Operation Manual

Goodrive290 Series
Low-Voltage Multifunction General-Purpose VFD

SHENZHEN INVT ELECTRIC CO., LTD.

No.	Change description	Version	Changed on
1	First release.	V1.0	May 2025

Preface

Thank you for choosing Goodrive290 series variable-frequency drive (VFD).

Goodrive290 series VFD is a low-voltage, general-purpose drive that integrates advanced control technology, robust industrial design, and flexible expandability, making it an ideal solution for industrial automation applications. It is suitable for constant-torque and variable-torque load equipment in industries such as municipal engineering, chemical processing, HVAC, textiles, food and beverage, and packaging.

Goodrive290 series VFD adopts advanced vector control technology to provide precise control of asynchronous motors, ensuring stable operation under complex working conditions and meeting demanding industrial requirements. It features an independent air duct for efficient heat dissipation and a thickened conformal coating on the circuit board for enhanced dust and moisture protection, ensuring reliable performance in harsh environments such as high temperature and humidity. The optimized circuit design offers excellent electromagnetic compatibility (EMC), enabling stable operation in complex electromagnetic conditions. The VFD supports multiple industrial communication protocols, including CAN and PROFINET, for easy integration into PLC, DCS, and other industrial control systems, enhancing system compatibility and intelligence. Its high power density design results in a more compact size for convenient cabinet integration. The optimized system design also helps reduce customer investment costs.

This manual provides detailed information on product specifications, installation guidelines, basic operation guidelines, communication configuration, and maintenance. 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.

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.

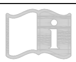
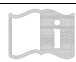
Warning: Personal injury or equipment damage can result if related requirements are not followed.

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

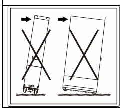
Warnings caution you about conditions that can result in severe injury or death and/or equipment damage and advice on how to prevent dangers. The following table lists the warning symbols in this manual.

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 discharge	The PCBA may be damaged if related requirements are not followed.	
 Hot sides	Hot sides	Do not touch. The VFD base may become hot.	
	Electric shock	As high voltage may still be present in the DC bus capacitors after power-off, to prevent electric shock, please wait at least 5 minutes (or 15/25 minutes, depending on the warning label on the machine) before performing any operation.	
	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 rowspan="3">380V</td><td>0.75kW–110kW</td><td>5 minutes</td></tr>
<tr><td>132kW–315kW</td><td>15 minutes</td></tr>
<tr><td>355kW and higher</td><td>25 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

	✧ Do not install the VFD on inflammables. In addition, prevent the VFD from contacting or adhering to inflammables. ✧ 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.
	✧ Do not push the VFD sidewards during moving. ✧ Prevent the VFD from tipping sidewards.

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.

✧ When the altitude exceeds 1000m, derate by 1% for every increase of 100m.

✧ Use the VFD in proper environments. (For details, see section 4.2.1 Installation environment.)

✧ Prevent the screws, cables and other conductive parts from falling into the VFD.

✧ As leakage current of the VFD during running may exceed 3.5mA, ground properly and ensure the grounding resistance is less than 10Ω. The conductivity of PE grounding conductor is the same as that of the phase conductor (with the same cross sectional area).

✧ R, S and T are the power input terminals, 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 control terminals form extra-low voltage (ELV) circuits. Therefore, you need to prevent the control terminals from connecting to accessible terminals of other devices when there is no isolation protection mechanism configured. ✧ The VFD may start up by itself when P01.21 is set to 1 (restart after power off). Do not get close to the VFD and motor. ✧ The VFD cannot be used as an "Emergency-stop device". ✧ The VFD cannot act as an emergency brake for the motor; it is a must to install a mechanical braking device.

Note:

✧ Do not switch on or switch off the input power supplies of the VFD frequently.

✧ If the VFD has been stored without use for a long time, perform capacitor reforming (described in chapter 8 Maintenance), inspection and pilot run for the VFD before the reuse.

✧ Close the VFD front cover before running; otherwise, electric shock may occur.

1.4.3 Maintenance 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 exceeded, derate 1% for every increase of 1°C. Do not use the VFD when the ambient temperature exceeds 50°C. **Note:** When the VFD is built in a cabinet, the ambient temperature is the temperature of air in the cabinet.
2.	Whether the actual ambient temperature is lower than -10°C. When the temperature is lower than -10°C, use heating devices. **Note:** When the VFD is built in a cabinet, the ambient temperature is the temperature of air in the cabinet.

3.	Whether the altitude of the application site exceeds 1000m. When exceeded, derate 1% for every increase of 100m.
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 input reactor, input filter, output reactor, output filter, and DC reactor).
3.	Whether the product is installed on non-flammable materials and the heat-radiating accessories (such as reactors) 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.

3 Product overview

3.1 What this chapter contains

This chapter mainly introduces the working principles, product features, layouts, nameplates and model designation rules.

3.2 Basic principles

The VFD can be used to control both asynchronous AC induction motors. The following figure shows the main circuit diagram of the VFD. The rectifier converts 3PH AC voltage into DC voltage, the capacitor bank of intermediate circuit stabilizes the DC voltage, and then the inverter converts DC voltage into AC voltage that can be used by an AC motor.

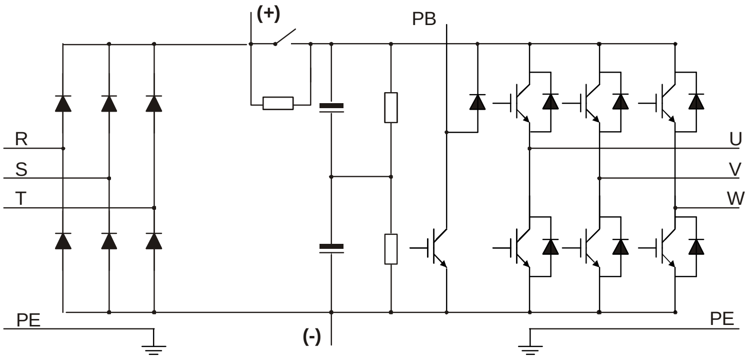


Figure 3-1 Main circuit for VFDs in T1–T8 frames

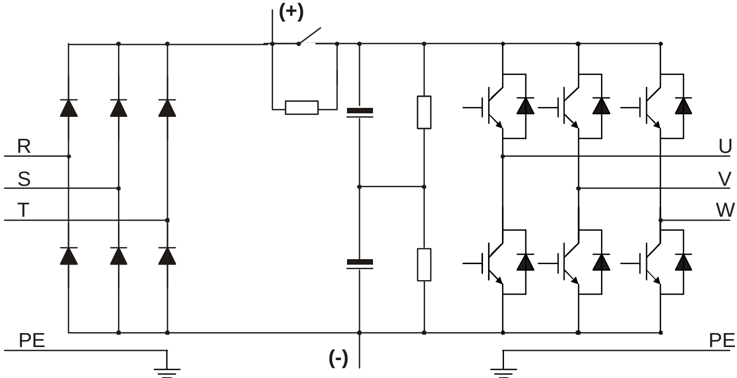


Figure 3-2 Main circuit for VFDs in T9–T11 frames

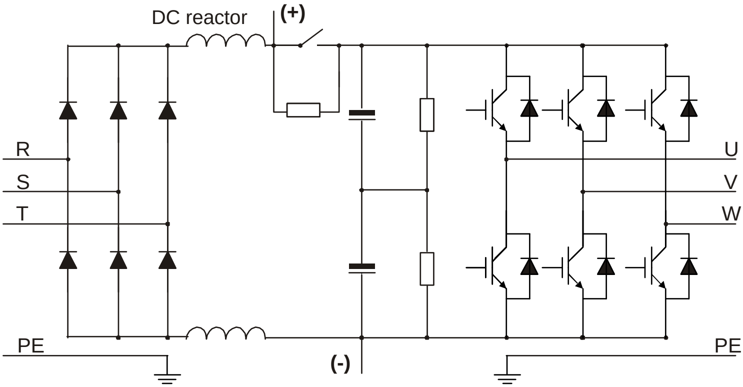


Figure 3-3 Main circuit for VFDs in T12 frame (embedded with DC reactor)

Note: The built-in DC reactor is standard only for VFDs in T12 frame.

3.3 Product specifications

Function		Specifications
Power input	Input voltage (V)	AC 3PH 380–480V, rated voltage: 380V
	Allowed voltage transient fluctuation	-15%–+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
	Output current (A)	See section 3.6 Product ratings.
	Output power (kW)	See section 3.6 Product ratings.
	Output frequency (Hz)	0–400Hz
Technical control performance	Control mode	Space voltage vector control, and sensorless vector control (SVC)
	Motor type	Asynchronous motor (AM)
	Speed ratio	For asynchronous motors (AMs): 1: 200 (SVC)
	Speed control accuracy	±0.2% (SVC)
	Speed fluctuation	±0.3% (SVC)
	Torque response	<20ms (SVC)
	Torque control accuracy	±10% (SVC)
	Overload capacity	For the G type, 150% of rated current for 1 minute and 180% for 10 seconds For the P type, 110% of rated current for 1 minute and overload allowed once every 5 minutes

Function		Specifications
Running control performance	Frequency setting method	Settings can be implemented through digital, analog, pulse frequency, multi-step speed run, simple PLC, PID, and communication. Settings can be combined and the setting channels can be switched.
	Automatic voltage regulation	The output voltage can be kept constant although the grid voltage changes.
	Fault protection	Various protection functions, such as protection against overcurrent, overvoltage, undervoltage, overtemperature, phase loss, and overload.
	Speed tracking restart function	Enables smooth startup of a rotating motor.
Peripheral interface	Terminal analog input resolution	No more than 20mV
	Terminal digital input resolution	No more than 2ms
	Analog input	Two inputs. AI1: 0(2)–10V / 0(4)–20mA; AI2: -10–+10V
	Analog output	Two outputs. AO0/AO1: 0(2)–10V/0(4)–20mA
	Digital input	Five regular inputs. Max. frequency: 1kHz; internal impedance: 3.3kΩ One high-speed input. Max. frequency: 50kHz
	Digital output	One Y terminal open collector output, sharing the terminal with S4. The function can be selected through a jumper.
	Relay output	Two programmable relay outputs RO1A: NO; RO1B: NC; RO1C: common RO2A: NO; RO2B: NC; RO2C: common Contact capacity: 3A/AC 250V, 1A/DC 30V
	Expansion interfaces	Two expansion interfaces, SLOT1 and SLOT2, supporting communication cards, I/O cards, and so on
Other	Mounting method	Supports wall mounting, floor mounting, and flange mounting.
	Temperature of running environment	-10–+50°C. Derating required above 40°C. For details, see section B.2.2.1 Derating due to temperature.
	Ingress protection (IP) rating	VFDs in T1–T9 frames: IP20 VFDs in T10–T12 frames: IP00
	Pollution degree	Degree 2
	Cooling method	0R7G/1R5P: Natural ratings Other models: Forced air cooling

3.4 Product nameplate

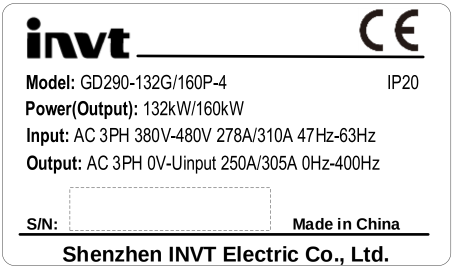


Figure 3-4 Product nameplate

Note: This is an example of standard product nameplate. The marking such as "CE" or "IP20" on the nameplate is marked according to actual certification conditions.

3.5 Model designation code

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

GD290-132G/160P-4

① ② ③

Figure 3-5 Model description

Field	Symbol	Field description	Example
Product series abbreviation	①	Product series abbreviation	GD290: Goodrive290 series low-voltage multifunction general-purpose VFD
Rated power	②	Rated power + Load type	Rated power: 132: 132kW 160: 160kW Load type: G: Constant torque load P: Variable torque load
Voltage class	③	Voltage class	4: AC 3PH 380V–480V, rated voltage: 380V

Note:

- ✧ Braking unit: VFDs in T1–T5 frames are equipped with a built-in braking unit as standard; VFDs in T6–T8 frames support the use of an optional built-in braking unit, indicated by the suffix "-B" in the product model, for example, GD290-037G-4-B.
- ✧ DC reactor configuration: 400P–500P and 315G–400G are equipped with a built-in DC reactor as standard.
- ✧ G/P design explanation: For 132G/160P and lower, G- and P-types are integrated; for the higher, they are separate.

3.6 Product ratings

Table 3-1 Ratings for AC 3PH 380V models

Frame	VFD model	Power (kW)	Input current (A)	Rated output current (A)
T1	GD290-0R7G/1R5P-4	0.75/1.5	3.5/5	2.5/3.7
	GD290-1R5G/2R2P-4	1.5/2.2	4.5/6	3.7/5
	GD290-2R2G/003P-4	2.2/3	6/10.5	5/6.8
	GD290-003G/004P-4	3/4	10.5/15	6.8/9.5
T2	GD290-004G/5R5P-4	4/5.5	15/20	9.5/13
	GD290-5R5G/7R5P-4	5.5/7.5	20/27	14/17
T3	GD290-7R5G/011P-4	7.5/11	27/35	18.5/25
	GD290-011G/015P-4	11/15	35/44	25/32
T4	GD290-015G/018P-4	15/18.5	38/46	32/38
	GD290-018G/022P-4	18.5/22	46/54	38/45
T5	GD290-022G/030P-4	22/30	54/75	45/60
	GD290-030G/037P-4	30/37	72/90	57/75
T6	GD290-037G/045P-4(-B)	37/45	90/108	75/92
T7	GD290-045G/055P-4(-B)	45/55	108/142	92/115
	GD290-055G/075P-4(-B)	55/75	142/177	115/150
	GD290-075G/090P-4(-B)	75/90	177/200	150/180
T8	GD290-090G/110P-4(-B)	90/110	200/240	180/215
	GD290-110G/132P-4(-B)	110/132	220/278	205/250
T9	GD290-132G/160P-4	132/160	278/310	250/305
	GD290-160G-4	160	310	305
	GD290-185P-4	185	335	330
	GD290-200P-4	200	385	380
T10	GD290-185G-4	185	345	340
	GD290-200G-4	200	370	365
	GD290-220P-4	220	430	425
	GD290-250P-4	250	465	460
T11	GD290-220G-4	220	430	425
	GD290-250G-4	250	485	480
	GD290-280G-4	280	530	520
	GD290-280P-4	280	540	530
	GD290-315P-4	315	605	600
	GD290-355P-4	355	655	650

Frame	VFD model	Power (kW)	Input current (A)	Rated output current (A)
T12	GD290-315G-4	315	605	600
	GD290-355G-4	355	655	650
	GD290-400G-4	400	660	720
	GD290-400P-4	400	660	720
	GD290-450P-4	450	745	820
	GD290-500P-4	500	800	860

Note:

✧ The rated output current is the output current when the output voltage is 380V.

✧ The data in the "Input current" column is measured at an input voltage of 380V.

