min. roll diameter	0.0 mm–P90.16	50.0 mm	○
P90.16	Max. roll diameter	P90.15–5000.0 mm	1000.0 mm	○
P90.17	Initial roll diameter 1	P90.15–P90.16 (mm)	100.0 mm	○
P90.18	Initial roll diameter 2	P90.15–P90.16 (mm)	100.0 mm	○
P90.19	Initial roll diameter 3	P90.15–P90.16 (mm)	100.0 mm	○
P90.20	Linear speed roll diameter calculation filter time	0.000–60.000 s	2.000 s	○

Function code	Name	Description	Default	Modify
P90.21	Linear speed roll diameter calculation restriction	0x00–0x11 Ones place: 0: No limit 1: Restrict changes in reverse direction Tens place: 0: No limit 1: Automatic restriction according to running frequency and material thickness	0x00	○
P90.22	Material thickness	0.001–65.535 mm	0.010 mm	○
P90.23	Number of coils per layer	1–10000	1	◎
P90.24	Revolution counting function selection	0: Digital terminal input 1: PG card input (applicable to thickness calculation method) 2: Running frequency (no input automatic revolution counting)	0	◎
P90.25	Number of pulses per revolution	1–60	1	◎
P90.26	Roll diameter set value	0.0–100.0%	80.0%	○
P90.27	Roll diameter reset setting	0x0000–0x1111 Ones place: During stop 0: Remain the present roll diameter 1: Restore to the initial roll diameter Tens place: Power failure at running 0: Remain the present roll diameter 1: Restore to the initial roll diameter Hundreds place: Roll diameter set value reached 0: Remain the present roll diameter 1: Restore to the initial roll diameter after stop Thousands place: Terminal reset restriction 0: Roll diameter reset allowed at running 1: Roll diameter reset only allowed during stop	0x1000	○
P90.28	Tension PID output reference	0: Max. value 1: Given value	0	○
P90.29	Tension PID parameter source	0: Fixed to parameter group 1 in group P90. 1: Roll diameter (max. roll diameter)	0	○

Function code	Name	Description	Default	Modify
	selection	2: Main reference frequency (max. frequency) 3: Running linear speed (max. linear speed) 4: Deviation (Reference 100%) 5: Terminal		
P90.30	Proportional gain of group 1	0.000–30.000	0.030	○
P90.31	Group 1 integral time	0.00–30.00 s	5.00 s	○
P90.32	Group 1 differential time	0.00–10.00 s	0.00 s	○
P90.33	Group 2 proportional gain	0.000–30.000	0.030	○
P90.34	Group 2 integral time	0.00–30.00 s	5.00 s	○
P90.35	Group 2 differential time	0.00–10.00 s	0.00 s	○
P90.36	PID parameter adjustment reference point 1	0.0%–P90.37	10.0%	○
P90.37	PID parameter adjustment reference point 2	P90.36–100.0%	50.0%	○
P90.38	Min. frequency for roll diameter calculation	0.00–50.00 Hz Note: Valid only for linear speed calculation with roll diameter.	0.30 Hz	○
P90.39	Min. line speed for roll diameter calculation	0.0–100.0% Note: This value is relative to the maximum line speed and is valid only for roll diameter calculation based on the linear speed.	3.0%	○

Group P91—Tension control in torque mode

Function code	Name	Description	Default	Modify
P91.00	Tension control zero speed reference	0–1 0: Max. line speed 1: Reserved	0	◎
P91.01	Tension control zero speed threshold	0.0–50.0%	3.0%	○

Function code	Name	Description	Default	Modify
P91.02	Zero speed offset	0.0–50.0%	2.0%	○
P91.03	Upper-limit frequency source of torque control	0: Set by P03.14 and P03.15 1: Forward rotation limit set by linear speed 2: Reverse rotation limit set by linear speed 3: Forward/reverse rotation limit set by linear speed	3	◎
P91.04	Running frequency upper limit offset of tension control	0.0–100.0%	5.0%	○
P91.05	Derivative separation threshold	0.0–100.0%	5.0%	○
P91.06	Zero-speed PID reverse limiting	0: Allow active reverse material tightening by PID at zero speed. 1: Do not allow active reverse material tightening by PID at zero speed.	0	◎
P91.07	Torque compensation selection	0x000–0x111 Ones place: Frictional torque compensation 0: No compensation 1: Compensation enabled Tens place: Inertia compensation 0: No compensation 1: Compensation enabled Hundreds place: Compensation direction 0: Consistent with the torque direction 1: Opposite to the torque direction	0x000	◎
P91.08	System mechanical parameter identification	0: No operation 1: Enable system mechanical inertia identification 2: Enable mechanical friction torque identification	0	◎
P91.09	Static friction torque compensation coefficient	0.0–100.0%	0.0%	○
P91.10	Sliding friction torque compensation coefficient 1	0.0–100.0%	0.0%	○
P91.11	Sliding friction	0.0–100.0%	0.0%	○

Function code	Name	Description	Default	Modify
	torque compensation coefficient 2			
P91.12	Sliding friction torque compensation coefficient 3	0.0–100.0%	0.0%	○
P91.13	High-speed torque compensation coefficient	0.0–100.0%	0.0%	○
P91.14	Compensation frequency point of static friction torque	0.0%–P91.15	1.0%	○
P91.15	Compensation frequency point of sliding friction torque 1	P91.14–P91.16(%)	20.0%	○
P91.16	Compensation frequency point of sliding friction torque 2	P91.15–P91.17(%)	50.0%	○
P91.17	Compensation frequency point of sliding friction torque 3	P91.16–P91.18(%)	80.0%	○
P91.18	High-speed friction torque compensation frequency point	P91.17–100.0%	100.0%	○
P91.19	ACC and DEC frequency source	0: Linear speed 1: Running frequency	0	◎
P91.20	Material density	0–30000 kg/m ³	0 kg/m ³	○
P91.21	Reel width	0.000–60.000 m	0.000 m	○
P91.22	ACC inertia compensation coefficient	0.0–100.0%	10.0%	○
P91.23	DEC inertia compensation	0.0–100.0%	10.0%	○

Function code	Name	Description	Default	Modify
	coefficient			
P91.24	Tension taper coefficient source	0: Keypad 1: AI1 2: AI2 3: AI3 4: High-speed pulse HDI	0	⊙
P91.25	Tension taper set through keypad	0.0–100.0%	30.0%	○
P91.26	Tension taper compensation correction	0.0–5000.0 mm	0.0 mm	○
P91.27	Tension taper curve selection	0: Inverse proportional curve 1: Multi-point polyline	0	⊙
P91.28	Roll diameter value 1	0.0–5000.0 mm	200.0 mm	○
P91.29	Tension taper coefficient for roll diameter value 1	0.0–50.0%	3.0%	○
P91.30	Roll diameter value 2	0.0–5000.0 mm	500.0 mm	○
P91.31	Tension taper coefficient for roll diameter value 2	0.0–50.0%	7.0%	○
P91.32	Tension offset value at zero speed	0.0–300.0%	0.0%	○
P91.33	Present roll diameter setting	0.0–5000.0mm	0.0mm	⊙

Group P92—Tension control optimization functions

Function code	Name	Description	Default	Modify
P92.00	Pre-drive speed gain	0.0–100.0%	100.0%	○
P92.01	Pre-drive torque limit	0: Set based on P03.20, P03.21 1: Set based on P93.02 2: Set based on the set tension	2	○
P92.02	Pre-drive torque limit setting	0.0–200.0%	100.0%	○
P92.03	Zero-position	0: Invalid	0	⊙

Function code	Name	Description	Default	Modify
	transition enable	1: Enable		
P92.04	Initial zero position	0.0–100.0%	10.0%	○
P92.05	Final zero position	0.0–100.0%	50.0%	○
P92.06	Conversion time from initial zero position to final zero position	0.00–60.00 s	5.00 s	○
P92.07	Conversion time from final zero position to initial zero position	0.00–60.00 s	5.00 s	○
P92.08	Material-break detection mode	0: No detection 1: Detect based on digital value 2: Detect based on roll diameter calculation value 3: Detect based on feedback position	0	○
P92.09	Material-break detection start delay time	0.0–200.0 s	20.0 s	○
P92.10	Frequency lower limit of material-break detection	0.00–300.00 Hz	10.00 Hz	○
P92.11	Error range of material-break detection	0.1–50.0%	10.0%	○
P92.12	Determination delay time of material-break detection	0.1–60.0 s	1.0 s	○
P92.13	Handling mode of material-break	0x000–0x111 Ones place: Stop mode 0: Decelerate to stop in emergency manner 1: Coast to stop Tens place: Alarm mode 0: Stop in the ones-place specified mode without reporting alarms 1: Report an alarm and coast to stop Hundreds place: Roll diameter memory function	0x000	◎

Function code	Name	Description	Default	Modify
		of material-break 0: Do not memorize 1: Memorize		
P92.14	Brake application frequency at stop	0.00–300.00 Hz	1.50 Hz	○
P92.15	Brake application time at stop	0.0–600.0 s	0.0 s	○

Group P93—Tension control status viewing

Function code	Name	Description	Default	Modify
P93.00	Actual control mode	0: Tension control is invalid 1: Closed-loop tension speed control 2: Open-loop tension torque control 3: Closed-loop tension torque control	0	●
P93.01	Actual winding/unwinding mode	0: Winding 1: Unwinding	0	●
P93.02	Initial roll diameter	0.0–5000.0 mm	0.0 mm	●
P93.03	Reset roll diameter	0.0–5000.0 mm	0.0 mm	●
P93.04	Roll diameter change rate	0.00–655.35 mm/s	0.00 mm/s	●
P93.05	Present roll diameter	0.0–5000.0 mm	0.0 mm	●
P93.06	Roll diameter for linear speed calculation	0.0–5000.0 mm	0.0 mm	●
P93.07	Set linear speed	0.0–6000.0 m/min	0.0 m/min	●
P93.08	Present linear speed	0.0–6000.0 m/min	0.0 m/min	●
P93.09	Main reference frequency	0.00–600.00 Hz	0.00 Hz	●
P93.10	Actual proportional gain	0.00–30.00	0.00	●
P93.11	Actual integral time	0.00–30.00 s	0.00 s	●
P93.12	Proportional output value	0–65535	0	●

Function code	Name	Description	Default	Modify
P93.13	Integral output value	0–65535	0	●
P93.14	PID upper limit	-100.0–100.0%	0.0%	●
P93.15	PID lower limit	-100.0–100.0%	0.0%	●
P93.16	PID output frequency	-99.99–99.99 Hz	0.00 Hz	●
P93.17	Main traction running frequency	-300.0–300.0 Hz	0.0 Hz	●
P93.18	Set tension	0–30000 N	0 N	●
P93.19	Tension taper coefficient	0.0–100.0%	0.0%	●
P93.20	Actual set tension	0–30000 N	0 N	●
P93.21	Basic torque reference value	-300.0–300.0%	0.0%	●
P93.22	Friction compensation torque value	-300.0–300.0%	0.0%	●
P93.23	System rotational inertia	0.00–655.35 kg·m ²	0.00 kg·m ²	●
P93.24	Frequency change rate	-99.99–327.67 Hz/s	0.00 Hz/s	●
P93.25	Torque compensation value of system rotational inertia	-300.0–300.0%	0.0%	●
P93.26	Reference value after torque compensation	-300.0–300.0%	0.0%	●
P93.27	PID output torque	-300.0–300.0%	0.0%	●
P93.28	Final output torque	-300.0–300.0%	0.0%	●
P93.29	Measured tension	0–30000 N	0 N	●
P93.30	Number of material turns on the reel	-100–32767	0	●
P93.31	Length of material on the reel	0–65535 m	0 m	●
P93.32	Length increment	0.0–6553.5 m	0.0 m	●

Group P94—Redundancy control

Function code	Name	Description	Default	Modify
P94.00	Synchronous master/slave control selection	0x000–0x212 Ones place: Synchronous master/slave mode selection 0: Invalid 1: Master 2: Slave Tens place: Synchronous mode selection 0: Synchronous mode 0 1: Reserved Hundreds place: Slave start command source 0: Follow the master start command 1: Reserved 2: Reserved Note: Restart the VFD after setting P94.00.	0x000	⊙
P94.01	Master response selection upon slave fault	0x000–0x111 Ones place: Slave contactor not-open fault selection 0: No fault reported 1: Fault, stop Tens place: Slave non-contactor not-open fault selection 0: No fault reported 1: Fault, stop Hundreds place: Slave operation selection when the master is faulty 0: Not allowed 1: Allowed to continue running	0x000	⊙
P94.02	Fiber-optic cable length	1–10 m	10 m	⊙
P94.03	Output voltage compensation cycle	0–50	8	○
P94.04	Slave operation priority upon master fault	0x1111–0x4444 Ones place: Priority 0 0: Reserved 1: Slave 1 2: Slave 2 3: Slave 3 4: Slave 4 Tens place: Priority 1	0x4321	⊙

Function code	Name	Description	Default	Modify
		0: Reserved 1: Slave 1 2: Slave 2 3: Slave 3 4: Slave 4 Hundreds place: Priority 2 0: Reserved 1: Slave 1 2: Slave 2 3: Slave 3 4: Slave 4 Thousands place: Priority 3 0: Reserved 1: Slave 1 2: Slave 2 3: Slave 3 4: Slave 4		
P94.05	Bus voltage threshold for enabling output	70.0–90.0%	80.0%	⊙
P94.06	Bus voltage delay time	0.000–50.000 s	0.500 s	○
P94.07	Synchronous master/slave fault delay count	0–100	5	○
P94.08	Slave count	0–4	0	⊙

7 Troubleshooting

7.1 What this chapter contains

The chapter tells you how to reset faults and check the fault history. 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.

7.2 Indications of alarms and faults

Faults are indicated by indicators. See section 5.4 Operation procedure. When the **TRIP** indicator is on, the alarm or fault code displayed on the keypad indicates the VFD is in exception state. This chapter covers most of the alarms and faults, and their possible causes and corrective measures. If you cannot find out the causes of alarms or faults, contact local INVT office.

7.3 Fault reset

The VFD can be reset by pressing the keypad key **STOP/RST**, digital inputs, or by cutting off the VFD power. After faults are removed, the motor can be started again.

7.4 Fault history

1. Description of fault records stored by function codes:

- (1) Records of the last six fault types: P07.27–P07.32
- (2) Records of the operating data for the last three faults:
 - Latest fault data: function codes P07.33–P07.40
 - Last fault data: function codes P07.41–P07.48
 - Second last fault data: function codes P07.49–P07.56

2. The product supports the fault record black box function. The fault record card must be installed with a button cell battery for power supply. After the RTC time is set through function codes P83.00–P83.03, a rising-edge signal generated by function code P83.04 enables the reset system time to take effect. The fault record information includes the real-time clock.

- (1) After the fault record card is installed, this function starts automatically at power-on. Fault recording supports two trigger modes:
 - a) Automatic trigger: The system automatically records data when a fault is detected.
 - b) Manual trigger: The trigger condition is customized through user terminals.

The black box recording function is triggered when either condition is met.

- (2) Fault data recording contains 10 sampling channels. Each channel is configured as follows:
 - a) Number of recording points: 1024 sampling points

- b) Sampling interval: 0.5ms
 - c) Configurable function options: No. 1 to No. 89 (including three-phase instantaneous current, bus voltage, running frequency, output frequency, output torque, output voltage, set frequency, etc.)
- (3) Each fault record contains the following information:
- a) Fault trigger time
 - b) Fault trigger condition
- (4) Data storage management
- a) Storage medium: fault record SD card
 - b) Storage capacity: up to 100 groups of fault data
 - c) Overwrite mechanism: Automatically overwrites the earliest records after exceeding 100 groups (sequential rolling storage).
- (5) One group of user-defined trigger conditions is supported. This condition can independently trigger the recording function.

7.5 Faults and solutions

When a fault occurs, handle the fault as follows:

1. Check whether the keypad display is abnormal. If yes, contact the local INVT office.
2. If no, check function code group P07 for the corresponding fault record parameters to determine the actual operating state when the fault occurred.
3. See the following table for a detailed solution and check for exceptions.
4. Rectify the fault or ask for help.
5. Ensure the fault has been rectified, perform fault reset, and run the product again.

7.5.1 Faults and solutions

Note: The numbers enclosed in square brackets such as [1], [2] and [3] in the Fault type column in the following table indicate the VFD fault type codes read through communication.

Fault code	Fault type	Possible cause	Solution
Out1	[1] Inverter unit U-phase protection	● ACC/DEC is too fast. ● IGBT module damaged.	● Increase ACC/DEC time. ● Replace the inverter unit.
Out2	[2] Inverter unit V-phase protection	● Misoperation caused by interference.	● Check whether the devices and system are grounded reliably.
Out3	[3] Inverter unit W-phase protection	● Drive wires are poorly connected. ● To-ground short circuit occurred.	● Check for loose drive wires. ● Check for abnormal motor wiring and

Fault code	Fault type	Possible cause	Solution
		● Sparking occurred inside the VFD due to harsh operating conditions.	● motor-to-ground short circuit. ● Remove the dust or oil stain inside the VFD regularly.
OC1	[4] Overcurrent during ACC	● ACC/DEC is too fast. ● Grid voltage is too low. ● VFD power is too low. ● Load transient or exception occurred. ● 3PH output current imbalance. ● There are strong external interference sources (contactor switchover or improper grounding).	● Increase ACC/DEC time. ● Increase grid input voltage. ● Select a VFD with larger power. ● Check for motor stalling, short circuit, and load device exceptions. ● Check for abnormal VFD 3PH output voltage and motor 3PH resistance imbalance. ● Check for strong interference (whether the motor cable is routed away from the contactor and system grounded reliably).
OC2	[5] Overcurrent during DEC		
OC3	[6] Overcurrent during constant speed running		
OV1	[7] Overvoltage during ACC	● ACC/DEC time is too short. ● Abnormal input voltage. ● The motor starts during rotating. ● Load energy regeneration is too large. ● Dynamic braking is disabled.	● Increase ACC/DEC time. ● Check the input voltage. ● Use the speed-tracking start function. ● Add dynamic braking devices or regenerative units. ● Set dynamic braking function parameters.
OV2	[8] Overvoltage during DEC		
OV3	[9] Overvoltage during constant speed running		
UV	[10] Bus undervoltage	● Grid voltage is too low. ● Abnormal bus voltage display. ● Abnormal precharge contactor closing.	● Increase grid input voltage. ● Contact the manufacturer.
OL1	[11] Motor overload	● Grid voltage is too low. ● Motor rated current is set incorrectly. ● Motor stalls or load jumps	● Increase grid input voltage. ● Reset the motor rated current in the motor parameter group.

Fault code	Fault type	Possible cause	Solution
		violently.	● Check the load and adjust the torque boost.
OL2	[12] VFD overload	● ACC is too fast. ● The motor is restarted while it is rotating. ● Grid voltage is too low. ● Load is too heavy. ● VFD power is too low.	● Increase ACC time. ● Avoid restart upon stop or enable speed-tracking start. ● Increase grid input voltage. ● Select a VFD with a higher power rating.
SPI	[13] Input phase loss	● R/S/T input phase loss or excessive input fluctuation. ● Input-side screws are loose.	● Check for abnormal input power and loose input cables. ● Set P11.00 to mask the fault.
SPO	[14] Output phase loss	● Output cables are broken or short-circuited to the ground. ● U/V/W output phase loss or severe three-phase load imbalance.	● Check for loose or broken output cables. ● Check for sharp load fluctuation and motor 3PH resistance imbalance.
OH1	[15] Rectifier module overheating	● Air duct is blocked or fan is damaged. ● Ambient temperature is too high. ● Long-time overload running.	● Ventilate the air duct or replace the fan. ● Keep good ventilation to lower ambient temperature. ● Select a VFD with a higher power rating.
OH2	[16] Inverter module overheating		
EF	[17] External fault	● The external fault input signal assigned to an S terminal is active.	● Check whether external device input is normal.
CE	[18] 485 communication fault	● Improper baud rate. ● Communication line fault. ● Incorrect communication address. ● Communication suffers from strong interference.	● Set proper baud rate. ● Check the communication port wiring. ● Set the communication address correctly. ● You are recommended to use shielded cables to improve anti-interference.
ItE	[19] Current detection fault	● Abnormal motor cable or motor insulation. ● Hall cable in poor contact.	● Remove motor cables to check. ● Check the Hall cable

Fault code	Fault type	Possible cause	Solution
		Hall component or current sampling optocoupler damaged.	- connector. - Contact the manufacturer.
tE	[20] Motor autotuning fault	- Motor capacity does not match with the VFD capacity. This fault may occur if the capacity difference exceeds five power classes. - Incorrect motor parameter setting. - The parameters gained from autotuning deviate sharply from the standard parameters. - Autotuning timeout. - Pulse current setting is too large.	- Change the VFD model, or adopt the V/F mode for control. - Check motor wiring, motor type, and parameter settings. - Empty the motor load and re-perform autotuning. - Check whether the upper limit frequency is larger than 2/3 of the rated frequency. - Decrease the pulse current setting properly.
EEP	[21] EEPROM operation fault	- Error in reading or writing control parameters. - EEPROM is damaged.	- Press STOP/RST to reset. - Replace the main control board.
PIDE	[22] PID feedback offline fault	- PID feedback offline. - PID feedback source disappears.	- Check PID feedback signal wires. - Check PID feedback source.
bCE	[23] Braking unit fault	- Fault occurred to the braking circuit or the braking transistor is damaged. - The resistance of the external braking resistor is too low.	- Check the braking unit, and replace with new braking transistor. - Increase the braking resistance.
END	[24] Running time reached	Actual VFD running time longer than internally set running time.	Contact the manufacturer.
OL3	[25] Electronic overload fault	The VFD reports the overload alarm according to the setting.	Check whether the overload pre-alarm threshold is set properly.
PCE	[26] Keypad	Keypad cable connected	Check the keypad cable and

Fault code	Fault type	Possible cause	Solution
	communication error	improperly or disconnected. ● Keypad cable too long, causing strong interference. ● Keypad or mainboard communication circuit error.	re-plug it to determine whether the fault persists. ● Check the surroundings to rule out interference source. ● Replace the hardware and seek maintenance services.
UPE	[27] Parameter upload error	● Keypad cable connected improperly or disconnected. ● Keypad cable too long, causing strong interference. ● Keypad or mainboard communication circuit error.	● Check the keypad cable and re-plug it to determine whether the fault persists. ● Check the surroundings to rule out interference source. ● Replace the hardware and seek maintenance services.
DNE	[28] Parameter download error	● Keypad cable connected improperly or disconnected. ● Keypad cable too long, causing strong interference. ● Data storage error in the keypad.	● Check the surroundings to rule out interference source. ● Replace the hardware and seek maintenance services. ● Back up the data in the keypad again, and check whether the version of the original control board software of parameter copy is the same as the version of the control board software to be downloaded.
ETH1	[32] To-ground short-circuit fault 1	● The output of the VFD is short-circuited to the ground. ● Current detection circuit fault. ● Actual motor power setup deviates sharply from the VFD power.	● Check whether the motor is short-circuited to the ground and wiring is normal. ● Check whether the motor wiring is normal. ● Replace the hall component. ● Replace the main control board. ● Reset the motor parameters
ETH2	[33] To-ground short-circuit fault 2		

Fault code	Fault type	Possible cause	Solution
			properly.
dEu	[34] Speed deviation fault	The load is too heavy or stalled.	- Check for overload, increase speed deviation detection time, or prolong ACC/DEC time. - Check motor parameter settings and re-perform motor parameter autotuning. - Check speed loop control parameter settings.
STo	[35] Out-of-step fault	- Load exception. - Incorrect SM parameter settings. - Auto-tuned motor parameters are inaccurate. - The VFD is not connected to the motor. - Flux weakening application.	- Check for overload or stalling. - Check motor parameter and back-EMF settings. - Re-perform motor parameter auto-tuning. - Increase the out-of-step detection time. - Adjust flux weakening coefficient and current loop parameters.
LL	[36] Electronic underload fault	The VFD reports the underload alarm according to the setting.	Check the load and underload pre-alarm thresholds.
ENC1o	[37] Encoder disconnection fault	- Incorrect encoder line sequence, or signal wires poorly connected. - The encoder signal is interfered. - Encoder is damaged.	- Check whether the encoder wiring is normal, and route the encoder cable separately from the power cable. - Use a shielded cable for the encoder cable, and ensure the shield layer is grounded reliably. Ensure the system is grounded reliably. - Replace the encoder with a new one.
ENC1d	[38] Encoder reverse direction fault	The encoder speed signal is opposite to the motor running direction.	Reset the encoder direction.

