Operation Manual

Goodrive350-CCS Series VFD for Marine Industry

SHENZHEN INVT ELECTRIC CO., LTD.

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2	● Added specifications for specialized function and I/O expansion card 2, table 3-2 in section 3.3 Product specifications. ● Added section 4.4.3 Control circuit wiring of I/O expansion card 2, chapter 5Commissioning guidelines, chapter 11Short description of communication PZD, section A.7 IoT expansion card, and section A.8 Power supply expansion cards. ● Updated chapter 7 Function parameter list: ✧ Added function code group P27, group P85, group P86, group P87, group P89, and group P94. ✧ Added function codes P02.31, P02.32, P03.34, P03.45–P03.46, P06.23–P06.26, P08.55–P08.64, P11.28–P11.57, P12.31, P14.07–P14.70, P16.54–P16.73, P17.57–P17.59, P21.31–P21.33, P23.15, P25.43–P25.48, P28.21–P28.22, and P92.40–P92.48. ✧ Updated function codes P04.33, P05.01–P05.07, P06.01–P06.05, P07.27–P07.32, P18.00, and P19.00–P19.02. ✧ Deleted function code group P22, and function codes P19.10–P19.14, P19.21–P19.29, P22.16–P22.17, P22.22–P22.24, P90.43, P90.47–P90.49. ● Updated section 8.5 Faults and solutions. ● Deleted description of EC-PC501-00 and EC-PG505-24. ● Added description of EC-TX510, EC-TX511B, EC-TX513, EC-TX515, and EC-PG507-24 to sections A.5.6, A.5.7 , A.5.8, A.5.9, and A.6.6. ● Deleted section B.7. ● Updated sections C.4 AC 3PH 380V–480V VFD dimensions. ● Updated sections D.2 External wiring, D.6 Harmonic filter, and D.7 EMC filter.	V1.1	Jul. 2024

Preface

Thank you for choosing Goodrive350-CCS series variable-frequency drive (VFD) for marine industry.

If not otherwise specified in this manual, the VFD always indicates Goodrive350-CCS series VFD, which is a VFD for marine industry with the capability to drive both synchronous motors and asynchronous motors, and support torque control, speed control, and position control. 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 hoisting-oriented process card, PG expansion card, communication expansion card and I/O expansion card to achieve various functions as needed. Each VFD can be installed with three expansion cards at most.

The PG card supports a variety of common 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 contain the impact of system faults.

The VFD supports mainstream bus and control automation communication modes, including Modbus, CANopen, PROFIBUS-DP, PROFINET, EtherNet IP, and EtherCAT, and thus can be seamlessly interconnected with various hoist control systems. 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 product is ultimately used for military affairs or weapon manufacture, comply with the export control regulations in the Foreign Trade Law of the People's Republic of China and complete related formalities.

The manual is subject to change without prior notice.

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1 Safety precautions

1.1 What this chapter contains

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

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

1.2 Safety definition

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

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

Note: Actions taken to ensure proper running.

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

1.3 Warning symbols

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

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

1.4 Safety guidelines

- ✧ Only trained and qualified professionals are allowed to carry out related operations.
- ✧ Do not perform wiring, inspection or component replacement when power supply is applied. Ensure all the input power supplies have been disconnected before wiring or inspection, and wait for at least the time designated on the VFD or until the DC bus voltage is less than 36V. The minimum waiting time is listed in the following.

VFD model		Minimum waiting time
380V	30kW–110kW	5 minutes
380V	132kW–315kW	15 minutes
380V	Higher than 355kW	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 measurements 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 operate the damaged or incomplete VFD.
- ✧ Do not contact the VFD with damp objects or body parts. Otherwise, electric shock may result.

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 product 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 VFD leakage current caused during running may exceed 3.5mA, apply reliable grounding and ensure the ground resistance is less than 10Ω. The PE ground conductor and phase conductor have equal conductivity capability. For the models of 30kW and higher, the cross

sectional area of the PE ground conductor can be slightly less than the recommended 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 presents inside the VFD during running. Do not carry out any operation on the VFD during running except for keypad setup.

✧ The VFD may start up by itself when P01.21 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.

✧ During driving a permanent magnet SM, besides above-mentioned items, the following work must be done before installation and maintenance:

  ✓ All input power supplies have been disconnected, including the main power and control power.

  ✓ The permanent-magnet SM has been stopped, and the voltage 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.

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 9 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 and component replacement

✧ Only trained and qualified professionals are allowed to perform maintenance, inspection, and component replacement for the VFD.

✧ Cut off all power supplies connected to the VFD before terminal wiring, and wait for at least the time designated on the VFD after disconnecting the power supplies.

✧ During maintenance and component replacement, take measures to prevent screws, cables and other conductive matters from falling into the internal of the VFD.

Note:

- Use proper torque to tighten screws. (For details, see section D.4.3 Recommended cable size.)
- 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, or whether the enclosure of the VFD is damaged or cracked. If any problems are found, contact the local INVT dealer or office.
4.	Whether the VFD nameplate is consistent with the model identifier on the exterior surface of the packing box. If any problems are found, contact the local INVT dealer or office.
5.	Whether the accessories (including the manual, keypad, and expansion card) inside the packing box are complete. If any problems are found, contact the local INVT dealer or office.

2.3 Checking before use

Check the following before using the VFD.

1.	Mechanical type of the load to be driven by the VFD to verify whether the VFD will be overloaded during work. Whether the power class of the VFD needs to be increased.
2.	Whether the actual running current of the motor is less than the rated current of the VFD.
3.	Whether the control accuracy required by the load is the same as that 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 the temperature exceeds 40°C, derate 1% for every increase of 1°C. Do not use the VFD when the ambient temperature exceeds 55°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 -10°C. If 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 the installation site altitude exceeds 1000 m, derate 1% for every increase of 100m.
4.	Whether the actual environment humidity exceeds 90% or condensation occurs. If yes, take additional protective measures.
5.	Whether there is direct sunlight or biological invasion in the environment where the VFD is to be used. If yes, take additional protective measures.
6.	Whether there is dust or inflammable and explosive gas in the environment where the VFD is to be used. If yes, take additional protective measures.

2.5 Checking after installation

Check the following after the VFD installation is complete.

1.	Whether the input power cables and motor cables meet the current-carrying capacity requirements of the actual load.
2.	Whether correct accessories are selected for the VFD, the accessories are correctly and properly installed, and the installation cables meet the capacity carrying requirements of all components (including the 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 product 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**	**λdu**	**λdd**	**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 mainly introduces the operation principles, product features, layouts, nameplates and model designation rules.

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, and the capacitor bank of intermediate circuit stabilizes the DC voltage. 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, external braking resistor will be connected to intermediate DC circuit to consume the feedback energy.

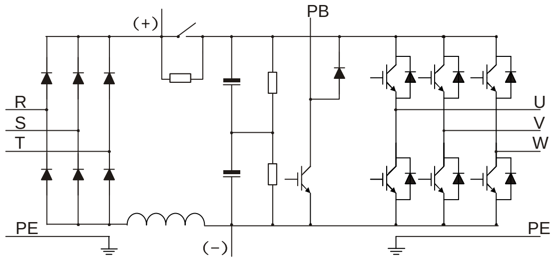


Figure 3-1 Main circuit diagram for 380V 30kW–110kW VFD models

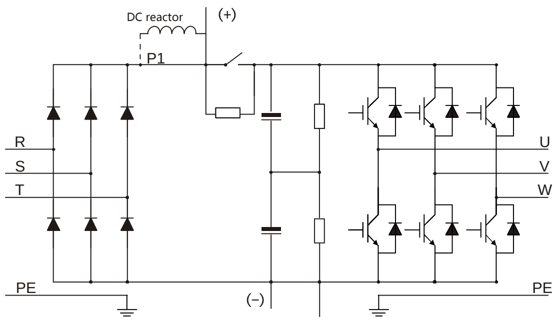


Figure 3-2 Main circuit diagram for 380V 132kW or higher VFD models

Note:

- The 380V 132kW and higher VFD models can be connected to external DC reactors. Before connection, remove the copper bar between P1 and (+). The 380V 132kW and higher VFD models can be connected to external braking unit. DC reactors and braking units are optional parts.

- The 380V 30kW–110kW (inclusive) VFD models are equipped with built-in DC reactors.
- The 380V 30kW–110kW (inclusive) VFD models carry built-in braking units. The models with built-in braking units can also be connected to external braking resistors. Braking resistors are optional parts.

3.3 Product specifications

Table 3-1 Product specifications

Function description		Specifications
Power input	Input voltage (V)	AC 3PH 380V–480V, rated voltage: 380V
	Input current (A)	See section 3.6 Product ratings.
	Input frequency (Hz)	50Hz or 60Hz; Allowed range: 47–63Hz
	Input power factor	30–110kW≥0.9
Power output	Output voltage (V)	0–Input voltage (V)
	Output current (A)	See section 3.6 Product ratings.
	Output power (kW)	See section 3.6 Product ratings.
	Output frequency (Hz)	0–400Hz
Technical control performance	Control mode	Space voltage vector control mode Sensorless vector control (SVC) mode Feedback vector control (FVC) mode
	Motor type	Asynchronous motor (AM) and permanent magnetic synchronous motor (SM)
	Speed ratio	1:200 (SVC), 1:1000 (FVC)
	Speed control accuracy	±0.2% (SVC), ±0.02% (FVC)
	Speed fluctuation	±0.3% (SVC), ±0.02% (FVC)
	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	150% for 1 minute, 180% for 10 seconds, and 200% for 1 second
	Braking capability	100% for long time, 120% for 1 minute, and 160% for 10 seconds
Running control performance	Frequency setting method	Settings can be implemented through digital, analog, pulse frequency, multi-step speed running, simple PLC, PID, Modbus communication, PROFIBUS communication and so on. Settings can be combined and the setting channels can be

Function description		Specifications
		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.
Specialized function	Braking protection	VFD models of 30kW, 37kW, 90kW, and 110kW provide the function of protecting against braking resistor short connection, braking unit short connection, and PB-PE short connection.
	Brake	Embedded with hoisting-oriented brake logic, and integrated with the torque verifying, brake feedback, zero position detection, restart after braking functions, which meet the industrial standards on the VFDs for cranes.
	Conical motor control	During startup, the magnetic flow is increased to release the brake. During stop, the magnetic flow is decreased to close the brake.
	Light load speed boost	In closed-loop mode, the speed can be boosted and limited at constant power status, and the speed is limited in stepped way. In open-loop mode, if the simplified speed boost way is used, the speed boosts to the set frequency in light load status; if the speed is boosted or limited in constant power status, the speed is limited in stepped way
	Zero servo	In closed-loop mode, if the VFD detects load downward slip, the VFD automatically enters the zero servo state and outputs a brake failure alarm. When a level-2 fault occurs, if load downward slip occurs, the VFD automatically resets the fault, enters the zero servo state, and outputs a brake failure alarm.
	Anti-sway for horizontal moving	By selecting different anti-sway modes, it can effectively eliminate the load swing caused by the acceleration and deceleration of the parallel traveling mechanism in different scenarios such as with rope length, without rope length, speed, and position control scenarios.
	Tower crane slewing without vortex	Embedded curves for tower crane slewing without vortex help to adjust the ACC in real time so that the torque is steady, which can suppress arm rebound and vibration when the arm pauses or stops.
	Wind resistance of	Embedded curves for tower crane slewing without vortex and

Function description		Specifications
	tower crane slewing	anti-sway self-adapting technology help to adjust the ACC in real time, so that the slewing mechanism operates smoothly and responds quickly. In windy slewing conditions, it can effectively eliminate the issues of easy sliding in favorable winds and failure to reach the given speed in adverse winds.
	Loose rope protection	If the loose rope state is detected during the hook runs down, the VFD reports a fault or alarm. This eliminates the safety hazards caused by hanging or squatting in operation.
	Upward or downward position limit	The function is used to limit the crane to run within the specified range. The VFD enables emergency stop and reports an alarm once the range is exceeded.
	Upward or downward DEC position	When the deceleration signal is valid, the running speed of the crane is limited once the crane runs within the slow speed area. The function also features uni-directional speed limit. For example, only the upward running speed is limited when the crane runs within the upward slow speed area.
	Load position	In closed-loop mode, an encoder is used to obtain load position information.
	Master/slave control	Including power balance and speed synchronization between the master and slave.
	Hoisting application macro	Including lifting, horizontal moving, construction elevator, and tower crane slewing, and user-defined application macros.
	Lifting and horizontal moving switchover	Three groups of motor parameters, control modes, and application macros can be switched.
	Frequency decrease by voltage	When the bus voltage is continuously low, the reference frequency is decreased to keep the normal output torque of VFD.
	Low voltage protection	When the bus voltage decreases transiently or the VFD quickly stops due to power outage, the function is used to ensure the hook does not slip. The low voltage protection function is automatically disabled once the bus voltage restores to the normal state.
	Low-speed run protection	The VFD reports the low-speed run protection fault when the low-speed run time exceeds the allowed time. The prevents the axial cooling motor from being damaged due to overheating caused by long-time running.
	Overload protection	In closed-loop mode, when overload occurs, upward lifting is

Function description		Specifications
		restricted.
	Vortex control	The HDO outputs PWM waves to directly control vortex.
	Brake feedback	When the brake control signal is inconsistent with the brake feedback signal, the VFD handles the inconsistency according to the brake status to ensure safety.
	Zero position detection	The zero position signal and running signal are mutually exclusive.
	Torque verification	The VFD verifies the current or torque before brake release. The VFD performs brake release when the verification succeeds, and the VFD reports the verification fault when the verification fails.
	One key open/closed loop switchover	The closed-loop control mode can be switched to the open-loop control mode through terminals. When the encoder is faulty, the open-loop control mode can be used. The switchover can get response only in stopped state but not in running state.
	Jogging	After receiving a jogging command, the VFD can automatically start, run, and stop at the preset running frequency and time according to the settings. During the process, the brake can be normally opened or closed under the control of VFD, ensuring the stability without hook slip or exception when the crane starts or stops.
	Smooth lifting	In high-speed lifting mode, the high speed is limited at the moment of steel rope straightening, reducing the impact caused by the sudden load to the crane at the lifting start.
	Set frequency exception protection	If the set frequency is lower than the threshold after the brake is opened, the VFD reports the set frequency exception, which prevents slip caused by insufficient force at low speed.
	Motor overheat protection	An I/O expansion card can receive the input from a motor temperature sensor (PT100, PT1000, or PTC); at the same time, AI analog can also receive the input from a motor temperature sensor (PT100, PT1000, KTY84, or PTC), for motor overheating protection.
Peripheral interface	Terminal analog input resolution	No more than 20mV
	Terminal digital input resolution	No more than 2ms
	Analog input	2 inputs; AI1: 0–10V/0–20mA; AI2: -10–+10V
	Analog output	1 input; AO1: 0–10V/0–20mA

Function description		Specifications
	Digital input	Four regular inputs; max. frequency: 1kHz; internal impedance: 3.3kΩ Two high-speed inputs; max. frequency: 50kHz; supporting quadrature encoder input; with speed measurement function
	Digital output	One high-speed pulse output; max. frequency: 50kHz One Y terminal open collector output
	Relay output	Two programmable relay outputs RO1A: NO; RO1B: NC; RO1C: common RO2A: NO; RO2B: NC; RO2C: common Contact capacity: 3A/250VAC, 1A/30VDC
	Extended interfaces	Three extended interfaces: SLOT1, SLOT2, and SLOT3 Supporting PG cards, programmable expansion cards, communication cards, I/O cards and so on
I/O expansion card 2	Relay output	Two programmable relay outputs. Contact capacity: 3A/250VAC, 1A/30VDC RO3A: NO; RO3C: common; RO4A: NO; RO4C: common
	Digital input	Three regular inputs Internal impedance: 6.6kΩ Max. input frequency: 1kHz Supporting the internal power 24V Supporting the voltage input of external power (-20%)24–48VDC(+10%) and (-10%)24–48VAC(+10%) Bidirectional input terminals, simultaneously supporting NPN and PNP connection methods One channel supports PTC input, while PTC acts at 2.5kΩ, and supports the input of only dry contacts sharing COM
	PT100 input	Independent PT100 and PT1000 input: 1. Resolution: 1°C 2. Range: -20°C–+150°C 3. Detection precision: ±3°C 4. Supporting offline protection
	PT1000 input	
Other	Mounting method	Supports wall-mounting, floor-mounting and flange-mounting.
	Temperature of running environment	-10°C–+55°C; Derating is required when the ambient temperature exceeds 40°C.
	Ingress protection (IP) rating	IP20
	Pollution level	Level 2
	Cooling method	Forced air cooling

Function description		Specifications
	DC reactor	Standard built-in part for 380V 30–110kW VFD models. Optional external part for 380V 132kW and higher models.
	Braking unit	Standard built-in part for 380V 110kW and lower VFD models.
	EMC filter	C3 filters are optional parts and can be built in the VFD. If a C3 filter is required, connect the jumper J10. After the C3 filter is configured, the VFD can meet IEC61800-3 C3 requirements. Optional external filters can be used to meet the IEC61800-3 C2 requirements.

Table 3-2 Specialized functions

Function			Control mode		
Specialized function	Mode		V/F	SVC	FVC
	Brake	Brake control in speed mode	√	√	√
		Restart after braking	√	√	√
		Brake feedback	√	√	√
		Zero position detection	√	√	√
		Current verification	√	√	√
		Torque verification	/	√	√
		Brake slip verification	/	/	√
		Speed deviation detection	√	√	√
		Jogging	√	√	√
		Set frequency exception protection	√	√	√
		Brake control in torque mode	/	√	√
	Torque control	Torque control	/	√	√
		Pre torque	/	√	√
	Conical motor	Conical motor control	√	/	/
	Light load speed boost	Simplified speed boost mode	√	√	√
		Constant power speed boost	√	√	√
		Constant power speed limit	√	√	√
		Stepped speed limit	√	√	√
	Safety functions	STO	√	√	√
		Zero servo	/	/	√
		Loose rope protection	/	/	√
		Stable lifting protection	/	/	√
		Upward or downward position limit	√	√	√
		Upward or downward DEC position limit	√	√	√

Function			Control mode		
		Overload protection	√	√	√
		Braking short-circuit protection	√	√	√
		Motor disconnection protection	√	√	√
		Anti-snag protection			√
	Master/slave control	Speed synchronization	√	√	√
		Power balance	√	√	√
		Position synchronization	/	/	√
	Control switchover	Open/closed switchover	√	√	√
		Motor parameter switchover	√	√	√
		Simultaneous motor and master/slave switchover	√	√	√
		Simultaneous motor and function macro switchover	√	√	√
		Simultaneous motor and speed control mode switchover	√	√	√
	Other functions	Load position	/	/	√
		Height measuring	/	/	√
		Anti-sway for smooth moving	√	√	√
		Motor temperature protection	√	√	√
		CVCF function	√	/	/

3.4 Product nameplate

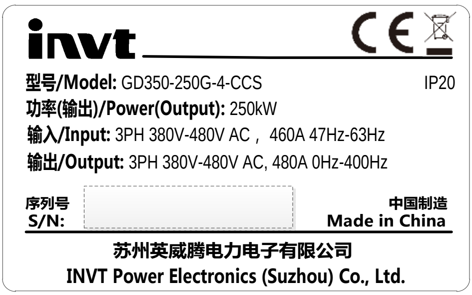


Figure 3-3 Product nameplate

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 and simplified nameplate.

GD350-250G-4-CCS

① ② ③ ④

Table 3-3 Model description

Field	Description	Example
①	Product series abbreviation	GD350: Goodrive350 series VFD
②	Power range + load type	250: 250kW; G: Constant torque load
③	Voltage class	4: AC 3PH 380V–480V
④	Certification mark	CCS: China Classification Society
Note: The braking unit has been built in the 380V 110kW and lower VFD models as a standard configuration.		

3.6 Product ratings

Table 3-4 AC 3PH 380V–480V

VFD model	Output power (kW)	Input current (A)	Output current (A)
GD350-030G-4-CCS	30	70	60
GD350-037G-4-CCS	37	80	75
GD350-045G-4-CCS	45	98	92
GD350-055G-4-CCS	55	128	115
GD350-075G-4-CCS	75	139	150
GD350-090G-4-CCS	90	168	180
GD350-110G-4-CCS	110	201	215
GD350-132G-4-CCS	132	265	260
GD350-160G-4-CCS	160	310	305
GD350-200G-4-CCS	200	385	380
GD350-220G-4-CCS	220	430	425
GD350-250G-4-CCS	250	460	480
GD350-280G-4-CCS	280	500	530
GD350-315G-4-CCS	315	580	600
GD350-355G-4-CCS	355	625	650
GD350-400G-4-CCS	400	715	720
GD350-500G-4-CCS	500	890	860

Note:

- The input current of the 30–500kW VFD models 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 Structure

The VFD structure is shown in the following figure (taking the 380V 30kW VFD model as an example).

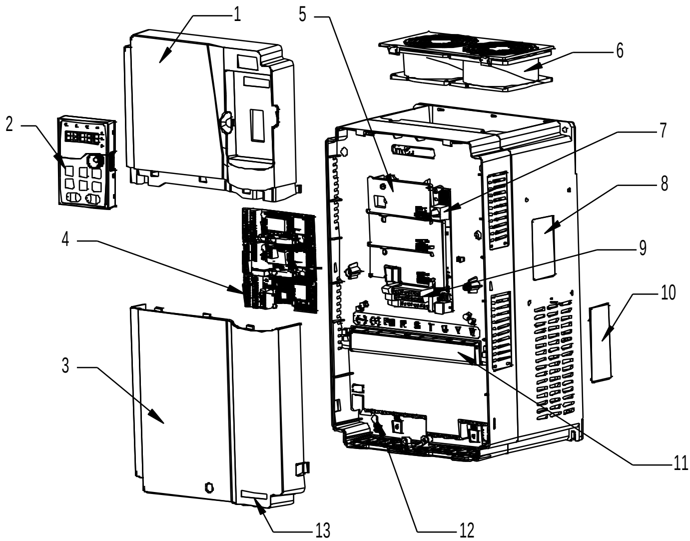


Table 3-5 Structure diagram

No.	Name	Description
1	Upper cover	Used to protect internal components.
2	Keypad	See section 6.2 Keypad introduction
3	Lower cover	Used to protect internal components.
4	Expansion card	Optional. For details, see Appendix A Expansion card.
5	Baffle of control board	Protects the control board and install extension card.
6	Cooling fan	See section 9 Maintenance.
7	Keypad interface	Connects the keypad.
8	Nameplate	See section 3 Product overview.
9	Control terminals	See section 4 Installation guidelines.
10	Cover plate of heat emission hole	Optional. Cover plate can upgrade protection level, however, as it will also increase internal temperature, derated use is required.
11	Main circuit terminals	See section 4 Installation guidelines.
12	POWER indicator	Power supply indicator
13	GD350-CCS 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. Please carry out operations according to instructions presented in chapter 1 Safety precautions. Ignoring these safety precautions may lead to physical injury or death, or device damage. ✧ Ensure the VFD power has been disconnected before installation. If the VFD has been powered on, disconnect the VFD power and wait for at least the time specified on the VFD, and ensure the POWER indicator is off. You are recommended to use a multimeter to check and ensure the VFD DC bus voltage is below 36V. ✧ The VFD installation must be designed and done according to applicable local laws and regulations. INVT does not assume any liability whatsoever for any VFD installation which breaches local laws or regulations. If recommendations given by INVT are not followed, the VFD may experience problems that the warranty does not cover.

4.2 Mechanical installation

4.2.1 Installation environment

The installation environment is essential for the VFD to operate with best performance in the long run. Install the VFD in an environment that meets the following requirements.

Environment	Condition
Installation site	Indoor
Ambient temperature	✧ -10–+55°C; ✧ When the temperature exceeds 40°C, derate 1% for every increase of 1°C. ✧ Do not use the VFD when the ambient temperature exceeds 55°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. ✧ When the temperature is too low, if you want to use the product that has been idled for a long time, install an external heating device before the use to eliminate the freeze inside the product. Otherwise, the product may be damaged.
Relative humidity (RH)	✧ RH: less than 90% ✧ Condensation is not allowed. ✧ The max. RH cannot exceed 60% in the environment where there are corrosive gases.

Environment	Condition
Storage temperature	-30–+60.0°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 hazard gases and liquids ✧ With low salt content ✧ Without direct sunlight.
Altitude	✧ Lower than 1000 meters ✧ When the altitude exceeds 1000m, derate by 1% for every increase of 100m. ✧ When the installation site altitude exceeds 3000m, consult the local INVT dealer or office.
Vibration	Max. vibration ACC: 5.8m/s^2 (0.6g)
Installation direction	Install the VFD vertically to ensure good heat dissipation performance.

Note:

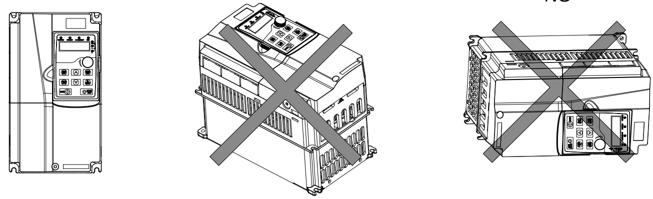
- The VFD must be installed in a clean and well-ventilated environment based on the housing IP rating.
- The cooling air must be clean enough and free from corrosive gases and conductive dust.

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.

OK NG NG



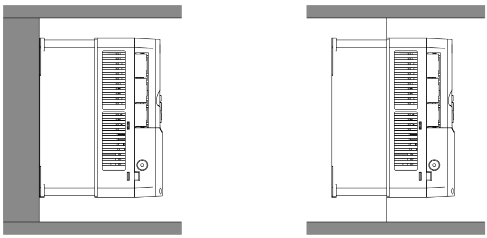
A. Vertical installation B. Horizontal installation C. Transverse installation

Figure 4-1 Installation direction

4.2.3 Mounting method

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

1. Wall-mounting: applicable to 380V 315kW and lower models.
2. Flange-mounting: applicable to 380V 200kW and lower models.
3. Floor-mounting: applicable to 380V 220–500kW models.



Wall-mounting Flange-mounting

Figure 4-2 Mounting method

Step 1 Mark the installation hole positions. For details about the installation hole positions, see Appendix D Dimension diagrams.

Step 2 Mount the screws or bolts onto the designated positions.

Step 3 Lean the VFD against the wall.

Step 4 Tighten the screws.

Note:

- When the flange mounting method is used, the (optional part) flange mounting plate is required for the 380V 30–75kW VFD models but not required for the 380V 90–200kW VFD models.
- The 380V 220–315kW VFD models support the (optional part) installation base, which can house an input AC reactor (or DC reactor) and an output AC reactor.

4.2.4 Installing one unit

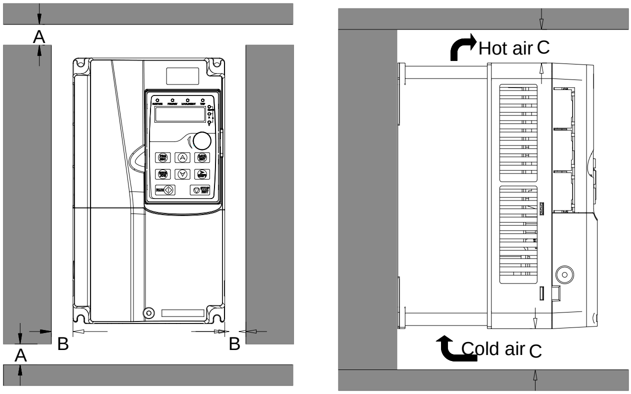


Figure 4-3 Single-unit installation

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

4.2.5 Multiple-VFD installation

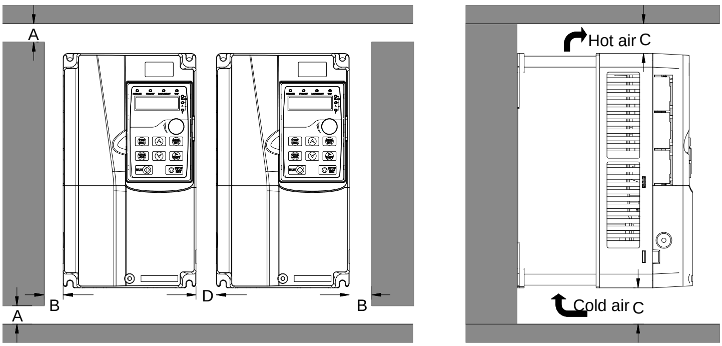


Figure 4-4 Parallel installation

Note:

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

4.2.6 Vertical installation

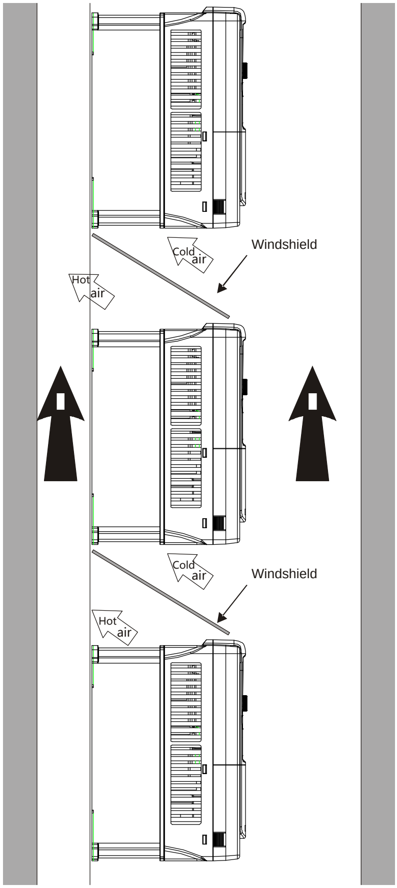


Figure 4-5 Vertical installation

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

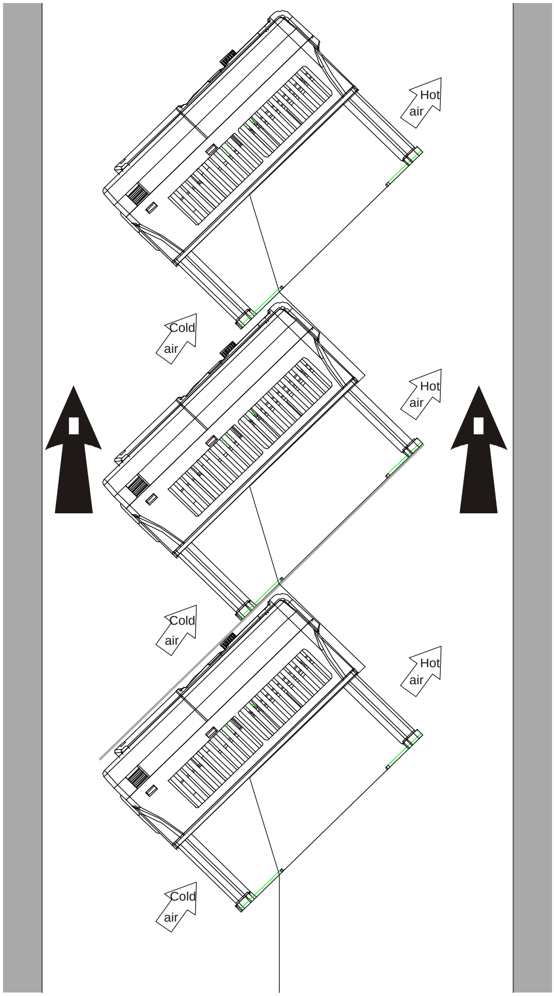


Figure 4-6 Tilted installation

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 Wiring diagram of the main circuit

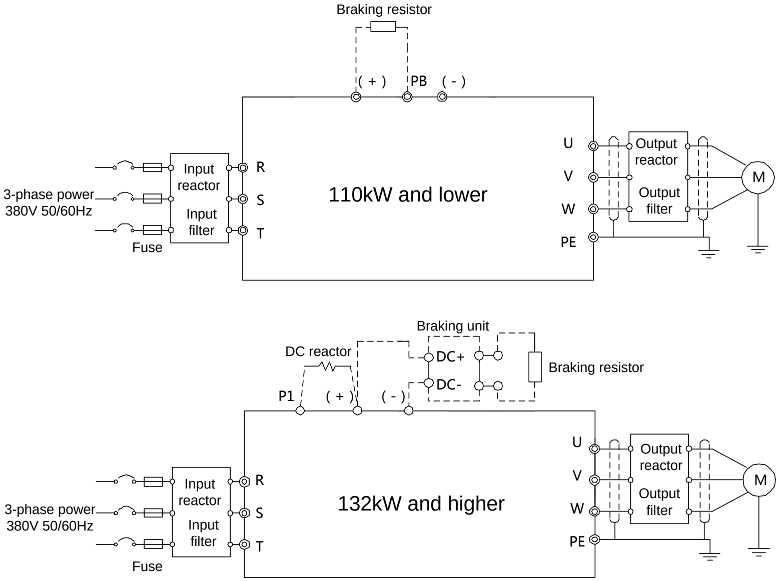


Figure 4-7 AC 3PH 380V–480V main circuit wiring

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 Optional peripheral accessories.
- P1 and (+) have been short connected by default for the 380V 132kW and higher VFD models. If you need to connect to an external DC reactor, take off the short-contact tag 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 380V 30kW–110kW VFD models are equipped with built-in braking units.

4.3.2 Main circuit terminal diagram

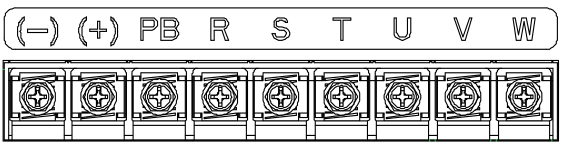


Figure 4-8 Main circuit terminal diagram for 3PH 380V 30–37kW

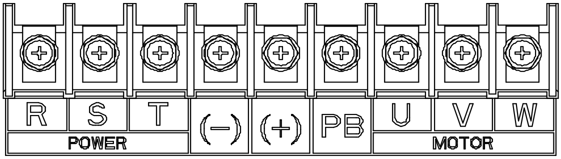


Figure 4-9 Main circuit terminal diagram for 3PH 380V 45–110kW

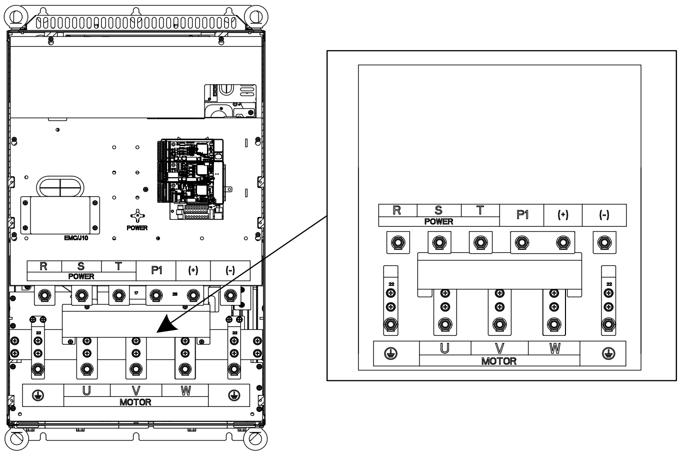


Figure 4-10 Main circuit terminal diagram for 380V 132–200kW

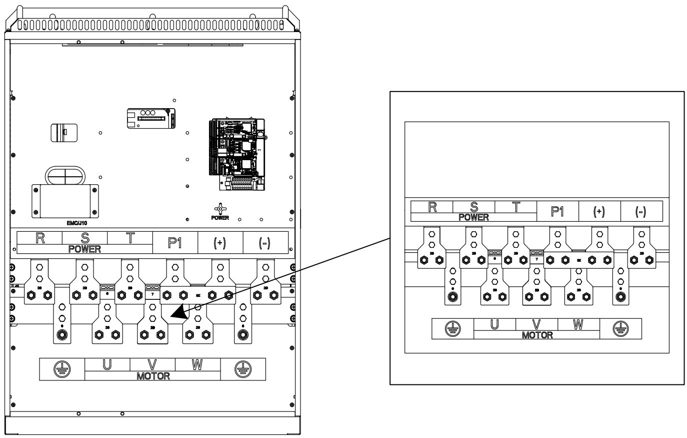


Figure 4-11 Main circuit terminal diagram for 380V 220–315kW

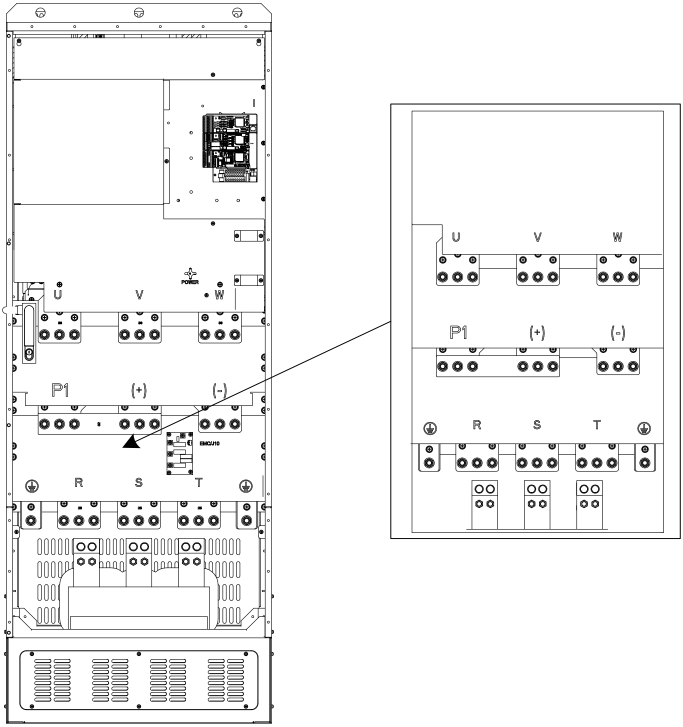


Figure 4-12 Main circuit terminal diagram for 380V 355–500kW

<table>
<tr><th rowspan="2">Terminal symbol</th><th colspan="3">Terminal name</th><th rowspan="2">Function description</th></tr>
<tr><th>380V 37kW and lower</th><th>380V 45–110kW (inclusive)</th><th>380V 132kW and higher</th></tr>
<tr><td>R, S, T</td><td colspan="3">Main circuit power input</td><td>3PH AC input terminals, connected to the grid</td></tr>
<tr><td>U, V, W</td><td colspan="3">VFD outputs</td><td>3PH AC output terminals, connected to the motor usually</td></tr>
<tr><td>P1</td><td>Not available</td><td>Not available</td><td>DC reactor terminal 1</td><td rowspan="3">P1 and (+) connect to the external DC reactor.
(+) and (-) connect to the external braking unit.
PB and (+) connect to external braking resistor terminal</td></tr>
<tr><td>(+)</td><td>Braking resistor terminal 1</td><td>Braking resistor terminal 1</td><td>1. DC reactor terminal
2. Braking unit terminal 1</td></tr>
<tr><td>(-)</td><td>/</td><td>/</td><td>Braking unit terminal 2</td></tr>
</table>

Terminal symbol	Terminal name			Function description
	380V 37kW and lower	380V 45–110kW (inclusive)	380V 132kW and higher	
PB	Braking resistor terminal 2	Braking resistor terminal 2	Not available	
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 inverter end and motor end.
- Braking resistor, braking unit and DC reactor are optional parts.
- Route the motor cable, input power cable and control cable separately.
- "Not available" means this terminal is not for external connection.

4.3.3 Wiring procedure for main circuit terminals

1. 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.
2. 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.
3. Connect optional parts such as the braking resistor that carries cables to designated positions.
4. Fasten all the cables outside the VFD mechanically if allowed.

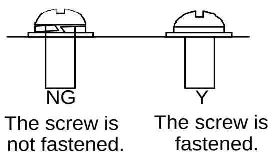


Figure 4-13 Screw installation diagram

4.4 Standard wiring of the control circuit

4.4.1 Wiring diagram of basic control circuit

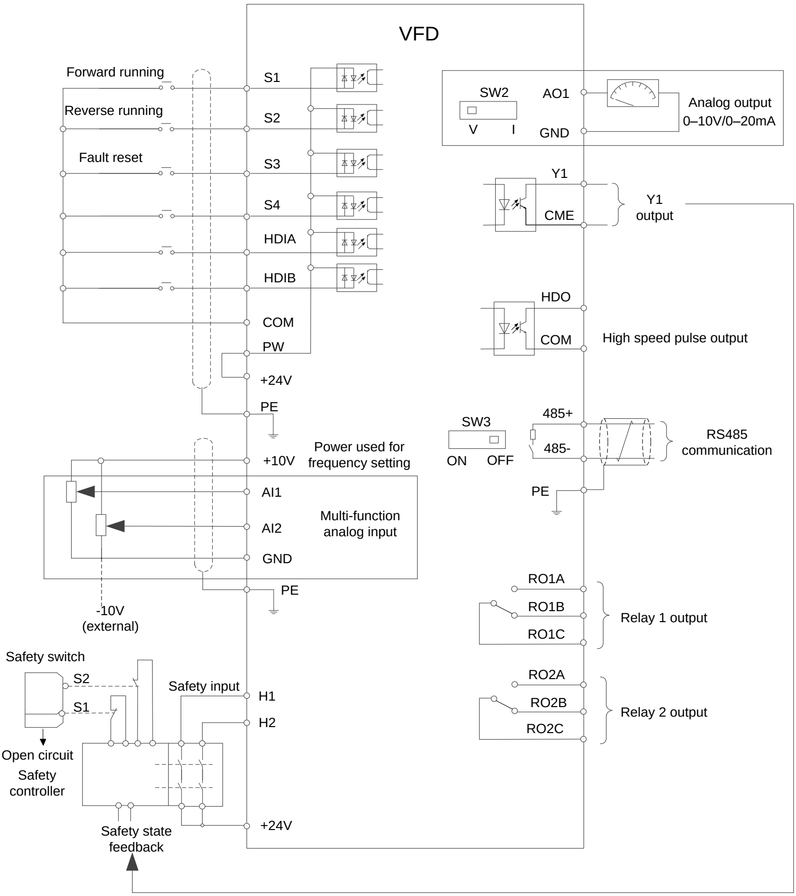


Table 4-1 Basic control circuit terminal description

Terminal name	Description
+10V	Locally provided +10.5V power supply
AI1	● Input range: For AI1, 0–10V or 0–20mA
AI2	● For AI2, -10V – +10V ● Input impedance: 20kΩ for voltage input or 250Ω for current input ● Whether voltage or current is used for input of AI1 is set through P05.50 ● Resolution: 5mV when 10V corresponds to 50Hz

Terminal name	Description	
	● Deviation: ±0.5% at 25°C, when input is above 5V/10mA.	
GND	+10.5V reference ground	
AO1	● Output range: 0–10V or 0–20mA ● Whether voltage or current is used for output is set through the DIP switch SW2 ● Deviation: ±0.5% at 25°C, when output is above 5V/10mA	
RO1A RO1B RO1C	RO1 output; RO1A: NO; RO1B: NC; RO1C: common Contact capacity: 3A/AC250V, 1A/DC30V	
RO2A RO2B RO2C	RO2 output; RO2A: NO; RO2B: NC; RO2C: common Contact capacity: 3A/AC250V, 1A/DC30V	
HDO	● Switch capacity: 200mA/30V ● Output frequency range: 0–50kHz ● Duty ratio: 50%	
COM	+24V reference ground	
CME	Common terminal of open collector output; short connected to COM by default	
Y1	Switch capacity: 200mA/30V Output frequency range: 0–1kHz	
485+ 485-	RS485 communication/differential signal port. The standard 485 communication interface should use shielded twisted pair; the 120ohm terminal matching resistor of RS485 communication is connected by toggle switch SW3.	
PE	Grounding terminal	
PW	External power input terminal for digital input circuits Voltage range: 12–30V	
+24V	User power supply provided by the VFD. Max. output current: 200mA	
S1	Digital input 1	● Internal impedance: 3.3kΩ ● 12–30V voltage input is acceptable ● Bi-direction input terminal, supporting both NPN and PNP ● Max. input frequency: 1kHz ● All are programmable digital input terminals, the functions of which can be set through function codes
S2	Digital input 2	
S3	Digital input 3	
S4	Digital input 4	
HDIA HDIB	In addition to S1–S4 functions, the terminals can also act as high frequency pulse input channels. Max. input frequency: 50kHz	

Terminal name	Description	
	Duty ratio: 30%–70% Supporting quadrature encoder input; with the 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. ● Safety input signal wires use shielded wires whose length is within 25m ● The H1 and H2 terminals are short connected to +24V by default. Remove the short connectors from the terminals before using STO function.
+24V—H2	STO input 2	

4.4.2 Input/output signal connection diagram

Set NPN /PNP mode and internal/external power via U-type short-contact tag. NPN internal mode is adopted by default.

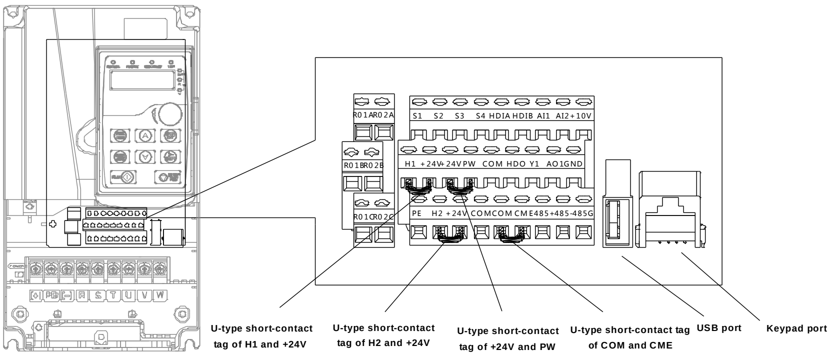


Figure 4-14 U-shaped jumper positions

Note: As shown in the figure above, 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.

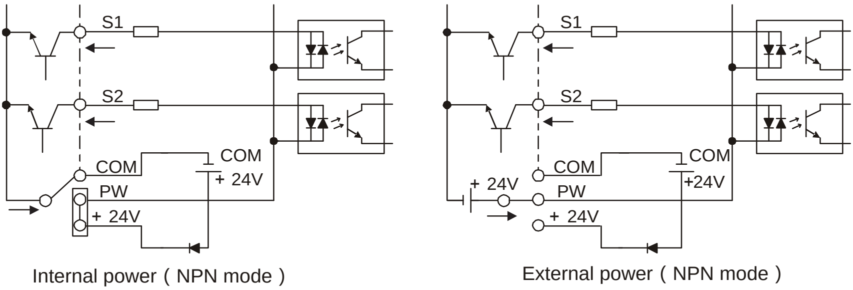


Figure 4-15 NPN mode

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

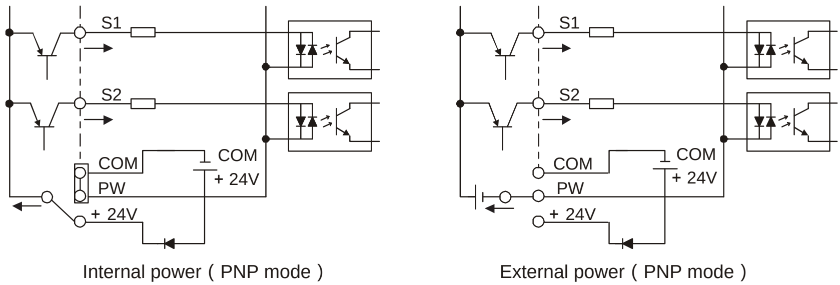


Figure 4-16 PNP mode

4.4.3 Control circuit wiring of I/O expansion card 2

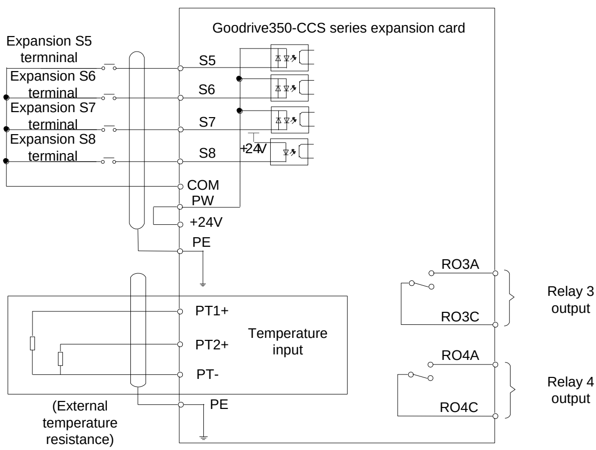


Figure 4-17 Control circuit wiring of I/O expansion card 2

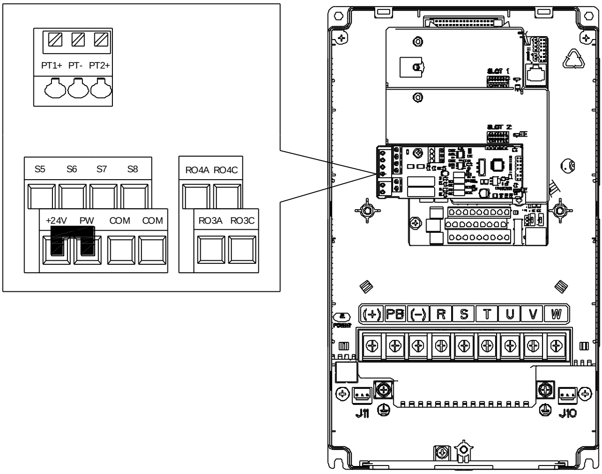


Figure 4-18 Terminal layout of I/O expansion card 2

<table>
<tr><th>Terminal name</th><th colspan="2">Description</th></tr>
<tr><td>PT1+</td><td colspan="2" rowspan="2">Independent PT100 and PT1000 inputs: PT1+ connects to PT100 resistor, while PT2+ connects to PT1000 resistor.
● Resolution: 1°C
● Range: -20°C–+150°C
● Detection precision: 3°C
● Supporting offline protection</td></tr>
<tr><td>PT2+</td></tr>
<tr><td>PT-</td><td colspan="2">Reference zero potential of PT100/PT1000</td></tr>
<tr><td>RO3A</td><td colspan="2" rowspan="2">RO3 output; RO3A: NO; RO3C: NC
Contact capacity: 3A/250VAC, 1A/30VDC</td></tr>
<tr><td>RO3C</td></tr>
<tr><td>RO4A</td><td colspan="2" rowspan="2">RO4 output. RO4A: NO; RO4C: NC
Contact capacity: 3A/250VAC, 1A/30VDC</td></tr>
<tr><td>RO4C</td></tr>
<tr><td>PW</td><td colspan="2">Used to provide input digital working power from the external to the internal
Voltage range: 24VDC(-20%)–48VDC(+10%), 24VAC(-10%)–48VAC(+10%)</td></tr>
<tr><td>+24V</td><td colspan="2">User power supply provided by the VFD. Max. output current: 200mA</td></tr>
<tr><td>COM</td><td colspan="2">Reference ground of +24V</td></tr>
<tr><td>S5</td><td>Digital input 5</td><td rowspan="3">● Internal impedance: 6.6kΩ
● Supporting the voltage input of external power (-20%)24–48VDC(+10%) and (-10%)24–48VAC(+10%)
● Supporting the internal power 24V
● Bi-direction input terminal, supporting both NPN and PNP
● Max. input frequency: 1kHz</td></tr>
<tr><td>S6</td><td>Digital input 6</td></tr>
<tr><td>S7</td><td>Digital input 7</td></tr>
</table>

Terminal name	Description	
		● All are programmable digital input terminals, the functions of which can be set through function codes
S8	Digital input 8	It supports PTC input, while PTC acts at 2.5kΩ. It supports internal pull-up of +24V, and it supports the input of only dry contacts sharing COM. The max. input frequency is 50Hz.

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.

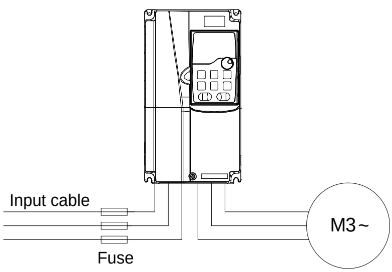


Figure 4-19 Fuse configuration

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 is able to protect the motor cable and motor during short circuit without other protective devices.

	✧ If the VFD is connected to multiple motors, use a 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 Commissioning guidelines

5.1 Lifting

In lifting mechanical equipment, mechanical braking is generally involved, which means that a motor can quickly stop rotation after the power supply to the motor is disconnected through the mechanical device. Mechanical braking is widely used in tower cranes, factory cranes, mining cranes, and port cranes, generally including electromagnetic braking and hydraulic braking.

In addition, there is special braking widely used in lifting equipment such as electric hoists and winches, and conical motors with the automatic braking capability at power outage.

This product has the built-in mechanical holding brake control logic function and conical motor control function.

5.1.1 Commissioning the mechanical holding brake function (P90.04=1)

The mechanical holding brake function indicates that the VFD takes account of mechanical holding brake action response time and drives and controls the mechanism holding brake through relays of control terminals so as to achieve stable control on brake release and closing.

The commissioning procedure for common holding brake is as follows:

Step 1 Set P90.04 to 1 to enable the brake function.

Step 2 Set relay brake output. If RO1 is connected to the braking contactor, set P06.03 to 49.

If the brake contactor has the feedback function, connect the brake feedback wire to an input terminal, for example, S6. reverse brake closing (T7), and delay after reverse brake closing (T8) are set to 0, the delay parameters for forwarding running are used.

Step 3 T1, T5, T3, and T7 are usually set to 0 (default value).

- T2, T6, T4, and T8 are related to the mechanical holding brake action time. For electromagnetic holding brake, the time is generally in the range of 0.200–0.400s; for hydraulic holding brake, the time is generally in the range of 0.300–1.000s. The time needs to be adjusted according to the actual situation.
- In closed loop vector control mode, the holding brake release frequency is generally in the range of 0.20–0.50Hz, and the brake closing frequency is 0.00Hz.
- For open loop vector and space voltage vector control modes, see subsequent parameter settings.

Step 4 Then set P25.02 to 75 indicating brake feedback signal. Set P90.31 to 1 to enable brake feedback detection. In closed-loop mode, the brake current monitoring function is enabled automatically. If a brake exception occurs, a protection method is applied depending on the present current and the value of P90.34. Skip this step if the braking contactor has no feedback function.

Step 5 Set the torque verification value during brake release to ensure there is enough torque before the brake is opened.

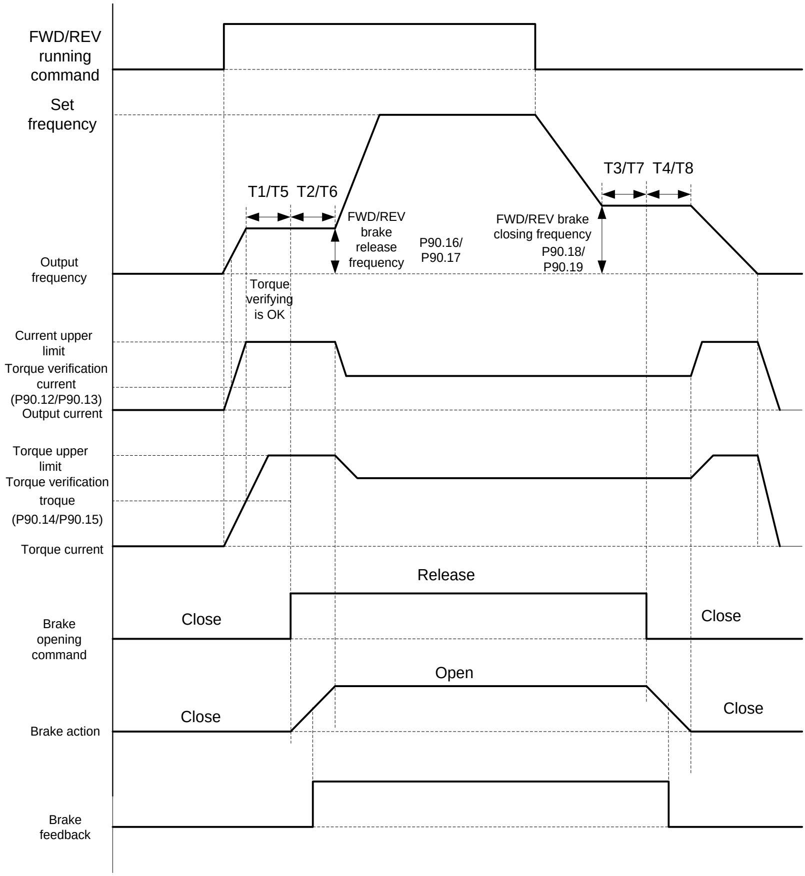
- In open-loop or closed-loop vector control mode, usually set P90.14 (Forward holding brake release torque) and P90.15 (Reverse holding brake release torque).

- In space voltage vector control mode, usually set P90.12 (Forward holding brake release current) and P90.13 (Reverse holding brake release current).

Step 6 Set the brake timing, including the forward/reverse brake release frequency, forward/reverse brake closing frequency, delay before forward brake release (T1), delay before reverse brake release (T5), delay after forward brake release (T2), delay after reverse brake release (T6), delay before forward brake closing (T3), delay before reverse brake closing (T7), delay after forward brake closing (T4), and delay after reverse brake closing (T8).

Note: If delay before reverse brake release (T5), delay after reverse brake release (T6), delay before

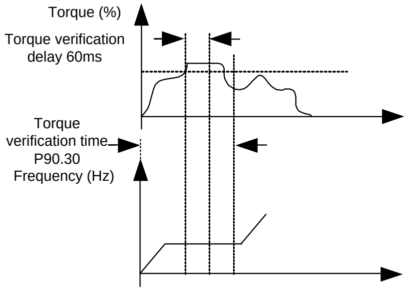
Perform trial run and check whether the holding brake timing is correct.



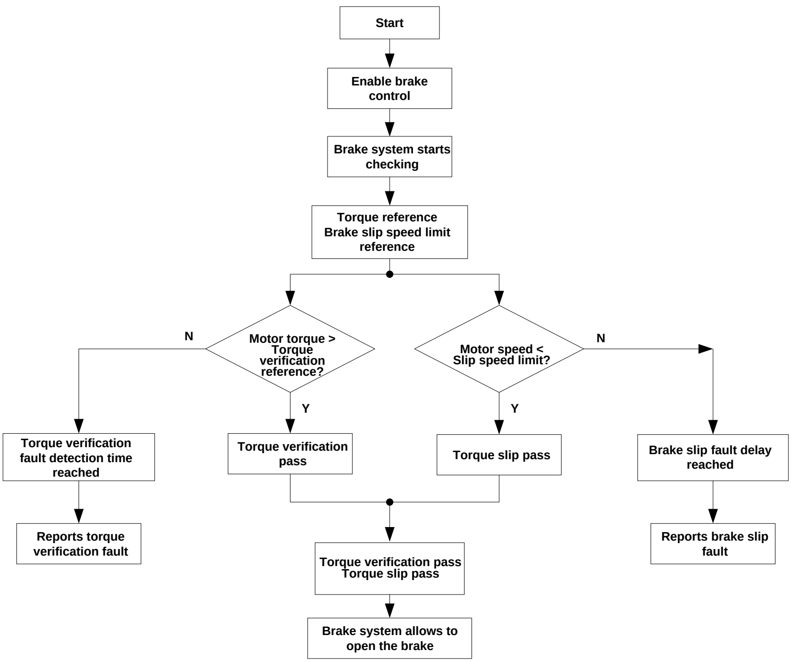
T1: Delay before forward brake release P90.20 T3: Delay before forward brake closing P90.24
T2: Delay after forward brake release P90.22 T4: Delay after forward brake closing P90.26
T5: Delay before reverse brake release P90.21 T7: Delay before reverse brake closing P90.25
T6: Delay after reverse brake release P90.23 T8: Delay after reverse brake closing P90.27

5.1.1.1 Description about torque verification and brake slip

After the VFD runs, the VFD output current or torque is checked before the brake release. If the VFD output current or torque is greater than the output current or torque setting (P90.12 or P90.15) and the situation lasts 60ms, torque verification succeeds. If torque verification does not pass after the torque verification time P90.30 is reached, the torque verification fault tPF is reported.



In closed-loop mode, if the brake slip fault delay P93.01 is greater than 0, the brake slip detection function is enabled. During torque verification, if the motor (encoder) speed is close to the brake release frequency and the situation duration exceeds P93.01, the brake failure fault bE is reported. The torque verification and holding brake slip flowchart is as follows:



5.1.1.2 Holding brake parameters in speed mode

Holding brake control generally refers to holding brake control in speed mode, or at least one working condition is holding brake in speed mode. The main relevant parameters are listed in the following.

Function code	Name	Description	Default
P90.04	Enabling brake-oriented logic	0–1 0: The brake is controlled by an external controller. 1: Braking is controlled by VFD	0
P90.05	Enabling forward torque for reverse-running start/stop	0x00–0x11 Ones place: indicates whether to enable forward torque for reverse-running start 0: Disable (The reverse-running start direction complies with the command.) 1: Enable (The reverse-running start direction is always the forward-running direction.) Tens place: indicates whether to enable forward torque for reverse-running stop 0: Disable (The reverse-running stop direction complies with the command.) 1: Enable (The reverse-running stop direction is always the forward-running direction.)	0x00
P90.12	Forward brake release current	0.0–200.0% (of the motor rated current)	0.0%
P90.13	Reverse braking/releasing current	0.0–200.0% (of the motor rated current)	0.0%
P90.14	Forward brake release torque	0.0–200.0% (of the motor rated torque)	0.0%
P90.15	Reverse brake release torque	0.0–200.0% (of the motor rated torque)	0.0%
P90.16	Forward brake release frequency	0.00–20.00Hz	3.00Hz
P90.17	Reverse brake release frequency	0.00–20.00Hz	3.00Hz
P90.18	Forward brake closing	0.00–20.00Hz	3.00Hz

Function code	Name	Description	Default
	frequency		
P90.19	Reverse brake closing frequency	0.00–20.00Hz	3.00Hz
P90.20	Delay before forward brake release	0.000–5.000s	0.300s
P90.21	Delay before reverse brake release	0.000–5.000s If set it to 0, the delay time before forward brake releasing is used.	0.000s
P90.22	Delay after forward brake release	0.000–5.000s	0.300s
P90.23	Delay after reverse brake release	0.000–5.000s If set it to 0, the delay time after forward brake releasing is used.	0.000s
P90.24	Delay before forward brake closing	0.000–5.000s	0.300s
P90.25	Delay before reverse brake closing	0.000–5.000s If set it to 0, the delay time before forward switch-on is used.	0.000s
P90.26	Delay after forward brake closing	0.000–5.000s	0.300s
P90.27	Delay after reverse brake closing	0.000–5.000s If set it to 0, the delay time after forward switch-on is used.	0.000s
P90.28	Maintenance frequency for stop	0.00–50.00Hz	5.00Hz
P90.29	Maintenance frequency hold time for stop	0.00–5.000s	0.000s
P90.30	Torque verification fault detection time	0.00–10.000s	6.000s
P90.31	Enabling the monitoring on brake status	0–1 0: Disable 1: Enable the brake current monitoring (and brake feedback detection).	0
P90.32	Brake feedback exception delay (brake feedback detection time)	0.00–20.000s	1.000s
P90.33	Brake monitoring current	0.0%–200.0%	100.0%

Function code	Name	Description	Default
	threshold	100.0% refers to the motor rated current	
P90.34	Enabling speed reference under brake status error	0–1 0: Disable (The brake feedback fault is reported.) 1: Enable (The brake feedback alarm is also reported.)	0
P90.35	Speed reference under brake status error	0.00–50.00Hz	5.00Hz
P90.37	Brake selection for forward/reverse switchover	0–1 0: No switchover 1: Switchover	0
P93.01	Brake slip fault delay	0.000–5.000s When it is 0, the brake slip is not detected. When it is not 0, the brake slip detection is enabled.	0.500s

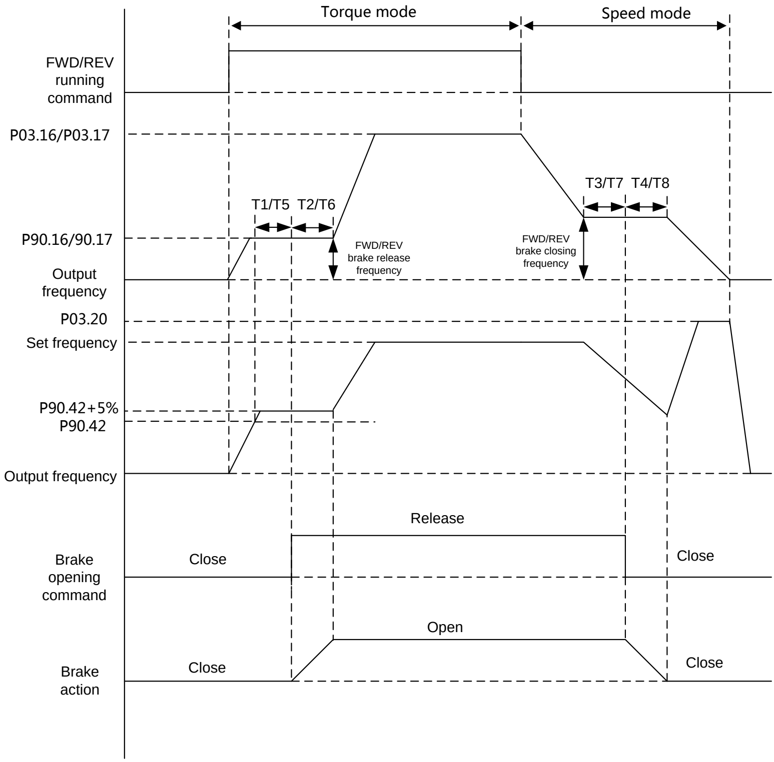
5.1.1.3 Commissioning brake in torque control

In vector control, after the torque mode is enabled (P03.32=1) and holding brake control is enabled (P90.04=1), the holding brake in torque mode is enabled.

Brake release start timing:

1. Before brake release, the torque frequency upper limit in forward/reverse rotation equals the holding brake release frequency reference in forward/reverse rotation, and the set torque equals P90.42+5.0%.
2. If the detected output torque is greater than or equal to the preset brake opening torque value (P90.42), the delay before brake release starts. When the delay time reaches, the release output is carried out, and then the delay after brake release starts. When the delay time reaches, it indicates that the release timing ends.
3. After brake release, the set torque returns to normal and the frequency upper limit of forward/reverse rotation in torque mode returns to normal. This is, the parameters in group P03 determines that the VFD runs in normal torque mode.

Brake closing timing for stop: The VFD automatically switches from the torque mode to the speed mode and then decelerates to stop. Then the holding brake logic can directly use the brake closing logic in the speed mode. The holding brake timing diagram is as follows:



T1: Delay before forward brake release P90.20
T2: Delay after forward brake release P90.22
T5: Delay before reverse brake release P90.21
T6: Delay after reverse brake release P90.23
T3: Delay before forward brake closing P90.24
T4: Delay after forward brake closing P90.26
T7: Delay before reverse brake closing P90.25
T8: Delay after reverse brake closing P90.27

For details about torque control function code settings, see P03.11–P03.17 and P03.32.

The parameters that are different from those in holding brake in speed mode are listed in the following.

Function code	Name	Description	Setting
P90.41	Brake release/closing torque limit in vector control	Setting range: 0.0–300.0% (of the motor rated current) During the vector control in speed mode, the torque amplitude is limited within the delay	250.0%

Function code	Name	Description	Setting
		time before brake release, after brake release, before brake closing, or after brake closing.	
P90.42	Torque setting for brake release	0.0–200.0% During running, when the torque feedback value is greater than or equal to P90.42, it enters the brake release timing. (It is valid only when P90.04=1, which indicates the brake is controlled by the VFD, and the VFD uses the torque mode.)	50.0%

Note: You need to set a reasonable torque limit for P90.41 according to the actual situation to prevent speed overshoot after brake release.

5.1.1.4 Commissioning brake in position mode

Holding brake control is supported in digital positioning mode. See the following procedure:

Step 1 Select digital positioning (P21.00 tens place =1) or select "51: Terminal for switching between position control and speed control" for the S terminal function; set other related parameters P21.16–P21.21 for digital positioning.

Step 2 Enable holding brake control (P90.04=1). If RO1 is connected to the holding brake contactor, set P06.03 to 49.

Step 3 Set brake release/closing logic related parameters.

- Brake release start timing:

Before brake release, the system will detect whether the present output current is greater than P21.47 (Brake release current in position control). If yes, a delay before brake release starts. When the delay time reaches, the brake release output is carried out. At the same time, the 0Hz operation will be carried and a delay after brake release starts. When the delay time reaches, the brake release timing ends and normal positioning work begins.

- Brake closing timing for stop:

During stop, the VFD automatically switches from the position mode to the speed mode and then decelerates to stop. Then the brake logic uses the brake closing logic in the speed mode.

Step 4 By setting P21.17 (Position set in digital mode) and starting the VFD, you can debug whether the brake release/closing meets the timing and position requirements. Afterwards, switch to the position set in communication mode and start debugging.

Main parameters are listed in the following.

Function code	Name	Description	Setting
P01.01	Starting frequency of direct start	0.00–50.00Hz	0.00Hz
P01.15	Stop speed	0.00–100.00Hz	0.00Hz
P01.24	Stop speed delay	0.0–600.0s	0.3s
P21.00	Positioning mode	Ones place: Control mode selection 0: Speed control 1: Position control Tens place: Position command source 0: Pulse train 1: Digital position 2: Positioning of photoelectric switch during stop Hundred place: Position feedback source 0: Pulses of channel P of the PG1 1: Pulses of channel F of the PG1 2: Pulses of channel P of the PG2 3: SSI signal of the PG2	0x0011
P21.16	Digital positioning mode	0x0000–0xFFFF Bit0: Reserved Bit1: Positioning cycle selection 0: Terminal-based cyclic positioning; 1: Automatic cyclic positioning Bit2: Reserved Bit3: P21.17 digital setting mode 0: Incremental; 1: Position Bit4–bit5: Reserved Bit6: Positioning completion signal selection 0: Valid in the positioning completion signal holding time (P21.25); 1: Always valid Bit7: Reserved Bit8: Positioning enable signal selection 0: Pulse signal; 1: Electrical level signal Bit9: Position source 0: PROFIBUS/CANopen/EtherCAT	0x5042 or 0x184A

Function code	Name	Description	Setting
		communication (when P21.17=0) or P21.17 (P21.17≠0); 1: Reserved Bit10: Reserved Bit11: Indicates whether to save incremental position during power outage 0: Don not save; 1: Save Bit12–bit13: Positioning curve selection 0: Straight line; 1: S curve; 2–3: Reserved Bit14: Indicates whether to keep 0Hz output within the time specified by P21.25 after positioning completes. 0: Don not keep; 1: Keep Bit15: Calculation insertion/interrupt selection during positioning 0: Do not support changing the target speed or position. 1: Support changing the target speed or position.	
P21.17	Position set in digital mode	0–65535 (Unit: tenfold)	0
P21.18	Positioning speed setting	0: Set by P21.19 1: AI1 2: AI2 3: AI3 4: High-speed pulse HDIA 5: High-speed pulse HDIB 6: EtherCAT communication	0
P21.19	Positioning speed set in digital mode	0.0–100.0% (of the max. frequency)	20.0%
P21.20	Positioning ACC time	0.01–30.00s (of the max. frequency)	3.00s
P21.21	Positioning DEC time	0.01–30.00s (of the max. frequency)	3.00s
P21.47	Brake release current in position control	0.0–200.0%	25.0%
P90.00	Logic special for holding brake	0–1	1

Function code	Name	Description	Setting
P90.18	Forward brake closing frequency	0.00–20.00Hz	0.00Hz
P90.19	Reverse brake closing frequency	0.00–20.00Hz	0.00Hz
P90.22	Delay after forward brake release	0.000–5.000s	0.300s
P90.26	Delay after forward brake closing	0.000–5.000s	0.300s

Generally, for single incremental positioning, P21.16 is set to 0x5042; for positional positioning, P21.16 is set to 0x184A.

5.1.1.5 Commissioning master/slave holding brake synchronization control (for winches)

In master/slave mode, if you need to perform brake release/closing for both the master and slave, refer to the following procedure:

Step 1 Set P90.04 to 1 on both the master and slave to enable the holding brake function for the master and slave.

Step 2 Set P28.00=1 for the master and P28.00=2 for the slave, and set P28.02 to select a master/slave mode.

Step 3 Set P28.14 to 0x11 to enable the master/slave holding brake synchronization function for the master and slave.

Step 4 Set relay holding brake output for the master and slave. If RO1 is connected to the holding brake contactor, set P06.03 to 49.

Step 5 Set the delay before forward brake closing and delay before reverse brake closing to 0 (that is, P90.24=0 and P90.25=0) for the master and slave.

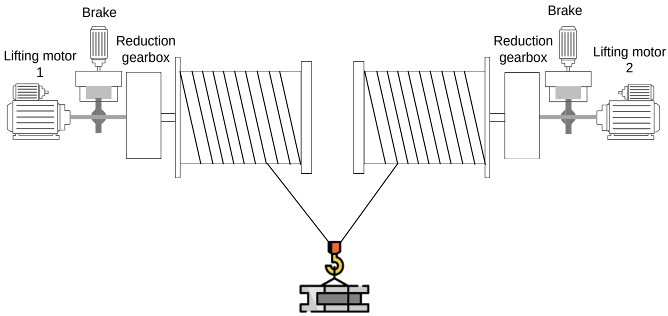
Step 6 For other holding brake parameters, see section 5.1.1.2 Holding brake parameters in speed mode–5.1.1.3 Commissioning brake in torque control. For other master/slave control parameters, see section 5.4 Master/slave control.

Step 7 Perform trial run and check whether the holding brake timing is correct.

Note:

- In master/slave mode, you need to set the delay before forward brake closing and delay before reverse brake closing to 0; otherwise the master and slave will not synchronize.
- In situations where the master and slave are rigidly connected, the holding brake can be controlled only by the master, and the master/slave holding brake synchronization control can be disabled (for the master and slave, P28.14=0x00), while the holding brake logic of the slave is not

activated (P90.04=1 for the master, and P90.04=0 for the slave).



Master/slave holding brake synchronization control requires the following additional function codes to be set.

Function code	Name	Description	Setting
P28.00	Master/slave mode	0: Master/slave control is invalid. 1: The local device is the master. 2: The local device is the slave.	Slave: 1 Slave: 2
P28.02	Master/slave control mode	0: Master/slave mode 0 1: Master/slave mode 1 2: Master/slave mode 2 3: Master/slave mode 3	For details, see section 5.5 Motor and macro switchover.
P28.14	Master/slave holding brake synchronization control	0x00–0x11 Ones place: brake release synchronization 0: Invalid 1: Valid Tens place: brake closing synchronization 0: Invalid 1: Valid	0x11

5.1.2 Commissioning steel wire rope (such as in a tower crane) lifting applications

5.1.2.1 Common wiring

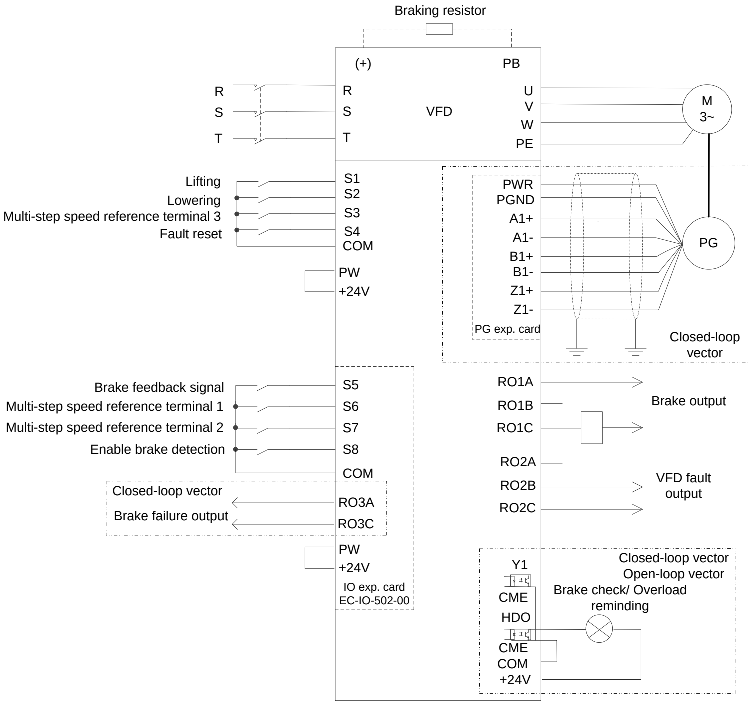


Figure 5-1 Wiring for lifting

Note: If the wiring is performed according to Figure 5-1, most VFD parameters need no adjustment. If the onsite function terminals are inconsistent with the terminals shown in the figure, adjust the input and output terminal functions according to the actual wiring after selecting this application macro (P90.00=1, 2, or 9).

5.1.2.2 Commissioning procedure

Step 1 Check the wiring and ensure the wiring is proper.

Step 2 Set P00.18=1 to restore to default settings.

Step 3 Set motor nameplate parameters in P02.

Step 4 Set P00.15=2. When the keypad displays "-ΓUN-". Press the RUN key to perform static autotuning.

Step 5 Set P90.00=1, set the encoder type parameter P20.00, set the pulse per resolution (PPR) parameter P20.01. Perform low-speed upward running. Check the value of P18.00. If the value is negative, the encoder direction is reversed. Then you only need to set

P20.02=0x001.

Step 6 Set P90.00=2 to select the closed-loop vector controlled lifting application macro.

Step 7 Perform low-speed trial run.

5.1.2.3 Macro parameters (P90.00=2)

Function code	Name	Setting	Remarks
P00.00	Speed control mode	3	Closed-loop vector control mode
P00.01	Channel of running commands	1	Terminal
P00.03	Max. output frequency	100.00Hz	/
P00.04	Upper limit of running frequency	100.00Hz	/
P00.06	Setting channel of A frequency command	6	Multi-step speed running
P00.11	ACC time 1	6.0s	/
P00.12	DEC time 1	4.0s	/
P01.01	Starting frequency of direct start	0.00Hz	/
P01.15	Stop speed	0.10Hz	/
P01.24	Stop speed delay	1.0s	/
P03.00	Speed-loop proportional gain 1	30.0	/
P03.01	Speed-loop integral time 1	0.100s	/
P03.06	Speed loop output filter	1	/
P03.10	Current-loop integral coefficient I	3500	/
P05.03	Function of S3	18	Multi-step speed 3
P05.04	Function of S4	7	Fault reset
P06.03	RO1 output	49	Brake output
P08.28	Auto fault reset count	1	/
P10.02	Multi-step speed 0	3.0%	/
P10.04	Multi-step speed 1	8.0%	/
P10.06	Multi-step speed 2	33.0%	/
P10.08	Multi-step speed 3	50.0%	/
P10.10	Multi-step speed 4	70.0%	/
P10.12	Multi-step speed 5	90.0%	/
P10.14	Multi-step speed 6	0.6%	Slow speed at 0.6Hz
P10.16	Multi-step speed 7	2.0%	Slow speed at 2.0Hz
P11.08	Pre-alarm selection for VFD/motor OL/UL	0x021	Enable underload protection to enhance equipment safety. (Common functions for tower cranes need to be set based on requirements.)
P11.11	Underload pre-alarm detection threshold	1%	
P11.12	Underload pre-alarm detection	1.00s	

Function code	Name	Setting	Remarks
	time		
P11.14	Speed deviation detection value	20.0%	/
P23.15	Enabling PI parameter switchover for start/stop in vector mode	1	Enable
P25.01	Function of S5	75	Brake feedback signal
P25.02	Function of S6	16	Multi-step speed 1
P25.03	Function of S7	17	Multi-step speed 2
P25.04	Function of S8	85	Enable brake detection
P25.10	Expansion card input terminal polarity	0x01	/
P26.04	RO3 output	57	Brake failure alarm
P90.04	Enabling brake-oriented logic	1	The brake is controlled by the VFD.
P90.14	Forward brake release torque	30.0%	Corresponding to the motor rated torque
P90.15	Reverse brake release torque	20.0%	Corresponding to the motor rated torque
P90.16	Forward brake release frequency	0.40Hz	/
P90.17	Reverse brake release frequency	0.40Hz	/
P90.18	Forward brake closing frequency	0.20Hz	/
P90.19	Reverse brake closing frequency	0.20Hz	/
P90.20	Delay before forward brake release	0.100s	/
P90.30	Torque verification fault detection time	2.000s	/
P90.31	Enabling the monitoring on brake status	1	Enable the brake current monitoring (and brake feedback detection).
P91.08	Light/heavy load speed regulation selection	3	Stepped speed limit (Common functions for tower cranes need to be set based on requirements.)
P91.18	Load limit T1 in stepped speed limit upward running	65.0%	
P91.19	Restricted frequency f1 in stepped speed limit upward running	55.00Hz	
P91.20	Load limit T2 in stepped speed limit upward running	40.0%	
P91.21	Restricted frequency f2 in	75.00Hz	

Function code	Name	Setting	Remarks
	stepped speed limit upward running		
P91.26	Load limit T1 in stepped speed limit downward running	50.0%	
P91.28	Load limit T2 in stepped speed limit downward running	45.0%	
P91.29	Restricted frequency f2 in stepped speed limit downward running	70.00Hz	
P93.02	Zero servo protection mode	1	Zero servo input slows down.

5.1.2.4 Points for attention

1. If you only want to check whether the VFD runs properly, set P90.00 to 0 (Common mode). When you perform the test without connecting to a motor, to make the output frequency equal the set frequency, set P00.00=2 (Space voltage vector control mode).
2. If you perform empty-load commissioning, set P90.00 to 1 (Lifting in open-loop vector control), set P11.08 to 0x000 (to shield the underload protection function), and set P90.14 and P90.15 to 0 to prevent the torque verification fault reporting caused by empty load. In addition, if no external braking resistor is connected, you need to increase the ACC/DEC time to prevent the bus overvoltage fault reporting caused by too fast stop.
3. If there is a brake feedback signal, set P25.01 to 75, and the macro has set this parameter by default. In addition, set P90.31 to 1. If there is no brake feedback signal, set P90.31 to 0 to prevent the misreporting of a brake feedback fault.
4. During onsite commissioning, if the VFD terminal signal upward/downward running command is inconsistent with the load lifting/lowering direction, adjust any two phase sequences of VFD output terminals U, V, and W.
5. If PLC control is used, speed signal and other input and output signal functions need to be adjusted according to the actual control logic.
6. This macro can meet the requirements of most lifting application cases, and the performance parameters have been optimized and do not need to be adjusted in most cases. If an exception occurs, see the function parameter chapter for adjustment or contact the technical support.

5.1.2.5 Macro parameters (P90.01=1)

According to the closed-loop vector control parameter table, you can switch to the open loop vector control by modifying the following parameters or setting P90.00=1.

Function code	Name	Setting	Remarks
P00.00	Speed control mode	1	Sensorless vector control (SVC) mode 1
P01.01	Starting frequency of direct start	1.00Hz	/
P01.15	Stop speed	1.50 Hz	/
P10.02	Multi-step speed 0	0.0%	/
P10.14	Multi-step speed 6	0.0%	/
P10.16	Multi-step speed 7	0.0%	/
P11.11	Underload pre-alarm detection threshold	10%	/
P23.15	Enabling PI parameter switchover for start/stop in vector mode	0	Disable
P26.04	RO3 output	0	Invalid
P90.14	Forward brake release torque	40.0%	Corresponding to the motor rated torque
P90.15	Reverse brake release torque	30.0%	Corresponding to the motor rated torque
P90.16	Forward brake release frequency	2.50Hz	/
P90.17	Reverse brake release frequency	2.50Hz	/
P90.18	Forward brake closing frequency	1.50Hz	/
P90.19	Reverse brake closing frequency	0.20Hz	/
P90.20	Delay before forward brake release	0.000s	/
P90.30	Torque verification fault detection time	6.000s	/
P91.08	Light load speed boost function selection	2	Constant power speed limit (Common functions for tower cranes need to be set based on requirements.)
P93.02	Zero servo protection mode	0	Disable zero servo

Note: Some parameters are consistent with the closed-loop vector application macro, and this macro table only lists inconsistencies.

5.1.2.6 Switching between closed-loop vector control lifting macro parameters and open-loop vector control lifting parameters

In closed-loop vector control, if an encoder exception occurs, you can switch closed-loop vector application macro parameters to open-loop vector application macro parameters through terminals or communication. The quick application macro parameter switchover can be performed as follows:

Step 1 Set P90.00=2 (Lifting in closed-loop vector control), and set P90.01=1 (Lifting in open-loop vector control).

Step 2 Set P90.03=5 (Switch to SVC1 control.

Step 3 Set S terminal function 62 to SVC1.

When the S terminal is invalid, the motor uses P90.00=2; when the S terminal is valid, the motor uses P90.01=1.

5.1.2.7 Snail speed

Some operating consoles have a snail speed function. If you need to use the function, perform the commissioning as follows:

Step 1 Perform wiring according to the snail speed terminal description on the operating console.

Step 2 Determine the multi-step speed corresponding to the snail speed function, and set the running frequency corresponding to the multi-step speed.

Note: The snail speed frequency must be higher than the brake release frequency.