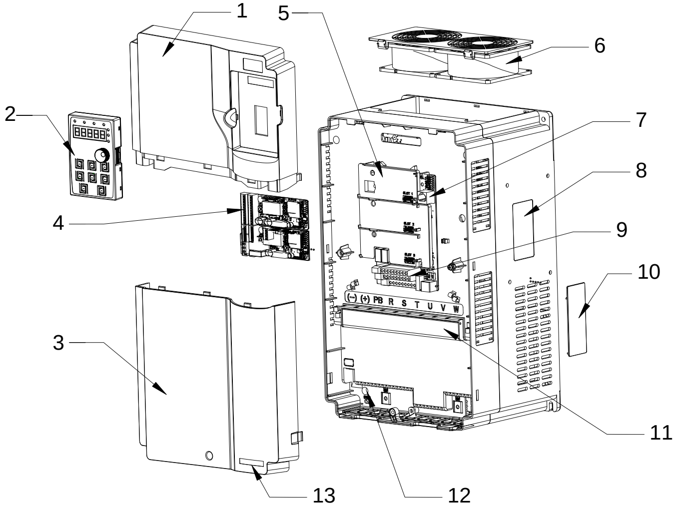
3.7 Product heat dissipation

VFD model	Entire machine full load power dissipation (W)	Heat dissipation (BTU/hr)	Air volume (m^3/h)	Air volume (ft^3/min(CFM))
GD290-0R7G/1R5P-4	42	143	/	/
GD290-1R5G/2R2P-4	54	184	35	21
GD290-2R2G/003P-4	81	291	52	30
GD290-003G/004P-4	118	403		
GD290-004G/5R5P-4	166	566	64	38
GD290-5R5G/7R5P-4	208	710		
GD290-7R5G/011P-4	303	1034	103	61
GD290-011G/015P-4	369	1259		
GD290-015G/018P-4	443	1513	116	68
GD290-018G/022P-4	497	1696		
GD290-022G/030P-4	768	2620	141	83
GD290-030G/037P-4	960	3276		
GD290-037G/045P-4 (-B)	1050	3583	291	171
GD290-045G/055P-4 (-B)	1837	6268	502	295
GD290-055G/075P-4 (-B)	2400	8189		
GD290-075G/090P-4 (-B)	2880	9827		
GD290-090G/110P-4 (-B)	2490	8496	669	394
GD290-110G/132P-4 (-B)	2780	9485		
GD290-132G/160P-4	2648	9035	1117	657
GD290-160G-4	3121	9762	1364	802

VFD model	Entire machine full load power dissipation (W)	Heat dissipation (BTU/hr)	Air volume (m^3/h)	Air volume (ft^3/min(CFM))
GD290-185P-4	2898	9888	1117	657
GD290-200P-4	3453	11782	1364	802
GD290-185G-4	2963	11135	1330	783
GD290-200G-4	3752	12751		
GD290-220P-4	3911	13344		
GD290-250P-4	4393	14989		
GD290-220G-4	4053	14156	2158	1269
GD290-250G-4	4612	15078		
GD290-280G-4	5312	18124		
GD290-280P-4	5136	17524		
GD290-315P-4	5814	19837		
GD290-355P-4	6299	21492		
GD290-315G-4	5797	18614	2006	1180
GD290-355G-4	6419	22789		
GD290-400G-4	6976	23802		
GD290-400P-4	6976	23802		
GD290-450P-4	7946	27112		
GD290-500P-4	8333	28432		

3.8 Product structure

The VFD structure is shown in the following figure (taking 380V 037G/045P for example).



No.	Name	Description
1	Upper cover	Protects internal components and parts.
2	Keypad	See section 5.2 Operation procedure.
3	Lower cover	Protects internal components and parts.
4	Expansion card	Optional. For details, see Appendix A Expansion card.
5	Baffle of control board	Protects the control board and install extension card.
6	Cooling fan	See chapter 8 Maintenance.
7	Keypad interface	Connects the keypad.
8	Nameplate	See chapter 3 Product overview.
9	Control terminals	See chapter 4 Installation guidelines.
10	Ventilation cover	Optional. Cover plate can upgrade protection level, however, as it will also increase internal temperature, derated use is required.
11	Main circuit terminals	See chapter 4 Installation guidelines.
12	POWER indicator	Power supply indicator
13	GD290 product series label	See section 3.5 Model designation code.

4 Installation guidelines

4.1 What this chapter contains

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

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

4.2 Mechanical installation

4.2.1 Installation environment

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

Environment	Condition
Installation site	Indoor
Ambient temperature	✧ -10–+50°C. ✧ When the ambient temperature exceeds 40°C, derate 1% for every increase of 1°C. ✧ It is not recommended to use the VFD when the ambient temperature exceeds 50°C. ✧ To improve reliability, do not use the VFD in the places where the temperature changes rapidly. ✧ When the VFD is used in a closed space, such as control cabinet, use a cooling fan or air conditioner for cooling, preventing the internal temperature from exceeding the temperature required. ✧ 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
Relative humidity (RH)	✧ RH: less than 90%. ✧ Condensation is not allowed. ✧ The max. RH cannot exceed 60% in the environment where there are corrosive gases.
Storage temperature	-30–+60°C
Running environment	Install the VFD in a place: ✧ Away from electromagnetic radiation sources ✧ Away from oil mist, corrosive gases, and combustible gases ✧ Without the chance for foreign objects such as metal powder, dust, oil and water to fall into the VFD (do not install the VFD onto combustible objects such as wood) ✧ Without radioactive substances or combustible objects ✧ Without hazard gases or liquids ✧ With low salt content ✧ Without direct sunlight
Altitude	✧ Lower than 1000m ✧ When the altitude exceeds 1000m, derate by 1% for every increase of 100m.
Vibration	The max. vibration acceleration cannot exceed 5.8m^2 (0.6g).
Installation direction	Install the VFD vertically to ensure good heat dissipation performance.

4.2.2 Installation method

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.

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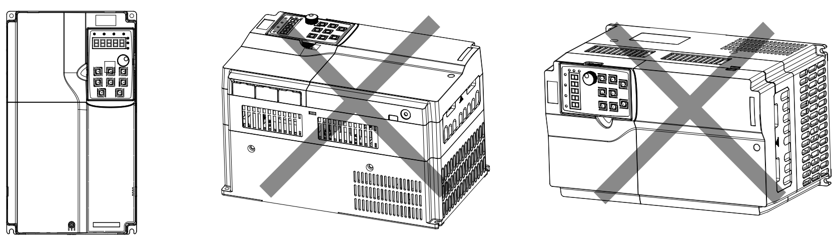
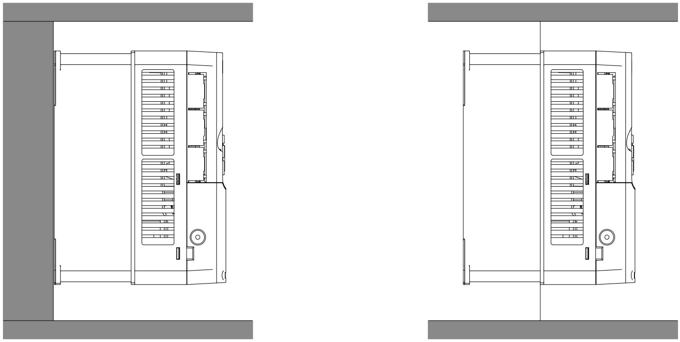


Vertical installation b. Horizontal installation c. Lateral installation

Figure 4-1 VFD installation direction

According to the frame size of the VFD, the installation method can be:

- Wall mounting: applicable to VFDs in T1–T10 frames
- Flange mounting: applicable to VFDs in T1–T9 frames
- Floor mounting: applicable to VFDs in T10–T12 frames



Wall mounting Flange mounting

Figure 4-2 Installation method

The installation procedure is as follows:

Step 1 Mark the installation hole positions. For details about the installation hole positions, see Appendix C Dimension drawings.

Step 2 Mount the screws or bolts into the marked positions.

Step 3 Lean the VFD against the wall.

Step 4 Tighten the fastening screws on the wall.

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

4.2.3 Cabinet design

4.2.3.1 Cabinet design for VFDs in T1–T9 frames

- **Space requirements inside the cabinet**

For VFDs in T1–T9 frames, multi-layer installation is recommended. The minimum clearance required between layers is listed in the table below. An air baffle must be installed above the lower layer VFD.

Table 4-1 Minimum clearance for multi-layer installation

	T1–T4	**T5–T7**	**T8–T9**
D1	≥100mm	≥200mm	≥300mm
D2	≥100mm	≥200mm	≥300mm
...	≥100mm	≥200mm	≥300mm
Dn	≥100mm	≥200mm	≥300mm
D (Side-by-side installation clearance)	≥30mm	≥50mm	≥100mm

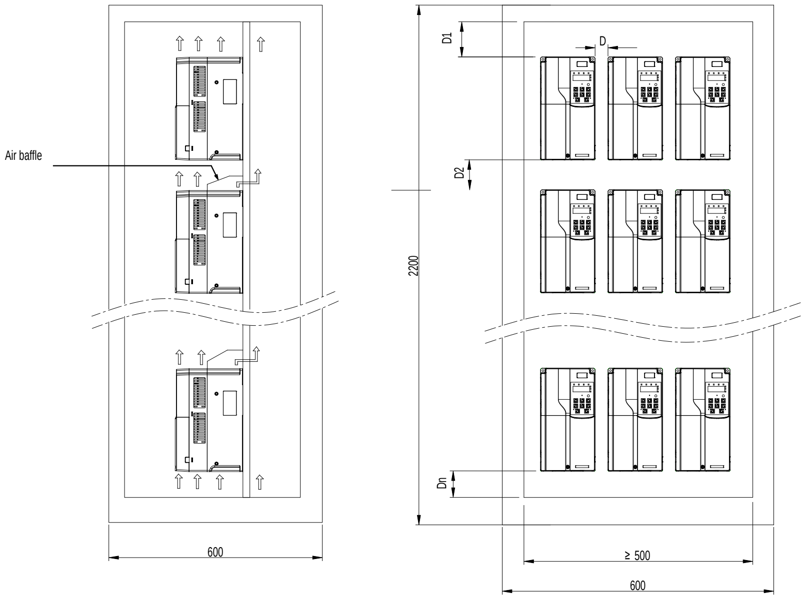


Figure 4-3 Multi-layer installation clearance requirements

■ **Installation backplane requirements**

To ensure that the VFD is installed and operated with good reliability, the following are detailed instructions regarding the thickness and rigidity reinforcement requirements of the backplate.

- ✧ In practical applications, the VFD may generate vibrations and thermal expansion during operation, so the backplate needs to have sufficient rigidity to withstand environmental and working conditions.
- ✧ The thickness of the backplate should be no less than 2mm, which provides the necessary basic rigidity to prevent deformation or damage during equipment operation.
- ✧ The backplate can be reinforced if necessary. It is recommended to weld a transverse reinforcement beam on the back of the backplate (as shown in Figure 4-4). This can significantly improve the load-bearing capacity of the backplate and enhance the overall structural stability.
- ✧ When installing the VFD, ensure that the backplate is securely fastened to the cabinet to minimize vibration transmission.
- ✧ Considering that the VFD generates heat during operation, the backplate should be designed with adequate clearance for heat dissipation to prevent overheating.
- ✧ Regularly inspect the condition of the backplate to ensure it is not deformed or damaged. If any

issues are identified, reinforcement or replacement should be carried out promptly.

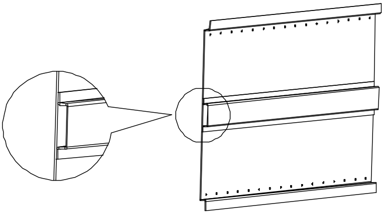


Figure 4-4 Welding a transverse reinforcement beam on the back of the backplane

■ **Heat dissipation description**

The VFD is cooled by a built-in fan (0R7G/1R5P models rely on natural cooling). To ensure sufficient cooling air enters the cabinet, a sufficiently large air inlet should be provided on the cabinet door.

The air inlet on the cabinet door should be positioned at least 50mm below the VFD's air inlet. This is to take advantage of the natural upward flow of cool air, ensuring that cool air can smoothly enter the cabinet.

Pay attention to the airflow direction when installing the fan: the fan should be oriented to extract air from inside the cabinet to the outside. This helps effectively discharge the hot air from within the cabinet, preventing heat buildup that could lead to VFD overheating or damage. The distance between the exhaust top cover and the fan outlet should be at least 200mm; otherwise, the fan's cooling performance may be affected. Ensure unobstructed airflow to prevent air obstruction.

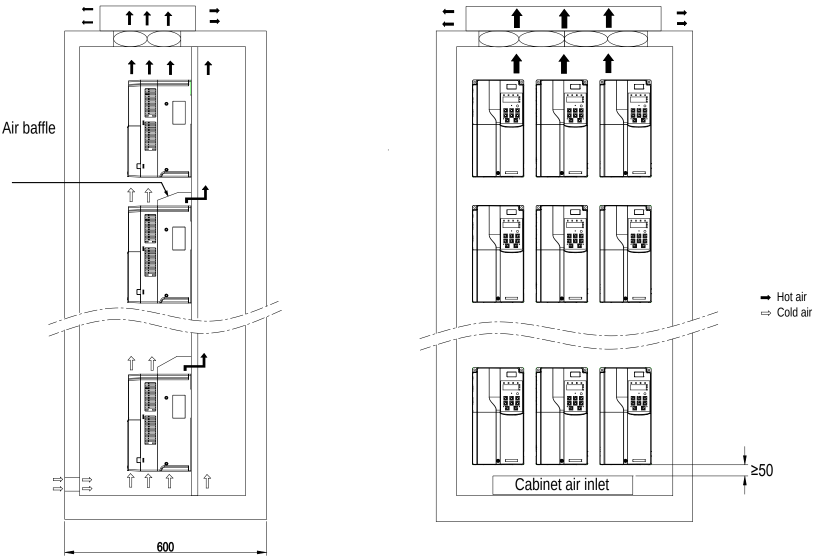


Figure 4-5 Cabinet air inlet cutout location

Note: When multiple devices are installed in a single cabinet, using a fan to blow air into the cabinet from outside through the air inlet may disrupt the airflow distribution among the internal devices, negatively affecting the overall cooling performance. Therefore, fans should not be installed at the air inlet to force air into the cabinet.

After the VFD is installed in the cabinet, refer to Table 4-2 for the minimum effective air inlet area.

The data in Table 4-2 applies to a single VFD only. If multiple VFDs are installed in the cabinet, the total air inlet area should be the sum of each VFD's required minimum air inlet area. For example, if the cabinet contains ten 004G/5R5P units and two 011G/015P units, the minimum effective air inlet area should be $10 \times 44 + 2 \times 58 = 556$ cm².

If a screen is installed at the air inlet, it will introduce additional airflow resistance. In this case, it is recommended to increase the calculated air inlet area by a factor of 1.2 to 1.5. The values provided in Table 4-2 represent the minimum effective air inlet area. If the actual design falls below this value, the cabinet may experience negative pressure, resulting in inadequate airflow through the intended ventilation paths and direction.

1. Passive cooling

Passive cooling utilizes the natural upward flow of hot air to exhaust the heated air from the VFD through the outlet at the top of the cabinet. However, passive ventilation may lead to hot air accumulating in the upper section of the cabinet, raising the temperature in that area. The suction effect of the VFD fan creates a relatively low air pressure near the air inlet, generating a pressure difference between the air inlet and outlet. This pressure difference can cause hot air to circulate within the cabinet, forming a closed airflow loop.

If the hot air continuously recirculates back to the air inlet, the VFD may repeatedly draw in this heated air, significantly increasing the internal temperature — which is clearly detrimental to both performance and service life. Therefore, to improve the performance of a passive ventilation system, barriers must be used to prevent hot air recirculation.

Such barriers can include metal plates or exhaust ducts, as shown in Figure 4-6. By installing an internal partition plate within the cabinet to separate the inlet and outlet areas, the likelihood of hot air recirculation can be effectively reduced. In addition, a dedicated exhaust duct can be installed to guide hot air directly out of the cabinet, further isolating cold and hot airflow for more effective heat dissipation.