Fault code	Fault type	Possible cause	Solution
ENC1Z	[39] Encoder Z pulse disconnection fault	● Z signal disconnection	● Check the wiring of Z signal and perform the wiring again.
OT	[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.
STO	[40] Safe torque off	● The STO function is activated by an external signal	-
STL1	[41] STO channel 1 safety circuit fault	● The wiring of STO is improper. ● Fault occurred to external switch of STO. ● Channel safety circuit hardware fault.	● 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.
STL2	[42] STO channel 2 safety circuit fault		
STL3	[43] Exception occurred to both channel 1 and channel 2	● Hardware fault occurred to STO circuit.	● Replace the control board.
CrCE	[44] Safety code FLASH CRC check fault	● Control board fault.	● Replace the control board.
E-Err	[55] Duplicate expansion card type	● The two inserted expansion cards are of the same type	● Do not insert two cards of the same type. Check the type of expansion card, and remove one card after power-off.
ENCUV	[56] Encoder UVW loss fault	● No electrical level change occurred to UVW signal.	● Check the UVW wiring. ● Check whether the encoder is damaged.
F1-Er	[60] Failed to identify the expansion card in	● There is data transmission in the interface of card slot	● Check whether the expansion card in the slot is

Fault code	Fault type	Possible cause	Solution
	card slot 1	1, but it cannot read the card type.	supported.
F2-Er	[61] Failed to identify the expansion card in card slot 2	There is data transmission in the interface of card slot 2, but it cannot read the card type.	- Stabilize the expansion card interface after power-off, and check whether the fault persists at next power-on. - Check whether the insertion port or card slot is damaged. If yes, replace the insertion port or card slot after power-off.
F3-Er	[62] Failed to identify the expansion card in card slot 3	There is data transmission in the interface of card slot 3, but it cannot read the card type.	
C1-Er	[63] Communication timeout of expansion card in slot 1	There is no data transmission in the interface of card slot 1.	
C2-Er	[64] Communication timeout of expansion card in slot 2	There is no data transmission in the interface of card slot 2.	
C3-Er	[65] Communication timeout of expansion card in slot 3	There is no data transmission in the interface of card slot 3.	
E-DP	[29] PROFIBUS card communication timeout fault	No data transmission between the communication card and the host controller (or PLC).	Check whether the communication card wiring is loose or disconnected.
E-NET	[30] Ethernet card communication timeout fault	There is no data transmission between the communication card and the host controller.	
E-CAN	[31] CANopen card communication timeout fault	No data transmission between the communication card and the host controller (or PLC).	
E-PN	[57] PROFINET card communication timeout fault	No data transmission between the communication card and the host controller (or PLC).	
E-CAT	[66] EtherCAT card communication timeout	No data transmission between the communication card and	

Fault code	Fault type	Possible cause	Solution
		the host controller (or PLC).	
E-BAC	[67] BACnet card communication timeout fault	No data transmission between the communication card and the host controller (or PLC).	
E-DEV	[68] DeviceNet card communication timeout fault	No data transmission between the communication card and the host controller (or PLC).	
SECAN	[58] CAN master/slave card communication timeout fault	There is no data transmission between the CAN master and slave communication cards.	
S-Err	[69] CAN slave fault in master/slave synchronization	Fault occurred to one of the CAN slave VFDs.	Detect the CAN slave VFD and analyze the corresponding fault cause.
P-E1– P-E10	[45]–[54]: PLC card customized faults 1–10	- PLC card user program logic error. - PLC card customized fault points experienced malfunctions.	- Check the PLC card user program logic. - Conduct troubleshooting based on actual customized faults.
OtE1	[70] EC PT100 detected OT	- The EC PT100 temperature sensor obtains inaccurate temperature or it is calibrated inaccurately. - Equipment or ambient temperature too high.	- Set related parameters for calibration. - Lower the equipment or ambient temperature.
OtE2	[71] EC PT1000 detected OT	- The temperature sensor obtains inaccurate temperature or it is calibrated inaccurately. - Equipment or ambient temperature too high.	
E-EIP	[72] EtherNet IP communication timeout	No data transmission between the communication card and the host controller (or PLC).	Check whether the communication card wiring is loose or disconnected.

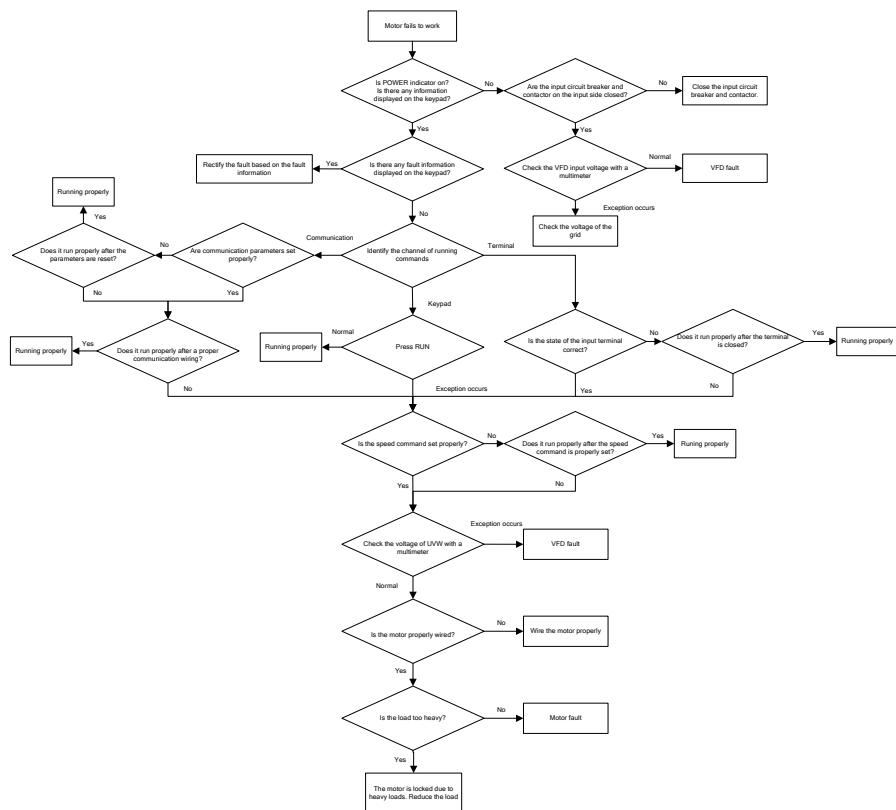
Fault code	Fault type	Possible cause	Solution
E-PAO	[73] No upgrade bootloader	Upgrade bootloader missing.	Contact the manufacturer.
E-AI1	[74] AI1 disconnection	- AI1 input too low - AI1 wiring disconnected	- Connect a 5 V voltage source or a 10 mA current source to check whether the input is normal. - Check the wiring or replace the cable.
E-cfr	[81] Carrier synchronization card slot error	Incorrect card slot	Install the card in the correct slot. For models 7.5 kW and above, install it in the middle slot. For models 1.5 kW and below, install it in the slot near the ribbon cable.
E-tsl	[82] Synchronization signal loss	Hardware problem	Replace the hardware.
E-cts	[83] Carrier synchronization card communication timeout	Communication timeout	- Check whether the fiber-optic cable is loose. - Check whether the carrier frequency has been changed.
E-ros	[84] Carrier synchronization relay feedback fault	Relay fault	Replace the relay.
E-ctr	[85] Carrier synchronization card master/slave fault	A fault occurs on the slave.	- Disable the slave fault response on the master. - Check the slave fault.

7.5.2 Other status

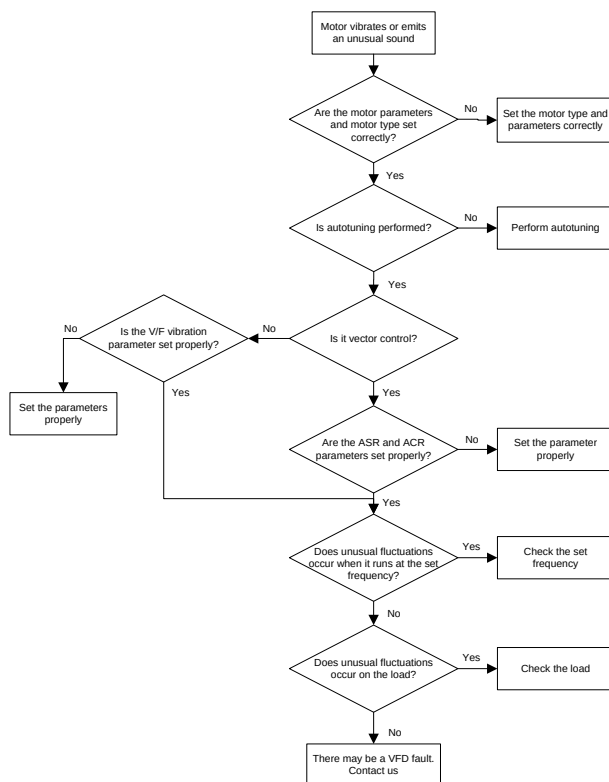
Displayed code	Status type	Possible cause	Solution
PoFF	System power failure	The system is powered off or the bus voltage is too low.	Check the grid conditions.

7.6 Analysis on common faults

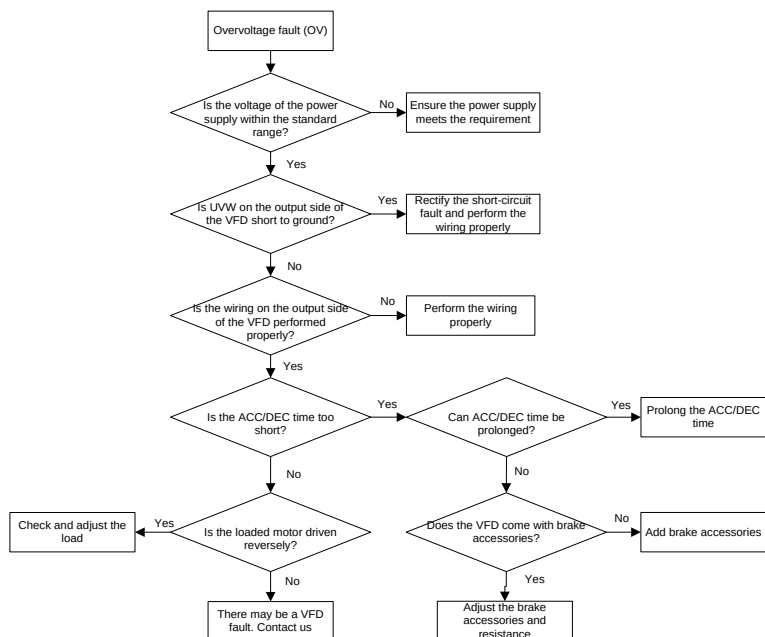
7.6.1 Motor fails to work



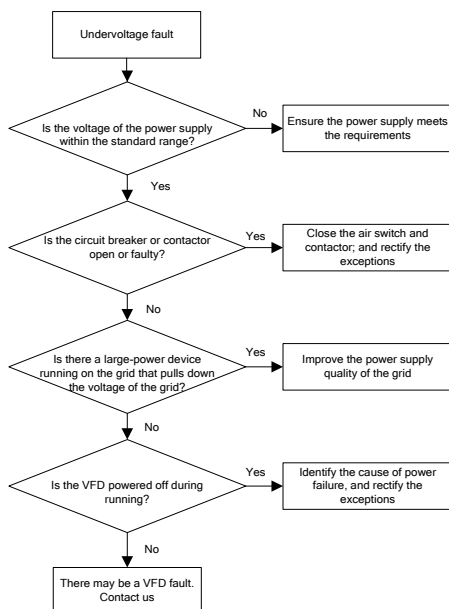
7.6.2 Motor vibrates



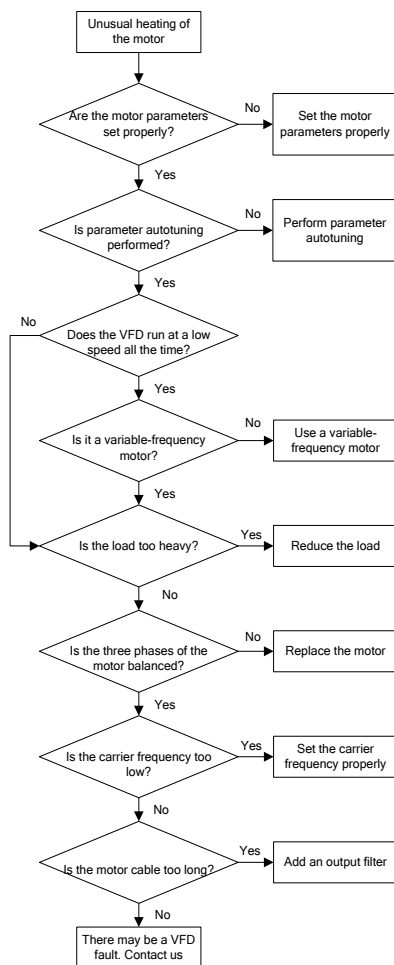
7.6.3 Overvoltage



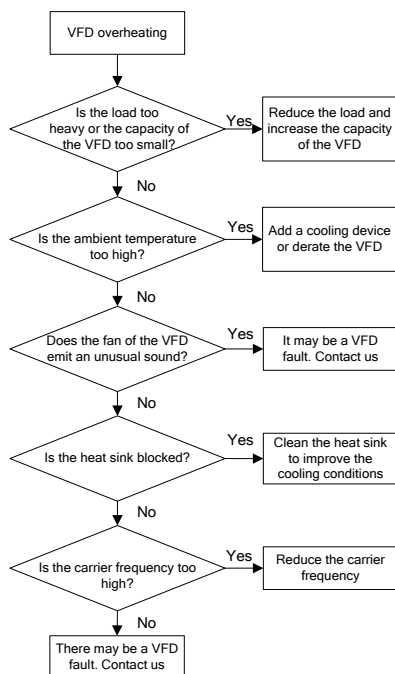
7.6.4 Undervoltage



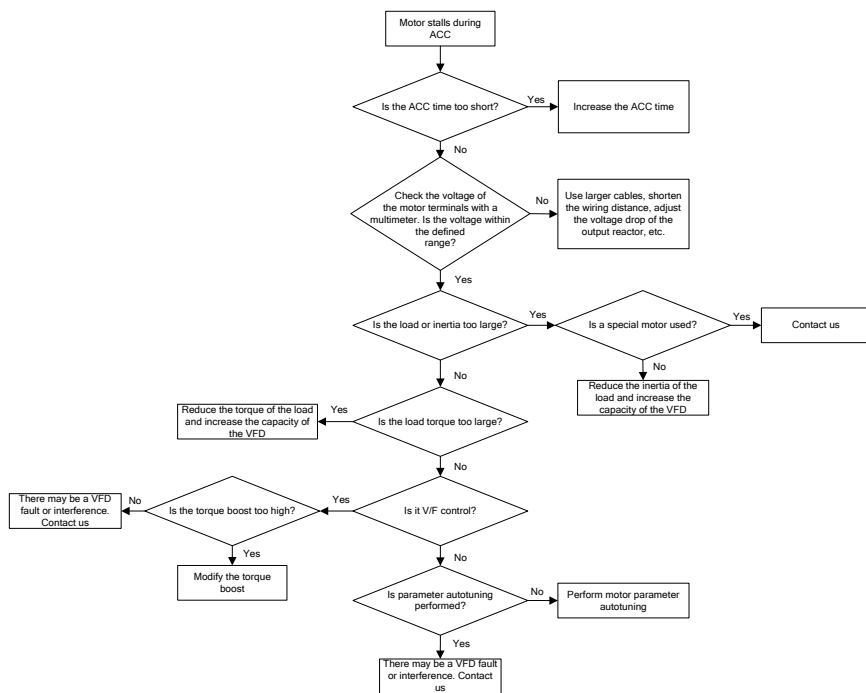
7.6.5 Motor overheating



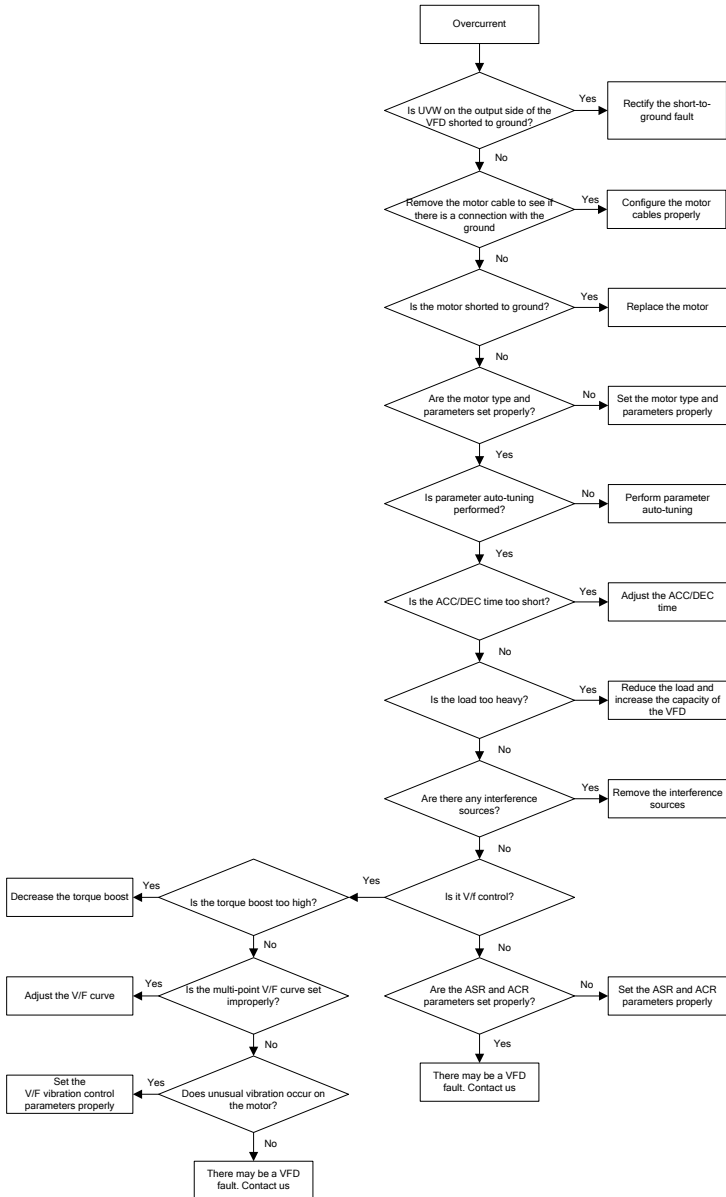
7.6.6 VFD overheating



7.6.7 Motor stalls during ACC



7.6.8 Overcurrent



7.7 Countermeasures on common interferences

7.7.1 Interference on meter switches and sensors

Interference symptoms:

The sensor signal (pressure, temperature, displacement, etc.) is collected and displayed via HMI device. The sensor value displayed after VFD starts is wrong, the common phenomena are listed as follows:

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 displayed value is stable but large deviation exists e.g. the displayed temperature value is tens of degrees higher than the normal value (often occurs with thermocouples).
4. The signal collected by the sensor does not display directly but acts as a feedback signal for drive system operation e.g. the VFD is supposed to decelerate when the air compressor has reached the upper limit pressure, however, the VFD starts to decelerate before upper limit pressure is reached.
5. After the VFD is started, the display of all kinds of meters (such as frequency meter and current meter) that are connected to the analog output (AO) terminal of the VFD is severely affected, displaying the values incorrectly.
6. Proximity switches are used in the system. After the VFD 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 VFD (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 grounding terminal block and PE terminal is lower than 1.5 Ω).
3. Try to add a safety capacitor of 0.1 μF to the signal end of the feedback signal terminal of the sensor.
4. Try to add a safety capacitor of 0.1 μF 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 AO terminal of the VFD, if AO uses 0–20 mA current signal, add a capacitor of 0.47 μF between the AO and GND terminals; if AO uses 0–10 V voltage signal, add a capacitor of 0.1 μF 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 20 mA 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 meters or sensors are disturbed, it is recommended that you configure an external C2 filter on the VFD input power end. For details, see section D.7.2 Filter model selection.

7.7.2 RS485 communication interferences

The RS485 communication interference mainly lies in communication delay, loss of synchronization, intermittent communication, or complete disconnection after VFD starts.

If communication is abnormal regardless of whether the VFD is running, interference may not be the cause, which can be ruled out by following means.

1. Check whether the RS485 communication bus is disconnected or in poor contact.
2. Check whether the A and B wires of the RS485 communication bus are connected reversely.
3. Check whether the communication protocol of the VFD is consistent with that of the host controller. 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.

If communication issues are confirmed to be caused by interference, the following methods can be used:

1. Simple inspection.
2. Arrange the communication cables and motor cables in different cable trays.
3. In multi-VFD application scenarios, adopt the daisy chain connection mode to connect the communication cables between VFDs, which can improve the anti-interference capability.
4. In multi-unit applications, ensure that the drive capability of the master is sufficient.
5. 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 VFD (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 grounding bar and PE terminal is lower than 1.5 Ω).
2. Do not connect the VFD and motor to the same ground terminal as the host controller (PLC, HMI, and touch screen). It is recommended that you connect the VFD 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 (GND) of the VFD with that of the host controller to ensure that ground potential of the communication chip on the control board of the VFD is consistent with that of the communication chip of the host controller.
4. Try to short GND of the VFD to its ground terminal (PE).

5. Try to add a safety capacitor of 0.1 μF on the power terminal of the host controller (PLC, HMI, and touch screen). During this process, pay attention to the voltage of the power supply and the voltage endurance capability of the capacitor. Alternatively, you can use a magnet ring (Fe-based nanocrystalline magnet rings are recommended). Put the power L/N line or +/- line of the host controller through the magnet ring in the same direction and wind 8 coils around the magnet ring.

7.7.3 Stop failure and indicator shimmering caused by coupling of motor cable

Interference phenomenon

1. Stop failure:

In a VFD 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 for the stop.

2. Dim indicator illumination:

After a VFD is started, the relay indicator, power distribution box indicator, PLC indicator, and indicators glow dimly/flicker, and the buzzer emits an abnormal sound.

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 μF 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, connect S1 and S4 in parallel.

Note: If the controller (such as PLC) in the system controls more than 5 VFDs at the same time through digital input terminals (S), this scheme is not applicable.

7.7.4 Leakage current and residual current device (RCD)

VFDs output high-frequency PWM voltage to drive motors. In this process, the distributed capacitance between the internal IGBT of a VFD and the heat sink and that between the stator and rotor of a motor may inevitably cause the VFD 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 a VFD may cause misoperation of a RCD.

1. Rules for selecting RCDs:

- (1) VFD 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 VFDs are grounded reliably.
- (2) 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 20 ms. For example, 1 s, 0.5 s, and 0.2 s.

- (3) For circuits in VFD 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)

- (1) Try to remove the jumper cap at "EMC/J10" from the middle casing of the VFD.
- (2) Try to decrease the carrier frequency to 1.5kHz (P00.14=1.5).
- (3) Try to modify the modulation method to "3PH modulation and 2PH modulation" (P08.40=00).

3. Solution to RCD misoperation (handling the system power distribution):

- (1) Check and ensure that the power cable is not soaking in water.
- (2) Check and ensure that cables are not damaged or spliced.
- (3) Check and ensure that no secondary grounding is performed on the neutral wire.
- (4) Check and ensure that the main power cable terminal is in good contact with the air switch or contactor (all screws are tightened).
- (5) Check 1PH powered devices, and ensure that no earth wires are used as neutral wires by these devices.
- (6) VFD power cable and motor cable should not be shielded ones.

7.7.5 Live device housing

After the VFD is started, a perceptible voltage is present on the chassis, and you may feel an electric shock when touching the chassis. However, when the VFD is powered up without running, the enclosure is not live (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 housing to the VFD grounding terminal PE, and ensure that the jumper at EMC/J10 is shorted.

8 Maintenance

8.1 What this chapter contains

This chapter describes how to carry out preventive maintenance on the VFD.

8.2 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, 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 for incomplete character display	Visual inspection	The requirements stated in this manual are met.
Main circuit	Common	Check whether bolts are loose or fall off.	Tighten them.	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	Check whether conductors are	Visual inspection	No exception

Check scope		Item	Method	Expected result
	wire	deformed or discolored due to overheating.		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 pressure relief valves have protruded.	Determine the service life based on the maintenance information, or measure them through electrostatic capacitance.	No exception occurs.
		Check whether the electrostatic capacitance is measured as required.	Use instruments to measure the capacity.	Electrostatic capacitance $\geq$ initial value $\times 0.85$
	Resistor	Check whether there is displacement caused by overheating.	Olfactory and visual inspection	No exception occurs.
		Check whether the resistor is open-circuited.	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, Reactor	Check whether there is unusual vibration, noise, or odor.	Auditory, olfactory, and visual inspection	No exception occurs.
	Electromagnetic contactor and Relay	Check whether there are abnormal vibration or noise during operation.	Auditory inspection	No exception occurs.
		Check whether the contacts are in good contact.	Visual inspection	No exception occurs.

Check scope		Item	Method	Expected result
Control circuit	Control PCB and connector	Check whether the screws and connectors are loose.	Tighten them.	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 are loose.	Tighten them.	No exception occurs.
		Check whether there is discoloration caused due to overheat.	Visual inspection, and determine the service life based on the maintenance information.	No exception occurs.
	Ventilation duct	Check whether there are foreign matters blocking or attached to the cooling fan, air inlets, or air outlets.	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**.

8.3 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 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.

