Operation Manual

Goodrive350 IP55

High-ingress Protection Series VFD

SHENZHEN INVT ELECTRIC CO., LTD.

No.	Change description	Version	Change date
1	First release	V1.0	September 2020
2	● Updated the preface. ● Updated the content of function codes. ● Added the profile and mounting dimensions of 6 power models.	V1.1	January 2021
3	Updated the section 3.6.	V1.2	April 2021
4	● Added section 2.7. ● Updated section 3.3. ● Updated the name of PE terminal in section 4.3.2 and deleted the duplicated COM terminal record in section 4.4.1. ● Updated the keypad diagrams and content in Chapter 5. ● Updated the function codes in Chapter 5 and Chapter 6. ● Updated the table in section 7.5.1. ● Added IO expansion 2 (EC-IO502-00), Ethernet/IP communication card (EC-TX510), Modbus TCP communication card (EC-TX515), 24V simplified PG card (EC-PG507-24), GPRS card (EC-IC501-2) in Appendix A. ● Updated the data in Table D-4. ● Changed the short connection between PW and +24V terminals to PW and COM terminals the in Figure 4-15 and Figure 4-16. ● Added Appendix G.	V1.3	March 2022
5	● Added information about -NS models (with EMC filter board and input switch removed) in section 3.5, 3.6; 4.3.2. ● Added function codes P06.23–P06.26, P17.57–P17.58; updated function code, including P11.08 (value 3, 4 are added for the ones place), P28.25. ● In Appendix A, added content of 4G expansion card, combine CANopen communication card and CAN master/slave control card to CAN multi-protocol communication card EC-TX505C, updated EC-PG505-24 card to EC-PG505-24B. ● Changed "IEC 60439-1" to "IEC 61439-1" in Appendix B. ● Updated dimension information in Appendix C and added dimension information for -NS models. ● Updated tables in Appendix D and Appendix G.	V1.4	September 2022

No.	Change description	Version	Change date
6	● Revised the nameplate diagram in section 3.4. ● Updated fuse symbols in all circuit diagrams. ● Modified the U-shaped jumper position in section 4.4.2, and added cautionary notes. ● Added a selection table for the flat keypad cable in section 5.2. ● Updated the diagram for sections 5.5.2, 5.5.5, 5.5.6, 5.5.14, 5.5.15, and 5.5.16. ● Adjusted the depiction in section 5.5.8. ● Updated the description for function codes P05.01–P05.06 option 43, revised the explanations for P00.03 and P06.05, updated the depiction for P09.08, and add cautionary notes for P18.00. ● Modified the UPE fault explanation in section 7.5.1. ● Removed the Modbus RTU command code: 08H, diagnostic function. ● Added the expansion card order number and updated the card models in Appendix A: removed EC-TX504, added EC-TX510B; and updated EC-TX503, EC-TX505C, EC-TX509 to EC-TX503D, EC-TX505D, EC-TX509C. ● Updated the indicators and descriptions in sections A.7.4 and A.7.5. ● Updated the diagram and descriptions in section D.2, modified sections D.6 and D.7. ● Revised the data in Table D-4.	V1.5	December 2024

Preface

Thank you for choosing Goodrive350 IP55 high-ingress protection series variable-frequency drive (VFD).

If not otherwise specified in this manual, the VFD always indicates Goodrive350 IP55 series VFD, which is a high-performance and multipurpose VFD 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.

To meet the basic needs of customers, VFDs of power range from 4 to 110 kW are developed for Goodrive350 IP55 high-ingress protection series VFDs. In order to meet diversified customer demands, the VFD provides abundant expansion cards including programmable expansion card, PG card, communication card and I/O expansion card to achieve various functions as needed. Each VFD can be installed with three expansion cards at most.

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

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

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

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

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

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

The manual is subject to change without prior notice.

Contents

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 pedestal 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	5 min

Symbol	Name	Description	Abbreviation
		the warning symbols on the machine) after power off to prevent electric shock.	
	Read manual	Read the operation manual before operating the equipment.	
Note	Note	Actions taken to ensure proper running.	Note

1.4 Safety guidelines

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

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

<table>
<tr><th colspan="2">VFD model</th><th>Minimum waiting time</th></tr>
<tr><td>380V</td><td>004G/5R5P–110G</td><td>5 minutes</td></tr>
</table>
</td></tr>
<tr><td></td><td>Do not refit the VFD unless authorized; otherwise fire, electric shock or other injury may result.</td></tr>
<tr><td></td><td>The base may become hot when the machine is running. Do not touch. Otherwise, you may get burnt.</td></tr>
<tr><td></td><td>The electrical parts and components inside the VFD are electrostatic sensitive. Take measurements to prevent electrostatic discharge when performing related operations.</td></tr>
</table>

1.4.1 Delivery and installation

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

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

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 leakage current of the drive during running may exceed 3.5mA, ground properly and ensure the grounding resistance is less than 10Ω. The conductivity of PE grounding conductor is the same as that of the phase conductor. The cross-sectional area of the PE grounding conductor for 30kW and higher models can be slightly smaller than the recommended cross-sectional area value.
- R, S and T are the power input terminals, and U, V and W are the output motor terminals. Connect the input power cables and motor cables properly; otherwise, damage to the VFD may occur.

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 (as described in chapter 8 "Maintenance"), inspection and pilot run for the VFD before the reuse.
- Close the VFD front cover before running; otherwise, electric shock may occur.

1.4.3 Maintenance 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.
- 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 product nameplate is consistent with the model identifier on the exterior surface of the packing box. If any problems are found, contact the local INVT dealer or office.
5.	Whether the accessories (including the manual, keypad, and expansion card) inside the packing box are complete. If any problems are found, contact the local INVT dealer or office.

2.3 Checking before use

Check the following before using the VFD.

1.	Mechanical type of the load to be driven by the VFD to verify whether the VFD will be overloaded during work. Whether the power class of the product needs to be increased.
2.	Whether the actual running current of the motor is less than the rated current of the product.
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 50°C. **Note:** When the VFD is built in a cabinet, the ambient temperature is the temperature of air in the cabinet.

2.	Whether the actual ambient temperature is lower than -10°C. 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 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.
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 product is to be used. If yes, take additional protective measures.

2.5 Checking after installation

Check the following after the VFD installation is complete.

1.	Whether the input power cables and motor cables meet the current-carrying capacity requirements of the actual load.
2.	Whether correct accessories are selected for the VFD, the accessories are correctly and properly installed, and the installation cables meet the 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 product 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 015G/018P and lower VFD models

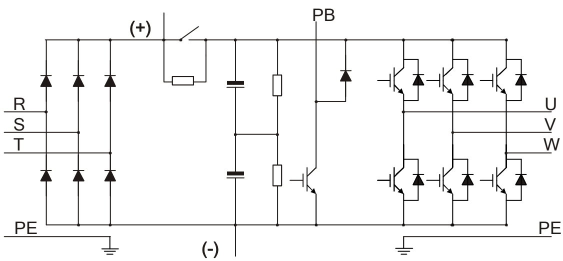
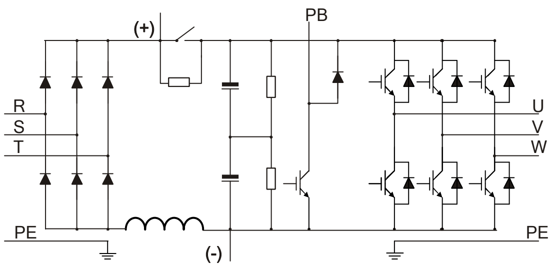


Figure 3-2 Main circuit diagram for 018G/022P–110G (inclusive) VFD models



Note:

- The VFDs of 018G/022P–110G (inclusive) models are equipped with built-in DC reactors.
- The 037G/045P and lower VFD models carry built-in braking units as a standard configuration. The models with built-in braking units can also be connected to external braking resistors. Braking resistors are optional parts.

- The 045G/055P–110G VFD models can be configured with optional built-in braking units. After a built-in braking unit is configured for the VFD, the VFD model is added with a suffix "-B", for example, GD350-045G/055P-45-AS-B.

3.3 Product specifications

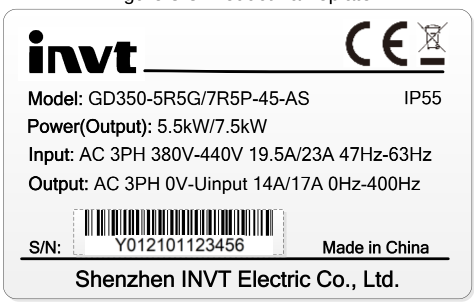
Function description		Specifications
Power input	Input voltage (V)	-4 model: 3PH 380V (-15%)–440V (+10%)
	Input current (A)	See section 3.6 Product ratings.
	Input frequency (Hz)	50Hz or 60Hz; Allowed range: 47–63Hz
Power output	Output voltage (V)	0–Input voltage (V)
	Output current (A)	See section 3.6 Product ratings.
	Output power (kW)	See section 3.6 Product ratings.
	Output frequency (Hz)	0–599Hz
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	For asynchronous motor (AM): 1:200 (SVC) For SMs: 1: 20 (SVC); 1: 1000 (FVC)
	Speed control accuracy	±0.2% (SVC) ±0.02% (FVC)
	Speed fluctuation	±0.3% (SVC)
	Torque response	<20ms (SVC) <10ms (FVC)
	Torque control accuracy	10% (SVC) 5% (FVC)
	Starting torque	For AMs: 0.25Hz/150% (SVC) For SMs: 2.5Hz/150% (SVC) 0Hz/200% (FVC)
	Overload capacity	G type: 150% of the rated current for 1 minute; 180% of the rated current for 10s; 200% of the rated current for 1s;
		P type: 120% of the rated current for 1 minute.
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

Function description		Specifications
		communication and so on. Settings can be combined and the setting channels can be switched.
	Automatic voltage regulation	The output voltage can be kept constant although the grid voltage changes.
	Fault protection	More than 30 protection functions, such as protection against overcurrent, overvoltage, undervoltage, overtemperature, phase loss, and overload
	Speed tracking restart	Used to implement impact-free smooth startup for rotating motors
	Retension at transient voltage drop	Keeps running with regenerative energy when the grid transiently drops.
	Motor switchover	Supports two groups of motor parameters to control motor switchover.
Peripheral interface	Terminal analog input resolution	No more than 20mV
	Terminal digital input resolution	No more than 2ms
	Analog input	2 channel AI1: 0–10V/0–20mA, AI2: -10–10V
	Analog output	1 channel AO1: 0–10V/0–20mA
	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/AC250V, 1A/DC30V
	Extended interfaces	SLOT1, SLOT2, and SLOT3 Supporting PG cards, programmable expansion cards, communication cards, I/O cards and so on
Other	Installation method	Wall mounting or flange installation
	Temperature of running environment	-10°C – 50°C. Derating is required when the ambient temperature exceeds 40°C.

Function description		Specifications
	Ingress protection (IP) rating	IP55
	Cooling method	Forced air cooling
	Braking unit	Standard built-in part for 380V 37kW and lower VFD models. Optional built-in part for the 045G/055P–110G VFD models. For models with a built-in braking unit configured, a suffix "-B" is added to the model, for example, GD350-045G/055P-45-AS-B.
	EMC filter	Conducted emissions of all models meet the requirements of C3 in the IEC/EN 61800-3 standard. The -AS models offers the 30m motor cable, meeting the C3 requirements. Optional external filters can be used to meet IEC61800-3 C2. **Note:** It is required to observe the EMC compliance required by the appendix of the manual. The motor and motor cables shall be selected based on technical requirements specified in the appendix of the manual.
	STO certification level	Meet the SIL2 level

3.4 Product nameplate

Figure 3-3 Product nameplate



Note: The preceding are standard product nameplate examples. The CE/TUV/IP55 marking on the top right will be marked according to actual certification conditions.

3.5 Model designation code

Figure 3-4 Model description

GD350-022G/030P-4 5-AS-B

① ② ③ ④ ⑤ ⑥

Field	Sign	Description	Example
Product category	①	Product series abbreviation	GD350: Goodrive350 high-performance multi-function VFD
Rated power	②	Power range + load type	022: 22kW G: Constant torque load P: Fan and water pump
Voltage class	③	Voltage class	4: 3PH 380V(-15%)V–440V(+10%)
Ingress protection (IP) rating	④	Ingress protection (IP) rating	5: IP55 ingress protection rating (It is impossible to completely prevent dust from entering, but the amount of dust from entering will not cause damage to the equipment. It will not cause damage when the product under normal installation state is immersed in water from each direction).
Accessory identifier	⑤	AC input switch	AS: Standard AC input switch NS: Without AC input switch
Built-in unit	⑥	Braking unit	B: Optional built-in braking unit

3.6 Product ratings

Frame code	VFD model	Constant torque				Variable torque			
		Output power (kW)	Input current (A)	Output current (A)	Carrier freq. (kHz)	Output power (kW)	Input current (A)	Output current (A)	Carrier freq. (kHz)
1	GD350-004G/5R5P-45-AS	4	13.5	9.5	8	5.5	19.5	12.5	4
	GD350-004G/5R5P-45-NS	4	13.5	9.5	8	5.5	19.5	12.5	4
	GD350-5R5G/7R5P-45-AS	5.5	19.5	14	8	7.5	23	17	4
	GD350-5R5G/7R5P-45-NS	5.5	19.5	14	8	7.5	23	17	4
2	GD350-7R5G/011P-45-AS	7.5	25	18.5	8	11	30	23	4
	GD350-7R5G/011P-45-NS	7.5	25	18.5	8	11	30	23	4
	GD350-011G/015P-45-AS	11	32	25	8	15	40	32	4
	GD350-011G/015P-45-NS	11	32	25	8	15	40	32	4
	GD350-015G/018P-45-AS	15	40	32	4	18.5	45	38	2
	GD350-015G/018P-45-NS	15	40	32	4	18.5	45	38	2
3	GD350-018G/022P-45-AS	18.5	45	38	4	22	51	45	2
	GD350-018G/022P-45-NS	18.5	45	38	4	22	51	45	2
	GD350-022G/030P-45-AS	22	51	45	4	30	64	60	2
	GD350-022G/030P-45-NS	22	51	45	4	30	64	60	2

Frame code	VFD model	Constant torque				Variable torque			
		Output power (kW)	Input current (A)	Output current (A)	Carrier freq. (kHz)	Output power (kW)	Input current (A)	Output current (A)	Carrier freq. (kHz)
4	GD350-030G/037P-45-AS	30	64	60	4	37	80	75	2
	GD350-030G/037P-45-NS	30	64	60	4	37	80	75	2
	GD350-037G/045P-45-AS	37	80	75	4	45	98	92	2
	GD350-037G/045P-45-NS	37	80	75	4	45	98	92	2
5	GD350-045G/055P-45-AS	45	100	92	4	55	128	115	2
	GD350-045G/055P-45-NS	45	100	92	4	55	128	115	2
	GD350-045G/055P-45-AS-B	45	100	92	4	55	128	115	2
	GD350-045G/055P-45-NS-B	45	100	92	4	55	128	115	2
	GD350-055G/075P-45-AS	55	128	115	4	75	139	150	2
	GD350-055G/075P-45-NS	55	128	115	4	75	139	150	2
	GD350-055G/075P-45-AS-B	55	128	115	4	75	139	150	2
	GD350-055G/075P-45-NS-B	55	128	115	4	75	139	150	2
6	GD350-075G/090P-45-AS	75	139	150	2	90	168	170	2
	GD350-075G/090P-45-NS	75	139	150	2	90	168	170	2
	GD350-075G/090P-45-AS-B	75	139	150	2	90	168	170	2
	GD350-075G/090P-45-NS-B	75	139	150	2	90	168	170	2
	GD350-090G/110P-45-AS	90	168	180	2	110	201	215	2
	GD350-090G/110P-45-NS	90	168	180	2	110	201	215	2
	GD350-090G/110P-45-AS-B	90	168	180	2	110	201	215	2
	GD350-090G/110P-45-NS-B	90	168	180	2	110	201	215	2
	GD350-110G-45-AS	110	201	215	2				
	GD350-110G-45-NS	110	201	215	2				
	GD350-110G-45-AS-B	110	201	215	2				
	GD350-110G-45-NS-B	110	201	215	2				

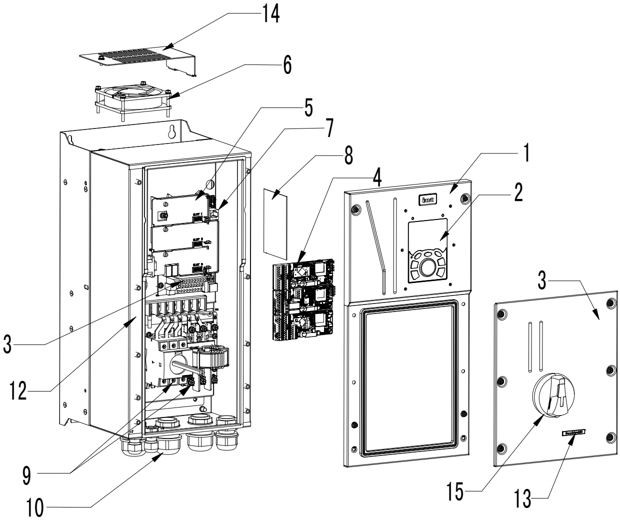
Note:

- There is no P type machine for 110kW models.
- The input current of the 004G/5R5P–055G/075P 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 015G/018P VFD model as an example).

Figure 3-5 Structural diagram



No.	Name	Description
1	Upper cover	Protects internal components.
2	Keypad	For details, see section 5.4 Operation procedure.
3	Lower cover	Protects 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	For details, see chapter 8 Maintenance.
7	Keypad interface	Connects the keypad.
8	Nameplate	For details, see chapter 3 Product overview.
9	Main circuit terminals	For details, see section 4.3 Standard wiring of the main circuit.
10	Control terminals	For details, see section 4.4 Standard wiring of the control circuit.
11	Waterproof connector	Locks and secures connection cables.
12	POWER indicator	Power supply indicator.
13	Label of GD350 IP55 product series	For details, see section 3.5 Model designation code.
14	Baffle of fan	Protects the fan.
15	Switch handle	Controls the main circuit power.

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–+50°C ● When the ambient temperature exceeds 40°C, derate 1% for every increase of 1°C. ● Do not use the VFD when the ambient temperature exceeds 50°C. ● To improve reliability, do not use the VFD in the places where the temperature changes rapidly. ● When the VFD is used in a closed space, such as control cabinet, use a cooling fan or air conditioner for cooling, preventing the internal temperature from exceeding the temperature required. ● When the temperature is too low, if you want to use the VFD that has been idled for a long time, install an external heating device before the use to eliminate the freeze inside the VFD. Otherwise, the VFD may be damaged.

Environment	Condition
Humidity	● Less than 90% ● The max. RH cannot exceed 60% in the environment where there are corrosive gases.
Storage temperature	-30–+60°C
Running environment	Install the VFD in a place: ● Away from electromagnetic radiation sources ● Away from oil mist, corrosive gases, or combustible gases ● Without the chance for foreign objects such as metal powder to fall into the VFD (do not install the VFD onto combustible objects such as wood) ● Without radioactive substances or combustible objects ● Away from corrosive liquid ● With low salt content ● Without direct sunlight
Altitude	● Lower than 1000m ● When the altitude exceeds 1000m, derate by 1% for every additional 100m. ● When the installation site altitude exceeds 3000m, consult the local INVT dealer or office.
Vibration	The max. amplitude of vibration cannot exceed 5.8m/s^2 (0.6g).
Installation direction	Install the VFD vertically to ensure good heat dissipation performance.

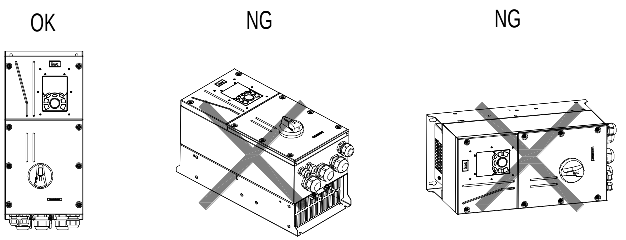
Note: The VFD needs to be installed at a ventilated environment free from corrosive gases and conductive dust.

4.2.2 Installation direction

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

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

Figure 4-1 Installation direction

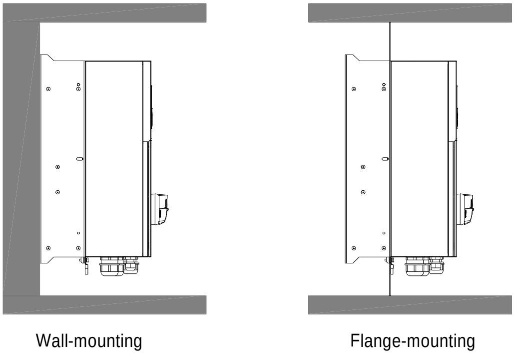


a. Vertical installation b.Horizontal installation c.Transverse installation

4.2.3 Installation method

The VFDs can be installed in two modes, depending on the different VFD dimensions.

Figure 4-2 Mounting method

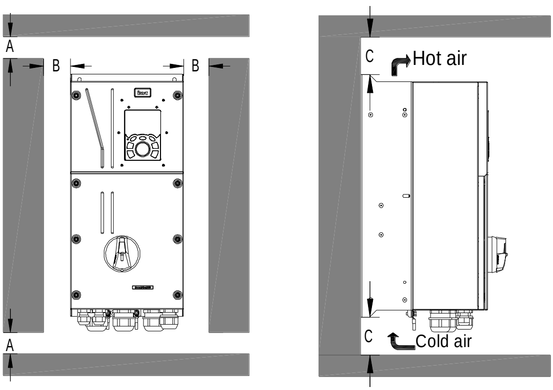


1. Mark the installation hole positions. For details about the installation hole positions, see Appendix C Dimension drawings.
2. Mount the screws or bolts onto the marked positions.
3. Lean the VFD against the wall.
4. Tighten the screws.

Note: Flange-mounting plate is a must for 004G/5R5P–110G VFDs that adopt flange-mounting mode.

4.2.4 Installing one unit

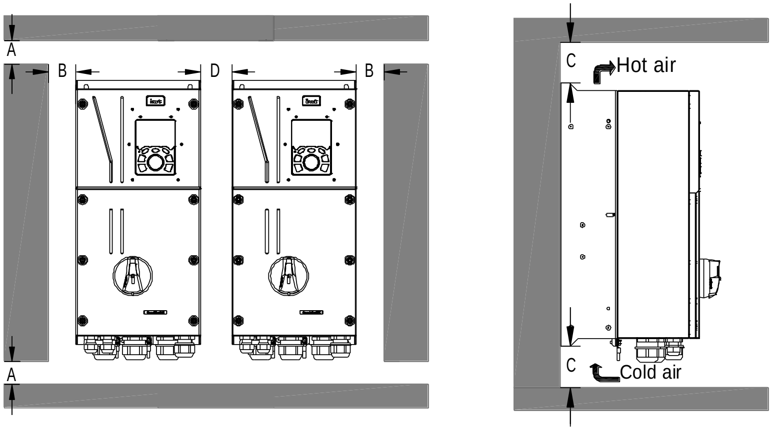
Figure 4-3 Single-unit installation



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

4.2.5 Multiple-product installation

Figure 4-4 Parallel installation

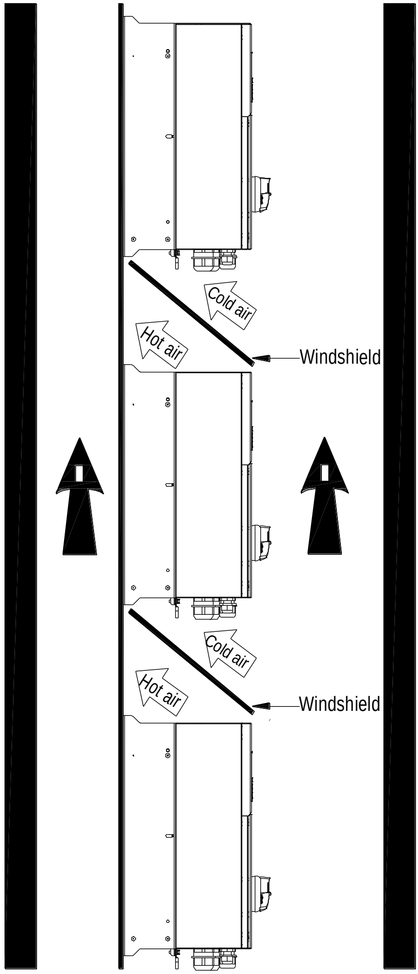


Note:

- When you install VFDs in different sizes, align the top of each VFD before installation for the convenience of future maintenance.
- The min dimensions of A, B, and C are 100mm, and the dimension of D can be 0, which means zero-clearance parallel installation is supported.

4.2.6 Vertical installation

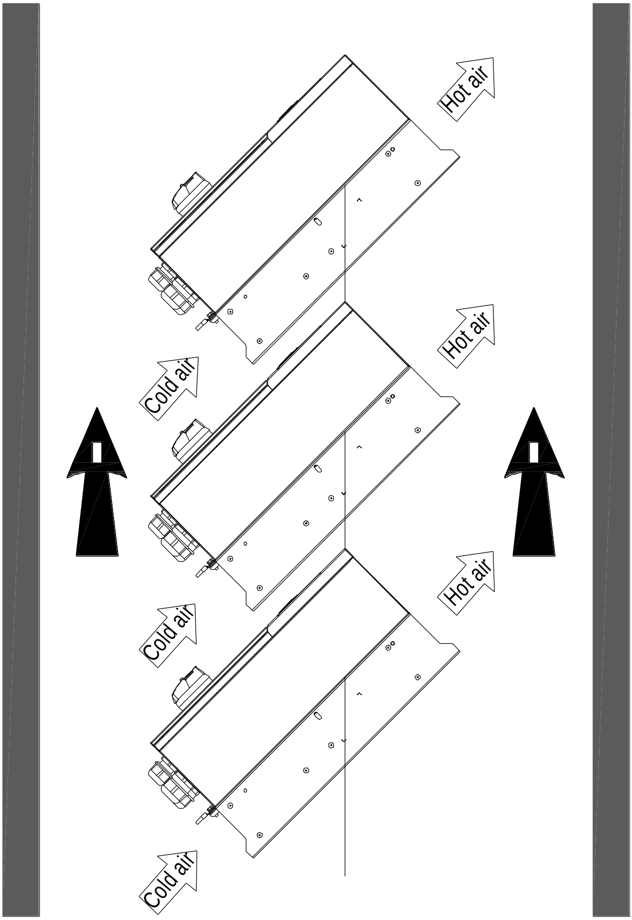
Figure 4-5 Vertical installation



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

4.2.7 Tilted installation

Figure 4-6 Tilted installation

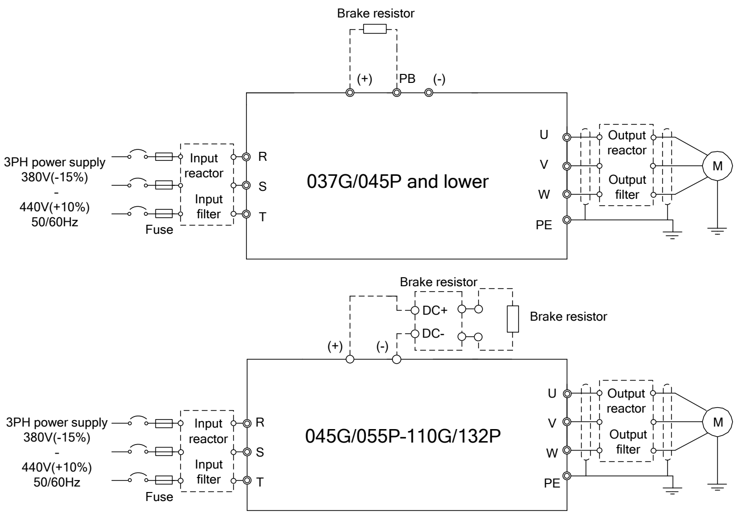


Note: During tilted installation, it is a must to ensure the air inlet duct and air outlet duct are separated from each other to avoid mutual interference.

4.3 Standard wiring of the main circuit

4.3.1 Main circuit wiring diagrams

Figure 4-7 Wiring diagram of the main circuit



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.
- Before connecting the braking resistor, remove the yellow warning label with PB, (+) and (-) from the terminal block; otherwise, poor contact may occur.

4.3.2 Main circuit terminal diagram

Figure 4-8 Main circuit terminals for the 004G/5R5P–5R5G/7R5P models

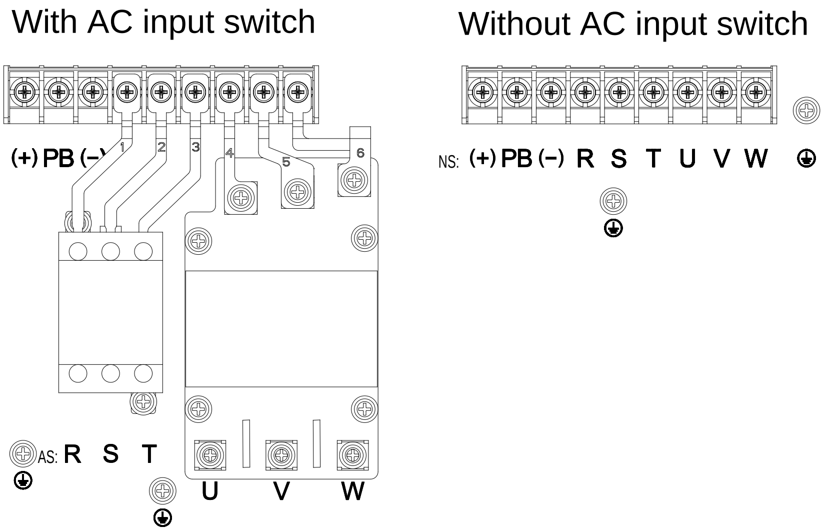


Figure 4-9 Main circuit terminals for the 7R5G/011P–015G/018P models

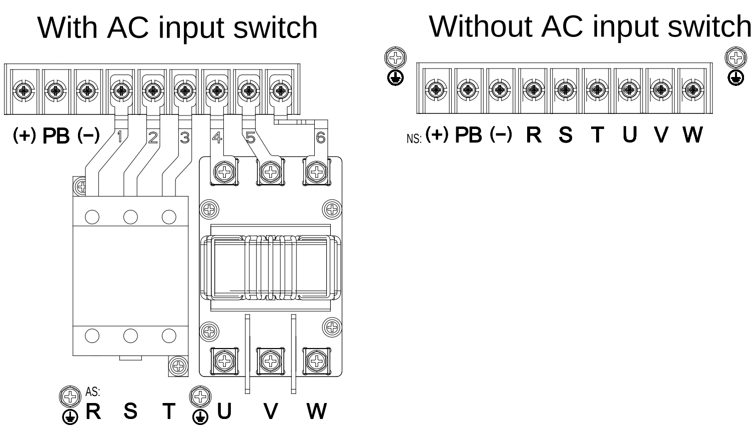
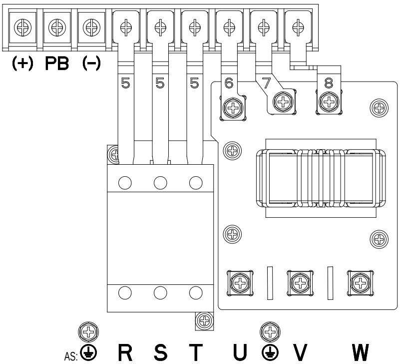


Figure 4-10 Main circuit terminals for the 018G/022P–022G/030P models

With AC input switch



Without AC input switch

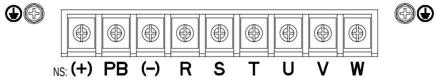
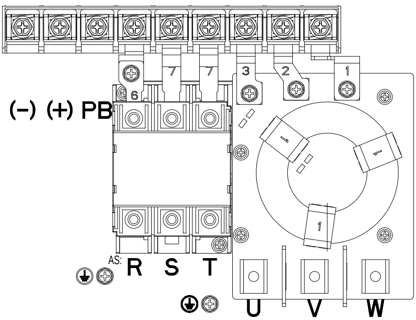


Figure 4-11 Main circuit terminals for the 030G/037P–037G/045P models

With AC input switch



Without AC input switch

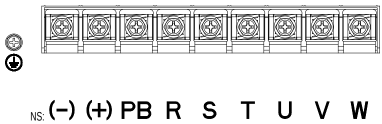


Figure 4-12 Main circuit terminals for the 045G/055P–055G/075P models

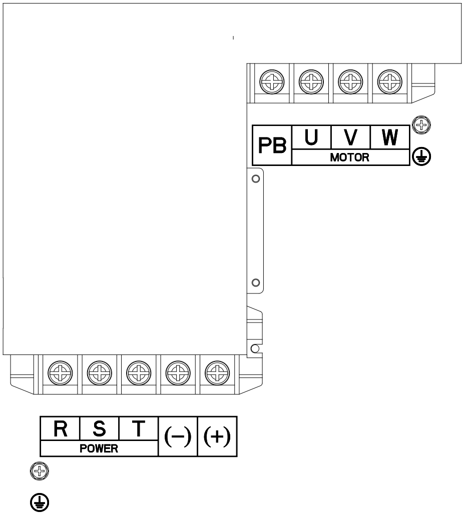
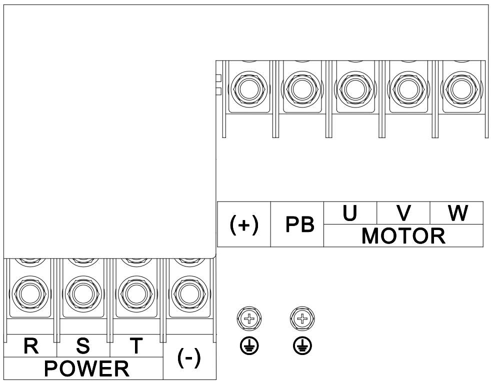


Figure 4-13 Main circuit terminals for the 075G/090P–110G models



Terminal symbol	Terminal name	Function description
R, S, T	Main circuit power input	3PH AC input terminals, connected to the grid
U, V, W	VFD outputs	3PH AC output terminals, connected to the motor usually
(+)	Braking unit terminal 1/Brake resistor terminal 1	(+) and (-) connect to the external braking unit. PB and (+) connect to external braking resistor terminal
(-)	Braking unit terminal 2	

Terminal symbol	Terminal name	Function description
PB	Braking resistor terminal 2	
PE	Grounding terminal for safe protection	Each VFD carries two PE terminals and proper grounding is required.

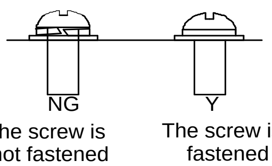
Note:

- It is not recommended to use asymmetrical motor cables. If there is a symmetrical grounding conductor in the motor cable besides the conductive shielded layer, ground the grounding conductor on the VFD end and motor end.
- Braking resistor, braking unit and DC reactor are optional parts.
- Route the motor cable, input power cable and control cable separately.
- GD series VFDs cannot share the DC bus with CH series VFDs.
- When sharing the DC bus, the VFDs must be the same in power and must be simultaneously powered on or off.
- In shared DC bus running mode, current balance on the VFD input side must be considered during wiring, and equalizing reactors are recommended to be configured.

4.3.3 Wiring procedure of 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. Fix all the cables outside the VFD mechanically if allowed.

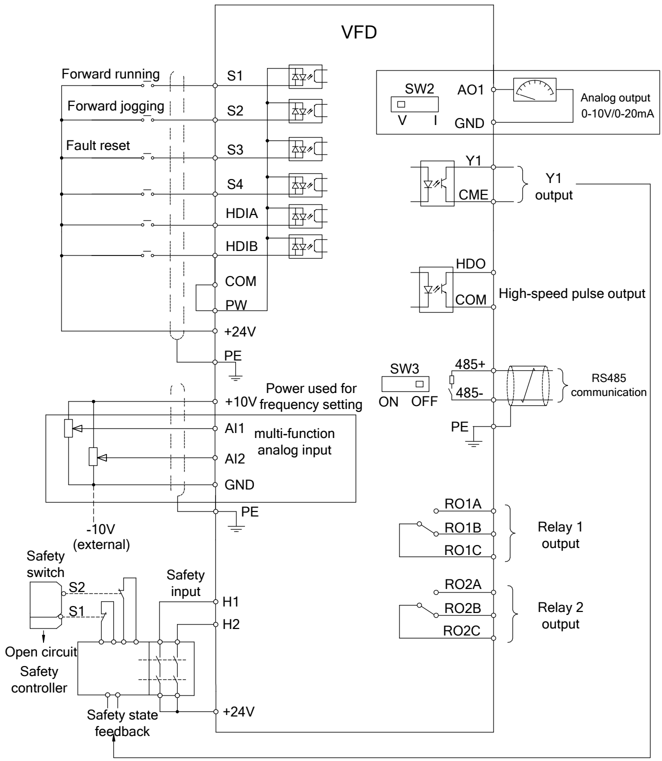
Figure 4-14 Screw installation diagram



4.4 Standard wiring of the control circuit

4.4.1 Wiring diagram of basic control circuit

Figure 4-15 Wiring diagram of control circuit



Note: If wire-passing board outlet space is insufficient when all terminals on the control board are wired, cut the knock-out hole on the lower cover for wire outlet. If a dangerous situation occurs when the knock-out hole is cut for a purpose but not wire outlet, we will not bear any responsibility.

Terminal symbol	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

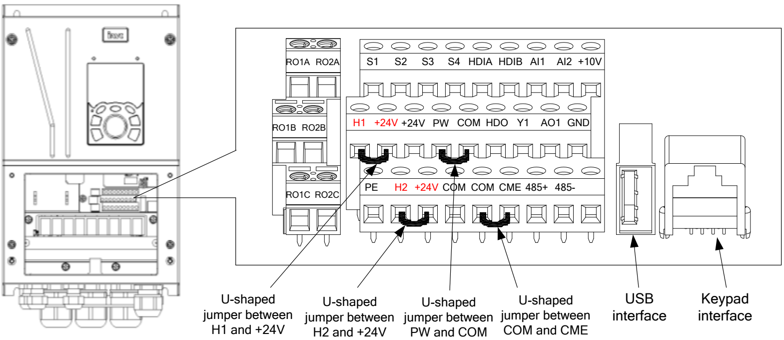
<table>
<tr><th>Terminal symbol</th><th colspan="2">Description</th></tr>
<tr><td></td><td colspan="2">Deviation: ±0.5% at 25°C, when input is above 5V/10mA</td></tr>
<tr><td>GND</td><td colspan="2">+10.5V reference ground</td></tr>
<tr><td>AO1</td><td colspan="2">Output range: 0–10V or 0–20mA
Whether voltage or current is used for output is set through the switch SW2
Deviation: ±0.5% when output exceeds 5V or 10mA at 25°C</td></tr>
<tr><td>RO1A</td><td colspan="2" rowspan="3">RO1 output; RO1A: NO; RO1B: NC; RO1C: common
Contact capacity: 3A/AC250V, 1A/DC30V</td></tr>
<tr><td>RO1B</td></tr>
<tr><td>RO1C</td></tr>
<tr><td>RO2A</td><td colspan="2" rowspan="3">RO2 output; RO2A: NO; RO2B: NC; RO2C: common
Contact capacity: 3A/AC250V, 1A/DC30V</td></tr>
<tr><td>RO2B</td></tr>
<tr><td>RO2C</td></tr>
<tr><td>HDO</td><td colspan="2">Switch capacity: 50mA/30V
Output frequency range: 0–50kHz
Duty ratio: 50%</td></tr>
<tr><td>COM</td><td colspan="2">+24V reference ground</td></tr>
<tr><td>CME</td><td colspan="2">Common terminal of open collector output; short connected to COM by default.</td></tr>
<tr><td>Y1</td><td colspan="2">Switch capacity: 50mA/30V
Output frequency range: 0–1kHz</td></tr>
<tr><td>485+</td><td colspan="2" rowspan="2">RS485 differential signal communication port. Use shielded twisted pairs for standard RS485 communication interfaces. You can determine whether to connect the 120Ω terminal matching resistor of RS485 communication through the corresponding switch SW3.</td></tr>
<tr><td>485-</td></tr>
<tr><td>PE</td><td colspan="2">Grounding terminal</td></tr>
<tr><td>PW</td><td colspan="2">External power input terminal for digital input circuits
Voltage range: 12–30V</td></tr>
<tr><td>24V</td><td colspan="2">External power input terminal for digital input circuits
Max. output current is 200mA</td></tr>
<tr><td>S1</td><td>Digital input 1</td><td rowspan="4">● 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</td></tr>
<tr><td>S2</td><td>Digital input 2</td></tr>
<tr><td>S3</td><td>Digital input 3</td></tr>
<tr><td>S4</td><td>Digital input 4</td></tr>
<tr><td>HDIA</td><td colspan="2" rowspan="2">Channels for both high frequency pulse input and digital input
Max. input frequency: 50kHz
Duty ratio: 30%–70%
Supports the input of a quadrature encoder with 24V power supply; equipped with speed-measurement function</td></tr>
<tr><td>HDIB</td></tr>
<tr><td>+24V—H1</td><td>STO input 1</td><td rowspan="2">● Safe torque off (STO) redundant input, connected to the external NC contact. When the contact opens, STO acts and the VFD stops output.</td></tr>
<tr><td>+24V—H2</td><td>STO input 2</td></tr>
</table>

Terminal symbol	Description	
		● 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 jumper from the terminals before using STO function.

4.4.2 Input/output signal connection diagram

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

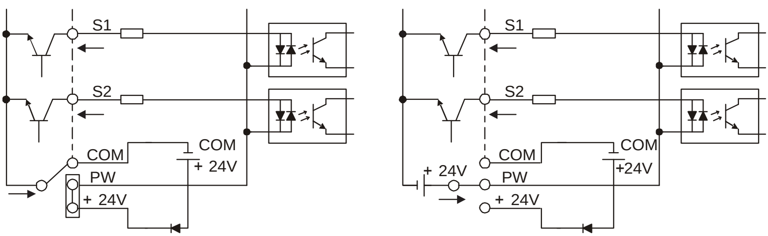
Figure 4-16 Position of U-type short-contact tag



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.

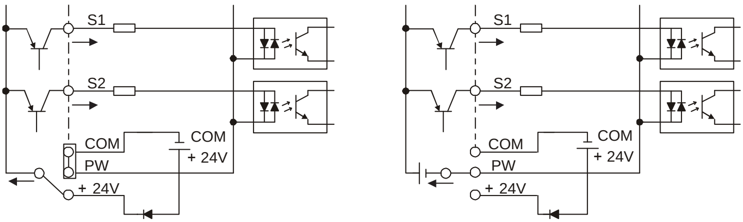
Figure 4-17 NPN mode



Internal power（NPN mode） External power（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 4-18 PNP mode



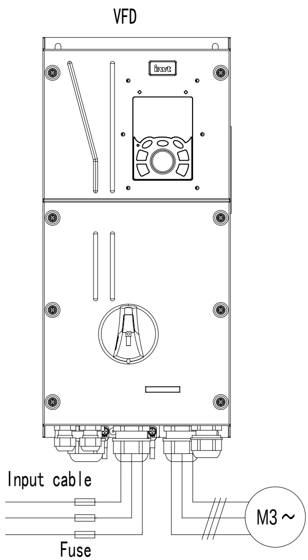
Internal power（PNP mode） External power（PNP mode）

4.5 Wiring protection

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

The VFD and input power cable can be protected in case of short circuit, avoiding thermal overload. Carry out protective measures according to the following figure.

Figure 4-19 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 Basic operation guidelines

5.1 What this chapter contains

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

5.2 Keypad introduction

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

Figure 5-1 Keypad

Note:

- The LCD keypad is equipped with a real-time clock, which can run properly after being installed with batteries even if the power line is disconnected. The clock battery (type: CR2032) is user purchased.
- The LCD keypad has the parameter copying function.
- The VFDs of the following power ranges must use flat ribbon cables, while for VFDs of other power ranges, both flat and standard keypad cables are acceptable.

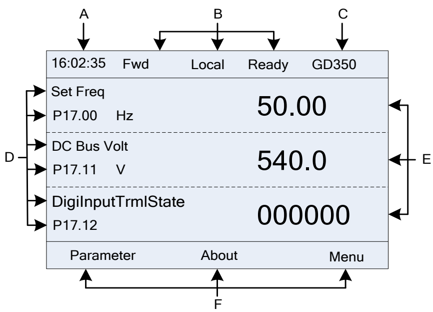
Name	Length (m)	Ordering code	Applied to
Flat keypad cable	1	67004-00053	18.5–37kW
	2	67004-00010	
	3	67004-00013	
	5	67004-00052	

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

Name	No.	Description		
	(11)		Direction key UP:  DOWN:  Left:  Right: 	UP: The function of UP key varies with interfaces, such as shifting up the displayed item, shifting up the selected item, and changing digits. DOWN: The function of DOWN key varies with interfaces, such as shifting down the displayed item, shifting down the selected item, changing digits. LEFT: The function of LEFT key varies with interfaces, such as switch over the monitoring interface, such as shifting the cursor leftward, exiting current menu and returning to previous menu. RIGHT: The function of RIGHT key varies with interfaces, such as switch over the monitoring interface, shifting the cursor rightward, enter the next menu etc.
Display area	(12)	LCD screen	Display screen	240×160 dot-matrix LCD; display three monitoring parameters or six sub-menu items simultaneously.
Other	(13)	RJ45 interface	RJ45 interface	Interface to connect to a VFD.
	(14)	Battery holder	Clock battery holder	The battery holder is used for replacing or installing a battery for the clock.
	(15)	USB terminal	Mini USB terminal	Mini USB terminal is used to connect to the USB flash drive through an adapter.

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

Figure 5-2 Main interface of LCD



Area	Name	Display
Header A	Real-time display area	Display the real-time; clock battery is not included; the time needs to be reset when powering on the VFD

Area	Name	Display
Header B	VFD running state display area	Displays the running status of the VFD: ● Displays motor rotation direction: ✧ "Fwd" – Run forward during operation; ✧ "Rev" – Run reversely during operation; ✧ "Forbid" – Reverse running is forbidden; ● Displays VFD running command channel: ✧ "Local" – Keypad; ✧ "Terminal"–Terminal; ✧ "Remote"–Communication; ● Displays current running state of the VFD: ✧ "Ready" – The VFD is in stop state (no fault); ✧ "Run" – The VFD is in running state; ✧ "Jog"–The VFD is in jogging state; ✧ "Pre-alarm"–the VFD is under pre-alarm state during running; ✧ "Fault"–VFD fault occurred.
Header C	Model display area	VFD model display: "GD350" – current VFD is GD350 IP55 series VFD.
Display D	Parameter names and function codes on the VFD homepage	Display a maximum of three parameter names and function codes on the homepage. The parameters displayed on the homepage can be managed.
Display E	Values of parameters on the VFD homepage	Display the values of parameters on the VFD homepage, which are updated in real time.
Footer F	Corresponding menu of function key (4), (5) and (6)	Corresponding menu of function key (4), (5) and (6). The corresponding menu of function key (4), (5) and (6) varies with interfaces, and the contents displayed in this area is also different.

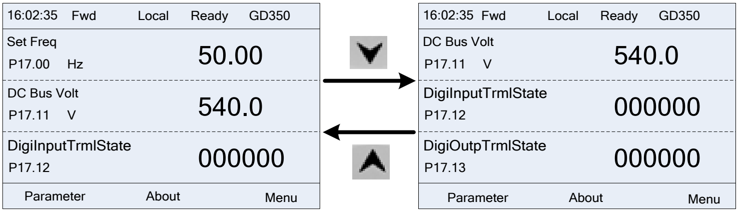
5.3 Keypad display

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

5.3.1 Displaying stopped-state parameters

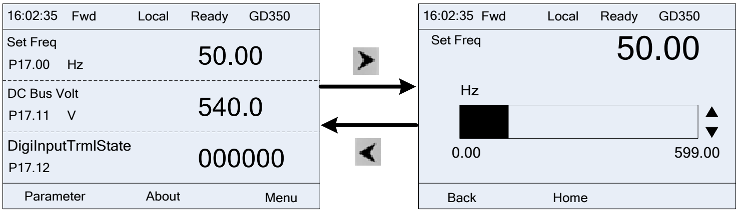
When the VFD is in stopped state, the keypad displays stopped-state parameters, and this interface is the main interface during power-on by default. Under stop state, parameters in various states can be displayed. Press  or  to shift the displayed parameter up or down.

Figure 5-3 Displaying stopped-state parameters



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

Figure 5-4 Displaying stopped-state parameters

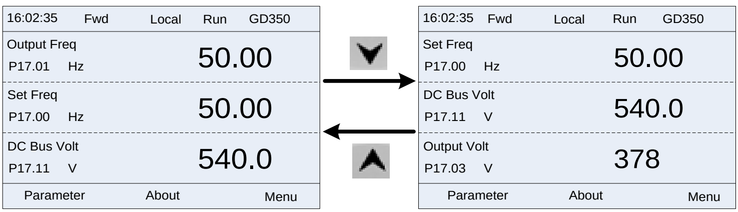


The stopped-state parameter display list is user defined, and each state variable function code can be added to the list as needed. The state variable which has been added to the list can also be deleted or shifted.

5.3.2 Displaying running-state parameters

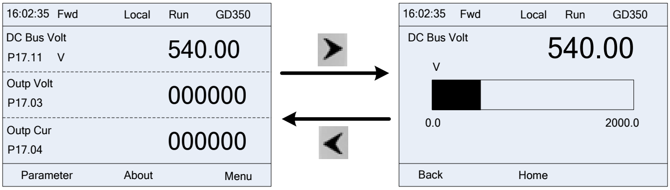
After receiving valid running command, the VFD will enter running state, and the keypad displays running state parameter with RUN indicator on the keypad turning on. Under running state, multiple kinds of state parameters can be displayed. Press or to shift up or down.

Figure 5-5 Displaying running-state parameters



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

Figure 5-6 Displaying running-state parameters



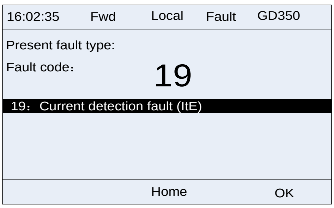
Under running state, multiple kinds of state parameters can be displayed. The running display parameter list is user defined, and each state variable function code can be added to the running display parameter list as needed. The state variable which has been added to the running display parameter list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

5.3.3 Displaying fault alarms

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

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

Figure 5-7 Displaying fault alarms



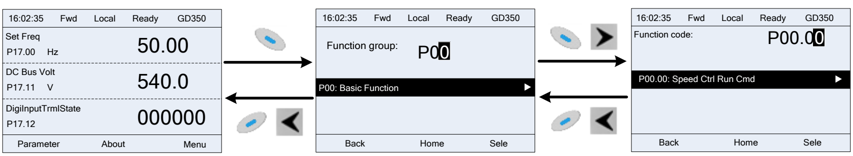
5.4 Operation procedure

Various operations can be performed on the VFD, including entering/exiting menu, parameter selection, list modification and parameter addition.

5.4.1 Entering/Exiting menus

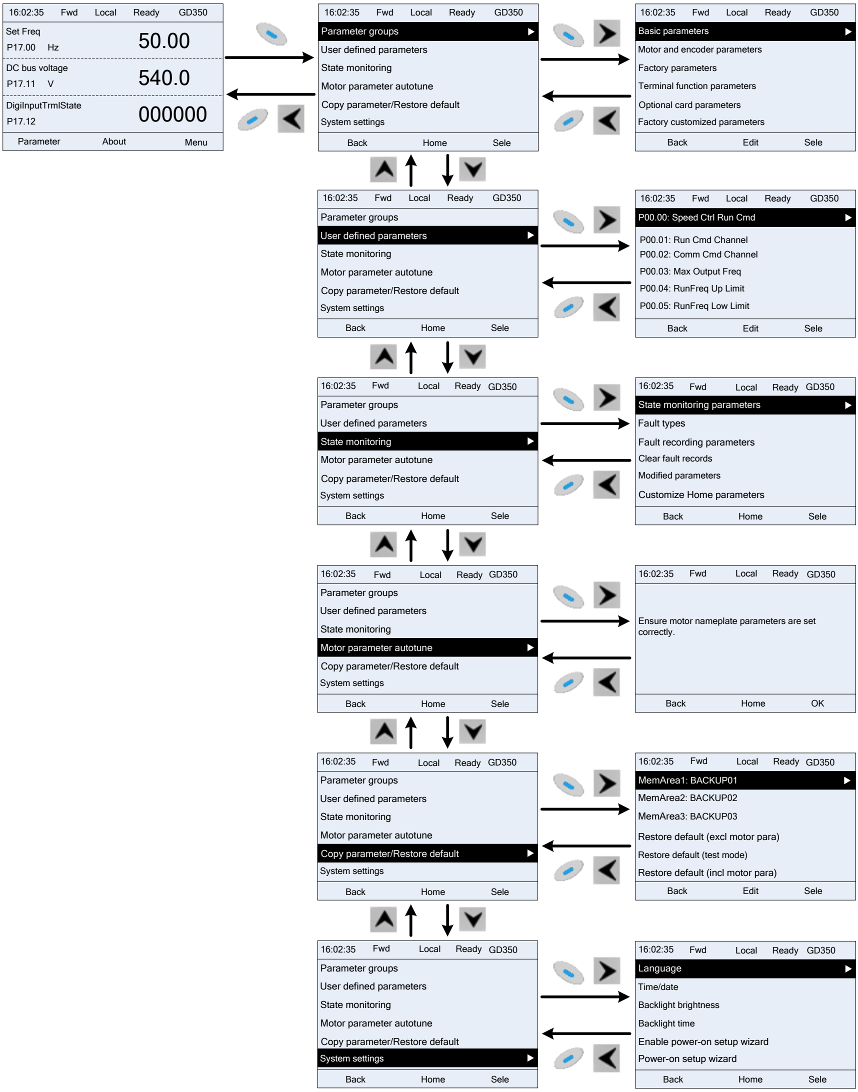
Regarding the monitoring menu, the operation relation between entering and exiting is shown as follows.

Figure 5-8 Enter/exit menu diagram 1



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

Figure 5-9 Enter/exit menu diagram 2



The keypad menu setup is shown as follows:

<table>
<tr><th>Level 1</th><th>Level 2</th><th>Level 3</th><th>Level 4</th></tr>
<tr><td rowspan="31">Parameter groups</td><td rowspan="14">Basic parameters</td><td>P00: Basic functions</td><td>P00.xx</td></tr>
<tr><td>P01: Start and stop control</td><td>P01.xx</td></tr>
<tr><td>P03: Vector control of motor 1</td><td>P03.xx</td></tr>
<tr><td>P04: V/F control</td><td>P04.xx</td></tr>
<tr><td>P07: Human-machine interface</td><td>P07.xx</td></tr>
<tr><td>P08: Enhanced functions</td><td>P08.xx</td></tr>
<tr><td>P09: PID control</td><td>P09.xx</td></tr>
<tr><td>P10: Simple PLC and multi-step speed control</td><td>P10.xx</td></tr>
<tr><td>P11: Protection parameters</td><td>P11.xx</td></tr>
<tr><td>P13: SM control parameters</td><td>P13.xx</td></tr>
<tr><td>P14: Serial communication functions</td><td>P14.xx</td></tr>
<tr><td>P21: Position control</td><td>P21.xx</td></tr>
<tr><td>P22: Spindle positioning</td><td>P22.xx</td></tr>
<tr><td>P23: Vector control of motor 2</td><td>P23.xx</td></tr>
<tr><td rowspan="4">Motor and encoder parameters</td><td>P02: Motor 1 parameters</td><td>P02.xx</td></tr>
<tr><td>P12: Motor 2 parameters</td><td>P12.xx</td></tr>
<tr><td>P20: Motor 1 encoder group</td><td>P20.xx</td></tr>
<tr><td>P24: Motor 2 encoder group</td><td>P24.xx</td></tr>
<tr><td>Factory parameters</td><td>P99: Factory function group</td><td>xxxxx</td></tr>
<tr><td rowspan="3">Terminal function parameters</td><td>P05: Input terminal group</td><td>P05.xx</td></tr>
<tr><td>P06: Output terminal group</td><td>P06.xx</td></tr>
<tr><td>P98: AIAO calibration functions</td><td>xxxxx</td></tr>
<tr><td rowspan="6">Optional card parameters</td><td>P15: Communication expansion card 1 functions</td><td>P15.xx</td></tr>
<tr><td>P16: Communication expansion card 2 functions</td><td>P16.xx</td></tr>
<tr><td>P25: Expansion I/O card input functions</td><td>P25.xx</td></tr>
<tr><td>P26: Expansion I/O card output functions</td><td>P26.xx</td></tr>
<tr><td>P27: Programmable expansion card functions</td><td>P27.xx</td></tr>
<tr><td>P28: Master/slave control</td><td>P28.xx</td></tr>
<tr><td rowspan="3">Factory customized parameters</td><td>P90: Tension control speed mode</td><td>P90.xx</td></tr>
<tr><td>P91: Tension control torque mode</td><td>P91.xx</td></tr>
<tr><td>P92: Tension control optimization</td><td>P92.xx</td></tr>
</table>

Level 1	Level 2	Level 3	Level 4
		functions	
User defined parameters	/	/	P00.00: Speed Ctrl Run Cmd
			P00.01: Run Cmd Channel
			Pxx.xx: Parameter setup xx
State monitoring	State monitoring parameters	P07: Human-machine interface	P07.xx
		P17: Status viewing functions	P17.xx
		P18 group: Closed-loop vector state check functions	P18.xx
		P19: Status viewing functions of expansion card	P19.xx
		P93: Tension control status viewing	P93.xx
	Fault types	/	P07.27: Type of present fault
			P07.28: Type of the last fault
			P07.29: Type of the 2nd-last fault
			P07.30: Type of the 3rd-last fault
			P07.31: Type of the 4th-last fault
			P07.32: Type of the 5th-last fault
	Fault recording parameters	/	P07.33: Running frequency at present fault
			P07.34: Ramp frequency at present fault
			P07.xx: xx state of the last but xx fault
	Clear fault records	/	Are you sure to clear fault history?
	Modified parameters	/	Pxx.xx: Modified parameter 1
			Pxx.xx: Modified parameter 2
			Pxx.xx: Modified parameter xx
	Customize Home parameters	Stopped-state parameters	/
		Running-state parameters	/
Motor parameter	/	Ensure motor nameplate parameters are set correctly.	Complete parameter rotary autotuning

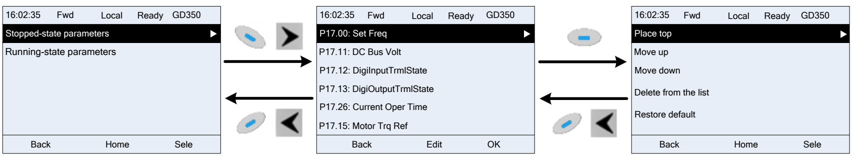
Level 1	Level 2	Level 3	Level 4
autotune			Complete parameter static autotuning
			Partial parameter static autotuning
			Complete parameter rotary autotuning 2 (for AM)
			Complete parameter static autotuning 2 (for AM)
Copy parameter/ Restore default	/	MemArea1: BACKUP01	Upload param from local to keypad
			Download all param from keypad
			Download non motor param from keypad
			Download motor param from keypad
		MemArea2: BACKUP02	Upload param from local to keypad
			Download all param from keypad
			Download non motor param from keypad
			Download motor param from keypad
		MemArea3: BACKUP03	Upload param from local to keypad
			Download all param from keypad
			Download non motor param from keypad
			Download motor param from keypad
		Restore default (excl motor para)	Sure to restore defaults (excl motor para)?
		Restore default (test mode)	Sure to restore default (test mode)?
		Restore default (incl motor para)	Sure to restore default (incl motor para)?

Level 1	Level 2	Level 3	Level 4
System settings	/	/	Language
			Time/date
			Backlight brightness
			Backlight time
			Enable power-on setup wizard
			Power-on setup wizard
			Keypad burning selection
			Enable fault time
			Control board burning selection
			Up/down key sensitivity

5.4.2 Editing list

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

Figure 5-10 Editing list 1

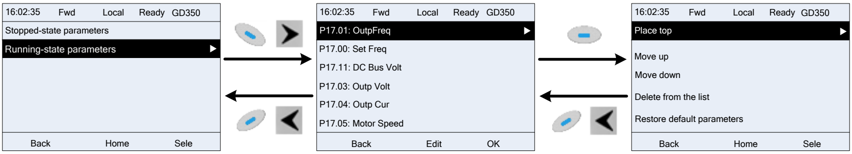


Press key to enter edit interface, select the operation needed, and press key, key or key to confirm the edit operation and return to the previous menu (parameter list), the returned list is the list edited. If key or key is pressed in edit interface without selecting an edit operation, it will return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

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

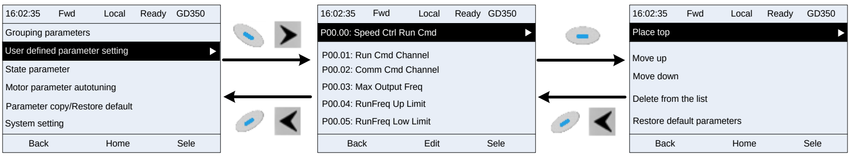
The items in the parameter list in running state can be added as needed (through the menu of user defined home parameters), and the list can also be edited such as "Place top", "Move up", "Move down", "Delete from the list", and "Restore default parameters". The edit function is shown in the interface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

Figure 5-11 Editing list 2



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

Figure 5-12 Editing list 3



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

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

Figure 5-13 Adding a parameter 1

After selecting a specific function code, press key to enter parameter addition interface, and press key, key or key to confirm the addition operation. If this parameter is not included in the list of parameters displayed in stopped state or list of parameters displayed in running state, the parameter added will be at the end of the list; if the parameter is already in the list of parameters displayed in stopped state or list of parameters displayed in running state, the addition operation will be invalid. If key or key is pressed without selecting addition operation in "Addition" interface, it will return to monitoring parameter list menu.