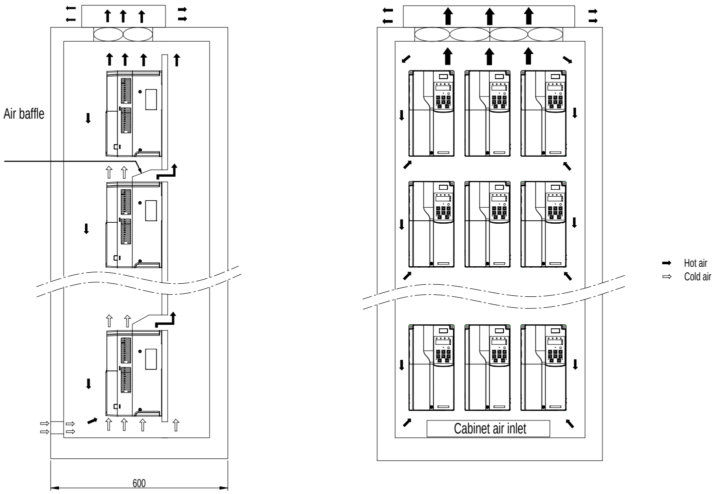


Figure 4-6 Passive ventilation air recirculation in the cabinet (without isolation device)

The temperature at the VFD outlet is higher, and the air density is lower compared to the air inlet. To allow hot air in the cabinet to be properly exhausted outside the cabinet when passive ventilation is used, refer to Table 4-2 for the minimum required effective area for the cabinet outlet.

The data in Table 4-2 applies to a single VFD only. If multiple VFDs are installed in the cabinet, the total air outlet area should be the sum of each VFD's required minimum air outlet area. If a screen is installed at the air outlet, it will introduce additional airflow resistance. In this case, it is recommended to increase the calculated air outlet area by a factor of 1.2 to 1.5.

2. Active cooling

Active cooling involves installing a fan at the top of the cabinet to extract the hot air from inside the cabinet to the outside. Active ventilation is a commonly used ventilation method. To ensure that the hot air inside the cabinet can be effectively exhausted, the total airflow of the system fans must be no less than the combined airflow requirements of all VFDs in the cabinet. The required cooling airflow is shown in the table below.

Table 4-2 Heat dissipation data for VFDs in T1–T9 frames

Frame		**VFD cooling airflow (CFM)**	**Air inlet min. effective area (mm²)**	**Air outlet min. effective area (mm²)**
T1	0R7G/1R5P	Natural heat dissipation	38	32
	1R5G/2R2P	21	38	32
	2R2G/003P	26	38	32
	003G/004P	30	38	32

Frame	VFD cooling airflow (CFM)	Air inlet min. effective area (mm^2)	Air outlet min. effective area (mm^2)
T2	38	52.8	57
T3	61	70	57
T4	68	80	75
T5	83	100	75
T6	171	140	125
T7	295	300	150
T8	394	384	250
T9	657	535	400
Note: 1CFM=1.7m^3/h The min. effective area refers to the actual open-through area of the cabinet's ventilation openings. The actual design should take the opening ratio into account. Calculation formula: Effective area = Opening area × Opening ratio (The recommended opening ratio is 50%–75%.)			

The cabinet fan selection procedure is as follows:

Step 1 Calculate the total required cooling airflow for all VFDs according to the table above.

Step 2 Determine the maximum airflow of the cabinet fan(s), and select the appropriate fan model and quantity.

- In normal conditions, the maximum airflow should be set to 1.3 to 1.5 times the calculated value.
- If components such as mesh screens or louver panels are installed at the cabinet air outlet, which may increase airflow resistance, the maximum airflow should be 1.8 to 2.2 times the calculated value.

Step 3 The selected fan airflow must meet or exceed the required maximum airflow. If a single fan is insufficient, multiple fans can be used.

4.2.3.2 Cabinet design for VFDs in T10–T12 frames

The VFDs in T10–T12 frames can be mounted in cabinets. Heat dissipation must be considered for the cabinet mounting method. Both active cooling and passive cooling solutions can be considered.

1. Passive cooling

When adopting a passive cooling solution, ensure that the air outlet area at the top of the cabinet and the air inlet area of the cabinet exceed the specified minimum values listed in Table 4-3. If components such as mesh screens or louver panels are installed, the air inlet and outlet areas should be increased by a factor of 1.3 to 1.5 to compensate for airflow resistance.

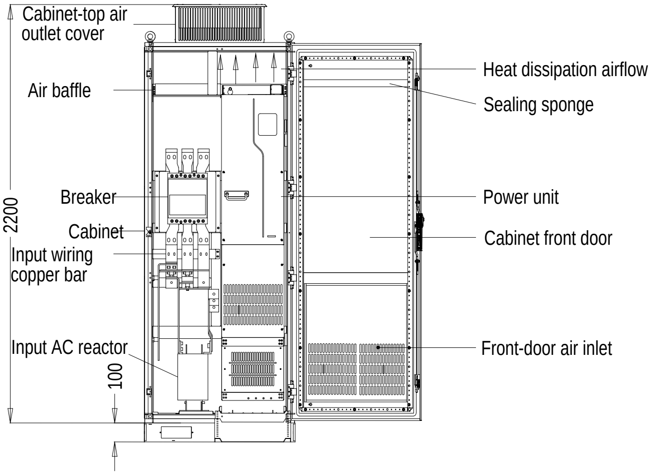


Figure 4-7 Direct exhaust cabinet (without fan at top)

Table 4-3 Passive cooling data for VFDs in T10–T12 frames

Frame	VFD cooling airflow (CFM)	Air inlet min. effective area (mm^2)	Air outlet min. effective area (mm^2)
T10	785	172560	37280
T11	1270	200670	42800
T12	1270	200670	50230
Note: CFM=1.7m^3/h. The effective area refers to the actual open-through area of the cabinet's ventilation openings. The actual design should take the opening ratio into account.			

2. Active cooling

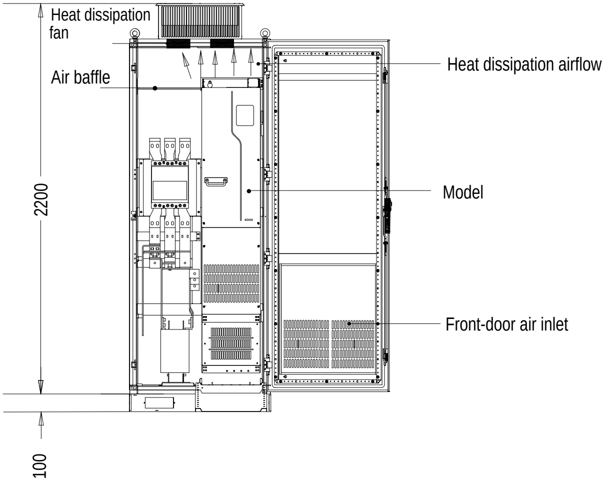


Figure 4-8 Top exhaust cabinet (with fan at top)

Table 4-4 Active cooling data for VFDs in T10–T12 frames

Frame	**VFD cooling airflow (CFM)**	**Air inlet effective area (mm^2)**	**Airflow required (CFM)**	**Top air outlet effective area (mm^2)**
T10	785	172560	864	≥Total ventilation area of selected fan(s)
T11	1270	200670	1400	
T12	1270	200670	1400	
Note: CFM≈1.7m^3/h				

As shown in Figure 4-9, the air duct of VFD must be isolated within the cabinet to prevent the hot air in the VFD outlet from circulating within the cabinet, and the air baffle design for isolation ensures that the hot air is discharged from the cooling holes at the top of cabinet.

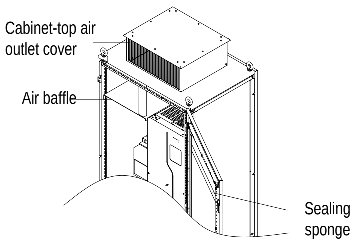


Figure 4-9 Cabinet air baffle

Note: A 40×40 sealing sponge must be used at the position corresponding to the air baffle in the front door panel, which prevents air duct short circuit.

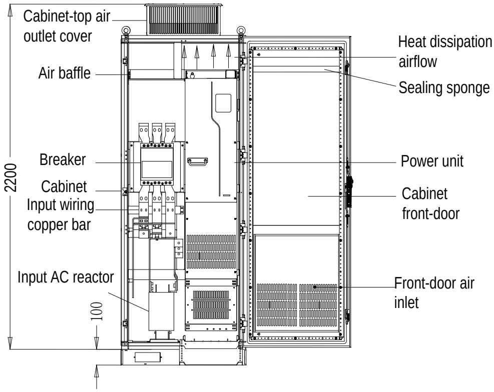


Figure 4-10 Recommended cabinet layout for VFDs in T10–T12 frames

- **In-cabinet mounting procedure**

No.	Description
1	Mount the crossbeam for VFD fixing in the nine-fold profile cabinet. (See Figure 4-11.)
2	Fix the bottom support crossbeams and mounting bracket in the cabinet. (See Figure 4-13.)
3	Assemble the mounting rail (optional part) and mount it in the cabinet.
4	Arrange two people to align the VFD casters with the mounting rail and push the VFD to the cabinet. (See Figure 4-15 and Figure 4-16. Use the auxiliary rope for mounting to prevent the VFD from side tipping during the push-in or push-out, as shown in Figure 4-17.)
5	Remove the auxiliary rope for mounting, and insert screws into the fixing holes at the back, top, and bottom of VFD to fix the VFD to the mounting crossbeam. (See Figure 4-18.)
6	Removed the mounting rail when you ensure the mounting is secure.

1. Fix the mounting crossbeam and reserve fixing holes.

   A. The nine-fold profile cabinet (PS cabinet) is recommended. Figure 4-11 shows the nine-fold profile cross section.

   B. When mounting a VFD in frame T11–T12 into a nine-fold profile cabinet with the depth of 600mm, you must bend the mounting crossbeam inwards (shown in Figure 4-12) to make use of the space of vertical post, which is not necessary for the mounting into a standard cabinet with the depth of 800mm or greater.

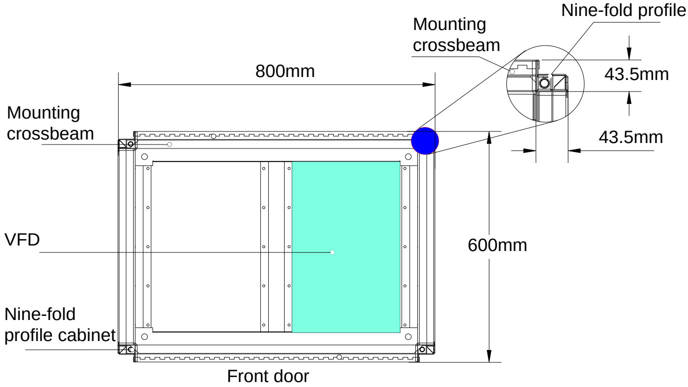


Figure 4-11 Top view of cabinet for VFDs in T11–T12 frames

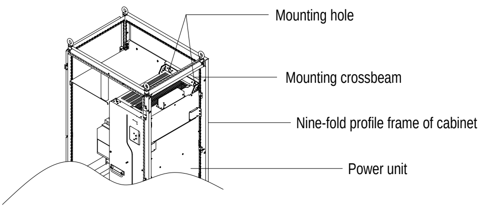


Figure 4-12 3D view of cabinet for VFDs in T11–T12 frames

2. Fix the bottom support crossbeams and mounting bracket. See Figure 4-13.

   A. Use eight M8 cage nuts to fix the two bottom support crossbeams to the base of the nine-fold profile cabinet frame. (The support crossbeams are user designed, T≥2.5mm, firmly installed.)

   B. Fix the mounting bracket to the nine-fold profile cabinet frame base with six M5 self-tapping screws, as shown in Figure 4-13. For details about mounting bracket dimensions, see Figure C-14 and Table C-7.

   C. If you use another type of cabinet but not nine-fold profile cabinet, the fixing holes for the mounting bracket need to be drilled and assembled on site.

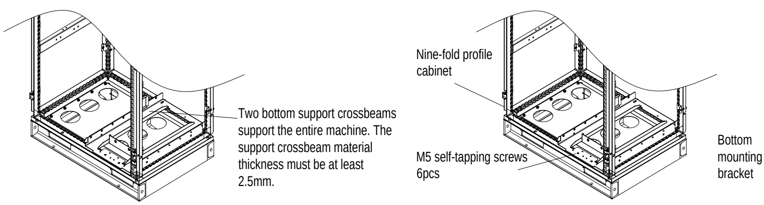


Figure 4-13 Bottom mounting bracket

3. Assemble the mounting rail (optional part).

   Assemble the mounting rail, align the two front hooks with the nine-fold profile notch, and snap them into place.

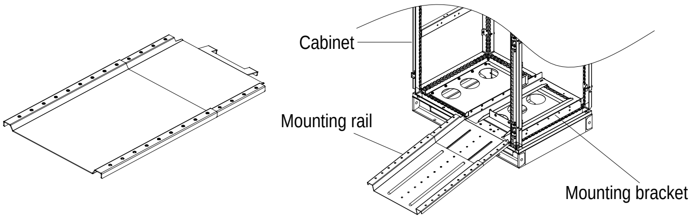


Figure 4-14 Assembling the mounting rail

4. Push the VFD into the cabinet.

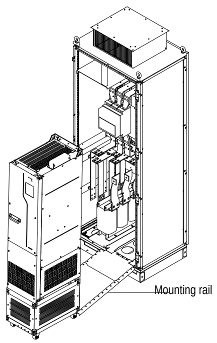


Figure 4-15 Aligning the VFD casters with the mounting rail

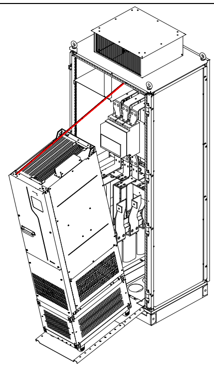


Figure 4-16 Pushing the VFD into the cabinet slowly

Note: Since the VFD barycenter is too high, use the auxiliary rope for mounting to prevent the VFD from rollover during the push-in or push-out. See Figure 4-17.