1. Stop the VFD, disconnect the AC power supply, and wait for a time no shorter than the waiting time designated on the VFD.
2. Open the cable clamp to loosen the fan cable. For models 1R5G/2R2P–7R5G/011P (inclusive), remove the middle housing of the VFD first.
3. Disconnect the fan cable.
4. Remove the fan with a screwdriver.
5. Follow the removal steps in reverse order to install a new fan. Assemble the VFD. Ensure that the air direction of the fan is consistent with that of the VFD, as shown in the following figure.

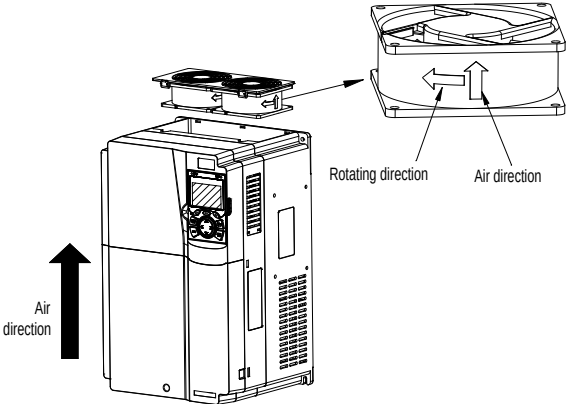


Figure 8-1 Fan maintenance for the 7R5G/011P and higher VFD models

6. Connect to the power supply.

8.4 Capacitor

8.4.1 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.

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,

Time	Operation principle
	✧ and then charge it at 50% of the rated voltage for 30 minutes, ✧ at 75% for another 30 minutes, ✧ 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 220 V AC, you can use a 1PH 220 V AC/2 A 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, 380V) 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 kΩ/100 W. If the voltage of the power supply is no higher than 380 V, you can also use an incandescent lamp of 100 W. If an incandescent lamp is used, it may go off or the light may become very weak.

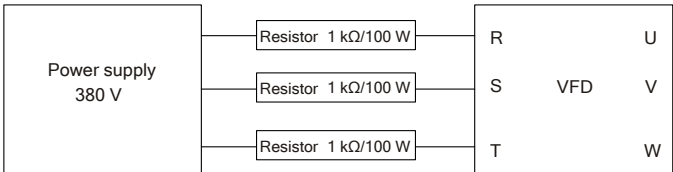


Figure 8-2 380V driving-device charging circuit example

8.4.2 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.
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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.

8.5 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. Switch on the power supply.

9 Communication protocol

9.1 What this chapter contains

This chapter describes the communication protocol of the GD350A-HR series VFD.

The VFD provides RS485 communication interfaces and adopts the master/slave communication based on the international standard Modbus communication protocol. You can implement centralized control (setting commands for controlling the VFD, modifying the running frequency and related function code parameters, and monitoring the working state and fault information of the VFD) through PC/PLC, upper control computer, or other devices to meet specific application requirements.

9.2 Modbus protocol introduction

Modbus is a communication protocol for use with electronic controllers. Through this protocol, controllers can communicate with other devices via transmission lines. It is a common industrial standard that enables control devices from different manufacturers to be connected into an industrial network for centralized monitoring.

The Modbus protocol provides two transmission modes, namely American Standard Code for Information Interchange (ASCII) and remote terminal units (RTU). On one Modbus network, all the device transmission modes, baud rates, data bits, check bits, stop bits, and other basic parameters must be set consistently.

A Modbus network is a control network with one master and multiple slaves, that is, on one Modbus network, there is only one device serving as the master, and other devices are the slaves. The master can communicate with any single slave or with all slaves. For separate access commands, a slave needs to return a response. For broadcast information, slaves do not need to return responses.

9.3 Application of the VFD

The VFD uses the Modbus RTU mode and communicates through RS485 interfaces.

9.3.1 RS485

RS485 interfaces work in half-duplex mode and transmit data signals in the differential transmission way, which is also referred to as balanced transmission. The two-wire RS485 interface uses a twisted pair, in which one wire is defined as A (+), and the other B (-). Generally, if the voltage difference between A and B at the transmitter ranges from +2 V to +6 V, the logic is "1"; and if it ranges from -6 V to -2 V, the logic is "0".

The 485+ terminal on the terminal block of the VFD corresponds to A, and 485- corresponds to B.

The communication baud rate (P14.01) indicates the number of bits sent in a second, and the unit bit/s(bps). A higher baud rate indicates faster

transmission and poorer anti-interference capability. When a twisted pair of 0.56 mm (24 AWG) is used, the maximum transmission distance varies according to the baud rate, as described in the following table.

Baud rate	Max. transmission distance	Baud rate	Max. transmission distance
2400 bps	1800 m	9600 bps	800 m

Baud rate	Max. transmission distance	Baud rate	Max. transmission distance
4800 bps	1200 m	19200 bps	600 m

In long-distance RS485 communication, it is recommended that you use shielded cables, and use the shielding layer as the ground wire.

When there are fewer devices and the transmission distance is short, the whole network works well without termination load resistors. The performance, however, degrades as the distance increases. Therefore, it is recommended that you use a 120 Ω termination resistor when the transmission distance is long.

9.3.1.1 Application to one VFD

Figure 9-1 is the Modbus wiring diagram of one VFD and a PC. Generally, PCs do not provide RS485 interfaces, and therefore you need to convert an RS232 interface or USB port of a PC to an RS485 interface. Connect end A of the RS485 communication cable to the 485+ port on the terminal block of the VFD, and connect end B to the 485- port. It is recommended that you use shielded twisted pairs. When an RS232-RS485 converter is used, the cable used to connect the RS232 interface of the PC and the converter cannot be longer than 15 m. Use a short cable when possible. It is recommended that you insert the converter directly into the PC. Similarly, when a USB-RS485 converter is used, use a short cable when possible.

After wiring, select the correct port (such as COM1 to connect the RS232-RS485 converter) on the host controller, and set the baud rate, data bits, parity, stop bits to match the VFD.

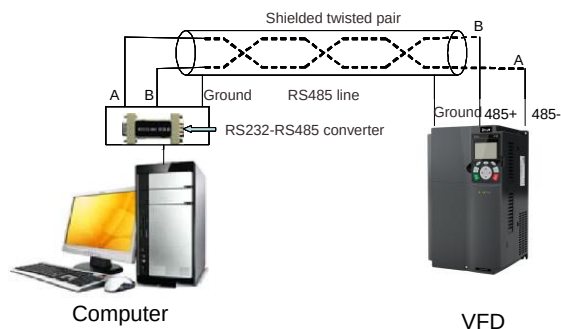


Figure 9-1 RS485 wiring of one VFD

9.3.1.2 Application to multiple VFDs

In practical application to multiple VFDs, daisy-chain connection and star connection are commonly used.

According to the requirements of the RS485 industrial bus standards, all the devices need to be connected in a daisy-chain topology with one 120 Ω termination resistor on each end, as shown in Figure 9-2. Figure 9-3 shows the simplified wiring diagram. Figure 9-4 shows the actual application.

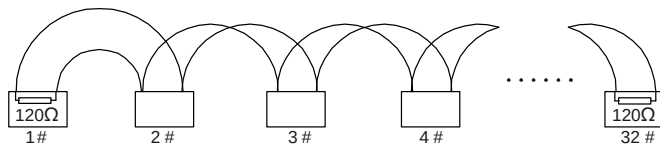


Figure 9-2 Onsite daisy chain connection

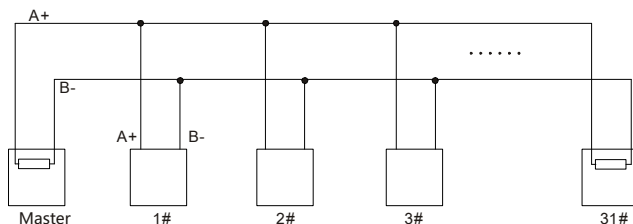


Figure 9-3 Simplified daisy chain connection

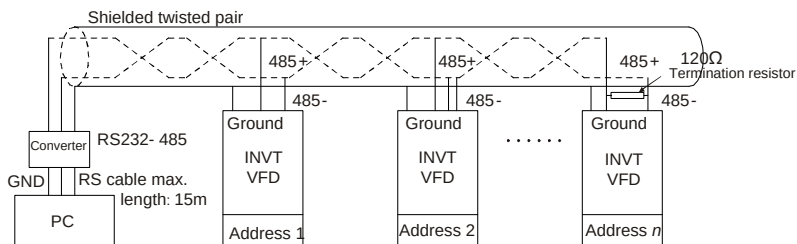


Figure 9-4 Practical daisy chain connection application

Figure 9-5 shows the star connection diagram. When this connection mode is adopted, the two devices at the furthest ends of the line must be fitted with a termination resistor (Devices #1 and #15).

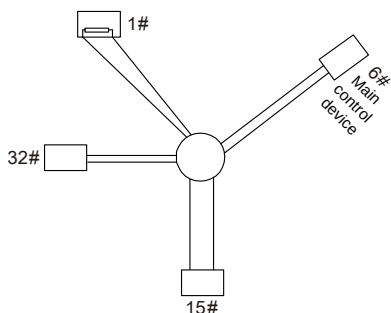


Figure 9-5 Star connection

Use shielded cables, if possible, in multi-device connection. The baud rates, data bit check settings, and other basic parameters of all the devices on the RS485 line must be set consistently, and addresses cannot be repeated.

9.3.2 RTU mode

9.3.2.1 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 can transmit more data with the same baud rate.

Coding system

- 1 start bit
- 7 or 8 data bits; the minimum valid bit is transmitted first. Each frame domain of 8 bits includes 2 hexadecimal characters (0–9, A–F).
- 1 odd/even check bit; this bit is not provided if no check is needed.
- 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 frame (bits 1 to 8 are data bits):

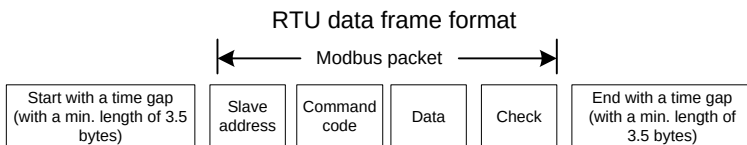
Start bit	Bit1	Bit2	Bit3	Bit4	Bit5	Bit6	Bit7	Bit8	Check bit	Stop bit
-----------	------	------	------	------	------	------	------	------	-----------	----------

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). The network devices constantly 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.

The following table describes the standard structure of an RTU 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)
Command code CMD	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 exchange.
CRC CHK LSB	Detection value: CRC verification value (16 bits)
CRC CHK MSB	
END (frame tail)	T1-T2-T3-T4 (3.5 character times)

9.3.2.2 RTU Communication frame error check methods

During the transmission of data, errors may occur due to various factors. Without error 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 each 8-bit character and the content in the register. The result is shifted toward the least significant bit, and the most significant bit is filled with 0. 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 eight 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.

9.4 RTU command code and communication data

9.4.1 Command code 03H, reading N words (continuously up to 16 words)

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 command frame structure is 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 one 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" is "03H", indicating that the command is used to read data from the VFD. "CMD" occupies one byte.

"Start address" means the address from which data reading starts, 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", which indicates reading data from the addresses 0004H and 0005H.

CRC occupies two bytes with LSB transmitted first and MSB second.

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
MSB of data in 0004H	13H
LSB of data in 0004H	88H
MSB of data in 0005H	00H
LSB of data in 0005H	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 VFD response to the 03H command from the master for reading data. "CMD" 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.

9.4.2 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, to write 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 9.4.1 and 9.4.2 mainly describe the command formats. For the detailed application, see the examples in section 9.4.7.

9.4.3 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 0004H content	13H
LSB of data 0004H content	88H
MSB of data 0005H content	00H
LSB of data 0005H content	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)

9.4.4 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.

9.4.4.1 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 P05.06 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 06, that is, the LSB is the hexadecimal form of 06. Therefore, the function code address is 0506H in the hexadecimal form. For P10.01, the parameter address is 0A01H.

Function code	Name	Description	Setting range	Default	Modify
P10.00	Simple PLC mode	0: Stop after running once 1: Keep running with the final value after running once 2: Cyclic running	0–2	0	○
P10.01	Simple PLC power-loss memory	0: Disable 1: Enable	0–1	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, if P00.07 is not to be stored in the EEPROM, you need only to modify the value of the RAM, that is, 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.

9.4.4.2 Addresses of other Modbus functions

Besides parameter configuration, the master can also control the VFD (such as start and stop commands) and monitor its real-time operating status. The following table lists other function parameters.

Function	Address definition	Data description	R/W
Communication 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	
Communication-based setting address	2001H	Communication-based frequency setting (0–Fmax, unit: 0.01 Hz)	R/W
	2002H	PID reference (0–1000, where 1000 corresponds to	

Function	Address definition	Data description	R/W
		100.0%)	
	2003H	PID feedback (0–1000, where 1000 corresponds to 100.0%)	R/W
	2004H	Torque setting (-3000–3000, where 1000 corresponds to 100.0% of the motor rated current)	R/W
	2005H	Forward upper limit frequency setpoint (0–Fmax, unit: 0.01 Hz)	R/W
	2006H	Reverse upper limit frequency setpoint (0–Fmax, unit: 0.01 Hz)	R/W
	2007H	Motoring torque upper limit (0–3000, where 1000 corresponds to 100.0% of the motor rated current)	R/W
	2008H	Braking torque upper limit (0–3000, where 1000 corresponds to 100.0% of the motor rated current)	R/W
	2009H	Special control command word: Bit1–bit0: =00: Motor 1 =01: Motor 2 Bit2: =1 Enable speed/torque control switchover =0: Disable speed/torque control switchover Bit3: =1 Clear electricity consumption data =0: Keep electricity consumption data Bit4: =1 Enable pre-excitation =0: Disable pre-excitation Bit5: =1 Enable DC braking =0: Disable DC braking	R/W
	200AH	Virtual input terminal command. Range: 0x000–0x3FF (corresponding to S8/S7/S6/S5/HDIB/HDIA/S4/S3/S2/S1)	R/W
	200BH	Virtual output terminal command (0x00–0x0F) Corresponding to local RO2/RO1/HDO/Y1	R/W
	200CH	Voltage setting (used for V/f separation) (0–1000, where 1000 corresponds to 100.0% of the motor rated voltage)	R/W
	200DH	AO setting 1 (-1000–+1000, where 1000 corresponds to 100.0%)	R/W
	200EH	AO setting 2 (-1000–+1000, where 1000 corresponds to 100.0%)	R/W
VFD status word 1	2100H	0001H: Forward running	R
		0002H: Reverse running	
		0003H: VFD stopped	
		0004H: VFD in fault	

Function	Address definition	Data description	R/W
		0005H: VFD in POFF state	
		0006H: Pre-exciting	
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: AM =1: SM Bit4: =0: No alarm upon overload =1: Alarm upon overload 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: Space voltage vector	R
VFD fault code	2102H	See the description of fault types.	R
VFD identification code	2103H	GD350A-----0x01A2	R
Running frequency	3000H	0–Fmax (Unit: 0.01 Hz)	R
Set frequency	3001H	0–Fmax (Unit: 0.01 Hz)	R
Bus voltage	3002H	0.0–2000.0V (Unit: 0.1 V)	R
Output voltage	3003H	0–1200V (Unit: 1 V)	R
Output current	3004H	0.0–3000.0A (Unit: 0.1 A)	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
Closed-loop setting	3008H	-100.0–100.0% (Unit: 0.1%)	R
Closed-loop feedback	3009H	-100.0–100.0% (Unit: 0.1%)	R
Input IO status	300AH	0x00–0x3F Corresponding to the local HDIB/ HDIA/S4/S3/S2/S1	R
Output IO status	300BH	0x00–0x0F Corresponding to local RO2/RO1/HDO/Y1	R
Analog input 1	300CH	0.00–10.00 V (Unit: 0.01 V)	R
Analog input 2	300DH	0.00–10.00 V (Unit: 0.01 V)	R

Function	Address definition	Data description	R/W
Analog input 3	300EH	-10.00–10.00 V (Unit: 0.01 V)	R
Analog input 4	300FH	/	R
Read input of HDIA high-speed pulse	3010H	0.00–50.00 kHz (Unit: 0.01 Hz)	R
Read input of HDIB high-speed pulse	3011H	/	R
Read the actual step of multi-step speed	3012H	0–15	R
External length value	3013H	0–65535	R
External count value	3014H	0–65535	R
Torque set value	3015H	-300.0–300.0% (Unit: 0.1%)	R
VFD identification code	3016H	/	R
Fault code	5000H	/	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 are valid only after they are enabled. Take the running and stop operations as examples, you need to set "Running command channel" (P00.01) to "Communication", and set "Communication mode of running 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 identification code 2103H of the VFD).

Code high byte	Meaning	Code low byte	Meaning
0x01	Goodrive	0xa2	GD350A series VFD

9.4.5 Fieldbus scale

In actual 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 as an example.

Function code	Name	Description	Setting range	Default	Modify
P01.20	Wake-up-from-sleep delay	0.0–3600.0 s (valid when the ones place of P01.19 is 2)	0.00–3600.0	0.0 s	○
P01.21	Power-off restart selection	0: Disable restart 1: Enable restart	0–1	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 5.0 s 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:

<u>01</u>	<u>06</u>	<u>01 14</u>	<u>00 32</u>	<u>49 E7</u>
VFD address	Write command	Parameter address	Parameter data	CRC

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 5.0 s.

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:

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

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 5.0 s.

9.4.6 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:

Code	Name	Meaning
		- 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 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. Note: It does not mean that the data item submitted for storage in the register includes a value unexpected by the program.
04H	Operation failure	The parameter setting is invalid during the write operation. For example, duplicate settings for input terminals are not allowed.
05H	Incorrect password	The password entered in the password verification address is different from that specified by P07.00.
06H	Incorrect data frame	The data frame sent from the host controller has an incorrect length, or in the RTU format, the value of the CRC check bit is inconsistent with the CRC value calculated by the downstream device.
07H	Parameter read-only	The parameter to be modified in the write operation of the host controller is a read-only parameter.
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 most significant bit is set to 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 running commands" (P00.01, the parameter address is 0001H) to 03 for the VFD whose address is 01H, the command is as follows:

<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 "Running command channel" 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".

9.4.7 Read/Write operation examples

For the formats of the read and write commands, see sections 9.4.1 and 9.4.2.

9.4.7.1 Example of read command 03H

Example 1: Read state word 1 of the VFD whose address is 01H. According to the table in section 9.4.4.2 Addresses of other Modbus functions, 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 "Most recent fault type" (P07.27) to "5th-last fault type" (P07.32) of which the parameter addresses are 071BH to 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>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

According to the returned data, all the fault types are 0023H, that is, 35 in the decimal form, which means the STo fault.

9.4.7.2 Example of write command 06H

Example 1: Set the VFD at address 03H to run forward. According to the other function parameter table, the address of "Communication-based control command" is 2000H, and 0001 indicates forward running.

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

The command sent 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 (same as the command transmitted from the master) is returned:

<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.

Function code	Name	Description	Setting range	Default	Modify
P00.03	Max. output frequency	Max(P00.04,10.00)–599.00Hz	100.00–590.00	50.00 Hz	☉

According to the number of decimal places, the fieldbus scale of max. output frequency (P00.03) is 100. Multiply 100 Hz by 100. The value 10000 is obtained, and it is 2710H in the hexadecimal form.

The command sent 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.

9.4.7.3 Example of continuous write command 10H

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

Function description	Address definition	Data description	R/W
Communication 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	
Communication-based setting address	2001H	Communication-based frequency setting (0–Fmax, unit: 0.01 Hz)	R/W
	2002H	PID reference (0–1000, where 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:

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

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

Function code	Name	Description	Default	Modify
P00.11	ACC time 1	Setting range of P00.11 and P00.12: 0.0–3600.0 s	Depends on model	☐
P00.12	DEC time 1		Depends on model	☐

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

The command sent from the master is as follows:

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

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

<u>01</u>	<u>10</u>	<u>00 0B</u>	<u>00 02</u>	<u>30 0A</u>
VFD address	Continuous write command	Parameter address	Parameter quantity	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.

9.4.7.4 Example of Modbus communication commissioning

A PC is used as the host, an RS232-RS485 converter is used for signal conversion, and the PC serial port used by the converter is COM1 (an RS232 port). The host controller commissioning software is the serial port commissioning assistant Commix, which can be downloaded from the Internet. Download a version that can automatically execute the CRC check function. The following figure shows the interface of Commix.



First, set the serial port to **COM1**. Then, set the baud rate consistently with P14.01. The data bits, check bits, and stop bits must be set consistently with P14.02. If the RTU mode is selected, you need to select the hexadecimal form **Input HEX**. To set the software to automatically execute the CRC function, you need to select **ModbusRTU**, select **CRC16 (MODBUS RTU)**, and set the start byte to **1**. After the auto CRC check function is enabled, do not enter CRC information in commands. Otherwise, command errors may occur due to repeated CRC check.

The commissioning command to set 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:

- Set the address (P14.00) of the VFD to 03.
- Set "Channel of running commands" (P00.01) to "Communication", and set "Communication channel of running commands" (P00.02) to the Modbus communication channel.
- Click **Send**. If the line configuration and settings are correct, a response from the VFD is received.

03

VFD
address

06

Write
command

20 00

Parameter
address

00 01

Forward running

42 28

CRC

9.5 Common communication faults

Common communication faults include the following:

- No response is returned.
- The VFD returns an exception response.

Possible causes of no response include the following:

- The serial port is set incorrectly. For example, the adapter uses the serial port COM1, but COM2 is selected for the communication.
- The settings of the baud rates, data bits, end bits, and check bits are inconsistent with those set on the VFD.
- The polarity of the RS485 A (+) and B (-) lines is reversed.
- The resistor connected to 485 terminals on the terminal block of the VFD is set incorrectly.

Appendix A Expansion card

A.1 Model definition

EC-PG 5 02-05 B

① ② ③ ④ ⑤ ⑥

Sign	Description	Naming example
①	Product category	EC: Expansion card
②	Board card category	IC: IoT card IO: IO expansion card PC: PLC card PG: PG card PS: Power supply card 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	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: Simplified incremental PG card
⑤	Working power supply	00: No power (passive)
		05: 5 V
		12: 12–15 V
		24: 24 V
⑥	Expansion card version	Empty: Version A B: Version B C: Version C

EC-PC 5 02-00

① ② ③ ④ ⑤

Sign	Description	Naming example
①	Product category	EC: Expansion card
②	Board card category	IC: IoT card IO: IO expansion card PC: PLC card PG: PG card PS: Power supply card 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: 10 points, with 6 inputs and 4 outputs (2 transistor outputs + 2 relay outputs)
		02: 8 points of IO, 1 point of AI, 1 point of AO, and 1 point of RS485 communication
		03: Reserved
⑤	Special requirement	Reserved

EC-TX 5 01 B

① ② ③ ④ ⑤

Sign	Description	Naming example
①	Product category	EC: Expansion card
②	Board card category	TX: communication expansion card PG: PG card PC: PLC card 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: Bluetooth communication card
		02: Wi-Fi communication card

Sign	Description	Naming example
		03: PROFIBUS communication card
		04: Ethernet communication card
		05: CAN multi-protocol communication card
		06: DeviceNet communication card
		07: BACnet communication card
		08: EtherCAT communication card
		09: PROFINET communication card
		10: EtherNet IP communication card
		11: CAN master/slave control communication card
		15: Modbus TCP communication card
		19: Fiber-optic master/slave control communication card
⑤	Expansion card version	Empty: Version A B: Version B C: Version C

EC-IO 5 01-00

① ② ③ ④ ⑤

Sign	Description	Naming example
①	Product category	EC: Expansion card
②	Board card category	IC: IoT card IO: IO expansion card PC: PLC card PG: PG card PS: Power supply card 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: Multiple-function I/O expansion card (four digital inputs, one digital output, one analog input, one analog output, and two relay outputs) 02: Digital I/O card 03: Analog I/O card 04: Reserved 1 05: Reserved 2
⑤	Special requirement	/

EC - IC 5 01 - 2 1 G

① ② ③ ④ ⑤ ⑥ ⑦

Sign	Description	Naming example
①	Product category	EC: Expansion card
②	Board card category	IC: IoT card IO: IO expansion card PC: PLC card PG: PG card PS: Power supply card 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	Product code (IoT card)	01: GPRS card 02: 4G card 03: Reserved
⑤	Antenna type of wireless communication card	1: Built-in 2: External
⑥	SIM card type	0: Plug-in card (Standard, default) 1: Surface-mounted
⑦	Special function	G: With GPS S: Surface-mounted SIM card This bit is omitted for standard models since special functions are not available for them.

EC - IC 5 02 - 2 1 G - CN

① ② ③ ④ ⑤ ⑥ ⑦ ⑧

Sign	Description	Naming example
①	Product category	EC: Expansion card
②	Board card category	TX: communication expansion card PG: PG card PC: PLC card IO: IO expansion card IC: IoT 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.

Sign	Description	Naming example
④	Product code (IoT card)	01: GPRS card 02: 4G card 03: Reserved
⑤	Antenna type of wireless communication card	1: Built-in 2: External
⑥	SIM card type	0: Plug-in 1: Surface-mounted Note: When this field is 0 or omitted, the SIM card type is plug-in.
⑦	Special function	G: With GPS Note: When this field is omitted, the expansion card does not have special functions.
⑧	International version	CN: China version EU: Europe version LA: Latin American version Note: A 4G SIM card is a standard configuration for the CN version, but not for the EU or LA version.