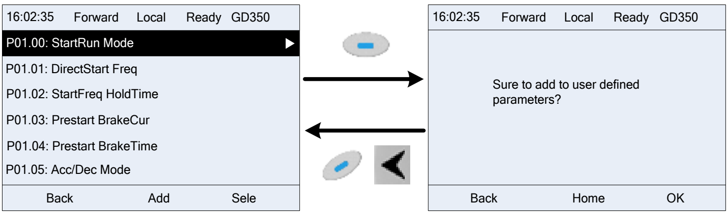
Part of the monitoring parameters in P07 HMI group can be added to the "parameter displayed in stop state" list or "parameter displayed in running state" list; all the parameters in P17, P18 and P19 group can be added to the "parameter displayed in stop state" list or "parameter displayed in running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

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

5.4.4 Adding parameters to the user defined parameter setting list

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

Figure 5-14 Adding a parameter 2



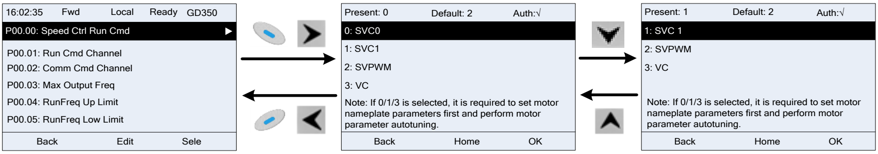
Press key to enter addition interface, and press key, key or key to confirm the addition operation. If this parameter is not included in the original user defined parameter list, the newly-added parameter will be at the end of the list; if this parameter is already in the user defined parameter list,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

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

5.4.5 Editing user defined parameters

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

Figure 5-15 Editing user defined parameters



In parameter selection edit interface, the "Auth" field in the upper right corner indicates whether this parameter is editable or not.

"√" indicates the set value of this parameter can be modified under current state.

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

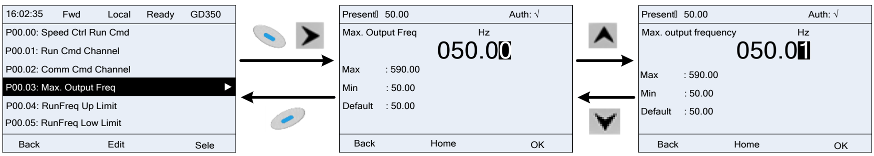
"Present" indicates the actually selected value.

"Default" indicates the default value of this parameter.

5.4.6 Editing parameters in parameter groups

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

Figure 5-16 Editing parameters in parameter groups



In parameter selection edit interface, the "Auth" field in the upper right corner indicates whether this parameter is editable or not.

"√" indicates the set value of this parameter can be modified under current state.

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

"Present" indicates the present value.

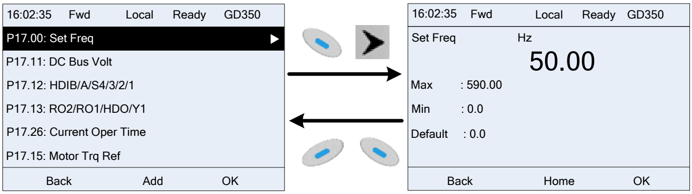
"Default" indicates the default value of this parameter.

5.4.7 Monitoring states

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

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

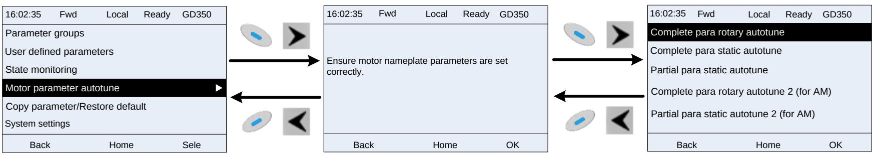
Figure 5-17 State monitoring interface



5.4.8 Autotuning motor parameters

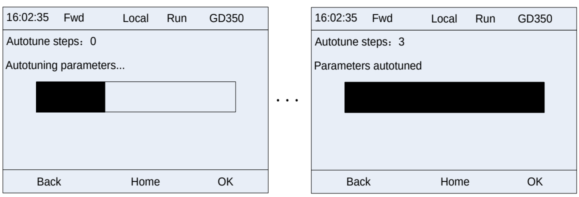
You can choose **Menu** > **Motor parameter autotune** and press key, key or key to enter motor parameter autotuning interface. However, before entering the motor parameter autotuning interface, you must set the motor nameplate parameters correctly. After entering the interface, select a motor autotuning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

Figure 5-18 Selecting a parameter autotuning type



After selecting a motor autotuning type, enter motor parameter autotuning interface, and press RUN key to start motor parameter autotuning. After autotuning is done, a message will pop up indicating autotuning is succeeded, and then it will return to the main interface of stop. During autotuning, you can press STOP/RST key to terminate autotuning; if any fault occur during autotuning, the keypad will display a fault interface.

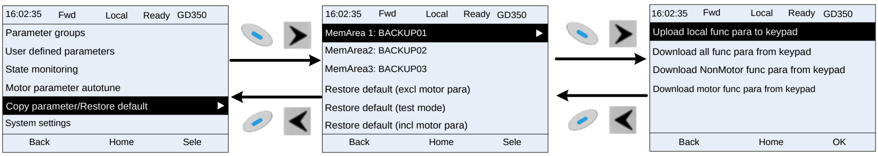
Figure 5-19 Parameter autotuning



5.4.9 Parameter backup

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

Figure 5-20 Parameter backup

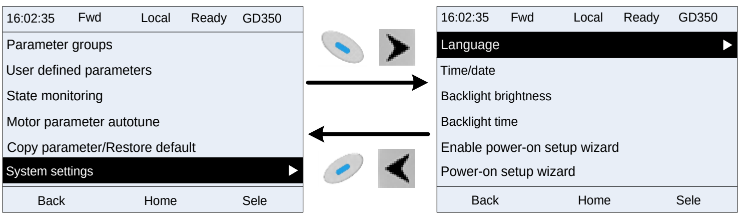


5.4.10 System settings

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

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

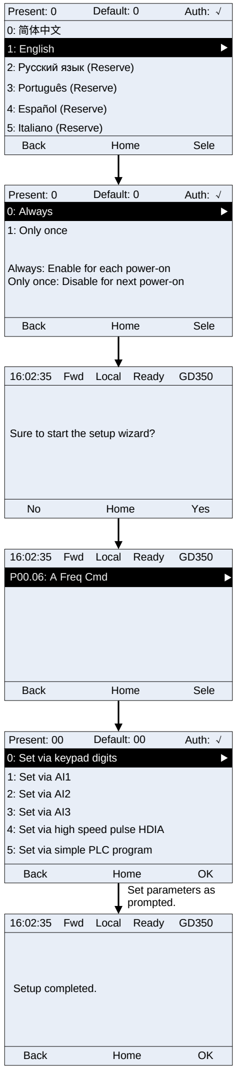
Figure 5-21 System settings



5.4.11 Power-on guiding settings

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

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



5.5 Basic operation description

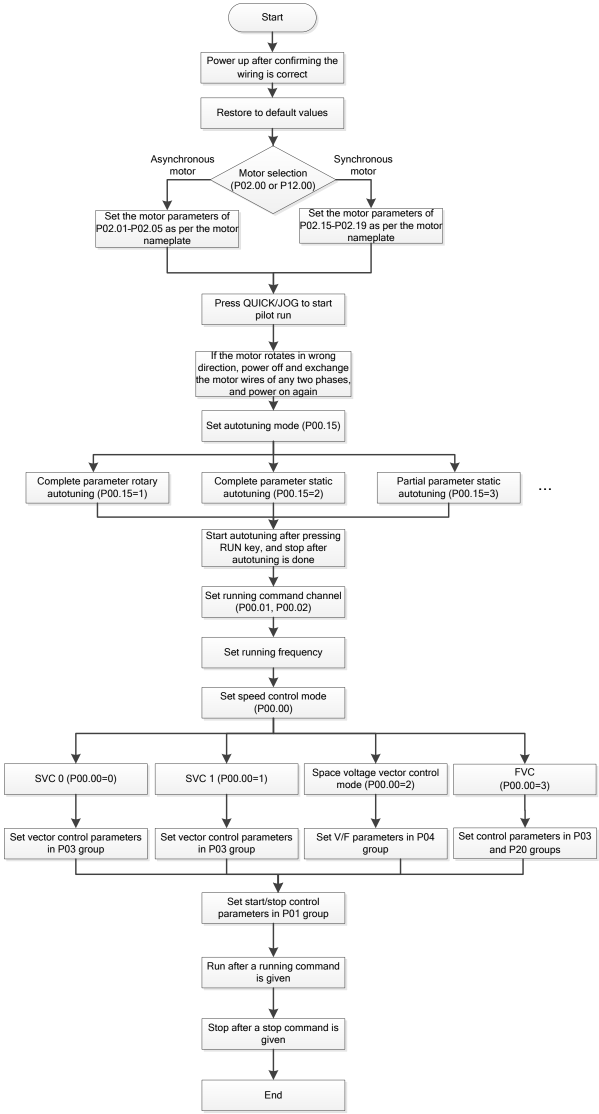
5.5.1 What this section describes

This section introduces the function modules inside the VFD.

⚠	● Ensure that all terminals have been securely connected. ● Ensure that the motor power matches the VFD power.

5.5.2 Common commissioning procedure

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



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

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

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

Note: "/" indicates this multifunction terminal is invalid under present reference channel.

Related parameter list:

Function code	Name	Description	Default
P00.00	Speed control mode	0: SVC mode 0 1: SVC mode 1 2: Space voltage vector control mode 3: Feedback vector control (FVC) mode **Note:** Before using a vector control mode, 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 2: Ethernet communication 3: EtherCAT/PROFINET/ EtherNet IP communication 4: Programmable expansion card 5: Wireless communication card 6: Reserved	0
P00.15	Perform motor parameter autotuning.	0: No operation 1: Rotary autotuning 1 Comprehensive motor parameter autotuning. It is recommended to use rotating autotuning when high control accuracy is required. 2: Static autotuning 1 (comprehensive autotuning) Motor parameter autotuning. It is applicable in scenarios where the motor cannot be disconnected from load.	0

Function code	Name	Description	Default
		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: Rotary autotuning 2 It is similar to rotary autotuning 1 but only valid for AMs. 5: Static autotuning 3 (partial autotuning) It is valid only for AMs.	
P00.18	Function parameter restoration	0: No operation 1: Restore default values 2: Clear fault records 3: Reserved 4: Reserved 5: Restore to default values (factory test mode) 6: Restore to default values (including motor parameters) **Note:** After the selected operation is performed, the function code is automatically restored to 0. Restoring the default values may delete the user password. Exercise caution when using this function. The option 5 can be used only for factory testing.	0
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
P02.15	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

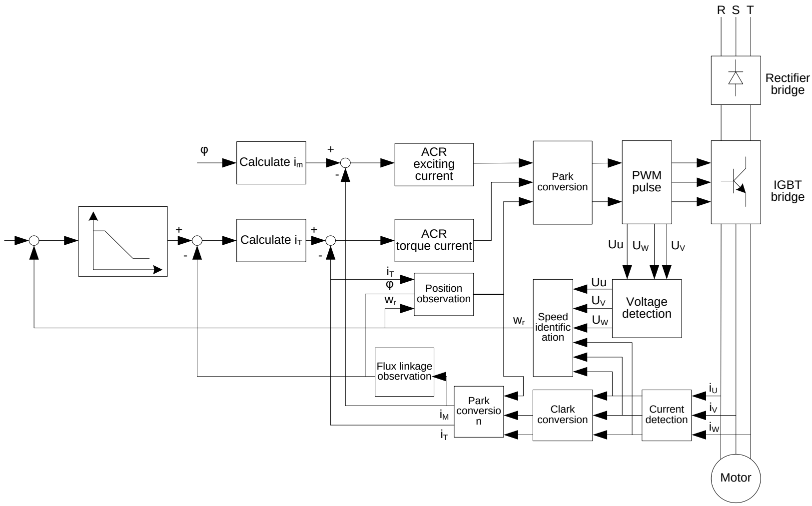
Function code	Name	Description	Default
P02.17	Number of pole pairs of SM 1	1–50	2
P02.18	Rated voltage of SM 1	0–1200V	Model depended
P02.19	Rated current of SM 1	0.8–6000.0A	Model depended
P05.01–P05.06	Function selection of multifunction digital input terminals (S1–S4, HDIA, HDIB)	36: Switch the running command channel to keypad 37: Switch the running command channel to terminal 38: Switch the running command channel to communication	See "Group P05—Input terminal functions"
P07.01	Reserved	/	/
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: Reserved Tens place: Reserved	0x01

5.5.3 Vector control

AMs feature high order, nonlinearity, strong coupling and multi-variables, which increase difficulty to control AMs during actual application. The vector control technology solves this situation as follows: measures and controls the stator current vector of the AM, and then decomposes the stator current vector into exciting current (current component that generates internal magnet field) and torque current (current component that generates torque) based on field orientation principle, and therefore controls the amplitude values and phase positions of the two components (namely, controls the stator current vector of the AM) to realize decoupled control on exciting current and torque current, thus achieving high-performance speed regulation of the AM.

The VFD uses the sensor-less vector control algorithm, which can be used to drive AMs and permanent-magnet SMs simultaneously. As the core algorithm of vector control is based on accurate motor parameter models, the accuracy of motor parameters affects vector control performance. It is recommended to enter accurate motor parameters and autotune motor parameters before executing vector control.

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



Function code	Name	Description	Default
P00.00	Speed control mode	0: SVC mode 0 1: SVC mode 1 2: Space voltage vector control mode 3: Feedback vector control (FVC) mode **Note:** Before using a vector control mode, enable the VFD to perform motor parameter autotuning first.	2
P00.15	Perform motor parameter autotuning.	0: No operation 1: Rotary autotuning 1 Comprehensive motor parameter autotuning. It is recommended to use rotating autotuning when high control accuracy is required. 2: Static autotuning 1 (comprehensive autotuning) Motor parameter autotuning. It is applicable in scenarios where the motor cannot be disconnected from load.	0

Function code	Name	Description	Default
		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: Rotary autotuning 2 It is similar to rotary autotuning 1 but only valid for AMs. 5: Static autotuning 3 (partial autotuning) It is valid only for AMs.	
P02.00	Type of motor 1	0: Asynchronous motor (AM) 1: Synchronous motor (SM)	0
P03.00	Speed-loop proportional gain 1	0–200.0	20.0
P03.01	Speed-loop integral time 1	0.000–10.000s	0.200s
P03.02	Low-point frequency for switching	0.00Hz–P03.05	5.00Hz
P03.03	Speed-loop proportional gain 2	0–200.0	20.0
P03.04	Speed-loop integral time 2	0.000–10.000s	0.200s
P03.05	High-point frequency for switching	P03.02–P00.03 (Max. output frequency)	10.00Hz
P03.06	Speed-loop output filter	0–8 (0–2^8/10ms)	0
P03.07	Electromotive slip compensation coefficient of vector control	50%–200%	100%
P03.08	Braking slip compensation coefficient of vector control	50%–200%	100%
P03.09	Current-loop proportional coefficient P	0–65535	1000
P03.10	Current-loop integral coefficient I	0–65535	1000
P03.32	Enabling torque	0: Disable	0

Function code	Name	Description	Default
	control	1: Enable	
P03.11	Torque setting method selection	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 10: Pulse frequency HDIB 11: EtherCAT/PROFINET/ EtherNet IP communication 12: Programmable expansion card **Note:** For these settings, 100% corresponds to the motor rated current.	0
P03.12	Torque set through keypad	-300.0%–300.0% (of the motor rated current)	50.0%
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 expansion card 12: Reserved **Note:** 100% corresponds to the max. frequency.	0
P03.15	Setting source of reverse rotation	0: Keypad (P03.17) 1–11: Same as those for P03.14	0

Function code	Name	Description	Default
	upper-limit frequency in torque control		
P03.16	Forward rotation frequency upper limit set through keypad in torque control	Setting range: 0.00 Hz–P00.03 (Max. output frequency)	50.00Hz
P03.17	Reverse rotation upper-limit frequency set through keypad in torque control		50.00Hz
P03.18	Setting source of 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) 1–10: 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)	180.0%
P03.21	Braking torque upper limit set through keypad		180.0%
P03.22	Weakening coefficient in constant power zone	0.1–2.0	0.3
P03.23	Lowest weakening point in constant	10%–100.0%	20%

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

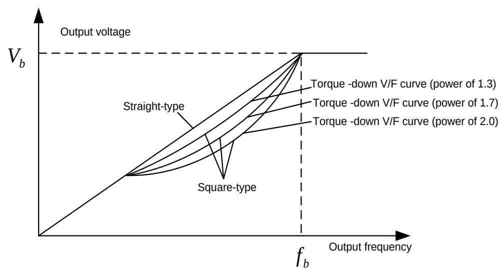
5.5.4 Space voltage vector control mode

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

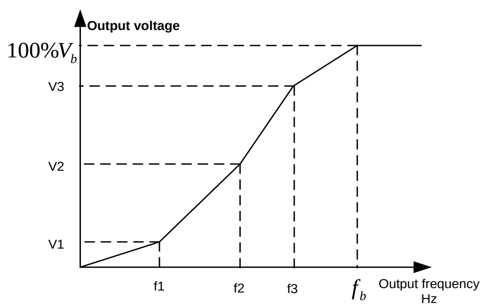
The VFD provides multiple V/F curve modes to meet different requirements. You can select V/F curves or set V/F curves as required.

Suggestions:

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



The VFD also provides multi-point V/F curves. You can change the V/F curves output by the VFD by setting the voltage and frequency of the three points in the middle. A whole curve consists of five points starting from (0Hz, 0V) and ending at (motor fundamental frequency, motor rated voltage). During setting, follow the rule: 0 ≤ f1 ≤ f2 ≤ f3 ≤ Motor fundamental frequency, and, 0 ≤ V1 ≤ V2 ≤ V3 ≤ Motor rated voltage



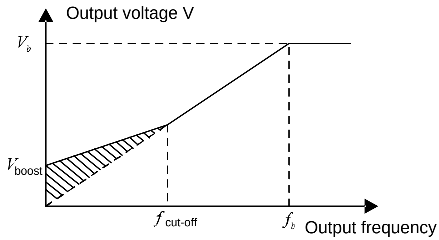
The VFD provides dedicated function codes for the space voltage control mode. You can improve the space voltage control performance by means of setting.

(1) Torque boost

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

Note:

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



(2) Energy-saving run

During actual running, the VFD can search for the max. efficiency point to keep running in the most efficient state to save energy.

Note:

- This function is generally used in light load or no-load cases.
- This function is no applicable to the cases where sudden load changes often occur.

(3) V/F slip compensation gain

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

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

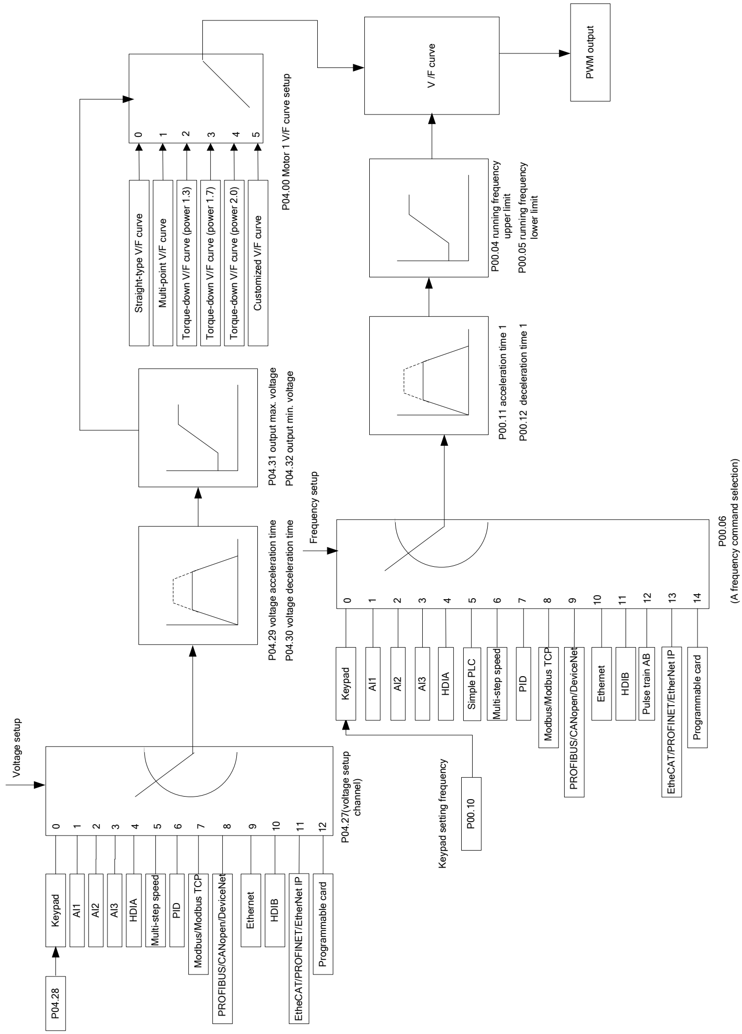
Note: Rated slip frequency = (Rated synchronous rotation speed of motor – Rated rotation speed of motor) x (Number of motor pole pairs)/60

(4) Oscillation control

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

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

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



When selecting the customized V/F curve function, you can specify the setting channels and acceleration/deceleration time of voltage and frequency respectively, which form a real-time V/F curve in combination manner.

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

Function code	Name	Description	Default
P00.00	Speed control mode	0: SVC mode 0 1: SVC mode 1 2: Space voltage vector control mode 3: Feedback vector control (FVC) mode **Note:** Before using a vector control mode (0, 1, or 3), enable the VFD to perform motor parameter autotuning first.	2
P00.03	Max. output frequency	P00.04–599.00Hz	50.00Hz
P00.04	Upper limit of running frequency	P00.05–P00.03	50.00Hz
P00.05	Lower limit of running frequency	0.00Hz–P00.04	0.00Hz
P00.11	ACC time 1	0.0–3600.0s	Model depended
P00.12	DEC time 1	0.0–3600.0s	Model depended
P02.00	Type of motor 1	0: Asynchronous motor (AM) 1: Synchronous motor (SM)	0
P02.02	Rated frequency of AM 1	0.01Hz–P00.03 (Max. output frequency)	50.00Hz
P02.04	Rated voltage of AM 1	0–1200V	Model depended
P04.00	V/F curve setting of motor 1	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)	0
P04.01	Torque boost of motor 1	0.0%: (automatic); 0.1%–10.0%	0.0%
P04.02	Torque boost cut-off of motor 1	0.0%–50.0% (of the rated frequency of motor 1)	20.0%
P04.03	V/F frequency point 1 of motor 1	0.00Hz–P04.05	0.00Hz
P04.04	V/F voltage point 1 of motor 1	0.0%–110.0%	0.0%

Function code	Name	Description	Default
P04.05	V/F frequency point 2 of motor 1	P04.03–P04.07	0.00Hz
P04.06	V/F voltage point 2 of motor 1	0.0%–110.0%	0.0%
P04.07	V/F frequency point 3 of motor 1	P04.05–P02.02 or P04.05–P02.16	0.00Hz
P04.08	V/F voltage point 3 of motor 1	0.0%–110.0%	0.0%
P04.09	V/F slip compensation gain of motor 1	0.0–200.0%	100.0%
P04.10	Low-frequency oscillation control factor of motor 1	0–100	10
P04.11	High-frequency oscillation control factor of motor 1	0–100	10
P04.12	Oscillation control threshold of motor 1	0.00Hz–P00.03 (Max. output frequency)	30.00Hz
P04.13	V/F curve setting of motor 2	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)	0
P04.14	Torque boost of motor 2	0.0%: (automatic); 0.1%–10.0%	0.0%
P04.15	Torque boost cut-off of motor 2	0.0%–50.0% (of the rated frequency of motor 1)	20.0%
P04.16	V/F frequency point 1 of motor 2	0.00Hz–P04.18	0.00Hz
P04.17	V/F voltage point 1 of motor 2	0.0%–110.0%	0.0%
P04.18	V/F frequency point 2 of motor 2	P04.16–P04.20	0.00Hz
P04.19	V/F voltage point 2 of motor 2	0.0%–110.0%	0.0%
P04.20	V/F voltage point 3 of motor 2	P04.18–P02.02 or P04.18–P02.16	0.00Hz
P04.21	V/F voltage point 3 of	0.0%–110.0%	0.0%

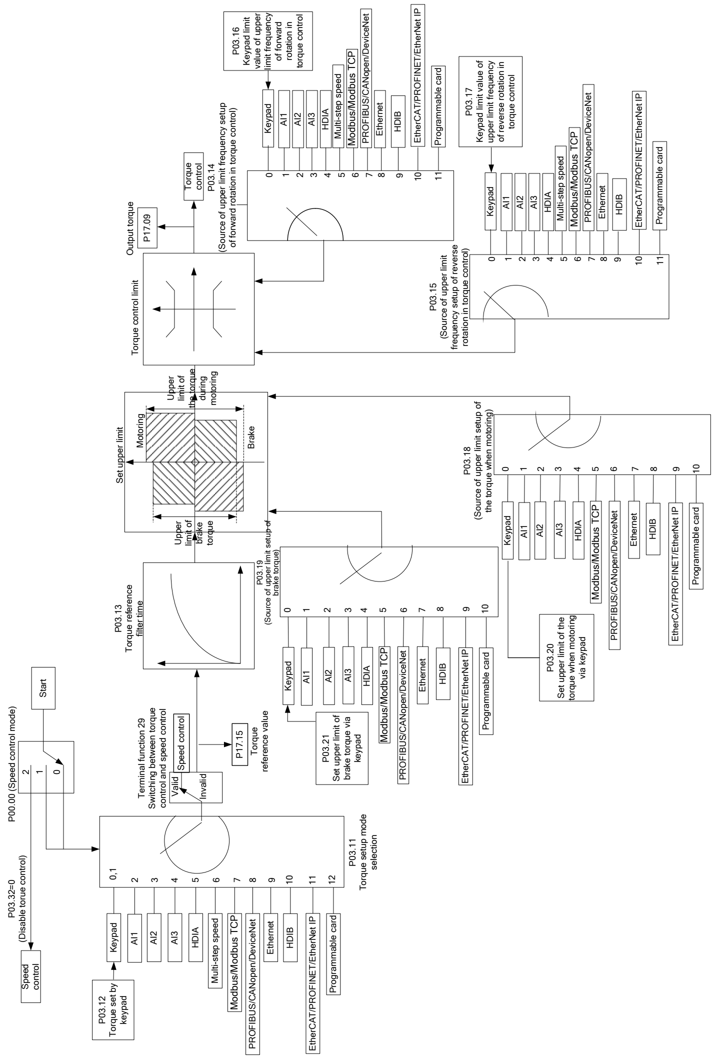
Function code	Name	Description	Default
	motor 2		
P04.22	V/F slip compensation gain of motor 2	0.0–200.0%	100.0%
P04.23	Low-frequency oscillation control factor of motor 2	0–100	10
P04.24	High-frequency oscillation control factor of motor 2	0–100	10
P04.25	Oscillation control threshold of motor 2	0.00Hz–P00.03 (Max. output frequency)	30.00Hz
P04.26	Energy-saving run	0: Disable 1: Automatic energy-saving run	0
P04.27	Voltage setting channel selection	0: Keypad; Output voltage is determined by P04.28. 1: AI1 2: AI2 3: AI3 4: HDIA 5: Multi-step running 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
P04.28	Voltage set through keypad	0.0%–100.0% (of the motor rated voltage)	100.0%
P04.29	Voltage increase time	0.0–3600.0s	5.0s
P04.30	Voltage decrease time	0.0–3600.0s	5.0s
P04.31	Max. output voltage	P04.32 –100.0% (of the motor rated voltage)	100.0%
P04.32	Min. output voltage	0.0%–P04.31 (motor rated 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	20.0%

Function code	Name	Description	Default
		than the frequency specified by P04.36. Setting range: -100.0%–+100.0% (of the motor rated current)	
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 higher than the frequency specified by P04.36. Setting range: -100.0%–+100.0% (of the motor rated current)	10.0%
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 IF mode for AM 1	0: Disable 1: Enable	0
P04.41	Current setting in IF mode for AM 1	When IF control is adopted for AM 1, the function code is used to set the output current. The value is a percentage in relative to the rated current of the motor.	120.0%

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

5.5.5 Torque control

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



Function code	Name	Description	Default
P00.00	Speed control mode	0: SVC mode 0 1: SVC mode 1 2: Space voltage vector control mode 3: Feedback vector control (FVC) mode **Note:** Before using a vector control mode (0, 1, or 3), enable the VFD to perform motor parameter autotuning first.	2
P03.32	Enabling torque control	0: Disable 1: Enable	0
P03.11	Torque setting method selection	0: Keypad (P03.12) 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 10: Pulse frequency HDIB 11: EtherCAT/PROFINET/ EtherNet IP communication 12: Programmable expansion card **Note:** For these settings, 100% corresponds to the motor rated current.	0
P03.12	Torque set through keypad	-300.0%–300.0% (of the motor rated current)	50.0%
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	0

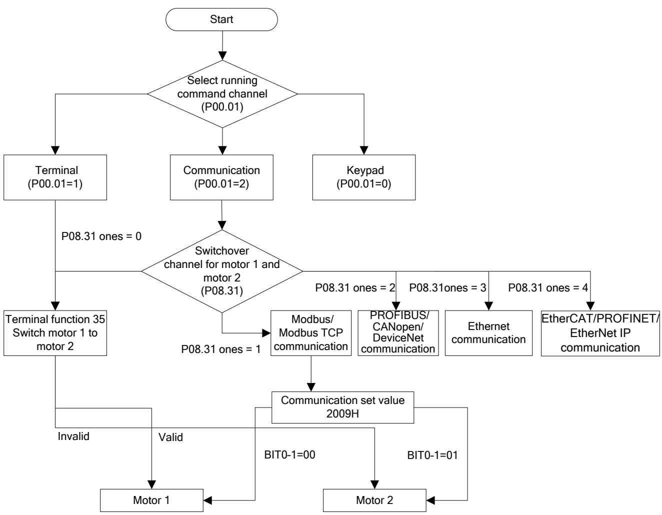
Function code	Name	Description	Default
		10: EtherCAT/PROFINET/ EtherNet IP communication 11: Programmable expansion card 12: Reserved **Note:** 100% corresponds to the max. frequency.	
P03.15	Setting source of reverse rotation upper-limit frequency in torque control	0: Keypad (P03.17) 1–11: Same as those for P03.14	0
P03.16	Forward rotation frequency upper limit set through keypad in torque control	0.00Hz–P00.03 (Max. output frequency)	50.00 Hz
P03.17	Reverse rotation upper-limit frequency set through keypad in torque control	0.00Hz–P00.03 (Max. output frequency)	50.00 Hz
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) 1–10: 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)	180.0%

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

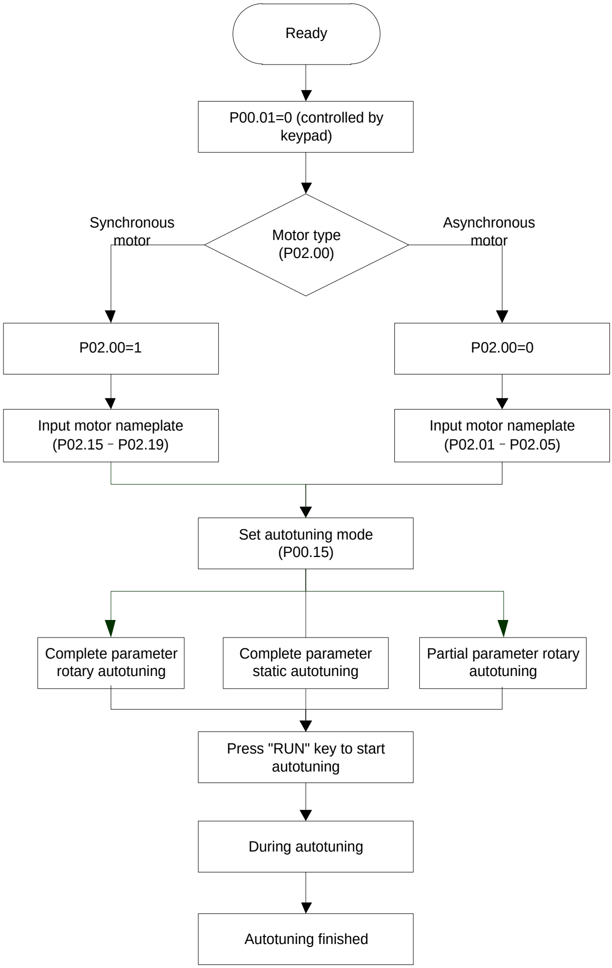
5.5.6 Motor parameters

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

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



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



Note:

- Motor parameters must be set correctly according to the motor nameplate.
- If rotary autotuning is selected during motor autotuning, disconnect the motor from the load to put the motor in static and no-load state. Otherwise, the motor parameter autotuning results may be incorrect. In addition, autotune P02.06–P02.10 for AMs and autotune P02.20–P02.23 for SMs.

- If static autotuning is selected for motor autotuning, there is no need to disconnect the motor from the load, but the control performance may be impacted as only a part of the motor parameters have been autotuned. In addition, autotune P02.06–P02.10 for AMs and autotune P02.20–P02.22 for SMs. P02.23 can be obtained through calculation.
- Motor autotuning can be carried out on the present motor only. If you need to perform autotuning on the other motor, switch the motor through selecting the switch-over channel of motor 1 and motor 2 by setting the ones place of P08.31.

Related parameter list:

Function code	Name	Description	Default
P00.01	Channel of running commands	0: Keypad 1: Terminal 2: Communication	0
P00.15	Perform motor parameter autotuning.	0: No operation 1: Rotary autotuning 1 Comprehensive motor parameter autotuning. It is recommended to use rotating autotuning when high control accuracy is required. 2: Static autotuning 1 (comprehensive autotuning) Motor parameter autotuning. It is applicable in scenarios where the motor cannot be disconnected from 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: Rotary autotuning 2 It is similar to rotary autotuning 1 but only valid for AMs. 5: Static autotuning 3 (partial autotuning) It is valid only for AMs.	0
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

Function code	Name	Description	Default
			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
P02.15	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	1–50	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 constant of SM 1	0–10000	300
P05.01–P05.06	Function selection of multifunction digital input terminals (S1–S4, HDIA, HDIB)	35: Switch from motor 1 to motor 2	See "Group P05—Input terminal

Function code	Name	Description	Default
			functions”
P08.31	Switching between motor 1 and motor 2	0x00–0x14 Ones place: Switchover channel 0: Terminal 1: Modbus/Modbus TCP communication 2: PROFIBUS/CANopen/DeviceNet communication 3: Ethernet communication 4: EtherCAT/PROFINET/ EtherNet IP communication Tens place: indicates whether to enable switchover during running 0: Disable 1: Enable	00
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	1–36000rpm	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 AM 2	0.1–6553.5A	Model depended
P12.15	Rated power of SM 2	0.1–3000.0kW	Model depended

Function code	Name	Description	Default
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	1–50	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 1	0–10000	300

5.5.7 Start/stop control

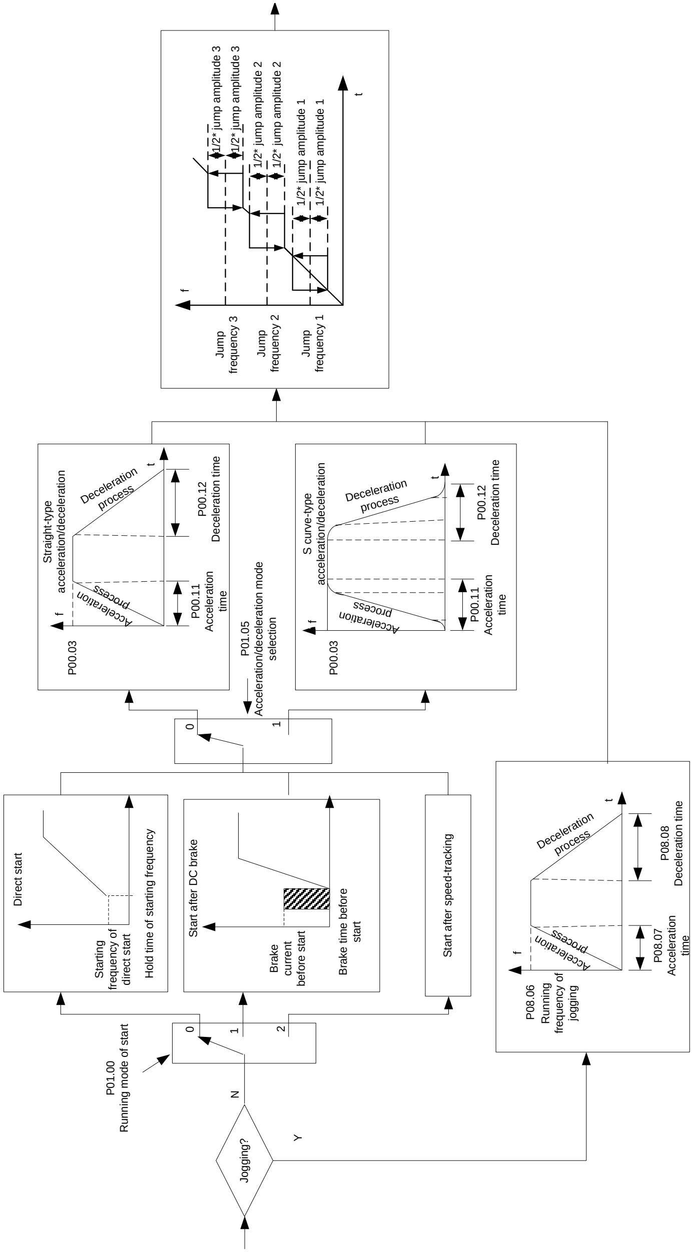
The start/stop control of the VFD involves three states: start after a running command is given at power-on; start after power-off restart is effective; start after automatic fault reset. The three start/stop control states are described in the following.

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

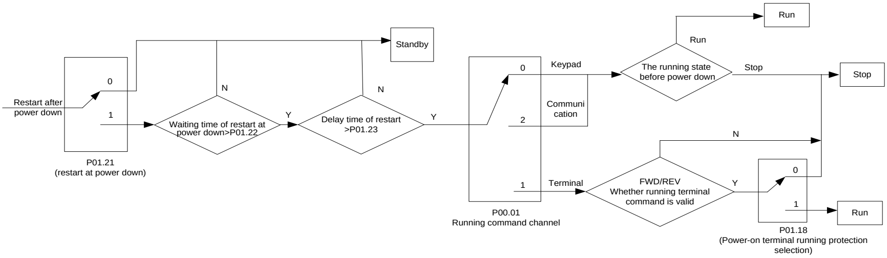
For large-inertia load, especially in cases where reversal may occur, you can choose to start after DC braking or start after speed tracking.

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

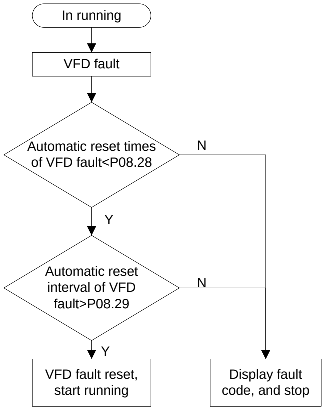
1. Logic diagram for start after a running command is given at power-on



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



3. Logic diagram for start after automatic fault reset



Related parameter list:

Function code	Name	Description	Default
P00.01	Channel of running commands	0: Keypad 1: Terminal 2: Communication	0
P00.11	ACC time 1	0.0–3600.0s	Model depended
P00.12	DEC time 1	0.0–3600.0s	Model depended
P01.00	Running mode of start	0: Direct start 1: Start after DC braking 2: Start after speed tracking	0
P01.01	Starting frequency of direct start	0.00–50.00Hz	0.50Hz

Function code	Name	Description	Default
P01.02	Hold time of starting frequency	0.0–50.0s	0.0s
P01.03	Braking current before start	0.0–100.0%	0.0%
P01.04	DC braking time before start	0.00–50.00s	0.00s
P01.05	ACC and DEC mode	0: Linear 1: S curve **Note:** If mode 1 is selected, set P01.06, P01.07, P01.27 and P01.08 accordingly.	0
P01.08	Stop mode	0: Decelerate to stop 1: Coast to stop	0
P01.09	Starting frequency of braking for stop	0.00Hz–P00.03 (Max. output frequency)	0.00Hz
P01.10	Wait time before DC braking for stop	0.00–50.00s	0.00s
P01.11	DC braking current for stop	0.0–100.0%	0.0%
P01.12	DC braking time for stop	0.00–50.00s	0.00s
P01.13	FWD/REV run deadzone time	0.0–3600.0s	0.0s
P01.14	FWD/REV run switching mode	0: Switch at zero frequency 1: Switch at the starting frequency 2: Switch after the speed reaches the stop speed with a delay	1
P01.15	Stop speed	0.00–100.00Hz	0.50 Hz
P01.16	Stop speed detection mode	0: Detect by the set speed (unique in space voltage vector control mode) 1: Detect according to speed feedback	1
P01.18	Terminal-based running command protection at power-on	0: The terminal running command is invalid at power-on 1: The terminal running command is valid at power-on	0
P01.19	Action selected when running frequency less than frequency lower limit (valid when frequency lower limit greater than 0)	Setting range: 0x00–0x12 Ones place: Action selection 0: Run at the frequency lower limit 1: Stop 2: Sleep Tens place: Stop mode	0x00

Function code	Name	Description	Default
		0: Coast to stop 1: Decelerate to stop	
P01.20	Wake-up-from-sleep delay	0.0–3600.0s (valid only when P01.19 ones place=2)	0.0s
P01.21	Restart after power off	0: Disable 1: Enable	0
P01.22	Wait time for restart after power-off	0.0–3600.0s (valid when P01.21 is 1)	1.0s
P01.23	Start delay	0.0–60.0s	0.0s
P01.24	Stop speed delay	0.0–100.0s	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	0.0–150.0% (of the VFD rated Output current)	0.0%
P01.30	Hold time of short-circuit braking for start	0.00–50.00s	0.00s
P01.31	Hold time of short-circuit braking for stop	0.00–50.00s	0.00s
P01.32	Pre-exciting time for jogging	0–10.000s	0.300s
P01.33	Starting frequency of braking for stop in jogging	0–P00.03	0.00Hz
P01.34	Sleep delay	0–3600.0s	0.0s
P05.01–P05.06	Digital input function selection	1: Run forward 2: Run reversely 4: Jog forward 5: Jog reversely 6: Coast to stop 7: Reset faults 8: Pause running	See "Group P05—Input terminal functions"

Function code	Name	Description	Default
		21: ACC/DEC time selection 1 22: ACC/DEC time selection 2 30: Disable ACC/DEC	
P08.06	Running frequency of jog	0.00Hz–P00.03 (Max. output frequency)	5.00Hz
P08.07	ACC time for jogging	0.0–3600.0s	Model depended
P08.08	DEC time for jogging	0.0–3600.0s	Model depended
P08.00	ACC time 2	0.0–3600.0s	Model depended
P08.01	DEC time 2	0.0–3600.0s	Model depended
P08.02	ACC time 3	0.0–3600.0s	Model depended
P08.03	DEC time 3	0.0–3600.0s	Model depended
P08.04	ACC time 4	0.0–3600.0s	Model depended
P08.05	DEC time 4	0.0–3600.0s	Model depended
P08.19	Switching frequency of ACC/DEC time	0.00–P00.03(Max. frequency) 0.00Hz: No switchover If the running frequency is greater than P08.19, switch to ACC/DEC time 2.	0
P08.21	Reference frequency of ACC/DEC time	0: Max. output frequency 1: Set frequency 2: 100Hz **Note:** Valid for straight-line ACC/DEC only.	0
P08.28	Auto fault reset count	0–10	0
P08.29	Auto fault reset interval	0.1–3600.0s	1.0s

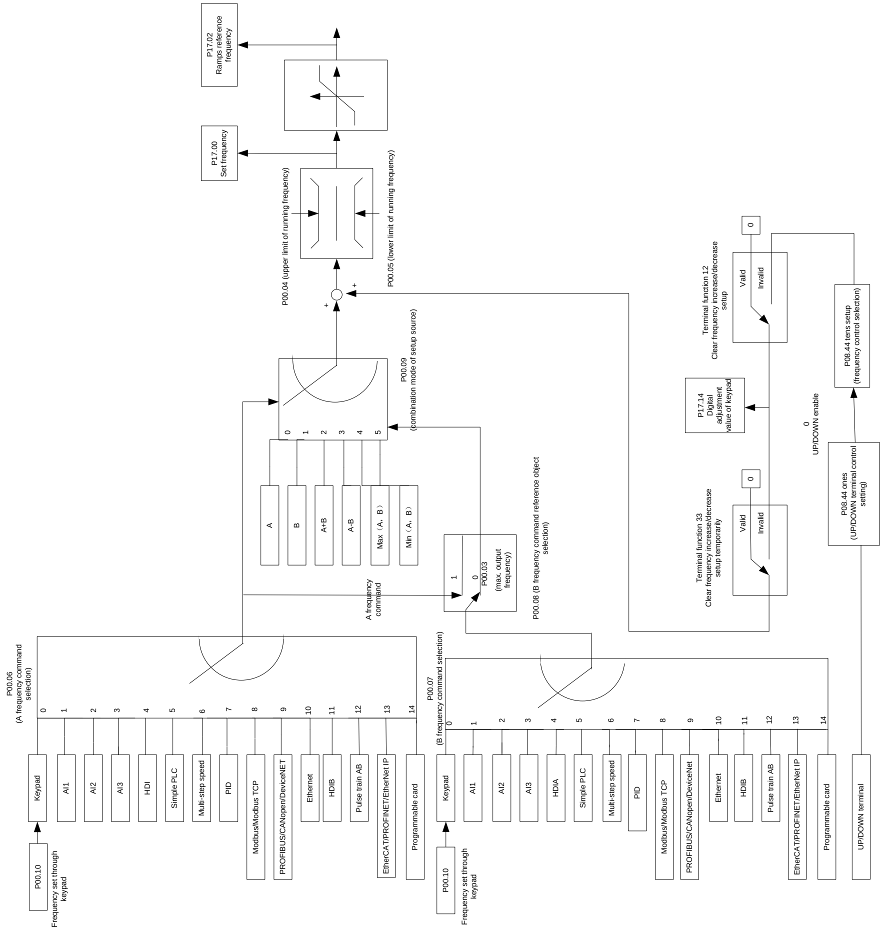
5.5.8 Frequency setting

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

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

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

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

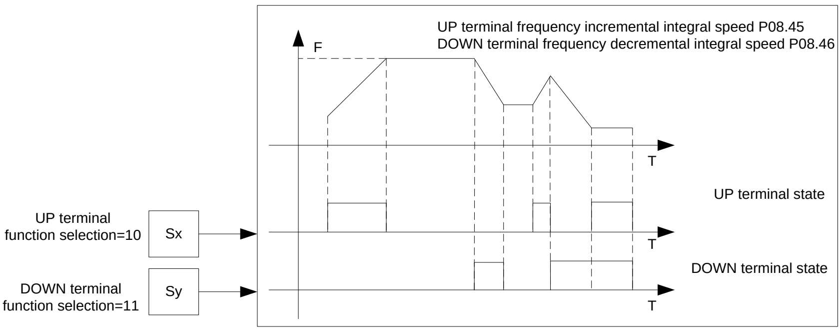


The VFD supports switch-over between different reference channels, and the rules for channel switch-over are shown as follows.

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

Note: "/" indicates this multifunction terminal is invalid under present reference channel.

When setting the auxiliary frequency inside the VFD via multi-function terminal UP (10) and DOWN (11), you can increase/decrease the frequency quickly by setting P08.45 (Frequency increment integral rate of the UP terminal) and P08.46 (Frequency increment change rate of the DOWN terminal).



Related parameter list:

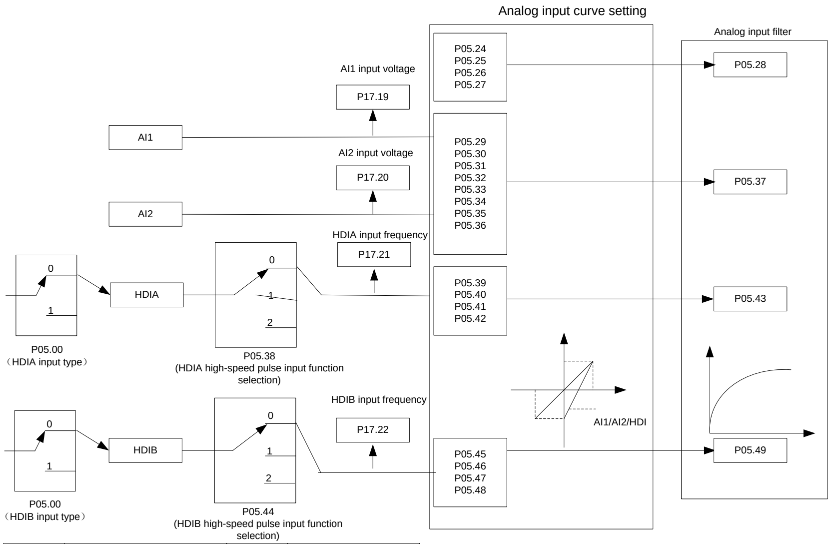
Function code	Name	Description	Default
P00.03	Max. output frequency	P00.04–599.00Hz	50.00Hz
P00.04	Upper limit of running frequency	P00.05–P00.03	50.00Hz
P00.05	Lower limit of running frequency	0.00Hz–P00.04	0.00Hz
P00.06	Setting channel of A frequency command	0: Keypad 1: AI1 2: AI2 3: AI3 4: High-speed pulse HDIA	0
P00.07	Setting channel of B frequency command		15

Function code	Name	Description	Default
		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: Reserved	
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
P05.01–P05.06	Function selection of multifunction digital input terminals (S1–S4, HDIA, HDIB)	10: Increase frequency setting (UP) 11: Decrease frequency setting (DOWN) 12: Clear the frequency increase/decrease setting 13: Switch between A setting and B setting 14: Switch between combination setting and A setting 15: Switch between combination setting and B setting	See "Group P05—Input terminal functions"
P08.42	Reserved	/	/
P08.43	Reserved	/	/
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.	0x000

Function code	Name	Description	Default
		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	0.01–50.00Hz/s	0.50 Hz/s
P08.46	Frequency integral rate of the DOWN terminal	0.01–50.00Hz/s	0.50 Hz/s
P17.00	Set frequency	0.00Hz–P00.03 (Max. output frequency)	0.00Hz
P17.02	Ramp reference frequency	0.00Hz–P00.03 (Max. output frequency)	0.00Hz
P17.14	Digital adjustment value	0.00Hz–P00.03 (Max. output frequency)	0.00Hz

5.5.9 Analog input

The VFD carries two analog input terminals (AI1 is 0–10V/0–20mA (voltage input or current input can be set by P05.50); AI2 is -10–10V) and two high-speed pulse input terminals. Each input can be filtered separately, and the corresponding reference curve can be set by adjusting the reference corresponds to the max. value and min. value.



P05.00	Ones： 0: HDIA is high-speed pulse input 1: HDIA is digital input	P05.38	0: Set input via frequency 1: Reserved 2: Input via encoder
P05.00	Tens： 0: HDIB is high-speed pulse input 1: HDIB is digital input	P05.44	0: Set input via frequency 1: Reserved 2: Input via encoder

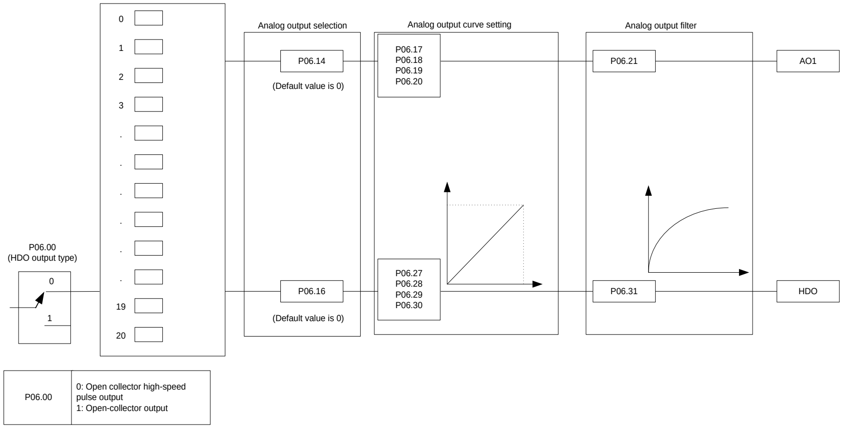
Related parameter list:

Function code	Name	Description	Default
P05.00	HDI input type	0x00–0x11 Ones place: HDIA input type 0: HDIA is high-speed pulse input 1: HDIA is digital input Tens place: HDIB input type 0: HDIB is high-speed pulse input 1: HDIB is digital input	0x00
P05.24	AI1 lower limit	0.00V–P05.26	0.00V
P05.25	Corresponding setting of AI1 lower limit	-300.0%–300.0%	0.0%
P05.26	AI1 upper limit	P05.24–10.00V	10.00V
P05.27	Corresponding setting of AI1 upper limit	-300.0%–300.0%	100.0%
P05.28	AI1 input filter time	0.000s–10.000s	0.100s
P05.29	AI2 lower limit	-10.00V–P05.31	-10.00V

Function code	Name	Description	Default
P05.30	Corresponding setting of AI2 lower limit	-300.0%–300.0%	-100.0%
P05.31	AI2 middle value 1	P05.29–P05.33	0.00V
P05.32	Corresponding setting of AI2 middle value 1	-300.0%–300.0%	0.0%
P05.33	AI2 middle value 2	P05.31–P05.35	0.00V
P05.34	Corresponding setting of AI2 middle value 2	-300.0%–300.0%	0.0%
P05.35	AI2 upper limit	P05.33–10.00V	10.00V
P05.36	Corresponding setting of AI2 upper limit	-300.0%–300.0%	100.0%
P05.37	AI2 input filter time	0.000s–10.000s	0.100s
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 frequency lower limit	-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%
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 frequency lower limit	-300.0%–300.0%	0.0%
P05.47	HDIB frequency upper limit	P05.45–50.000kHz	50.000kHz
P05.48	Corresponding setting of HDIB upper limit frequency	-300.0%–300.0%	100.0%
P05.49	HDIB frequency input filter time	0.000s–10.000s	0.030s
P05.50	AI1 input signal type	0–1 0: Voltage 1: Current	0

5.5.10 Analog output

The VFD carries one analog output terminal (0–10V/0–20mA) and one high-speed pulse output terminal. Analog output signals can be filtered separately, and the proportional relation can be adjusted by setting the max. value, min. value, and the percentage of their corresponding output. Analog output signal can output motor speed, output frequency, output current, motor torque and motor power at a certain proportion.