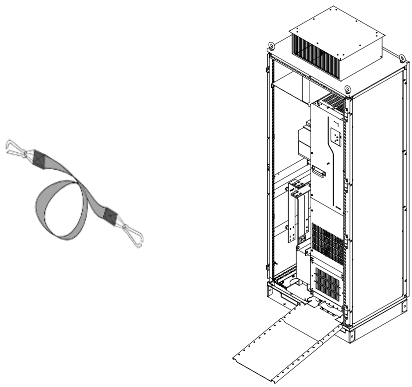


Figure 4-17 VFD already in the cabinet

5. Remove the mounting rail.

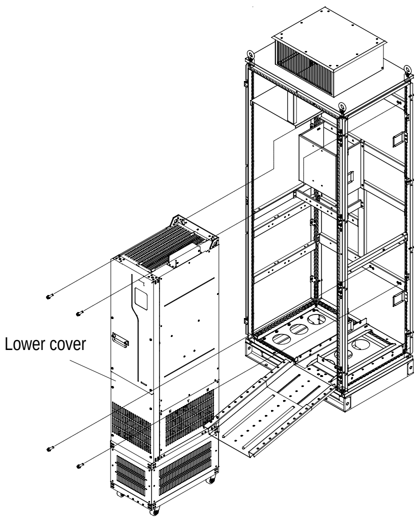
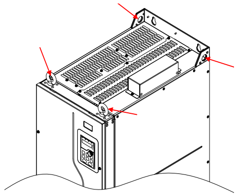


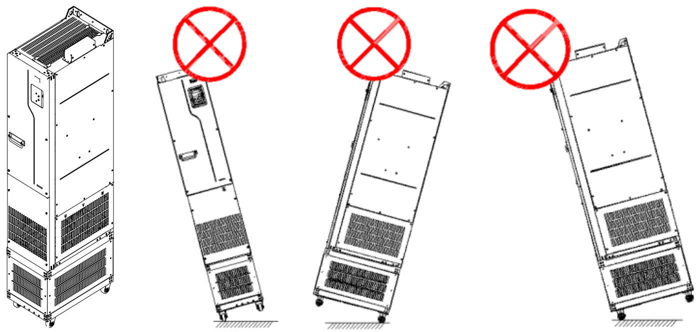
Figure 4-18 Fixing the VFD to the cabinet crossbeam through the four fixing holes at the VFD back

Pay attention to the following:

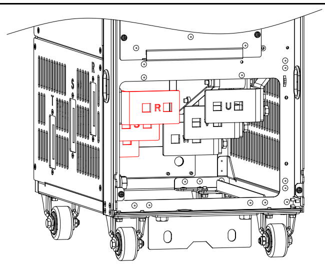
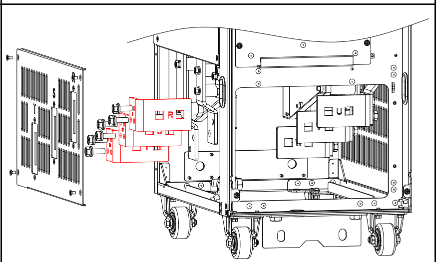
- ✧ Detach the VFD from the cabinet by following the preceding procedure in reverse sequence.
- ✧ When fixing the VFD, ensure that the four mounting holes of VFD have been securely connected to the mounting crossbeam.
- ✧ Use the lifting ring on the top of VFD for lifting and moving. Never apply force to the positive and negative bus terminals.

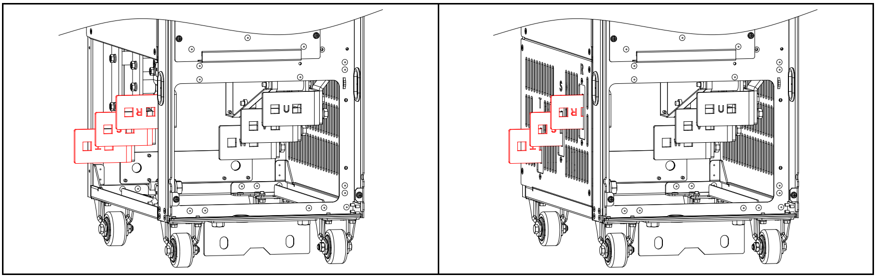


✧ If you need to place the VFD vertically, avoid applying force to VFD sides or placing the VFD on a tilted surface. If the tilted angle is more than 5°, the VFD may suffer rollover since the VFD has a large size and heavy weight (about 200kg).



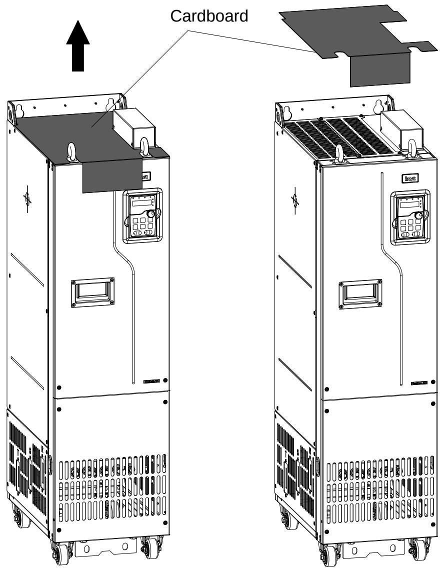
4.2.4 Reversed installation description for input aluminum busbar

1. The aluminum busbar has been installed into the internal of system.	2. Remove the side cover and the input aluminum busbar.
	
3. Reinstall the input aluminum busbar in reverse.	4. Install the side cover.



4.2.5 Top cardboard removal description

For VFDs in T10–T12 frames, keep the cardboard fixed on top of the VFD during installation to prevent conductive foreign objects from falling into the VFD. The cardboard must be removed before powering on and running the VFD after installation is complete. The cardboard location is shown in the figure below.



4.3 Electrical installation

4.3.1 Main circuit wiring

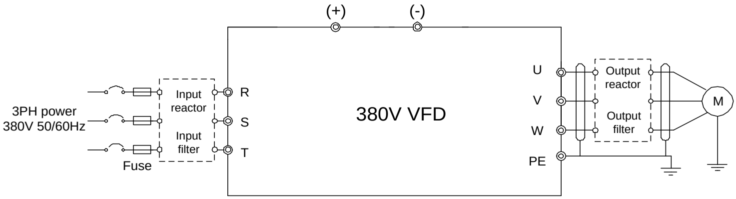


Figure 4-19 AC 3PH 380V main circuit wiring

Note: The fuse, input reactor, input filter, output reactor, and output filter are optional parts. For details, see Appendix D Peripheral accessories.

4.3.1.1 Length requirements of motor cables

When the distance between the VFD and the motor is too long, the large parasitic capacitance to ground produces high harmonic current, which causes the VFD to frequently enable overcurrent protection and even causes motor insulation damage.

You must configure the output reactor nearby the VFD when the cable length is equal to or greater than the values in the following table.

Select the appropriate one based on the cable type and length, with the reference to section D.5 Harmonic filter. Note that the supported motor cable lengths with and without a harmonic filter cannot be added together.

For example, GD290-004G/5R5P-4 supports up to 50m of non-shielded cable without any output filter. When a 1% output reactor is configured (which supports up to 150m of non-shielded cable), the system's maximum cable length is 150m, but not 50 + 150 = 200 m.

Table 4-5 Motor cable length for various output filter configurations (unit: m)

Frame	Max. motor cable length (Without reactor/filter)	Max. motor cable length (With a 1% output reactor)	Max. motor cable length (With a dv/dt filter)	Max. motor cable length (With a sine-wave filter)
Shielded motor cable				
T1–T2	25	100	230	500
T3–T6	50	100	230	500
T7–T12	75	100	230	500
Non-shielded motor cable				
T1–T2	50	150	450	1000
T3–T6	100	150	450	1000
T7–T12	150	150	450	1000

Note:

- ✧ When one VFD drives multiple motors at the same time, you are advised to take the sum of cable lengths of all motors as the total motor cable length.
- ✧ The motor cable lengths provided in the preceding table represent the maximum capability of the VFD. In actual applications, it is recommended to design based on 80% of the motor cable lengths given in the table.

4.3.2 Main circuit terminals

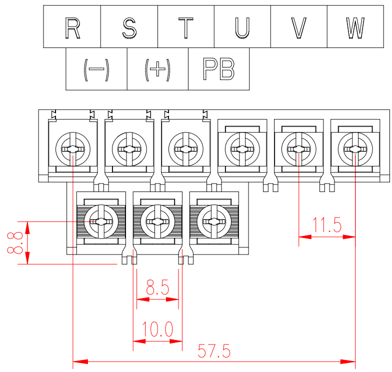


Figure 4-20 Main circuit terminals for VFDs in T1–T2 frames (unit: mm)

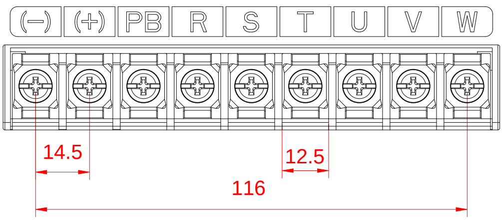


Figure 4-21 Main circuit terminals for VFDs in T3 frame (unit: mm)

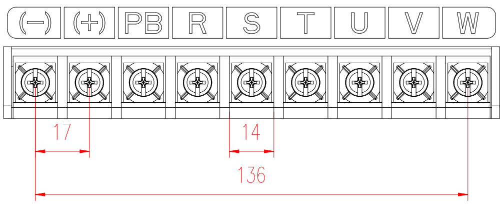


Figure 4-22 Main circuit terminals for VFDs in T4 frame (unit: mm)

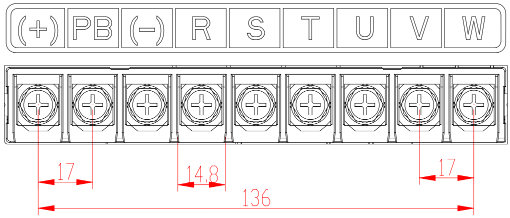


Figure 4-23 Main circuit terminals for VFDs in T5 frame (unit: mm)

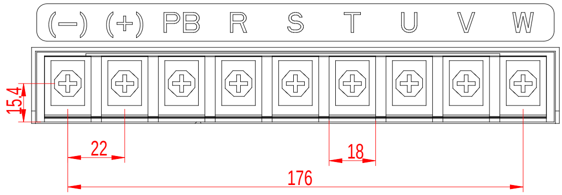


Figure 4-24 Main circuit terminals for VFDs in T6 frame (unit: mm)

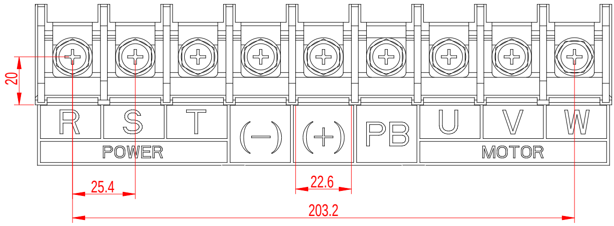


Figure 4-25 Main circuit terminals for VFDs in T7 frame (unit: mm)

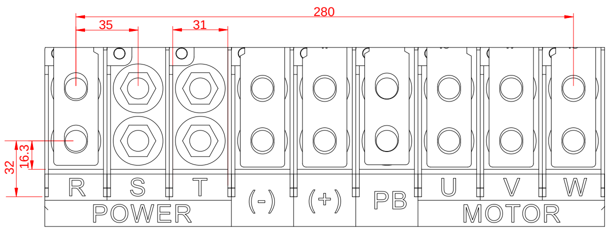


Figure 4-26 Main circuit terminals for VFDs in T8 frame (unit: mm)

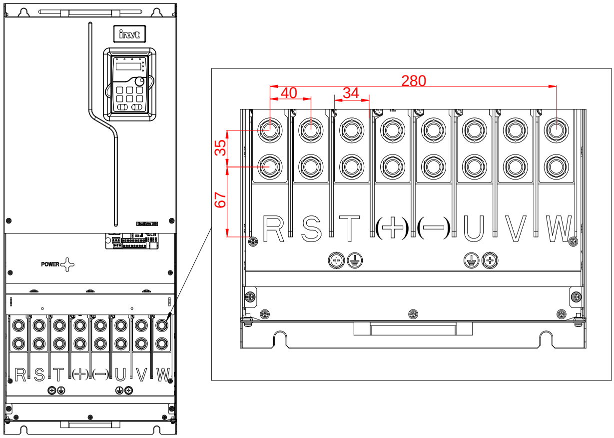


Figure 4-27 Main circuit terminals for VFDs in T9 frame (unit: mm)

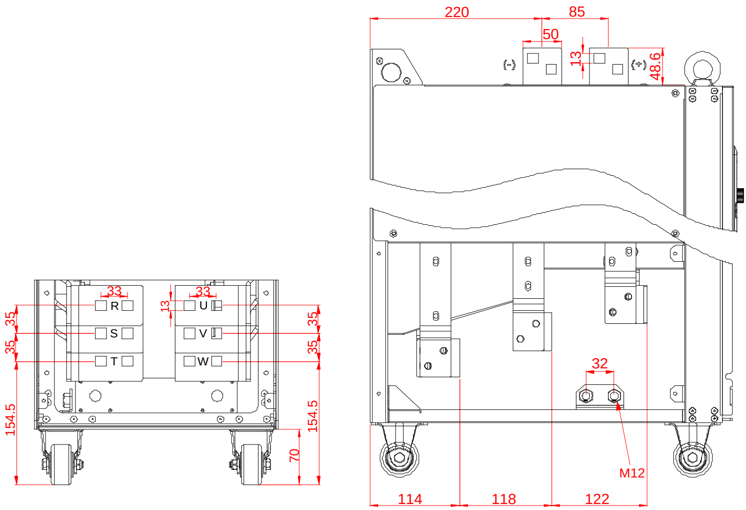


Figure 4-28 Main circuit terminals for VFDs in T10 frame (unit: mm)

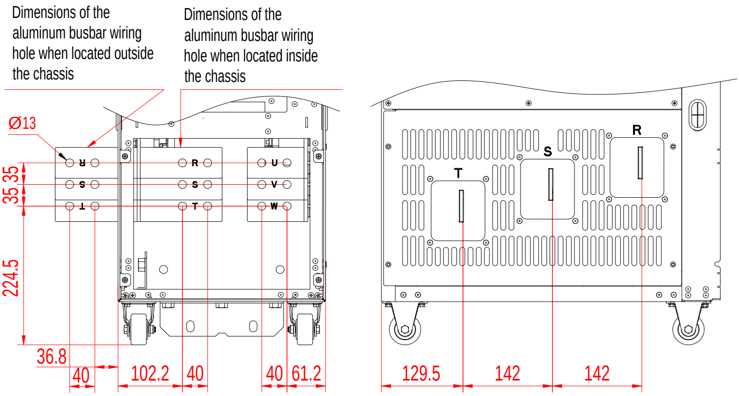


Figure 4-29 Input aluminum busbar mounting method for VFDs in T10 frame

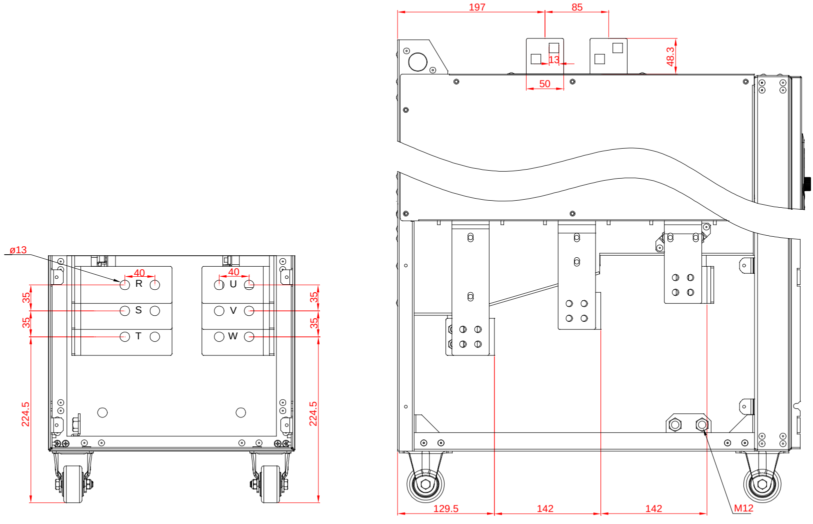


Figure 4-30 Main circuit terminals for VFDs in T11 frame (unit: mm)