5.1.3 Zero servo

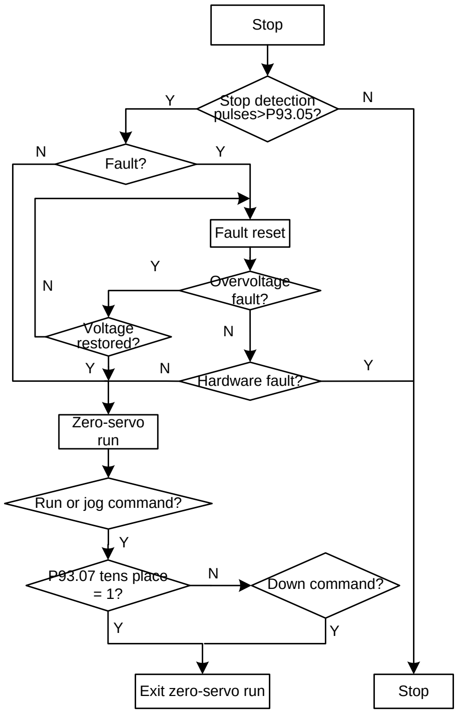
5.1.3.1 Zero servo function description

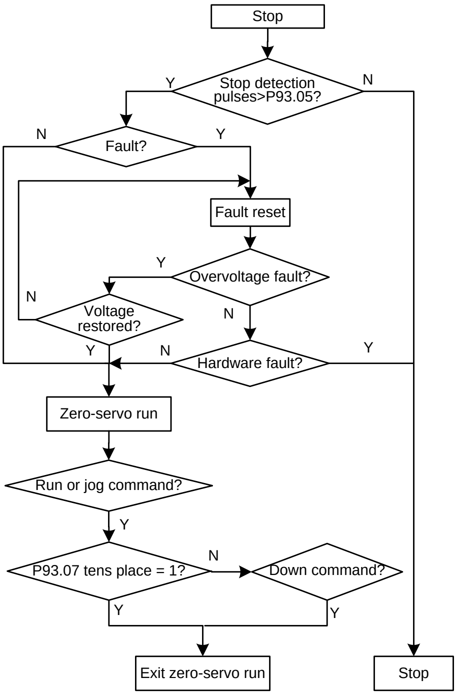
The zero servo function needs to be used in closed-loop vector control. During stop, the VFD checks whether the pulse value is greater than P93.05. If yes, the VFD reports the holding brake failure alarm A-bS, and the alarm can be configured with relay action output.

After reporting A-bS, it selects an action according to the ones place of P93.02 after the delay time specified by P93.06 (if the pulse value during this period is greater than 3 times the value specified by P93.05, this delay time is skipped:

- If P93.02 ones place=1, the motor runs down slowly at the frequency specified by P93.03, after the time specified by P93.04 elapses, the motor coasts to stop and performs detection again. This process will be repeated.
- If P93.02 ones place=2, the motor keeps zero speed running. This mode makes the motor locked at the positioning function in stopped state. This means even if the motor is subjected to external forces, the VFD keeps the motor unmoved and the load stopped at the position where it stops.
- If P93.02 ones place=3, the motor keeps zero speed running for a period specified by P93.07, and later it automatically switches to the zero speed slow lowering down mode.

When the motor runs in zero serve state, it can choose whether to exit according to the tens place value of P93.02.


Stop
Stop detection pulses>P93.05?
Y
N
Fault?
N
Y
Fault reset
Overvoltage fault?
Y
N
Voltage restored?
N
Y
Hardware fault?
N
Y
Zero-servo run
Run or jog command?
Y
P93.07 tens place = 1?
N
Down command?
Y
Y
Exit zero-servo run
Stop



Note:

- At certain faults that cannot be reset, such as VFD internal hardware damaged, zero servo cannot be entered. At the faults that can be reset, with zero servo conditions met, zero servo can be entered.
- Every time zero servo is exited, torque verification is not performed only at the first running command giving, which means the verification is performed at all the following running command giving.
- When P93.02 ones place=2, the motor becomes hot, the fan cannot be mounted at the same shaft as the motor, and it must be independently controlled.

The following faults cannot be reset:

Fault code	Fault type	Fault code	Fault type
OUt1	Inverter unit U-phase protection	ETH1	To-ground short-circuit fault 1
OUt2	Inverter unit V-phase protection	ETH2	To-ground short-circuit fault 2
OUt3	Inverter unit W-phase protection	STO	Safe torque off
UV	Bus undervoltage fault	STL1	Exception occurred to safe circuit of channel 1

Fault code	Fault type	Fault code	Fault type
SPI	Phase loss on input side	STL2	Exception occurred to safe circuit of channel 2
SPO	Phase loss on output side	STL3	Exception occurred to channel 1 and channel 2
OH1	Rectifier module overheating	OT	Motor over-temperature fault
OH2	Inverter module overheating	dIS	VFD disabled
EF	External fault	AdE	Analog speed reference deviation fault
ItE	Current detection fault	OtE1	PT100 overtemperature fault
bCE	Braking unit/ resistor fault	OtE2	PT1000 overtemperature fault

After determining the hook slip protection distance, you can calculate the encoder pulses specified by P93.05 corresponding to the distance. The calculation principle is similar to that for height measuring in section 5.1.4 Height measuring. The formula is as follows.

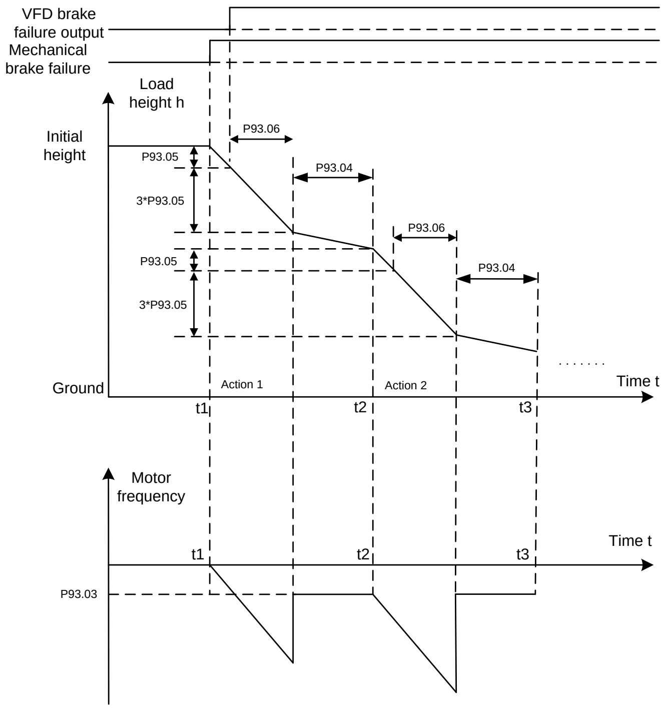
Zero servo tolerance pulse threshold = (Hook slip protection distance) * (Encoder PPR) * (Motor drum DEC ratio) * (Pulley set suspension ratio) / (π *Drum diameter)

In extreme cases (if the value of pulse change during zero servo determination is greater than 3 times P93.05, P93.06 is skipped directly), the zero servo is triggered until the actual slippage is 4 times the slip protection distance. If P93.06 is set to 0, zero servo is triggered at the hook slip protection distance. In other cases, zero servo is triggered at one to fourfold hook slip protection distance. At this time, the load falling speed is as follows:

$$\text{Load falling speed} = \sqrt{2g * \text{Actual hook slip distance}}$$

Example: Zero servo slow lowering mode (P93.02 ones place=1)

Slow lowering action period in this mode = Zero servo action taking delay process (coasting to stop) + Slow lowering (controlled run)



5.1.3.2 Zero servo function codes

Function code	Name	Description	Setting
P00.00	Speed control mode	3: Closed-loop vector control mode	3
P93.02	Zero servo protection mode selection and exit selection	0x00–0x23 Ones place: Zero servo protection mode selection 0: Disable zero servo 1: Zero servo input slows down 2: Zero servo input is always valid (keep running at zero speed) 3: Lower slowly when the zero speed maintenance time is reached Tens place: Zero servo mode exit selection 0: Only for downward running 1: Both for upward and downward running 2: Only for reset commands	0x01
P93.03	Slow lowering	Setting range: P90.17 (Reverse brake release	4.00Hz

Function code	Name	Description	Setting
	frequency at zero servo	frequency)–8.00Hz	
P93.04	Slow lowering hold time at zero servo	Setting range: 0.0s–30.0s	2.0s
P93.05	Zero servo tolerance pulse threshold	Setting range: 0–60000	20000
P93.06	Zero servo action taking delay	0–20.000s	0.500s
P93.07	Zero-servo zero-speed hold time	0–60min	10min

5.1.4 Height measuring

5.1.4.1 Commissioning description

Internal measuring (Motor encoder)

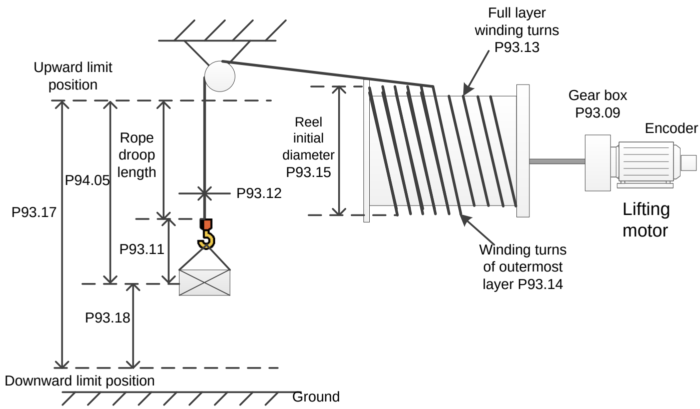


Figure 5-2 Internal measuring (motor encoder), using pulleys

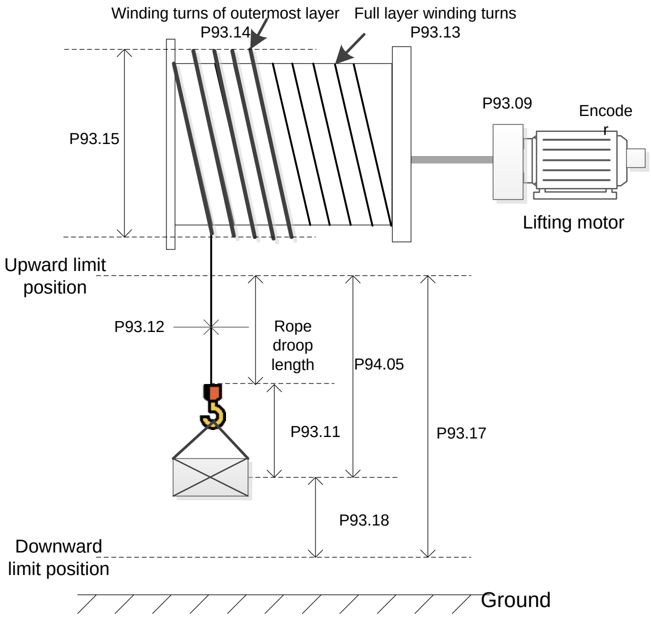


Figure 5-3 Internal measuring (motor encoder), without pulleys

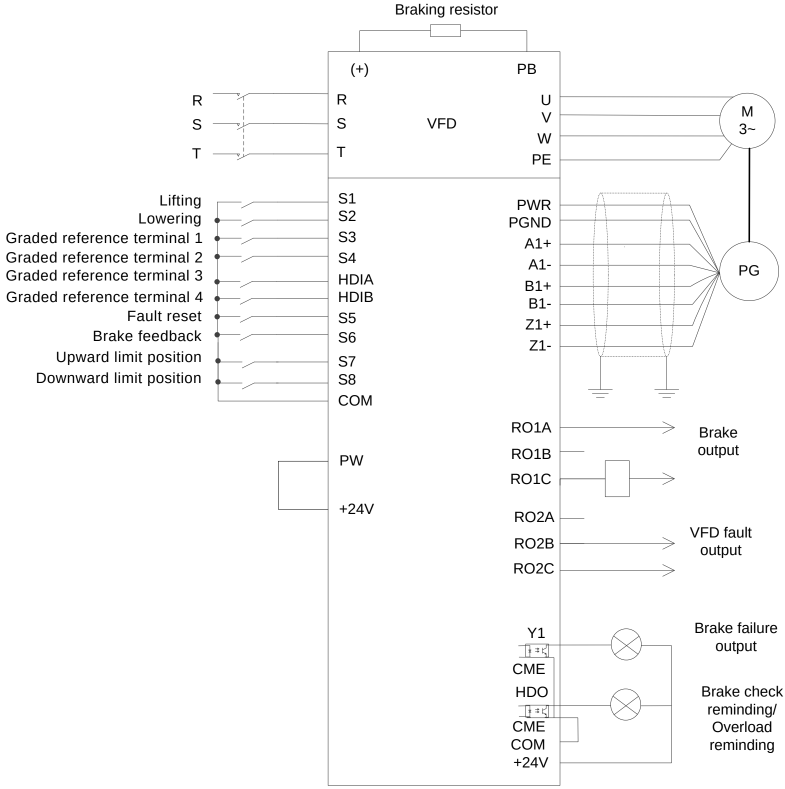


Figure 5-4 Wiring for internal measuring (motor encoder)

For wiring for internal measuring (motor encoder), you need to set the suspension ratio P93.10 when pulleys are used, so that the height can be correctly measured in the closed-loop mode. Then the measured encoder pulse count is used to calculate the actual running distance of the motor. Before first running, the upward limit position must be calibrated. You need to use a PG card to connect the encoder (see section A.6 for specific connection method), set P00.00=3 (Closed-loop control mode), P93.08=1 to enable internal measuring (motor encoder), and then set winding drum and cable parameters such as P93.09, P93.10, P93.11, P93.12, P93.13, P93.14 and P93.15.

The procedure for first running is as follows:

Step 1 Set the upward limit terminal. For example, set P25.03=64, which indicates the S7 terminal is used as for upper limit input.

Step 2 Enable forward running (upward) and stop when the upward limit position is reached. Then perform calibration.

Step 3 Record the values of P93.12 and P93.13 and reset P94.05, P94.06, and P94.07.

Step 4 After the calibration, send the running command through the S2 terminal to run downward. Check the values of P94.05, P94.06, and P94.07.

If the downward limit position needs to be used as the reference point, the procedure for first running is as follows:

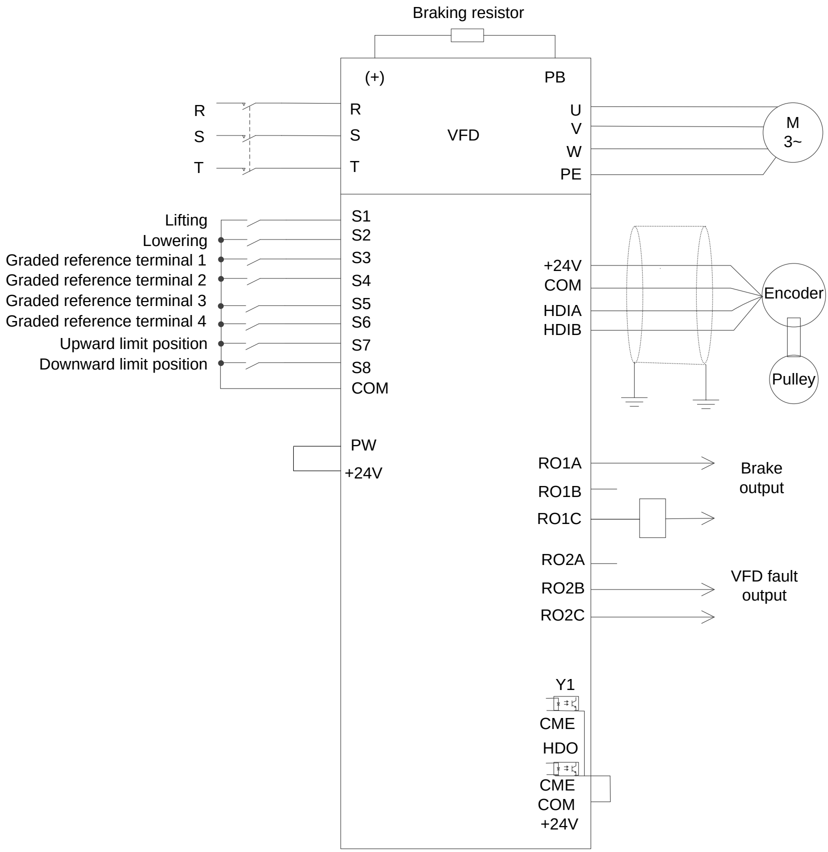
Step 1 Set the upward and downward limit terminals S7 and S8. For example, set P25.03=64 and P25.04=65.

Step 2 Enable forward running (upward) and stop when the upward limit position is reached. Then perform calibration.

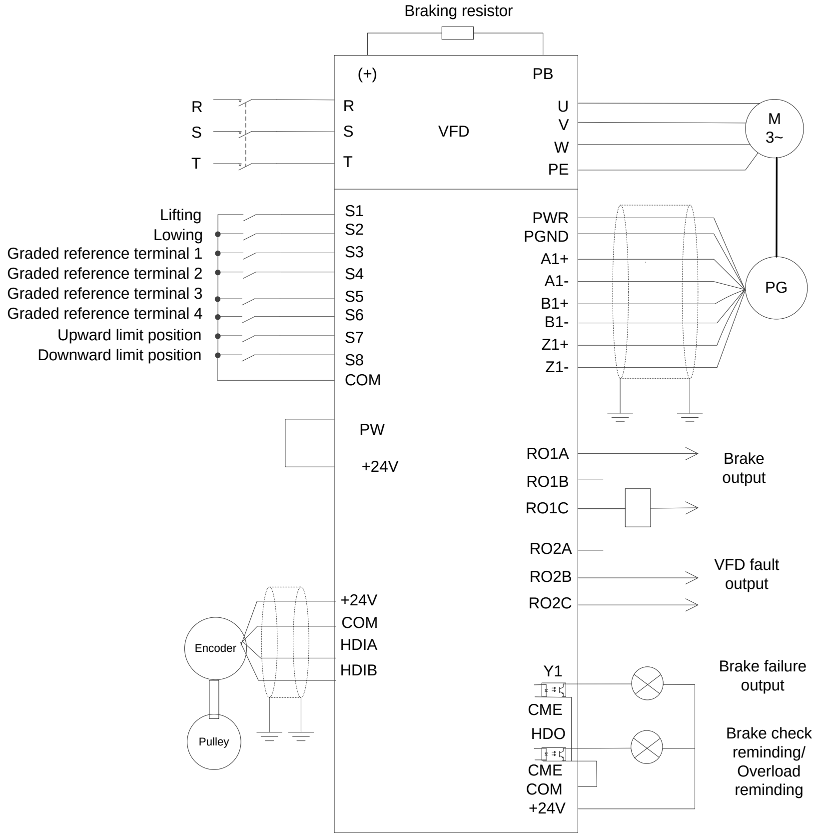
Step 3 Record the values of P93.12 and P93.13 and reset P94.05, P94.06, and P94.07.

Step 4 The calibration is completed, which indicates proper running. P93.17 displays the height from the downward limit position to the upward limit position, P93.18 displays the height using the downward limit position as the reference point (the height is 0 at the downward limit position, the height is positive when it is above the downward limit position, the height is negative when it is under the downward limit position), and P94.05 displays the height using the upward limit position as the reference point (the height is 0 at the upward limit position, and only downward running is allowed when the upward limit position is reached, and P94.05 indicates the rope droop length when the upward limit position is not reached).

External measuring (HDI)



Note: During external measuring (HDI), only 24V incremental encoders can be used to measure pulley rotational speeds.



Note: During external measuring (HDI), only 24V incremental encoders can be used to measure pulley rotational speeds.

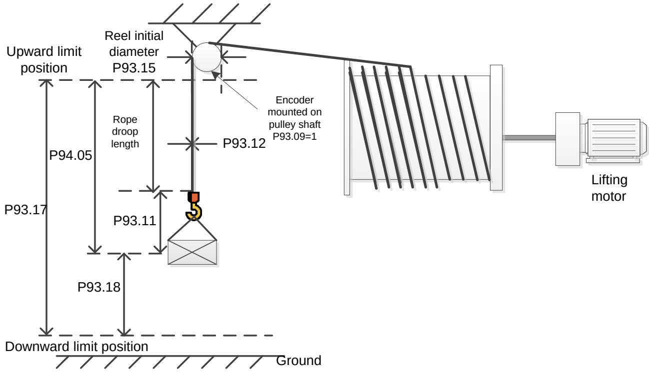


Figure 5-5 External measuring (HDI)

You need to set P05.38=2 and P05.44=2 to connect the encoder to HDIA and HDIB. In open/closed-loop mode, the encoder measures the encoder pulse count at the pulley side to calculate the actual cable running distance of pulley. Before first running, the upward limit position must be calibrated.

Do as follows:

Step 1 Set the upward limit terminal. For example, set P25.03=64, which indicates the S7 terminal is used as for upper limit input.

Step 2 Enable forward running (upward) and stop when the upward limit position is reached. Then perform calibration. Reset P94.05, P94.06, and P94.07.

Step 3 After the calibration, send the running command through the S2 terminal to run downward. Check the values of P94.05, P94.06, and P94.07.

If the downward limit position needs to be used as the reference point, the procedure for first running is as follows:

Step 1 Set the upward and downward limit terminals S7 and S8. For example, set P25.03=64 and P25.04=65.

Step 2 Enable forward running (upward) and stop when the upward limit position is reached. Then perform calibration. Reset P94.05, P94.06, and P94.07.

Step 3 Send the running command through the S2 terminal to run downward only if the downward limit terminal S8 is valid. P93.17 displays the height from the upward limit position to the downward limit position and P93.18 displays 0.

Step 4 The calibration is completed, which indicates proper running. P93.17 displays the height from the downward limit position to the upward limit position, P93.18 displays the height using the downward limit position as the reference point (the height is 0 at the downward limit position, the height is positive when it is above the downward limit position, the height is negative when it is under the downward limit position), and P94.05 displays the height using the upward limit position as the reference point (the height is 0 at the upward limit position, and only downward running is allowed when the upward limit position is reached, and P94.05 indicates the rope droop length when the upward limit position is not reached).

Note: During external measuring (HDI) (for the encoder to measuring the pulley rotational speed), P93.09 indicates the transmission ratio between the encoder and pulley, while P93.15 indicates the pulley diameter.

5.1.4.2 Parameters about height measuring

Table 5-1 Parameters about internal measuring (motor encoder)

Function code	Name	Description	Setting
P00.00	Speed control mode	0: SVC mode 0 1: SVC mode 1 2: Space voltage vector control mode 3: Closed-loop vector control mode **Note:** Before using a vector control mode (0, 1, or 3), enable the VFD to perform motor parameter autotuning first.	3
P00.01	Channel of running commands	0: Keypad 1: Terminal 2: Communication	1
P05.01	Function of S1	1: Run forward	1
P05.02	Function of S2	2: Run reversely	2
P25.03	Function of S7	64: Limit of forward run (upward)	64
P25.04	Function of S8	65: Limit of reverse run (downward)	65
P20.15	Speed measurement mode	0: Measuring speed by PG card/Measuring height locally	0
P93.08	Height measurement enable	0–2 0: Disable 1: Enable internal measuring (motor encoder) (In closed-loop mode, the encoder measures the speed and height.) 2: Enable external measuring (HDI) (In open- and closed-loop modes, the pulley encoder measures the height.) **Note:** When P93.08=2, P20.15=0 indicates HDI measuring the height.	1
P93.09	Mechanical	0.01–300.00	10.00

Function code	Name	Description	Setting
	transmission rate		
P93.10	Suspension ratio	1–4	1
P93.11	Wire rope length compensation	0.00–50.00m	0.00m
P93.12	Cable diameter	0.1–100.0mm	10.0mm
P93.13	Number of coils per layer of reel cable	1–200	30
P93.14	Number of initial coils of the reel cable	0–P93.11 (Per-layer turns of drum winding)	0
P93.15	Reel initial diameter	100.0–2000.0mm (Max. drum diameter in upward limit, including cable thickness)	600.0mm
P93.16	Upper, lower limit reach enable	0x00–0x11 Ones place: 0: The upward limit position is not reached. 1: The upward limit position is reached. Tens place: 0: Lower limit not reached 1: The downward limit position is reached. **Note:** Used for height measuring without upward or downward limit device.	0x00
Height status check			
P93.17	Total height measured	0.00–655.35m (Total height measured from the upward limit position to the downward limit position)	0.00m
P93.18	Measured height 1	-50.00–655.35m (Using the downward limit position as the reference point)	0.00m
P94.05	Measured height	0.00–655.35m (Hook lowering distance using the upward limit position as the reference point)	0.00m
P94.06	High bits of measured height count value	0–65535	0
P94.07	Low bits of measured height count value	0–65535	0

5.1.5 Commissioning the conical motor function

5.1.5.1 Wiring

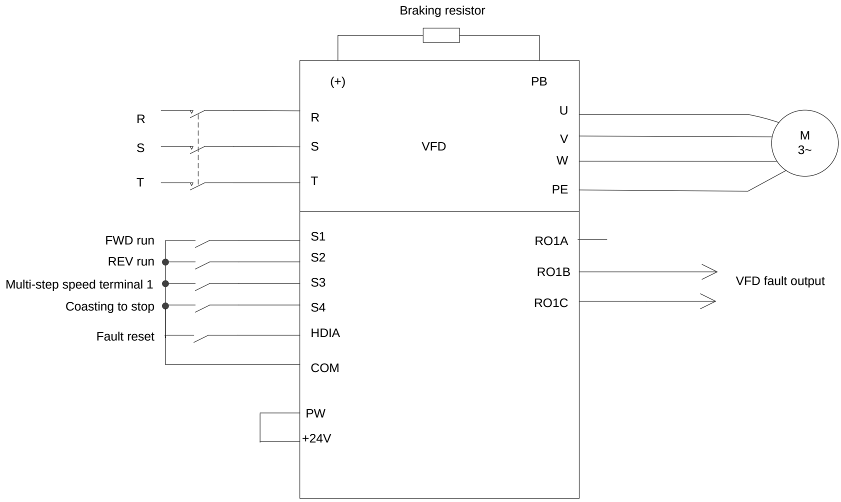


Figure 5-6 Wiring for the conical motor

Note: If the wiring is performed according to Figure 5-6, most VFD parameters need no adjustment. If the onsite function terminals are inconsistent with the terminals shown in the figure, adjust the input and output terminal functions according to the actual wiring after selecting this application macro.

5.1.5.2 Commissioning procedure

Step 1 Check the wiring and ensure the wiring is proper.

Step 2 Set P00.18=1 to restore to default settings.

Step 3 Set motor parameters in P02.

Step 4 Set P90.00=5 to select the conical motor function macro.

Step 5 Perform low-speed trial run.

5.1.5.3 Macro parameters (P90.00=5)

Function code	Name	Setting	Remarks
P00.01	Channel of running commands	1	Terminal
P00.06	Setting channel of A frequency command	6	Multi-step speed running
P00.11	ACC time 1	3.0s	Time taken to accelerate from 0Hz to the max. frequency.
P00.12	DEC time 1	2.0s	Time taken to decelerate from the max. frequency to 0Hz.
P01.01	Starting frequency of direct start	2.00Hz	2.00Hz

Function code	Name	Setting	Remarks
P05.00	HDI input type	0x01	HDIA is digital input.
P05.03	Function of S3	16	Multi-step speed terminal 1
P05.04	Function of S4	6	Coast to stop
P05.05	Function of HDIA terminal	7	Fault reset
P06.03	RO1 output	5	Fault output
P10.02	Multi-step speed 0	50.0%	50% of the max. output frequency P00.03
P10.04	Multi-step speed 1	100.0%	100% of the max. output frequency P00.03
P91.00	Enabling the conical motor function	1	Enabling the conical motor function

5.1.5.4 Points for attention

1. If you only want to check whether the VFD runs properly, set P90.00=0 (Common mode).
2. If the direction is incorrect when the heavy load runs upward during lifting in forward running mode, adjust any two phase sequences of VFD output terminals U, V, and W but not change the value of P00.13.
3. The starting frequency cannot be set too low. During onsite commissioning, ensure the starting frequency is set properly so that the brake can be turned on, and ensure the brake has been turned on before running.
4. The lifting ACC time can be 3s at most. If the ACC time is too long, the brake may not be opened.
5. The rated voltage must be at least 380V. If the grid rated voltage is too low (lower than 85% Ue), the brake cannot be opened; if the voltage is too low, the speed cannot be boosted.
6. The rated voltage must be at least 380V. If the grid rated voltage is too low (lower than 85% Ue), the brake cannot be opened; if the voltage is too low, the speed cannot be boosted.

When the conical motor performs constant-power variable-frequency speed regulation (boost), the max. rotational speed cannot exceed 1.2 times the rated speed (60Hz). Otherwise, the motor cannot run properly since the pressure spring cannot be pushed due to the axial magnetic pull force reduce, and therefore the VFD encounters the current limit or overcurrent fault.

5.2 Commissioning horizontal moving

5.2.1 Wiring

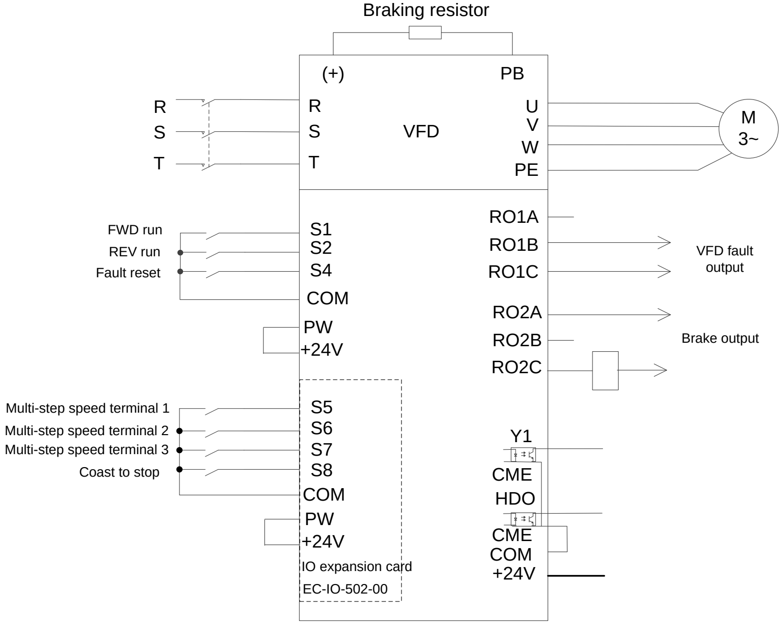


Figure 5-7 Wiring for horizontal moving

Note: If the wiring is performed according to Figure 5-7, most VFD parameters need no adjustment. If the onsite function terminals are inconsistent with the terminals shown in the figure, adjust the input and output terminal functions according to the actual wiring after selecting this application macro.

5.2.2 Commissioning procedure

Step 1 Check the wiring and ensure the wiring is proper.

Step 2 Set P00.18=1 to restore to default settings.

Step 3 Set motor nameplate parameters in P02.

Step 4 Set P90.00=3 to select the horizontal moving application macro.

Step 5 Perform low-speed trial run.

5.2.3 Macro parameters (P90.00=3)

Function code	Name	Setting	Remarks
P00.01	Channel of running commands	1	Terminal
P00.03	Max. output frequency	100.00Hz	/

Function code	Name	Setting	Remarks
P00.04	Upper limit of running frequency	60.00Hz	/
P00.06	Setting channel of A frequency command	6	Multi-step speed running
P00.11	ACC time 1	5.0s	/
P00.12	DEC time 1	4.0s	/
P01.01	Starting frequency of direct start	2.00Hz	/
P01.15	Stop speed	1.00Hz	/
P05.03	Function of S3	0	No function
P05.04	Function of S4	7	Fault reset
P06.03	RO1 output	5	VFD fault
P06.04	RO2 output	1	Running
P10.04	Multi-step speed 1	8.0%	Corresponding to the max. frequency
P10.06	Multi-step speed 2	18.0%	Corresponding to the max. frequency
P10.08	Multi-step speed 3	32.0%	Corresponding to the max. frequency
P10.10	Multi-step speed 4	50.0%	Corresponding to the max. frequency
P11.05	Current limit mode	0x11	Enable software and hardware current limit.
P11.06	Automatic current limit threshold	160.0%	/
P11.26	Enabling special functions	0x001	/
P25.01	Function of S5	16	Multi-step speed 1
P25.02	Function of S6	17	Multi-step speed 2
P25.03	Function of S7	18	Multi-step speed 3
P25.04	Function of S8	6	Coast to stop
P25.10	Expansion card input terminal polarity	0x08	Terminal polarity

Note: The macro parameter table does not contain some parameters that are factory default parameters.

5.2.4 Points for attention

1. If you only want to check whether the VFD runs properly, set P90.00=0 (Common application mode).
2. If you perform empty-load commissioning, set P90.00 to 3 (Horizontal moving application macro), set P11.08 to 0x000 to disable underload protection, and set P90.12 and P90.13 to 0 to prevent the torque verification fault reporting caused by empty load.

3. During onsite commissioning, if the VFD terminal signal upward/downward running command is inconsistent with the hook lifting/lowering, swap any two phase wires of VFD output terminals U, V, and W.
4. This macro can meet the requirements of most horizontal moving application cases, and the performance parameters have been optimized and do not need to be adjusted in most cases. If an exception occurs, see the function parameter chapter for adjustment or contact the technical support.

5.2.5 Commissioning anti-sway

This product has been embedded with the anti-sway algorithm. The anti-sway function can be enabled by setting P85.00 or input terminal function 90.

Anti-sway is divided into:

- Anti-sway mode with P85.01=0 and P85.01=2, in which the rope length needs to be obtained in real time. This can take good effect if the initial status is standstill.
- Anti-sway mode with P85.01=1, in which the rope length does not need to be obtained in real time. This can have a quick stop but there is still minor sway.

The anti-sway related rope height is usually measured by the lifting VFD, which is transmitted to the cross and long travel mechanism/luffing VFDs through analog AI or high-speed pulse HDI. The transmitted rope height can be viewed through P94.33.

Lifting VFD parameter settings:

Function code	Name	Description	Setting
Rope length output setting			
P06.14	AO1 output	35: Hook rope length	35
P06.16	HDO high-speed pulse output		35
P85.04	Max. rope length	5.00–150.00m	40.00m
Height measuring			
P93.08	Height measurement enable	0–2 0: Disable 1: Enable internal measuring (motor encoder) (In closed-loop mode, the encoder measures the speed and height.) 2: Enable external measuring (HDI) (In open- and closed-loop modes, the pulley encoder measures the height.) **Note:** When P93.08=2, P20.15=0 indicates HDI measuring the height.	1

Function code	Name	Description	Setting
P93.09	Mechanical transmission rate	0.01–300.00	10.00
P93.10	Suspension ratio	1–4	1
P93.11	Wire rope length compensation	0.00–50.00m	0.00m
P93.12	Cable diameter	0.1–100.0mm	10.0mm
P93.13	Number of coils per layer of reel cable	1–200	30
P93.14	Number of initial coils of the reel cable	0–P93.11 (Per-layer turns of drum winding)	0
P93.15	Reel initial diameter	100.0–2000.0mm (Max. drum diameter in upward limit, including cable thickness)	600.0mm
P93.16	Upper, lower limit reach enable	0x00–0x11 Ones place: 0: The upward limit position is not reached. 1: The upward limit position is reached. Tens place: 0: Lower limit not reached 1: The downward limit position is reached. **Note:** Used for height measuring without upward or downward limit device.	0x00
P94.05	Measured height	0.00–655.35m (Hook lowering distance) (As the master in master/slave control, it sends this value.)	/
P94.06	High bits of measured height count value	0–65535	/
P94.07	Low bits of measured height count value	0–65535	/

Cross travel, long travel, and luffing mechanism VFD parameter settings

Function code	Name	Description	Setting
P85.02	Rope length obtaining source	0–6 0: Keypad 1: AI1 2: AI2 3: HDIA 4: HDIB	0

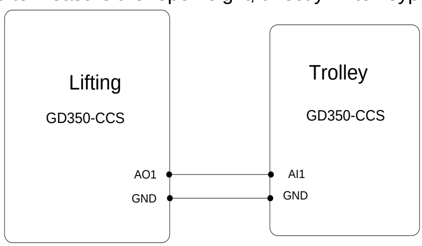
Function code	Name	Description	Setting
		5: Max(AI1, HDIA) combination 6: Max(AI2, HDIB) combination	
P85.03	Keypad set rope length	0.00–100.00mm	0.00m
P85.04	Max. rope length	5.00–150.00m	40.00m
P85.05	Rope length compensation value	0.00–150.00m	0.00m
P94.32	Obtained rope length	0–600.00m (Rope length obtained through P85.02)	/
P94.33	Rope length with compensation	0–600.00m	/

Note: If external device can obtain the rope length in real time, it can be updated to P85.03 through communication.

5.2.5.1 Commissioning procedure of the anti-sway function for tower cranes

Step 1 Enable the anti-sway function by setting the trolley VFD function code P85.00=1 or S terminal function 90.

Step 2 If AI is used to transmit the rope height: Set the cross travel mechanism VFD P85.02=1 or 2, and set the lifting VFD P06.14=35 (Hook rope height) and P85.03 (Keypad set rope height), so that the cross travel mechanism receives the rope height from the lifting mechanism in real time. The same rule is used if HDI is used to transmit the rope height. (If an external mechanism is used to measure the rope height, directly write keypad set rope height P85.03.)

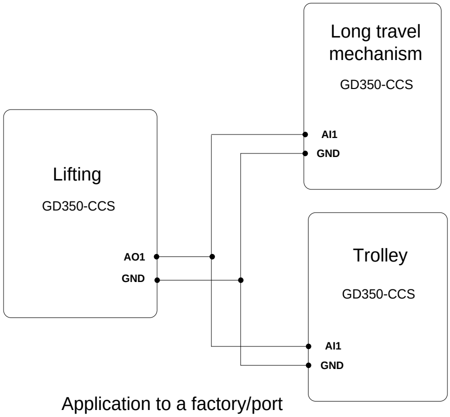


Tower crane application

Step 3 Configure the lifting VFD to measure the height. For details, see section 5.1.4 Height measuring. After the height measuring, check whether P94.32 (height that the slave receives) and P94.05 (height that the master measures) are the same.

Step 4 Perform low-speed trial run.

5.2.5.2 Commissioning procedure of anti-sway for factory/port cranes (with one hook)

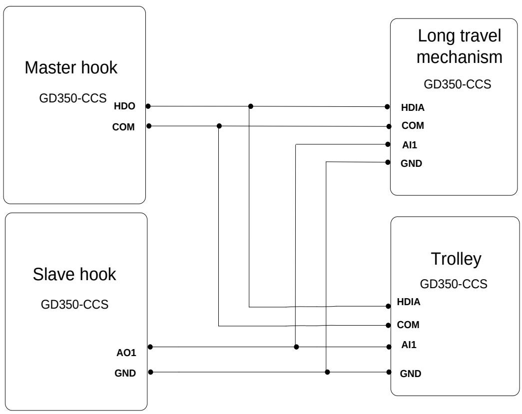


Application to a factory/port crane (with one hook)

Step 1 Set lifting and cross travel mechanism VFD parameters, which are the same as section 5.2.5.1 Commissioning procedure of the anti-sway function for tower cranes.

Step 2 Set long travel mechanism VFD parameters, which are the same as cross travel mechanism VFD parameters.

5.2.5.3 Commissioning procedure of anti-sway for factory/port cranes (with two hooks)



Application to a factory/port crane (with two hooks)

Step 1 Set the VFD function code P85.04 of lifting mechanisms (including the main and auxiliary hooks) to be equal to the max. rope height of the long and cross travel mechanisms. The lifting mechanism main hook and auxiliary hook VFDs use HDO and AO1 output rope heights respectively. As shown in the wiring, set the main hook VFD P06.16=35 (HDO outputs hook rope height), and the auxiliary VFD P06.14=35 (AO1 outputs hook rope height).

Step 2 The long and cross travel mechanism VFDs use AI1 and HDIA or AI2 and HDIB to receive the rope heights transmitted by the main and auxiliary hook VFDs, and the rope height source P85.02 is set to 5 or 6. The long travel mechanism VFD and cross travel mechanism VFD must be the same in P85.04.

5.2.5.4 Long/cross travel and luffing mechanism anti-swing parameters

When P85.01=0 (Common anti-sway mode), related parameters are listed in the following.

Function code	Name	Description	Setting
P85.06	Anti-sway switching frequency threshold	0.00–50.00Hz Anti-sway is not started when the difference between the set frequency and present frequency is less than P85.06.	10.00 Hz
P85.07	Damping factor	0.000–1.000 Increasing this value enhances the ability to suppress sway.	0.400
P85.08	Gear switchover filtering delay	0.000–10.000s	0.100s
P85.09	Anti-sway percentage	0–100	30

When P85.01=1 (Anti-sway mode without rope length), set P85.11 (Anti-sway approximate ACC/DEC time). Related parameters are listed in the following.

Function code	Name	Description	Setting
P85.06	Anti-sway switching frequency threshold	0.00–50.00Hz Anti-sway is not started when the difference between the set frequency and present frequency is less than P85.06.	10.00Hz
P85.07	Damping factor	0.000–1.000 Increasing this value enhances the ability to suppress sway.	0.400
P85.08	Gear switchover filtering delay	0.000–10.000s	0.100s
P85.09	Anti-sway percentage	0–100	30
P85.10	Residual sway percentage	0–100	11
P85.11	Anti-sway ACC/DEC time	0.00–10.00s	6.00s

When P85.01=2 (S curve anti-sway mode), related parameters are listed in the following.

Function code	Name	Description	Setting
P01.05	ACC and DEC mode	1: S curve	1
P01.06	Time of starting segment of ACC S curve	0.0–50.0s	0.5s
P01.07	Time of ending segment of ACC S curve	0.0–50.0s	1.0s
P01.27	Time of starting segment of DEC S curve	0.0–50.0s	0.5s
P01.28	Time of ending segment of DEC S curve	0.0–50.0s	1.0s
P85.00	Enabling anti-sway	1: Enable	1
P85.06	Anti-sway switching frequency threshold	0.00–50.00Hz Anti-sway is not started when the difference between the set frequency and present frequency is less than P85.06.	10.00Hz
P85.07	Damping factor	0.000–1.000 Increasing this value enhances the ability to suppress sway.	0.400
P85.15	S curve gain coefficient	0.0–1.0 Reducing this value enhances the ability to suppress sway, but increase the ACC/DEC time.	0.6
P85.16	Anti-sway jogging time	0.000–5.000s Setting this value properly can help respond to rapid jogging.	0.000s

5.3 Commissioning the electric potentiometer

5.3.1 Wiring

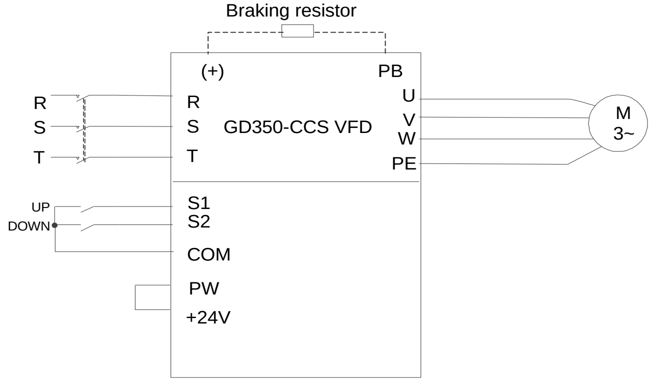


Figure 5-8 Electric potentiometer wiring

5.3.2 Commissioning procedure

Step 1 Check the wiring and ensure the wiring is proper.

Step 2 Set P00.18=1 to restore to default settings.

Step 3 Set motor parameters in P02.

Step 4 Set P05.01=10 and P05.02=11 to specify the UP/DOWN terminals.

Step 5 Set P08.44 to set terminal control validity, and set P08.45 and P08.46 to set the increase/decrease change rate of the UP/DOWN terminal frequency.

Step 6 Press UP/DOWN to run.

The following figure shows the electric potentiometer value curve.

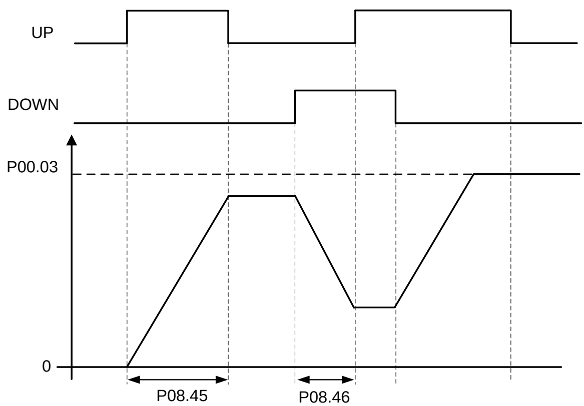


Figure 5-9 Electric potentiometer commissioning

5.3.3 Electric potentiometer commissioning parameters

Table 5-2 Electric potentiometer commissioning parameters

Function code	Name	Setting	Remarks
P00.03	Max. output frequency	50	The function code is used to set the max. output frequency of the VFD.
P05.01	Function of S1	10	Increase frequency setting (UP)
P05.02	Function of S2	11	Decrease frequency setting (DOWN)
P08.44	UP/DOWN terminal control setting	0x000	0x000–0x221 Ones place: Frequency setting selection 0: The setting made through UP/DOWN is valid. 1: The setting made through UP/DOWN is invalid. Tens place: Frequency control selection 0: Valid only when P00.06=0 or P00.07=0 1: Valid for all frequency setting methods 2: Invalid for multi-step speed running when multi-step speed running has the priority Hundreds place: Action selection for stop 0: Setting is valid. 1: Valid during running, cleared after stop 2: Valid during running, cleared after a stop command is received
P08.45	Frequency increment integral rate of the UP terminal	0.50Hz/s	0.01–50.00Hz/s
P08.46	Frequency integral rate of the DOWN terminal	0.50Hz/s	0.01–50.00Hz/s

5.4 Master/slave control

5.4.1 Function description

Master/slave control is classified into power balance and speed synchronization.

1. Master/slave power balance

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

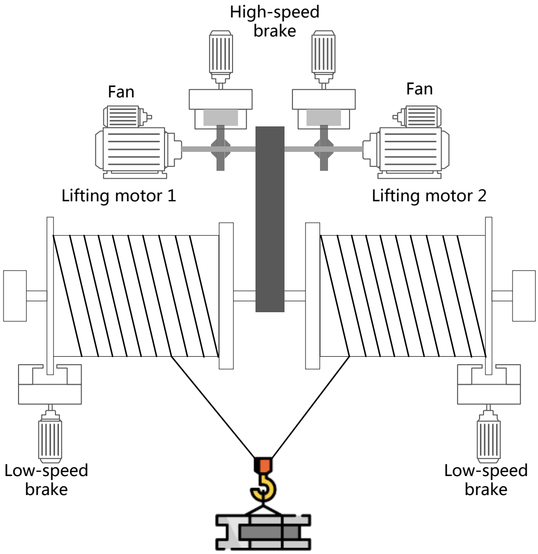


Figure 5-10 Mechanical structure 1

In general, if multiple VFDs control multiple motors through belt connection, it is considered as flexible connection (or soft connection). When flexible connection is applied, generally, the slave adopts the speed control mode, and then the droop function is used to achieve better power balance performance. Therefore, in the terminal master/slave mode, master/slave mode a is recommended; in the CAN communication master/slave mode, master/slave mode 0 is recommended.

In general, if multiple VFDs control multiple motors through shaft, gear, or chain connection, it is considered as rigid connection (or hard connection). When rigid connection is applied, generally, the slave adopts the torque control mode for better power balance performance. Therefore, in the terminal master/slave mode, master/slave mode b is recommended; in the CAN communication master/slave mode, master/slave mode 1 is recommended.

2. Master/slave speed synchronization

Master/slave speed synchronization is used for the speed synchronization between two motors. Using the function requires that both motors have the encoder installed, and the VFD has the encoder pulse counting function. The mechanical structure is shown in Figure 5-11.

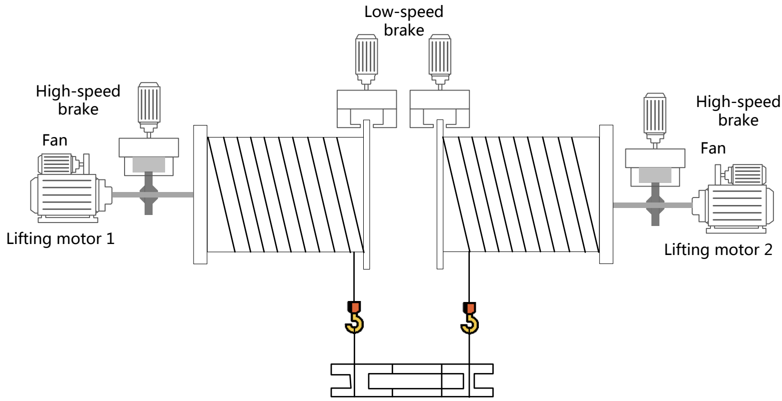


Figure 5-11 Mechanical structure 2

Since master/slave speed synchronization requires speed consistency, the VFD must use the closed-loop mode. Therefore, only master/slave mode 4 in the CAN communication master/slave mode can be used.

5.4.2 Terminal master/slave function

A. Using the VFD high-speed pulse input terminal HDIA and high-speed pulse output terminal HDO to implement simplified master/slave control

1. Terminal master/slave mode a

The master adopts the speed control mode and sends the ramp frequency to the slave HDIA terminal through the HDO terminal. The slave adopts the speed control mode and the frequency reference is set by the HDIA terminal. Then, adjust reduction ratio of droop control P08.30 of the salve to meet power balance.

Master parameters:

Function code	Name	Description	Setting
P06.00	HDO output type	0: Open collector high-speed pulse output 1: Open collector output	0

Function code	Name	Description	Setting
P06.16	HDO high-speed pulse output	2: Ramp reference frequency	2
P06.27	HDO output lower limit	-300.0%–P06.29	0.00%
P06.28	HDO output corresponding to lower limit	0.00–50.00kHz	0.00kHz
P06.29	HDO output upper limit	P06.27–300.0%	100.0%
P06.30	HDO output corresponding to upper limit	0.00–50.00kHz	50.00kHz

Slave parameters:

Function code	Name	Description	Setting
P00.06	Setting channel of A frequency command	0–15 4: High-speed pulse HDIA	4
P05.00	HDI input type	Ones place: HDIA input type 0: HDIA is high-speed pulse input Tens place: HDIB input type 0: HDIB is high-speed pulse input	0x00
P05.38	HDIA high-speed pulse input function selection	0: Input set through frequency 1: Reserved 2: Input set through encoder, used together with HDIB	0
P05.39	HDIA frequency lower limit	0.000kHz–P05.41	0.000kHz
P05.40	Corresponding setting of HDIA lower limit frequency	-300.0%–300.0%	0.0%
P05.41	HDIA frequency upper limit	P05.39–50.000kHz	50.000kHz
P05.42	Corresponding setting of HDIA upper limit frequency	-300.0%–300.0%	100.0%
P08.30	Frequency decrease ratio in drop control	0.00–50.00Hz	1.00Hz

2. Terminal master/slave mode b

The master adopts the speed control mode and sends the torque current to the slave HDIA terminal through the HDO terminal. The slave adopts the torque control mode and the torque reference is set by the HDIA terminal.

Master parameters:

Function code	Name	Description	Setting
P06.00	HDO output type	0: Open collector high-speed pulse output	0
P06.16	HDO high-speed pulse output	22: Torque current (relative to triple the motor rated current)	22

Slave parameters:

Function code	Name	Description	Setting
P03.11	Torque setting method	5: Pulse frequency HDIA	5
P03.32	Enabling torque control	1: Enable	1
P05.00	HDI input type	Ones place: HDIA input type 0: HDIA is high-speed pulse input Tens place: HDIB input type 0: HDIB is high-speed pulse input	0x00

B. Using the VFD analog input terminal (for example, AI1) and analog output terminal (for example, AO1) to implement simplified master/slave control

3. Analog terminal master/slave mode a

The master adopts the speed control mode and sends the ramp frequency to the slave AI1 terminal through the AO1 terminal. The slave adopts the speed control mode and the frequency reference is set by the AI1 terminal. Then, adjust reduction ratio of droop control P08.30 of the salve to meet power balance.

Master parameters:

Function code	Name	Description	Setting
P06.14	AO1 output	2: Ramp reference frequency	2
P06.17	AO1 output lower limit	Setting range of P06.17: -300.0%–P06.19 Setting range of P06.18: 0.00V–10.00V Setting range of P06.19: P06.17–100.0% Setting range of P06.20: 0.00V–10.00V Setting range of P06.21: 0.000s–10.000s	0.0%
P06.18	AO1 output corresponding to lower limit		0.00V
P06.19	AO1 output upper limit		100.0%
P06.20	AO1 output corresponding to upper limit		10.00V
P06.21	AO1 output filter time		0.000s

Slave parameters:

Function code	Name	Description	Setting
P00.06	Setting channel of A frequency command	1: AI1	1
P05.24	AI1 lower limit	Setting range of P05.24: 0.00V–P05.26 Setting range of P05.25: -300.0% –300.0% Setting range of P05.26: P05.24–10.00V Setting range of P05.27: -300.0% –300.0% Setting range of P05.28: 0.000s–10.000s	0.00V
P05.25	Corresponding setting of AI1 lower limit		0.0%
P05.26	AI1 upper limit		10.00V
P05.27	Corresponding setting of AI1 upper limit		100.0%
P05.28	AI1 input filter time		0.030s
P08.30	Frequency decrease ratio in drop control	0.00–50.00Hz	1.00Hz

4. Analog terminal master/slave mode b

The master adopts the speed control mode and sends the torque current to the slave AI1 terminal through the AO1 terminal. The slave adopts the torque control mode and the torque reference is set by the AI1 terminal.

Master parameters:

Function code	Name	Description	Setting
P06.14	AO1 output	22: Torque current (relative to triple the motor rated current)	22
P06.17	AO1 output lower limit	Setting range of P06.17: -300.0%–P06.19	0.0%

Function code	Name	Description	Setting
P06.18	AO1 output corresponding to lower limit	Setting range of P06.18: 0.00V–10.00V Setting range of P06.19: P06.17–300.0% Setting range of P06.20: 0.00V–10.00V Setting range of P06.21: 0.000s–10.000s	0.00V
P06.19	AO1 output upper limit		100.0%
P06.20	AO1 output corresponding to upper limit		10.00V
P06.21	AO1 output filter time		0.000s

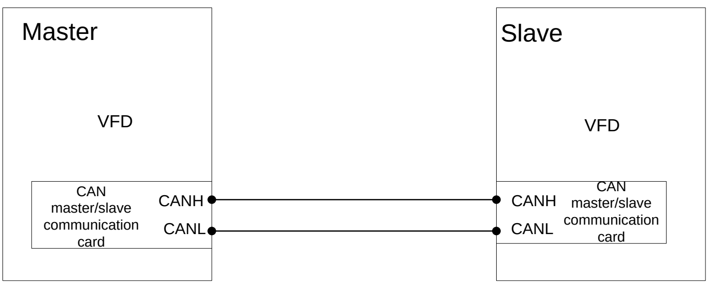
Slave parameters:

Function code	Name	Description	Setting
P03.11	Torque setting method	2: AI1	2
P03.32	Enabling torque control	1: Enable	1
P05.24	AI1 lower limit	Setting range of P05.24: 0.00V–P05.26 Setting range of P05.25: -300.0% –300.0% Setting range of P05.26: P05.24–10.00V Setting range of P05.27: -300.0% –300.0% Setting range of P05.28: 0.000s–10.000s	0.00V
P05.25	Corresponding setting of AI1 lower limit		0.0%
P05.26	AI1 upper limit		10.00V
P05.27	Corresponding setting of AI1 upper limit		100.0%
P05.28	AI1 input filter time		0.030s

Note: When the terminal master/slave function is used, commissioning is unrelated to P28.

5.4.3 Master/slave communication

The VFDs can implement the master/slave control function by using the CAN master/slave communication card. The wiring diagram is as follows.



The specific CAN communication master/slave modes are: master/slave mode 0–2 are master/slave power balance modes, master/slave mode 4 is the closed-loop speed synchronization mode, and master/slave mode 3 is reserved. Master/slave mode 0 and master/slave mode 1 are used often.

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

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

Commissioning method: Set P28.00 to 1 for the master, set P28.00 to 2 for the slave, set the ones place of P28.02 to 0 both for the master and slave to select master/slave mode 0, and adjust P28.03 for the slave based on the actual situation.

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

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

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

Commissioning method: Set P28.00 to 1 for the master, set P28.00 to 2 for the slave, set the ones place of P28.02 to 1 both for the master and slave to select master/slave mode 1, and adjust P28.04 to set the torque gain for the slave and adjust P28.21 to increase or reduce the slave torque based on the actual situation. The slave will be switched to torque mode automatically, and therefore P03 parameters do not need to be adjusted.

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

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

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

Commissioning method: Set P28.00 to 1 for the master, set P28.00 to 2 for the slave, set the ones place of P28.02 to 2 both for the master and slave to select master/slave mode 2, and adjust P28.03 and P28.04 for the slave based on the actual situation. In addition, set P28.05.

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

4. Master/slave mode 3 (Reserved)

Function code	Name	Description	Default
P28.00	Master/slave mode	0: Master/slave control is invalid. 1: The local device is the master.	0

Function code	Name	Description	Default
		2: The local device is the slave.	
P28.01	Master/slave mode selection	0: CAN 1: Reserved	0
P28.02	Master/slave control mode	Ones place: Master/slave running mode selection 0: Master/slave mode 0. (Both the master and slave use speed control, and power balancing is performed by droop control.) 1: Master/slave mode 1. (The master and slave must be in the same type of vector control. When the master is in speed control, the slave is forced into torque control.) 2: Combined mode (Master/slave mode 2). The slave switches from speed mode (master/slave mode 0) to torque mode (master/slave mode 1) at a frequency point. 3: Master/slave mode 3 (Reserved)(Both the master and slave adopt speed control, and the slave performs power balance depending on the speed loop integral result of the master.) 0: Master 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	It is a percentage of the master ramp frequency. When the master and slave are different in the DEC ratio: 0.0–500.0% When the master and slave are the same in the DEC ratio: 100.0%	100.0%
P28.04	Slave torque gain	It is a percentage of the set frequency of the master. When the master and slave are different in the motor power: 0.0–500.0% When the master and slave are the same in the motor power: 100.0%	100.0%
P28.05	Frequency point for switching between speed mode and	0.00–10.00Hz	5.00Hz

Function code	Name	Description	Default
	torque mode in master/slave mode 2		
P28.06	Number of slaves	0–15	1
P28.07	Enabling the slave speed deviation window	0–1 0: Disable 1: Enable When the slave adopts the torque control mode, the speed deviation monitoring function can be enabled.	0
P28.08	Slave positive speed deviation window upper limit	0.00–50.00Hz When the actual speed is higher than the reference speed, if the actual speed is higher than (Reference speed + P28.08) and exceeds this upper limit, the speed has to be adjusted.	5.00Hz
P28.09	Slave negative speed deviation window lower limit	0.00–50.00Hz When the actual speed is lower than the reference speed, if the actual speed is lower than (Reference speed - P28.09) and the window lower limit, the speed has to be adjusted.	5.00Hz
P28.13	CAN slave torque offset	-100.0–100.0%	0.0%
P28.14	Master/slave holding brake synchronization control	0x00–0x11 Ones place: brake release synchronization 0: Invalid 1: Valid Tens place: brake closing synchronization 0: Invalid 1: Valid **Note:** In a master/slave mode, when the function specified by P28.14 is enabled, the master and slave must be the same in brake release frequency and brake closing frequency, and the brake closing frequency should be smaller than the brake release frequency.	0x11
P28.15	Master/slave brake release synchronization timeout time	0.00–30.00s	1.00s
P28.16	Master/slave brake	0.00–30.00s	1.00s

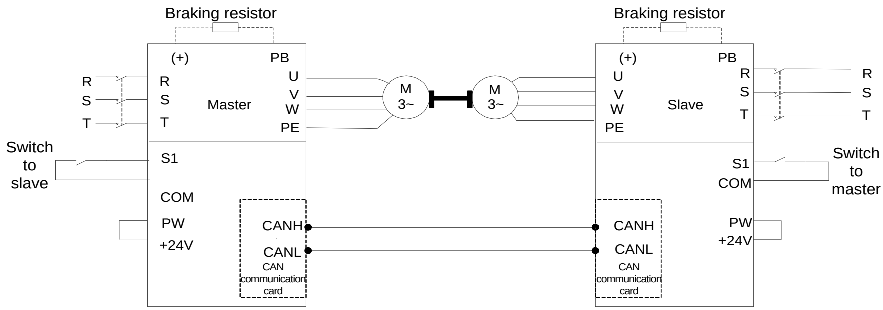
Function code	Name	Description	Default
	closing synchronization timeout time		
P28.17	Droop negative limit	0.00–20.00Hz **Note:** Valid when it is set to a non-0 value.	0.00Hz
P28.18	Slave torque direction in torque mode	0–2 0: Common mode 1: Forced to follow the master torque direction 2: Reserved	0

5.4.4 Master/slave switchover

1. Normal master/slave switchover work conditions

Application description: Both the master VFD and slave VFD drive a motor, but in certain cases, the master and slave must be switched over.

Commissioning description: Set an S (for example, S1) terminal of the master to 72, and an S (for example, S1) terminal of the slave to 71. Enable the S1 terminal of the master to make the master working as the slave. Enable the S1 terminal of the slave to make the slave working as the master. If different parameters need to be set for the master and slave, you can set P90.03.



Note: Refer to section 5.5 Motor and macro switchover to set master and slave parameters. The following mainly describes the master/slave switchover.

Master parameters:

Function code	Name	Description	Setting
P05.01	Function of S1	72: Switch to the slave	72
P90.03	Method for terminals to switch application macros	3: Switch from the master to the slave	3

Slave parameters:

Function code	Name	Description	Setting
P05.01	Function of S1	71: Switch to the master	71
P90.03	Method for terminals to switch application macros	4: Switch from the salve to the master	4

2. Motor and master/slave switchover work conditions

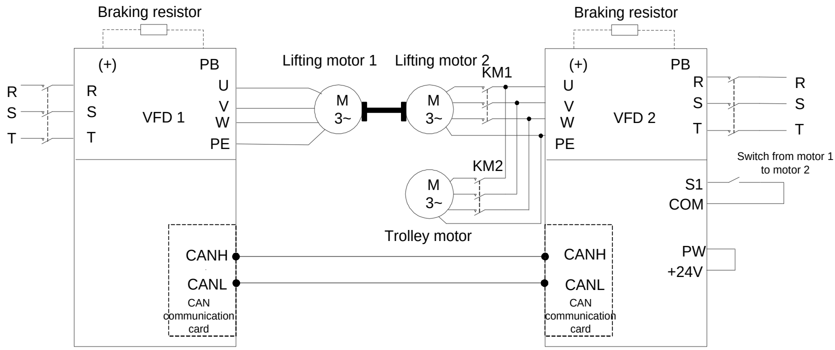
In the lifting job of port crane, VFD 1 as the master drives lifting motor 1, while VFD 2 as the slave drives lifting motor 2. After completing the lifting job, VFD 2 needs to drive the cross travel mechanism motor independently.

To do this, VFD 2 needs to:

(1) Disable the master/slave mode and run independently.

(2) Switch the motor from lifting motor 2 to trolley motor.

(3) Switch motor and VFD parameters.



Note: The power supply switchover of lifting motor 2 and trolley must be controlled by the PLC.

Commissioning procedure

Step 1 Set P90.00=6 (User-defined macro 1) for VFD 2, set running parameters for lifting motor 2 according to the following table of user-defined application macro parameter settings, and note that A81.24=2 (Slave mode).

Step 2 Set P90.01=7 (User-defined macro 2) for VFD 2, set the parameters for trolley motor according to the following table of user-defined application macro parameter settings, and note that A81.24=0 (Disable master/slave mode).

Step 3 When the S1 terminal of VFD 2 is invalid, VFD 2 drives lifting motor 2 and VFD 1 drives lifting motor 1 to complete the lifting work. When the S2 terminal of VFD 2 is valid, VFD 2 independently drives the trolley motor to work.

Motor run status	VFD 1	VFD 2	KM1	KM2	VFD 2 S1 terminal	Lifting motor 1	Lifting motor 2	Trolley motor
Lifting run	For a master, P28.00=1	For a slave, A81.24=2 (P28.00=2)	Closed	Opened	Invalid	Run	Run	Stop
Trolley run	When no master/slave is valid, P28.00=0, you can modify through the PLC.	When no master/slave is valid, A82.24=0 (P28.00=0), you can switch through S1.	Opened	Closed	Valid	Stop	Stop	During running, switch through S1.

Note: For VFD 1, the master/slave control function code P28.00 needs to be modified through the PLC. At the work conditions of cross travel mechanism run, if it is difficult to change VFD 1 from master/slave control mode to non master/slave control mode (P28.00=0) through the PLC, you can set the hundreds place of P28.02 to 1 or use S terminal function 91 for VFD 1 to exit the master/slave mode.

Parameters of VFD 2

Function code	Name	Description	Setting
P05.01	Function of S1	35: Switch from motor 1 to motor 2	35
P90.00	Hoisting application macro setting	6: User-defined application macro 1 7: User-defined application macro 2	6
P90.01	Terminal-switched application macro setting		7
P90.03	Method for terminals to switch application macros	1: Switch from motor 1 to motor 2	1
A81.24	Master/slave mode	2: The local device is the slave.	2

5.4.5 User-defined application macros

You can enter user-defined application macro settings through P90.02.

Function code	Name	Description	Default
P90.02	User-defined application macro setting	0–3 0: None 1: Enter the settings of user-defined application macro 1 2: Enter the settings of user-defined application macro 2 3: Enter the settings of user-defined application macro 3	0

When P90.02=1, you will automatically enter A81.00–A81.46 to set related function codes.

When P90.02=2, you will automatically enter A82.00–A82.46 to set related function codes.

When P90.02=3, you will automatically enter A83.00–A83.46 to set related function codes.

Currently, there are 50 common function codes available for you to define macros. The three user-defined macro tables are the same. The following lists A81.00–A81.46.

User-defined function	Related function code	Name	Description	Setting range	Default
A81.00	P00.00	Speed control mode	0: SVC mode 0 1: SVC mode 1 2: V/F control 3: Closed-loop vector control mode	0–3	2
A81.01	P00.01	Channel of running commands	0: Keypad 1: Terminal 2: Communication	0–2	0
A81.02	P00.06	Setting channel of A frequency command	0: Keypad 1–14: See chapter 7 Function parameter list. 15: Multi-step speed run	0–15	0
A81.03	P00.11	ACC time 1	0.0–3600.0s	0.0–3600.0	10.0s
A81.04	P00.12	DEC time 1	0.0–3600.0s	0.0–3600.0	10.0s
A81.05	P01.05	ACC/DEC mode	0: Linear 1: S curve	0–1	0
A81.06	P01.08	Stop mode	0: Decelerate to stop 1: Coast to stop	0–1	0
A81.07	P03.32	Enabling torque control	0: Disable 1: Enable	0–1	0
A81.08	P04.40	Enabling I/F mode for AM 1	0–1	0–1	0
A81.09	P04.41	Forward current setting in I/F mode for AM 1	0.0–200.0%	0.0–200.0	120.0%
A81.10	P04.52	Reverse current setting in I/F mode for AM 1	0.0–200.0%	0.0–200.0	120.0%
A81.11	P05.03	Function of S3	0: No function	0–95	0
A81.12	P05.04	Function of S4	1: Run forward	0–95	0

User-defined function	Related function code	Name	Description	Setting range	Default
			2: Run reversely 3–95: See the function parameter chapter.		
A81.13	P06.01	Y1 output	0: Invalid 1: Running 2: Running forward 3: Running reversely 4–71: See the function parameter chapter.	0–71	0
A81.14	P06.03	RO1 output		0–71	0
A81.15	P06.04	RO2 output		0–71	0
A81.16	P10.02	Multi-step speed 0	0.0–100.0%	0.0–100.0	0.0%
A81.17	P10.04	Multi-step speed 1	0.0–100.0%	0.0–100.0	0.0%
A81.18	P10.06	Multi-step speed 2	0.0–100.0%	0.0–100.0	0.0%
A81.19	P10.08	Multi-step speed 3	0.0–100.0%	0.0–100.0	0.0%
A81.20	P10.10	Multi-step speed 4	0.0–100.0%	0.0–100.0	0.0%
A81.21	P25.01	Function of S5	Same as P05	0–95	0
A81.22	P25.02	Function of S6		0–95	0
A81.23	P25.03	Function of S7		0–95	0
A81.24	P28.00	Master/slave mode	0: The master/slave mode is invalid. 1: The local device is the master. 2: The local device is the slave.	0–2	0
A81.25	P90.04	Enabling brake-oriented logic	0–1 0: The brake is controlled by an external controller. 1: Braking is controlled by VFD	0–1	0
A81.26	P90.05	Enabling forward torque for reverse-running start/stop	0x00–0x11 Ones place: indicates whether to enable forward torque for reverse-running start 0: Disable (The reverse-running start direction complies with the	0x00–0x11	0x00

User-defined function	Related function code	Name	Description	Setting range	Default
			command.) 1: Enable (The reverse-running start direction is always the forward-running direction.) Tens place: indicates whether to enable forward torque for reverse-running stop 0: Disable (The reverse-running stop direction complies with the command.) 1: Enable (The reverse-running stop direction is always the forward-running direction.)		
A81.27	P90.06	Graded multi-step speed reference 0	0.0–100.0%	0.0–100.0	0.0%
A81.28	P90.07	Graded multi-step speed reference 1	0.0–100.0%	0.0–100.0	0.0%
A81.29	P90.08	Graded multi-step speed reference 2	0.0–100.0%	0.0–100.0	0.0%
A81.30	P90.09	Graded multi-step speed reference 3	0.0–100.0%	0.0–100.0	0.0%
A81.31	P90.10	Graded multi-step speed reference 4	0.0–100.0%	0.0–100.0	0.0%
A81.32	P90.12	Forward brake release current	0.0–200.0% (of the motor rated current)	0.0–200.0	0.0%
A81.33	P90.13	Reverse braking/releasing current	0.0–200.0% (of the motor rated current)	0.0–200.0	0.0%
A81.34	P90.14	Forward brake release torque	0.0–200.0% (of the motor rated torque)	0.0–200.0	0.0%
A81.35	P90.15	Reverse brake release torque	0.0–200.0% (of the motor rated torque)	0.0–200.0	0.0%

User-defined function	Related function code	Name	Description	Setting range	Default
A81.36	P90.16	Forward brake release frequency	0.00–20.00Hz	0.00–20.00	3.00Hz
A81.37	P90.17	Reverse brake release frequency	0.00–20.00Hz	0.00–20.00	3.00Hz
A81.38	P90.18	Forward brake closing frequency	0.00–20.00Hz	0.00–20.00	3.00Hz
A81.39	P90.19	Reverse brake closing frequency	0.00–20.00Hz	0.00–20.00	3.00Hz
A81.40	P90.20	Delay before forward brake release	0.000–5.000s	0.000–5.000	0.300s
A81.41	P90.22	Delay after forward brake release	0.000–5.000s	0.000–5.000	0.300s
A81.42	P90.24	Delay before forward brake closing	0.000–5.000s	0.000–5.000	0.300s
A81.43	P90.26	Delay after forward brake closing	0.000–5.000s	0.000–5.000	0.300s
A81.44	P90.31	Enabling the monitoring on brake status	0–1 0: Disable 1: Enable the brake current monitoring (and brake feedback detection).	0–1	0
A81.45	P05.05	Function of HDIA terminal	0: No function 1: Run forward 2: Run reversely 3–95: See the function parameter chapter.	0–95	0
A81.46	P05.06	Function of HDIB		0–95	0
A81.47	P00.03	Max. frequency	0.00–630.00Hz	0.00–630.00	50.00Hz
A81.48	P00.04	Upper limit frequency	0.00–200.00Hz	0.00–200.00	50.00Hz
A81.49	P00.14	Carrier frequency	1.0–15.0kHz	1.0–15.0	4.0kHz
A82.00–A82.49	With the same functions as A81.00–A81.49				

User-defined function	Related function code	Name	Description	Setting range	Default
A83.00–A83.49	With the same functions as A81.00–A81.49				

5.5 Motor and macro switchover

5.5.1 Function description

The VFD supports the switchover between parameters of up to three motors. You can switch between motors through terminals. The method is as follows:

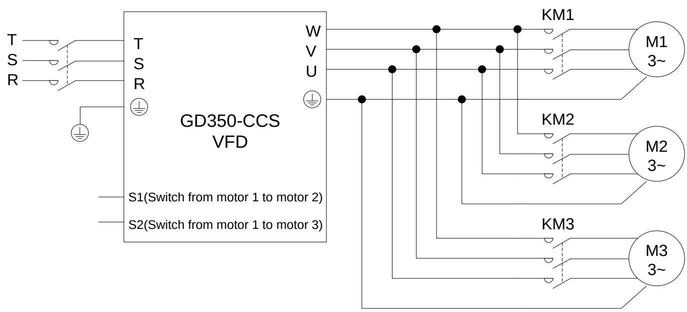
1. Set the ones place of P08.31 to 0 (using terminal control to switch between motors).
2. Select function 35 (switching motor 1 to motor 2) and function 88 (switching motor 1 to motor 3) for the S terminals to perform motor switchover.

In addition, motors can be switched through communication, only if you have set P08.31 to communication, and then the motor switchover command is given through communication.

In addition to motor switchover, up to two groups of control parameters can be switched over as follows:

1. Set P90.03 to 1 or 2, and select the motor that requires function parameter switchover. If motor 3 needs to switch function parameters, set P90.03 to 0.
2. Set P90.00 and P90.01. P90.00 corresponds to control parameters of motor 1, while P90.01 corresponds to control parameters of motor 2 or 3.

The following takes terminal-based switchover for example. It is similar for communication-based switchover. (Note that you need to set P90.03=1 or 2 during communication-based switchover.)



Note:

- Switching from motor 1 to motor 2 takes priority over switching from motor 1 to motor 3. That is, the signal for switching from motor 1 to motor 3 is detected only after no signal for switching from motor 1 to motor 2 is detected.

- The motor parameters for motor 2 are separate from those for motor 3. Group P12 is for motor 2 and group P89 is for motor 3.
  - If P90.03=0, the three motors have the same control method parameters, such as V/F and vector control parameters.
  - If P90.03=1, motor 1 and motor 3 have the same control parameters, but motor 2 has the independent running parameters.
  - If P90.03=2, motor 1 and motor 2 have the same control parameters, but motor 3 has the independent running parameters.
- During motor switching, the terminals to which application macros have assigned values cannot be used for switching. Otherwise, after the application macro is changed, the value is overwritten to the pre-assigned value, resulting in switching failure.

5.5.2 Description about switching from motor 2 to motor 3

The terminal input function does not contain the ability to switch from motor 2 to motor 3. To switch from motor 2 to motor 3, remove the signal for switching from motor 1 to motor 2, and then input the signal for switching from motor 1 to motor 3. If the signal for switching from motor 1 to motor 2 and switching from motor 1 to motor 3 are given simultaneously, the signal for switching from motor 1 to motor 2 is affected since the switching from motor 1 to motor 2 has higher priority (as mentioned earlier), and motor 2 is used automatically.

Example

If S1 is set to have terminal function 35 (for switching from motor 1 to motor 2) and S2 is set to have terminal function 88 (for switching from motor 1 to motor 3), there are four types of combination:

S1 status	S2 status	Present motor status	Contactor switch status
OFF	OFF	Switched to motor 1	KM1 closed, KM2 opened, KM3 opened
ON	OFF	Switched to motor 2	KM1 opened, KM2 closed, KM3 opened
OFF	ON	Switched to motor 3	KM1 opened, KM2 opened, KM3 closed
ON	ON	Switched to motor 2	KM1 opened, KM2 closed, KM3 opened

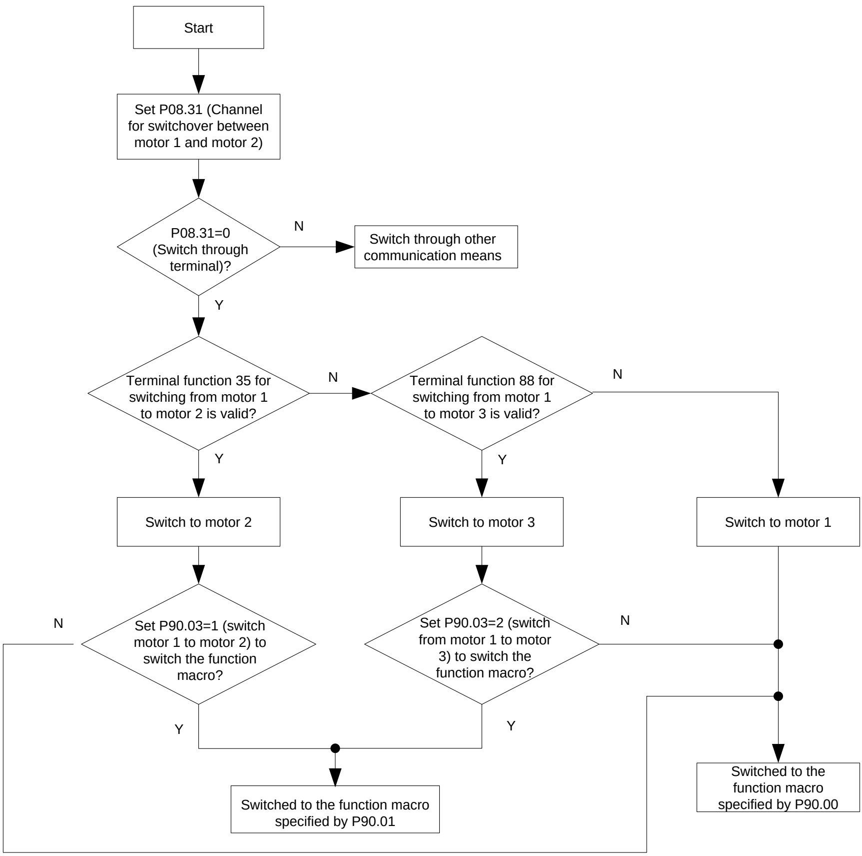
5.5.3 Motor and macro switchover parameters

Function code	Name	Description	Default
P08.31	Channel switching for motor 1 to motor 3	0x00–0x14 Ones place: Switchover channel 0: Terminal 1: Modbus communication 2: PROFIBUS/CANopen/DeviceNet communication (same as the above) 3: Ethernet communication (same as the	0x00

Function code	Name	Description	Default
		above) 4: EtherCAT/PROFINET/ EtherNet IP communication 5: Reserved Tens place: indicates whether to enable switchover during running 0: Disable 1: Enable	
P90.00	Setting of hoisting application macro 1	0–15 0: Common application mode 1: Lifting mode 1 (in open-loop vector control) 2: Lifting mode 2 (in closed-loop vector control) 3: Horizontal moving mode (in space voltage vector control) 4: Tower crane slewing mode 5: Conical motor application mode 6: Custom function macro 1 7: Custom function macro 2 8: Custom function macro 3 9: Lift mode 3 for hoisting (space voltage vector) 10: Construction hoist mode 11: Closed loop winch (for mine hoist and winch) 12: Open loop winch (for mine hoist and winch) 13: Construction elevator mode 2 (for medium-speed elevator application) 14: Tower crane slewing without vortex in closed-loop vector control 15: Tower crane slewing without vortex in space voltage vector control	0
P90.01	Setting of hoisting application macro 2		0
P90.02	User-defined application macro setting	0–3 0: None 1: Enter the settings of user-defined application macro 1 2: Enter the settings of user-defined application macro 2 3: Enter the settings of user-defined application macro 3	0
P90.03	Switchover selection	0–5 0: No switchover	0

Function code	Name	Description	Default
	for hoisting application macros 1 and 2	1: Switch from motor 1 to motor 2 2: Switch from motor 1 to motor 3 3: Switch from the master to the slave 4: Switch from the salve to the master 5: Switch to SVC1 control (open-loop vector control 1)	
P94.39	Present application macro	0–18	0

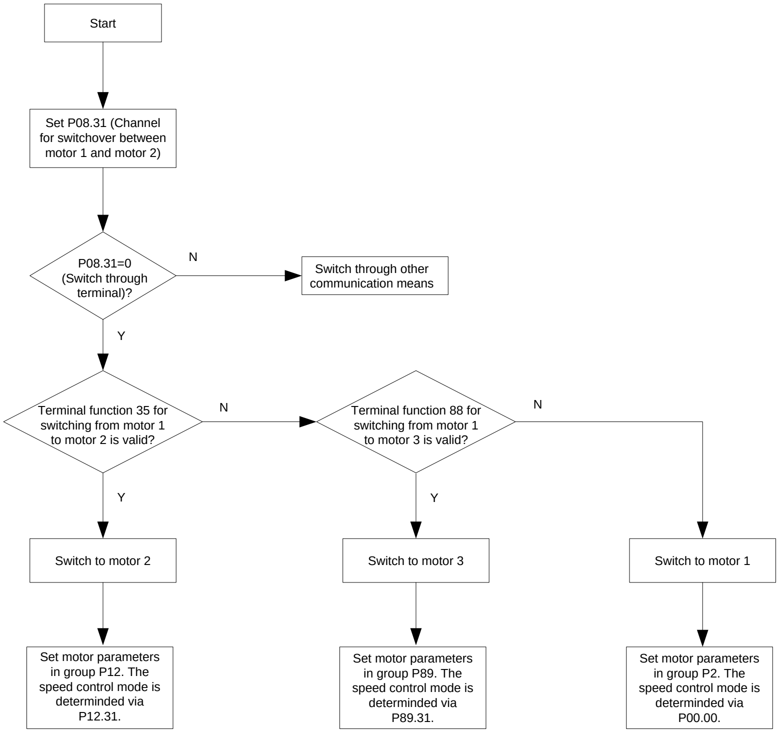
5.5.4 Terminal-based motor and macro switchover flowchart



Note: For user-defined application macros, see section 5.4.5 User-defined application macros.

5.5.5 Shortcut multi-motor speed control mode switchover

If you need to only switch over motor parameters and the control mode but not setting function parameters again during motor switchover, you do not need to switch the speed control mode through the application macro. In this case, you only need to set the speed control mode for motor 2 through P12.31 and that for motor 3 through P89.31.



Related parameters:

Function code	Name	Description	Default
P05.03	Function of S3	35: Switch from motor 1 to motor 2 88: Switch from motor 1 to motor 3	0
P08.31	Channel switching for motor 1 to motor 3	0x00–0x14 Ones place: Switchover channel 0: Terminal 1: Modbus communication 2: PROFIBUS/CANopen/DeviceNet communication (same as the above)	0x00

Function code	Name	Description	Default
		3: Ethernet communication (same as the above) 4: EtherCAT/PROFINET/ EtherNet IP communication 5: 216 communication Tens place: indicates whether to enable switchover during running 0: Disable 1: Enable	
P12.31	Speed control switchover mode of motor 2	0: No switchover, which indicates keeping consistent with P00.00 of motor 1 1: Switch to SVC1 2: Switch to VF 3: Switch to FVC	0
P89.31	Speed control switchover mode of motor 3	0: No switchover, which indicates keeping consistent with P00.00 of motor 1 1: Switch to SVC1 2: Switch to VF 3: Switch to FVC	0

5.5.6 PG card switchover

For applications that require motor switching, if both motors are equipped with encoders, the PG card needs to be switched simultaneously when switching motors (see section 5.5.5 Shortcut multi-motor speed control mode switchover). The following parameters need to be set (the PG card slot of motor 2 needs to be set to 1 in the corresponding bit of P21.34). The encoder parameters of motor 1 correspond to group P20, and the encoder parameters of motor 2 correspond to group P24. After motor switching, the PG card switching automatically follows.

Function code	Name	Description	Setting
P21.34	Dual PG card selection	0x0000–0x3111 Ones place–Hundreds place: Second PG card position selection Ones place: programmable card selection for card slot 1(near the cable) Tens place: Selection of PG card at card slot 2 Hundreds place: Selection of PG card at card slot 3 (near the terminal) 0: Speed closed-loop programmable card,	0x0000

Function code	Name	Description	Setting
		parameter group P20 1: Position closed-loop programmable card, parameter group P24 Thousands place: Speed closed-loop selection 0: Disable 1: Position closed-loop PG card, as the speed closed-loop for switching to motor 2 2: Position closed-loop SSI PG card, using incremental signal as the speed closed-loop selection 3: SSI absolute position as the speed closed-loop (at this time, you need to set corresponding installation card slots for the bits from ones place to hundreds place)	

For example, if the PG card for motor 1 needs to be inserted at card slot 1, and the PG card for motor 2 needs to be inserted at card slot 3, you need to set P21.34=0x1100.

5.6 Temperature measuring

5.6.1 Using PT100/PT1000

1. Through an expansion card

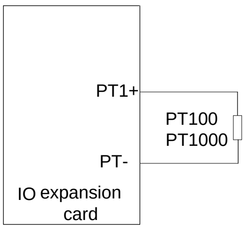


Figure 5-12 PT100/PT1000 measuring temperature through an expansion card

Procedure:

Step 1 Connect the expansion card EC-IO502-00 to PT100/PT1000 according to Figure 5-12.

Step 2 Set P92.12=0x01 to enable PT100 to detect temperature or set P92.12=0x10 to enable PT1000 to detect temperature. In addition, set P92.13=0x01 to enable PT100 to detect disconnection or set P92.13=0x10 to enable PT1000 to detect disconnection.

Step 3 Check whether P94.16 (PT100 present temperature) and P94.17 (PT100 present digital) are correct, or check whether P94.18 (PT1000 present temperature) and P94.19 (PT1000 present digital) are correct.