The following table describes expansion cards that the VFD supports. The expansion cards are optional and need to be purchased separately.

Name	Model	Specification	Ordering information
IO expansion card 1	EC-IO501-00	- Four digital inputs - One digital output - One analog input - One analog output - Two relay outputs: one double-contact output, and one single-contact output.	11023-00083
IO expansion card 2	EC-IO502-00	- Four digital inputs - One PT100 - One PT1000 - Two relay outputs, each with a single normally open contact.	11023-00119
PLC card	EC-PC502-00	Uses a mainstream PLC development environment, supporting multiple types of programming languages, such as the instruction language, ladder diagram, and sequential function chart;	11023-00146

Name	Model	Specification	Ordering information
		● Supports breakpoint debugging and task period execution mode selection ● Provides a user program storage space of 16K steps and data storage space of 8K words ● Six digital inputs ● Two relay outputs ● One analog input and 1 output ● One RS485 communication channel, master/slave switchover by host controller ● Supports saving data of 1K words at power off	
Bluetooth communication card	EC-TX501-1 EC-TX501-2	● Supports Bluetooth 4.0. ● With INVT's mobile phone APP, you can set the parameters and monitor the states of the VFD through Bluetooth. ● Max. communication distance in an unobstructed environment: 30 m ● EC-TX501-1 is equipped with a built-in antenna and applicable to molded case machines. ● EC-TX501-2 is equipped with an external suction-cup antenna and applicable to sheet metal machines.	11023-00088 11023-00089
Wi-Fi communication card	EC-TX502-1 EC-TX502-2	● Meets requirements of IEEE802.11b/g/n. ● With INVT's mobile phone APP, you can monitor the VFD locally or remotely through Wi-Fi. ● Max. communication distance in an unobstructed environment: 30 m ● EC-TX502-1 is equipped with a built-in antenna and applicable to molded case machines ● EC-TX502-2 is equipped with an external suction-cup antenna and applicable to sheet metal machines	11023-00101 11023-00102
PROFIBUS-DP communication card	EC-TX503	● Supports the PROFIBUS-DP protocol.	11023-00080

Name	Model	Specification	Ordering information
Ethernet communication card	EC-TX504	- Supports Ethernet communication with INVT's internal protocol - Used with INVT Workshop, the upper controller monitoring software.	11023-00081
CAN multi-protocol communication card	EC-TX505C	- Based on the CAN2.0A and CAN2.0B physical layer - Supports the CANopen protocol. - Adopts INVT's master/slave control proprietary protocol.	11023-00148
PROFINET communication card	EC-TX509	Supports the PROFINET protocol.	11023-00100
Ethernet/IP communication card	EC-TX510	- Supports the EtherNet/IP protocol and ODVA protocol. - Equipped with two EtherNet IP ports, supporting 10/100 Mbit/s half-/full-duplex operation. - Supports star, line, and ring network topologies (but the ring network monitoring is not available).	11023-00107
Modbus TCP communication card	EC-TX515	- Equipped with two Modbus TCP IO ports, supporting 100M full/half duplex operating, and supporting line and star network topologies, with the nodes up to 32. - Available as Modbus TCP slave.	11023-00125
Fiber-optic master/slave control communication card	EC-TX519	- Communication network: Ring network topology. Starting from the master, devices are connected in sequence. A network with up to one master and four slaves is supported. - Communication distance: Standard fiber-optic cables are used, with a maximum supported distance of 10 m per cable.	Standard configuration for the hot-redundancy VFDs
Sin/Cos PG card	EC-PG502	- Applicable to Sin/Cos encoders with or without CD signals. - Supports A, B, Z frequency-divided output; - Supports input of pulse train reference	11023-00109

Name	Model	Specification	Ordering information
Incremental PG card with UVW	EC-PG503-05	● Applicable to differential encoders of 5 V ● Supports the orthogonal input of A, B, and Z ● Supports pulse input of phase U, V, and W; ● Supports the frequency-divided output of A, B, and Z ● Supports input of pulse train reference	11023-00085
Resolver PG card	EC-PG504-00	● Applicable to resolver encoders ● Supports frequency-divided output of resolver-simulated A, B, Z ● Supports input of pulse train reference	11023-00086
5 V/12 V multi-function incremental PG card	EC-PG505-12	● Applicable to OC encoders of 5 V or 12 V. ● Applicable to push-pull encoders of 5 V or 12 V. ● Applicable to differential encoders of 5 V. ● Supports the orthogonal input of A, B, and Z. ● Supports the frequency-divided output of A, B, and Z. ● Supports input of pulse train reference.	11023-00087
24 V incremental PG card	EC-PG505-24B	● Applicable to OC encoders of 24 V. ● Applicable to push-pull encoders of 24 V. ● Supports the orthogonal input of A, B, and Z. ● Supports the frequency-divided output of A, B, and Z. ● Supports input of pulse train reference.	11023-00139
5 V/12 V simplified incremental PG card	EC-PG507-12	● Applicable to OC encoders of 5 V or 12 V. ● Applicable to push-pull encoders of 5 V or 12 V. ● Applicable to differential encoders of 5 V.	11023-00115
24 V simplified incremental PG card	EC-PG507-24	● Applicable to OC encoders of 24 V. ● Applicable to push-pull encoders of 24 V. ● Applicable to differential encoders of 24 V.	11023-00121
GPRS expansion card	EC-IC501-2	● Supports IoT monitoring ● Supports remote VFD upgrade	11023-00130
4G expansion card	EC-IC502-2-CN EC-IC502-2-EU EC-IC502-2-LA	● Supports standard RS485 interface. ● Supports 4G communication.	11095-00009 11095-00017 11095-00018

Note: Please contact us for details about the EtherCAT communication card, 24 V power supply card, and the vibration-resistant GPRS card with high-precision GPS positioning.

IO expansion card 1 EC-IO501-00	IO expansion card 2 EC-IO502-00	Programmable expansion card EC-PC502-00	Bluetooth communication card EC-TX501 Wi-Fi communication card EC-TX502
PROFIBUS-DP communication card EC-TX503	Ethernet communication card EC-TX504	CAN multi-protocol communication card EC-TX505C	PROFINET communication card EC-TX509

			
Ethernet/IP communication card EC-TX510 /Modbus TCP Communication card EC-TX515	Fiber-optic master/slave control communication card EC-TX519	Sin/Cos PG card EC-PG502	Incremental PG card with UVW EC-PG503-05
			
Resolver PG card EC-PG504-00	5 V/12 V Multi-function incremental PG card EC-PG505-12	24 V incremental PG card EC-PG505-24B	Simplified incremental PG card EC-PG507-12

			
24 V simplified incremental PG card EC-PG507-24	GPRS IoT card EC-IC501-2	4G card EC-IC502-2-CN EC-IC502-2-EU EC-IC502-2-LA	

A.2 Dimensions and installation

All expansion cards have the same dimensions and installation method.

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. Expansion cards must be installed into the corresponding slots (SLOT1, SLOT2, or SLOT3) as required.
3. The 1R5G/2R2P VFD model can be configured with two expansion cards at the same time, and the 7R5G/011P and higher VFD models can be configured with three expansion cards.
4. If interference occurs on the external wires after the expansion card is installed, change the installation slot flexibly to facilitate the wiring. For example, it is recommended to install the PROFIBUS-DP card in SLOT1, as its connector is relatively large.
5. To ensure high anti-interference capability in closed-loop control, you need to use a shielded cable as the encoder cable and ground the two ends of the cable. That is, connect the motor side shield layer to the motor housing, and connect the PG card side shield layer to the PE terminal.
6. Fiber-optic master/slave control communication card EC-TX519 installation position: Applicable only to card slot SLOT1 for the 1R5G/2R2P model, and applicable only to card slot SLOT2 for the 7R5G/011P and higher models.

The following figure shows the installation diagram and a VFD with expansion cards installed.

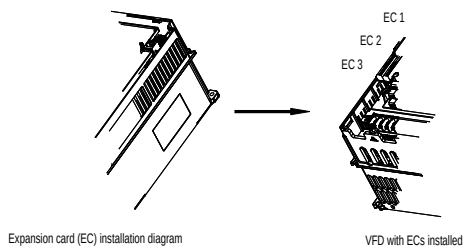


Figure A-1 VFD diagram of 7R5G/011P or higher models with expansion cards installed

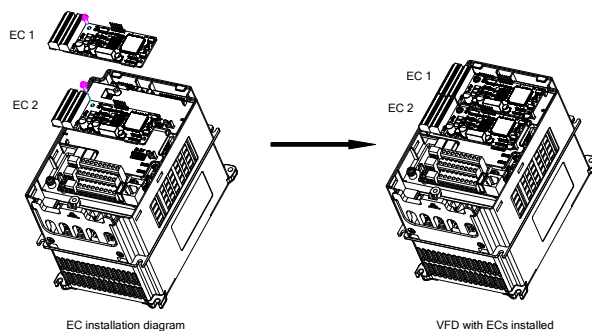


Figure A-2 VFD diagram of the 1R5G/2R2P model with expansion cards installed

Expansion card installation procedure:

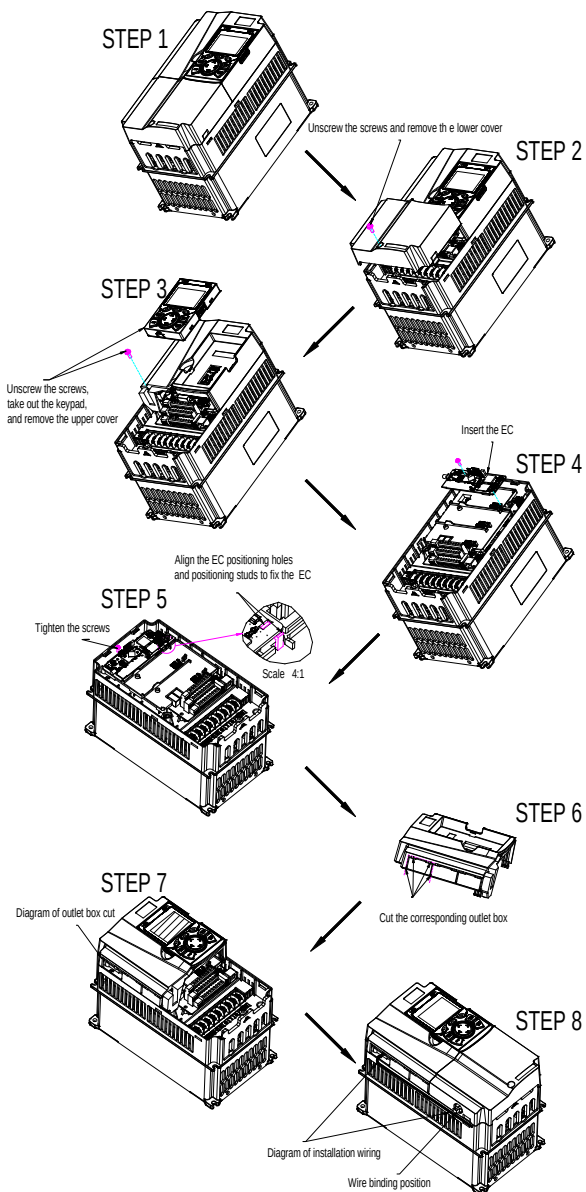


Figure A-3 Expansion card installation procedure

A.3 Wiring

1. Ground the cable shield as follows

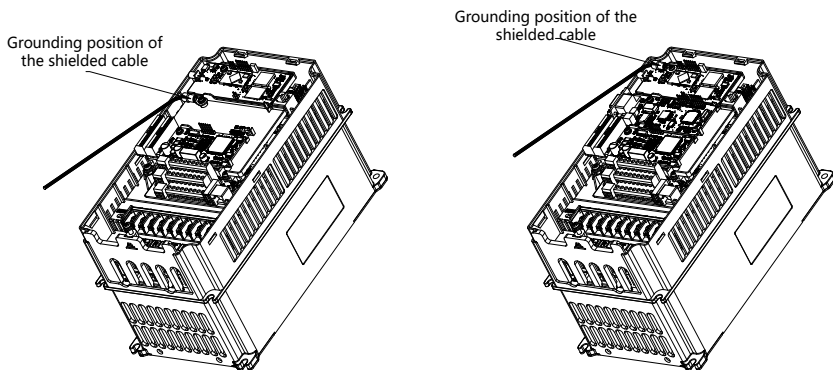


Figure A-4 Expansion card grounding cable connection

2. Wire an expansion card as follows:

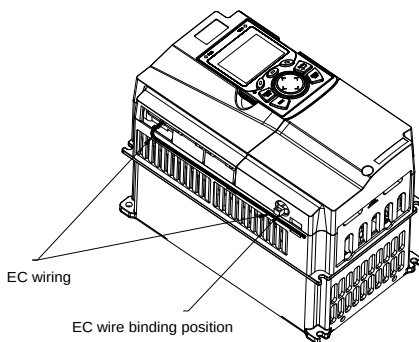
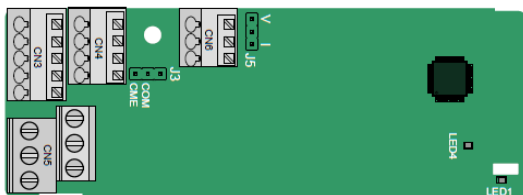


Figure A-5 Expansion card wiring

A.4 IO expansion cards

A.4.1 I/O expansion card 1 (EC-IO501-00)



The terminals are arranged as follows:

CME and COM are shorted through J3 before delivery, and J5 is the jumper for selecting the output type (voltage or current) of AO2.

AI3	AO2	GND
-----	-----	-----

COM	CME	Y2	S5			RO3A	RO3B	RO3C	
PW	+24 V	S6	S7	S8			RO4A		RO4C

Indicator definition:

Indicator	Definition	Function
LED1	Status indicator	On: The expansion card is establishing a connection with the control board. Blinking periodically (the period is 1 s, on for 0.5 s, and off for the other 0.5 s): The expansion card is properly connected to the control board. Off: The expansion card is disconnected from the control board.
LED4	Power indicator	This indicator is on after the IO expansion card is powered on by the control board.

The EC-IO501-00 expansion card can be used in scenarios where the I/O interfaces of a VFD cannot meet the application requirements. It can provide 4 digital inputs, 1 digital output, 1 analog input, 1 analog output, and two relay outputs. It is user-friendly, providing relay outputs through European-type screw terminals and other inputs and outputs through spring terminals.

EC-IO501-00 terminal function description

Category	Terminal symbol	Name	Description
Power supply	PW	External power supply	External power input terminal for digital input circuits Voltage range: 12–30 V PW and +24V have been shorted before delivery.
Analog input/output	AI3—GND	Analog input 1	1. Input range: For AI3, 0–10 V or 0–20 mA 2. Input impedance: 20 k Ω for voltage input or 250 Ω for current input 3. Whether voltage or current is used for input is set through the corresponding function code 4. Resolution: 5 mV when 10 V corresponds to 50 Hz, the minimum resolution is 5 mV. Deviation: $\pm 0.5\%$; input of 5 V or 10 mA or higher at the temperature of 25°C

Category	Terminal symbol	Name	Description
	AO2—GND	Analog output 1	1. Output range: 0–10 V or 0–20 mA 2. Whether voltage or current is used for output is set through the jumper J5. Deviation: $\pm 0.5\%$; output of 5 V or 10 mA or higher at the temperature of 25°C
Digital input and output	S5—COM	Digital input 1	1. Internal impedance: 3.3 k Ω 2. 12–30V voltage input is acceptable 3. Bi-direction input terminal 4. Max. input frequency: 1 kHz
	S6—COM	Digital input 2	
	S7—COM	Digital input 3	
	S8—COM	Digital input 4	
	Y2—CME	Digital output	1. Switch capacity: 50 mA/30 V 2. Output frequency range: 0–1 kHz 3. The terminals CME and COM are shorted through J3 before delivery.
Relay output	RO3A	NO contact of relay 3	Contact capacity: 3 A/AC 250 V, 1 A/DC 30 V Cannot be used as high frequency digital output
	RO3B	NC contact of relay 3	
	RO3C	Common contact of relay 3	
	RO4A	NO contact of relay 4	
	RO4C	Common contact of relay 4	

A.4.2 I/O expansion card 2 (EC-IO502-00)



The terminals are arranged as follows:

PT1+	PT-	PT2+					
S5	S6	S7	S8		RO4A	RO4C	
+24 V	PW	COM	COM			RO3A	RO3C

Indicator definition:

Indicator	Definition	Function
LED1	Status indicator	On: The expansion card is establishing a connection with the control board. Blinking periodically (the period is 1 s, on for 0.5 s, and off for the other 0.5 s): The expansion card is properly connected to the control board. Off: The expansion card is disconnected from the control board.
LED4	Power indicator	This indicator is on after the IO expansion card is powered on by the control board.

EC-IO502-00 can be used in scenarios where the I/O interfaces of a VFD cannot meet the application requirements. It can provide four digital inputs, one PT100 temperature measuring input (PT1+), one PT1000 temperature measuring input (PT2+), and two relay outputs. It is user-friendly, providing relay outputs and digital inputs through European-type screw terminals and temperature measuring inputs through spring terminals.

EC-IO502-00 terminal function description

Category	Terminal symbol	Name	Description
Power supply	PW	External power supply	External power input terminal for digital input circuits Voltage range: 24 VDC (-20%)–48 VDC (+10%), 24 VAC (-10%)–48 VAC (+10%) voltage input.
	+24 V	Internal power supply	User power supply provided by the VFD. Max. output current: 200 mA
	COM	Power reference	+24V common terminal.
Digital input	S5—COM	Digital input 5	1. Internal impedance: 6.6 kΩ 2. Supports the voltage input of external power 24(-20%)–48 VDC(+10%) and 24(-10%)–48 VAC(+10%) voltage input 3. Supports the internal power 24 V 4. Bi-direction input terminals, supporting both NPN and PNP connection methods 5. Max. input frequency: 1kHz 6. Programmable digital input terminals, the functions of which can be set through the related parameters
	S6—COM	Digital input 6	
	S7—COM	Digital input 7	
	S8—COM	Digital input 8	
Temperature detection input	PT1+	PT100 resistor input	Independent PT100 and PT1000 inputs: PT1+ connects to PT100, while PT2+ connects to PT1000.
	PT2+	PT1000 resistor input	

Category	Terminal symbol	Name	Description
			1. Resolution: 1°C 2. Range: -20°C–150°C 3. Detection precision: 3°C 4. Supports sensor disconnection protection
	PT-	Reference input of PT100/PT1000	Reference zero potential of PT100/PT1000.
Relay output	RO3A	Contact A of NO relay 3	RO3 outputs. RO3A: NO; RO3C: common Contact capacity: 3 A/AC250 V, 1 A/DC30 V
	RO3C	Contact C of relay 3	
	RO4A	Contact A of NO relay 4	RO4 outputs. RO4A: NO; RO4C: common Contact capacity: 3 A/AC250 V, 1 A/DC30 V
	RO4C	Contact C of relay 4	

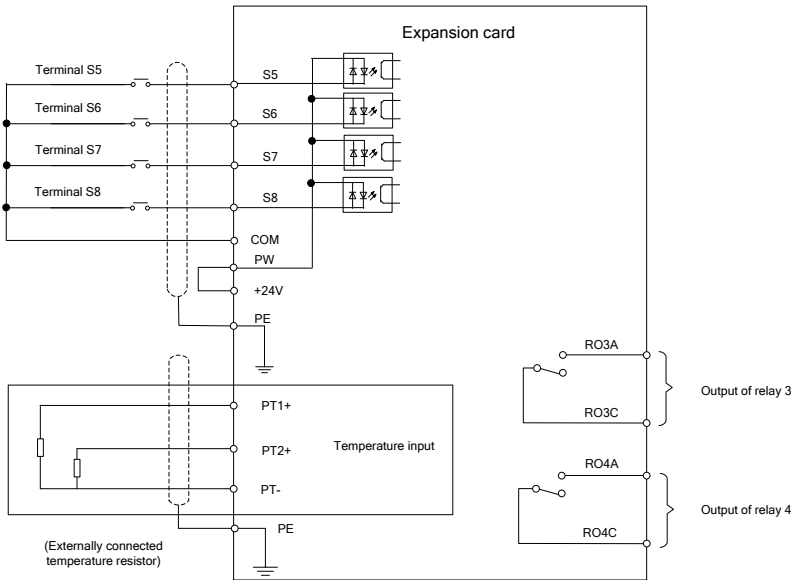
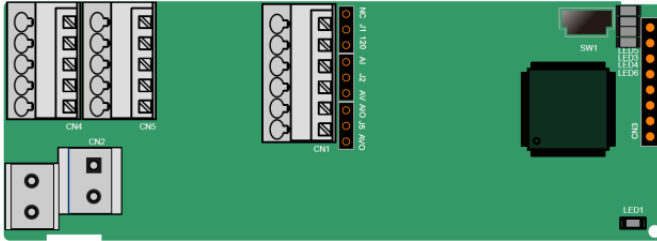


Figure A-6 Control circuit wiring of I/O expansion card 2

A.5 Programmable expansion card (EC-PC502-00)



SW1 indicates the run-stop switch of the PLC card, CN1 indicates the PE, 485-, 485+, GND, AI1, AO1 terminals with corresponding jumpers next to them. "AI" and "AV" are the current type input selection and voltage type input selection of AI1, and they can be selected through J2. "AIO" and "AVO" are the current type output selection and voltage type output selection of AO1, and they can be selected through J5. "120" indicates 120 Ω termination resistor, and the 120 Ω termination resistor is connected through jumper J1. By default, J1 connects to NC, J2 to AV, and J5 to AVO. The terminals are arranged as follows.

PE	485-	485+	GND	AI1	AO1
----	------	------	-----	-----	-----

COM	COM	PS1	PS2	PS3		PRO1A	PRO1C
PW	24 V	PS4	PS5	PS6		PRO2A	PRO2C

Indicator definition:

Indicator	Definition	Function
LED1	PWR power indicator (green)	The indicator is on when the expansion card is powered on.
LED3	COMM communication indicator (green)	On: The expansion card is establishing a connection with the control board. Blinking periodically (the period is 1 s, on for 0.5 s, and off for the other 0.5 s): The expansion card is properly connected to the control board. Off: The expansion card is disconnected from the control board.
LED4	ERR fault indicator (red)	Blinking periodically (the period is 1 s, on for 0.5 s, and off for the other 0.5 s): an error occurs. The error type can be queried through the "AutoStation" host software; Off: no fault.
LED5	PWR power indicator (green)	The indicator is on when the expansion card is powered on.
LED6	RUN status indicator	On: PLC program is running

Indicator	Definition	Function
	(green)	Off: PLC program stops

The EC-PC502-00 PLC card can be used in place of a micro PLC in some applications and utilizes an internationally mainstream PLC card development environment. It supports the instruction language (IL), ladder diagram (LD), and sequential function chart (SFC). It provides a user program storage space of 16K steps and data storage space of 8K words, and supports saving data of 1K words at power failure, facilitating secondary development for customers and meeting customization requirements.

EC-PC502-00 has six switching inputs, two relay outputs, one analog input, one analog output, one RS485 communication channel (supporting master/slave switchover). It uses European-style screw terminals for relay outputs and uses spring terminals for the others.

EC-PC502-00 terminal function description

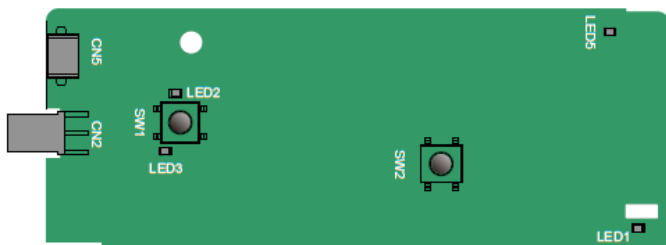
Category	Terminal symbol	Name	Description
Power supply	PW	External power supply	External power input terminal for digital input circuits Voltage range: 12–24 V PW and +24V should be short-connected.
	24 V	Internal power supply	Internal output power, 100mA.
Digital input and output	PS1—COM	Digital input 1	1. Internal impedance: 4 kΩ 2. 12–30 V voltage input is acceptable 3. Bi-direction input terminal 4. Max. input frequency: 1 kHz 5. Source/sink input, and the input type should be consistent.
	PS2—COM	Digital input 2	
	PS3—COM	Digital input 3	
	PS4—COM	Digital input 4	
	PS5—COM	Digital input 5	
	PS6—COM	Digital input 6	
Analog input/output	AI1	Analog input 1	1. Input range: For AI1, 0–10 V or 0–20 mA 2. Input impedance: 20 kΩ for voltage input or 250 Ω for current input 3. Whether voltage or current is used for input is set through the jumper 4. Resolution: 5 mV when 10 V corresponds to 50 Hz, the minimum resolution is 5 mV. 5. Deviation: ±1%, 25°C, full measuring range
	AO1	Analog output 1	1. Output range: 0–10 V or 0–20 mA 2. Whether voltage or current is used for output is set through the jumper 3. Deviation: ±1%, 25°C, full measuring range
Relay output	PRO1A	NO contact of relay 1	Contact capacity: 2 A/AC250 V, 1 A/DC30 V
	PRO1C	Common contact of	Cannot be used as high frequency digital

Category	Terminal symbol	Name	Description
		relay 1	output
	PRO2A	NO contact of relay 2	
	PRO2C	Common contact of relay 2	

For details about how to use the programmable card, see the Goodrive350 series AutoStation programmable card manual.