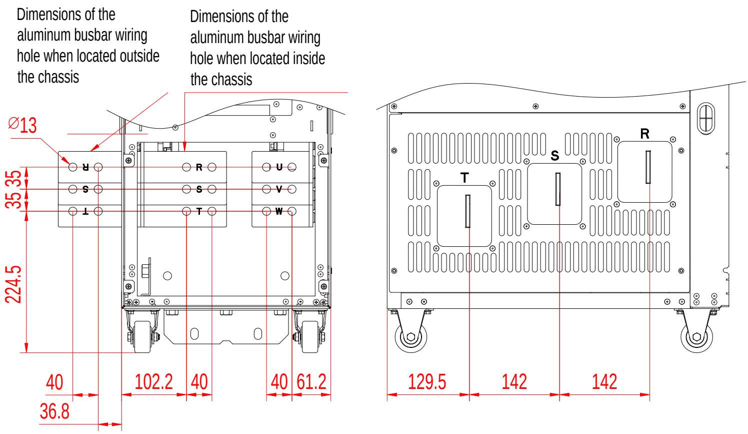


Figure 4-31 Input aluminum busbar mounting method for VFDs in T11 frame

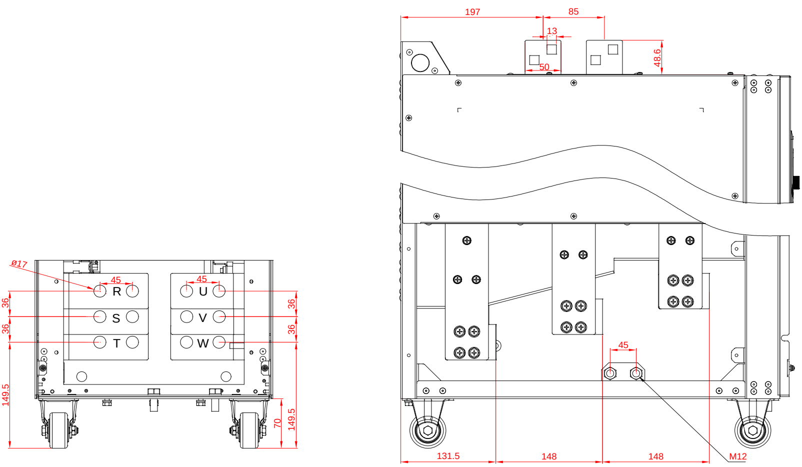


Figure 4-32 Main circuit terminals for VFDs in T12 frame (unit: mm)

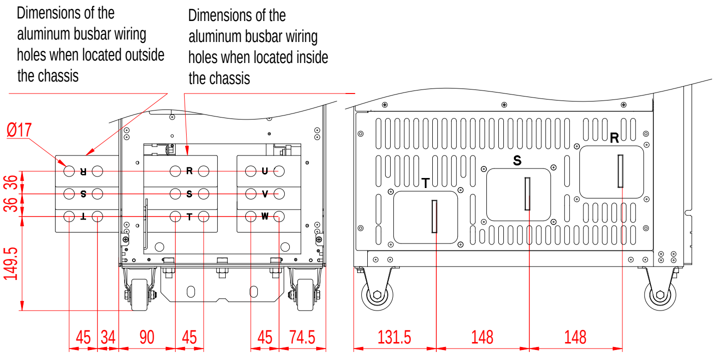


Figure 4-33 Output aluminum busbar mounting method for VFDs in T12 frame

Table 4-6 Terminal description

Terminal symbol	Function
R, S, T	3PH AC input terminals, connected to the grid.
U, V, W	3PH AC output terminals, connected to the motor usually.
(+)	(+) and (-) can share the DC bus or connect to an external DC power supply.
(-)	
PE	Grounding terminal for safe protection; each machine must carry two PE terminals and proper grounding is required.
PB	Connected to the external braking resistor.

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.

✧ Route the motor cable, input power cable and control cable separately.

4.3.3 Wiring procedure for main circuit terminals

1. Connect the grounding line of the input power cable to the grounding terminal (PE) of the VFD, and connect the 3PH input cable to R, S and T terminals and tighten up.
2. Connect the ground wire of the motor cable to the PE terminal of the VFD, connect the motor 3PH cable to the U, V and W terminals, and tighten up.
3. Fasten all the cables outside the VFD mechanically if allowed.

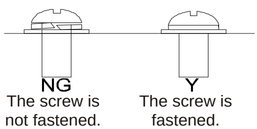


Figure 4-34 Screw installation

4.3.4 Wiring of basic control circuit

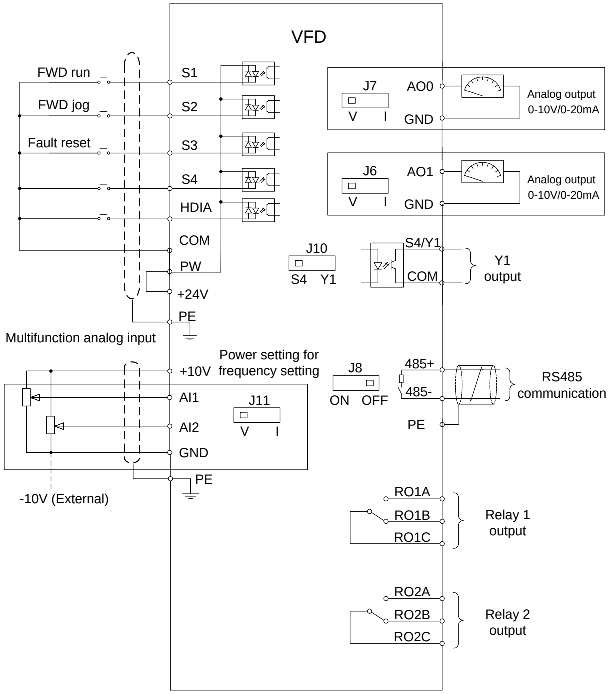


Figure 4-35 Control circuit wiring

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 name	Description
+10V	Locally provided +10.5V power supply
AI1 AI2	Input range: For AI1, 0(2)–10V or 0(4)–20mA For AI2, -10V–+10V Input impedance: 20kΩ for voltage input; 250Ω for current input Whether voltage or current is used for input is set through jumper J11. Resolution: 5mV when 10V corresponds to 50Hz Deviation: ±0.5% at 25°C, when input is above 5V/10mA
GND	+10.5V reference ground
AO0 AO1	Output range: 0(2)–10V or 0(4)–20mA Whether voltage or current is used for output of AO0 and AO1 is set through jumpers

<table>
<tr><th>Terminal name</th><th colspan="2">Description</th></tr>
<tr><td></td><td colspan="2">J7 and J6.
Deviation: ±0.5% when output is 5V 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>COM</td><td colspan="2">+24V reference ground</td></tr>
<tr><td>Y1</td><td colspan="2">Switch capacity: 50mA/30V
Output frequency range: 0–1kHz
Y1 and S4 share the output terminal. The selection is made through J10.</td></tr>
<tr><td>485+</td><td colspan="2" rowspan="2">RS485 communication port, RS485 differential signal port and standard RS485 communication port must use shielded twisted pairs; the 120ohm terminal matching resistor for RS485 communication is connected through jumper J8.</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">User power supply provided by the VFD, 24V(-10%–+15%). Max. output current: 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
S4 and Y1 share the output terminal. The selection is made through jumper J10.</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">In addition to digital input functions, the terminal can also act as a high frequency pulse input channel.
Max. input frequency: 50kHz
Duty ratio: 30%–70%</td></tr>
</table>

4.3.5 Input/output signal connection

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

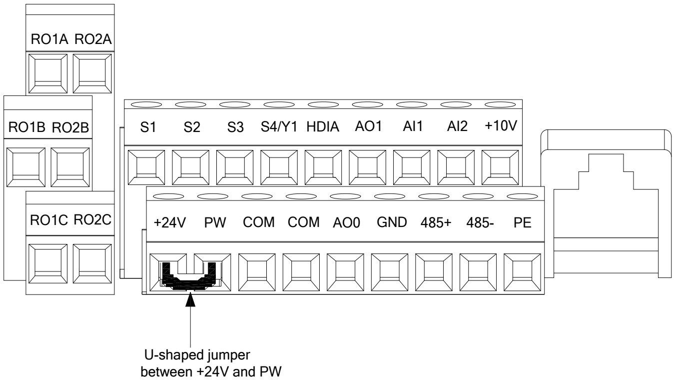


Figure 4-36 U-shaped jumper position for VFDs in T1–T2 frames

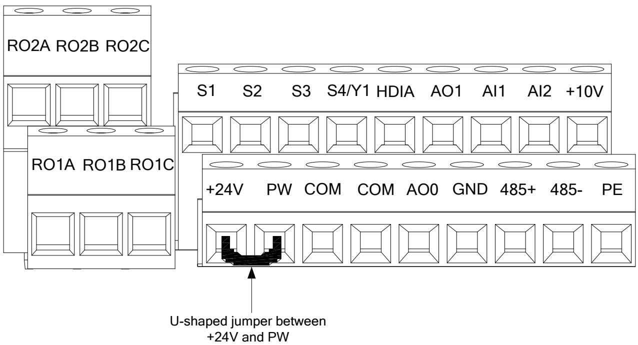


Figure 4-37 U-shaped jumper position for VFDs in T3–T12 frames

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.

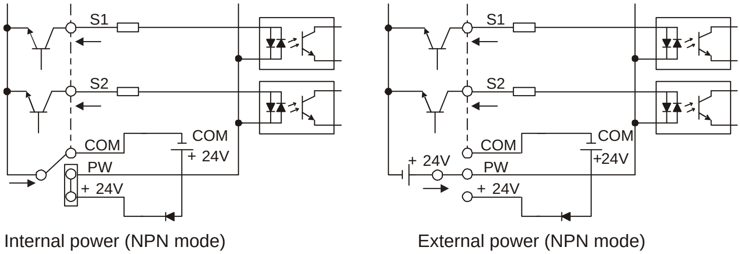


Figure 4-38 NPN mode

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

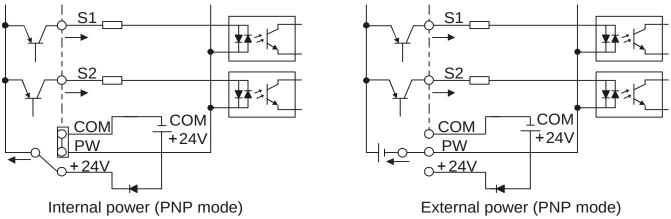


Figure 4-39 PNP mode

4.3.6 External optional keypad wiring

GD290 supports optional LED keypad (BOP-270) and LCD keypad (SOP-290). Note the following when externally connecting an optional keypad:

- ✧ The VFDs in T1–T4 frames use the membrane keypad design, which allows you to connect an external optional LED or LCD keypad to the electrical cabinet through the keypad interface A. With connection to an external keypad, the VFD support display and operation on both the local membrane keypad and external keypad.
- ✧ The VFDs in T5–T12 frames are configured with independent keypads as standard parts. Before delivery, the local keypad of any of these models has been connected to the keypad interface B by default. If you want to move the keypad from the local to the electrical cabinet, to ease wiring, disconnect the default keypad wiring and connect the keypad through the keypad interface A. Keypad interfaces A and B cannot be connected at the same time. Otherwise, the keypad fails to operate or display properly.

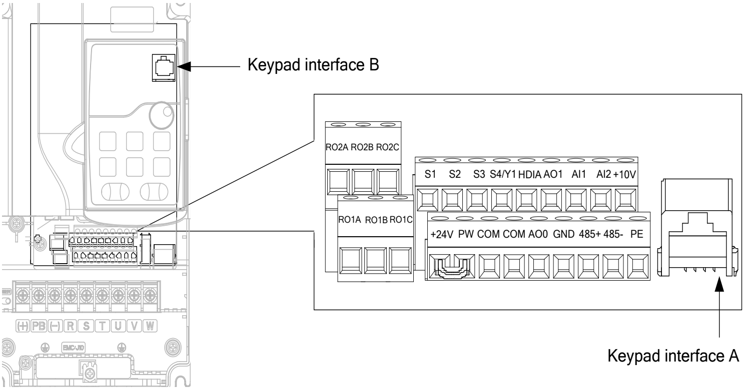


Figure 4-40 External keypad interface

4.3.7 Wiring protection

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.

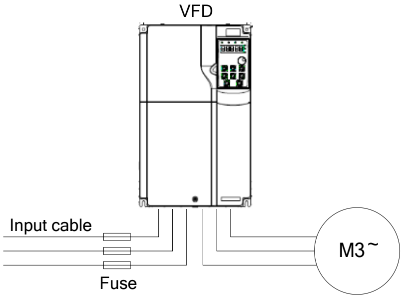


Figure 4-41 Fuse configuration

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.

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.

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. 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 Operation procedure

The VFD is equipped with a LED 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. You can also choose a LCD keypad. The LCD keypad supports multi-language display, parameter copying function, and 10-line high-definition display. Its overall size is the same as the LED keypad.

Figure 5-1 LED keypad

Figure 5-2 Membrane keypad

Figure 5-3 LCD keypad (optional)

Note:

✧ The VFDs in T1–T4 frames are equipped with membrane keypads as standard configuration. If you need an external keypad and bracket, please purchase them separately.

✧ The VFDs in T5–T12 frames come standard with a LED keypad that can be externally mounted. To mount it externally, you only need to purchase the optional bracket.

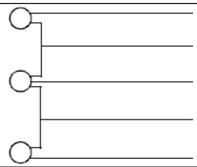
5.3 LED keypad (BOP-270) display and operation

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

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

Table 5-1 LED keypad (BOP-270) component description

No.	Name	Description	
1	Status indicator	RUN/TUNE	VFD operation status indicator Off: The VFD is stopped.

<table>
<tr><th>No.</th><th>Name</th><th colspan="3">Description</th></tr>
<tr><td rowspan="4"></td><td rowspan="4"></td><td></td><td colspan="2">Blinking: The VFD is in parameter autotuning.
On: The VFD is running.</td></tr>
<tr><td>FWD/REV</td><td colspan="2">Forward or reverse running indicator
Off: The VFD is running forward.
On: The VFD is running reversely.</td></tr>
<tr><td>LOCAL/REMOT</td><td colspan="2">Indicates whether the VFD is controlled through the keypad, terminals, or communication.
Off: The VFD is controlled through the keypad.
Blinking: The VFD is controlled through terminals.
On: The VFD is controlled remotely.</td></tr>
<tr><td>TRIP</td><td colspan="2">Fault indicator
Off: The VFD is in normal state.
Blinking: The VFD is in pre-alarm state.
On: The VFD is in fault state.</td></tr>
<tr><td rowspan="6">2</td><td rowspan="6">Unit indicator</td><td colspan="3">Unit displayed currently</td></tr>
<tr><td rowspan="5"></td><td>Hz</td><td>Frequency unit</td></tr>
<tr><td>RPM</td><td>Rotation speed unit</td></tr>
<tr><td>A</td><td>Current unit</td></tr>
<tr><td>%</td><td>Percentage</td></tr>
<tr><td>V</td><td>Voltage unit</td></tr>
<tr><td>3</td><td>Digital display zone</td><td colspan="3">Five-digit LED displays various monitoring data and alarm codes such as the frequency setting and output frequency.
<table>
<tr><th>Display</th><th>Means</th><th>Display</th><th>Means</th><th>Display</th><th>Means</th></tr>
<tr><td>0</td><td>0</td><td>1</td><td>1</td><td>2</td><td>2</td></tr>
<tr><td>3</td><td>3</td><td>4</td><td>4</td><td>5</td><td>5</td></tr>
<tr><td>6</td><td>6</td><td>7</td><td>7</td><td>8</td><td>8</td></tr>
<tr><td>9</td><td>9</td><td>A</td><td>A</td><td>b</td><td>b</td></tr>
<tr><td>C</td><td>C</td><td>d</td><td>d</td><td>E</td><td>E</td></tr>
<tr><td>F</td><td>F</td><td>H</td><td>H</td><td>I</td><td>I</td></tr>
<tr><td>L</td><td>L</td><td>N</td><td>N</td><td>n</td><td>n</td></tr>
<tr><td>o</td><td>O</td><td>P</td><td>P</td><td>r</td><td>r</td></tr>
<tr><td>S</td><td>S</td><td>t</td><td>t</td><td>U</td><td>U</td></tr>
<tr><td>v</td><td>v</td><td>.</td><td>.</td><td>-</td><td>-</td></tr>
</table></td></tr>
<tr><td>4</td><td>Digital potentiometer</td><td colspan="3">Used for frequency regulation. For details, see the description of P08.42.</td></tr>
<tr><td>5</td><td>Keys</td><td>PRG ESC</td><td>Programming key</td><td>Press it to enter or exit level-1 menus or delete a parameter.</td></tr>
</table>

No.	Name	Description		
			Confirmation key	Press it to enter menus in cascading mode or confirm the setting of a parameter.
			UP key	Press it to increase data or move upward.
			Down key	Press it to decrease data or move downward.
			Right-shifting key	Press it to select display parameters rightward in the interface for the product in stopped or running state or to select digits to change during parameter setting.
			Run key	Press it to run the product when using the keypad for control.
			Stop/Reset key	Press it to stop the VFD that is running. The function of this key is restricted by P07.04. In fault alarm state, this key can be used for reset in any control modes.
			Multifunction shortcut key	The function of this key is determined by the ones place of P07.02.