Function parameter settings

Function code	Name	Description	Setting
P92.12	Enabling PT100/PT1000 temperature detection	Ones place: PT100 temperature detection 0: Disable 1: Enable Tens place: PT1000 temperature detection 0: Disable 1: Enable	0x01 or 0x10
P92.13	Enabling PT100/PT1000 disconnection detection	Ones place: whether to enable PT100 disconnection detection 0: Disable 1: Enable Tens place: PT1000 disconnection detection 0: Disable 1: Enable	0x01
P92.14	PT100 detected OH protection threshold	0.0–150.0°C	120.0°C
P92.15	PT100 overtemperature pre-alarm point	0.0–150.0°C	100.0°C
P92.16	PT1000 detected OH protection threshold	0.0–150.0°C	120.0°C
P92.17	PT1000 overtemperature pre-alarm point	0.0–150.0°C	100.0°C
P92.18	PT100/PT1000 calibrated temperature upper limit	50.0–150.0°C	120.0°C
P92.19	PT100/PT1000 calibrated temperature lower limit	-20.0–50.0°C	20.0°C
P92.20	Digital of PT100/PT1000 calibrated temperature	0–4 0: Normal detection 1: PT100 lower limit digital calibration autotuning 2: PT100 upper limit digital calibration autotuning 3: PT1000 lower limit digital calibration autotuning 4: PT1000 upper limit digital calibration autotuning	0

Function code	Name	Description	Setting
		After autotuning is completed, the function code is automatically cleared, and the calibration value is automatically saved to the I/O card.	

2. Through an AI terminal

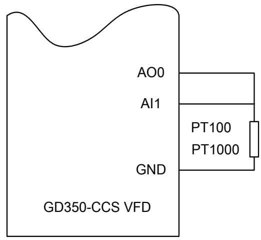


Figure 5-13 Wiring between analog terminals and PT100/PT1000

Note: Turn SW2 on the control board to "I" for current output.

Procedure:

Step 1 Connect PT100/PT1000 according to Figure 5-13.

Step 2 Set P92.22=1 to select PT100, or set P92.22=2 to select PT1000.

Step 3 Set P92.23 (AI detected motor overtemperature protection threshold) and P92.24 (AI detected motor overtemperature alarm threshold).

Step 4 Check whether P94.20 (AI detected motor temperature) is correct.

Function parameter settings

Function code	Name	Description	Setting
P92.22	Type of sensor for AI to detect motor temperature	1: PT100 2: PT1000	1 or 2
P92.23	AI detected motor overtemperature protection threshold	0.0–200.0°C When P94.20 is greater than P92.24, the motor overtemperature (OT) fault is reported and the VFD stops.	110.0°C
P92.24	AI detected motor overtemperature pre-alarm threshold	0.0–200.0°C When P94.20 is greater than P92.24, the A-Aot alarm is reported, but the VFD still runs.	90.0°C
P94.20	AI detected motor temperature	-20.0–200.0°C	0.0°C

5.6.2 Using KTY84

Through an AI terminal

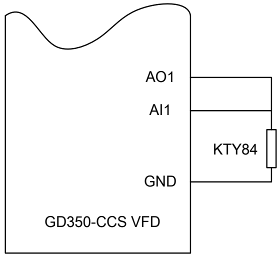


Figure 5-14 Wiring between analog terminals and KTY84

Note: Turn SW2 on the control board to "I" for current output.

Procedure:

Step 1 Connect KTY84 according to Figure 5-14.

Step 2 Set P92.22=3 to select KTY84.

Step 3 Set P92.23 (AI detected motor overtemperature protection threshold) and P92.24 (AI detected motor overtemperature alarm threshold).

Step 4 Check whether P94.20 (AI detected motor temperature) is correct.

Function parameter settings

Function code	Name	Description	Setting
P92.22	Type of sensor for AI to detect motor temperature	3: KTY84	3
P92.23	AI detected motor overtemperature protection threshold	0.0–200.0°C When P94.20 is greater than P92.24, the motor overtemperature (OT) fault is reported and the VFD stops.	110.0°C
P92.24	AI detected motor overtemperature pre-alarm threshold	0.0–200.0°C When P94.20 is greater than P92.24, the A-Aot alarm is reported, but the VFD still runs.	90.0°C
P94.20	AI detected motor temperature	-20.0–200.0°C	0.0°C

5.6.3 Using PTC

1. Through an expansion card

A. You can connect external PTC signal to terminal S8 through the expansion card EC-IO502-00, and set the terminal function to 86 (PTC overtemperature signal is valid).

B. You can set P92.21 (PTC overtemperature selection) to determine whether the VFD reports the alarm A-Ptc to run normally or report PtcE to stop when the PTC overtemperature switch signal is valid.

Note: This function supports only terminal S8, the connected PTC acts at 2.5kΩ and supports only dry-contact shared COM input.

Function parameter settings

Function code	Name	Description	Setting
P92.21	PTC overtemperature selection	0: The PTC function is enabled through terminal selection. When the PTC overtemperature alarm A-Ptc is reported, this cannot terminate normal running. 1: The PTC function is valid through terminal selection. When the PTC overtemperature fault PtcE is reported, this results in stop.	0
P25.04	Function of S8	86: Valid signal of PTC overtemperature	86

2. Through terminal AI1

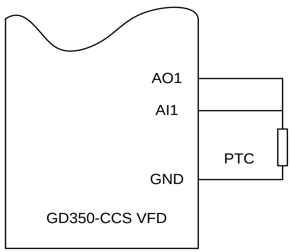


Figure 5-15 Wiring between PTC and analog terminals

Note: Turn SW2 on the control board to "I" for current output. Only AI1 and AO1 are supported for PTC to measure temperature.

Procedure:

Step 1 Connect the PTC according to Figure 5-15.

Step 2 Set P92.22=4 to set the temperature sensor type to PTC.

Step 3 Set P06.23 (often using the default value).

Step 4 Set P06.24 and P06.25 according to the selected PTC model resistance and temperature curve.

Step 5 Check whether the actual PTC resistance is correct.

Function code	Name	Description	Setting
P92.22	Type of sensor for AI to detect motor temperature	4: PTC (supporting only AI1)	4
P06.23	AO1 output current setting	0.000–20.000mA	4.000mA
P06.24	PTC resistance alarm threshold	0–60000Ω When P06.26 is greater than P06.24, the VFD reports the alarm A-Aot and runs normally.	750Ω
P06.25	PTC resistance alarm recovery threshold	0–60000Ω When P06.26 is less than P06.25, the alarm A-Aot is cleared.	150Ω
P06.26	Actual PTC resistance	0–60000Ω	

6 Basic operation guidelines

6.1 What this chapter contains

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

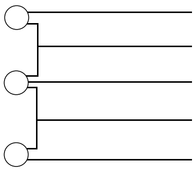
6.2 Keypad introduction

The VFD has been equipped with a LED keypad as a standard configuration part. You can use the keypad to control the VFD, read status data, and adjust parameters of the VFD.

Figure 6-1 Keypad

Note: The external keypad can be mounted directly with M3 threaded screws or with a keypad mounting bracket. The mounting bracket is an optional part for the 380V 30–75kW models, but it is a standard part for the 380V 90–500kW models.

No.	Name	Description	
1	Status indicator	RUN/TUNE	Off: The VFD is stopped. Blinking: The VFD is in parameter autotuning. On: The VFD is running.
		FWD/REV	Forward or reverse running indicator Off: The VFD is running forward. On: The VFD is running reversely.
		LOCAL/REMOT	Indicates whether the VFD is controlled through the keypad, terminals, or communication. Off: The keypad is used for control. Blinking: Terminals are used for control. On: Remote communication is used for control.
		TRIP	Fault indicator Off: The VFD is in normal state.

<table>
<tr><th>No.</th><th>Name</th><th colspan="3">Description</th></tr>
<tr><td></td><td></td><td colspan="2"></td><td>Blinking: The VFD is in in the pre-alarm state.
On: The VFD is in fault state.</td></tr>
<tr><td rowspan="6">2</td><td rowspan="6">Unit indicator</td><td colspan="3">Unit displayed currently</td></tr>
<tr><td rowspan="5"></td><td>Hz</td><td>Frequency unit</td></tr>
<tr><td>RPM</td><td>Rotation speed unit</td></tr>
<tr><td>A</td><td>Current unit</td></tr>
<tr><td>%</td><td>Percentage</td></tr>
<tr><td>V</td><td>Voltage unit</td></tr>
<tr><td>3</td><td>Digital display zone</td><td colspan="3">Five-digit LED displays various monitoring data and alarm codes such as the frequency setting and output frequency.
<table>
<tr><th>Display Means</th><th>Means Means</th><th>Display Means</th><th>Means Means</th><th>Display Means</th><th>Means Means</th></tr>
<tr><td>0</td><td>0</td><td>1</td><td>1</td><td>2</td><td>2</td></tr>
<tr><td>3</td><td>3</td><td>4</td><td>4</td><td>5</td><td>5</td></tr>
<tr><td>6</td><td>6</td><td>7</td><td>7</td><td>8</td><td>8</td></tr>
<tr><td>9</td><td>9</td><td>A.</td><td>A</td><td>b.</td><td>B</td></tr>
<tr><td>C.</td><td>C</td><td>d</td><td>d</td><td>E.</td><td>E</td></tr>
<tr><td>F.</td><td>F</td><td>H.</td><td>H</td><td>I.</td><td>I</td></tr>
<tr><td>L.</td><td>L</td><td>n.</td><td>N</td><td>n</td><td>n</td></tr>
<tr><td>o</td><td>o</td><td>P.</td><td>P</td><td>r</td><td>r</td></tr>
<tr><td>S.</td><td>S</td><td>t</td><td>t</td><td>U.</td><td>U</td></tr>
<tr><td>v</td><td>v</td><td>.</td><td>.</td><td>-</td><td>-</td></tr>
</table></td></tr>
<tr><td>4</td><td>Digital potentiometer</td><td colspan="3">Used for frequency regulation. For details, see the description of P08.42.</td></tr>
<tr><td rowspan="6">5</td><td rowspan="6">Keys</td><td></td><td>Programming key</td><td>Press it to enter or exit level-1 menus or delete a parameter.</td></tr>
<tr><td></td><td>Confirmation key</td><td>Press it to enter menus in cascading mode or confirm the setting of a parameter.</td></tr>
<tr><td></td><td>Up key</td><td>Press it to increase data or move upward.</td></tr>
<tr><td></td><td>Down key</td><td>Press it to decrease data or move downward.</td></tr>
<tr><td></td><td>Right-shifting key</td><td>Press it to select display parameters rightward in the interface for the product in stopped or running state or to select digits to change during parameter setting.</td></tr>
<tr><td></td><td>Run key</td><td>Press it to run the product when using the keypad for control.</td></tr>
</table>

No.	Name	Description		
			Stop/ Reset key	Press it to stop the VFD that is running. 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.
			Multifunction shortcut key	The function is determined by P07.02.

6.3 Keypad display

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

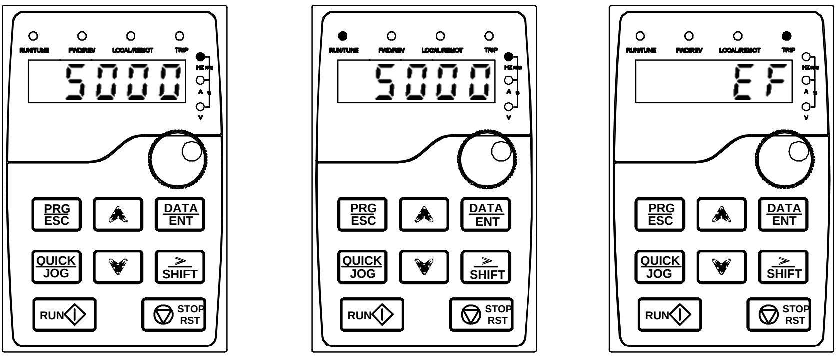
6.3.1 Displaying fault information

After detecting a fault signal, the VFD enters the fault alarm state immediately, the fault code blinks on the keypad, and the TRIP indicator is 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.

6.3.2 Editing function codes

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



Parameters displayed in stopped state | Parameters displayed in running state | Information displayed in faulty state

Figure 6-2 Status display

6.4 Operation procedure

You can operate the VFD by using the keypad. For details about function code descriptions, see the 7.2 Function parameter list.

6.4.1 Modifying function codes

The VFD provides three levels of menus, including:

• Function code group number (level-1 menu)

• Function code number (level-2 menu)

• Function code setting (level-3 menu)

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

If you enter the level-3 menu but the parameter does not have a digit blinking, the parameter cannot be modified due to either of the following reasons:

- It is read only, such as actual detection parameters and running record parameters.
- It cannot be modified in running state and can be modified only in stopped state.

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

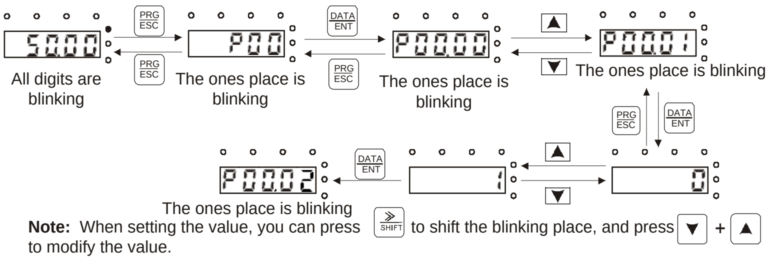
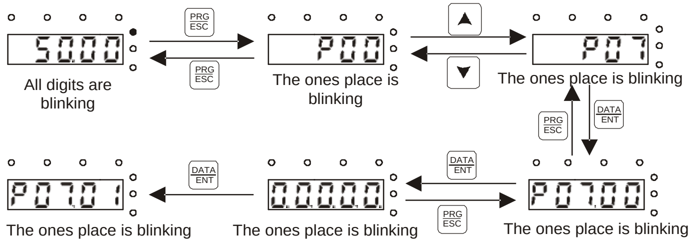


Figure 6-3 Modifying a parameter

6.4.2 Setting a password for the VFD

The VFD provides the user password protection function. When you set P07.00 to a non-zero value, the value is the user password. If password protection is enabled within 1 minute, 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: To disable the password protection function, you need only to set P07.00 to 0.

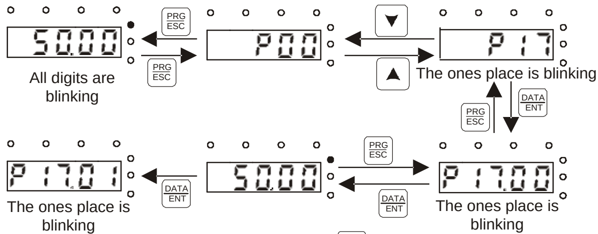


Note: When setting the value, you can press SHIFT to shift the blinking place, and press ▼ + ▲ to modify the value.

Figure 6-4 Setting a password

6.4.3 Viewing VFD status

The VFD provides group P17 for status viewing. You can enter group P17 for viewing.



Note: When setting the value, you can press SHIFT to shift the blinking place, and press ▼ + ▲ to modify the value.

Figure 6-5 Viewing a parameter

6.5 Basic operation description

6.5.1 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.

6.5.2 Common commissioning procedure

6.5.3 Vector control

6.5.4 Space voltage vector control mode

6.5.5 Torque control

6.5.6 Motor parameters

6.5.7 Start/stop control

6.5.8 Frequency setting

6.5.9 Analog input

6.5.10 Analog output

6.5.11 Digital input

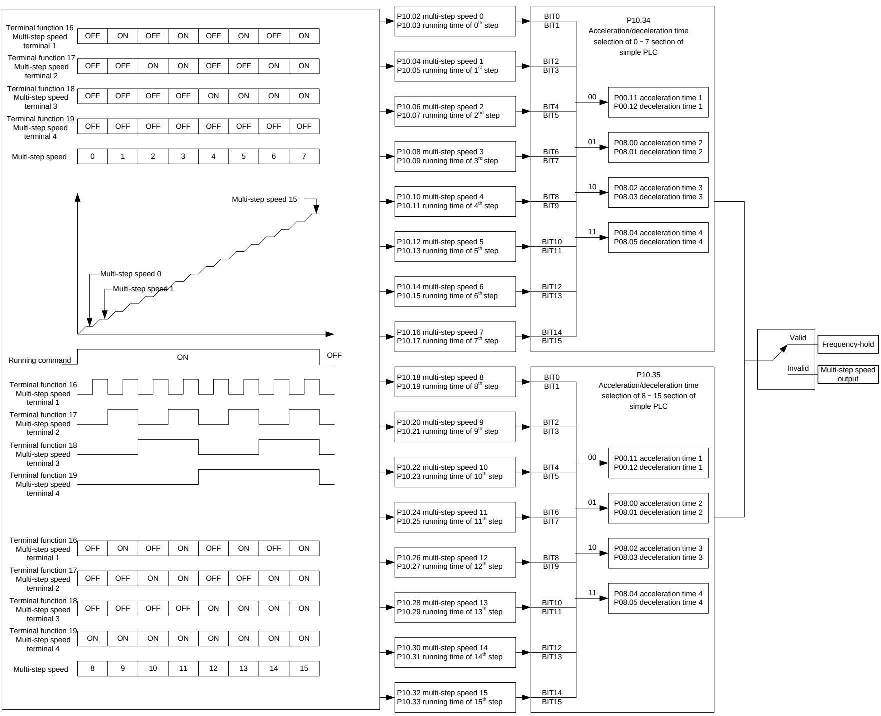
6.5.12 Digital output

6.5.13 Simple PLC

For details about to sections 6.5.2–6.5.13, see the *Goodrive350 Series High-performance Multifunction VFD Operation Manual*.

6.5.14 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: Pause multi-step speed running	
P10.02	Multi-step speed 0	-100.0–100.0%	0.0%
P10.03	Running time of step 0	0.0–6553.5s (min)	0.0s
P10.04	Multi-step speed 1	-100.0–100.0%	0.0%
P10.05	Running time of step 1	0.0–6553.5s (min)	0.0s
P10.06	Multi-step speed 2	-100.0–100.0%	0.0%
P10.07	Running time of step 2	0.0–6553.5s (min)	0.0s
P10.08	Multi-step speed 3	-100.0–100.0%	0.0%
P10.09	Running time of step 3	0.0–6553.5s (min)	0.0s
P10.10	Multi-step speed 4	-100.0–100.0%	0.0%
P10.11	Running time of step 4	0.0–6553.5s (min)	0.0s
P10.12	Multi-step speed 5	-100.0–100.0%	0.0%
P10.13	Running time of step 5	0.0–6553.5s (min)	0.0s
P10.14	Multi-step speed 6	-100.0–100.0%	0.0%
P10.15	Running time of step 6	0.0–6553.5s (min)	0.0s
P10.16	Multi-step speed 7	-100.0–100.0%	0.0%
P10.17	Running time of step 7	0.0–6553.5s (min)	0.0s
P10.18	Multi-step speed 8	-100.0–100.0%	0.0%
P10.19	Running time of step 8	0.0–6553.5s (min)	0.0s
P10.20	Multi-step speed 9	-100.0–100.0%	0.0%
P10.21	Running time of step 9	0.0–6553.5s (min)	0.0s
P10.22	Multi-step speed 10	-100.0–100.0%	0.0%
P10.23	Running time of step 10	0.0–6553.5s (min)	0.0s
P10.24	Multi-step speed 11	-100.0–100.0%	0.0%
P10.25	Running time of step 11	0.0–6553.5s (min)	0.0s
P10.26	Multi-step speed 12	-100.0–100.0%	0.0%
P10.27	Running time of step 12	0.0–6553.5s (min)	0.0s
P10.28	Multi-step speed 13	-100.0–100.0%	0.0%
P10.29	Running time of step 13	0.0–6553.5s (min)	0.0s
P10.30	Multi-step speed 14	-100.0–100.0%	0.0%
P10.31	Running time of step 14	0.0–6553.5s (min)	0.0s

Function code	Name	Description	Default
P10.32	Multi-step speed 15	-100.0–100.0%	0.0%
P10.33	Running time of step 15	0.0–6553.5s (min)	0.0s
P10.34	ACC/DEC time of steps 0–7 of simple PLC	0x0000–0xFFFF	0x0000
P10.35	ACC/DEC time of steps 8–15 of simple PLC	0x0000–0xFFFF	0x0000
P17.27	Simple PLC and actual step of multi-step speed	0–15	0

6.5.15 Graded multi-step speed reference

Graded reference is a speed reference method for hoisting applications. Graded reference supports the graded operating lever mode and graded remote-control mode. Graded reference can implement 6-step speeds by combing the five graded multi-step reference terminals. The combination methods are as follows:

Graded reference terminal 1	Graded reference terminal 2	Graded reference terminal 3	Graded reference terminal 4	Graded reference terminal 5	Speed setting	Function code
OFF	OFF	OFF	OFF	OFF	Graded multi-step speed reference 0	P90.06
ON	OFF	OFF	OFF	OFF	Graded multi-step speed reference 1	P90.07
ON	ON	OFF	OFF	OFF	Graded multi-step speed reference 2	P90.08
ON	ON	ON	OFF	OFF	Graded multi-step speed reference 3	P90.09
ON	ON	ON	ON	OFF	Graded multi-step speed reference 4	P90.10
ON	ON	ON	ON	ON	Graded multi-step speed reference 5	P90.11

Related parameter list:

Function code	Name	Description	Default
P05.01–P05.06 I/O expansion card P25.01–	Digital input function selection	77: Graded reference terminal 1 78: Graded reference terminal 2 79: Graded reference terminal 3 80: Graded reference terminal 4 81: Graded reference terminal 5	

Function code	Name	Description	Default
P25.08			
P90.06	Graded multi-step speed reference 0	-100.0–100.0%, relative to P00.03	0.0%
P90.07	Graded multi-step speed reference 1	-100.0–100.0%, relative to P00.03	0.0%
P90.08	Graded multi-step speed reference 2	-100.0–100.0%, relative to P00.03	0.0%
P90.09	Graded multi-step speed reference 3	-100.0–100.0%, relative to P00.03	0.0%
P90.10	Graded multi-step speed reference 4	-100.0–100.0%, relative to P00.03	0.0%
P90.11	Graded multi-step speed reference 5	-100.0–100.0%, relative to P00.03	0.0%

Note: The multi-step settings of a higher grade can be closed only after the multi-step settings of all lower grades are closed.

6.5.16 Local encoder input

6.5.17 Commissioning procedures for position control

6.5.18 Fault handling

For details about to sections 6.5.16–6.5.18, see the *Goodrive350 Series High-performance Multifunction VFD Operation Manual*.

7 Function parameter list

7.1 What this chapter contains

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

7.2 Function parameter list

The function parameters of the VFD are divided into groups by function. Among the function parameter groups, groups P85–P94 are hoisting function groups, P98 is the analog input and output calibration group, while P99 contains the factory function parameters, which are user inaccessible. Each group includes several function codes (each function code identifies a function parameter). A three-level menu style is applied to function codes. For example, "P08.08" indicates the 8th function code in the 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 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.)

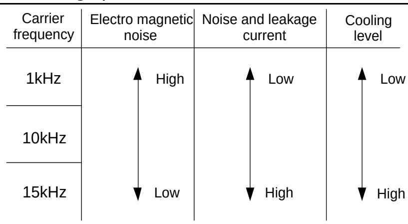
2. The parameters adopt the decimal system (DEC). If the hexadecimal system is adopted, all bits are mutually independent on data during parameter editing, and the setting ranges at some bits can be hexadecimal (0–F).
3. "Default" indicates the factory setting of the function parameter. If the value 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: SVC mode 0 1: SVC mode 1 2: Space voltage vector control mode 3: Closed-loop vector control mode **Note:** Before using a vector control mode (0, 1, or 3), enable the VFD to perform motor parameter autotuning first.	2	◎
P00.01	Channel of running 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: Programmable expansion card 5: Wireless communication card 6: Reserved 7: USB (Reserved) **Note:** The options 1, 2, 3, 4, 5, 6, and 7 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)–630.00Hz	50.00Hz	◎

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td>P00.04</td><td>Upper limit of running frequency</td><td>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)</td><td>50.00Hz</td><td>◎</td></tr>
<tr><td>P00.05</td><td>Lower limit of running frequency</td><td>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.
Setting range: 0.00Hz–P00.04 (Upper limit of running frequency)
Note: Max. output frequency ≥ Upper limit of frequency ≥ Lower limit of frequency</td><td>0.00Hz</td><td>◎</td></tr>
<tr><td>P00.06</td><td>Setting channel of A frequency command</td><td rowspan="2">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: Programmable expansion card
15: Multi-step speed run
16: Reserved</td><td>0</td><td>○</td></tr>
<tr><td>P00.07</td><td>Setting channel of B frequency command</td><td>1</td><td>○</td></tr>
</table>

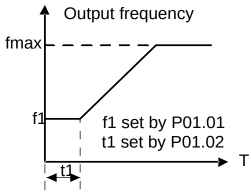
Function code	Name	Description	Default	Modify
P00.08	Reference object of B frequency command	0: Max. output frequency 1: A frequency command	0	○
P00.09	Combination mode of setting source	0: A 1: B 2: (A+B) 3: (A-B) 4: Max(A, B) 5: Min(A, B)	0	○
P00.10	Frequency set through keypad	When A and B frequency commands select the keypad for setting, the value of the function code is the original setting one of the frequency data of the 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 speeds down from the max. output frequency (P00.03) to 0Hz. 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 of P00.11 and P00.12: 0.0–3600.0s	Model depended	○
P00.12	DEC time 1		Model depended	○
P00.13	Running direction	0: Run at the default direction. 1: Run at the opposite direction. 2: Disable reverse running. **Note:** It can be modified only when P11.26 is 1 indicating special functions are enabled.	0	○
P00.14	Carrier frequency setting		Model depended	○

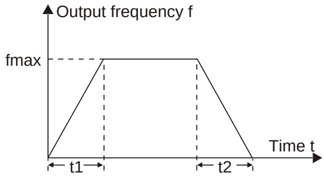
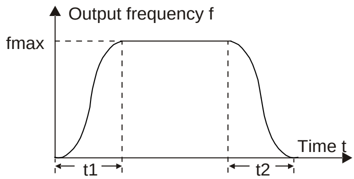
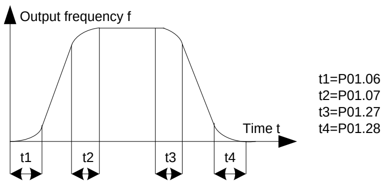
<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td></td><td></td><td>The relationship between models and carrier frequencies is as follows:
<table>
<tr><th colspan="2">Model</th><th>Default carrier frequency</th></tr>
<tr><td rowspan="2">380V</td><td>0.4–11kW</td><td>4kHz</td></tr>
<tr><td>15kW and higher</td><td>1.5kHz</td></tr>
<tr><td rowspan="2">660V</td><td>22–55kW</td><td>4kHz</td></tr>
<tr><td>75kW and higher</td><td>2kHz</td></tr>
</table>
Advantage of high carrier frequency: ideal current waveform, little current harmonic wave and motor noise.
Disadvantage of high carrier frequency: increasing the switch loss, increasing 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 increase of 1k carrier frequency.
Setting range: 1.0–15.0kHz</td><td></td><td></td></tr>
<tr><td>P00.15</td><td>Motor parameter autotuning</td><td>0: No operation
1: Rotary autotuning.
Comprehensive motor parameter autotuning. It is recommended to use rotating autotuning when high control accuracy is needed.
2: Static autotuning 1 (comprehensive autotuning); static autotuning 1 is used in cases where the motor cannot be disconnected from</td><td>0</td><td>◎</td></tr>
</table>

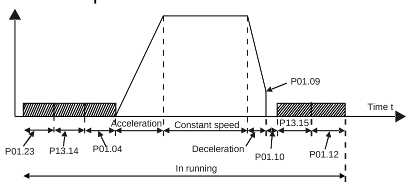
Function code	Name	Description	Default	Modify
		load. 3: Static autotuning 2 (partial autotuning); when the present motor is motor 1, only P02.06, P02.07, and P02.08 are autotuned; when the present motor is motor 2, only P12.06, P12.07, and P12.08 are autotuned. 4: Dynamic autotuning 2 (valid only for AMs) 5: Partial parameter static autotuning 2 (valid only 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	○
P00.18	Function parameter restore	Setting range of P00.18: 0–6 0: No operation 1: Restore to default values (excluding motor parameters) 2: Clear fault records 3: Lock keypad parameters 4: Reserved 5: Restore to default values (factory test mode) 6: Restore to default values (including motor parameters) **Note:** After the selected operation is performed, the function code is automatically restored to 0. Restoring the default values may delete the user password. Exercise caution when using this function.	0	◎

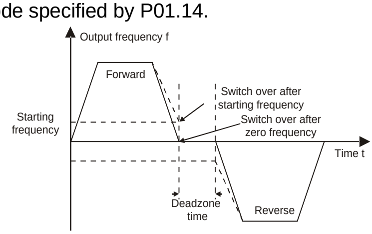
Group P01—Start and stop control

Function code	Name	Description	Default	Modify
P01.00	Start mode	0: Direct start 1: Start after DC braking 2: Start after speed tracking **Note:** It can be modified only when P11.26 is 1 indicating special functions are enabled.	0	◎

Function code	Name	Description	Default	Modify
P01.01	Starting frequency of direct start	The function code indicates the initial frequency during VFD start. See P01.02 (Starting frequency hold time) for detailed information. Setting range: 0.00–50.00Hz	0.50Hz	◎
P01.02	Starting frequency hold time	 Setting a proper starting frequency can increase the torque during VFD start. During the hold time of the starting frequency, the output frequency of the VFD is the starting frequency. And then, the VFD runs from the starting frequency to the set frequency. If the set frequency is lower than the starting frequency, the VFD stops running and keeps in the standby state. The starting frequency is not limited in the lower limit frequency. Setting range: 0.0–50.0s	0.0s	◎
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. Stronger braking current indicates larger braking power. 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: 0.00–50.00s	0.0%	◎
P01.04	Braking time before start		0.00s	◎
P01.05	ACC and DEC mode	Used to indicate the changing mode of the frequency during start and running. 0: Linear type. The output frequency increases or decreases linearly.	0	◎

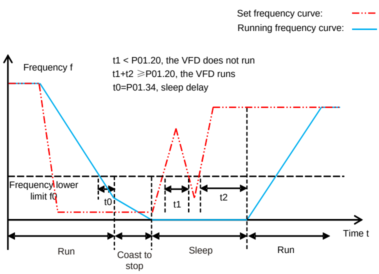
Function code	Name	Description	Default	Modify
		 1: S curve. The output frequency increases or decreases according to the S curve. The S curve is generally applied to elevators, conveyors, and other application scenarios where smoother start or stop is required.  2: Slewing application mode **Note:** When the function parameter is set to 1, you also need to set P01.06, P01.07, P01.27, and P01.28.		
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.  Setting range: 0.0–50.0s	0.1s	◎
P01.07	Time of ending segment of ACC S curve		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	○

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td>P01.09</td><td>Starting frequency of DC braking for stop</td><td rowspan="4">Starting frequency of DC braking for stop: During the deceleration to stop, the VFD starts DC braking for stop when running frequency reaches the starting frequency determined by P01.09.
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.
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.


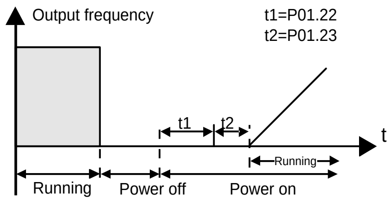
Setting range of P01.09: 0.00Hz–P00.03 (Max. output frequency)
Setting range of P01.10: 0.00–30.00s
Setting range of P01.11: 0.0–100.0% (of the rated VFD output current)
Setting range of P01.12: 0.0–50.0s</td><td>0.00Hz</td><td>○</td></tr>
<tr><td>P01.10</td><td>Demagnetization time</td><td>0.00s</td><td>○</td></tr>
<tr><td>P01.11</td><td>DC braking current for stop</td><td>0.0%</td><td>○</td></tr>
<tr><td>P01.12</td><td>DC braking time for stop</td><td>0.00s</td><td>○</td></tr>
<tr><td>P01.13</td><td>FWD/REV running deadzone time</td><td>This function code specifies the transition time of the switching in FWD/REV running switching mode specified by P01.14.


Setting range: 0.0–3600.0s</td><td>0.0s</td><td>○</td></tr>
</table>

Function code	Name	Description	Default	Modify
P01.14	FWD/REV running switching mode	0: Switch at zero frequency 1: Switch at the starting frequency 2: Switch after the speed reaches the stop speed with a delay	1	◎
P01.15	Stop speed	0.00–100.00Hz	0.20Hz	◎
P01.16	Stop speed detection mode	0: Detect by the set speed (unique in space voltage vector control mode) 1: Detect by the feedback speed	0	◎
P01.17	Stop speed detection time	0.00–100.00s	0.50s	◎
P01.18	Terminal-based running 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 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 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. 2: The terminal running command is invalid at power-on, and a fault is reported. (Power-on terminal command exception POE). During power on, the VFD does not run but reports the fault, although the running command terminal is valid. The fault disappears only when the running command is canceled. **Note:** Exercise caution before using this function. Otherwise, serious result may follow.	0	○
P01.19	Action selected when running frequency less than frequency lower limit (valid when frequency lower	The function code determines the running state of the VFD when the set frequency is lower than the lower-limit one. 0x00–0x12 Ones place: Action selection 0: Run at the frequency lower limit	0x00	◎

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td></td><td>limit greater than 0)</td><td>1: Stop
2: Sleep
Tens place: Stop mode
0: Coast to stop
1: Decelerate to stop
The VFD coasts to stop or decelerates to stop based on the tens place setting when the set frequency is lower than the lower-limit one.
When the set frequency exceeds the lower limit one again and it lasts for the time set by P01.20, the VFD resumes the running state automatically.</td><td></td><td></td></tr>
<tr><td>P01.20</td><td>Wake-up-from -sleep delay</td><td>Specifies 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 exceeds the lower limit one again and it lasts for the time set by P01.20, the VFD runs automatically.


Setting range: 0.0–3600.0s (valid when P01.19=2)</td><td>0.0s</td><td>○</td></tr>
<tr><td>P01.21</td><td>Power-off restart selection</td><td>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.</td><td>0</td><td>○</td></tr>
<tr><td>P01.22</td><td>Wait time for restart after power-off</td><td>The function code indicates the wait time before the automatic running of the VFD that is</td><td>1.0s</td><td>○</td></tr>
</table>

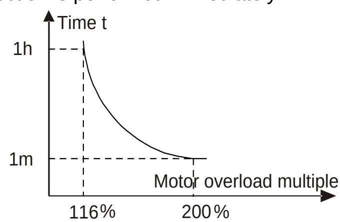
Function code	Name	Description	Default	Modify
		re-powered on.  Setting range: 0.0–3600.0s (valid when P01.21=1)		
P01.23	Start delay	After a VFD running command is given, the VFD is in standby state and restarts with the delay defined by P01.23 to implement brake release. Setting range: 0.0–600.0s	0.0s	○
P01.24	Stop speed delay	0.0–600.0s	0.0s	○
P01.25	Open-loop 0Hz output selection	0: Output without voltage 1: Output with voltage 2: Output with the DC braking current for stop	0	○
P01.26	DEC time for emergency stop	0.0–60.0s	2.0s	○
P01.27	Time of starting segment of DEC S curve	0.0–50.0s	0.1s	◎
P01.28	Time of ending segment of DEC S curve	0.0–50.0s	0.1s	◎
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)	0.0%	○
P01.30	Hold time of short-circuit braking for start		0.00s	○
P01.31	Hold time of short-circuit braking for stop		0.00s	○

Function code	Name	Description	Default	Modify
		Setting range of P01.30: 0.0–50.0s Setting range of P01.31: 0.0–50.0s		
P01.32	Pre-exciting time for jogging	0–10.000s	0.000s	○
P01.33	Starting frequency of braking for stop in jogging	0–P00.03	0.00Hz	○
P01.34	Sleep delay	0–3600.0s	0.0s	○

Group P02—Parameters of motor 1

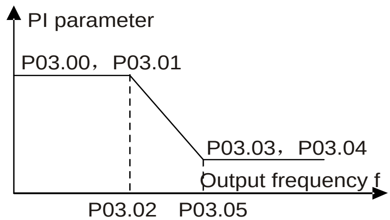
Function code	Name	Description	Default	Modify
P02.00	Type of motor 1	0: Asynchronous motor (AM) 1: Synchronous motor (SM)	0	◎
P02.01	Rated power of AM 1	0.1–3000.0kW	Model depended	◎
P02.02	Rated frequency of AM 1	0.01Hz–P00.03 (Max. output frequency)	50.00Hz	◎
P02.03	Rated speed of AM 1	1–60000RPM	Model depended	◎
P02.04	Rated voltage of AM 1	0–1200V	Model depended	◎
P02.05	Rated current of AM 1	0.8–6000.0A	Model depended	◎
P02.06	Stator resistance of AM 1	0.001–65.535Ω	Model depended	○
P02.07	Rotor resistance of AM 1	0.001–65.535Ω	Model depended	○
P02.08	Leakage inductance of AM 1	0.1–6553.5mH	Model depended	○
P02.09	Mutual inductance of AM 1	0.1–6553.5mH	Model depended	○
P02.10	No-load current of AM 1	0.1–6553.5A	Model depended	○
P02.11	Magnetic saturation coefficient 1 of iron core of AM 1	0.0–100.0%	80.0%	○

Function code	Name	Description	Default	Modify
P02.12	Magnetic saturation coefficient 2 of iron core of AM 1	0.0–100.0%	68.0%	○
P02.13	Magnetic saturation coefficient 3 of iron core of AM 1	0.0–100.0%	57.0%	○
P02.14	Magnetic saturation coefficient 4 of iron core of AM 1	0.0–100.0%	40.0%	○
P02.15	Rated power of SM 1	0.1–3000.0kW	Model depended	◎
P02.16	Rated frequency of SM 1	0.01Hz–P00.03 (Max. output frequency)	50.00Hz	◎
P02.17	Number of pole pairs of SM 1	1–128	2	◎
P02.18	Rated voltage of SM 1	0–1200V	Model depended	◎
P02.19	Rated current of SM 1	0.8–6000.0A	Model depended	◎
P02.20	Stator resistance of SM 1	0.001–65.535Ω	Model depended	○
P02.21	Direct-axis inductance of SM 1	0.01–655.35mH	Model depended	○
P02.22	Quadrature-axis inductance of SM 1	0.01–655.35mH	Model depended	○
P02.23	Counter-emf of SM 1	0–10000	300	○
P02.24	Initial pole position of SM 1	0x0000–0xFFFF	0x0000	●
P02.25	Identification current of SM 1	0%–50% (of the motor rated current)	10%	●
P02.26	Overload protection of motor 1	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,	2	◎

Function code	Name	Description	Default	Modify
		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.		
P02.27	Overload protection coefficient of motor 1	Motor overload multiples M=Iout/(In*K) In is rated motor current, Iout is VFD output current, K is 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=200%, protection is performed after motor overload lasts for 60 seconds; and when M≥400%, protection is performed immediately.  Setting range: 20.0%–150.0%	100.0%	○
P02.28	Power display calibration coefficient of motor 1	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	Parameter display of motor 1	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	○

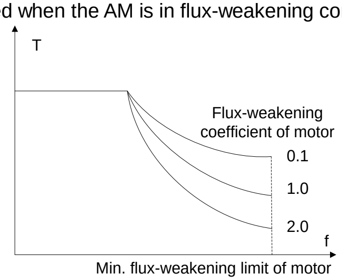
Function code	Name	Description	Default	Modify
P02.30	System inertia of motor 1	0–30.000kg.m^2	0kg.m^2	○
P02.31	Max. slip limit	When P02.31=0, the max. slip limit cannot be used.	0	◎
P02.32	Reserved	0–65535	0	●

Group P03—Vector control of motor 1

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 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:  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	10.0	○
P03.01	Speed-loop integral time 1		0.200s	○
P03.02	Low-point frequency for switching		5.00Hz	○
P03.03	Speed-loop proportional gain 2		20.0	○
P03.04	Speed-loop integral time 2		0.200s	○
P03.05	High-point frequency for switching		10.00Hz	○

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td></td><td></td><td>depending on different loads to meet various demands.
Setting range of P03.00: 0.0–200.0
Setting range of P03.01: 0.000–10.000s
Setting range of P03.02: 0.00Hz–P03.05
Setting range of P03.03: 0.0–200.0
Setting range of P03.04: 0.000–10.000s
Setting range of P03.05: P03.02–P00.03 (Max. output frequency)</td><td></td><td></td></tr>
<tr><td>P03.06</td><td>Speed-loop output filter</td><td>0–8 (0–2^8/10ms)</td><td>0</td><td>○</td></tr>
<tr><td>P03.07</td><td>Electromotive slip compensation coefficient of vector control</td><td rowspan="2">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%</td><td>100%</td><td>○</td></tr>
<tr><td>P03.08</td><td>Power-generation slip compensation coefficient of vector control</td><td>100%</td><td>○</td></tr>
<tr><td>P03.09</td><td>Current-loop proportional coefficient P</td><td rowspan="2">Setting range: 0–65535
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 closed-loop vector control mode (P00.00=3).</td><td>1000</td><td>○</td></tr>
<tr><td>P03.10</td><td>Current-loop integral coefficient I</td><td>1000</td><td>○</td></tr>
<tr><td>P03.11</td><td>Torque setting method</td><td>0–1: Keypad (P03.12)
2: AI1
3: AI2
4: AI3
5: Pulse frequency HDIA
6: Multi-step torque
7: Modbus/Modbus TCP communication
8: PROFIBUS/CANopen/DeviceNet communication
9: Ethernet communication</td><td>0</td><td>○</td></tr>
</table>

Function code	Name	Description	Default	Modify
		10: Pulse frequency HDIB 11: EtherCAT/PROFINET/ EtherNet IP communication 12: Programmable expansion card 13: Reserved **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	0.000–10.000s	0.010s	○
P03.14	Setting source of forward rotation frequency upper limit in torque control	0: Keypad (P03.16) 1: AI1 2: AI2 3: AI3 4: Pulse frequency HDIA 5: Multi-step setting 6: Modbus/Modbus TCP communication 7: PROFIBUS/CANopen/DeviceNet communication 8: Ethernet communication 9: Pulse frequency HDIB 10: EtherCAT/PROFINET/ EtherNet IP communication 11: Programmable card 12: Reserved **Note:** For these settings, 100% corresponds to the max. frequency.	0	○
P03.15	Setting source of reverse rotation upper-limit frequency in torque control	0: Keypad (P03.17) 1–12: Same as those for P03.14	0	○
P03.16	Forward rotation upper-limit frequency set through keypad in torque control	Used to set the frequency upper limits. 100% corresponds to the max. frequency. P03.16 specifies the value when P03.14=1, while P03.17 specifies the value when P03.15=1. Setting range: 0.00Hz–P00.03 (Max. output frequency)	50.00Hz	○
P03.17	Reverse rotation		50.00Hz	○

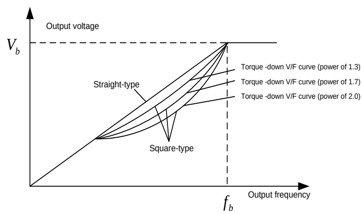
Function code	Name	Description	Default	Modify
	upper-limit frequency set through keypad in torque control			
P03.18	Setting source of electromotive torque upper limit	0: Keypad (P03.20) 1: AI1 2: AI2 3: AI3 4: Pulse frequency HDIA 5: Modbus/Modbus TCP communication 6: PROFIBUS/CANopen/DeviceNet communication 7: Ethernet communication 8: Pulse frequency HDIB 9: EtherCAT/PROFINET/ EtherNet IP communication 10: Programmable expansion card 11: Reserved **Note:** For these settings, 100% corresponds to the motor rated current.	0	○
P03.19	Setting source of braking torque upper limit	0: Keypad (P03.21) 1–11: Same as those for P03.18	0	○
P03.20	Electromotive torque upper limit set through keypad	0.0–300.0% (of the motor rated current) **Note:** It can be modified only when the ones place of P11.26 = 1 indicating special functions are enabled.	250.0%	○
P03.21	Braking torque upper limit set through keypad		250.0%	○
P03.22	Weakening coefficient in constant power zone	Used when the AM is in flux-weakening control.  The function codes P03.22 and P03.23 are	0.8	○
P03.23	Lowest weakening point in constant power zone		20%	○

Function code	Name	Description	Default	Modify
		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%		
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%	100.0%	○
P03.25	Pre-exciting 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: 0.000–10.000s	0.000s	○
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	○
P03.28	Static friction compensation coefficient	0.0–100.0%	0.0%	○
P03.29	Corresponding frequency point of static friction	0.50Hz–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	○

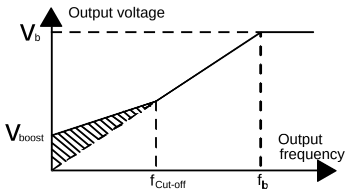
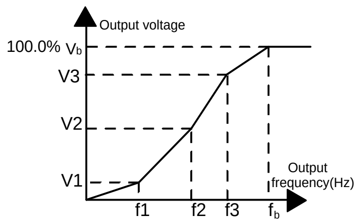
Function code	Name	Description	Default	Modify
P03.32	Enabling torque control	0: Disable 1: Enable	0	◎
P03.33	Flux-weakening integral gain	0–8000	1200	○
P03.34	Flux-weakening control mode selection	0x000–0x111 Ones place: Control mode selection 0: Mode 0 1: Mode 1 In Mode 0, the weak magnetic current obtained from the weak magnetic curve is used for calculation of slip coefficient, and the filter time is fixed to 1 (Mode0 is stable). In Mode 1, the actual weak magnetic current is used for calculation of slip coefficient, and the filter time is fixed to 1. Tens place: Compensation of inductance saturation coefficient 0: Yes 1: No Hundreds place: Current loop feedforward compensation 0: Yes 1: No	0x000	◎
P03.35	Control optimization setting	0x0000–0x1111 Ones place: Torque command selection 0: Torque reference 1: Torque current reference Tens place: Reserved Hundreds place: indicates whether to enable speed-loop integral separation 0: Disable 1: Enable Thousands place: Reserved	0x0000	○
P03.36	Speed-loop differential gain	0.00–10.00s	0.00s	○
P03.37	High-frequency current-loop proportional	In the closed-loop vector control mode (P00.00=3), when the frequency is lower than the current-loop high-frequency switching	1000	○

Function code	Name	Description	Default	Modify
	coefficient	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)		
P03.38	High-frequency current-loop integral coefficient		1000	○
P03.39	Current-loop high-frequency switching threshold		100.0%	○
P03.40	Enabling inertia compensation	0: Disable 1: Enable	0	○
P03.41	Upper limit of inertia compensation torque	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 times	Filter times of inertia compensation torque, used to smooth inertia compensation torque. Setting range: 0–10	7	○
P03.43	Inertia identification torque	Due to friction force, it is required to set certain identification torque for the inertia identification to be performed properly. Setting range: 0.0–100.0% (of the motor rated torque)	10.0%	○
P03.44	Enabling inertia identification	0: No operation 1: Enable	0	◎
P03.45	Current loop proportional coefficient after autotuning	0–65535	0	○
P03.46	Current integral proportional coefficient after autotuning	0–65535	0	○

Group P04––V/F control

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td>P04.00</td><td>V/F curve setting of motor 1</td><td>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: Torque-down V/F curve (power of 1.3)
3: Torque-down V/F curve (power of 1.7)
4: Torque-down V/F curve (power of 2.0)
Curves 2 – 4 are applicable to the torque loads such as fans and water pumps. You can adjust according to the characteristics of the loads to achieve best performance.
5: Customized V/F (V/F separation); in this mode, V can be separated from F and F can be adjusted through the frequency setting channel set by P00.06 or the voltage setting channel set by P04.27 to change the characteristics of the curve.


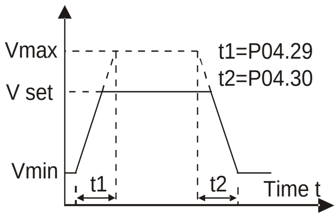
Note: In the figure, V_b indicates the motor rated voltage and f_b indicates the motor rated frequency.</td><td>0</td><td>◎</td></tr>
<tr><td>P04.01</td><td>Torque boost of motor 1</td><td rowspan="2">In order to compensate for low-frequency torque characteristics, you can make some boost compensation 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</td><td>0.0%</td><td>○</td></tr>
<tr><td>P04.02</td><td>Torque boost cut-off of motor 1</td><td>20.0%</td><td>○</td></tr>
</table>

Function code	Name	Description	Default	Modify
		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. 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%		
P04.03	V/F frequency point 1 of motor 1	When P04.00=1 (multi-dot V/F curve), you can set the V/F curve through P04.03–P04.08. The V/F curve is generally set according to the load characteristics of the motor. **Note:** V1 < V2 < V3, f1 < f2 < f3. Too high voltage for low frequency will cause motor overheat or damage and cause VFD overcurrent stall or overcurrent protection.  Setting range of P04.03: 0.00Hz–P04.05	0.00Hz	○
P04.04	V/F voltage point 1 of motor 1		00.0%	○
P04.05	V/F frequency point 2 of motor 1		0.00Hz	○
P04.06	V/F voltage point 2 of motor 1		0.0%	○
P04.07	V/F frequency point 3 of motor 1		0.00Hz	○
P04.08	V/F voltage point 3 of motor 1		00.0%	○

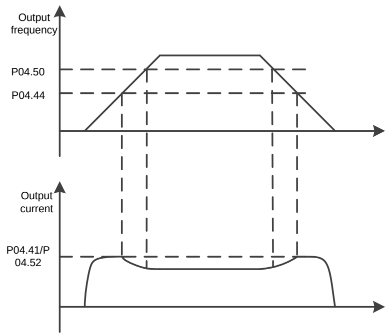
Function code	Name	Description	Default	Modify
		Setting range of P04.04: 0.0%–110.0% (of the rated voltage of motor 1) Setting range of P04.05: P04.03 –P04.07 Setting range of P04.06: 0.0%–110.0% (of the rated voltage of motor 1) Setting range of P04.07: P04.05–P02.02 (of the rated frequency of AM 1) or P04.05– P02.16 (of the rated frequency of SM 1) Setting range of P04.08: 0.0%–110.0% (of the rated voltage of motor 1)		
P04.09	V/F slip compensation gain of motor 1	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. You need to calculate the rated slip frequency of the motor as follows: $\triangle f=f_b-n*p/60$ Of which, 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 $\triangle f$ of motor 1. Setting range: 0.0–200.0%	0.0%	○
P04.10	Low-frequency oscillation control factor of motor 1	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 two function codes properly to eliminate such phenomenon. Setting range of P04.10: 0–100 Setting range of P04.11: 0–100 Setting range of P04.12: 0.00Hz–P00.03 (Max. output frequency)	10	○
P04.11	High-frequency oscillation control factor of motor 1		10	○
P04.12	Oscillation control threshold of motor 1		30.00Hz	○
P04.13	V/F curve setting of motor 2	The function code defines the V/F curve of motor 2 to meet the needs of different loads.	0	◎

Function code	Name	Description	Default	Modify
		0: Straight-line V/F curve 1: Multi-point V/F curve 2: Torque-down V/F curve (power of 1.3) 3: Torque-down V/F curve (power of 1.7) 4: Torque-down V/F curve (power of 2.0) 5: Customized V/F curve (V/F separation) **Note:** Refer to the description for P04.00.		
P04.14	Torque boost of motor 2	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) **Note:** Refer to the descriptions for P04.01 and P04.02.	0.0%	○
P04.15	Torque boost cut-off of motor 2		20.0%	○
P04.16	V/F frequency point 1 of motor 2	Setting range of P04.16: 0.00Hz–P04.18 Setting range of P04.17: 0.0%–110.0% (of the rated voltage of motor 2) Setting range of P04.18: P04.16–P04.20 Setting range of P04.19: 0.0%–110.0% (of the rated voltage of motor 2) 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) Setting range of P04.21: 0.0%–110.0% (of the rated voltage of motor 2) **Note:** Refer to the descriptions for P04.03 and P04.08.	0.00Hz	○
P04.17	V/F voltage point 1 of motor 2		00.0%	○
P04.18	V/F frequency point 2 of motor 2		0.00Hz	○
P04.19	V/F voltage point 2 of motor 2		00.0%	○
P04.20	V/F frequency point 3 of motor 2		0.00Hz	○
P04.21	V/F voltage point 3 of motor 2		00.0%	○
P04.22	V/F slip compensation gain of motor 2	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. You need to calculate the rated slip frequency of the motor as follows: $\triangle f=f_b-n*p/60$ Of which, f_b is the rated frequency of the motor, 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%	0.0%	○

Function code	Name	Description	Default	Modify
		corresponds to the rated slip frequency △f of motor 2. Setting range: 0.0–200.0%		
P04.23	Low-frequency oscillation control factor of motor 2	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 two function codes properly to eliminate such phenomenon. Setting range of P04.23: 0–100 Setting range of P04.24: 0–100 Setting range of P04.25: 0.00Hz–P00.03 (Max. output frequency)	10	○
P04.24	High-frequency oscillation control factor of motor 2		10	○
P04.25	Oscillation control threshold of motor 2		30.00Hz	○
P04.26	Energy-saving 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 (The output voltage is determined by P04.28.) 1: AI1 2: AI2 3: AI3 4: HDIA 5: Multi-step running (The setting is determined by related parameters in group 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: Programmable expansion card 13: Reserved	0	○

Function code	Name	Description	Default	Modify
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 frequency. Voltage decrease time means the time needed for the VFD to decelerate from the max. output frequency to min. output voltage. Setting range: 0.0–3600.0s	5.0s	○
P04.30	Voltage decrease time		5.0s	○
P04.31	Max. output voltage	The function codes are used to set the upper and lower limits of output voltage.  Setting range of P04.31: P04.32 –100.0% (of the motor rated voltage) Setting range of P04.32: 0.00Hz–P04.31	100.0%	◎
P04.32	Min. output voltage		0.0%	◎
P04.33	Weakening coefficient in constant power zone	1.00–1.30	1.00	○
P04.34	Pull-in current 1 in SM V/F control	When the SM VF 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	Pull-in current 2 in SM V/F control	When the SM VF 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	10.0%	○

Function code	Name	Description	Default	Modify
		rated current)		
P04.36	Frequency threshold for pull-in current switching in SM V/F control	When the SM VF 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 VF control mode is enabled, the function code is used to set the proportional coefficient of reactive current closed-loop control. Setting range: 0–3000	50	○
P04.38	Reactive current closed-loop integral time in SM V/F control	When the SM VF 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 VF control	When the SM VF control mode is enabled, the function code is used to set the output limit of the reactive current closed-loop control. A greater value indicates a higher reactive closed-loop compensation voltage and higher output power of the motor. In general, you do not need to modify the function code. Setting range: 0–16000	8000	○
P04.40	Enabling I/F mode for AM 1	0: Invalid 1: Enable **Note:** The I/F mode is not applicable to conical motors.	0	◎
P04.41	Forward current setting in I/F mode for AM 1	When I/F control is adopted for AM 1, this parameter is used to set the output current. The value is a percentage in relative to the rated current of the motor. Setting range: 0.0–200.0%	120.0%	○
P04.42	Proportional coefficient in I/F mode for AM 1	When I/F control is adopted for AM 1, this parameter is used to set the proportional coefficient of the output current in closed-loop	350	○

Function code	Name	Description	Default	Modify
		control. Setting range: 0–5000		
P04.43	Integral coefficient in I/F mode for AM 1	When I/F control is adopted for AM 1, this parameter is used to set the integral coefficient of the output current in closed-loop control. Setting range: 0–5000	150	○
P04.44	Starting frequency for switching off I/F mode for AM 1	When I/F control is adopted for AM 1, this parameter is used to set the starting frequency for switching off the output current closed-loop control. When the output frequency is lower than the value of this parameter, the current closed-loop control in the I/F control mode is enabled. When the output frequency is higher than the value of this parameter, the I/F control mode is switched off. When the output frequency is higher than P04.50, the current closed-loop control in the I/F control mode is disabled.  Setting range: 0.00–20.00Hz	10.00Hz	○
P04.45	Enabling I/F mode for AM 2	0: Disable 1: Enable **Note:** The I/F mode is not applicable to conical motors.	0	◎
P04.46	Forward current setting in I/F mode for AM 2	When I/F control is adopted for AM 2, this parameter is used to set the output current. The value is a percentage in relative to the rated current of the motor. Setting range: 0.0–200.0%	120.0%	○

Function code	Name	Description	Default	Modify
P04.47	Proportional coefficient in I/F mode for AM 2	When I/F control is adopted for AM 2, the function code is used to set the proportional coefficient of output current in closed-loop control. Setting range: 0–5000	350	○
P04.48	Integral coefficient in I/F mode for AM 2	When I/F control is adopted for AM 2, the function code is used to set the integral coefficient of output current in closed-loop control. Setting range: 0–5000	150	○
P04.49	Starting frequency for switching off I/F mode for AM 2	When I/F control is adopted for AM 2, this parameter is used to set the starting frequency for switching off the output current closed-loop control. When the output frequency is lower than the value of this parameter, the current closed-loop control in the I/F control mode is enabled; and when the output frequency is higher than P04.51, the current closed-loop control in the I/F control mode is disabled. Setting range: 0.00–20.00Hz	10.00Hz	○
P04.50	End frequency for switching off I/F mode for motor 1	P04.44–P00.03	25.00Hz	○
P04.51	End frequency for switching off I/F mode for motor 2	P04.49–P00.03	25.00Hz	○
P04.52	Reverse current setting in I/F mode for AM 1	0.0–200.0%	120.0%	○
P04.53	Reverse current setting in I/F mode for AM 2	0.0–200.0%	120.0%	○

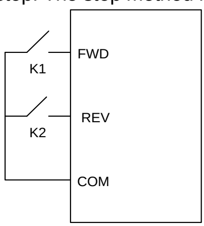
Group P05––Input terminals

Function code	Name	Description	Default	Modify
P05.00	HDI input type	0x00–0x11 Ones place: HDIA input type	0x00	◎

Function code	Name	Description	Default	Modify
		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		
P05.01	Function of S1	0: No function	1	◎
P05.02	Function of S2	1: Run forward (FWD)	2	◎
P05.03	Function of S3	2: Run reversely (REV)	7	◎
P05.04	Function of S4	3: Three-wire running control (S_{In})	0	◎
P05.05	Function of HDIA terminal	4: Jog forward 5: Jog reversely	0	◎
P05.06	Function of HDIB	6: Coast to stop 7: Fault reset 8: Pause running 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: Pause multi-step speed running 21: ACC/DEC time selection 1 22: ACC/DEC time selection 2 23: Simple PLC stop reset 24: Pause simple PLC 25: Pause PID control 26: Pause wobbling frequency 27: Reset wobbling frequency 28: Counter reset 29: Switch between speed control and torque	0	◎

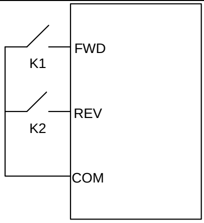
Function code	Name	Description	Default	Modify
		control 30: Disable ACC/DEC 31: Trigger the counter 32: Input power failure trigger 33: Clear the frequency increase/decrease setting temporarily 34: DC braking 35: Switch from motor 1 to motor 2 36: Switch the running command channel to keypad 37: Switch the running command channel to terminal 38: Switch the running command channel to communication 39: Pre-exciting command 40: Clear electricity consumption 41: Keep electricity consumption 42: Switch the setting source of braking torque upper limit to keypad 43: Position reference point input (only valid for S2, S3 and S4) 44: Reserved 45: Local positioning zeroing 46–50: Reserved 51: Terminal for switching between position control and speed control 52: Disable pulse input 53: Clear position deviation 54: Switch position proportional gains 55: Enable cyclic digital positioning 56: Emergency stop 57: Motor overtemperature fault input 58: Enable rigid tapping 59: Switch to V/F control 60: Switch to FVC control 61: Switch PID polarities 62: Switch to SVC1 control (open-loop vector control 1)		

Function code	Name	Description	Default	Modify
		63: Enable servo 64: Limit of forward run (upward) 65: Limit of reverse run (downward) 66: Clear encoder counting 67: Increase pulses 68: Enable pulse superposition 69: Decrease pulses 70: Electronic gear selection 71: Switch to the master 72: Switch to the slave 73: Enable the VFD 74: Contactor feedback signal 75: Brake feedback signal 76: Operating lever zero-point position 77: Graded reference terminal 1 78: Graded reference terminal 2 79: Graded reference terminal 3 80: Graded reference terminal 4 81: Graded reference terminal 5 82: Upward DEC limit position 83: Downward DEC limit position 84: Light load speed boost signal 85: Brake detection 86: PTC overtemperature valid signal (supporting only S8 of EC-IO502-00) 87: Reserved 88: Switch from motor 1 to motor 3 89: Anti-snag protection input 90: Enable anti-sway 91: Switch from master/slave mode to a non master/slave mode 92: Reserved 93: Foot braking 94: Top-hitting prevention 95: Slewing jog		
P05.07	Reserved	0–65535	0	●
P05.08	Input terminal polarity	The function code is used to set the polarity of input terminals.	0x00	○

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td></td><td></td><td>0x00–0x3F
Corresponding to HDIB, HDIA, S4, S3, S2, and S1 in sequence
When a bit is 0, the input terminal is positive.
when a bit is 1, the input terminal is negative.</td><td></td><td></td></tr>
<tr><td>P05.09</td><td>Digital input filter time</td><td>The function code is used to set the filter time for S1–S4, HDIA, and HDIB. In strong interference cases, increase the value to avoid maloperation.
0.000–1.000s</td><td>0.010s</td><td>○</td></tr>
<tr><td>P05.10</td><td>Virtual terminal setting</td><td>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</td><td>0x00</td><td>◎</td></tr>
<tr><td>P05.11</td><td>Terminal control mode</td><td>The function code is used to set the mode of terminal control.
0: Two-wire control 1, the enabling consistent with the direction. This mode is widely used. The defined FWD/REV terminal command determines the motor rotation direction and stop. The stop method is specified by P01.08.


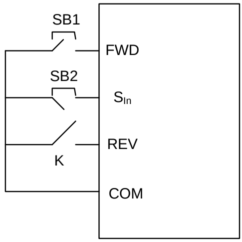
<table>
<tr><th>FWD</th><th>REV</th><th>Running command</th></tr>
<tr><td>OFF</td><td>OFF</td><td>Stop</td></tr>
<tr><td>ON</td><td>OFF</td><td>Forward running</td></tr>
<tr><td>OFF</td><td>ON</td><td>Reverse running</td></tr>
<tr><td>ON</td><td>ON</td><td>Hold</td></tr>
</table>
1: Two-wire control 2, the enabling separated from the direction. In this mode, FWD is the enabling terminal. The direction depends on the defined REV state.</td><td>0</td><td>◎</td></tr>
</table>

Function code	Name	Description	Default	Modify



FWD	REV	Running command
OFF	OFF	Stop
ON	OFF	Forward running
OFF	ON	Stop
ON	ON	Reverse running

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 terminal FWD generates a rising edge signal, then 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 stop method is specified by P01.08.

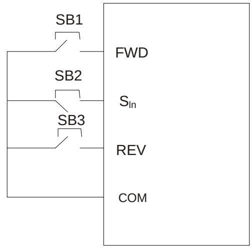


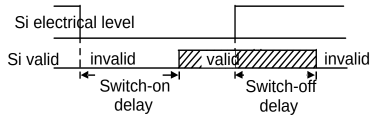
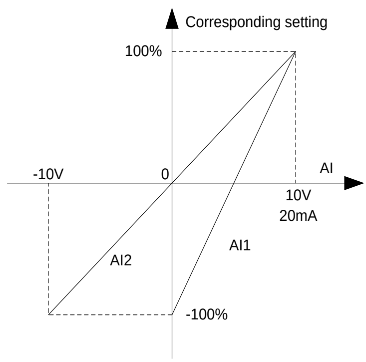
The direction control is as follows during running:

<table>
<tr><th>S_{In}</th><th>REV</th><th>Previous direction</th><th>Present 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">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

Function code	Name	Description	Default	Modify
		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 REV or FWD generates a rising edge signal, then the VFD starts to run in the direction set by the state of terminal; the VFD needs to be stopped by disconnecting terminal S_{In}. The stop method is specified by P01.08.  <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>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.)		
P05.12	S1 switch-on delay	These function codes specify the delay time corresponding to the electrical level changes when the programmable input terminals switch	0.000s	○
P05.13	S1 switch-off delay		0.000s	○
P05.14	S2 switch-on delay		0.000s	○

Function code	Name	Description	Default	Modify
P05.15	S2 switch-off delay	on or switch off.  Setting range: 0.000–50.000s **Note:** After a virtual terminal is enabled, the state of the terminal can be changed only in communication mode. The communication address is 0x200A.	0.000s	○
P05.16	S3 switch-on delay		0.000s	○
P05.17	S3 switch-off delay		0.000s	○
P05.18	S4 switch-on delay		0.000s	○
P05.19	S4 switch-off delay		0.000s	○
P05.20	HDIA switch-on delay		0.000s	○
P05.21	HDIA switch-off delay		0.000s	○
P05.22	HDIB switch-on delay		0.000s	○
P05.23	HDIB switch-off delay		0.000s	○
P05.24	AI1 lower limit	Used to define the relationship between the analog input voltage and its corresponding setting. When the analog input voltage exceeds the range from the upper limit to the lower limit, the upper limit or lower limit is used. When the analog input is current input, 0mA–20mA current corresponds to 0V–10V voltage. In different applications, 100.0% of the analog setting corresponds to different nominal values. See the descriptions of each application section for details. The following figure illustrates the cases of several settings: 	0.00V	○
P05.25	Corresponding setting of AI1 lower limit		0.0%	○
P05.26	AI1 upper limit		10.00V	○
P05.27	Corresponding setting of AI1 upper limit		100.0%	○
P05.28	AI1 input filter time		0.030s	○
P05.29	AI2 lower limit		-10.00V	○
P05.30	Corresponding setting of AI2 lower limit		-100.0%	○
P05.31	AI2 middle value 1		0.00V	○
P05.32	Corresponding setting of AI2 middle value 1		0.0%	○
P05.33	AI2 middle value 2		0.00V	○
P05.34	Corresponding setting of AI2 middle value 2		0.0%	○
P05.35	AI2 upper limit		10.00V	○
P05.36	Corresponding setting of AI2 upper		100.0%	○

Function code	Name	Description	Default	Modify
	limit	Input filter time: to adjust the sensitivity of analog input. Increasing the value properly can enhance analog input anti-interference but may reduce the sensitivity of analog input. **Note:** AI1 supports the 0–10V/0–20mA input. When AI1 selects the 0–20mA input, the corresponding voltage of 20mA is 10V. AI2 supports the -10–+10V input. Setting range of P05.24: 0.00V–P05.26 Setting range of P05.25: -300.0% –300.0% Setting range of P05.26: P05.24–10.00V Setting range of P05.27: -300.0% –300.0% Setting range of P05.28: 0.000s–10.000s Setting range of P05.29: -10.00V–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: P05.33–10.00V Setting range of P05.36: -300.0% –300.0% Setting range of P05.37: 0.000s–10.000s		
P05.37	AI2 input filter time		0.030s	○
P05.38	HDIA high-speed pulse input function selection	0: Input set through frequency 1: Reserved 2: Input set through encoder, used together with HDIB	0	◎
P05.39	HDIA frequency lower limit	0.000kHz–P05.41	0.000kHz	○
P05.40	Corresponding setting of HDIA lower limit frequency	-300.0%–300.0%	0.0%	○
P05.41	HDIA frequency upper limit	P05.39–50.000kHz	50.000 kHz	○
P05.42	Corresponding setting of HDIA upper limit frequency	-300.0%–300.0%	100.0%	○

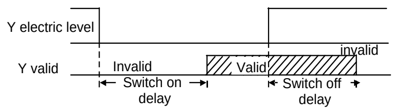
Function code	Name	Description	Default	Modify
P05.43	HDIA frequency input filter time	0.000s–10.000s	0.030s	○
P05.44	HDIB high-speed pulse input function selection	0: Input set through frequency 1: Reserved 2: Input set through encoder, used together with HDIA	0	◎
P05.45	HDIB frequency lower limit	0.000kHz–P05.47	0.000kHz	○
P05.46	Corresponding setting of HDIB lower limit frequency	-300.0%–300.0%	0.0%	○
P05.47	HDIB frequency upper limit	P05.45–50.000kHz	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	0.000s–10.000s	0.030s	○
P05.50	AI1 input signal type	0: Voltage 1: Current **Note:** You can set the AI1 input signal type through the corresponding function code.	0	◎

Group P06––Output terminals

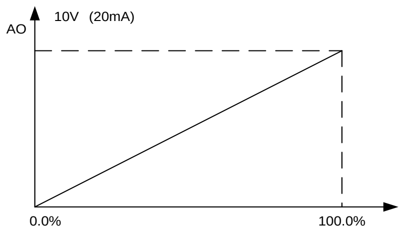
Function code	Name	Description	Default	Modify
P06.00	HDO output type	0: Open collector high-speed pulse output (The max. frequency of pulse is 50.00kHz. For details about the related functions, see P06.27–P06.31) 1: Open collector output (For details about the related functions, see P06.02)	0	◎
P06.01	Y1 output	0: Invalid 1: Running 2: Running forward 3: Running reversely	0	○
P06.02	HDO output selection		0	○
P06.03	RO1 output		1	○

Function code	Name	Description	Default	Modify
	selection	4: Jogging		
P06.04	RO2 output selection	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: Lower limit frequency reached 12: Ready for running 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: Running time reached 23: Modbus/ Modbus TCP communication virtual terminal output (RO2/RO1/HDO/Y1) 24: PROFIBUS/CANopen/DeviceNet communication virtual terminal output (RO2/RO1/HDO/Y1) 25: Ethernet communication virtual terminal output (RO2/RO1/HDO/Y1) 26: DC bus voltage established 27: Z pulse output 28: Superposing pulses 29: STO action 30: Positioning completed 31: Spindle zeroing completed 32: Spindle scale division completed 33: In speed limit 34: EtherCAT/PROFINET communication virtual terminal output (RO2/RO1/HDO/Y1) 35: Modbus/Modbus TCP/PROFIBUS/CANopen /DeviceNet/EtherCAT/Profinet/Ethernet IP	0	○

Function code	Name	Description	Default	Modify
		communication virtual terminal output (RO4/RO3/Y3/Y2) 36: Speed/position control switchover completed 37: Any frequency reached 38: Non STO fault 39–40: Reserved 41: C_Y1 from PLC (Set P27.00 to 1.) 42: C_Y2 from PLC (Set P27.00 to 1.) 43: C_HDO from PLC (Set P27.00 to 1.) 44: C_RO1 from PLC (Set P27.00 to 1.) 45: C_RO2 from PLC (Set P27.00 to 1.) 46: C_RO3 from PLC (Set P27.00 to 1.) 47: C_RO4 from PLC (Set P27.00 to 1.) 48: Contactor output 49: Brake output 50: Ready to release the brake 51: Ready to close the brake 52: Upward limit position reached 53: Downward limit position reached 54: Low voltage protection 55: Overload protection 56: Brake detection reminding 57: Brake failure alarm 58: Input phase loss alarm 59: Loose rope status (Loose rope fault in REV lowering) 60: In motor 1 state 61: In motor 2 state 62: In motor 3 state 63: PT100 temperature alarm 64: PT1000 temperature alarm 65: Boosting the speed with light load 66: Frequency decrease with voltage 67: Weighing alarm 68: AI detected temperature alarm 69: Reserved 70: Stopped or running at zero speed 71: Input power off		

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td>P06.05</td><td>Output terminal polarity selection</td><td>The function code is used to set the polarity of output terminals.
When the current bit is set to 0, the output terminal is positive.
When the current bit is set to 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: 0x0 –0xF</td><td>0x0</td><td>○</td></tr>
<tr><td>P06.06</td><td>Y1 switch-on delay</td><td rowspan="8">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: 0.000–50.000s
Note: P06.08 and P06.09 are valid only when P06.00=1.</td><td>0.000s</td><td>○</td></tr>
<tr><td>P06.07</td><td>Y1 switch-off delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P06.08</td><td>HDO switch-on delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P06.09</td><td>HDO switch-off delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P06.10</td><td>RO1 switch-on delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P06.11</td><td>RO1 switch-off delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P06.12</td><td>RO2 switch-on delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P06.13</td><td>RO2 switch-off delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P06.14</td><td>AO1 output</td><td rowspan="2">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–Speed corresponding to max. output frequency)
4: Output (0–Twice the inverter unit rated current)
5: Output current (0–Twice the motor rated current)
6: Output (0–1.5 times the inverter unit rated voltage)
7: Output power (0–Twice the motor rated power)
8: Set torque (0–Twice the motor rated torque)</td><td>0</td><td>○</td></tr>
<tr><td>P06.16</td><td>HDO high-speed pulse output</td><td>0</td><td>○</td></tr>
</table>

Function code	Name	Description	Default	Modify
		9: Output torque (Absolute value, 0–±Twice the motor rated torque) 10: AI1 input (0–10V/0–20mA) 11: AI2 input (0–10V) 12: AI3 input (0–10V/0–20mA) 13: HDIA input (0.00–50.00kHz) 14: Value 1 set through Modbus/Modbus TCP communication (0–1000) 15: Value 2 set through Modbus/Modbus TCP communication (0–1000) 16: Value 1 set through PROFIBUS/CANopen/DeviceNet communication (0–1000) 17: Value 2 set through PROFIBUS/CANopen/DeviceNet communication (0–1000) 18: Value 1 set through Ethernet communication (0–1000) 19: Value 2 set through Ethernet communication (0–1000) 20: HDIB input (0.00–50.00kHz) 21: Value 1 set through EtherCAT/PROFINET/EtherNet IP communication (0–1000) 22: Torque current (bipolar, 0–Triple the motor rated current) 23: Exciting current (bipolar, 0–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: Value 2 set through EtherCAT/PROFINET/EtherNet IP communication (0–1000) 28: C_AO1 from PLC (Set P27.00 to 1) (0–		

Function code	Name	Description	Default	Modify
		1000) 29: C_AO2 from PLC (Set P27.00 to 1) (0–1000) 30: Rotational speed (0–Twice the motor rated synchronous speed) 31: Output torque (Actual value, 0–Twice the motor rated torque) 32: AIAO detected temperature output 33–34: Reserved 35: Hook rope length (0–Max. rope length) 36–63: Reserved		
P06.17	AO1 output lower limit	The function codes define the relationship between the output value and analog output. When the output value exceeds the allowed range, the output uses the lower limit or upper limit. When the analog output is current output, 1mA equals 0.5V. In different cases, the corresponding analog output of 100% of the output value is different.  Setting range of P06.17: -300.0%–P06.19 Setting range of P06.18: 0.00V–10.00V Setting range of P06.19: P06.17–300.0% Setting range of P06.20: 0.00V–10.00V Setting range of P06.21: 0.000s–10.000s	0.0%	○
P06.18	AO1 output corresponding to lower limit		0.00V	○
P06.19	AO1 output upper limit		100.0%	○
P06.20	AO1 output corresponding to upper limit		10.00V	○
P06.21	AO1 output filter time		0.000s	○
P06.23	AO1 output current setting	Applicable to P92.22=4 (using PTC for temperature measuring). Refer to section 5.6.3 Using PTC. Set P06.24 and P06.25 according to the selected PTC model resistance and temperature curve.	4.000mA	○
P06.24	PTC resistance alarm threshold		750Ω	○
P06.25	PTC resistance		150Ω	○

Function code	Name	Description	Default	Modify
	alarm recovery threshold	When P06.26 is greater than P06.24, the VFD reports the alarm A-Aot and runs normally. When P06.26 is less than P06.25, the alarm A-Aot is cleared. Setting range of P06.23: 0.00–20.000mA Setting range of P06.24: 0–60000Ω Setting range of P06.25: 0–60000Ω Setting range of P06.26: 0–60000Ω		
P06.26	Actual PTC resistance		0Ω	●
P06.27	HDO output lower limit	-300.0%–P06.29	0.00%	○
P06.28	HDO output corresponding to lower limit	0.00–50.00kHz	0.00kHz	○
P06.29	HDO output upper limit	P06.27–300.0%	100.0%	○
P06.30	HDO output corresponding to upper limit	0.00–50.00kHz	50.00kHz	○
P06.31	HDO output filter time	0.000s–10.000s	0.000s	○
P06.33	Detection value for frequency being reached	0Hz–P00.03	1.00Hz	○
P06.34	Frequency reaching detection time	0–3600.0s	0.5s	○

Group P07––Human-machine interface

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. 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	0	○

Function code	Name	Description	Default	Modify
		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	Parameter copy	Range: 0–4 0: No operation 1: Upload parameters to the keypad 2: Download all parameters (including motor parameters) 3: Download non-motor parameters 4: Download motor parameters	0	◎
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 rotating 4: Clear the UP/DOWN setting 5: Coast to stop 6: Switch command channels in sequence 7: Quick commissioning mode (based on non-factory parameter settings) Tens place: Reserved	0x01	◎
P07.03	Sequence of switching running-command channels by pressing QUICK	When P07.02=6, set the sequence of switching running-command channels by pressing this key. 0: Keypad→Terminal→Communication 1: Keypad←→Terminal 2: Keypad←→Communication	0	○

Function code	Name	Description	Default	Modify
		3: Terminal←→Communication		
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: 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	0	○
P07.05	Selection 1 of parameters displayed in running state	0x0000–0xFFFF	0x03FF	
P07.06	Selection 2 of parameters displayed in running state	0x0000–0xFFFF	0x0000	
P07.07	Selection of parameters displayed in stopped state	0x0000–0xFFFF	0x00FF	
P07.08	Frequency display coefficient	0.01–10.00 Display frequency = Running frequency× P07.08	1.00	○
P07.09	Rotational speed display coefficient	0.1–999.9% Mechanical rotation speed = 120× (Displayed running frequency) × P07.09/(Number of motor pole pairs)	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	/	●
P07.12	Inverter module temperature	-20.0–120.0°C	/	●
P07.13	Control board software version	1.00–655.35	/	●

Function code	Name	Description	Default	Modify
P07.14	Local accumulative running time	0–65535h	/	●
P07.15	VFD electricity consumption MSB	Used to display the electricity consumption of the VFD VFD electricity consumption = P07.15*1000 + P07.16 Setting range of P07.15: 0–65535 kWh (×1000) Setting range of P07.16: 0.0–999.9 kWh	/	●
P07.16	VFD electricity consumption LSB		/	●
P07.17	VFD model	0x0000–0xFFF1 Ones place: G/P type 0: G type 1: P type Tens place: Chip type 0: DSP 1: ARM Hundreds place–thousands place: Reserved	0x0000	●
P07.18	VFD rated power	0.4–3000.0kW	/	●
P07.19	VFD rated voltage	50–1200V	/	●
P07.20	VFD rated current	0.1–6000.0A	/	●
P07.21	Factory bar code 1	0x0000–0xFFFF	/	●
P07.22	Factory bar code 2	0x0000–0xFFFF	/	●
P07.23	Factory bar code 3	0x0000–0xFFFF	/	●
P07.24	Factory bar code 4	0x0000–0xFFFF	/	●
P07.25	Factory bar code 3	0x0000–0xFFFF	/	●
P07.26	Factory bar code 4	0x0000–0xFFFF	/	●
P07.27	Type of present fault	0: No fault 1: Inverter unit U-phase protection (OUt1) 2: Inverter unit V-phase protection (OUt2) 3: Inverter unit W-phase protection (OUt3) 4: Overcurrent during acceleration (OC1) 5: Overcurrent during deceleration (OC2) 6: Overcurrent during constant speed running (OC3) 7: Overvoltage during acceleration (OV1) 8: Overvoltage during deceleration (OV2) 9: Overvoltage during constant speed running (OV3) 10: Bus undervoltage fault (UV)	/	●
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		/	●

Function code	Name	Description	Default	Modify
		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 overheat (OH1) 16: Inverter module overheat (OH2) 17: External fault (EF) 18: RS485 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 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: Programmable card customized fault 1 (P-E1) 46: Programmable card customized fault 2 (P-E2)		

Function code	Name	Description	Default	Modify
		47: Programmable card customized fault 3 (P-E3) 48: Programmable card customized fault 4 (P-E4) 49: Programmable card customized fault 5 (P-E5) 50: Programmable card customized fault 6 (P-E6) 51: Programmable card customized fault 7 (P-E7) 52: Programmable card customized fault 8 (P-E8) 53: Programmable card customized fault 9 (P-E9) 54: Programmable 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 at slot 1 (F1-Er) 61: Failure to identify the card at slot 2 (F2-Er) 62: Failure to identify the card at slot 3 (F3-Er) 63: Communication timeout of the card at slot 1 (C1-Er) 64: Communication timeout of the card at slot 2 (C2-Er) 65: Communication timeout of the card at 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: VFD disabled (dIS) 71: Contactor feedback fault (tbE) 72: Brake feedback fault (FAE) 73: Torque verification fault (tPF)		

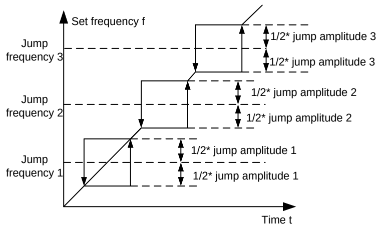
Function code	Name	Description	Default	Modify
		74: Operating lever zero-position fault (STC) 75: Low speed running protection fault (LSP) 76: Terminal command exception (tCE) 77: Power-on terminal command exception (POE) 78: Loose rope protection fault (SLE) 79: Brake failure (bE) 80: Master/slave position synchronization fault (ELS) 81: Analog speed reference deviation fault (AdE) 82: PT100 overtemperature (OtE1) 83: PT1000 overtemperature (OtE2) 84: Set frequency fault (SFE) 85: Current imbalance fault (Cuu) 86: PTC overtemperature fault (PtcE) 87: Overload fault (E-OvL) 88: Overspeed fault (E-OS) 89: Stalling fault (E-dS) 90–91: Reserved 92: AI1 disconnection fault (E-AI1) 93: AI2 disconnection fault (E-AI2) 94: AI3 disconnection fault (E-AI3) 95: EtherNet IP communication timeout fault (E-EIP) 96: No upgrade bootload (E-PAO) 97: Second encoder disconnection (Enc2o) 98: SSI position deviation fault (ENCPI) 99: SSI position forward limit (E-PUP) 100: SSI position downward limit (E-Pdn) 101: SSI positioning offline fault (E-SSd) 102: SSI positioning initial fault (E_SSS) 103: SSI positioning timeout fault (E-SSF) 104: Fault of instant stop at load change (E-CL)		
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	●

Function code	Name	Description	Default	Modify
P07.35	Output current at present fault	0–1200V	0V	●
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	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 status 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 status at last fault	0x0000–0xFFFF	0x0000	●
P07.48	Output terminal status 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	●

Function code	Name	Description	Default	Modify
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 status at 2nd-last fault	0x0000–0xFFFF	0x0000	●
P07.56	Output terminal status at 2nd-last fault	0x0000–0xFFFF	0x0000	●

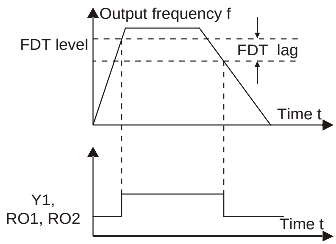
Group P08––Enhanced functions

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: 0.0–3600.0s	Model depended	○
P08.01	DEC time 2		Model depended	○
P08.02	ACC time 3		Model depended	○
P08.03	DEC time 3		Model depended	○
P08.04	ACC time 4		Model depended	○
P08.05	DEC time 4		Model depended	○
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 jogging	ACC time for jogging means the time needed for the VFD to accelerate from 0Hz to the max. output frequency (P00.03). DEC time for jogging means the time needed for the VFD to decelerate from the max. output frequency (P00.03) to 0Hz. Setting range: 0.0–3600.0s	Model depended	○
P08.08	DEC time for jogging		Model depended	○

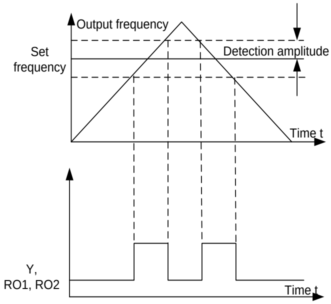
<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td>P08.09</td><td>Jump frequency 1</td><td rowspan="6">When the set frequency is within the range of jump frequency, the VFD runs at the boundary of jump frequency.
The VFD can avoid mechanical 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.