AO output relationship description:

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

Setting	Function	Description
0	Running frequency	0–Max. output frequency
1	Set frequency	0–Max. output frequency
2	Ramp reference frequency	0–Max. output frequency
3	Rotational speed	0–Synchronous speed corresponding to max. output frequency
4	Output current (relative to the VFD)	0–Twice the VFD rated current
5	Output current (relative to motor)	0–Twice the motor rated current
6	Output voltage	0–1.5 times the VFD rated voltage
7	Output power	0–Twice the motor rated power
8	Set torque value (bipolar)	0–Twice the motor rated current. A negative value corresponds to 0.0% by default.
9	Output torque (absolute value)	0–±(Twice the motor rated torque)
10	AI1 input	0–10V/0–20mA
11	AI2 input	0V–10V. A negative value corresponds to

Setting	Function	Description
		0.0% by default.
12	AI3 input	0–10V/0–20mA
13	High-speed pulse 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	Set value 2 of 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	High-speed pulse HDIA input	0.00–50.00kHz
21	Value 1 set through EtherCAT/PROFINET/EtherNet IP communication	0–1000. A negative value corresponds to 0.0% by default.
22	Torque current (bipolar)	0–Three times the motor rated current. A negative value corresponds to 0.0% by default.
23	Exciting current	0–Three times the motor rated current. A negative value corresponds to 0.0% by default.
24	Set frequency (bipolar)	0–Max. output frequency. A negative value corresponds to 0.0% by default.
25	Ramp reference frequency (bipolar)	0–Max. output frequency. A negative value corresponds to 0.0% by default.
26	Rotational speed (bipolar)	0–Synchronous rotation speed corresponding to max. output frequency. A negative value corresponds to 0.0% by default.
27	Value 2 set through EtherCAT/PROFINET/EtherNet IP communication	0–1000
28	AO1 from the programmable card	0–1000

Setting	Function	Description
29	AO2 from the programmable card	0–1000
30	Rotational speed	0–Twice the motor rated synchronous rotation speed
31	Output torque (bipolar)	0–Twice the motor rated torque. A negative value corresponds to 0.0% by default.
32	AIAO detected temperature output	AO output temperature in the AIAO temperature detection.
33–47	Reserved	/

Related parameter list:

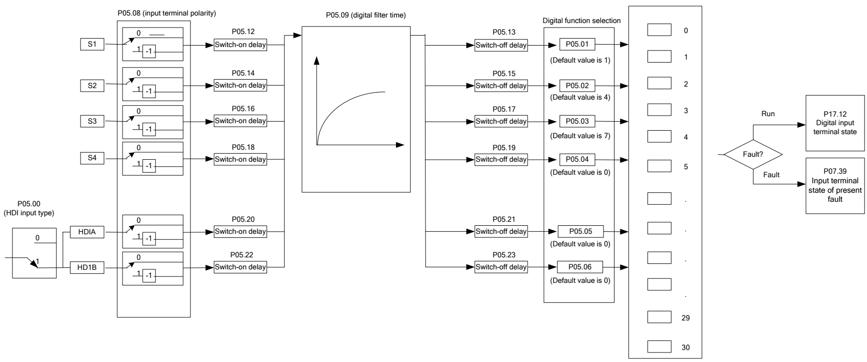
<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th></tr>
<tr><td>P06.00</td><td>HDO output type</td><td>0: Open collector high-speed pulse output
1: Open collector output</td><td>0</td></tr>
<tr><td>P06.14</td><td>AO1 output selection</td><td rowspan="3">0: Running frequency (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 VFD rated current)
5: Output current (0–Twice the motor rated current)
6: Output (0–1.5 times the VFD rated voltage)
7: Output power (0–Twice the motor rated power)
8: Set torque (0–Twice the motor rated torque)
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 (0–1000)</td><td>0</td></tr>
<tr><td>P06.15</td><td>Reserved</td><td>0</td></tr>
<tr><td>P06.16</td><td>HDO high-speed pulse output</td><td>0</td></tr>
</table>

Function code	Name	Description	Default
		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 set through EtherCAT/PROFINET/EtherNet IP (0–1000) 28: AO1 from the programmable card (0–1000) 29: AO2 from the programmable card (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 33–63: Reserved	
P06.17	AO1 output lower limit	-300.0%–P06.19	0.0%
P06.18	AO1 output corresponding to lower limit	0.00V–10.00V	0.00V
P06.19	AO1 output upper limit	P06.17–300.0%	100.0%
P06.20	AO1 output corresponding to upper limit	0.00V–10.00V	10.00V

Function code	Name	Description	Default
P06.21	AO1 output filter time	0.000s–10.000s	0.000s
P06.22	Reserved	0–65535	0
P06.23	PTC constant output current setting	0.000–20.000mA	4.000 mA
P06.24	PTC resistance alarm threshold	0–60000Ω	750Ω
P06.25	PTC resistance alarm recovery threshold	0–60000Ω	150Ω
P06.26	Actual PTC resistance	0–60000Ω	0Ω
P06.27	HDO output lower limit	-300.0%–P06.29	0.0%
P06.28	HDO output corresponding to lower limit	0.00–50.00kHz	0.0kHz
P06.29	HDO output upper limit	P06.27–300.0%	100.0%
P06.30	HDO output corresponding to upper limit	0.00–50.00kHz	50.00kHz
P06.31	HDO output filter time	0.000s–10.000s	0.000s

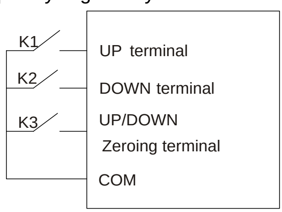
5.5.11 Digital input

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



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

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

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

<table>
<tr><th>Setting</th><th>Function</th><th>Description</th></tr>
<tr><td></td><td></td><td>setting can clear the frequency value of auxiliary channel set by UP/DOWN, thus restoring the reference frequency to the frequency given by main reference frequency command channel.</td></tr>
<tr><td>13</td><td>Switch between A setting and B setting</td><td rowspan="3">The function is used to switch between the frequency setting channels.
A frequency reference channel and B frequency reference channel can be switched by function 13; the combination channel set by P00.09 and the A frequency reference channel can be switched by function 14; the combination channel set by P00.09 and the B frequency reference channel can be switched by function 15.</td></tr>
<tr><td>14</td><td>Switch between combination setting and A setting</td></tr>
<tr><td>15</td><td>Switch between combination setting and B setting</td></tr>
<tr><td>16</td><td>Multi-step speed terminal 1</td><td rowspan="4">A total of 16-step speeds can be set by combining digital states of these four terminals.
Note: Multi-step speed 1 is the low-order bit, and multi-step speed 4 is the high-order bit.
<table>
<tr><th>Multi-step speed 4</th><th>Multi-step speed 3</th><th>Multi-step speed 2</th><th>Multi-step speed 1</th></tr>
<tr><td>Bit3</td><td>Bit2</td><td>Bit1</td><td>Bit0</td></tr>
</table></td></tr>
<tr><td>17</td><td>Multi-step speed terminal 2</td></tr>
<tr><td>18</td><td>Multi-step speed terminal 3</td></tr>
<tr><td>19</td><td>Multi-step speed terminal 4</td></tr>
<tr><td>20</td><td>Pause multi-step speed running</td><td>The multi-step speed selection function can be screened to keep the set value in the present state.</td></tr>
<tr><td>21</td><td>ACC/DEC time selection 1</td><td rowspan="2">The status of the two terminals can be combined to select four groups of ACC/DEC time.
<table>
<tr><th>T1</th><th>T2</th><th>ACC/DEC time</th><th>Parameter</th></tr>
<tr><td>OFF</td><td>OFF</td><td>ACC/DEC time 1</td><td>P00.11/P00.12</td></tr>
<tr><td>ON</td><td>OFF</td><td>ACC/DEC time 2</td><td>P08.00/P08.01</td></tr>
<tr><td>OFF</td><td>ON</td><td>ACC/DEC time 3</td><td>P08.02/P08.03</td></tr>
<tr><td>ON</td><td>ON</td><td>ACC/DEC time 4</td><td>P08.04/P08.05</td></tr>
</table></td></tr>
<tr><td>22</td><td>ACC/DEC time selection 2</td></tr>
<tr><td>23</td><td>Simple PLC stop reset</td><td>Used to clear the previous PLC state memory information and restart the simple PLC process.</td></tr>
<tr><td>24</td><td>Pause simple PLC</td><td>Used to pause the simple PLC. When the function is revoked, the simple PLC resumes the running.</td></tr>
<tr><td>25</td><td>Pause PID control</td><td>PID is ineffective temporarily, and the VFD maintains current frequency output.</td></tr>
<tr><td>26</td><td>Pause wobbling frequency (stop at current frequency)</td><td>The VFD pauses at current output. After this function is canceled, it continues wobbling-frequency operation at current frequency.</td></tr>
<tr><td>27</td><td>Reset wobbling frequency (back to center frequency)</td><td>The set frequency of VFD reverts to center frequency.</td></tr>
</table>

Setting	Function	Description
28	Reset the counter	The counter is cleared.
29	Switch between speed control and torque control	The VFD switches from torque control mode to speed control mode, or vice versa.
30	Disable ACC/DEC	Used to ensure the VFD is not impacted by external signals (except for stop command), and maintains the present output frequency.
31	Trigger the counter	Used to enable the counter to count pulses.
33	Clear the frequency increase/decrease setting temporarily	When the terminal is closed, the frequency value set by the UP/DOWN key can be cleared and restored to the frequency given by frequency command channel; when the terminal is opened, it is changed to the frequency value after frequency increase/decrease setting.
34	DC braking	The VFD starts DC brake immediately after the command becomes valid.
35	Switch between motor 1 and motor 2	When the function is enabled, you can realize switchover control of two motors.
36	Switch the running command channel to keypad	When the function is enabled, the running command channel is switched to keypad. When the function is disabled, the running command channel is restored to the previous setting.
37	Switch the running command channel to terminal	When the function is enabled, the running command channel is switched to terminal. When the function is disabled, the running command channel is restored to the previous setting.
38	Switch the running command channel to communication	When the function is enabled, the running command channel is switched to communication. When the function is disabled, the running command channel is restored to the previous setting.
39	Pre-exciting command	When the function is enabled, motor pre-exciting is started until the function becomes invalid.
40	Clear power consumption quantity	After this command becomes valid, the power consumption quantity of the VFD will be zeroed out.
41	Keep power consumption quantity	When the function is enabled, the present operation of the VFD does not impact the power consumption quantity.
42	Switch the setting source of braking torque upper limit to keypad	The torque upper limit is set through the keypad when the command is valid.
43	Position reference point input	Only valid for S1, S2, S3
44	Disable spindle orientation	Spindle positioning is disabled.
45	Spindle zeroing / Local positioning zeroing	Trigger the spindle positioning function

Setting	Function	Description
46	Spindle zeroing position selection 1	Spindle zeroing position 1 selected through terminal
47	Spindle zeroing position selection 2	Spindle zeroing position 2 selected through terminal
48	Spindle scale division selection 1	Spindle scale division value 1 selected through terminal
49	Spindle scale division selection 2	Spindle scale division value 2 selected through terminal
50	Spindle scale division selection 3	Spindle scale division value 3 selected through terminal
51	Terminal for switching between position control and speed control	Switch between position control and speed control
52	Disable pulse input	When the terminal is active, the pulse input is invalid
53	Clear position deviation	Clear the input deviation of the position loop
54	Switch position proportional gains	Switch the position proportional gains
55	Enable cyclic digital positioning	Enabling cyclic positioning function in digital position positioning mode
56	Emergency stop	When the function is enabled, the motor decelerates to stop in emergency manner according to the time specified by P01.25.
57	Motor overtemperature fault input	When there is motor overtemperature fault input, the motor stops due to the fault.
59	Switch from VC to space voltage vector control	When the function is enabled in stopped state, space voltage vector control is used.
60	Switch to VC control	When the function is enabled in stopped state, VC is used.
61	Switch PID polarities	Used to switch the output polarity of PID. It is used together with P09.03.
62	Reserved	/
63	Enabling servo	When the thousands place of P21.00 enables servo, the servo enabling terminal is valid, which controls the VFD to enter zero servo control. At this time, the start command is not needed.
64	Limit on forward running	Limit on forward running.
65	Limit on reverse running	Limit on reverse running.
66	Clear encoder counting	Used to clear the position counting value.
67	Increase pulses	If the terminal is valid when the function is selected, the pulse input is increased according to P21.27 (Pulse superposition speed).
68	Enable pulse superposition	Pulse increment and pulse decrement can be valid only after pulse superimposition is enabled.

Setting	Function	Description
69	Decrease pulses	If the terminal is valid when the function is selected, the pulse input is decreased according to P21.27 (Pulse superposition speed).
70	Electronic gear selection	If the terminal is valid when the function is selected, the proportional numerator is switched to P21.30 (Numerator of the 2nd command ratio).
71	Switch to the master	When the function is enabled in stopped state, the unit switches to the master mode.
72	Switch to the slave	When the function is enabled in stopped state, the unit switches to the slave mode.
73	Rolling diameter reset	If the terminal is valid when the tension-specific function is used, the terminal resets the roll diameter.
74	Winding/unwinding switchover	If the terminal is valid when the tension-specific function is used, the terminal switches between the winding mode and unwinding mode.
75	Tension control pre-driving	If the terminal is valid when the tension-specific function is used, the VFD performs tension control pre-driving.
76	Disabling roll diameter calculation	If the terminal is valid when the tension-specific function is used and the terminal is valid, the VFD does not calculate the roll diameter.
77	Clearing alarm display	If the terminal is valid when the tension-specific function is used, tension alarm display is cleared.
78	Manual braking in tension control	If the terminal is valid when the tension-specific function is used, manual braking is allowed.
79	Triggering a forcible material feeding interrupt signal	If the terminal is valid when the tension-specific function is used, the VFD triggers a forcible material feeding interrupt signal.
80	Initial roll diameter selection 1	If the terminal is valid when the tension-specific function is used, initial roll diameters 2 and 2 are combined for different initial roll diameter selection.
81	Initial roll diameter selection 2	If the terminal is valid when the tension-specific function is used, initial roll diameters 1 and 2 are combined for different initial roll diameter selection.
82	Triggering fire control	If the terminal is valid when the fire mode is enabled, the VFD triggers a fire control signal.
83	PID switchover in tension control	If the terminal is valid when the tension-specific function is used, the terminal switches from the first group of PID parameter to the second group. The first group is the default PID parameter group.
84–95	Reserved	/

Related parameter list:

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th></tr>
<tr><td>P05.00</td><td>HDI input type</td><td>0x00–0x11
Ones place: HDIA input type
0: HDIA is high-speed pulse input
1: HDIA is digital input
Tens place: HDIB input type
0: HDIB is high-speed pulse input
1: HDIB is digital input</td><td>0x00</td></tr>
<tr><td>P05.01</td><td>Function of S1</td><td rowspan="6">0: No function
1: Run forward
2: Run reversely
3: Three-wire running control
4: Jog forward
5: Jog reversely
6: Coast to stop
7: Reset faults
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</td><td>1</td></tr>
<tr><td>P05.02</td><td>Function of S2</td><td>4</td></tr>
<tr><td>P05.03</td><td>Function of S3</td><td>7</td></tr>
<tr><td>P05.04</td><td>Function of S4</td><td>0</td></tr>
<tr><td>P05.05</td><td>Function of HDIA</td><td>0</td></tr>
<tr><td>P05.06</td><td>Function of HDIB</td><td>0</td></tr>
</table>

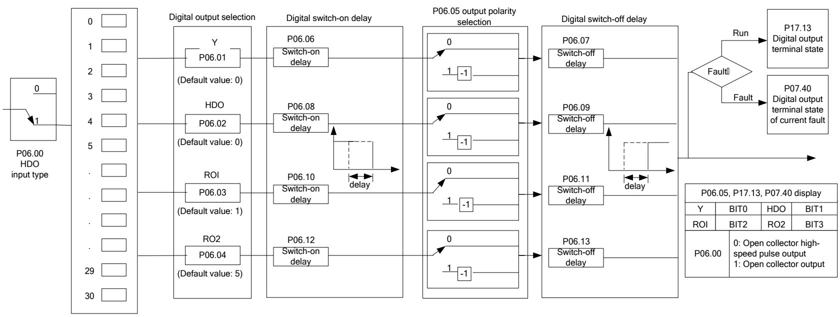
Function code	Name	Description	Default
		28: Counter reset 29: Switch between speed control and torque control 30: Disable ACC/DEC 31: Trigger the counter 32: Reserved 33: Clear the frequency increase/decrease setting temporarily 34: DC braking 35: Switch from motor 1 to motor 2 36: Switch the running 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: Disable spindle orientation 45: Spindle zeroing / Local positioning zeroing 46: Spindle zeroing position selection 1 47: Spindle zeroing position selection 2 48: Spindle scale division selection 1 49: Spindle scale division selection 2 50: Spindle scale division selection 3 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 59: Switch to V/F control 60: Switch to FVC control	

Function code	Name	Description	Default
		61: Switch PID polarities 62: Reserved 63: Enable servo 64: Limit on forward running 65: Limit on reverse running 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: Roll diameter reset 74: Winding/unwinding switchover 75: Tension control pre-driving 76: Disable roll diameter calculation 77: Clear alarm display 78: Manual braking in tension control 79: Trigger a forcible material feeding interrupt signal 80: Initial roll diameter selection 1 81: Initial roll diameter selection 2 82: Triggering fire control 83: Tension PID switchover 84–95: Reserved	
P05.08	Input terminal polarity selection	0x00–0x3F	0x00
P05.09	Digital input filter time	0.000–1.000s	0.010s
P05.10	Virtual terminal setting	0x00–0x3F (0: Disable. 1: Enable) Bit 0: S1 virtual terminal Bit 1: S2 virtual terminal Bit 2: S3 virtual terminal Bit 3: S4 virtual terminal Bit4: HDIA virtual terminal Bit5: HDIB virtual terminal	0x00
P05.11	Terminal control mode	0: Two-wire control mode 1 1: Two-wire control mode 2 2: Three-wire control mode 1 3: Three-wire control mode 2	0

Function code	Name	Description	Default
P05.12	S1 switch-on delay	0.000–50.000s	0.000s
P05.13	S1 switch-off delay	0.000–50.000s	0.000s
P05.14	S2 switch-on delay	0.000–50.000s	0.000s
P05.15	S2 switch-off delay	0.000–50.000s	0.000s
P05.16	S3 switch-on delay	0.000–50.000s	0.000s
P05.17	S3 switch-off delay	0.000–50.000s	0.000s
P05.18	S4 switch-on delay	0.000–50.000s	0.000s
P05.19	S4 switch-off delay	0.000–50.000s	0.000s
P05.20	HDIA switch-on delay	0.000–50.000s	0.000s
P05.21	HDIA switch-off delay	0.000–50.000s	0.000s
P05.22	HDIB switch-on delay	0.000–50.000s	0.000s
P05.23	HDIB switch-off delay	0.000–50.000s	0.000s
P07.39	Input terminal status at present fault	0x0000–0xFFFF	0x0000
P17.12	Digital input terminal state	Displays the present digital input terminal state of the VFD. 0x00–0x3F Corresponds to HDIB, HDIA, S4, S3, S2 and S1 respectively.	0x00

5.5.12 Digital output

The VFD carries two groups of relay output terminals, one open collector Y output terminal and one high-speed pulse output (HDO) terminal. All the digital output terminal functions can be used for programming through function code setting. The HDO terminals select high-speed pulse output or digital output through function code setting.



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

Setting	Function	Description
0	Invalid	The output terminal does not have any function.
1	Running	The ON signal is output when there is frequency output during running.
2	Running forward	The ON signal is output when there is frequency output during forward running.
3	Running reversely	The ON signal is output when there is frequency output during reverse running.
4	Jogging	The ON signal is output when there is frequency output during jogging.
5	VFD fault	The ON signal is output when a VFD fault occurred.
6	Frequency level detection FDT1	(Refer to the descriptions for P08.32–P08.33.)
7	Frequency level detection FDT2	(Refer to the descriptions for P08.34, P08.35.)
8	Frequency reached	(Refer to the description for P08.36.)
9	Running at zero speed	Output ON signal when the VFD output frequency and reference frequency are both zero.
10	Upper limit frequency reached	The ON signal is output when the running frequency reaches the upper limit.
11	Lower limit frequency reached	The ON signal is output when the running frequency reaches the lower limit frequency.
12	Ready to run	The ON signal is output when main circuit and control circuit powers are established, the protection functions do not act, and the VFD is ready to run.
13	Pre-exciting	The ON signal is output when the VFD is in pre-exciting.
14	Overload pre-alarm	The ON signal is output when the pre-alarm time elapsed based on the pre-alarm threshold; for details, see descriptions for P11.08–P11.10.
15	Underload pre-alarm	The ON signal is output after the pre-alarm time elapsed based on the pre-alarm threshold. For details, see the descriptions for P11.11–P11.12.
16	Simple PLC stage completed	When the present state of the simple PLC is completed, it outputs a signal.
17	Simple PLC cycle completed	When a single cycle of the simple PLC is completed, it outputs a signal.
23	Modbus/ Modbus TCP communication virtual terminal output	A signal is output based on the value set through Modbus/Modbus TCP communication. When the value is 1, the ON signal is output; when the value is 0, the OFF signal is output.

Setting	Function	Description
24	PROFIBUS/CANopen/DeviceNet communication virtual terminal output	Output corresponding signal based on the set value of PROFIBUS/CANopen. Output ON signal when it is set to 1, output OFF signal when it is set to 0.
25	Ethernet communication virtual terminal output	A signal is output based on the value set through Ethernet communication. When the value is 1, the ON signal is output; when the value is 0, the OFF signal is output.
26	DC bus voltage established	When the bus voltage is above the inverter undervoltage, the output is valid.
27	Z pulse output	When the encoder Z pulse is reached, the output is valid, which becomes invalid 10 seconds later.
28	Superposing pulses	When the pulse superposition terminal input function is valid, the output is valid.
29	STO action	When an STO fault occurs, the output is valid.
30	Positioning completed	When positioning is completed, the output is valid.
31	Spindle zeroing completed	When spindle zeroing is completed, the output is valid.
32	Spindle scale division completed	When spindle scale division is completed, the output is valid.
33	Speed limit reached in torque control	When the frequency is limited, the output is valid.
34	EtherCAT/PROFINET/EtherNet IP communication virtual terminal output	A signal is output based on the value set through PROFINET communication. When the value is 1, the ON signal is output; when the value is 0, the OFF signal is output.
35	Reserved	/
36	Speed/position control switchover completed	When the mode switchover is completed, the output is valid.
37	Any frequency reached	The frequency reaching signal is output when the ramp reference frequency is greater than the detected value of frequency reaching.
38–40	Reserved	/
41	Y1	Y1 from the programmable card
42	Y2	Y2 from the programmable card
43	HDO	HDO from the programmable card
44	RO1	RO1 from the programmable card
45	RO2	RO2 from the programmable card
46	RO3	RO3 from the programmable card
47	RO4	RO4 from the programmable card

Setting	Function	Description
48	EC PT100 detected OH pre-alarm	Pre-alarm of overheating (OH) detected by the expansion card (EC) with PT100.
49	EC PT1000 detected OH pre-alarm	Pre-alarm of overheating (OH) detected by the expansion card (EC) with PT1000.
50	AIAO detected OH pre-alarm	Overheating detected by the temperature detection AI or AO terminal.
51	Stopped or running in zero speed	The VFD is stopped or running at zero speed.
52	Tension control disconnection	Disconnection is detected when the tension-specific function disconnection detection is enabled.
53	Specified roll diameter reached	The specified roll diameter is reached when the tension-specific function is enabled.
54	Max. roll diameter reached	The max. roll diameter is reached when the tension-specific function is enabled.
55	Min. roll diameter reached	The min. roll diameter is reached when the tension-specific function is enabled.
56	Fire mode enabled	The fire mode is enabled.
57–63	Reserved	/

Related parameter list:

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th></tr>
<tr><td>P06.00</td><td>HDO output type</td><td>0: Open collector high-speed pulse output
1: Open collector output</td><td>0</td></tr>
<tr><td>P06.01</td><td>Y1 output</td><td rowspan="4">0: Disable
1: Running
2: Running forward
3: Running reversely
4: Jogging
5: VFD in fault
6: Frequency level detection FDT1
7: Frequency level detection FDT2
8: Frequency reached
9: Running at zero speed
10: Frequency upper limit reached
11: Frequency lower limit reached
12: Ready for running
13: Pre-exciting</td><td>0</td></tr>
<tr><td>P06.02</td><td>HDO output</td><td>0</td></tr>
<tr><td>P06.03</td><td>RO1 output</td><td>1</td></tr>
<tr><td>P06.04</td><td>RO2 output</td><td>5</td></tr>
</table>

Function code	Name	Description	Default
		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 24: PROFIBUS/CANopen/DeviceNet communication virtual terminal output 25: Ethernet communication virtual terminal output 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: Speed limit reached in torque control 34: EtherCAT/PROFINET/EtherNet IP communication virtual terminal output 35: Reserved 36: Speed/position control switchover completed 37: Any frequency reached 38–40: Reserved 41: Y1 from the programmable card 42: Y2 from the programmable card 43: HDO from the programmable card 44: RO1 from the programmable card 45: RO2 from the programmable card 46: RO3 from the programmable card 47: RO4 from the programmable card 48: EC PT100 detected OH pre-alarm	

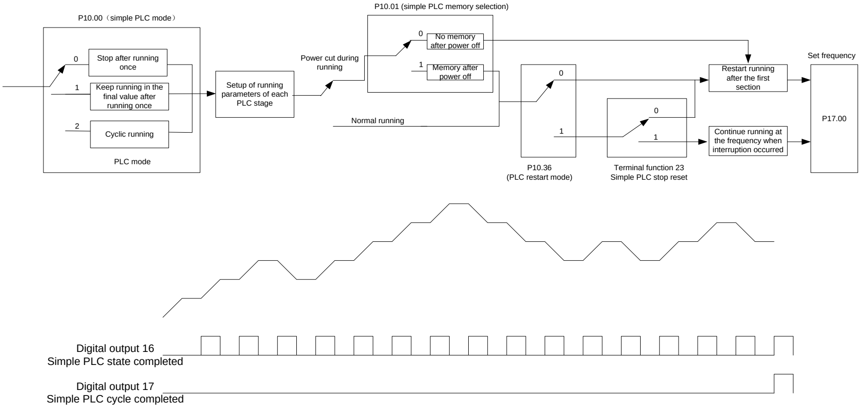
Function code	Name	Description	Default
		49: EC PT1000 detected OH pre-alarm 50: AIAO detected OT pre-alarm 51: Stopped or running in zero speed 52: Tension control disconnection 53: Specified roll diameter reached 54: Max. roll diameter reached 55: Min. roll diameter reached 56: Fire mode enabled 57–63: Reserved	
P06.05	Output terminal polarity selection	0x00–0x0F	0x00
P06.06	Y switch-on delay	0.000–50.000s	0.000s
P06.07	Y switch-off delay	0.000–50.000s	0.000s
P06.08	HDO switch-on delay	0.000–50.000s (valid when P06.00 is 1)	0.000s
P06.09	HDO switch-off delay	0.000–50.000s (valid when P06.00 is 1)	0.000s
P06.10	RO1 switch-on delay	0.000–50.000s	0.000s
P06.11	RO1 switch-off delay	0.000–50.000s	0.000s
P06.12	RO2 switch-on delay	0.000–50.000s	0.000s
P06.13	RO2 switch-off delay	0.000–50.000s	0.000s
P07.40	Output terminal status at present fault	0x0000–0xFFFF	0x0000
P17.13	Digital output terminal state	Displays the present digital output terminal state of the VFD. 0x00–0x0F The bits correspond to RO2, RO1, HDO, and Y1 respectively.	0x00

5.5.13 Simple PLC

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

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

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



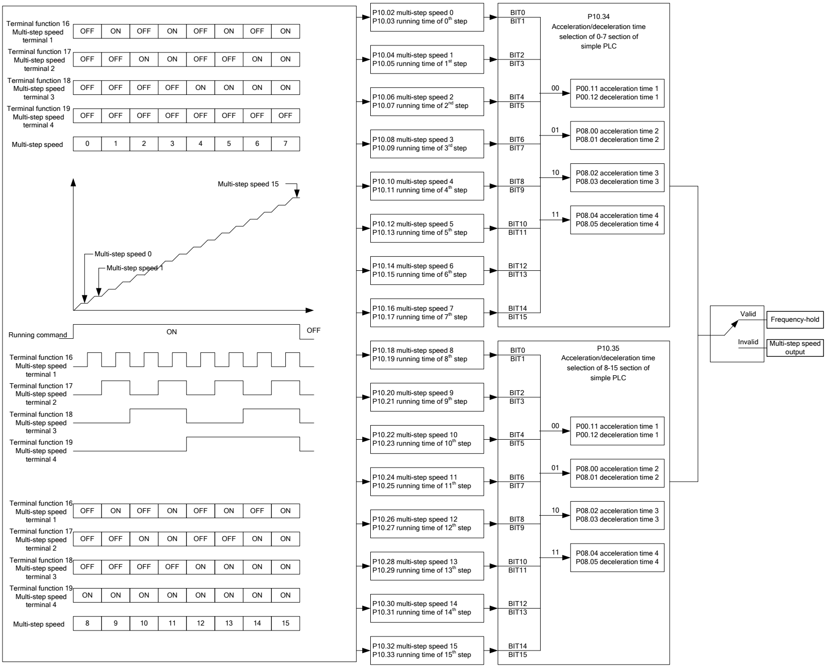
Related parameter list:

Function code	Name	Description	Default
P05.01–P05.06	Digital input function selection	23: Simple PLC stop reset 24: Pause simple PLC 25: Pause PID control	See "Group P05—Input terminal functions"
P06.01–P06.04	Digital output function selection	16: Simple PLC stage reached 17: Simple PLC cycle reached	See "Group P06—Output terminal functions"
P10.00	Simple PLC mode	0: Stop after running once 1: Keep running with the final value after running once 2: Cyclic running	0
P10.01	Simple PLC memory selection	0: Do not memorize at power outage 1: Memorize at power off	0
P10.02	Multi-step speed 0	-300.0–300.0%	0.0%
P10.03	Running time of step 0	0.0–6553.5s (min)	0.0s
P10.04	Multi-step speed 1	-300.0–300.0%	0.0%
P10.05	Running time of step 1	0.0–6553.5s (min)	0.0s
P10.06	Multi-step speed 2	-300.0–300.0%	0.0%

Function code	Name	Description	Default
P10.07	Running time of step 2	0.0–6553.5s (min)	0.0s
P10.08	Multi-step speed 3	-300.0–300.0%	0.0%
P10.09	Running time of step 3	0.0–6553.5s (min)	0.0s
P10.10	Multi-step speed 4	-300.0–300.0%	0.0%
P10.11	Running time of step 4	0.0–6553.5s (min)	0.0s
P10.12	Multi-step speed 5	-300.0–300.0%	0.0%
P10.13	Running time of step 5	0.0–6553.5s (min)	0.0s
P10.14	Multi-step speed 6	-300.0–300.0%	0.0%
P10.15	Running time of step 6	0.0–6553.5s (min)	0.0s
P10.16	Multi-step speed 7	-300.0–300.0%	0.0%
P10.17	Running time of step 7	0.0–6553.5s (min)	0.0s
P10.18	Multi-step speed 8	-300.0–300.0%	0.0%
P10.19	Running time of step 8	0.0–6553.5s (min)	0.0s
P10.20	Multi-step speed 9	-300.0–300.0%	0.0%
P10.21	Running time of step 9	0.0–6553.5s (min)	0.0s
P10.22	Multi-step speed 10	-300.0–300.0%	0.0%
P10.23	Running time of step 10	0.0–6553.5s (min)	0.0s
P10.24	Multi-step speed 11	-300.0–300.0%	0.0%
P10.25	Running time of step 11	0.0–6553.5s (min)	0.0s
P10.26	Multi-step speed 12	-300.0–300.0%	0.0%
P10.27	Running time of step 12	0.0–6553.5s (min)	0.0s
P10.28	Multi-step speed 13	-300.0–300.0%	0.0%
P10.29	Running time of step 13	0.0–6553.5s (min)	0.0s
P10.30	Multi-step speed 14	-300.0–300.0%	0.0%
P10.31	Running time of step 14	0.0–6553.5s (min)	0.0s
P10.32	Multi-step speed 15	-300.0–300.0%	0.0%
P10.33	Running time of step 15	0.0–6553.5s (min)	0.0s
P10.36	PLC restart mode	0: Restart from step 1 1: Resume from the paused step	0
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
P17.00	Set frequency	0.00Hz–P00.03 (Max. output frequency)	0.00Hz
P17.27	Present step of simple PLC	Used to display the present step of the simple PLC function.	0

5.5.14 Multi-step speed running

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



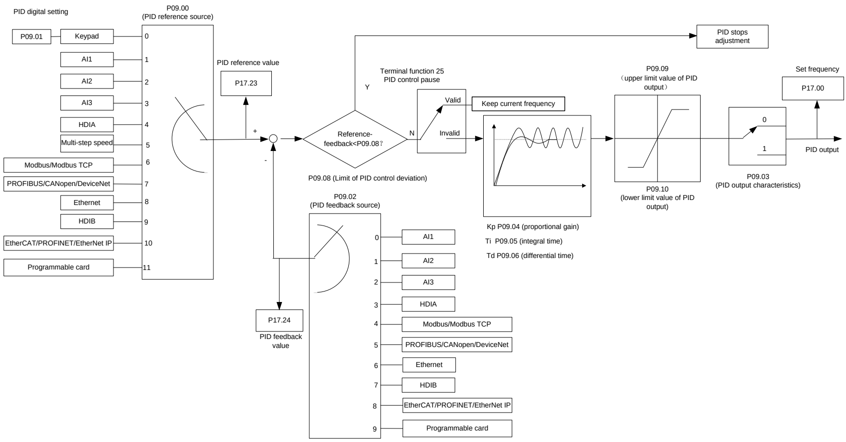
Related parameter list:

Function code	Name	Description	Default
P05.01–P05.06	Digital input function selection	16: Multi-step speed terminal 1 17: Multi-step speed terminal 2 18: Multi-step speed terminal 3 19: Multi-step speed terminal 4 20: Pause multi-step speed running	See "Group P05—Input terminal functions"
P10.02	Multi-step speed 0	-300.0–300.0%	0.0%
P10.03	Running time of step 0	0.0–6553.5s (min)	0.0s
P10.04	Multi-step speed 1	-300.0–300.0%	0.0%
P10.05	Running time of step 1	0.0–6553.5s (min)	0.0s
P10.06	Multi-step speed 2	-300.0–300.0%	0.0%

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

5.5.15 PID control

PID control, a common mode for process control, is mainly used to adjust the VFD output frequency or output voltage by performing scale-division, integral and differential operations on the difference between feedback signal of controlled variables and signal of the target, thus forming a negative feedback system to keep the controlled variables above the target. It is applicable to flow control, pressure control, temperature control, and so on. The following is the basic schematic block diagram for output frequency regulation.



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

Proportional control (Kp):

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

Integral time (Ti):

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

Differential time (Td):

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

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

5.5.15.1 General procedures for PID parameter setup

Step 1 Determining proportional gain P

When determining proportional gain P, first, remove the integral term and derivative term of PID by making Ti=0 and Td=0 (see PID parameter setup for details), thus turning PID into pure proportional control. Set the input to 60%–70% of the max. allowable value, and increase proportional gain P gradually from 0 until system oscillation occurred, and then in turn, decrease proportional gain P gradually from current value until system oscillation disappears, record the proportional gain P at this point and set the proportional gain P of PID to 60%–70% of current value. This is the entire commissioning procedure of proportional gain P.

Step 2 Determine integral time Ti

After proportional gain P is determined, set the initial value of integral time Ti to a large value, and decrease Ti gradually until system oscillation occurs. Then in reverse, increase Ti until system oscillation disappears. Record the value of Ti at this point. Set the integral time constant Ti of PID to 150%–180% of this value. This is the commissioning procedure of integral time constant Ti.

Step 3 Determining derivative time Td

The differential time Td is generally set to 0.

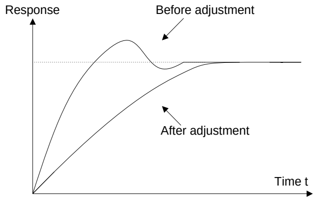
If you need to set Td to another value, the setting method is similar to that for P and Ti, namely, set Td to 30% of the value when there is no oscillation.

Step 4 Empty system load, perform load-carrying joint debugging, and then fine-tune PID parameter until fulfilling the requirement.

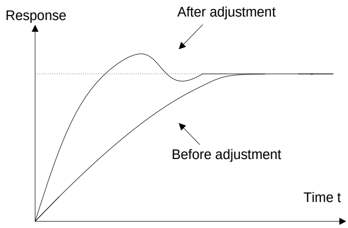
5.5.15.2 How to fine-tune PID

After setting the parameters controlled by PID, you can adjust these parameters by the following means.

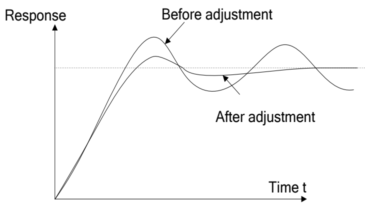
Control overshoot: When overshoot occurred, shorten the derivative time (Td) and prolong integral time (Ti).



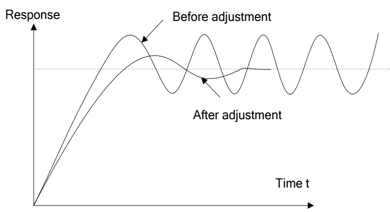
Stabilize the feedback value as fast as possible: When overshoot occurred, shorten integral time (Ti) and prolong derivative time (Td) to stabilize control as fast as possible.



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



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



Related parameter list:

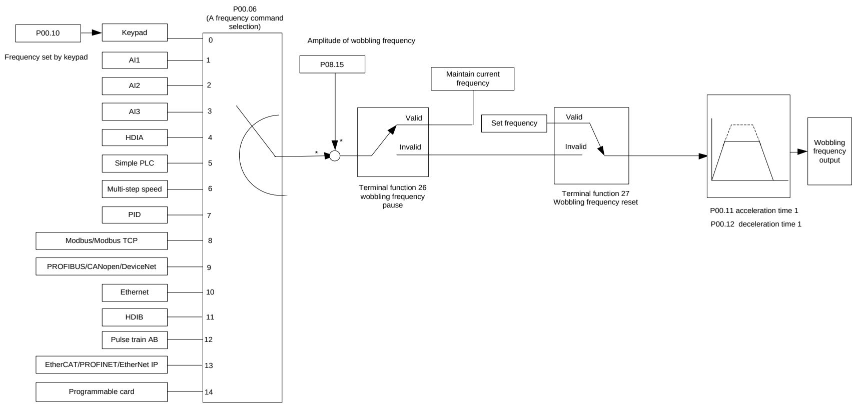
Function code	Name	Description	Default
P09.00	PID reference source	0: Set by P09.01 1: AI1 2: AI2 3: AI3 4: High-speed pulse HDIA 5: Multi-step running 6: Modbus/Modbus TCP communication 7: PROFIBUS/CANopen/DeviceNet communication 8: Ethernet communication 9: High-speed pulse HDIB 10: EtherCAT/PROFINET/ EtherNet IP communication 11: Programmable expansion card 12: Reserved	0
P09.01	PID digital setting	-100.0%–100.0%	0.0%
P09.02	PID feedback source	0: AI1 1: AI2 2: AI3 3: High-speed pulse HDIA 4: Modbus/Modbus TCP communication 5: PROFIBUS/CANopen/DeviceNet communication 6: Ethernet communication 7: High-speed pulse HDIB 8: EtherCAT/PROFINET/ EtherNet IP communication 9: Programmable expansion card 10: Reserved	0
P09.03	PID output characteristics selection	0: PID output is positive. 1: PID output is negative.	0
P09.04	Proportional gain (Kp)	0.00–100.00	1.80
P09.05	Integral time (Ti)	0.01–10.00s	0.90s
P09.06	Differential time (Td)	0.00–10.00s	0.00s

Function code	Name	Description	Default
P09.07	Sampling cycle (T)	0.000–10.000s	0.100s
P09.08	PID control deviation limit	0.0–100.0%	0.0%
P09.09	PID output upper limit	P09.10–100.0% (Max. frequency or voltage)	100.0%
P09.10	PID output lower limit	-100.0%–P09.09 (Max. frequency or voltage)	0.0%
P09.11	Feedback offline detection value	0.0–100.0%	0.0%
P09.12	Feedback offline detection time	0.0–3600.0s	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. ACC/DEC of main reference A frequency source precharging is invalid. 1: A+B frequency. Acceleration /deceleration of main reference A frequency source buffering is valid.	0x0001
P09.14	Low frequency proportional gain (Kp)	0.00–100.00	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
P09.17	Reserved	/	/
P09.18	Low frequency integral time (Ti)	0.00–10.00s	0.90s
P09.19	Low frequency differential time (Td)	0.00–10.00s	0.00s

Function code	Name	Description	Default
P09.20	Low frequency point for PID parameter switching	0.00–P09.21	5.00Hz
P09.21	High frequency point for PID parameter switching	P09.20–P00.04	10.00Hz
P17.00	Set frequency	0.00Hz–P00.03 (Max. output frequency)	0.00Hz
P17.23	PID reference value	-100.0–100.0%	0.0%
P17.24	PID feedback value	-100.0–100.0%	0.0%

5.5.16 Run at wobbling frequency

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



Function code	Name	Description	Default
P00.03	Max. output frequency	P00.04–599.00Hz	50.00Hz
P00.06	Setting channel of A frequency command	0: Keypad 1: AI1 2: AI2 3: AI3 4: High-speed pulse HDIA 5: Simple PLC program 6: Multi-step speed running	0

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

5.5.17 Local encoder input

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

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

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

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

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

(1) Restore to default values through the keypad.

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

(3) Perform motor parameter autotuning.

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

(4) Verify whether the encoder is installed and set properly.

a) Determine the encoder direction and parameter settings.

Set P20.01 (encoder PPR), set P00.00=2 and P00.10=20.00Hz, and run the VFD. Then the motor rotates at 20Hz. Check whether the speed measurement value of P18.00 is correct. If the value is negative, it indicates the encoder direction is reversed. In this case, set P20.02 to 1. If the speed measurement value deviates greatly, it indicates P20.01 is set improperly. Check whether P18.02 (encoder Z pulse count value) fluctuates. If yes, it indicates the encoder suffers interference or P20.01 is set improperly. Then check the wiring and the shield layer.

b) Determine the Z pulse direction.

Set P00.10=20.00Hz, and set P00.13 (running direction) to forward and reverse in turn to check whether the difference in P18.02 is less than 5. If the difference remains greater than 5 after reversing the Z pulse direction through P20.02, power off and swap phase A and phase B of the encoder. Then check the difference in P18.02 between forward rotation and reverse rotation. The Z pulse direction only affects the forward/reverse positioning precision of the spindle positioning carried out with Z pulses.

(5) Perform closed-loop vector pilot-run.

Set P00.00=3, and perform closed-loop vector control, and adjust P00.10 and speed loop and current loop PI parameters in group P03 to implement stable run in the entire range.

(6) Perform flux-weakening control.

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

2. Commissioning procedure for closed-loop vector control on SMs

(1) Set P00.18=1 to restore to default settings.

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

(3) Set P20.01.

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

(4) Verify whether the encoder is installed and set properly.

When the motor stops, check whether P18.21 (resolver angle) fluctuates. If it fluctuates sharply, check the wiring and grounding. Rotate the motor slowly, and check whether P18.21 changes accordingly. If yes, it indicates that the motor is connected correctly; if the value of P18.02 remains unchanged as a non-zero value after multiple turns of rotation, it indicates that the encoder Z signal is correct.

(5) Autotune the initial position of magnetic pole.

Set P20.11 to 2 (static autotuning) or 3 (rotary autotuning), and press the RUN key to run the VFD.

a) Rotary autotuning (P20.11=3)

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

During running, if the ENC1o or ENC1d fault occurs, set P20.02=1 and carry out autotuning again.

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

b) Static autotuning

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

(6) Perform closed-loop vector pilot-run.

Adjust P00.10 and speed loop and current loop PI parameters in group P03 to implement stable run in the entire range. If oscillation occurs, reduce the value of P03.00, P03.03, P03.09 and P03.10. If current oscillation noise occurs during low speed running, adjust P20.05.

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

3. Commissioning procedure for pulse train control

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

(1) Restore to default values through the keypad.

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

(3) Motor parameter autotuning: rotary parameter autotuning or static parameter autotuning.

(4) Verify whether the encoder is installed and set properly. Set P00.00=3 and P00.10=20.00Hz to run the system, and check the control effect and performance of the system.

(5) Set P21.00=0001 to set positioning mode to position control, namely pulse-train control. There are four kinds of pulse command modes, which can be set by P21.01 (pulse command mode).

In position control mode, you can check the high bit and low bit of position reference and feedback, P18.02 (Encoder Z pulse count value), P18.00 (Actual frequency of encoder), P18.17 (Pulse command frequency), and P18.19 (Position regulator output), through which you can figure out the relation between P18.08 (Pulse command feedforward) and P18.02 (Encoder Z pulse count value), and between P18.17 (Pulse command frequency), P18.18 (Pulse command feedforward) and P18.19 (Position regulator output).

(6) The position regulator has two gains, namely P21.02 and P21.03, and they can be switched by speed command, torque command and terminals.

(7) When P21.08 (Output limit of position controller) is set to 0, the position control will be invalid, and at this point, the pulse train acts as frequency source, P21.13 (Position feedforward gain) should be set to 100%, and the speed acceleration/deceleration time is

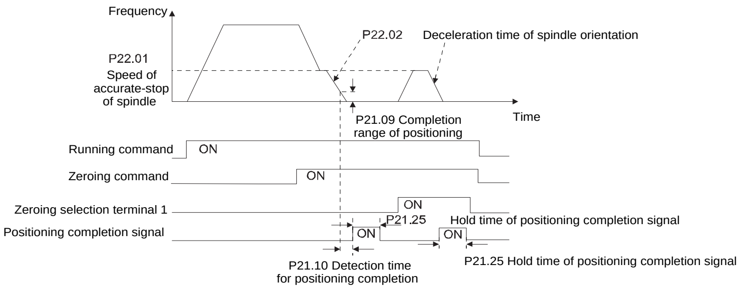
determined by the acceleration /deceleration time of pulse train, the pulse train acceleration/deceleration time of the system can be adjusted. If the pulse train acts as the frequency source in speed control, you can also set P21.00 to 0000, and set the frequency source reference P00.06 or P00.07 to 12 (Pulse train AB), at this point, the acceleration/deceleration time is determined by the acceleration/deceleration time of the VFD, meanwhile, the parameters of pulse train AB is still set by P21 group. In speed mode, the filter time of pulse train AB is determined by P21.29.

(8) The input frequency of pulse train is the same with the feedback frequency of encoder pulse, the relation between them can be changed by altering P21.11 (Numerator of position command ratio) and P21.12 (Denominator of position command ratio).

(9) When running command or servo enabling is valid (by setting P21.00 or terminal function 63), it will enter pulse train servo running mode.

4. Commissioning procedures for spindle positioning

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



(1)–(4) These four steps are the same with the first four steps of the commissioning procedures for closed-loop vector control, which aim to fulfill the control requirements of closed-loop vector control, thus realizing spindle positioning function in either position control or speed control mode.

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

(6) Spindle zeroing operation

a) Select the positioning direction by setting P22.00.bit4;

b) There are four zero positions in P22 group, you can choose one out of four zeroing positions by setting zeroing input terminal selection (46, 47) in P05 group. When executing zeroing function, the motor will stop accurately at corresponding zeroing position according to the set positioning direction, which can be viewed via P18.10;

c) The positioning length of spindle zeroing is determined by the deceleration time of accurate-stop and the speed of accurate-stop;

(7) Spindle division operation

There are seven scale-division positions in P22 group, you can choose one out of seven scale-division positions by setting scale-division input terminal selection (48, 49, 50) in P05 group. Enable corresponding scale-division terminal after the motor stops accurately, and the motor will check the scale-division position state and switch to corresponding position incrementally, at this point, you can check P18.09.

(8) Priority level of speed control, position control and zeroing

The priority level of speed running is higher than that of the scale division, when the system runs in scale-division mode, if spindle orientation is prohibited, the motor will turn to speed mode or position mode.

The priority level of zeroing is higher than that of the scale division.

Scale-division command is valid when the scale-division terminal is from 000 state to non-000 state, eg, in 000–011, the spindle executes scale division 3. The transition time during terminal switch-over needs to be less than 10ms; otherwise, wrong scale division command may be executed.

(9) Hold positioning

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

(10) Positioning command selection (bit6 of P22.00)

Electric level signal: Positioning command (zeroing and scale division) can be executed only when there is running command or the servo is enabled.

(11) Spindle reference point selection (bit0 of P22.00)

Encoder Z pulse positioning supports the following spindle positioning modes:

a) the encoder is installed on the motor shaft, the motor shaft and spindle is 1:1 rigid connection;

b) the encoder is installed on the motor shaft, the motor shaft and spindle is 1:1 belt connection;

At this point, the belt may slip during high-speed running and cause inaccurate positioning, it is recommended to install proximity switch on the spindle.

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

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

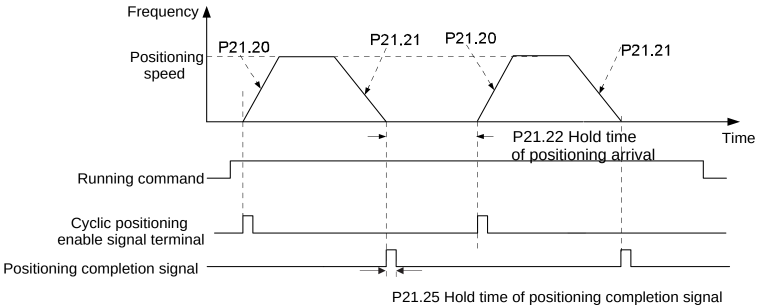
Proximity switch positioning supports the following spindle positioning modes:

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

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

5. Commissioning procedures for digital positioning

The diagram for digital positioning is shown as follows.



(1)–(4) These four steps are the same with the first four steps of the commissioning procedures for closed-loop vector control, which aim to fulfill the control requirements of closed-loop vector control.

(5) Set P21.00=0x0011 to enable digital positioning. Set P21.17, P21.11 and P21.12 (set positioning displacement) according to actual needs ; set P21.18 and P21.19 (set positioning speed); set P21.20 and P21.21 (set acceleration/deceleration time of positioning).

(6) Single positioning operation

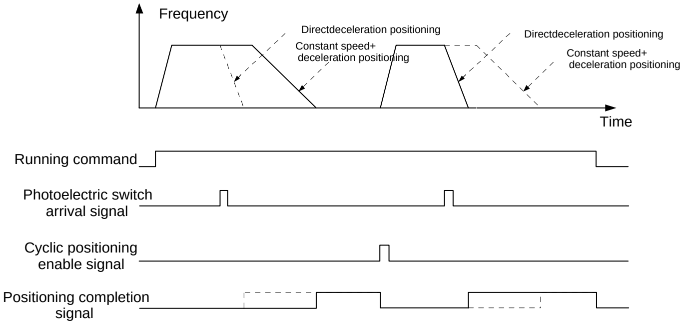
Set P21.16.bit1=0, and the motor will carry out single positioning action and stay in the positioning position according to the setup in step 5.

(7) Cyclic positioning operation

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

6. Commissioning procedures for positioning of photoelectric switch

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



(1)–(4) These four steps are the same with the first four steps of the commissioning procedures for closed-loop vector control, which aim to fulfill the control requirements of closed-loop vector control.

Set P21.00=0x0021 to enable photoelectric switch positioning, the photoelectric switch signal can be connected to S8 terminal only, and set P05.08=43, meanwhile, set P21.17, P21.11 and P21.12 (set positioning displacement) based on actual needs; set P21.21 (Deceleration time of positioning), however, when present running speed is too fast or the set positioning displacement is too small, the deceleration time of positioning will be invalid, and it will enter direct deceleration positioning mode.

(6) Cyclic positioning operation

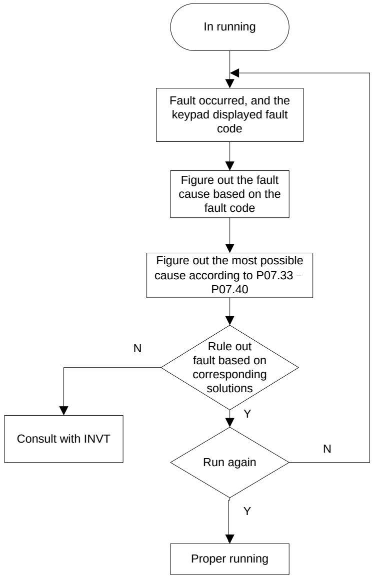
After positioning is done, the motor will stay in current position. You can set cyclic positioning through input terminal function selection (55: enable cyclic digital positioning) in P05 group; when the terminal receives cyclic positioning enable signal (pulse signal), the motor will continue running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

(7) Hold positioning

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

5.5.19 Fault handling

The following provides fault handling information.



Related parameter list:

Function code	Name	Description	Default
P07.27	Present fault type	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 ACC (OC1) 5: Overcurrent during DEC (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) 11: Motor overload (OL1) 12: VFD overload (OL2)	0
P07.28	Last fault type		0
P07.29	2nd-last fault type		0
P07.30	3rd-last fault type		0
P07.31	4th-last fault type		0
P07.32	5th-last fault type		0

Function code	Name	Description	Default
		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: Modbus/Modbus TCP communication fault (CE) 19: Current detection fault (ItE) 20: Motor autotuning fault (tE) 21: EEPROM operation fault (EEP) 22: PID feedback offline fault (PIDE) 23: Braking unit fault (bCE) 24: Running time reached (END) 25: Electronic overload (OL3) 26: Keypad communication error (PCE) 27: Parameter upload error (UPE) 28: Parameter download error (DNE) 29: PROFIBUS DP communication fault (E_dP) 30: Ethernet communication fault (E-NET) 31: CANopen communication fault (E-CAN) 32: To-ground short-circuit fault 1 (ETH1) 33: To-ground short-circuit fault 2 (ETH2) 34: Speed deviation fault (dEu) 35: Mal-adjustment fault (STo) 36: Underload fault (LL) 37: Encoder disconnection fault (ENC1o) 38: Encoder direction reversal fault (ENC1d) 39: Encoder Z-pulse disconnection fault (ENC1Z) 40: Safe torque off (STO) 41: Channel 1 safety circuit exception (STL1) 42: Channel 2 safety circuit exception (STL2) 43: Exception to both channels 1 and 2 (STL3) 44: Safety code FLASH CRC fault (CrCE) 45: Programmable card customized faults 1 (P-E1)	

Function code	Name	Description	Default
		46: Programmable card customized faults 2 (P-E2) 47: Programmable card customized faults 3 (P-E3) 48: Programmable card customized faults 4 (P-E4) 49: Programmable card customized faults 5 (P-E5) 50: Programmable card customized faults 6 (P-E6) 51: Programmable card customized faults 7 (P-E7) 52: Programmable card customized faults 8 (P-E8) 53: Programmable card customized faults 9 (P-E9) 54: Programmable card customized faults 10 (P-E10) 55: Duplicate expansion card type (E-Err) 56: Encoder UVW lost (ENCUV) 57: PROFINET communication timeout fault (E-PN) 58: CAN communication fault (SECAN) 59: Motor overtemperature fault (OT) 60: Failure to identify the card 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)	

Function code	Name	Description	Default
		70: EC PT100 detected overheating (OtE1) 71: EC PT1000 detected overheating (OtE2) 72: EtherNet IP communication timeout fault (E-EIP) 73: No upgrade bootload (E-PAO) 74: AI1 disconnection (E-AI1) 75: AI2 disconnection (E-AI2) 76: AI3 disconnection (E-AI3)	
P07.33	Running frequency at present fault	0.00Hz–P00.03	0.00Hz
P07.34	Ramp reference frequency at present fault	0.00Hz–P00.03	0.00Hz
P07.35	Output 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	Max. temperature at present fault	-20.0–120.0°C	0.0°C
P07.39	Input terminal status at present fault	0x0000–0xFFFF	0x0000
P07.40	Output terminal 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	Max. temperature at last fault	-20.0–120.0°C	0.0°C
P07.47	Input terminal state at last fault	0x0000–0xFFFF	0x0000
P07.48	Output terminal state at last fault	0x0000–0xFFFF	0x0000

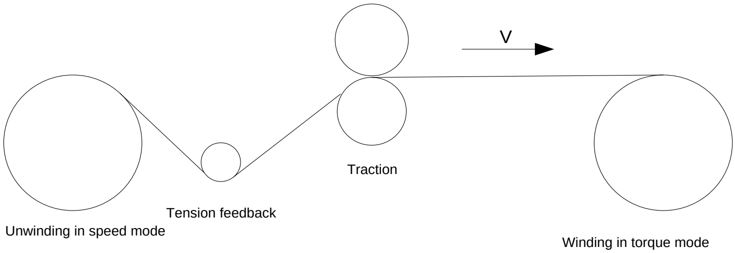
Function code	Name	Description	Default
P07.49	Running frequency at 2nd-last fault	0.00Hz–P00.03	0.00Hz
P07.50	Ramp reference frequency at 2nd-last fault	0.00Hz–P00.03	0.00Hz
P07.51	Output voltage at 2nd-last fault	0–1200V	0V
P07.52	Output current at 2nd-last fault	0.0–6300.0A	0.0A
P07.53	Bus voltage at 2nd-last fault	0.0–2000.0V	0.0V
P07.54	Temperature at 2nd-last fault	-20.0–120.0°C	0.0°C
P07.55	Input terminal state at 2nd-last fault	0x0000–0xFFFF	0x0000
P07.56	Output terminal state at 2nd-last fault	0x0000–0xFFFF	0x0000

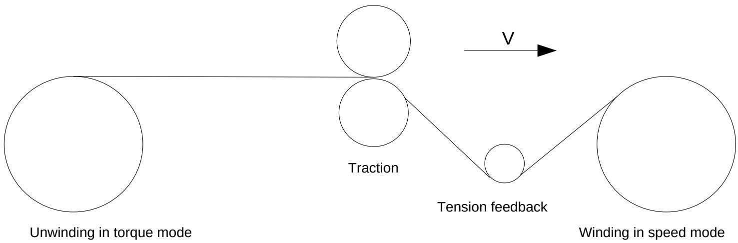
5.5.20 Tension control solutions

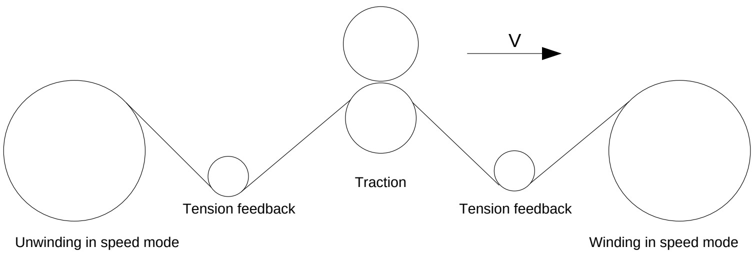
In many fields of industrial production, precise tension control is needed to maintain a constant output tension of the drive equipment, in order to improve the quality of the products. In the winding and unwinding of some industries such as paper processing, printing and dyeing, packing, wire and cable manufacturing, textile, fiber, optic cable, leather, metal foil material processing and so on, tension needs to keep constant.

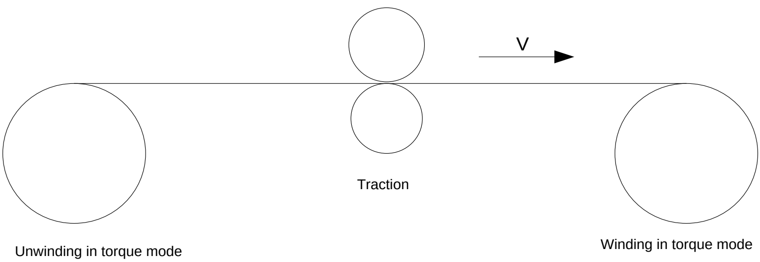
The VFD controls the tension through the output torque or speed of the motor. There are three kinds of control modes: tension speed control mode, open loop tension torque control mode and close-loop tension torque control mode.

5.5.20.1 Sketch map of tension control







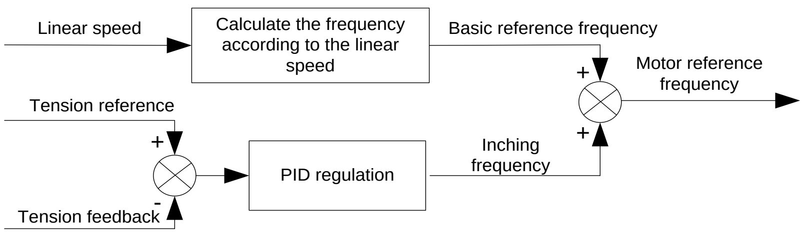


In some special situations, if the coil diameter can be counted through thickness, the following modes are available:

5.5.20.2 Tension speed control mode

The detection feedback signal is needed in the close loop adjustment. PID calculation is carried out according to the feedback signal for the motor speed adjustment, linear speed and stable tension control. If tension rod or floating roller is used for feedback, changing the setting value (PID reference) may change the actual tension, at the same time, changing the mechanical configuration such as tension rocker or floating roller weight can also change the tension.

The control principle is:



Relevant modes:

(1) Input module of linear speed: this part is important for the calculation of the basic setting frequency according to the linear speed and the calculation of coil diameter according to the linear speed.

(2) Calculation module of the real-time coil diameter: the calculation of coil diameter determines the control performance. The coil diameter can be calculated according to the

output frequency of the VFD and the linear speed or be calculated through the thickness or sensor, of which, the linear speed is widely used for the calculation and if using this method, it is necessary to select whether enable the function of coil diameter limiting.

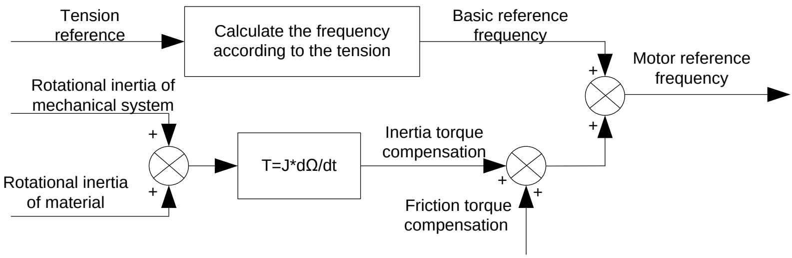
(3) PID adjustment module: mainly set in P09 group, with two sets of PID parameters available. The linear speed synchronization and stable tension can be kept through PID adjustment, but PID parameters can be adjusted according to the site commissioning. Parameters can be switched between two groups of PID parameters to PID improvement.

(4) Detection and processing module of materials break. The function is valid when enabling the materials detection.

(5) Pre-drive: if the pre-drive function terminal is valid, when automatic volume-changing, after starting the VFD, the drum will run at the setting linear speed, if the terminal is invalid, the VFD will automatically switch to the corresponding control mode.

5.5.20.3 Open-loop tension torque control mode

Open loop means no tension feedback signal; the mode controls the tension through the motor torque control directly. The rotation speed changes with the linear speed of the material automatically. The basic is: in frizzy control system, the relationship between the tension F of the roller with materials, current coil diameter D and output torque of the shaft is: $T = F \times D/2$. If the output torque can be adjusted according to the variation of coil diameter, the tension can be controlled. In order to ensure the constant tension in the process of acceleration and deceleration, there is internal friction compensation module and inertia compensation module in the VFD to calculate the real time the moment of inertia, and compensate the torque according to the current speed rate of change. The control principle is:



Relevant modes:

(1) Linear speed input modes: Linear speed input modes: two functions, one is used to count the synchronous frequency in torque control system according to the linear speed; the other is used to count the coil diameter according to the linear speed.

(2) Tension setting modes: Set the tension with the control system, need to adjust according to the actual situation. After confirmation, the value remains the same, and for some need to improve the winding, tension taper function can be selected to raise the tension with the

increasing coil diameter.

(3) Coil diameter real time calculation module: Coil diameter calculation directly determines the effect of the control. There are several kinds of coil diameter calculation methods. Linear speed, output frequency, thickness and sensor are available. The most convenient is to calculate through the thickness. And it is necessary to enable the coil diameter changing limit when using linear speed to calculate the coil diameter.

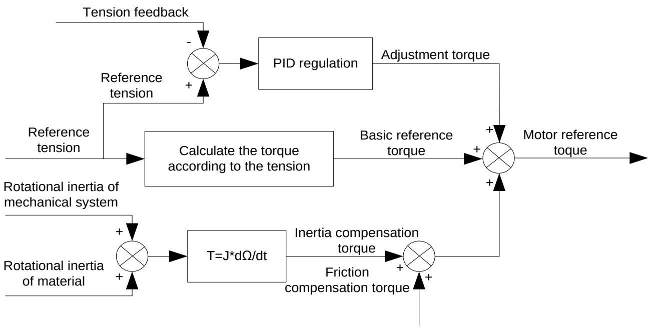
(4) Torque compensation module: include friction torque compensation and inertia torque compensation. Of which, the friction torque compensation is used to eliminate the impact of friction and tension, and it needs to be adjusted according to actual requirements; the inertia torque compensation includes the moment of inertia moment of mechanical systems and materials. In order to keep the tension stable in ACC/DEC, the compensation torque is required. But in some cases which do not need tension control, disabling the inertia torque compensation can also meet the requirements.

(5) Detection and processing module of materials break. The function is valid when enabling the materials detection.

(6) Pre-drive: if the pre-drive function terminal is valid, when automatic volume-changing, after starting the VFD, the drum will run at the setting linear speed, if the terminal is invalid, the VFD will automatically switch to the corresponding control mode.

5.5.20.4 Closed-loop tension torque control mode

Close-loop tension torque control mode is similar to open-loop tension torque control mode, the difference is that the former has tension detection sensor installed on wind/unwind side. This mode supports all the function modules of open-loop tension torque control, in additional, it is added with an additional tension feedback PID close-loop regulator module. The control principle is:



6 Function parameter list

6.1 What this chapter contains

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

6.2 Function parameter list

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

The function group numbers correspond to the level-1 menus, the function codes correspond to the level-2 menus, and the function parameters correspond to the level-3 menus.