A.6 Communication cards

A.6.1 Bluetooth communication card (EC-TX501) and Wi-Fi communication card (EC-TX502)



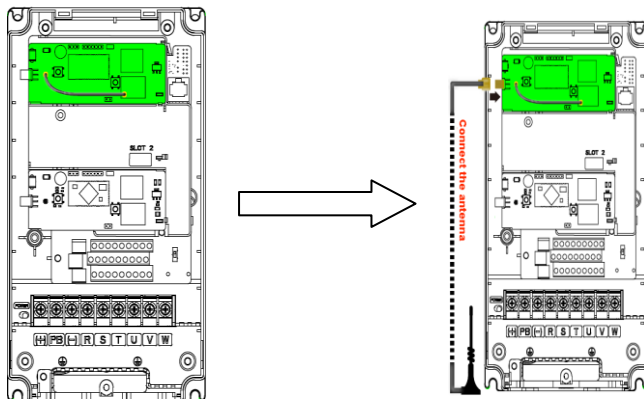
Definition of indicators and function keys:

Indicator	Definition	Function
LED1/LED3	Bluetooth/ Wi-Fi status indicator	On: The expansion card is establishing a connection with the control board. Blinking periodically (the period is 1 s, on for 0.5 s, and off for the other 0.5 s): The expansion card is properly connected to the control board. Off: The communication card is disconnected from the control board.
LED2	Bluetooth communication status indicator	On: The Bluetooth communication is online and data can be exchanged. Off: The Bluetooth communication card is not in the online state.
LED5	Power indicator	The indicator is on when the Bluetooth communication card is powered by the control board.
SW1	Wi-Fi factory reset button	It is restored to default values and returned to the local monitoring mode.
SW2	Wi-Fi hardware reset button	It is used to reboot the expansion card.

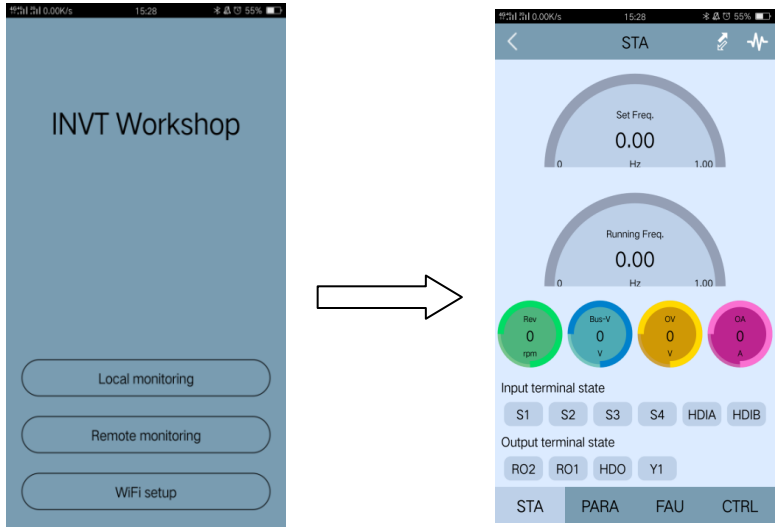
The wireless communication card is especially useful for scenarios where you cannot directly use the keypad to operate the VFD due to the restriction of the installation space. With a mobile phone APP, you can operate the VFD within a maximum distance of 30 m. You can choose a PCB antenna or an

external suction-cup antenna. If the VFD is located in an open space and is a molded case machine, you can use a built-in PCB antenna; and if it is a sheet-metal machine and located in a metal cabinet, you need to use an external suction-cup antenna.

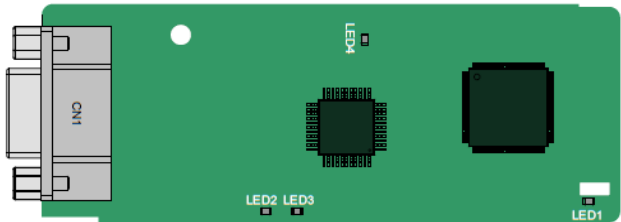
When installing a suction-cup antenna, install a wireless communication card on the VFD first, and then lead the SMA connector of the suction-cup antenna into the VFD and screw it to CN2, as shown in the following figure. Place the antenna base on the chassis and expose the upper part. Try to keep it unblocked.



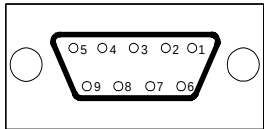
The wireless communication card must be used with the INVT VFD APP. Scan the QR code of the VFD nameplate to download it. For details, refer to the wireless communication card manual provided with the expansion card. The main interface is shown as follows.



A.6.2 PROFIBUS-DP communication card (EC-TX503)



CN1 is a 9-pin D-type connector, as shown in the following figure.



Connector pin		Description
1	-	Unused
2	-	Unused
3	B-Line	Data+ (twisted pair 1)
4	RTS	Request to send
5	GND_BUS	Isolation ground
6	+5V BUS	Isolated power supply of 5 V DC

Connector pin		Description
7	-	Unused
8	A-Line	Data- (twisted pair 2)
9	-	Unused
Housing	SHLD	PROFIBUS cable shielding line

+5V and GND_BUS are used to supply power to bus terminators. Some devices, such as the optical transceiver (RS485), may need to obtain power through these pins.

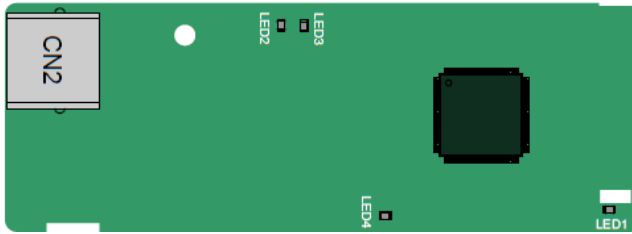
In certain devices, RTS is used to determine the transmission/reception direction. In normal applications, only A-Line, B-Line, and the shield layer need to be used.

Indicator definition:

Indicator	Definition	Function
LED1	Status indicator	On: The expansion card is establishing a connection with the control board. Blinking periodically (the period is 1 s, on for 0.5 s, and off for the other 0.5 s): The expansion card is properly connected to the control board. Off: The communication card is disconnected from the control board.
LED2	Online indicator	On: The expansion card is online and data exchange can be performed. Off: The expansion card is not in the online state.
LED3	Offline/Fault indicator	On: The expansion card is offline and data exchange cannot be performed. Blinking: The expansion card is not in the offline state. Blinking at the frequency of 1 Hz: A configuration error occurs. The length of the user parameter data set during the initialization of the expansion card is different from that during the network configuration. Blinking at the frequency of 2 Hz: 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. Blinking at the frequency of 4 Hz: An error occurs in the ASIC initialization of PROFIBUS communication. It is off when the diagnosis function is disabled.
LED4	Power indicator	This indicator is on after the control board feeds power to the expansion card.

For details, see the manual of the communication card.

A.6.3 Ethernet communication card (EC-TX504)

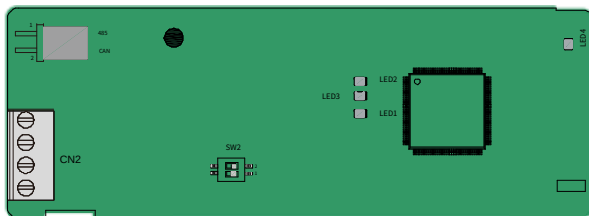


EC-TX504 uses standard RJ45 terminals. The EC-TX504 communication card is used only on the host controller intended for use with INVT Workshop host software. If you want to support the standard EtherNet/IP protocol, select the card EC-TX510.

Indicator definition:

Indicator	Definition	Function
LED1	Status indicator	On: The expansion card is establishing a connection with the control board. Blinking periodically (the period is 1 s, on for 0.5 s, and off for the other 0.5 s): The expansion card is properly connected to the control board. Off: The communication card is disconnected from the control board.
LED2	Network connection status indicator	On: The physical connection to the host controller is normal. Off: The host controller is disconnected.
LED3	Network communication status indicator	On: There is data exchange with the host controller. Blinking: The physical connection is normal, but no data is being exchanged.
LED4	Power indicator	This indicator is on after the control board feeds power to the expansion card.

A.6.4 CAN multi-protocol communication card (EC-TX505C)



The communication card EC-TX505C is user-friendly, adopting European-type screw terminals.

Signal	Port	Description
PGND	Isolation ground	Isolation ground
PE	Shielded cable	CAN bus shielding
CANH	CAN positive input	CAN bus high level signal
CANL	CAN negative input	CAN bus low level signal
485	RS485 termination resistor switch	No termination resistor is connected between RS485+ and RS485-.
		A 120 Ω termination resistor is connected between RS485+ and RS485-.
CAN	CAN termination resistor switch	No termination resistor is connected between CAN_H and CAN_L.
		CAN_H and CAN_L are connected to a termination resistor of 120 Ω .

Note: To select the protocol of this expansion card, please set the switch SW2 according to the following relationship before power on.

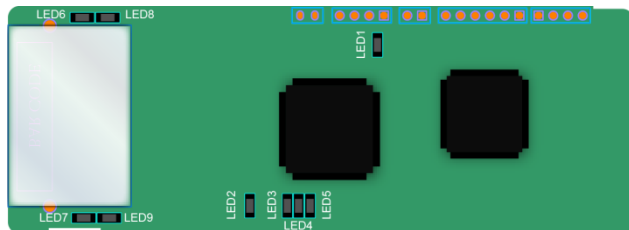
SW2		
1	2	Protocol type
OFF	OFF	CANopen
ON	OFF	CAN master/slave

Indicator definition:

Indicator	Definition	Function
LED1	Status indicator	On: The expansion card is establishing a connection with the control board. Blinking periodically (the period is 1 s, on for 0.5 s, and off for the other 0.5 s): The expansion card is properly connected to the control board. Off: The expansion card is disconnected from the control board.
LED2	Run indicator	On: The communication card is in the operating state. Off: A fault occurs. Check whether the reset pin of the communication card and the power supply are properly connected. The expansion card is in a stopped state. Blinking: The communication card is in the pre-operational state.
LED3	Error indicator	On: The CAN controller bus is off, a fault occurs on the VFD, or the received frame is lost or incorrect. Off: The communication card is in the working state.
LED4	Power indicator	This indicator is on after the control board feeds power to the expansion card.

For details, see the manual of the communication card.

A.6.5 PROFINET communication card (EC-TX509)



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–LED5 are the communication status indicators of the communication card, and LED6–LED9 are the status indicators of the network port.

LED	Color	Status	Description
LED1	Green		3.3V power indicator
LED2 (Bus status indicator)	Red	On	No network connection
		Blinking	The network cable connection to the PROFINET controller is normal, but communication has not been 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.
		Blinking	TPS-1 waits for MCU initialization.
		Off	TPS-1 protocol stack does not start.
LED5	Green		Manufacturer-specific, depending on the

LED	Color	Status	Description
(Maintenance status indicator)			characteristics of the device
LED6/7 (Network port status indicator)	Green	On	The PROFINET communication card and PC/PLC have been connected by using 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 adopts standard RJ45 interfaces, which can be used in a linear network topology and a star network topology. The line network topology electrical connection diagram is shown as follows.

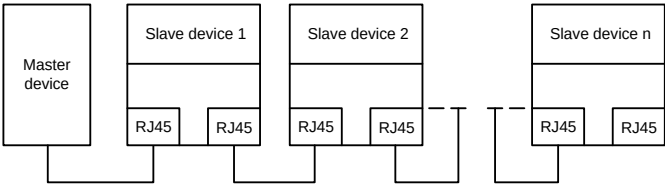
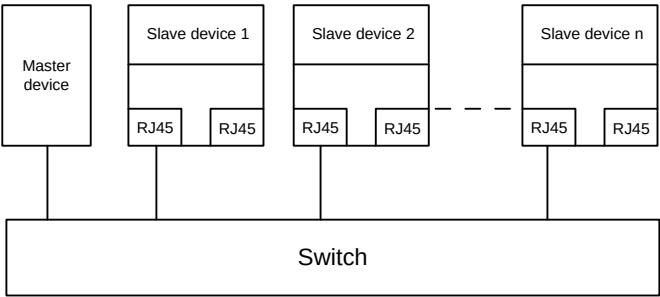


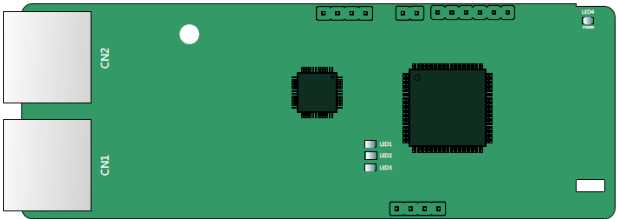
Figure A-7 Line network topology electrical connection

Note: For the star network topology, you need to prepare PROFINET switches.

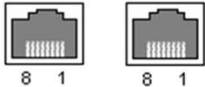
The star network topology electrical connection diagram is shown as follows.



A.6.6 EtherNet IP communication card (EC-TX510) and Modbus TCP communication card (EC-TX515)



Communication port: Standard RJ45 interfaces are used. This communication card provides two RJ45 interfaces, which are not direction-specific and can be connected interchangeably. The interface diagram is shown in the following figure, and the interface functions are listed in the following table.



Two standard RJ45 interfaces

Functions of the standard RJ45 interface:

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

Status indicator:

The communication card provides four LED indicators and four network port indicators to indicate different operating states of the communication card. The specific definitions are listed in the following table:

LED	Color	Status	Description
LED1	Green	On	Handshaking with the VFD.
		Blinking (1Hz)	Communication with the VFD is normal.
		Off	Communication with the VFD is faulty
LED2	Green	On	Communication with the PLC is online, and data exchange is available.

LED	Color	Status	Description
		Blinking (1 Hz)	IP address conflict with the PLC.
		Off	Communication with the PLC is not online.
LED3	Red	On	Failed to establish I/O communication with the PLC.
		Blinking (1 Hz)	Incorrect PLC configuration.
		Blinking (2 Hz)	Failed to send data to the PLC.
		Blinking (4 Hz)	Connection with the PLC timed out.
		Off	No fault
LED4	Red	On	3.3 V power indicator
Net port indicator	Yellow	On	Link indicator, indicating successful Ethernet connection.
		Off	Link indicator, indicating Ethernet connection not established.
Net port indicator	Green	On	ACK indicator, indicating data interchange being performed.
		Off	ACK indicator, indicating that no data exchange is being performed.

Electrical connection:

The communication card adopts standard RJ45 interfaces, which can be used in line, star, and ring network topologies. The electrical connection diagram is shown as follows.

Use CAT5, CAT5e, or CAT6 network cables for electrical wiring. When the communication distance is greater than 50 m, use high-quality network cables that comply with the applicable national standards.

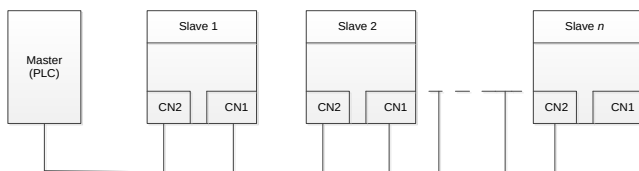


Figure A-8 Line network topology electrical connection

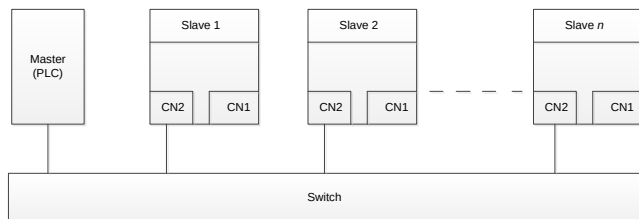


Figure A-9 Star network topology electrical connection

Note: For the star network topology, you need to prepare Ethernet switches.

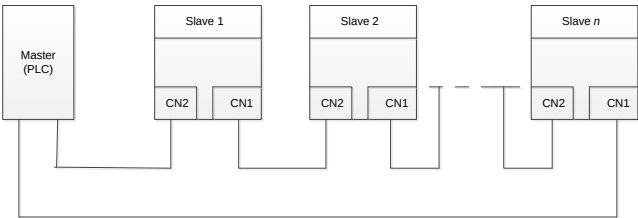
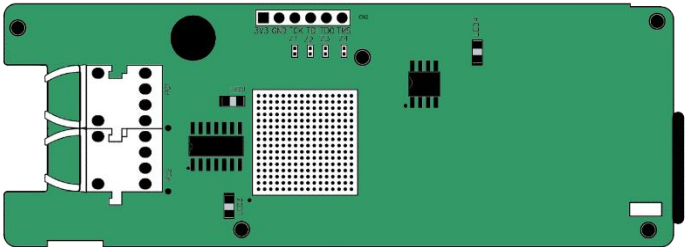


Figure A-10 Ring network topology electrical connection

A.6.7 Fiber-optic master/slave control communication card (EC-TX519)



EC-TX519 is a standard fiber-optic master/slave control expansion card applicable to hot-redundancy VFDs. The fiber-optic connector supports one receive channel and one transmit channel, and must be used with the corresponding fiber-optic cable and fiber-optic plug. This expansion card is applicable only to card slot SLOT1 for the 1R5G/2R2P model, and applicable only to card slot SLOT2 for the 7R5G/011P and higher models.

Note: The fiber-optic master/slave control communication card (EC-TX519) is supplied as standard and must be connected in a network. Otherwise, the VFD will continuously report a fault.

Indicator definition:

Indicator	Definition	Function
LED1	Status indicator	On: The expansion card is establishing a connection with the control board. Blinking periodically (the period is 1 s, on for 0.5 s, and off for the other 0.5 s): The expansion card is properly connected to the control board. Off: The communication card is disconnected from the control board.
LED3	Fault indicator	On: Fiber-optic communication is faulty. Off: Fiber-optic communication is operating.
LED4	Power indicator	This indicator is on after the control board feeds power to the

Indicator	Definition	Function
		expansion card.

EC-TX519 terminal functions:

Category	Terminal symbol	Name	Description
Fiber-optic interface signal	RX	Fiber-optic receive	1. Communication network: Ring network topology. Starting from the master, devices are connected in sequence. A network with up to one master and four slaves is supported. 2. Communication distance: Standard fiber-optic cables are used, with a maximum supported distance of 10 m per cable.
	TX	Fiber-optic transmit	

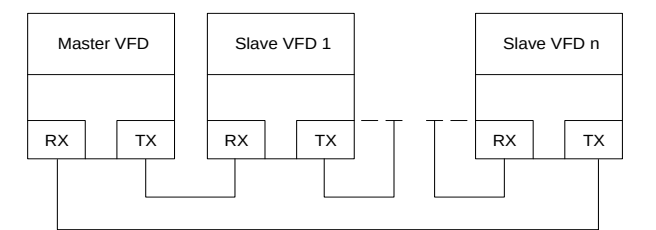
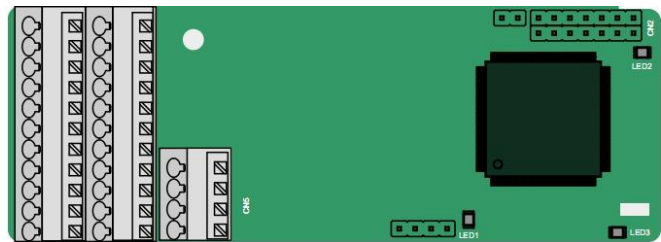


Figure A-11 Ring network topology electrical connection

A.7 PG expansion cards

A.7.1 Sin/Cos PG card (EC-PG502)



The terminals are arranged as follows:

							C1+	C1-	D1+	D1-
PE	AO+	BO+	ZO+	A1+	B1+	R1+	A2+	B2+	Z2+	PWR
GND	AO-	BO-	ZO-	A1-	B1-	R1-	A2-	B2-	Z2-	GND

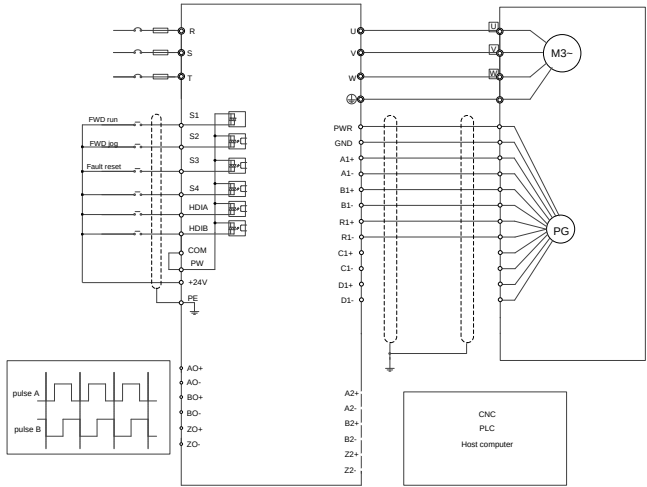
Indicator definition:

Indicator	Definition	Function
LED1	Disconnection indicator	This indicator is off when A1 and B1 of the encoder are disconnected; it blinks when C1 and D1 of the encoder are disconnected; and it is on when the encoder signals are normal.
LED2	Power indicator	This indicator is on after the control board feeds power to the PG card.
LED3	Status indicator	On: The expansion card is establishing a connection with the control board. Blinking periodically (the period is 1 s, on for 0.5 s, and off for the other 0.5 s): The expansion card is properly connected to the control board. Off: The expansion card is disconnected from the control board.

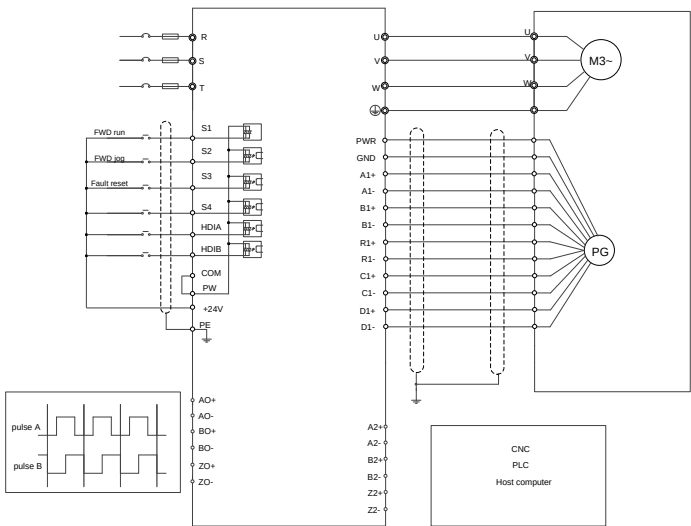
EC-PG502 terminal function:

Signal	Port	Description
PWR	Encoder power supply	Voltage: 5 V $\pm$ 5%
GND		Max. output current: 150 mA
A1+	Encoder interface	1. Supports Sin/Cos encoders. 2. SINA/SINB/SINC/SIND 0.6–1.2 Vpp; SINR 0.2–0.85 Vpp 3. Max. frequency response of A/B signals: 200 kHz Max. frequency response of C/D signals: 1 kHz
A1-		
B1+		
B1-		
R1+		
R1-		
C1+		
C1-		
D1+		
D1-		
A2+	Pulse reference	1. Supports 5 V differential signal 2. Response frequency: 200 kHz
A2-		
B2+		
B2-		
Z2+		
Z2-		
AO+	Frequency-division output	1. Differential output, compatible with 5 V differential output. 2. Supports frequency division by powers of 2, which can be set through P20.16 or P24.16. Max. output frequency: 200 kHz
AO-		
BO+		
BO-		
ZO+		
ZO-		

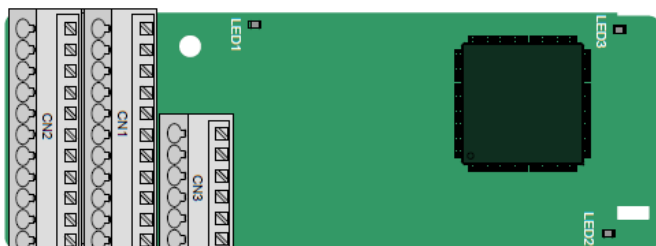
The following figure shows the external wiring of the PG card when it is used in combination with an encoder without CD signals.



The following figure shows the external wiring of the PG card when it is used in combination with an encoder with CD signals.



A.7.2 Incremental PG card with UVW (EC-PG503-05)



The terminals are arranged as follows:

					A2+	A2-	B2+	B2-	Z2+	Z2-
PE	AO+	BO+	ZO+	A1+	B1+	Z1+	U+	V+	W+	PWR
GND	AO-	BO-	ZO-	A1-	B1-	Z1-	U-	V-	W-	PGND

Indicator definition:

Indicator	Definition	Function
LED1	Disconnection indicator	This indicator is off only when A1 or B1 signal is disconnected while the encoder is rotating; and it is on in other cases.
LED2	Status indicator	On: The expansion card is establishing a connection with the control board. Blinking periodically (the period is 1 s, on for 0.5 s, and off for the other 0.5 s): The expansion card is properly connected to the control board. Off: The communication card is disconnected from the control board.
LED3	Power indicator	This indicator is on after the control board feeds power to the PG card.