Setting range: 0.00Hz–P00.03 (Max. output frequency)</td><td>0.00Hz</td><td>○</td></tr>
<tr><td>P08.10</td><td>Jump frequency amplitude 1</td><td>0.00Hz</td><td>○</td></tr>
<tr><td>P08.11</td><td>Jump frequency 2</td><td>0.00Hz</td><td>○</td></tr>
<tr><td>P08.12</td><td>Jump frequency amplitude 2</td><td>0.00Hz</td><td>○</td></tr>
<tr><td>P08.13</td><td>Jump frequency 3</td><td>0.00Hz</td><td>○</td></tr>
<tr><td>P08.14</td><td>Jump frequency amplitude 3</td><td>0.00Hz</td><td>○</td></tr>
<tr><td>P08.15</td><td>Wobbling frequency amplitude percentage</td><td>0.0–100.0% (of the set frequency)</td><td>0.0%</td><td>○</td></tr>
<tr><td>P08.16</td><td>Amplitude of sudden jump frequency</td><td>0.0–50.0% (of the amplitude of wobbling frequency)</td><td>0.0%</td><td>○</td></tr>
<tr><td>P08.17</td><td>Rise time of wobbling frequency</td><td>0.1–3600.0s</td><td>5.0s</td><td>○</td></tr>
<tr><td>P08.18</td><td>Fall time of wobbling frequency</td><td>0.1–3600.0s</td><td>5.0s</td><td>○</td></tr>
<tr><td>P08.19</td><td>Switching frequency of ACC/DEC time</td><td>0.00–P00.03 (Max. output frequency)
0.00Hz, no switchover.
If the running frequency is greater than P08.19, switch to ACC/DEC time 2.</td><td>0.00Hz</td><td>○</td></tr>
<tr><td>P08.20</td><td>Frequency threshold of the start of drop control</td><td>0.00–50.00Hz</td><td>2.00Hz</td><td>○</td></tr>
<tr><td>P08.21</td><td>Reference frequency of ACC/DEC time</td><td>0–2
0: Max. output frequency
1: Set frequency</td><td>0</td><td>◎</td></tr>
</table>

Function code	Name	Description	Default	Modify
		2: 100Hz **Note:** Valid only for straight-line ACC/DEC.		
P08.22	Output torque calculation method	0–1 0: Based on torque current 1: Based on output power	0	○
P08.23	Number of decimal points of frequency	0–1 0: Two 1: One	0	○
P08.24	Number of decimal places of linear speed	0–3 0: No decimal place 1: One 2: Two 3: Three	0	○
P08.25	Set counting value	P08.26–65535	0	○
P08.26	Designated counting value	0–P08.25	0	○
P08.27	Set running time	0–65535min	0min	○
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. Auto fault reset interval: Time interval from when a fault occurred to when automatic fault reset takes effect. After VFD starts, If no fault occurred within 600s 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: 0.1–3600.0s	0	○
P08.29	Auto fault reset interval		1.0s	○
P08.30	Frequency decrease ratio in drop 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 a same load. Setting range: 0.00–50.00Hz	0.00Hz	○
P08.31	Channel switching for motor 1 to motor 3	0x00–0x15 Ones place: Switchover channel 0: Terminal 1: Modbus/Modbus TCP communication 2: PROFIBUS/CANopen/DeviceNet	0x00	◎

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td></td><td></td><td>communication
3: Ethernet communication
4: EtherCAT/PROFINET/ EtherNet IP communication
5: Reserved
Tens place: indicates whether to enable switchover during running
0: Disable
1: Enable</td><td></td><td></td></tr>
<tr><td>P08.32</td><td>FDT1 electrical level detection value</td><td rowspan="4">When the output frequency exceeds the corresponding frequency of FDT electrical level, the multifunction digital output terminal continuously outputs the signal of "Frequency level detection FDT". The signal is invalid only when the output frequency decreases to a value lower than the frequency corresponding to (FDT electrical level—FDT 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)</td><td>50.00Hz</td><td>○</td></tr>
<tr><td>P08.33</td><td>FDT1 lagging detection value</td><td>5.0%</td><td>○</td></tr>
<tr><td>P08.34</td><td>FDT2 electrical level detection value</td><td>50.00Hz</td><td>○</td></tr>
<tr><td>P08.35</td><td>FDT2 lagging detection value</td><td>5.0%</td><td>○</td></tr>
<tr><td>P08.36</td><td>Detection value for frequency being reached</td><td>When the output frequency is within the detection range, the multifunction digital output terminal outputs the signal of "Frequency reached".</td><td>0.00Hz</td><td>○</td></tr>
</table>

Function code	Name	Description	Default	Modify
		 Setting range: 0.00Hz–P00.03 (Max. output frequency)		
P08.37	Enabling dynamic braking	0x00–0x11 Ones place: 0: Disable 1: Enable Tens place: 0: Brake short-circuit protection disabled 1: Enable braking short-circuit protection **Note:** For the 380V models, the default value is 0x11 for 30kW, 37kW, 90kW, and 110kW, 0x01 for 45–75kW (included), and 0x00 for 110kW and above.	Model depended	○
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: 200.0–2000.0V	For 220V: 380.0V For 380V: 700.0V For 660V: 1120.0V	○
P08.39	Cooling-fan running mode	0: The fan runs with the VFD; the fan stops 1 minute after the VFD stops. 1: Permanent running after power-on 2. Run mode 2. In addition to the running requirements in run mode 0, run mode 2 has the feature that the fan still runs even when the ramp frequency is greater than 0. 3: Speed regulation mode. The fan rotation speed is automatically regulated based on the	0	○

Function code	Name	Description	Default	Modify
		temperature and output current (this requires hardware support).		
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: 0: Disable 1: Enable Tens place 0: Mild overmodulation 1: Deepened overmodulation Hundreds place: Carrier frequency limit 0:Yes 1:No Thousands place: Output voltage compensation 0: No 1: Yes	0x1001	◎
P08.42	LED keypad digit control setting	0x0000–0x1223 Ones place: Frequency adjustment selection 0: Both the ∧/∨ key and digital potentiometer can be used for the control. 1: Only the ∧/∨ key can be used for the	0x0003	○

Function code	Name	Description	Default	Modify
		control. 2: Only control through the digital potentiometer is valid. 3: Both the ∧/∨ key and digital potentiometer can be used for the control. Tens place: Frequency control selection 0: Valid only when P00.06=0 or P00.07=0 1: Valid for all frequency setting methods 2: Invalid for multi-step speed running when multi-step speed running has the priority Hundreds place: Action selection for stop 0: Setting is valid. 1: Valid during running, cleared after stop 2: Valid during running, cleared after a stop command is received Thousands place: Integral function of the ∧/∨ key and digital potentiometer 0: Enable the integral function 1: Disable the integral function		
P08.43	LED keypad digital potentiometer integral rate	0.01–10.00s	0.10s	○
P08.44	UP/DOWN terminal control setting	0x000–0x221 Ones place: Frequency setting selection 0: The setting made through UP/DOWN is valid. 1: The setting made through UP/DOWN is invalid. Ones 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	Frequency	0.01–50.00Hz/s	0.50Hz/s	○

Function code	Name	Description	Default	Modify
	increment integral rate of the UP terminal			
P08.46	Frequency integral rate of the DOWN terminal	0.01–50.00Hz/s	0.50Hz/s	○
P08.47	Action selection at power-off during frequency setting	0x000–0x111 Ones place: Action selection at power-off during frequency adjusting through digitals. 0: Save the setting at power-off. 1: Clear the setting at power-off. Action selection at power-off during frequency adjusting through Modbus communication 0: Save the setting at power-off. 1: Clear the setting at power-off. Hundreds place: Action selection at power-off during frequency adjusting through DP communication methods 0: Save the setting at power-off. 1: Clear the setting at power-off.	0x000	○
P08.48	Initial electricity consumption MSB	Used to set the initial electricity consumption. Initial electricity consumption = P08.48*1000 + P08.49 Setting range of P08.48: 0–59999kWh (k) Setting range of P08.49: 0.0–999.9 kWh	0kWh	○
P08.49	Initial electricity consumption LSB		0.0kWh	○
P08.50	Magnetic flux braking	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	0	○

Function code	Name	Description	Default	Modify
		change. The other advantages include: Braking is performed instantly after the stop command is given. The braking can be started without waiting for magnetic flux weakening. This will have better motor cooling effect. During the magnetic flux braking period, the stator current of the motor increases while the rotor current does not, and the cooling of the stator is much more effective than that of the rotor.		
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 required after state restoration if STO occurs. 1: No lock on STO alarm No lock on STO alarm indicates STO alarm disappears automatically after state restoration if STO occurs.	0	○
P08.53	Upper limit frequency bias value in torque control	0.00Hz–P00.03 (Max. output frequency) **Note:** Valid only for torque control.	0.00Hz	○
P08.54	Upper limit frequency ACC/DEC selection in torque control	0: No limit on acceleration or deceleration 1: ACC/DEC time 1 2: ACC/DEC time 2 3: ACC/DEC time 3 4: ACC/DEC time 4	0	○
P08.55	Enabling auto carrier frequency reduction	0: Disable 1: Enable **Note:** Automatic carrier frequency reduction indicates that the VFD automatically reduces the carrier frequency when detecting the heat sink temperature exceeds the rated temperature. When the temperature decreases to a certain degree, the carrier frequency recovers. This function reduces the chance of	0	○

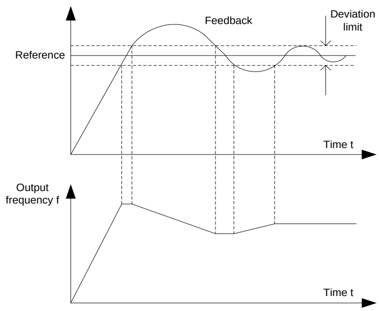
Function code	Name	Description	Default	Modify
		VFD overheat alarm.		
P08.56	Min. carrier frequency	1.0–15.0kHz	Model depended	●
P08.57	Temperature point of auto carrier frequency reduction	40.0–85.0°C	70.0°C	○
P08.58	Interval of carrier frequency reduction	0–30min	10min	○
P08.59	AI1 disconnection detection threshold	0–100%	0%	○
P08.60	AI2 disconnection detection threshold	0–100%	0%	○
P08.61	AI3 disconnection detection threshold	0–100%	0%	○
P08.62	Output current filter time	0.000–10.000s	0.000s	○
P08.63	Output torque filter times	0–8	8	○
P08.64	24V power supply card power-on delay time	0.000–5.000s	0.000s	○
P08.65	Current filtering times in coordinate change	0–3	0	○
P08.66	Motor parameter autotuning selection during power-on	0: No operation 1: Power-on dynamic autotuning 1 2: Power-on static autotuning 1 (Complete autotuning) 3: Power-on static autotuning 2 (Partial autotuning) 4: Power-on dynamic autotuning 2 (valid only for AMs) 5: Power-on partial parameter static autotuning 2 (valid only for AMs) **Note:** The function is valid only when the hundreds place of P11.26 is 1.	0	○

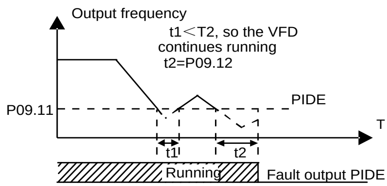
Function code	Name	Description	Default	Modify
		Exercise caution before using this function. Otherwise, serious result may follow.		

Group P09––PID control

Function code	Name	Description	Default	Modify
P09.00	PID reference source	When the frequency command selection (P00.06, P00.07) is 7 or the voltage setting channel selection (P04.27) is 6, the VFD is process PID controlled. The function code determines the target given channel during the PID process. 0: P09.01 reference 1: AI1 2: AI2 3: AI3 4: High-speed pulse HDIA 5: Multi-step 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: Programmable 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. Setting range: -100.0%–100.0%	0.0%	○
P09.02	PID feedback source	The function code is used to select the PID feedback channel. 0: AI1 1: AI2	0	○

Function code	Name	Description	Default	Modify
		2: AI3 3: High-speed pulse HDIA 4: Modbus/ModbusTCP communication 5: PROFIBUS/CANopen/DeviceNet communication 6: Ethernet communication 7: High-speed pulse HDIB 8: EtherCAT/PROFINET/ EtherNet IP communication 9: Programmable expansion card 10: Max(AI1, AI2) 11: Reserved **Note:** The reference channel and feedback channel cannot be duplicate. Otherwise effective PID control cannot be achieved.		
P09.03	PID output characteristics 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. 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.	0	○
P09.04	Proportional gain (Kp)	The function is applied to the proportional gain P of PID input. P determines the strength of the whole PID adjuster. The larger the value of P, the stronger the adjustment intensity. The value 100 indicates that when the difference between the PID feedback value and given value is 100%, the range within which the PID regulator can regulate the output frequency command is the max. frequency (ignoring integral function and differential function). Setting range: 0.00–100.00	1.80	○
P09.05	Integral time (Ti)	Used to determine the speed of the integral adjustment on the deviation of PID feedback and reference from the PID regulator. When the deviation of PID feedback and	0.90s	○

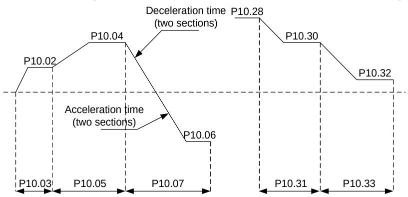
Function code	Name	Description	Default	Modify
		reference is 100%, the integral adjuster works continuously during the time (ignoring proportional and differential function) to achieve the max. output frequency (P00.03) or the max. voltage (P04.31). Shorter integral time indicates stronger adjustment. Setting range: 0.00–10.00s		
P09.06	Differential time (Td)	Used to determine the strength of the change ratio adjustment on the deviation of PID feedback and reference from the PID regulator. If the PID feedback changes 100% during the time, the adjustment of the differential regulator (ignoring proportional and integral function) is the max. output frequency (P00.03) or the max. voltage (P04.31). Longer differential time indicates stronger adjustment. Setting range: 0.00–10.00s	0.00s	○
P09.07	Sampling cycle (T)	Used to indicate the sampling cycle of feedback. The regulator calculates in each sampling cycle. A longer sampling cycle indicates slower response. Setting range: 0.001–10.000s	0.001s	○
P09.08	PID control deviation limit	The output of the PID system is relative to the max. deviation of the closed loop reference. As shown in the following figure, the PID regulator stops regulating in the range of deviation limit. Set the function parameter properly to adjust the accuracy and stability of the PID system. 	0.0%	○

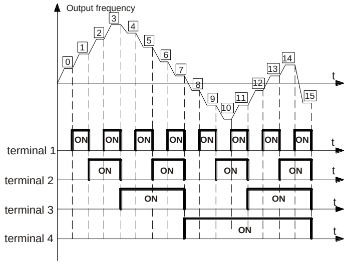
Function code	Name	Description	Default	Modify
		Setting range: 0.0–100.0%		
P09.09	PID output upper limit	The function codes are used to set the upper and lower limits of PID regulator output values. 100.0% corresponds to the max. output frequency (P00.03) or max. voltage (P04.31). Setting range of P09.09: P09.10–100.0% Setting range of P09.10: 0.00Hz–P09.09	100.0%	○
P09.10	PID output lower limit		0.0%	○
P09.11	Feedback offline 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: 0.0–3600.0s	0.0%	○
P09.12	Feedback offline detection time		1.0s	○
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 as per the max. frequency 1: Limit as per A frequency Thousands place: 0: A+B frequency. Acceleration /deceleration of main reference A frequency source buffering is invalid. 1: A+B frequency. Acceleration/ deceleration of	0x0001	○

Function code	Name	Description	Default	Modify
		main reference A frequency source precharging is valid. The acceleration/deceleration is determined by P08.04 (acceleration time 4).		
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	ACC/DEC time of PID command	0.0–1000.0s	0.0s	○
P09.16	PID output filter time	0.000–10.000s	0.000s	○
P09.18	Low frequency integral time	0.00–10.00s	0.90s	○
P09.19	Low frequency differential time	0.00–10.00s	0.00s	○
P09.20	Low frequency point for PID parameter switching	0.00Hz–P09.21	5.00Hz	○
P09.21	High frequency point for PID parameter switching	P09.20–P00.03	10.00Hz	○

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 with the final value after running once 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	0	○

Function code	Name	Description	Default	Modify
		one cycle until receiving the stop command.		
P10.01	Simple PLC memory selection	0: Do not memorize at power outage 1: Memory at power-off. The PLC memories its running stage and running frequency before power-off.	0	○
P10.02	Multi-step speed 0	Frequency setting range for steps from step 0 to step 15: -100.0–100.0%. 100.0% corresponds to the max. output frequency P00.03. Running time setting range for steps from step 0 to step 15: 0.0–6553.5s(min). The time unit is specified by P10.37. When simple PLC operation is selected, it is required to set P10.02–P10.33 to determine the running frequency and running time of each step. **Note:** The symbol of multi-step speed determines the running direction of simple PLC, and the negative value means reverse running.  When selecting multi-step speed running, the multi-step speed is within the range of -Fmax–Fmax, 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 the setting of 16-step speed, which are set by combined codes of multi-step terminals 1–4 set by S terminals, corresponding to function code P05.01–P05.06) and correspond to multi-step speed 0 to 15.	0.0%	○
P10.03	Running time of step 0		0.0s (min)	○
P10.04	Multi-step speed 1		0.0%	○
P10.05	Running time of step 1		0.0s (min)	○
P10.06	Multi-step speed 2		0.0%	○
P10.07	Running time of step 2		0.0s (min)	○
P10.08	Multi-step speed 3		0.0%	○
P10.09	Running time of step 3		0.0s (min)	○
P10.10	Multi-step speed 4		0.0%	○
P10.11	Running time of step 4		0.0s (min)	○
P10.12	Multi-step speed 5		0.0%	○
P10.13	Running time of step 5		0.0s (min)	○
P10.14	Multi-step speed 6		0.0%	○
P10.15	Running time of step 6		0.0s (min)	○
P10.16	Multi-step speed 7		0.0%	○
P10.17	Running time of step 7		0.0s (min)	○
P10.18	Multi-step speed 8		0.0%	○
P10.19	Running time of step 8		0.0s (min)	○
P10.20	Multi-step speed 9		0.0%	○
P10.21	Running time of step 9		0.0s (min)	○
P10.22	Multi-step speed 10		0.0%	○
P10.23	Running time of step 10		0.0s (min)	○
P10.24	Multi-step speed 11		0.0%	○

Function code	Name	Description	Default	Modify
P10.25	Running time of step 11		0.0s (min)	○
P10.26	Multi-step speed 12		0.0%	○
P10.27	Running time of step 12		0.0s (min)	○
P10.28	Multi-step speed 13		0.0%	○
P10.29	Running time of step 13		0.0s (min)	○
P10.30	Multi-step speed 14		0.0%	○
P10.31	Running time of step 14	When terminal 1–4 are OFF, the frequency input mode is set by P00.06 or P00.07. When terminal 1–4 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.	0.0s (min)	○
P10.32	Multi-step speed 15		0.0%	○
P10.33	Running time of step 15	The relationship between terminals 1–4 and multi-step speed steps are shown in the following (T indicates terminal).	0.0s (min)	○

T 1	OFF	ON	OFF	ON	OFF	ON	OFF	ON
T 2	OFF	OFF	ON	ON	OFF	OFF	ON	ON
T 3	OFF	OFF	OFF	OFF	ON	ON	ON	ON
T 4	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Step	0	1	2	3	4	5	6	7
T 1	OFF	ON	OFF	ON	OFF	ON	OFF	ON
T 2	OFF	OFF	ON	ON	OFF	OFF	ON	ON
T 3	OFF	OFF	OFF	OFF	ON	ON	ON	ON
T 4	ON	ON	ON	ON	ON	ON	ON	ON
Step	8	9	10	11	12	13	14	15

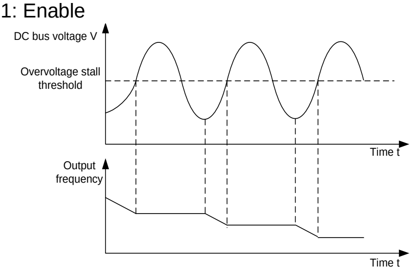
Function code	Name	Description	Default	Modify
P10.34	ACC/DEC time of steps 0–7 of simple PLC	The description is as follows:	0x0000	○
P10.35	ACC/DEC time of steps 8–15 of simple PLC		0x0000	○

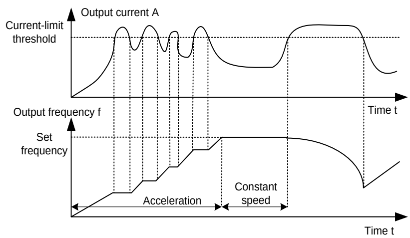
Function code	Binary		Step	ACC/DEC time 1	ACC/DEC T2	ACC/DEC T3	ACC/DEC T4
P10.34	Bit1	Bit0	0	00	01	10	11
	Bit3	Bit2	1	00	01	10	11
	Bit5	Bit4	2	00	01	10	11
	Bit7	Bit6	3	00	01	10	11
	Bit9	Bit8	4	00	01	10	11
	Bit11	Bit10	5	00	01	10	11
	Bit13	Bit12	6	00	01	10	11
	Bit15	Bit14	7	00	01	10	11

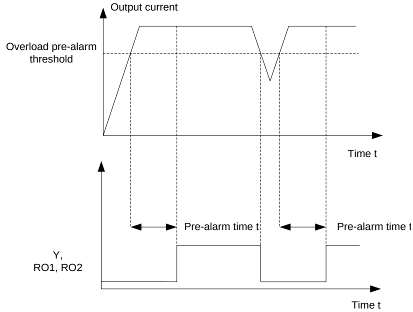
<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td></td><td></td><td>
<table>
<tr><td rowspan="8">P10.35</td><td>Bit1</td><td>Bit0</td><td>8</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>Bit3</td><td>Bit2</td><td>9</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>Bit5</td><td>Bit4</td><td>10</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>Bit7</td><td>Bit6</td><td>11</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>Bit9</td><td>Bit8</td><td>12</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>Bit11</td><td>Bit10</td><td>13</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>Bit13</td><td>Bit12</td><td>14</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>Bit15</td><td>Bit14</td><td>15</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
</table>
Select corresponding acceleration/deceleration time, and then convert 16-bit binary number into hexadecimal number, finally, and then set corresponding function codes.
ACC/DEC time 1 is set by P00.11 and P00.12;
ACC/DEC time 2 is set by P08.00 and P08.01;
ACC/DEC time 3 is set by P08.02 and P08.03;
ACC/DEC time 4 is set by P08.04 and P08.05.
Setting range: 0x0000–0xFFFF</td><td></td><td></td></tr>
<tr><td>P10.36</td><td>PLC restart mode</td><td>0: Restart from the first step, namely if the VFD stops during running (caused by stop command, fault or power down), it will run from the first step after restart.
1: Continue running from the step frequency when interruption occurred, namely if the VFD stops during running (caused by stop command or fault), it will record the running time of current step, and enters this step automatically after restart, then continue running at the frequency defined by this step in the remaining time.</td><td>0</td><td>◎</td></tr>
<tr><td>P10.37</td><td>Multi-step time unit</td><td>0: second; the running time of each step is counted in seconds
1: minute; the running time of each step is counted in minutes</td><td>0</td><td>◎</td></tr>
</table>

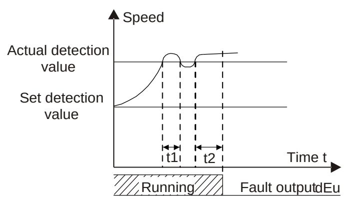
Group P11—Protection parameters

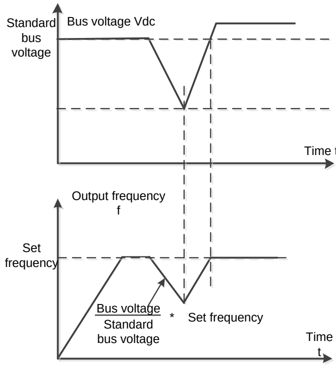
Function code	Name	Description	Default	Modify
P11.00	Protection against phase loss	0x000–0x1111 Ones place: Reserved Tens place: 0: Output phase loss protection disabled	Model depended	○

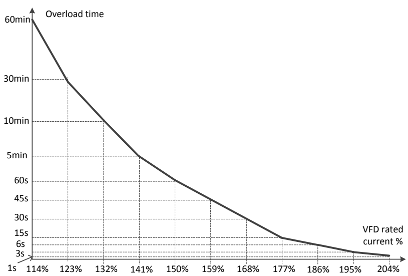
Function code	Name	Description	Default	Modify
		1: Protection against output phrase loss enabled Hundreds place: 0: Disable hardware input phase loss protection. 1: Enable hardware input phase loss protection. Thousands place: 0: During stop, if a hardware input phase loss fault occurs, it reports SPI. 1: During stop, if a hardware input phase loss fault occurs, it reports A-SPI.		
P11.01	Frequency decrease at sudden power loss	0: Disable 1: Enable	0	○
P11.02	Enabling energy-consumption braking for stop	0: Enable 1: Disable	0	◎
P11.03	Overvoltage stalling protection	0: Disable 1: Enable  **Note:** It can be modified only when **P11.26** is 1 indicating special functions are enabled.	0	○
P11.04	Overvoltage stalling protection voltage	120–150% (standard bus voltage) (380V) 120–150% (standard bus voltage) (220V)	136% 120%	○
P11.05	Current limit mode	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. 0x00–0x21	10	◎

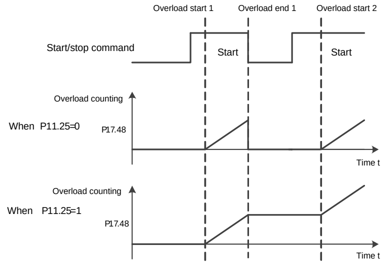
Function code	Name	Description	Default	Modify
		Ones place: Hardware and software current-limit action selection 0: Invalid 1: Always valid Tens place: Hardware current limit overload alarm 0: OL2 is valid. 1: OL2 is invalid. 2: Reserved **Note:** It can be modified only when P11.26 is 1 indicating special functions are enabled.		
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 level again, it will continue accelerated running.  Setting range of P11.06: 50.0–250.0% (of the rated VFD output current) Setting range of P11.07: 0.00–50.00Hz/s	250.0%	◎
P11.07	Frequency drop rate during current limit		10.00 Hz/s	◎
P11.08	Pre-alarm selection for VFD/motor OL/UL	If the VFD or motor output current is larger than the overload pre-alarm detection level (P11.09), and the duration exceeds the overload pre-alarm detection time (P11.10), overload pre-alarm signal will be outputted.	0x0000	○
P11.09	Overload pre-alarm detection threshold		150%	○

Function code	Name	Description	Default	Modify
P11.10	Overload pre-alarm detection time	 P11.08 enables and defines overload pre-alarm function of the VFD and motor. Setting range: 0x0000–0x1132 Ones place: 0: Motor OL/UL pre-alarm, relative to the motor rated current. 1: VFD OL/UL pre-alarm, relative to VFD rated output current. 2: Motor output torque OL/UL pre-alarm, relative to motor rated torque. 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: Detect all the time. 1: Detect during constant speed running Thousands place: VFD overload current reference selection 0: Related to current calibration coefficient 1: Irrelated to current calibration coefficient Setting range of P11.09: P11.11–200% (relative value determined by the ones place of P11.08) Setting range of P11.10: 0.01–3600.00s	1.00s	○

Function code	Name	Description	Default	Modify
P11.11	Underload pre-alarm detection threshold	Underload pre-alarm signal will be outputted 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). Setting range of P11.11: 0–P11.09 (relative value determined by the ones place of P11.08) Setting range of P11.12: 0.01–360.00s	25%	○
P11.12	Underload pre-alarm detection time		0.05s	○
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 the automatic reset period	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	Used to set the speed deviation detection time. If P11.14 is set to a non-zero value, and the speed deviation is greater than the value of P11.14, which lasts the time specified by P11.15, the speed deviation fault dEu is reported. **Note:** Speed deviation protection is invalid when P11.15=0.0.  t1<t2, so the VFD continues running t2=P11.15 Setting range: 0.0–10.0s	2.0s	○
P11.16	Automatic frequency-reductio	0–1 0: Invalid	0	○

Function code	Name	Description	Default	Modify
	n during voltage drop	1: Valid 		
P11.17	Proportional coefficient of voltage regulator during undervoltage stall	This parameter is used to set 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	This parameter is used to set the integral coefficient of the bus voltage regulator during undervoltage stall. Setting range: 0–1000	40	○
P11.19	Proportional coefficient of current regulator during undervoltage stall	This parameter is used to set the proportional coefficient of the active current regulator during undervoltage stall. Setting range: 0–1000	25	○
P11.20	Integral coefficient of current regulator during undervoltage stall	This parameter is used to set the integral coefficient of the active current regulator during undervoltage stall. Setting range: 0–2000	150	○
P11.21	Proportional coefficient of voltage regulator during overvoltage stall	This parameter is used to set the proportional coefficient of the bus voltage regulator during overvoltage stall. Setting range: 0–1000	60	○
P11.22	Integral coefficient of voltage regulator	This parameter is used to set the integral coefficient of the bus voltage regulator during	10	○

Function code	Name	Description	Default	Modify
	during overvoltage stall	overvoltage stall. Setting range: 0–1000		
P11.23	Proportional coefficient of current regulator during overvoltage stall	This parameter is used to set the proportional coefficient of the active current regulator during overvoltage stall. Setting range: 0–1000	60	○
P11.24	Integral coefficient of current regulator during overvoltage stall	This parameter is used to set the integral coefficient of the active current regulator during overvoltage stall. Setting range: 0–2000	250	○
P11.25	Enable VFD overload integral	0: Disable 1: Enable When this parameter is set to 0, the overload timing value P17.48 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 P17.48 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. VFD overload curve 	0	◎

Function code	Name	Description	Default	Modify
				
P11.26	Enabling special functions	Ones place: Special function 1 0: Disable 1: Enable Tens place: Special function 2 0: Disable 1: Enable Hundreds place: Special function 3 0: Disable 1: Enable Special functions 1 include P11.03 (Overvoltage stall protection), P11.05 (Current-limit selection), P01.00 (Running mode of start), P00.13 (Running direction), P03.20 (Set upper limit of the torque when motoring via keypad), P03.21 (Set upper limit of brake torque via keypad), and P08.37 (Enabling dynamic braking). When this parameter is set to 0, special function codes (except P08.37) are restored to the factory settings and are not displayed, and therefore cannot be modified. When this parameter is set to 1, special function codes can be modified and used normally. Special function 2 includes: When it is set to 0, the function is invalid. When it is set to 1, different parameters are automatically matched for the open-loop vector and closed-loop vector.	0x000	◎

Function code	Name	Description	Default	Modify
		Special function 3 includes: When it is set to 0, the function is invalid. When it is set to 1, P08.66 (Motor parameter autotuning selection during power-on) can be valid.		
P11.27	VF oscillation control method	0x00–0x11 Ones place: 0: Method 1 1: Method 2 Tens place: Reserved **Note:** For SMs, only method 1 is supported; for AMs, both methods are supported.	0x00	◎
P11.28	SPO switch-on detection delay time	**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. Setting range of P11.28: 0.0–60.0s Setting range of P11.29: 0–10	5.0	○
P11.29	SPO unbalance multiple		6	○
P11.30	Reserved	0–2	0	◎
P11.31	Fault severity group 1	0x0000–0x3333 Thousands place/hundreds place/tens place/ones place: 0: Report a fault 1: Report a fault after deceleration to stop in emergency 2: Pre-alarm, with the action executed according to P11.56 3: Screen out fault **Note:** Different fault actions are taken for different fault severities. The first 10 faults are not grouped by severity, but each four of the subsequent faults are grouped by severity in ascending order from right to left in hexadecimal format, that is, from the ones place to the thousands place (for example, the ones place of fault severity group 1 corresponds to fault 11, OL1). Group 1: Faults 11–14 (OL1, OL2, SPI, SPO) Group 2: Faults 15–18 (OH1, OH2, EF, CE)	0x0000	○
P11.32	Fault severity group 2		0x0000	○
P11.33	Fault severity group 3		0x0000	○
P11.34	Fault severity group 4		0x0000	○
P11.35	Fault severity group 5		0x0000	○
P11.36	Fault severity group 6		0x0000	○
P11.37	Fault severity group 7		0x0000	○
P11.38	Fault severity group 8		0x0000	○
P11.39	Fault severity group 9		0x0000	○
P11.40	Fault severity group		0x0000	○

Function code	Name	Description	Default	Modify
	10	Group 3: Faults 19–22 (ItE, tE, EEP, PIDE) 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) 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, dIS) Group 16: Faults 71–74 (tbE, FAE, tPF, STC) Group 17: Faults 75–78 (LSP, tCE, POE, SLE) Group 18: Faults 79–82 (bE, ELS, AdE, OtE1) Group 19: Faults 83–86 (OtE2, SFE, Cuu, PtcE) Group 20: Faults 87–90 (E-OvL, E-OS, E-dS, Reserved) Group 21: Faults 91–94 (Reserved, E-AI1, E-AI2, E-AI3) Group 22: Faults 95–98 (E-EIP, E-PAO, EnC2O, EnCPI) Group 23: Faults 99–102 (E-PuP, E-Pdn, E-CL, Reserved) Group 24: Faults 103–106 (Reserved, Reserved, Reserved, Reserved)		
P11.41	Fault severity group 11		0x0000	○
P11.42	Fault severity group 12		0x0000	○
P11.43	Fault severity group 13		0x0000	○
P11.44	Fault severity group 14		0x0000	○
P11.45	Fault severity group 15		0x0000	○
P11.46	Fault severity group 16		0x0000	○
P11.47	Fault severity group 17		0x0000	○
P11.48	Fault severity group 18		0x0000	○
P11.49	Fault severity group 19		0x0000	○
P11.50	Fault severity group 20		0x0000	○
P11.51	Fault severity group 21		0x0000	○
P11.52	Fault severity group 22		0x0000	○
P11.53	Fault severity group 23		0x0000	○
P11.54	Fault severity group 24		0x0000	○
P11.55	Fault severity group 25		0x0000	○

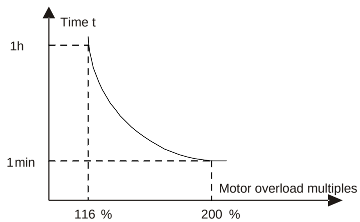
Function code	Name	Description	Default	Modify
		Group 25: Faults 107–110 (Reserved, Reserved, Reserved, Reserved)		
P11.56	Action for fault pre-alarm	0–4 0: Run at the set frequency 1: Run at the output frequency at the time of failure 2: Run at the upper limit frequency 3: Run at the lower limit frequency 4: Run at the backup frequency upon exceptions	0	○
P11.57	Backup frequency upon exceptions	0.00–630.00Hz	0.00Hz	○
P11.59	SM weakening current limit in V/F control	0.0–150.0%	50.0%	○
P11.61	SSI position downward limit low value	0–65535	0	○
P11.62	SSI position downward limit high value	0–65535	0	○
P11.63	SSI position upward limit low value	0–65535	0	○
P11.64	SSI position upward limit high value	0–65535	0	○
P11.65	Communication timeout screening selection	0x00–0x12 Ones place: 0: It can be shielded according to the communication timeout time of 0. 1: It can be shielded according to the communication timeout time of 0. At the same time, shielding is also supported under the non-communication running command. Switching from the communication running command to the non-communication running command does not support automatic reset of	0x00	○

Function code	Name	Description	Default	Modify
		the communication timeout fault. 2: It can be shielded according to the communication timeout time of 0. At the same time, shielding is also supported under the non-communication running command. Switching from the communication running command to the non-communication running command supports automatic reset of the communication timeout fault. **Note:** This function is available for PROFIBUS-DP/CANopen/PROFINET/EtherNet IP/EtherCAT communication. Tens place: Reserved		

Group P12––Parameters of motor 2

Function code	Name	Description	Default	Modify
P12.00	Type of motor 2	0: Asynchronous motor (AM) 1: Synchronous motor (SM)	0	◎
P12.01	Rated power of AM 2	0.1–3000.0kW	Model depended	◎
P12.02	Rated frequency of AM 2	0.01Hz–P00.03 (Max. output frequency)	50.00Hz	◎
P12.03	Rated speed of AM 2	1–60000RPM	Model depended	◎
P12.04	Rated voltage of AM 2	0–1200V	Model depended	◎
P12.05	Rated current of AM 2	0.8–6000.0A	Model depended	◎
P12.06	Stator resistance of AM 2	0.001–65.535Ω	Model depended	○
P12.07	Rotor resistance of AM 2	0.001–65.535Ω	Model depended	○
P12.08	Leakage inductance of AM 2	0.1–6553.5mH	Model depended	○
P12.09	Mutual inductance of AM 2	0.1–6553.5mH	Model depended	○
P12.10	No-load current of	0.1–6553.5A	Model	○

Function code	Name	Description	Default	Modify
	AM 2		depended	
P12.11	Magnetic saturation coefficient 1 of iron core of AM 2	0.0–100.0%	80%	○
P12.12	Magnetic saturation coefficient 2 of iron core of AM 2	0.0–100.0%	68%	○
P12.13	Magnetic saturation coefficient 3 of iron core of AM 2	0.0–100.0%	57%	○
P12.14	Magnetic saturation coefficient 4 of iron core of AM 2	0.0–100.0%	40%	○
P12.15	Rated power of SM 2	0.1–3000.0kW	Model depended	◎
P12.16	Rated frequency of SM 2	0.01Hz–P00.03 (Max. output frequency)	50.00Hz	◎
P12.17	Number of pole pairs of SM 2	1–128	2	◎
P12.18	Rated voltage of SM 2	0–1200V	Model depended	◎
P12.19	Rated current of SM 2	0.8–6000.0A	Model depended	◎
P12.20	Stator resistance of SM 2	0.001–65.535Ω	Model depended	○
P12.21	Direct-axis inductance of SM 2	0.01–655.35mH	Model depended	○
P12.22	Quadrature-axis inductance of SM 2	0.01–655.35mH	Model depended	○
P12.23	Counter-emf constant of SM 2	0–10000V	300V	○
P12.24–P12.25	Reserved	/	/	●
P12.26	Overload protection of motor 2	0: No protection 1: Common motor (with low-speed compensation) 2: Frequency-variable motor (without low-speed	2	◎

Function code	Name	Description	Default	Modify
		compensation)		
P12.27	Overload protection coefficient of motor 2	Motor overload multiplication M = $I_{out}/(I_n*K)$ I_n indicates the rated motor current, I_{out} indicates the VFD output current, and K indicates 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=200%, protection is performed after motor overload lasts for 60 seconds; and when M≥400%, protection is performed immediately.  Setting range: 20.0%–150.0%	100.0%	○
P12.28	Power display calibration coefficient of motor 2	0.00–3.00	1.00	○
P12.29	Parameter display of motor 2	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	System inertia of motor 2	0–30.000kg.m^2	0.000 kg.m^2	○
P12.31	Speed control switchover mode of motor 2	0: No switchover, which indicates keeping consistent with P00.00 of motor 1 1: Switch to SVC1 2: Switch to VF 3: Switch to FVC	0	◎

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	Detection mode of initial pole	0: No detection 1: High frequency superposition 2: Pulse superposition	0	◎
P13.02	Pull-in current 1	Pull-in current is the pole position orientation current; pull-in current 1 is valid within the lower limit of pull-in current switch-over frequency threshold. If you need to increase the start torque, increase the value of this function parameter properly. Setting range: 0.0%–100.0% (of the motor rated current)	20.0%	○
P13.03	Pull-in current 2	Pull-in current is the pole position orientation current; pull-in current 2 is valid within the lower limit of pull-in current switch-over frequency threshold. You do not need to change the value in most cases. Setting range: 0.0%–100.0% (of the motor rated current)	10.0%	○
P13.04	Pull-in current switchover frequency	0.0–200.0% (of the motor rated frequency)	20.0%	○
P13.05	High frequency superimposed frequency	200–1000Hz	500Hz	◎
P13.06	High-frequency superposition voltage	Specifies the pulse current threshold when the initial magnetic pole position is detected in the pulse mode. The value is a percentage in relative to the rated current of the motor. Setting range: 0.0–300% (of the motor rated voltage)	100.0%	◎

Function code	Name	Description	Default	Modify
P13.07	Control parameter 0	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: 0–655.35	50.00	○
P13.10	Initial compensation angle of SM	0.0–359.9	0.0	○
P13.11	Maladjustment detection time	Used to adjust the responsiveness of anti-maladjustment function. If the load inertia is large, increase the value of this parameter properly, however, the responsiveness may slow down accordingly. Setting range: 0.0–10.0s	0.5s	○
P13.12	High-frequency compensation coefficient of SM	Valid when the motor speed exceeds the rated speed. If oscillation occurred to the motor, adjust this parameter properly. Setting range: 0.0–100.0%	0.0%	○
P13.13	High-frequency pull-in current	0–300.0% (of the rated VFD output current)	20.0%	◎
P13.14	Identifying initial pole angle after SM dual PG card switchover	0: Identify again after switchover 1: Do not identify after switchover	0	◎

Group P14––Serial communication

Function code	Name	Description	Default	Modify
P14.00	Local communication address	Setting range: 1–247 When the master writes the slave communication address to 0 indicating a	1	○

Function code	Name	Description	Default	Modify
		broadcast address in a frame, all the salves 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. **Note:** The communication address of a slave cannot be set to 0.		
P14.01	Communication baud rate	The function code is used to set the rate of data transmission between the upper computer 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 upper computer. Otherwise, the communication fails. A greater baud rate indicates faster communication.	4	○
P14.02	Data bit check setting	The data format set on the VFD must be consistent with that on the upper computer. Otherwise, the communication fails. 0: No check (N, 8, 1) for RTU 1: Even check (E, 8, 1) for RTU 2: Odd check (O, 8, 1) for RTU 3: No check (N, 8, 2) for RTU 4: Even check (E, 8, 2) for RTU 5: Odd check (O, 8, 2) for RTU	1	○
P14.03	Communication response delay	0–200ms The function code 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 rectifier processing time, the rectifier sends response data to the host controller after processing data.	5ms	○

Function code	Name	Description	Default	Modify
		If the delay is longer than the rectifier processing time, the rectifier does not send response data to the host controller until the delay is reached although data has been processed.		
P14.04	Communication timeout time	0.0 (invalid)–60.0s When the function code is set to 0.0, the communication timeout time is invalid. When the function code is set to a non-zero value, the system reports the "485 communication fault" (CE) if the communication interval exceeds the value. In general, the function code is set to 0.0. When continuous communication is required, you can set the function code to monitor communication status.	0.0s	○
P14.05	Transmission error processing	0: Report an alarm and coast to stop 1: Keep running without reporting an alarm 2: Stop in enabled stop mode without reporting an alarm (applicable only to communication mode) 3: Stop in enabled stop mode without reporting an alarm (applicable to any mode)	0	○
P14.06	Modbus communication processing action selection	0x000–0x111 Ones place: 0: Respond to write operations 1: Not respond to write operations Tens place: 0: Communication password protection is invalid. 1: Communication password protection is valid. Hundreds place: 0: Custom addresses of P14.07, P14.08 are invalid. 1: Custom addresses of P14.07, P14.08 are valid.	0x000	○
P14.07	User-defined running command address	0x0000–0xFFFF **Note:** This parameter specifies the user-defined Modbus run command address.	0x2000	○

Function code	Name	Description	Default	Modify
P14.08	User-defined frequency setting address	0x0000–0xFFFF **Note:** This parameter specifies the user-defined Modbus frequency setting address.	0x2001	○
P14.09	Modbus TCP communication timeout time	0.0–60.0s **Note:** The parameter is invalid when it is set to 0.0.	5.0s	○
P14.10	Enabling 485 upgrade program	0–1 0: Disable 1: Enable	0	◎
P14.11	Bootload software version	0.00–655.35	0.00	●
P14.12	Display of no upgrade bootload fault	0–1 0: Display 1: Do not display	1	○
P14.14	Low bit of digital locating position reference	0–65535	0	○
P14.15	High bit of digital locating position reference	0–65535	0	○
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 of received PZD2	0x0000–0xFFFF	0x0000	○
P14.50	Mapped function code of received PZD3	0x0000–0xFFFF	0x0000	○
P14.51	Mapped function code of received	0x0000–0xFFFF	0x0000	○

Function code	Name	Description	Default	Modify
	PZD4			
P14.52	Mapped function code of received PZD5	0x0000–0xFFFF	0x0000	○
P14.53	Mapped function code of received PZD6	0x0000–0xFFFF	0x0000	○
P14.54	Mapped function code of received PZD7	0x0000–0xFFFF	0x0000	○
P14.55	Mapped function code of received PZD8	0x0000–0xFFFF	0x0000	○
P14.56	Mapped function code of received PZD9	0x0000–0xFFFF	0x0000	○
P14.57	Mapped function code of received PZD10	0x0000–0xFFFF	0x0000	○
P14.58	Mapped function code of received PZD11	0x0000–0xFFFF	0x0000	○
P14.59	Mapped function code of received PZD12	0x0000–0xFFFF	0x0000	○
P14.60	PZD2 sends mapping function code	0x0000–0xFFFF	0x0000	○
P14.61	Mapped function code of sent PZD3	0x0000–0xFFFF	0x0000	○
P14.62	Mapped function code of sent PZD4	0x0000–0xFFFF	0x0000	○
P14.63	Mapped function code of sent PZD5	0x0000–0xFFFF	0x0000	○
P14.64	Mapped function code of sent PZD6	0x0000–0xFFFF	0x0000	○
P14.65	Mapped function code of sent PZD7	0x0000–0xFFFF	0x0000	○

Function code	Name	Description	Default	Modify
P14.66	Mapped function code of sent PZD8	0x0000–0xFFFF	0x0000	○
P14.67	Mapped function code of sent PZD9	0x0000–0xFFFF	0x0000	○
P14.68	Mapped function code of sent PZD10	0x0000–0xFFFF	0x0000	○
P14.69	Mapped function code of sent PZD11	0x0000–0xFFFF	0x0000	○
P14.70	Mapped function code of sent PZD12	0x0000–0xFFFF	0x0000	○

Group P15––Communication expansion card 1 functions

Function code	Name	Description	Default	Modify
P15.01	Module address	0–127	2	◎
P15.02	Received PZD2	0–49 0: Invalid 1: Set frequency (-Fmax–Fmax, unit: 0.01Hz) 2: PID reference (-1000–1000, in which 1000 corresponds to 100.0%) 3: PID feedback (-1000–1000, in which 1000 corresponds to 100.0%) 4: Torque setting (-3000–+3000, in which 1000 corresponds to 100.0% of the motor rated current) 5: Setting of the upper limit of forward running frequency (0–Fmax, unit: 0.01Hz) 6: Setting of the upper limit of reverse running frequency (0–Fmax, unit: 0.01Hz) 7: Upper limit of the electromotive torque (0–3000, in which 1000 corresponds to 100.0% of the motor rated current) 8: Upper limit of braking torque (0–3000, in which 1000 corresponds to 100% of the motor rated current) 9: Virtual input terminal command. Range:	0	○
P15.03	Received PZD3		0	○
P15.04	Received PZD4		0	○
P15.05	Received PZD5		0	○
P15.06	Received PZD6		0	○
P15.07	Received PZD7		0	○
P15.08	Received PZD8		0	○
P15.09	Received PZD9		0	○
P15.10	Received PZD10		0	○
P15.11	Received PZD11		0	○
P15.12	Received PZD12		0	○

Function code	Name	Description	Default	Modify
		0x000–0x3FF 10: Virtual output terminal command (range: 0x00–0xFF (RO4/RO3/Y3/Y2/RO2/RO1/HDO/Y1) 11: Voltage setting (special for V/F separation) (0–1000, in which 1000 corresponds to 100% of the motor rated voltage) 12: AO1 output setting 1 (-1000–+1000, in which 1000 corresponds to 100.0%) 13: AO2 output setting 2 (-1000–+1000, in which 1000 corresponds to 100.0%) 14: MSB of position reference (signed) 15: LSB of position reference (unsigned) 16: MSB of position feedback (signed) 17: LSB of position feedback (unsigned) 18: Position feedback setting flag (position feedback can be set only after this flag is set to 1 and then to 0) 19–20: Reserved 21: Non-standard frequency reference 22: Pre torque setting (-3000–+3000, in which 1000 corresponds to 100.0% of the motor rated current) 23–25: Reserved 26: Encoder high bit 27: Encoder low bit 28–46: Reserved 47: ACC time (0–1000 corresponds to 0.0–100.0s) 48: DEC time (0–1000 corresponds to 0.0–100.0s) 49: Function parameter mapping (PZD2–PZD12 correspond to P14.49–P14.59)		
P15.13	Sent PZD2	0–67 0: Invalid 1: Running frequency (×100, Hz) 2: Set frequency (×100, Hz) 3: Bus voltage (×10, V)	0	○
P15.14	Sent PZD3		0	○
P15.15	Sent PZD4		0	○
P15.16	Sent PZD5		0	○
P15.17	Sent PZD6		0	○

Function code	Name	Description	Default	Modify
P15.18	Sent PZD7	4: Output voltage (×1, V)	0	○
P15.19	Sent PZD8	5: Output current (×10, A)	0	○
P15.20	Sent PZD9	6: Actual output torque (×10, %)	0	○
P15.21	Sent PZD10	7: Actual output power (×10, %)	0	○
P15.22	Sent PZD11	8: Rotation speed of running (×1, RPM)	0	○
P15.23	Sent PZD12	9: Linear speed of running (×1, m/s) 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 status 17: Terminal output status 18: PID reference (×100, %) 19: PID feedback (×100, %) 20: Motor rated torque 21: MSB of position reference (signed) 22: LSB of position reference (unsigned) 23: MSB of position feedback (signed) 24: LSB of position feedback (unsigned) 25: Status word 2 26: HDIB frequency value (*100, kHz) 27: PG card pulse feedback count high bit 28: PG card pulse feedback count low bit 29: Brake status 30: Non-standard status 31: Reserved 32: Encoder feedback frequency (-Fmax–Fmax, unit: 0.01Hz) 33–51: Reserved 52: Module temperature 53: U-phase current transient value 54: V-phase current transient value 55: W-phase current transient value 56–57: Reserved 58: Load weight 59: Current peak value	0	○

Function code	Name	Description	Default	Modify
		60: Filter torque setting (filter after running) 61: MWh electromotive status (MSB) 62: kWh electromotive status (LSB) (×10, kWh) 63: MWh electricity generation status (MSB) 64: kWh electricity generation status (LSB) (×10, kWh) 65: PG card pulse reference count high bit 66: PG card pulse reference count low bit 67: Function parameter mapping (PZD2–PZD12 correspond to P14.60–P14.70)		
P15.25	DP communication timeout period	0.0–60.0s	1.0s	○
P15.26	CANopen communication timeout period	0.0–60.0s	1.0s	○
P15.27	CANopen communication baud rate	0–7 0: 1000k bps 1: 800k bps 2: 500k bps 3: 250k bps 4: 125k bps 5: 100k bps 6: 50k bps 7: 20k bps	3	◎
P15.28	Master/slave CAN communication address	0–127	1	◎
P15.29	Master/slave CAN communication baud rate	0: 50k bps 1: 100k bps 2: 125k bps 3: 250k bps 4: 500k bps 5: 1M bps	2	◎
P15.30	Master/slave CAN communication timeout period	0.0 (invalid)–60.0s	0.0s	○
P15.31	DeviceNET communication	0.0–60.0s	1.0s	○

Function code	Name	Description	Default	Modify
	timeout period (reserved)			
P15.32	Display node baud rate	0–65535	0	●
P15.33	Polling enable	0–1	1	○
P15.34	Instance number of polling output	19–27 19: INVT VFD output 20: ODVA basic speed control output 21: ODVA extended speed control output 22: ODVA speed and torque control output 23: ODVA extended speed and torque control output 24: INVT basic speed control output 25: INVT extended speed control output 26: INVT speed and torque control output 27: INVT extended speed and torque control output	19	○
P15.35	Instance number of polling input	69–77 69: INVT VFD input 70: ODVA basic speed control input 71: ODVA extended speed control input 72: ODVA speed and torque control input 73: ODVA extended speed and torque control input 74: INVT basic speed control input 75: INVT extended speed control input 76: INVT speed and torque control input 77: INVT extended speed and torque control input	69	○
P15.36	State change/cycle enable	0–1	0	○
P15.37	State change/cycle output instance	19–27 19: INVT VFD output 20: ODVA basic speed control output 21: ODVA extended speed control output 22: ODVA speed and torque control output 23: ODVA extended speed and torque control output	19	○

Function code	Name	Description	Default	Modify
		24: INVT basic speed control output 25: INVT extended speed control output 26: INVT speed and torque control output 27: INVT extended speed and torque control output		
P15.38	State change/cycle input instance	69–77 69: INVT VFD input 70: ODVA basic speed control input 71: ODVA extended speed control input 72: ODVA speed and torque control input 73: ODVA extended speed and torque control input 74: INVT basic speed control input 75: INVT extended speed control input 76: INVT speed and torque control input 77: INVT extended speed and torque control input	69	○
P15.39	Component 19 output length	8–32	32	○
P15.40	Component 19 input length	8–32	32	○
P15.41	BACnet communication mode (reserved)	0: P16.22 (I_M service) is valid. 1: P15.42 (Baud rate of BACnet_MSTP) is valid.	0	◎
P15.42	Baud rate of BACnet_MSTP (reserved)	0–5	0	◎
P15.43	Communication control word expression format	0–1 0: Decimal format 1: Binary format	0	◎

Group P16––Communication expansion card 2 functions

Function code	Name	Description	Default	Modify
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	0–255	0	◎

Function code	Name	Description	Default	Modify
	card IP address 3			
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 card gateway 2	0–255	168	◎
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 monitoring variable address 2	0x0000–0xFFFF	0x0000	○
P16.16	Ethernet card monitoring variable address 3 (reserved)	0x0000–0xFFFF	0x0000	○
P16.17	Ethernet card monitoring variable address 4 (reserved)	0x0000–0xFFFF	0x0000	○
P16.18	Ethernet monitoring card communication timeout period (reserved)	0.0 (invalid)–60.0s	0.0	○
P16.19	EtherCAT synchronization cycle (reserved)	0–4 0: 250μs 1: 500μs	2	○

Function code	Name	Description	Default	Modify
		2: 1ms 3: 2ms 4: Reserved		
P16.20	BACnet device No. MSB (reserved)	0–4194 **Note:** BACnet device No. range is 0– 4194303.	0	◎
P16.21	BACnet device No. LSB (reserved)	0–999 **Note:** BACnet device No. range is 0– 4194303.	1	◎
P16.22	BACnet "I-Am" service selection (reserved)	0: Send at power-on 1: Send constantly	0	○
P16.23	BACnet communication timeout period (reserved)	0.0 (invalid)–60.0s	5.0s	○
P16.24	Time to identify expansion card in card slot 1	0.0–600.0s **Note:** The value 0.0 indicates disconnection faults will not be detected.	0.0s	○
P16.25	Time to identify expansion card in card slot 2	0.0–600.0s **Note:** The value 0.0 indicates disconnection faults will not be detected.	0.0s	○
P16.26	Time to identify expansion card in card slot 3	0.0–600.0s **Note:** The value 0.0 indicates disconnection faults will not be detected.	0.0s	○
P16.27	Communication timeout period of card at slot 1	0.0–600.0s **Note:** The value 0.0 indicates disconnection faults will not be detected.	0.0s	○
P16.28	Communication timeout period of expansion card in card slot 2	0.0–600.0s **Note:** The value 0.0 indicates disconnection faults will not be detected.	0.0s	○
P16.29	Communication timeout period of card at slot 3	0.0–600.0s **Note:** The value 0.0 indicates disconnection faults will not be detected.	0.0s	○
P16.30	EtherCAT communication timeout time	0.0–60.0s	5.0s	○
P16.31	Profinet communication timeout time	0.0–60.0s	5.0s	○

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td>P16.32</td><td>Received PZD2</td><td rowspan="11">0–49
0: Invalid
1: Set frequency (0–Fmax, unit: 0.01Hz)
2: PID reference (-1000–1000, in which 1000 corresponds to 100.0%)
3: PID feedback (-1000–1000, in which 1000 corresponds to 100.0%)
4: Torque setting (-3000–+3000, in which 1000 corresponds to 100.0% of the motor rated current)
5: Setting of the upper limit of forward running frequency (0–Fmax, unit: 0.01Hz)
6: Setting of the upper limit of reverse running frequency (0–Fmax, unit: 0.01Hz)
7: Upper limit of the electromotive torque (0–3000, in which 1000 corresponds to 100.0% of the motor rated current)
8: Upper limit of braking torque (0–3000, in which 1000 corresponds to 100% of the motor rated current)
9: Virtual input terminal command. Range: 0x000–0x3FF
10: Virtual output terminal command. Range: 0x00–0xFF (RO4/RO3/Y3/Y2/RO2/RO1/HDO/Y1)
11: Voltage setting (special for V/F separation) (0–1000, in which 1000 corresponds to 100% of the motor rated voltage)
12: AO1 output setting 1 (-1000–+1000, in which 1000 corresponds to 100.0%)
13: AO2 output setting 2 (-1000–+1000, in which 1000 corresponds to 100.0%)
14: MSB of position reference (signed)
15: LSB of position reference (unsigned)
16: MSB of position feedback (signed)
17: LSB of position feedback (unsigned)
18: Position feedback setting flag (position feedback can be set only after this flag is set to 1 and then to 0)</td><td>0</td><td>○</td></tr>
<tr><td>P16.33</td><td>Received PZD3</td><td>0</td><td>○</td></tr>
<tr><td>P16.34</td><td>Received PZD4</td><td>0</td><td>○</td></tr>
<tr><td>P16.35</td><td>Received PZD5</td><td>0</td><td>○</td></tr>
<tr><td>P16.36</td><td>Received PZD6</td><td>0</td><td>○</td></tr>
<tr><td>P16.37</td><td>Received PZD7</td><td>0</td><td>○</td></tr>
<tr><td>P16.38</td><td>Received PZD8</td><td>0</td><td>○</td></tr>
<tr><td>P16.39</td><td>Received PZD9</td><td>0</td><td>○</td></tr>
<tr><td>P16.40</td><td>Received PZD10</td><td>0</td><td>○</td></tr>
<tr><td>P16.41</td><td>Received PZD11</td><td>0</td><td>○</td></tr>
<tr><td>P16.42</td><td>Received PZD12</td><td>0</td><td>○</td></tr>
</table>

Function code	Name	Description	Default	Modify
		19–20: Reserved 21: Non-standard frequency reference 22: Pre torque setting (-3000–+3000, in which 1000 corresponds to 100.0% of the motor rated current) 23–25: Reserved 26: Encoder high bit 27: Encoder low bit 28–46: Reserved 47: ACC time (0–1000 corresponds to 0.0–100.0s) 48: DEC time (0–1000 corresponds to 0.0–100.0s) 49: Function parameter mapping (PZD2–PZD12 correspond to P14.49–P14.59)		
P16.43	Sent PZD2	0–67 0: Invalid 1: Running frequency (×100, Hz) 2: Set frequency (×100, Hz) 3: Bus voltage (×10, V) 4: Output voltage (×1, V) 5: Output current (×10, A) 6: Actual output torque (×10, %) 7: Actual output power (×10, %) 8: Rotation speed of running (×1, RPM) 9: Linear speed of running (×1, m/s) 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 status 17: Terminal output status 18: PID reference (×100, %) 19: PID feedback (×100, %) 20: Motor rated torque 21: MSB of position reference (signed) 22: LSB of position reference (unsigned)	0	○
P16.44	Sent PZD3		0	○
P16.45	Sent PZD4		0	○
P16.46	Sent PZD5		0	○
P16.47	Sent PZD6		0	○
P16.48	Sent PZD7		0	○
P16.49	Sent PZD8		0	○
P16.50	Sent PZD9		0	○
P16.51	Sent PZD10		0	○
P16.52	Sent PZD11		0	○
P16.53	Sent PZD12		0	○

Function code	Name	Description	Default	Modify
		23: MSB of position feedback (signed) 24: LSB of position feedback (unsigned) 25: Status word 2 26: HDIB frequency value (*100, kHz) 27: PG card pulse feedback count high bit 28: PG card pulse feedback count low bit 29: Brake status 30: Non-standard status 31: Reserved 32: Encoder feedback frequency (-Fmax–Fmax, unit: 0.01Hz) 33–51: Reserved 52: Module temperature 53: U-phase current transient value 54: V-phase current transient value 55: W-phase current transient value 56–57: Reserved 58: Load weight 59: Current peak value 60: Filter torque setting (filter after running) 61: MWh electromotive status (high bit) 62: kWh status (low bit) (×10, kWh) 63: MWh electricity generation status (high bit) 64: kWh electricity generation status (low bit) (×10, kWh) 65: PG card pulse reference count high bit 66: PG card pulse reference count low bit 67: Function parameter mapping (PZD2–PZD12 correspond to P14.60–P14.70)		
P16.54	EtherNet IP communication timeout period	0.0 (invalid)–60.0s When EtherNet IP communication fault occurs, the VFD reports an EtherNet IP communication fault (E-EIP).	5.0s	○
P16.55	EtherNet IP communication rate	0: Self adaptive 1: 100M full duplex 2: 100M half duplex 3: 10M full duplex 4: 10M half duplex	0	◎

Function code	Name	Description	Default	Modify
P16.56–P16.57	Reserved	0–65535	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	◎
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 subnet mask 4	0–255	1	◎

Function code	Name	Description	Default	Modify
P16.70	Two-in-one card working mode	0: CAN master/slave Ethernet two-in-one card 1: CAN master/slave card 2: Ethernet card **Note:** If the parameter setting is changed, the change takes effect only after the VFD is restarted.	0	◎
P16.71	CAN data frame sending/receiving delay	When the two-in-one card working mode is 0, the CAN data frame sending/receiving cycle, the time is 0.25ms. A greater parameter setting indicates longer CAN master/slave communication delay, but shorter Ethernet oscilloscope data indicates better oscilloscope effect. Shorter CAN master/slave communication delay indicates longer Ethernet oscilloscope data delay and worse oscilloscope effect. Adjust the parameter setting based on the number of slaves to obtain good oscilloscope effect when the master/slave communication is normal. **Note:** The parameter setting change takes effect after power-off and restart. Range: 3–20	5	◎
P16.72	CW and SW selection	0x00–0x74 Ones place: CW and SW selection 0: Standard CW and SW 1: CW and SW 1 for dedicated applications 2: CW and SW for special CANopen 3: CW and SW 2 for dedicated applications 4: CW and SW 2 for special CANopen Tens place: Reserved	0x00	◎
P16.73	Communication set ACC/DEC time selection	0: Non communication 1: PROFIBUSDP/CANopen communication 2: PROFIBUSNet or EtherNet IP communication	0	◎
P16.77	Save EtherCAT-written function code	0: Yes 1: No	0	○

Function code	Name	Description	Default	Modify
P16.79	EtherCAT input pulse frequency and other control selection	0x000–0x311 Ones place: Input pulse frequency selection 0: Input rotation speed unit is RPM 1: Input rotation speed unit is plus/s Tens place: P-channel pulse position value source 0: First channel PG card 1: Second channel PG card Hundreds place: 0x60BA probe function selection 0: Rising value for probe 1 1: Reserved 2: P-channel position value of second channel PG card 3: SSI feedback absolute position	0x000	○
P16.80	EtherCAT slave address	0–255	0	○
P16.81	EtherCAT standard speed mode special function	0x0000–0x1121 Ones place: Standard speed mode special function 1 0: Respond CW, and the control mode is determined by PLC 1: Only respond to the control word, and the control mode is determined by the VFD Tens place: Special function 2 0: The PDO object addresses of ACC and DEC time are 0x6083, 0x6084 respectively. 1: The PDO object addresses of ACC and DEC time are 0x6071, 0x6072 respectively. 2: The PDO anti-sway rope length address is 0x6072. Hundreds place: whether P00.00 support SDO modification of EtherCAT 0: Yes 1: No Thousands place: SW 0x6041 feedback value 0: Customized status word (consistent with GD350) 1: CW 0x6040 received value	0x0000	○

Group P17—Status viewing

Function code	Name	Description	Default	Modify
P17.00	Set frequency	Displays the present set frequency of the VFD. Range: 0.00Hz–P00.03	50.00Hz	●
P17.01	Output frequency	Displays the present output frequency of the VFD. Range: 0.00Hz–P00.03	0.00Hz	●
P17.02	Ramp reference frequency	Displays the present ramp reference frequency of the VFD. Range: 0.00Hz–P00.03	0.00Hz	●
P17.03	Output voltage	Displays the present output voltage of the VFD. Range: 0–1200V	0V	●
P17.04	Output current	Displays the valid value of present output current of the VFD. Range: 0.0–5000.0A	0.0A	●
P17.05	Motor rotation speed	Displays the present motor rotation speed. Range: 0–65535RPM	0RPM	●
P17.06	Torque current	Displays the present torque current of the VFD. Range: -3000.0–3000.0A	0.0A	●
P17.07	Exciting current	Displays the present exciting current of the VFD. Range: -3000.0–3000.0A	0.0A	●
P17.08	Motor power	Displays the power of the present motor. 100% is relative to the rated motor power. A positive value indicates it is the motoring state while a negative value indicates it is in the generating state. Range: -300.0–300.0% (relative to the rated motor power)	0.0%	●
P17.09	Motor output torque	Displays the actual output torque value of the VFD. 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% (of the motor rated torque)	0.0%	●
P17.10	Estimated motor frequency	Displays the estimated motor rotor frequency under the open-loop vector condition. Range: 0.00–P00.03	0.00Hz	●

Function code	Name	Description	Default	Modify
P17.11	DC bus voltage	Displays the present DC bus voltage of the VFD. Range: 0.0–2000.0 V	0V	●
P17.12	Digital input terminal status	Displays the present digital input terminal state of the VFD. Range: 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. Range: 0x0–0xF Corresponds to RO2, RO1, HDO and Y1 respectively	0	●
P17.14	Digital adjustment value	Displays the adjustment on the VFD made through the UP/DOWN terminal. Range: 0.00Hz–P00.03	0.00Hz	●
P17.15	Torque reference value	Relative to the percentage of the rated torque of the present motor, displaying the torque reference. Range: -300.0%–300.0% (of the motor rated current)	0.0%	●
P17.16	Linear speed	0–65535	0	●
P17.17	Reserved	0–65535	0	●
P17.18	Count value	0–65535	0	●
P17.19	AI1 input voltage	Displays the AI1 input signal. Range: 0.00–10.00V	0.00V	●
P17.20	AI2 input voltage	Displays the AI2 input signal. Range: -10.00V–10.00V	0.00V	●
P17.21	HDIA input frequency	Displays HDIA input frequency. Range: 0.000–50.000kHz	0.000kHz	●
P17.22	HDIB input frequency	Displays HDIB input frequency. Range: 0.000–50.000kHz	0.000kHz	●
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	●

Function code	Name	Description	Default	Modify
P17.26	Duration of this run	Displays the duration of this run of the VFD. Range: 0–65535min	0m	●
P17.27	Simple PLC and actual step of multi-step speed	Displays simple PLC and present step number of multi-step speed. Range: 0–15	0	●
P17.28	Motor ASR controller output Output	Displays the ASR controller output value under the vector control mode, relative to the percentage of rated motor torque. 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%	●
P17.33	Exciting current reference	Displays the exciting current reference value under the vector control mode. Range: -3000.0–3000.0A	0.0A	●
P17.34	Torque current reference	Displays the torque current reference value under the vector control mode. Range: -3000.0–3000.0A	0.0A	●
P17.35	AC incoming current	Displays the valid value of incoming current on AC side. Range: 0.0–5000.0A	0.0A	●
P17.36	Output torque	Display output torque. During forward running, a positive value indicates it is in the motoring state while a negative value indicates it is in the generating state. During reverse running, a positive value indicates it is in the generating state while a negative value indicates it is in the motoring state. Range: -3000.0Nm–3000.0Nm	0.0Nm	●

Function code	Name	Description	Default	Modify
P17.37	Motor overload count value	0–65535	0	●
P17.38	Process PID output	-100.0%–100.0%	0.00%	●
P17.39	Function codes in parameter download error	0.00–99.00	0.00	●
P17.40	Motor control mode	Ones place: Control mode 0: Vector 0 1: Vector 1 2: Space voltage vector control 3: Closed-loop vector control Tens place: Control status 0: Speed control 1: Torque control 2: Position control Hundreds place: Motor number 0: Motor 1 1: Motor 2 2: Motor 3	0x2	●
P17.41	Electromotive torque upper limit	0.0%–300.0% (of the motor rated current)	180.0%	●
P17.42	Braking torque upper limit	0.0%–300.0% (of the motor rated current)	180.0%	●
P17.43	Forward rotation upper-limit frequency in torque control	0.00Hz–P00.03	50.00Hz	●
P17.44	Reverse rotation upper-limit frequency in torque control	0.00Hz–P00.03	50.00Hz	●
P17.45	Inertia compensation torque	-100.0%–100.0%	0.0%	●
P17.46	Friction compensation torque	-100.0%–100.0%	0.0%	●
P17.47	Motor pole pairs	0–65535	0	●

Function code	Name	Description	Default	Modify
P17.48	VFD overload count value	0–65535	0	●
P17.49	Frequency set by A source	0.00Hz–P00.03	0.00Hz	●
P17.50	Frequency set by B source	0.00Hz–P00.03	0.00Hz	●
P17.51	PID proportional output	-100.0%–100.0%	0.00%	●
P17.52	PID integral output	-100.0%–100.0%	0.00%	●
P17.53	PID differential output	-100.0%–100.0%	0.00%	●
P17.54	Present proportional gain	0.00–100.00%	0.00%	●
P17.55	Present integral time	0.00–10.00s	0.00s	●
P17.56	Present differential time	0.00–10.00s	0.00s	●
P17.57	Present terminal status in multi-step speed setting	0x0–0xF	0x0	●
P17.58	High bits in VFD power generated	0–65535kWh (*1000)	0kWh	●
P17.59	Low bits in VFD power generated	0.0–999.9kWh	0.0kWh	●
P17.60	SSI encoder present position low bit	0–65535	0	●
P17.61	SSI encoder present position high bit	0–65535	0	●
P17.62	SSI locating process deviation	-32768–32768	0	●
P17.63	SSI locating final deviation	-32768–32768	0	●
P17.64	SSI locating initial position	0–65535 Displays ten times the present feedback value.	0	●
P17.65	SSI locating communication reference position	0–65535 Displays ten times the communication giving value.	0	●

Group P18––Status viewing in closed-loop control

Function code	Name	Description	Default	Modify
P18.00	Actual frequency of encoder	Used to indicate the actual-measured encoder frequency. The value of forward running is positive; the value of reverse running is negative. Range: -999.9–3276.7Hz **Note:** P18.00 is only displayed in V/F and closed-loop modes. In open loop mode, it is not displayed.	0.0Hz	●
P18.01	Encoder position count value	Encoder count value, quadruple frequency. Range: 0–65535	0	●
P18.02	Encoder Z pulse count value	Corresponding count value of encoder Z pulse. Range: 0–65535	0	●
P18.03	High bit of position reference value	It is cleared after stop. Setting range: 0–30000	0	●
P18.04	Low bit of position reference value	It is cleared after stop. Range: 0–65535	0	●
P18.05	High bit of position feedback value	It is cleared after stop. Setting range: 0–30000	0	●
P18.06	Low bit of position feedback value	It is cleared after stop. Range: 0–65535	0	●
P18.07	Position deviation	Deviation between the reference position and actual running position. Setting range: -32768–32767	0	●
P18.08	Position of position reference point	Position of reference point of Z pulse when the spindle stops accurately Range: 0–65535	0	●
P18.09	Present position setting of spindle	Present position setting when the spindle stops accurately. Setting range: 0–359.99	0.00	●
P18.10	Present position when spindle stops accurately	Present position when spindle stops accurately Range: 0–65535	0	●
P18.11	Encoder Z pulse direction	Z pulse direction display. When the spindle stops accurately, there may be a couple of pulses' error between the position of forward and reverse orientation, which can be eliminated by adjusting Z pulse direction of	0	●

Function code	Name	Description	Default	Modify
		P20.02 or exchanging phase AB of encoder. 0: Forward 1: Reverse		
P18.12	Encoder Z pulse angle	Reserved. Setting range: 0.00–359.99	0.00	●
P18.13	Encoder Z pulse error times	Reserved. Range: 0–65535	0	●
P18.14	High bit of encoder pulse count value	Encoder pulse count value. The count value is accumulated only if the VFD is powered on. Range: 0–65535	0	●
P18.15	Low bit of encoder pulse count value	Encoder pulse count value. The count value is accumulated only if the VFD is powered on. Range: 0–65535	0	●
P18.16	Speed measured by main control board	-3276.8–3276.7Hz	0.0Hz	●
P18.17	Pulse command frequency	Pulse command (A2/B2 terminal) is converted to the set frequency, and it is valid under the pulse position mode and pulse speed mode. Range: -3276.8–3276.7Hz	0.0Hz	●
P18.18	Pulse command feedforward	Pulse command (A2/B2 terminal) is converted to the set frequency, and it is valid under the pulse position mode and pulse speed mode. Range: -3276.8–3276.7Hz	0.0Hz	●
P18.19	Position regulator output	Position regulator output frequency in position control. Range: -327.68–327.67Hz	0.00Hz	●
P18.20	Count value of resolver	Count value of resolver Range: 0–65535	0	●
P18.21	Resolver angle	Pole position angle read by the resolver-type encoder. Setting range: 0.00–359.99	0.00	●
P18.22	Closed-loop SM pole angle	Present pole position. Setting range: 0.00–359.99	0.00	●
P18.23	SW 2	0–65535	0	●
P18.24	High-order bit of count value of	Pulse command (A2,B2) count value. The count value is accumulated only if the VFD is	0	●

Function code	Name	Description	Default	Modify
	pulse reference	powered on. Range: 0–65535		
P18.25	Low-order bit of count value of pulse reference	Pulse command (A2,B2) count value. The count value is accumulated only if the VFD is powered on. Range: 0–65535	0	●
P18.26	Speed measured by PG card	-3276.8–3276.7Hz	0.0Hz	●
P18.27	Encoder UVW sectors	0–7	0	●
P18.28	Encoder PPR display	0–65535	0	●
P18.29	Angle compensation value of SM	-180.0–180.0	0.0	●
P18.30	Z pulse angle of SM	0.00–655.35	0	●
P18.31	Z pulse value of pulse reference	0–65535	0	●
P18.32	Main control board measured value of pulse reference	-3276.8–3276.7Hz	0.0Hz	●
P18.33	PG card measured value of pulse reference	-3276.8–3276.7Hz	0.0Hz	●
P18.34	Present encoder filter width	0–63	0	●
P18.35	8K test duration	0–65535	0	●
P18.36	2nd PG card feedback pulse low bit	0–65535	0	●
P18.37	2nd PG card P-channel Z-pulse position	0–65535	0	●
P18.38	2nd PG card P-channel position accumulative pulse feedback high bit	0–65535	0	●

Function code	Name	Description	Default	Modify
P18.39	2nd PG card P-channel position accumulative pulse feedback low bit	0–65535	0	●

Group P19––Expansion card status viewing

Function code	Name	Description	Default	Modify
P19.00	Expansion card type of card slot 1	0–65535 0: No card 1: PLC card 2: I/O card 1 3: Incremental PG card 4: Incremental PG card with UVW 5: Ethernet communication card 6: DP 7: Reserved 8: Rotary PG card 9: CANopen communication card 10: Wi-Fi card/4G card 11: PROFINET communication card 12: Sine-cosine PG card without CD signals 13: Sine-cosine PG card with CD signals 14: Absolute encoder PG card 15: CAN master/slave communication card 16: Modbus/Modbus TCP communication card 17: EtherCAT communication card 18: BACnet communication card 19: DeviceNet communication card 20: I/O card 2 for hoisting 21: EtherNet IP card 22: MECHATROLINK communication card 23: Reserved 24: CAN-NET two-in-one communication card 25: Reserved 26: PN-NET two-in-one communication card 27–31: Reserved 32: SSI encoder card 33–65535: Reserved	0	●
P19.01	Expansion card type of card slot 2		0	●
P19.02	Expansion card type of card slot 3		0	●

Function code	Name	Description	Default	Modify
P19.03	Software version of expansion card at slot 1	0.00–655.35	0.00	●
P19.04	Software version of expansion card at slot 2	0.00–655.35	0.00	●
P19.05	Software version of expansion card at slot 3	0.00–655.35	0.00	●
P19.06	Terminal input status of I/O card	0x0000–0xFFFF	0x0000	●
P19.07	Terminal output status of I/O card	0x0000–0xFFFF	0x0000	●
P19.09	AI3 input voltage of I/O card	0.00–10.00V	0.00V	●
P19.15	Communication card control word	0x0000–0xFFFF Specifies the control word that the PROFIBUS-DP/CANopen/PROFINET/EtherCAT card sends to the VFD during communication.	0x0000	●
P19.16	VFD status word	0x0000–0xFFFF Specifies the status word that the VFD returns to the PROFIBUS-DP/CANopen/PROFINET/EtherCAT card during communication.	0x0000	●
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 (Fixed to the speed loop rotation reference variable)	0	●
P19.20	Ethernet monitoring variable 4	0–65535 (Fixed to the speed loop rotation feedback variable)	0	●
P19.21	EtherCAT state machine	0–8 0: Reserved 1: Initialization state 2: Pre-operation state 3: Reserved 4: Safe running state 5–7: Reserved 8: Operation state	0	●

Group P20––Encoder of motor 1

Function code	Name	Description	Default	Modify
P20.00	Encoder type display	0: Incremental encoder 1: Resolver-type encoder 2: Sin/Cos encoder 3: Endat/SSI absolute encoder	0	●
P20.01	Encoder pulse number	Number of pulses generated when the encoder revolves for one turn. Setting range: 0–16000	1024	◎
P20.02	Encoder direction	Ones place: AB direction 0: Forward 1: Reverse Tens place: Z pulse direction (reserved) 0: Forward 1: Reverse Hundreds place: CD/UVW pole signal direction 0: Forward 1: Reverse	0x000	◎
P20.03	Encoder disconnection fault detection time	Specifies the detection time of encoder offline fault (ENC1O). Setting range: 0.0–10.0s	2.0s	○
P20.04	Encoder reversal fault detection time	Specifies the detection time of encoder reversal fault (ENC1D). Setting range: 0.0–100.0s	0.8s	○
P20.05	Filter times of encoder detection	Setting range: 0x00–0x99 Ones place: Low-speed filter time, corresponding to 2^(0–9)×125μs Tens place: High-speed filter times, corresponding to 2^(0–9)×125μs	0x33	○
P20.06	Speed ratio between encoder mounting shaft and motor	You need to set the function parameter when the encoder is not installed on the motor shaft and the drive ratio is not 1. Setting range: 0.001–65.535	1.000	○
P20.07	Control parameters of SM	0x0000–0xFFFF Bit0: Enable Z pulse calibration Bit1: Enable encoder angle calibration Bit2: Enable SVC speed measurement Bit3–bit5: Reserved Bit6: Enable the CD signal calibration	0x0007	○

Function code	Name	Description	Default	Modify
		Bit7: Reserved Bit8: Do not detect encoder faults during autotuning Bit9: Enable Z pulse detection optimization Bit10: Enable the initial Z pulse calibration optimization Bit12: Clear the Z pulse arrival signal after stop Bit13: Reserved Bit14: Detect Z pulse after one rotation Bit15: Reserved		
P20.08	Enable Z pulse offline detection	0x00–0x11 Ones place: Z pulse detection 0: Disable 1: Enable Tens place: UVW pulse detection (for SM) 0: Disable 1: Enable	0x10	○
P20.09	Initial angle of Z pulse	Relative electric angle between the encoder Z pulse and the motor pole position. Setting range: 0.00–359.99	0.00	○
P20.10	Pole initial angle	Relative electric angle between the encoder position and the motor pole position. Setting range: 0.00–359.99	0.00	○
P20.11	Initial pole angle autotuning	Range: 0–3 1: Rotary autotuning (DC braking) 2: Static autotuning (suitable for resolver-type encoder, sin/cos with CD signal feedback) 3: Rotary autotuning (initial angle identification) The pole initial angle obtained through rotary autotuning (DC braking) is accurate. Rotary autotuning 1 is recommended in most cases, in which the motor needs to be decoupled from the load or the motor load is light.	0	◎
P20.12	Speed measurement optimization selection	0: No optimization 1: Optimization mode 1 2: Optimization mode 2	1	◎
P20.13	CD signal zero offset gain	0–65535	0	○

Function code	Name	Description	Default	Modify
P20.14	Encoder type selection	0x00–0x11 Ones place: Incremental encoder 0: without UVW 1: with UVW Tens place: Sin/Cos encoder 0: without CD signal 1: With CD signal	0x00	◎
P20.15	Speed measurement mode	0: Measuring speed by PG card/Measuring height by HDI 1: Measuring locally through HDIA and HDIB. Only the 24V incremental encoders are supported. 2: Pulses are obtained through CANopen or PROFIBUS DP communication to measure the speed. 3: Pulses are obtained through PROFINET or EtherNet IP communication to measure the speed. **Note:** HDI height measuring is implemented through the HDIA and HDIB and supports only incremental 24V encoders.	0	◎
P20.16	Frequency division coefficient	0–255 When the function parameter is set to 0 or 1, frequency division of 1:1 is implemented.	0	○
P20.17	Pulse filter handling selection	0x0000–0xFFFF Bit0: Enable/disable encoder input filter 0: No filter 1: Filter Bit1: Encoder signal filter mode 0: Self-adaptive filter 1: Use P20.18 as the filter parameter Bit2: Encoder channel P frequency-division output filter enabling 0: Disable 1: Filter Bit3: Pulse reference channel F frequency-division output filter enabling 0: No filter	0x0033	○

Function code	Name	Description	Default	Modify
		1: Filter Bit4: Pulse reference channel F filter enabling 0: Disable 1: Filter Bit5: Pulse reference channel F filter mode 0: Self-adaptive filter 1: Use P20.19 as the filter parameter Bit6: Frequency-divided output source setting 0: Encoder signals 1: Pulse reference signals Bit7–bit15: Reserved		
P20.18	Encoder channel P filter width	0–63 The filter time is P20.18×0.25μs. The value 0 or 1 indicates 0.25μs.	2	○
P20.19	Pulse reference channel F filter width	0–63 The filter time is P20.19×0.25μs. The value 0 or 1 indicates 0.25μs.	2	○
P20.20	F-channel pulse reference PPR	0–16000	1024	◎
P20.21	Enabling SM angle compensation	0–1	0	○
P20.22	Frequency point of speed measurement mode switchover	0–630.00Hz Note: Valid only when P20.12=0.	1.00Hz	○
P20.23	Angle compensation coefficient	-200.0–200.0%	100.0%	○
P20.24	Motor pole pairs in initial pole angle autotuning	1–128	2	◎
P20.25	SSI encoder resolution low bit	0–20	16	○
P20.26	SSI encoder resolution high bit	0–20	8	○
P20.27	SSI data format	0x000–0x111 Ones place: Reserved Tens place: Binary/Gray code selection for	0x000	○

Function code	Name	Description	Default	Modify
		transmission type 0: Gray code parsing 1: Binary parsing Hundreds place: Reserved		
P20.28	SSI data shift	0–63 When it is less than 32, it is right shift data. When it is greater than 32, it is left shift data (P20.28–31)	0	○
P20.29	SSI card protocol	0: Standard protocol 1: Fully closed-loop protocol **Note:** The parameter change takes effect after power-off and restart.	1	◎
P20.30	Reserved	0–6	4	◎
P20.31	SSI pulse linear resolution	0.0–10.0mm/pls	0.1 mm/pls	○

Group P21––Position control

Function code	Name	Description	Default	Modify
P21.00	Positioning mode	0x0000–0x7321 Ones place: Control mode selection (only for closed-loop vector control) 0: Speed control 1: Position control Tens place: Position command source 0: Pulse train, using PG card terminal (A2, B2) pulse giving signal for position control. 1: Digital position. The setting of P21.17 is used for positioning, while the positioning mode can be set through P21.16. 2: Positioning of photoelectric switch during stop. When a terminal receives a photoelectric switch signal (terminal function 43 selected), the VFD starts positioning for stop, and the stop distance can be set through P21.17. Hundred place: Position feedback source 0: Encoder signals 1 Pulses of channel F of the PG1	0x0000	○

Function code	Name	Description	Default	Modify
		2: Pulses of channel P of the PG2 3: SSI signal of the PG2 Thousands place: Servo mode (reserved) 0: No deviation 1: With deviation Bit1: Enable/disable servo 0: Disable (The servo can be enabled by terminals.) 1: Enable Bit2–bit7: Reserved **Note:** In the pulse train or spindle positioning mode, the VFD enters the servo operation mode when there is a valid servo enabling signal. If there is no servo enabling signal, the VFD enter the servo operation mode only after it receives a forward running or reverse running command.		
P21.01	Pulse command mode	Ones place: Pulse mode 0: A/B quadrature pulse; A leads B 1: A: PULSE, B:SIGN If channel B is of low electric level, the edge counts up; if channel B is of high electric level, the edge counts down. 2: A: Positive pulse; channel A is positive pulse, and channel B needs no wiring. 3: A/B dual-channel pulse; channel A pulse edge counts up, channel B pulse edge counts down Tens place: Pulse direction 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	0x0000	◎

Function code	Name	Description	Default	Modify
		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		
P21.02	APR gain 1	The two automatic position regulator (APR) gains are switched based on the switching mode set through P21.04. When the spindle orientation function is used, the gains are switched automatically, regardless of the setting of P21.04. P21.03 is used for dynamic running, and P21.02 is used for maintaining the locked state. Setting range: 0.00–40.00	3.00	○
P21.03	APR gain 2		3.00	○
P21.04	APR 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	APR gain switchover threshold in torque command	0.0–100.0% (of the motor rated torque)	10.0%	○
P21.06	APR gain switchover threshold in speed command	0.0–100.0% (of the motor rated speed)	10.0%	○
P21.07	Smooth filter coefficient for gain switchover	Smooth filter coefficient for APR gain switchover. Setting range: 0–15	5	○

Function code	Name	Description	Default	Modify
P21.08	APR output limit	It specifies the 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 P00.03)	20.0%	○
P21.09	Positioning completion zone	When the position deviation is less than P21.09, and the duration is greater than P21.10, positioning completion signal will be outputted. Setting range: 0–1000	10	○
P21.10	Detection time for positioning completion	0.0–1000.0ms	10.0ms	○
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	0.0–3200.0ms For pulse train reference only (position control)	3.0ms	○
P21.15	Position command filter time constant	Position feedforward filter time constant during the pulse train positioning. 0.0–3200.0ms	0.0ms	◎
P21.16	Digital positioning mode	Bit 0: Positioning mode 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	0	○

Function code	Name	Description	Default	Modify
		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 (support the 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 needs to be conducted again after each positioning is enabled. The position type indicates that the displacement is set through P21.17, and the new position is be located automatically if P21.17 is changed. 0: Incremental 1: Position type (do not support the continuous mode) Bit4: Origin searching mode 0: Search for the origin only for once 1: Search for the origin in every time of running Bit5: Origin calibration mode 0: Calibration in real time 1: One-time calibration 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 valid 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: Valid		

Function code	Name	Description	Default	Modify
		Bit 8: Positioning enabling signal setting (for terminal-based cyclic positioning). In the pulse form, after positioning is completed or in the first positioning, the jump edge of the positioning enabling 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 is detected that the positioning enabling terminal is switched on. 0: Pulse signal 1: Electrical level signal Bit 9: Position source 0: PROFIBUS/CANopen/EtherCAT communication (when P21.17=0) or P21.17 (P21.17≠0) 1: Reserved Bit 10: Indicates whether to save encoder pulse count value at power-off 0: No 1: Yes Bit11: Indicates whether to save incremental position during power outage 0: No 1: Yes Bit12–bit13: Positioning curve selection 0: Straight line 1: S curve 2–3: Reserved Bit14: Indicates whether to keep 0Hz output within the time specified by P21.25 after positioning completes. 0: No 1: Yes Bit15: Calculation insertion/interrupt selection during positioning 0: Do not support changing the target speed or position. 1: Support changing the target speed or position.		