1. The content of the function code table is as follows:

   Column 1 "Function code": Code of the function group and parameter.

   Column 2 "Name": Full name of the function parameter.

   Column 3 "Description": Detailed description of the function parameter.

   Column 4 "Default": Initial value set in factory.

   Column 5 "Modify": Whether the function parameter can be modified, and conditions for the modification.

   "○" indicates that the value of the parameter can be modified when the 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.

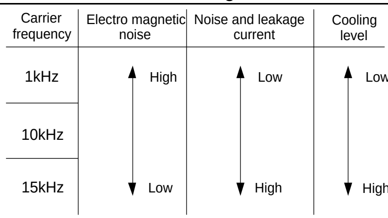
4. To better protect parameters, the VFD provides the password protection function. After a password is set (that is, P07.00 is set to a non-zero value), "0.0.0.0.0" is displayed when

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: Feedback vector control (FVC) 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 2: Ethernet communication 3: EtherCAT/ PROFINET/ EtherNet IP communication 4: Programmable expansion card 5: Wireless communication card 6: Reserved **Note:** Modbus TCP in option 0 and options 1, 2, 3, 4, and 5 are add-on functions and are available only when corresponding expansion cards are configured.	0	○
P00.03	Max. output frequency	The function code is used to set the max. output frequency of the VFD. Pay attention to the function code because it is the foundation of the frequency setting and the speed of acceleration	50.00Hz	◎

<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>(ACC) and deceleration (DEC).
Setting range: Max (P00.04, 10.00)–599.00Hz</td><td></td><td></td></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.
Note: Max. output frequency ≥ Upper limit of frequency ≥ Lower limit of frequency.
Setting range: 0.00Hz–P00.04 (Upper limit of running 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</td><td>0</td><td>○</td></tr>
<tr><td>P00.07</td><td>Setting channel of B frequency command</td><td>15</td><td>○</td></tr>
</table>

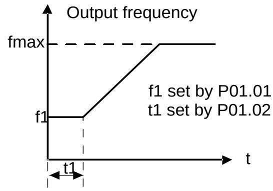
Function code	Name	Description	Default	Modify
		15: Reserved		
P00.08	Reference object of B frequency command	0: Max. output frequency 1: A frequency command	0	○
P00.09	Combination mode of setting source	0: A 1: B 2: (A+B) 3: (A-B) 4: Max(A, B) 5: Min(A, B)	0	○
P00.10	Frequency set through keypad	When 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: 0.00 Hz–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. P00.11 and P00.12 setting range: 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.	0	○
P00.14	Carrier frequency setting	 The relationship between models and carrier	Model depended	○

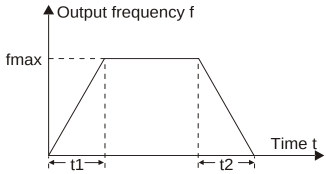
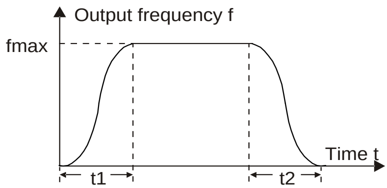
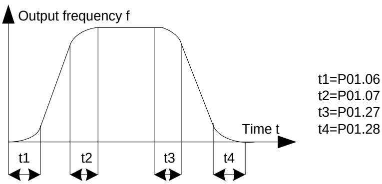
Function code	Name	Description	Default	Modify
		frequencies is as follows: <table><tr><th colspan="2">VFD model</th><th>Default carrier frequency</th></tr><tr><td rowspan="3">380V</td><td>004G/5R5P–011G/015P</td><td>8kHz</td></tr><tr><td>015G/018P–055G/075P</td><td>4kHz</td></tr><tr><td>075G/090P and 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 a 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		
P00.15	Perform motor parameter autotuning.	0: No operation 1: Rotary autotuning 1 Comprehensive motor parameter autotuning. It is recommended to use rotating autotuning when high control accuracy is required. 2: Static autotuning 1 (comprehensive autotuning) Motor parameter autotuning. It is applicable in scenarios where the motor cannot be disconnected from load.	0	◎

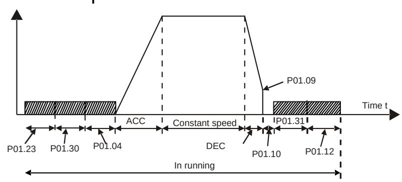
Function code	Name	Description	Default	Modify
		3: Static autotuning 2 (partial autotuning) When the present motor is motor 1, only P02.06, P02.07, and P02.08 are autotuned; when the present motor is motor 2, only P12.06, P12.07, and P12.08 are autotuned. 4: Rotary autotuning 2 It is similar to rotary autotuning 1 but only valid for AMs. 5: Static autotuning 3 (partial autotuning) It is valid only for AMs.		
P00.16	AVR function selection	0: Disable 1: Valid during the whole process The auto-adjusting function of the VFD can eliminate the impact on the output voltage of the VFD because of the bus voltage fluctuation.	1	○
P00.17	VFD type	0: G type 1: P type		
P00.18	Function parameter restoration	0: No operation 1: Restore default values 2: Clear fault records 3: Reserved 4: Reserved 5: Restore to default values (factory test mode) 6: Restore to default values (including motor parameters) **Note:** After the selected operation is performed, the function code is automatically restored to 0. Restoring the default values may delete the user password. Exercise caution when using this function. The option 5 can be used only for factory testing.	0	◎

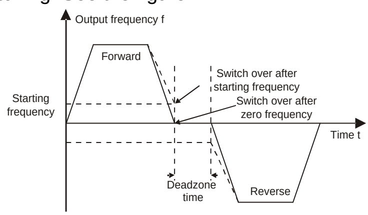
Group P01—Start and stop control

Function code	Name	Description	Default	Modify
P01.00	Running mode of start	0: Direct start 1: Start after DC braking	0	◎

Function code	Name	Description	Default	Modify
		2: Start after speed tracking		
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	Hold time of starting frequency	 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	The function code is used to indicate the changing mode of the frequency during start and running. 0: Linear type. The output frequency increases or decreases linearly.	0	◎

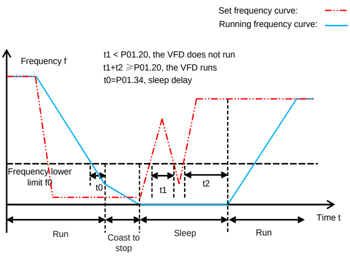
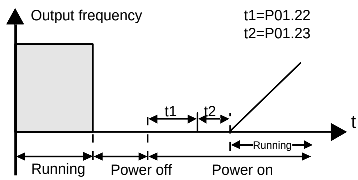
Function code	Name	Description	Default	Modify
		 1: S curve. The output frequency increases or decreases according to the S curve. The S curve is generally applied to elevators, conveyors, and other application scenarios where smoother start or stop is required.  **Note:** If mode 1 is selected, set P01.06, P01.07, P01.27, and P01.28 accordingly.		
P01.06	Time of starting segment of ACC S curve	The curvature of S curve is determined by the ACC range and ACC/DEC time.  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	○
P01.09	Starting frequency	Starting frequency of DC braking for stop:	0.00Hz	○

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td></td><td>of braking for stop</td><td rowspan="4">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></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 run deadzone time</td><td>This function code indicates the transition time specified in P01.14 during FWD/REV rotation switching. See the figure.


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 run switching mode	0: Switch at zero frequency 1: Switch at the starting frequency 2: Switch after the speed reaches the stop speed with a delay	1	◎
P01.15	Stop speed	0.00–100.00Hz	0.50Hz	◎
P01.16	Stop speed detection mode	0: Detect by the set speed (unique in space voltage vector control mode) 1: Detect according to speed feedback	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. **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 limit greater than 0)	The function code determines the running state of the VFD when the set frequency is lower than the lower-limit one. Setting range: 0x00–0x12 Ones place: Action selection 0: Run at the frequency lower limit 1: Stop 2: Sleep Tens place: Stop mode 0: Coast to stop 1: Decelerate to stop The VFD stops as set in the tens place if the	0x00	◎

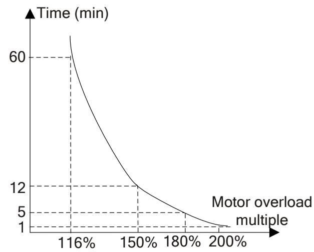
Function code	Name	Description	Default	Modify
		action selection is stop or sleep when the set frequency is lower than the lower limit. The VFD resumes the running state automatically when the set frequency is above the lower limit again and this situation lasts for the time set by P01.20.		
P01.20	Wake-up-from-sleep delay	The function code 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 only when P01.19 ones place=2.)	0.0s	○
P01.21	Restart after power off	The function code indicates whether the VFD automatically runs after re-power on. 0: Disable 1: Enable. If the restart condition is met, the VFD will run automatically after waiting the time defined by P01.22.	0	○
P01.22	Wait time for restart after power-off	The function code indicates the wait time before the automatic running of the VFD that is re-powered on. 	1.0s	○

Function code	Name	Description	Default	Modify
		Setting range: 0.0–3600.0s (valid only when P01.21 = 1)		
P01.23	Start delay	After a VFD running command is given, the VFD restarts running output with the delay defined by P01.23 from the standby state, 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 specified by P01.12. (See descriptions for P01.09–P01.12.) P01.29 setting range: 0.0–150.0% (of the rated VFD output current) Setting range of P01.30: 0.0–50.0s Setting range of P01.31: 0.0–50.0s	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	○
P01.32	Pre-exciting time for jogging	0.000s–10.000s	0.300s	○
P01.33	Starting frequency of braking for stop in jogging	0.00Hz–P00.03	0.00Hz	○
P01.34	Sleep delay	0.0s–3600.0s	0.0s	○

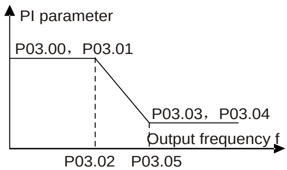
Group P02—Parameters of motor 1

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%	○
P02.12	Magnetic saturation coefficient 1 of iron core of AM 2	0.0–100.0%	68.0%	○
P02.13	Magnetic saturation coefficient 1 of iron core of AM 3	0.0–100.0%	57.0%	○
P02.14	Magnetic saturation coefficient 1 of iron core of AM 4	0.0–100.0%	40.0%	○
P02.15	Rated power of SM 1	0.1–3000.0kW	Model depended	◎

Function code	Name	Description	Default	Modify
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 selection 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, the low compensation indicates lowering the overload protection threshold of the motor whose running frequency is lower than 30Hz. 2: Variable-frequency motor protection (without low speed compensation). Because the heat dissipation function for a variable-frequency motor is not impacted by the rotation speed, it is not necessary to adjust the protection value at low speed running.	2	◎
P02.27	Overload protection coefficient of motor 1	Motor overload multiples M=Iout/(In*K) In is rated motor current, Iout is VFD output current, K is motor overload protection	100.0%	○

Function code	Name	Description	Default	Modify
		coefficient. A smaller value of "K" indicates a bigger value of "M". When M=116%, protection is performed after motor overload lasts for 1 hour; when M=150%, protection is performed after motor overload lasts for 12 minutes; when M=200%, protection is performed after motor overload lasts for 1 minute; and when M≥400%, protection is performed immediately.  Setting range: 20.0%–120.0%		
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	○
P02.30	System inertia of motor 1	0.000–30.000kg·m^2	0.000 kg·m^2	○
P02.31–P02.32	Reserved	-	-	-

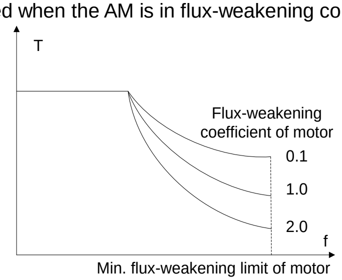
Group P03—Vector control of motor 1

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td>P03.00</td><td>Speed-loop proportional gain 1</td><td rowspan="6">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 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>20.0</td><td>○</td></tr>
<tr><td>P03.01</td><td>Speed-loop integral time 1</td><td>0.200s</td><td>○</td></tr>
<tr><td>P03.02</td><td>Low-point frequency for switching</td><td>5.00Hz</td><td>○</td></tr>
<tr><td>P03.03</td><td>Speed-loop proportional gain 2</td><td>20.0</td><td>○</td></tr>
<tr><td>P03.04</td><td>Speed-loop integral time 2</td><td>0.200s</td><td>○</td></tr>
<tr><td>P03.05</td><td>High-point frequency for switching</td><td>10.00Hz</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>P03.06</td><td>Speed-loop output filter</td><td>0–8 (corresponding to 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>Vector control slip compensation coefficient (for power generation)</td><td>100%</td><td>○</td></tr>
<tr><td>P03.09</td><td>Current-loop proportional coefficient P</td><td rowspan="2">Note:
● The two function codes impact the dynamic response speed and control accuracy of the system. Generally, you do not need to modify the two function codes.
● Applicable to SVC mode 0 (P00.00=0), SVC mode 1 (P00.00=1), and FVC mode (P00.00=3).
Setting range: 0–65535</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 selection</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
10: Pulse frequency HDIB
11: EtherCAT/PROFINET/ EtherNet IP communication
12: Programmable expansion card
Note: 100% corresponds to the motor rated current.</td><td>0</td><td>○</td></tr>
<tr><td>P03.12</td><td>Torque set through keypad</td><td>-300.0%–300.0% (of the motor rated current)</td><td>20.0%</td><td>○</td></tr>
<tr><td>P03.13</td><td>Torque reference</td><td>0.000–10.000s</td><td>0.010s</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>filter time</td><td></td><td></td><td></td></tr>
<tr><td>P03.14</td><td>Setting source of forward rotation frequency upper limit in torque control</td><td>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 expansion card
12: Reserved
Note: 100% corresponds to the max. frequency.</td><td>0</td><td>○</td></tr>
<tr><td>P03.15</td><td>Setting source of reverse rotation upper-limit frequency in torque control</td><td>0: Keypad (P03.17)
1–11: Same as those for P03.14</td><td>0</td><td>○</td></tr>
<tr><td>P03.16</td><td>Forward rotation frequency upper limit set through keypad in torque control</td><td rowspan="2">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)</td><td>50.00Hz</td><td>○</td></tr>
<tr><td>P03.17</td><td>Reverse rotation upper-limit frequency set through keypad in torque control</td><td>50.00Hz</td><td>○</td></tr>
<tr><td>P03.18</td><td>Setting source of electromotive torque upper limit</td><td>0: Keypad (P03.20)
1: AI1
2: AI2
3: AI3
4: Pulse frequency HDIA</td><td>0</td><td>○</td></tr>
</table>

Function code	Name	Description	Default	Modify
		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:** 100% corresponds to the motor rated current.		
P03.19	Setting source of braking torque upper limit	0: Keypad (P03.21) 1–10: Same as those for P03.18	0	○
P03.20	Electromotive torque upper limit set through keypad	Used to set torque limits. Setting range: 0.0–300.0% (of the motor rated current)	180.0%	○
P03.21	Braking torque upper limit set through keypad		180.0%	○
P03.22	Weakening coefficient in constant power zone	Used when the AM is in flux-weakening control.  The function codes P03.22 and P03.23 are valid at constant power. The motor enters the flux-weakening state when the motor runs above the rated speed. Change the flux-weakening curvature by modifying the flux-weakening control coefficient. The larger the coefficient, the steeper the curve, the smaller the coefficient, the smoother the curve. Setting range of P03.22: 0.1–2.0	0.3	○
P03.23	Lowest weakening point in constant power zone		20%	○

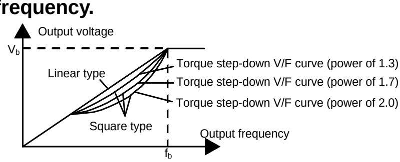
Function code	Name	Description	Default	Modify
		Setting range of P03.23: 10%–100.0%		
P03.24	Max. voltage limit	P03.24 sets the max. output voltage of the VFD, which is the percentage of motor rated voltage. Set the value according to onsite conditions. Setting range: 0.0–120.0%	100.0%	○
P03.25	Pre-exciting 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	0.300s	○
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	0.50–P03.31	1.00Hz	○
P03.30	High speed friction compensation coefficient	0.0–100.0%	0.0%	○
P03.31	Corresponding frequency of high speed friction torque	P03.29–400.00Hz	50.00Hz	○
P03.32	Enabling torque control	0: Disable 1: Enable	0	◎
P03.33	Flux-weakening integral gain	0–8000	1200	○
P03.34	Flux-weakening control mode	0x000–0x112 Ones place: Control mode selection 0: Mode 0 1: Mode 1 2: Mode 2	0x000	○

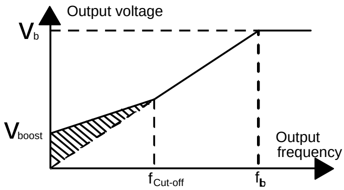
Function code	Name	Description	Default	Modify
		Tens place: Compensation of inductance saturation coefficient 0: Yes 1: No Hundreds place: Reserved 0: Reserved 1: Reserved		
P03.35	Control mode optimization selection	0–0x1111 Ones place: Torque command selection 0: Torque reference 1: Torque current reference Tens place: Reserved 0: Reserved 1: Reserved Hundreds place: indicates whether to enable speed-loop integral separation 0: Disable 1: Enable Thousands place: Reserved 0: Reserved 1: Reserved Range: 0x0000–0x1111	0x0000	○
P03.36	Speed-loop differential gain	0.00–10.00s	0.00s	○
P03.37	Proportional coefficient of high-frequency current loop	In the FVC mode (P00.00=3), when the frequency is lower than the current-loop high-frequency switching threshold (P03.39), the current-loop PI parameters are P03.09 and P03.10; and when the frequency is higher than the current-loop high-frequency switching threshold, the current-loop PI parameters are P03.37 and P03.38. Setting range of P03.37: 0–65535 Setting range of P03.38: 0–65535 Setting range of P03.39: 0.0–100.0% (of the max. frequency)	1000	○
P03.38	Integral coefficient of high-frequency current loop		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	The max. inertia compensation torque is limited	10.0%	○

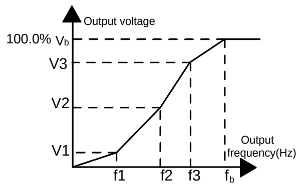
Function code	Name	Description	Default	Modify
	inertia compensation torque	to prevent inertia compensation torque from being too large. Setting range: 0.0–150.0% (of the motor rated torque)		
P03.42	Inertia compensation filter times	Filter times of inertia compensation torque, used to smooth inertia 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. 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	Automatic update will be performed after motor parameter autotuning. In the FVC mode for synchronous motors, you can set the value of this function code to P03.09. Setting range: 0–65535 **Note: Set the value to 0 if motor parameter autotuning is not performed.**	0	●
P03.46	Current-loop integral proportional coefficient after autotuning	Automatic update will be performed after motor parameter autotuning. In the FVC mode for synchronous motors, you can set the value of this function code to P03.10. Setting range: 0–65535 **Note: Set the value to 0 if motor parameter autotuning is not performed.**	0	●

Group P04—V/F control

Function code	Name	Description	Default	Modify
P04.00	V/F curve setting of motor 1	The 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)	0	◎

Function code	Name	Description	Default	Modify
		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 specified by P00.06 or the voltage setting channel specified by P04.27 to change the characteristics of the curve. **Note: In the following figure, V_b is the motor rated voltage and f_b is the motor rated frequency.** 		
P04.01	Torque boost of motor 1	In order to compensate for low-frequency torque characteristics, you can make some boost compensation for the output voltage. P04.01 is relative to the max. output voltage V_b. P04.02 defines the percentage of cut-off frequency of manual torque boost to the rated motor frequency f_b. Torque boost can improve the low-frequency torque characteristics of V/F. You need to select torque boost based on the load. For example, larger load requires larger torque boost, however, if the torque boost is too large, the motor will run at over-excitation, which may cause increased output current and motor overheating, thus decreasing the efficiency. When torque boost is set to 0.0%, the VFD uses automatic torque boost. Torque boost cut-off threshold: Below this frequency threshold, torque boost is valid;	0.0%	○
P04.02	Torque boost cut-off of motor 1		20.0%	○

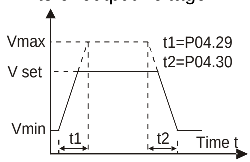
<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td></td><td></td><td>exceeding this threshold will invalidate torque boost.


Setting range of P04.01: 0.0%: Automatic; 0.1%–10.0%
Setting range of P04.02: 0.0%–50.0%</td><td></td><td></td></tr>
<tr><td>P04.03</td><td>V/F frequency point 1 of motor 1</td><td rowspan="6">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
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 (Rated frequency of motor 1) or P04.05–P02.16 (Rated frequency of motor 1)
Setting range of P04.08: 0.0%–110.0% (of the rated voltage of motor 1)</td><td>0.00Hz</td><td>○</td></tr>
<tr><td>P04.04</td><td>V/F voltage point 1 of motor 1</td><td>0.0%</td><td>○</td></tr>
<tr><td>P04.05</td><td>V/F frequency point 2 of motor 1</td><td>0.00Hz</td><td>○</td></tr>
<tr><td>P04.06</td><td>V/F voltage point 2 of motor 1</td><td>0.0%</td><td>○</td></tr>
<tr><td>P04.07</td><td>V/F frequency point 3 of motor 1</td><td>0.00Hz</td><td>○</td></tr>
<tr><td>P04.08</td><td>V/F voltage point 3 of motor 1</td><td>0.0%</td><td>○</td></tr>
<tr><td>P04.09</td><td>V/F slip</td><td>Used to compensate for the motor rotating</td><td>100.0%</td><td>○</td></tr>
</table>

Function code	Name	Description	Default	Modify
	compensation gain of motor 1	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: $\Delta f = f_b - n*p/60$ 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 Δf of the motor. Setting range: 0.0–200.0%		
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. Eliminate the results by adjusting the parameters properly. 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	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)	0	◎
P04.14	Torque boost of motor 2	0.0%: (automatic); 0.1%–10.0%	0.0%	○
P04.15	Torque boost cut-off of motor 2	0.0%–50.0% (of the rated frequency of motor 2)	20.0%	○
P04.16	V/F frequency point 1 of motor 2	0.00Hz– P04.18	0.00Hz	○
P04.17	V/F voltage point 1 of motor 2	0.0%–110.0% (of the rated voltage of motor 2)	0.0%	○

Function code	Name	Description	Default	Modify
P04.18	V/F frequency point 2 of motor 2	P04.16– P04.20	0.00Hz	○
P04.19	V/F voltage point 2 of motor 2	0.0%–110.0% (of the rated voltage of motor 2)	0.0%	○
P04.20	V/F voltage point 3 of motor 2	P04.18 –P12.02 (Rated frequency of AM 2) P04.18 –P12.16 (Rated frequency of SM 2)	0.00Hz	○
P04.21	V/F voltage point 3 of motor 2	0.0%–110.0% (of the motor rated voltage)	0.0%	○
P04.22	V/F slip compensation gain of motor 2	0.0–200.0%	0.0%	○
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. Eliminate the results by adjusting the parameters properly. 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 selection	0: Keypad (determined by P04.28) 1: AI1 2: AI2 3: AI3 4: HDIA 5: Multi-step speed running (The setting is determined by related parameters in group P10.) 6: PID 7: Modbus/Modbus TCP communication 8: PROFIBUS/CANopen/DeviceNet communication	0	○

Function code	Name	Description	Default	Modify
		9: Ethernet communication 10: HDIB 11: EtherCAT/PROFINET/ EtherNet IP communication 12: Programmable expansion card 13: Reserved		
P04.28	Voltage set through keypad	The function code is the voltage digital setting when "keypad" is selected as the voltage setting channel. Setting range: 0.0%–100.0%	100.0%	○
P04.29	Voltage increase time	Voltage increase time means the time needed for the VFD to accelerate from min. output voltage to the max. output frequency.	5.0s	○
P04.30	Voltage decrease time	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	○
P04.31	Max. output voltage	The function codes are used to set the upper and lower limits of output voltage.	100.0%	◎
P04.32	Min. output voltage	 Setting range of P04.31: P04.32–100.0% (of the motor rated voltage) Setting range of P04.32: 0.00Hz–P04.31	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 V/F control mode is enabled, the function code is used to set the reactive current of the motor when the output frequency is lower than the frequency specified by P04.36. Setting range: -100.0%–100.0% (of the motor rated current)	20.0%	○
P04.35	Pull-in current 2 in SM VF control	When the SM VF control mode is enabled, the function code is used to set the reactive current	10.0%	○

Function code	Name	Description	Default	Modify
		of the motor when the output frequency is higher than the frequency specified by P04.36. Setting range: -100.0%–100.0% (of the motor rated current)		
P04.36	Frequency threshold for pull-in current switching in SM V/F control	When the SM V/F control mode is enabled, the function code is used to set the frequency threshold for the switching between pull-in current 1 and pull-in current 2. Setting range: 0.0%–200.0% (of the motor rated frequency).	20.0%	○
P04.37	Reactive current closed-loop proportional coefficient in SM V/F control	When the SM V/F control mode is enabled, the function code is used to set the proportional coefficient of reactive current closed-loop control. Setting range: 0–3000	50	○
P04.38	Reactive current closed-loop integral time in SM V/F control	When the SM V/F control mode is enabled, the function code is used to set the integral coefficient of reactive current closed-loop control. Setting range: 0–3000	30	○
P04.39	Reactive current closed-loop output limit in SM VF control	When the SM V/F 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 IF mode for AM 1	0: Disable 1: Enable	0	◎
P04.41	Current setting in IF mode for AM 1	When IF control is adopted for AM 1, the function code is used to set the output current. The value is a percentage in relative to the rated current of the motor. Setting range: 0.0–200.0%	120.0%	○
P04.42	Proportional coefficient in IF mode for AM 1	When IF control is adopted for AM 1, the function code is used to set the proportional coefficient of the output current closed-loop	350	○

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

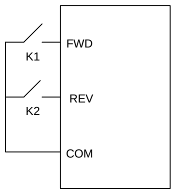
Group P05—Input terminal functions

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td>P05.00</td><td>HDI input type</td><td>0x00–0x11
Ones place: HDIA input type
0: HDIA is high-speed pulse input
1: HDIA is digital input
Tens place: HDIB input type
0: HDIB is high-speed pulse input
1: HDIB is digital input</td><td>0x00</td><td>◎</td></tr>
<tr><td>P05.01</td><td>Function of S1</td><td rowspan="6">0: No function
1: Run forward
2: Run reversely
3: Three-wire running control
4: Jog forward
5: Jog reversely
6: Coast to stop
7: Reset faults
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</td><td>1</td><td>◎</td></tr>
<tr><td>P05.02</td><td>Function of S2</td><td>4</td><td>◎</td></tr>
<tr><td>P05.03</td><td>Function of S3</td><td>7</td><td>◎</td></tr>
<tr><td>P05.04</td><td>Function of S4</td><td>0</td><td>◎</td></tr>
<tr><td>P05.05</td><td>Function of HDIA</td><td>0</td><td>◎</td></tr>
<tr><td>P05.06</td><td>Function of HDIB</td><td>0</td><td>◎</td></tr>
</table>

Function code	Name	Description	Default	Modify
		27: Reset wobbling frequency 28: Counter reset 29: Switch between speed control and torque control 30: Disable ACC/DEC 31: Trigger the counter 32: Reserved 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: Disable spindle orientation 45: Spindle zeroing / Local positioning zeroing 46: Spindle zeroing position selection 1 47: Spindle zeroing position selection 2 48: Spindle scale division selection 1 49: Spindle scale division selection 2 50: Spindle scale division selection 3 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		

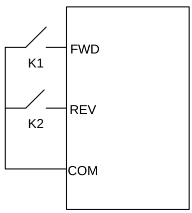
Function code	Name	Description	Default	Modify
		57: Motor overtemperature fault input 58: Enable rigid tapping 59: Switch to V/F control 60: Switch to FVC control 61: Switch PID polarities 62: Reserved 63: Enable servo 64: Limit on forward running 65: Limit on reverse running 66: Clear encoder counting 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: Roll diameter reset 74: Winding/unwinding switchover 75: Tension control pre-driving 76: Disable roll diameter calculation 77: Clear alarm display 78: Manual braking in tension control 79: Trigger a forcible material feeding interrupt signal 80: Initial roll diameter selection 1 81: Initial roll diameter selection 2 82: Triggering fire control 83: Tension PID switchover 84–95: Reserved		
P05.07	Reserved	-	-	-
P05.08	Input terminal polarity selection	The function code is used to set the polarity of input terminals. When a bit is 0, the input terminal is positive. When a bit is 1, the input terminal is negative. 0x00–0x3F	0x00	○
P05.09	Digital input filter time	Used to specify the sampling filter time of the S1–S4 and HDI terminals. In strong interference cases, increase the value to avoid	0.010s	○

<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>maloperation.
0.000–1.000s</td><td></td><td></td></tr>
<tr><td>P05.10</td><td>Virtual terminal setting</td><td>0x00–0x3F (0: Disable. 1: Enable)
Bit 0: S1 virtual terminal
Bit 1: S2 virtual terminal
Bit 2: S3 virtual terminal
Bit 3: 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>Used to set the terminal control mode.
0: Two-wire control 1, the enabling consistent with the direction. This mode is widely used. The defined FWD/REV terminal command determines the motor rotation direction.



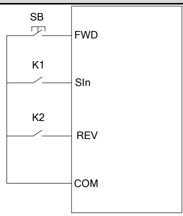
<table>
<tr><th>FWD</th><th>REV</th><th>Running command</th></tr>
<tr><td>OFF</td><td>OFF</td><td>Stop</td></tr>
<tr><td>ON</td><td>OFF</td><td>Forward running</td></tr>
<tr><td>OFF</td><td>ON</td><td>Reverse running</td></tr>
<tr><td>ON</td><td>ON</td><td>Hold</td></tr>
</table>

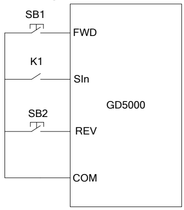
1: Two-wire control 2, the enabling separated from the direction. In this mode, FWD is the enabling terminal. The direction depends on the defined REV state.



<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>Stop</td></tr>
<tr><td>ON</td><td>ON</td><td>Reverse running</td></tr>
</table>

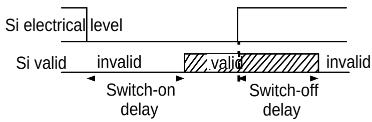
2: Three-wire control mode 1. If S_{In} (In=1-12) is 3 (three-wire control enabled), when S_{In} switches on, the running command will be generated by FWD (terminal rising edge is valid) and the direction will be controlled by REV (REV off indicates forward running; REV on indicates reverse running.). When S_{In} switches off, the system will stop.</td><td>0</td><td>◎</td></tr>
</table>

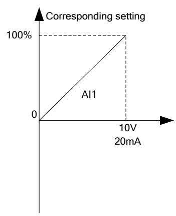
<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td></td><td></td><td>


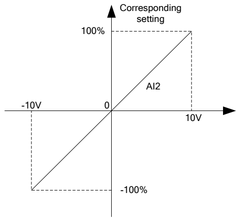
<table>
<tr><th>K1</th><th>K2</th><th>SB</th><th>Running command</th></tr>
<tr><td rowspan="2">ON</td><td>OFF</td><td rowspan="2">Action</td><td>FWD running</td></tr>
<tr><td>ON</td><td>REV running</td></tr>
<tr><td rowspan="2">OFF</td><td>OFF</td><td rowspan="2"></td><td rowspan="2">Stop</td></tr>
<tr><td>ON</td></tr>
</table>
K1: Enabling switch; SB: Running button; K2: Running direction switch.3: Three-wire control mode 2. If S_{In} (In=1-12) is 3 (three-wire control enabled), when S_{In} switches on, the running command will be generated by FWD or REV and the direction will be controlled by both of them. When S_{In} switches off, FWD and REV are invalid. FWD and REV (both rising edges are valid) refer to inputs of forward and reverse running commands respectively.


<table>
<tr><th>K1</th><th>SB1</th><th>SB2</th><th>Running command</th></tr>
<tr><td rowspan="2">ON</td><td>Action</td><td>No action</td><td>FWD running</td></tr>
<tr><td>No action</td><td>Action</td><td>REV running</td></tr>
<tr><td>OFF</td><td></td><td></td><td>Stop</td></tr>
</table>
SB1: Forward running; K1: Enabling switch; SB2: 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.)
</td><td></td><td></td></tr>
<tr><td>P05.12</td><td>S1 switch-on delay</td><td rowspan="4">The 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>P05.13</td><td>S1 switch-off delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P05.14</td><td>S2 switch-on delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P05.15</td><td>S2 switch-off delay</td><td>0.000s</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>P05.16</td><td>S3 switch-on delay</td><td rowspan="8">

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.</td><td>0.000s</td><td>○</td></tr>
<tr><td>P05.17</td><td>S3 switch-off delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P05.18</td><td>S4 switch-on delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P05.19</td><td>S4 switch-off delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P05.20</td><td>HDIA switch-on delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P05.21</td><td>HDIA switch-off delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P05.22</td><td>HDIB switch-on delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P05.23</td><td>HDIB switch-off delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P05.24</td><td>AI1 lower limit</td><td rowspan="13">The function codes define the relationship between the analog input voltage and its corresponding setting. When the analog input voltage exceeds the range from the upper limit to the lower limit, the upper limit or lower limit is used.
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:

</td><td>0.00V</td><td>○</td></tr>
<tr><td>P05.25</td><td>Corresponding setting of AI1 lower limit</td><td>0.0%</td><td>○</td></tr>
<tr><td>P05.26</td><td>AI1 upper limit</td><td>10.00V</td><td>○</td></tr>
<tr><td>P05.27</td><td>Corresponding setting of AI1 upper limit</td><td>100.0%</td><td>○</td></tr>
<tr><td>P05.28</td><td>AI1 input filter time</td><td>0.030s</td><td>○</td></tr>
<tr><td>P05.29</td><td>AI2 lower limit</td><td>-10.00V</td><td>○</td></tr>
<tr><td>P05.30</td><td>Corresponding setting of AI2 lower limit</td><td>-100.0%</td><td>○</td></tr>
<tr><td>P05.31</td><td>AI2 middle value 1</td><td>0.00V</td><td>○</td></tr>
<tr><td>P05.32</td><td>Corresponding setting of AI2 middle value 1</td><td>0.0%</td><td>○</td></tr>
<tr><td>P05.33</td><td>AI2 middle value 2</td><td>0.00V</td><td>○</td></tr>
<tr><td>P05.34</td><td>Corresponding setting of AI2 middle value 2</td><td>0.0%</td><td>○</td></tr>
<tr><td>P05.35</td><td>AI2 upper limit</td><td>10.00V</td><td>○</td></tr>
<tr><td>P05.36</td><td>Corresponding setting of AI2 upper limit</td><td>100.0%</td><td>○</td></tr>
</table>

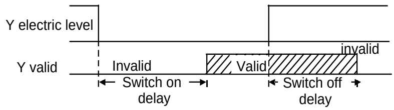
Function code	Name	Description	Default	Modify
P05.37	AI2 input filter time	 Input filter time: to adjust the sensitivity of analog input. Increasing the value properly can enhance analog input anti-interference but may reduce the sensitivity of analog input. **Note:** AI1 supports the 0–10V/0–20mA input. 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	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	0.000 kHz	○
P05.40	Corresponding setting of HDIA frequency lower	-300.0%–300.0%	0.0%	○

Function code	Name	Description	Default	Modify
	limit			
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%	○
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	0.000 kHz	○
P05.46	Corresponding setting of HDIB frequency lower limit	-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	0–1 0: Voltage 1: Current **Note:** You can set the AI1 input signal type through the corresponding function code.	0	◎
P05.51–P05.52	Reserved	-	-	-

Group P06—Output terminal functions

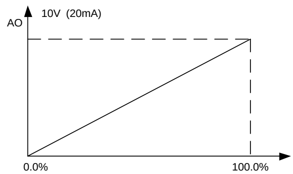
<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td>P06.00</td><td>HDO output type</td><td>0: Open collector high-speed pulse output
The max. frequency of pulse is 50.00kHz. For details about the related functions, see P06.27–P06.31.
1: Open collector output
See P06.02 for related function codes.</td><td>0</td><td>◎</td></tr>
<tr><td>P06.01</td><td>Y1 output</td><td rowspan="4">0: Disable
1: Running
2: Running forward
3: Running reversely
4: Jogging
5: VFD in fault
6: Frequency level detection FDT1
7: Frequency level detection FDT2
8: Frequency reached
9: Running at zero speed
10: Frequency upper limit reached
11: Frequency lower limit reached
12: Ready for running
13: Pre-exciting
14: Overload pre-alarm
15: Underload pre-alarm
16: Simple PLC stage completed
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
24: PROFIBUS/CANopen/DeviceNet communication virtual terminal output
25: Ethernet communication virtual terminal output
26: DC bus voltage established
27: Z pulse output</td><td>0</td><td>○</td></tr>
<tr><td>P06.02</td><td>HDO output</td><td>0</td><td>○</td></tr>
<tr><td>P06.03</td><td>RO1 output</td><td>1</td><td>○</td></tr>
<tr><td>P06.04</td><td>RO2 output</td><td>5</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>28: Superposing pulses
29: STO action
30: Positioning completed
31: Spindle zeroing completed
32: Spindle scale division completed
33: Speed limit reached in torque control
34: EtherCAT/PROFINET/EtherNet IP communication virtual terminal output
35: Reserved
36: Speed/position control switchover completed
37: Any frequency reached
38–40: Reserved
41: Y1 from the programmable card
42: Y2 from the programmable card
43: HDO from the programmable card
44: RO1 from the programmable card
45: RO2 from the programmable card
46: RO3 from the programmable card 47: RO4 from the programmable card
48: EC PT100 detected OH pre-alarm
49: EC PT1000 detected OH pre-alarm
50: AIAO detected OT pre-alarm
51: Stopped or running in zero speed
52: Tension control disconnection
53: Specified roll diameter reached
54: Max. roll diameter reached
55: Min. roll diameter reached
56: Fire mode enabled
57–63: Reserved</td><td></td><td></td></tr>
<tr><td>P06.05</td><td>Output terminal polarity selection</td><td>Used to set the output terminal polarity.
When a bit is 0, the output terminal is positive.
When a bit is 1, the output terminal is negative.<table><tr><th>Bit3</th><th>Bit2</th><th>Bit1</th><th>Bit0</th></tr><tr><td>RO2</td><td>RO1</td><td>HDO</td><td>Y</td></tr></table>Setting range: 0x00–0x0F</td><td>0x00</td><td>○</td></tr>
<tr><td>P06.06</td><td>Y1 switch-on delay</td><td rowspan="2">Used to specify the delay time corresponding to the electrical level changes when the</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>
</table>

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td>P06.08</td><td>HDO switch-on delay</td><td rowspan="6">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>P06.09</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 selection</td><td rowspan="3">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 VFD rated current)
5: Output current (0–Twice the motor rated current)
6: Output (0–1.5 times the VFD rated voltage)
7: Output power (0–Twice the motor rated power)
8: Set torque (0–Twice the motor rated torque)
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 (0–1000)</td><td>0</td><td>○</td></tr>
<tr><td>P06.15</td><td>Reserved</td><td></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
		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 set through EtherCAT/PROFINET/EtherNet IP (0–1000) 28: AO1 from the programmable card (0–1000) 29: AO2 from the programmable card (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 33–63: 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.	0.0%	○
P06.18	AO1 output corresponding to lower limit		0.00V	○
P06.19	AO1 output upper limit		100.0%	○

Function code	Name	Description	Default	Modify
P06.20	AO1 output corresponding to upper limit	In different cases, the corresponding analog output of 100% of the output value is different.	10.00V	○
P06.21	AO1 output filter time	 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	0.000s	○
P06.22	Reserved	-	-	-
P06.23	PTC constant output current setting	0.000–20.000mA	4.000 mA	○
P06.24	PTC resistance alarm threshold	0–60000Ω	750Ω	○
P06.25	PTC resistance alarm recovery threshold	0–60000Ω	150Ω	○
P06.26	Actual PTC resistance	0–60000Ω	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	50.00 kHz	○
P06.31	HDO output filter time	0.000s–10.000s	0.000s	○
P06.32	Reserved	-	-	-
P06.33	Detection value for	0.00Hz–P00.03	1.00Hz	○

Function code	Name	Description	Default	Modify
	frequency being reached			
P06.34	Frequency reaching detection time	0.0s–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 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.	0	○
P07.01	Reserved	-	-	-
P07.02	Key function selection	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	0x01	◎

Function code	Name	Description	Default	Modify
		5: Coast to stop 6: Switch command channels in sequence 7: Reserved Tens place: Reserved		
P07.03	Sequence of switching running-command channels by pressing QUICK	When P07.02 ones place=6, set the sequence of switching running-command channels by pressing this key. 0: Keypad→Terminal→Communication 1: Keypad←→Terminal 2: Keypad←→Communication 3: Terminal←→Communication	0	○
P07.04	Stop function validity of STOP/RST	Used to specify the stop function validity of STOP/RST. For fault reset, STOP/RST is valid in any conditions. 0: Valid for keypad control only 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–P07.07	Reserved	-	-	-
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	0.0°C	●
P07.12	Inverter module temperature	-20.0–120.0°C	0.0°C	●
P07.13	Control board software version	1.00–655.35	Version depended	●
P07.14	Local accumulative	0–65535h	0h	●

Function code	Name	Description	Default	Modify
	running time			
P07.15	VFD electricity consumption high-order bits	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	0kWh	●
P07.16	VFD electricity consumption low-order bits		0.0kWh	●
P07.17	VFD model	0x0000–0xFFF1 Bit0–bit3: G type or P type 0x0: G type 0x1: P type Bit4–bit11: Chip type and manufacturer 0x00: DSP(TI) 0x01–0x20: Reserved 0x21: MCU(ST) 0x22–0xFF: Reserved Bit12–bit15: VFD series 0x0: GD350 0x1: GD350A 0x2: GD350-UL 0x3: GD350IP55 0x4–0xF: Reserved	Model depended	●
P07.18	VFD rated power	0.4–3000.0kW	Model depended	●
P07.19	VFD rated voltage	50–1200V	Model depended	●
P07.20	VFD rated current	0.1–6000.0A	Model depended	●
P07.21	Factory bar code 1	0x0000–0xFFFF	Model depended	●
P07.22	Factory bar code 2	0x0000–0xFFFF	Model depended	●
P07.23	Factory bar code 3	0x0000–0xFFFF	Model depended	●
P07.24	Factory bar code 4	0x0000–0xFFFF	Model depended	●
P07.25	Factory bar code 5	0x0000–0xFFFF	Model depended	●

Function code	Name	Description	Default	Modify
P07.26	Factory bar code 6	0x0000–0xFFFF	Model depended	●
P07.27	Present fault type	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 ACC (OC1) 5: Overcurrent during DEC (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) 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: Modbus/Modbus TCP communication fault (CE) 19: Current detection fault (ItE) 20: Motor autotuning fault (tE) 21: EEPROM operation fault (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)	0	●
P07.28	Last fault type		0	●
P07.29	2nd-last fault type		0	●
P07.30	3rd-last fault type		0	●
P07.31	4th-last fault type		0	●
P07.32	5th-last fault type		0	●

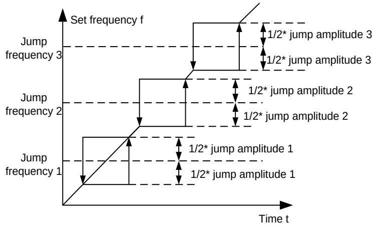
Function code	Name	Description	Default	Modify
		33: To-ground short-circuit fault 2 (ETH2) 34: Speed deviation fault (dEu) 35: Mal-adjustment fault (STo) 36: Underload fault (LL) 37: Encoder disconnection fault (ENC1o) 38: Encoder direction reversal fault (ENC1d) 39: Encoder Z-pulse disconnection fault (ENC1Z) 40: Safe torque off (STO) 41: Channel 1 safety circuit exception (STL1) 42: Channel 2 safety circuit exception (STL2) 43: Exception to both channels 1 and 2 (STL3) 44: Safety code FLASH CRC fault (CrCE) 45: Programmable card customized faults 1 (P-E1) 46: Programmable card customized faults 2 (P-E2) 47: Programmable card customized faults 3 (P-E3) 48: Programmable card customized faults 4 (P-E4) 49: Programmable card customized faults 5 (P-E5) 50: Programmable card customized faults 6 (P-E6) 51: Programmable card customized faults 7 (P-E7) 52: Programmable card customized faults 8 (P-E8) 53: Programmable card customized faults 9 (P-E9) 54: Programmable card customized faults 10 (P-E10) 55: Duplicate expansion card type (E-Err) 56: Encoder UVW lost (ENCUV) 57: PROFINET communication timeout fault (E-PN) 58: CAN communication fault (SECAN)		

Function code	Name	Description	Default	Modify
		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: EC PT100 detected overheating (OtE1) 71: EC PT1000 detected overheating (OtE2) 72: EtherNet IP communication timeout fault (E-EIP) 73: No upgrade bootload (E-PAO) 74: AI1 disconnection (E-AI1) 75: AI2 disconnection (E-AI2) 76: AI3 disconnection (E-AI3)		
P07.33	Running frequency at present fault	0.00Hz–P00.03	0.00Hz	●
P07.34	Ramp reference frequency at present fault	0.00Hz–P00.03	0.00Hz	●
P07.35	Output 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	Max. temperature at present fault	-20.0–120.0°C	0.0°C	●
P07.39	Input terminal status at present fault	0x0000–0xFFFF	0x0000	●

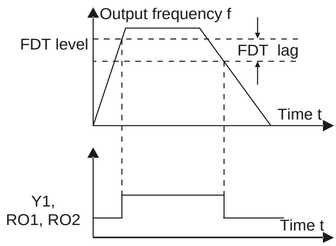
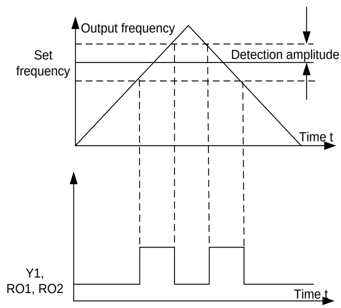
Function code	Name	Description	Default	Modify
P07.40	Output terminal status at present fault	0x0000–0xFFFF	0x0000	●
P07.41	Running frequency at last fault	0.00Hz–P00.03	0.00Hz	●
P07.42	Ramp reference frequency at last fault	0.00Hz–P00.03	0.00Hz	●
P07.43	Output voltage at last fault	0–1200V	0V	●
P07.44	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 state at last fault	0x0000–0xFFFF	0x0000	●
P07.48	Output terminal state at last fault	0x0000–0xFFFF	0x0000	●
P07.49	Running frequency at 2nd-last fault	0.00Hz–P00.03	0.00Hz	●
P07.50	Ramp reference frequency at 2nd-last fault	0.00Hz–P00.03	0.00Hz	●
P07.51	Output voltage at 2nd-last fault	0–1200V	0V	●
P07.52	Output current at 2nd-last fault	0.0–6300.0A	0.0A	●
P07.53	Bus voltage at 2nd-last fault	0.0–2000.0V	0.0V	●
P07.54	Max. temperature at 2nd-last fault	-20.0–120.0°C	0.0°C	●
P07.55	Input terminal state at 2nd-last fault	0x0000–0xFFFF	0x0000	●
P07.56	Output terminal state at 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	○
P08.09	Jump frequency 1	When the set frequency is within the range of jump frequency, the VFD runs at the boundary of jump frequency. The VFD can avoid mechanical resonance points by setting jump frequencies. The VFD supports the setting of three jump frequencies. If the jump frequency points are set to 0, this function is invalid.	0.00Hz	○
P08.10	Jump frequency amplitude 1		0.00Hz	○
P08.11	Jump frequency 2		0.00Hz	○
P08.12	Jump frequency amplitude 2		0.00Hz	○
P08.13	Jump frequency 3		0.00Hz	○
P08.14	Jump frequency amplitude 3		0.00Hz	○

Function code	Name	Description	Default	Modify
		 Setting range: 0.00Hz–P00.03 (Max. output frequency)		
P08.15	Amplitude of wobbling frequency	0.0–100.0% (of the set frequency)	0.0%	○
P08.16	Amplitude of sudden jump frequency	0.0–50.0% (of the amplitude of wobbling frequency)	0.0%	○
P08.17	Rise time of wobbling frequency	0.1–3600.0s	5.0s	○
P08.18	Fall time of wobbling frequency	0.1–3600.0s	5.0s	○
P08.19	Switching frequency of ACC/DEC time	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.	0.00Hz	○
P08.20	Frequency threshold of the start of droop control	0.00–50.00Hz	2.00Hz	○
P08.21	Reference frequency of ACC/DEC time	0: Max. output frequency 1: Set frequency 2: 100Hz **Note:** Valid only for straight-line ACC/DEC.	0	◎
P08.22	Output torque calculation method	0: Based on torque current 1: Based on output power	0	○
P08.23	Number of decimal points of frequency	0: Two 1: One	0	○
P08.24	Number of decimal places of linear speed	0: No decimal point 1: One 2: Two	0	○

Function code	Name	Description	Default	Modify
		3: Three		
P08.25	Set counting value	P08.26–65535	0	○
P08.26	Designated counting value	0–P08.25	0	○
P08.27	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 droop control	The output frequency of the VFD changes as the load changes. The function code is mainly used to balance the power when several motors drive a same load. Setting range: 0.00–50.00Hz	0.00Hz	○
P08.31	Channel for switching between motor 1 and motor 2	0x00–0x14 Ones place: Switchover channel 0: Terminal 1: Modbus/Modbus TCP communication 2: PROFIBUS/CANopen/DeviceNet communication 3: Ethernet communication 4: EtherCAT/PROFINET/ EtherNet IP communication Tens place: indicates whether to enable switchover during running 0: Disable 1: Enable	0x00	◎
P08.32	FDT1 electrical level detection	When the output frequency exceeds the corresponding frequency of FDT electrical level,	50.00Hz	○

Function code	Name	Description	Default	Modify
	value	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)		
P08.33	FDT1 lagging detection value		5.0%	○
P08.34	FDT2 electrical level detection value		50.00Hz	○
P08.35	FDT2 lagging detection value		5.0%	○
P08.36	Detection value for frequency being reached	When the output frequency is within the detection range, the multifunction digital output terminal outputs the signal of "Frequency reached".  Setting range: 0.00Hz–P00.03 (Max. output frequency)	0.00Hz	○

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

Function code	Name	Description	Default	Modify
		Thousands place: Output voltage compensation 0: No 1: Yes		
P08.42	Reserved	-	-	-
P08.43	Reserved	-	-	-
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. Tens place: Frequency control selection 0: Valid only when P00.06 = 0 or P00.07 = 0 1: Valid for all frequency setting methods 2: Invalid for multi-step speed running when multi-step speed running has the priority Hundreds place: Action selection for stop 0: Setting is valid. 1: Valid during running, cleared after stop 2: Valid during running, cleared after a stop command is received	0x000	○
P08.45	Frequency increment integral rate of the UP terminal	0.01–50.00Hz/s	0.50Hz/s	○
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. Tens place: Action selection at power-off during frequency setting through Modbus/Modbus TCP communication 0: Save the setting at power-off. 1: Clear the setting at power-off.	0x000	○

Function code	Name	Description	Default	Modify
		Hundreds place: Action selection at power-off during frequency setting through DP communication 0: Save the setting at power-off. 1: Clear the setting at power-off.		
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: 0–59999 kWh (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	The function code is used to enable magnetic flux braking. 0: Disable 100–150: A greater coefficient indicates greater braking strength. The VFD can quickly slow down the motor by increasing the magnetic flux. The energy generated by the motor during braking can be transformed into heat energy by increasing the magnetic flux. The VFD monitors the state of the motor continuously even during the magnetic flux period. Magnetic flux braking can be used for motor stop, as well as for motor rotation speed change. The other advantages include: Braking is performed immediately after the stop command is given. The braking can be started without waiting for magnetic flux weakening. The cooling is better. The current of the stator other than the rotor increases during magnetic flux braking, while the cooling of the stator is more effective than the rotor.	0	○
P08.51	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.	0	○

Function code	Name	Description	Default	Modify
		1: No lock on STO alarm No lock on STO alarm indicates STO alarm disappears automatically after state restoration if STO occurs.		
P08.53	Upper limit frequency bias value in torque control	0.00 Hz–P00.03 (Max. output frequency)	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 specified value, the carrier frequency restores to the setting. This function reduces the chance of VFD overheat alarm.	0	○
P08.56	Min. carrier frequency	0.0–15.0kHz	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	○

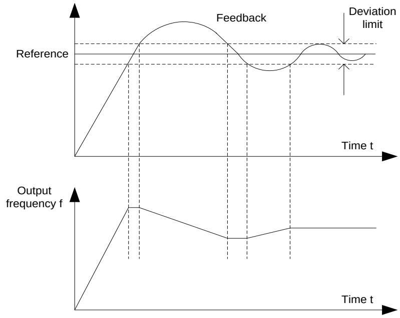
Function code	Name	Description	Default	Modify
P08.63	Output torque filter times	0–8	8	○

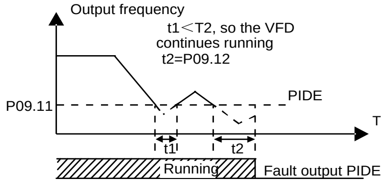
Group P09—PID control

Function code	Name	Description	Default	Modify
P09.00	PID reference source	When frequency command selection (P00.06, P00. 07) is 7, or voltage setting channel (P04.27) is 6, the running mode of VFD is process PID control. The function code determines the target given channel during the PID process. 0: Set by P09.01 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 expansion 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 calculates a related 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	○

Function code	Name	Description	Default	Modify
		0: AI1 1: AI2 2: AI3 3: High-speed pulse HDIA 4: Modbus/Modbus TCP communication 5: PROFIBUS/CANopen/DeviceNet communication 6: Ethernet communication 7: High-speed pulse HDIB 8: EtherCAT/PROFINET/ EtherNet IP communication 9: Programmable expansion card 10: 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. Example: PID control on strain during unwinding. 1: PID output is negative. When the feedback signal is greater than the PID reference value, the output frequency of the VFD will increase to balance the PID. Example: PID control on tension during unwinding.	0	○
P09.04	Proportional gain (Kp)	The function is applied to the proportional gain P of PID input. P determines the strength of the whole PID adjuster. The larger the value of P, the stronger the adjustment intensity. The value 100 indicates that when the 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	○

Function code	Name	Description	Default	Modify
P09.05	Integral time (Ti)	Used to determine the speed of the integral adjustment on the deviation of PID feedback and reference from the PID regulator. When the deviation of PID feedback and reference is 100%, the integral 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	0.90s	○
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%	○

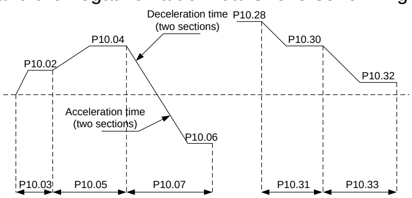
<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td></td><td></td><td>

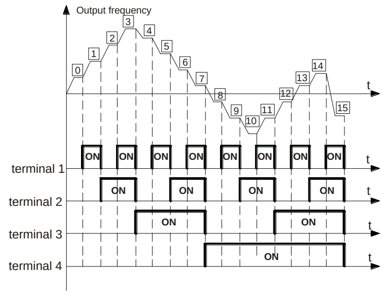
Setting range: 0.0–100.0%</td><td></td><td></td></tr>
<tr><td>P09.09</td><td>PID output upper limit</td><td rowspan="2">Used to set the upper and lower limits of PID regulator output values.
100.0% corresponds to the max. output frequency (P00.03) or max. voltage (P04.31).
Setting range of P09.09: P09.10—100.0%
Setting range of P09.10: -100.0%–P09.09</td><td>100.0%</td><td>○</td></tr>
<tr><td>P09.10</td><td>PID output lower limit</td><td>0.0%</td><td>○</td></tr>
<tr><td>P09.11</td><td>Feedback offline detection value</td><td rowspan="2">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</td><td>0.0%</td><td>○</td></tr>
<tr><td>P09.12</td><td>Feedback offline detection time</td><td>1.0s</td><td>○</td></tr>
<tr><td>P09.13</td><td>PID control selection</td><td>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:</td><td>0x0001</td><td>○</td></tr>
</table>

Function code	Name	Description	Default	Modify
		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. ACC/DEC of main reference A frequency source precharging is invalid. 1: A+B frequency. ACC/DEC of main reference A frequency source precharging is valid. The ACC/DEC is determined by P08.04 (ACC 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	○
P09.17	Reserved	-	-	-
P09.18	Low frequency integral time (Ti)	0.00–10.00s	0.90s	○
P09.19	Low frequency differential time (Td)	0.00–10.00s	0.00s	○
P09.20	Low frequency point for PID parameter switching	0.00–P09.21	5.00Hz	○
P09.21	High frequency point for PID parameter switching	P09.20–P00.04	10.00Hz	○
P09.22–P09.28	Reserved	-	-	-

Group P10—Simple PLC and multi-step speed control

Function code	Name	Description	Default	Modify
P10.00	Simple PLC mode	0: Stop after running once The VFD stops automatically after running for one cycle, and it can be started only after receiving the running command. 1: Keep running 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 one cycle until receiving the stop command.	0	○
P10.01	Simple PLC memory selection	0: Do not memorize at power outage 1: Memorize at power outage. 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: -300.0–100.0%. 300.0% 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–	0.0%	○
P10.03	Running time of step 0		0.0s	○
P10.04	Multi-step speed 1		0.0%	○
P10.05	Running time of step 1		0.0s	○
P10.06	Multi-step speed 2		0.0%	○
P10.07	Running time of step 2		0.0s	○
P10.08	Multi-step speed 3		0.0%	○
P10.09	Running time of step 3		0.0s	○
P10.10	Multi-step speed 4		0.0%	○
P10.11	Running time of step 4		0.0s	○
P10.12	Multi-step speed 5		0.0%	○
P10.13	Running time of step 5		0.0s	○
P10.14	Multi-step speed 6		0.0%	○
P10.15	Running time of step 6		0.0s	○
P10.16	Multi-step speed 7		0.0%	○

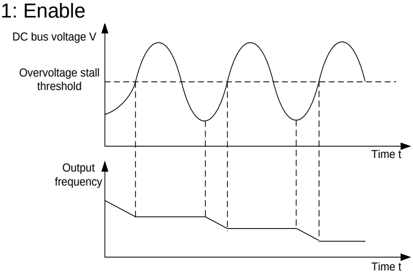
<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td>P10.17</td><td>Running time of step 7</td><td rowspan="17">fmax, and it can be set continuously. The start/stop of multi-step stop running is also determined by P00.01.
The VFD supports the 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 multi-step speed 15.