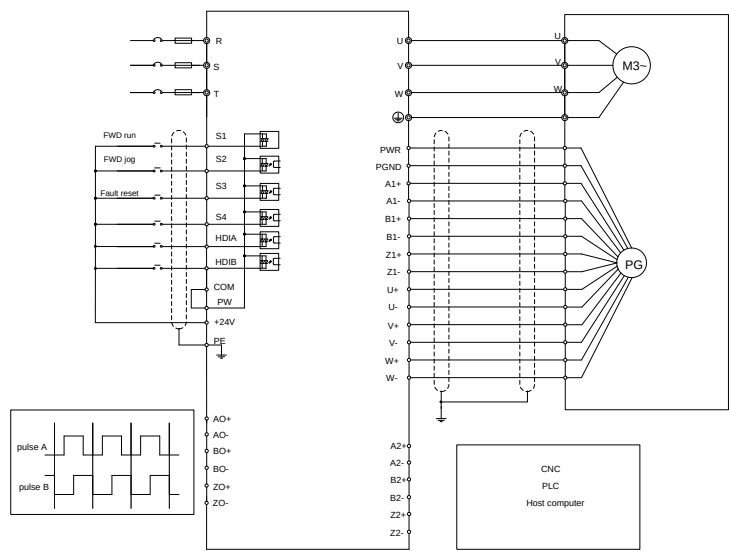
The EC-PG503-05 expansion card supports the input of absolute position signals, integrates the advantages of absolute and incremental encoders, and adopts spring-loaded terminals for easy use.

EC-PG503-05 terminal function description:

Signal	Port	Description
PWR	Encoder power supply	Voltage: 5 V $\pm$ 5%
PGND		Max. output current: 200 mA
A1+	Encoder interface	1. 5 V differential incremental PG interface 2. Response frequency: 400 kHz
A1-		
B1+		
B1-		
Z1+		
Z1-		

Signal	Port	Description
A2+	Pulse reference	1. Differential input of 5V 2. Response frequency: 200 kHz
A2-		
B2+		
B2-		
Z2+		
Z2-		
AO+	Frequency-division output	1. Differential output of 5V 2. Supports frequency division of 1–255, which can be set through P20.16 or P24.16.
AO-		
BO+		
BO-		
ZO+		
ZO-		
U+	UVW encoder interface	1. Hybrid encoder UVW absolute-position signals; 5 V differential input 2. Response frequency: 40 kHz
U-		
V+		
V-		
W+		
W-		

The following figure shows the external wiring when EC-PG503-05 is used.



A.7.3 Resolver PG card (EC-PG504-00)

PE	AO+	BO+	ZO+	EX+	SI+	CO+	A2+	B2+	Z2+	PWR
GND	AO-	BO-	ZO-	EX-	SI-	CO-	A2-	B2-	Z2-	GND

Indicator definition:

Indicator	Definition	Function
LED1	Status indicator	On: The expansion card is establishing a connection with the control board. Blinking periodically (the period is 1 s, on for 0.5 s, and off for the other 0.5 s): The expansion card is properly connected to the control board. Off: The communication card is disconnected from the control board.
LED2	Disconnection indicator	This indicator is off when the encoder is disconnected; it is on when the encoder signals are normal; and it blinks when the encoder signals are not stable.
LED3	Power indicator	This indicator is on after the control board feeds power to the PG card.

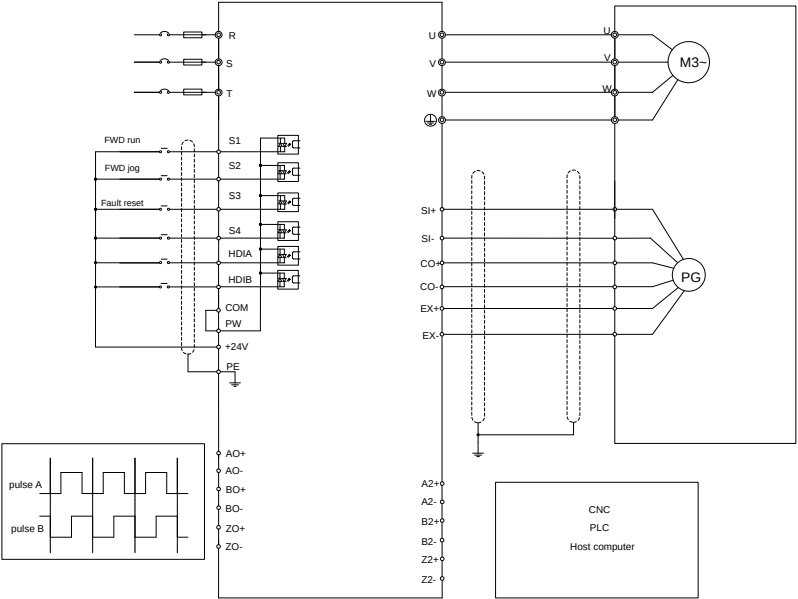
EC-PG504-00 can be used in combination with a resolver of excitation voltage 7 Vrms. It is user-friendly, adopting spring-loaded terminals.

EC-PG504-00 terminal functions:

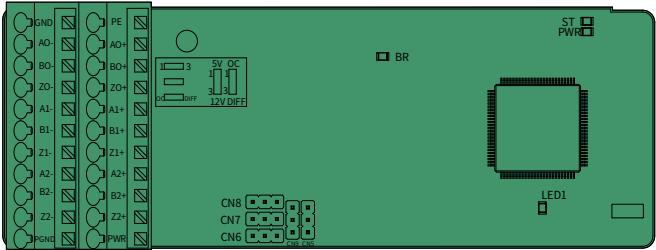
Signal	Port	Description
SI+	Encoder signal input	Recommended resolver transformation ratio: 0.5
SI-		
CO+		
CO-		
EX+	Encoder excitation signal	1. Factory setting of excitation: 10 kHz 2. Supports resolvers with an excitation voltage of 7 Vrms
EX-		
A2+	Pulse reference	1. Differential input of 5 V 2. Response frequency: 200 kHz
A2-		
B2+		
B2-		

Signal	Port	Description
Z2+	Frequency-division output	1. Differential output of 5 V 2. Frequency-divided output simulating the resolver A1, B1, and Z1 signals, which is equal to an incremental PG card of 1024 pps. 3. Supports frequency division of 1–255, which can be set through P20.16 or P24.16 Max. output frequency: 200 kHz
Z2-		
AO+		
AO-		
BO+		
BO-		
ZO+		
ZO-		

The following figure shows the external wiring when EC-PG504-00 is used.



A.7.4 5 V/12 V Multi-function incremental PG card (EC-PG505-12)



The external terminal arrangement is shown below. The encoder supply voltage level, 5 V or 12 V, is selected by jumper cap CN9.

PE	AO+	BO+	ZO+	A1+	B1+	Z1+	A2+	B2+	Z2+	PWR
GND	AO-	BO-	ZO-	A1-	B1-	Z1-	A2-	B2-	Z2-	PGND

Indicator definition:

Indicator	Definition	Function
LED1	Signal indicator	On: The encoder input differential signal is disconnected. Off: The encoder input differential signal is not disconnected.
PWR	Power indicator	On: The expansion card is powered on. Off: The expansion card is not powered on.
ST	Status indicator	On: The expansion card is connecting with the control board. Blinking (On: 500ms; Off: 500ms): The expansion card is properly connected to the control board. Off: The expansion card is disconnected from the control board.
BR	Disconnection indicator	On: The encoder input differential signal is disconnected. Off: The encoder input differential signal is not disconnected.

The EC-PG505-12 expansion card can be used in combination with multiple types of incremental encoders through different modes of wiring. It is user-friendly, adopting spring-loaded terminals. EC-PG505-12 terminal function description:

Signal	Port	Description
PE	Grounding terminal	Connected to the ground and the shielding layer of the encoder cable to enhance the anti-interference performance.
PWR	Encoder power supply	1. Voltage: 5 V/12 V $\pm$ 5% Max. output: 150 mA 2. GND serves as the signal ground (functionally equivalent to AGND). The encoder input and pulse command signals use PGND as the reference ground, while the frequency-division output is provided as differential signals.
PGND		
GND		
A1+	Encoder input	1. Applicable to 5 V/12 V push-pull encoders 2. Applicable to 5 V/12 V OC encoders 3. Applicable to 5 V/12 V differential encoders with differential signal disconnection detection function 4. Response frequency: 400 kHz
A1-		
B1+		
B1-		
Z1+		
Z1-		

Signal	Port	Description
A2+	Pulse reference	1. Applicable to 5 V/12 V push-pull encoders 2. Applicable to 5 V/12 V OC encoders 3. Applicable to 5 V/12 V differential encoders. 4. Response frequency: 400 kHz
A2-		
B2+		
B2-		
Z2+		
Z2-		
AO+	Frequency-division output	1. Differential output of 5V 2. Supports frequency division of 1–255, which can be set through P20.16 or P24.16 3. Supports frequency-divided output source selection, which can be set through P20.17 or P24.17.
AO-		
BO+		
BO-		
ZO+		
ZO-		

Wiring precautions:

- For open collector and push-pull wiring methods, the recommended maximum cable length is 50 m. For differential wiring, the recommended maximum cable length is 100 m. Encoder feedback cables must be routed at least 20 cm away from motor cables. The shield of the encoder feedback cable is connected to PE at the VFD side.
- The differential disconnection detection fault can be configured via the encoder disconnection detection (hardware) time setting. When it is set to 0, the differential disconnection fault is disabled. When it is set to a non-zero value, the differential disconnection fault is enabled.
- In some field applications, if the Z channel of the encoder input is not used, Z+ can be directly connected to PWR, and Z- can be directly connected to PGND.
- The PG expansion card is configured with a pull-up resistor and can work in combination with multiple types of incremental encoders through various external wiring modes. For the wiring methods, see Figure A-12, Figure A-13 and Figure A-14.

Table A-1 Jumper definitions for different wiring methods

Port	Jumper interface	Differential connection (default), or push-pull connection	Open collector wiring
Encoder input	CN6, CN7, CN8	Jumper DIFF	Jumper OC
Pulse reference	CN5	Jumper DIFF	Jumper OC

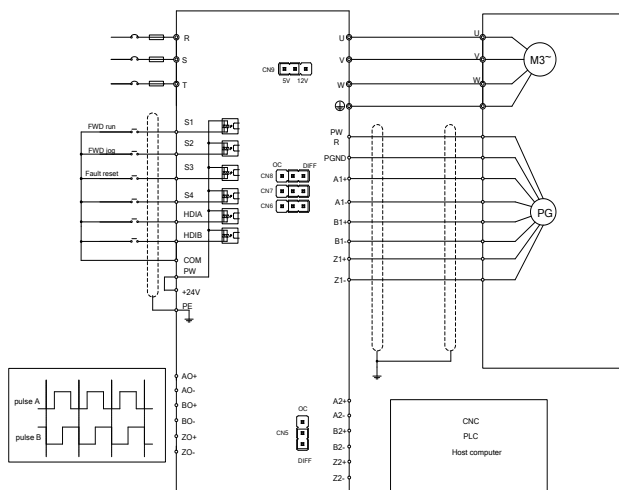


Figure A-12 External wiring diagram when used with a differential encoder

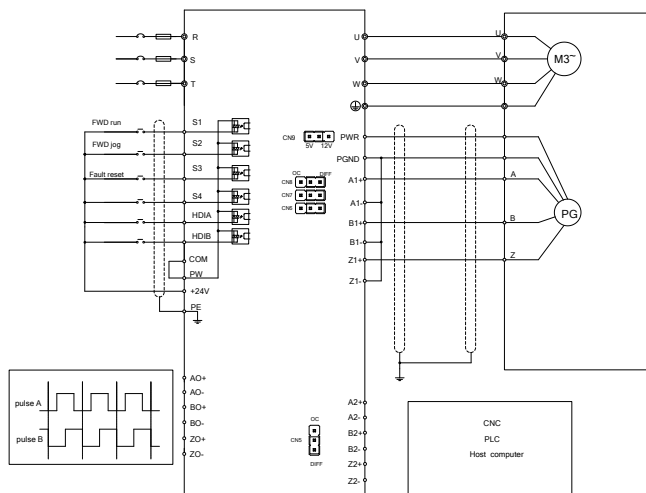


Figure A-13 External wiring diagram when used with a push-pull encoder

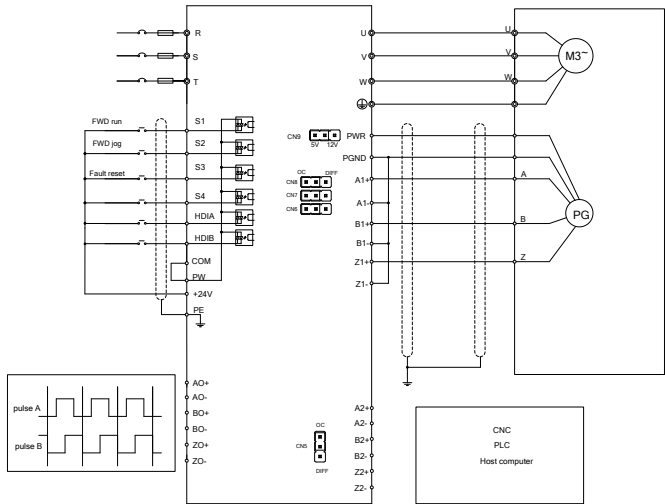
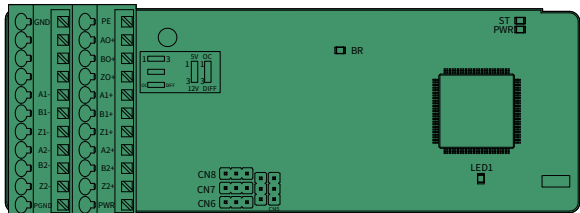


Figure A-14 External wiring diagram when used with an open collector encoder

A.7.5 24 V incremental PG card (EC-PG505-24B)



The terminals are arranged as follows:

PE	AO+	BO+	ZO+	A1+	B1+	Z1+	A2+	B2+	Z2+	PWR
GND				A1-	B1-	Z1-	A2-	B2-	Z2-	PGND

Indicator definition:

Indicator	Definition	Function
LED1	Signal indicator	On: The encoder input differential signal is disconnected. Off: The encoder input differential signal is not disconnected.
PWR	Power indicator	On: The expansion card is powered on. Off: The expansion card is not powered on.
ST	Status indicator	On: The expansion card is connecting with the control board. Blinking (On: 500ms; Off: 500ms): The expansion card is properly connected to the control board. Off: The expansion card is disconnected from the control board.

Indicator	Definition	Function
BR	Disconnection indicator	On: The encoder input differential signal is disconnected. Off: The encoder input differential signal is not disconnected.

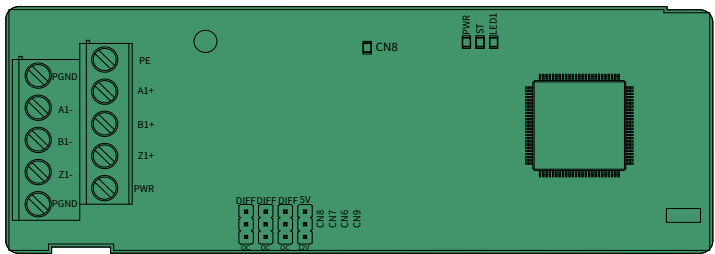
The EC-PG505-24B expansion card can be used in combination with multiple types of incremental encoders through different modes of wiring. It is user-friendly, adopting spring-loaded terminals. AO-, BO-, and ZO- are internally shorted to PGND.

EC-PG505-24B terminal function description:

Signal	Port	Description
PE	Grounding terminal	Connected to the ground and the shielding layer of the encoder cable to enhance the anti-interference performance.
PWR	Encoder power supply	1. Voltage: 24 V $\pm$ 5% Max. output: 150 mA Selects the voltage class through the jumper CN9 based on the voltage class of the used encoder. 2. The encoder input and pulse command signals use PGND as the reference ground, while the frequency-division output uses GND as the reference ground.
PGND		
GND		
A1+	Encoder input	1. Applicable to 24 V push-pull encoders 2. Applicable to 24 V OC encoders 3. Applicable to 24 V differential encoders with differential signal disconnection detection function 4. Response frequency: 400 kHz
A1-		
B1+		
B1-		
Z1+		
Z1-		
A2+	Pulse reference	1. Applicable to 24 V push-pull encoders 2. Applicable to 24 V OC encoders 3. Supports 24 V differential interfaces 4. Response frequency: 400 kHz
A2-		
B2+		
B2-		
Z2+		
Z2-		
AO+	Frequency-division output	1. Supports open-collector output. The OC input is connected to the external power supply via an internal pull-up resistor (3 k Ω for a 24 V supply, or 1 k Ω for a 5 V supply). 2. Supports frequency division of 1–255, which can be set through P20.16 or P24.16 3. Supports frequency-divided output source selection, which can be set through P20.17 or P24.17
BO+		
ZO+		

For wiring precautions and external wiring methods, see section A.7.4 5 V/12 V Multi-function incremental PG card (EC-PG505-12).

A.7.6 5 V/12 V simplified incremental PG card (EC-PG507-12)



The external terminal arrangement is shown below. The encoder supply voltage level, 5 V or 12 V, is selected by jumper cap CN9.

PE	A1+	B1+	Z1+	PWR
PGND	A1-	B1-	Z1-	PGND

Indicator definition:

Indicator	Definition	Function
LED1	Signal indicator	On: The encoder input differential signal is disconnected. Off: The encoder input differential signal is not disconnected.
PWR	Power indicator	On: The expansion card is powered on. Off: The expansion card is not powered on.
ST	Status indicator	On: The expansion card is connecting with the control board. Blinking (On: 500ms; Off: 500ms): The expansion card is properly connected to the control board. Off: The expansion card is disconnected from the control board.
BR	Disconnection indicator	On: The encoder input differential signal is disconnected. Off: The encoder input differential signal is not disconnected.

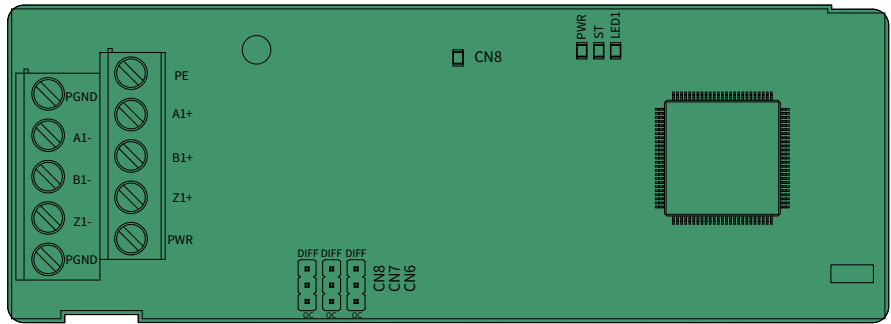
EC-PG507-12 can work in combination with multiple types of incremental encoders through various external wiring modes. EC-PG507-12 terminal function description:

Signal	Port	Description
PE	Grounding terminal	Connected to the ground and the shielding layer of the encoder cable to enhance the anti-interference performance.
PWR	Encoder power supply	Voltage: 5 V/12 V $\pm$ 5% Max. output: 150 mA
PGND		
A1+	Encoder input	1. Applicable to 5 V/12 V push-pull encoders 2. Applicable to 5 V/12 V OC encoders
A1-		

Signal	Port	Description
B1+		3. Applicable to 5 V/12 V differential encoders with differential signal disconnection detection function 4. Response frequency: 400 kHz
B1-		
Z1+		
Z1-		

For wiring precautions and external wiring methods, see section A.7.4 5 V/12 V Multi-function incremental PG card (EC-PG505-12).

A.7.7 24 V simplified incremental PG card (EC-PG507-24)



The terminals are arranged as follows:

PE	A1+	B1+	Z1+	PWR
PGND	A1-	B1-	Z1-	PGND

Indicator definition:

Indicator	Definition	Function
LED1	Signal indicator	On: The encoder input differential signal is disconnected. Off: The encoder input differential signal is not disconnected.
PWR	Power indicator	On: The expansion card is powered on. Off: The expansion card is not powered on.
ST	Status indicator	On: The expansion card is connecting with the control board. Blinking (On: 500 ms; Off: 500 ms): The expansion card is properly connected to the control board. Off: The expansion card is disconnected from the control board.
BR	Disconnection indicator	On: The encoder input differential signal is disconnected. Off: The encoder input differential signal is not disconnected.

The EC-PG507-24 expansion card can be used in combination with multiple types of incremental encoders through different modes of wiring. It is user-friendly, adopting 5.08 mm pitch terminals.

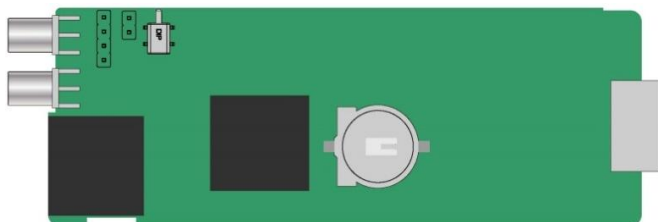
EC-PG507-24 terminal function description:

Signal	Port	Description
PE	Grounding terminal	Connected to the ground and the shielding layer of the encoder cable to enhance the anti-interference performance.
PWR	Encoder power supply	Voltage: 24 V $\pm$ 5%
PGND		Max. output: 150 mA Voltage level selection using the CN9 jumper is not supported.
A1+	Encoder input	1. Applicable to 24 V push-pull encoders 2. Applicable to 24 V OC encoders 3. Applicable to 24 V differential encoders with differential signal disconnection detection function 4. Response frequency: 400 kHz
A1-		
B1+		
B1-		
Z1+		
Z1-		

For wiring precautions and external wiring methods, see section A.7.4 5 V/12 V Multi-function incremental PG card (EC-PG505-12).

A.8 IoT card

A.8.1 GPRS IoT card (EC-IC501-2)



CN6 pin definition

Pin	Name	Description
1	485-	485B
2	485+	485A
3	GND	Power ground
4	24V	24 V power supply

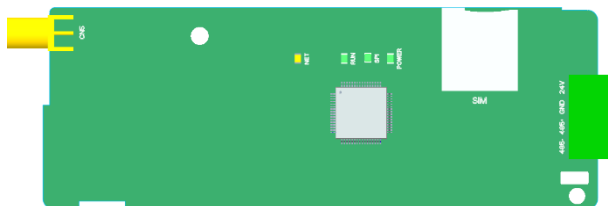
Indicator definition:

Indicator	Definition	Description
LED1	Handshaking indicator	Blinking with an interval of 1s: The expansion card is connected with the control board.
LED2	Power indicator	On: The expansion card is powered on. Off: The expansion card is not powered on.

Indicator	Definition	Description
LED3	Run indicator	The expansion card communicates properly.
LED4	GPRS state indicator	Blinking (On: 64 ms; Off: 300 ms): GPRS module is connected to the network. Blinking (On: 64 ms; Off: 800 ms): The network is not registered.
LED5	Status indicator	On: The GPRS module is turned on.

For details about the operation, see the manual of the EC series GPRS expansion card.

A.8.2 4G card (EC-IC502-2-CN, EC-IC502-2-EU, EC-IC502-2-LA)



Terminal function description:

Port ID	Port
24 V	Power supply +
GND	Power supply -
485+	485A
485-	485B
4G	4G antenna
CN3	SIM card socket

Indicator instruction:

Indicator identifier	Description
NET	Network indicator Blinking (ON: 600 ms; OFF: 600 ms): No SIM card/Network registration in progress/Registration failed. Blinking (On: 75 ms; Off: 75 ms): Data link established.
RUN	Run indicator Blinking (On: 1 s; Off: 1 s): The system runs properly. Steady On or Off: A system exception has occurred.
SPI	Blinking (On: 1 s; Off: 1 s): The handshake between expansion card and VFD control board succeeds. On: Handshake failed or no handshake.
POWER	Power supply indicator

For details, see the manual of the EC series 4G expansion card.

Appendix B Technical data

B.1 What this chapter contains

This chapter describes the technical data of the VFD and its compliance to CE and other quality certification systems.

B.2 Derated application

B.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 than or equal to the rated current of the motor. The rated power of the VFD must be higher than or equal to that of the motor.

Note:

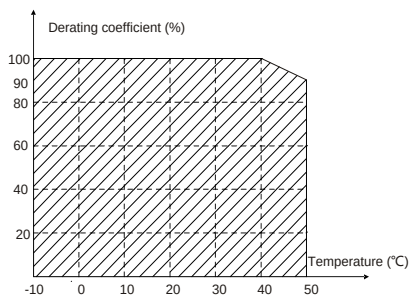
- The maximum allowable shaft power of the motor is limited to 1.5 times the rated power of the motor. If the limit is exceeded, the VFD automatically restricts the torque and current of the motor. This function effectively protects the input rectifier bridge against overload.
- The rated capacity is 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.