Function code	Name	Description	Default	Modify
P21.17	Position set in digital mode	Used to set the position for digital positioning. Actual position=P21.17×P21.11/P21.12 0–65535 (Unit: tenfold)	0	○
P21.18	Positioning speed setting	0: Setting of P21.19 1: AI1 2: AI2 3: AI3 4: High-speed pulse HDIA 5: High-speed pulse HDIB 6: EtherCAT communication	0	○
P21.19	Positioning speed set in digital mode	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. 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 speeds down from the max. output frequency (P00.03) to 0Hz. Setting range of P21.20: 0.01–300.00s Setting range of P21.21: 0.01–300.00s	3.00s	○
P21.21	Positioning DEC time		3.00s	○
P21.22	Positioning holding time	The function code is used to set the holding time after the destination position is reached. Setting range: 0.000–60.000s	0.100s	○
P21.23	Origin searching speed	0.00–50.00Hz	2.00Hz	○
P21.24	Origin bias	0–65535	0	○
P21.25	Positioning completion signal holding time	Time for holding the positioning completion signal. This parameter is also valid for the positioning in spindle orientation. Setting range: 0.000–60.000s	0.200s	○
P21.26	Pulse superposition	P21.26: 0–65535 P21.27: 0–3000.0/ms The function is valid in the pulse speed reference (P00.06=12) or pulse position mode (P21.00=1). 1. Input terminal function 68 (Enable the pulse superimposition)	0	○
P21.27	Pulse superposition rate		8.0/ms	○
P21.28	ACC/DEC time after pulse inhibition		5.0s	○

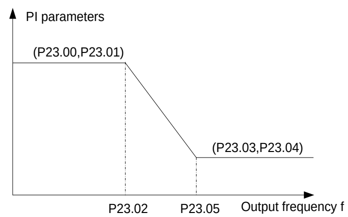
Function code	Name	Description	Default	Modify
		When the rising edge of the terminal is detected, add the value set in P21.26 to the set pulse value, and compensate to the pulse reference channel based on the pulse superposition speed set in P21.27. 2. Input terminal function 67 (pulse increase) When 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/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 time sequence of this function is same as the above. The difference is that this terminal is the pulse number that is superposed degressively. **Note:** The pulses mentioned above are superposed to A2 and B2 of pulse reference channel. Functions such as filtering and electronic gear are still valid for superposed pulses. 4. Output terminal function 28 (during pulse superposition) During the pulse superposition, the output terminal is valid. After the pulse superposition is completed, the output terminal is invalid.		
P21.29	Speed feedforward filtering time constant (pulse train-based 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: 0–3200.0ms	10.0ms	○
P21.30	Numerator of the 2nd command ratio	1–65535	1000	○
P21.31	Speed measuring method of pulse reference	0: By main control board 1: By PG card 2: Hybrid method	0	○

Function code	Name	Description	Default	Modify
P21.32	Pulse reference feedforward source	0x0–0x1 0: AI1 or HDIA 1: Encoder F-channel pulses	0x0	◎
P21.33	Setting of encoder count value clearing	0–65535	0	◎
P21.34	Dual PG card selection	0x0000–0x3111 Ones place–Hundreds place: Second PG card position selection Ones place: programmable card selection for card slot 1(near the cable) Tens place: Selection of PG card at card slot 2 Hundreds place: Selection of PG card at card slot 3 (near the terminal) 0: Speed closed-loop programmable card, parameter group P20 1: Position closed-loop programmable card, parameter group P24 Thousands place: Speed closed-loop selection 0: Disable 1: Position closed-loop PG card, as the speed closed-loop for switching to motor 2 2: Position closed-loop SSI PG card, using incremental signal as the speed closed-loop selection 3: SSI absolute position as the speed closed-loop (at this time, you need to set corresponding installation card slots for the bits from ones place to hundreds place)	0x0000	◎
P21.35	SSI positioning control polarity selection	0x00–0x11 Ones place: Feedforward control polarity selection 0: Positive 1: Negative Tens place: Absolute position polarity selection 0: Positive 1: Negative	0x00	◎
P21.39	Positioning pre-exciting time	0.000–10.000s	0.100s	○

Function code	Name	Description	Default	Modify
P21.40	Speed-to-position switchover delay	0.000–8.000s	0.500s	○
P21.41	Communication positioning and SSI feedback position control selection	0x0000–0xF121 Ones place: PN and EC communication positioning 0: PN communication 1: EC communication Tens place: SSI feedback position control filter 0: Invalid 1: Filter during positioning 2: Filter at the initial position and during positioning Hundreds place: Feedback position display filter 0: No filter 1: Filter Thousands place: SSI sensor sampling cycle 0–F: 1–15ms	0x2010	○
P21.42	SSI incremental filter width	0–60000 (SSI pulses) When the feedforward frequency is greater than 0.8Hz, pulse fluctuations greater than P20.30 will be filtered out. When P20.30<1000, the filter value at each frequency is the set value of P20.30. When P20.30>1000, the filter value at each frequency is 1000+the linearized value of the relative maximum frequency.	0	○
P21.43	SSI max. linear speed	6.0–6000.0m/min	300.0 m/min	○
P21.44	SSI static filter width	0.0–6000.0mm	5.0mm	○
P21.45	SSI dynamic filter width	0.0–6000.0mm	2000.0 mm	○
P21.46	Position deviation timeout time	0.00–50.00s	0.20s	○
P21.47	Brake release current in position control	0.0–200.0%	0.0%	○
P21.48	Short distance adaptive	0–60000 (SSI pulses) When the positioning distance is less than	10000	○

Function code	Name	Description	Default	Modify
	positioning ACC/DEC	P21.48, the present positioning ACC/DEC increases by two times.		
P21.49	SSI limit timeout period	0.00–10.00s	0.20s	○
P21.50	SSI position feedback filter time	0.000–5.000s	0.200s	○
P21.51	SSI positioning timeout period	0.000–8.000s	2.000s	○

Group P23––Vector control of motor 2

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td>P23.00</td><td>Speed-loop proportional gain 1</td><td rowspan="6">The parameters P23.00–P23.05 are applicable only to vector control mode. Below the switching frequency 1 (P23.00), 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:


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.</td><td>20.0</td><td>○</td></tr>
<tr><td>P23.01</td><td>Speed-loop integral time 1</td><td>0.200s</td><td>○</td></tr>
<tr><td>P23.02</td><td>Low-point frequency for switching</td><td>5.00Hz</td><td>○</td></tr>
<tr><td>P23.03</td><td>Speed-loop proportional gain 2</td><td>20.0</td><td>○</td></tr>
<tr><td>P23.04</td><td>Speed-loop integral time 2</td><td>0.200s</td><td>○</td></tr>
<tr><td>P23.05</td><td>High-point frequency for switching</td><td>10.00Hz</td><td>○</td></tr>
</table>

Function code	Name	Description	Default	Modify
		PI parameters have a close relationship with the inertia of the system. Adjust PI parameters depending on different loads to meet various demands. Setting range of P23.00: 0.0–200.0 Setting range of P23.01: 0.000–10.000s Setting range of P23.02: 0.00Hz–P23.05 Setting range of P23.03: 0.0–200.0 Setting range of P23.04: 0.000–10.000s Setting range of P23.05: P23.02–P00.03 (Max. output frequency)		
P23.06	Speed-loop output filter	0–8 (0–2^8/10ms)	0	○
P23.07	Electromotive slip compensation coefficient of vector control	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%	○
P23.08	Power-generation slip compensation coefficient of vector control		100%	○
P23.09	Current-loop proportional coefficient P	**Note:** ● 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 closed-loop vector control mode (P00.00=3). Setting range: 0–65535	1000	○
P23.10	Current-loop integral coefficient I		1000	○
P23.11	Speed-loop differential gain	0–10.00s	0.00s	○
P23.12	High-frequency current-loop proportional coefficient	In the closed-loop vector control 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	1000	○
P23.13	Integral coefficient of high-frequency current loop		1000	○

Function code	Name	Description	Default	Modify
P23.14	Current-loop high-frequency switching threshold	current-loop PI parameters are P23.12 and P23.13. Setting range of P23.12: 0–65535 Setting range of P23.13: 0–65535 Setting range of P23.14: 0.0–100.0% (of the max. frequency)	100.0%	○
P23.15	Enabling PI parameter switchover for start/stop in vector mode	0: Disable 1: Enable If the function is enabled, PI parameters in group P03 are used for running; PI parameters in group P23 are used for stop.	0	◎

Group P24––Encoder of motor 2

Function code	Name	Description	Default	Modify
P24.00	Encoder type display	0: Incremental encoder 1: Resolver-type encoder 2: Sin/Cos encoder 3: Endat/SSI absolute encoder	0	●
P24.01	Encoder pulse number	Number of pulses generated when the encoder revolves for one turn. Setting range: 0–16000	1024	◎
P24.02	Encoder direction	Ones place: AB direction 0: Forward 1: Reverse Tens place: Z pulse direction (reserved) 0: Forward 1: Reverse Hundreds place: CD/UVW pole signal direction 0: Forward 1: Reverse	0x000	◎
P24.03	Encoder disconnection fault detection time	Specifies the encoder disconnection fault detection time. Setting range: 0.0–10.0s	2.0s	○
P24.04	Encoder reversal fault detection time	Specifies the detection time of encoder reversal fault. Setting range: 0.0–100.0s	0.8s	○
P24.05	Filter times of	Setting range: 0x00–0x99	0x33	○

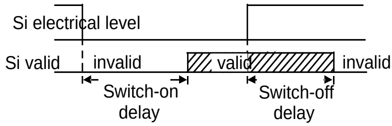
Function code	Name	Description	Default	Modify
	encoder detection	Ones place: Low-speed filter time, corresponding to 2^(0–9)×125μs Tens place: High-speed filter times, corresponding to 2^(0–9)×125μs		
P24.06	Speed ratio between encoder mounting shaft and motor	You need to set the function parameter when the encoder is not installed on the motor shaft and the drive ratio is not 1. Setting range: 0.001–65.535	1.000	○
P24.07	Control parameters of SM	Bit0: Enable Z pulse calibration Bit1: Enable encoder angle calibration Bit2: Enable SVC speed measurement Bit3–bit5: Reserved Bit6: Enable the CD signal calibration Bit7: Reserved Bit8: Do not detect encoder faults during autotuning Bit9: Enable Z pulse detection optimization Bit10: Enable the initial Z pulse calibration optimization Bit12: Clear the Z pulse arrival signal after stop Bit14: Detect Z pulse after one rotation	0x0007	○
P24.08	Enable Z pulse offline detection	0x00–0x11 Ones place: Z pulse detection 0: Disable 1: Enable Tens place: UVW pulse detection (for SM) 0: No detection 1: Enable	0x10	○
P24.09	Initial angle of Z pulse	Relative electric angle between the encoder Z pulse and the motor pole position. Setting range: 0.00–359.99	0.00	○
P24.10	Pole initial angle	Relative electric angle between the encoder position and the motor pole position. Setting range: 0.00–359.99	0.00	○
P24.11	Initial pole angle autotuning	0–3 1: Rotary autotuning 1 (DC braking) 2: Static autotuning 2 (suitable for resolver-type encoder, sin/cos with CD signal feedback) 3: Rotary autotuning (initial angle identification)	0	◎

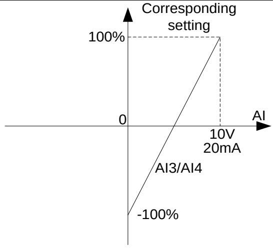
Function code	Name	Description	Default	Modify
		The pole initial angle obtained through rotary autotuning 1 is accurate. Rotary autotuning 1 is recommended in most cases, in which the motor needs to be decoupled from the load or the motor load is light.		
P24.12	Speed measurement optimization selection	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 1: With UVW Tens place: Sin/Cos encoder 0: without CD signal 1: With CD signal	0x00	◎
P24.15	Speed measurement mode	0: By PG card 1: Locally measured through HDIA and HDIB. Only the 24V incremental encoders are supported. **Note:** HDI height measuring is implemented through the HDIA and HDIB and supports only incremental 24V encoders.	0	◎
P24.16	Frequency division coefficient	0–255 When the function parameter is set to 0 or 1, frequency division of 1:1 is implemented.	0	○
P24.17	Pulse filter handling selection	0x0000–0xFFFF Bit0: Enable/disable encoder input filter 0: No filter 1: Filter Bit1: Encoder signal filter mode 0: Self-adaptive filter 1: Use P24.18 as the filter parameter Bit2: Enable/disable encoder frequency-division output filter 0: No filter 1: Filter Bit3: Enable/disable pulse reference	0x0033	○

Function code	Name	Description	Default	Modify
		frequency-division output filter 0: No filter 1: Filter Bit4: Enable/disable pulse reference filter 0: No filter 1: Filter Bit5: Pulse reference filter mode (valid when Bit4 is set to 1) 0: Self-adaptive filter 1: Use P24.19 as the filter parameter Bit6: Frequency-divided output source setting 0: Encoder signals 1: Pulse reference signals Bit7–bit15: Reserved		
P24.18	Encoder pulse filter width	0–63 The filter time is P24.18*0.25μs, but both 0 and 1 indicate 0.25μs.	2	○
P24.19	Pulse reference filter width	0–63 The filter time is P24.19*0.25μs, but both 0 and 1 indicate 0.25μs.	2	○
P24.20	F-channel pulse reference PPR	0–16000	1024	◎
P24.21	Enabling SM angle compensation	0–1	0	○
P24.22	Frequency point of speed measurement mode switchover	0–630.00Hz	1.00Hz	○
P24.23	Angle compensation coefficient	-200.0–200.0%	100.0%	○
P24.24	Motor pole pairs in initial pole angle autotuning	0–128	2	◎
P24.25	SSI encoder 2 resolution low bit	0–20	16	○
P24.26	SSI encoder 2 resolution high bit	0–20	8	○

Group P25––I/O card input functions

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td>P25.00</td><td>HDI3 input type</td><td>0–1
0: HDI3 is high-speed pulse input
1: HDI3 is digital input</td><td>0</td><td>◎</td></tr>
<tr><td>P25.01</td><td>Function of S5</td><td rowspan="9">Same as P05</td><td>0</td><td>◎</td></tr>
<tr><td>P25.02</td><td>Function of S6</td><td>0</td><td>◎</td></tr>
<tr><td>P25.03</td><td>Function of S7</td><td>0</td><td>◎</td></tr>
<tr><td>P25.04</td><td>Function of S8</td><td>0</td><td>◎</td></tr>
<tr><td>P25.05</td><td>Function of S9</td><td>0</td><td>◎</td></tr>
<tr><td>P25.06</td><td>Function of S10</td><td>0</td><td>◎</td></tr>
<tr><td>P25.07</td><td>Function of S11</td><td>0</td><td>◎</td></tr>
<tr><td>P25.08</td><td>Function of S12</td><td>0</td><td>◎</td></tr>
<tr><td>P25.09</td><td>Function of HDI3</td><td>0</td><td>◎</td></tr>
<tr><td>P25.10</td><td>Expansion card input terminal polarity</td><td>0x000–0x1FF
<table><tr><td></td><td></td><td></td><td>Bit8</td></tr><tr><td></td><td></td><td></td><td>HDI3</td></tr><tr><td>Bit7</td><td>Bit6</td><td>Bit5</td><td>Bit4</td></tr><tr><td>S12</td><td>S11</td><td>S10</td><td>S9</td></tr><tr><td>Bit3</td><td>Bit2</td><td>Bit1</td><td>Bit0</td></tr><tr><td>S8</td><td>S7</td><td>S6</td><td>S5</td></tr></table></td><td>0x000</td><td>○</td></tr>
<tr><td>P25.11</td><td>Expansion card virtual terminal setting</td><td>0x000–0x1FF (0: Disable. 1: Enable)
Bit0: S5 virtual terminal
Bit1: S6 virtual terminal
Bit2: S7 virtual terminal
Bit3: S8 virtual terminal
Bit4: S9 virtual terminal
Bit5: S10 virtual terminal
Bit6: S11 virtual terminal
Bit7: S12 virtual terminal
Bit8: HDI3 virtual terminal</td><td>0x000</td><td>◎</td></tr>
<tr><td>P25.12</td><td>HDI3 switch-on delay</td><td rowspan="6">These function codes specify the delay time corresponding to the electrical level changes when the programmable input terminals switch on or switch off.</td><td>0.000s</td><td>○</td></tr>
<tr><td>P25.13</td><td>HDI3 switch-off delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P25.14</td><td>S5 switch-on delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P25.15</td><td>S5 switch-off delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P25.16</td><td>S6 switch-on delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P25.17</td><td>S6 switch-off delay</td><td>0.000s</td><td>○</td></tr>
</table>

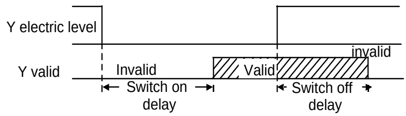
Function code	Name	Description	Default	Modify
P25.18	S7 switch-on delay	 Setting range: 0.000–50.000s	0.000s	○
P25.19	S7 switch-off delay		0.000s	○
P25.20	S8 switch-on delay		0.000s	○
P25.21	S8 switch-off delay		0.000s	○
P25.22	S9 switch-on delay		0.000s	○
P25.23	S9 switch-off delay		0.000s	○
P25.24	S10 switch-on delay		0.000s	○
P25.25	S10 switch-off delay		0.000s	○
P25.26	S11 switch-on delay		0.000s	○
P25.27	S11 switch-off delay		0.000s	○
P25.28	S12 switch-on delay		0.000s	○
P25.29	S12 switch-off delay		0.000s	○
P25.30	AI3 lower limit	Used to define the relationship between the analog input voltage and its corresponding setting. When the analog input voltage exceeds the range from the upper limit to the lower limit, the upper limit or lower limit is used. When the analog input is current input, 0mA–20mA current corresponds to 0V–10V voltage. In different applications, 100.0% of the analog setting corresponds to different nominal values. See the descriptions of each application section for details. The following figure illustrates the cases of several settings:	0.00V	○
P25.31	Corresponding setting of AI3 lower limit		0.0%	○
P25.32	AI3 upper limit		10.00V	○
P25.33	Corresponding setting of AI3 upper limit		100.0%	○
P25.34	AI3 input filter time		0.030s	○
P25.35	AI4 lower limit		0.00V	○
P25.36	Corresponding setting of AI4 lower limit		0.0%	○

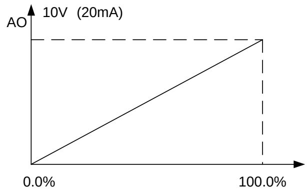
Function code	Name	Description	Default	Modify
P25.37	AI4 upper limit		10.00V	○
P25.38	Corresponding setting of AI4 upper limit		100.0%	○
P25.39	AI4 input filter time	Input filter time: to adjust the sensitivity of analog input. Increasing the value properly can enhance analog input anti-interference but may reduce the sensitivity of analog input. **Note:** AI3 can support 0–10V/0–20mA input. When AI3 selects 0–20mA input, the corresponding voltage of 20mA is 10V. Setting range of P25.30/P25.35: 0.00V–P25.32/ P25.37 Setting range of P25.31/P25.36: -300.0% – 300.0% Setting range of P25.32/P25.37: P25.30/ P25.35–10.00V Setting range of P25.33/P25.38: -300.0% – 300.0% Setting range of P25.34/P25.39: 0.000s– 10.000s	0.030s	○
P25.40	HDI3 high-speed pulse input function selection	0–1 0: Frequency setting input 1: Counting function	0	◎
P25.41	HDI3 lower limit frequency	0.000kHz–P25.43	0.000kHz	○
P25.42	Corresponding setting of HDI3 lower limit frequency	-300.0–300.0%	0.0%	○
P25.43	HDI3 upper limit frequency	P25.41–50.000kHz	50.000 kHz	○

Function code	Name	Description	Default	Modify
P25.44	Corresponding setting of HDI3 upper limit frequency	-300.0–300.0%	100.0%	○
P25.45	HDI3 frequency input filter time	0.000–10.000s	0.030s	○
P25.46	AI3 input signal type	0–1 0: Voltage 1: Current	0	○
P25.48	S terminal power signal selection (I/O card 2)	0–1 0: DC (24–48V DC) 1: AC (24–48V AC)	0	◎

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 selection		0	○
P26.03	Y3 output		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	0x0000–0x1FFF RO12, R10…RO3, HDO2,Y3, Y2 in sequence	0x0000	○
P26.13	HDO2 switch-on delay	0.000–50.000s	0.000s	
P26.14	HDO2 switch-off delay	0.000–50.000s	0.000s	
P26.15	Y2 switch-on delay	The function codes specify the delay time corresponding to the electrical level changes	0.000s	○
P26.16	Y2 switch-off delay		0.000s	○

Function code	Name	Description	Default	Modify
P26.17	Y3 switch-on delay	when the programmable output terminals switch on or switch off.  Setting range: 0.000–50.000s	0.000s	
P26.18	Y3 switch-off delay		0.000s	
P26.19	RO3 switch-on delay		0.000s	○
P26.20	RO3 switch-off delay		0.000s	○
P26.21	RO4 switch-on delay		0.000s	○
P26.22	RO4 switch-off delay		0.000s	○
P26.23	RO5 switch-on delay		0.000s	○
P26.24	RO5 switch-off delay		0.000s	○
P26.25	RO6 switch-on delay		0.000s	○
P26.26	RO6 switch-off delay		0.000s	○
P26.27	RO7 switch-on delay		0.000s	○
P26.28	RO7 switch-off delay		0.000s	○
P26.29	RO8 switch-on delay		0.000s	○
P26.30	RO8 switch-off delay		0.000s	○
P26.31	RO9 switch-on delay		0.000s	○
P26.32	RO9 switch-off delay		0.000s	○
P26.33	RO10 switch-on delay		0.000s	○
P26.34	RO10 switch-off delay		0.000s	○
P26.35	AO2 output	Same as the description for P06.14	0	○
P26.36	AO3 output		0	○
P26.38	AO2 output lower limit	The function codes define the relationship between the output value and analog output. When the output value exceeds the allowed	0.0%	○
P26.39	AO2 output		0.00V	○

Function code	Name	Description	Default	Modify
	corresponding to lower limit	range, the output uses the lower limit or upper limit.		
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.	10.00V	○
P26.42	AO2 output filter time		0.000s	○
P26.43	AO3 output lower limit		0.0%	○
P26.44	AO3 output corresponding to lower limit	Setting range of P26.38: -300.0%–P26.40 Setting range of P26.39: 0.00V–10.00V	0.00V	○
P26.45	AO3 output upper limit	Setting range of P26.40: P26.38–300.0% Setting range of P26.41: 0.00V–10.00V	100.0%	○
P26.46	AO3 output corresponding to upper limit	Setting range of P26.42: 0.000s–10.000s Setting range of P26.43: -300.0%–P26.45 Setting range of P26.44: 0.00V–10.00V	10.00V	○
P26.47	AO3 output filter time	Setting range of P26.45: P26.43–300.0% Setting range of P26.46: 0.00V–10.00V Setting range of P26.47: 0.000s–10.000s	0.000s	○

Group P27––Programmable expansion card functions

Function code	Name	Description	Default	Modify
P27.00	Enabling PLC card functions	0: Disable 1: Enable	0	◎
P27.01	C_WrP1	0–65535 **Note:** Used to write a value to WrP1 of the programmable card.	0	○
P27.02	C_WrP2	0–65535 **Note:** Used to write a value to WrP2 of the programmable card.	0	○
P27.03	C_WrP3	0–65535 **Note:** Used to write a value to WrP3 of the programmable card.	0	○

Function code	Name	Description	Default	Modify
P27.04	C_WrP4	0–65535 **Note:** Used to write a value to WrP4 of the programmable card.	0	○
P27.05	C_WrP5	0–65535 **Note:** Used to write a value to WrP5 of the programmable card.	0	○
P27.06	C_WrP6	0–65535 **Note:** Used to write a value to WrP6 of the programmable card.	0	◎
P27.07	C_WrP7	0–65535 **Note:** Used to write a value to WrP7 of the programmable card.	0	○
P27.08	C_WrP8	0–65535 **Note:** Used to write a value to WrP8 of the programmable card.	0	○
P27.09	C_WrP9	0–65535 **Note:** Used to write a value to WrP9 of the programmable card.	0	○
P27.10	C_WrP10	0–65535 **Note:** Used to write a value to WrP10 of the programmable card.	0	○
P27.11	PLC card status	0: Stop 1: Run	0	●
P27.12	C_MoP1	0–65535 **Note:** Used to monitor/view the MoP1 value of the programmable card.	0	●
P27.13	C_MoP2	0–65535 **Note:** Used to monitor/view the MoP2 value of the programmable card.	0	●
P27.14	C_MoP3	0–65535 **Note:** Used to monitor/view the MoP3 value of the programmable card.	0	●
P27.15	C_MoP4	0–65535 **Note:** Used to monitor/view the MoP4 value of the programmable card.	0	●
P27.16	C_MoP5	0–65535 **Note:** Used to monitor/view the MoP5 value of the programmable card.	0	●

Function code	Name	Description	Default	Modify
P27.17	C_MoP6	0–65535 **Note:** Used to monitor/view the MoP6 value of the programmable card.	0	●
P27.18	C_MoP7	0–65535 **Note:** Used to monitor/view the MoP7 value of the programmable card.	0	●
P27.19	C_MoP8	0–65535 **Note:** Used to monitor/view the MoP8 value of the programmable card.	0	●
P27.20	C_MoP9	-9999–32767 **Note:** Used to monitor/view the MoP9 value of the programmable card.	0	●
P27.21	C_MoP10	-9999–32767 **Note:** Used to monitor/view the MoP10 value of the programmable card.	0	●
P27.22	Digital input terminal status of programmable card	0x00–0x3F Bit0: PS1 Bit1: PS2 Bit2: PS3 Bit3: PS4 Bit4: PS5 Bit5: PS6	0x00	●
P27.23	Digital output terminal status of programmable card	0x00–0x03 Bit0: PRO1 Bit1: PRO2	0x00	●
P27.24	AI1 of the programmable card	0–65535 Relative to 0–10.00V/0.00–20.00mA **Note:** AI1 value from the programmable card.	0	●
P27.25	AO1 of the programmable card	0–65535 Relative to 0–10.00V/0.00–20.00mA **Note:** AO1 value from the programmable card.	0	●
P27.26	Length of data sent by programmable card and PZD communication object	0x00–0x28 Ones place: Quantity of data sent from the programmable card and VFD (that is, quantity of data sent from the programmable card + from VFD sending table 1 + from VFD sending table 2) 0: 0+24+60 1: 12+24+60	0x03	○

Function code	Name	Description	Default	Modify
		2: 24+24+60 3: 36+24+60 4: 48+24+60 5: 60+48+60 6: 72+24+36 7: 84+24+36 8: 96+96+96 Tens place: Card that communicates with the programmable card through PZD (valid only when the ones place of P27.26 is 5) 0: DP card 1: CANopen card 2: PN card **Note:** After this parameter is changed, restart the VFD to take effect.		
P27.27	Programmable 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	0–2 0: Master/slave control is invalid. 1: The local device is the master. 2: The local device is the slave.	0	◎
P28.01	Master/slave communication data selection	0–1 0: CAN 1: Reserved	0	◎
P28.02	Master/slave control mode	Ones place: Master/slave running mode selection 0: Master/slave mode 0. (Both the master and slave use speed control, and power balancing is performed by droop control.) 1: Master/slave mode 1. (The master and slave must be in the same type of vector control. When the master is in speed control, the slave is forced into torque control.) 2: Combined mode (Master/slave mode 2). The	0x001	◎

Function code	Name	Description	Default	Modify
		slave switches from speed mode (master/slave mode 0) to torque mode (master/slave mode 1) at a frequency point. 3: Master/slave mode 3 (Reserved)(Both the master and slave adopt speed control, and the slave performs power balance depending on the speed loop integral result of the master.) Tens place: Slave start command source 0: Master 1: Determined by P00.01 Hundreds place: Whether to enable master/slave to send/receive data 0: Enable 1: Disable		
P28.03	Slave speed gain	It is a percentage of the master ramp frequency. When the master and slave are different in the DEC ratio: 0.0–500.0% When the master and slave are the same in the DEC ratio: 100.0%	100.0%	○
P28.04	Slave torque gain	It is a percentage of the set frequency of the master. When the master and slave are different in the motor power: 0.0–500.0% When the master and slave are the same in the motor power: 100.0%	100.0%	○
P28.05	Frequency point for switching between speed mode and torque mode in master/slave mode 2	0.00–10.00Hz	5.00Hz	○
P28.06	Number of slaves	0–15	1	◎
P28.07	Enabling the slave speed deviation window	0–1 0: Disable 1: Enable When the slave adopts the torque control mode, the speed deviation monitoring function can be enabled.	0	○

Function code	Name	Description	Default	Modify
P28.08	Slave positive speed deviation window upper limit	0.00–50.00Hz When the actual speed is higher than the reference speed, if the actual speed is higher than (Reference speed + P28.08) and exceeds this upper limit, the speed has to be adjusted.	5.00Hz	○
P28.09	Slave negative speed deviation window lower limit	0.00–50.00Hz When the actual speed is lower than the reference speed, if the actual speed is lower than (Reference speed - P28.09) and the window lower limit, the speed has to be adjusted.	5.00Hz	○
P28.13	CAN slave torque offset	-100.0–100.0%	0.0%	○
P28.14	Master/slave holding brake synchronization control	0x00–0x11 Ones place: brake release synchronization 0: Invalid 1: Valid Tens place: brake closing synchronization 0: Invalid 1: Valid **Note:** In a master/slave mode, when the function specified by P28.14 is enabled, the master and slave must be the same in brake release frequency and brake closing frequency, and the brake closing frequency should be smaller than the brake release frequency.	0x11	○
P28.15	Master/slave brake release synchronization timeout time	0.00–30.00s	1.00s	○
P28.16	Master/slave brake closing synchronization timeout time	0.00–30.00s	1.00s	○
P28.17	Droop negative limit	0.00–20.00Hz **Note:** Valid when it is set to a non-0 value.	0.00Hz	○
P28.18	Slave torque direction in torque mode	0–2 0: Common mode 1: Forced to follow the master torque direction 2: Reserved	0	○

Group P85—Anti-sway control

Function code	Name	Description	Default	Modify
P85.00	Enabling anti-sway	0–1 0: Invalid 1: Enable **Note:** The anti-sway mode can be enabled by setting P85.00=1 or through terminal function selection.	0	◎
P85.01	Anti-sway mode selection	0–2 0: Common anti-sway 1: Anti-sway without rope length 2: S curve anti-sway	0	◎
P85.02	Rope length obtaining source	0–6 0: Keypad 1: AI1 2: AI2 3: HDIA 4: HDIB 5: Max(AI1, HDIA) combination 6: Max(AI2, HDIB) combination	0	◎
P85.03	Keypad set rope length	0.00–100.00mm	0.00m	○
P85.04	Max. rope length	5.00–150.00m	40.00m	◎
P85.05	Rope length compensation value	0.00–150.00m	0.00m	◎
P85.06	Anti-sway switching frequency threshold	0.00–50.00Hz Anti-sway is not started when the difference between the set frequency and present frequency is less than P85.06.	10.00Hz	○
P85.07	Damping factor	0.000–1.000	0.400	◎
P85.08	Gear switchover filtering delay	0.000–10.000s Applicable to P85.01=0 or 1.	0.100s	◎
P85.09	Anti-sway percentage	0–100 Applicable to P85.01=0 or 1.	30	○
P85.10	Residual sway percentage	0–100 Applicable to P85.01=1 Anti-sway without rope length.	11	○
P85.11	Anti-sway ACC/DEC time	0.00–10.00s Applicable to P85.01=1 Anti-sway without rope length.	6.00s	○

Function code	Name	Description	Default	Modify
P85.12–P85.14	Reserved	/	/	/
P85.15	S curve gain coefficient	0.0–1.0 Applicable to P85.01=2 S curve anti-sway.	0.6	○
P85.16	Anti-sway jogging time	0.000–5.000s Applicable to P85.01=2 S curve anti-sway.	0.000s	○
P85.17–P85.18	Reserved	/	/	/

Group P86––Slewing control

Function code	Name	Description	Default	Modify
P86.00	Curve entrance frequency	1.00–25.00Hz	8.00Hz	◎
P86.01	Curve coefficient	10–100	70	◎
P86.02	Stop torque hold time 1	1.0–50.0s	16.0s	○
P86.03	Stop torque hold time 2	1.0–50.0s	6.0s	○
P86.04	Stop comparison frequency	0.00–50.00Hz The value 0.00Hz indicates no use. During stop, if the frequency is lower than P86.04, the low speed is valid.	0.00Hz	◎
P86.05	Low-speed segment curve selection	0–1 0: The low-speed segment curve uses the time specified by P86.03. 1: The low-speed segment does not use the curve manner but uses the straight line manner. Used when the curve mode P01.05=2 is used. When the stop frequency is lower than P86.04 (low-speed function is valid).	0	◎
P86.06	Enabling discontinuous curves	0–1 0: Continuous 1: Discontinuous	1	◎
P86.07	Low-speed segment curve coefficient	0–100	70	◎
P86.08	Gear switchover ACC curve time	0.0–30.0s	10.0s	○

Function code	Name	Description	Default	Modify
P86.09	ACC curve entrance frequency ratio of gear switchover	0–100.0% (of the set frequency)	90%	◎
P86.10	Gear switchover DEC curve time	0.0–30.0s The value 0 indicates no use of gear switchover curves.	10.0s	○
P86.11	DEC curve entrance frequency ratio of gear switchover	0.0–50.0% (of the set frequency)	20.0%	◎
P86.12	Direction change switchover mode selection	0: Normal mode 1: Quick switchover mode 1 (single tap-braking)	0	◎
P86.13	Direction change switchover basis DEC time	0.0–50.0s	8.0s	○
P86.14	Lagging value of direction change switchover basis time	100%–500% (Used together with multi-step speed running)	100%	○
P86.15	Direction change switchover retaining frequency	0.00–15.00Hz	3.50Hz	◎
P86.16	Hold time 1 of direction change switchover frequency	0.000–50.000s	4.000s	○
P86.17	Hold time 2 of direction change switchover frequency	0.000–50.000s	3.000s	○
P86.18	Direction change switchover comparison frequency	0.00–50.00Hz During direction change switchover, if the entrance point is lower than P86.18, P86.17 is used.	0.00Hz	◎
P86.19	Enable 5-gear quick start	0–1 0: Disable 1: Enable	0	◎

Function code	Name	Description	Default	Modify
P86.21	Enabling reverse-rotation braking	0–2 (If this function is enabled, the reverse-gear stop DEC time is used during reverse-gear stop.) 0: Disable 1: Enable. Reverse-rotation braking is used as usual. 2: Enable. The retaining frequency is added during reverse-rotation braking. That is, if the frequency is higher than P86.23 when reverse braking is valid, P86.25 is kept for P86.24.	0	◎
P86.22	Reverse-rotation braking duration	0–50.0s	8.0s	○
P86.23	Reverse-rotation braking comparison frequency	0.00–50.00Hz	15.00Hz	◎
P86.24	Reverse-rotation braking retaining frequency hold time	0.000–50.000s	1.500s	○
P86.25	Reverse-rotation braking retaining frequency	0.00–50.00Hz	15.00Hz	◎
P86.28	Enabling wind resistance	0x000–0x111 Ones place: Wind resistance function enabling selection 0: Disable 1: Enable Tens place: ACC phase mode 0: Clearing the droop value through auto adaptation 1: Setting the droop value change rate manually Hundreds place: DEC phase mode 0: Quick compensating for the droop value 1: Setting the droop value change rate manually	0x000	◎
P86.29	Droop value change rate at ACC phase	0.00–20.00Hz/s	1.00 Hz/s	○
P86.30	Droop value change rate at DEC phase	0.00–20.00Hz/s	1.00 Hz/s	○

Function code	Name	Description	Default	Modify
P86.31	Slewing jog stop mode	0–1 0: Curve 1: Straight line	1	○
P86.32	Slewing jog speed loop KP	0.0–200.0	10.0	○
P86.33	Slewing jog speed loop Ti	0.000–10.000s	0.200s	○
P86.34	Jog action time judgment	0.000–5.000s	2.000s	○
P86.35	Jog frequency judgment	0.00–20.00Hz	5.00Hz	○
P86.36	Jog ACC time	0.0–60.0s	5.0s	○
P86.37	Jog DEC time	0.0–60.0s	5.0s	○
P86.39	Enabling tower crane deformation compensation	0–1 0: Disable 1: Enable	0	◎
P86.40	Deformation compensation coefficient 1	0.0–22.0	15.0	○
P86.41	Deformation compensation coefficient 2	0.0–10.0	0.0	○
P86.42	Deformation compensation filter times	0–30	17	◎
P86.43	Low frequency compensation reference frequency	0.00–100.00Hz	3.00Hz	○
P86.44	Low frequency deformation compensation filter times	0–30	23	◎

Group P89—Parameters of motor 3

Function code	Name	Description	Default	Modify
P89.00	Type of motor 3	0: Asynchronous motor (AM) 1: Synchronous motor (SM)	0	◎

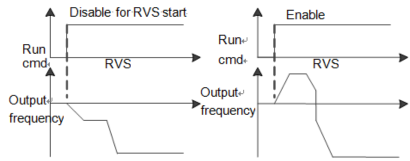
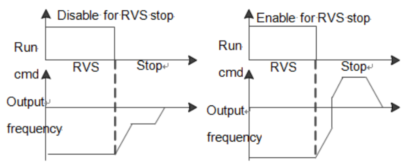
Function code	Name	Description	Default	Modify
P89.01	Rated power of AM 3	0.1–3000.0kW	Model depended	◎
P89.02	Rated frequency of AM 3	0.01Hz–P00.03 (Max. output frequency)	50.00Hz	◎
P89.03	Rated speed of AM 3	1–60000RPM	Model depended	◎
P89.04	Rated voltage of AM 3	0–1200V	Model depended	◎
P89.05	Rated current of AM 3	0.8–6000.0A	Model depended	◎
P89.06	Stator resistance of AM 3	0.001–65.535Ω	Model depended	○
P89.07	Rotor resistance of AM 3	0.001–65.535Ω	Model depended	○
P89.08	Leakage inductance of AM 3	0.1–6553.5mH	Model depended	○
P89.09	Mutual inductance of AM 3	0.1–6553.5mH	Model depended	○
P89.10	No-load current of AM 3	0.1–6553.5A	Model depended	○
P89.11	Magnetic saturation coefficient 1 of iron core of AM 3	0.0–100.0%	80.0%	○
P89.12	Magnetic saturation coefficient 2 of iron core of AM 3	0.0–100.0%	68.0%	○
P89.13	Magnetic saturation coefficient 3 of iron core of AM 3	0.0–100.0%	57.0%	○
P89.14	Magnetic saturation coefficient 4 of iron core of AM 3	0.0–100.0%	40.0%	○
P89.15	Rated power of SM 3	0.1–3000.0kW	Model depended	◎
P89.16	Rated frequency of SM 3	0.01Hz–P00.03 (Max. output frequency)	50.00Hz	◎
P89.17	Number of pole pairs of SM 3	1–128	2	◎

Function code	Name	Description	Default	Modify
P89.18	Rated voltage of SM 3	0–1200V	Model depended	◎
P89.19	Rated current of SM 3	0.8–6000.0A	Model depended	◎
P89.20	Stator resistance of SM 3	0.001–65.535Ω	Model depended	○
P89.21	Direct-axis inductance of SM 3	0.01–655.35mH	Model depended	○
P89.22	Quadrature-axis inductance of SM 3	0.01–655.35mH	Model depended	○
P89.23	Counter-emf constant of SM 3	0–10000V	300V	○
P89.24	Initial pole position of SM 3 (reserved)	0x0000–0xFFFF	0x0000	●
P89.25	Identification current of SM 2 (reserved)	0%–50% (of the motor rated current)	10%	●
P89.26	Overload protection of motor 3	0: No protection 1: Common motor (with low-speed compensation) 2: Frequency-variable motor (without low-speed compensation)	2	◎
P89.27	Overload protection coefficient of motor 3	20.0%–150.0%	100.0%	○
P89.28	Power display calibration coefficient of motor 3	0.00–3.00	1.00	○
P89.29	Parameter display of motor 3	0–1 0: Display by motor type 1: Display all	0	○
P89.30	System inertia of motor 3	0–30.000kg.m^2	0.000 kg.m^2	○
P89.31	Speed control switchover mode of motor 3	0–3 0: No switchover, which indicates keeping consistent with P00.00 of motor 1 1: Switch to SVC1 2: Switch to VF 3: Switch to FVC	0	◎

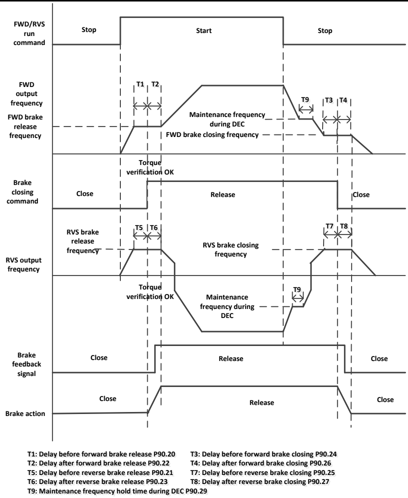
Group P90––Functions special for cranes

Function code	Name	Description	Default	Modify
P90.00	Setting of hoisting application macro 1	0–40 0: Common application mode 1: Lifting mode 1 (in open-loop vector control) 2: Lifting mode 2 (in closed-loop vector control) 3: Horizontal moving mode (in space voltage vector control) 4: Tower crane slewing mode 5: Conical motor application mode 6: User-defined application macro 1 (when P90.02=1) 7: User-defined application macro 2 (when P90.02=2) 8: User-defined application macro 3 (when P90.02=3) 9: Lifting mode 3 (in space voltage vector control) 10: Construction elevator mode 11: Closed-loop winching (for lifting in mineral wells and winches) 12: Open-loop winching (for lifting in mineral wells and winches) 13: Construction elevator mode 2 (for medium-speed elevator application) 14: Tower crane slewing without vortex in closed-loop vector control 15: Tower crane slewing without vortex in space voltage vector control 16–40: Reserved	0	◎
P90.01	Setting of hoisting application macro 2		0	◎
P90.02	User-defined application macro setting	0–3 1: Enter the settings of user-defined application macro 1 2: Enter the settings of user-defined application macro 2 3: Enter the settings of user-defined application macro 3	0	◎
P90.03	Switchover selection for	0–5 0: No switchover	0	◎

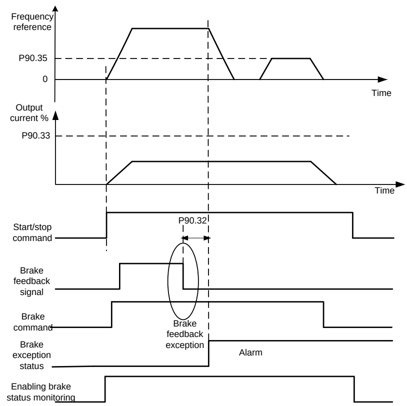
Function code	Name	Description	Default	Modify
	hoisting application macros 1 and 2	1: Switch from motor 1 to motor 2 When the S terminal selects function 35 and takes effect, and P90.03=1, the macro parameter is switched from P90.00 to P90.01, and motor parameters are automatically switched. 2: Switch from motor 1 to motor 3 When the S terminal selects function 88 and takes effect, and P90.03=2, the macro parameter is switched from P90.00 to P90.01, and motor parameters are automatically switched. 3: Switch from the master to the slave When the S terminal selects function 72 and takes effect, and P90.03=3, the macro parameter is switched from P90.00 to P90.01, and the master/slave switchover is automatically performed. 4: Switch from the salve to the master When the S terminal selects function 71 and takes effect, and P90.03=4, the macro parameter is switched from P90.00 to P90.01, and the master/slave switchover is automatically performed. 5: Switch to SVC1 control (open-loop vector control 1) When P90.03=5, P90.00 must be 2, while P90.01 must be 1; alternatively, P90.00 must be 11, while P90.01 must be 12. Only control mode can be switched, and the S terminal selects function 62 and takes effect. **Note:** When P90.03=1 or 2, function macros can be switched over through communication, of which mode is set by P08.31.		
P90.04	Enabling brake-oriented logic	0–1 0: The brake is controlled by an external controller. 1: Braking is controlled by VFD	0	◎

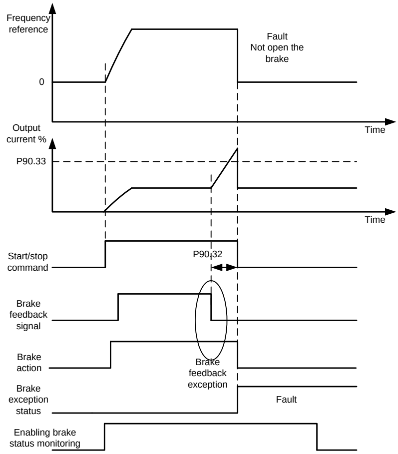
Function code	Name	Description	Default	Modify
P90.05	Enabling forward torque for reverse-running start/stop	0x00–0x11 Ones place: indicates whether to enable forward torque for reverse-running start 0: Disable (The reverse-running start direction complies with the command.) 1: Enable (The reverse-running start direction is always the forward-running direction.)  Tens place: indicates whether to enable forward torque for reverse-running stop 0: Disable (The reverse-running stop direction is consistent with the command.) 1: Enable (The reverse-running stop direction is always the forward-running direction.)  When reverse startup or forward torque for stop is enabled, the VFD first runs in forward direction and then runs in reverse direction, so as to ensure enough torque to drive the load.	0x00	◎
P90.06	Graded multi-step speed reference 0	Graded reference is a speed reference method for hoisting applications. Graded reference supports the graded operating lever mode and graded remote-control mode. Graded reference can implement 6-step speeds by combing the five graded multi-step reference terminals. The combination methods are as follows:	0.0%	○
P90.07	Graded multi-step speed reference 1		0.0%	○
P90.08	Graded multi-step speed reference 2		0.0%	○
P90.09	Graded multi-step		0.0%	○

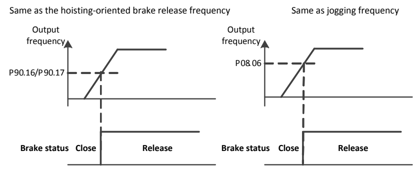
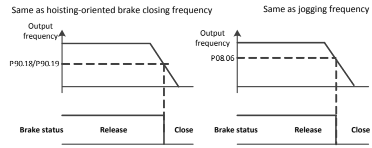
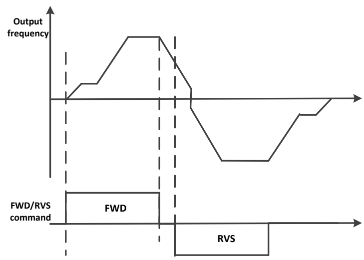
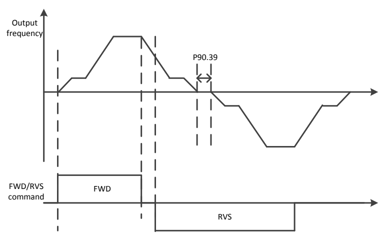
<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td></td><td>speed reference 3</td><td rowspan="3">Graded reference terminal
<table>
<tr><th>T 1</th><th>T 2</th><th>T 3</th><th>T 4</th><th>T 5</th><th>Speed setting</th><th>Function code</th></tr>
<tr><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>Graded setting 0</td><td>P90.06</td></tr>
<tr><td>ON</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>Graded setting 1</td><td>P90.07</td></tr>
<tr><td>ON</td><td>ON</td><td>OFF</td><td>OFF</td><td>OFF</td><td>Graded setting 2</td><td>P90.08</td></tr>
<tr><td>ON</td><td>ON</td><td>ON</td><td>OFF</td><td>OFF</td><td>Graded setting 3</td><td>P90.09</td></tr>
<tr><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>OFF</td><td>Graded setting 4</td><td>P90.10</td></tr>
<tr><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>Graded setting 5</td><td>P90.11</td></tr>
</table>
Set P00.06=15 or P00.07=15. The multi-step speed setting terminals are specified by P05 or P25, which can select functions 77–8. The speeds are specified by P90.06–P90.11 (P00.03: max. frequency).
Setting range of P90.06, P90.07, P90.08, P90.09, P90.10, P90.11: 0.0–100.0%
Note: The multi-step settings of a higher grade can be closed only after the multi-step settings of all lower grades are closed.</td><td></td><td></td></tr>
<tr><td>P90.10</td><td>Graded multi-step speed reference 4</td><td>0.0%</td><td>○</td></tr>
<tr><td>P90.11</td><td>Graded multi-step speed reference 5</td><td>0.0%</td><td>○</td></tr>
<tr><td>P90.12</td><td>Forward brake release current</td><td rowspan="7">The brake timing diagram in V/F mode is as follows:</td><td>0.0%</td><td>○</td></tr>
<tr><td>P90.13</td><td>Reverse braking/releasing current</td><td>0.0%</td><td>○</td></tr>
<tr><td>P90.14</td><td>Forward brake release torque</td><td>0.0%</td><td>○</td></tr>
<tr><td>P90.15</td><td>Reverse brake release torque</td><td>0.0%</td><td>○</td></tr>
<tr><td>P90.16</td><td>Forward brake release frequency</td><td>2.50Hz</td><td>○</td></tr>
<tr><td>P90.17</td><td>Reverse brake release frequency</td><td>2.50Hz</td><td>○</td></tr>
<tr><td>P90.18</td><td>Forward brake</td><td>1.50Hz</td><td>○</td></tr>
</table>

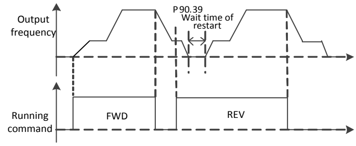
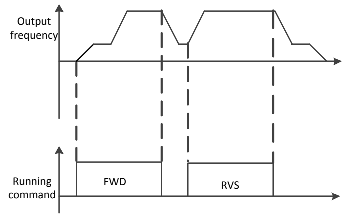
Function code	Name	Description	Default	Modify
	closing frequency	 Use forward-running timing sequence as example: Start: When the VFD is in standby state, the brake output signal is closed. After receiving the running command, the VFD accelerates with the target frequency P90.16. In addition, the VFD starts torque verification, if the verification is OK (condition: output current>= P90.12) (it is P90.13 in reverse running) and output torque >= P90.14 (it is P90.15 in reverse running), output frequency is at least equal to P90.16 (it is P90.17 in reverse running), the delay before forward brake release starts, and the VFD outputs the brake release signal when P90.20 (or P90.21 in reverse running) is reached. Then the delay after forward brake release starts. The VFD normally accelerates to the set frequency within the time specified by P90.22 (or P90.23 in reverse running). Stop: To prevent hook slip, sufficient output torque must be ensured before brake is closed. After receiving the stop command, the VFD decelerates to P90.28 with a maintenance		
P90.19	Reverse brake closing frequency		1.50Hz	○
P90.20	Delay before forward brake release		0.000s	○
P90.21	Delay before reverse brake release		0.000s	○
P90.22	Delay after forward brake release		0.300s	○
P90.23	Delay after reverse brake release		0.000s	○
P90.24	Delay before forward brake closing		0.000s	○
P90.25	Delay before reverse brake closing		0.000s	○
P90.26	Delay after forward brake closing		0.300s	○
P90.27	Delay after reverse brake closing		0.000s	○
P90.28	Maintenance frequency for stop		5.00Hz	○
P90.29	Maintenance frequency hold time for stop		0.000s	○
P90.30	Torque verification fault detection time		6.000s	○

Function code	Name	Description	Default	Modify
		frequency within P90.29. When output frequency <= P90.18 (or P90.19 in reverse running), the delay before brake release starts. When the delay reaches P90.24 (or P90.25 in reverse running), the VFD outputs brake closing signal. The delay after brake release starts. The VFD decelerates to zero and stops within the time P90.26 (or P90.27 in reverse running). Setting range of P90.12, P90.13: 0.0–200.0% (of the motor rated current) Setting range of P90.14, P90.15: 0.0–200.0% (of the motor rated torque) Setting range of P90.16, P90.17, P90.18, P90.19: 0.00–20.00Hz Setting range of P90.20, P90.21, P90.22, P90.23, P90.24, P90.25, P90.26, P90.27: 0.000–5.000s **Note:** If reverse-running delay is 0, the forward-running delay is used. Setting range of P90.28: 0.00–50.00Hz Setting range of P90.29: 0.000–5.000s Setting range of P90.30: 0.000–10.000s		
P90.31	Enabling the monitoring on brake status	Setting range of P90.31: 0–1 0: Disable 1: Enable the brake current monitoring (and brake feedback detection). When the function is disabled, no brake feedback fault is reported. After it is enabled, brake status can be monitored. In open-loop mode: If the actual brake status is different from the S-terminal given brake feedback signal during running or stop, the brake feedback fault (FAE) is reported after the brake feedback exception delay P90.32. In closed loop mode: When stopping, a fault will be reported directly after P90.32 brake feedback abnormal delay if the brake feedback is abnormal. When running, the current will be monitored after the P90.32 brake feedback	0	◎
P90.32	Brake feedback exception delay time (Brake feedback detection time)		1.000s	○
P90.33	Brake monitoring current threshold		100.0%	○
P90.34	Enabling speed reference under brake status error		0	◎
P90.35	Speed reference under brake status		5.00Hz	○

Function code	Name	Description	Default	Modify
	error	abnormal delay if the brake feedback is abnormal. If the present current is less than the brake monitoring current, it is considered that the brake is not closed at this time, which will be carried out according to the action set by P90.34. When P90.34=0, the brake feedback fault (FAE) is reported. When P90.34=1, open the brake and run at the speed specified by P90.35, and report the brake feedback alarm (A-FA) simultaneously.  In closed-loop mode: During running, if a brake feedback exception occurs, the VFD starts monitoring current after the brake feedback exception delay (P90.32). If the present current is greater than the brake monitoring current, the present actual frequency is checked. If the actual frequency is lower than the forward brake frequency during forward rotating or the actual frequency is lower than the reverse brake frequency during reverse rotating, it is considered that the brake has been closed, the brake feedback fault (FAE) is reported.		

Function code	Name	Description	Default	Modify
		 Setting range of P90.32: 0.000–20.000s Setting range of P90.33: 0.0%–200.0% (100.0% corresponding to the motor rated current) Setting range of P90.34: 0–1 0: Disable (Report the brake feedback fault FAE directly) 1: Enable brake status error speed giving (Report the brake feedback alarm A-FA simultaneously) Setting range of P90.35: 0.00–50.00Hz		
P90.36	Jog braking type	0x00–0x11 Ones place: Brake release type 0: Same as the hoisting-oriented brake release frequency 1: Same as the jog frequency Tens place: Brake closing type 0: Same as hoisting-oriented brake closing frequency 1: Same as the jog frequency Same as hoisting-oriented brake release frequency:	0x00	◎

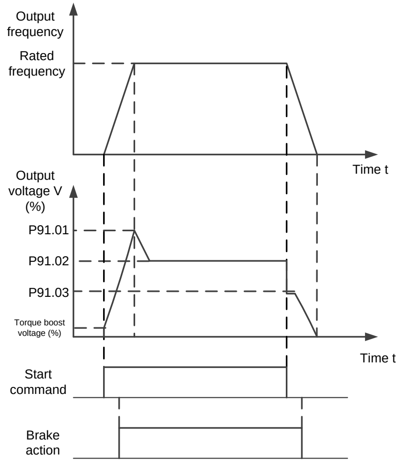
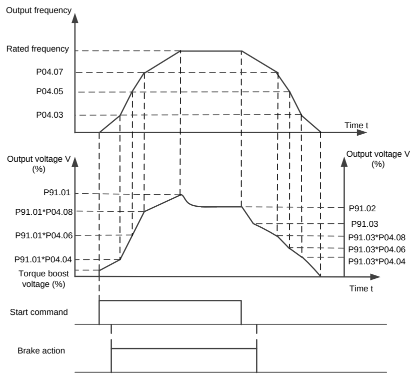
Function code	Name	Description	Default	Modify
		 Same as jog frequency: 		
P90.37	Brake selection for forward/reverse switchover	0–1 0: No switchover 1: Switchover When P90.37=0, the switchover is performed directly, and the brake does not act.  When P90.37=1, during the switchover, the VFD decelerates with braking to stop, and then opens the brake to run in reverse direction. 	0	◎
P90.38	Restart selection during braking	Setting range of P90.38: 0–1 0: No restart during braking	0	◎

Function code	Name	Description	Default	Modify
P90.39	Wait time for restart	 During the stop, if the brake closing command has been output, the system does not accept any new startup commands, and it can be restarted with a wait time of P90.39 after the brake is closed and VFD stops. 1: Restart allowed during braking  Though the brake closing command has been output during stop, the VFD accepts a new start command. Setting range of P90.39: 0.0–10.0s	0.5s	◎
P90.40	Braking method in open-loop vector control	0–3 0: Common mode 1: Torque mode with limit 1 The limit is specified by P90.41. 2: Torque/speed switchover mode 1 (boost with braking) It is used when P90.04=1 since the brake is involved. When the brake is opened, the speed mode is automatically used. 3: Torque/speed switchover mode 2 (horizontal moving) Since the brake is not involved, the torque/speed switchover is set through P90.44. The set frequency needs to be greater than P90.44.	0	◎
P90.41	Brake release/closing torque limit in	Setting range: 0.0–300.0% (of the motor rated current) During the vector control in speed mode, the	250.0%	○

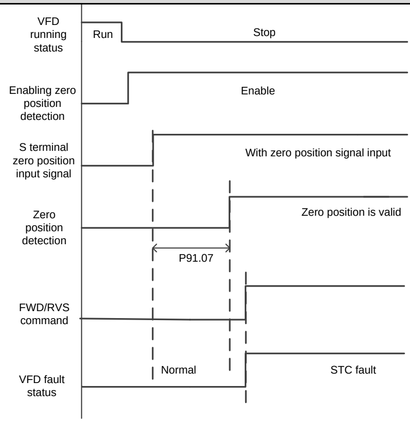
Function code	Name	Description	Default	Modify
	vector control	torque amplitude is limited within the delay time before brake release, after brake release, before brake closing, or after brake closing.		
P90.42	Torque setting for brake release	0.0–200.0% During running, when the torque feedback value is greater than or equal to P90.42, it enters the brake release timing. (It is valid only when P90.04=1, which indicates the brake is controlled by the VFD, and the VFD uses the torque mode.)	50.0%	○
P90.44	Brake closing delay after stop DC braking starts	0.00–50.00Hz Used in torque/speed switchover mode 2	8.00Hz	◎
P90.45	Torque verification mode	0–1 0: Mode 0 1: Mode 1	0	◎
P90.46	ACC/DEC time switchover selection for REV rotation	0–2 0: No switchover (Same as ACC/DEC time for FWD rotation.) 1: Switch to the DEC time. (P08.05 is used.) 2: Switch the ACC/DEC time. (P08.04 and P08.05 are used.)	0	◎

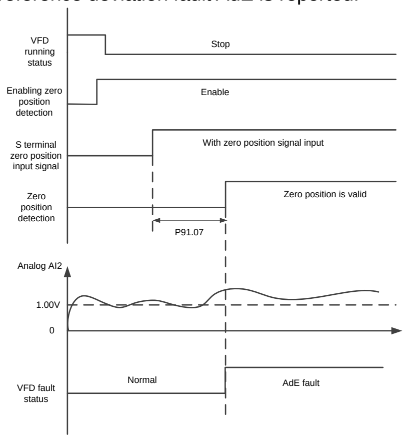
Group P91––Functions special for cranes

Function code	Name	Description	Default	Modify
P91.00	Enabling the conical motor function	The conical motor does not require external braking since it implements braking by using internal magnetic flux control. During start, the starting frequency needs to be increased for brake release. During stop, quick demagnetizing needs to be implemented to prevent slip in case of overdue brake closing. Setting range of P91.00: 0–1 0: Disable 1: Enable P91.00=0: Disable. Normal voltage curves are used. P91.00=1: Enable. Conical motor voltage curves are used. Setting range of P91.01: P91.02–150.0%	0	◎
P91.01	Conical motor ACC process voltage coefficient K1		120.0%	○
P91.02	Conical motor constant process voltage coefficient K2		100.0%	○
P91.03	Conical motor DEC process voltage coefficient K3		80.0%	○

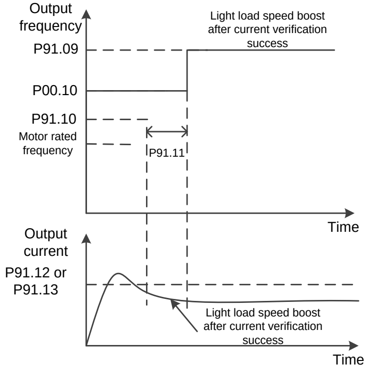
Function code	Name	Description	Default	Modify
		(100% corresponds to the motor rated voltage) Setting range of P91.02: P91.03–P91.01 Setting range of P91.03: 0.0–P91.02  The conical motor function is used simultaneously with the multi-dot V/F function.  The conical motor function is used simultaneously with the multi-dot V/F function. **Note:** ● The torque boost voltage is related to P04.01. ● The I/F mode is not applicable to conical motors.		

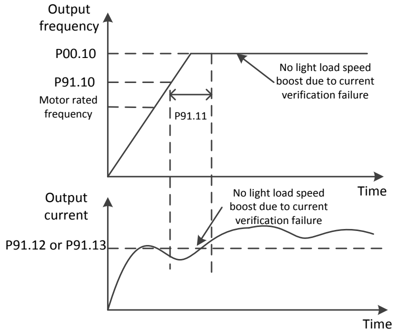
Function code	Name	Description	Default	Modify
P91.04	Contactor control selection	0–1 0: Controlled by an external controller 1: Controlled by the VFD	0	◎
P91.05	Contactor feedback detection time	0.00–20.000s	1.000s	◎
P91.06	Enabling operating lever zero point position detection	0x00–0x11 Ones place: 0: Disable zero point position detection 1: Enable zero point position detection Tens place: 0: Do not detect AI2 after zero position detection 1: Detect AI2 after zero position detection	0x00	◎
P91.07	Operating lever zero point position delay	After the zero position detection signal is enabled, the terminal zero position signal is given in stop state, the zero position detection is completed (valid) with a delay specified by P91.07, the zero position signal is released, and the VFD runs only after being given with the running command. After the zero position signal detection takes effect, if both the zero position signal and running command signal are detected, the operating lever zero position fault STC is reported. If the running command is given during zero position detection, the VFD does not respond. If both the zero position signal and running command signal still exist after zero position detection, the operating lever zero position fault STC is also reported. If the zero position signal is removed suddenly during zero position detection, the VFD does not respond to the running command since zero position detection is incomplete.	0.300s	○

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td></td><td></td><td>

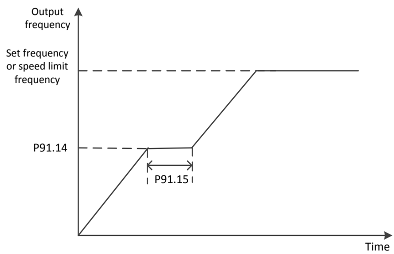
After the VFD stops, the VFD starts zero position detection. When the zero position detection delay is reached, if the detection finds that AI2 is greater than 1.00V, the analog speed reference deviation fault AdE is reported.


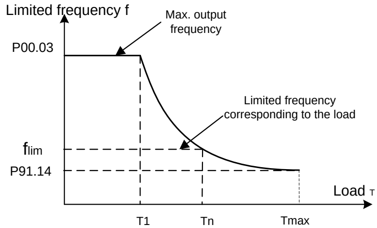
Setting range: 0.000–10.000s</td><td></td><td></td></tr>
<tr><td>P91.08</td><td>Light/heavy load speed regulation selection</td><td>0–5
0: Disable
1: ACC at constant power
2: Constant power speed limit
3: Stepped speed limit</td><td>0</td><td>◎</td></tr>
</table>

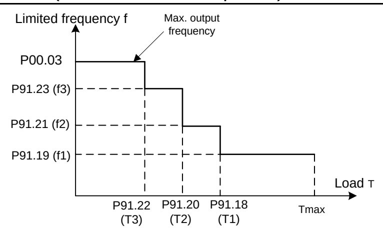
<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td></td><td></td><td>4: Light load speed boost 1 (by set current and frequency)
5: Speed boost through external terminal signal</td><td></td><td></td></tr>
<tr><td>P91.09</td><td>Light-load speed-boost target frequency setting</td><td rowspan="5">P91.08=4: Light load speed boost mode 1 (according to set current and frequency)


Light-load speed boost after current verification success


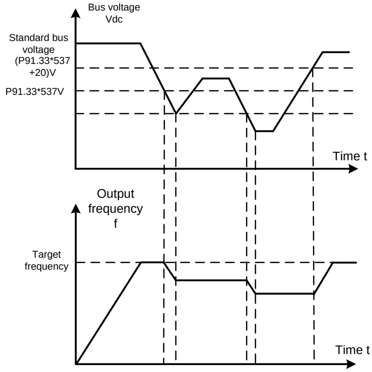
No light-load speed boost due to current verification failure
If light-load speed boost mode 1 is enabled, processing for light-load speed boost is performed only when the set frequency is equal to or greater than P02.02 (Motor rated frequency). After running, if the ramp frequency is equal to or greater than P91.10, current is</td><td>70.00Hz</td><td>○</td></tr>
<tr><td>P91.10</td><td>Light-load speed-boost detection frequency</td><td>90.0%</td><td>○</td></tr>
<tr><td>P91.11</td><td>Light-load speed-boost current detection time</td><td>1.000s</td><td>○</td></tr>
<tr><td>P91.12</td><td>FWD light-load speed-boost current detection value</td><td>60.0%</td><td>○</td></tr>
<tr><td>P91.13</td><td>REV light-load speed-boost current detection value</td><td>40.0 %</td><td>○</td></tr>
</table>

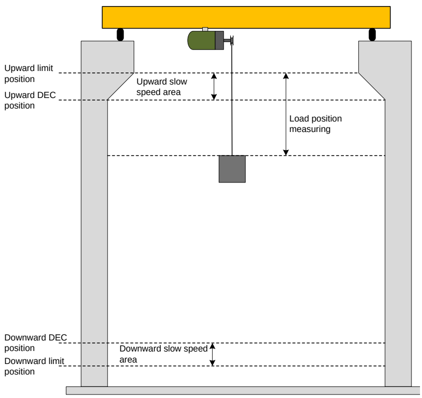
Function code	Name	Description	Default	Modify
		detected and count starts. When P91.11 is reached, if the current is less than P91.12 (or P91.13 in reverse running), the current detection passes, the VFD increases the frequency to P91.09. If the current detection fails, the VFD remains the original frequency. Note: The light-load speed-boost target frequency setting must be higher than the set frequency. Otherwise, speed boost cannot be implemented although the conditions are met. If the set frequency is higher than P91.10, the original frequency is remained. Setting range of P91.09: 0.00–100.00Hz Setting range of P91.10: 50.0%–100.0% (100.0% corresponds to the motor rated frequency.) Setting range of P91.11: 0.000–10.000s Setting range of P91.12, P91.13: 0.0–150.0% **Note:** Light load speed boost mode 1 is applicable to the open-loop mode.		
P91.14	Heavy-load speed-limit detection frequency		80.0%	○
P91.15	Heavy-load speed-limit detection delay	When the set frequency is greater than the heavy load speed-limit detection frequency (P91.14), the motor running frequency becomes stable after reaching the detection frequency (P91.14), and load detection is performed after the time specified by P91.15. The load detection value is used for heavy load speed limit calculation. The load detection value (P19.11) can be viewed through the keypad.	0.35s	○

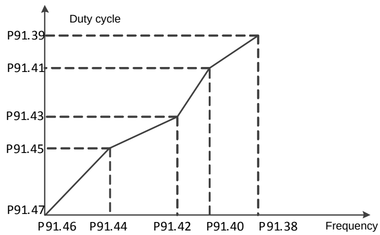
Function code	Name	Description	Default	Modify
		Setting range of P91.14: 0.0–120.0% (of the motor rated frequency) Setting range of P91.15: 0.00–5.00s Setting range of P94.01: 0.0% –150.0% (of the motor rated torque)		
P91.16	Electromotive power upper limit of constant-power speed boost/limit		90.0%	○
P91.17	Electricity generation power upper limit of constant-power speed boost/limit	Constant power speed limit frequency = Power upper limit * Motor rated frequency/Load detection value The constant power mode is used for speed adjustment. The constant power speed limit frequency under the present load is calculated by using algorithms (using P91.16, P91.17, and P94.01 for reference). 1. When P91.08=1, in constant power speed boost mode, if the constant power speed limit frequency is lower than or equal to the frequency upper limit P00.04, the VFD runs at the constant power speed limit frequency. At the same time, if the set frequency is higher than or equal to the constant power speed limit frequency, the speed is limited at constant power; if the set frequency is lower than the constant power speed limit frequency, the speed boosts. 2. When P91.08=2, in constant power speed limit mode, if the constant power speed limit frequency is lower than or equal to the frequency upper limit P00.04: if the set frequency is higher than or equal to the constant power speed limit frequency, the speed is limited at constant power; if the set frequency is lower than the constant power speed limit frequency, the set frequency is used	100.0%	○

Function code	Name	Description	Default	Modify
		for running. For example, when P00.03=100Hz, P91.16=90.0%, and motor rated frequency=50.00Hz: If the detected load value during motor upward running is 30.0%, the limited frequency=150Hz (90.0%*50.00Hz/30.0%), the calculated limited frequency is higher than P00.03. If P91.08=1, the set frequency P00.03 is used for running. If P91.08=2, the constant power speed limit frequency does not work, and the set frequency is used for running. If the detected load value during motor upward running is 60.0%, the limited frequency =75Hz(90.0%*50.00Hz/60.0%), the heavy load speed limit function works. The upward max. output frequency is limited to 75Hz. If P91.08=1, the frequency 75Hz is used for running. If P91.08=2, the max. running frequency is 75Hz, and the set frequency is used for running. The similar calculation method is applicable to motor downward running, only replacing P91.16 with P91.17. **Note:** During open/closed loop switchover (there is difference in load detection value), adjust P91.16 and P91.17, and the heavy load speed limit frequency cannot be lower than the heavy load speed limit detection frequency P91.14. Setting range of P91.16, P91.17: 30.0%–120.0% (of the motor rated power)		
P91.18	Load limit T1 in stepped speed limit upward running		70.0%	○
P91.19	Restricted frequency f1 in stepped speed limit upward running		50.00Hz	○
P91.20	Load limit T2 in	When the stepped speed limit mode is used,	45.0%	○

Function code	Name	Description	Default	Modify
	stepped speed limit upward running	the limit parameters for upward running and for downward running are set separately and can		
P91.21	Restricted frequency f2 in stepped speed limit upward running	be adjusted according to the actual situation. When the detected load (open-loop output current or closed-loop output torque) exceeds the limited value, the running frequency must	75.00Hz	○
P91.22	Load limit T3 in stepped speed limit upward running	be lower than the set restricted frequency. For example, during motor upward running, when the detected load is greater than P91.18,	25.0%	○
P91.23	Restricted frequency f3 in stepped speed limit upward running	the frequency is restricted to P91.19 (or when the set frequency is less than P91.19, the running frequency is the set frequency). When the detected load is greater than P91.20 (but	100.00Hz	○
P91.24	Load limit adjusted gain in stepped speed limit upward running	less than P91.18), the frequency is restricted to P91.21. The detected load values in open/closed loop state have deviation. During the open/closed	0.0%	○
P91.25	Torque limit adjusted gain in stepped speed limit downward running	loop switchover process, the load limit value can be adjusted through P91.24. P91.24 is valid for P91.18, P91.20, and P91.22. For example, when the same load is carried	0.0%	○
P91.26	Load limit T1 in stepped speed limit downward running	upward and tested, if P94.01=50.0% in closed-loop state and P94.01=55.0% in open-loop state, there is a difference of 5%. In	55.0%	○
P91.27	Restricted frequency f1 in stepped speed limit downward running	the actual use, after setting closed-loop parameters, if you need to switch to the open-loop state, you only need to set P91.24 to 5.0% (0 in closed-loop state), and you do not	50.00Hz	○
P91.28	Load limit T2 in stepped speed limit downward running	need to modify P91.18, P91.20, or P91.22. The situation of downward running is similar and therefore you only need to set parameters	48.0%	○
P91.29	Restricted frequency f2 in stepped speed limit downward running	related to downward running. **Note:** The heavy load speed limit frequency cannot be lower than P91.14. Setting range of P91.18, P91.20, P91.22,	75.00Hz	○
P91.30	Load limit T3 in stepped speed limit downward running	P91.26, P91.28, P91.30: 0.0%–150.0% (Open-loop output current is relative to the	25.0%	○

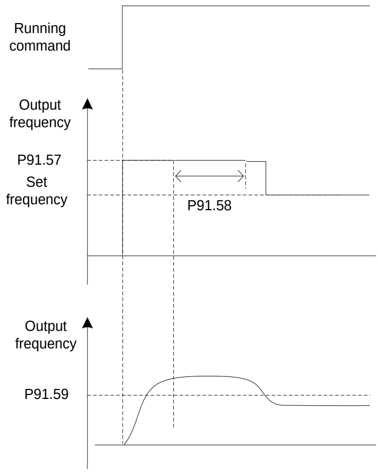
Function code	Name	Description	Default	Modify
P91.31	Restricted frequency f3 in stepped speed limit downward running	motor rated current, while closed-loop output torque is relative to the motor rated torque.) Setting range of P91.19, P91.21, P91.23, P91.27, P91.29, P91.31: 0.00–P00.04 Setting range of P91.24, P91.25: -20.0%–20.0% (Open-loop output current is relative to the motor rated current, while closed-loop output torque is relative to the motor rated torque.).	100.00Hz	○
P91.32	Enabling frequency decrease with voltage	Frequency decrease with voltage indicates that the VFD can automatically decrease the output frequency to maintain torque output in case of low line or bus voltage.	0	◎
P91.33	Starting voltage of frequency decrease with voltage	 The following assumes that the target frequency is set as the rated frequency. When P91.32=1, frequency decrease with voltage is enabled. If the bus voltage is less than the starting frequency (Standard bus voltage*P91.33), output frequency starts decrease, the regulated target frequency is (Rated frequency*Present bus voltage/Standard bus voltage). If the bus voltage increases but it does not reach the restoration voltage (Standard bus voltage*(P91.33+5%), the output frequency remains unchanged. If the bus voltage	85.0%	○

Function code	Name	Description	Default	Modify
		continuously decreases, the output frequency continuously decreases. If the bus voltage rises and becomes greater than the restoration voltage, the output frequency increases to the rated frequency. Setting range of P91.32: 0–1 0: Disable 1: Enable Setting range of P91.33: 70.0%–95.0% (Standard bus voltage 537V)		
P91.34	DEC position limit mode	0–1 0: Single direction limit 1: Bi-directional limit  Single direction limit: When the upward DEC limit position is reached, the upward slow speed area is entered, the VFD runs at P91.35 and stops at sudden if the upward limit position is reached; the upward speed is restricted, but the downward speed is not restricted. Downward DEC position limit uses the similar rule. Bi-directional limit: When the upward/downward DEC limit position is reached, the upward/downward slow speed zone is entered, which indicates that both the upward and downward speeds are limited. (Terminal command mode)	0	◎

Function code	Name	Description	Default	Modify
P91.35	DEC position limit restricted frequency	0.00–20.00Hz	10.00Hz	○
P91.37	Enabling HDO based vortex control for tower crane slewing	0–1 0: HDO remains consistent with P06.00 settings 1: HDO is used as PWM signal for voltage regulating output P91.37=1: Enable the tower crane rotating vortex control. HDO connects to the PWM input of the turbulence module. You can enable the output voltage of the turbulence module to change with the frequency by setting P91.38–P91.47.	0	◎
P91.38	Frequency f0	Setting range of P91.38: P91.40–P00.03 (Max. output frequency) Setting range of P91.40: P91.42–P91.38 Setting range of P91.42: P91.44–P91.40 Setting range of P91.44: P91.46–P91.42 Setting range of P91.46: 0.00Hz–P91.44 Setting range of P91.39, P91.41, P91.43, P91.47: 0.0%–100.0% Segmented adjustment is performed based on the cycle ratio and frequency.  **Note:** The HDO output polarity is specified by P06.05.	50.00Hz	○
P91.39	Duty ratio corresponding to frequency f0		100.0%	○
P91.40	Frequency f1		40.00Hz	○
P91.41	Duty ratio corresponding to frequency f1		80.0%	○
P91.42	Frequency f2		20.00Hz	○
P91.43	Duty ratio corresponding to frequency f2		40.0%	○
P91.44	Frequency f3		10.00Hz	○
P91.45	Duty ratio corresponding to frequency f3		20.0%	○
P91.46	Frequency f4		0.00Hz	○
P91.47	Duty ratio corresponding to frequency f4		0.0%	○
P91.48	HDO carrier frequency	0.5–10.0kHz	1.0kHz	○
P91.49	HDO closing delay during stop	0–100.0s	5.0s	○

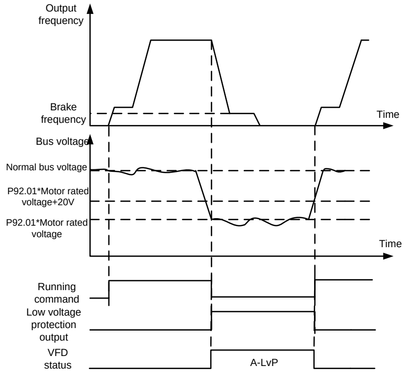
Function code	Name	Description	Default	Modify
P91.50	Pre-torque input signal source and effective period	0x00–0x17 Ones place: Input signal type 0: Invalid 1: AI1 2: AI2 3: Modbus 4: Internal setting 5: PROFIBUS/CANopen/PROFINET communication 6: Reserved 7: Keypad Tens place: Pre-torque action effective period 0: During brake release in VFD brake control 1: When the given pre-torque changes **Note (when the tens place is 1):** ● If the given pre-torque changes during operation, the actual pre-torque compensation value is the difference between the present given value and the last pre-torque given value. A negative change value indicates negative torque compensation. When the pre-torque given value is 0, the actual pre-torque is not the amount of change from the last time, but the pre-torque is invalid. ● As long as the operation command is given, the pre-torque compensation value will take effect even if the given frequency is 0Hz. ● When the synchronous motor is started for the first time, the pre-torque compensation function will not take effect until the present magnetic pole angle is found through static identification.	0x00	○
P91.51	Pre torque offset	In closed-loop mode: Setting pre torque is to output the torque corresponding to load weight in advance so as to reduce the start impact and prevent reserve driving or slip during start.	0.0%	○
P91.52	Drive side gain		1.000	○
P91.53	Braking-side gain		1.000	○

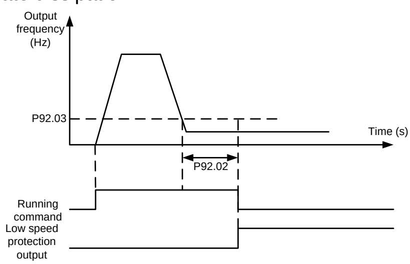
Function code	Name	Description	Default	Modify
		Setting P91.51 is to eliminate the impact of mechanical counterweight for lifting; pre torque compensation is directly performed if there is no mechanical counterweight. Pre torque compensation quantity = K*(P91.50 – P91.51), in which K= P91.52 when the motor is in electromotive state and K= P91.53 when the motor is in power generation (braking) state. Setting range of P91.51: -100.0–100.0% Setting range of P91.52 and P91.53: 0.000–7.000		
P91.54	Pre torque direction	0–1 0: Forward 1: Reverse	0	○
P91.55	Pre torque keypad setting value	0.0–300.0%	0.0%	○
P91.56	Enabling rope tracking	Setting range of P91.56: 0–1 Setting range of P91.57: 0.00–50.00Hz Setting range of P91.58: 0.000–10.000s Setting range of P91.59: 0.00–120.0% When the rope tracking function has been enabled, if the set frequency is lower than the rope tracking frequency, the VFD boosts to the rope tracking frequency after startup and takes a delay later. When the delay is reached, the VFD calculates the output torque. If the output frequency is greater than the preset torque (empty-load torque usually), the VFD considers the rope is too tight. Then the frequency is decreased to the set frequency.	0	○
P91.57	Rope-tracking speed boost frequency		25.00Hz	○
P91.58	Delay when rope-tracking frequency reached		1.000s	○
P91.59	Rope-tracking torque		40.0%	○

Function code	Name	Description	Default	Modify
		 **Note:** This function is mainly applicable to crane trolleys.		

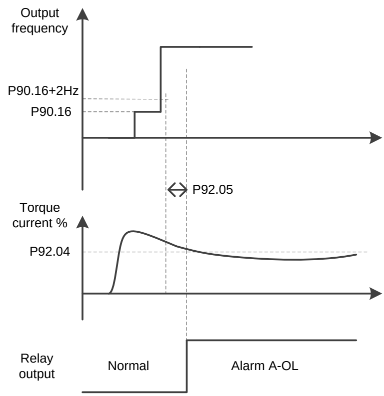
Group P92—Hoisting protection functions

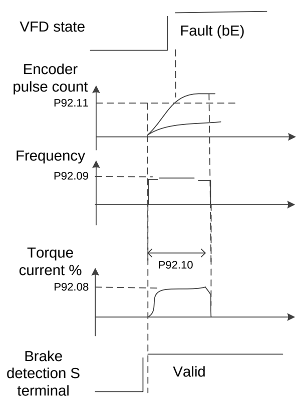
Function code	Name	Description	Default	Modify
P92.00	Selecting from low voltage protection, power-on brake detection, and 3PH input power loss detection	0x000–0x111 Ones place: Low-voltage protection enabling 0: Disable 1: Enable Used together with P92.01 to perform low voltage protection. Tens place: Power-on brake detection enabling 0: Disable 1: Enable Used together with P92.08–P92.11 to perform power-on brake detection in closed-loop vector mode. Hundreds place: 3PH input power loss detection 0: Disable 1: Enable Used together with P92.47 to perform 3PH input power loss detection.	0x000	◎

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td>P92.01</td><td>Low-voltage protection point</td><td>

When the ones place of P92.00=1, if the bus voltage is less than (P92.01×Motor rated voltage), low voltage protection is started, the VFD decelerates to stop.
If the bus voltage restores to a value greater than (P92.01*Motor rated voltage + 20V), low-voltage protection function is automatically disabled.
Setting range of P92.01: 1.00–1.30</td><td>1.05</td><td>○</td></tr>
<tr><td>P92.02</td><td>Low-speed run protection time</td><td rowspan="2">Low-speed run protection is applied to devices to which long-time low speed running is not applicable, preventing overheating caused by late dissipation.