5.3.1 Displaying stopped-state parameters

When the VFD is in stopped state, the keypad displays stopped-state parameters, as shown in Figure 5-4.

In the stopped state, various kinds of parameters can be displayed. You can determine which parameters are displayed in stopped state by setting function code P07.07. For details, see the description of P07.07.

In stopped state, there are 15 parameters that can be selected for display, including the set frequency, bus voltage, PID reference value, PID feedback value, input terminal state, output terminal state, torque setting, PLC and the present step of multi-step speed, AI1 value, AI2 value, AI3 value, high-speed pulse HDI frequency, pulse counting value, length value, and upper limit frequency (Hz on). You can press 》/SHIFT to shift selected parameters from left to right or press QUICK/JOG (when ones place of P07.02=2) to shift selected parameters from right to left.

5.3.2 Displaying running-state parameters

After receiving a valid running command, the VFD enters the running state, and the keypad displays running-state parameters, with the RUN/TUNE indicator on. The on/off state of the FWD/REV indicator is determined by the actual running direction. It is shown as Figure 5-4.

In running state, there are 25 parameters that can be selected for display, including the running frequency, set frequency, bus voltage, output voltage, output current, running speed, output power, output torque, PID reference value, PID feedback value, input terminal state, output terminal state, torque setting, length value, PLC and the current step of multi-step speed, AI1, AI2, AI3, high-speed pulse HDI frequency, motor overload percentage, VFD overload percentage, ramp reference value, linear speed, AC input current, and upper limit frequency (Hz on). You can determine which parameters are displayed in stopped state by setting function codes P07.05 and P07.06. You can press 》/SHIFT to shift selected parameters from left to right or press QUICK/JOG (when ones place of P07.02=2) to shift selected parameters from right to left.

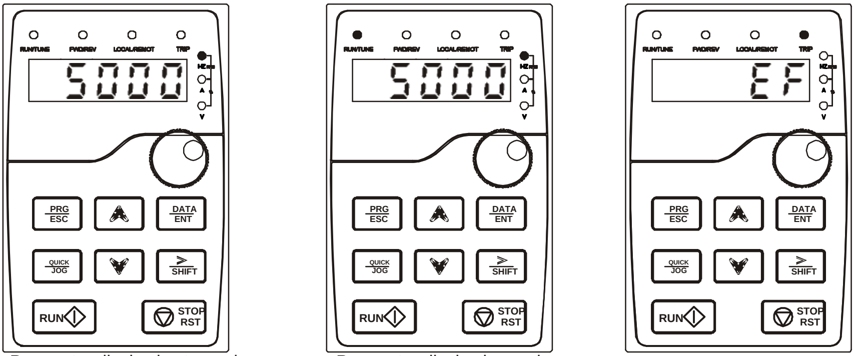
5.3.3 Displaying fault alarms

After detecting a fault signal, the VFD enters the fault alarm state immediately, the fault code blinks on the keypad, and the TRIP indicator is on. You can perform fault reset by using the STOP/RST key, control terminals, or communication commands.

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

5.3.4 Editing function codes

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



Parameter display in stopped state | Parameter display in running state | Fault display

Figure 5-4 Status display

5.3.5 Modifying parameters

The VFD provides three levels of menus, including:

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

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

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

✧ It is read only. Read-only parameters include actual detection parameters and running record parameters.

✧ It cannot be modified in running state and can be modified only in stopped state.

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

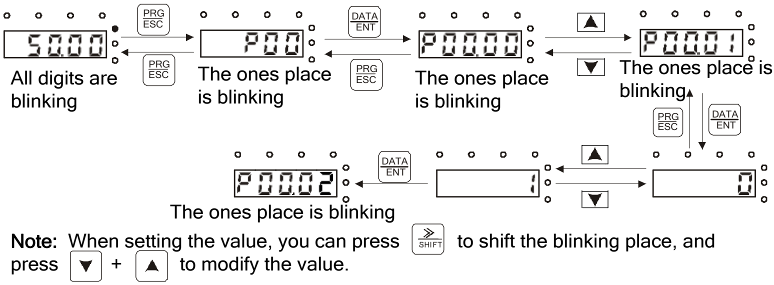


Figure 5-5 Modifying a parameter

5.3.6 Setting a password

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

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.

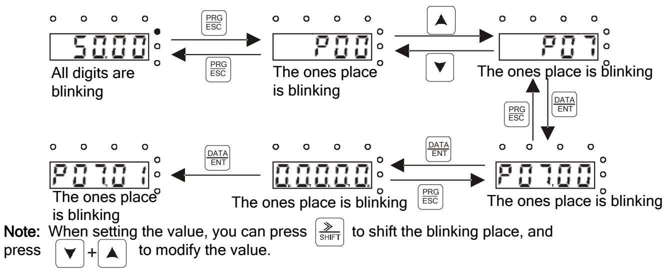


Figure 5-6 Setting a password

5.3.7 Viewing parameters

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

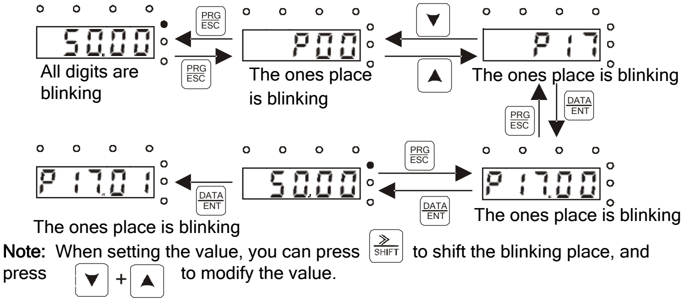
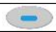


Figure 5-7 Viewing a parameter

5.4 LCD keypad (SOP-290) display and operation

Table 5-2 LCD keypad (SOP-290) component description

No.	Name	Description		
1	Status indicator	RUN		Run indicator Off: The VFD is stopped. Blinking: The VFD is in parameter autotuning. On: The VFD is running.
		TRIP		Fault indicator Off: The VFD is in normal state. Blinking: The VFD is in pre-alarm state. On: The VFD is in fault state.
		QUICK/JOG		Short-cut key indicator, which displays the function-specific state. See definition of the QUICK/JOG key for details.
2	Keys	  	Function key	The function of function keys varies with the menu. The function of function keys is displayed in the footer.
			Short-cut key	Re-definable. It is defined as JOG function by default, namely jogging. The function of short-cut key can be set by the ones place of P07.02, as shown in the following: 0: No function 1: Jogging (linked indicator logic: steady on) 2: Reserved 3: FWD/REV switchover (linked indicator logic: steady

No.	Name	Description		
				off) 4: Clear the UP/DOWN setting (linked indicator logic: steady off) 5: Coast to stop (linked indicator logic: steady off) 6: Switch command channels in sequence (linked indicator logic: steady off) 7: Reserved **Note:** After restoring to default values, the default function of short-cut key is 1.
			Confirmation key	The function of confirmation key varies with menus, such as confirming parameter setup, confirming parameter selection, and entering the next menu.
			Run key	Under keypad operation mode, the running key is used for running operation or autotuning operation.
			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.
			Direction key UP: DOWN: LEFT: RIGHT:	Up: The Up key function varies with interfaces, such as shifting up the displayed item, shifting up the selected item, and changing digits. Down: The Down key function varies with interfaces, such as shifting down the displayed item, shifting down the selected item, changing digits. Left: The Left key function 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 Right key function of varies with interfaces, such as switching the monitoring interface, shifting the cursor rightward, and entering the next menu.
3	Display area	LCD screen	Display screen	240×160 dot-matrix LCD; displays three monitoring parameters or six sub-menu items simultaneously.
4	Other	RJ45 interface	RJ45 interface	Used to connect the VFD.
		Battery cover	Clock battery cover	Remove this cover when replacing or installing clock battery, and close the cover after battery is installed.
		USB terminal	Mini USB terminal	Used to connect to the USB flash drive through an adapter.

The LCD has different display areas, which displays different content under different interfaces. The following figure shows an example of the main interface in stopped state.

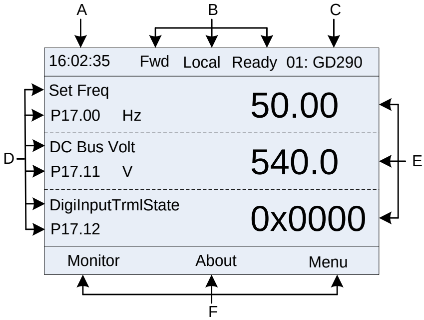


Figure 5-8 LCD main interface

Area	Name	Display
Header A	Real-time display area	Display the real-time; clock battery is not included; the time needs to be reset when powering on the VFD
Header B	VFD running state display area	Display the running state of the VFD: Displays the motor rotation direction: "Fwd" – Run forward during operation; Rev – Run reversely during operation; "Disrev" – Reverse running is forbidden Displays the VFD running command channel: "Local" – Keypad; "Trml" – Terminal; "Remote" - Communication 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	VFD station No. and model display area	Display VFD station No.: 01–99, applied in multi-drive applications (reserved function); VFD model display: "GD290" – current VFD is GD290 series VFD.
Display D	The parameter name and function code monitored by the VFD	Display the parameter name and corresponding function code monitored by the VFD; three monitoring parameters can be displayed simultaneously. The monitoring parameter list can be edited.
Display E	Parameter value monitored by the VFD	Display the parameter value monitoring by the VFD, the monitoring value will be refreshed in real time
Footer F	Corresponding menu of function key	The corresponding menu of the function key varies with interfaces, and the content in this area also varies.

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

5.4.1 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.

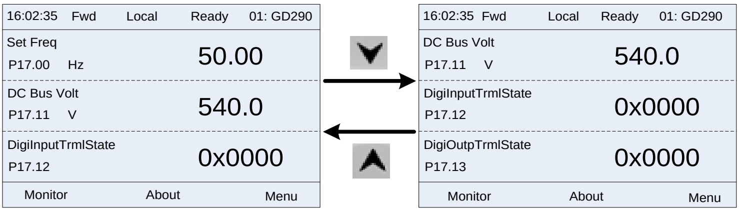


Figure 5-9 Stopped-state parameter display 1

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

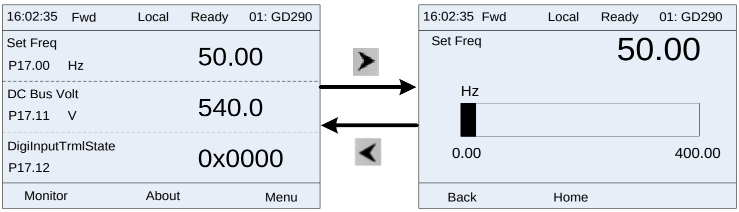


Figure 5-10 Stopped-state parameter display 2

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.

5.4.2 Displaying running-state parameters

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

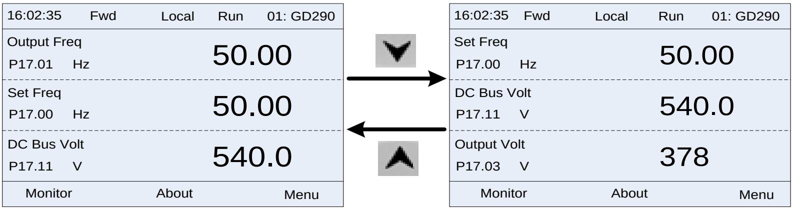


Figure 5-11 Running-state parameter display 1

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

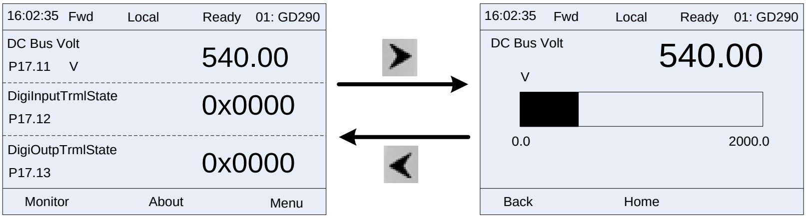


Figure 5-12 Running-state parameter display 2

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.

5.4.3 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.