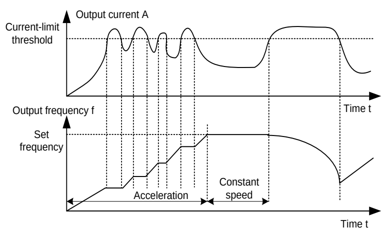
When terminal 1, terminal 2, terminal 3 and terminal 4 are OFF, the frequency input mode is set by P00.06 or P00.07. When terminal 1, terminal 2, terminal 3 and terminal 4 are not all OFF, the frequency set by multi-step speed will prevail, and the priority of multi-step setting is higher than that of the keypad, analog, high-speed pulse, PID, and communication settings.
The relation between terminal 1, terminal 2, terminal 3 and terminal 4 are shown in the following (T indicates terminal).
<table>
<tr><td>T1</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td></tr>
<tr><td>T2</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td></tr>
<tr><td>T3</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td></tr>
<tr><td>T4</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td></tr>
<tr><td>Step</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr>
<tr><td>T1</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td></tr>
<tr><td>T2</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td></tr>
<tr><td>T3</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td></tr>
</table></td><td>0.0s</td><td>○</td></tr>
<tr><td>P10.18</td><td>Multi-step speed 8</td><td>0.0%</td><td>○</td></tr>
<tr><td>P10.19</td><td>Running time of step 8</td><td>0.0s</td><td>○</td></tr>
<tr><td>P10.20</td><td>Multi-step speed 9</td><td>0.0%</td><td>○</td></tr>
<tr><td>P10.21</td><td>Running time of step 9</td><td>0.0s</td><td>○</td></tr>
<tr><td>P10.22</td><td>Multi-step speed 10</td><td>0.0%</td><td>○</td></tr>
<tr><td>P10.23</td><td>Running time of step 10</td><td>0.0s</td><td>○</td></tr>
<tr><td>P10.24</td><td>Multi-step speed 11</td><td>0.0%</td><td>○</td></tr>
<tr><td>P10.25</td><td>Running time of step 11</td><td>0.0s</td><td>○</td></tr>
<tr><td>P10.26</td><td>Multi-step speed 12</td><td>0.0%</td><td>○</td></tr>
<tr><td>P10.27</td><td>Running time of step 12</td><td>0.0s</td><td>○</td></tr>
<tr><td>P10.28</td><td>Multi-step speed 13</td><td>0.0%</td><td>○</td></tr>
<tr><td>P10.29</td><td>Running time of step 13</td><td>0.0s</td><td>○</td></tr>
<tr><td>P10.30</td><td>Multi-step speed 14</td><td>0.0%</td><td>○</td></tr>
<tr><td>P10.31</td><td>Running time of step 14</td><td>0.0s</td><td>○</td></tr>
<tr><td>P10.32</td><td>Multi-step speed 15</td><td>0.0%</td><td>○</td></tr>
<tr><td>P10.33</td><td>Running time of step 15</td><td>0.0s</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><table><tr><td>T4</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td></tr><tr><td>Step</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td></tr></table></td><td></td><td></td></tr>
<tr><td>P10.34</td><td>ACC/DEC time of steps 0–7 of simple PLC</td><td rowspan="2">The description is as follows:
<table>
<tr><th>Function code</th><th colspan="2">Binary</th><th>Step</th><th>ACC/ DEC time 1</th><th>ACC/ DEC time 2</th><th>ACC/ DEC time 3</th><th>ACC/ DEC time 4</th></tr>
<tr><td rowspan="8">P10.34</td><td>Bit1</td><td>Bit0</td><td>0</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>Bit3</td><td>Bit2</td><td>1</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>Bit5</td><td>Bit4</td><td>2</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>Bit7</td><td>Bit6</td><td>3</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>Bit9</td><td>Bit8</td><td>4</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>Bit11</td><td>Bit10</td><td>5</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>Bit13</td><td>Bit12</td><td>6</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>Bit15</td><td>Bit14</td><td>7</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<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>0x0000</td><td>○</td></tr>
<tr><td>P10.35</td><td>ACC/DEC time of steps 8–15 of simple PLC</td><td>0x0000</td><td>○</td></tr>
<tr><td>P10.36</td><td>PLC restart mode</td><td>0: Restart from step 1
If the VFD stops during running (caused by stop command, fault or power down), it will run from the first step after restart.
1: Resume from the paused step
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</td><td>0</td><td>◎</td></tr>
</table>

Function code	Name	Description	Default	Modify
		automatically after restart, then continue running at the frequency defined by this step in the remaining time.		
P10.37	Multi-step time unit	0: second The running time of each step is counted in seconds. 1: minute The running time of each step is counted in minutes.	0	◎

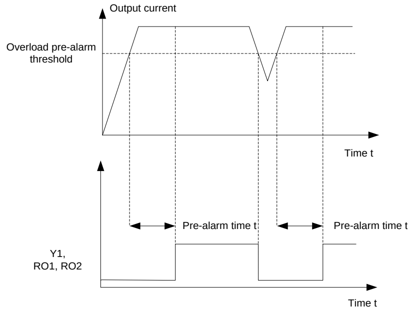
Group P11—Protection parameters

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

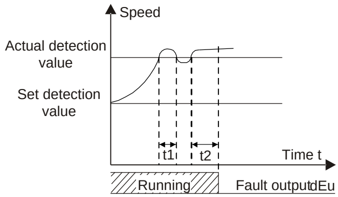
<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td rowspan="2">P11.04</td><td rowspan="2">Overvoltage stall protection voltage</td><td>120–150% (standard bus voltage) (380V)</td><td>136%</td><td rowspan="2">○</td></tr>
<tr><td>120–150% (standard bus voltage) (220V)</td><td>120%</td></tr>
<tr><td>P11.05</td><td>Current limit selection</td><td>During accelerated running, as the load is too large, the actual acceleration rate of motor is lower than that of output frequency, if no measures are taken, the VFD may trip due to overcurrent during acceleration.
0x00–0x11
Ones place: Current limit action
0: Invalid
1: Always valid
Tens place: Hardware current limit overload alarm
0: Valid
1: Invalid</td><td>0x01</td><td>◎</td></tr>
<tr><td>P11.06</td><td>Automatic current limit threshold</td><td rowspan="2">Current-limit protection function detects output current during running, and compares it with the current-limit level defined by P11.06, if it exceeds the current-limit level, the VFD will run at stable frequency during accelerated running, or run in decreased frequency during constant-speed running; if it exceeds the current-limit level continuously, the VFD output frequency will drop continuously until reaching 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: 50.0–200.0% (of the rated VFD output current)
Setting range of P11.07: 0.00–50.00Hz/s</td><td>G type: 160.0%
P type: 120.0%</td><td>◎</td></tr>
<tr><td>P11.07</td><td>Frequency decrease ratio in current limiting</td><td>10.00 Hz/s</td><td>◎</td></tr>
</table>

Function code	Name	Description	Default	Modify
P11.08	Pre-alarm selection for VFD/motor OL/UL	0x0000–0x1134 Ones place: 0: Motor OL/UL pre-alarm, relative to the motor rated current. 1: VFD OL/UL pre-alarm, relative to rated VFD output current. 2: Motor output torque OL/UL pre-alarm, relative to motor rated torque. 3: Motor OL/UL pre-alarm. The overload is relative to the motor rated current; while the underload is relative to the motor rated power. 4: VFD OL/UL pre-alarm. The overload is relative to the VFD rated current; while the underload is relative to the VFD rated power. Tens place: 0: The VFD continues to work for an OL/UL alarm 1: The VFD continues to work for a UL alarm but stops running for an OL fault. 2: The VFD continues to work for an OL alarm but stops running for a UL fault. 3: The VFD stops running for an OL/UL alarm. Hundreds place: 0: 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	0x0000	○
P11.09	Overload pre-alarm detection threshold	If the VFD or motor output current is larger than the overload pre-alarm detection level (P11.09), and the duration exceeds the overload pre-alarm detection time (P11.10), overload pre-alarm signal will be outputted.	G type: 150% P type: 120%	○
P11.10	Overload pre-alarm detection time		1.0s	○

<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>

P11.09 setting range: P11.11–200% (relative value determined by the ones place of P11.08)
Setting range of P11.10: 0.1–3600.0s</td><td></td><td></td></tr>
<tr><td>P11.11</td><td>Underload pre-alarm detection threshold</td><td rowspan="2">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).
P11.11 setting range: 0–P11.09 (relative value determined by the ones place of P11.08)
Setting range of P11.12: 0.1–3600.0s</td><td>50%</td><td>○</td></tr>
<tr><td>P11.12</td><td>Underload pre-alarm detection time</td><td>1.0s</td><td>○</td></tr>
<tr><td>P11.13</td><td>Fault output terminal action upon fault occurring</td><td>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</td><td>0x00</td><td>○</td></tr>
<tr><td>P11.14</td><td>Speed deviation detection value</td><td>0.0–50.0%
Used to set the speed deviation detection value.</td><td>10.0%</td><td>○</td></tr>
<tr><td>P11.15</td><td>Speed deviation detection time</td><td>Setting range: 0.0–10.0s (0.0 indicates no speed deviation protection)
Used to set the speed deviation detection time.
Note: Speed deviation protection is invalid when P11.15=0.0.</td><td>2.0s</td><td>○</td></tr>
</table>

Function code	Name	Description	Default	Modify
		 t1<t2, so the VFD continues running t2=P11.15		
P11.16	Automatic frequency-reduction during voltage drop	0–1 0: Disable 1: Enable	0	○
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 during overvoltage stall	This parameter is used to set the integral coefficient of the bus voltage regulator during overvoltage stall. Setting range: 0–1000	10	○

Function code	Name	Description	Default	Modify
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	Enabling VFD overload integral	0: Disable 1: Enable When this parameter is set to 0, the overload timing value is reset to zero after the VFD is stopped. In this case, the determination of VFD overload takes more time, and therefore the effective protection over the VFD is weakened. When this parameter is set to 1, the overload timing value is not reset, and the overload timing value is accumulative. In this case, the determination of VFD overload takes less time, and therefore the protection over the VFD can be performed more quickly.	0	◎
P11.26	Reserved	-	-	-
P11.27	VF oscillation control method	0x00–0x11 Ones place: 0: Method 1 1: Method 2 Tens place: 0: Reserved 1: Reserved	0x00	◎
P11.28	SPO switch-on detection delay time	0.0–60.0s **Note:** The SPO detection is started only after the VFD runs for the delay time P11.28 to avoid false alarms caused by the unstable frequency.	5.0	○
P11.29	SPO unbalance factor	0–10	6	○
P11.30	Reserved	-	-	-

Function code	Name	Description	Default	Modify
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 2: Pre-alarm, with the action executed according to P11.51 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). Group 1: Faults 11–14 (OL1, OL2, SPI, SPO) Group 2: Faults 15–18 (OH1, OH2, EF, CE) 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)	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 10		0x0000	○
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	○

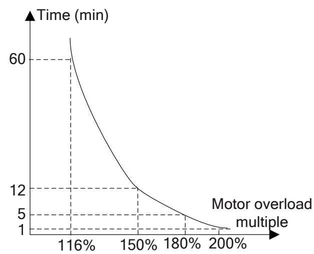
Function code	Name	Description	Default	Modify
P11.49	Fault severity group 19	Group 13: Faults 59–62 (OT, F1-Er, F2-Er, F3-Er)	0x0000	○
P11.50	Fault severity group 20	Group 14: Faults 63–66 (C1-Er, C2-Er, C3-Er, E-CAT) Group 15: Faults 67–70 (E-BAC, E-DEV, S-Err, OtE1) Group 16: Faults 71–75 (OtE2, E-EIP, E-PAO, E-AI1) Group 17: Faults 75–78 (E-AI2, E-AI3, Reserved, Reserved) Group 18: Faults 79–82 (Reserved, Reserved, Reserved, Reserved) Group 19: Faults 83–86 (Reserved, Reserved, Reserved, Reserved) Group 20: Faults 87–90 (Reserved, Reserved, Reserved, Reserved)	0x0000	○
P11.51	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 frequency reserved for exception	0	○
P11.52	Frequency reserved for exception	0.00–630.00Hz	0.00 Hz	○
P11.53	Fire mode function	0–2 0: Disable 1: Fire mode 1 2: Fire mode 2 **Note:** When P11.53=0, the fire mode is invalid. In this case, the VFD runs in normal mode and stops when encountering a fault. When the fire mode function is valid, the VFD runs at the speed specified by P11.54. In fire mode 1, the VFD keeps running except when the VFD has been damaged. In fire mode 2, the VFD keeps running, but	0	◎

Function code	Name	Description	Default	Modify
		stops upon the following faults: OUT1, OUT2, OUT3, OC1, OC2, OC3, OV1, OV2, OV3, and SPO. Terminal control must be used for a fire mode. **Note:** After the fire mode is active for 5 minutes, P11.55 is reset, and the warranty is no longer valid. Please use with caution.		
P11.54	Running frequency in fire mode	0.00Hz–P00.03	50.00Hz	○
P11.55	Fire mode flag	0–1 **Note:** If the fire mode has lasted 5 minutes, this flag is reset to 1, and no warranty of repair is granted.	0	●
P11.56–P11.69	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	○

Function code	Name	Description	Default	Modify
P12.09	Mutual inductance of AM 2	0.1–6553.5mH	Model depended	○
P12.10	No-load current of AM 2	0.1–6553.5A	Model depended	○
P12.11	Magnetic saturation coefficient 2 of iron core of AM 1	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 2 of iron core of AM 3	0.0–100.0%	57%	○
P12.14	Magnetic saturation coefficient 2 of iron core of AM 4	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	300	○
P12.24	Initial pole position of SM 2	0x0000–0xFFFF	0x0000	/●
P12.25	Identification current of SM 2	0–50% (of the motor rated current)	10%	/●

Function code	Name	Description	Default	Modify
P12.26	Overload protection selection of motor 2	0: No protection 1: Common motor (with low-speed compensation) 2: Frequency-variable motor (without low-speed compensation)	2	◎
P12.27	Overload protection coefficient of motor 2	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=150%, protection is performed after motor overload lasts for 12 minutes; when M=200%, protection is performed after motor overload lasts for 1 minute; and when M≥400%, protection is performed immediately.  Setting range: 20.0%–120.0%	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–P12.32	Reserved	-	-	-

Group P13—SM control

Function code	Name	Description	Default	Modify
P13.00	SM injected-current decrease ratio	0.0%–100.0% (of the motor rated current)	80.0%	○
P13.01	Initial pole detection method	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 upper 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 switching frequency	0.0–200.0% **Note:** Relative to the motor rated frequency.	20.0%	○
P13.05	High frequency superimposed frequency	200–1000Hz	500	◎
P13.06	High-frequency superposition voltage	0.0–300.0% (of the motor rated voltage)	100.0%	◎
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	2.00	○

Function code	Name	Description	Default	Modify
		when the running frequency is higher than that, the phase-locked loop is enabled. Setting range: 0.00–655.35		
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	SM high-frequency compensation coefficient	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%	◎

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 broadcast address in a frame, all the salves on the Modbus/Modbus TCP 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.	1	○
P14.01	Communication baud rate setting	Used to set the rate of data transmission between the upper computer and the VFD. 0: 1200bps 1: 2400bps 2: 4800bps	4	○

Function code	Name	Description	Default	Modify
		3: 9600bps 4: 19200bps 5: 38400bps 6: 57600bps 7: 115200bps **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.		
P14.02	Data bit check	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 upper computer. If the response delay is shorter than the rectifier processing time, the rectifier sends response data to the host controller after processing data. If the delay is longer than the rectifier processing time, the rectifier does not send response data to the host controller until the delay is reached although data has been processed.	5ms	○
P14.04	485 communication timeout period	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 "Modbus/Modbus TCP communication fault" (CE) if the communication interval exceeds the value.	0.0s	○

Function code	Name	Description	Default	Modify
		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.		
P14.05	Transmission error processing	0: Report an alarm and coast to stop 1: Keep running without reporting an alarm 2: Stop according to the stop mode without generating alarms (only in the communication-based control mode) 3: Stop according to the stop mode without generating alarms (in all control modes)	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: (valid for RS485 communication only) 0: User-defined addresses specified by P14.07 and P14.08 are invalid. 1: User-defined addresses specified by P14.07 and P14.08 are valid.	0x000	○
P14.07	User-defined running command address	0x0000–0xFFFF	0x2000	○
P14.08	User-defined frequency setting address	0x0000–0xFFFF	0x2001	○
P14.09	Modbus TCP communication timeout period	0.0–60.0s	5.0s	○
P14.10	Enabling 485 upgrade program	0–1 0: Disable	0	◎

Function code	Name	Description	Default	Modify
		1: Enable		
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	0	○
P14.13–P14.47	Reserved	-	-	-
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 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	○

Function code	Name	Description	Default	Modify
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	○
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
P15.00	Reserved	-	-	-
P15.01	Module address	0–127	2	◎
P15.02	Received PZD2	0–31 0: Disable 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: 0.01 Hz) 6: Setting of the upper limit of reverse running frequency (0–Fmax, unit: 0.01 Hz) 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, corresponding to S8/S7/S6/S5/HDIB/ HDIA/S4/S3/S2/S1) 10: Virtual output terminal command (range: 0x00–0x0F, corresponding to RO2/RO1/HDO/Y1) 11: Voltage setting (special for V/F separation) (0–1000, 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)	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
		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: Function parameter mapping (PZD2–PZD12 correspond to P14.49–P14.59) 20–31: Reserved		
P15.13	Sent PZD2	0–31 0: Disable 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 26: HDIB frequency value (*100, kHz) 27: PG card pulse feedback count high bit 28: PG card pulse feedback count low bit	0	○
P15.14	Sent PZD3		0	○
P15.15	Sent PZD4		0	○
P15.16	Sent PZD5		0	○
P15.17	Sent PZD6		0	○
P15.18	Sent PZD7		0	○
P15.19	Sent PZD8		0	○
P15.20	Sent PZD9		0	○
P15.21	Sent PZD10		0	○
P15.22	Sent PZD11		0	○
P15.23	Sent PZD12		0	○

Function code	Name	Description	Default	Modify
		29: PG card pulse reference count MSB 30: PG card pulse reference count LSB 31: Function parameter mapping (PZD2–PZD12 correspond to P14.60–P14.70)		
P15.24	Reserved	-	-	-
P15.25	DP communication timeout period	0.0 (invalid)–60.0s	5.0	○
P15.26	CANopen communication timeout period	0.0 (invalid)–60.0s	5.0	○
P15.27	CANopen communication baud rate	0–7 0: 1000kbps 1: 800kbps 2: 500kbps 3: 250kbps 4: 125kbps 5: 100kbps 6: 50kbps 7: 20kbps	3	◎
P15.28	Master/slave CAN communication address	0–127	1	◎
P15.29	Master/slave CAN communication baud rate	0: 50Kbps 1: 100kbps 2: 125kbps 3: 250kbps 4: 500kbps 5: 1Mbps	2	◎
P15.30	Master/slave CAN communication timeout period	0.0 (invalid)–300.0s	5.0s	○
P15.31–P15.42	Reserved	-	-	-
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
P16.00–P16.01	Reserved	-	-	-
P16.02	Ethernet monitoring card IP address 1	0–255	192	◎
P16.03	Ethernet monitoring card IP address 2	0–255	168	◎
P16.04	Ethernet monitoring card IP address 3	0–255	0	◎
P16.05	Ethernet monitoring card IP address 4	0–255	1	◎
P16.06	Ethernet monitoring card subnet mask 1	0–255	255	◎
P16.07	Ethernet monitoring card subnet mask 2	0–255	255	◎
P16.08	Ethernet monitoring card subnet mask 3	0–255	255	◎
P16.09	Ethernet monitoring card subnet mask 4	0–255	0	◎
P16.10	Ethernet monitoring card gateway 1	0–255	192	◎
P16.11	Ethernet monitoring 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 card monitoring variable address 1	0x0000–0xFFFF	0x0000	○
P16.15	Ethernet card monitoring variable address 2	0x0000–0xFFFF	0x0000	○
P16.16	Ethernet card monitoring variable address 3	0x0000–0xFFFF	0x0000	○
P16.17	Ethernet card	0x0000–0xFFFF	0x0000	○

Function code	Name	Description	Default	Modify
	monitoring variable address 4			
P16.18–P16.23	Reserved	-	-	-
P16.24	Time to identify expansion card in card slot 1	0.0–600.0s The value 0.0 indicates that identification fault will not be detected.	0.0s	○
P16.25	Time to identify expansion card in card slot 2	0.0–600.0s The value 0.0 indicates offline fault will not be detected.	0.0s	○
P16.26	Time to identify expansion card in card slot 3	0.0–600.0s The value 0.0 indicates offline fault will not be detected.	0.0s	○
P16.27	Communication timeout period of expansion card in card slot 1	0.0–600.0s The value 0.0 indicates offline fault will not be detected.	0.0s	○
P16.28	Communication timeout period of expansion card in card slot 2	0.0–600.0s The value 0.0 indicates offline fault will not be detected.	0.0s	○
P16.29	Communication timeout period of expansion card in card slot 3	0.0–600.0s The value 0.0 indicates offline fault will not be detected.	0.0s	○
P16.30	Reserved	-	-	-
P16.31	PROFINET communication timeout time	0.0–60.0s	5.0s	○
P16.32	Received PZD2	0–31 0: Disable 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	0	○
P16.33	Received PZD3		0	○
P16.34	Received PZD4		0	○
P16.35	Received PZD5		0	○
P16.36	Received PZD6		0	○
P16.37	Received PZD7		0	○
P16.38	Received PZD8		0	○
P16.39	Received PZD9		0	○

Function code	Name	Description	Default	Modify
P16.40	Received PZD10	corresponds to 100.0% of the motor rated current) 5: Setting of the upper limit of forward running frequency (0–Fmax, unit: 0.01 Hz) 6: Setting of the upper limit of reverse running frequency (0–Fmax, unit: 0.01 Hz) 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, corresponding to S8/S7/S6/S5/HDIB/ HDIA/S4/S3/S2/S1) 10: Virtual output terminal command (range: 0x00–0x0F, corresponding to RO2/RO1/HDO/Y1) 11: Voltage setting (special for V/F separation) (0–1000, 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: Function parameter mapping (PZD2–PZD12 correspond to P14.49–P14.59) 20–31: Reserved	0	○
P16.41	Received PZD11		0	○
P16.42	Received PZD12		0	○
P16.43	Sent PZD2	0–31 0: Invalid 1: Running frequency (×100, Hz)	0	○
P16.44	Sent PZD3		0	○
P16.45	Sent PZD4		0	○

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td>P16.46</td><td>Sent PZD5</td><td rowspan="8">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
26: HDIB frequency value (×100, kHz)
27: PG card pulse feedback count high bit
28: PG card pulse feedback count low bit
29: PG card pulse reference count MSB
30: PG card pulse reference count LSB
31: Function parameter mapping (PZD2–PZD12 correspond to P14.60–P14.70)</td><td>0</td><td>○</td></tr>
<tr><td>P16.47</td><td>Sent PZD6</td><td>0</td><td>○</td></tr>
<tr><td>P16.48</td><td>Sent PZD7</td><td>0</td><td>○</td></tr>
<tr><td>P16.49</td><td>Sent PZD8</td><td>0</td><td>○</td></tr>
<tr><td>P16.50</td><td>Sent PZD9</td><td>0</td><td>○</td></tr>
<tr><td>P16.51</td><td>Sent PZD10</td><td>0</td><td>○</td></tr>
<tr><td>P16.52</td><td>Sent PZD11</td><td>0</td><td>○</td></tr>
<tr><td>P16.53</td><td>Sent PZD12</td><td>0</td><td>○</td></tr>
<tr><td>P16.54</td><td>EtherNet IP communication timeout period</td><td>0.0–60.0s</td><td>5.0s</td><td>○</td></tr>
<tr><td>P16.55</td><td>EtherNet IP communication rate</td><td>0–4
0: Self adaptive
1: 100M full duplex
2: 100M half duplex</td><td>0</td><td>◎</td></tr>
</table>

Function code	Name	Description	Default	Modify
		3: 10M full duplex 4: 10M half duplex		
P16.56	Bluetooth pairing code	0–65535	0	●
P16.57	Bluetooth host type	0–65535 0: No host connection 1: Mobile App 2: Bluetooth box 3–65535: Reserved	0	●
P16.58	Industrial Ethernet communication card IP address 1	0–255	192	◎
P16.59	Industrial Ethernet communication card IP address 2	0–255	168	◎
P16.60	Industrial Ethernet communication card IP address 3	0–255	0	◎
P16.61	Industrial Ethernet communication card IP address 4	0–255	20	◎
P16.62	Industrial Ethernet communication card subnet mask 1	0–255	255	◎
P16.63	Industrial Ethernet communication card subnet mask 2	0–255	255	◎
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	0–255	168	◎

Function code	Name	Description	Default	Modify
	card gateway 2			
P16.68	Industrial Ethernet communication card gateway 3	0–255	0	◎
P16.69	Industrial Ethernet communication card gateway 4	0–255	1	◎

Group P17—Status viewing

Function code	Name	Description	Default	Modify
P17.00	Set frequency	Displays the present set frequency of the VFD. Range: 0.00Hz–P00.03	0.00Hz	●
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 present motor power. 100% corresponds to the rated motor power. The positive value is the motoring state while the negative value is the generating state. Range: -300.0–300.0% (relative to the rated motor power)	0.0%	●

Function code	Name	Description	Default	Modify
P17.09	Motor output torque	Displays the present output torque of the VFD; 100% relative to the rated motor torque. During forward running, the positive value is the motoring state while the negative value is generating state. During reverse running, the positive value is the generating state while the negative value is the motoring state. Range: -250.0–250.0%	0.0%	●
P17.10	Estimated motor frequency	Displays the estimated motor rotor frequency under the open-loop vector condition. Range: 0.00–P00.03	0.00Hz	●
P17.11	DC bus voltage	Displays the present DC bus voltage of the VFD. Range: 0.0–2000.0 V	0.0V	●
P17.12	Digital input terminal state	Displays the present digital input terminal state of the VFD. 0x00–0x3F Corresponds to HDIB, HDIA, S4, S3, S2 and S1 respectively.	0x00	●
P17.13	Digital output terminal state	Displays the present digital output terminal state of the VFD. 0x00–0x0F The bits correspond to RO2, RO1, HDO, and Y1 respectively.	0x00	●
P17.14	Digital adjustment value	Displays the adjustment on the VFD through the 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	-	-	-
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	AI 2 input voltage	Displays the AI2 input signal.	0.00V	●

Function code	Name	Description	Default	Modify
		Range: -10.00V–10.00V		
P17.21	HDIA input frequency	Display HDIA input frequency. Range: 0.000–50.000kHz	0.000 kHz	●
P17.22	HDIB input frequency	Display HDIB input frequency. Range: 0.000–50.000kHz	0.000 kHz	●
P17.23	PID reference value	Displays the PID reference value. Range: -100.0–100.0%	0.0%	●
P17.24	PID feedback value	Displays the PID feedback value. Range: -100.0–100.0%	0.0%	●
P17.25	Motor power factor	Displays the power factor of the current motor. Range: -1.00–1.00	0.00	●
P17.26	Duration of this run	Displays the duration of this run of the VFD. Range: 0–65535min	0min	●
P17.27	Present step of simple PLC	Used to display the present step of the simple PLC function.	0	●
P17.28	Motor ASR controller 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.	0.0A	●

Function code	Name	Description	Default	Modify
		Range: 0.0–5000.0A		
P17.36	Output torque	Displays the output torque value. During forward running, the positive value is the motoring state while the negative value is generating state. During reverse running, the positive value is the generating state while the negative value is the motoring state. Range: -3000.0Nm–3000.0Nm	0.0Nm	●
P17.37	Motor overload count value	0–65535	0	●
P17.38	Process PID output	-100.0%–100.0%	0.0%	●
P17.39	Function codes in parameter download error	0.00–99.00	0.00	●
P17.40	Motor control mode	0x000–0x123 Ones place: Control mode 0: Vector 0 1: Vector 1 2: V/F control 3: Closed-loop vector Tens place: Control status 0: Speed control 1: Torque control 2: Position control Hundreds place: Motor number 0: Motor 1 1: Motor2	0x000	●
P17.41	Electromotive torque upper limit	0.0%–300.0% (of the motor rated current)	0.0%	●
P17.42	Braking torque upper limit	0.0%–300.0% (of the motor rated current)	0.0%	●
P17.43	Forward rotation upper-limit frequency in torque control	0.00–P00.03	0.00Hz	●
P17.44	Reverse rotation upper-limit frequency in torque	0.00–P00.03	0.00Hz	●

Function code	Name	Description	Default	Modify
	control			
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	●
P17.48	VFD overload count value	0–65535	0	●
P17.49	Frequency set by A source	0.00–P00.03	0.00Hz	●
P17.50	Frequency set by B source	0.00–P00.03	0.00Hz	●
P17.51	PID proportional output	-100.0%–100.0%	0.0%	●
P17.52	PID integral output	-100.0%–100.0%	0.0%	●
P17.53	PID differential output	-100.0%–100.0%	0.0%	●
P17.54	PID present proportional gain	0.00–100.00	0.00	●
P17.55	PID present integral gain	0.00–10.00s	0.00s	●
P17.56	PID present differential time	0.00–10.00s	0.00s	●
P17.57	Actual steps of multi-step speed	0–15	0	●
P17.58	100Hz component peak value (square waves quadrature)	0.0–300.0(V) **Note:** Peak-to-peak value of bus voltage fluctuation at 100Hz frequency component, which is detected by using a square-wave orthogonal function.	0.0	●
P17.59	100Hz component peak value (sin quadrature)	0.0–300.0(V) **Note:** Peak-to-peak value of bus voltage fluctuation at 100Hz frequency component, which is detected by using a sin-wave orthogonal function.	0.0	●

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 setup when the spindle stops accurately. Setting range: 0–359.99	0.00	●
P18.10	Present position when spindle stops accurately	Present position when the spindle stops accurately. Range: 0–65535	0	●
P18.11	Encoder Z pulse direction	Z pulse direction display. When the spindle stops accurately, there may be a couple of pulses' error between the position of forward and reverse orientation, which can be	0	●

Function code	Name	Description	Default	Modify
		eliminated by adjusting Z pulse direction of 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	0–65535	0	●
P18.15	Low bit of encoder pulse count value	0–65535	0	●
P18.16	Speed measured by main control board	-3276.8–3276.7Hz	0.0Hz	●
P18.17	Pulse command frequency	The pulse command (A2/B2 terminal) is converted to the set frequency, and it is valid under the pulse position mode and pulse speed mode. Range: -3276.8–3276.7Hz	0.0Hz	●
P18.18	Pulse command feedforward	The pulse command (A2/B2 terminal) is converted to the set frequency, and it is valid under the pulse position mode and pulse speed mode. Range: -3276.8–3276.7Hz	0.0Hz	●
P18.19	Position regulator output	-327.68–327.67Hz	0.00Hz	●
P18.20	Count value of resolver	Count value of the 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	0x0000–0xFFFF	0x0000	●
P18.24	High-order bit of count value of	0–65535	0	●

Function code	Name	Description	Default	Modify
	pulse reference			
P18.25	Low-order bit of count value of pulse reference	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	0.00	●
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	●

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: Programmable card 2: I/O card 3: Incremental PG card 4: Incremental PG card with UVW 5: Ethernet communication card	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
		6: DP communication card 7: Bluetooth card 1 8: Resolver PG card 9: CANopen communication card 10: WIFI 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 TCP communication card 17: EtherCAT communication card 18: BACnet communication card 19: DeviceNet communication card 20: PT100/PT1000 temperature detection card 21: EtherNet IP card 22: MECHATROLINK communication card 23: Bluetooth card 2 24–65535: Reserved		
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	●
P19.08	Reserved	-	-	-
P19.09	AI3 input voltage of I/O card	0.00–10.00V	0.00V	●
P19.10	EC PT100 detected temperature	-50.0–150.0°C	0.0°C	●
P19.11	EC PT100 detected	0–4096	0	●

Function code	Name	Description	Default	Modify
	digital			
P19.12	EC PT1000 detected temperature	-50.0–150.0°C	0.0°C	●
P19.13	EC PT1000 detected digital	0–4096	0	●
P19.14	Warning display	0–4 0: None 1: PT100 detected OH alarm (A-Ot1) 2: PT1000 detected OH alarm (A-Ot2) 3: PT100 disconnection alarm (A-Pt1) 4: PT1000 disconnection alarm (A-Pt2)	0	●
P19.15	Communication card control word	0x0000–0xFFFF	0x0000	●
P19.16	Communication card status word	0x0000–0xFFFF	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	0	●
P19.20	Ethernet monitoring variable 4	0–65535	0	●
P19.21	AIAO temperature	-20.0–200.0°C	0.0°C	●

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 absolute encoder	0	●
P20.01	Encoder pulse count	Number of pulses generated when the encoder revolves for one circle. Setting range: 0–60000	1024	◎
P20.02	Encoder direction	0x000–0x111	0x000	◎

Function code	Name	Description	Default	Modify
		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		
P20.03	Encoder disconnection fault detection time	0.0–10.0s	2.0s	○
P20.04	Encoder reversal fault detection time	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: Resolver based speed measurement mode selection Bit4: Z pulse capture mode Bit5: Do not detect the encoder initial angle in V/F control Bit6: Enable the CD signal calibration Bit7: Disable sin/cos subdivision speed measurement Bit8: Do not detect encoder faults during autotuning Bit 9: Enable Z pulse detection optimization	0x0003	○

Function code	Name	Description	Default	Modify
		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: No detection 1: Enable Tens place: UVW pulse detection (for SM) 0: No detection 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	0–3 0: No operation 1: Rotary autotuning (DC braking) 2: Static autotuning (suitable for resolver-type encoder, sin/cos with CD signal feedback) 3: Rotary autotuning (initial angle identification)	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	○
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	◎

Function code	Name	Description	Default	Modify
P20.15	Speed measurement mode	0: PG card 1: Locally measured through HDIA and HDIB. Only the 24V incremental encoders are supported.	0	◎
P20.16	Frequency division coefficient	0–255	0	○
P20.17	Pulse filter handling selection	0x0000–0xFFFF Bit0: Enable/disable encoder input filter 0: Disable 1: Enable Bit1: Encoder signal filter mode (set bit0 or bit2 to 1) 0: Self-adaptive filter 1: Use P20.18 as the filter parameter Bit2: Enable/disable encoder frequency-division output filter 0: Disable 1: Enable Bit3: Reserved Bit4: Enable/disable pulse reference filter 0: Disable 1: Enable Bit5: Pulse reference filter mode (valid when bit4 is set to 1) 0: Self-adaptive filter 1: Use P20.19 as the filter parameter Bit6–15: Reserved	0x0033	○
P20.18	Encoder pulse filter width	0–63 0 indicates 0.25μs.	2	○
P20.19	Pulse reference filter width	0–63 0 indicates 0.25μs.	2	○
P20.20	Pulse number of pulse reference	0–65535	1024	◎
P20.21	Enabling SM angle compensation	0–1	1	○
P20.22	Frequency point of speed measurement	0–630.00Hz	1.00Hz	○

Function code	Name	Description	Default	Modify
	mode switchover			
P20.23	SM angle compensation coefficient	-200.0–200.0%	100.0%	○
P20.24	Number of pole pairs in initial pole angle autotuning	1–128	2	◎

Group P21—Position control

Function code	Name	Description	Default	Modify
P21.00	Positioning mode	0x0000–0x7121 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: PG1 1: PG2 Thousands place: Servo mode 0: Disable servo, without position deviation 1: Disable servo, with position deviation 2: Enable servo, without position deviation 3: Enable servo, with position deviation 4–7: Reserved **Note:** In the pulse train or spindle positioning mode, the VFD enters the servo operation	0x0000	○

Function code	Name	Description	Default	Modify
		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	0x0000–0x3133 Ones place: Pulse mode 0: A/B quadrature pulse; A leads B 1: A is PULSE and B is SIGN If channel B is of low electric level, the edge counts up; if channel B is of high electric level, the edge counts down. 2: A is positive pulse Channel A is positive pulse; channel B needs no wiring 3: A/B dual-channel pulse; channel A pulse edge counts up, 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: Reserved Thousands place: Pulse control selection Bit0: Pulse filter selection 0: Inertia filter 1: Moving average filter Bit1: Overspeed control 0: No control 1: Control	0x0000	◎
P21.02	Position loop gain 1	The two 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	20.0	○
P21.03	Position loop gain 2		30.0	○

Function code	Name	Description	Default	Modify
		of P21.04. P21.03 is used for dynamic running, and P21.02 is used for maintaining the locked state. Setting range: 0.0–400.0		
P21.04	Position loop gain switchover mode	Used to select the mode for switching between APR gains. To use torque command-based switching, you need to set P21.05; and to use speed command-based switching, you need to set P21.06. 0: No switchover 1: Torque command 2: Speed command 3–5: Reserved	0	○
P21.05	Position gain switchover threshold in torque command	0.0–100.0% (of the motor rated torque)	10.0%	○
P21.06	Position gain switchover threshold in speed command	0.0–100.0% (of the motor rated speed)	10.0%	○
P21.07	Smooth filter coefficient for gain switchover	Smooth filter coefficient for APR gain switchover. Setting range: 0–15	5	○
P21.08	Position controller output limit	Position regulator output 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	Electronic gear ratio, used to adjust the	1000	○

Function code	Name	Description	Default	Modify
	position command ratio	corresponding relation between position command and actual running displacement. Setting range: 1–65535		
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	0x0000–0xFFFF 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 can be set to cyclic positioning or reciprocating positioning through bit2 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	0x0000	○

Function code	Name	Description	Default	Modify
		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. This function is reserved. 0: Search for the origin only for once 1: Search for the origin in every time of running Bit5: Origin calibration mode. This function is reserved. 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: Disable 1: Enable Bit 8: Positioning enabling signal setting (for terminal-based cyclic positioning). In the pulse form, after positioning is completed or in the first positioning, 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		

Function code	Name	Description	Default	Modify
		positioning enabling terminal is switched on. 0: Pulse signal 1: Electrical level signal Bit 9: Position source 0: Set by P21.17 1: PROFIBUS/CANopen setting Bit 10: Indicates whether to save encoder pulse count value at power-off 0: No 1: Yes Bit11: Reserved Bit 12: Positioning curve setting (Reserved) 0: Straight line 1: S curve		
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	0	○
P21.18	Positioning speed setting selection	0: Set by P21.19 1: AI1 2: AI2 3: AI3 4: High-speed pulse HDIA 5: High-speed pulse HDIB	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	○

Function code	Name	Description	Default	Modify
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	Setting range of P21.26: -9999–32767	0	○
P21.27	Pulse superposition rate	Setting range of P21.27: 0–3000.0 pulse/ms	8.0 pulse/ms	○
P21.28	ACC/DEC time after pulse inhibition	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) When the rising edge of the terminal is detected, add the value set in P21.26 to the set pulse value, and compensate to the pulse reference channel based on the pulse superposition speed set in P21.27. 2. Input terminal function 67 (pulse increase) When the terminal is valid, superpose the pulse value to the pulse reference channel based on the pulse superposition speed set in P21.27. **Note: Terminal filter P05.09 may affect the actual superposed value.** For example: P21.27 = 1.0 pulse/ms P05.05 = 67 When the S5 terminal input signal is 0.5s, 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	5.0s	○

Function code	Name	Description	Default	Modify
		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	0–2 0: By main control board 1: By PG card 2: Hybrid method	0	○
P21.32	Pulse reference feedforward source	0x0–0x1	0x0	◎
P21.33	Setting of encoder count value clearing	0–65535	0	◎

Group P22—Spindle positioning

Function code	Name	Description	Default	Modify
P22.00	Spindle positioning mode selection	0x0000–0xFFFF Bit0: Enable/disable spindle positioning 0: Disable 1: Enable Bit1: Spindle positioning reference point selection 0: Z pulse input 1: S2/S3/S4 terminal input Bit2: Search for reference point 0: Search the reference point only once 1: Search the reference point every time	0x0000	○

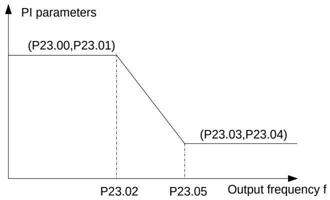
Function code	Name	Description	Default	Modify
		Bit3: Enable reference point calibration 0: Disable 1: Enable Bit4: Positioning mode selection 1 0: Set direction positioning 1: Near-by direction positioning Bit5: Positioning mode selection 2 0: Forward positioning 1: Reverse positioning Bit6: Zeroing command selection 0: Electric level mode 1: Pulse mode Bit7: Reference point calibration mode 0: Calibrate at the first time 1: Calibration in real time Bit8: Action selection after zeroing signal cancellation (electric level type) 0: Switch to speed mode 1: Position lock mode Bit9: Positioning completion signal selection 0: Electrical level signal 1: Pulse signal Bit10: Z pulse signal source 0: Motor 1: Spindle Bit11–15: Reserved		
P22.01	Speed of spindle orientation	During spindle orientation, the speed of the position point of orientation will be searched, and then it will switch over to position control orientation. Setting range: 0.00–100.00Hz	10.00Hz	○
P22.02	DEC time of spindle orientation	DEC time of spindle orientation. Spindle orientation deceleration time means the time needed for the VFD to decelerate from Max. output frequency (P00.03) to 0Hz. Setting range: 0.0–100.0s	3.0s	○
P22.03	Spindle zeroing position 0	You can select four spindle zeroing positions by terminals (functions 46 and 47).	0	○

Function code	Name	Description	Default	Modify
		Setting range: 0–65535		
P22.04	Spindle zeroing position 1	Setting range: 0–65535	0	○
P22.05	Spindle zeroing position 2	Setting range: 0–65535	0	○
P22.06	Spindle zeroing position 3	Setting range: 0–65535	0	○
P22.07	Spindle scale-division angle 1	You can select seven spindle scale-division angles by terminals (functions 48, 49, and 50). Setting range: 0.00–359.99	15.00	○
P22.08	Spindle scale-division angle 2	Setting range: 0.00–359.99	30.00	○
P22.09	Spindle scale-division angle 3	Setting range: 0.00–359.99	45.00	○
P22.10	Spindle scale-division angle 4	Setting range: 0.00–359.99	60.00	○
P22.11	Spindle scale-division angle 5	Setting range: 0.00–359.99	90.00	○
P22.12	Spindle scale-division angle 6	Setting range: 0.00–359.99	120.00	○
P22.13	Spindle scale-division angle 7	Setting range: 0.00–359.99	180.00	○
P22.14	Spindle drive ratio	Used to set the reduction ratio of the spindle and the mounting shaft of the encoder. Setting range: 0.000–30.000	1.000	○
P22.15	Spindle zero-point communication setting	P22.15 is used to set spindle zero-point offset. If the selected spindle zero point is P22.03, the final spindle zero point will be the sum of P22.03 and P22.15. Setting range: 0–39999	0	○
P22.16	Reserved	-	-	-

Function code	Name	Description	Default	Modify
P22.17	Reserved	-	-	-
P22.18	Rigid tapping selection	0x00–0x31 Ones place: Enabling selection 0: Disable 1: Enable Tens place: Analog port selection 0: Disable 1: AI1 2: AI2 3: AI3	0x00	◎
P22.19	Analog filter time of rigid tapping	0.0ms–1000.0ms	1.0ms	○
P22.20	Max. frequency of rigid tapping	0.00–400.00Hz	50.00Hz	○
P22.21	Corresponding frequency of analog zero drift of rigid tapping	0.00–10.00Hz	0.00Hz	○
P22.22–P22.24	Reserved	-	-	-

Group P23—Vector control of motor 2

Function code	Name	Description	Default	Modify
P23.00	Speed-loop proportional gain 1	The parameters P23.00–P23.05 are applicable only to vector control mode. Below the switching frequency 1 (P23.02), the speed-loop PI parameters are: P23.00 and P23.01. Above the switching frequency 2 (P23.05), the speed-loop PI parameters are: P23.03 and P23.04. PI parameters are obtained according to the linear change of two groups of parameters. See the following figure:	20.0	○
P23.01	Speed-loop integral time 1		0.200s	○
P23.02	Low-point frequency for switching		5.00Hz	○
P23.03	Speed-loop proportional gain 2		20.0	○
P23.04	Speed-loop integral time 2		0.200s	○
P23.05	High-point frequency for switching		10.00Hz	○

Function code	Name	Description	Default	Modify
		 The speed loop dynamic response characteristics of vector control can be adjusted by setting the proportional coefficient and integral time of speed regulator. Increasing proportional gain or reducing integral time can accelerate dynamic response of speed loop; however, if the proportional gain is too large or integral time is too small, system oscillation and overshoot may occur; If proportional gain is too small, stable oscillation or speed offset may occur. PI parameters have a close relationship with the inertia of the system. Adjust PI parameters depending on different loads to meet various demands. Setting range of P23.00: 0.0–200.0 Setting range of P23.01: 0.000–10.000s Setting range of P23.02: 0.00Hz–P23.05 Setting range of P23.03: 0.0–200.0 Setting range of P23.04: 0.000–10.000s Setting range of P23.05: P23.02–P00.03 (Max. output frequency)		
P23.06	Speed-loop output filter	0–8 (corresponding to 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	Vector control slip compensation coefficient (for		100%	○

Function code	Name	Description	Default	Modify
	power generation)			
P23.09	Current-loop proportional coefficient P	**Note:** ● The two function codes impact the dynamic response speed and control accuracy of the system. Generally, you do not need to modify the two function codes. ● Applicable to SVC mode 0 (P00.00=0), SVC mode 1 (P00.00=1), and FVC mode (P00.00=3). Setting range: 0–65535	1000	○
P23.10	Current-loop integral coefficient I		1000	○
P23.11	Speed-loop differential gain	0.00–10.00s	0.00s	○
P23.12	Proportional coefficient of high-frequency current loop	In the FVC mode (P00.00=3), when the frequency is lower than the current-loop high-frequency switching threshold (P23.14), the current-loop PI parameters are P23.09 and P23.10; and when the frequency is higher than the current-loop high-frequency switching threshold, the current-loop PI parameters are P23.12 and P23.13. 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)	1000	○
P23.13	Integral coefficient of high-frequency current loop		1000	○
P23.14	Current-loop high-frequency switching threshold		100.0%	○
P23.15–P23.19	Reserved	-	-	-

Group P24—Encoder 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 absolute encoder	0	●
P24.01	Encoder pulse count	Number of pulses generated when the encoder revolves for one circle. Setting range: 0–60000	1024	◎
P24.02	Encoder direction	0x000–0x111	0x000	◎

Function code	Name	Description	Default	Modify
		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		
P24.03	Encoder disconnection fault detection time	0.0–10.0s	2.0s	○
P24.04	Encoder reversal fault detection time	0.0–100.0s	0.8s	○
P24.05	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	○
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	0x0000–0xFFFF Bit0: Enable Z pulse calibration Bit1: Enable encoder angle calibration Bit2: Enable SVC speed measurement Bit3: Reserved Bit4: Reserved Bit5: Reserved Bit6: Enable the CD signal calibration Bit7: Reserved Bit8: Do not detect encoder faults during autotuning Bit 9: Enable Z pulse detection optimization Bit10: Enable the initial Z pulse calibration optimization Bit11: Reserved	0x0003	○

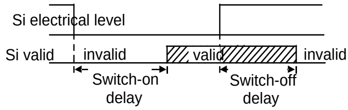
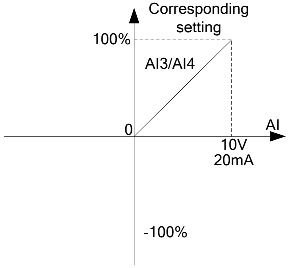
Function code	Name	Description	Default	Modify
		Bit12: Clear the Z pulse arrival signal after stop Bit13: Reserved Bit14: Detect Z pulse after one rotation Bit15: Reserved		
P24.08	Enable Z pulse offline detection	0x00–0x11 Ones place: Z pulse detection 0: No detection 1: Enable Tens place: UVW pulse 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 (DC braking) 2: Static autotuning (suitable for resolver-type encoder, sin/cos with CD signal feedback) 3: Rotary autotuning (initial angle identification)	0	◎
P24.12	Speed measurement optimization selection	0: No optimization 1: Optimization mode 1 2: Optimization mode 2	1	◎
P24.13	CD signal zero offset gain	0–65535	0	○
P24.14	Encoder type selection	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	◎
P24.15	Speed measurement mode	0: PG card 1: Locally measured through HDIA and HDIB. Only the 24V incremental encoders are	0	◎

Function code	Name	Description	Default	Modify
		supported.		
P24.16	Frequency division coefficient	0–255	0	○
P24.17	Pulse filter handling selection	0x0000–0xFFFF Bit0: Enable/disable encoder input filter 0: Disable 1: Enable Bit1: Encoder signal filter mode (set bit0 or bit2 to 1) 0: Self-adaptive filter 1: Use P24.18 as the filter parameter Bit2: Enable/disable encoder frequency-division output filter 0: Disable 1: Enable Bit3: Reserved Bit4: Enable/disable pulse reference filter 0: Disable 1: Enable Bit5: Pulse reference filter mode (valid when bit4 is set to 1) 0: Self-adaptive filter 1: Use P24.19 as the filter parameter Bit6–15: Reserved	0x0033	○
P24.18	Encoder pulse filter width	0–63 The filter time is P24.18*0.25μs. The value 0 or 1 indicates 0.25μs.	2	○
P24.19	Pulse reference filter width	0–63 The filter time is P24.19*0.25μs. The value 0 or 1 indicates 0.25μs.	2	○
P24.20	Pulse number of pulse reference	0–16000	1024	◎
P24.21	Enabling SM angle compensation	0–1	1	○
P24.22	Frequency point of speed measurement mode switchover	0–630.00Hz	1.00Hz	○

Function code	Name	Description	Default	Modify
P24.23	SM angle compensation coefficient	-200.0–200.0%	100.0%	○
P24.24	Number of pole pairs in initial pole angle autotuning	1–128	2	◎

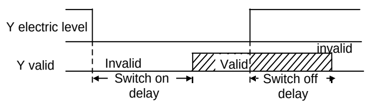
Group P25—I/O card input functions

Function code	Name	Description	Default	Modify
P25.00	HDI3 input type	0: HDI3 is high-speed pulse input 1: HDI3 is digital input	0	◎
P25.01	Function of S5	Same as the description for P05	0	◎
P25.02	Function of S6		0	◎
P25.03	Function of S7		0	◎
P25.04	Function of S8		0	◎
P25.05	Function of S9		0	◎
P25.06	Function of S10		0	◎
P25.07	Function of HDI3		0	◎
P25.08	Expansion card input terminal polarity	0x00–0x7F	0x00	○
P25.09	Expansion card virtual terminal setting	0x00–0x7F (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: HDI3 virtual terminal	0x00	◎
P25.10	HDI3 switch-on delay	The function codes specify the delay time corresponding to the electrical level changes when the programmable input terminals switch on or switch off.	0.000s	○
P25.11	HDI3 switch-off delay		0.000s	○
P25.12	S5 switch-on delay		0.000s	○
P25.13	S5 switch-off delay		0.000s	○
P25.14	S6 switch-on delay		0.000s	○

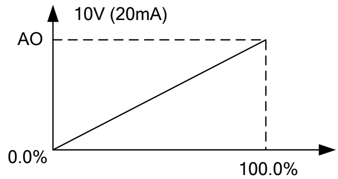
Function code	Name	Description	Default	Modify
P25.15	S6 switch-off delay	 Setting range: 0.000–50.000s	0.000s	○
P25.16	S7 switch-on delay		0.000s	○
P25.17	S7 switch-off delay		0.000s	○
P25.18	S8 switch-on delay		0.000s	○
P25.19	S8 switch-off delay		0.000s	○
P25.20	S9 switch-on delay		0.000s	○
P25.21	S9 switch-off delay		0.000s	○
P25.22	S10 switch-on delay		0.000s	○
P25.23	S10 switch-off delay		0.000s	○
P25.24	Lower limit value of AI3	The function codes define the relationship between the analog input voltage and its corresponding setting. When the analog input voltage exceeds the range from the upper limit to the lower limit, the upper limit or lower limit is used. 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	○
P25.25	Corresponding setting of AI2 lower limit		0.0%	○
P25.26	Upper limit value of AI3		10.00V	○
P25.27	Corresponding setting of AI3 upper limit		100.0%	○
P25.28	AI3 input filter time		0.030s	○
P25.29	Lower limit value of AI4		0.00V	○
P25.30	Corresponding setting of AI4 lower limit		0.0%	○
P25.31	Upper limit value of AI4		10.00V	○
P25.32	Corresponding setting of AI4 upper limit		100.0%	○
P25.33	AI4 input filter time	Input filter time: to adjust the sensitivity of analog input. Increasing the value properly can enhance analog input anti-interference but may reduce the sensitivity of analog input.	0.030s	○

Function code	Name	Description	Default	Modify
		Note: AI3 and AI4 can support 0–10V/0–20mA input. When AI3 and AI4 select 0–20mA input, the corresponding voltage of 20mA is 10V. Setting range of P25.24: 0.00V–P25.26 Setting range of P25.25: -300.0%–300.0% Setting range of P25.26: P25.24–10.00V Setting range of P25.27: -300.0%–300.0% Setting range of P25.28: 0.000s–10.000s Setting range of P25.29: 0.00V–P25.31 Setting range of P25.30: -300.0%–300.0% Setting range of P25.31: P25.29–10.00V Setting range of P25.32: -300.0%–300.0% Setting range of P25.33: 0.000s–10.000s		
P25.34	HDI3 high-speed pulse input function selection	0: Input set through frequency 1: Counting function	0	◎
P25.35	HDI3 lower limit frequency	0.000 kHz – P25.37	0.000 kHz	○
P25.36	Corresponding setting of HDI3 lower limit frequency	-300.0%–300.0%	0.0%	○
P25.37	HDI3 upper limit frequency	P25.35–50.000kHz	50.000 kHz	○
P25.38	Corresponding setting of HDI3 upper limit frequency	-300.0%–300.0%	100.0%	○
P25.39	HDI3 frequency input filter time	0.000s–10.000s	0.030s	○
P25.40	AI3 input signal type	Range: 0–1 0: Voltage 1: Current	0	○
P25.41	AI4 input signal type	Range: 0–1 0: Voltage 1: Current	0	○
P25.42–P25.45	Reserved	-	-	-

Group P26—I/O card output functions

Function code	Name	Description	Default	Modify
P26.00	HDO2 output type	0: Open collector high-speed pulse output 1: Open collector output	0	◎
P26.01	HDO2 output selection	Same as the description for P06.01	0	○
P26.02	Y2 output		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 Bit0: Y2 Bit1: Y3 Bit2: HDO2 Bit3: RO3 Bit4: RO4 Bit5: RO5 Bit6: RO6 Bit7: RO7 Bit8: RO8 Bit9: RO9 Bit10: RO10 Bit11: RO11 Bit12: RO12	0x0000	○
P26.13	HDO2 switch-on delay	Used to 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	0.000s	○
P26.14	HDO2 switch-off delay		0.000s	○
P26.15	Y2 switch-on delay		0.000s	○
P26.16	Y2 switch-off delay		0.000s	○
P26.17	Y3 switch-on delay		0.000s	○
P26.18	Y3 switch-off delay		0.000s	○
P26.19	RO3 switch-on		0.000s	○

Function code	Name	Description	Default	Modify
	delay	**Note:** P26.13 and P26.14 are valid only when P26.00=1.		
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 selection		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 range, the output uses the lower limit or upper	0.0%	○
P26.39	AO2 output corresponding to lower limit		0.00V	○

Function code	Name	Description	Default	Modify
P26.40	AO2 output upper limit	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 P26.38: -300.0%–P26.40 Setting range of P26.39: 0.00V–10.00V Setting range of P26.40: P26.38–300.0% Setting range of P26.41: 0.00V–10.00V 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 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	100.0%	○
P26.41	AO2 output corresponding to upper limit		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		0.00V	○
P26.45	AO3 output upper limit		100.0%	○
P26.46	AO3 output corresponding to upper limit		10.00V	○
P26.47	AO3 output filter time		0.000s	○
P26.48–P26.52	Reserved	-	-	-

Group P27—Programmable expansion card functions

Function code	Name	Description	Default	Modify
P27.00	Enabling programmable card	0–1 The function code is used to enable the programmable card function. This function is reserved.	0	◎
P27.01	I_WrP1	0–65535 The function code is used for the VFD to write a value to WrP1 of the programmable card.	0	○
P27.02	I_WrP2	0–65535 The function code is used for the VFD to write a value to WrP2 of the programmable card.	0	○

Function code	Name	Description	Default	Modify
P27.03	I_WrP3	0–65535 The function code is used for the VFD to write a value to WrP3 of the programmable card.	0	○
P27.04	I_WrP4	0–65535 The function code is used for the VFD to write a value to WrP4 of the programmable card.	0	○
P27.05	I_WrP5	0–65535 The function code is used for the VFD to write a value to WrP5 of the programmable card.	0	○
P27.06	I_WrP6	0–65535 The function code is used for the VFD to write a value to WrP6 of the programmable card.	0	○
P27.07	I_WrP7	0–65535 The function code is used for the VFD to write a value to WrP7 of the programmable card.	0	○
P27.08	I_WrP8	0–65535 The function code is used for the VFD to write a value to WrP8 of the programmable card.	0	○
P27.09	I_WrP9	0–65535 The function code is used for the VFD to write a value to WrP9 of the programmable card.	0	○
P27.10	I_WrP10	0–65535 The function code is used for the VFD to write a value to WrP10 of the programmable card.	0	○
P27.11	Programmable card status	0–1 Used to display the status of the programmable card. 0: Stop 1: Run	0	●
P27.12	C_MoP1	0–65535 The function code is used for the VFD to monitor/view the MoP1 value of the PLC.	0	●
P27.13	C_MoP2	0–65535 The function code is used for the VFD to monitor/view the MoP2 value of the PLC.	0	●
P27.14	C_MoP3	0–65535 The function code is used for the VFD to monitor/view the MoP3 value of the PLC.	0	●
P27.15	C_MoP4	0–65535	0	●

Function code	Name	Description	Default	Modify
		The function code is used for the VFD to monitor/view the MoP4 value of the PLC.		
P27.16	C_MoP5	0–65535 The function code is used for the VFD to monitor/view the MoP5 value of the PLC.	0	●
P27.17	C_MoP6	0–65535 The function code is used for the VFD to monitor/view the MoP6 value of the PLC.	0	●
P27.18	C_MoP7	0–65535 The function code is used for the VFD to monitor/view the MoP7 value of the PLC.	0	●
P27.19	C_MoP8	0–65535 The function code is used for the VFD to monitor/view the MoP8 value of the PLC.	0	●
P27.20	C_MoP9	0–65535 The function code is used for the VFD to monitor/view the MoP9 value of the PLC.	0	●
P27.21	C_MoP10	0–65535 The function code is used for the VFD to monitor/view the MoP10 value of the PLC.	0	●
P27.22	Digital input terminal state of programmable card	0x00–0x3F The function code is used to display the input terminal status on the programmable card. Bit5–bit0 indicate PS6–PS1.	0x00	●
P27.23	Digital output terminal state of programmable card	0x0–0x3 The function code is used to display the output terminal status on the programmable card. Bit0 indicates PRO1, and bit1 indicates PRO2.	0x0	●
P27.24	AI1 of the programmable card	0–10.00V/0.00–20.00mA The function code is used to display the AI1 value from the programmable card.	0	●
P27.25	AO1 of the programmable card	0–10.00V/0.00–20.00mA The function code is used to display the 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)	0x03	○

Function code	Name	Description	Default	Modify
		0: 0+24+60 1: 12+24+60 2: 24+24+60 3: 36+24+60 4: 48+24+60 5: 60+48+60 6: 72+24+60 7: 84+24+60 8: 96+96+96 Tens place: Card that communicates with the 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:** P27.26 can be changed at any time, but the change will only take effect after the re-power on.		
P27.27	Programmable card save function at power off	0–1 0: Disable 1: Enable	1	◎

Group P28—Master/slave control

Function code	Name	Description	Default	Modify
P28.00	Master/slave mode	0: Master/slave control is invalid. 1: The local device is the master. 2: The local device is the slave.	0	◎
P28.01	Master/slave communication data selection	0: CAN 1: Reserved	0	◎
P28.02	Master/slave control mode	0x000–0x112 Ones place: Master/slave running mode selection 0: Master/slave mode 0 (The master and slave adopt speed control and maintain the power balance by droop control.) 1: Master/slave mode 1	0x001	◎

Function code	Name	Description	Default	Modify
		(The master and slave must be in the same type of vector control mode. When the master is in speed control, the slave is forced into torque control.) 2: Master/slave mode 2 The slave switches from speed mode (master/slave mode 0) to torque mode (master/slave mode 1) at a frequency point. Tens place: Slave start command source 0: Master 1: Determined by P00.01 Hundreds place: Whether to enable master/slave to send/receive data 0: Enable 1: Disable		
P28.03	Slave speed gain	0.0–500.0%	100.0%	○
P28.04	Slave torque gain	0.0–500.0%	100.0%	○
P28.05	Frequency point for switching between speed mode and torque mode in master/slave mode 2	0.00–10.00Hz	5.00Hz	○
P28.06	Slave count	0–15	1	◎
P28.07–P28.08	Reserved	-	-	-
P28.09	CAN slave torque offset	-100.0–100.0(%)	0.0%	○
P28.10	Enabling EC PT100/PT1000 to detect temperature	0x00–0x11 Ones place: PT100 temperature detection 0: Disable 1: Enable Tens place: PT1000 temperature detection 0: Disable 1: Enable	0x00	◎
P28.11	EC PT100 detected OH protection threshold	0.0–150.0°C	120.0°C	○

Function code	Name	Description	Default	Modify
P28.12	EC PT100 detected OH pre-alarm threshold	0.0–150.0°C	100.0°C	○
P28.13	EC PT100 detected temperature calibration upper limit	50.0–150.0°C	120.0°C	○
P28.14	EC PT100 detected temperature calibration lower limit	-20.0–50.0°C	10.0°C	○
P28.15	EC PT100 calibration upper limit digital	0–4096	2950	○
P28.16	EC PT100 calibration lower limit digital	0–4096	1270	○
P28.17	EC PT1000 detected OH protection threshold	0.0–150.0°C	120.0°C	○
P28.18	EC PT1000 detected OH pre-alarm threshold	0.0–150.0°C	100.0°C	○
P28.19	EC PT1000 detected temperature calibration upper limit	50.0–150.0°C	120.0°C	○
P28.20	EC PT1000 detected temperature calibration lower limit	-20.0–50.0°C	10.0°C	○
P28.21	EC PT1000 calibration upper limit digital	0–4096	3100	○
P28.22	EC PT1000 calibration lower limit digital	0–4096	1100	○