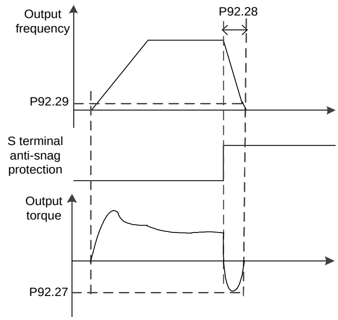
When P92.02 is a non-zero value, low-speed running protection is enabled, if the running frequency of the VFD is equal to or less than P92.03, and the last time is equal to or greater</td><td>0.000s</td><td>◎</td></tr>
<tr><td>P92.03</td><td>Setting of low-speed run frequency</td><td>5.00Hz</td><td>○</td></tr>
</table>

Function code	Name	Description	Default	Modify
		than P92.02, the VFD reports a low-speed running protection fault (LSP). Setting range of P92.02: 0.000–50.000s Setting range of P92.03: 0.00–20.00Hz		
P92.04	Overload protection current detection value	When P92.38=1 overload protection is enabled. When P92.04>0, if the ramp frequency is equal to or greater than (P90.16+2.00Hz) during	0.0%	◎
P92.05	Overload detection time	upward running, the VFD starts checking the current (closed-loop torque current or open-closed output current). If the current is equal to or greater than P92.04, the VFD reports the overload protection alarm after the detection time reaches P92.05. This restriction is not applicable to downward running.  Setting range of P92.04: 0.0–150.0% (relative to the motor rated torque in closed-loop state; relative to the motor rated current in open-loop state; 0 indicates disabling) Setting range of P92.05: 0.0–5.0s	0.5s	○
P92.06	Brake detection reminding interval	When P92.06>0, the brake detection reminding function is enabled, if the accumulative running	0.0	◎
P92.07	Brake detection reminding hold time	time of the VFD is equal to or greater than P92.06, the signal indicator is controlled through relay output signal or braking detection is reminded through the buzzer. The reminding hold time is specified by P92.07. After the time	5	○

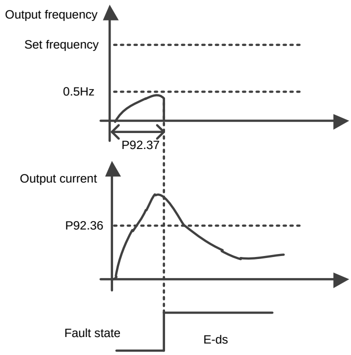
Function code	Name	Description	Default	Modify
		elapsed, reminding is not performed until re-power on. Setting range of P92.06: 0.0–1000.0h Setting range of P92.07: 0–100min		
P92.08	Brake detection torque setting	In open-loop control: Set a fixed torque and frequency and run the VFD. Through visual inspection, if the brake is not opened within the detection time, braking is normal. Otherwise, braking is abnormal. In closed-loop control mode, there are two startup situations: Situation 1: When P92.00 tens place=1, brake detection is automatically performed after power-on. Situation 2: When the braking force detection terminal enabling signal is valid (terminal function 85 is selected), the VFD keeps the brake closed and enters the brake timing. The detection logic is as follows: The VFD runs with P92.08 at P92.09 and detects the encoder pulse count. If the detected encoder pulse count exceeds P92.11 within P92.10, it is considered that braking force is insufficient and slip risk may exist. Then the multifunction output terminal outputs brake failure signal and the brake slip fault and outputs the brake failure fault (bE).  	100.0%	○
P92.09	Brake detection frequency setting		2.00Hz	○
P92.10	Brake detection time setting		1.5s	○
P92.11	Brake detection judging pulse threshold (closed-loop)		1000	○

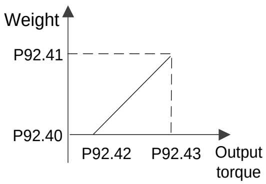
Function code	Name	Description	Default	Modify
		Note: If receiving a running command during the detection, the VFD automatically exits from detection and responds to the running command. Setting range of P92.08: 0.0–180.0% (of the motor rated torque) Setting range of P92.09: 0.00–20.00Hz Setting range of P92.10: 0.0–30.0s Setting range of P92.11: 0–20000		
P92.12	Enabling PT100/PT1000 temperature detection	0x00–0x11 Ones place: PT100 temperature detection 0: Disable 1: Enable Tens place: PT1000 temperature detection 0: Disable 1: Enable	0x00	◎
P92.13	Enabling PT100/PT1000 disconnection detection	0x00–0x11 Ones place: PT100 disconnection detection 0: Disable 1: Enable Tens place: PT1000 disconnection detection 0: Disable 1: Enable	0x00	◎
P92.14	PT100 detected OH protection threshold	0.0–150.0°C	120.0°C	○
P92.15	PT100 overtemperature pre-alarm point	0.0–150.0°C	100.0°C	○
P92.16	PT1000 detected OH protection threshold	0.0–150.0°C	120.0°C	○
P92.17	PT1000 overtemperature pre-alarm point	0.0–150.0°C	100.0°C	○
P92.18	PT100/PT1000 calibrated temperature upper	50.0–150.0°C	120.0°C	○

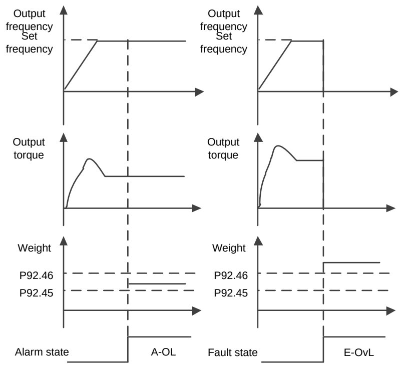
Function code	Name	Description	Default	Modify
	limit			
P92.19	PT100/PT1000 calibrated temperature lower limit	-20.0–50.0°C	20.0°C	○
P92.20	Digital of PT100/PT1000 calibrated temperature	0–4 0: Normal detection 1: PT100 lower limit digital calibration autotuning 2: PT100 upper limit digital calibration autotuning 3: PT1000 lower limit digital calibration autotuning 4: PT1000 upper limit digital calibration autotuning After autotuning is completed, the function code is automatically cleared, and the calibration value is automatically saved to the I/O card.	0	○
P92.21	PTC overtemperature selection	0–1 0: The PTC function is enabled through terminal selection. When the PTC overtemperature alarm A-Ptc is reported, this cannot terminate normal running. 1: The PTC function is valid through terminal selection. When the PTC overtemperature fault PtcE is reported, this results in stop.	0	◎
P92.22	Type of sensor for AI to detect motor temperature	0–4 0: Without 1: PT100 2: PT1000 3: KTY84 4: PTC (supporting only AI1)	0	○
P92.23	AI detected motor overtemperature protection threshold	0.0–200.0°C	110.0°C	○
P92.24	AI detected motor overtemperature pre-alarm threshold	0.0–200.0°C	90.0°C	○

Function code	Name	Description	Default	Modify
P92.25	Input phase loss delay frequency at REV run	If the VFD runs in reverse direction, and the frequency is lower than P92.25, the phase loss alarm is reported only when this situation lasts a time specified by P92.26. Setting range of P92.25: 0.00–50.00Hz Setting range of P92.26: 0.0–10.0s	30.00Hz	○
P92.26	Input phase loss delay time at REV run		0s	○
P92.27	Anti-snag protection braking torque	 Anti-snag indicates that the VFD outputs reserve torque so that the motor can stop at the fastest speed. A smaller value of P92.28 indicates a faster braking speed. When the motor decelerates to P92.29, the VFD stops. Setting range of P92.27: 0.0–300.0% (of the motor rated current) Setting range of P92.28: 0.000–10.000s Setting range of P92.29: 0.00–30.00Hz	0.0%	○
P92.28	Braking torque ACC/DEC time		0.200s	○
P92.29	Braking torque end frequency		0.10Hz	○
P92.30	Enabling set frequency protection	0–4 0: Disable 1: If Set frequency ≤ Brake closing frequency, the VFD reports A-rSF, and it closes the brake but does not stop. 2: If Set frequency ≤ Brake closing frequency, the VFD reports A-rSF, and it closes the brake and stops. 3: If Set frequency ≤ Brake closing frequency, the VFD reports SFE, and it closes the brake and stops. 4: If Set frequency ≤ P92.31, the VFD reports SFE, and it closes the brake and stops. After the function is enabled, if the brake is	0	◎

Function code	Name	Description	Default	Modify
		opened, detection protection is performed. When the set frequency is equal to or lower than the brake frequency or the value of P92.31, the system decreases the speed to the brake frequency or P92.31, and then performs the action specified by P92.30. It will not be detected when the brake is closed.		
P92.31	Set frequency fault protection frequency point	0.00–10.00Hz	2.00Hz	◎
P92.32	Current unbalance multiple	0.0–5.5 When the value is not zero, current imbalance detection is enabled. When the 3PH current max. value divided by the min. value is greater than this multiple, the Cuu fault is reported.	0.0	◎
P92.33	Enabling overspeed fault detection	Setting range of P92.33: 0–1 Setting range of P92.34: 100.0%–500.0% (of the set frequency) The overspeed protection function can be enabled in open/closed loop vector mode, but in closed loop mode, the actual speed feedback comes from the encoder. When the overspeed protection function is enabled, the overspeed protection threshold of VFD is calculated, which is Set frequency * Overspeed protection percentage. When the VFD runs, if the actual frequency is greater than or equal to the protection threshold, the VFD considers it is in the overspeed state, reports an overspeed fault, and stops running.	0	◎
P92.34	Overspeed fault value		150.0%	◎
P92.35	Enabling stalling fault detection	Setting range of P92.35: 0–1 Setting range of P92.36: 0.0 –250.0% (100.0% corresponding to the motor rated current) Setting range of P92.37: 0.00–10.00s The stalling protection function is valid only in closed-loop vector mode, but in closed loop mode, the actual speed feedback comes from the encoder. When the stalling protection	0	◎
P92.36	Stalling detection current value		200.0%	◎
P92.37	Stalling detection time		3.00s	◎

Function code	Name	Description	Default	Modify
		function is enabled, if the target frequency is greater than 0.50Hz during VFD running, the VFD starts delay timing. When the preset time is reached, if the actual running frequency is still lower than 0.50Hz, and the output current is greater than the stalling protection current value, which lasts 20ms, the VFD considers stalling occurs, and then it reports the fault and stops running. 		
P92.38	Enabling overload	0–2 0: Disable 1: Torque overload, determined by P92.04 and P92.05. 2: Weight overload, determined by P92.39–P92.46.	0	○
P92.39	Weighing calibration	Setting range of P92.39: 0–2 0: Normal mode 1: Peeled autotuning 2: Loaded autotuning This parameter is automatically cleared after autotuning is completed. Setting range of P92.40: 0.0–20.00t Setting range of P92.41: 0.0–20.00t Setting range of P92.42: 0–250.0% (of the motor rated torque) Setting range of P92.43: 0–250.0% (of the	0	◎
P92.40	Peeled loading		0.00t	○
P92.41	Non-empty loading		0.00t	○
P92.42	Peeled torque		0.0%	○
P92.43	Loaded torque		0.0%	○

Function code	Name	Description	Default	Modify
		motor rated torque) For peeled autotuning, when P92.39=1, the LED keypad displays "LoAd1". After pressing "Run", the autotuning starts, and the obtained torque value is automatically saved to P92.42. In addition, the VFD decelerates to stop. When the VFD stops, the LED keypad does not display "LoAd1". For loaded autotuning, when you have entered the weight to P92.41 and set P92.39=2, the LED keypad displays "LoAd2". After pressing "Run", the autotuning starts, and the obtained torque value is automatically saved to P92.43. In addition, the VFD decelerates to stop. When the VFD stops, the LED keypad does not display "LoAd2".  		
P92.44	Mechanism rated load	0.00–20.00t	2.00	◎
P92.45	Mechanism overload pre-alarm point	0–150.0% (of the mechanism rated load)	90.0%	◎
P92.46	Mechanism overload protection point	0–150.0% (of the mechanism rated load) When the weighing function is enabled, if the VFD reaches the constant speed running state, the VFD output torque is obtained in real time, and then the present weight is calculated by using the torque and weight line simulated by weight autotuning. The weight is displayed through P94.37. If the present weight is greater than the protection point, the overweight fault is reported, and the VFD stops. If the present weight is less than the protection point but greater than the pre-alarm point, the overweight alarm is reported, but the VFD still runs.	105.0%	◎

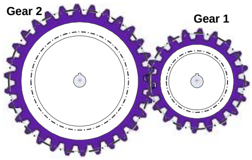
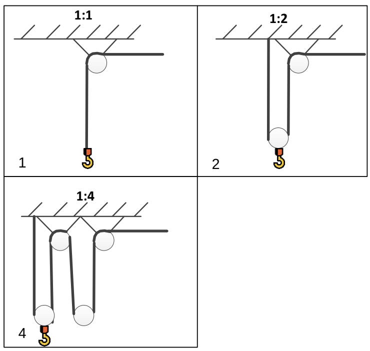
Function code	Name	Description	Default	Modify
		When the weighing function is enabled, the VFD displays the weight in real time during constant speed running; the VFD displays zero during ACC/DEC or stop. 		
P92.47	Power-off detection delay time	0.00–5.00s If this is set to 0, the hundreds place of P92.00 is invalid.	0.50s	○
P92.48	Power-loss recovery delay	0.00–5.00s	0.30s	○
P92.49	Brake detection light-wear alarm pulse threshold	0–20000 During manual brake detection or power-on brake detection, when the detected pulse exceeds P92.49 (non-0) but less than P92.11, A-LbE is reported. When the detected pulse exceeds P92.11, if P92.49 is not 0, A-obE is reported; if P92.49 is 0, bE fault is reported.	0	○

Group P93––Closed-loop hoisting functions

Function code	Name	Description	Default	Modify
P93.00	Brake slip speed deviation	0.05–1.00Hz **Note:** In FVC mode, when the detected feedback frequency is greater than the (brake release frequency P93.00) and lasts for the time specified in P93.01, it will be considered as the fault bE.	0.05Hz	○

Function code	Name	Description	Default	Modify
P93.01	Brake slip fault delay	0.000–5.000s The value 0 indicates brake slip is not detected, while a non-zero value indicates brake slip is detected. If the encoder feedback frequency is close to the brake release frequency, which lasts the time specified by P93.01, the brake failure fault (bE) is reported. For details, see the torque verifying and brake slip descriptions in the brake function commissioning section.	0.500s	○
P93.02	Zero servo protection mode and reset	0x00–0x23 Ones place: Zero servo protection mode selection 0: Disable zero servo 1: Zero servo input slows down 2: Zero servo input is always valid (keep running at zero speed) 3: Lower slowly when the zero speed maintenance time is reached Tens place: Brake failure protection reset method 0: Only for downward running 1: Both for upward and downward running 2: Only for reset commands **Note:** ● At certain faults that cannot be reset, such as VFD internal hardware damaged, zero servo cannot be entered. At the faults that can be reset, with zero servo conditions met, zero servo can be entered. ● Every time zero servo is exited, torque verification is not performed only at the first running command giving, which means the verification is performed at all the following running command giving. ● When P93.02 ones place=2, the motor becomes hot, the fan cannot be mounted at the same shaft as the motor, and it must be independently controlled.	0x00	◎

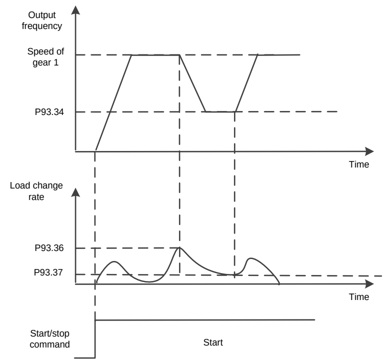
Function code	Name	Description	Default	Modify
P93.03	Slow lowering frequency at zero servo	The zero servo function needs to be used in closed-loop vector control. During stop, the VFD checks whether the pulse value is greater than P93.05. If yes, the VFD reports the holding brake failure alarm A-bS, and the alarm can be configured with relay action output. After reporting A-bS, it selects an action according to the ones place of P93.02 after the delay time specified by P93.06 (if the pulse value during this period is greater than 3 times the value specified by P93.05, this delay time is skipped: 1. If P93.02 ones place=1, the motor runs down slowly at the frequency specified by P93.03, after the time specified by P93.04 elapses, the motor coasts to stop and performs detection again. This process will be repeated. 2. If P93.02 ones place=2, the running is kept at zero speed. 3. If P93.02 ones place=3, the motor keeps zero speed running for a period specified by P93.07, and then it automatically switches to the zero speed slow lowering down mode. Setting range of P93.03: P90.17 (Reverse brake release frequency)–8.00Hz Setting range of P93.04: 0.0–30.0s Setting range of P93.05: 0–60000	4.00Hz	○
P93.04	Slow lowering hold time at zero servo		2.0s	○
P93.05	Zero servo tolerance pulse threshold		20000	○
P93.06	Zero servo action taking delay	0–20.000s	0.500s	○
P93.07	Zero-servo zero-speed hold time	0–60min	10min	◎
P93.08	Height measurement enable	0–2 0: Disable 1: Enable internal measuring (motor encoder) 2: Enable external measuring (HDI)	0	◎
P93.09	Mechanical transmission rate	For internal measurement (motor encoder), the encoder is mounted on the motor shaft, and P93.09 is the reduction ratio between the motor shaft and drum shaft.	10.00	○

Function code	Name	Description	Default	Modify
		For external measurement (HDI), P93.09 is the reduction ratio between the encoder mounting shaft and pulley shaft. If the encoder is mounted on the pulley, set P93.09=1. For example, for gear speed reduction, Mechanical transmission ratio = (Number of teeth in gear 2)/(Number of teeth in gear 1)  Setting range: 0.01–300.00		
P93.10	Suspension ratio	Specifies the suspension ratio (See the following figure.) Setting range: 1–4 1: 1:1 2: 1:2 3: Reserved 4: 1:4  **Note:** The suspension ratio is related to the pulley through which the steel rope goes.	1	◎
P93.11	Wire rope length compensation	Compensates the length of the wire rope between the gravity center of the heavy object and the hook. 0.00–50.00m	0.00m	○
P93.12	Cable diameter	1. To measure heights correctly in closed-loop	10.0mm	○

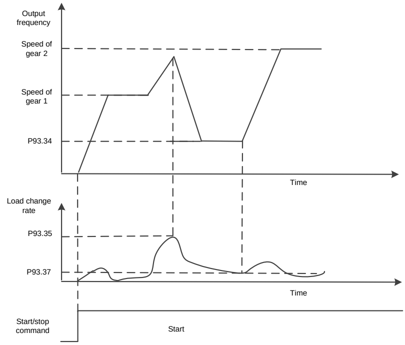
<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td>P93.13</td><td>Number of coils per layer of reel cable</td><td rowspan="3">mode, the actual running distance of the motor is calculated by using the encoder pulse count. Before first running, the upward limit position must be calibrated. Do as follows:
Step 1 Set the upward limit position terminal, for example, P05.05=64. Then the HDI terminal functions as the upward limit position input.
Step 2 If internal measurement (motor encoder) is enabled, set P93.08=1.
Step 3 Start the tower crane to run upward and stop at the upward limit position.
Step 4 Record the values of P93.14 (Initial turns of drum winding) and P93.15 (Initial diameter of drum/pulley diameter).
2. In open/closed loop mode, if external measurement (HDI0) is enabled, set P93.08=2. Start the tower crane to run upward and stop at the upward limit position.
Setting range of P93.12: 0.1–100.0mm
Setting range of P93.13: 1–200
Setting range of P93.14: 0–P93.13 (Per-layer turns of drum winding)
Setting range of P93.15: 100.0–2000.0mm (Max. drum diameter in upward limit, including cable thickness)
Setting range of P94.05: 0.00–655.35m (hook lowering distance)
Setting range of P94.06 and P94.07: 0–65535</td><td>30</td><td>○</td></tr>
<tr><td>P93.14</td><td>Number of initial coils of the reel cable</td><td>0</td><td>○</td></tr>
<tr><td>P93.15</td><td></td><td>600.0mm</td><td>◎</td></tr>
<tr><td>P93.16</td><td>Upper, lower limit reach enable</td><td>0x00–0x11
Ones place:
0: The upward limit position is not reached.
1: The upward limit position is reached.
Tens place:
0: Lower limit not reached
1: The downward limit position is reached.
For example, when the upward/downward limit position needs to be set manually, you can</td><td>0x00</td><td>○</td></tr>
</table>

Function code	Name	Description	Default	Modify
		enable the check of whether the upward/downward limit position is reached. When the hook reaches a certain distance from the top, the upward limit position is reached, P94.05=0 (droop height); when the hook reaches a certain distance from the ground, P93.18=0 (distance from downward limit position); P93.17 displays the distance between the upward and downward limit positions. During normal running between the upward and downward limit positions, P93.18 displays the downward limit position distance, while P94.05 displays the upward limit position distance; if the mechanism runs below the downward limit position, P93.18 displays a negative value.		
P93.17	Total height measured	0.00–655.35m (Total height measured from the upward limit position to the downward limit position)	0.00m	●
P93.18	Measured height 1	-50.00–655.35m The following limit is the reference point. P93.18=0.00m at lower limit.	0.00m	●
P93.19	Load torque autotuning	0: Invalid 1: Autotuning for upward 2: Autotuning for downward	0	◎
P93.20	Loose rope detection and anchor hanging protection	0x000–0x111 Ones place: downward loose rope detection enabling 0: Disable 1: Enable Tens place: Stable lifting selection 0: Disable 1: Enable Hundreds place: Selection of instant stop at load change 0: Disable 1: Enable	0x000	◎
P93.21	Downward loose rope detection method	0–2 0: Set through torque 1: Set through torque autotuning	0	◎

Function code	Name	Description	Default	Modify
		2: Set through external signal detection (AI1)		
P93.22	Upward autotuning load torque	The autotuning procedure is as follows: Step 1 Put the hook on the ground and loosen the rope. Step 2 Set P93.19=1 (or P93.19=2 for downward running). Step 3 Push the operating lever to step-2 speed (higher than 10Hz), which is held at least 1s in the loose rope state after the frequency is stable (to autotune stable frequency torque). Step 4 Stop the device and check the autotuning result. If P93.22 (or P93.23 for downward running) is not 0, autotuning is successful. Otherwise, you have to perform autotuning again. Setting range of P93.22, P93.23: 0.0–50.0%(of the rated torque from the autotuning result)	0.0	○
P93.23	Downward autotuning load torque		0.0	○
P93.24	Downward loose rope external signal setting	0.0–10.0V When the detected AI1 signal is less than P93.24 at downstream, a loose rope has occurred.	0.0V	○
P93.25	Downstream loose rope protection torque setting	0.0–50.0% When the detected load torque is less than (P93.25± P93.29) at downstream, a loose rope has occurred.	5.0%	○
P93.26	Downward loose rope protection starting frequency	10.00Hz–P02.02	15.00Hz	○
P93.27	Downward loose rope detection delay	0.0–5.0s	0.8s	○
P93.28	Downward loose rope detection time window	0.000–20.000s	0.300s	○
P93.29	Downward loose rope detection allowed error	0.0–5.0%	0.5%	○
P93.30	Downward loose rope detection ratio	0.0–100.0%	70.0%	○

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td></td><td>threshold</td><td></td><td></td><td></td></tr>
<tr><td>P93.31–P93.32</td><td>Reserved</td><td>0–65535</td><td>0</td><td>●</td></tr>
<tr><td>P93.33</td><td>Smooth lifting window time</td><td>0.0–20.0s</td><td>2.0s</td><td>○</td></tr>
<tr><td>P93.34</td><td>Smooth lifting protection frequency</td><td rowspan="4">When P93.20 tens place =1, indicating stable lifting protection is enabled to attenuate the shock caused by violent jittering up and down when the load is lifted and by sudden changes in load during high-speed running.
When the running frequency is greater than P93.34, if the detected torque change rate is greater than the smooth lifting torque change rate protection point (specified by P93.35 or P93.36; the boundary frequency between low speed and high speed is P93.38), the smooth lifting function is enabled, and the smooth lifting function set frequency (P93.34) is used. At this time, if the detected torque change rate is less than the smooth lifting torque change rate protection point 3 (specified by P93.37), acceleration to the set frequency is executed.
1. Timing of handling exceptions detected at gear-1 constant speed


2. Timing of handling exceptions detected at gear-2 ACC</td><td>10.00Hz</td><td>○</td></tr>
<tr><td>P93.35</td><td>Smooth lifting torque change rate protection point 1 (in low speed)</td><td>40.0%/s</td><td>○</td></tr>
<tr><td>P93.36</td><td>Smooth lifting torque change rate protection point 2 (in high speed)</td><td>40.0%/s</td><td>○</td></tr>
<tr><td>P93.37</td><td>Smooth lifting torque change rate protection point 3 (exiting smooth lifting)</td><td>10.0%/s</td><td>○</td></tr>
</table>

Function code	Name	Description	Default	Modify
		 Setting range of P93.34: 5.00–50.00Hz Setting range of P93.35: 0.0–150.00%/s Setting range of P93.36: 0.0–150.00%/s Setting range of P93.37: 0.0–150.0%/s **Note:** The smooth lifting function is applicable only to the upward running.		
P93.38	Smooth lifting torque change rate judgment switching frequency	0.00–50.00Hz	10.00Hz	○
P93.39	ACC/DEC delay detection time in smooth lifting	0.0–20.0s	0.8s	○
P93.40	Max. allowed threshold of torque change rate	0.0–50.0	2.0	○
P93.41	Top-hitting prevention	0–3 0: Invalid 1: Upward limit calibration 2: Block by time 3: Valid When P93.41=0, the anti-roofing function is invalid. When P93.41=1, the present count pulse equals to P93.42, and it restores to 3 automatically. When P93.41=2, the top-hitting prevention	0	○

Function code	Name	Description	Default	Modify
		function is invalid within 1 minute; 1 minute later, the function takes effect, and it is automatically reset to 3.		
P93.42	Upward limit position calibrated pulses	0–65535 Unit: 100 times During upward running, when the present count pulse is detected to be less than (P93.42–P93.43), an A-PSP warning is reported.	1000	○
P93.43	Upward limit position offset pulses	0–65535 Unit: 100 times	400	○
P93.44	Upward limit position DEC pulse threshold	0–65535 Unit: 100 times During upward running, when the present count pulse is detected to be less than P93.44, decelerate to P91.35 according to the emergency deceleration time of P01.26.	3000	○

Group P94—Hoisting status display

Function code	Name	Description	Default	Modify
P94.00	Alarm display value	0–22 0: No alarm 1: Input phase loss alarm (A-SPI) 2: Upward position limit alarm (A-LU) 3: Downward position limit alarm (A-Ld) 4: Low voltage protection alarm (A-LvP) 5: Overload protection alarm (A-OL) 6: Brake failure alarm (A-bS) 7: Brake feedback alarm (A-FA) 8: Loose rope protection alarm (A-SL) 9: PT100 overtemperature alarm (A-Ot1) 10: PT1000 overtemperature alarm (A-Ot2) 11: PT100 disconnection alarm (A-Pt1) 12: PT1000 disconnection alarm (A-Pt2) 13: PTC overtemperature alarm (A-Ptc) 14: AI detected overtemperature alarm (A-AOt) 15: Weighing alarm (A-OvL) 16: Alarm of slave brake feedback in	0	●

Function code	Name	Description	Default	Modify
		master/slave control (A-SLO) 17: Alarm of automatic brake detection at power-on (A-bEt) 18: Alarm indicating the set frequency is less than the brake closing frequency after brake release (A-rSF) 19: Brake detection light-wear alarm (A-LbE) 20: Reserved 21: Tower crane lifting top-hitting alarm (A-PSP) 22: Electronic overload (A_OL3)		
P94.01	Detected load torque value	0.0% –150.0% (of the motor rated torque)	0.0%	●
P94.02	Brake detection reminding time	0.0–1000.0h	0.0h	●
P94.03	Actual step of graded multi-step speed	0–6	0	●
P94.04	Zero-point position status	0–2 0: There is input at zero-point position, but the VFD is still in running state. 1: The VFD has stopped, but there is input of zero-point signal, and zero position delay is reached (zero position is valid). 2: In condition of status 1, if a run command is given and the zero position has been left, the run command is effective.	0	●
P94.05	Measured height	0.00–655.35m (hook height) (As the master in master/slave control, it sends this value.)	0.00	●
P94.06	High bits of measured height count value	0–65535	0	●
P94.07	Low bits of measured height count value	0–65535	0	●
P94.08	PT100 calibrated temperature upper	-20.0–150.0°C	0.0°C	●

Function code	Name	Description	Default	Modify
	limit			
P94.09	Lower limit of PT100 calibration temperature	-20.0–150.0°C	0.0°C	●
P94.10	Digital of PT100 calibrated temperature upper limit	0–4096	0	●
P94.11	Digital of PT100 calibrated temperature lower limit	0–4096	0	●
P94.12	PT1000 calibrated temperature upper limit	-20.0–150.0°C	0.0°C	●
P94.13	EC PT1000 detected temperature calibration lower limit	-20.0–150.0°C	0.0°C	●
P94.14	Digital of PT1000 calibrated temperature upper limit	0–4096	0	●
P94.15	Digital of PT1000 calibrated temperature lower limit	0–4096	0	●
P94.16	PT100 present temperature	-50.0–150.0°C	0.0°C	●
P94.17	PT100 present digital	0–4096	0	●
P94.18	PT1000 present temperature	-50.0–150.0°C	0.0°C	●
P94.19	PT1000 present digital	0–4096	0	●
P94.20	AI detected motor temperature	-20.0–200.0°C	0.0°C	●

Function code	Name	Description	Default	Modify
P94.21	Brake slip speed	0.00Hz–10.00Hz	0.00Hz	●
P94.22	Brake slip pulses	0–65535	0	●
P94.23	Light load speed boost status	0–3 0: Normal mode 1: Forward speed boost with light load 2: Reverse speed boost with light load 3: Constant power speed boost	0	●
P94.24	Status of frequency decrease with voltage	0–1 0: Normal 1: In state of frequency decrease with voltage	0	●
P94.25	Average torque of loose rope	0.0% –150.0% (of the motor rated torque)	0.0%	●
P94.26	Load torque change rate in smooth lifting	0.0–100.0%/s	0.0%	●
P94.27	Status of smooth lifting	0–1 0: Normal mode 1: In smooth lifting	0	●
P94.28	Current unbalance multiple	0.0–6553.5	0.0	●
P94.31	Anti-sway mode	0–3	0	●
P94.32	Obtained rope length	0–600.00m	0.00m	●
P94.33	Rope length with compensation	0–600.00m	0.00m	●
P94.34	Pendulum length cycle	0–60000ms	0ms	●
P94.35	Real-time ACC/DEC time	0–60000ms	0ms	●
P94.36	Present ACC speed	-300.00–300.00Hz/ms	0.00 Hz/ms	●
P94.37	Mechanism real-time load	0.00–20.00t	0.00t	●
P94.38	Max. slip per-unit display	0–65535	0	●
P94.39	Present application macro	0–23	0	●

Function code	Name	Description	Default	Modify
P94.40	Present counting pulse low value of top-hitting prevention	0–65535	0	●
P94.41	Present counting pulse high value of top-hitting prevention	0–65535	0	●
P94.42	Top-hitting prevention validity	0–1 0: Invalid 1: Valid	0	●
P94.43	Motor group number before last power-off	0–2 0: Motor group 1 1: Motor group 2 2: Motor group 3	0	●
P94.44	Downward loose rope detection time rate	0.0–100.0%/s	0.0%/s	●

8 Troubleshooting

8.1 What this chapter contains

The chapter tells you how to reset faults and check faults 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.

8.2 Indications of alarms and faults

The fault is indicated by indicators. When the TRIP indicator is on, the alarm or fault code displayed on the keypad indicates the VFD is in abnormal 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.

8.3 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.

8.4 Fault history

The function codes from P07.27 to P07.32 record the types of the last six faults. The function codes P07.33–P07.40, P07.41–P07.48, P07.49–P07.56 record the running data of the VFD at the last three faults.

8.5 Faults and solutions

When a fault occurred, handle the fault as follows:

Step 1 Check whether there is any exception on the keypad. If yes, contact the local INVT office.

Step 2 If no, check function code group P07 for the corresponding fault record parameters to determine the real state when the fault occurred.

Step 3 See the following table for a detailed solution and check for exceptions.

Step 4 Rectify the fault or ask for help.

Step 5 Ensure the fault has been rectified, perform fault reset, and run the product again.

8.5.1 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 is too fast. ● IGBT module is damaged	● Increase ACC time. ● Replace the power unit.

Fault code	Fault type	Possible cause	Solution
OUt2	[2] Inverter unit V-phase protection	● Misoperation caused by interference. ● Drive wires are poorly connected. ● To-ground short circuit occurred.	● Check drive wires. ● Check whether there is strong interference surrounding the peripheral device.
OUt3	[3] Inverter unit W-phase protection		
OC1	[4] Overcurrent during ACC	● ACC/DEC is too fast. ● Grid voltage is too low. ● VFD power is too small. ● Load transient or exception occurred. ● To-ground short circuit or output phase loss occurred. ● There is strong external interference. ● Overcurrent stalling protection disabled.	● Increase ACC/DEC time. ● Check the input power. ● Select the VFD with larger power ● Check whether the load is short circuited (to-ground short circuit or line-to-line short circuit) or the rotation is not smooth. ● Check the output wiring. ● Check if there is strong interference. ● Check the setting of related function codes.
OC2	[5] Overcurrent during DEC		
OC3	[6] Overcurrent during constant speed running		
OV1	[7] Overvoltage during ACC	● Abnormal input voltage. ● Large energy feedback. ● Lack of braking units. ● Dynamic brake is not enabled. ● Deceleration time too short.	● Check the input power. ● Check whether load DEC time is too short or the motor starts during rotating. ● Install dynamic brake components ● Check the setting of related function codes.
OV2	[8] Overvoltage during DEC		
OV3	[9] Overvoltage during constant speed running		
UV	[10] Bus undervoltage	● Grid voltage is too low. ● Overvoltage stall protection disabled.	● Check the grid input power. ● Check the setting of related function codes.
OL1	[11] Motor overload	● Grid voltage is too low. ● Motor rated current is set incorrectly. ● Motor stall or load jumps violently	● Check the grid voltage. ● Set the motor rated current. ● Check the load and adjust torque boost.
OL2	[12] VFD overload	● ACC is too fast. ● The motor is restarted	● Increase ACC time. ● Avoid restart after stop.

Fault code	Fault type	Possible cause	Solution
		during rotating. ● The grid voltage is too low ● Load is too heavy. ● Power is too small.	● Check the grid voltage. ● Select a VFD with larger power. ● Select a proper motor.
SPI	[13] Phase loss on input side	Phase loss or violent fluctuation occurred on inputs R, S, and T.	● Check the input power. ● Check the installation wiring.
SPO	[14] Phase loss on output side	Phase loss occurred to U, V, W output or the three phases of load were seriously asymmetrical.	● Check the output wiring. ● Check the motor and cable.
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. ● Lower the ambient temperature.
OH2	[16] Module overheating		
EF	[17] External fault	SI external fault input terminal acts.	Check external device input.
CE	[18] RS485 communication fault	● Incorrect baud rate ● Communication line fault. ● Incorrect communication address. ● Communication suffers from strong interference.	● Set a proper baud rate. ● Check the communication port cable. ● Set the communication address correctly. ● Replace or change the wiring to enhance the anti-interference capacity.
ItE	[19] Current detection fault	● Poor contact of the connector of control board ● Hall components are broken ● Exception occurred to amplification circuit.	● Check the connector and re-plug ● Replace the hall component. ● Replace the main control board.
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.	● Change the VFD model, or adopt the V/F mode for control. ● Set the motor type and nameplate parameters correctly.

Fault code	Fault type	Possible cause	Solution
		● Incorrect motor parameter setting. ● The parameters gained from autotuning deviate sharply from the standard parameters. ● Autotuning timeout.	● Empty the motor load and re-perform autotuning. ● Check motor wiring and parameter settings. ● Check whether the upper limit frequency is larger than 2/3 of the rated frequency.
EEP	[21] EEPROM operation fault	● Error in reading or writing control parameters ● EEPROM is damaged.	● Press the STOP/ RST key to reset. ● Replace the main control board.
PIDE	[22] PID feedback offline fault	● PID feedback is disconnected. ● PID feedback source disappears.	● Check PID feedback signal wires. ● Check PID feedback source.
bCE	[23] Braking unit/resistor fault	● Fault occurred to the braking circuit or the braking pipe is damaged. ● Resistance of the external braking resistor is small. ● Braking resistor short circuited or PB-to-PE short circuited.	● Check the braking unit, and replace with new braking pipe ● Increase the brake resistance. ● Check the wiring of braking resistors
END	[24] Running time reached	Actual VFD running time longer than internally set running time.	Ask the supplier to adjust the preset running time.
OL3	[25] Electronic overload fault	The VFD reports overload pre-alarm according to the setting.	Check the load and overload pre-alarm threshold.
PCE	[26] Keypad communication fault	● Keypad cable connected improperly or disconnected. ● Keypad cable too long, causing strong interference. ● Keypad or mainboard communication circuit error	● Check the keypad cable to determine whether a fault occurs. ● Check the surroundings to rule out interference source ● Replace the hardware and seek maintenance services.
UPE	[27] Parameter upload	● Keypad cable connected	● Check the surroundings to

Fault code	Fault type	Possible cause	Solution
	error	improperly or disconnected. ● Keypad cable too long, causing strong interference. ● Keypad or mainboard communication circuit error	rule out interference source ● Replace the hardware and seek maintenance services. ● 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. ● Keypad data storage error	● Check the surroundings to rule out interference source ● Replace the hardware and seek maintenance services. ● Re-back up the data on the keypad.
E-DP	[29] PROFIBUS card communication timeout fault	There is no data transmission between the communication card and the host controller (or PLC).	Check whether the communication card wiring is loose or dropped.
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	There is no data transmission between the communication card and the host controller (or PLC).	
ETH1	[32] To-ground short-circuit fault 1	● The output of the VFD is short circuited to the ground. ● Current detection circuit is faulty. ● Actual motor power setup deviates sharply from the VFD power.	● Check whether the motor wiring is normal. ● Replace the hall component. ● Replace the main control board. ● Reset the motor parameters properly.
ETH2	[33] To-ground short-circuit fault 2	● The output of the VFD is short circuited to the ground. ● Current detection circuit is faulty. ● Actual motor power setup deviates sharply from the VFD power.	
dEu	[34] Speed deviation	The load is too heavy or	● Check the load to ensure it

Fault code	Fault type	Possible cause	Solution
	fault	stalled.	is proper, and increase the detection time. ● Check whether the control parameters are set properly.
STo	[35] Mal-adjustment fault	● Control parameters of the synchronous motor are set improperly. ● Autotuned parameters are not accurate. ● The VFD is not connected to the motor.	● Check the load and ensure the load is normal. ● Check whether control parameters are set correctly. ● Increase the maladjustment detection time.
LL	[36] Electronic underload fault	The VFD reports underload pre-alarm according to the setting.	Check the load and underload pre-alarm thresholds.
ENC1O	[37] Encoder disconnection fault	Encoder line sequence is wrong, or signal wires are poorly connected.	Check the encoder wiring
ENC1D	[38] Encoder reserve-rotation fault	The encoder speed signal is contrary to the motor running direction.	Reset encoder direction.
ENC1Z	[39] Encoder Z-pulse disconnection fault	Z signal wires are disconnected.	Check the wiring of Z signal.
STO	[40] Safe torque off	Safe torque off function is enabled by external forces.	/
STL1	[41] Exception occurred to safe circuit of channel 1	● The wiring of STO is improper ● Fault occurred to external switch of STO. ● Hardware fault occurred to safety circuit of channel 1	● Check whether terminal wiring of STO is proper and firm enough. ● Check whether the external switch of STO can work properly ● Replace the control board.
STL2	[42] Exception occurred to safe circuit of channel 2	● The wiring of STO is improper ● Fault occurred to external switch of STO. ● Hardware fault occurred to safety circuit of channel 2	● Check whether terminal wiring of STO is proper and firm enough. ● Check whether the external switch of STO can work properly

Fault code	Fault type	Possible cause	Solution
			● Replace the control board.
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 is faulty.	
E-Err	[55] Duplicate expansion card type	The two inserted expansion cards are of the same type	You should not insert two cards with the same type. Check the type of expansion card, and remove one card after power-off.
ENCUV	[56] Encoder UVW loss fault	No electric level variation occurred to UVW signal	● Check the wiring of UVW ● Encoder is damaged.
E-PN	[57] PROFINET 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 dropped.
SECAN	[58] CAN master/slave card communication timeout fault	There is no data transmission between the CAN master and slave communication cards.	
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.
F1-Er	[60] Failed to identify the expansion card at card slot 1	There is data transmission in interfaces of card slot 1, however, it cannot read the card type.	● Confirm whether the expansion card inserted can be supported. ● Stabilize the expansion card interfaces after power-off, and check whether the fault
F2-Er	[61] Failed to identify the expansion card at	There is data transmission in interfaces of card slot 2,	

Fault code	Fault type	Possible cause	Solution
	card slot 2	however, it cannot read the card type.	persists at next power-on. ● Check whether the insertion port is damaged. If yes, replace the insertion port after power-off.
F3-Er	[62] Failed to identify the expansion card at card slot 3	There is data transmission in interfaces of card slot 3, however, it cannot read the card type.	
C1-Er	[63] Communication timeout of expansion card at card slot 1	There is no data transmission in interface at card slot 1.	
C2-Er	[64] Communication timeout of expansion card at card slot 2	There is no data transmission in interface at card slot 2.	
C3-Er	[65] Communication timeout of expansion card at card slot 3	There is no data transmission in interface at card slot 3.	
E-CAT	[66] EtherCAT card communication timeout fault	There is no data transmission between the communication card and the host controller (or PLC).	Check whether the communication card wiring is loose or dropped.
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	There is no data transmission between the communication card and the host controller (or PLC).	
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 of the VFD.
dIS	[70] VFD disabled	The input terminal selects VFD enabling, but the terminal signal is invalid.	Check the input terminal setting and terminal signal.
tbE	[71] Contactor feedback fault	● The contactor feedback circuit is disconnected or in poor contact. ● The contactor feedback detection time is too short.	● Check the contactor feedback circuit. ● Increase the detection time P91.05 properly.

Fault code	Fault type	Possible cause	Solution
FAE	[72] Brake feedback fault	● The brake feedback circuit is disconnected or in poor contact. ● The brake feedback detection time is too short.	● Check the brake feedback circuit ● Increase the detection time P90.32 properly.
tPF	[73] Torque verification fault	The torque verification current, moment force setting, and torque verification fault detection time are set improperly.	● Set the torque verification current, moment force setting, and torque verification fault detection time P90.30 properly. ● Check whether the motor rated power is set correctly
StC	[74] Operating lever zero-position fault	● The operating lever does not return to the zero position. ● The operating lever zero-position signal is adhered.	● Put the operating lever to the zero position. ● Check out the operating lever zero-position signal.
LSP	[75] Low-speed run protection fault	Running speed too low.	Check whether the running speed is continuously lower than P92.03.
tCE	[76] Terminal command exception	The terminal gives both the upward and downward commands at the same time.	Check the input terminal signal.
POE	[77] Power-on terminal command exception	The terminal command is detected at power-on.	● Check whether P01.18 is set to enable the VFD reports a fault when a terminal command is valid at power-on. ● Check the input terminal signal.
SLE	[78] Loose rope protection fault	● The hook rope is abnormal. ● The downward loose rope parameter setting is improper.	● Check whether the hook rope is normal. ● Check whether the downward loose rope detection torque is proper.
bE	[79] Brake failure	● The brake force is insufficient.	● Check whether the brake is normal.

Fault code	Fault type	Possible cause	Solution
		● The brake detection parameter setting is improper.	● Check whether the brake slip parameter setting is proper.
ELS	[80] Master/slave position synchronization fault	● The encoder pulse difference between the master and slave is too large. ● The pulse threshold setting is improper.	● Check whether the master and slave encoders are abnormal. ● Check whether the salve pulse threshold is set too small.
AdE	[81] Analog speed reference deviation fault	● If the speed is given by analog, the analog voltage is greater than 1.0V after zero-position detection is complete.	Check the analog wiring and current voltage value.
OtE1	[82] PT100 overtemperature fault	● Ambient temperature too high. ● PT100 detection wiring error; ● PT100 overtemperature protection setting is improper.	● Check the present ambient temperature; ● Check the PT100 wiring; ● Check whether the over-temperature fault point of PT100 is set too small.
OtE2	[83] PT1000 overtemperature fault	● Ambient temperature too high. ● PT1000 detection wiring error; ● PT1000 overtemperature protection setting is improper.	● Check the present ambient temperature; ● Check the PT1000 wiring; ● Check whether the over-temperature fault point of PT1000 is set too small.
SFE	[84] Set frequency fault	The set frequency is too small.	● Check whether the frequency reference is less than the set frequency fault protection frequency point.
Cuu	[85] Output current imbalance	3PH output current imbalance.	● Check the load wiring with UVW. ● Check whether the value of P92.32 is too small.
PtcE	[86] PTC overtemperature fault	Ambient temperature too high.	Check the ambient temperature.

Fault code	Fault type	Possible cause	Solution
E-OvL	[87] Overload fault	Load too heavy.	● Check whether load is too heavy. ● Check whether P92.46 (Mechanism overload protection point) is too small.
E-OS	[88] Overspeed fault	Motor overspeed.	Check whether P92.34 is too small.
E-dS	[89] Stalling fault	Motor suffers stalling.	● Check whether the brake can be opened properly. ● Check whether P92.36 is too small.
E-AI1	[92] AI1 disconnection	AI1 is disconnected.	Check AI1 wiring.
E-AI2	[93] AI2 disconnection	AI2 is disconnected.	Check AI2 wiring.
E-AI3	[94] AI3 disconnection	AI3 is disconnected.	Check AI3 wiring.
E-EIP	[95] 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 dropped.
E-PAO	[96] No upgrade bootloader	The burned file does not contain a bootloader.	● Burn the file with a bootloader again. ● You can screen out this fault by setting P14.12. (The absence of a bootloader does not affect the normal running of machine.)
ENC2O	[97] Second channel encoder disconnection	Second channel encoder disconnection	● Check the second channel encoder wiring.
ENCPI	[98] SSI position deviation fault	A position sensor position feedback exception occurred during positioning.	● Check whether the data feedback from the position sensor to P17.60 and P17.61 is normal.
E-PUP	[99] SSI position forward limit position	The position feedback from the position sensor has exceeded the maximum software limit position.	● Check whether the feedback from the position sensor is proper. ● Check whether the maximum software limit position settings P11.63 and P11.64 are proper.

Fault code	Fault type	Possible cause	Solution
E-Pdn	[100] SSI position backward limit position	The position feedback from the position sensor has exceeded the maximum software limit position.	● Check whether the feedback from the position sensor is proper. ● Check whether the maximum software limit position settings P11.61 and P11.62 are proper.
E-SSd	[101] SSI feedback offline fault	The SSI positioning sensor is disconnected or there is strong interference.	● Check the sensor wiring. ● Increase P21.50 Position value feedback filter time to a proper value.
E-SSS	[102] SSI positioning initial fault		● Check the sensor wiring.
E-SSF	[103] SSI positioning timeout fault		● Check the sensor wiring. ● Increase P21.51 SSI positioning timeout period to a proper value.
E-CL	[104] Fault of instant stop at load change	When P93.20 hundreds place=1, the lifting mechanism detects a sudden load change after the load is lifted off the ground.	Check whether there are any exceptions in the upward operation of the lifting mechanism.

8.5.2 Alarms and solutions

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

Alarm code	Alarm type	Possible cause	Solution
A-SPI	[1] Input phase loss alarm	During stop, a loss of either input phase R, S, or T occurs or fluctuation is great.	Check the input power and wiring.
A-LU	[2] Upward position limit alarm	The input terminal has set the upward limited position reaching function, and there is a signal reference to the terminal.	● Check whether the allowed highest position point has been reached. ● Check the input terminal signal.
A-Ld	[3] Downward position limit alarm	The input terminal has set the downward limited position reaching function, and there is	● Check whether the allowed lowest position point has been reached.

Alarm code	Alarm type	Possible cause	Solution
		a signal reference to the terminal.	● Check the input terminal signal.
A-LvP	[4] Low voltage alarm	The bus voltage is too low.	● Check whether the voltage protection point is too high. ● Check whether the grid voltage or rectifier module is abnormal.
A-OL	[5] Overload protection alarm	● Load is too large. ● Overload protection parameters are set improperly.	● Check whether the load is too large. ● Check whether the overload protection point is set too low.
A-bS	[6] Brake failure alarm	● The brake force is insufficient. ● Encoder is abnormal. ● Zero servo detection parameters are set improperly.	● Check whether the brake is normal. ● Check whether the encoder works normally. ● Check whether zero servo tolerance pulse threshold is set too small.
A-FA	[7] Brake feedback alarm	● The brake feedback circuit is disconnected or in poor contact. ● The brake feedback detection time is too short.	● Check the brake feedback circuit ● Increase the detection time P90.32 properly.
A-SL	[8] Loose rope protection alarm	● The hook rope is abnormal. ● The downward loose rope parameter setting is improper.	● Check whether the hook rope is normal. ● Check whether the downward loose rope detection torque is proper.
A-Ot1	[9] PT100 overtemperature alarm	● The ambient temperature is too high. ● PT100 overtemperature pre-alarm setting is improper.	● Check the present ambient temperature; ● Check whether the over-temperature protection point of PT100 is set too small.
A-Ot2	[10] PT1000 overtemperature alarm	● The ambient temperature is too high. ● PT1000 overtemperature pre-alarm setting is improper.	● Check the present ambient temperature; ● Check whether the over-temperature protection point of PT1000 is set too small.

Alarm code	Alarm type	Possible cause	Solution
A-Pt1	[11] PT100 disconnection alarm	PT100 wiring circuit is disconnected.	Check the PT100 wiring circuit.
A-Pt2	[12] PT1000 disconnection alarm	PT1000 wiring circuit is disconnected.	Check the PT1000 wiring circuit.
A-Ptc	[13] PTC overtemperature alarm	The ambient temperature is too high.	Check the ambient temperature.
A-AOt	[14] AI detected over-temperature alarm	● The ambient temperature is too high. ● Abnormal temperature sensor detection line. ● Improper overtemperature protection setting.	● Check the temperature sensor wiring. ● Check whether P92.24 is too small.
A-OvL	[15] Weighing alarm	Motor overloaded.	Check whether P92.04 is to small.
A-SLO	[16] Alarm of slave brake feedback in master/slave control	The brake release of the slave is not synchronous with that of the master.	Check parameter settings.
A-bEt	[17] Reminding in power-on auto brake detection	Automatic brake detection is performed after power-on.	Check the tens place setting of P92.00.
A-rSF	[18] Alarm indicating the set frequency is less than the brake closing frequency after brake release	The set frequency is lower than the brake closing frequency after the brake is released in the situation where brake control is enabled.	Check the setting of P92.30 to check whether the set frequency is lower than the brake closing frequency.
A_LbE	[19] Alarm of brake detection at power-on	● Slight brake wear. ● The brake detection parameter setting is improper.	● Check whether the brake is normal. ● Check whether the brake detection parameter setting is proper.
A_PSP	[21] Upward top-hitting	● Software-calibrated upward limit position is reached. ● Incorrect upward limit position parameter setting.	● Check whether the upward/forward rotation is in the direction of increasing pulse volume (for downward/reverse rotation, check the current pulse values from P93.40 and P93.41). ● Check whether the calibrated position of P93.42 matches

Alarm code	Alarm type	Possible cause	Solution
			the actual position. ● Check whether the offset set in P93.43 is reasonable.
A_OL3	[22] Electronic overload	● Load is too large. ● Overload protection parameters are set improperly.	● Check whether the load is too large. ● Check whether the overload protection point is set too low.

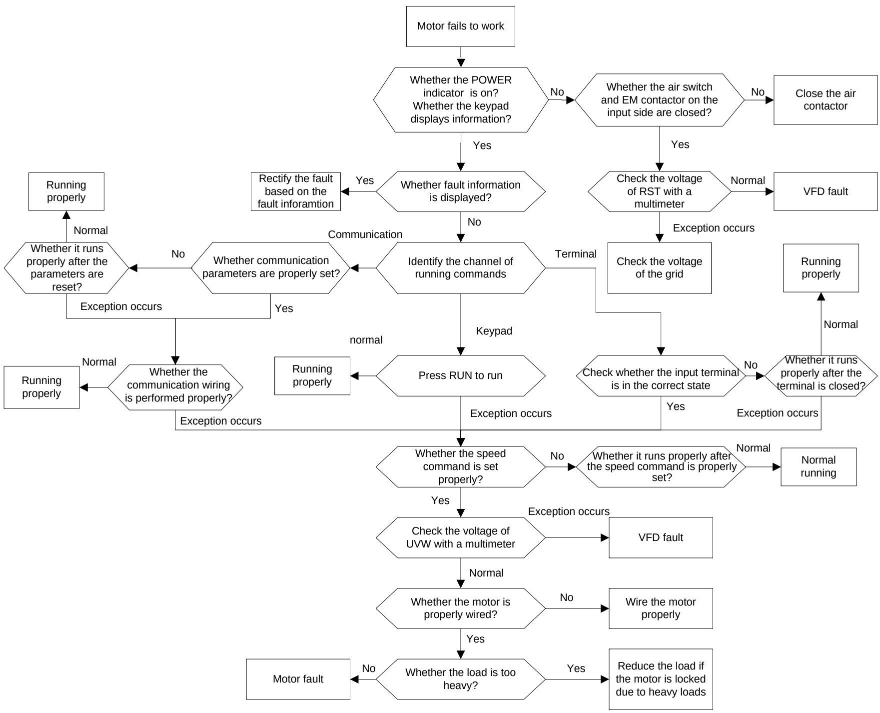
Note: After fault recovery, the corresponding alarm is automatically cleared.

8.5.3 Other status

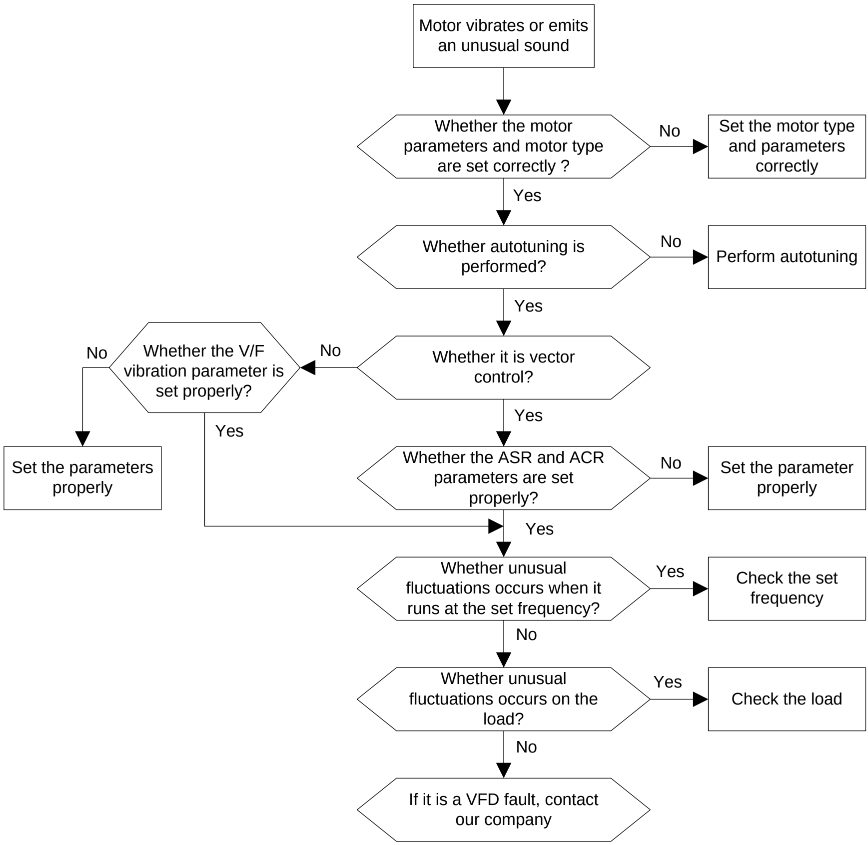
Displayed code	Status type	Possible cause	Solution
PoFF	System power failure	The system is powered off or the bus voltage is too low.	Check the grid environment.

8.6 Analysis on common faults

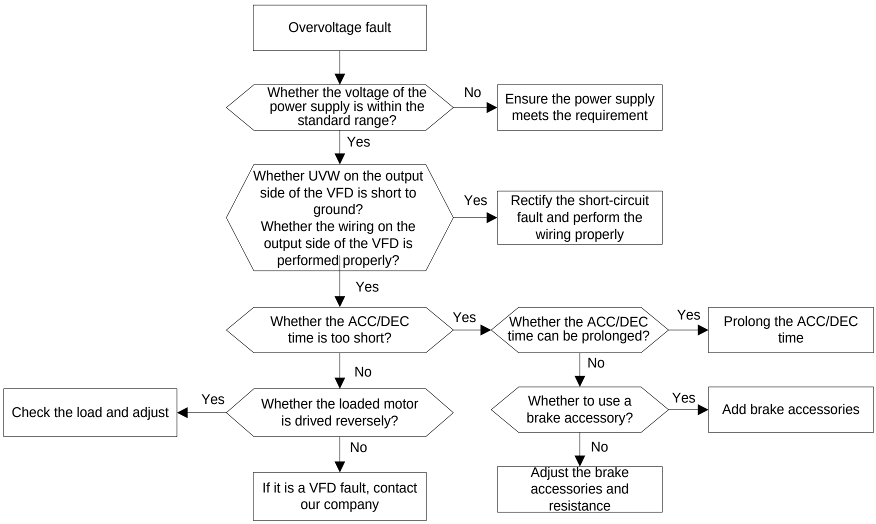
8.6.1 Motor fails to work



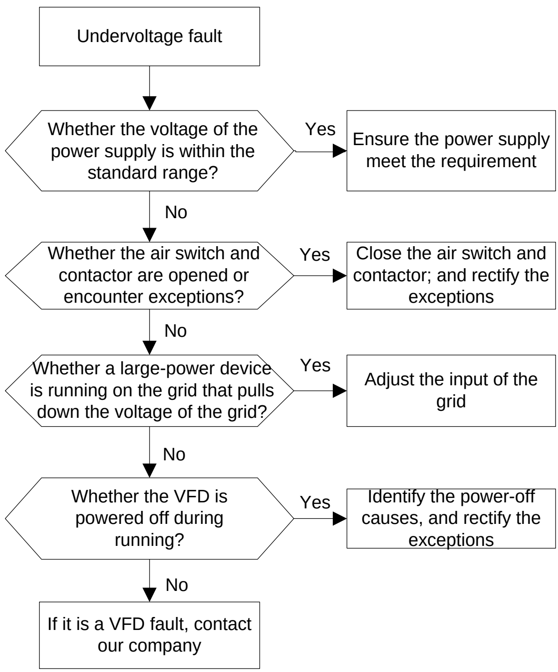
8.6.2 Motor vibrates



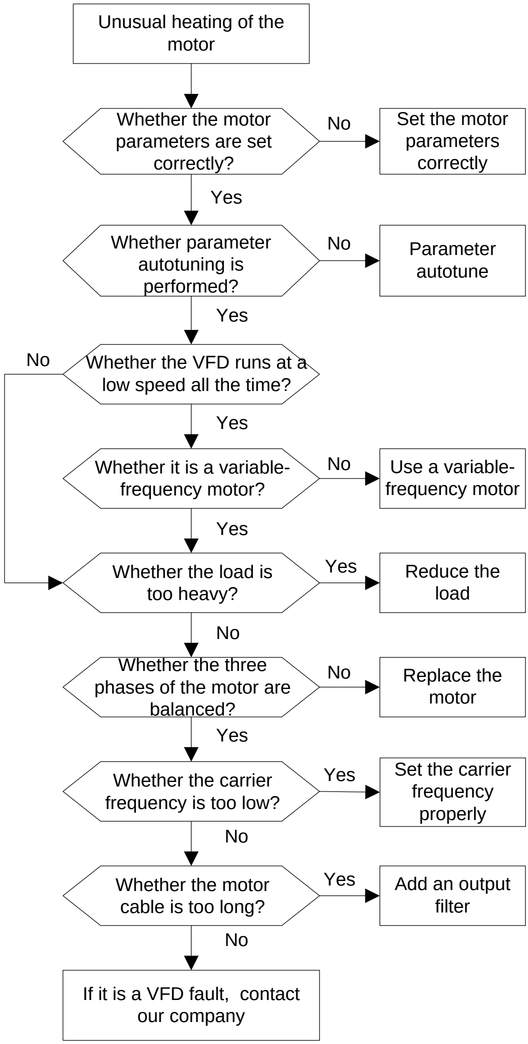
8.6.3 Overvoltage



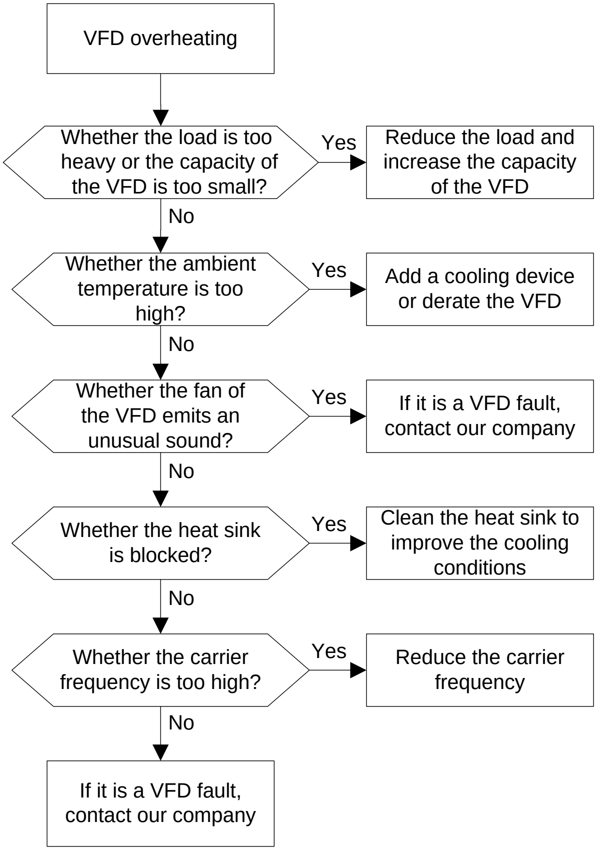
8.6.4 Undervoltage



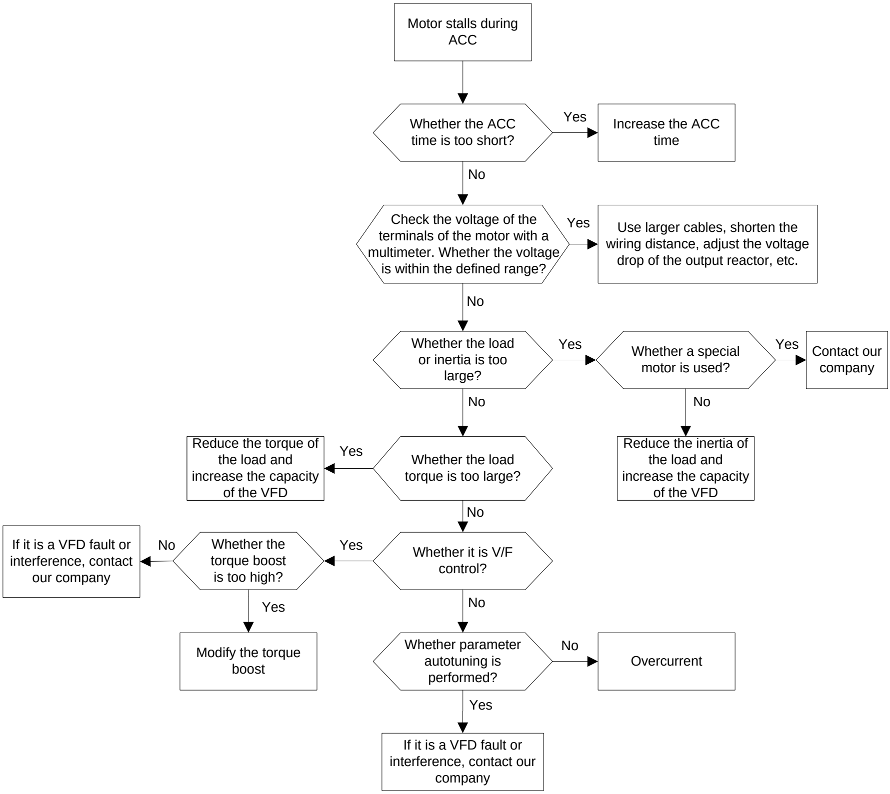
8.6.5 Motor overheating



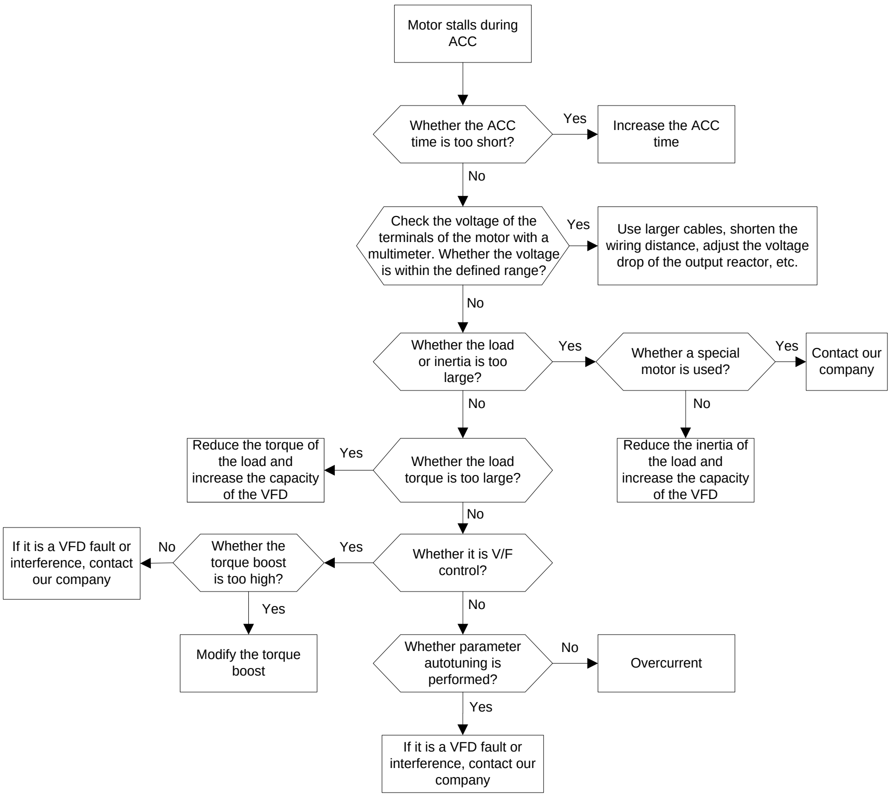
8.6.6 VFD overheating



8.6.7 Motor stalls during ACC



8.6.8 Overcurrent



8.7 Countermeasures on common interference

8.7.1 Interference on meter switches and sensors

Interference phenomenon

Pressure, temperature, displacement, and other signals of a sensor are collected and displayed by a human-machine interaction device. The values are incorrectly displayed as follows after the VFD is started:

1. The upper or lower limit is wrongly displayed, for example, 999 or -999.
2. The display of values jumps (usually occurring on pressure transmitters.
3. The display of values is stable, but there is a large deviation. For example, the temperature is dozens of degrees higher than the common temperature (usually occurring on thermocouples).
4. A signal collected by a sensor is not displayed but functions as a drive system running feedback signal. For example, the VFD is expected to decelerate when the upper pressure limit of the

compressor is reached, but in actual running, it starts to decelerate before the upper pressure limit is reached.

5. After the 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 ground block and PE terminal is lower than 1.5 Ω).
3. Try to add a safety capacitor of 0.1μF to the signal end of the feedback signal terminal of the sensor.
4. Try to add a safety capacitor of 0.1μF 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 0–20mA current signal, add a capacitor of 0.47μF between the AO and GND terminals; if AO uses 0–10V voltage signal, add a capacitor of 0.1μF 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 30 V 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. (See section D.7 EMC filter for details.)

8.7.2 Interference on RS485 communication

The interference described in this section on RS485 communication mainly includes communication delay, out of synchronization, occasional power-off, or complete power-off that occurs after the VFD is started.

If the communication cannot be implemented properly, regardless of whether the VFD is running, the exception is not necessarily caused by interference. You can find out the causes as follows:

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 computer.

If you are sure that communication exceptions are caused by interference, you can resolve the problem through the following measures:

1. Simple inspection.
2. Arrange the communication cables and motor cables in different cable trays.
3. In multi-VFD application scenarios, adopt the chrysanthemum connection mode to connect the communication cables between VFDs, which can improve the anti-interference capability.
4. In multi-VFD application scenarios, check and ensure that the driving capacity of the master is sufficient.
5. In the connection of multiple VFDs, you need to configure one 120 Ω terminal resistor on each end.

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 ground block and PE terminal is lower than 1.5 Ω).
2. Do not connect the VFD and motor to the same ground terminal as the upper computer (PLC, HMI, and touch screen). It is recommended that you connect the VFD and motor to the power ground, and connect the upper computer separately to a ground stud.
3. Try to short the signal reference ground terminal (GND) of the VFD with that of the upper computer 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 upper computer.
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 upper computer (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 upper computer through the magnet ring in the same direction and wind 8 coils around the magnet ring.

8.7.3 Failure to stop and indicator shimmering due to motor cable coupling

Interference phenomenon

1. Failure to stop

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 to stop the inverter.

2. Indicator shimmering

After the VFD is started, the relay indicator, power distribution box indicator, PLC indicator, and indication buzzer shimmer, blink, or emit unusual sounds unexpectedly.

Solution

1. Check and ensure that the exception signal cable is arranged 20 cm or farther away from the motor cable.
2. Add a safety capacitor of 0.1μF between the digital input terminal (S) and the COM terminal.
3. Connect the digital input terminal (S) that controls the start and stop to other idle digital input terminals in parallel. For example, if S1 is used to control the start and stop and S4 is idle, you can try to short connect S1 to S4 in parallel.

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

8.7.4 Leakage current and interference on 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) Inverter systems are special. In these systems, it is required that the rated residual current of common RCDs at all levels is larger than 200 mA, and the 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 20ms. For example, 1s, 0.5s, and 0.2s.

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" on 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 the 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 lines are used as neutral wires by these devices.

6) Do not use shielded cables as VFD power cables and motor cables.

8.7.5 Live device chassis

After the VFD is started, there is sensible voltage on the chassis, and you may feel an electric shock when touching the chassis. The chassis, however, is not live (or the voltage is far lower than the human safety voltage) when the VFD is powered on but not running.

Solution

1. If there is power distribution ground or ground stud on the site, ground the cabinet chassis of the VFD through the power ground or stud.

2. If there is no grounding on the site, you need to connect the motor chassis to the ground terminal PE of the VFD, and ensure that the jumper at "EMC/J10" on the middle casing of the VFD is shorted.

9 Maintenance

9.1 What this chapter contains

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

9.2 Periodical maintenance

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. The following table describes the routine maintenance periods recommended by INVT.

<table>
<tr><th colspan="2">Check scope</th><th>Check item</th><th>Method</th><th>Expected result</th></tr>
<tr><td colspan="2" rowspan="2">Ambient environment</td><td>Check the temperature, and humidity, and whether there is vibration, dust, gas, oil spray, and water droplets in the environment.</td><td>Visual inspection, and use instruments for measurement.</td><td>The requirements stated in this manual are met.</td></tr>
<tr><td>Check whether there are foreign matters, such as tools, or dangerous substances placed nearby.</td><td>Visual inspection</td><td>There are no tools or dangerous substances placed nearby.</td></tr>
<tr><td colspan="2">Voltage</td><td>Check the voltage of the main circuit and control circuit.</td><td>Use multimeters or other instruments for measurement.</td><td>The requirements stated in this manual are met.</td></tr>
<tr><td colspan="2" rowspan="2">Keypad</td><td>Check the display of information.</td><td>Visual inspection</td><td>The characters are displayed properly.</td></tr>
<tr><td>Check whether characters are not completely displayed.</td><td>Visual inspection</td><td>The requirements stated in this manual are met.</td></tr>
<tr><td rowspan="3">Main circuit</td><td rowspan="3">Common</td><td>Check whether the bolts loose or come off.</td><td>Screw them up.</td><td>No exception occurs.</td></tr>
<tr><td>Check whether the machine is deformed, cracked, or damaged, or their color changes due to overheating and aging.</td><td>Visual inspection</td><td>No exception occurs.</td></tr>
<tr><td>Check whether there are stains and dust attached.</td><td>Visual inspection</td><td>No exception occurs.
Note: Discoloration of copper bars does not mean that they cannot work</td></tr>
</table>

Check scope		Check item	Method	Expected result
				properly.
	Conductor and wire	Check whether conductors are deformed or color change for overheat.	Visual inspection	No exception occurs.
		Check whether the wire sheaths are cracked or their color changes.	Visual inspection	No exception occurs.
	Terminal block	Check whether there is damage.	Visual inspection	No exception occurs.
	Filter capacitor	Check whether there is electrolyte leakage, discoloration, cracks, and chassis expansion.	Visual inspection	No exception occurs.
		Check whether the safety valves are released.	Determine the service life based on the maintenance information, or measure them through electrostatic capacity.	No exception occurs.
		Check whether the electrostatic capacity is measured as required.	Use instruments to measure the capacity.	Electrostatic capacity ≥ initial value x 0.85
	Resistor	Check whether there is displacement caused due to overheat.	Olfactory and visual inspection	No exception occurs.
		Check whether the resistors are disconnected.	Visual inspection, or remove one end of the connection cable and use a multimeter for measurement.	Resistance range: ±10% (of the standard resistance)
	Transformer, Reactor	Check whether there is unusual vibration sounds or smells.	Auditory, olfactory, and visual inspection	No exception occurs.
	Electromagnetic contactor and Relay	Check whether there are vibration sounds in the workshop.	Auditory inspection	No exception occurs.
		Check whether the contacts are in good contact.	Visual inspection	No exception occurs.

Check scope		Check item	Method	Expected result
Control circuit	Control PCB and connector	Check whether the screws and connectors loose.	Screw them up.	No exception occurs.
		Check whether there is unusual smell or discoloration.	Olfactory and visual inspection	No exception occurs.
		Check whether there are cracks, damage, deformation, or rust.	Visual inspection	No exception occurs.
		Check whether there is electrolyte leakage or deformation.	Visual inspection, and determine the service life based on the maintenance information.	No exception occurs.
Cooling system	Cooling fan	Check whether there are unusual sounds or vibration.	Auditory and visual inspection, and turn the fan blades with your hand.	The rotation is smooth.
		Check whether the bolts loose.	Screw them up.	No exception occurs.
		Check whether there is decoloration 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. Check whether there are foreign objects attached.	Visual inspection	No exception occurs.

For more details about maintenance, contact the local INVT office, or visit our website www.invt.com, and choose **Support** > **Services**.

9.3 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.

Step 1 Stop the VFD, disconnect the AC power supply, and wait for a time no shorter than the waiting time designated on the VFD.

Step 2 Open the cable clamp to loose the fan cable (for the 380V 1.5–30 kW VFD models, the middle casing needs to be removed).

Step 3 Disconnect the fan cable.

Step 4 Remove the fan with a screwdriver.

Step 5 Install a new fan in the VFD in the reverse steps. Assemble the VFD. Ensure that the air direction of the fan is consistent with that of the VFD, as shown in Figure 9-1.

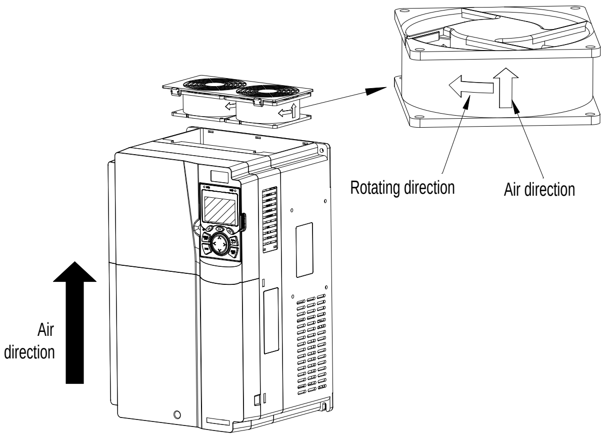


Figure 9-1 Fan maintenance for the 7.5kW and higher VFD models

Step 6 Connect to the power supply.

9.4 Capacitor

9.4.1 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 VFD is delivered.

Storage time	Operation principle
Less than 1 year	No charging operation is required.
1 to 2 years	The VFD needs to be powered on for 1 hour before the first running command.
2 to 3 years	Use a voltage controlled power supply to charge the VFD:

Storage time	Operation principle
	● Charge the VFD at 25% of the rated voltage for 30 minutes, ● and then charge it at 50% of the rated voltage for 30 minutes, ● at 75% for another 30 minutes, ● 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 VAC, you can use a 1PH 220VAC/2A voltage regulator. Both 1PH and 3PH VFDs can be charged with a 1PH voltage controlled power supply (connect L+ to R, and N to S or T). All the DC bus capacitors share one rectifier, and therefore they are all charged.

For VFDs of a high voltage class, ensure that the voltage requirement (for example, 380 V) is met during charging. Capacitor changing 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 drive 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 380V drive device, use a resistor of 1 kΩ/100W. If the voltage of the power supply is no higher than 380 V, you can also use an incandescent lamp of 100W. If an incandescent lamp is used, it may go off or the light may become very weak.

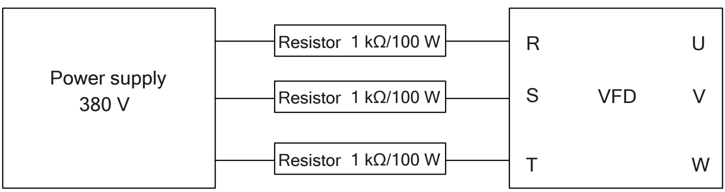


Figure 9-2 380V drive device charging circuit example

9.4.2 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.

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.

9.5 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. Connect to the power.

10 Communication protocol

10.1 What this chapter contains

This chapter describes the communication of the VFD.

The VFD provides RS485 communication interfaces and adopts the 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.

10.2 Modbus protocol introduction

Modbus is a communication protocol for use with electronic controllers. By using this protocol, a controller can communicate with other devices through transmission lines. It is a general industrial standard. With this standard, control devices produced by different manufacturers can be connected to form an industrial network and be monitored in a centralized way.

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, end 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 broadcasted information, slaves do not need to return responses.

10.3 Application of Modbus

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

10.3.1 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. An RS485 interface uses a twisted pair, where one wire is defined as A (+), and the other B (-). Generally, if the positive electrical level between the transmission drives A and B ranges from +2V to +6V, the logic is "1"; and if it ranges from -2V to -6V, 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 is bit/s (bps). A higher baud rate indicates faster transmission and poorer anti-interference capability. When a twisted pair of 0.56mm (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
2400bps	1800m	9600bps	800m

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

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 terminal load resistors. The performance, however, degrades as the distance increases. Therefore, it is recommended that you use a 120Ω terminal resistor when the transmission distance is long.

10.3.1.1 Application to one VFD

Figure 10-1 is the Modbus wiring diagram of one VFD and a PC. Generally, PCs do not provide RS485 interfaces, so you need to convert an RS232 or USB interface of a PC to an RS485 interface through an adapter. Connect end A of the RS485 interface 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 upper computer, and set the basic parameters such as baud rate and data bit check consistent with those of the VFD.

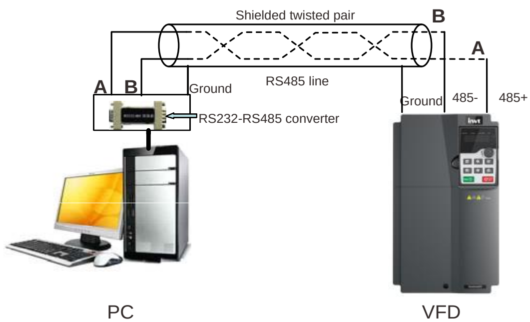


Figure 10-1 RS485 wiring of one VFD

10.3.1.2 Application to multiple VFDs

In practical application to multiple VFDs, chrysanthemum 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 chrysanthemum mode with one 120 Ω terminal resistor on each end, as shown in Figure 10-2. Figure 10-3 shows the simplified wiring diagram. Figure 10-4 shows the actual application.

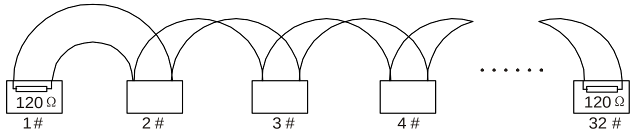


Figure 10-2 Onsite chrysanthemum connection

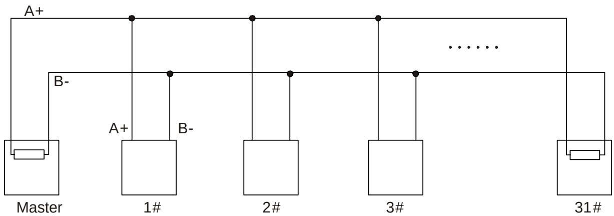


Figure 10-3 Simplified chrysanthemum connection

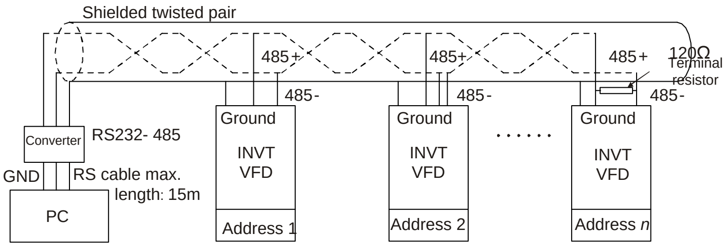


Figure 10-4 Practical chrysanthemum connection application

Figure 10-5 shows the start connection diagram. When this connection mode is adopted, each of the two devices that are farthest away from each other on the line must be configured with a terminal resistor (in this figure, the two devices are devices 1# and 15#).

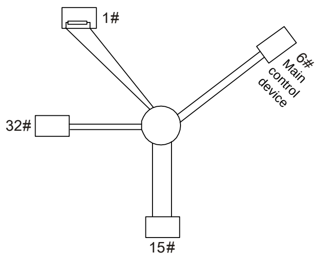


Figure 10-5 Star connection

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.

10.3.2 RTU mode

10.3.2.1 RTU communication frame structure

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

Code 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 check performed), 2 bits (without check)

Error detection domain

• Cyclic redundancy check (CRC)

The following table describes the data format.

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

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

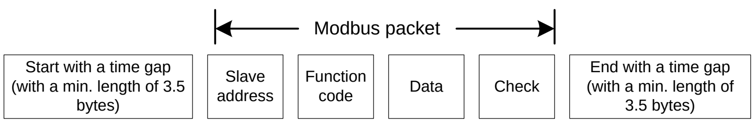
10-bit character frame (bits 1 to 7 are data bits):

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

In a character frame, only the data bits carry information. The start bit, check bit, and end bit are used to facilitate the transmission of the data bits to the destination device. In practical applications, you must set the data bits, parity check bits, and stop bits consistently.

In RTU mode, a new frame always must be preceded by a time gap with a minimum length of 3.5 bytes. On a network where the transmission rate is calculated based on the baud rate, the transmission time of 3.5 bytes can be easily obtained. After the idle time ends, the data domains are transmitted in the following sequence: slave address, operation command code, data, and CRC check character. Each byte sent in each domain includes 2 hexadecimal characters (0–9, A–F). The network devices always monitor the communication bus. After receiving the first domain (address information), each network device identifies the byte. After the last byte is sent, a similar transmission interval (with a minimum transmission time of 3.5 bytes) is used to indicate that the frame transmission ends. Then, the transmission of a new frame starts.

RTU data frame format



The information of a frame must be transmitted in a continuous data flow. If there is an interval greater than the transmission time of 1.5 bytes before the transmission of the entire frame is complete, the receiving device deletes the incomplete information, and mistakes the subsequent byte for the address domain of a new frame. Similarly, if the transmission interval between two frames is shorter than the transmission time of 3.5 bytes, the receiving device mistakes it for the data of the last frame. The CRC check value is incorrect due to the disorder of the frames, and thus a communication fault occurs.

The following table describes the standard structure of an RTU frame.

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

10.3.2.2 RTU communication frame error check modes

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

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

The following 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.

10.4 RTU command codes and communication data

10.4.1 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, to read two contiguous data content pieces from 0004H from the VFD with the address of 01H (that is, to read content from data addresses 0004H and 0005H), the frame structure is as follows:

RTU master command (from the master to the VFD)

START	T1-T2-T3-T4 (transmission time of 3.5 bytes)
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 (transmission time of 3.5 bytes)

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

ADDR=01H means the command message is sent to the VFD with the address of 01H and ADDR occupies one byte.

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

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

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

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

RTU slave response (from the VFD to the master)

START	T1-T2-T3-T4 (transmission time of 3.5 bytes)
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 (transmission time of 3.5 bytes)

The definition of the response information is described as follows:

"ADDR" is "01H", indicating that the message is sent by the VFD whose address is 01H. The ADDR information occupies one byte.

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

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

A piece of data contains two bytes, with the MSB on the left and LSB on the right. From the response, the data in 0004H is 1388H, and that in 0005H is 0000H.

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

10.4.2 Command code 06H, writing a word

This command is used by the master to write data to the VFD. One command can be used to write only one piece of data. It is used to modify the parameters and running mode of the VFD.

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

RTU master command (from the master to the VFD)

START	T1-T2-T3-T4 (transmission time of 3.5 bytes)
ADDR	02H
CMD	06H
MSB of data writing address	00H
LSB of data writing address	04H
MSB of data content	13H
LSB of data content	88H
CRC LSB	C5H
CRC MSB	6EH
END	T1-T2-T3-T4 (transmission time of 3.5 bytes)

RTU slave response (from the VFD to the master)

START	T1-T2-T3-T4 (transmission time of 3.5 bytes)
ADDR	02H
CMD	06H
MSB of data writing address	00H
LSB of data writing address	04H
MSB of data content	13H
LSB of data content	88H
CRC LSB	C5H
CRC MSB	6EH
END	T1-T2-T3-T4 (transmission time of 3.5 bytes)

Note: The sections 10.4.1 and 10.4.2 mainly describe the command formats. For the detailed application, see the examples in section 10.4.7.

10.4.3 Command code 10H, continuous writing

The command code 10H is used by the master to write data to the VFD. The quantity of data to be written is determined by "Data quantity", and a maximum of 16 pieces of data can be written.