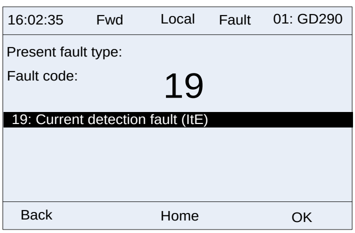


Figure 5-13 Fault alarm display

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

5.4.4 Entering/Exiting menus

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

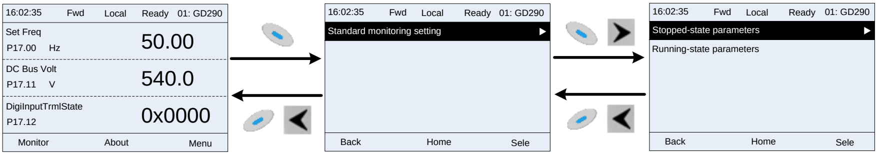


Figure 5-14 Example 1 of entering/exiting different menus

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

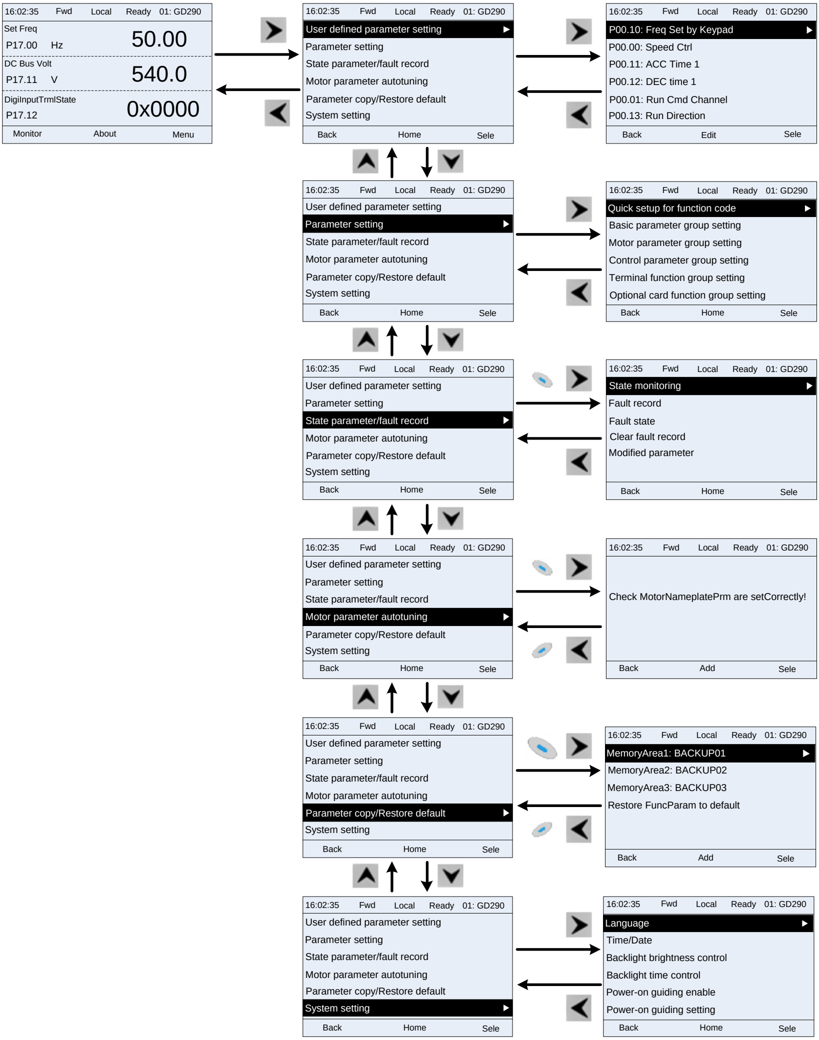


Figure 5-15 Example 2 of entering/exiting different menus

The keypad menu setting is shown as follows:

Level 1	Level 2	Level 3	Level 4
User defined parameter setting	/	/	P00.10: Freq Set by Keypad
			P00.00: Speed Ctrl
			Pxx.xx: Common parameter setting xx
Parameter setting	Quick setup for function code	/	Pxx.xx
	Basic parameter group setting	P00: Basic functions	P00.xx
		P07: Human-machine interface	P07.xx
		P08: Enhanced functions	P08.xx
		P11: Protection parameters	P11.xx
		P14: Serial communication function group	P14.xx
	Motor parameter group setting	P02: Motor 1 parameters	P02.xx
		P12: Motor 2 parameters	P12.xx
	Control parameter group setting	P01: Start and stop control	P01.xx
		P03: Vector control of motor 1	P03.xx
		P04: V/F control	P04.xx
		P09: PID control	P09.xx
		P10: Simple PLC and multi-step speed control	P10.xx
		P23: Vector control of motor 2	P23.xx
	Terminal function group setup	P05: Input terminal functions	P05.xx
		P06: Output terminal functions	P06.xx
	Optional card function group setting	P15: Communication expansion card 1 functions	P15.xx
		P16: Communication expansion card 2 functions	P16.xx
		P25: Expansion I/O card input functions	P25.xx
		P26: Expansion I/O card output functions	P26.xx
		P28: Master/slave control	P28.xx
	Factory-defined control function group setting	P90: PID control 1	P90.xx
		P91: PID control 2	P91.xx
		92: Real-time clock and timer (available at use of LCD keypad)	P92.xx
State parameter /fault record	State monitoring	P07: Human-machine interface	P07.xx
		P17: Status viewing functions	P17.xx
		P19: Status viewing functions of expansion card	P19.xx
		P89: HVAC status viewing	P89.xx
	Fault record	/	P07.27: Type of present fault
			P07.28: Type of the last fault
			P07.29: Type of the 2nd-last fault

Level 1	Level 2	Level 3	Level 4
			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 state	/	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 record	/	Are you sure to clear fault history?
	Modified parameter	/	Pxx.xx has modified parameter 1
			Pxx.xx has modified parameter 2
			Pxx.xx has modified parameter xx
Motor parameter autotuning	/	/	Dynamic autotuning 1
			Complete parameter static autotuning
			Partial parameter static autotuning 1
			Dynamic autotuning 2
			Partial parameter static autotuning 2
Parameter copy/restore default	/	Memory area 1: BACKUP01	Upload param from local to keypad
			Download all param from keypad
			Download non motor param from keypad
			Download motor param from keypad
		Memory area 2: BACKUP02	/
		Memory area 3: BACKUP03	/
		Restore function parameter to default	Are you sure to restore function parameters to default value?
System setting	/	/	Language selection
			Time/date
			Adjust backlight brightness
			Adjust backlight time
			Power-on guiding enable
			Power-on guiding settings
			Keypad burning selection
			Enable fault time
			Control board burning selection

5.4.5 Editing list

The monitoring items displayed in the parameter list of stop state can be added as needed (through the menu of the function code in state check group), and the list can also be edited such as "Move up", "Move down" and "Delete from the list". The following figure shows the interface.

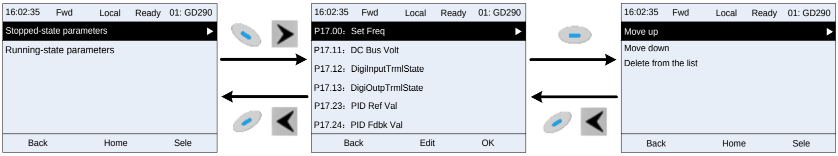


Figure 5-16 Editing list 1

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

Note: For the parameter objects in the list header, the shift-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 shifted up automatically.

The monitoring items displayed in the parameter list of running state can be added as needed (through the menu of the function code in state check group), and the list can also be edited such as "Move up", "Move down" and "Delete from the list". The following figure shows the interface.

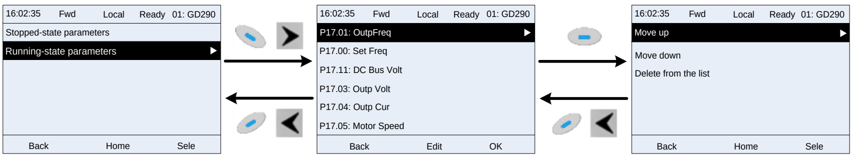


Figure 5-17 Editing list 2

The parameter list of common parameter setup can be added, deleted or adjusted as needed, including delete, shift-up and shift-down; the addition function can be set in a certain function code of a function group. The following figure shows the interface.

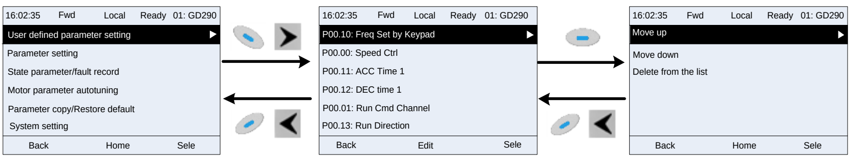


Figure 5-18 Editing list 3

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

You can choose **Menu** > **State parameter**, 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.

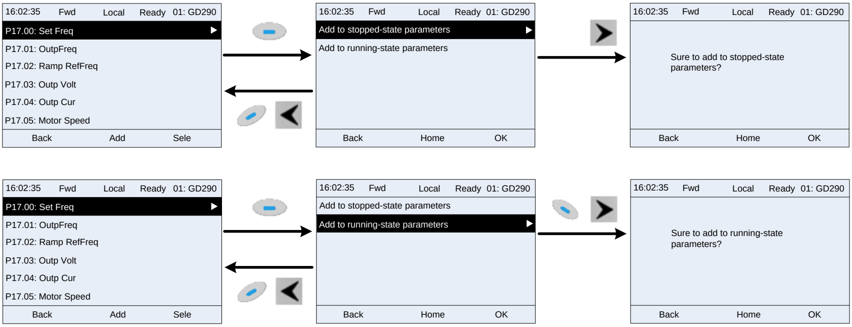


Figure 5-19 Illustration 1 of adding parameters

After selecting a specific function code, press the key to enter the parameter addition interface, select the operation needed, and press the 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, the addition operation will be invalid. If the key or key is pressed without selecting the addition operation in the adding interface, it will return to the monitoring parameter list menu.

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

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

5.4.7 Adding parameters to common parameter setting list

You can choose **Menu** > **Parameter setting**, the parameters in the list can be added to the user defined parameter setting list as shown as follows.

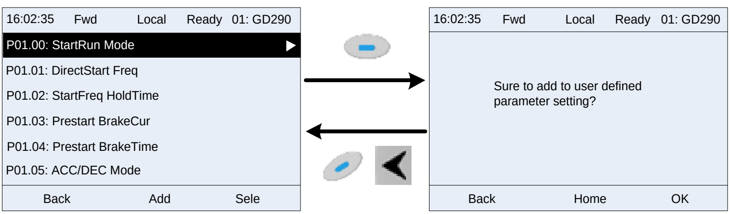


Figure 5-20 Illustration 2 of adding parameters

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

All the function code groups under parameter setting sub-menu can be added to the common parameter setting list. Up to 64 function codes can be added to the common parameter setting list.

5.4.8 Parameter selection edit interface

Under the **User defined parameter setting** menu, press the key, key, or key to enter parameter selection edit interface. After entering the edit interface, the present value will be highlighted. Press the key or key to edit the present parameter value, and the corresponding parameter item of present value will be highlighted automatically. After parameter selection is done, press the key or key to save the selected parameter and return to the previous menu. In the parameter selection edit interface, press the key to maintain the parameter value and return to the previous menu.

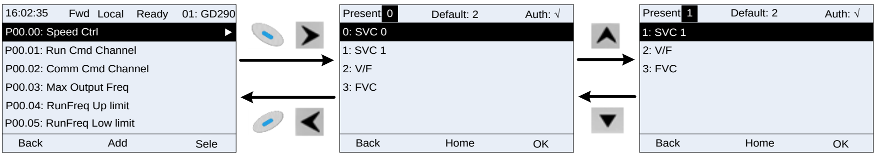


Figure 5-21 Parameter selection edit interface

In the 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.

"Present" indicates the actually selected value.

"Default" indicates the default value of this parameter.

5.4.9 Parameter setting edit interface

Under the **Parameter setting** menu, press the key, key or key to enter parameter setting edit interface. After entering the edit interface, set the parameter from low bit to high bit, and the bit under setting will be highlighted. Press the 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 the or to shift the bit to edit. After parameters are set, press key or key to save the set parameters and return to the previous parameter. In the parameter setup edit interface, press to maintain the original parameter value and return to the previous menu.

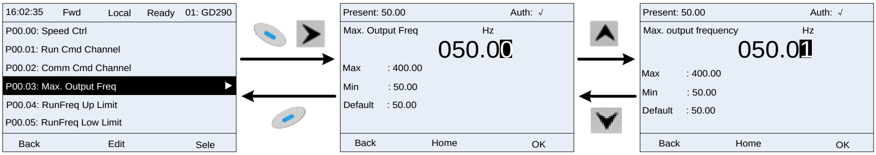


Figure 5-22 Parameter setup edit interface

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.

"Present" indicates the value saved last time.

"Default" indicates the default value of this parameter.

5.4.10 State monitoring interface

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

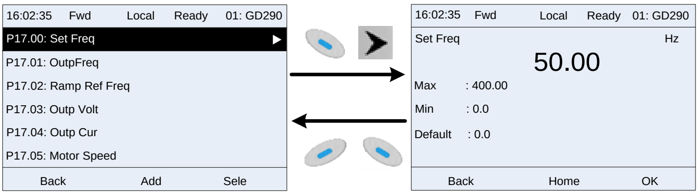


Figure 5-23 State monitoring interface

5.4.11 Motor parameter autotuning

You can choose **Menu** > **Motor parameter autotuning** and press the key, key, or key to enter the motor parameter autotuning interface, however, before entering the motor parameter autotuning interface, you must set the motor nameplate parameters correctly. In the motor parameter autotuning interface, press the key or key to return to the previous menu.

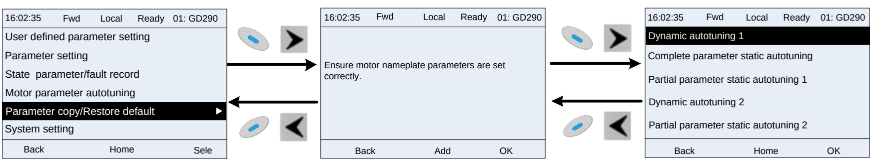


Figure 5-24 Parameter autotuning operation

After selecting the motor autotuning type, enter the motor parameter autotuning interface, and press the RUN key to start motor parameter autotuning. After autotuning is done, a prompt will pop out indicating autotuning is succeeded, and then it will return to the stop-state main interface. During autotuning, you can press the STOP/RST key to terminate autotuning; if any fault occurs during autotuning, the fault interface will be displayed.

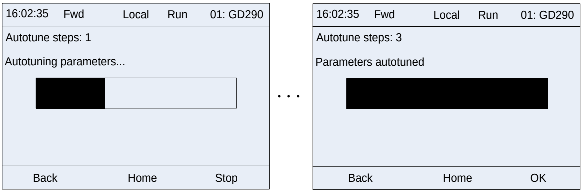


Figure 5-25 Parameter autotuning finished

5.4.12 Parameter backup

You can choose **Menu** > **Parameter copy/Restore default**, and press the , key, or key to enter the function parameter backup setting interface and function parameter restoration setup 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, namely it can save parameters of three VFDs in total.

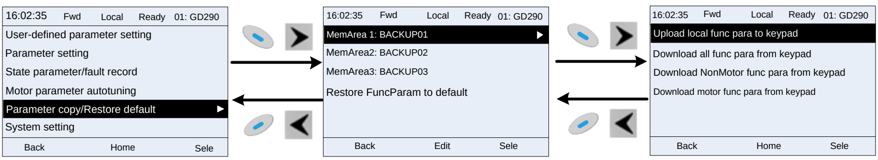


Figure 5-26 Parameter backup

5.4.13 System setting

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

Note: No clock battery is equipped by default, and the keypad time/date needs to be reset after keypad re-power on. If time-keeping after power off is needed, you should purchase the clock batteries separately.