Function code	Name	Description	Default	Modify
P28.23	Detecting for PT100/PT1000 disconnection from EC	0x00–0x11 Ones place: PT100 disconnection detection 0: Disable 1: Enable Tens place: PT1000 disconnection detection 0: Disable 1: Enable	0x00	◎
P28.24	Enabling digital calibration in EC PT100/PT1000 temperature detection	0–4 0: Disable 1: Enable PT100 lower limit digital calibration 2: Enable PT100 upper limit digital calibration 3: Enable PT1000 lower limit digital calibration 4: Enable PT1000 upper limit digital calibration	0	○
P28.25	Type of sensor for AI/AO to detect motor temperature	0–4 0: No temperature sensor 1: PT100 2: PT1000 3: KTY84 4: PTC **Note:** Temperature is displayed through P19.21. To measure temperature, switch the output of AO1 to current, and connect one end of the temperature resistor to AI1 and AO1, and the other end to GND.	0	◎
P28.26	AIAO detected motor OT protection threshold	0.0–200.0°C **Note:** When the motor temperature exceeds the threshold, the VFD releases the OT alarm.	110.0°C	○
P28.27	AIAO detected motor OT pre-alarm threshold	0.0–200.0°C **Note:** When the motor temperature exceeds the value, the DO terminal with function 48 (AI detected motor OH pre-alarm) outputs a valid signal.	90.0°C	○

Group P90—Tension control

Function code	Name	Description	Default	Modify
P90.00	Tension control mode	0: Disable 1: Tension speed control 2: Open loop tension torque control 3: Close-loop tension torque control **Note:** The value 0 indicates invalid and the VFD implements the general function. A non-zero value indicates enabling the tension control function.	0	◎
P90.01	Winding/unwinding mode	0: Winding 1: Unwinding **Note:** The motor forward rotation direction is the winding direction. When using the tension control mode, check whether the motor rotation direction is correct in the winding mode; if not, change the rotation direction by swapping two phase wires of the motor. After the rotation direction is corrected, the winding mode can be switched to the unwinding mode by setting P90.01 to 1 or changing the winding/unwinding switchover terminals.	0	○
P90.02	Reel mechanical transmission rate	0.01–600.00 =Motor rotation speed/reel rotation speed=Reel diameter/motor shaft diameter	1.00	○
P90.03	Max. linear speed	0.0–6000.0m/min	1000.0 m/min	○
P90.04	Linear speed input source selection	0: Keypad 1: AI1 2: AI2 3: AI3 4: High-speed pulse HDI 5: Main traction encoder frequency-division input	0	◎
P90.05	Linear speed set through keypad	0.0–100.0%	20.0%	○
P90.06	Diameter of main traction	0.0–6000.0mm	99.0mm	○
P90.07	Main traction drive	0.000–60.000	1.000	○

Function code	Name	Description	Default	Modify
	ratio			
P90.08	Linear speed ACC time	0.00–600.00s	0.00s	○
P90.09	Linear speed DEC time	0.00–600.00s	0.00s	○
P90.10	Tension setting source selection	0x00–0x14 Ones place: Tension setting source 0: Keypad 1: AI1 2: AI2 3: AI3 4: High-speed pulse HDI Tens place: Multiplication selection of max. tension P90.12 0: 1 1: 10	0x00	◎
P90.11	Tension set through keypad	0.0–100.0%	10.0%	○
P90.12	Max. tension	0–60000 (N, tens place of P90.10=0) When the tens place of P90.10 is 1, the setting range is (0–60000)*10N.	1000	○
P90.13	Roll diameter calculation method selection	0: Not calculated 1: AI1 2: AI2 3: AI3 4: High-speed pulse HDI 5: Linear speed 6: Thickness (wire) 7: Thickness (strip)	0	◎
P90.14	Roll diameter calculation delay time	0.0–100.0s	1.0s	○
P90.15	Min. rolling diameter	0.0mm–P90.16	50.0mm	○
P90.16	Max. roll diameter	P90.15–5000.0 mm	1000.0 mm	○
P90.17	Initial roll diameter 1	P90.15–P90.16	100.0 mm	○

Function code	Name	Description	Default	Modify
P90.18	Initial roll diameter 2	P90.15–P90.16	100.0 mm	○
P90.19	Initial roll diameter 3	P90.15–P90.16	100.0 mm	○
P90.20	Linear speed roll diameter calculation filter time	0.000–60.000s	2.000s	○
P90.21	Linear speed roll diameter calculation restriction	0x00–0x11 Ones place: 0:No 1: Restrict changes in reverse direction Tens place: 0:No 1: Automatic restriction according to running frequency and material thickness	0x00	○
P90.22	Material thickness	0.001–65.535mm	0.010 mm	○
P90.23	Number of coils per layer	1–10000	1	◎
P90.24	Revolution counting function selection	0: Digital terminal input 1: PG card input (applicable to thickness calculation method) 2: Running frequency (no input automatic revolution counting)	0	◎
P90.25	Number of pulses per revolution	1–60	1	◎
P90.26	Roll diameter set value	0.0–100.0%	80.0%	○
P90.27	Roll diameter reset setting	0x0000–0x1111 Ones place: At stop 0: Remain current roll diameter 1: Restore to initial roll diameter Tens place: Power off at running 0: Remain current roll diameter 1: Restore to initial roll diameter Hundreds place: Reach the roll diameter set value	0x1000	○

Function code	Name	Description	Default	Modify
		0: Remain current roll diameter 1: Restore to initial roll diameter Thousands place: Terminal reset limitation 0: Reset allowed at running 1: Reset only allowed at stop		
P90.28	Tension PID output reference	0: Maximum value 1: Given value	0	○
P90.29	Tension PID parameter source	0: First group of P90 1: Roll diameter (max. roll diameter) 2: Main reference frequency (max. Frequency) 3: Running linear speed (max. linear speed) 4: Deviation (Reference 100%) 5: Terminal	0	○
P90.30	Group 1 proportional gain	0.000–30.000	0.030	○
P90.31	Group 1 integral time	0.00–30.00s	5.00s	○
P90.32	Group 1 differential time	0.00–10.00s	0.00s	○
P90.33	Group 2 proportional gain	0.000–30.000	0.030	○
P90.34	Group 2 integral time	0.00–30.00s	5.00s	○
P90.35	Group 2 differential time	0.00–10.00s	0.00s	○
P90.36	PID parameter adjustment reference point 1	0.0–P90.37%	10.0%	○
P90.37	PID parameter adjustment reference point 2	P90.36–100.0%	50.0%	○
P90.38	Min. frequency for roll diameter calculation	0.00–50.00Hz **Note:** Valid only for linear speed calculation with roll diameter.	0.30Hz	○
P90.39	Min. linear speed for roll diameter calculation	0.0–100.0% Note: Relative to the max. linear speed. **Note:** Valid only for linear speed calculation with roll diameter.	3.0%	○

Group P91—Tension control in torque mode

Function code	Name	Description	Default	Modify
P91.00	Tension control zero speed reference	0–1 0: Max. linear speed 1: Reserved	0	◎
P91.01	Tension control zero speed threshold	0.0–50.0%	0.5%	○
P91.02	Zero speed offset	0.0–50.0%	2.0%	○
P91.03	Upper-limit frequency source of torque control	0: P03.14, P03.15 1: Forward rotation limit set by line speed 2: Reverse rotation limit set by line speed 3: Forward and reverse rotations limit set by line speed	3	◎
P91.04	Running frequency upper limit offset of tension control	0.0–100.0%	5.0%	○
P91.05	Differential separation threshold	0.0–100.0%	5.0%	○
P91.06	PID restricts reverse limit at zero speed	0: Enable 1: Disable	0	◎
P91.07	Torque compensation selection	0x000–0x111 Ones place: Frictional torque compensation 0: No 1: Yes Tens place: Inertia compensation 0: No 1: Yes Hundreds place: Compensation direction 0: In line with torque direction 1: Different from torque direction	0x000	◎
P91.08	System mechanical parameters identification	0: No operation 1: Enabling system mechanical inertia identification 2: Enabling mechanical friction torque identification	0	◎
P91.09	Static friction	0.0–100.0%	0.0%	○

Function code	Name	Description	Default	Modify
	torque compensation coefficient			
P91.10	Sliding friction torque compensation coefficient 1	0.0–100.0%	0.0%	○
P91.11	Sliding friction torque compensation coefficient 2	0.0–100.0%	0.0%	○
P91.12	Sliding friction torque compensation coefficient 3	0.0–100.0%	0.0%	○
P91.13	High speed torque compensation coefficient	0.0–100.0%	0.0%	○
P91.14	Compensation frequency point of static friction torque	0.0%–P91.15	1.0%	○
P91.15	Compensation frequency point of sliding friction torque 1	P91.14–P91.16%	20.0%	○
P91.16	Compensation frequency point of sliding friction torque 2	P91.15–P91.17%	50.0%	○
P91.17	Compensation frequency point of sliding friction torque 3	P91.16–P91.18%	80.0%	○
P91.18	High-speed friction torque compensation frequency point	P91.17–100.0%	100.0%	○
P91.19	ACC and DEC	0: Linear speed	0	◎

Function code	Name	Description	Default	Modify
	frequency source	1: Running frequency		
P91.20	Material density	0–3000kg/m^3	0kg/m^3	○
P91.21	Reel width	0.000–60.000m	0.000m	○
P91.22	ACC inertia compensation coefficient	0.0–100.0%	10.0%	○
P91.23	DEC inertia compensation coefficient	0.0–100.0%	10.0%	○
P91.24	Tension taper coefficient source	0: Keypad 1: AI1 2: AI2 3: AI3 4: High-speed pulse HDI	0	◎
P91.25	Tension taper set through keypad	0.0–100.0%	30.0%	○
P91.26	Tension taper compensation correction	0.0–5000.0mm	0.0mm	○
P91.27	Tension taper curve selection	0: Inverse proportional curve 1: Multi-point curve	0	◎
P91.28	Roll diameter value 1	0.0–5000.0mm	200.0 mm	○
P91.29	Tension taper coefficient for roll diameter value 1	0.0–50.0%	3.0%	○
P91.30	Roll diameter value 2	0.0–5000.0mm	500.0 mm	○
P91.31	Tension taper coefficient for roll diameter value 2	0.0–50.0%	7.0%	○
P91.32	Tension offset value at zero speed	0.0–300.0%	0.0%	○
P91.33	Present roll diameter setting	0.0–5000.0mm	0.0mm	◎

Group P92—Tension control optimization functions

Function code	Name	Description	Default	Modify
P92.00	Pre-drive speed gain	0.0–100.0%	100.0%	○
P92.01	Pre-drive torque limit	0–2 0: Set based on P03.20, P03.21 1: Set based on P93.02 2: Set based on the set tension	2	○
P92.02	Pre-drive torque limit setting	0.0–200.0%	100.0%	○
P92.03	Zero bit conversion enabling	0–1 0: Disable 1: Enable	0	◎
P92.04	Initial zero bit	0.0–100.0%	10.0%	○
P92.05	Final zero bit	0.0–100.0%	50.0%	○
P92.06	Conversion time from initial zero bit to final zero bit	0.00–60.00s	5.00s	○
P92.07	Conversion time from final zero bit to initial zero bit	0.00–60.00s	5.00s	○
P92.08	Feeding interrupt detection mode	0–3 0: No detection 1: Detect based on digital value 2: Detect based on roll diameter calculation value 3: Detect based on feedback position	0	○
P92.09	Feeding interrupt detection start delay time	0.0–200.0s	20.0s	○
P92.10	Frequency lower limit of feeding interrupt detection	0.00–300.00Hz	10.00Hz	○
P92.11	Error range of feeding interrupt detection	0.1–50.0%	10.0%	○
P92.12	Determination delay time of	0.1–60.0s	1.0s	○

Function code	Name	Description	Default	Modify
	feeding interrupt detection			
P92.13	Handling mode of feeding interrupt	0x000–0x111 Ones place: Stop mode 0: Decelerate to stop in emergency manner 1: Coast to stop Tens place: Alarm mode 0: Stop in enabled stop mode without reporting an alarm 1: Report an alarm and coast to stop Hundreds place: Roll diameter memory function of feeding interrupt 0: Disable 1: Enable	0x000	◎
P92.14	Stop braking frequency	0.00–300.00Hz	1.50Hz	○
P92.15	Stop braking time	0.0–600.0s	0.0s	○

Group P93—Tension control status viewing

Function code	Name	Description	Default	Modify
P93.00	Actual control mode	0: Invalid tension control 1: Close-loop tension speed control 2: Open loop tension torque control 3: Close-loop tension torque control	0	●
P93.01	Actual winding/unwinding mode	0: Winding 1: Unwinding	0	●
P93.02	Initial roll diameter	0.0–5000.0mm	0.0mm	●
P93.03	Reset roll diameter	0.0–5000.0mm	0.0mm	●
P93.04	Roll diameter change rate	0.00–655.35mm/s	0.00 mm/s	●
P93.05	Present roll diameter	0.0–5000.0mm	0.0mm	●
P93.06	Roll diameter for linear speed calculation	0.0–5000.0mm	0.0mm	●

Function code	Name	Description	Default	Modify
P93.07	Set linear speed	0.0–6000.0m/min	0.0m/min	●
P93.08	Present linear speed	0.0–6000.0m/min	0.0m/min	●
P93.09	Main reference frequency	0.00–600.00Hz	0.00Hz	●
P93.10	Actual proportional gain	0.00–30.00	0.00	●
P93.11	Actual integral time	0.00–30.00s	0.00s	●
P93.12	Proportional output value	0–65535	0	●
P93.13	Integral output value	0–65535	0	●
P93.14	PID upper limit	-100.0–100.0%	0.0%	●
P93.15	PID lower limit	-100.0–100.0%	0.0%	●
P93.16	PID output frequency	-99.99–99.99Hz	0.00Hz	●
P93.17	Main traction running frequency	-300.0–300.0Hz	0.0Hz	●
P93.18	Set tension	0–30000N	0N	●
P93.19	Tension taper coefficient	0.0–100.0%	0.0%	●
P93.20	Actual set tension	0–30000N	0N	●
P93.21	Basic torque reference value	-300.0–300.0%	0.0%	●
P93.22	Friction compensation torque value	-300.0–300.0%	0.0%	●
P93.23	System rotational inertia	0.00–655.35kg·m^2	0.00 kg·m^2	●
P93.24	Frequency change rate	-99.99–327.67Hz/s	0.00Hz/s	●
P93.25	Torque compensation value of system rotational inertia	-300.0–300.0%	0.0%	●
P93.26	Reference value after torque	-300.0–300.0%	0.0%	●

Function code	Name	Description	Default	Modify
	compensation			
P93.27	PID output torque	-300.0–300.0%	0.0%	●
P93.28	Final output torque	-300.0–300.0%	0.0%	●
P93.29	Measured tension	0–30000N	0N	●
P93.30	Number of material turns on the reel	-100–32767	0	●
P93.31	Length of material on the reel	0–65535m	0m	●
P93.32	Length increment	0.0–6553.5m	0.0m	●

7 Troubleshooting

7.1 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”.

7.2 Indications of alarms and faults

The fault is indicated by indicators. See section 5.4 "Operation procedure". When the TRIP indicator is on, the alarm or fault code displayed on the keypad indicates the VFD is in 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.

7.3 Fault reset

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

7.4 Fault history

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, and P07.49–P07.56 record the running data of the VFD at the last three faults.

7.5 Faults and solutions

When a fault occurred, handle the fault as follows:

1. Check whether there is any exception on the keypad. If yes, contact the local INVT office.
2. If no, check the function codes in P07 group to determine the real state when the fault occurred.
3. Check the following table for the exception and solution.
4. Rectify the fault or ask for help.
5. After confirming the fault is removed, perform fault reset, and start running.

7.5.1 Faults and solutions

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

Fault code	Fault type	Possible cause	Solution
OUt1	[1] Inverter unit U-phase protection	ACC is too fast. IGBT module is damaged. Misoperation caused by interference. Drive wires are poorly connected. To-ground short circuit occurs.	Increase ACC time. Replace the power unit. Check drive wires. Check whether there is strong interference surrounding the peripheral device.
OUt2	[2] Inverter unit V-phase protection		
OUt3	[3] Inverter unit W-phase protection		
OC1	[4] Overcurrent during ACC	ACC/DEC is too fast. The grid voltage is too low. VFD power is too small. Load transient or exception occurred. To-ground short circuit or output phase loss occurred. Strong external interference sources existed. The overcurrent stall protection is not enabled.	Increase ACC/DEC time. Check the input power. Select a 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 whether there is strong interference. Check the settings of related function codes.
OC2	[5] Overcurrent during DEC		
OC3	[6] Overcurrent during constant speed running		
OV1	[7] Overvoltage during ACC	Deceleration time is too short. Abnormal input voltage. Large energy feedback. Lack of braking units. Energy-consumption braking disabled. Deceleration time is 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 settings of related function codes.
OV2	[8] Overvoltage during DEC		
OV3	[9] Overvoltage during constant speed running		
UV	[10] Bus undervoltage	The grid voltage is too low. The overvoltage stall protection is not enabled.	Check the grid input power. Check the settings of related function codes.
OL1	[11] Motor overload	Grid voltage too low. Motor rated current is set incorrectly. The motor stall occurs or the load transient is too large.	Check the grid voltage. Reset the rated current of the motor. Check the load and adjust the torque boost quantity.
OL2	[12] VFD	ACC is too fast.	Increase ACC time.

Fault code	Fault type	Possible cause	Solution
	overload	The motor is restarted during rotating. Grid voltage too low. Load is too heavy. Power is too small.	Avoid restart after stop. 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 input R, S, 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 motor is asymmetrical).	Check the output wiring. Check the motor and cable.
OH1	[15] Rectifier module overheating	Air duct blocked or fan damaged. Ambient temperature is too high. Long-time overload running.	Ventilate the air duct or replace the fan. Lower the ambient temperature.
OH2	[16] Inverter module overheat		
EF	[17] External fault	SI external faulty input terminal action.	Check external device input.
CE	[18] Modbus/Modbus TCP 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. The Hall component is damaged. 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. Incorrect motor parameter setting.	Change the VFD model, or adopt V/F mode for control; Set proper motor type and nameplate parameters. Empty the motor load and re-perform autotuning. Check motor wiring and

Fault code	Fault type	Possible cause	Solution
		The parameters gained from autotuning deviate sharply from the standard parameters. Autotuning timeout.	parameter settings. Check whether the upper limit frequency is larger than 2/3 of the rated frequency.
EEP	[21] EEPROM operation fault	Control parameter reading/writing error. EEPROM damaged.	Press STOP/RST to reset. Replace the main control board.
PIDE	[22] PID feedback offline fault	PID feedback offline. PID feedback source disappears.	Check PID feedback signal wires. Check PID feedback source.
bCE	[23] Braking unit fault	Fault occurred to the braking circuit or the braking pipe is damaged. Resistance of the external braking resistor is small.	Check the braking unit, and replace with new braking pipe; Increase the brake resistance.
END	[24] Running time reached	The actual running time of the VFD is longer than the internal set running time.	Ask for the supplier and adjust the set 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 and re-plug to determine whether a fault occurs. Check for and remove the external interference source. Replace the hardware and seek maintenance services.
UPE	[27] Parameter upload error	Keypad cable connected improperly or disconnected. Keypad cable too long, causing strong interference. Keypad or mainboard communication circuit error.	Check the keypad cable and re-plug to determine whether a fault occurs. Check for and remove the external interference source. Replace the hardware and seek maintenance services.
DNE	[28] Parameter download error	Keypad cable connected improperly or disconnected. Keypad cable too long, causing	Check for and remove the external interference source. Replace the hardware and seek

Fault code	Fault type	Possible cause	Solution
		strong interference. Data storage error occurred to the keypad.	maintenance services. Re-back up the data on the keypad.
E-DP	[29] PROFIBUS card communication timeout fault	No data transmission between the communication card and the host controller (or PLC).	Check whether the communication card wiring is loose or dropped.
E-NET	[30] Ethernet card communication timeout fault	There is no data transmission between the communication card and the host controller.	Check whether the communication card wiring is loose or dropped.
E-CAN	[31] CANopen 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.
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.	Check whether the motor wiring is normal. Replace the hall component. Replace the main control board. Reset the motor parameters properly.
dEu	[34] Speed deviation fault	The load is too heavy or stalled.	Check the load to ensure it is proper, and increase the detection time. Check whether the control parameters are set properly.
STo	[35] Mal-adjustment fault	Control parameters of the synchronous motor are set improperly. Autotuned parameters are not accurate.	Check the load and ensure the load is normal. Check whether control parameters are set correctly. Increase the mal-adjustment

Fault code	Fault type	Possible cause	Solution
		The VFD is not connected to the motor.	detection time.
LL	[36] Electronic underload fault	The VFD reports underload pre-alarm according to the setting.	Check the load and the underload pre-alarm points.
ENC1o	[37] Encoder disconnection fault	Encoder line sequence is wrong, or signal wires are poorly connected.	Check the encoder wiring.
ENC1d	[38] Encoder reversal 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; 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.	Replace the control board.
P-E1–P-E10	[45]–[54]: Programmable card customized faults 1–10	User program logic error in the programmable card. A fault of the custom type occurred.	Check the user program logic. Perform troubleshooting based on actual custom faults.

Fault code	Fault type	Possible cause	Solution
E-Err	[55] Repetitive 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] PROFITNET 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.	Check whether the communication card wiring is loose or dropped.
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] Failure to identify the card at 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 persists at next power-on. Check whether the insertion port is damaged, if yes, replace the insertion port after power-off.
F2-Er	[61] Failure to identify the card at slot 2	There is data transmission in interfaces of card slot 2, 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 persists at next power-on. Check whether the insertion port is damaged, if yes, replace the

Fault code	Fault type	Possible cause	Solution
			insertion port after power-off.
F3-Er	[62] Failure to identify the card at slot 3	There is data transmission in interfaces of card slot 3, 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 persists at next power-on. Check whether the insertion port is damaged, if yes, replace the insertion port after power-off.
C1-Er	[63] Communication timeout of the card at slot 1	There is no data transmission in interfaces of card slot 1.	Confirm whether the expansion card inserted can be supported. Stabilize the expansion card interfaces after power-off, and check whether the fault persists at next power-on. Check whether the insertion port is damaged, if yes, replace the insertion port after power-off.
C2-Er	[64] Communication timeout of the card at slot 2	There is no data transmission in interfaces of card slot 2.	Confirm whether the expansion card inserted can be supported. Stabilize the expansion card interfaces after power-off, and check whether the fault persists at next power-on. Check whether the insertion port is damaged, if yes, replace the insertion port after power-off.
C3-Er	[65] Communication timeout of the card at slot 3	There is no data transmission in interfaces of card slot 3.	Confirm whether the expansion card inserted can be supported. Stabilize the expansion card interfaces after power-off, and check whether the fault persists at next power-on. Check whether the insertion port is damaged, if yes, replace the insertion port after power-off.
E-CAT	[66] EtherCAT	No data transmission between	Check whether the

Fault code	Fault type	Possible cause	Solution
	card communication timeout	the communication card and the host controller (or PLC).	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).	Check whether the communication card wiring is loose or dropped.
E-DEV	[68] DeviceNet 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.
S-Err	[69] Master/slave synchronous CAN slave fault	Fault occurred to one of the CAN slave VFDs.	Detect the CAN slave VFD and analyze the corresponding fault cause of the VFD.
OtE1	[70]: PT100 overtemperature	The PT100 temperature sensor is inaccurate or not calibrated. Device or ambient temperature is too high.	Calibrate the sensor through parameter settings. Lower the device or ambient temperature.
OtE2	[71] PT1000 overtemperature	The PT1000 temperature sensor is inaccurate or not calibrated. Device or ambient temperature is too high.	Calibrate the sensor through parameter settings. Lower the device or ambient temperature.
E-EIP	[72] EtherNet IP communication timeout	No data transmission between the communication card and the host controller (or PLC).	Check whether the communication card wiring is loose or dropped.
E-PAO	[73] No upgrade bootloader	The upgrade bootload is missing.	Contact us.
E-AI1	[74] AI1 disconnection	Input voltage of AI1 is too low; AI1 wiring is disconnected.	Connect a 5V or 10mA power source to check if the input is normal; Check the wiring or replace the cables.
E-AI2	[75] AI2 disconnection	Input voltage of AI2 is too low. AI2 wiring is disconnected.	Connect a 5V or 10mA power source to check if the input is normal; Check the wiring or replace the cables.
E-AI3	[76] AI3	Input voltage of AI3 is too low.	Connect a 5V or 10mA power

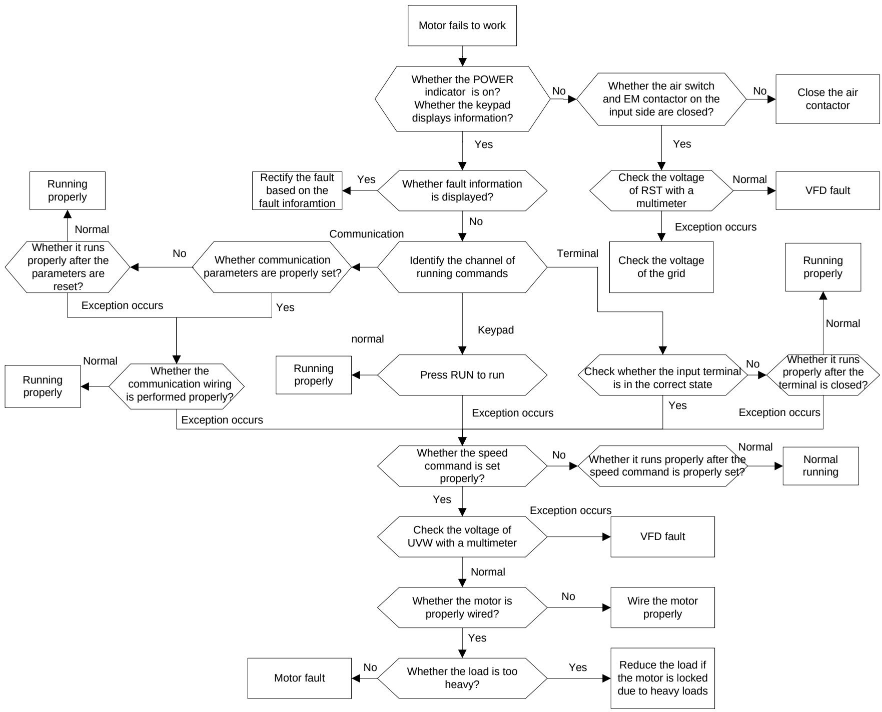
Fault code	Fault type	Possible cause	Solution
	disconnection	AI3 wiring is disconnected.	source to check if the input is normal; Check the wiring or replace the cables.

7.5.2 Other status

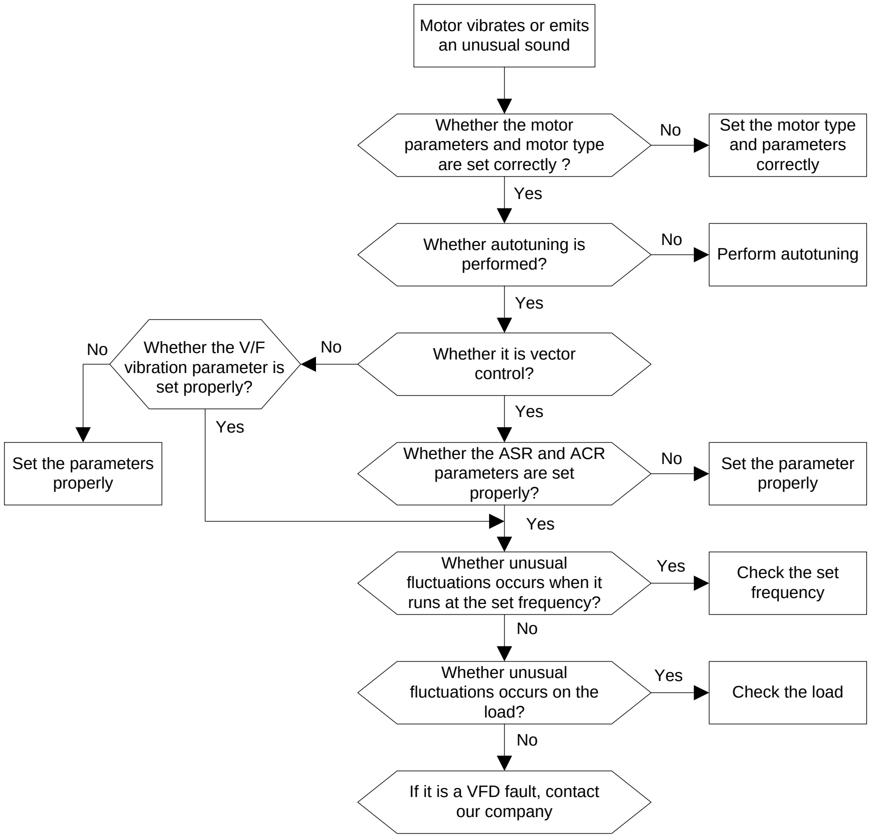
Displayed code	Status type	Possible cause	Solution
PoFF	System power failure	The system is powered off or the bus voltage is too low.	Check the grid conditions.

7.6 Analysis on common faults

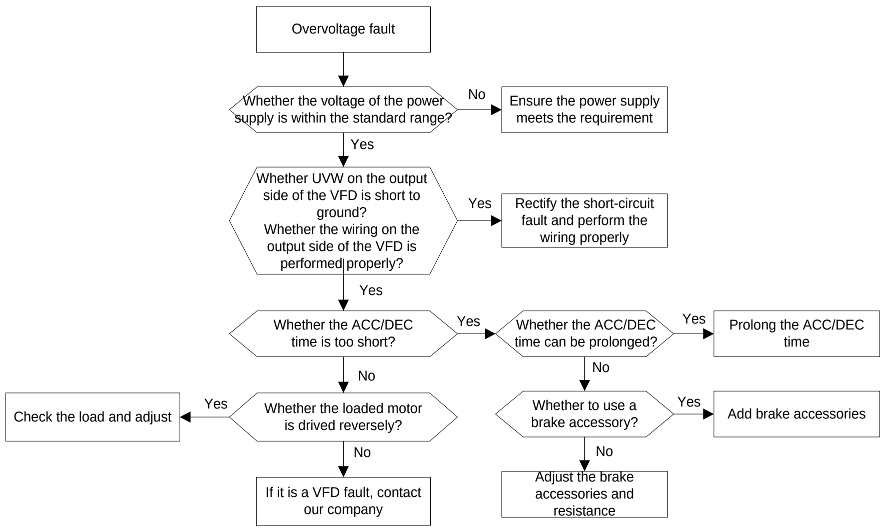
7.6.1 Motor fails to work



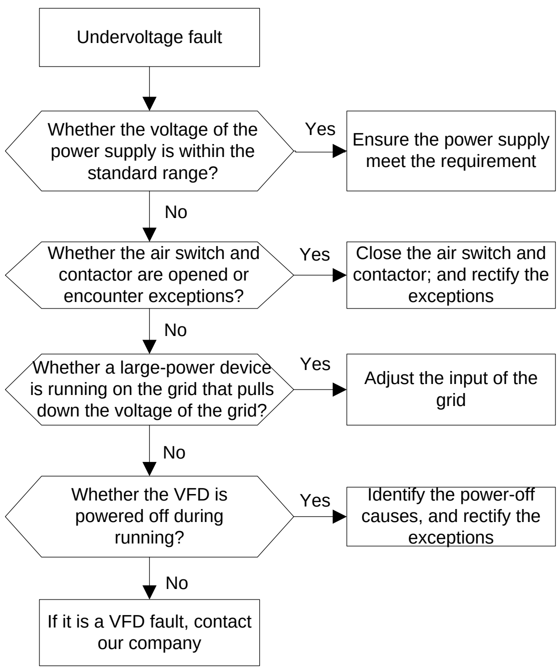
7.6.2 Motor vibrates



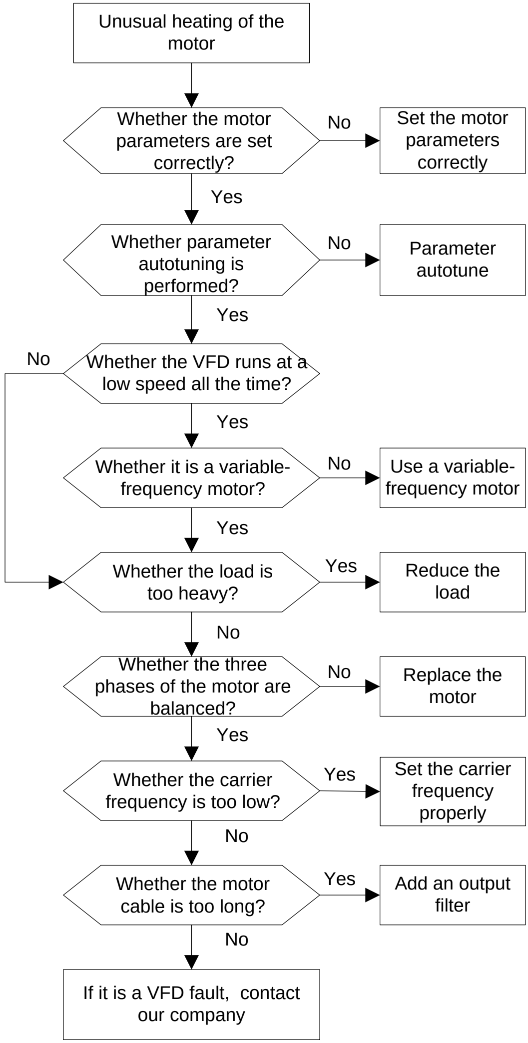
7.6.3 Overvoltage



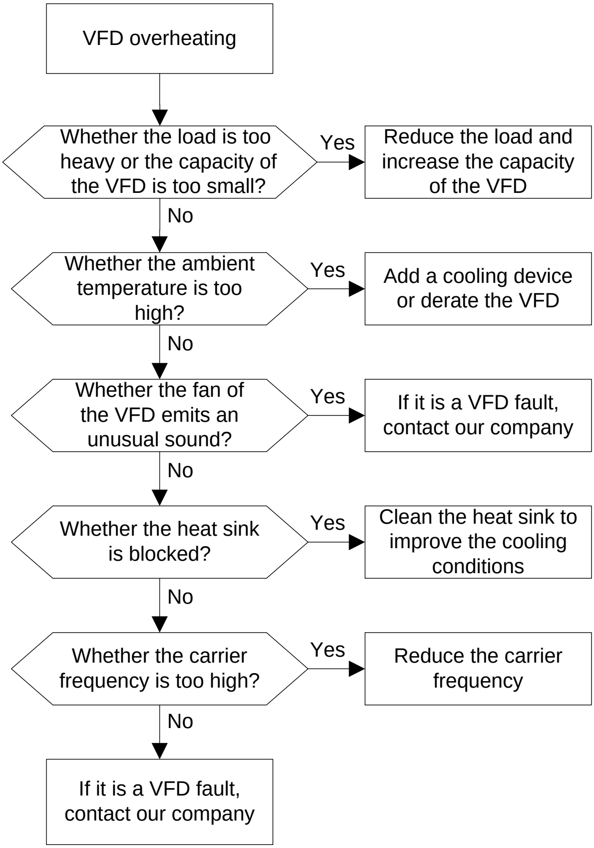
7.6.4 Undervoltage



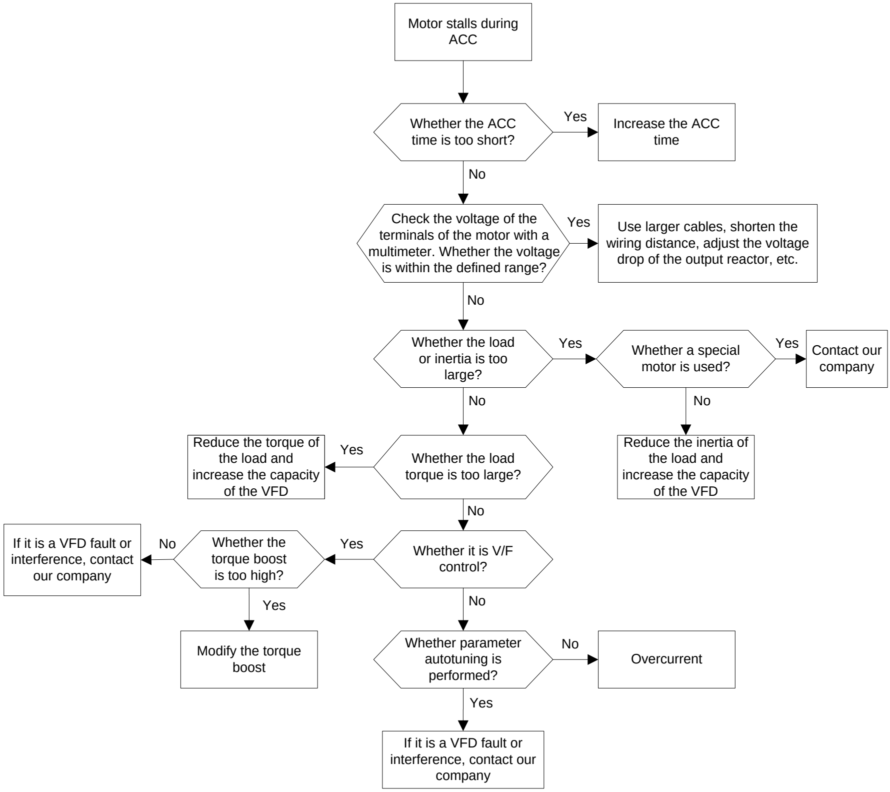
7.6.5 Motor overheating



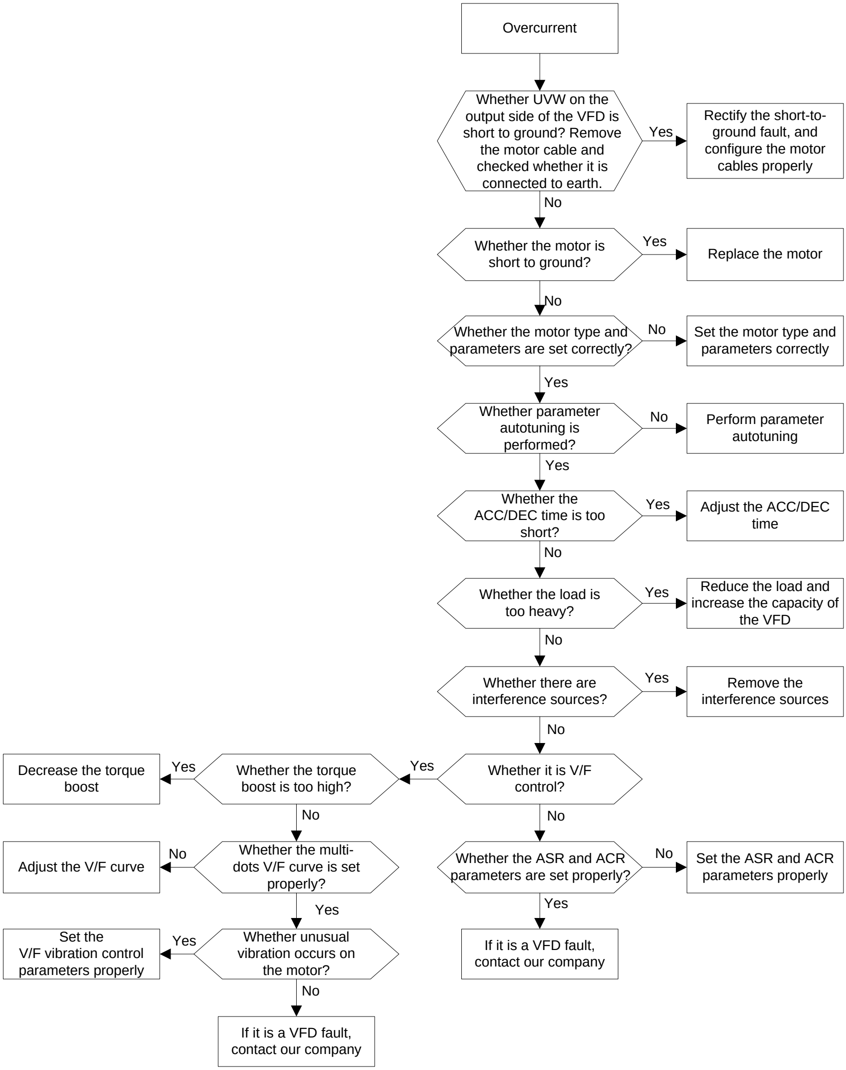
7.6.6 VFD overheating



7.6.7 Motor stalls during ACC



7.6.8 Overcurrent



7.7 Countermeasures on common interference

7.7.1 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 VFD AO terminal, if AO uses current signals of 0 to 20 mA, add a capacitor of 0.47 μF between the AO and GND terminals; and if AO uses voltage signals of 0 to 10 V, add a capacitor of 0.1 μF between the AO and GND terminals.

Note:

- When a decoupling capacitor is required, add it to the terminal of the device connected to the sensor. For example, if a thermocouple is to transmit signals of 0 to 20 mA to a temperature meter, the capacitor needs to be added on the terminal of the temperature meter.; if an electronic ruler is to transmit signals of 0 to 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. For details, see section D.7 EMC filter.

7.7.2 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 upper 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 at both ends.

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.

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

Interference phenomenon

1. Unable 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 VFD.

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.
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.

7.7.4 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

A. VFD systems are special. In these systems, it is required that the rated residual current of common RCDs at all levels is larger than 200 mA, and the VFDs are grounded reliably.

B. 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, or 0.2s.

C. 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)

A. Try to remove the jumper cap at "EMC/J10" from the middle casing of the VFD.

B. Try to decrease the carrier frequency to 1.5kHz (P00.14=1.5).

C. 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)

A. Check and ensure that the power cable is not soaking in water.

B. Check and ensure that the cables are not damaged or.

C. Check and ensure that no secondary grounding is performed on the neutral wire.

D. Check and ensure that the main power cable terminal is in good contact with the air switch or contactor (all screws are tightened).

E. Check 1PH powered devices, and ensure that no earth wires are used as neutral wires by these devices.

F. Do not use shielded cables as VFD power cables and motor cables.

7.7.5 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 grounding 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.

8 Maintenance

8.1 What this chapter contains

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

8.2 Periodical inspection

Little maintenance is required when the VFD is installed in an environment that meets requirements. The following table describes the routine maintenance periods recommended by INVT. The following table describes the routine maintenance periods recommended by INVT.

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

Check scope		Check item	Method	Expected result
				not mean that they cannot work properly.
	Conductor and wire	Check whether conductors are deformed or color change for overheat.	Visual inspection	No exception occurs.
		Check whether the wire sheaths are cracked or their color changes.	Visual inspection	No exception occurs.
	Terminal block	Check whether there is damage.	Visual inspection	No exception occurs.
	Filter capacitor	Check whether there is electrolyte leakage, discoloration, cracks, and chassis expansion.	Visual inspection	No exception occurs.
		Check whether the safety valves are released.	Determine the service life based 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 and reactor	Check whether there is unusual vibration sounds or smells.	Auditory, olfactory, and visual inspection	No exception occurs.
	Electromagnetic contactor and	Check whether there are vibration sounds in the	Auditory inspection	No exception occurs.

Check scope		Check item	Method	Expected result
	relay	workshop.		
		Check whether the contacts are in good contact.	Visual inspection	No exception occurs.
Control circuit	Control PCB and connector	Check whether the screws and connectors 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.	Visual inspection	No exception occurs.

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

8.3 Cooling fan

The service life of the cooling fan of the VFD is more than 25,000 hours. The actual service life of the cooling fan is related to the use of the VFD and the temperature in the ambient environment.

You can view the running duration of the VFD through P07.14 (Accumulated running time).

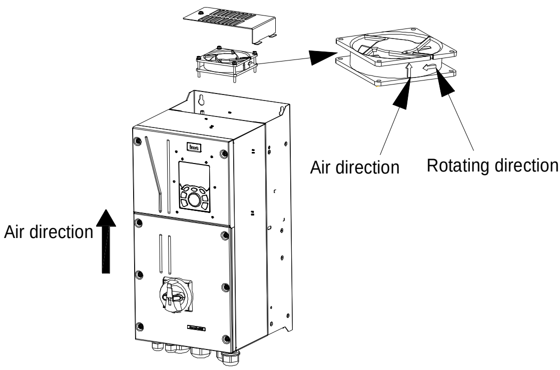
The increase of the bearing noise indicates a fan fault. If the VFD is applied in a key position, replace the fan once the fan starts to generate unusual noise. You can purchase spares of fans from INVT.

Cooling fan replacement:

⚠	Read chapter 1 Safety precautions carefully and follow the instructions to perform operations. Ignoring these safety precautions may lead to physical injury or death, or device damage.

1. Stop the VFD, disconnect the AC power supply, and wait for a time no shorter than the waiting time designated on the VFD.
2. Open the cable clamp to loose the fan cable (for the 004G/5R5P–030G/037P VFD models, the middle casing needs to be removed).
3. Disconnect the fan cable.
4. Remove the fan with a screwdriver.
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 8-1.
6. Connect to the power supply.

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



8.4 Capacitor

8.4.1 Capacitor reforming

If the VFD has been left unused for a long time, you need to follow the instructions to reform the DC bus capacitor before using it. The storage time is calculated from the date the 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: ● 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 a voltage controlled power supply depends on the power supply of the VFD. For VFDs with an incoming voltage of 1PH/3PH 230 V AC, you can use a 230 V AC/2 A voltage regulator. Both 1PH and 3PH VFDs can be charged with a 1PH voltage controlled power supply (connect L+ to R, and N to S or T). All the DC bus capacitors share one rectifier, and therefore they are all charged.

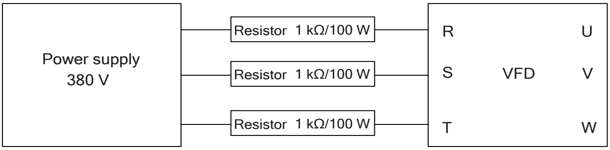
For VFDs of a high voltage class, ensure that the voltage requirement (for example, 380 V) is met during charging. Capacitor changing requires little current, and therefore you can use a small-capacity power supply (2 A is sufficient).

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 1kΩ/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 8-2 380V driving-device charging circuit example



8.4.2 Electrolytic capacitor replacement

⚠	Read chapter 1 Safety precautions carefully and follow the instructions to perform operations. Ignoring these safety precautions may lead to physical injury or death, or device damage.

The electrolytic capacitor of a VFD must be replaced if it has been used for more than 35,000 hours. For details about the replacement, contact the local INVT office.

8.5 Power cable

⚠	Read chapter 1 Safety precautions carefully and follow the instructions to perform operations. Ignoring these safety precautions may lead to physical injury or death, or device damage.

1. Stop the VFD, disconnect the power supply, and wait for a time no shorter than the waiting time designated on the VFD.
2. Check the connection of the power cables. Ensure that they are firmly connected.
3. Connect to the power.

9 Communication protocol

9.1 What this chapter contains

This chapter describes the communication of the VFD.

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

9.2 Modbus protocol introduction

Modbus is a communication protocol for use with electronic controllers. 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 broadcast information, slaves do not need to return responses.

9.3 Application of Modbus

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

9.3.1 RS485

RS485 interfaces work in half-duplex mode and transmit data signals in the differential transmission way, which is also referred to as balanced transmission. The two-wire RS485 interface uses a twisted pair, in which one wire is defined as A (+), and the other B (-). Generally, if the 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 (24AWG) 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
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.

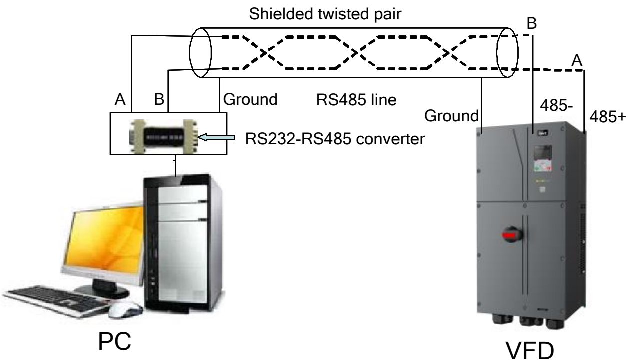
When there are fewer devices and the transmission distance is short, the whole network works well without terminal load resistors. The performance, however, degrades as the distance increases. Therefore, it is recommended that you use a 120Ω terminal resistor when the transmission distance is long.

9.3.1.1 Application to one VFD

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

When the wiring is completed, select the correct port (for example, COM1 to connect to the RS232-RS485 adapter) for the upper computer of the PC, and keep the settings of basic parameters such as communication baud rate and data check bit consistent with those of the VFD.

Figure 9-1 Wiring of RS485 applied to one VFD



9.3.1.2 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 9-2. Figure 9-3 is the simplified wiring diagram, and Figure 9-4 is the practical application diagram.

Figure 9-2 On-site chrysanthemum connection diagram

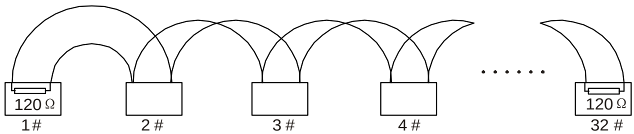


Figure 9-3 Simplified chrysanthemum connection diagram

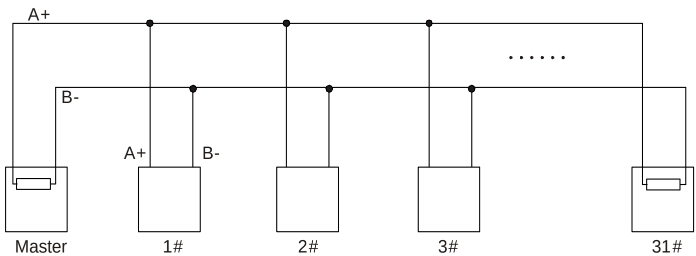


Figure 9-4 Practical application diagram of chrysanthemum connection

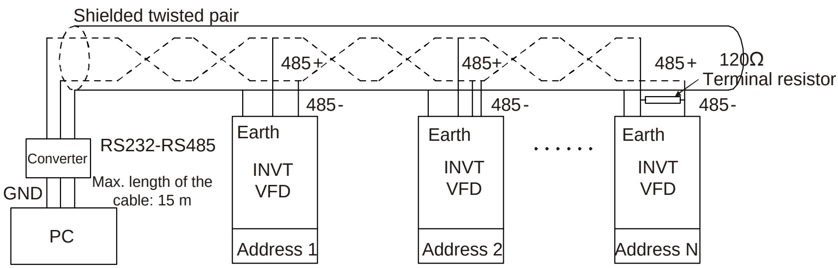
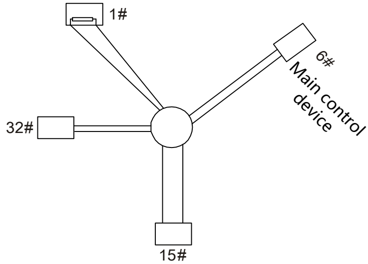


Figure 9-5 shows the start connection diagram. When this connection mode is adopted, the two devices that are farthest away from each other on the line must be connected with a terminal resistor (the two devices are devices #1 and #15).

Figure 9-5 Star connection



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

9.3.2 RTU mode

9.3.2.1 RTU communication frame structure

When a controller is set to use the RTU communication mode on a Modbus network, every byte (8 bits) in the message includes 2 hexadecimal characters (each includes 4 bits). Compared with the ASCII mode, the RTU mode 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

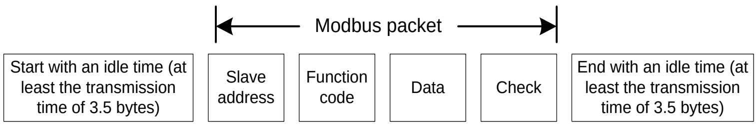
10-bit character frame (bits 1 to 7 are data bits):

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, the transmission of a new frame always starts from an idle time (the transmission time 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 transmitted 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 transmitted, a similar transmission interval (the transmission time of 3.5 bytes) is used to indicate that the transmission of the frame ends. Then, the transmission of a new frame starts.

RTU data frame format



The information of a frame must be sent 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 (transmission time 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 parameters 06H: write slave parameters
Data domain DATA (N-1) … DATA (0)	Data of 2*N 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 (transmission time of 3.5 bytes)

9.3.2.2 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 for 8 times. After the last bit (8th bit) is detected and processed, the XOR operation is performed on the next 8-bit byte and the current content in the register. The final values in the register are the CRC values obtained after operations are performed on all the bytes in the frame.

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

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

```
unsigned int crc_cal_value(unsigned char*data_value,unsigned char data_length)
{
    int i;
    unsigned int crc_value=0xffff;
    while(data_length--)
    {
        crc_value^=*data_value++;
        for(i=0;i<8;i++)
        {
            if(crc_value&0x0001)
                crc_value=(crc_value>>1)^0xa001;
            else
                crc_value=crc_value>>1;
        }
    }
    return(crc_value);
}
```

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

9.4 RTU command code and communication data

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

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

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

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

RTU master command (from the master to the VFD)

START	T1-T2-T3-T4 (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" is "01H", indicating that the command is sent to the VFD whose address is 01H. "ADDR" occupies one byte.

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

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

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

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

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

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

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

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

9.4.2 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, to write 5000 (1388H) to 0004H of the VFD whose address is 02H, the frame structure is as follows.

RTU master command (from the master to the VFD)

START	T1-T2-T3-T4 (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 9.4.1 and 9.4.2 mainly describe the command formats. For the detailed application, see the examples in section 9.4.7.

9.4.3 Command code 10H, continuous 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, if the master writes 5000 (1388H) and 50 (0032H) to 0004H and 0005H 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	10H
MSB of data writing address	00H
LSB of data writing address	04H
Data count MSB	00H
Data count LSB	02H
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)

9.4.4 Data address definition

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

9.4.4.1 Function code address format rules

The address of a function code consists of two bytes, with the high-order byte on the left and low-order byte on the right. The MSB ranges from 00 to FFH, and the LSB also ranges from 00 to FFH. The MSB is the hexadecimal form of the group number before the dot mark, and LSB is that of the number behind the dot mark. Take P05.06 as an example. The group number is 05, that is, the MSB of the parameter address is the hexadecimal form of 05; and the number behind the dot mark is 06, that is, the LSB is the hexadecimal form of 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 value after running once 2: Cyclic running	0–2	0	○
P10.01	Simple PLC memory selection	0: Do not memorize at power outage 1: Memorize at power off	0–1	0	○

Note:

- The parameters in the P99 group are set by the manufacturer and cannot be read or modified. Some parameters cannot be modified when the VFD is running; some cannot be modified regardless of the VFD status. Pay attention to the setting range, unit, and description of a parameter when modifying it.

- The service life of the Electrically Erasable Programmable Read-Only Memory (EEPROM) may be reduced if it is frequently used for storage. Some function codes do not need to be stored during communication. The application requirements can be met by modifying the value of the on-chip RAM, that is, modifying the MSB of the corresponding function code address from 0 to 1. For example, if P00.07 is not to be stored in the EEPROM, you need only to modify the value of the RAM, that is, set the address to 8007H. The address can be used only for writing data to the on-chip RAM, and it is invalid when used for reading data.

9.4.4.2 Addresses of other Modbus functions

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 description	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	
		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%)	
	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: 0.01 Hz)	R/W
	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

Function description	Address	Data description	R/W
	2009H	Special control command word Bit1–2: = 00: Motor 1 =01: Motor 0 Bit2: =1: Enable speed/torque control switchover =0: Disable speed/torque control switchover Bit3: =1: Clear electricity consumption data =0: Keep electricity consumption data Bit4: =1: Enable pre-excitation =0: Disable pre-excitation Bit5: =1: Enable DC braking =0: Disable DC braking	R/W
	200AH	Virtual input terminal command. Range: 0x000–0x3FF (corresponding to S8/S7/S6/S5/HDIB/ HDIA/S4/S3/S2/S1 in sequence)	R/W
	200BH	Virtual output terminal command (range: 0x00–0x0F) (corresponding to local RO2/RO1/HDO/Y1)	R/W
	200CH	Voltage setting (used when V/F separation is implemented) (0–1000, in which 1000 corresponds 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 corresponding to 100.0%)	R/W
VFD status word 1	2100H	0001H: Forward running 0002H: Reverse running 0003H: Stopped 0004H: Faulty 0005H: POFF state 0006H: Pre-exciting	R
VFD status word 2	2101H	Bit0: =0: Not ready to run =1: Ready to run Bit2–2: = 00: Motor 1 =01: Motor 1 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	R

<table>
<tr><th>Function description</th><th>Address</th><th colspan="2">Data description</th><th>R/W</th></tr>
<tr><td></td><td></td><td colspan="2">Bit8=0: Speed control =1: Torque control
Bit9=0: Non position control
=1: Position control
Bit11–Bit10=0: Vector 0
=1: Vector 1
=2: Closed-loop vector
= 3: 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="17">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 IO state</td><td>300AH</td><td>0x00–0x3F
Corresponding to the local HDIB/HDIA/S4/S3/S2/S1</td><td>R</td></tr>
<tr><td>Output IO state</td><td>300BH</td><td>0x00–0x0F
Corresponding to local RO2/RO1/HDO/Y1</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>
</table>

Function description	Address	Data description		R/W
Read input of HDIB high-speed pulse	3011H			R
Read the actual step of multi-step speed	3012H	0–15		R
External length value	3013H	0–65535		R
External counting value	3014H	0–65535		R
Torque set value	3015H	-300.0–300.0% (Unit: 0.1%)		R
VFD identification code	3016H			R
Fault code	5000H			R

The Read/Write (R/W) characteristics indicate whether a function code 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/Modbus TCP. For another example, when modifying "PID reference", you need to set "PID reference source" (P09.00) to Modbus/Modbus TCP communication.

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

8 MSBs	Meaning	8 LSBs	Meaning
0x01	Goodrive	0x08	Goodrive35 vector VFD
		0x09	Goodrive35-H1 vector VFD
		0x0a	Goodrive300 vector VFD
		0xa0	Goodrive350 vector VFD

9.4.5 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 as an example.

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

The value specified in "Setting range" or "Default" contains one decimal place, and therefore the fieldbus scale is 10. If the value received by the 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.

9.4.6 Error message response

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

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

Code	Name	Description
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.
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 is set to an invalid value in the write operation. For example, a function input terminal cannot be set repeatedly.
05H	Incorrect password	The password entered in the password verification address is different from that set in P07.00.
06H	Data frame error	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 0001H) 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".

9.4.7 Read/Write operation examples

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

9.4.7.1 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 in section 9.4.4.2 Addresses of other Modbus functions, 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 "Type of present fault" (P07.27) to "Type of 5th-last fault" (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	Most recent fault type	Last fault type	2nd-last fault type	3rd-last fault type	4th-last fault type	5th-last fault type	CRC

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

9.4.7.2 Example of writing command 06H

Example 1: Set the VFD whose address is 03H to run forward. According to the table of address description of other function codes in section 9.4.4.2 Addresses of other Modbus functions, the parameter address of "communication-based control command" is 2000H and forward running is 0001H. See the following figure.

Function description	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	
		0007H: Fault reset	
		0008H: Jogging stop	

The command sent 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 100Hz for the VFD with the address of 03H.

Function code	Name	Description	Setting range	Default	Modify
P00.03	Max. output frequency	P00.04–599.00Hz	P00.04–599.00	50.00Hz	◎

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

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

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.

9.4.7.3 Example of continuous writing command 10H

Example 1: Set the VFD whose address is 01H to be forward running at the frequency of 10 Hz. Refer to section 9.4.4.2 Addresses of other Modbus functions, 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	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	
		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
P00.11	ACC time 1	P00.11 and P00.12 setting range: 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

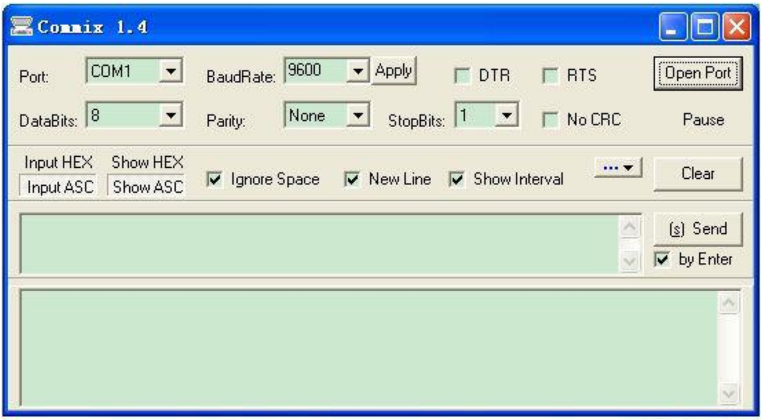
If the operation is successful, the following response is returned:

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.

9.4.7.4 Example of Modbus communication commissioning

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



First, set the serial port to **COM1**. Then, set the baud rate consistently with P14.01. The data bits, check bits, and stop bits must be set consistently with P14.02. If the RTU mode is selected, you need to select the hexadecimal form **Input HEX**. To set the software to automatically execute the CRC function, you need to select **ModbusRTU**, select **CRC16 (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 run forward 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 P00.01 (Running command channel) to "Communication", and set P00.02 (Communication running command channel) to "Modbus/Modbus TCP".
- After you click Send, if the line configuration and settings are correct, a response transmitted by the VFD is received.

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

9.5 Common communication faults

Common communication faults include the following:

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

Possible causes of no response include the following:

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.