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 (transmission time of 3.5 bytes)
ADDR	02H
CMD	10H
MSB of data writing address	00H

LSB of data writing address	04H
Data count MSB	00H
Data count LSB	02H
Number of bytes	04H
MSB of data to be written to 0004H	13H
LSB of data to be written to 0004H	88H
MSB of data to be written to 0005H	00H
LSB of data to be written to 0005H	32H
CRC LSB	C5H
CRC MSB	6EH
END	T1-T2-T3-T4 (transmission time of 3.5 bytes)

RTU slave response (from the VFD to the master)

START	T1-T2-T3-T4 (transmission time of 3.5 bytes)
ADDR	02H
CMD	10H
MSB of data writing address	00H
LSB of data writing address	04H
Data count MSB	00H
Data count LSB	02H
CRC LSB	C5H
CRC MSB	6EH
END	T1-T2-T3-T4 (transmission time of 3.5 bytes)

10.4.4 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.

10.4.4.1 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 high-order byte ranges from 00 to ffH, and the low-order byte 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 05. 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	0–2	0	○

Function code	Name	Description	Setting range	Default	Modify
		value after running once 2: Cyclic running			
P10.01	Simple PLC memory selection	0: Do not memorize at power outage 1: Memorize at power outage	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.

10.4.4.2 Addresses of other Modbus functions

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

Function	Address	Data description	R/W
Communication-based control command	2000H	0001H: Run forward	R/W
		0002H: Run reversely	
		0003H: Jog forward	
		0004H: Jog reversely	
		0005H: Stop	
		0006H: Coast to stop (in emergency)	
		0007H: Fault reset	
		0008H: Jogging stop	
Communication-based setting address	2001H	Communication-based frequency setting (0–Fmax, unit: 0.01Hz)	R/W
	2002H	PID reference (0–1000, in which 1000 corresponds to 100.0%)	
	2003H	PID feedback (0–1000, in which 1000 corresponds to 100.0%)	R/W
	2004H	Torque setting (-3000–3000, in which 1000 corresponds to 100.0% of the motor rated current)	R/W
	2005H	Upper limit setting of forward running frequency (0–Fmax; unit:	R/W

Function	Address	Data description	R/W
		0.01Hz)	
	2006H	Upper limit setting of reverse running frequency (0–Fmax; unit: 0.01Hz)	R/W
	2007H	Electromotive torque upper limit (0–3000, in which 1000 corresponds to 100.0% of the motor rated current)	R/W
	2008H	Braking torque upper limit (0–3000, in which 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 (0x000–0x3FF) Corresponding to S8/S7/S6/S5/HDIB/HDIA/S4/ S3/ S2/S1	R/W
	200BH	Virtual output terminal command (range: 0x00–0x0F) Corresponding to local RO2/RO1/HDO/Y1	R/W
	200CH	Voltage setting (special for V/F separation). Range: 0–1000, 1000 corresponding to 100.0% of the motor rated voltage.	R/W
	200DH	AO setting 1 (-1000–+1000, in which 1000 corresponding to 100.0%)	R/W
	200EH	AO setting 2 (-1000–+1000, in which 1000 corresponds to 100.0%)	R/W
VFD status word 1	2100H	0001H: Forward running	R
		0002H: Reverse running	
		0003H: Stopped	
		0004H: Faulty	
		0005H: POFF	
		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 pre-alarm upon overload =1: overload pre-alarm Bit6–bit5=00: Keypad-based control =01: Terminal-based control =10: Communication-based control Bit7: Reserved Bit8=0: Speed control =1: Torque control Bit9=0: Non position control	R

<table>
<tr><th>Function</th><th>Address</th><th colspan="2">Data description</th><th>R/W</th></tr>
<tr><td></td><td></td><td colspan="2">=1: Position control
Bit11–bit10: =0: Vector 0 =1: Vector 1
=10: Closed-loop vector = 11: Space voltage vector</td><td></td></tr>
<tr><td>VFD fault code</td><td>2102H</td><td colspan="2">See the description of fault types.</td><td>R</td></tr>
<tr><td>VFD identification code</td><td>2103H</td><td colspan="2">GD350-----0x01a0</td><td>R</td></tr>
<tr><td>Running frequency</td><td>3000H</td><td>0–Fmax (Unit: 0.01Hz)</td><td rowspan="18">Compatible with CHF100A and CHV100 communication addresses</td><td>R</td></tr>
<tr><td>Set frequency</td><td>3001H</td><td>0–Fmax (Unit: 0.01Hz)</td><td>R</td></tr>
<tr><td>Bus voltage</td><td>3002H</td><td>0.0–2000.0V (Unit: 0.1V)</td><td>R</td></tr>
<tr><td>Output voltage</td><td>3003H</td><td>0–1200V (Unit: 1V)</td><td>R</td></tr>
<tr><td>Output current</td><td>3004H</td><td>0.0–3000.0A (Unit: 0.1A)</td><td>R</td></tr>
<tr><td>Rotational speed</td><td>3005H</td><td>0–65535 (Unit: 1RPM)</td><td>R</td></tr>
<tr><td>Output power</td><td>3006H</td><td>-300.0–300.0% (Unit: 0.1%)</td><td>R</td></tr>
<tr><td>Output torque</td><td>3007H</td><td>-250.0–250.0% (Unit: 0.1%)</td><td>R</td></tr>
<tr><td>Closed-loop setting</td><td>3008H</td><td>-100.0–100.0% (Unit: 0.1%)</td><td>R</td></tr>
<tr><td>Closed-loop feedback</td><td>3009H</td><td>-100.0–100.0% (Unit: 0.1%)</td><td>R</td></tr>
<tr><td>Input I/O status</td><td>300AH</td><td>0x0000–0xFFFF<table><tr><td>Bit11</td><td>Bit10</td><td>Bit9</td><td>Bit8</td><td>Bit7</td><td>Bit6</td></tr><tr><td>S8</td><td>S7</td><td>S6</td><td>S5</td><td>/</td><td>/</td></tr><tr><td>Bit5</td><td>Bit4</td><td>Bit3</td><td>Bit2</td><td>Bit1</td><td>Bit0</td></tr><tr><td>HDIB</td><td>HDIA</td><td>S4</td><td>S3</td><td>S2</td><td>S1</td></tr></table></td><td>R</td></tr>
<tr><td>Output I/O status</td><td>300BH</td><td>0x0000–0x1FFF<table><tr><td>Bit13</td><td>Bit12</td><td>Bit11</td><td>Bit10</td><td>Bit9</td><td>Bit8</td><td>Bit7</td></tr><tr><td>/</td><td>RO4</td><td>RO3</td><td>/</td><td>/</td><td>Y2</td><td>/</td></tr><tr><td>Bit6</td><td>Bit5</td><td>Bit4</td><td>Bit3</td><td>Bit2</td><td>Bit1</td><td>Bit0</td></tr><tr><td>/</td><td>/</td><td>/</td><td>RO2</td><td>RO1</td><td>HDO</td><td>Y1</td></tr></table></td><td>R</td></tr>
<tr><td>Analog input 1</td><td>300CH</td><td>0.00–10.00V (Unit: 0.01V)</td><td>R</td></tr>
<tr><td>Analog input 2</td><td>300DH</td><td>0.00–10.00V (Unit: 0.01V)</td><td>R</td></tr>
<tr><td>Analog input 3</td><td>300EH</td><td>-10.00–10.00V (Unit: 0.01V)</td><td>R</td></tr>
<tr><td>Analog input 4</td><td>300FH</td><td>/</td><td>R</td></tr>
<tr><td>Read input of HDIA high-speed pulse</td><td>3010H</td><td>0.00–50.00kHz (Unit: 0.01Hz)</td><td>R</td></tr>
<tr><td>Read input of HDIB high-speed pulse</td><td>3011H</td><td>/</td><td>R</td></tr>
</table>

Function	Address	Data description		R/W
Read the actual step of multi-step speed	3012H	0–15		R
External length value	3013H	0–65535		R
External counting value	3014H	0–65535		R
Torque setting	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).

8 MSBs	Meaning	8 LSBs	Meaning
0x01	Goodrive	0xa0	Goodrive350 vector VFD

10.4.5 Fieldbus scale

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

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

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

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

If "Setting range" or "Default value" contains one decimal, the fieldbus scale is 10. If the value received by the upper computer is 50, "Delay of auto fault reset" of the rectifier is 5.0 (5.0=50/10).

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

01	06	01 14	00 32	49 E7
VFD 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 5.0s.

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

01	03	02	00 32	39 91
VFD 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 5.0s.

10.4.6 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 by the upper computer is not allowed to be executed. The possible causes are as follows: The function code is applicable only on new devices and is not implemented on this device. The slave is in the faulty state when processing this request.
02H	Invalid data Address	For the VFD, the data address in the request of the upper computer is not allowed. In particular, the combination of the register address and the number of the to-be-sent bytes is invalid.

Code	Name	Meaning
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 in the write operation. For example, a function input terminal cannot be set repeatedly.
05H	Incorrect password	The password entered in the password verification address is different from that set in P07.00.
06H	Incorrect data frame	The data frame sent from the host controller is incorrect in the length, or in the RTU format, the value of the CRC check bit is inconsistent with the CRC value calculated by the lower computer.
07H	Parameter read-only	The parameter to be modified in the write operation of the host controller is a read-only parameter.
08H	Parameter cannot be modified in running	The parameter to be modified in the write operation of the host controller cannot be modified during the running of the VFD.
09H	Password protection	If the host controller does not provide the correct password to unlock the system to perform a read or write operation, the error of “system being locked” is reported.

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

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

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

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

1 0 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 send 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 0000H) to 03 for the VFD whose address is 01H, the command is as follows:

01	**06**	**00 01**	**00 03**	**98 0B**
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:

01	86	04	43 A3
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".

10.4.7 Read/Write operation examples

For the formats of the read and write commands, see section 10.4.1 Command code 03H, reading N words (continuously up to 16 words) and section 10.4.2 Command code 06H, writing a word.

10.4.7.1 Example of reading command 03H

Example 1: Read SW 1 of the VFD whose address is 01H. According to the table of other Modbus function addresses, the parameter address of state word 1 of the VFD is 2100H.

The read command transmitted to the VFD is as follows:

01	03	21 00	00 01	8E 36
VFD address	Read command	Parameter address	Data quantity	CRC

Assume that the following response is returned:

01	03	02	00 03	F8 45
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 "Present 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:

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

Assume that the following response is returned:

03	03	0C	00 23	00 23	00 23	00 23	00 23	00 23	5F D2
VFD address	Read command	Number of bytes	Type of current fault	Type of last fault	Type of last but one fault	Type of last but two fault	Type of last but three fault	Type of last but four fault	CRC

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

10.4.7.2 Example of writing command 06H

Example 1: Set the VFD whose address is 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. See the following figure.

Function description	Address definition	Data description	R/W
Communication-based control command	2000H	0001H: Run forward	R/W
		0002H: Run reversely	
		0003H: Jog forward	
		0004H: Jog reversely	
		0005H: Stop	
		0006H: Coast to stop (in emergency)	
		0007H: Fault reset	
		0008H: Jogging stop	

The command transmitted from the master is as follows:

03	06	20 00	00 01	42 28
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:

03	06	20 00	00 01	42 28
VFD address	Write command	Parameter address	Forward running	CRC

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

Function code	Name	Description	Setting range	Default	Modify
P00.03	Max. output frequency	P00.04–600.00H (400.00Hz)	100.00–600.00	50.00Hz	◎

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

The command transmitted from the master is as follows:

03	06	00 03	27 10	62 14
VFD address	Write command	Parameter address	Parameter data	CRC

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

03	06	00 03	27 10	62 14
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.

10.4.7.3 Example of continuously writing command 10H

Example 1: Set the VFD whose address is 01H to be forward running at the frequency of 10Hz. 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 value setting" is 2001H, as shown in the following figure. 10 Hz is 03E8H in the hexadecimal form.

Function description	Address definition	Data description	R/W
Communication-based control command	2000H	0001H: Run forward	R/W
		0002H: Run reversely	
		0003H: Jog forward	
		0004H: Jog reversely	
		0005H: Stop	
		0006H: Coast to stop (in emergency)	
		0007H: Fault reset	
		0008H: Jogging stop	
Communication-based setting address	2001H	Communication-based frequency setting (0–Fmax; unit: 0.01 Hz)	R/W
	2002H	PID reference (0–1000, in which 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:

01	10	20 00	00 02	04	00 01	03 E8	3B 10
VFD address	Continuous write command	Parameter address	Parameter quantity	Number of bytes	Froward running	10 Hz	CRC

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

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

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

Function code	Name	Description	Default	Modify

Function code	Name	Description	Default	Modify
P00.11	ACC time 1	Setting range of P00.11 and P00.12: 0.0–3600.0s	Model depended	○
P00.12	DEC time 1		Model depended	○

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

The command sent from the master is as follows:

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

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

01	**10**	**00 0B**	**00 02**	**30 0A**
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.

10.4.7.4 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 end 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 (MODBU SRTU)**, 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 be forward running is as follows:

03	**06**	**20 00**	**00 01**	**42 28**
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/Modbus TCP communication channel.
- Click **Send**. If the line configuration and settings are correct, a response transmitted from the VFD is received.

10.4.8 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:

1. The serial port is set incorrectly. For example, the adapter uses the serial port COM1, but COM2 is selected for the communication.
2. The settings of the baud rates, data bits, end bits, and check bits are inconsistent with those set on the VFD.
3. The positive pole (+) and negative pole (-) of the RS485 bus are connected reversely.
4. The resistor connected to 485 terminals on the terminal block of the VFD is set incorrectly.

11 Short description of communication PZD

11.1 Standard CWs and SWs

In CANopen/PROFIBUS and PROFINET/EtherNet IP, P15.43 provides CWs and SWs defined in decimal and bits.

Function code	Name	Description	Setting
P15.43	Communication CW and SW expression format	0: Decimal format 1: Binary format	0

11.1.1 CW

When P15.43=0(CW defined in decimal), the definition of CW is as follows:

Bit	Name	Value	State/Description
0–7	COMMAND BYTE Communication-based control command	1	Run forward
		2	Run reversely
		3	Jog forward
		4	Jog reversely
		5	Decelerate to stop
		6	Coast to stop
		7	Fault reset
		8	Jog stop
		9	Decelerate to stop in emergency manner
8	WIRTE ENABLE	1	Enable read and write (PKW1–PKW4)
		0	Disable
9–10	Motor group setting	00	Select motor 1
		01	Select motor 2
		02	Select motor 3
		03	Select motor 4 (reserved)
11	Torque/speed switchover	1	Switch to torque control
		0	Switch to speed control
12	ELECTRIC CONSUMPTION CLEAR	1	Enable
		0	Disable
13	PRE-EXCIATION	1	Enable
		0	Disable
14	DC BRAKE	1	Enable
		0	Disable
15	HEARTBEAT REF (Heartbeat reference)	1	Enable
		0	Disable

When P15.43=1(CW defined in binary), the definition of CW is as follows:

Bit	Name	Description	Priority
0	Forward running	0: Decelerate to stop 1: Forward running	1
1	Reverse running	0: Decelerate to stop 1: Reverse running	2
2	Fault reset	0: No 1: Fault reset	3
3	Coast to stop	0: No 1: Coast to stop	4
4	Forward jogging	0: No 1: Forward jogging	5
5	Reverse jogging	0: No 1: Reverse jogging	6
6	Jog stop	0: No 1:Jogging stop	7
7	Reserved		
8	Enable read and write (PKW1–4)	0: Disable 1: Enable	/
9	Reserved		
10	Decelerate to stop in emergency manner	0: No 1: Decelerate to stop in emergency manner	0: Top priority
11–15	Reserved		

Note: Write enabling is enabled by default on the communication expansion card, that is, P19.15 control word bit8=1.

11.1.2 SW

When P15.43=0(SW defined in decimal), the definition of SW is as follows:

Bit	Name	Value	State/Description
0–7	Run status byte	1	Running forward
		2	Running reversely
		3	Stopped
		4	In fault
		5	VFD POFF state
8	Bus voltage established	1	Ready to run
		0	Not ready to run
9–10	Motor group feedback	0(0x00)	Feedback of motor 1
		1(0x01)	Feedback of motor 2
		2(0x10)	Feedback of motor 3
		3(0x11)	Feedback of motor 4 (Reserved)
11	Motor type feedback	1	Synchronous motor (SM)
		0	Asynchronous motor (AM)
12	Overload pre-alarm feedback	1	Overload pre-alarm
		0	No overload pre-alarm
13–14	RUN/STOP MODE (Running mode selection)	0(0x00)	Keypad-based control
		1(0x01)	Terminal-based control

Bit	Name	Value	State/Description
		2(0x10)	Communication-based control
		3(0x11)	Reserved
15	HEARTBEAT FEEDBACK (Heartbeat feedback)	1	Heartbeat feedback
		0	No heartbeat feedback

When P15.43=1(SW defined in binary), the definition of SW is as follows:

Bit	Name	Description	Priority
0	Forward running	0: Decelerate to stop 1: Forward running	1
1	Reverse running	0: Decelerate to stop 1: Reverse running	2
2	Stop	0: No 1: Stopped	3
3	Fault	0: No 1: In fault	4
4	POFF	0: No 1: VFD POFF state	5
5	Pre-exciting	0: No 1: Pre-exciting	6
6–15	Reserved		

11.2 CWs and SWs for dedicated applications

In some crane applications, CANopen, PROFIBUS, PROFINET, and EtherNet IP communication control words (CWs) and status words (SWs) are controlled by bit. INVT CWs and SWs are expressed in format of value. You can choose the CWs and SWs special for port crane applications or INVT standard CWs and SWs based on your requirements.

Function code	Name	Description	Setting
P16.72	CW and SW selection	0x00–0x74 Ones place: CW and SW selection 0: Standard CW and SW 1: CW and SW 1 for dedicated applications 2: Reserved 3: CW and SW 2 for dedicated applications 4: Reserved Tens place: Reserved	Ones place=1 or 3

11.2.1 Dedicated CW (P16.72 ones place=1 or 3)

Bit	Name	Value	State/Description
0	COMMAND BYTE Communication-based control command	1	Run forward
1		1	Run reversely
2		1	Jog forward
3		1	Jog reversely
4		1	Decelerate to stop
5		1	Coast to stop

Bit	Name	Value	State/Description
6		1	Fault reset
7		1	Enabling run
8	WIRTE ENABLE	1	Enable read and write (PKW1–PKW4)
9–10	MOTOR GROUP SELECTION	00	MOTOR GROUP 1 SELECTION
		01	MOTOR GROUP 2 SELECTION
		02	MOTOR GROUP 3 SELECTION
		03	MOTOR GROUP 4 SELECTION
11	Torque/speed switchover	0	Switch to speed control
		1	Switch to torque control
12	External fault	1	External fault
13	PRE-EXCIATION	0	Disable
		1	Enable
When P16.72 ones place=1, bit 14 is defined as follows:			
14	Torque limit value setting (Reserved)	0	Disable
		1	Enable
When P16.72 ones place=3, bit 14 and bit 15 are defined as follows:			
14	HEARTBEAT REF	0	Disable
		1	Enable
15	Zero torque reference function	0	Disable
		1	Enable

11.2.2 Dedicated SW (16.72 ones place=1 or 3)

Bit	Name	Value	State/Description
0	RUN STATUS BYTE	1	Running forward
1		1	Running reversely
2		1	Stopped
3		1	In fault
4		1	Ready
5		1	Pre-exciting
6		1	Brake status
7		1	Alarm
8	Multi-step speed terminal status	1	Status of multi-step speed terminal 1
9		1	Status of multi-step speed terminal 2
10		1	Status of multi-step speed terminal 3
11		1	Status of multi-step speed terminal 4
12–13	Motor group feedback	0(0x00)	Feedback of motor 1
		1(0x01)	Feedback of motor 2
		2(0x10)	Feedback of motor 3

Bit	Name	Value	State/Description
		3(0x11)	Feedback of motor 4 (Reserved)
When P16.72 ones place=1, bit 14 and bit 15 are defined as follows:			
14–15	Running mode selection	0(0x00)	Keypad-based control
		1(0x01)	Terminal-based control
		2(0x10)	Communication-based control
		3(0x11)	Reserved
When P16.72 ones place=3, bit 14 and bit 15 are defined as follows:			
14	Reserved		
15	Heartbeat feedback	0	No heartbeat feedback
		1	With heartbeat feedback

11.3 CANopen/PROFIBUS DP PZD communication

Received parameters:

Function code	Name	Description
P15.02	Received PZD2	0: Invalid 1: Set frequency (-Fmax–Fmax, unit: 0.01Hz) 2: PID reference (-1000–1000, in which 1000 corresponds to 100.0%) 3: PID feedback (-1000–1000, in which 1000 corresponds to 100.0%) 4: Torque setting (-3000–+3000, in which 1000 corresponds to 100.0% of the motor rated current) 5: Setting of the upper limit of forward running frequency (0–Fmax, unit: 0.01Hz) 6: Setting of the upper limit of reverse running frequency (0–Fmax, unit: 0.01Hz) 7: Upper limit of the electromotive torque (0–3000, in which 1000 corresponds to 100.0% of the motor rated current) 8: Upper limit of braking torque (0–3000, in which 1000 corresponds to 100% of the motor rated current) 9: Virtual input terminal command. Range: 0x0000–0x3FFF (corresponding to S12, S11, S10, S9, S8, S7, S6, S5, HDIB, HDIA, S4, S3, S2, and S1 in sequence) 10: Virtual output terminal command. Range: 0x00–0x0F (corresponding to RO2, RO1, HDO, and Y1 in sequence)
P15.03	Received PZD3	
P15.04	Received PZD4	
P15.05	Received PZD5	
P15.06	Received PZD6	
P15.07	Received PZD7	
P15.08	Received PZD8	
P15.09	Received PZD9	
P15.10	Received PZD10	
P15.11	Received PZD11	
P15.12	Received PZD12	

Function code	Name	Description
		11: Voltage setting (special for V/F separation) (0–1000, in which 1000 corresponds to 100% of the motor rated voltage) 12: AO1 output setting 1 (-1000–+1000, in which 1000 corresponds to 100.0%) 13: AO2 output setting 2 (-1000–+1000, in which 1000 corresponds to 100.0%) 14: MSB of position reference (signed) 15: LSB of position reference (unsigned) 16: MSB of position feedback (signed) 17: LSB of position feedback (unsigned) 18: Position feedback setting flag (position feedback can be set only after this flag is set to 1 and then to 0) 19–20: Reserved 21: Non-standard frequency reference (Reserved) 22–25: Reserved 26: Reference encoder pulse MSBs 27: Reference encoder pulse LSBs 28–46: Reserved 47: ACC time (0–1000 corresponds to 0.0–100.0s) 48: DEC time (0–1000 corresponds to 0.0–100.0s) 49: Function parameter mapping (PZD2–PZD12 correspond to P14.49–P14.59)

When the option "1: Set frequency (-Fmax–Fmax, unit: 0.01Hz)" is selected, it is applicable only when P00.06 (Setting channel of A frequency command) is set to PROFIBUS DP communication, and a negative value indicates reverse rotating, while a positive value indicates forward rotating.

Function code	Name	Description	Setting
P00.06	Setting channel of A frequency command	9: PROFIBUS/CANopen/DeviceNet communication	9

When encoder pulses are used, P20.15 must be used together.

Function code	Name	Description	Setting
P20.15	Speed measurement mode	2: Pulses are obtained through CANopen or PROFIBUS DP communication to measure the speed.	2

When ACC/DEC time is used, P16.73 must be used together.

Function code	Name	Description	Setting
P16.73	Communication set ACC/DEC time selection	1: PROFIBUS DP or CANopen communication	1

For function code mapping, it must be used together with P14.48–P14.59.

Function code	Name	Description	Setting
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	0x00
P14.49	PZD2 receives mapping function code	0x0000–0xFFFF Set the function code address to be mapped. For example, if the parameter to be mapped is P85.04, set it to 0x5504.	0x0000
P14.50	Mapped function code of received PZD3	0x0000–0xFFFF	0x0000
P14.51	Mapped function code of received PZD4	0x0000–0xFFFF	0x0000
P14.52	Mapped function code of received PZD5	0x0000–0xFFFF	0x0000
P14.53	Mapped function code of received PZD6	0x0000–0xFFFF	0x0000
P14.54	Mapped function code of received PZD7	0x0000–0xFFFF	0x0000
P14.55	Mapped function code of received PZD8	0x0000–0xFFFF	0x0000
P14.56	Mapped function code of received PZD9	0x0000–0xFFFF	0x0000
P14.57	Mapped function code of received PZD10	0x0000–0xFFFF	0x0000
P14.58	Mapped function code of received PZD11	0x0000–0xFFFF	0x0000
P14.59	Mapped function code of received PZD12	0x0000–0xFFFF	0x0000

Sent parameters

Function code	Name	Description
P15.13	Sent PZD2	0: Invalid 1: Running frequency (×100, Hz) 2: Set frequency (×100, Hz) 3: Bus voltage (×10, V) 4: Output voltage (×1, V) 5: Output current (×10, A) 6: Actual output torque (×10, %) 7: Actual output power (×10, %) 8: Rotation speed of running (×1, RPM) 9: Linear speed of running (×1, m/s) 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 status 17: Terminal output status 18: PID reference (×100, %) 19: PID feedback (×100, %) 20: Motor rated torque 21: MSB of position reference (signed) 22: LSB of position reference (unsigned) 23: MSB of position feedback (signed) 24: LSB of position feedback (unsigned) 25: Status word 2 26: HDIB frequency value (*100, kHz) 27: PG card pulse feedback count high bit 28: PG card pulse feedback count low bit 29: Brake status 30: Non-standard state (Reserved) 31–51: Reserved 52: Module temperature 53: U-phase current transient value 54: V-phase current transient value 55: W-phase current transient value 56–57: Reserved 58: Load weight 59: Current peak value 60: Filter torque setting (filter after running)
P15.14	Sent PZD3	
P15.15	Sent PZD4	
P15.16	Sent PZD5	
P15.17	Sent PZD6	
P15.18	Sent PZD7	
P15.19	Sent PZD8	
P15.20	Sent PZD9	
P15.21	Sent PZD10	
P15.22	Sent PZD11	
P15.23	Sent PZD12	

Function code	Name	Description
		61: kWh electromotive status (MSB) 62: kWh electromotive status (LSB) (×10,kWh) 63: kWh electricity generation status (MSB) 64: kWh electricity generation status (LSB) (×10, kWh) 65: PG card pulse reference count MSB 66: PG card pulse reference count LSB 67: Function parameter mapping (PZD2–PZD12 correspond to P14.60–P14.70)

For function code mapping, it must be used together with P14.48, P14.60–P14.70.

Function code	Name	Description	Setting
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	0x11
P14.60	PZD2 sends mapping function code	0x0000–0xFFFF Set the function code address to be mapped. For example, if the parameter to be mapped is P94.39, set it to 0x5E27.	0x0000
P14.61	Mapped function code of sent PZD3	0x0000–0xFFFF	0x0000
P14.62	Mapped function code of sent PZD4	0x0000–0xFFFF	0x0000
P14.63	Mapped function code of sent PZD5	0x0000–0xFFFF	0x0000
P14.64	Mapped function code of sent PZD6	0x0000–0xFFFF	0x0000
P14.65	Mapped function code of sent PZD7	0x0000–0xFFFF	0x0000
P14.66	Mapped function code of sent PZD8	0x0000–0xFFFF	0x0000
P14.67	Mapped function code of sent PZD9	0x0000–0xFFFF	0x0000
P14.68	Mapped function code of sent PZD10	0x0000–0xFFFF	0x0000

Function code	Name	Description	Setting
P14.69	Mapped function code of sent PZD11	0x0000–0xFFFF	0x0000
P14.70	Mapped function code of sent PZD12	0x0000–0xFFFF	0x0000

11.4 PROFINET/EtherNet IP PZD communication

Received parameters:

Function code	Name	Description
P16.32	Received PZD2	0: Invalid 1: Set frequency (-Fmax–Fmax, unit: 0.01Hz) 2: PID reference (-1000–1000, in which 1000 corresponds to 100.0%) 3: PID feedback (-1000–1000, in which 1000 corresponds to 100.0%) 4: Torque setting (-3000–+3000, in which 1000 corresponds to 100.0% of the motor rated current) 5: Setting of the upper limit of forward running frequency (0–Fmax, unit: 0.01Hz) 6: Setting of the upper limit of reverse running frequency (0–Fmax, unit: 0.01Hz) 7: Upper limit of the electromotive torque (0–3000, in which 1000 corresponds to 100.0% of the motor rated current) 8: Upper limit of braking torque (0–3000, in which 1000 corresponds to 100% of the motor rated current) 9. Virtual input terminal command (range: 0x0000–0x3FFF, corresponding to S12/S11/S10/S9/S8/S7/S6/S5/HDIB/HDIA/S4/S3/S2/S1) 10: Virtual output terminal command. Range: 0x00–0x0F (corresponding to RO2, RO1, HDO, and Y1 in sequence) 11: Voltage setting (special for V/F separation) (0–1000, in which 1000 corresponds to 100% of the motor rated voltage) 12: AO1 output setting 1 (-1000–+1000, in which 1000 corresponds to 100.0%) 13: AO2 output setting 2 (-1000–+1000, in which 1000 corresponds to 100.0%) 14: High-order bit of position reference (signed) 15: LSB of position reference (unsigned) 16: MSB of position feedback (signed)
P16.33	Received PZD3	
P16.34	Received PZD4	
P16.35	Received PZD5	
P16.36	Received PZD6	
P16.37	Received PZD7	
P16.38	Received PZD8	
P16.39	Received PZD9	
P16.40	Received PZD10	
P16.41	Received PZD11	
P16.42	Received PZD12	

Function code	Name	Description
		17: LSB of position feedback (unsigned) 18: Position feedback setting flag (position feedback can be set only after this flag is set to 1 and then to 0) 19–20: Reserved 21: Non-standard frequency reference (Reserved) 22–25: Reserved 26: Reference encoder pulse MSBs 27: Reference encoder pulse LSBs 28–46: Reserved 47: ACC time (0–1000 corresponds to 0.0–100.0s) 48: DEC time (0–1000 corresponds to 0.0–100.0s) 49: Function parameter mapping (PZD2–PZD12 correspond to P14.49–P14.59)

When the option "1: Set frequency (-Fmax–Fmax, unit: 0.01Hz)" is selected, it is applicable only when P00.06 (Setting channel of A frequency command) is set to PROFINET communication, and a negative value indicates reverse rotating, while a positive value indicates forward rotating.

Function code	Name	Description	Setting
P00.06	Setting channel of A frequency command	13: EtherCAT/PROFINET/ EtherNet IP communication	13

When encoder pulses are used, P20.15 must be used together.

Function code	Name	Description	Setting
P20.15	Speed measurement mode	3: Pulses are obtained through PROFINET/EtherNet IP communication to measure the speed.	3

When ACC/DEC time is used, P16.73 must be used together.

Function code	Name	Description	Setting
P16.73	Communication set ACC/DEC time selection	2: PROFINET/EtherNet IP communication	2

For function code mapping, it must be used together with P14.48–P14.59. The usage method is similar to that in section 11.3 CANopen/PROFIBUS DP PZD communication.

Sent parameters

Function code	Name	Description
P16.43	Sent PZD2	0: Invalid

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th></tr>
<tr><td>P16.44</td><td>Sent PZD3</td><td rowspan="10">1: Running frequency (×100, Hz)
2: Set frequency (×100, Hz)
3: Bus voltage (x10, V)
4: Output voltage (×1, V)
5: Output current (×10, A)
6: Actual output torque (×10, %)
7: Actual output power (×10, %)
8: Rotation speed of running (×1, RPM)
9: Linear speed of running (×1, m/s)
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 status
17: Terminal output status
18: PID reference (×100, %)
19: PID feedback (×100, %)
20: Motor rated torque
21: MSB of position reference (signed)
22: LSB of position reference (unsigned)
23: MSB of position feedback (signed)
24: LSB of position feedback (unsigned)
25: Status word 2
26: HDIB frequency value (*100, kHz)
27: PG card pulse feedback count high bit
28: PG card pulse feedback count low bit
29: Brake status
30: Non-standard state (Reserved)
31–51: Reserved
52: Module temperature
53: U-phase current transient value
54: V-phase current transient value
55: W-phase current transient value
56–57: Reserved
58: Load weight
59: Current peak value
60: Filter torque setting (filter after running)
61: MWh electromotive status (MSB)
62: kWh status (LSB) (*10,kWh)</td></tr>
<tr><td>P16.45</td><td>Sent PZD4</td></tr>
<tr><td>P16.46</td><td>Sent PZD5</td></tr>
<tr><td>P16.47</td><td>Sent PZD6</td></tr>
<tr><td>P16.48</td><td>Sent PZD7</td></tr>
<tr><td>P16.49</td><td>Sent PZD8</td></tr>
<tr><td>P16.50</td><td>Sent PZD9</td></tr>
<tr><td>P16.51</td><td>Sent PZD10</td></tr>
<tr><td>P16.52</td><td>Sent PZD11</td></tr>
<tr><td>P16.53</td><td>Sent PZD12</td></tr>
</table>

Function code	Name	Description
		63: MWh electricity generation status (MSB) 64: kWh electricity generation status (LSB) (*10,kWh) 65: PG card pulse reference count high bit 66: PG card pulse reference count LSB 67: Function parameter mapping (PZD2–PZD12 correspond to P14.60–P14.70)

For function code mapping, it must be used together with P14.48, P14.60–P14.70. The usage method is similar to that in section 11.3 CANopen/PROFIBUS DP PZD communication.

11.5 PZD interaction data monitoring

In CANopen/PROFIBUS and PROFINET/EtherNet IP, it is possible to display the interaction between the communication card and the VFD in P19.15 and P19.16 by setting P14.47, which facilitates commissioning.

Function code	Name	Description	Setting
P14.47	PZD display selection	0x00–0xCC Ones place: Received PZD 0–1: P19.15 displays CW 2–C: P19.15 displays PZD2–PZD12 sequentially Tens place: Sent PZD 0–1: P19.16 displays SW 2–C: P19.16 displays PZD2–PZD12 sequentially	00

When the ones place of P16.47 is set to 0–1, P19.15 specifies the control word that the PROFIBUS-DP/CANopen/PROFINET/EtherCAT card sends to the VFD during communication.

When the ones place of P16.47 is set to 2–0xC, P19.15 specifies the PZD2–PZD12 sequentially that the PROFIBUS-DP/CANopen/PROFINET card sends to the VFD during communication.

When the tens place of P16.47 is set to 0–1, P19.16 specifies the status word that the VFD returns to the PROFIBUS-DP/CANopen/PROFINET/EtherCAT card during communication.

When the tens place of P16.47 is set to 2–0xC, P19.16 specifies the PZD2–PZD12 sequentially that the VFD sends to the PROFIBUS-DP/CANopen/PROFINET card during communication.

Function code	Name	Description	Display value
P19.15	Communication card control word	0x0000–0xFFFF	/
P19.16	VFD status word	0x0000–0xFFFF	/

Appendix A Expansion card

A.1 Model definition

EC-PG 5 02-05 B

① ② ③ ④ ⑤ ⑥

No.	Description	Naming example
①	Product category	EC: Expansion card
②	Board card category	IC: IoT card IO: IO expansion 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	Distinguishing 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	00: Passive
		05: 5V
		12: 12–15V
		24: 24V
⑥	Expansion card version	Empty: Version A B: Version B C: Version C

EC-TX 5 01 B

① ② ③ ④ ⑤

No.	Name	Naming example
①	Product category	EC: Expansion card

No.	Name	Naming example
②	Board card category	IC: IoT card IO: IO expansion 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	Distinguishing code	01: Bluetooth communication card
		02: Wi-Fi communication card
		03: PROFIBUS communication card
		04: Ethernet communication card
		05: CANopen communication card
		06: DeviceNet communication card
		07: BACnet communication card
		08: EtherCAT communication card
		09: PROFINET communication card
		10: EtherNet/IP communication card
		11: CAN master-slave control communication card
		15: Modbus TCP 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

No.	Name	Naming example
①	Product category	EC: Expansion card
②	Board card category	IC: IoT card IO: IO expansion 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	Distinguishing	01: Multiple-function I/O expansion card (four digital inputs, one

No.	Name	Naming example
	code	digital output, one analog input, one analog output, and two relay outputs)
		02: Digital I/O expansion card (four digital inputs, two relay outputs, one PT100 output, and one PT1000 output)
		03: Analog I/O card
		04: Reserved 1
		05: Reserved 2
⑤	Special requirement	/

EC-IC 5 02-2 1 G-CN

① ② ③ ④ ⑤ ⑥ ⑦ ⑧

No.	Name	Naming example
①	Product category	EC: Expansion card
②	Board card category	IC: IoT card IO: IO expansion 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	Distinguishing code	01: GPRS card
		02: 4G card
		03: Reserved
⑤	Antenna type	1: Built in
		2: External
⑥	SIM card type	0: Plug-in type **Note:** When this bit is 0 or omitted, the card is plug-in type.
		1: Embedded
⑦	Special function	G: With GPS **Note:** This bit is omitted for when the special functions are not available.
⑧	International version	CN: China version EU: Europe version LA: Latin America version **Note:** 4G SIM card is standard for version.

EC-PS 5 01-24
① ② ③ ④ ⑤

No.	Name	Naming example
①	Product category	EC: Expansion card
②	Board card category	IC: IoT card IO: IO expansion 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	01: Provide power supply for the entire control board and keypad
⑤	Working power	24: DC 24V

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

Name	Model	Specifications	Ordering code
I/O 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
I/O expansion card 2	EC-IO502-00	● Four digital inputs ● One PT100 ● One PT1000 ● Two relay outputs: single-contact NO output ● For function details, see section 4.4.3 Control circuit wiring of I/O expansion card 2.	11023-00119
WIFI communication card	EC-TX502-1 EC-TX502-2	● Meeting requirements of IEEE802.11b/g/n ● With INVT's mobile phone APP, you can monitor the VFD locally or remotely through WIFI ● Maximum communication distance in open environments: 30m	11023-00101 11023-00102

Name	Model	Specifications	Ordering code
		● EC-TX502-1 is equipped with a built-in antenna and applicable to molded case machines ● EC-TX502-2 is equipped with an external sucker antenna and applicable to sheet metal machines	
PROFIBUS-DP communication card	EC-TX503D	● Supporting the PROFIBUS-DP protocol	11023-00080
Ethernet monitoring card	EC-TX504	● Supporting Ethernet communication with internal INVT protocol ● Can be used with INVT Workshop, the upper controller monitoring software.	11023-00081
CANopen/CAN master-slave control communication card	EC-TX505D	● Based on the CAN2.0A physical layer ● Supporting the CANopen protocol ● Adopting INVT master-slave control proprietary protocol	11023-00164
EtherCAT communication card	EC-TX508	● Supporting the EtherCAT COE 402 protocol and automatic network address configuration ● Supporting the PDO and SDO service and supporting the use of SDO to read VFD function codes ● Not supporting EtherCAT synchronization cycle	11023-00120
PROFINET communication card	EC-TX509C	● Supporting the PROFINET protocol	11023-00149
EtherNet IP communication card	EC-TX510	● Supporting the EtherNet IP protocol ● Equipped with two EtherNet IP ports, supporting 10/100M half/full duplex operating ● Supporting star, line, and ring network topologies (but the ring network monitoring is not available)	11023-00107
CAN-NET two-in-one communication card	EC-TX511B	● Supporting Ethernet communication with internal INVT protocol ● Can be used with INVT Workshop, the upper controller monitoring software ● Based on the CAN2.0A physical layer	11023-00124

Name	Model	Specifications	Ordering code
		● Supporting the CANopen protocol	
216 communication card	EC-TX513	● Supporting the 216 communication protocol.	11023-00134
Modbus TCP communication card	EC-TX515	● Supporting the Modbus TCP protocol and Modbus TCP secondary nodes ● Equipped with two Modbus TCP ports, supporting 100M full duplex operating, and supporting line and star network topologies, with the nodes up to 32 ● Available as Modbus TCP slave	11023-00125
Sin/Cos PG card	EC-PG502	● Applicable to Sin/Cos encoders with or without CD signals ● Supporting the frequency-divided output of A, B, and Z ● Supporting input of pulse train reference	11023-00109
Incremental PG card with UVW	EC-PG503-05	● Applicable to differential encoders of 5V ● Supporting the orthogonal input of A, B, and Z ● Supporting the pulse input of phase U, V, and W ● Supporting the frequency-divided output of A, B, and Z ● Supporting input of pulse train reference	11023-00085
Resolver PG card	EC-PG504-00	● Applicable to resolver encoders ● Supporting frequency-divided output of resolver-simulated A, B, Z ● Supporting input of pulse train reference	11023-00086
Multi-function incremental PG card	EC-PG505-12	● Applicable to OC encoders of 5V or 12V ● Applicable to push-pull encoders of 5V or 12V ● Applicable to differential encoders of 5V ● Supporting the orthogonal input of A, B, and Z ● Supporting the frequency-divided output of A, B, and Z ● Supporting input of pulse train reference	11023–00087
Simplified incremental PG card	EC-PG507-12B	● Applicable to OC encoders of 5V or 12V ● Applicable to push-pull encoders of 5V or 12V ● Applicable to differential encoders of 5V	11023-00115
24V simplified incremental PG	EC-PG507-24	● Applicable to OC encoders of 24V ● Applicable to push-pull encoders of 24V	11023-00121

Name	Model	Specifications	Ordering code
card		● Applicable to differential encoders of 24V	
Absolute encoder SSI communication PG card	EC-PG508-05B	● SSI signal, differential input of 5V ● Applicable to encoders of 24V or 5V ● Pulse reference supporting 5V differential, 24V push-pull, and OC encoders	11023-00177
24V multi-function incremental PG card	EC-PG505-24B	● Applicable to OC encoders of 24V ● Applicable to push-pull encoders of 24V ● Applicable to differential encoders of 24V ● Supporting the frequency-divided output of A, B, and Z ● Supporting input of pulse train reference	11023–00139
4G expansion card	EC-IC502-2-CN EC-IC502-2-EU EC-IC502-2-LA	● Supporting standard RS485 interface ● Supporting 4G communication	11095-00009 11095-00017 11095-00018
24V power supply expansion card	EC-PS501-24	● Input voltage range: DC18–30V(Rated 24V DC)/2A ● Three channels of output voltage: +5V/1A (±5%), +15V/0.2A (±10%), -15V/0.2A (±10%)	11023-00135

I/O expansion card 1 EC-IO501-00

I/O expansion card 2 EC-IO502-00

WIFI communication card EC-TX502

PROFIBUS-DP communication card EC-TX503D

Ethernet monitoring card
EC-TX504

CANopen/CAN master-slave communication card
EC-TX505D

PROFINET communication card
EC-TX509C

CAN-NET two-in-one communication card
EC-TX511B

216 communication card
EC-TX513

EtherNet IP/Modbus TCP communication card
EC-TX510/515

Sin/Cos PG card
EC-PG502

UVW incremental PG card
EC-PG503-05

Resolver PG card
EC-PG504-00

Multifunction incremental PG card
EC-PG505-12

Simplified incremental PG card
EC-PG507-12

24V simplified incremental PG card
EC-PG507-24

SSI card
EC-PG508-05B

4G expansion card
EC-IC502-2-CN/EU/LA

24V power supply expansion card
EC-PS501-24

A.2 Dimensions and installation

All expansion cards are of the same dimensions (108x39mm) and can be installed in the same way.

Comply with the following rules when installing or removing an expansion card:

1. Ensure that no power is applied before installing the extension card.
2. The extension card can be installed in any one of the SLOT1, SLOT2, and SLOT3 card slots.
3. The 5.5 kW and lower VFD models can be configured with two extension cards at the same time, and the 7.5 kW and higher VFD models can be configured with three extension cards.
4. If interference occurs on the external wires after extension cards are installed, change their installation card slots flexibly to facilitate the wiring. For example, the connector of the connection

cable of the DP card is large, so it is recommended to be installed in the SLOT1 card slot.

5. To ensure high anti-interference capability in closed-loop control, you need to use a shielding wire in the encoder cable and ground the two ends of the shielding wire, that is, connect the shielding layer to the housing of the motor on the motor side, and connect the shielding layer to the PE terminal on the PG card side.

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

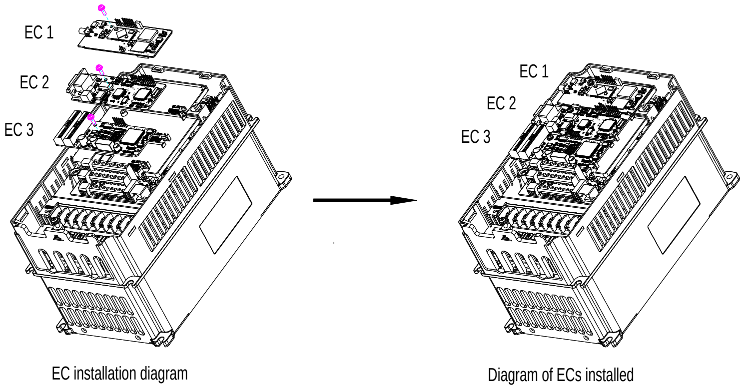


Figure A-1 7.5kW or higher VFD models with extension cards installed

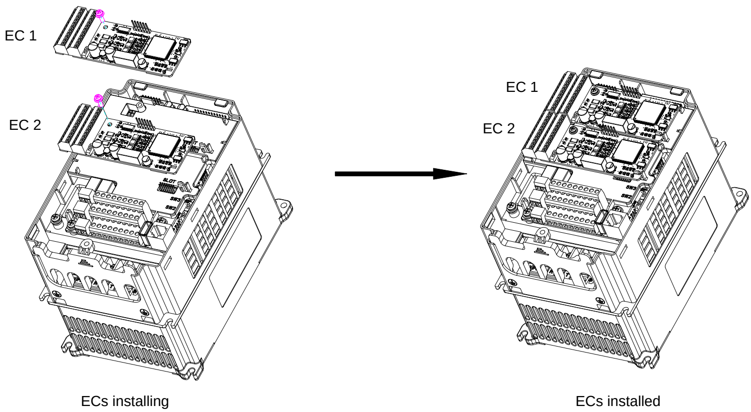


Figure A-2 5.5kW or lower VFD models with extension cards installed

Expansion card installation procedure:

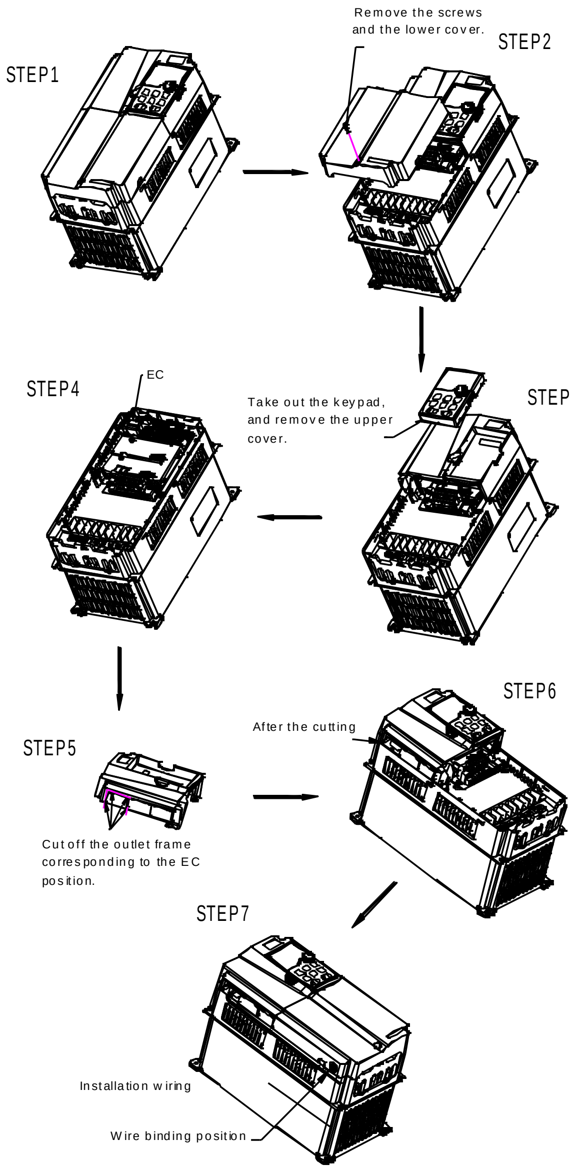


Figure A-3 Expansion card installation procedure

A.3 Wiring

Ground a shielded cable as follows:

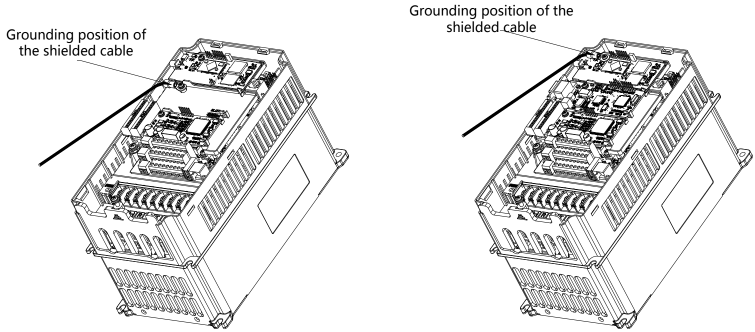
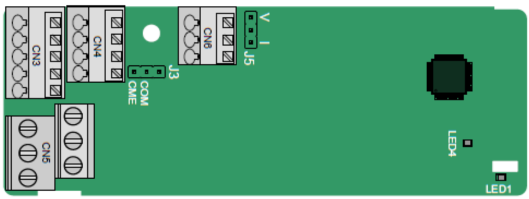


Figure A-4 Expansion card grounding

A.4 I/O 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	
PW	+24V	S6	S7	S8

RO3A	RO3B	RO3C	
	RO4A		RO4C

Indicator definition:

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

The EC-IO501-00 extension card can be used in scenarios where the I/O interfaces of an GD350-CCS 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.

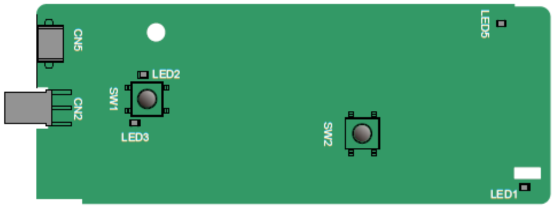
EC-IO501-00 terminal functions:

Category	Terminal symbol	Terminal name	Description
Power supply	PW	External power	Used to provide input digital working power from the external to the internal Voltage range: 12–30V PW and +24V have been short connected before delivery.
Analog Input and output	AI3—GND	Analog input 1	● Input range: For AI3, 0–10V or 0–20mA ● Input impedance: 20kΩ for voltage input or 250Ω for current input ● Whether voltage or current is used for input is set through the corresponding function code ● Resolution: 5mV when 10V corresponds to 50Hz ● Deviation: ±0.5%; input of 5V or 10mA or higher at the temperature of 25°C.
	AO2—GND	Analog output 1	● Output range: 0–10V or 0–20mA ● Whether voltage or current is used for output is set through the jumper J5. ● Deviation: ±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	● Internal impedance: 6.6kΩ ● 12–30V voltage input is acceptable ● Bi-direction input terminal ● Max. input frequency: 1kHz
	S6—COM	Digital input 2	
	S7—COM	Digital input 3	
	S8—COM	Digital input 4	
	Y2—CME	Digital output	● Switch capacity: 50mA/30V ● Output frequency range: 0–1kHz ● The terminals CME and COM are shorted through J3 before delivery.
Relay output	RO3A	NO contact of relay 3	● Contact capacity: 3A/AC250V, 1A/DC30V ● Cannot be used as high frequency digital
	RO3B	NC contact of relay 3	
	RO3C	Common contact of relay 3	

Category	Terminal symbol	Terminal name	Description
	RO4A	NO contact of relay 4	output
	RO4C	Common contact of relay 4	

A.5 Communication cards

A.5.1 WIFI communication card (EC-TX502)

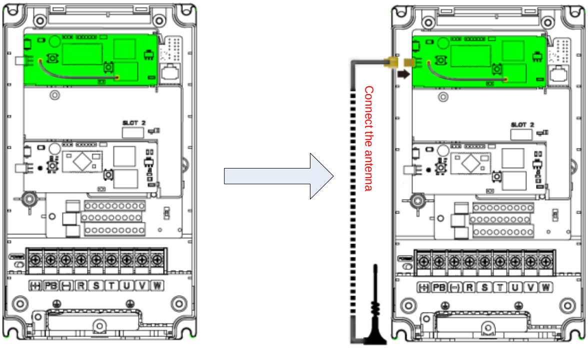


Definition of indicators and function keys:

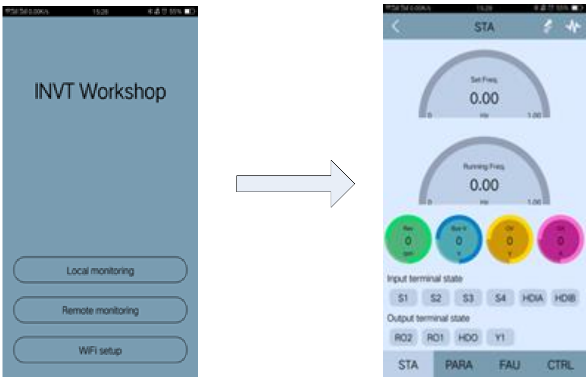
Indicator	Definition	Function
LED3	WIFI status indicator	On: The expansion card is connecting with the control board. Blinking periodically (the period is 1s, on for 0.5s, and off for the other 0.5s): The expansion card is properly connected to the control board. Off: The expansion card is disconnected from the control board.
LED5	Power indicator	On: The control board feeds power to the communication card.
SW1	WIFI factory reset button	It is used to restore the expansion card to default values and return to the local monitoring mode.
SW2	WIFI hardware reset button	It is used to restart 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 in a maximum distance of 30m. You can choose a PCB antenna or an external sucker 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 sheetmetal machine and located in a metal cabinet, you need to use an external sucker antenna.

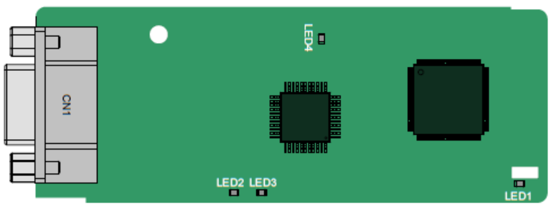
When installing a sucker antenna, install a wireless communication card on the VFD first, and then lead the SMA connector of the sucker antenna into the VFD and screw it to CN2, as shown in the following figure. Place the antenna base on the chassis and expose the upper part. Try to keep it unblocked.



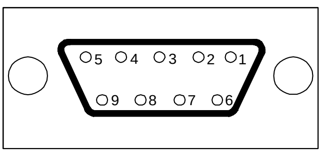
The wireless communication card must be used with the INVT VFD APP. For details, refer to the wireless communication card manual provided with the extension card. The main interface is shown as follows.



A.5.2 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 sending
5	GND_BUS	Isolation ground
6	+5V BUS	Isolated power supply of 5VDC
7	/	Unused
8	A-Line	Data- (twisted pair 2)
9	/	Unused
Housing	SHLD	PROFIBUS cable shielding line

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

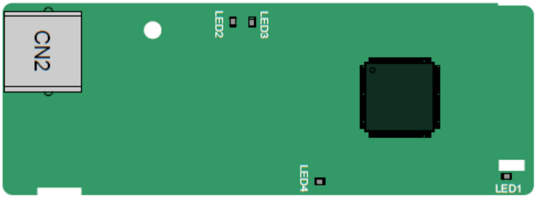
On some devices, the transmission and receiving directions are determined by RTS. In normal applications, only A-Line B-Line, and the shield layer need to be used.

Indicator definition:

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

For details, see the VFD communication card manual.

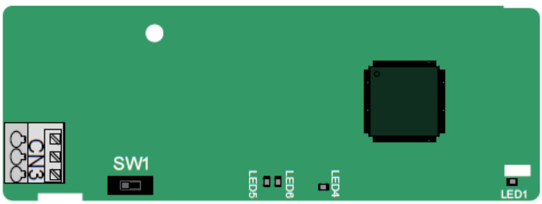
A.5.3 Ethernet monitoring card (EC-TX504)



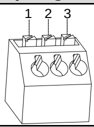
The EC-TX504 communication card adopts standard RJ45 terminals. It is used only on the host controller that supports INVT Workshop. If you want to support the standard EtherNet/IP protocol, select the card EC-TX510. Indicator definition:

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

A.5.4 CANopen/CAN master-slave communication card (EC-TX505D)



The EC-TX505D communication card is user-friendly, adopting spring terminals.

3-Pin spring terminal	Pin	Function	Description
	1	CANH	CANopen bus high level signal
	2	CANG	CANopen bus shielding
	3	CANL	CANopen bus low level signal

Terminal resistor switch function description:

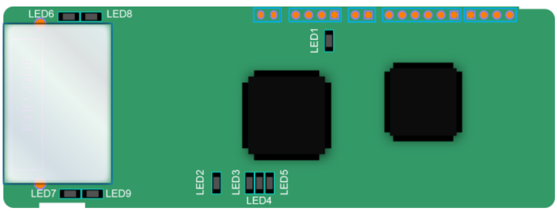
Terminal resistor switch	Position value	Function	Description
	Left	OFF	CAN_H and CAN_L are not connected to a terminal resistor.
	Right	ON	CAN_H and CAN_L are connected to a terminal resistor of 120Ω.

Indicator definition:

Indicator No.	Definition	Function
LED1	Status indicator	On: The expansion card is connecting with the control board. Blinking periodically (the period is 1s, on for 0.5s, and off for the other 0.5s): The expansion card is properly connected to the control board. Off: The expansion card is disconnected from the control board.
LED4	Power indicator	On: The control board feeds power to the communication card.
LED5	Run indicator	On: The communication card is in the operating state. Blinking: The communication card is in the pre-operation state. Blinking once: The communication card is in the stopped state. Off: A fault occurs. Check whether the reset pin of the communication card and the power supply are properly connected.
LED6	Error indicator	On: The CAN controller bus is off or the VFD has a fault. Blinking: The address setting is incorrect. Blinking once: A received frame is missed or an error occurs during frame receiving. Off: The communication card is in the working state.

For details, see the Goodrive350 series VFD communication card manual.

A.5.5 PROFINET communication card (EC-TX509C)



The terminal CN2 adopts standard RJ45 interfaces, which are in the dual design, and the two RJ45 interfaces are not distinguished from each other and can be interchangeably inserted. They are arranged as follows:

Pin	Function	Description
1	TX+	Transmit Data+

Pin	Function	Description
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.

Indicator No.	Color	Status	Description
LED1	Green		3.3V power indicator
LED2 (Bus status indicator)	Red	On	No network connection
		Blinking	The connection to the network cable between the PROFINET controller is OK, but the communication is not established.
		Off	Communication with the PROFINET controller has been established.
LED3 (System fault indicator)	Green	On	PROFINET diagnosis exists.
		Off	No PROFINET diagnosis.
LED4 (Slave ready indicator)	Green	On	TPS-1 protocol stack has started.
		Blinking	TPS-1 waits for MCU initialization.
		Off	TPS-1 protocol stack does not start.
LED5 (Maintenance status indicator)	Green	/	Manufacturer-specific, depending on the characteristics of the device
LED6/7 (Network port status indicator)	Green	On	The PROFINET communication card and PC/PLC have been connected 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 linear network topology electrical connection diagram is shown as follows.

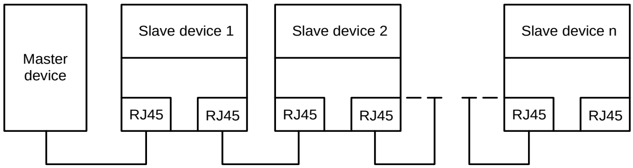
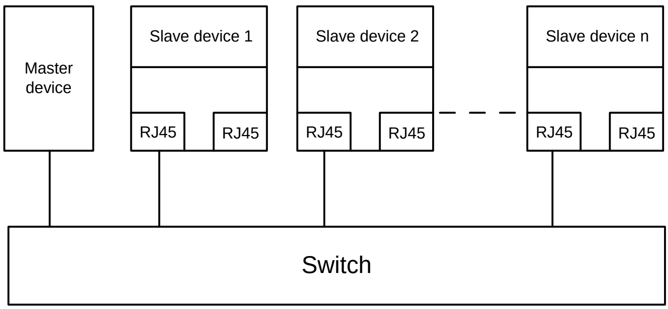


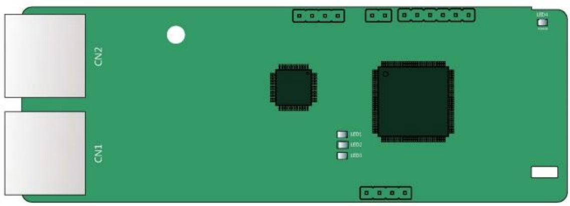
Figure A-5 Linear network topology electrical connection

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

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



A.5.6 EtherNet IP communication card (EC-TX510)



The communication port adopts standard dual RJ45 interfaces, and the two RJ45 interfaces are not distinguished from each other and can be interchangeably inserted.

Interface functions

Pin	Function	Description
1	TX+	Transmit Data+

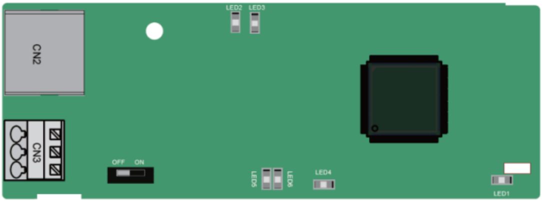
Pin	Function	Description
2	TX-	Transmit Data-
3	RX+	Receive Data+
4	n/c	Not connected
5	n/c	Not connected
6	RX-	Receive Data-
7	n/c	Not connected
8	n/c	Not connected

The EtherNet IP communication card provides four LED indicators and four net port indicators to indicate its states.

Indicator No.	Color	Status	Description
LED1	Green	On	EtherNet IP card is shaking hands with the VFD.
		Blinking (1Hz)	EtherNet IP card and VFD communicate normally.
		Off	EtherNet IP card and VFD communicate improperly.
LED2 (Bus status indicator)	Green	On	The communication between the EtherNet IP card and the PLC is online and data exchange is allowed.
		Blinking (1Hz)	IP address conflict between the card and PLC.
		Off	The communication between the EtherNet IP card and PLC is offline.
LED3 (System fault indicator)	Red	On	Failed to set up I/O between the card and PLC.
		Blinking (1Hz)	Incorrect PLC configuration.
		Blinking (2Hz)	The card failed to send data to the PLC.
		Blinking (4Hz)	The connection between the card and PLC timed out.
		Off	No fault
LED4	Red	On	3.3V 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 data interchange not be performed.

For details, see the manual of the communication card.

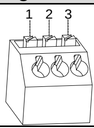
A.5.7 CAN-NET two-in-one communication card (EC-TX511B)



The EC-TX511B communication card is user-friendly, adopting spring terminals.

The CN2 communication card adopts standard RJ45 terminals.

CN3 terminal function:

3-Pin spring-loaded terminal	Pin	Function	Description
	1	CANH	CANopen bus high level signal
	2	CANG	CANopen bus shielding
	3	CANL	CANopen bus low level signal

Terminal resistor switch function description:

Terminal resistor switch	Position value	Function	Description
	Left	OFF	CAN_H and CAN_L are not connected to a terminal resistor.
	Right	ON	CAN_H and CAN_L are connected to a terminal resistor of 120 Ω.

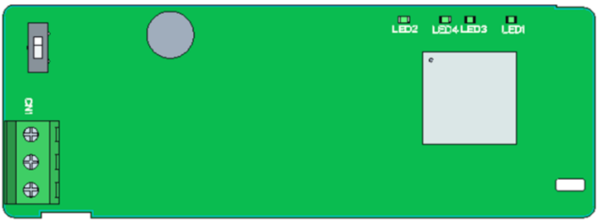
Indicator definition:

Indicator	Definition	Function
LED1	Status indicator	On: The expansion card is connecting with the control board. Blinking periodically (the period is 1s, on for 0.5s, and off for the other 0.5s): The expansion card is properly connected to the control board. Off: The expansion card is disconnected from the control board.
LED2	Network connection status indicator	On: The physical connection to the upper computer is normal. Off: The upper computer is disconnected.
LED3	Network communication status indicator	On: There is data exchange with the upper computer. Off: There is no data exchange with the upper computer.
LED4	Power indicator	This indicator is on after the control board feeds power to the card.
LED5	Run indicator	On: The communication card is in the operating state.

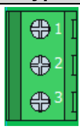
Indicator	Definition	Function
		Blinking: The communication card is in the pre-operation state. Blinking once: The communication card is in the stopped state. Off: A fault occurs. Check whether the reset pin of the communication card and the power supply are properly connected.
LED6	Error indicator	On: The CAN controller bus is off or the VFD has a fault. Blinking: The address setting is incorrect. Blinking once: A received frame is missed or an error occurs during frame receiving. Off: The communication card is in the working state.

For details, see the manual of the communication card.

A.5.8 216 communication card (EC-TX513)



The EC-TX513 communication card is user-friendly, adopting European-type screw terminals.

3-Pin European-type screw terminal	Pin	Function	Description
	1	E+	216 bus high level signal
	2	E-	216 bus low level signal
	3	PE	216 bus shielded cable

Terminal resistor switch function description:

Terminal resistor switch	Position value	Function	Description
	Upward	OFF	E+ and E- are not connected to a terminal resistor.
	Downward	ON	E+ and E- are connected to a terminal resistor of 120Ω.

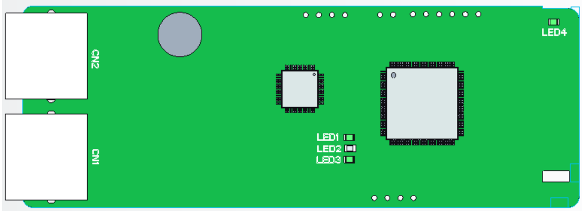
Indicator definition:

Indicator	Definition	Function
LED1	216 communication fault indicator	Indicates the communication status between the card and external bus (such as PLC).

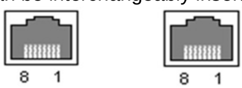
Indicator	Definition	Function
		On: 216 communication disconnected Blinking: Packet loss in 216 communication Off: 216 communication works normally
LED2	Internal communication fault indicator	indicate the internal SPI communication status between the communication card and main control board. On: Internal SPI communication disconnected Blinking: Packet loss in internal SPI communication Off: Internal SPI communication works normally
LED3	Power indicator	On: The control board feeds power to the communication card.
LED4	Status indicator	On: Communication between the communication card and main control board is established Off: Communication between the communication card and main control board is not established

For details, see the manual of the communication card.

A.5.9 Modbus TCP communication card (EC-TX515)



The communication port adopts standard dual RJ45 interfaces, and the two RJ45 interfaces are not distinguished from each other and can be interchangeably inserted.



Interface functions

Pin	Function	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

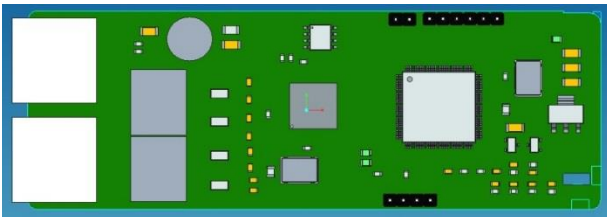
The communication card provides four LED indicators and four net port indicators to indicate its states.

Indicator No.	Color	Status	Description
LED1	Green	On	Modbus TCP card is shaking hands with the VFD.
		Blinking (1Hz)	Modbus TCP card and VFD communicate normally.
		Off	Modbus TCP card and VFD communicate improperly.
LED2 (Bus status indicator)	Green	On	The communication between the Modbus TCP card and the PLC is online and data exchange is allowed.
		Blinking (1Hz)	IP address conflict between the Modbus TCP card and PLC.
		Off	The communication between the Modbus TCP card and PLC is offline.
LED3 (System fault indicator)	Red	On	Modbus TCP card has no valid data received.
		Blinking (1Hz)	The message function code is not used or defined
		Blinking (8Hz)	Message address error
		Off	No fault
LED4	Red	On	3.3V 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 data interchange not be performed.

For details, see the Goodrive350 series VFD communication card manual.

A.5.10 EtherCAT communication card (EC-TX508)

EC-TX508 is defined as an EtherCAT slave communication card, which can be used on the product.



1. Supported functions

➢ EtherCAT COE 402 protocol

➢ Automatic network address configuration

2. Supported services

➢ **PDO** service

- **SDO** service
- Manufacturer-defined object dictionary
- Use of SDO to read VFD function codes

3. Not supporting EtherCAT synchronization cycle

4. Communication port

Standard RJ45 ports are used in EtherCAT communication. The communication card provides two RJ45 ports with transmission direction defined. The following figure shows the ports. IN (indicating input) and OUT (indicating output) are EtherCAT wiring network ports.

Interface functions:

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

5. Status indicators

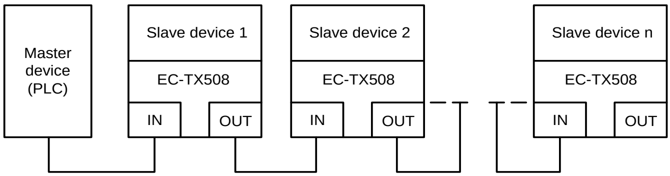
The EtherCAT communication card provides four LED indicators and four net port indicators to indicate its states.

Indicator	Color	Function
RUN (EtherCAT run status)	Green	ON: OP state Blinking periodically (the period is 0.4s, on for 0.2s, and off for the other 0.2s): Pre-OP state Blinking periodically (the period is 1.2s, on for 1s, and off for the other 0.2s): Safe-OP state Off: Init state
ALM (EtherCAT fault state)	Red	ON: OP fault state Blinking periodically (the period is 0.4s, on for 0.2s, and off for the other 0.2s): Init, Pre-OP fault state Blinking periodically (the period is 1.2s, on for 1s, and off for the other 0.2s): Safe-OP fault state Off: No fault
PWR	Red	3.3V power indicator

Indicator	Color	Function
Net port indicator (IN)	Yellow	On: Ethernet connection is successful. Off: Ethernet connection is not established.
	Green	On: There is a link but no activity. Blinking: There is a link and activity. Off: There is no link.
Network port indicator (OUT)	Yellow	On: Ethernet connection is successful. Off: Ethernet connection is not established.
	Green	On: There is a link but no activity. Blinking: There is a link and activity. Off: There is no link.

6. Electrical connection

An EtherCAT network often consists of a master (such as PLC) and multiple slaves (such as drives or bus expansion terminals). Each EtherCAT slave has two standard Ethernet interfaces. The following figure shows the electrical connection.



7. EtherCAT communication parameter settings in common control mode

A. Parameter addresses for VFD data receiving

Parameters when the standard speed mode (3 is written to 0x6060) is used:

- Speed control ACC time: 0x6083, 32-bit data, 3 decimal places, 0.001s
- Speed control DEC time: 0x6084, 32-bit data, 3 decimal places, 0.001s
- Set frequency: 0x60FF, set rotation speed value, 32-bit data, unit: 1 RPM

Note: You need to set P16.79 ones place to 1, and set P00.06=13.

Parameters when the standard positioning mode (1 is written to 0x6060) is used:

- Positioning speed: 0x6081, set rotation speed value, 32-bit data, unit: 1 RPM
- Position reference: 0x607A, 32-bit data
- Positioning ACC time: 0x6083, 32-bit data, 3 decimal places, 0.001s
- Positioning DEC time: 0x6084, 32-bit data, 3 decimal places, 0.001s

Note: You need to set P21.18=6.

A. Parameter addresses for VFD data sending

- Speed feedback: 0x606C, 32-bit data, unit: 1 RPM

- Terminal output status: 0x60FD, 32-bit data, low 16 bits indicate input terminal status, while high 16 bits indicate output terminal status. The mapping between bits and I/O ports is as follows.

Bit29	Bit28	Bit27	Bit26	Bit25	Bit24	Bit23
/	RO4	RO3	/	/	Y2	/
Bit22	Bit21	Bit20	Bit19	Bit18	Bit17	Bit16
/	/	/	RO2	RO1	HDO	Y1

Bit11	Bit10	Bit9	Bit8	Bit7	Bit6
S8	S7	S6	S5	/	/
Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
HDIB	HDIA	S4	S3	S2	S1

- Output current: 0x6078, 16-bit data, 1 decimal place, unit: 0.1%, relative to the motor rated current
- Motor encoder pulse count: 0x6064, 32-bit data
- SSI position reference: 0x60BA, 32-bit data
- Present motor control mode: 0x6061, 8-bit data, display value (=0, zero mode; =1, standard positioning mode; =3, standard speed mode)

Note: You need to set P16.79 hundreds place to 3.

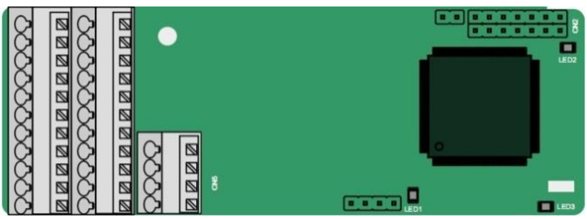
In addition, if you need to distinguish between standard speed mode and standard positioning mode, use different ACC/DEC time reference addresses. You can set P16.81 tens place to 1. At this time, the ACC/DEC parameter addresses in standard speed mode will be automatically switched, while they will not be changed in standard positioning mode.

- Speed control ACC time: 0x6071, 16-bit data, 3 decimal places, 0.001s
- Speed control DEC time: 0x6072, 16-bit data, 3 decimal places, 0.001s

For details, see the Goodrive350 series VFD communication card manual.

A.6 PG extension cards

A.6.1 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:

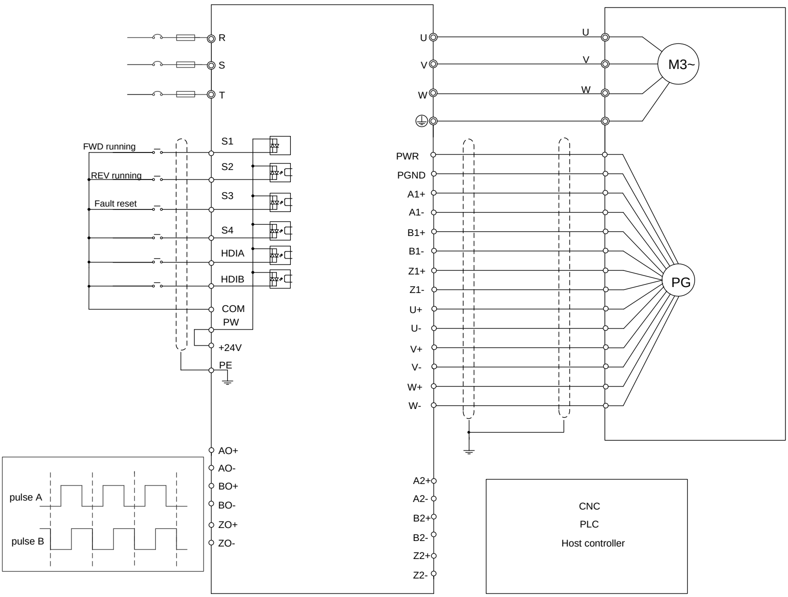
Indicator	Definition	Function
LED1	Disconnection indicator	This indicator is off when A1 and B1 of the encoder are disconnected; it blinks when C1 and D1 of the encoder are disconnected; and it is on when the encoder signals are normal.
LED2	Power indicator	This indicator is on after the control board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

EC-PG502 terminal function description:

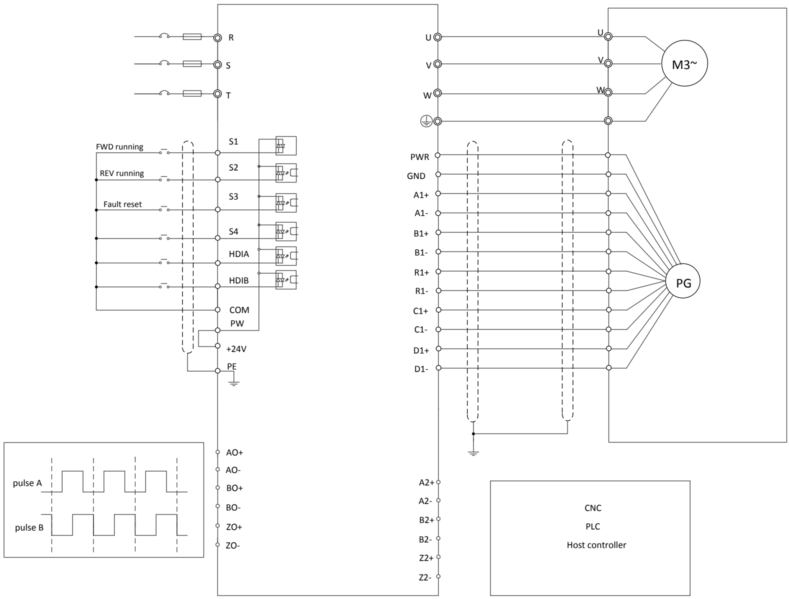
Signal	Port	Description
PE	Grounding terminal	It is connected to the ground for enhancing the anti-interference performance.
PWR	Encoder power	Voltage: 5V ± 5% Max. output current: 150mA
GND		
A1+	Encoder interface	1. Supporting Sin/Cos encoders (with CD signal or without CD signal) 2. SINA/SINB/SINC/SIND 0.6–1.2Vpp; SINR 0.2–0.85Vpp 3. Max. frequency response of A/B signals: 200kHz Max. frequency response of C/D signals: 1kHz.
A1-		
B1+		
B1-		
R1+		
R1-		
C1+		
C1-		
D1+		
D1-		
A2+	Pulse reference	1. Supporting 5V differential signal 2. Response frequency: 200 kHz
A2-		
B2+		
B2-		
Z2+		
Z2-		
AO+	Frequency-divided	1. Differential output of 5V;

Signal	Port	Description
AO-	output	2. Supporting frequency division of 2^N, which can be set through P20.16 or P24.16; Max. output frequency: 200 kHz
BO+		
BO-		
ZO+		
ZO-		

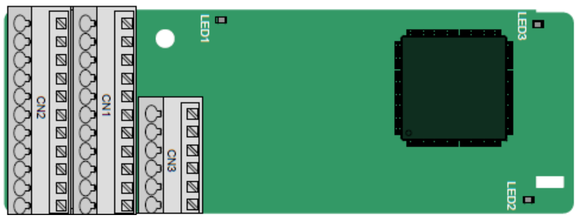
The following figure shows the external wiring of the PG card when it is used in combination with an encoder without CD signals.



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



A.6.2 UVW incremental PG card (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 during encoder rotating; and it is on in other cases.
LED2	Status indicator	On: The expansion card is connecting with the control board. Blinking periodically (the period is 1s, on for 0.5s, and off for the

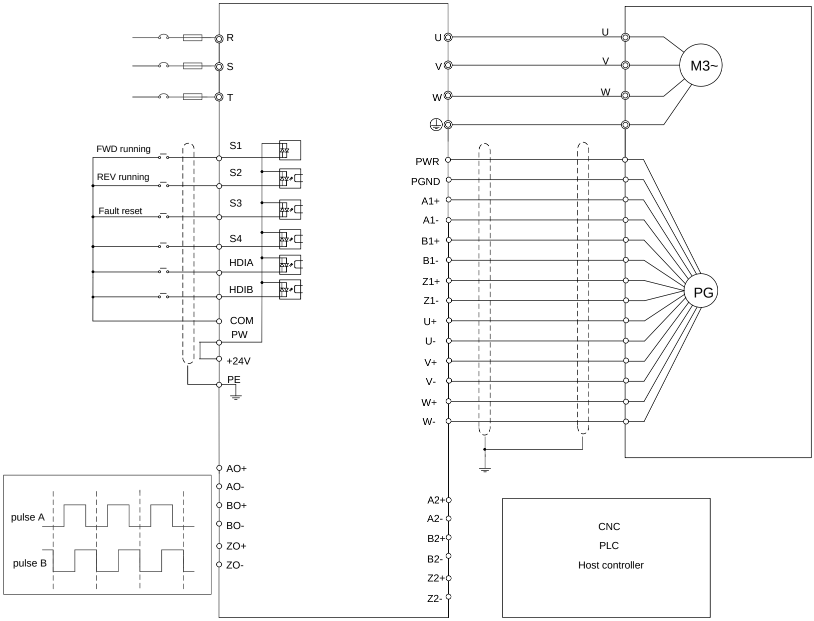
Indicator	Definition	Function
		other 0.5s): The expansion card is properly connected to the control board. Off: The expansion card is disconnected from the control board.
LED3	Power indicator	This indicator is on after the control board feeds power to the PG card.

The EC-PG503-05 extension card supports the input of absolute position signals and integrates the advantages of absolute and incremental encoders. It is user-friendly, adopting spring terminals.

EC-PG503-05 terminal function description:

Signal	Port	Description
PE	Grounding terminal	It is connected to the ground for enhancing the anti-interference performance.
PGND	Ground	Ground of PCB internal power
PWR PGND	Encoder power	Voltage: 5V ± 5% Max. current: 200mA (PGND is isolation power ground).
A1+ A1- B1+ B1- Z1+ Z1-	Encoder interface	1. Differential incremental PG interface of 5 V 2. Response frequency: 400kHz
A2+ A2- B2+ B2- Z2+ Z2-	Pulse reference	1. Differential input of 5V 2. Response frequency: 200 kHz
AO+ AO- BO+ BO- ZO+ ZO-	Frequency-divided output	1. Differential output of 5V 2. Supporting frequency division of 1–255, which can be set through P20.16 or P24.16
U+ U- V+ V- W+ W-	UVW encoder interface	1. Absolute position (UVW information) of the hybrid encoder, differential input of 5V 2. Response frequency: 40kHz

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



A.6.3 Resolver PG card (EC-PG504-00)

The terminals are arranged as follows:

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 connecting with the control board. Blinking periodically (the period is 1s, on for 0.5s, and off for the other 0.5s): The expansion card is properly connected to the control board. Off: The expansion card is disconnected from the control board.

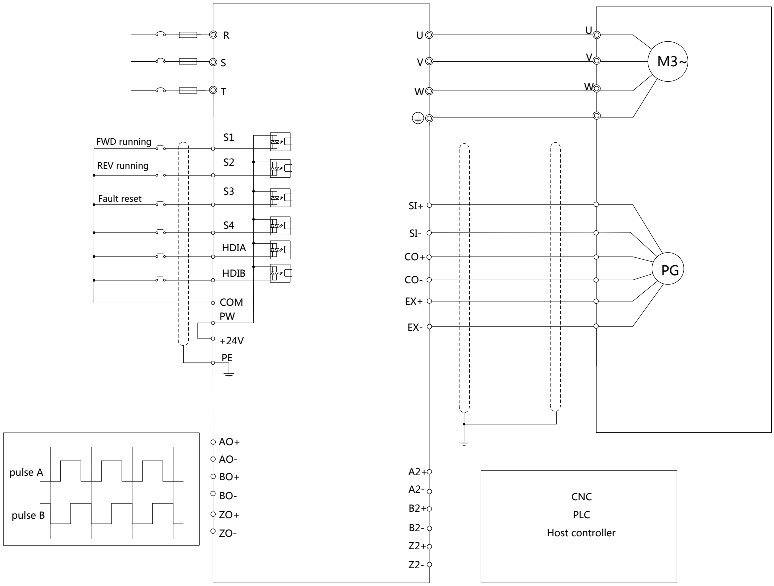
Indicator	Definition	Function
LED2	Disconnection indicator	This indicator is off when the encoder is disconnected; it is on when the encoder signals are normal; and it blinks when the encoder signals are not stable.
LED3	Power indicator	This indicator is on after the control board feeds power to the PG card.

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

EC-PG504-00 terminal functions:

Signal	Port	Description
PE	Grounding terminal	It is connected to the ground for enhancing the anti-interference performance.
PWR	Output power supply	Voltage 5V±5%
GND		
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. Supporting resolvers with an excitation voltage of 7Vrms
EX-		
A2+	Pulse reference	1. Differential input of 5V 2. Response frequency: 200 kHz
A2-		
B2+		
B2-		
Z2+		
Z2-		
AO+	Frequency-divided output	1. Differential output of 5 V 2. Frequency-divided output of resolver simulated A1, B1, and Z1, which is equal to an incremental PG card of 1024pps. Supporting frequency division of 2N, which can be set through P20.16 or P24.16. Max. output frequency: 200kHz
AO-		
BO+		
BO-		
ZO+		
ZO-		

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



A.6.4 Multi-function incremental PG card (EC-PG505-12)

The terminals are arranged as follows:

The dual in-line package (DIP) switch SW1 is used to set the voltage class (5V or 12V) of the power supply of the encoder. The DIP switch can be operated with an auxiliary tool.

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
LED3	Status indicator	On: The expansion card is connecting with the control board. Blinking periodically (the period is 1s, on for 0.5s, and off for the other 0.5s): The expansion card is properly connected to the control board. Off: The expansion card is disconnected from the control board.