B.2.2 Derating

If the ambient temperature at the VFD installation site exceeds 40°C, the VFD installation site altitude exceeds 1000m, a cover with heat dissipation vents is used, or the carrier frequency is higher than the recommended (for the recommended frequency, see P00.14), the VFD needs to be derated.

B.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 1°C increase. 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, we shall not be held liable for the consequences caused.

B.2.2.2. Derating due to altitude

When the VFD installation site altitude is lower than 1000 m, the VFD can run at the rated power. When the altitude exceeds 1000 m, derate by 1% for each increase of 100 m. When the altitude exceeds 3000 m, consult the local INVT dealer or office for details.

B.2.2.3. Derating due to carrier frequency

VFDs of different power ratings have different carrier-frequency settings. The rated power of a VFD is defined based on the carrier frequency set in factory. If the carrier frequency exceeds the factory setting, the power of the VFD is derated by 10% for each increased 1 kHz.

B.3 Grid specifications

Grid voltage	AC 3PH 380 V (-15%) – 440 V (+10%)
Short-circuit capacity	According to IEC 61439-1, the rated short-time withstand current at the incoming terminals of the switchgear assembly is up to 100 kA. The VFD is suitable for applications where the prospective short-circuit current does not exceed the breaking capacity (for example, 100 kA) of its protective devices, and its rated operational current is significantly lower than this value—typically ≤ 1 kA.
Frequency	50/60 Hz $\pm$ 5%, with a maximum change rate of 20%/s

B.4 Motor connection data

Motor type	Asynchronous induction motor or permanent-magnet synchronous motor
Voltage	0–U1 (motor rated voltage), 3PH symmetrical, Umax (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	0–400 Hz
Frequency resolution	0.01 Hz
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

B.4.1 EMC compatibility and motor cable length

To meet the requirements of the EU EMC Directive (2014/30/EU), the maximum length of motor cables for the -AS model is as follows:

All models	Maximum motor cable length (m)
Environment category II (C3)	30

You can learn the maximum length of the motor cable through the running parameters of the VFD. To understand the accurate maximum cable length for using an external EMC filter, contact the local INVT office.

For the definition of Category C3 (Second Environment), refer to section B.6 EMC regulations.

B.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
GB/T 30844.1	General-purpose variable-frequency adjustable-speed equipment of 1 kV and lower—Part 1: Technical conditions
GB/T 30844.2	General-purpose variable-frequency adjustable-speed equipment of 1 kV and lower—Part 2: Test methods
GB/T 30844.3	General-purpose variable-frequency adjustable-speed equipment of 1 kV and lower—Part 3: Safety requirements

B.5.1 CE marking

The CE marking on the VFD nameplate indicates that the VFD is CE-compliant, meeting the regulations of the European low-voltage directive (2014/35/EU) and EMC directive (2014/30/EU).

B.5.2 EMC compliance declaration

European Union (EU) stipulates that the electronic and electrical equipment 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 regulations.

B.6 EMC regulations

The EMC product standard (EN 61800-3) stipulates 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 1000 V, applied to the first environment.

VFDs of C2: Rated voltage lower than 1000 V, 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 1000 V, or rated current higher than or equal to 400 A, applied to complex systems in the second environment.

B.6.1 Category C2

The conducted emission limits shall meet the following stipulations:

1. Select an optional EMC filter according to Appendix D 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 length of the motor cable, see section B.4.1 "EMC compatibility and motor cable length".



The product may generate radio interference in a residential environment, and measures need to be taken to reduce the interference.

B.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 D 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 length of the motor cable, see section B.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 VFD may generate radio frequency electromagnetic interference.

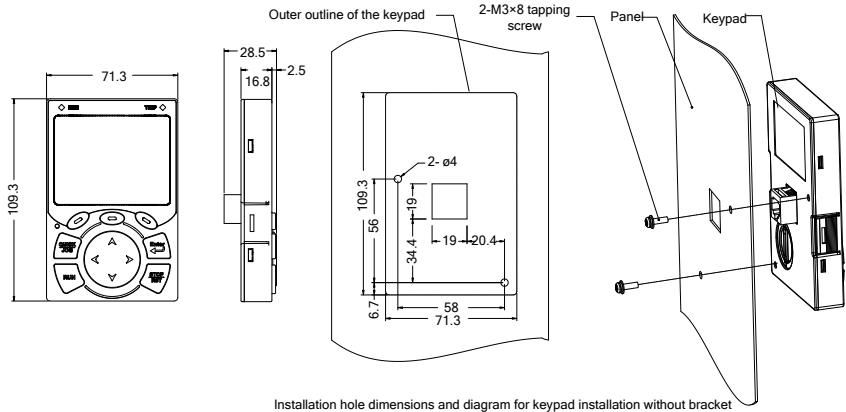
Appendix C Dimension drawings

C.1 What this chapter contains

This chapter provides the dimension drawings, in which millimeters are used.

C.2 Keypad structure

C.2.1 Structure diagram



Installation hole dimensions and diagram for keypad installation without bracket

Figure C-1 Keypad structure

Note: The VFDs of the following power ranges must use flat ribbon cables, while for VFDs of other power ranges, both flat and standard keypad cables are acceptable.

Name	Length (m)	Ordering code	Applied to
Flat keypad cable	1	67004-00053	380 V 1R5G/2R2P-7R5G/011P 380 V 355G/400P-500G
	2	67004-00010	
	3	67004-00013	
	5	67004-00052	

C.2.2 Keypad mounting bracket

The external keypad can be mounted directly with M3 threaded screws or with a keypad bracket. For VFDs of 1R5G/2R2P-075G/090P models, the keypad mounting bracket is an optional part. For those of 090G/110P-500G models, you can use optional brackets or use the standard keypad brackets externally.

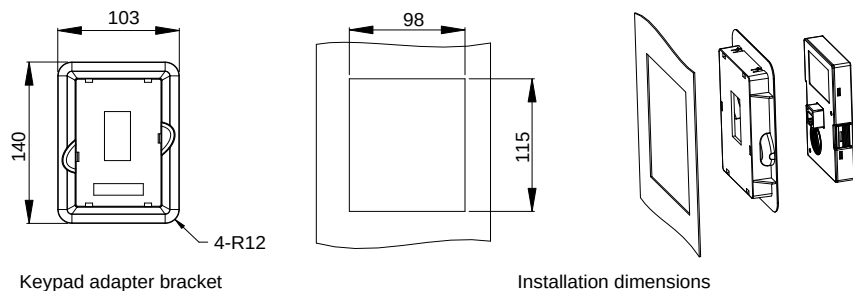


Figure C-2 (Optional) Keypad mounting bracket

C.3 VFD structure

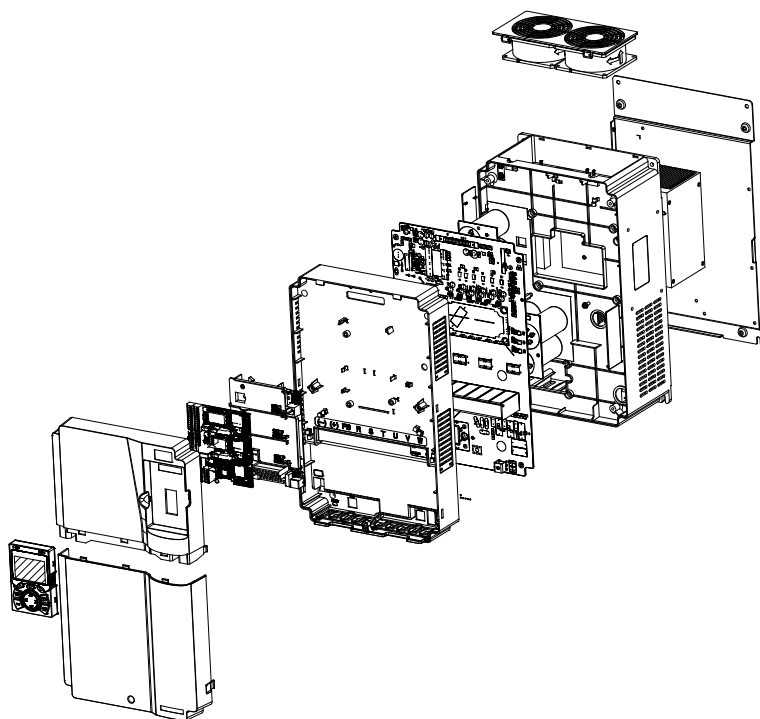


Figure C-3 VFD structure

C.4 VFD dimension

C.4.1 Wall-mounting dimensions

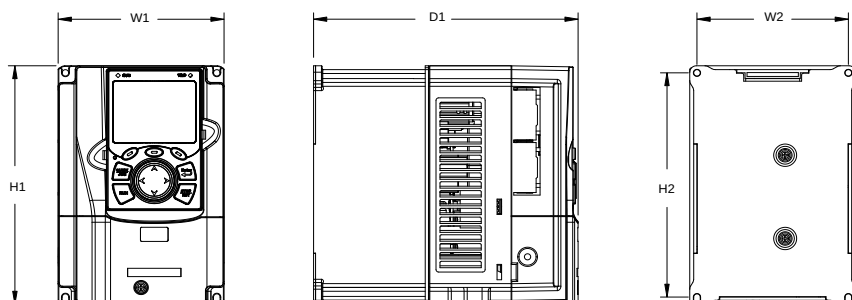


Figure C-4 Wall mounting diagram for 1R5G/2R2P-7R5G/011P

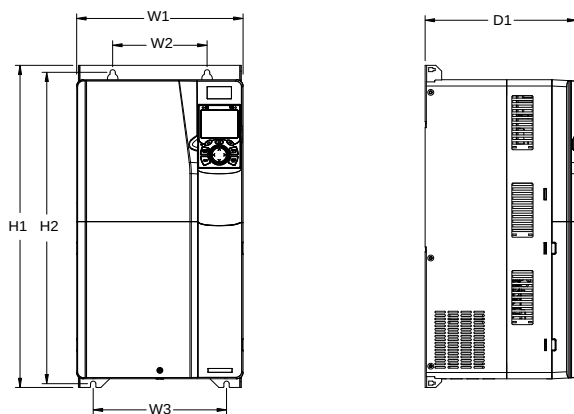


Figure C-5 Wall mounting diagram for 055G/075P-075G/090P

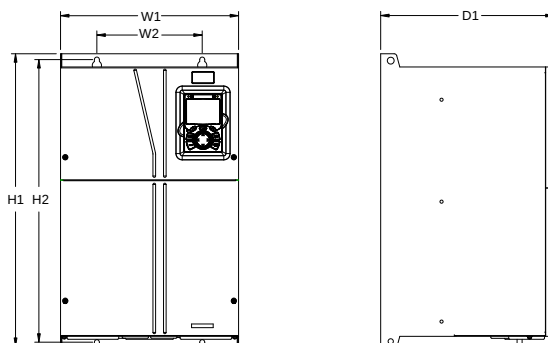


Figure C-6 Wall mounting diagram for 090G/110P-110G/132P

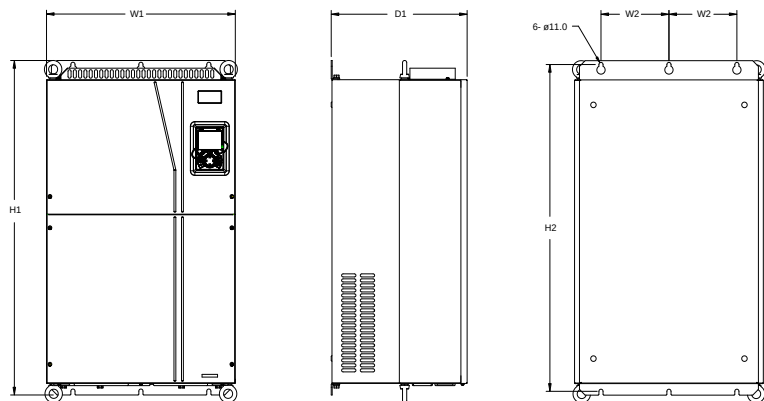


Figure C-7 Wall mounting diagram for 132G/160P-200G/220P

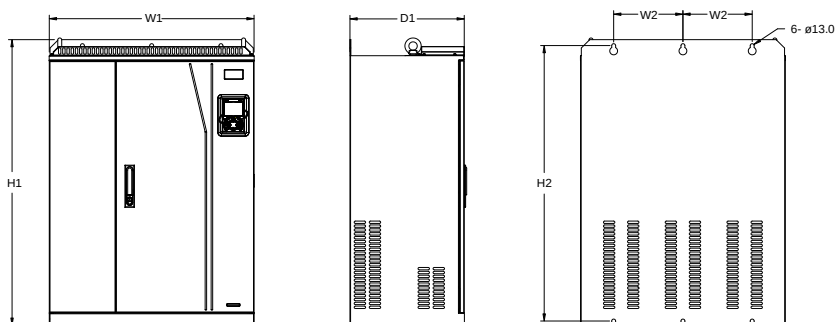


Figure C-8 Wall mounting diagram for 220G/250P-315G/355P

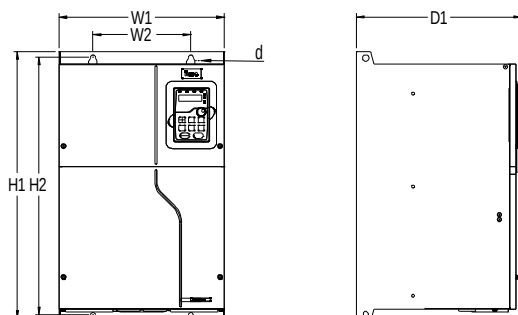


Figure C-9 Wall mounting diagram for 132G/160P-160G/185P-S

Table C-1 Wall-mounting dimensions (unit: mm)

VFD model	W1	W2	W3	H1	H2	D1	Hole diameter	Fixing screw
1R5G/2R2P	126	115	-	186	175	185	Ø5	M4
7R5G/011P	146	131	-	256	243.5	192	Ø6	M5
055G/075P-075G/090P	282	160	226	560	542	258	Ø9	M8
090G/110P-110G/132P	338	200	-	554	535	330	Ø10	M8
132G/160P-200G/220P	500	180	-	872	850	360	Ø11	M10
220G/250P-315G/355P	680	230	-	960	926	380	Ø13	M12
132G/160P-160G/185P-S	338	260	-	825	800	398	Ø11	M10

C.4.2 Flange mounting dimensions

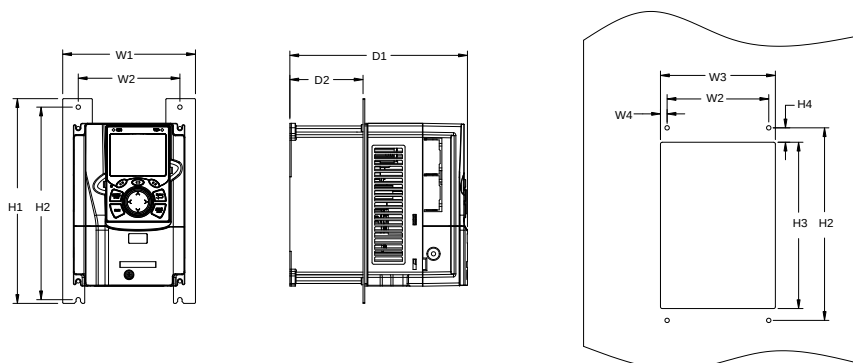


Figure C-10 Flange mounting diagram for 1R5G/2R2P-075G/090P

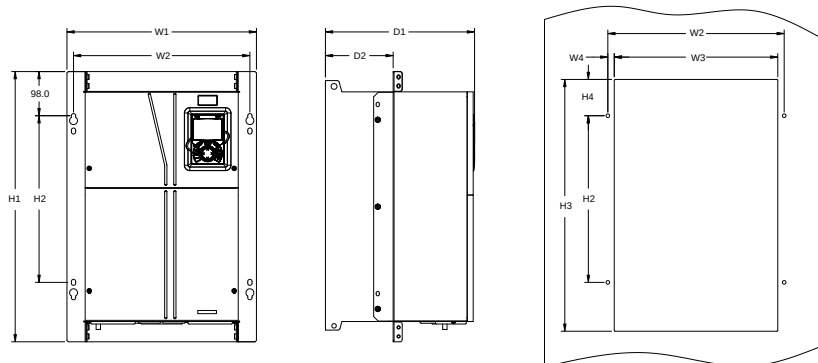


Figure C-11 Flange mounting diagram for 090G/110P-110G/132P

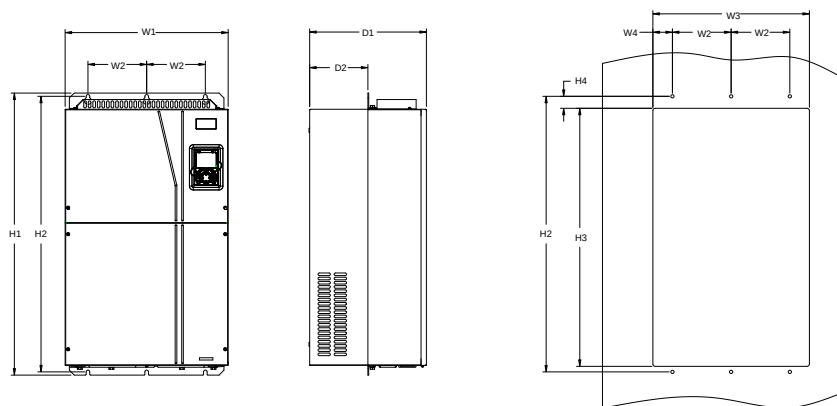


Figure C-12 Flange mounting diagram for 132G/160P–200G/220P

Table C-2 Flange mounting dimensions (unit: mm)

VFD model	W1	W2	W3	W4	H1	H2	H3	H4	D1	D2	Hole diameter	Fixing screw
1R5G/2R2P	150.2	115	130	7.5	234	220	190	13.5	185	65.5	Ø5	M4
7R5G/011P	170.2	131	150	9.5	292	276	260	6	192	84.5	Ø6	M5
055G/075P– 075G/090P	352	332	306	12	580	400	570	80	258	133.8	Ø9	M8
090G/110P– 110G/132P	418.5	389.5	361	14.2	600	370	559	108.5	330	149.5	Ø10	M8
132G/160P– 200G/220P	500	180	480	60	872	850	796	37	360	178.5	Ø11	M10

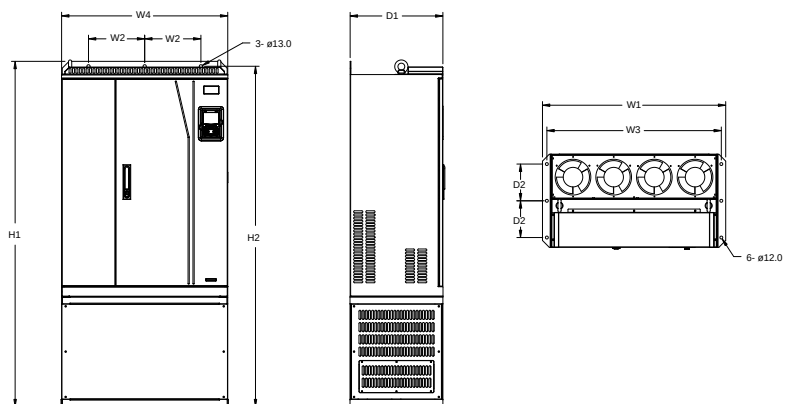
C.4.3 Floor mounting dimensions

Figure C-13 Floor mounting diagram for 220G/250P-315G/355P (optional base)

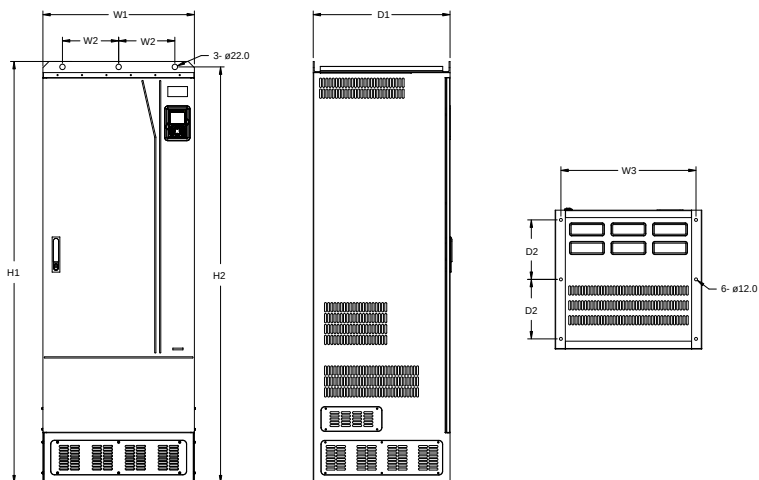


Figure C-14 Floor mounting diagram for 355G/400P-500G (optional base)

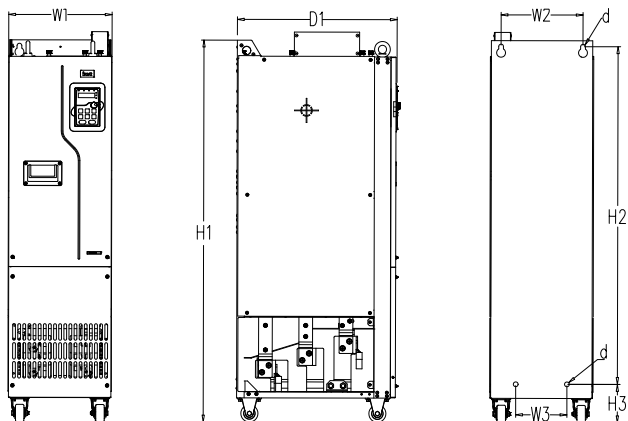


Figure C-15 Floor mounting diagram for 185G/200P-450G/500P-S

Table C-3 Floor mounting dimensions (unit: mm)

VFD model	W1	W2	W3	W4	H1	H2	H3	D1	D2	Hole diameter	Fixing screw
220G/250P-315G/355P	750	230	714	680	1410	1390	-	380	150	Ø13/12	M12/M10
355G/400P-500G	620	230	572	-	1700	1678	-	560	240	Ø22/12	M20/M10
185G/200P-315G/355P-S	330	225	185	-	1288	1150	122	552	-	Ø13	M12
355G/400P-450G/500P-S	330	240	200	-	1398	1280	101	552	-	Ø14	M12

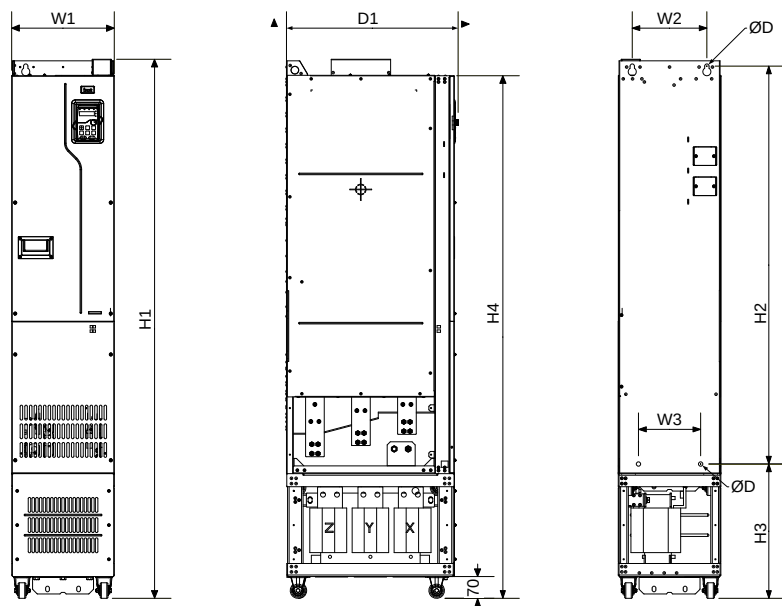


Figure C-16 Floor mounting diagram for 200G/220P-450G/500P-L3-S with output reactor

VFD model	W1	W2	W3	W4	H1	H2	H3	H4	D1	Hole diameter	Fixing screw
200G/220P-315G/355P-L3-S	330	225	185	390	1619	1150	453	1571	552	Ø13	M12
355G/400P-450G/500P-L3-S	330	240	200	390	1729	1280	432	1681	552	Ø14	M12

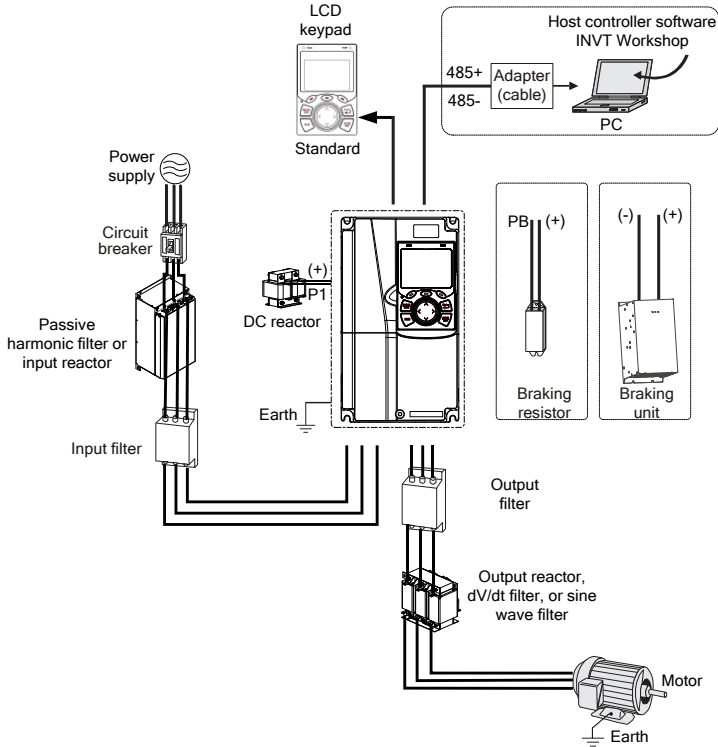
Appendix D Peripheral options

D.1 What this chapter contains

This chapter describes how to select optional accessories for the VFD.