Appendix A Expansion card

A.1 Model definition

EC-PG 5 01-05 B

① ② ③ ④ ⑤ ⑥

Symbol	Description	Naming example
①	Product category	EC expansion card
②	Board card category	IC: IoT card IO: IO expansion card PC: Programmable card PG: PG card PS: Power supply card TX: communication extension 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-PC 5 02-00

① ② ③ ④ ⑤

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

EC-TX 5 01 B

① ② ③ ④ ⑤

Symbol	Description	Naming example
①	Product category	EC expansion card
②	Board card category	IC: IoT card IO: IO expansion card PC: Programmable card PG: PG card PS: Power supply card TX: communication extension 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: Bluetooth communication card

Symbol	Description	Naming example
	code	02: Wi-Fi communication card
		03: PROFIBUS communication card
		04: Ethernet communication card
		05: CAN multi-protocol communication card
		06: DeviceNet communication card
		07: BACnet communication card
		08: EtherCAT communication card
		09: PROFINET communication card
		10: 485 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

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

EC - IC 5 01 - 2 1 G
① ② ③ ④ ⑤ ⑥ ⑦

Symbol	Description	Naming example
①	Product category	EC expansion card
②	Board card category	TX: communication extension card PG: PG card PC: PLC programmable card IO: IO expansion card IC: IoT card
③	Technology version	Indicates the generation of a technical version by using odd numbers, for example, 1, 3, 5, and 7 indicate the 1st, 2nd, 3rd and 4th generations of the technical version.
④	Product code (IoT card)	01: GPRS card 02: 4G card 03: Reserved
⑤	Antenna types for wireless communication cards	1: Built in 2: External
⑥	SIM card type	0: Plug-in card (Standard, default) 1: Embedded SIM card **Note:** When this field is 0 or omitted, the SIM card type is plug-in.
⑦	Special function	G: With GPS S: Surface mounted SIM card **Note:** When this field is omitted, the expansion card does not have special functions.

EC – IC 5 02 - 2 1 G - CN
① ② ③ ④ ⑤ ⑥ ⑦ ⑧

Symbol	Description	Naming example
①	Product category	EC expansion card
②	Board card category	TX: communication extension card PG: PG card PC: PLC programmable card IO: IO expansion card IC: IoT card

Symbol	Description	Naming example
③	Technology version	Indicates the generation of a technical version by using odd numbers, for example, 1, 3, 5, and 7 indicate the 1st, 2nd, 3rd and 4th generations of the technical version.
④	Product code (IoT card)	01: GPRS card 02: 4G card 03: Reserved
⑤	Antenna types for wireless communication cards	1: Built in 2: External
⑥	SIM card type	0: Plug-in 1: Surface mounted **Note:** When this field is 0 or omitted, the SIM card type is plug-in.
⑦	Special function	G: With GPS **Note:** When this field is omitted, the expansion card does not have special functions.
⑧	International version	CN: China version EU: Europe version LA: Latin America version **Note:** A 4G SIM card is a standard configuration for the CN version, but not for the EU or LA version.

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

Name	Model	Specification	Ordering code
IO expansion card	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.	11023-00119
Programmable card	EC-PC502-00	● Adopting the global mainstream programmable card development environment, supporting multiple	11023-00146

<table>
<tr><th>Name</th><th>Model</th><th>Specification</th><th>Ordering code</th></tr>
<tr><td></td><td></td><td>programming languages such as the instruction language, ladder diagram, and sequential function chart.
● Supporting resumable commissioning and task period execution mode selection;
● Providing a user program storage space of 16K steps and data storage space of 8K words;
● Six digital inputs:
● Two relay outputs;
● One analog input and 1 output;
● One RS485 communication channel, master/slave switchover by upper computer;
● Supporting saving data of 1K words at power failure.</td><td></td></tr>
<tr><td rowspan="2">Bluetooth communication card</td><td>EC-TX501-1</td><td rowspan="2">● Supporting Bluetooth 4.0
● With INVT's mobile phone APP, you can set the parameters and monitor the states of the VFD through Bluetooth.
● Maximum communication distance in open environments: 30m
● EC-TX501-1 is equipped with a built-in antenna and applicable to molded case machines.
● EC-TX501-2 is equipped with an external sucker antenna and applicable to sheet metal machines.</td><td>11023-00101</td></tr>
<tr><td>EC-TX501-2</td><td>11023-00102</td></tr>
<tr><td rowspan="2">WIFI communication card</td><td>EC-TX502-1</td><td rowspan="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
● 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</td><td>11023-00101</td></tr>
<tr><td>EC-TX502-2</td><td>11023-00102</td></tr>
</table>

Name	Model	Specification	Ordering code
		metal machines	
PROFIBUS-DP communication card	EC-TX503D	Supporting the PROFIBUS-DP protocol	11023-00151
CAN multi-protocol communication card	EC-TX505D	● Based on the CAN2.0A and CAN2.0B physical layer ● Supporting the CANopen protocol. ● Adopting INVT's master-slave control proprietary protocol.	11023-00164
PROFINET communication card	EC-TX509C	Supporting the PROFINET protocol	11023-00149
EtherNet IP multi-protocol communication card	EC-TX510B	● Set the switch to EtherNet IP: ✧ Supporting the EtherNet IP protocol and EtherNet IP slaves ✧ Equipped with two EtherNet IP ports, supporting 10/100M half/full duplex operating ✧ Equipped with two standard RJ45 interfaces, which do not distinguish the direction and can be swappable ✧ Supporting star and line IP network topologies ● Set the switch to Modbus TCP: ✧ Supporting the Modbus TCP protocol and Modbus TCP secondary nodes ✧ Equipped with two Modbus TCP ports, supporting 10/100M half/full duplex operating ✧ Supporting star and line TCP network topologies ● Set the switch to Ethernet: ✧ Supporting INVT Ethernet protocol ✧ Supporting the connection to INVT's host controller monitoring software INVT Workshop for monitoring and oscillography, allowing multi-card networking monitoring	11023-00197

Name	Model	Specification	Ordering code
Sin/Cos PG card	EC-PG502	● Applicable to Sin/Cos encoders with or without CD signals. ● Supporting A, B, Z frequency-divided output; ● 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 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 5 V or 12 V ● Applicable to push-pull encoders of 5 V 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
24V incremental PG card	EC-PG505-24B	● Applicable to OC encoders of 24V. ● Applicable to push-pull encoders of 24V; ● 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	11023-00139
Simplified incremental PG card	EC-PG507-12	● Applicable to OC encoders of 5 V or 12 V ● Applicable to push-pull encoders of 5 V or 12V; ● Applicable to differential encoders of 5V.	11023-00115
24V simplified incremental PG card	EC-PG507-24	● Applicable to OC encoders of 24V. ● Applicable to push-pull encoders of 24V; ● Applicable to differential encoders of 24V.	11023-00121

Name	Model	Specification	Ordering code
GPRS extension card	EC–IC501-2	● Supporting IoT monitoring ● Supporting remote VFD upgrade	11023-00130
4G expansion card	EC-IC502-2-CN	● Supporting standard RS485 interface ● Supporting 4G communication	11095-00009
	EC-IC502-2-EU		11095-00017
	EC-IC502-2-LA		11095-00018

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

IO extension card
EC-IO501-00

IO extension card 2
EC-IO502-00

Programmable
extension card
EC-PC502-00

Bluetooth/WIFI
communication card
EC-TX501/502

PROFIBUS-DP communication card EC-TX503D

CAN multi-protocol communication card EC-TX505D

PROFINET communication card EC-TX509C

EtherNet IP multi-protocol communication card EC-TX510B

Sin/Cos PG card EC-PG502

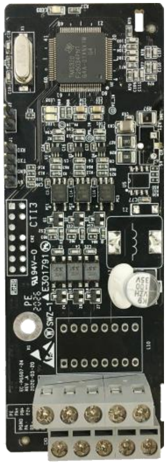
Incremental PG card with UVW EC-PG503-05

Resolver PG card EC-PG504-00

Multi-function incremental PG card EC-PG505-12

24V incremental PG card EC-PG505-24B

Simplified incremental PG card
EC-PG507-12



24V simplified incremental PG card
EC-PG507-24

GPRS IoT card
EC-IC501-2

4G expansion card
EC-IC502-2-CN
EC-IC502-2-EU
EC-IC502-2-LA

A.2 Dimensions and installation

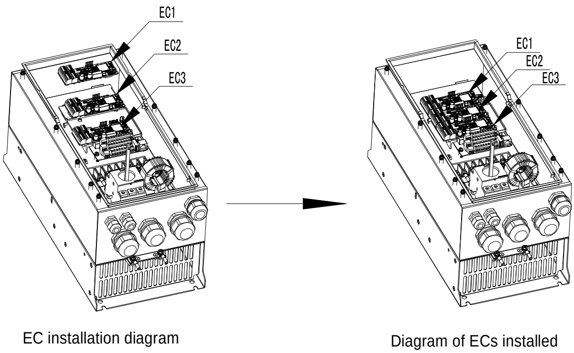
All expansion cards are of the same dimensions (108×39mm) and can be installed in the same way.

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 VFD supports the simultaneous installation of three expansion cards.
4. If interference occurs on the external wires after the expansion card is installed, change the installation slot flexibly to facilitate the wiring. For example, the connector of the connection cable of the DP card is large, and you are recommended to install the card at SLOT1.

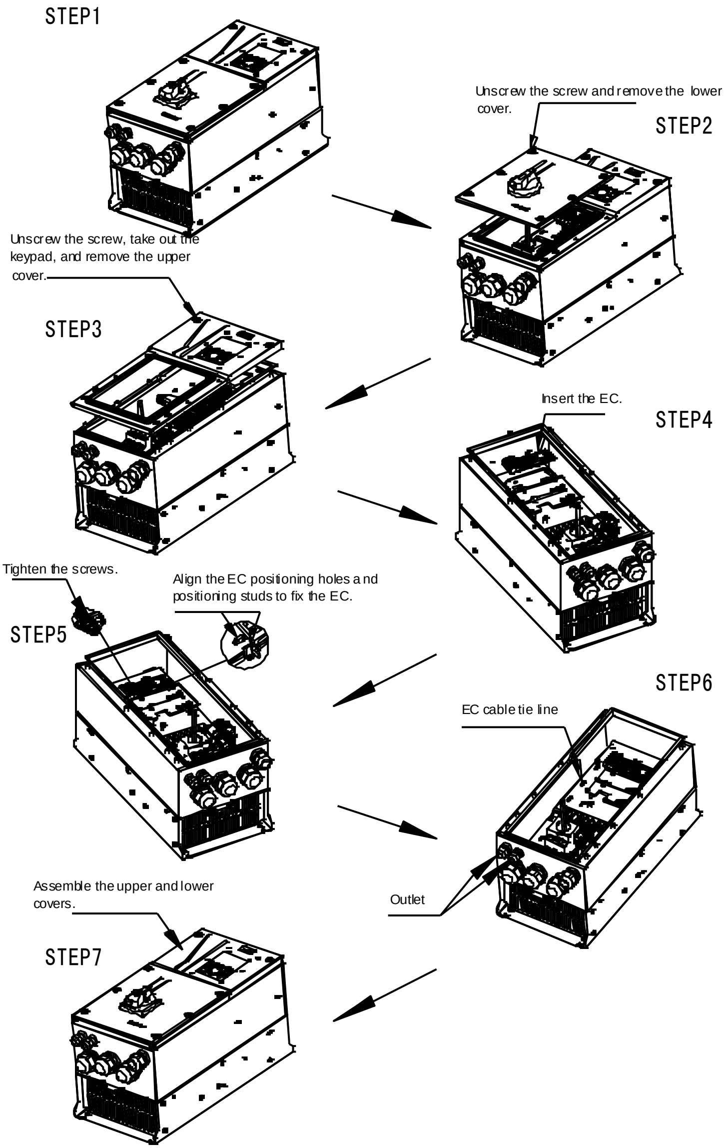
The following figure shows the installation diagram and the VFD with expansion cards installed.

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



Expansion card installation procedure:

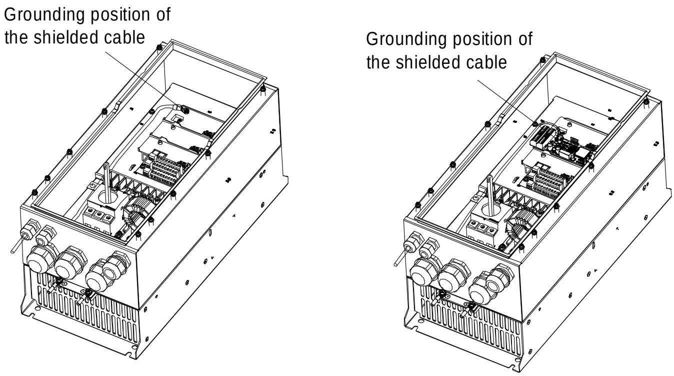
Figure A-2 Expansion card installation procedure



A.3 Wiring

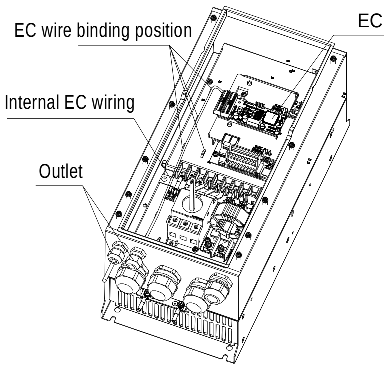
1. Ground a shielded cable as follows:

Figure A-3 Expansion card grounding diagram



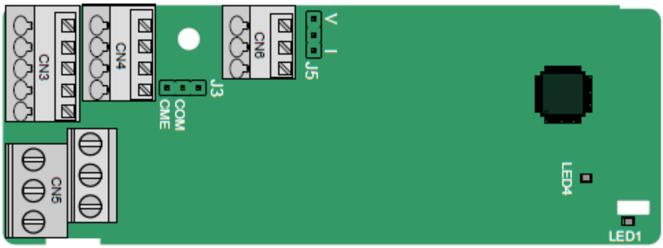
2. Wire an expansion card as follows:

Figure A-4 Expansion card wiring diagram



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

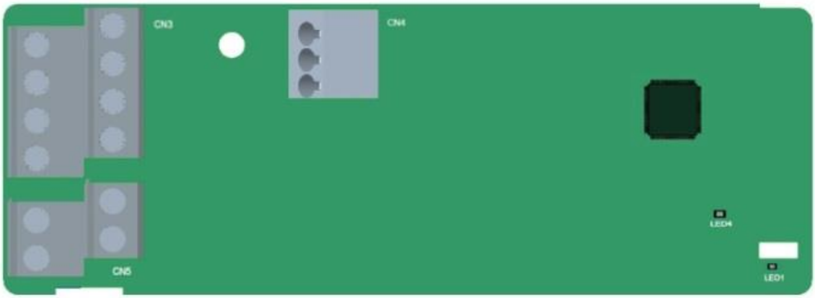
The EC-IO501-00 extension card can be used in scenarios where the I/O interfaces of a VFD cannot meet the application requirements. It can provide 4 digital inputs, 1 digital output, 1 analog input, 1 analog output, and two relay outputs. It is user-friendly, providing relay outputs through European-type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

EC-IO501-00 terminal function description

Category	Terminal symbol	Terminal name	Description
Power supply	PW	External power	External power input terminal for digital input circuits

Category	Terminal symbol	Terminal name	Description
			Voltage range: 12–30V PW and +24V have been short connected before delivery.
Analog input/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/output	S5—COM	Digital input 1	● Internal impedance: 3.3kΩ ● 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 output.
	RO3B	NC contact of relay 3	
	RO3C	Common contact of relay 3	
	RO4A	NO contact of relay 4	
	RO4C	Common contact of relay 4	

A.4.2 IO expansion card 2 (EC-IO502-00)



The terminals are arranged as follows:

PT1+	PT-	PT2+

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

Indicator definition:

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

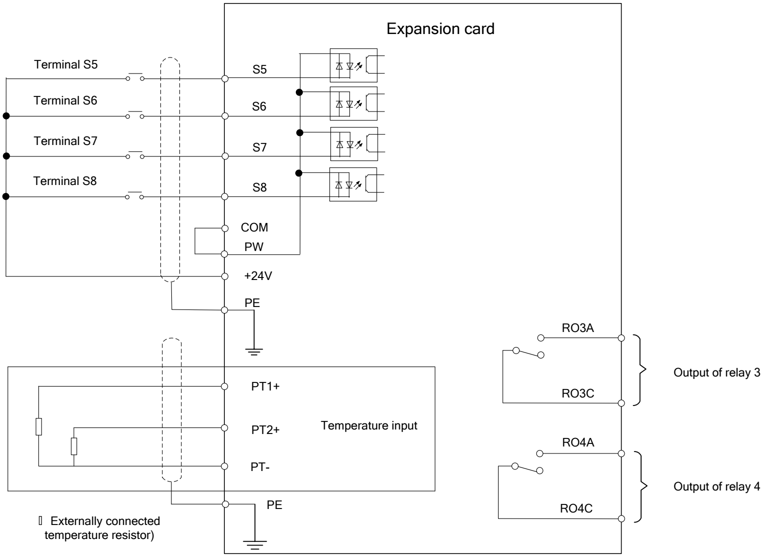
EC-IO502-00 can be used in scenarios where the I/O interfaces of a VFD cannot meet the application requirements. It can provide four digital inputs, one PT100 temperature measuring input (PT1+), one PT1000 temperature measuring input (PT2+), and two relay outputs. It is user-friendly, providing relay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

EC-IO502-00 terminal function description

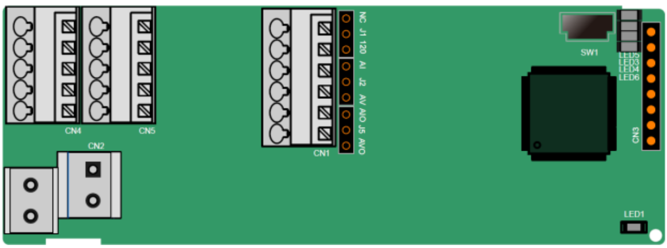
Category	Terminal symbol	Terminal name	Description
Power supply	PW	External power	External power input terminal for digital input circuits Voltage range: 24(-20%)–48VDC(+10%), 24(-10%)–48VAC(+10%) voltage input

Category	Terminal symbol	Terminal name	Description
	+24V	Internal power	User power supply provided by the VFD. Max. output current: 200mA
	COM	Power reference	Reference ground of +24V
Digital input	S5—COM	Digital input 5	● Internal impedance: 6.6kΩ ● Supporting the voltage input of external power 24(-20%)–48VDC(+10%) and 24(-10%)–48VAC(+10%) voltage input ● Supporting the internal power 24V ● 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
	S6—COM	Digital input 6	
	S7—COM	Digital input 7	
	S8—COM	Digital input 8	
Temperature detection input	PT1+	PT100 resistor input	Independent PT100 and PT1000 inputs: PT1+ connects to PT100 resistor, while PT2+ connects to PT1000 resistor. ● Resolution rate: 1°C ● Range -20°C–150°C ● Detection precision: 3°C ● Supporting offline protection
	PT2+	PT1000 resistor input	
	PT-	Reference input of PT100/PT1000	Reference zero potential of PT100/PT1000
Relay output	RO3A	Contact A of NO relay 3	RO3 outputs. RO3A: NO; RO3C: common Contact capacity: 3A/AC250V, 1A/DC30V
	RO3C	Contact C of NO relay 3	
	RO4A	Contact A of NO relay 4	RO4 outputs. RO4A: NO; RO4C: common Contact capacity: 3A/AC250V, 1A/DC30V
	RO4C	Contact C of NO relay 4	

Figure A-5 Control circuit wiring of I/O expansion card 2



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



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

PE	485-	485+	GND	AI1	AO1

COM	COM	PS1	PS2	PS3
PW	24V	PS4	PS5	PS6

PRO1A	PRO1C
PRO2A	PRO2C

Indicator definition:

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

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

The EC-PC502-00 programmable extension card provides 6 digital inputs, 2 relay outputs, 1 analog input, 1 analog output, 1 RS485 communication channel (supports master/slave switchover). It is user-friendly, providing relay outputs through European-type screw terminals and other inputs and outputs through spring terminals.

EC-PC502-00 terminal function description

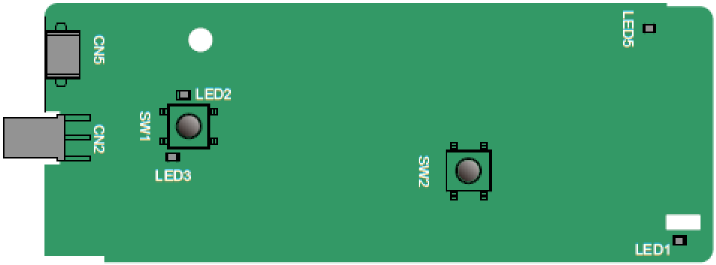
Category	Terminal symbol	Terminal name	Description
Power supply	PW	External power	External power input terminal for digital input circuits Voltage range: 12–24V PW and +24V should be short-connected.
	24V	Internal power	Internal output power, 100mA
Digital	PS1—COM	Digital input 1	● Internal impedance: 4kΩ

Category	Terminal symbol	Terminal name	Description
input/output	PS2—COM	Digital input 2	● 12–30V voltage input is acceptable ● Bi-direction input terminal ● Max. input frequency: 1kHz ● Source/sink inputs, and the input type should be consistent
	PS3—COM	Digital input 3	
	PS4—COM	Digital input 4	
	PS5—COM	Digital input 5	
	PS6—COM	Digital input 6	
Analog input/output	AI1	Analog input 1	● Input range: For AI1, 0–10V or 0–20mA ● Input impedance: 20kΩ for voltage input; 250Ω for current input ● Whether voltage or current is used for input is set through the jumper ● Resolution: 5mV when 10V corresponds to 50Hz ● Deviation: ±1%, 25°C, full measuring range
	AO1	Analog output 1	● Output range: 0–10V or 0–20mA ● Whether voltage or current is used for output is set through the jumper ● Deviation: ±1%, 25°C, full measuring range
Relay output	PRO1A	NO contact of relay 1	● Contact capacity: 2A/AC250V, 1A/DC30V ● Cannot be used as high frequency digital output.
	PRO1C	Common contact of relay 1	
	PRO2A	NO contact of relay 2	
	PRO2C	Common contact of relay 2	

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

A.6 Communication cards

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

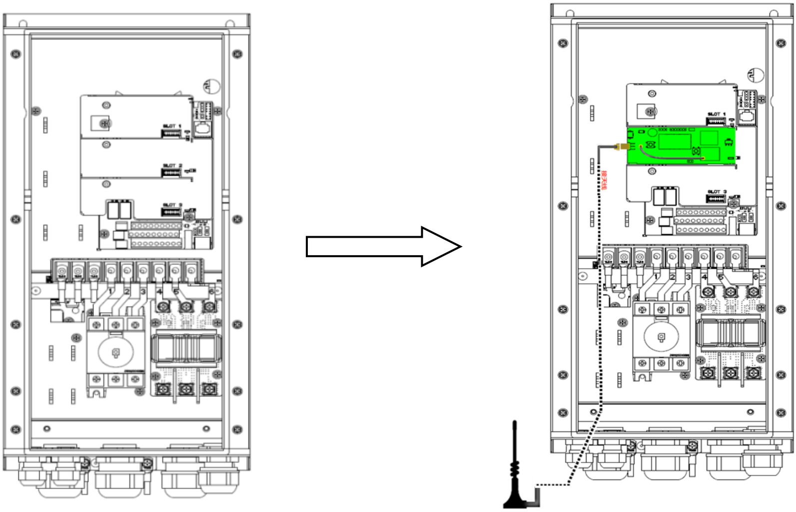


Definition of indicators and function keys:

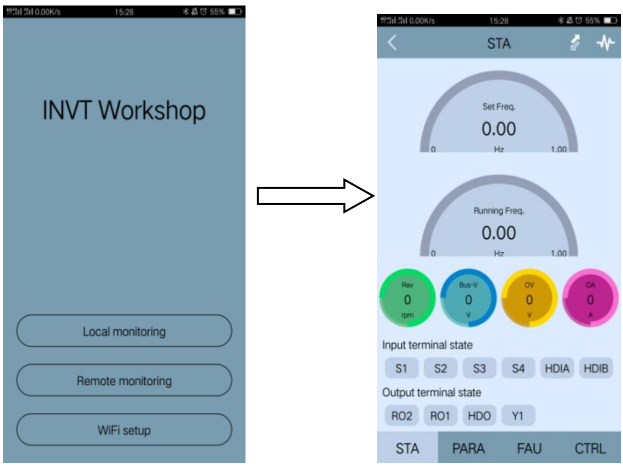
Indicator	Definition	Function
LED1/LED3	Bluetooth/WIFI status indicator	This indicator is on when the expansion card is establishing a connection with the control board; it blinks periodically after the expansion card is properly connected to the control board (the period is 1s, on for 0.5s, and off for the other 0.5s); and it is off when the expansion card is disconnected from the control board.
LED2	Bluetooth communication state indicator	This indicator is on when the communication card is online and data exchange can be performed. It is off when the Bluetooth communication card is not in the online state.
LED5	Power indicator	It is off when Bluetooth communication is not in the online state.
SW1	WIFI factory reset button	It is restored to default values and returned to the local monitoring mode.
SW2	WIFI hardware reset button	It is used to reboot the extension 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 30 m. 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.

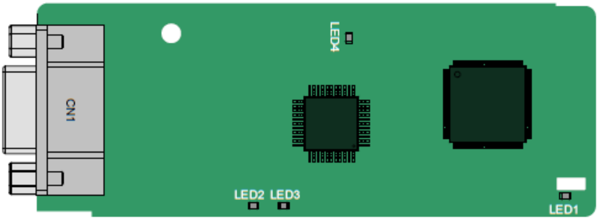
When installing a sucker antenna, install a wireless communication card on the VFD first, and then lead the SMA connector of the sucker antenna into the VFD and screw it to CN2, as shown in the following figure. Place the antenna base on the chassis and expose the upper part. Try to keep it unblocked.



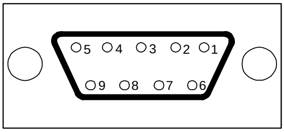
The wireless communication card must be used with the INVT VFD APP. Scan the QR code of the VFD nameplate to download it. For details, refer to the wireless communication card manual provided with the extension card. The main interface is shown as follows.



A.6.2 PROFIBUS-DP communication card (EC-TX503D)



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 5 V DC
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.

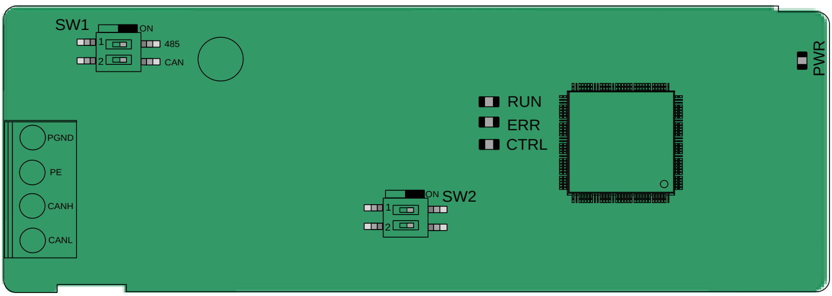
Indicator definition:

Indicator	Definition	Function
LED1	Status indicator	On: The expansion card is establishing a connection with the control board. Blinks periodically: The expansion card is properly connected to the control board (the period is 1s, on for 0.5s, and off for the other 0.5s). Off: The expansion card is disconnected from the control board.
LED2	Online indicator	On: The communication card is online and data exchange can be

Indicator	Definition	Function
		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. Blinks: The communication card is not in the offline state. Blinks at the frequency of 1 Hz: 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. Blinks at the frequency of 2 Hz: User parameter data is incorrect. The length or content of the user parameter data set during the initialization of the 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 manual of the communication card.

A.6.3 CAN multi-protocol communication card (EC-TX505D)



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

Signal	Description	Description
PGND	Isolation ground	Isolation ground
PE	Shielded cable	CAN bus shielding
CANH	CAN positive input	CAN bus high level signal
CANL	CAN negative input	CAN bus low level signal
485	RS485 terminal resistor switch	No terminal resistor is connected between RS485+ and RS485-.

Signal	Description	Description
		A 120Ω terminal resistor is connected between RS485+ and RS485-.
CAN	CAN terminal resistor switch	No terminal resistor is connected between CAN_H and CAN_L.
		CAN_H and CAN_L are connected to a terminal resistor of 120Ω.

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

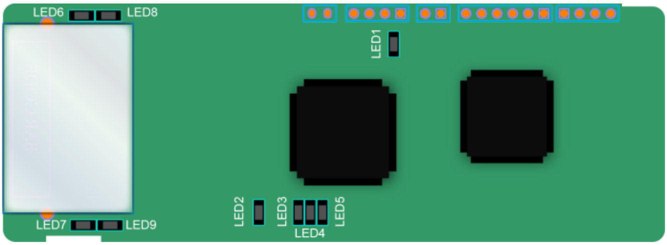
SW2		
1	**2**	**Protocol type**
OFF	OFF	CANopen
ON	OFF	CAN master/slave

Indicator definition:

Indicator	Definition	Function
CTRL	Status indicator	On: The expansion card is establishing a connection with the control board. it blinks periodically after the expansion card is properly connected to the control board (the period is 1s, on for 0.5s, and off for the other 0.5s); Off: The expansion card is disconnected from the control board.
RUN	Run indicator	On: The communication card is running. Off: A fault occurs. Check whether the reset pin of the communication card and the power supply are properly connected. The expansion card is in a stopped state. Blinking: The communication card is in the pre-operation state.
ERR	Fault indicator	On: The CAN controller bus is off, a fault occurs on the VFD, or the received frame is lost or incorrect. Off: The communication card is in the working state.
PWR	Power indicator	On: The control board feeds power to the communication card.

For details, see the manual of the communication card.

A.6.4 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	Name	Description
1	n/c	Not connected
2	n/c	Not connected
3	RX-	Receive Data-
4	n/c	Not connected
5	n/c	Not connected
6	RX+	Receive Data+
7	TX-	Transmit Data-
8	TX+	Transmit Data+

Indicator definition:

The PROFINET communication card has 9 indicators, among which LED1 is the power indicator, LED2–5 are the communication status indicators of the communication card, and LED6–9 are the status indicators of the network port.

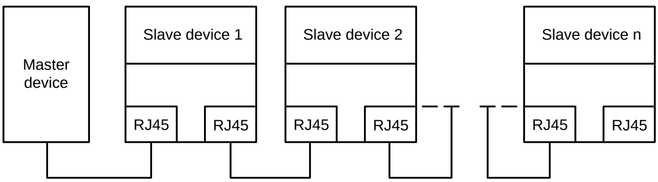
LED	Color	State	Description
LED1	Green		3.3V power indicator
LED2 (Bus status indicator)	Red	On	No network connection
		Blinking	The connection to the network cable between the PROFINET controller is normal, but the communication is not established.
		Off	Communication with the PROFINET controller has 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.

LED	Color	State	Description
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	Blinking	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.

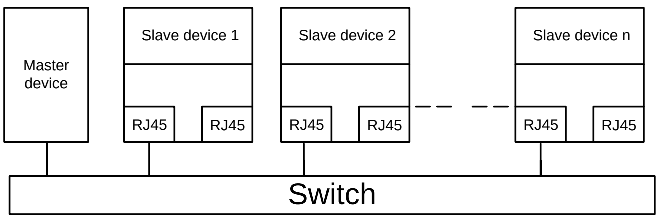
Figure A-6 Linear network topology electrical connection diagram



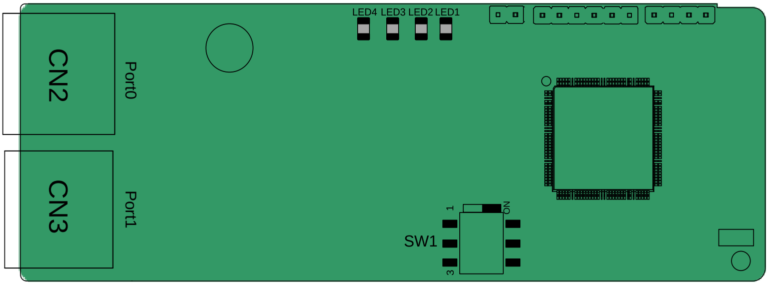
Note: For the star network topology, you need to prepare PROFINET switches.

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

Figure A-7 Star network topology electrical connection diagram



A.6.5 EtherNet IP multi-protocol communication card (EC-TX510B)



The communication terminals CN1 and CN2 of the expansion card adopts standard the RJ45 interfaces, which can be interchangeably inserted. You can select a protocol via the switch before power-on, with EtherNet IP as the default and options for Modbus TCP and Ethernet communication.

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

Table A-1 Switch

	Protocol type	1	2	3
SW1	EtherNet IP	ON	ON	ON
	Ethernet	OFF	ON	ON
	Modbus TCP	ON	OFF	ON
	Reserved	Other	Other	Other

Table A-2 EtherNet IP LED description

Indicator	Color	Definition	Function
LED1	Green	On	The card is shaking hands with the VFD.
		Blinking (1Hz)	The card and VFD communicate normally.
		Off	The card and VFD communicate improperly.
LED2	Green	On	The communication between the card and the PLC is online and data exchange is allowed.
		Off	The communication between the card and PLC is offline.
LED3	Red	On	Failed to set up I/O between the card and the 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

Table A-3 Modbus TCP LED description

Indicator	Color	Definition	Function
LED1	Green	On	The card is shaking hands with the VFD.
		Blinking (1Hz)	The card and VFD communicate normally.
		Off	The card and VFD communicate improperly.
LED2	Green	On	The communication between the card and the PLC is online and data exchange is allowed.
		Off	The communication between the card and PLC is offline.
LED3	Red	On	The 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

Table A-4 Ethernet LED description

Indicator	Color	Definition	Function
LED1	Green	On	The card is shaking hands with the VFD.
		Blinking (1Hz)	The card and VFD communicate normally (handshake successful).
		Off	The card and VFD communicate improperly.
LED2	Green	On	The connection between the card and the PC is successful.
		Off	The connection between the card and the PC has failed (network cable issue).
LED3	Red	Blinking (4Hz)	The connection between the card and the PC is successful, but communication has failed (IP address issue).
		Off	No fault
LED4	Red	On	3.3V power indicator

Electrical connection:

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

Use CAT5, CAT5e, and CAT6 network cables for electrical wiring. When the communication distance is greater than 50m, use high-quality network cables that meet the high-quality standards.

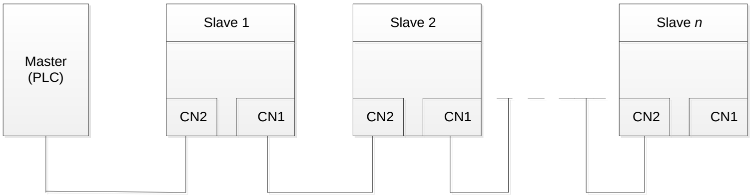


Figure A-8 Linear network topology electrical connection diagram

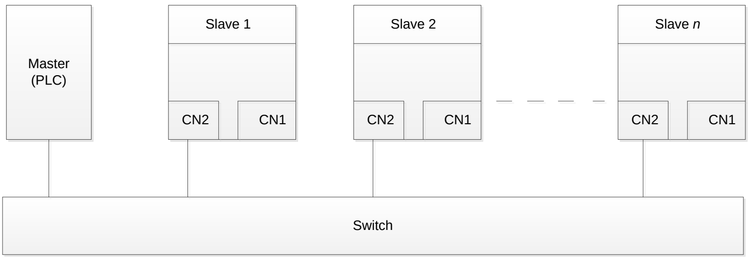
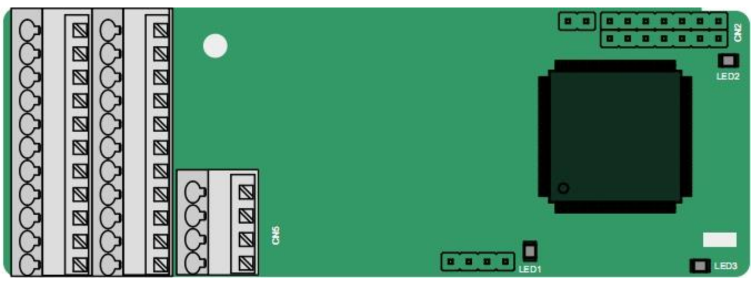


Figure A-9 Star network topology electrical connection diagram

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

A.7 PG extension cards

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



The terminals are arranged as follows:

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

Indicator definition:

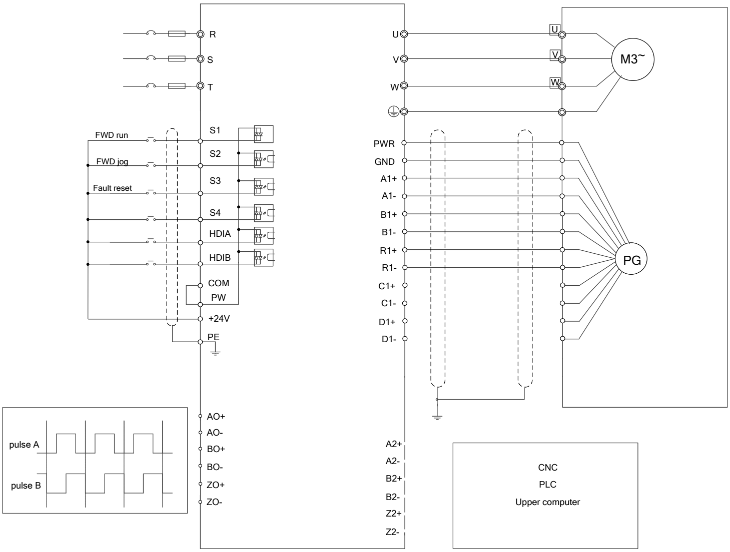
Indicator	Definition	Function
LED1	Disconnection	Off: A1 or B1 of the encoder is disconnected.

Indicator	Definition	Function
	indicator	Blinking: C1 or D1 of the encoder is disconnected. On: 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.

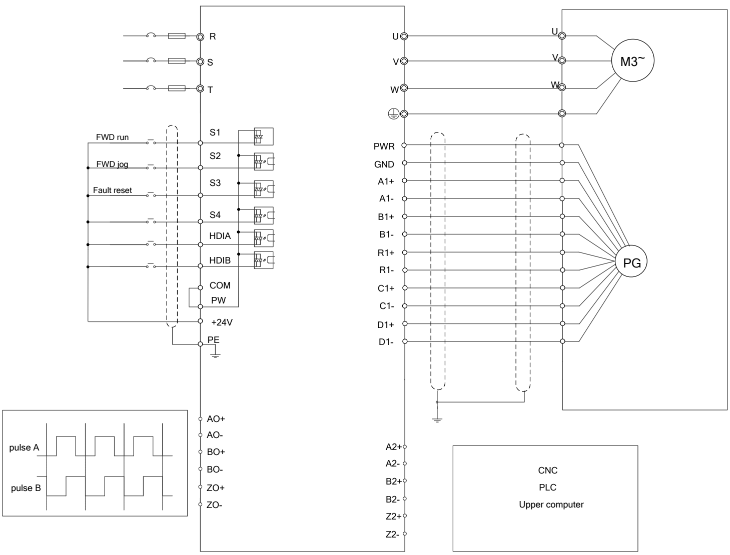
EC-PG502 terminal function:

Signal	Description	Description
PWR	Encoder power	Voltage: 5V ± 5% Max. output current: 150mA
GND		
A1+	Encoder interface	● Supporting Sin/Cos encoders ● SINA/SINB/SINC/SIND 0.6–1.2Vpp; SINR 0.2–0.85Vpp ● Max. frequency response of A/B signals: 200 kHz Max. frequency response of C/D signals: 1 kHz
A1-		
B1+		
B1-		
R1+		
R1-		
C1+		
C1-		
D1+		
D1-		
A2+	Pulse reference	● Supporting 5V differential signal ● Response frequency: 200 kHz
A2-		
B2+		
B2-		
Z2+		
Z2-		
AO+	Frequency-divided output	● Differential output of 5 V ● Supporting frequency division of 1–255, which can be set through P20.16 or P24.16 Max. output frequency: 200 kHz
AO-		
BO+		
BO-		
ZO+		
ZO-		

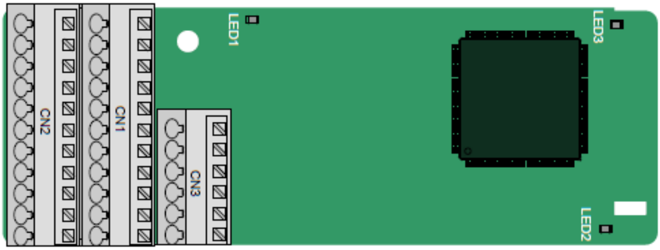
The following figure shows the external wiring of the PG card when it is used in combination with an encoder without CD signals.



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



A.7.2 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	Blinking: A1 or B1 signal is disconnected during encoder rotating. On: 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 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.

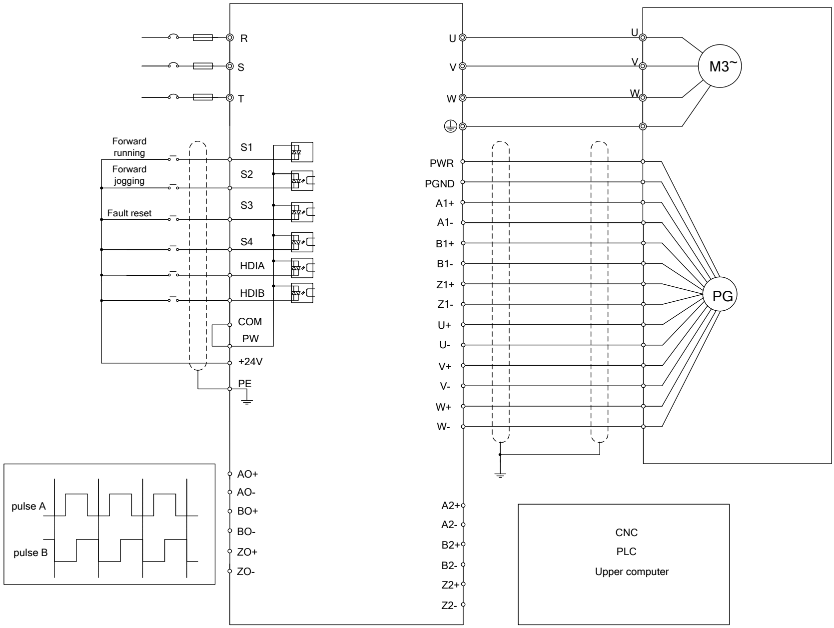
The EC-PG503-05 expansion card supports the input of absolute position signals, integrating the advantages of absolute and incremental encoders and adopts spring-loaded terminals for easy use.

EC-PG503-05 terminal function description:

Signal	Description	Description
PWR	Encoder power	● Voltage: 5V ± 5% ● Max. current: 200mA
PGND		
A1+	Encoder interface	● Differential incremental PG interface of 5 V ● Response frequency: 400kHz
A1-		
B1+		
B1-		

Signal	Description	Description
Z1+		
Z1-		
A2+	Pulse reference	● Differential input of 5V ● Response frequency: 200 kHz
A2-		
B2+		
B2-		
Z2+		
Z2-		
AO+	Frequency-divided output	● Differential output of 5V ● Supporting frequency division of 1–255, which can be set through P20.16 or P24.16
AO-		
BO+		
BO-		
ZO+		
ZO-		
U+	UVW encoder interface	● Absolute position (UVW information) of the hybrid encoder, differential input of 5V ● Response frequency: 40kHz
U-		
V+		
V-		
W+		
W-		

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



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

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

Indicator definition:

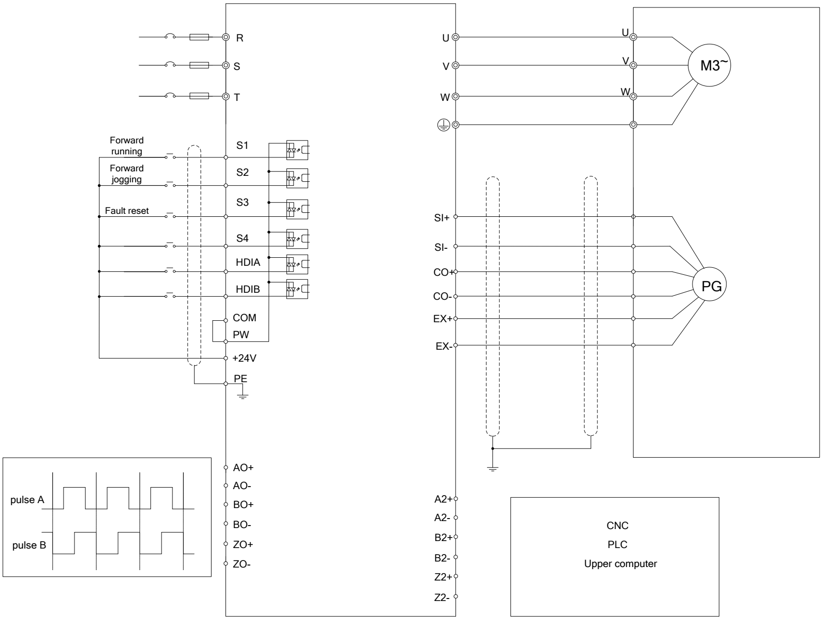
Indicator	Definition	Function
LED1	Status indicator	On: The expansion card is connecting with the control board. Blinking periodically (the period is 1s, on for 0.5s, and off for the other 0.5s): The expansion card is properly connected to the control board.

Indicator	Definition	Function
		Off: The expansion card is disconnected from the control board.
LED2	Disconnection indicator	On: Encoder signals are normal. Blinking: Encoder signals are not stable. Off: The encoder is disconnected.
LED3	Power indicator	This indicator is on after the control board feeds power to the PG card.

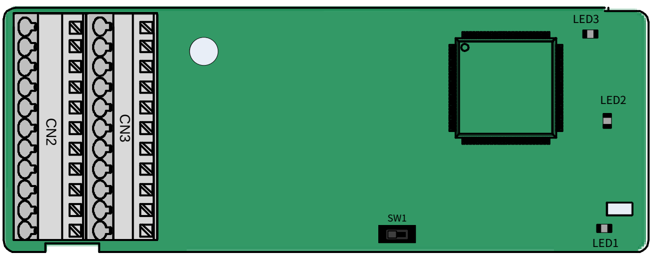
EC-PG504-00 can be used in combination with a resolver of excitation voltage 7Vrms. It is user-friendly, adopting spring-loaded terminals. EC-PG504-00 terminal function description

Signal	Description	Description
SI+ SI- CO+ CO-	Encoder signal input	Recommended resolver transformation ratio: 0.5
EX+ EX-	Encoder excitation signal	● Factory setting of excitation: 10kHz ● Supporting resolvers with an excitation voltage of 7Vrms
A2+ A2- B2+ B2- Z2+ Z2-	Pulse reference	● Differential input of 5V ● Response frequency: 200 kHz
AO+ AO- BO+ BO- ZO+ ZO-	Frequency-divided output	● Differential output of 5 V ● Frequency-divided output of resolver simulated A1, B1, and Z1, which is equal to an incremental PG card of 1024 pps. ● Supporting frequency division of 1–255, which can be set through P20.16 or P24.16 ● Max. output frequency: 200 kHz

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



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



The terminals are arranged as follows:

The SW1 switch is used to set the voltage class (5V or 12V) of the power supply of the encoder. The 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:

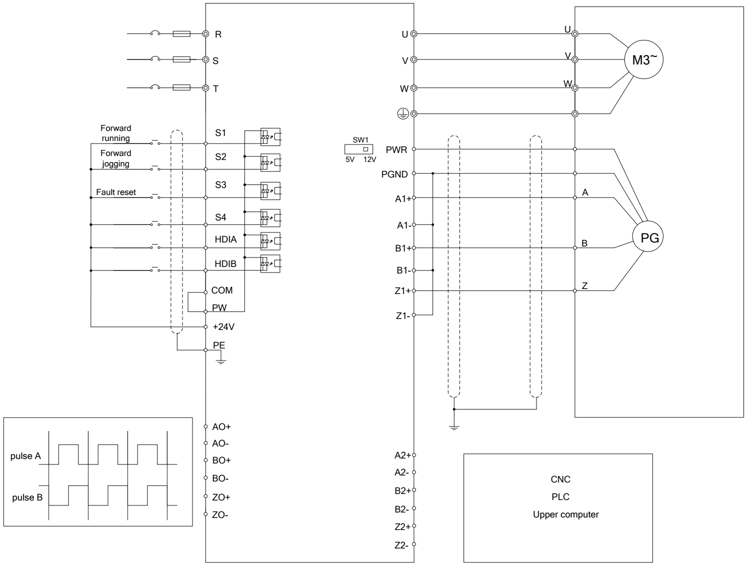
Indicator	Definition	Function
LED1	Signal indicator	Blinking (On: 500ms; Off: 500ms): A1 or B1 signal is disconnected during encoder rotating.

Indicator	Definition	Function
		On: Other cases
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: 500ms; Off: 500ms): The expansion card is connected with the control board. Off: The expansion card is disconnected from the control board.

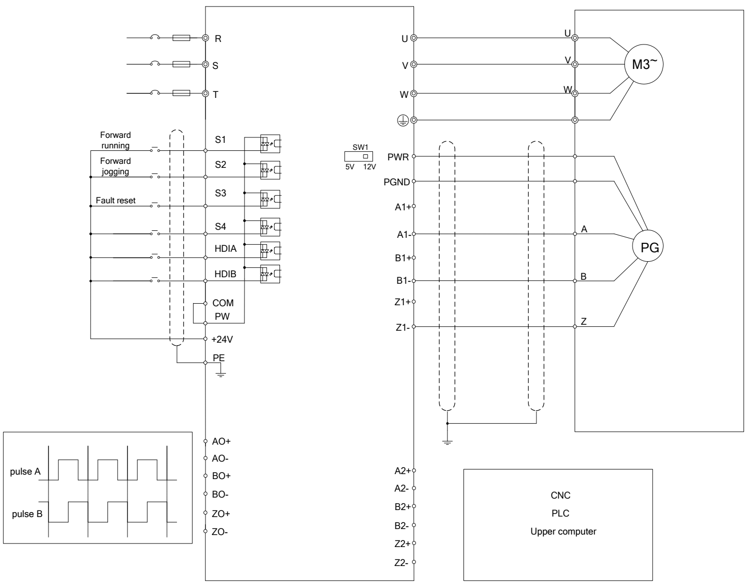
The EC-PG505-12 expansion card can be used in combination with multiple types of incremental encoders through different modes of wiring. It is user-friendly, adopting spring-loaded terminals. EC-PG505-12 terminal function description:

Signal	Description	Description
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	● Applicable to 5V/12V push-pull encoders ● Applicable to 5V/12V OC encoders ● Applicable to 5V differential encoders ● Response frequency: 400kHz
A1-		
B1+		
B1-		
Z1+		
Z1-		
A2+	Pulse reference	● Supporting the same signal types as the encoder signal types ● Response frequency: 400kHz
A2-		
B2+		
B2-		
Z2+		
Z2-		
AO+	Frequency-divided output	● Differential output of 5V ● Supporting frequency division of 1–255, which can be set through P20.16 or P24.16
AO-		
BO+		
BO-		
ZO+		
ZO-		

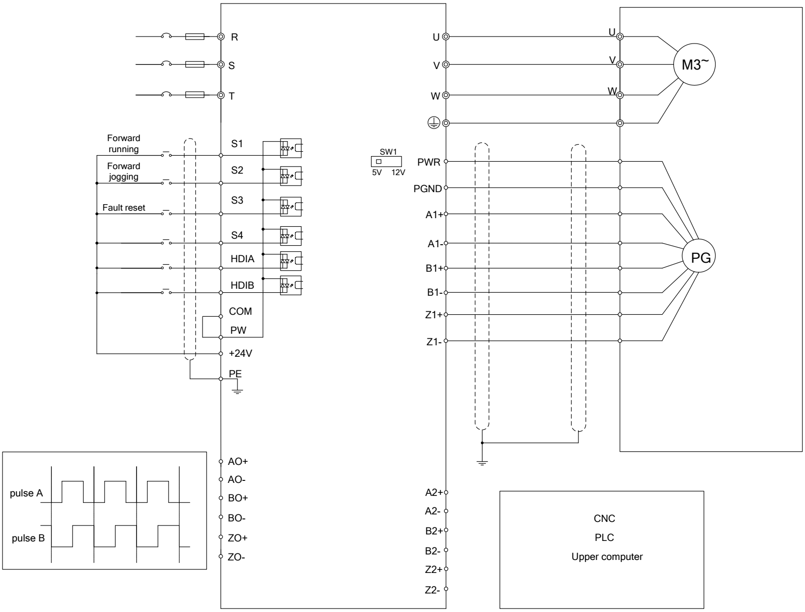
The following figure shows the external wiring when the expansion card is used in combination with an open collector encoder. A pull-up resistor is configured inside the PG card.



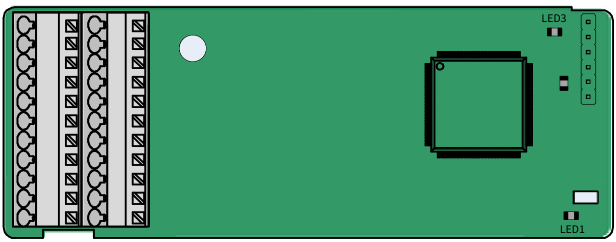
The following figure shows the external wiring when the expansion card is used in combination with a push-pull encoder.



The following figure shows the external wiring when the expansion card is used in combination with a differential encoder.



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



The terminals are arranged as follows:

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

Indicator definition:

Indicator	Definition	Function
LED1	Signal indicator	Blinking (On: 500ms; Off: 500ms): A1 or B1 signal is disconnected during encoder rotating. On: Other cases
LED2	Power indicator	On: The expansion card is powered on.

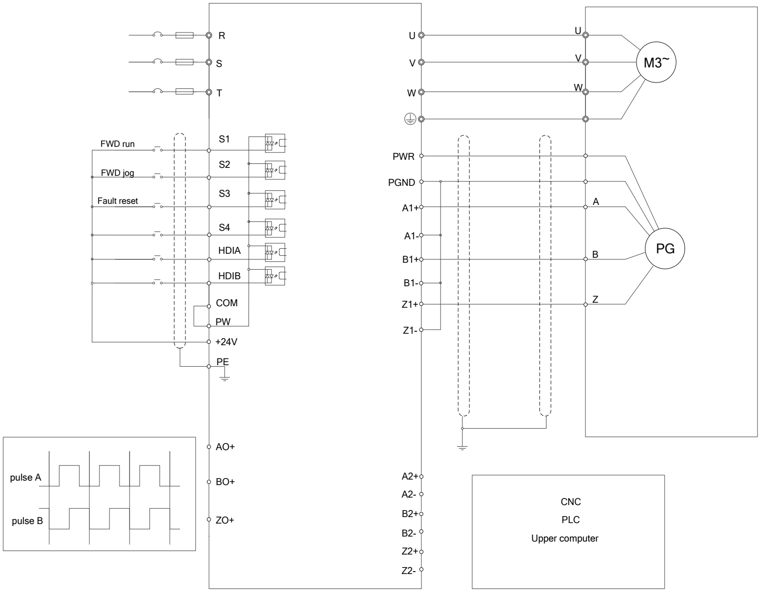
Indicator	Definition	Function
		Off: The expansion card is not powered on.
LED3	Status indicator	On: The expansion card is connecting with the control board. Blinking (On: 500ms; Off: 500ms): The expansion card is connected with the control board. Off: The expansion card is disconnected from the control board.

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

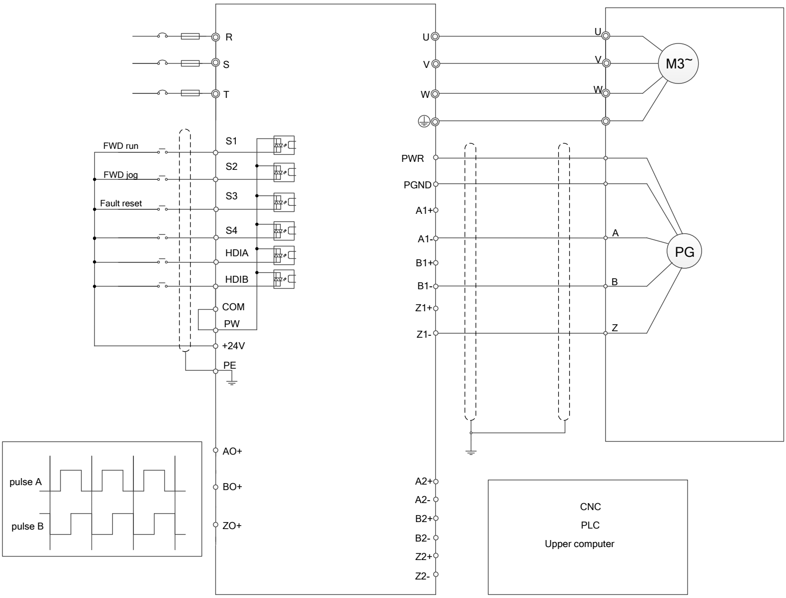
EC-PG505-24 terminal function description:

Signal	Description	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 24 V push-pull and open collector interfaces ● Supporting 5V differential interfaces ● 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+		

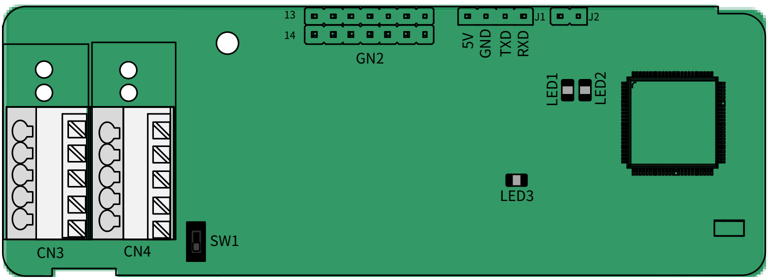
The following figure shows the external wiring when the expansion card is used in combination with an open collector encoder. A pull-up resistor is configured inside the PG card.



The following figure shows the external wiring when the expansion card is used in combination with a push-pull encoder.



A.7.6 Simplified incremental PG card (EC-PG507-12)



The terminals are arranged as follows:

The SW1 switch is used to set the voltage class (5V or 12V) of the power supply of the encoder. The switch can be operated with an auxiliary tool.

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

Indicator definition:

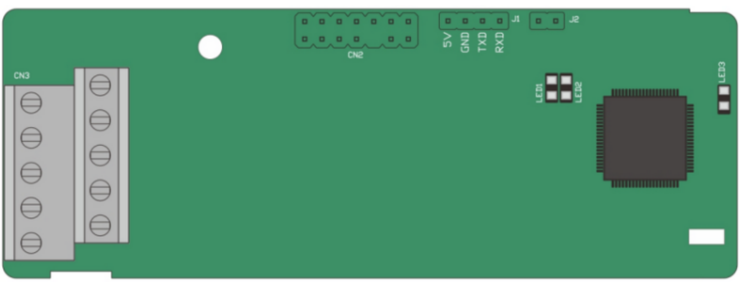
Indicator	Definition	Function
LED1	Status indicator	On: The expansion card is connecting with the control board. Blinking periodically (the period is 1s, on for 0.5s, and off for the other 0.5s): The expansion card is properly connected to the control board. Off: The expansion card is disconnected from the control board.
LED2	Disconnection indicator	Off: A1 or B1 of the encoder is disconnected. On: Encoder pulses are normal.
LED3	Power indicator	This indicator is on after the control board feeds power to the PG card.

EC-PG507-12 can work in combination with multiple types of incremental encoders through various external wiring modes. The wiring configuration for the encoder interface is the same as that of the EC-PG505-12 PG card.

EC-PG507-12 terminal function description:

Signal	Description	Description
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		
A1+	Encoder interface	● Applicable to 5V/12V push-pull encoders ● Applicable to 5V/12V OC encoders ● Applicable to 5V differential encoders ● Response frequency: 400kHz ● Supporting the encoder cable length of up to 50m
A1-		
B1+		
B1-		
Z1+		
Z1-		

A.7.7 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:

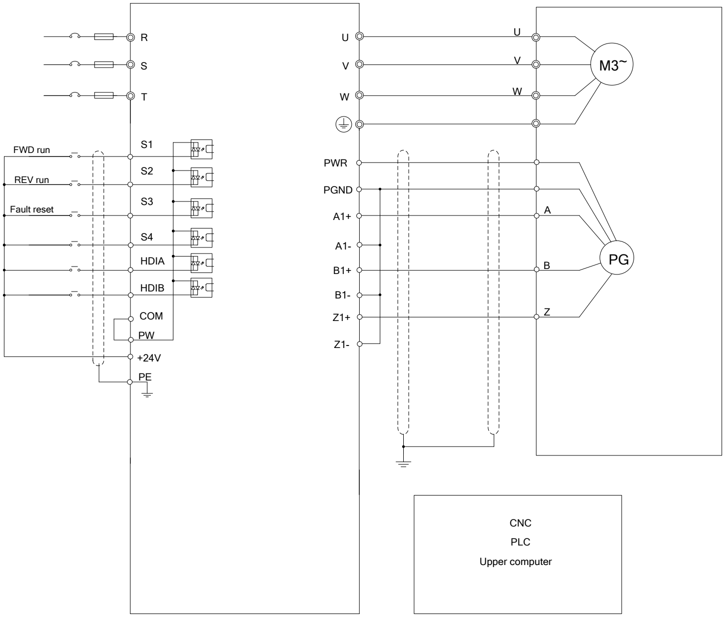
Indicator	Definition	Function
LED1	Status indicator	On: The expansion card is connecting with the control board. Blinking periodically (the period is 1s, on for 0.5s, and off for the other 0.5s): The expansion card is properly connected to the control board. Off: The expansion card is disconnected from the control board.
LED2	Disconnection indicator	Off: A1 or B1 of the encoder is disconnected. On: Encoder pulses are normal.
LED3	Power indicator	This indicator is on after the control board feeds power to the PG card.