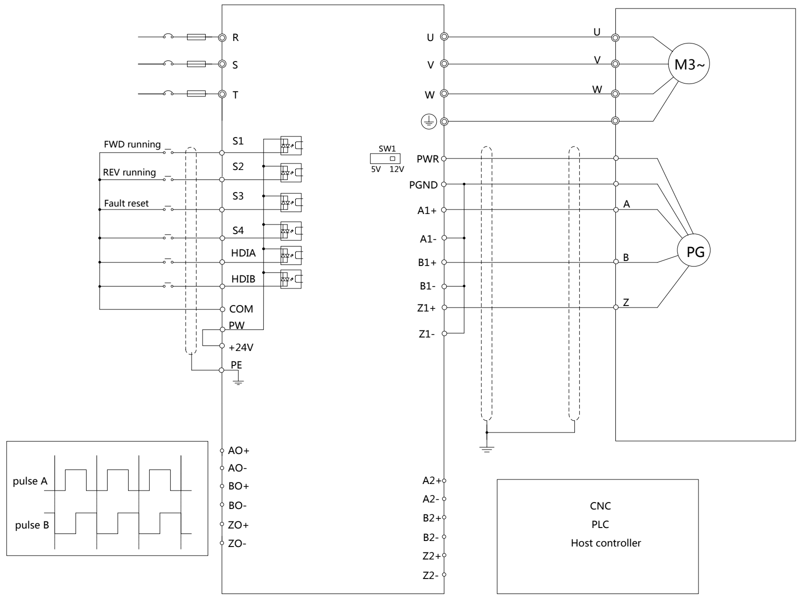
Indicator	Definition	Function
LED1	Signal indicator	On: Other cases Blinking (On: 0.5s; Off: 0.5s): A1 or B1 signal is disconnected during encoder rotating.
LED2	Power indicator	On: The expansion card is powered on. Off: The expansion card is not powered on.

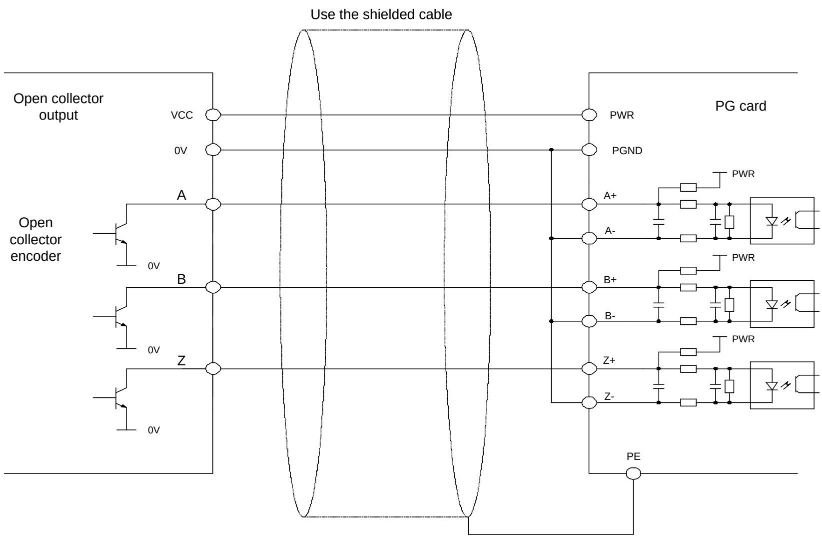
The EC-PG505-12 extension card can be used in combination with multiple types of incremental encoders through different modes of wiring. It is user-friendly, adopting spring terminals.

EC-PG505-12 terminal function description:

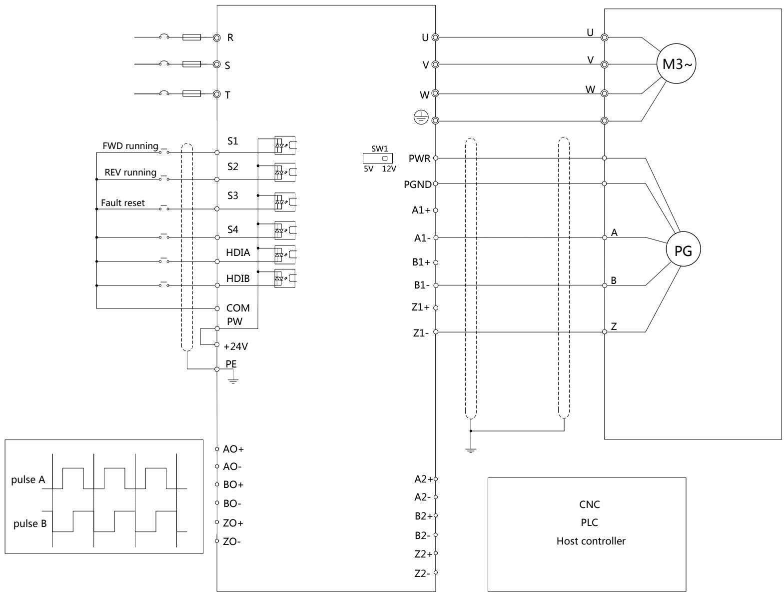
Signal	Port	Description
PE	Grounding terminal	It is connected to the ground for enhancing the anti-interference performance.
PGND	Ground	Ground of PCB internal power
PWR PGND	Encoder power	Voltage: 5V/12V ± 5% Max. output: 150 mA Select the voltage class through SW1 based on the voltage class of the used encoder. (PGND is the isolation power ground.)
A1+ A1- B1+ B1- Z1+ Z1-	Encoder interface	1. Applicable to 5V/12V push-pull encoders 2. Applicable to 5V/12V OC encoders 3. Applicable to 5V differential encoders 4. Response frequency: 200 kHz
A2+ A2- B2+ B2- Z2+ Z2-	Pulse reference	1. Supporting the same signal types as the encoder signal types 2. Response frequency: 200 kHz
AO+ AO- BO+ BO- ZO+ ZO-	Frequency-divided output	1. Differential output of 5V 2. Supporting frequency division of 1–255, which can be set through P20.16 or P24.16.

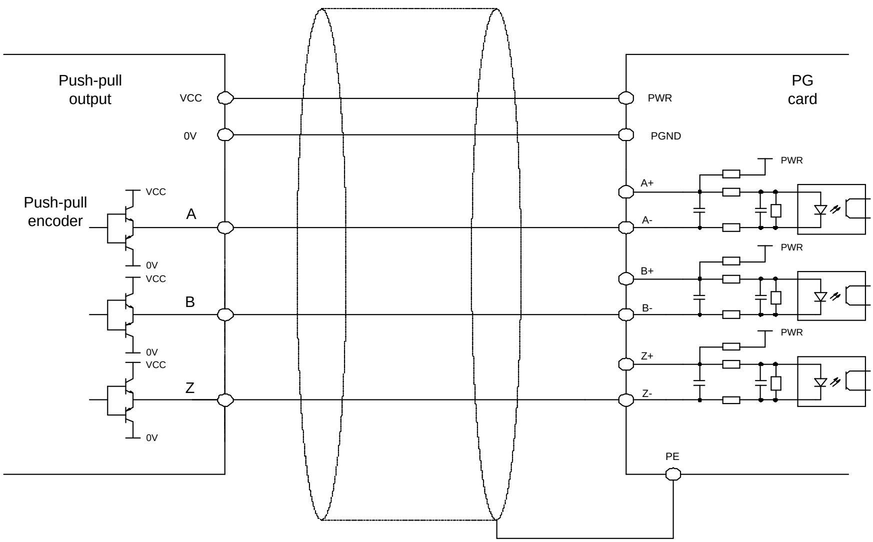
The following figure shows the external wiring when the expansion card is used in combination with an open collector encoder. A pull-up resistor is configured inside the PG card.



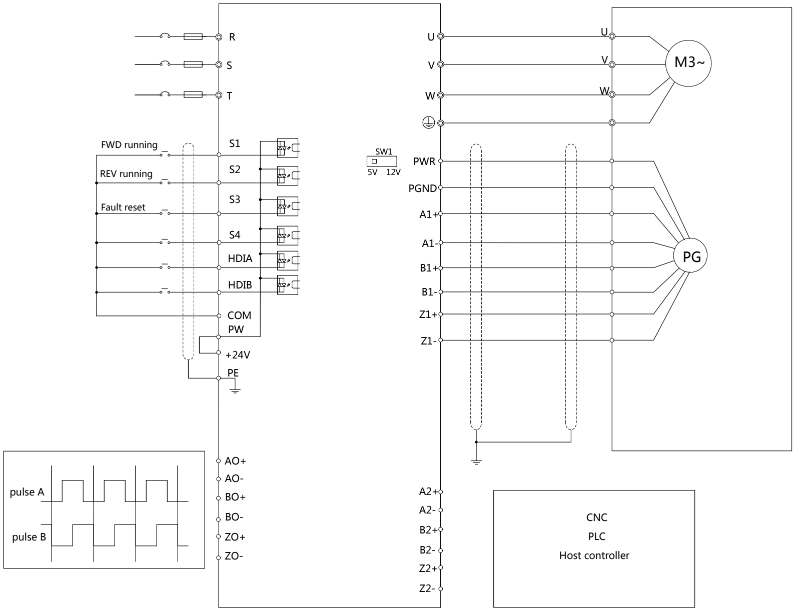


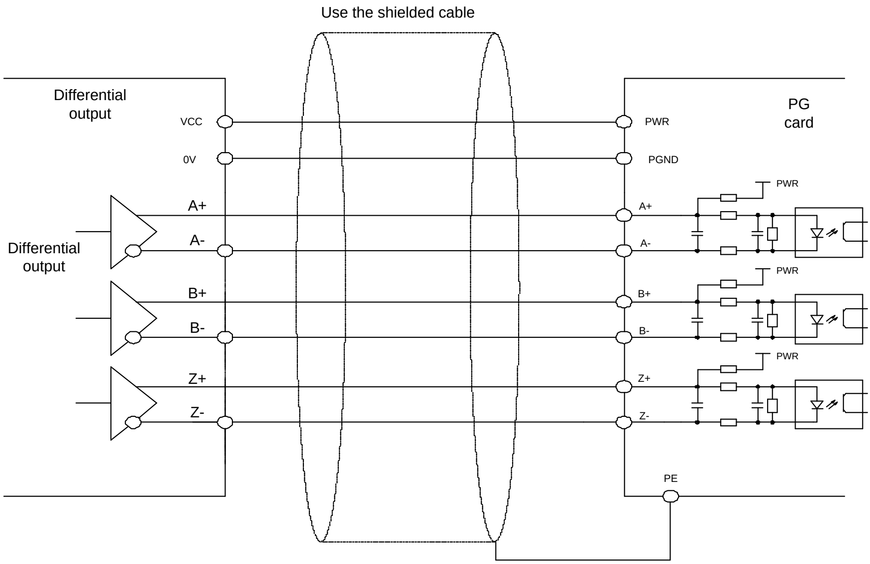
The following figure shows the external wiring when the expansion card is used in combination with a push-pull encoder.



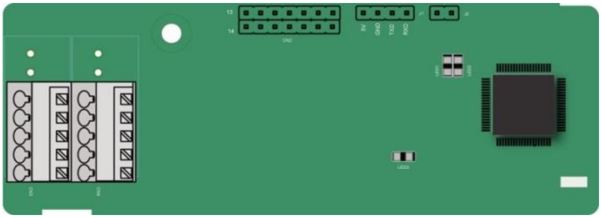


The following figure shows the external wiring when the expansion card is used in combination with a differential encoder.





A.6.5 Simplified incremental PG card (EC-PG507-12)



The terminals are arranged as follows:

The dual in-line package (DIP) switch SW1 is used to set the voltage class (5V or 12V) of the power supply of the encoder. The DIP switch can be operated with an auxiliary tool.

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

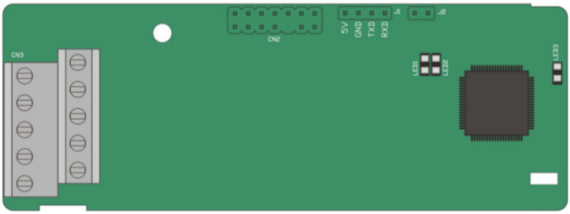
Indicator definition:

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

EC-PG507-12 can work in combination with multiple types of incremental encoders through various external wiring modes, which are similar to the wiring modes of EC-PG505-12. EC-PG507-12 terminal function description:

Signal	Port	Description
PE	Grounding terminal	It is connected to the ground for enhancing the anti-interference performance.
PWR	Encoder power	Voltage: 5V/12V ± 5% Max. output: 150 mA Select the voltage class through SW1 based on the voltage class of the used encoder. (PGND is the isolation power ground.)
PGND		
A1+	Encoder interface	1. Applicable to 5V/12V push-pull encoders 2. Applicable to 5V/12V OC encoders 3. Applicable to 5V differential encoders 4. Response frequency: 400kHz 5. Supporting the encoder cable length of up to 50m
A1-		
B1+		
B1-		
Z1+		
Z1-		

A.6.6 24V simplified incremental PG card (EC-PG507-24)



The terminals are arranged as follows:

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

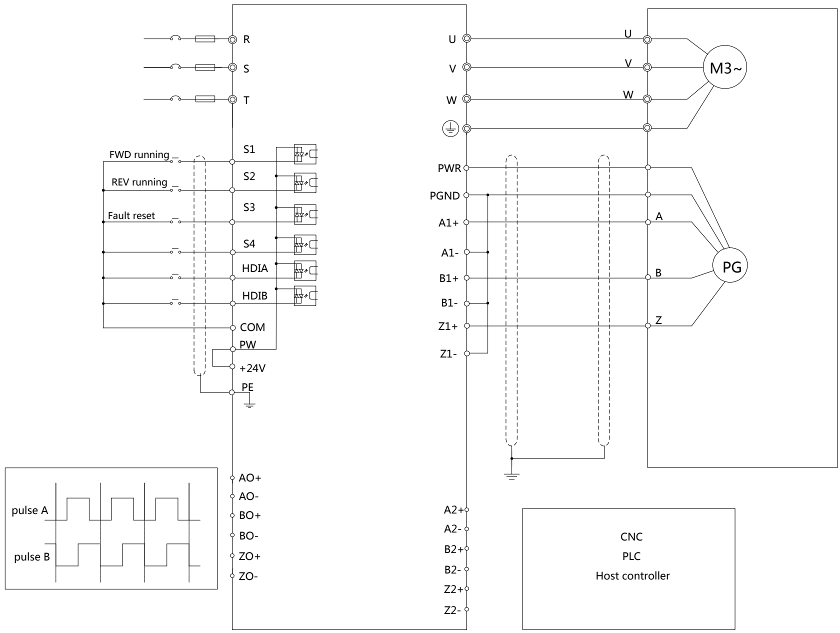
Indicator definition:

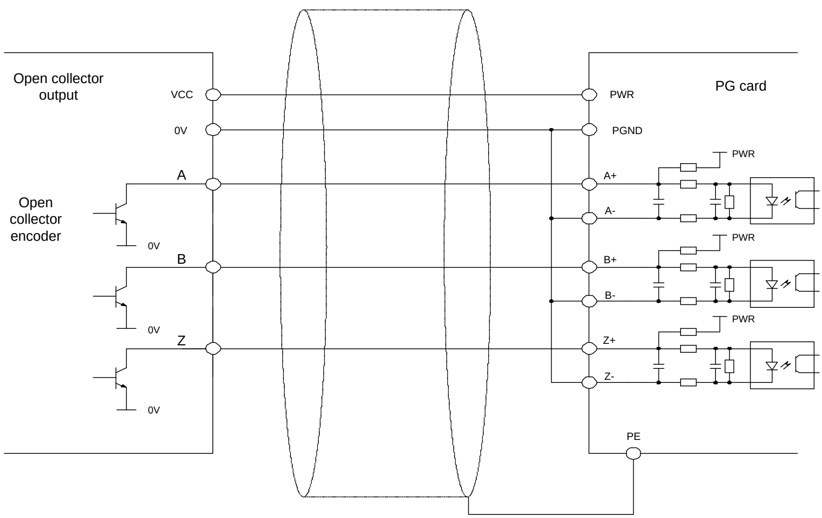
Indicator	**Definition**	**Function**
LED1	Status indicator	On: The expansion card is connecting with the control board. Blinking periodically (the period is 1s, on for 0.5s, and off for the other 0.5s): The expansion card is properly connected to the control board. Off: The expansion card is disconnected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

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

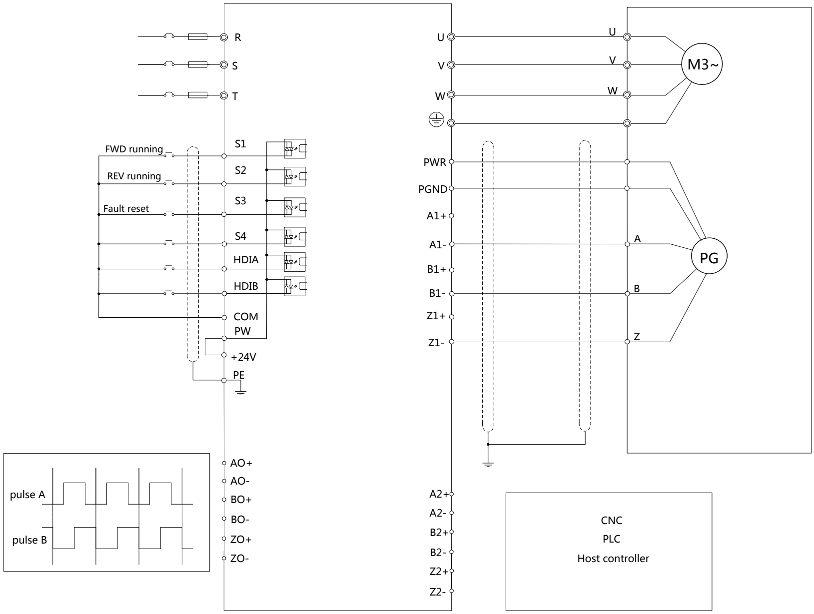
Signal	**Port**	**Description**
PE	Grounding terminal	It is connected to the ground for enhancing the anti-interference performance.
PWR	Encoder power	Voltage: 24V ± 5% Max. output current: 150mA (PGND is the isolation power ground.)
PGND		
A1+	Encoder interface	1. Applicable to 24V push-pull encoders 2. Applicable to 24V OC encoders 3. Applicable to 24V differential encoders 4. Response frequency: 200 kHz 5. Supporting the encoder cable length of up to 100m
A1-		
B1+		
B1-		
Z1+		
Z1-		

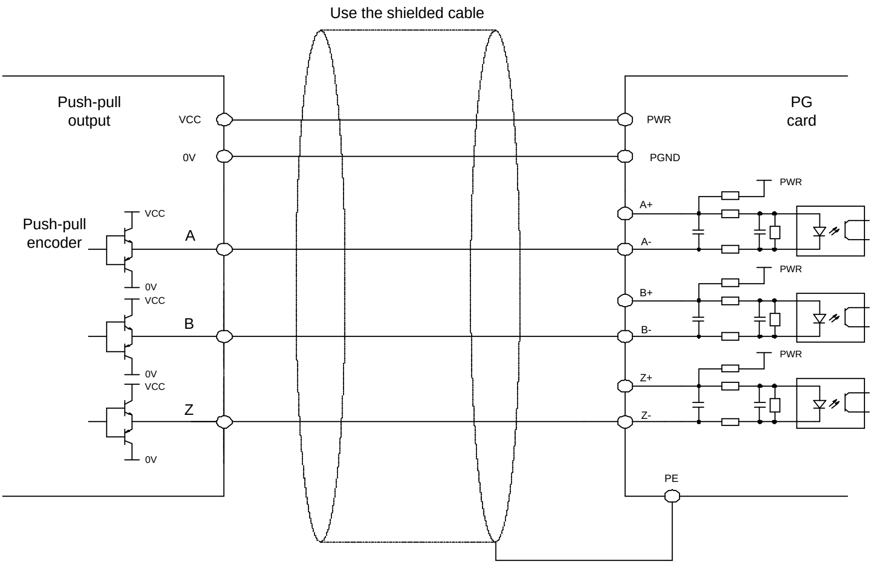
The following figure shows the external wiring when the expansion card is used in combination with an open collector encoder. A pull-up resistor is configured inside the PG card.



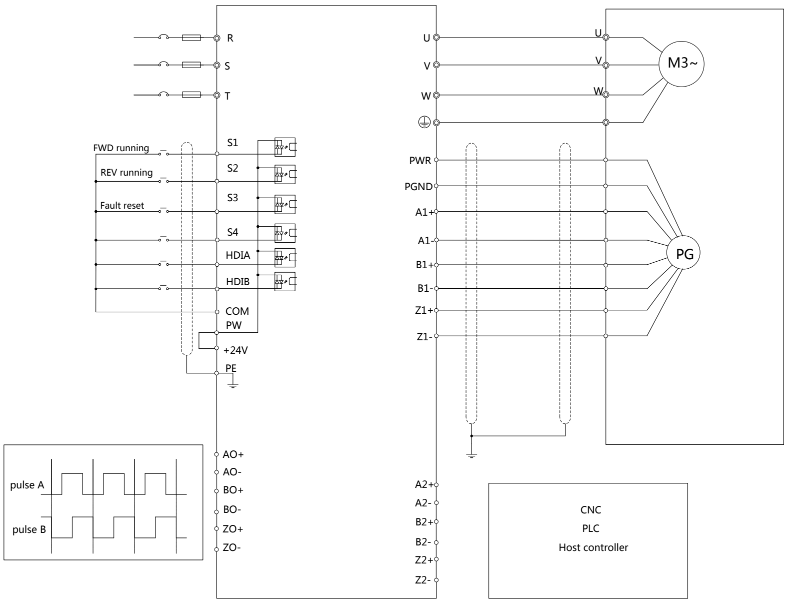


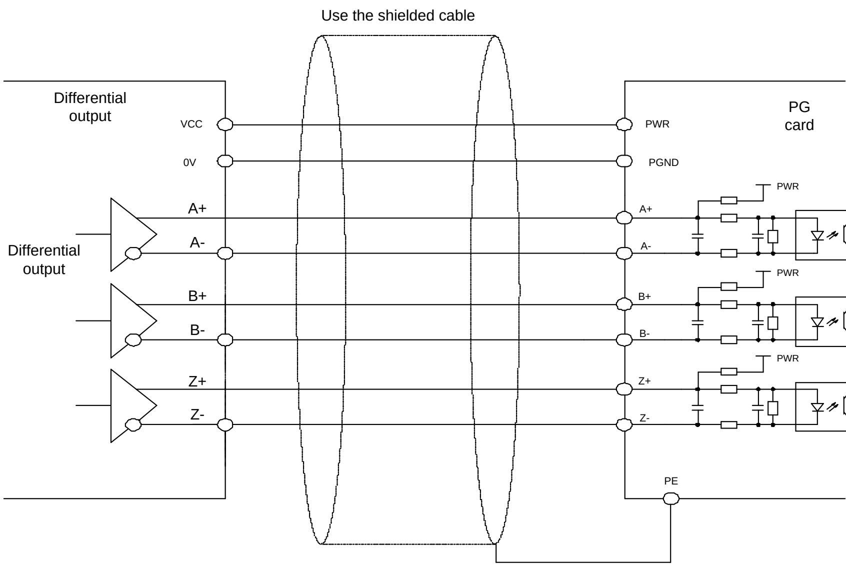
The following figure shows the external wiring when the expansion card is used in combination with a push-pull encoder.



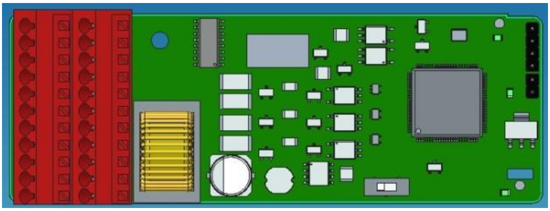


The following figure shows the external wiring when the expansion card is used in combination with a differential encoder.





A.6.7 24V multi-function incremental PG card (EC-PG505-24B)



Terminal function description:

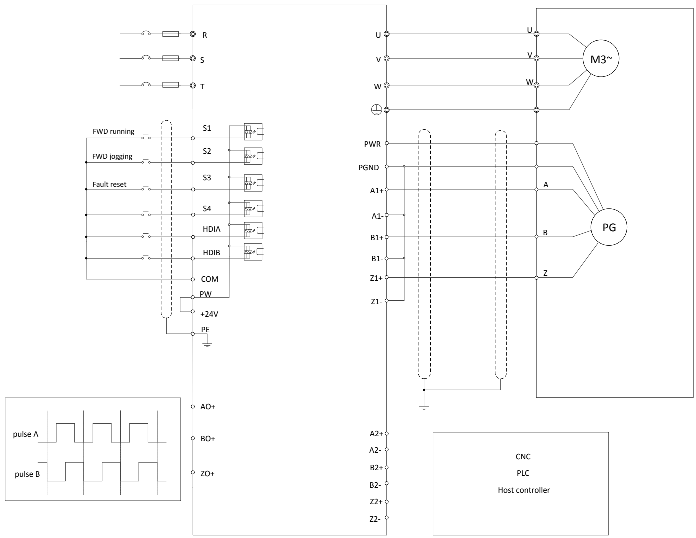
Symbol	Name	Function description
PWR	Encoder power	Voltage: 24V ± 5% Max. output current: 150mA
PGND		
A1+	Encoder interface	● Applicable to 24V push-pull encoders ● Applicable to 24V OC encoders ● Applicable to 24V differential encoders ● Response frequency: 400kHz
A1-		
B1+		
B1-		
Z1+		
Z1-		
A2+	Pulse reference	● Supporting the same signal types as the encoder signal types ● Applicable to 5V differential encoders (Differential signal requires different COMs) ● Response frequency: 400kHz
A2-		
B2+		
B2-		
Z2+		
Z2-		
AO+	Frequency-divided output	● Supporting open collector output with a pull-up resistor externally connected to the input port ● Supporting frequency division of 1–255, which can be set through P20.16 or P24.16 ● Supporting frequency-divided output source selection, which can be set through P20.17 or P24.17
BO+		
ZO+		

Indicator definition:

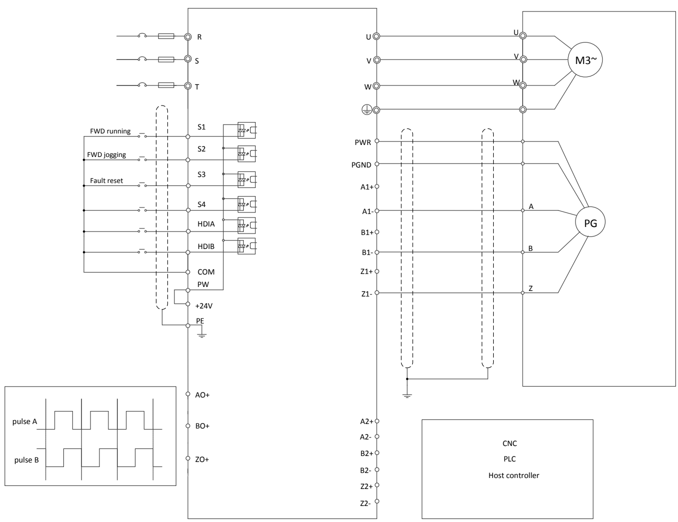
Symbol	Name	Description
LED1	Signal indicator	On: Other cases Blinking (On: 0.5s; Off: 0.5s): A1 or B1 signal is disconnected during encoder rotating.
LED2	Power indicator	On: The expansion card is powered on. Off: The expansion card is not powered on.
LED3	Status indicator	On: The expansion card is connecting with the control board. Blinking (On: 0.5s; Off: 0.5s): The expansion card is connected with the control board. Off: The expansion card is disconnected from the control board.

The EC-PG505-24B expansion card adopts spring terminals. AO-, BO-, ZO- have been short connected internally. The 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. The wiring methods are as follows.

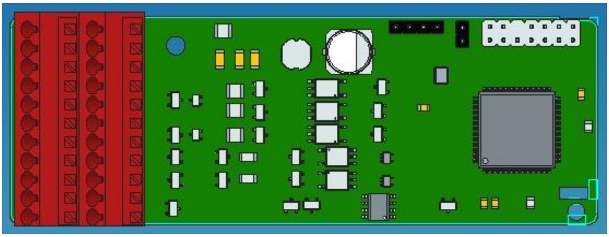
External wiring diagram for use with an open collector encoder



External wiring diagram for use with a push-pull encoder



A.6.8 Absolute encoder SSI communication PG card (EC-PG508-05B)



The terminals are arranged as follows:

PE	AO+	BO+	ZO+	A2+	B2+	Z2+	Da+	CK+	A1+	B1+
PGND	PGND	+24V	+5V	A2-	B2-	Z2-	Da-	CK-	A1-	B1-

Indicator definition:

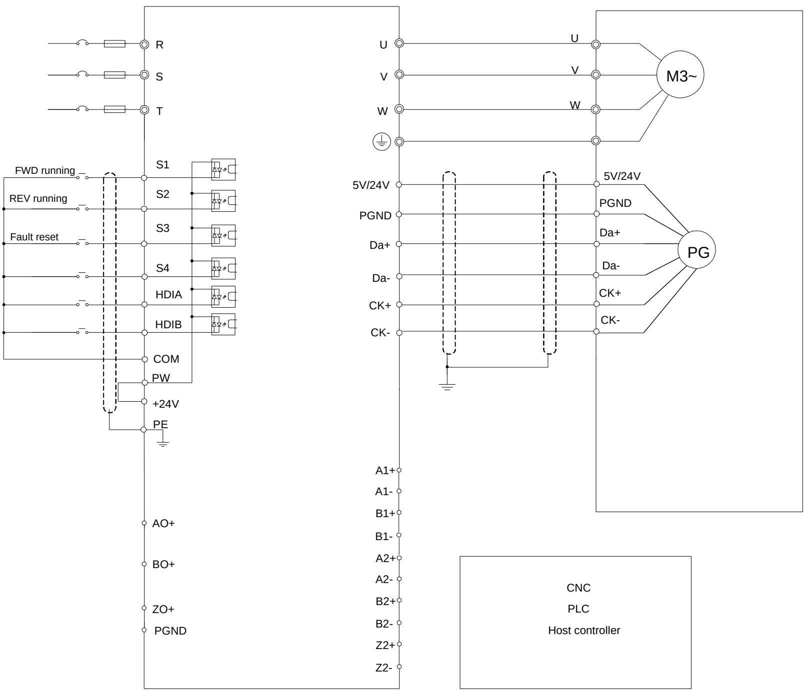
Indicator	Definition	Function
LED1	Status indicator	On: The expansion card is connecting with the control board. Blinking periodically (the period is 1s, on for 0.5s, and off for the other 0.5s): The expansion card is properly connected to the control board. Off: The expansion card is disconnected from the control board.
LED2	Reserved	/
LED3	Power indicator	This indicator is on after the control board feeds power to the expansion card.

EC-PG508-05B terminal function description:

Signal	Port	Description
5V	Encoder power	Voltage: 5.2V ± 5% Max. output current: 150mA
PGND		
24V		Voltage: 24V ± 5% Max. output current: 100mA
PGND		
PE	Encoder shield ground	It is recommended to ground the two ends of the shielded wire.
Da+	Encoder interface	SSI signal, 5V differential input, interrupted clock signal synchronization, with clock frequency up to 736k
Da-		
CK+		
CK-		
A1+	Reserved	/
A1-		
B1+		
B1-		

Signal	Port	Description
A2+	Incremental input signal	1. Supporting 5V differential, 24V push-pull, OC encoder signals 2. Response frequency: 400kHz
A2-		
B2+		
B2-		
Z2+		
Z2-		
AO+	Frequency-divided output	1. Supporting open collector output 2. Response frequency: 400kHz 3. Supporting frequency-divided output source selection, which can be set through the corresponding function code
BO+		
ZO+		

The following figure shows the SSI card absolute signal encoder wiring when P21.34=0x3010 (SSI card inserted at slot 2).



In fully closed-loop wiring diagram, P21.34=0x2010 (SSI card inserted at slot 2), three types of input signal encoders are supported: 5V differential incremental encoder, 24V push-pull output incremental encoder, and 24V collector open incremental encoder.

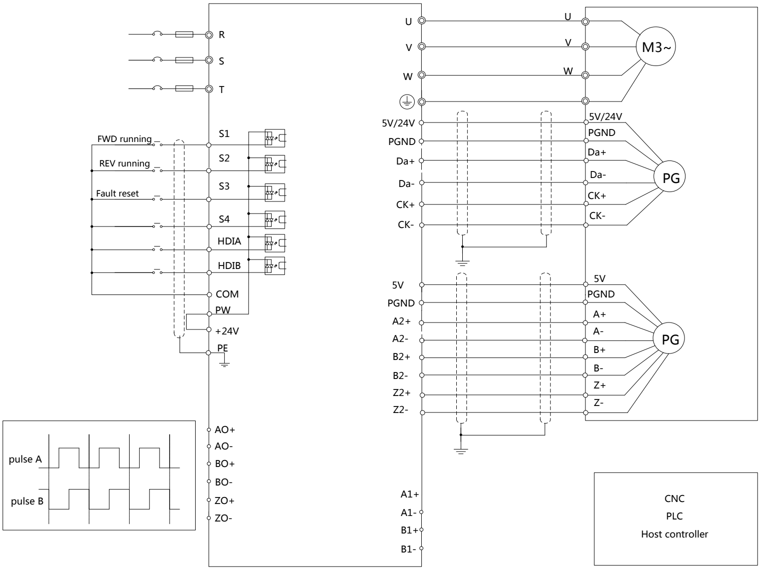


Figure A-6 Wiring of an SSI absolute encoder and 5V differential incremental encoder in a fully closed-loop mode

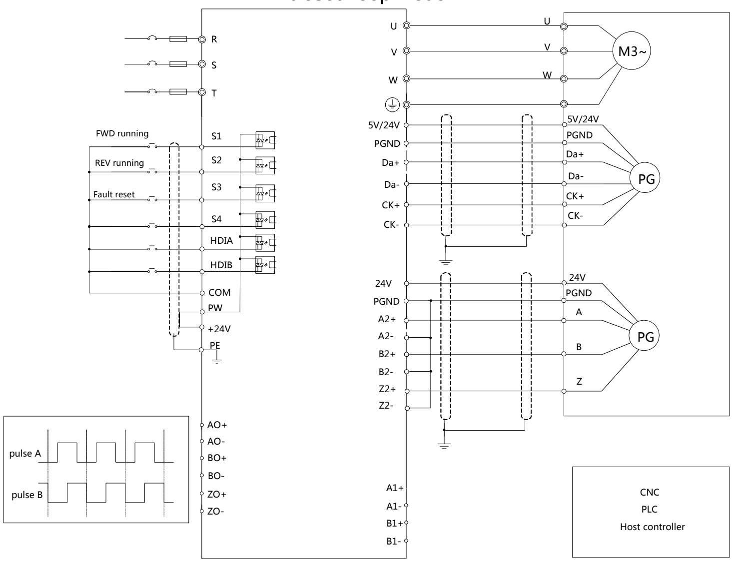


Figure A-7 Wiring of an SSI absolute encoder and 24V open collector incremental encoder in a fully closed-loop mode

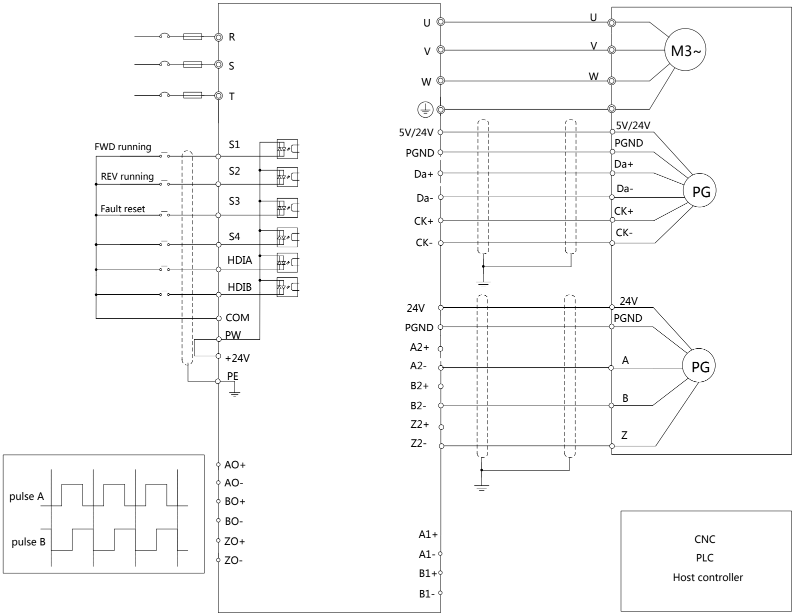
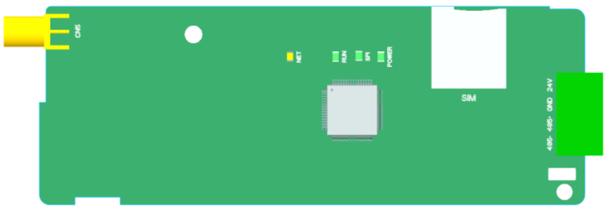


Figure A-8 Wiring of an SSI absolute encoder and 24V push-pull incremental encoder in a fully closed-loop mode

For the method of connecting the SSI card to an incremental encoder, refer to the preceding three wiring methods in a fully closed-loop mode.

A.7 IoT expansion card

A.7.1 4G expansion card (EC-IC502-2-CN/EC-IC502-2-EU/EC-IC502-2-LA)



Terminal symbol and meaning

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

Indicator meaning:

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

A.8 Power supply expansion cards

A.8.1 24V power supply expansion card (EC-PS501-24)

Indicator definition:

Indicator	Definition	Function
LED1	24V power indicator	Indicator for the external 24V power.
LED2	5V power indicator	Indicator for the 5V power that is provided for the control board after the switch power converts external power.

Note: The 24V power supply card is mainly used to connect to external 24V power to power the control board, avoiding to apply electricity for independent control board commissioning. During wiring, connect to +24V and COM according to the CN2 sign.

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 ensure the rated power of the motor, the rated output current of the VFD must be larger or equal to the rated current of the motor. The rated power of the VFD must be higher or equal to that of the motor.

Note:

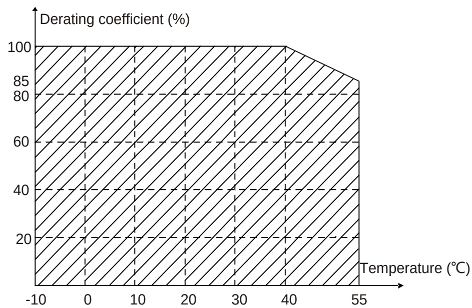
- The maximum allowable shaft power of the motor is limited to 1.5 times the rated power of the motor. If the limit is exceeded, the VFD automatically restricts the torque and current of the motor. This function effectively protects the input shaft against overload.
- The rated capacity is the capacity at the ambient temperature of 40°C.
- You need to check and ensure that the power flowing through the common DC connection in the common DC system does not exceed the rated power of the motor.

B.2.2 Derating

If the ambient temperature on the site where the inverter is installed exceeds 40°C, the altitude exceeds 1000m, or the carrier frequency is changed from 4 kHz to 8, 12, or 15 kHz, the VFD needs to be derated.

B.2.2.1 Derating due to temperature

When the temperature ranges from 40°C to 55°C, the rated output current is derated by 1% for each increased 1°C. For the actual derating, see the following figure.



Note: It is not recommended to use the VFD at an environment with the temperature higher than 55°C. If you do, you shall be held accountable for the consequences caused.

B.2.2.2 Derating due to altitude

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

B.2.2.3 Derating due to carrier frequency

The carrier frequency of the VFD varies with power class. The VFD rated power is defined based on the carrier frequency factory setting. If the carrier frequency exceeds the factory setting, the VFD power is derated by 10% for each increased 1 kHz.

B.3 Grid specifications

Grid voltage	AC 3PH 380V–480V
Short-circuit capacity	According to the definition in IEC 61439-1, the maximum allowable short-circuit current at the incoming end is 100 kA. Therefore, the VFD is applicable to scenarios where the transmitted current in the circuit is no larger than 100kA when the VFD runs at the maximum rated voltage.
Frequency	50/60Hz±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	0–400Hz
Frequency resolution	0.01Hz
Current	See section 3.6 Product ratings.
Power limit	1.5 times of the motor rated power
Field-weakening point	10–400Hz
Carrier frequency	4, 8, 12, or 15kHz

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 30844.1-2014	General-purpose variable-frequency adjustable-speed equipment of 1 kV and lower—Part 1: Technical conditions
GB/T 30844.2-2014	General-purpose variable-frequency adjustable-speed equipment of 1 kV and lower—Part 2: Test methods
GB/T 30844.3-2017	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 electric and electrical devices sold in Europe cannot generate electromagnetic disturbance that exceeds the limits stipulated in related standards, and can work properly in environments with certain electromagnetic interference. The EM product standard (EN 61800-3) describes the EMC standards and specific test methods for adjustable speed electrical power drive systems. Our products have been compliant with these EMC regulations.

B.6 EMC regulations

The EMC product standard (EN 61800-3) describes the EMC requirements on VFDs.

Application environment categories:

First environment: Civilian environment, including application scenarios where VFDs are directly connected to the civil power supply low-voltage grids without intermediate transformers.

Second environment: All environments except those in Category I.

VFD categories:

Category C1: VFD of rated voltage lower than 1000V, applied to the first environment.

C2: Rated voltage lower than 1000 V, non-plug, socket, or mobile devices; power drive systems that must be installed and operated by specialized personnel when applied to environments of Category I

Note: The EMC standard IEC/EN 61800-3 no longer restricts the power distribution of VFDs, but it specifies their use, installation, and commissioning. 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.

Category C3: VFD of rated voltage lower than 1000V, applied to the second environment. They cannot be applied to the first environment.

Category C4: VFD of rated voltage higher than 1000V, or rated current higher or equal to 400A, applied to complex systems in the second environment.

B.6.1 VFD category of C2

The induction disturbance limit meets the following stipulations:

1. Select an optional EMC filter according to Appendix D Optional peripheral accessories 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.

	✧ The VFD may generate radio interference, you need to take measures to reduce the interference.

B.6.2 VFD category of C3

The anti-interference performance of the VFD meets the requirements of the second environment in the IEC/EN 61800-3 standard.

The induction disturbance limit meets the following stipulations:

1. Select an optional EMC filter according to Appendix D Optional peripheral accessories 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.

	✧ 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.

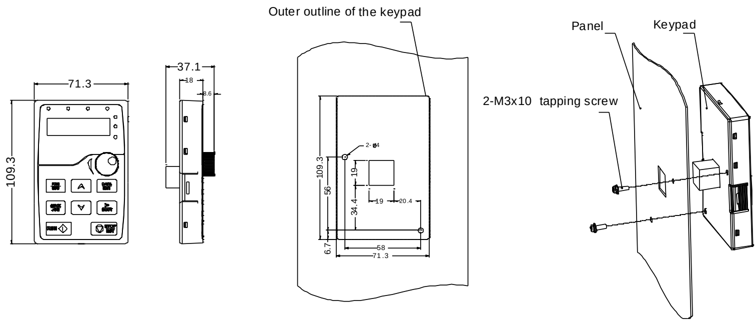
Appendix C Dimension drawings

C.1 What this chapter contains

This chapter provides the dimension drawings of the VFD, which uses millimeter (mm) as the unit.

C.2 LED keypad

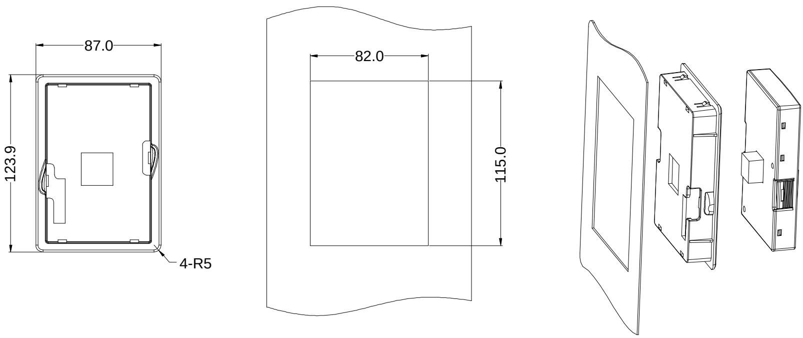
C.2.1 Structure diagram



Installation hole dimensions and diagram for keypad installation without bracket

C.2.2 Keypad mounting bracket

Note: The external keypad can be mounted directly with M3 threaded screws or with a keypad mounting bracket. For 380V 30–75kW VFD models, the keypad mounting bracket is an optional part. For 380V 90–500kW VFD models, you can use optional brackets or use the standard keypad brackets externally.



Keypad adapter bracket Installation dimensions

Figure C-1 Keypad mounting bracket (optional) for 380V 30–500kW models

C.3 VFD structure

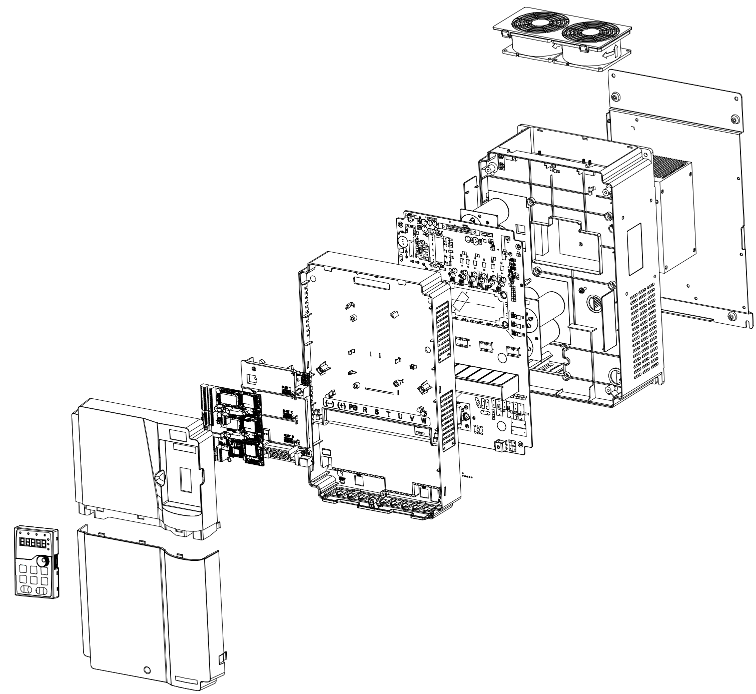


Figure C-2 VFD structure

C.4 AC 3PH 380V–480V VFD dimensions

C.4.1 Wall-mounting dimensions

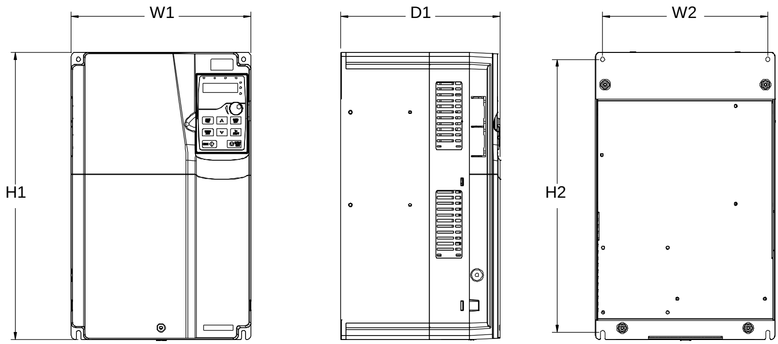


Figure C-3 Wall mounting for 380V 30–37kW VFD models

VFD model	Outline dimensions (mm)			Mounting hole distance (mm)		Hole diameter (mm)	Fixing screw	Net weight (kg)	Gross weight (kg)
	W1	H1	D1	W2	H2				
30–37kW	250	400	223	230	380	Ø6	M5	16	17

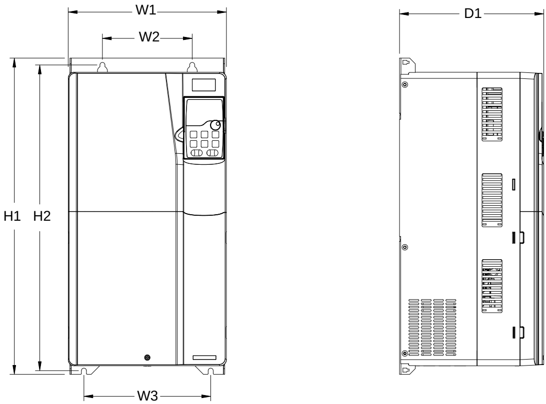


Figure C-4 Wall mounting for 380V 45–37kW VFD models

VFD model	Outline dimensions (mm)			Mounting hole distance (mm)			Hole diameter (mm)	Fixing screw	Net weight (kg)	Gross weight (kg)
	W1	H1	D1	W2	W3	H2				
45–75kW	282	560	258	160	226	542	Ø9	M8	25	29

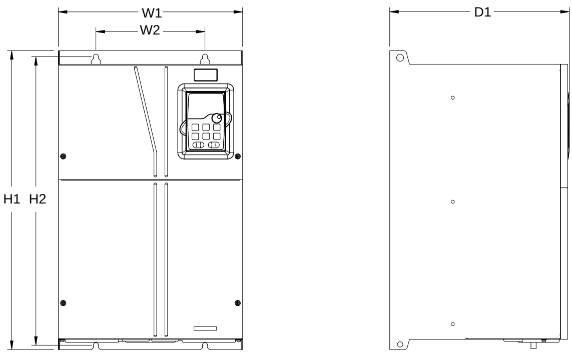


Figure C-5 Wall mounting for 380V 90–110kW VFD models

VFD model	Outline dimensions (mm)			Mounting hole distance (mm)		Hole diameter (mm)	Fixed Screw	Net weight (kg)	Gross weight (kg)
	W1	H1	D1	W2	H2				
90–110kW	338	554	330	200	535	Ø9.5	M8	41	52

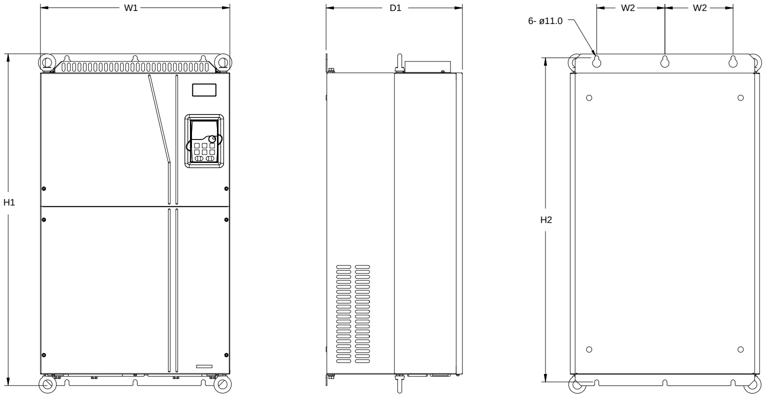


Figure C-6 Wall-mounting diagram for 380V 132–200kW VFD models

VFD model	Outline dimensions (mm)			Mounting hole distance (mm)		Hole diameter (mm)	Fixing screw	Net weight (kg)	Gross weight (kg)
	W1	H1	D1	W2	H2				
132–200kW	500	872	360	180	850	Ø11	M10	85	110

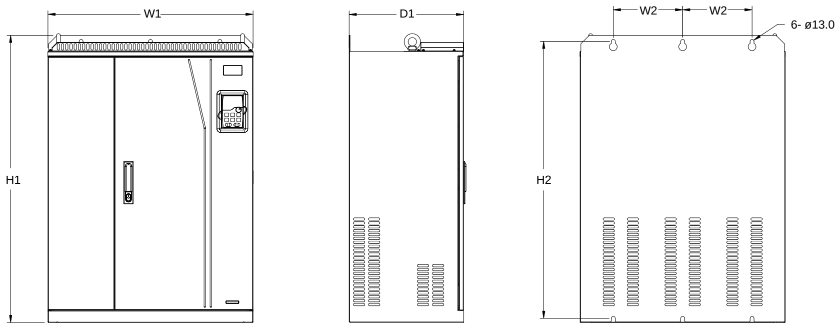


Figure C-7 Wall mounting for 380V 220–315kW VFD models

VFD model	Outline dimensions (mm)			Mounting hole distance (mm)		Hole diameter (mm)	Fixing screw	Net weight (kg)	Gross weight (kg)
	W1	H1	D1	W2	H2				
220–315kW	680	960	380	230	926	Ø13	M12	135	165

C.4.2 Flange mounting dimensions

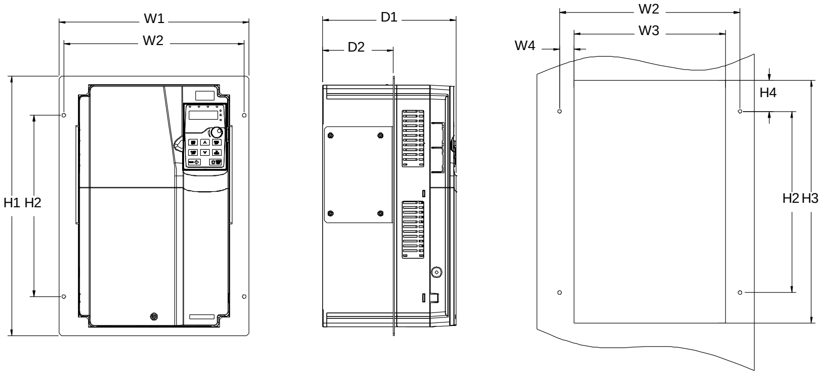


Figure C-8 Flange mounting for 380V 30–75kW VFD models

VFD model	Outline dimensions (mm)			Installation dimension (mm)			Mounting hole distance (mm)				Hole diameter (mm)	Fixing screw	Net weight (kg)	Gross weight (kg)
	W1	H1	D1	W2	H2	D2	W3	H3	W4	H4				
30–37kW	316	430	223	300	300	118.3	274	410	13	55	Ø6	M5	16	17
45–75kW	352	580	258	332	400	133.8	361	570	12	80	Ø9	M8	25	29

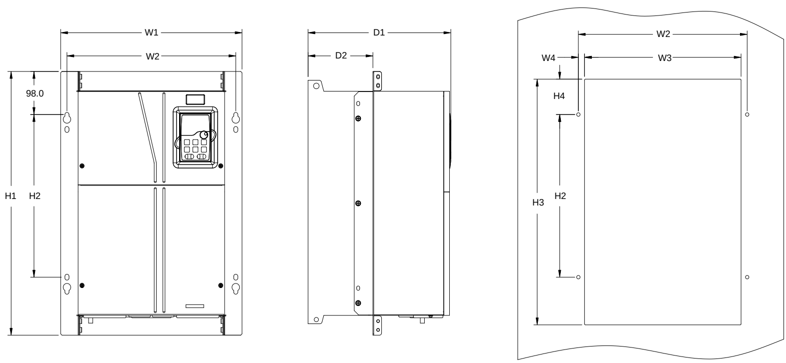


Figure C-9 Flange mounting for 380V 90–110kW VFD models

VFD model	Outline dimensions (mm)			Installation dimension (mm)			Mounting hole distance (mm)				Hole diameter (mm)	Fixing screw	Net weight (kg)	Gross weight (kg)
	W1	H1	D1	W2	H2	D2	W3	H3	W4	H4				
90–110kW	418.5	600	330	389.5	370	149.5	361.1	559	14.2	108.5	Ø9.5	M8	41	52

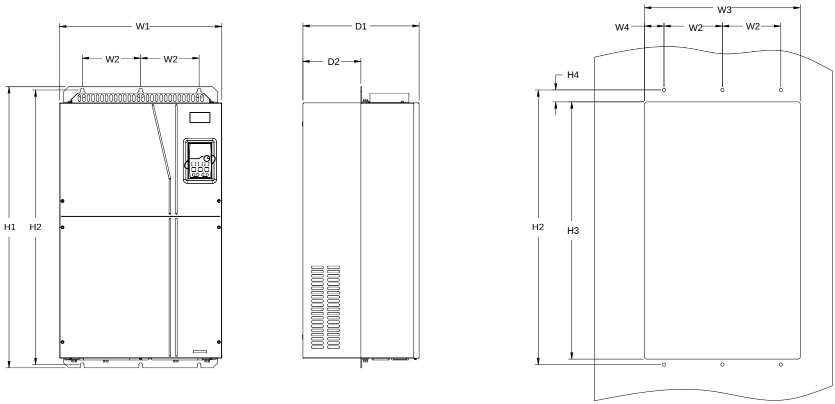


Figure C-10 Flange mounting for 380V 132–200kW VFD models

VFD model	Outline dimensions (mm)			Installation dimension (mm)			Mounting hole distance (mm)				Hole diameter (mm)	Fixing screw	Net weight (kg)	Gross weight (kg)
	W1	H1	D1	W2	H2	D2	W3	H3	W4	H4				
132–200kW	500	872	360	180	850	178.5	480	796	60	37	Ø11	M10	85	110

C.4.3 Floor mounting dimensions

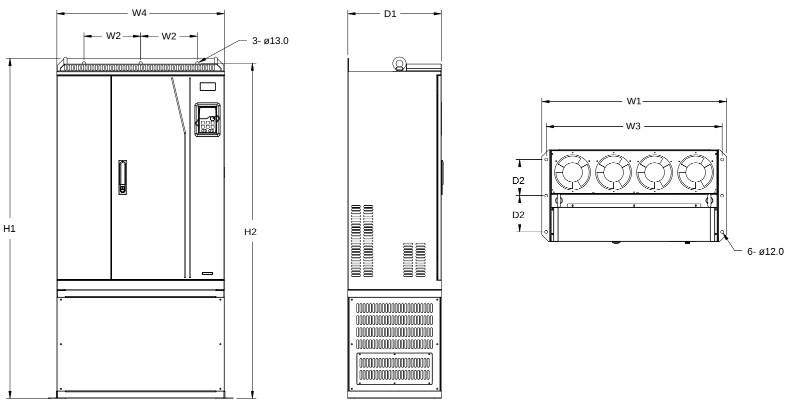


Figure C-11 Floor mounting for 380V 220–315kW VFD models

VFD model	Outline dimensions (mm)				Installation dimension (mm)				Hole diameter (mm)	Fixing screw	Net weight (kg)	Gross weight (kg)
	W1	H1	D1	W4	W2	W3	H2	D2				
220–315kW	750	1410	380	680	230	714	1390	150	Ø13/12	M12/M10	135	165

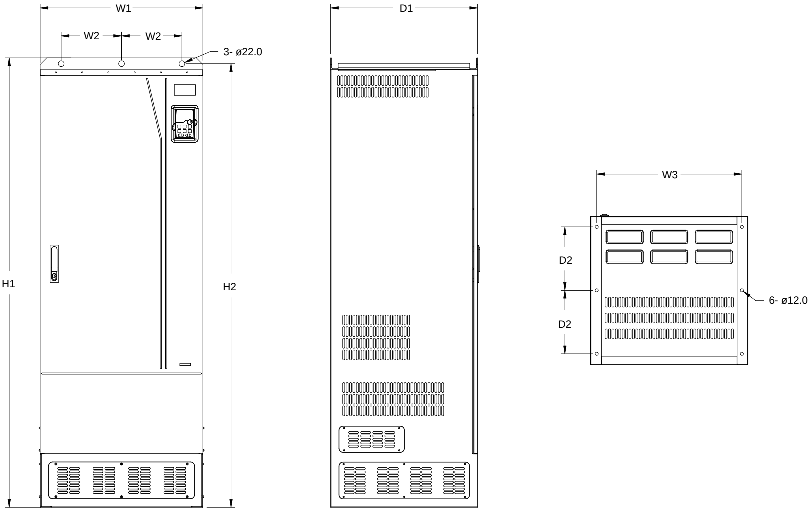


Figure C-12 Floor mounting for 380V 355–500kW VFD models

VFD model	Outline dimensions (mm)			Installation dimension (mm)				Hole diameter (mm)	Fixing screw	Net weight (kg)	Gross weight (kg)
	W1	H1	D1	W2	W3	H2	D2				
355–500kW	620	1700	560	230	572	1678	240	Ø22/12	M20/M10	350	407

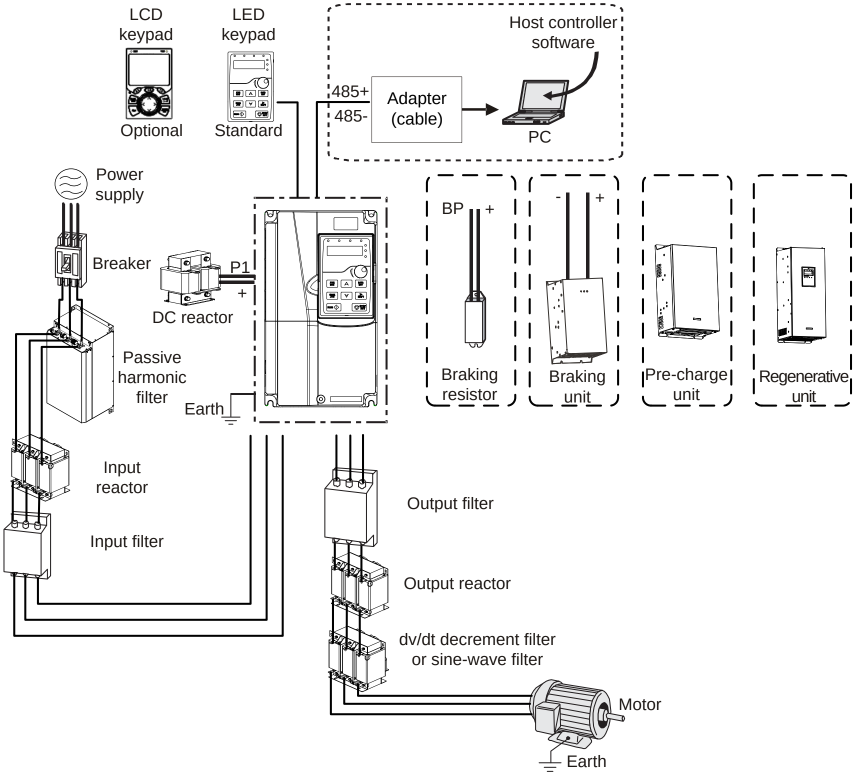
Appendix D Optional peripheral accessories

D.1 What this chapter contains

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

D.2 External wiring

The following figure shows the external wiring of the VFD.



Note:

- The 380V 110kW and lower VFD models are equipped with built-in braking units.
- The 380V 30–110kW VFD models are equipped with built-in DC reactors.
- P1 terminals are equipped only for the 380V 132kW and higher models, 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.

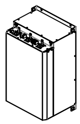
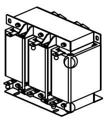
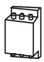
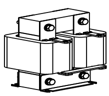
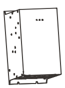
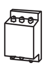
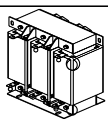
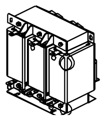
Image	Name	Description
	Cable	Accessory for signal transmission.
	Breaker	Device for electric shock prevention and protection against short-to-ground that may cause current leakage and fire. Select residual-current circuit breakers (RCCBs) that are applicable to VFDs and can restrict high-order harmonics, and of which the rated sensitive current for one VFD is larger than 30 mA.
	Passive harmonic filter	Device used to reduce the current distortion rate and harmonic content, thereby improving the power factor.
	Input reactor	Device used to prevent instantaneous high currents from flowing into the input power circuit and damaging rectifier components when high voltage is input from the power grid. Additionally, it can improve the power factor on the input side.VFDs of 380V 30–110kW are equipped with built-in reactors, and VFDs of 380V 132kW and higher can be directly connected to external DC reactors.
	Input filter	Device that restricts the electromagnetic interference generated by the VFD and transmitted to the public grid through the power cable. Install as close to the input terminal of the VFD as possible.
	DC reactor	Device used to reduce the input side current distortion rate, increase the power factor, and protect the DC bus capacitors. DC reactors can be directly connected to VFDs of 132kW.
 and 	Braking unit and braking resistor	Device used to consume the regenerative energy of the motor to reduce the DEC time. VFDs of 380V 110kW and lower need only to be configured with braking resistors, while VFDs of 380V, 132kW and higher need to be configured with braking units additionally.
	Output filter	Device used to suppress interference generated from the wiring on the output side of the VFD. Install as close to the output terminal of the VFD as possible.
	Output reactor	Device used to extend the effective transmission distance of the VFD and effectively suppress instantaneous high voltage generated when the IGBT module of the VFD switches.

Image	Name	Description
	dv/dt decrement filter	Device used to suppress voltage spikes, reduce traveling waves in long cables, and reflect dv/dt transient voltages, thereby reducing motor eddy current losses and noise, and providing motor insulation protection.
	Sine-wave filter	Device used to suppress and absorb high-order harmonic currents derived from switching frequency ripple currents, correcting the waveform to approximate a sine wave, significantly extending the length of the output cable, reducing motor eddy current losses and noise, and protecting motor insulation.

D.3 Power supply

See chapter 4 Installation guidelines.

	✧ Ensure that the voltage class of the VFD is consistent with that of the grid.

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.

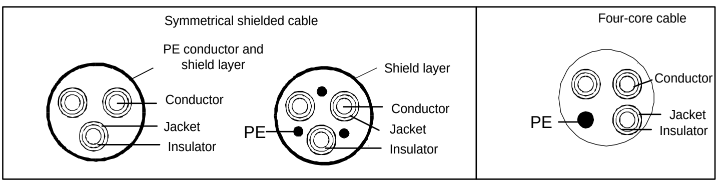
✧ The maximum temperature margin of the motor cables in continuous operation cannot be lower than 70°C.

✧ The conductivity of the PE grounding conductor is the same as that of the phase conductor (for 30kW and higher, it can be slightly reduced).

✧ 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 at least be 1/10 of the conductivity of the phase conductor. This requirement can be well met by a copper or aluminum shield layer. The following figure shows the minimum requirement on motor cables of a VFD. The cable must consist of a layer of spiral-shaped copper strips. The denser the shield layer is, the more effectively the electromagnetic interference is restricted.

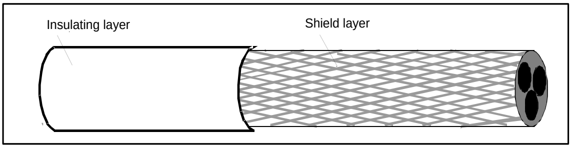


Figure D-1 Cable cross section

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.

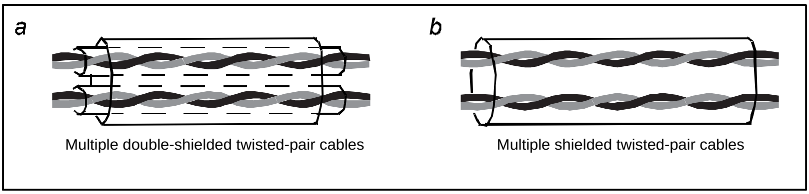


Figure D-2 Power cable arrangement

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

Relay cables need to be those with metal braided shield layers.

Keypads need to be connected by using network cables. In complicated electromagnetic environments, shielded network cables are recommended.

Note: Analog signals and digital signals cannot use the same cables, and their cables must be arranged separately.

Dielectric withstand tests have been performed between the main circuit and housing of each VFD before delivery. In addition, the VFD has the internal voltage limiting circuit, which can automatically cut off the test voltage. Do not perform any voltage withstand or insulation resistance tests, such as high-voltage insulation tests or using a megameter to measure the insulation resistance, on the VFD or its components.

Note: Check the insulation conditions of the input power cable of a VFD according to the local regulations before connecting it.

D.4.3 Recommended cable size

Table D-1 AC 3PH 380V–480V

VFD model	Recommended cable size (mm²)				Fixing screw	
	R, S, T U, V, W	PE	P1 (+)	PB (+), (-)	Terminal screw	Fastening torque (Nm)
GD350-030G-4-CCS	16	16	16	16	M8	9–11
GD350-037G-4-CCS	25	16	26	26	M8	9–11
GD350-045G-4-CCS	25	16	25	25	M8	9–11
GD350-055G-4-CCS	35	16	35	35	M10	18–23
GD350-075G-4-CCS	50	25	50	50	M10	18–23
GD350-090G-4-CCS	70	35	70	70	M10	18–23
GD350-110G-4-CCS	95	50	95	95	M12	31–40
GD350-132G-4-CCS	95	50	95	95	M12	31–40
GD350-160G-4-CCS	150	70	150	150	M12	31–40
GD350-200G-4-CCS	185	95	185	185	M12	31–40
GD350-220G-4-CCS	2×95	95	2×95	2×95	M12	31–40
GD350-250G-4-CCS	2×95	95	2×95	2×95	M12	31–40
GD350-280G-4-CCS	2×150	150	2×150	2×150	M12	31–40
GD350-315G-4-CCS	2×150	150	2×150	2×150	M12	31–40
GD350-355G-4-CCS	2×185	150	2×185	2×185	M12	31–40
GD350-400G-4-CCS	3×150	2×120	3×150	3×150	M12	31–40
GD350-500G-4-CCS	3×185	2×150	3×185	3×185	M12	31–40

Note:

- Cables of the sizes 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 100 m, 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 inverters can be arranged in parallel. It is recommended that you arrange the motor cables, input power cables, and control cables separately in different trays. The output dU/dt of the inverters may increase electromagnetic interference on other cables. Do not arrange other cables and the motor cables in parallel.

If a control cable and power cable must cross each other, ensure that the angle between them is 90°.

The cable trays must be connected properly and well grounded. Aluminum trays can implement local equipotential.

The following figure shows the cable arrangement.

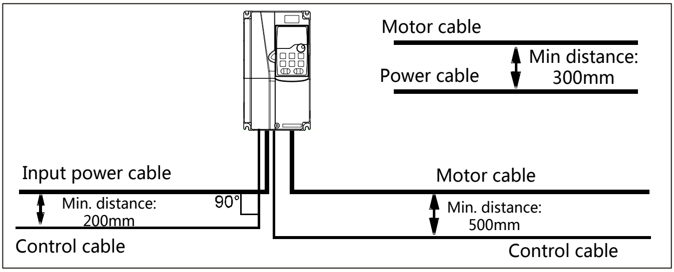


Figure D-3 Cable routing distance

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 500VDC to measure the insulation resistance between each phase conductor and the protection grounding conductor. For details about the insulation resistance of the motor, see the description provided by the manufacturer.

Note: The insulation resistance is reduced if it is damp inside the motor. If it may be damp, you need to dry the motor and then measure the insulation resistance again.

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 extra caution when installing and placing the breaker. Follow the manufacturer's instructions.

Table D-2 AC 3PH 380V–480V

VFD model	Fuse (A)	Circuit breaker (A)	Contactor rated current (A)
GD350-030G-4-CCS	125	100	80
GD350-037G-4-CCS	125	125	98
GD350-045G-4-CCS	150	140	115
GD350-055G-4-CCS	200	180	150
GD350-075G-4-CCS	250	225	185
GD350-090G-4-CCS	300	250	225
GD350-110G-4-CCS	350	315	265
GD350-132G-4-CCS	400	400	330
GD350-160G-4-CCS	500	500	400
GD350-200G-4-CCS	600	630	500
GD350-220G-4-CCS	700	630	500
GD350-250G-4-CCS	800	700	630
GD350-280G-4-CCS	1000	800	630
GD350-315G-4-CCS	1000	1000	800
GD350-355G-4-CCS	1000	1000	800
GD350-400G-4-CCS	1200	1000	1000
GD350-500G-4-CCS	1400	1250	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-1 Output filters 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 type	Output reactor (1% output voltage drop)	/	/
	/	dv/dt decrement filter	/
	/	/	Sine wave filter

Table D-3 Reactor model selection for AC 3PH 380V–480V VFD models

VFD model	Input reactor	DC reactor	Output reactor
GD350-030G-4-CCS	GDL-ACL0070-4AL	Standard	GDL-OCL0060-4AL
GD350-037G-4-CCS	GDL-ACL0090-4AL	Standard	GDL-OCL0075-4AL
GD350-045G-4-CCS	GDL-ACL0110-4AL	Standard	GDL-OCL0092-4AL
GD350-055G-4-CCS	GDL-ACL0150-4AL	Standard	GDL-OCL0115-4AL
GD350-075G-4-CCS	GDL-ACL0150-4AL	Standard	GDL-OCL0150-4AL
GD350-090G-4-CCS	GDL-ACL0220-4AL	Standard	GDL-OCL0220-4AL
GD350-110G-4-CCS	GDL-ACL0220-4AL	Standard	GDL-OCL0220-4AL
GD350-132G-4-CCS	GDL-ACL0265-4AL	GDL-DCL0300-4AL	GDL-OCL0265-4AL
GD350-160G-4-CCS	GDL-ACL0330-4AL	GDL-DCL0365-4AL	GDL-OCL0330-4AL
GD350-200G-4-CCS	GDL-ACL0390-4AL	GDL-DCL0455-4AL	GDL-OCL0400-4AL
GD350-220G-4-CCS	GDL-ACL0450-4AL	GDL-DCL0505-4AL	GDL-OCL0450-4AL
GD350-250G-4-CCS	GDL-ACL0500-4AL	GDL-DCL0550-4AL	GDL-OCL0500-4AL
GD350-280G-4-CCS	GDL-ACL0500-4AL	GDL-DCL0675-4AL	GDL-OCL0560-4AL
GD350-315G-4-CCS	GDL-ACL0580-4AL	GDL-DCL0675-4AL	GDL-OCL0660-4AL
GD350-355G-4-CCS	Standard	GDL-DCL0810-4AL	GDL-OCL0660-4AL
GD350-400G-4-CCS	Standard	GDL-DCL0810-4AL	GDL-OCL0720-4AL
GD350-500G-4-CCS	Standard	GDL-DCL1000-4AL	GDL-OCL1000-4AL

Note:

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

Table D-2 Filter selection

VFD model	Input filter	Output filter	
	Passive harmonic filter	dv/dt decrement filter	Sine-wave filter
GD350-030G-4-CCS	GDL-H0070-4AL	GDL-DUL0060-4AL	GDL-OSF0060-4AL
GD350-037G-4-CCS	GDL-H0080-4AL	GDL-DUL0075-4AL	GDL-OSF0075-4AL
GD350-045G-4-CCS	GDL-H0100-4AL	GDL-DUL0100-4AL	GDL-OSF0095-4AL
GD350-055G-4-CCS	GDL-H0130-4AL	GDL-DUL0120-4AL	GDL-OSF0120-4AL
GD350-075G-4-CCS	GDL-H0160-4AL	GDL-DUL0150-4AL	GDL-OSF0150-4AL
GD350-090G-4-CCS	GDL-H0190-4AL	GDL-DUL0180-4AL	GDL-OSF0180-4AL
GD350-110G-4-CCS	GDL-H0225-4AL	GDL-DUL0220-4AL	GDL-OSF0220-4AL
GD350-132G-4-CCS	GDL-H0265-4AL	GDL-DUL0260-4AL	GDL-OSF0260-4AL
GD350-160G-4-CCS	GDL-H0320-4AL	GDL-DUL0320-4AL	GDL-OSF0320-4AL
GD350-200G-4-CCS	GDL-H0400-4AL	GDL-DUL0400-4AL	GDL-OSF0400-4AL

VFD model	Input filter	Output filter	
	Passive harmonic filter	dv/dt decrement filter	Sine-wave filter
GD350-220G-4-CCS	GDL-H0485-4AL	GDL-DUL0480-4AL	GDL-OSF0480-4AL
GD350-250G-4-CCS	GDL-H0485-4AL	GDL-DUL0480-4AL	GDL-OSF0480-4AL
GD350-280G-4-CCS	GDL-H0545-4AL	GDL-DUL0540-4AL	GDL-OSF0600-4AL
GD350-315G-4-CCS	GDL-H0610-4AL	GDL-DUL0600-4AL	GDL-OSF0600-4AL
GD350-355G-4-CCS	GDL-H0800-4AL	GDL-DUL0800-4AL	GDL-OSF0800-4AL
GD350-400G-4-CCS	GDL-H0800-4AL	GDL-DUL0800-4AL	GDL-OSF0800-4AL
GD350-500G-4-CCS	GDL-H1000-4AL	GDL-DUL1000-4AL	GDL-OSF1000-4AL

Note:

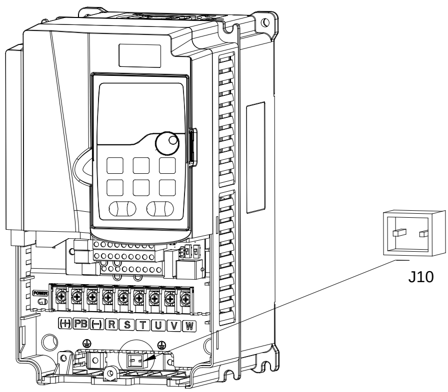
- The preceding table describes external accessories. You need to specify the ones you choose when purchasing accessories.
- For the selection of accessories with different material requirements than those listed above, please refer to the low-voltage VFD GDL series filter option brochure.

D.7 EMC filter

J10 is not connected in factory for the 380V 110kW 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 380V 132kW and higher VFD models, all of which meet the requirements of level C3.

Disconnect J10 in any of the following situations:

- The EMC filter is applicable to the neutral-grounded grid system. If it is used for the IT grid system (that is, non-neutral grounded grid system), disconnect J10.
- If leakage protection occurs during configuration of a residual-current circuit breaker, disconnect J10.



- Do not connect C3 filters in IT power systems.

FLT – P 04 045 L – B

A B C D E F

Field	Description
A	FLT: EMC filter series
B	Filter type P: Power input filter L: Output filter
C	Voltage class 04: AC 3PH 380V–480V
D	3-digit code indicating the rated current. For example, 015 indicates 15 A.
E	EMC filter performance L: General H: High-performance
F	EMC filter application environment A: Environment Category I (IEC61800-3), C1 (EN 61800-3) B: First environment (IEC61800-3), category C2 (EN 61800-3) C: Environment Category II (IEC61800-3), C3 (EN 61800-3)

Table D-4 AC 3PH 380V–480V

VFD model	Input filter	Output filter
GD350-030G-4-CCS	FLT-P04065L-B	FLT-L04065L-B
GD350-037G-4-CCS	FLT-P04100L-B	FLT-L04100L-B
GD350-045G-4-CCS		
GD350-055G-4-CCS	FLT-P04150L-B	FLT-L04150L-B
GD350-075G-4-CCS		
GD350-090G-4-CCS	FLT-P04240L-B	FLT-L04240L-B
GD350-110G-4-CCS		
GD350-132G-4-CCS		
GD350-160G-4-CCS	FLT-P04400L-B	FLT-L04400L-B
GD350-200G-4-CCS		
GD350-220G-4-CCS	FLT-P04600L-B	FLT-L04600L-B
GD350-250G-4-CCS		
GD350-280G-4-CCS		
GD350-315G-4-CCS	FLT-P04800L-B	FLT-L04800L-B
GD350-355G-4-CCS		
GD350-400G-4-CCS		
GD350-500G-4-CCS	FLT-P041000L-B	FLT-L041000L-B

Note:

- The input EMI meets the C2 requirements after an input filter is configured.

- The preceding table describes external accessories. You need to specify the ones you choose when purchasing accessories.

D.8 Braking system

D.8.1 Braking component selection

When the VFD driving a high-inertia load decelerates or needs to decelerate abruptly, the motor runs in the power generation state and transmits the load-carrying energy to the DC circuit of the VFD, causing the bus voltage of the VFD to rise. If the bus voltage exceeds a specific value, the VFD reports an overvoltage fault. To prevent this from happening, you need to configure braking components.

	✧ The design, installation, commissioning, and operation of the device must be performed by trained and qualified professionals. ✧ Follow all the "Warning" instructions during the operation. Otherwise, major physical injuries or property loss may be caused. ✧ Only qualified electricians are allowed to perform the wiring. Otherwise, damage to the VFD or braking components may be caused. ✧ Read the braking resistor or unit instructions carefully before connecting them to the VFD. ✧ Connect braking resistors only to the terminals PB and (+), and braking units only to the terminals (+) and (-). Do not connect them to other terminals. Otherwise, damage to the braking circuit and VFD and fire may be caused.
	✧ Connect the braking components to the VFD according to the wiring diagram. If the wiring is not properly performed, damage to the VFD or other devices may be caused.

The 380V 110kW and lower VFD models are equipped with built-in braking units, and the 380V 132kW and higher VFD models need to be configured with external braking units. Select braking resistors according to the specific requirements on site.

Table D-5 Braking unit for AC 3PH 380V–480V

VFD model	**Braking unit model**	**Resistance applicable for 100% braking torque (Ω)**	**Braking resistor dissipation power (kW)**	**Braking resistor dissipation power (kW)**	**Braking resistor dissipation power (kW)**	**Min. allowed braking resistance (Ω)**
			10% braking usage	**50% braking usage**	**80% braking usage**	
GD350-030G-4-CCS	Built-in braking unit	17	5	23	36	17
GD350-037G-4-CCS		13	6	28	44	11.7
GD350-045G-4-CCS		10	7	34	54	6.4

VFD model	Braking unit model	Resistance applicable for 100% braking torque (Ω)	Braking resistor dissipation power (kW) 10% braking usage	Braking resistor dissipation power (kW) 50% braking usage	Braking resistor dissipation power (kW) 80% braking usage	Min. allowed braking resistance (Ω)
GD350-055G-4-CCS		8	8	41	66	
GD350-075G-4-CCS		6.5	11	56	90	
GD350-090G-4-CCS		5.4	14	68	108	4.4
GD350-110G-4-CCS		4.5	17	83	132	
GD350-132G-4-CCS	DBU100H-220-4	3.7	20	99	158	3.2
GD350-160G-4-CCS	DBU100H-320-4	3.1	24	120	192	2.2
GD350-200G-4-CCS		2.5	30	150	240	
GD350-220G-4-CCS	DBU100H-400-4	2.2	33	165	264	1.8
GD350-250G-4-CCS		2.0	38	188	300	
GD350-280G-4-CCS	Two sets of DBU100H-320-4	3.6*2	21*2	105*2	168*2	2.2*2
GD350-315G-4-CCS		3.2*2	24*2	118*2	189*2	
GD350-355G-4-CCS		2.8*2	27*2	132*2	210*2	
GD350-400G-4-CCS		2.4*2	30*2	150*2	240*2	
GD350-500G-4-CCS	Two sets of DBU100H-400-4	2.0*2	38*2	186*2	300*2	1.8*2

Note:

- Select braking resistors according to the resistance and power data provided by INVT. Users can choose different resistance values and powers according to their actual situation, but the resistance value must not be less than the minimum allowable braking resistance value in the table, otherwise the braking unit may be burned out. The selection of braking resistor needs to be determined based on the power generated by the motor in the actual application system, which is related to the system inertia, deceleration time, and potential energy load energy. The larger the system inertia, the shorter the deceleration time, and the more frequent the braking, the braking resistor with larger power and smaller resistance value needs to be selected.
- When the grid voltage is different, users can adjust the dynamic braking threshold voltage. If the threshold voltage needs to be raised, the corresponding braking resistance needs to be increased.
- The recommended minimum power of the braking resistor mentioned above refers to the rated power that the resistor can operate for a long time under natural cold conditions. If there is a cooling fan on site, the power of the braking resistor can be slightly reduced.

- When using an external braking unit, set the brake voltage class of the braking unit properly by referring to the manual of the 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.

D.8.2 Braking resistor cable selection

Braking resistor cables should be shielded cables.

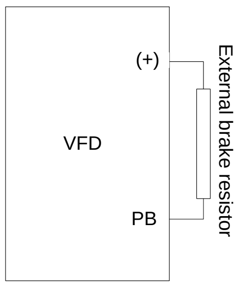
D.8.3 Braking resistor installation

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 is of hundreds of degrees Celsius. Prevent any materials from coming into contact with the resistor.

Braking resistor installation

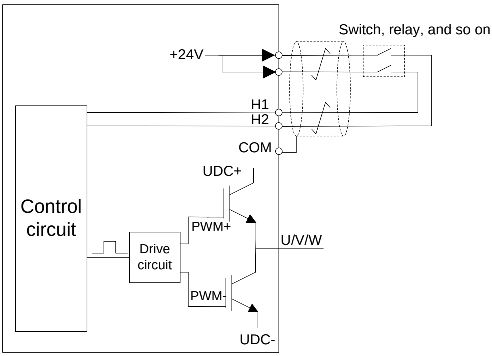
	✧ The 380V 110kW and lower VFD models need only external braking resistors. ✧ PB and (+) are the terminals for connecting braking resistors.



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



Note:

- The opening or closing of safety switch contact must be within 250.
- The maximum length of the cable between the VFD and safety switch is 25m.

E.1 STO function logic table

The following table describes the input states and corresponding faults of the STO function.

STO input state	Corresponding fault
H1 and H2 opened simultaneously	The STO function is triggered, and the drive stops running. Fault code: 40: Safe torque off (STO)
H1 and H2 closed simultaneously	The STOP function is not triggered, and the drive runs properly.
One of H1 and H2 opened, and the other closed	The STL1, STL2, or STL3 fault occurs. Fault code: 41: Channel H1 exception (STL1) 42: Channel H2 exception (STL2) 43: Channel H1 and H2 exceptions (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

STO trigger delay: Time interval between trigger the STO function and switching off the drive output.

STO indication delay: Time interval between trigger the STO function and STO output state indication.

E.3 Function installation checklist

Before installing the STO, check the items described in the following table to ensure that the STO function can be properly used.

	Item
□	Ensure that the drive can be run or stopped randomly during commissioning.
□	Stop the drive (if it is running), disconnect the input power supply, and isolate the drive from the power cable through the switch.
□	Check the STO circuit connection according to the circuit diagram.
□	Check whether the shielding layer of the STO input cable is connected to the +24 V reference ground COM.
□	Connect the power supply.
□	Test the STO function as follows after 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. Ensure that the motor coasts to stop rotating. ✧ 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 you query about. 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, directly contact online service personnel or choose **Contact Us** to obtain contact information.

F.3 Documents on the Internet

You can find manuals and other product documents in the PDF format on the Internet. Visit www.invt.com and choose **Support** > **Download**.

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Shenzhen INVT Electric Co., Ltd. (origin code: 01)
Address: INVT Guangming Technology Building, Songbai Road, Matian, Guangming District, Shenzhen, China

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Address: 1# Kunlun Mountain Road, Science&Technology Town, Gaoxin District, Suzhou, Jiangsu, China

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