D.2 Peripheral wiring

The following figure shows the external wiring of the VFD.



Note:

- The 7R5G/011P and lower models are equipped with built-in braking units, and the 055G/075P–075G/090P models can be configured with optional built-in braking units.
- The 055G/075P–110G/132P (inclusive) models are equipped with built-in DC reactors.
- Only models 132G/160P and higher are equipped with P1 terminals, which enable the VFDs to be directly connected to external DC reactors.
- The braking units are INVT DBU series standard braking units. For details, see the DBU operation manual.

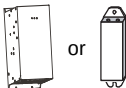
Image	Name	Description
	Cable	Medium used for the transmission of electrical power or signals.
	Breaker	For electric shock prevention and protection against short-to-ground that may cause current leakage and fire. Select residual-current circuit breakers (RCCBs) that are applicable to VFDs and can restrict high-order harmonics, and of which the rated residual operating current for one VFD is greater than 30 mA.
	Passive harmonic filter	To reduce the current distortion rate and harmonic content and effectively restrict higher-order harmonic currents, thereby improving the power factor.
	Input reactor	To prevent instantaneous high current from entering the input power circuit and damaging rectifier components under high grid voltage conditions. An AC reactor must be installed on the input side. It also helps improve the input power factor and suppress higher-order harmonic currents.
	Input filter	To restrict 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.
	DC reactor	DC reactors can be directly connected to VFDs of 132G/160P or higher models. To improve the power factor, suppress high-order harmonic currents, avoid damage to bridge rectifiers caused due to large input current of the VFD when large-capacity transformers are connected, and also avoid damage to the rectification circuit caused due to harmonics generated by grid voltage transients or phase-control loads.
 or 	Braking unit or braking resistor	To consume the regenerative energy of the motor to reduce the DEC time. VFDs of 037G/045P or lower models only need to be configured with braking resistors, those of 132G/160P or higher models also need to be configured with braking units, and those of 045G/055P–055G/075P models can be configured with optional built-in braking units.
	Output filter	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.

Image	Name	Description
	Output reactor	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	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	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.

D.3 Power supply

See section 1.4 Safety guidelines.

	◇ Ensure that the voltage class of the VFD is consistent with that of the grid.
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D.4 Cable

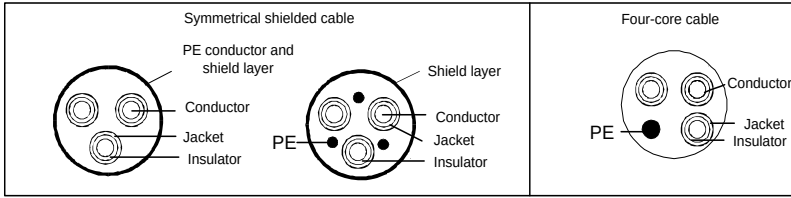
D.4.1 Power cable

The sizes of the input power cables and motor cables must comply with local regulations.

- ◇ The input power cables and motor cables must be able to carry the corresponding load currents.
- ◇ The continuous operating temperature rating of the motor cables should be at least 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 B 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 be at least 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.

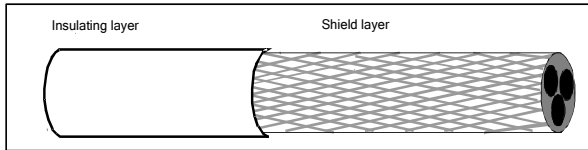


Figure D-1 Cable cross section

D.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.

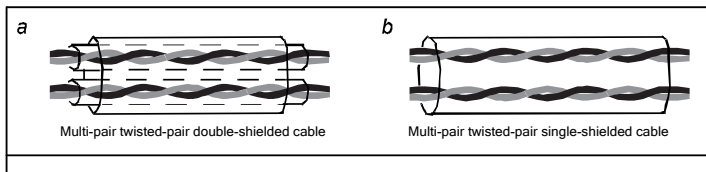


Figure D-2 Power cable arrangement

For low-voltage digital signals, double-shielded cables are recommended, but shielded or unshielded twisted pairs (as shown in figure b) can also be used. For frequency signals, however, only shielded cables can be used.

Relay cables must have a braided metal shield.

The keypad must be connected using a network cable. In environments with complex electromagnetic conditions, a shielded network cable is recommended.

Note: Analog signals and digital signals cannot share the same cable, and their cables must be routed 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 megohmmeter to measure the insulation resistance, on the VFD or its components.

Note: Before connecting the input power cable of the VFD, check the insulation conditions of the cable according to local regulations.

D.4.3 Recommended cable size

Table D-1 AC 3PH 380V(-15%)–440V(+10%)

VFD model	Recommended cable size (mm ²)				Screw	
	R, S, T U, V, W	PE	P1, (+)	PB, (+), (-)	Terminal screw	Fastening torque (N·m)
GD350A-1R5G/2R2P-4-HR	1.0/1.0	1.0/1.0	1.0/1.0	1.0/1.0	M4	1.2–1.5
GD350A-7R5G/011P-4-HR	4/6	4/6	4/6	4/6	M4	1.2–1.5
GD350A-055G/075P-4-HR	35/50	16/25	35/50	35/50	M8	9–11
GD350A-075G/090P-4-HR	50/70	25/35	50/70	50/70	M8	9–11
GD350A-090G/110P-4-HR	70/95	35/50	70/95	70/95	M12	31–40
GD350A-110G/132P-4-HR	95/95	50/50	95/95	95/95	M12	31–40
GD350A-132G/160P-4-HR	95/150	50/70	95/150	95/150	M12	31–40
GD350A-160G/185P-4-HR	150/185	70/95	150/185	150/185	M12	31–40
GD350A-185G/200P-4-HR	185/185	95/95	185/185	185/185	M12	31–40
GD350A-200G/220P-4-HR	185/2×95	95/95	185/2×95	185/2×95	M12	31–40
GD350A-220G/250P-4-HR	2×95/2×95	95/95	2×95/2×95	2×95/2×95	M12	31–40
GD350A-250G/280P-4-HR	2×95/2×150	95/150	2×95/2×150	2×95/2×150	M12	31–40
GD350A-280G/315P-4-HR	2×150/2×150	150/150	2×150/2×150	2×150/2×150	M12	31–40
GD350A-315G/355P-4-HR	2×150/2×185	150/185	2×150/2×185	2×150/2×185	M12	31–40
GD350A-355G/400P-4-HR	2×185/3×150	185/2×120	2×185/3×150	2×185/3×150	M12	31–40
GD350A-400G/450P-4-HR	3×150	2×120/2×150	3×150	3×150	M12	31–40
GD350A-450G/500P-4-HR	3×185	2×150/2×150	3×185	3×185	M12	31–40
GD350A-500G-4-HR	3×185	2×150	3×185	3×185	M12	31–40

Note:

- The cables recommended for the main circuit can be used in scenarios where the ambient temperature is lower than 40°C, the wiring distance is shorter than 100m, and the current is the rated current.
- The terminals P1, (+), PB, and (-) are used to connect to DC reactors and braking accessories.

D.4.4 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 to route motor cables, input power cables, and control cables in separate cable trays. Do not route other cables in parallel with motor cables, because the VFD output dU/dt may increase electromagnetic interference to those cables.

If control cables and power cables must cross, ensure that they do so at a 90° angle.

The cable trays must be connected properly and well grounded. Aluminum cable trays can help provide local equipotential bonding. The following figure shows the cable arrangement.

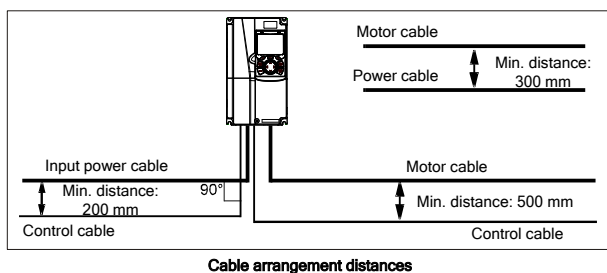


Figure D-3 Cable routing distance

D.4.5 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 500 V 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: If the inside of the motor is moist, the insulation resistance is reduced. If you suspect the inside of motor is moist, dry and re-measure the motor.

D.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 caution when installing and placing the breaker, and follow the manufacturer's instructions for operation.

Table D-2 AC 3PH 380V(-15%)–440V(+10%)

VFD model	Breaker rated current (A)	Fast-acting fuse rated current (A)	Contactors rated current (A)
GD350A-1R5G/2R2P-4-HR	6/10	10/10	9/9
GD350A-7R5G/011P-4-HR	32/50	40/50	32/38
GD350A-055G/075P-4-HR	180/225	200/250	150/185
GD350A-075G/090P-4-HR	225/250	250/300	185/225
GD350A-090G/110P-4-HR	250/315	300/350	225/265
GD350A-110G/132P-4-HR	315/400	350/400	265/330
GD350A-132G/160P-4-HR	400/500	400/500	330/400
GD350A-160G/185P-4-HR	500/500	500/600	400/400
GD350A-185G/200P-4-HR	500/630	600/600	400/500
GD350A-200G/220P-4-HR	630/630	600/700	500/500
GD350A-220G/250P-4-HR	630/700	700/800	500/630
GD350A-250G/280P-4-HR	700/800	800/1000	630/630
GD350A-280G/315P-4-HR	800/1000	1000/1000	630/800
GD350A-315G/355P-4-HR	1000/1000	1000/1000	800/800
GD350A-355G/400P-4-HR	1000/1000	1000/1200	800/1000
GD350A-400G/450P-4-HR	1000/1250	1200/1200	1000/1000
GD350A-450G/500P-4-HR	1250/1250	1200/1400	1000/1000
GD350A-500G-4-HR	1250	1400	1000

Note: The accessory specifications described in the preceding table are ideal values. You can select accessories based on the actual market conditions, but try not to use those with lower values.

D.6 Harmonic filter

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.

Table D-3 Output filter selection for motor cable lengths

Non-shielded cable length	50m–150m	150m–450m	450m–1000m
Shielded cable length	30m–100m	100m–230m	230m–500m
Output filter category	Output reactor (1%)	/	/
	/	dv/dt decrement filter	/
	/	/	Sine-wave filter

Table D-4 Reactor selection

VFD power	Input reactor	Output reactor	DC reactor
1.5kW	GDL-ACL0005-4CU	GDL-OCL0005-4CU	/
2.2kW	GDL-ACL0006-4CU	GDL-OCL0006-4CU	/
7.5kW	GDL-ACL0025-4CU	GDL-OCL0020-4CU	/
11kW	GDL-ACL0035-4AL	GDL-OCL0025-4CU	/
55kW	GDL-ACL0150-4AL	GDL-OCL0115-4AL	Standard
75kW	GDL-ACL0150-4AL	GDL-OCL0150-4AL	Standard
90kW	GDL-ACL0220-4AL	GDL-OCL0220-4AL	Standard
110kW	GDL-ACL0220-4AL	GDL-OCL0220-4AL	Standard
132kW	GDL-ACL0265-4AL	GDL-OCL0265-4AL	GDL-DCL0300-4AL
160kW	GDL-ACL0330-4AL	GDL-OCL0330-4AL	GDL-DCL0365-4AL
185kW	GDL-ACL0390-4AL	GDL-OCL0400-4AL	GDL-DCL0455-4AL
200kW	GDL-ACL0390-4AL	GDL-OCL0400-4AL	GDL-DCL0455-4AL
220kW	GDL-ACL0450-4AL	GDL-OCL0450-4AL	GDL-DCL0505-4AL
250kW	GDL-ACL0500-4AL	GDL-OCL0500-4AL	GDL-DCL0550-4AL
280kW	GDL-ACL0500-4AL	GDL-OCL0560-4AL	GDL-DCL0675-4AL
315kW	GDL-ACL0580-4AL	GDL-OCL0660-4AL	GDL-DCL0675-4AL
355kW	Standard	GDL-OCL0660-4AL	GDL-DCL0810-4AL
400kW	Standard	GDL-OCL0720-4AL	GDL-DCL0810-4AL
450kW	Standard	GDL-OCL0820-4AL	GDL-DCL1000-4AL
500kW	Standard	GDL-OCL1000-4AL	GDL-DCL1000-4AL

Note:

- The rated input voltage drop of input reactor is designed to be $\geq 1.5\%$.
- The rated output voltage drop of output reactor is designed to be 1% .
- The preceding table lists only external accessories. You need to specify whether external or built-in accessories are needed in your purchase order.

Table D-5 Filter model selection

VFD power	Input filter	Output filter	
	Passive harmonic filter	dv/dt decrement filter	Sine-wave filter
1.5 kW	GDL-H0006-4AL	GDL-DUL0005-4CU	GDL-OSF0005-4AL
2.2 kW	GDL-H0006-4AL	GDL-DUL0005-4CU	GDL-OSF0005-4AL
7.5 kW	GDL-H0025-4AL	GDL-DUL0020-4CU	GDL-OSF0020-4AL
11 kW	GDL-H0032-4AL	GDL-DUL0025-4CU	GDL-OSF0025-4AL
55 kW	GDL-H0130-4AL	GDL-DUL0120-4AL	GDL-OSF0120-4AL
75 kW	GDL-H0160-4AL	GDL-DUL0150-4AL	GDL-OSF0150-4AL
90 kW	GDL-H0190-4AL	GDL-DUL0180-4AL	GDL-OSF0180-4AL

VFD power	Input filter	Output filter	
	Passive harmonic filter	dv/dt decrement filter	Sine-wave filter
110 kW	GDL-H0225-4AL	GDL-DUL0220-4AL	GDL-OSF0220-4AL
132 kW	GDL-H0265-4AL	GDL-DUL0260-4AL	GDL-OSF0260-4AL
160 kW	GDL-H0320-4AL	GDL-DUL0320-4AL	GDL-OSF0320-4AL
185 kW	GDL-H0400-4AL	GDL-DUL0400-4AL	GDL-OSF0400-4AL
200 kW	GDL-H0400-4AL	GDL-DUL0400-4AL	GDL-OSF0400-4AL
220 kW	GDL-H0485-4AL	GDL-DUL0480-4AL	GDL-OSF0480-4AL
250 kW	GDL-H0485-4AL	GDL-DUL0480-4AL	GDL-OSF0480-4AL
280 kW	GDL-H0545-4AL	GDL-DUL0540-4AL	GDL-OSF0600-4AL
315 kW	GDL-H0610-4AL	GDL-DUL0600-4AL	GDL-OSF0600-4AL
355 kW	GDL-H0800-4AL	GDL-DUL0800-4AL	GDL-OSF0800-4AL
400 kW	GDL-H0800-4AL	GDL-DUL0800-4AL	GDL-OSF0800-4AL
450 kW	GDL-H1000-4AL	GDL-DUL1000-4AL	GDL-OSF1000-4AL
500 kW	GDL-H1000-4AL	GDL-DUL1000-4AL	GDL-OSF1000-4AL

Note:

- The preceding table lists only external accessories. You need to specify whether external or built-in accessories are needed in your purchase order.
- For the selection of accessories with different material requirements than those listed above, please refer to the low-voltage VFD GDL series filter option brochure.

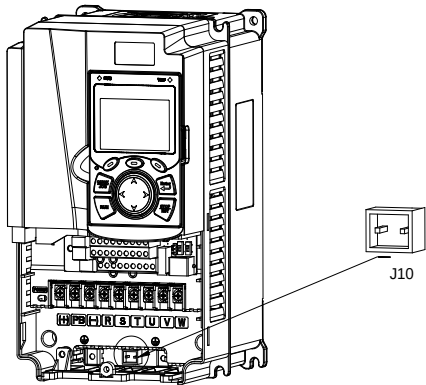
D.7 Filter

J10 is not connected in factory for the 110G/132P and lower VFD models. Connect the J10 packaged with the manual if the requirements of level C3 need to be met.

J10 is connected in factory for the 132G/160P and higher VFD models, all of which meet the requirements of level C3.

Note: Disconnect J10 in the following situations:

- The EMC filter is applicable to the neutral-grounded grid system. If it is used in an IT power grid system (neutral not grounded), disconnect J10.
- If the residual-current circuit breaker trips during startup when a residual-current circuit breaker has been configured, disconnect J10.



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.

INVT provides some of the filters for you to choose.

D.7.1 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 380 V (-15%)–440 V (+10%) 06: AC 3PH 520 V (-15%)–690 V (+10%)
D	3-digit code indicating the rated current. "015" indicates 15A.
E	Filter performance L: Standard type H: High-performance type
F	Filter application environment A: First environment (IEC 61800-3), category C1 (EN 61800-3) B: First environment (IEC 61800-3), category C2 (EN 61800-3) C: Second environment (IEC 61800-3), category C3 (EN 61800-3)

D.7.2 Filter model selection

Table D-6 Filter model selection

VFD model	Input filter	Output filter
GD350A-1R5G/2R2P-4-HR	FLT-P04006L-B	FLT-L04006L-B
GD350A-7R5G/011P-4-HR	FLT-P04032L-B	FLT-L04032L-B
GD350A-055G/075P-4-HR	FLT-P04150L-B	FLT-L04150L-B
GD350A-075G/090P-4-HR		
GD350A-090G/110P-4-HR	FLT-P04240L-B	FLT-L04240L-B
GD350A-110G/132P-4-HR		
GD350A-132G/160P-4-HR		
GD350A-160G/185P-4-HR	FLT-P04400L-B	FLT-L04400L-B
GD350A-185G/200P-4-HR		
GD350A-200G/220P-4-HR		
GD350A-220G/250P-4-HR	FLT-P04600L-B	FLT-L04600L-B
GD350A-250G/280P-4-HR		
GD350A-280G/315P-4-HR		
GD350A-315G/355P-4-HR	FLT-P04800L-B	FLT-L04800L-B
GD350A-355G/400P-4-HR		
GD350A-400G/450P-4-HR		
GD350A-450G/500P-4-HR	FLT-P041000L-B	FLT-L041000L-B
GD350A-500G-4-HR		

Note:

- The input EMI meets the C2 requirements after an input filter is configured.
- The preceding table lists only external accessories. All accessories listed above are external and must be specified when ordering.

D.8 Braking system

D.8.1 Braking component selection

When the VFD is driving a high-inertia load decelerates or needs to decelerate abruptly, the motor runs in the power generation state and transmits the load 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.

For GD350A-HR series VFDs, models 7R5G/011P and below have a built-in braking unit. Models 055G/075P and above require an external braking unit. For the 055G/075P model, a built-in braking unit is available as an option. Add the suffix "-B" to the model number, for example, GD350A-045G/055P-4-HR-B. For models that use an external braking unit, select the resistance and power rating of the braking resistor according to the actual site conditions, including the required braking torque and braking utilization level.

Table D-7 Braking unit selection

VFD model	Braking unit model	Resistance applicable for 100% braking torque (Ω)	Braking resistor dissipation power (kW)			Min. allowable braking resistance (Ω)
			10% braking ratio	50% braking ratio	80% braking ratio	
GD350A-1R5G/2R2P-4-HR	Built-in braking unit	326	0.23	1.1	1.8	170
GD350A-7R5G/011P-4-HR		65	1.1	5.6	9	47
GD350A-055G/075P-4-HR	DBU100H-110-4	8	8	41	66	6.4
GD350A-075G/090P-4-HR		6.5	11	56	90	
GD350A-090G/110P-4-HR	DBU100H-160-4	5.4	14	68	108	4.4
GD350A-110G/132P-4-HR		4.5	17	83	132	
GD350A-132G/160P-4-HR	DBU100H-220-4	3.7	20	99	158	3.2
GD350A-160G/185P-4-HR	DBU100H-320-4	3.1	24	120	192	2.2
GD350A-185G/200P-4-HR		2.8	28	139	222	
GD350A-200G/220P-4-HR		2.5	30	150	240	
GD350A-220G/250P-4-HR	DBU100H-400-4	2.2	33	165	264	1.8
GD350A-250G/280P-4-HR		2.0	38	188	300	
GD350A-280G/315P-4-HR	Two DBU100H-320-4	3.6*2	21*2	105*2	168*2	2.2*2
GD350A-315G/355P-4-HR		3.2*2	24*2	118*2	189*2	
GD350A-355G/400P-4-HR		2.8*2	27*2	132*2	210*2	
GD350A-400G/450P-4-HR		2.4*2	30*2	150*2	240*2	
GD350A-450G/500P-4-HR	Two	2.2*2	34*2	168*2	270*2	1.8*2
GD350A-500G-4-HR	DBU100H-400-4	2.0*2	38*2	186*2	300*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 describes the resistance and power for 100% brake torque, 10% braking ratio, 50% braking ratio, and 80% braking ratio. You can select the braking system based on the actual operation 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 utilization is greater than 10%, you need to select a braking resistor with higher power as required by the operating conditions according to the preceding table.

D.8.2 Braking resistor cable selection

Braking resistor cables should be shielded cables.

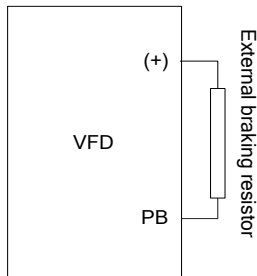
D.8.3 Braking resistor installation

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 may reach several hundred degrees Celsius. Prevent any materials from coming into contact with the resistor.
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Braking resistor installation:

	✧ For models 7R5G/011P and lower, only an external braking resistor is required. ✧ PB and (+) are the terminals for connecting braking resistors.
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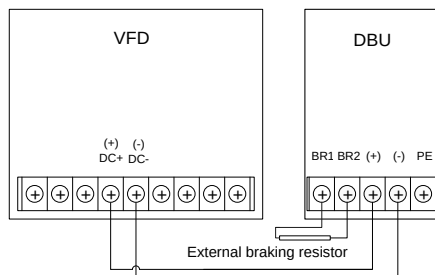


Braking unit installation:



- ✧ (+) 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 5 m, 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 10 m.

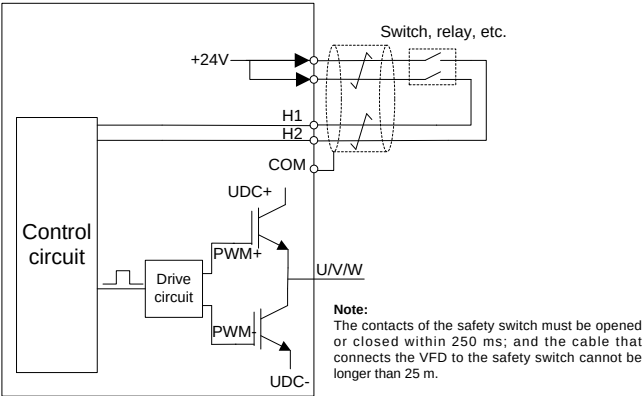
Single connection:



Appendix E 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-duration operations (such as non-electrical cleaning in the lathe industry) and maintain the non-electrical components of the device without switching off the drive.



E.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: 40: Safe torque off (STO)
H1 and H2 closed simultaneously	The STO function is not triggered, and the drive runs properly.
One of H1 and H2 opened, and the other closed	STL1, STL2, or STL3 fault occurred. Fault code: 41: Channel H1 exception (STL1) 42: Channel H2 exception (STL2) 43: Exception to both channels H1 and H2 (STL3)

E.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

1. STO trigger delay: time interval between triggering the STO function and switching off the drive output.
2. STO indication delay: Time interval between triggering the STO function and STO output state indication.

E.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.

	Action
☐	Ensure that the drive can be started and stopped as required 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 to 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 drive. Ensure that the motor is running properly. ✧ Activate the STO circuit. ✧ The drive reports an STO fault (for details, see section 5.5.19 Troubleshooting), ensuring that the motor coasts freely to a complete stop. ✧ Deactivate the STO circuit.
☐	Restart the drive, and check whether the motor is running properly.

Appendix F Further information

F.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 in question. You can visit www.invt.com to find a list of INVT offices.

F.2 Feedback on INVT VFD manuals

Your comments on our manuals are welcome. Visit www.invt.com and choose **Contact Us**.

F.3 Documents on the Internet

You can find manuals and other product documents in PDF format on the Internet. Visit www.invt.com and choose **Support > Download**.

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