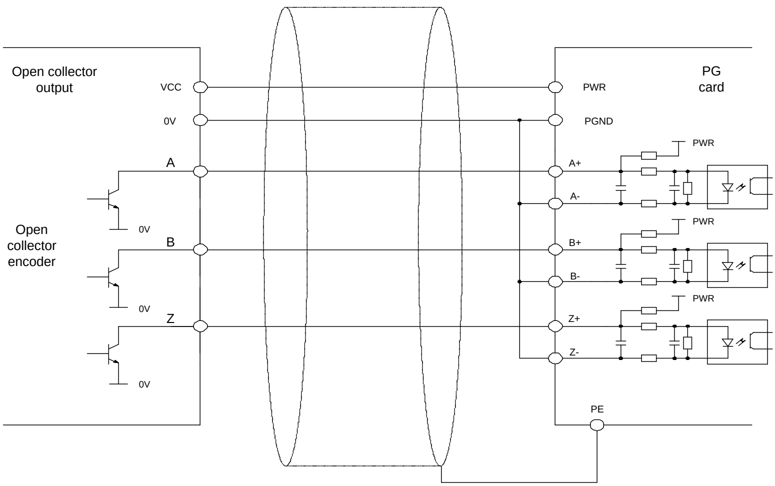
The EC-PG507-24 extension card can be used in combination with multiple types of incremental encoders through different modes of wiring. It is user-friendly, adopting 5.08mm pitch terminals.

EC-PG507-24 terminal function description:

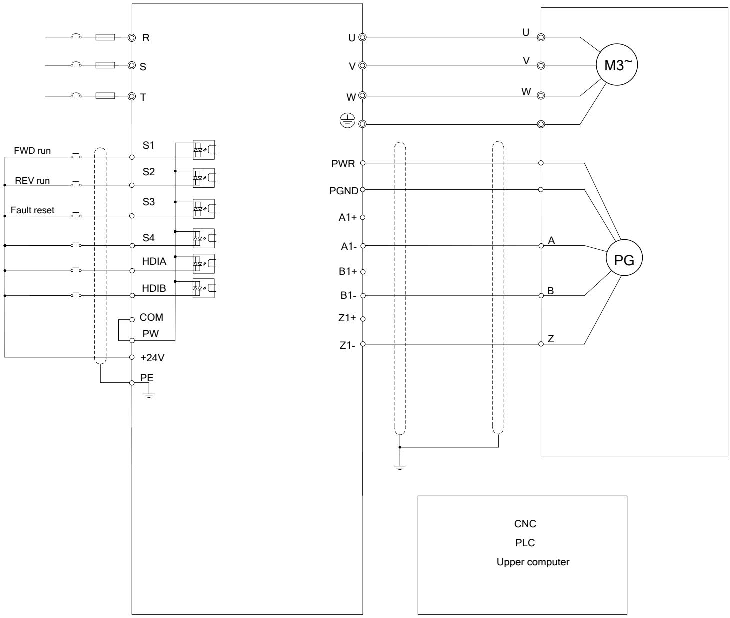
Signal	Description	Description
PE	Grounding terminal	It is connected to the ground for enhancing the anti-interference performance.
PWR	Encoder power	Voltage: 24V ± 5% Max. output current: 150mA (PGND is the isolation power ground.)
PGND		
A1+	Encoder interface	● Applicable to 24V push-pull encoders ● Applicable to 24V OC encoders ● Applicable to 24V differential encoders ● Response frequency: 200kHz ● Supporting the encoder cable length of up to 100m.
A1-		
B1+		
B1-		
Z1+		
Z1-		

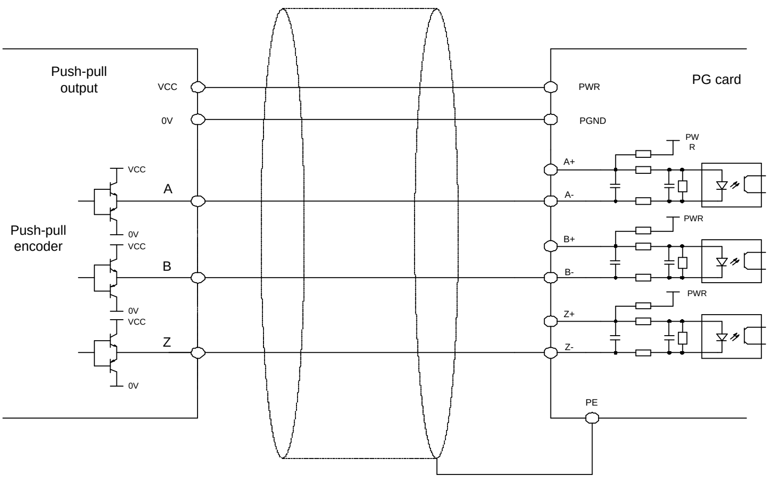
The following figure shows the external wiring when the expansion card is used in combination with an open collector encoder. A pull-up resistor is configured inside the PG card.



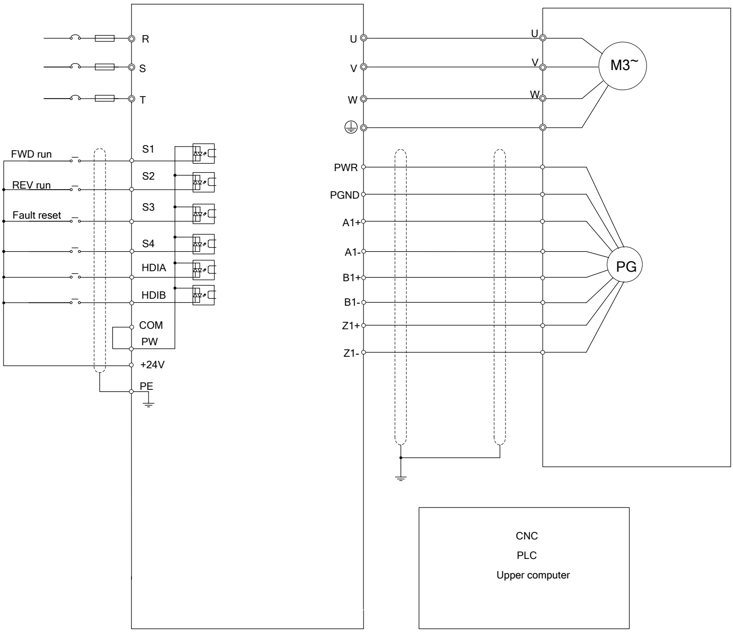


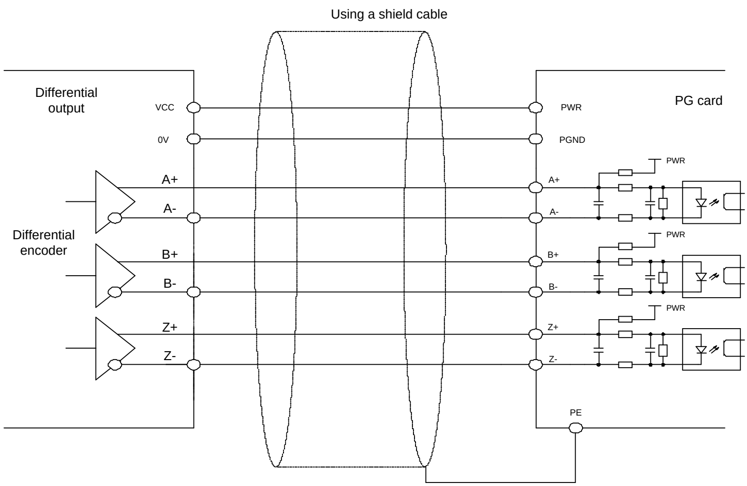
The following figure shows the external wiring when the expansion card is used in combination with a push-pull encoder.





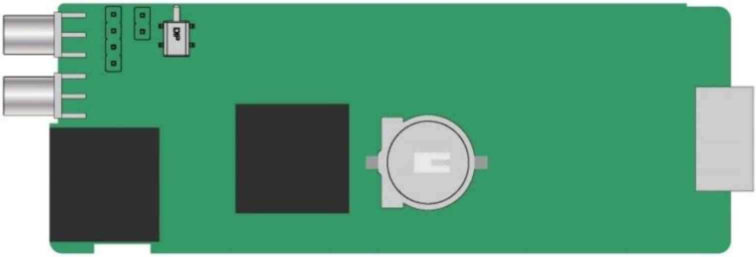
The following figure shows the external wiring when the expansion card is used in combination with a differential encoder.





A.8 IoT card

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



CN6 pin definition

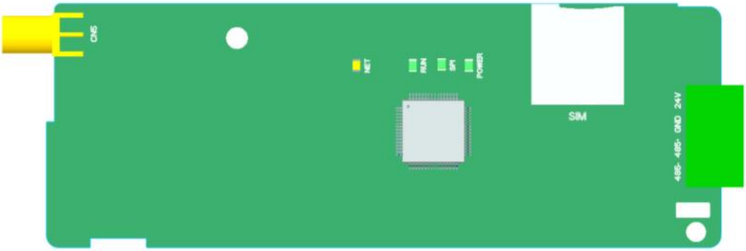
Pin	Name	Description
1	485-	485B
2	485+	485A
3	GND	Power ground
4	24V	24V power supply

Indicator definition:

Indicator	Definition	Description
LED1	Handshaking indicator	Blinking with an interval of 1s: The expansion card is connected with the control board.
LED2	Power indicator	On: The expansion card is powered on. Off: The expansion card is not powered on.
LED3	Running indicator	On: The expansion card communicates properly.
LED4	GPRS state indicator	Blinking (On: 64ms; Off: 300ms): GPRS connects to the network. Blinking (On: 64ms; Off: 800ms): The network is not registered.
LED5	Status indicator	On: The GPRS module is turned on.

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

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



Terminal description

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

Indicator description

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): The system runs properly. On or Off: System exceptions occurred.
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

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

Appendix B Technical data

B.1 What this chapter contains

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

B.2 Derated application

B.2.1 Capacity

Choose a VFD model based on the rated current and power of the motor. To 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.

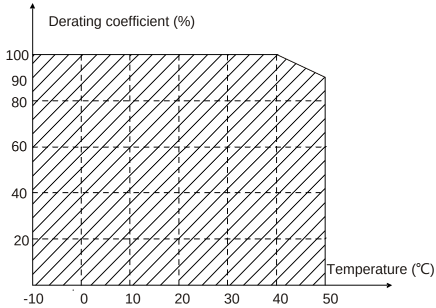
B.2.2 Derating

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

B.2.2.1 Derating due to temperature

When the temperature ranges from 40°C to 50°C, the rated output current is derated by 1% for each increased 1°C. For the actual derating, see the following figure.

Figure B-1 Temperature-based derating diagram



Note: It is not recommended to use the VFD at an environment with the temperature higher than 50°C. If you do, we shall not hold 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 VFDs in different power classes are different in carrier frequency. The rated power of a VFD is defined based on the carrier frequency set in factory. If the carrier frequency exceeds the factory setting, the power of the VFD is derated by 10% for each increased 1 kHz.

B.3 Grid specifications

Grid voltage	AC 3PH 380V(-15%) – 440V(+10%)
Short-circuit capacity	According to the definition in IEC 61439-1, the maximum allowable short-circuit current at the incoming end is 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	0–599Hz
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.4.1 EMC compatibility and motor cable length

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

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

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

For details about the environment categories, see section B.6 "EMC regulations".

B.5 Application standards

The following table describes the standards that VFDs comply with.

EN/ISO 13849-1	Safety of machinery—Safety-related parts of control systems—Part 1: General principles for design
IEC/EN 60204-1	Safety of machinery. Electrical equipment of machines. Part 1: General requirements
IEC/EN 62061	Safety of machinery—Safety-related functional safety of electrical, electronic, and programmable electronic control systems
IEC/EN 61800-3	Adjustable speed electrical power drive systems. Part 3: EMC requirements and specific test methods
IEC/EN 61800-5-1	Adjustable speed electrical power drive systems—Part 5-1: Safety requirements—Electrical, thermal and energy
IEC/EN 61800-5-2	Adjustable speed electrical power drive systems—Part 5-2: Safety requirements—Function
GB/T 30844.1	General-purpose variable-frequency adjustable-speed equipment of 1 kV and lower—Part 1: Technical conditions
GB/T 30844.2	General-purpose variable-frequency adjustable-speed equipment of 1 kV and lower—Part 2: Test methods
GB/T 30844.3	General-purpose variable-frequency adjustable-speed equipment of 1 kV and lower—Part 3: Safety requirements

B.5.1 CE marking

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

B.5.2 EMC compliance declaration

European union (EU) stipulates that the electric and electrical devices sold in Europe cannot generate electromagnetic disturbance that exceeds the limits stipulated in related standards, and can work properly in environments with certain electromagnetic interference. The EMC product standard (EN 61800-3) describes the EMC standards and specific test methods for adjustable speed electrical power drive systems. Our products have been compliant with these 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 1000V, 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.

C3: Rated voltage lower than 1000V, applied to environments of Category II. They cannot be applied to environments of Category I.

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.
4. For the maximum length of the motor cable, see section B.4.1 "EMC compatibility and motor cable length".

	The product may generate radio interference in some environments, and 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.
4. For the maximum length of the motor cable, see section B.4.1 "EMC compatibility and motor cable length".

	VFDs of category C3 cannot be applied to civilian low-voltage common grids. When applied to such grids, the VFD may generate radio frequency electromagnetic interference.

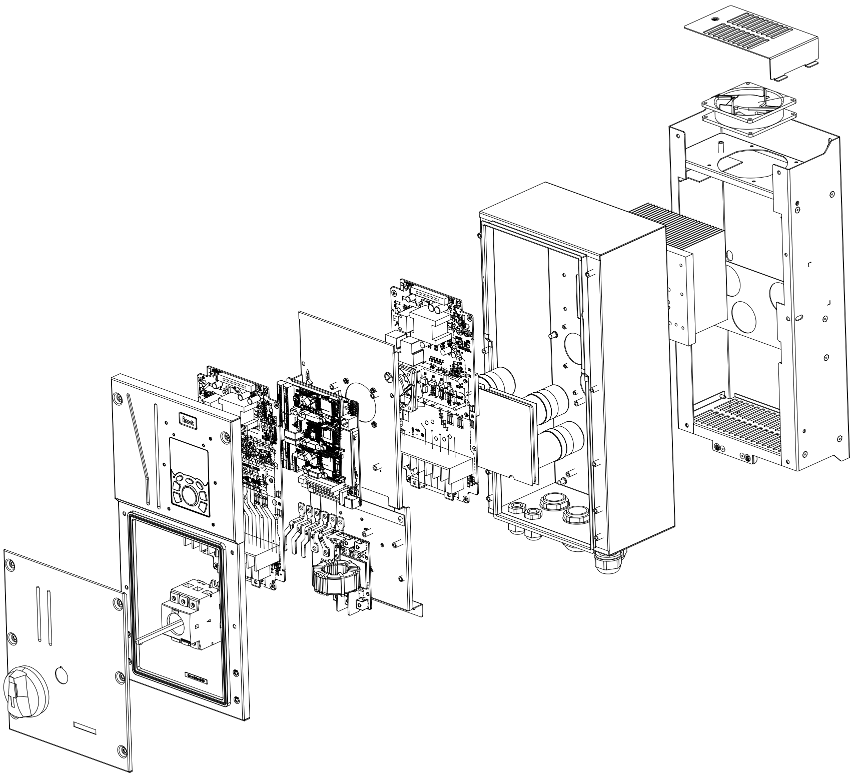
Appendix C Dimension drawings

C.1 What this chapter contains

This chapter provides the dimension drawings of the VFD. which use millimeter (mm) as the unit.

C.2 VFD structure

Figure C-1 VFD structure



C.3 VFD dimension

C.3.1 Wall-mounting dimensions

Figure C-2 Wall-mounting diagram for the 004G/5R5P–037G/045P models

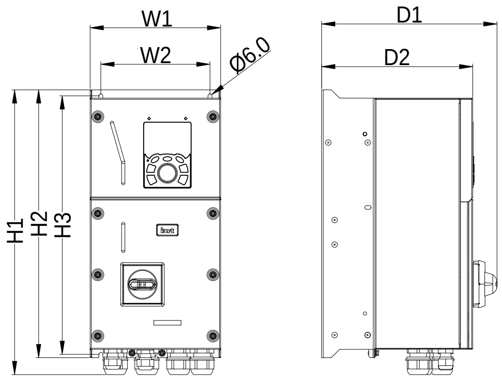


Table C-1 Wall-mounting dimensions

VFD model	W1	W2	H1	H2	H3	D1	D2	Hole diameter	Fixing screw	Net weight (kg)	Gross weight (kg)
GD350-004G/5R5P-45-AS	196	164	428.5	403	389	262.8	227	Ø6	M5	9	11
GD350-5R5G/7R5P-45-AS											
GD350-004G/5R5P-45-NS						-				8.5	10.5
GD350-5R5G/7R5P-45-NS											
GD350-7R5G/011P-45-AS	223	187	503.8	475	458.5	289.4	250.7	Ø7	M6	13	16
GD350-011G/015P-45-AS											
GD350-015G/018P-45-AS											
GD350-7R5G/011P-45-NS						-				12.5	15
GD350-011G/015P-45-NS											
GD350-015G/018P-45-NS											
GD350-018G/022P-45-AS	274	234	551.5	522	504	281.8	246	Ø7	M6	21	24.5
GD350-022G/030P-45-AS											
GD350-018G/022P-45-NS						-				20	23
GD350-022G/030P-45-NS											
GD350-030G/037P-45-AS	318	263	619	587	566.5	290	242.9	Ø9	M8	27	31.5
GD350-037G/045P-45-AS											
GD350-030G/037P-45-NS						-				26.5	30
GD350-037G/045P-45-NS											

Figure C-3 Wall-mounting diagram for the 045G/055P–110G models

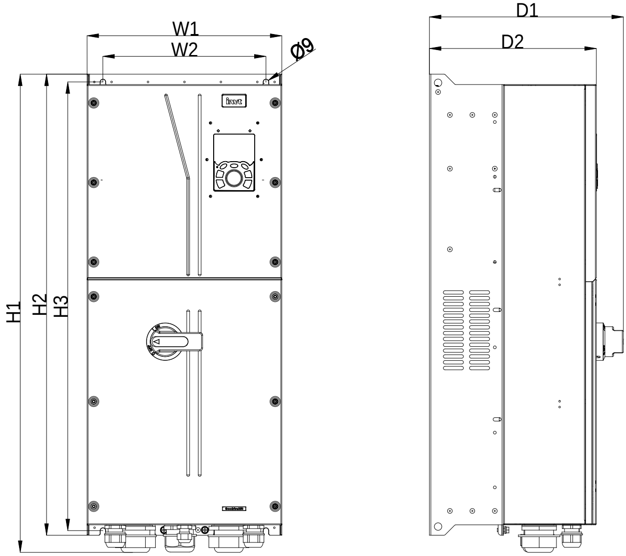


Table C-2 Wall-mounting dimensions

<table>
<tr><th>VFD model</th><th>W1</th><th>W2</th><th>H1</th><th>H2</th><th>H3</th><th>D1</th><th>D2</th><th>Hole diameter</th><th>Fixing screw</th><th>Net weight (kg)</th><th>Gross weight (kg)</th></tr>
<tr><td>GD350-045G/055P-45-AS</td><td rowspan="8">338</td><td rowspan="8">283</td><td rowspan="8">829.8</td><td rowspan="8">800</td><td rowspan="8">778.5</td><td rowspan="4">336.7</td><td rowspan="8">289.7</td><td rowspan="8">Ø9</td><td rowspan="8">M8</td><td rowspan="4">48</td><td rowspan="4">55</td></tr>
<tr><td>GD350-045G/055P-45-AS-B</td></tr>
<tr><td>GD350-055G/075P-45-AS</td></tr>
<tr><td>GD350-055G/075P-45-AS-B</td></tr>
<tr><td>GD350-045G/055P-45-NS</td><td rowspan="4">-</td><td rowspan="4">42.12</td><td rowspan="4">48.34</td></tr>
<tr><td>GD350-045G/055P-45-NS-B</td></tr>
<tr><td>GD350-055G/075P-45-NS</td></tr>
<tr><td>GD350-055G/075P-45-NS-B</td></tr>
<tr><td>GD350-075G/090P-45-AS</td><td rowspan="7">370</td><td rowspan="7">310</td><td rowspan="7">825.3</td><td rowspan="7">788</td><td rowspan="7">764.5</td><td rowspan="6">382</td><td rowspan="7">335</td><td rowspan="7">Ø11</td><td rowspan="7">M10</td><td rowspan="6">64</td><td rowspan="6">82.8</td></tr>
<tr><td>GD350-075G/090P-45-AS-B</td></tr>
<tr><td>GD350-090G/110P-45-AS</td></tr>
<tr><td>GD350-090G/110P-45-AS-B</td></tr>
<tr><td>GD350-110G-45-AS</td></tr>
<tr><td>GD350-110G-45-AS-B</td></tr>
<tr><td>GD350-075G/090P-45-NS</td><td>-</td><td>63.65</td><td>82.45</td></tr>
</table>

VFD model	W1	W2	H1	H2	H3	D1	D2	Hole diameter	Fixing screw	Net weight (kg)	Gross weight (kg)
GD350-075G/090P-45-NS-B											
GD350-090G/110P-45-NS											
GD350-090G/110P-45-NS-B											
GD350-110G-45-NS											
GD350-110G-45-NS-B											

C.3.2 Flange mounting dimensions

Figure C-4 Flange installation diagram for the 004G/5R5P–037G/045P models

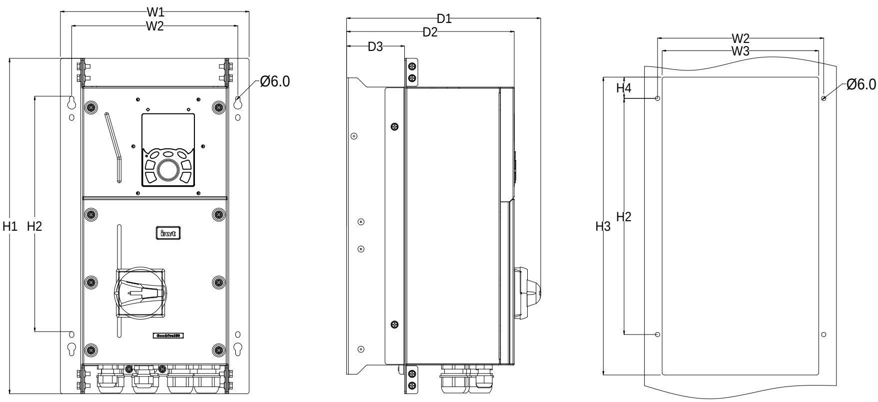


Table C-3 Flange mounting dimensions for 004G/5R5P–037G/045P models (unit: mm)

VFD model	W1	W2	W3	H1	H2	H3	H4	D1	D2	D3	Hole diameter	Fixing screw
GD350-004G/5R5P-45-AS	255.5	225	212	456	321	405	29	262.8	227	78.5	Ø6	M5
GD350-5R5G/7R5P-45-AS												
GD350-004G/5R5P-45-NS								-				
GD350-5R5G/7R5P-45-NS												
GD350-7R5G/011P-45-AS	282.5	258.5	239	520	333.5	477	58.5	289.4	250.7	100.5	Ø7	M6
GD350-011G/015P-45-AS												
GD350-015G/018P-45-AS												
GD350-7R5G/011P-45-NS								-				
GD350-011G/015P-45-NS												
GD350-015G/018P-45-NS												
GD350-018G/022P-45-AS	346	310.5	291	560	371.5	524	63	281.8	246	100.5	Ø7	M6
GD350-022G/030P-45-AS												

VFD model	W1	W2	W3	H1	H2	H3	H4	D1	D2	D3	Hole diameter	Fixing screw
GD350-018G/022P-45-NS								-				
GD350-022G/030P-45-NS												
GD350-030G/037P-45-AS	382	354	336	624	457	589	49.5	290	242.9	101.5	Ø9	M8
GD350-037G/045P-45-AS												
GD350-030G/037P-45-NS								-				
GD350-037G/045P-45-NS												

Figure C-5 Flange installation diagram for the 045G/055P–055G/075P models

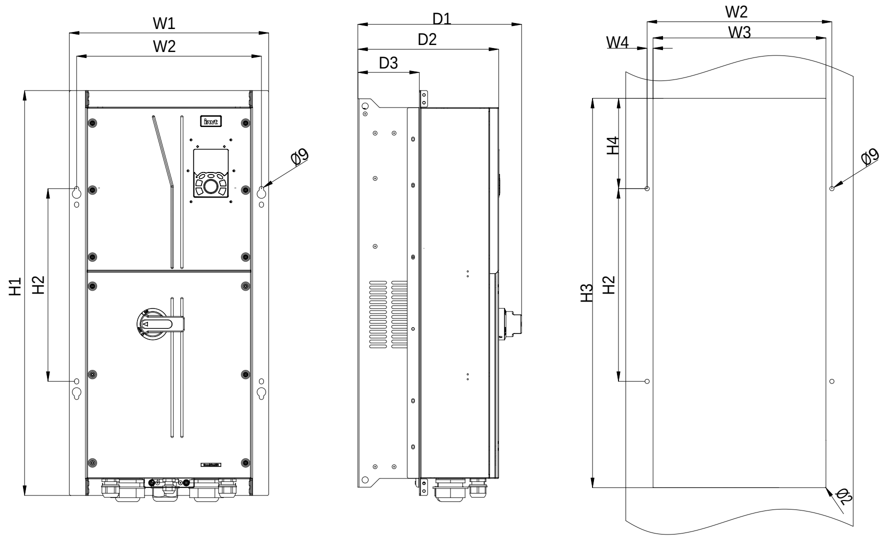


Table C-4 Flange mounting dimensions for 045G/055P–055G/075P models (unit: mm)

VFD model	W1	W2	W3	W4	H1	H2	H3	H4	D1	D2	D3	Hole diameter	Fixing screw
GD350-045G/055P-45-AS	410	380	355.6	12.2	834	397	802	186	336.7	289.7	126.5	Ø9	M8
GD350-045G/055P-45-AS-B													
GD350-055G/075P-45-AS													
GD350-055G/075P-45-AS-B													
GD350-045G/055P-45-NS									-				
GD350-045G/055P-45-NS-B													
GD350-055G/075P-45-NS													
GD350-055G/075P-45-NS-B													

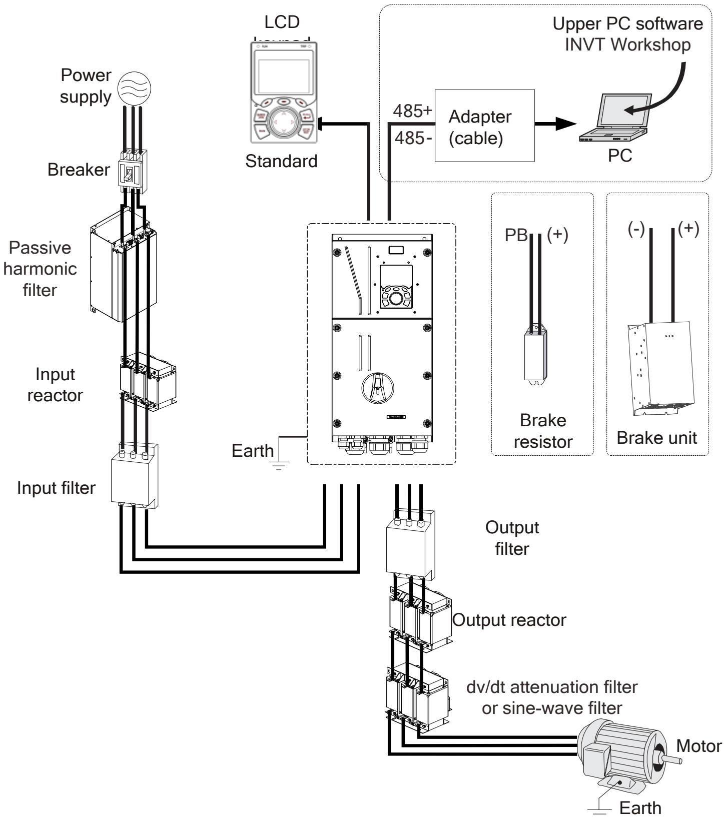
Appendix D Optional peripheral accessories

D.1 What this chapter contains

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

D.2 External wiring

The following figure shows the external wiring of the VFD.



Note:

- The 037G/045P and lower models are equipped with built-in braking units, and the 045G/055P–110G models can be configured with optional built-in braking units.
- The 018G/022P–110G models are equipped with built-in DC reactors.
- The braking units are INVT DBU series standard braking units. For details, see the DBU operation manual.

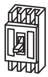
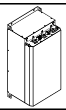
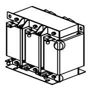
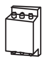
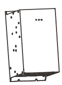
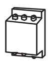
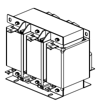
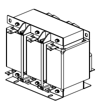
Image	Name	Description
	Cable	Accessory for signal transmission.
	Breaker	Device for electric shock prevention and protection against short-to-ground that may cause current leakage and fire. Select residual-current circuit breakers (RCCBs) that are applicable to VFDs and can restrict high-order harmonics, and of which the rated sensitive current for one VFD is larger than 30 mA.
	Passive harmonic filters	Device used to reduce the current distortion rate and harmonic content, thereby improving the power factor.
	Input reactors	Accessories used to improve the power factor on the input side of the VFD, and thus restrict high-order harmonic currents.
	Input filter	Accessory that restricts the electromagnetic interference generated by the VFD and transmitted to the public grid through the power cable. Try to install the input filter near the input terminal side of the VFD.
 or 	Braking unit or braking resistor	Accessories used to consume the regenerative energy of the motor to reduce the DEC time. For 037G/045P and lower VFD models, only the installation of a braking resistor is required. The 045G/055P–110G models can be configured with optional built-in braking units.
	Output filter	Accessory used to restrict interference generated in the wiring area on the output side of the VFD. Try to install the output filter near the output terminal side of the VFD.
	Output reactors	Accessory used to lengthen the valid transmission distance of the VFD, which effectively restrict the transient high voltage generated during the switch-on and switch-off of the IGBT module of the VFD.
	dv/dt decrement filters	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,

Image	Name	Description
		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

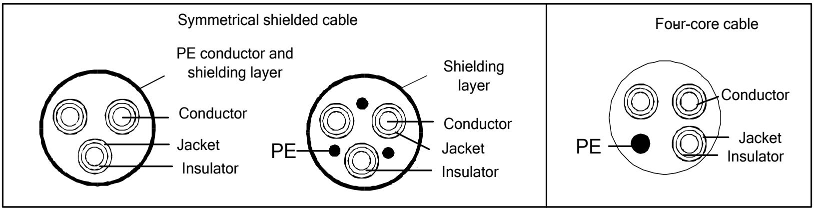
D.4.1 Power cable

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 working cannot be lower than 70°C.
- The conductivity of PE grounding conductor is the same as that of the phase conductor. The cross-sectional area of the PE grounding conductor for 30kW and higher models can be slightly smaller than the recommended cross-sectional area value.
- 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.



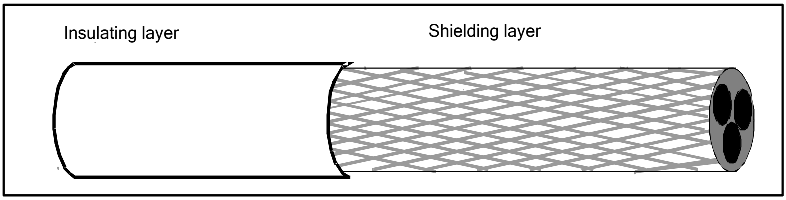
Note: If the electrical conductivity of the motor cable shield layer does not meet the requirements, a separate PE conductor must be used.

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.

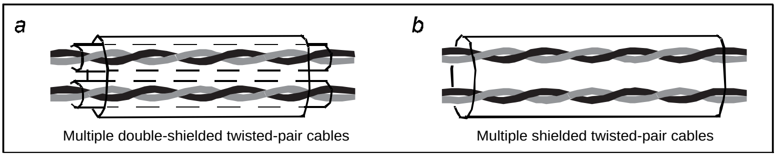
Figure D-1 Cross-section of the cable



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.

A relay cable needs to carry the metal braided shield layer.

The keypad needs to be connected by using a network cable. In complicated electromagnetic environments, a shielded network cable is recommended.

Note: Analog signals and digital signals cannot share a same cable, and their cables must be routed separately.

Do not perform any voltage endurance 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. Insulation and voltage endurance tests have been performed between the main circuit and chassis of each VFD before delivery. In addition, voltage limiting circuits that can automatically cut off the test voltage are configured inside the VFDs.

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

Table D-1 Recommended cable size

VFD model	Recommended cable size (mm²)		Fixing screw	
	R, S, T U, V, W,	**PE**	**Terminal screw**	**Fastening torque (Nm)**
GD350-004G/5R5P-45-AS	3×1.5/3×2.5	1.5/2.5	M4	1.2
GD350-004G/5R5P-45-NS				
GD350-5R5G/7R5P-45-AS	3×2.5/3×4	2.5/4		
GD350-5R5G/7R5P-45-NS				
GD350-7R5G/011P-45-AS	3×4/3×6	4/6	M5	2.3
GD350-7R5G/011P-45-NS				
GD350-011G/015P-45-AS	3×6/3×10	6/10		
GD350-011G/015P-45-NS				
GD350-015G/018P-45-AS	3×10/3×10	10/10		
GD350-015G/018P-45-NS				
GD350-018G/022P-45-AS	3×10/3×16	10/16		
GD350-018G/022P-45-NS				
GD350-022G/030P-45-AS	3×16/3×16	16/16	M6	2.5
GD350-022G/030P-45-NS				
GD350-030G/037P-45-AS	3×16/3×25	16/16		
GD350-030G/037P-45-NS				
GD350-037G/045P-45-AS	3×25/3×35	16/16		
GD350-037G/045P-45-NS				
GD350-045G/055P-45-AS	3×35/3×50	16/25	M8	10
GD350-045G/055P-45-NS				
GD350-045G/055P-45-AS-B				
GD350-045G/055P-45-NS-B				
GD350-055G/075P-45-AS	3×50/3×70	25/35		
GD350-055G/075P-45-NS				
GD350-055G/075P-45-AS-B				
GD350-055G/075P-45-NS-B				
GD350-075G/090P-45-AS	3×70/3×95	35/50	M12	35
GD350-075G/090P-45-NS				
GD350-075G/090P-45-AS-B				

VFD model	Recommended cable size (mm^2)		Fixing screw	
	R, S, T U, V, W,	PE	Terminal screw	Fastening torque (Nm)
GD350-075G/090P-45-NS-B				
GD350-090G/110P-45-AS	3×95/3×120	50/70		
GD350-090G/110P-45-NS				
GD350-090G/110P-45-AS-B				
GD350-090G/110P-45-NS-B				
GD350-110G-45-AS	3×120	70		
GD350-110G-45-NS				
GD350-110G-45-AS-B				
GD350-110G-45-NS-B				

Note:

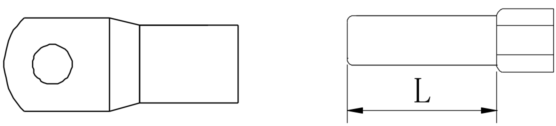
- The numbers on the left and right of "/" indicate the recommended device parameters for G and P models respectively.
- The cables recommended for the main circuit can be used in scenarios where the ambient temperature is lower than 40°C, the wiring distance is shorter than 100m, and the current is the rated current.
- The terminals PB, (+), and (-) are used to connect to braking accessories.

Table D-2 Recommended terminal model

VFD model	Recommended copper tube terminal					
	R, S, T	Terminal screw	U, V, W	Terminal screw	PE	Terminal screw
GD350-004G/5R5P-45-AS	DBN1.25-14/ DBN2-14	/	GTNR1.25-4/ GTNR2.5-4	M4	GTNR1.25-4/ GTNR1.25-4	M4
GD350-004G/5R5P-45-NS						
GD350-5R5G/7R5P-45-AS	DBN2-14/ DBN5.5-14		GTNR2.5-4/ GTNR4-4		GTNR2.5-4/ GTNR4-4	
GD350-5R5G/7R5P-45-NS						
GD350-7R5G/011P-45-AS	DBN5.5-14/ DBN5.5-14	/	GTNR4-4/ GTNR6-4	M6	GTNR4-4/ GTNR6-4	M4
GD350-7R5G/011P-45-NS						
GD350-011G/015P-45-AS	DBN5.5-14/ DBN8-14		GTNR6-4/ GTNR10-4		GTNR6-4/ GTNR10-4	
GD350-011G/015P-45-NS						
GD350-015G/018P-45-AS	DBN8-14/ DBN8-14		GTNR10-4/ GTNR10-4		GTNR10-4/ GTNR10-4	
GD350-015G/018P-45-NS						
GD350-018G/022P-45-AS	DBN8-14/ DBN14-16	/	GTNR10-5/ GTNR16-5	M6	GTNR10-5/ GTNR16-5	M5
GD350-018G/022P-45-NS						

VFD model	Recommended copper tube terminal					
	R, S, T	Terminal screw	U, V, W	Terminal screw	PE	Terminal screw
GD350-022G/030P-45-AS GD350-022G/030P-45-NS	DBN14-16/ DBN14-16	/	GTNR16-5/ GTNR16-5	M6	GTNR16-5/ GTNR16-5	M5
GD350-030G/037P-45-AS GD350-030G/037P-45-NS	DBN14-16/ DBN22-16		GTNR16-5/ GTNR25-5		GTNR16-5/ GTNR16-5	
GD350-037G/045P-45-AS GD350-037G/045P-45-NS	DBN22-16/ DBN38-16		GTNR25-5/ GTNR35-5		GTNR16-5/ GTNR16-5	
GD350-045G/055P-45-AS GD350-045G/055P-45-NS	GTNR35-8/ GTNR50-8	M8	GTNR35-8/ GTNR50-8	M8	GTNR16-8/ GTNR25-8	M6
GD350-045G/055P-45-AS-B GD350-045G/055P-45-NS-B	GTNR35-8/ GTNR50-8		GTNR35-8/ GTNR50-8		GTNR16-8/ GTNR25-8	
GD350-055G/075P-45-AS GD350-055G/075P-45-NS	GTNR50-8/ GTNR70-8		GTNR50-8/ GTNR70-8		GTNR25-8/ GTNR35-8	
GD350-055G/075P-45-AS-B GD350-055G/075P-45-NS-B	GTNR50-8/ GTNR70-8		GTNR50-8/ GTNR70-8		GTNR25-8/ GTNR35-8	
GD350-075G/090P-45-AS GD350-075G/090P-45-NS	GTNR70-12/ GTNR95-12	M12	GTNR70-12/ GTNR95-12	M12	GTNR35-8/ GTNR50-8	M8
GD350-075G/090P-45-AS-B GD350-075G/090P-45-NS-B	GTNR70-12/ GTNR95-12		GTNR70-12/ GTNR95-12		GTNR35-8/ GTNR50-8	
GD350-090G/110P-45-AS GD350-090G/110P-45-NS	GTNR95-12/ GTNR120-12		GTNR95-12/ GTNR120-12		GTNR50-8/ GTNR70-8	
GD350-090G/110P-45-AS-B GD350-090G/110P-45-NS-B	GTNR95-12/ GTNR120-12		GTNR95-12/ GTNR120-12		GTNR50-8/ GTNR70-8	
GD350-110G-45-AS GD350-110G-45-NS	GTNR120-12		GTNR120-12		GTNR70-8	
GD350-110G-45-AS-B GD350-110G-45-NS-B	GTNR120-12		GTNR120-12		GTNR70-8	

Figure D-3 Terminal drawing



GTNR series terminal DBN series terminal

DBN1.25-14	DBN2-14	DBN5.5-14	DBN8-14	DBN14-16	DBN22-16	DBN38-16

L=14mm	L=16mm

Table D-3 Recommended terminal model and torque

VFD model	R, S, T		U, V, W		PE	
	Terminal screw	Fastening torque (Nm)	Terminal screw	Fastening torque (Nm)	Terminal screw	Fastening torque (Nm)
GD350-004G/5R5P-45-AS GD350-004G/5R5P-45-NS GD350-5R5G/7R5P-45-AS GD350-5R5G/7R5P-45-NS	/	0.8	M4	1.2	M4	1.2
GD350-7R5G/011P-45-AS GD350-7R5G/011P-45-NS GD350-011G/015P-45-AS GD350-011G/015P-45-NS GD350-015G/018P-45-AS GD350-015G/018P-45-NS	/	2.0	M6	2.0	M4	1.2
GD350-018G/022P-45-AS GD350-018G/022P-45-NS GD350-022G/030P-45-AS GD350-022G/030P-45-NS	/	2.0	M6	2.0	M5	2.5
GD350-030G/037P-45-AS GD350-030G/037P-45-NS GD350-037G/045P-45-AS GD350-037G/045P-45-NS	/	6.0	M6	2.0	M5	2.5
GD350-045G/055P-45-AS GD350-045G/055P-45-NS GD350-045G/055P-45-AS-B GD350-045G/055P-45-NS-B GD350-055G/075P-45-AS GD350-055G/075P-45-NS GD350-055G/075P-45-AS-B GD350-055G/075P-45-NS-B	M8	4.0	M8	4.0	M6	4.0
GD350-075G/090P-45-AS GD350-075G/090P-45-NS GD350-075G/090P-45-AS-B GD350-075G/090P-45-NS-B GD350-090G/110P-45-AS GD350-090G/110P-45-NS	M12	35	M12	35	M8	10

VFD model	R, S, T		U, V, W		PE	
	Terminal screw	Fastening torque (Nm)	Terminal screw	Fastening torque (Nm)	Terminal screw	Fastening torque (Nm)
GD350-090G/110P-45-AS-B						
GD350-090G/110P-45-NS-B						
GD350-110G-45-AS						
GD350-110G-45-NS						
GD350-110G-45-AS-B						
GD350-110G-45-NS-B						

D.4.3 Cable arrangement

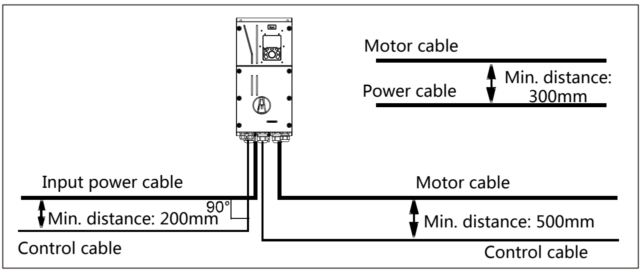
Motor cables must be arranged away from other cables. The motor cables of several VFDs can be arranged in parallel. It is recommended that you arrange the motor cables, input power cables, and control cables separately in different trays. The output dU/dt of the VFDs may increase electromagnetic interference on other cables. Do not arrange other cables and the motor cables in parallel.

If a control cable and power cable must cross each other, ensure that the angle between them is 90 degrees.

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-4 Cable routing distance



D.4.4 Insulation inspection

Check the motor and the insulation conditions of the motor cable before running the motor.

1. Ensure that the motor cable is connected to the motor, and then remove the motor cable from the U, V, and W output terminals of the VFD.
2. Use a megohmmeter of 500V DC to measure the insulation resistance between each phase conductor and the protection grounding conductor. For details about the insulation

resistance of the motor, see the description provided by the manufacturer.

Note: If the inside of motor is moist, the insulation resistance is reduced. 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-4 Fuse, breaker, and contactor model selection

VFD model	Breaker rated current (A)	Fast-acting fuse rated current (A)	Contactor rated current AC-3 (A)
GD350-004G/5R5P-45-AS	25	32	16
GD350-004G/5R5P-45-NS			
GD350-5R5G/7R5P-45-AS	32	40	26
GD350-5R5G/7R5P-45-NS			
GD350-7R5G/011P-45-AS	40	50	26
GD350-7R5G/011P-45-NS			
GD350-011G/015P-45-AS	50	63	38
GD350-011G/015P-45-NS			
GD350-015G/018P-45-AS	63	80	40
GD350-015G/018P-45-NS			
GD350-018G/022P-45-AS	63	80	50
GD350-018G/022P-45-NS			
GD350-022G/030P-45-AS	80	100	63
GD350-022G/030P-45-NS			
GD350-030G/037P-45-AS	100	125	75
GD350-030G/037P-45-NS			
GD350-037G/045P-45-AS	125	160	95
GD350-037G/045P-45-NS			
GD350-045G/055P-45-AS	160	200	110
GD350-045G/055P-45-NS			
GD350-045G/055P-45-AS-B			
GD350-045G/055P-45-NS-B			
GD350-055G/075P-45-AS	160	200	145
GD350-055G/075P-45-NS			

VFD model	Breaker rated current (A)	Fast-acting fuse rated current (A)	Contactor rated current AC-3 (A)
GD350-055G/075P-45-AS-B			
GD350-055G/075P-45-NS-B			
GD350-075G/090P-45-AS	200	250	145
GD350-075G/090P-45-NS			
GD350-075G/090P-45-AS-B			
GD350-075G/090P-45-NS-B			
GD350-090G/110P-45-AS	250	315	185
GD350-090G/110P-45-NS			
GD350-090G/110P-45-AS-B			
GD350-090G/110P-45-NS-B			
GD350-110G-45-AS	315	355	210
GD350-110G-45-NS			
GD350-110G-45-AS-B			
GD350-110G-45-NS-B			

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-5 Output filter selection for motor cable lengths

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

Table D-6 Reactor model selection

VFD power	Input reactors	Output reactors
4kW	GDL-ACL0014-4CU	GDL-OCL0010-4CU
5.5kW	GDL-ACL0020-4CU	GDL-OCL0014-4CU

VFD power	Input reactors	Output reactors
7.5kW	GDL-ACL0025-4CU	GDL-OCL0020-4CU
11kW	GDL-ACL0035-4AL	GDL-OCL0025-4CU
15kW	GDL-ACL0040-4AL	GDL-OCL0035-4AL
18.5kW	GDL-ACL0051-4AL	GDL-OCL0040-4AL
22kW	GDL-ACL0051-4AL	GDL-OCL0050-4AL
30kW	GDL-ACL0070-4AL	GDL-OCL0060-4AL
37kW	GDL-ACL0090-4AL	GDL-OCL0075-4AL
45kW	GDL-ACL0110-4AL	GDL-OCL0092-4AL
55kW	GDL-ACL0150-4AL	GDL-OCL0115-4AL
75kW	GDL-ACL0150-4AL	GDL-OCL0150-4AL
90kW	GDL-ACL0220-4AL	GDL-OCL0220-4AL
110kW	GDL-ACL0220-4AL	GDL-OCL0220-4AL

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 describes external accessories. You need to specify the ones you choose when purchasing accessories.

Table D-7 Filter model selection

VFD power	Input filter	Output filter	
	Passive harmonic filters	dv/dt decrement filters	Sine-wave filter
4kW	GDL-H0014-4AL	GDL-DUL0010-4CU	GDL-OSF0010-4AL
5.5kW	GDL-H0020-4AL	GDL-DUL0014-4CU	GDL-OSF0014-4AL
7.5kW	GDL-H0025-4AL	GDL-DUL0020-4CU	GDL-OSF0020-4AL
11kW	GDL-H0032-4AL	GDL-DUL0025-4CU	GDL-OSF0025-4AL
15kW	GDL-H0040-4AL	GDL-DUL0032-4CU	GDL-OSF0032-4AL
18.5kW	GDL-H0047-4AL	GDL-DUL0040-4AL	GDL-OSF0040-4AL
22kW	GDL-H0056-4AL	GDL-DUL0045-4AL	GDL-OSF0045-4AL
30kW	GDL-H0070-4AL	GDL-DUL0060-4AL	GDL-OSF0060-4AL
37kW	GDL-H0080-4AL	GDL-DUL0075-4AL	GDL-OSF0075-4AL
45kW	GDL-H0100-4AL	GDL-DUL0100-4AL	GDL-OSF0095-4AL
55kW	GDL-H0130-4AL	GDL-DUL0120-4AL	GDL-OSF0120-4AL
75kW	GDL-H0160-4A	GDL-DUL0150-4AL	GDL-OSF0150-4AL
90kW	GDL-H0190-4AL	GDL-DUL0180-4AL	GDL-OSF0180-4AL
110kW	GDL-H0225-4AL	GDL-DUL0220-4AL	GDL-OSF0220-4AL

Note:

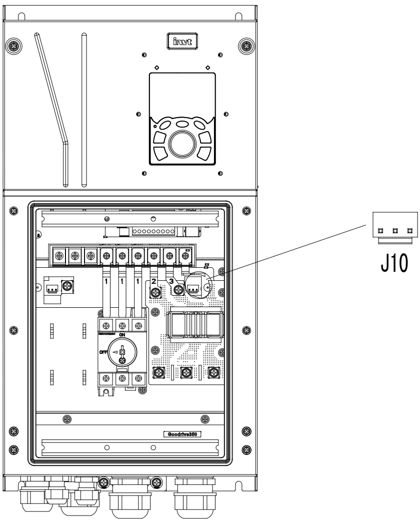
- The preceding table describes external accessories. You need to specify the ones you choose when purchasing accessories.
- For the selection of accessories with different material requirements than those listed above, please refer to the low-voltage VFD GDL series filter option brochure.

D.7 EMC filter

The product is shipped with J10 jumper pre-installed.

Note: Disconnect J10 in 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.



Note: Do not connect C3 filters in IT power systems.

Figure D-5 Filter model

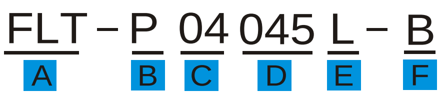


Table D-8 Model description

Field identifier	Description
A	FLT: EMC filter series

Field identifier	Description
B	EMC filter type P: Power input filter L: Output filter
C	Voltage class 04: AC 3PH 380V (-15%)–440V (+10%)
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: First environment (IEC61800-3), category C1 (EN 61800-3) B: First environment (IEC61800-3), category C2 (EN 61800-3) C: Second environment (IEC61800-3), category C3 (EN 61800-3)

Table D-9 EMC filter model selection

VFD model	Input filter	Output filter
GD350-004G/5R5P-45-AS	FLT-P04016L-B	FLT-L04016L-B
GD350-004G/5R5P-45-NS		
GD350-5R5G/7R5P-45-AS		
GD350-5R5G/7R5P-45-NS		
GD350-7R5G/011P-45-AS	FLT-P04032L-B	FLT-L04032L-B
GD350-7R5G/011P-45-NS		
GD350-011G/015P-45-AS		
GD350-011G/015P-45-NS		
GD350-015G/018P-45-AS	FLT-P04045L-B	FLT-L04045L-B
GD350-015G/018P-45-NS		
GD350-018G/022P-45-AS		
GD350-018G/022P-45-NS		
GD350-022G/030P-45-AS	FLT-P04065L-B	FLT-L04065L-B
GD350-022G/030P-45-NS		
GD350-030G/037P-45-AS		
GD350-030G/037P-45-NS		
GD350-037G/045P-45-AS	FLT-P04100L-B	FLT-L04100L-B
GD350-037G/045P-45-NS		
GD350-045G/055P-45-AS		
GD350-045G/055P-45-NS		
GD350-045G/055P-45-AS-B		
GD350-045G/055P-45-NS-B		

VFD model	Input filter	Output filter
GD350-055G/075P-45-AS	FLT-P04150L-B	FLT-L04150L-B
GD350-055G/075P-45-NS		
GD350-055G/075P-45-AS-B		
GD350-055G/075P-45-NS-B		
GD350-075G/090P-45-AS		
GD350-075G/090P-45-NS		
GD350-075G/090P-45-AS-B		
GD350-075G/090P-45-NS-B		
GD350-090G/110P-45-AS	FLT-P04240L-B	FLT-L04240L-B
GD350-090G/110P-45-NS		
GD350-090G/110P-45-AS-B		
GD350-090G/110P-45-NS-B		
GD350-110G-45-AS		
GD350-110G-45-NS		
GD350-110G-45-AS-B		
GD350-110G-45-NS-B		

Note:

- The input EMI meets the C2 requirements after an EMC 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 037G/045P and lower models are equipped with built-in braking units, and the 045G/055P–110G models can be configured with optional built-in braking units. Select braking resistors according to the specific requirements (such as the braking torque and braking usage) on site.

Table D-10 Braking unit model

VFD model	Braking unit model	Resistance applicable for 100% braking torque (Ω)	Braking resistor dissipation power (kW)			Min. allowed braking resistance (Ω)
			10% braking ratio	50% braking ratio	80% braking ratio	
GD350-004G/5R5P-45-AS	Built-in braking unit	122	0.6	3	4.8	80
GD350-004G/5R5P-45-NS						
GD350-5R5G/7R5P-45-AS		89	0.75	4.1	6.6	60
GD350-5R5G/7R5P-45-NS						
GD350-7R5G/011P-45-AS		65	1.1	5.6	9	47
GD350-7R5G/011P-45-NS						
GD350-011G/015P-45-AS		44	1.7	8.3	13.2	31
GD350-011G/015P-45-NS						
GD350-015G/018P-45-AS		32	2	11	18	23
GD350-015G/018P-45-NS						
GD350-018G/022P-45-AS		27	3	14	22	19
GD350-018G/022P-45-NS						
GD350-022G/030P-45-AS		22	3	17	26	17
GD350-022G/030P-45-NS						
GD350-030G/037P-45-AS		17	5	23	36	17
GD350-030G/037P-45-NS						
GD350-037G/045P-45-AS		13	6	28	44	11.7
GD350-037G/045P-45-NS						
GD350-045G/055P-45-AS	DBU100H-110-4	10	7	34	54	6.4
GD350-045G/055P-45-NS						
GD350-045G/055P-45-AS-B						
GD350-045G/055P-45-NS-B						
GD350-055G/075P-45-AS		8	8	41	66	

<table>
<tr><th rowspan="2">VFD model</th><th rowspan="2">Braking unit model</th><th rowspan="2">Resistance applicable for 100% braking torque (Ω)</th><th colspan="3">Braking resistor dissipation power (kW)</th><th rowspan="2">Min. allowed braking resistance (Ω)</th></tr>
<tr><th>10% braking ratio</th><th>50% braking ratio</th><th>80% braking ratio</th></tr>
<tr><td>GD350-055G/075P-45-NS</td><td rowspan="7"></td><td rowspan="3"></td><td rowspan="3"></td><td rowspan="3"></td><td rowspan="3"></td><td rowspan="7"></td></tr>
<tr><td>GD350-055G/075P-45-AS-B</td></tr>
<tr><td>GD350-055G/075P-45-NS-B</td></tr>
<tr><td>GD350-075G/090P-45-AS</td><td rowspan="4">6.5</td><td rowspan="4">11</td><td rowspan="4">56</td><td rowspan="4">90</td></tr>
<tr><td>GD350-075G/090P-45-NS</td></tr>
<tr><td>GD350-075G/090P-45-AS-B</td></tr>
<tr><td>GD350-075G/090P-45-NS-B</td></tr>
<tr><td>GD350-090G/110P-45-AS</td><td rowspan="8">DBU100H-160-4</td><td rowspan="4">5.4</td><td rowspan="4">14</td><td rowspan="4">68</td><td rowspan="4">108</td><td rowspan="8">4.4</td></tr>
<tr><td>GD350-090G/110P-45-NS</td></tr>
<tr><td>GD350-090G/110P-45-AS-B</td></tr>
<tr><td>GD350-090G/110P-45-NS-B</td></tr>
<tr><td>GD350-110G-45-AS</td><td rowspan="4">4.5</td><td rowspan="4">17</td><td rowspan="4">83</td><td rowspan="4">132</td></tr>
<tr><td>GD350-110G-45-NS</td></tr>
<tr><td>GD350-110G-45-AS-B</td></tr>
<tr><td>GD350-110G-45-NS-B</td></tr>
</table>

Note:

- Select braking resistors according to the resistance and power data provided by INVT.
- The braking resistor may increase the braking torque of the VFD. The above table describes the resistance and power for 100% braking torque, 10% braking ratio, 50% braking ratio and 80% braking ratio. You can select the braking system based on the actual operation conditions.
- When using an external braking unit, set the brake voltage class of the braking unit properly by referring to the manual of the DBU100H dynamic braking unit. If the voltage class is set incorrectly, the VFD may not run properly.

	Do not use braking resistors whose resistance is lower than the specified minimum resistance. The VFD does not provide protection against overcurrent caused by resistors with low resistance.
	In scenarios where braking is frequently implemented, that is, the braking usage is greater than 10%, you need to select a braking resistor with higher power as required by the operation conditions according to the preceding table.

D.8.2 Braking resistor cable selection

Braking resistor cables should be shielded cables.

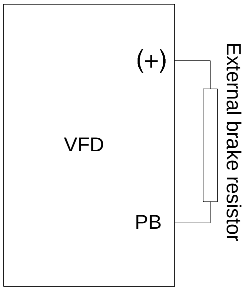
D.8.3 Braking resistor installation

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

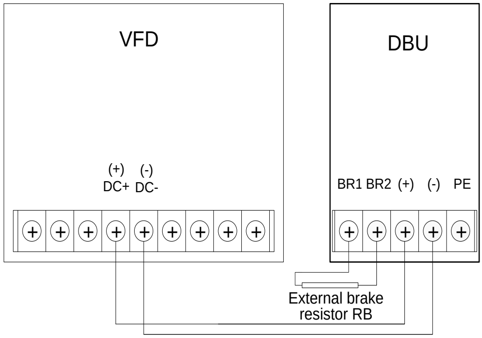
	● The 037G/045P and lower VFD models need only internal braking resistors. ● PB and (+) are the terminals for connecting braking resistors.



Braking unit installation

	● (+) and (-)are the terminals for connecting braking units. ● The connection cable length between the (+) and (-) terminals of the VFD and those of a braking unit must be shorter than 5 m, and the connection cable length between the BR1 and BR2 terminals of a braking unit and the terminals of a braking resistor must be shorter than 10 m.

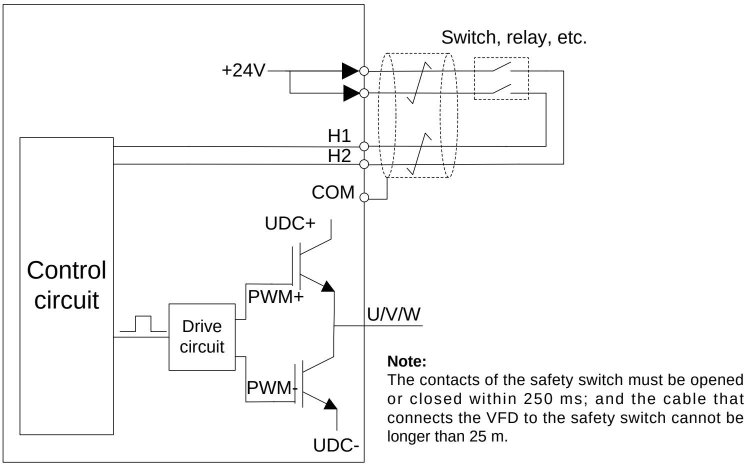
Single unit connection:


VFD
(+)
DC+
(-)
DC-
DBU
BR1
BR2
(+)
(-)
PE
External brake
resistor RB

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.



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	STL1, STL2, or STL3 fault occurred. Fault code: 41: Channel H1 exception (STL1) 42: Channel H2 exception (STL2) 43: Exception to both channel H1 and H2 (STL3)

E.2 STO channel delay description

The following table describes the trigger and indication delay of the STO channels.

STO mode	STO trigger delay[1] and indication delay[2]
STO fault: STL1	Trigger delay < 10ms Indication delay < 280ms
STO fault: STL2	Trigger delay < 10ms Indication delay < 280ms
STO fault: STL3	Trigger delay < 10ms Indication delay < 280ms
STO fault: STO	Trigger delay < 10ms Indication delay < 100ms

1: STO trigger delay: time interval between trigger the STO function and switching off the drive output

2: STO instruction delay: Time interval between trigger the STO function and STO output state indication

E.3 STO function installation checklist

Before installing the STO, check the items described in the following table to ensure that the STO function can be properly used.

	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 to 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 (for details, see section 5.5.19 Fault handling). 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**.

E-mail:overseas@invt.com.cn Website:www.invt.com

The products are owned by **Shenzhen INVT Electric Co.,Ltd.**
Two companies are commissioned to manufacture: (For product code, refer to the 2nd/3rd place of S/N on the name plate.)

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■New Energy Vehicle Motor

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