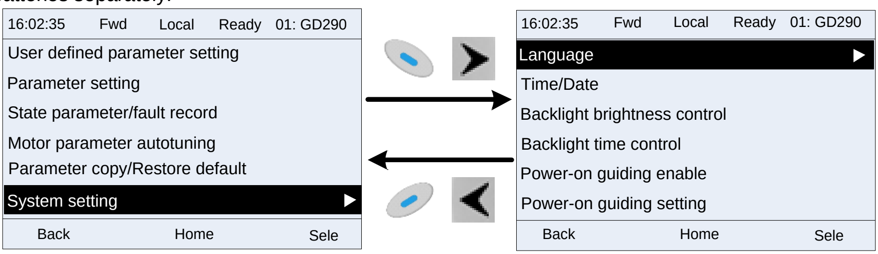


Figure 5-27 System setting

5.4.14 Power-on guiding settings

The keyboard supports the power-on guiding function, mainly for the first power-on situation, guiding you to enter the setting menu, and gradually implementing basic functions such as basic parameter setting, direction judgment, mode setting and autotuning. The power-on guiding enable menu guides you to enable power-on to boot each time. Power-on guiding setup menu guides you to set step by step according to the functions. The power-on guide is shown as follows:

Level 1		Level 2		Level 3		Level 4	
Language	0: Simplified Chinese	Power-on guiding enable	0: Always	Whether to enter the power-on guiding settings?	0: Yes	Whether to test the motor rotation direction?	Yes
	1: English		1: Only once		1: No		No
				P00.06 Setting channel of A frequency command	0: Keypad	Press the JOG button first. It is currently forward. Is it consistent with the expectations?	Yes
					1: AI1		
					2: AI2		No
					3: AI3		
					4: High-speed pulse HDIA	P02.01 Rated power of AM 1	
					5: Simple PLC program	P02.02 Rated frequency of AM 1	
					6: Multi-step speed running	P02.03 Rated speed of AM 1	
					7: PID control	P02.04 Rated voltage of AM 1	
					8: Modbus/Modbus TCP communication	P02.05 Rated current of AM 1	
					9: PROFIBUS/CANopen communication		
					10: Ethernet communication		
					11: High-speed pulse HDIB		
					12: Pulse train AB		
					13: PROFINET/ EtherNet IP communication		
					14: Programmable card	Whether to conduct autotuning?	Yes
					15–17: Reserved		
					18: Keypad (applicable to 1.5–22kW models)		No
				P00.01 Running command	0: Keypad	Motor parameter autotuning interface	

Level 1		Level 2		Level 3		Level 4	
				channel	1: Terminal		
					2: Communication		
				P00.02 Communication mode of running commands	0: Modbus/Modbus TCP communication		
					1: PROFIBUS/CANopen communication		
					2: Ethernet communication		
					3: PROFINET/EtherNet IP communication		
					4: Programmable card		
					5: Wireless communication card		
				P08.37 Reserved			
				P00.00 Speed control mode	0: SVC mode 0		
					1: SVC mode 1		
					2: Space voltage vector control mode		
				P01.08 Stop mode	0: Decelerate to stop		
					1: Coast to stop		
				P00.11 ACC time 1			
				P00.12 DEC time 1			

5.5 Basic operation description

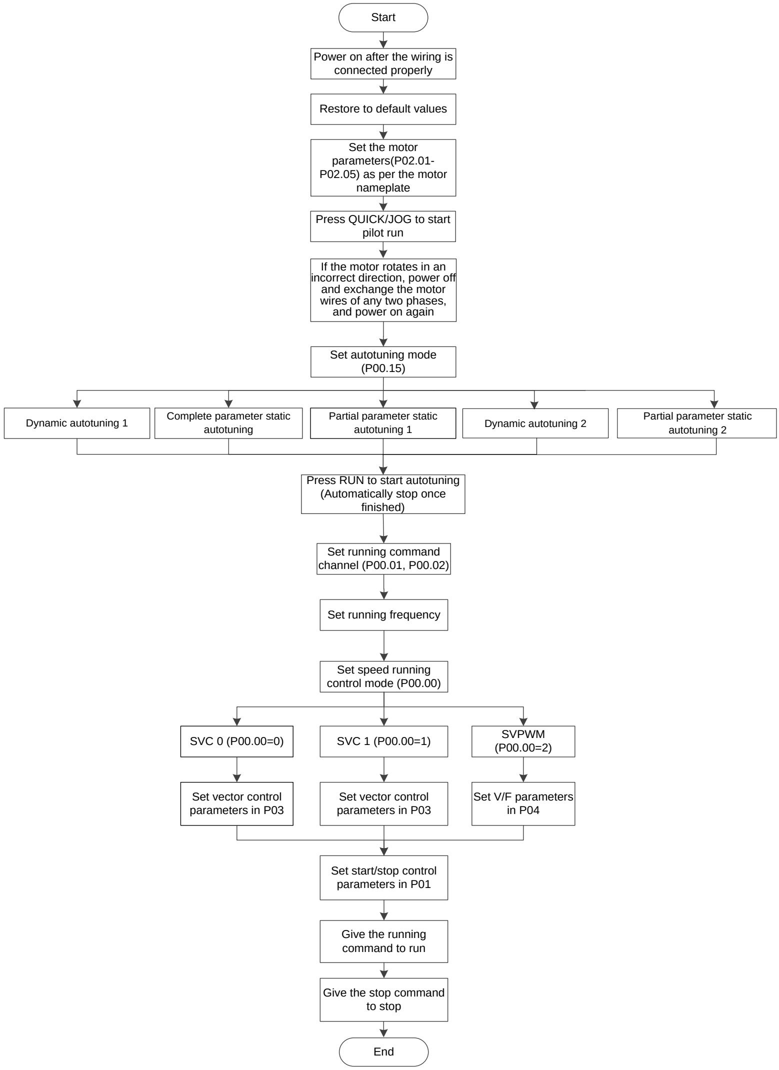
5.5.1 What this section describes

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, remove the fault cause 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.

Function code	Name	Description	Default
P00.00	Speed control mode	0: SVC mode 0 1: SVC mode 1 2: Space voltage vector control mode **Note:** Before using a vector control mode (0 or 1), 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 communication 2: Ethernet communication 3: EtherCAT/PROFINET/EtherNet IP communication 4: Programmable card 5: Wireless communication card	0
P00.15	Motor parameter autotuning	0: No operation 1: Dynamic autotuning 1 Comprehensive motor parameter autotuning. It is recommended to use rotating autotuning when high control accuracy is required. 2: Complete parameter static autotuning Used in scenarios where the motor cannot be disconnected from load. 3: Partial parameter static autotuning 1 When the present motor is motor 1, only P02.06, P02.07, and P02.08 are autotuned; when the present motor is motor 2, only P12.06, P12.07, and P12.08 are autotuned. 4: Dynamic autotuning 2 (similar to dynamic	0

Function code	Name	Description	Default
		autotuning 1) 5: Partial parameter static autotuning 2	
P00.18	Function parameter restoration	0: No operation 1: Restore to default values (excluding motor parameters) 2: Clear fault records 3: Lock keypad parameters 4: Reserved 5: Restore to default values (factory test mode) 6: Restore to default values (including motor parameters) **Note:** After the selected operation is performed, the function code is automatically restored to 0. Restoring the default values may delete the user password. Exercise caution when using this function.	0
P02.01	Rated power of AM 1	Range: 0.1–3000.0kW	Model depended
P02.02	Rated frequency of AM 1	Range: 0.01Hz–P00.03 (Max. output frequency)	50.00Hz
P02.03	Rated speed of AM 1	Range: 1–60000rpm	Model depended
P02.04	Rated voltage of AM 1	Range: 0–1200V	Model depended
P02.05	Rated current of AM 1	Range: 0.8–6000.0A	Model depended
P05.01–P05.06	Function selection of multifunction digital input terminals (S1–S4, and HDIA)	36: Switch the running command channel to keypad 37: Switch the running command channel to terminal 38: Switch the running command channel to communication	
P07.01	Parameter copy	Used to set the parameter copy mode. 0: No operation 1: Upload parameters to the keypad 2: Download all parameters (including motor parameters) 3: Download non-motor parameters 4: Download motor parameters **Note:** After any operation among 1–4 is completed,	0

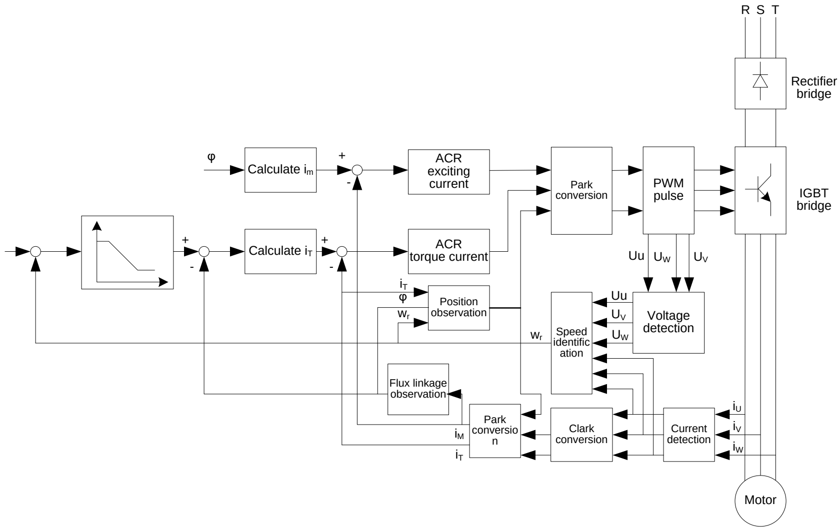
Function code	Name	Description	Default
		the parameter restores to 0. The upload and download functions are not applicable to group P29.	
P07.02	Function selection of **QUICK/JOG**	Range: 0x00–0x28 Ones place: Function of QUICK/JOG 0: No function 1: Jog 2: Reserved 3: Switch between forward and reverse rotating 4: Clear the UP/DOWN setting 5: Coast to stop 6: Switch command channels in sequence 7: Quick commissioning mode 8: Switch command channels in sequence + frequency switchover **Note:** When switched to the key mode, the frequency setting is determined by P00.10, and in other cases, it is determined by P00.06. Tens place: 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.

Integrated with the sensor-less vector control algorithm, the VFD can drive AMs. 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 Note: Before using a vector control mode (0 or 1), enable the VFD to perform motor parameter autotuning first.	2
P00.15	Motor parameter autotuning	0: No operation 1: Dynamic autotuning 1 Comprehensive motor parameter autotuning. It is recommended to use rotating autotuning when high control accuracy is required. 2: Complete parameter static autotuning Used in scenarios where the motor cannot be disconnected from load. 3: Partial parameter static autotuning 1 When the present motor is motor 1, only P02.06, P02.07, and P02.08 are autotuned; when the present motor is motor 2, only P12.06, P12.07, and P12.08 are autotuned. 4: Dynamic autotuning 2 (similar to dynamic autotuning 1)	0

Function code	Name	Description	Default
		5: Partial parameter static autotuning 2	
P03.00	Speed-loop proportional gain 1	Range: 0–200.0	20.0
P03.01	Speed-loop integral time 1	Range: 0.000–10.000s	0.200s
P03.02	Low-point frequency for switching	Range: 0.00Hz–P03.05	5.00Hz
P03.03	Speed-loop proportional gain 2	Range: 0–200.0	20.0
P03.04	Speed-loop integral time 2	Range: 0.000–10.000s	0.200s
P03.05	High-point frequency for switching	Setting range: P03.02–P00.03 (Max. output frequency)	10.00Hz
P03.06	Speed-loop output filter	Range: 0–8 (corresponding to 0–2^8/10ms)	0
P03.07	Electromotive slip compensation coefficient of vector control	Range: 50%–200%	100°
P03.08	Braking slip compensation coefficient of vector control	Range: 50%–200%	100°
P03.09	Current-loop proportional coefficient P	Range: 0–65535	1000
P03.10	Current-loop integral coefficient I	Range: 0–65535	1000
P03.11	Torque setting method selection	1: Keypad (P03.12) 2: AI1 3: AI2 4: AI3	1

Function code	Name	Description	Default
		5: Pulse frequency HDIA 6: Multi-step torque 7: Modbus/Modbus TCP communication 8: PROFIBUS/CANopen communication 9: Ethernet communication 10: Pulse frequency HDIB 11: EtherCAT/PROFINET/EtherNet IP communication 12: Programmable card 13–17: Reserved 18: Keypad analog (valid for VFDs in T1–T4 frames) **Note: 100% corresponds to the motor rated current.**	
P03.12	Torque set through keypad	Range: -300.0%–300.0% (of the motor rated current)	50.0°
P03.13	Torque reference filter time	Range: 0.000–10.000s	0.010s
P03.14	Setting source of forward rotation upper limit frequency in torque control	0: Keypad (P03.16) 1: AI1 (100% corresponds to the max. frequency) 2: AI2 (same as the above) 3: AI3 (same as the above) 4: Pulse frequency HDIA 5: Multi-step setting 6: Modbus/Modbus TCP communication (same as the above) 7: PROFIBUS/CANopen communication (same as the above) 8: Ethernet communication (same as the above) 9: Pulse frequency HDIB 10: EtherCAT/PROFINET/EtherNet IP communication (same as the above) 11: Programmable card (same as the above) 12–17: Reserved 18: Keypad analog (valid for VFDs in T1–T4 frames)	0
P03.15	Setting source of reverse rotation upper limit frequency in torque control	0: Keypad (P03.17) 1–18: Same as those for P03.14	0
P03.16	Forward rotation	Range: 0.00Hz–P00.03 (Max. output frequency)	50.00Hz

Function code	Name	Description	Default
	upper limit frequency set through keypad in torque control		
P03.17	Reverse rotation upper limit frequency set through keypad in torque control		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 communication 7: Ethernet communication 8: Pulse frequency HDIB 9: EtherCAT/PROFINET/EtherNet IP communication 10: Programmable card 11–17: Reserved 18: Keypad analog (valid for VFDs in T1–T4 frames) **Note:** For setting sources 0–18, 100% corresponds to three times the rated motor current.	0
P03.19	Setting source of braking torque upper limit	0: Keypad (P03.21) 1–18: Same as those for P03.18	0
P03.20	Electromotive torque upper limit set through keypad	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	Range: 0.1–2.0	0.3

Function code	Name	Description	Default
P03.23	Lowest weakening point in constant power zone	Range: 10%–100%	20°
P03.24	Max. voltage limit	Range: 0.0–120.0%	100.0°
P03.25	Pre-exciting time	Range: 0.000–10.000s	0.300s
P03.32	Enabling torque control	0: Disable 1: Enable	0
P03.33	Flux-weakening integral gain	Range: 0–8000	1200
P03.35	Control optimization setting	Range: 0x0000–0x1111 Ones place: Torque command selection 0: Torque reference 1: Torque current reference Tens place: Reserved Hundreds place: indicates whether to enable speed-loop integral separation 0: Disable 1: Enable Thousands place: Reserved	0x0000
P03.36	Speed-loop differential gain	Range: 0.00–10.00s	0.00s
P03.37	Proportional coefficient of high-frequency current loop	In the vector control 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. P03.37 range: 0–65535 P03.38 range: 0–65535 P03.39 range: 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	Range: 0.0–200.0%	0.0°

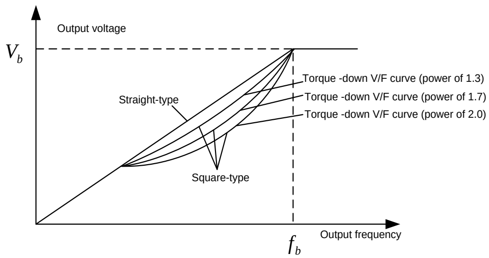
5.5.4 Space voltage vector control mode

The VFD also provides the space voltage control function. The space voltage control mode can be used in cases where mediocre control precision is enough and in cases where a VFD needs to drive multiple motors.

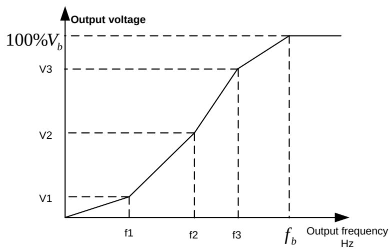
The VFD provides multiple V/F curve modes to meet different requirements. You can select V/F curves or set V/F curves as required.

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.

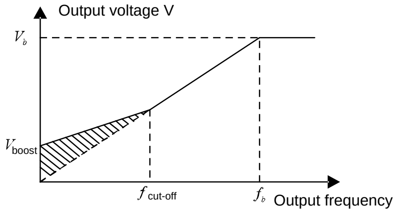
1. Torque boost

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. 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

3. Oscillation control

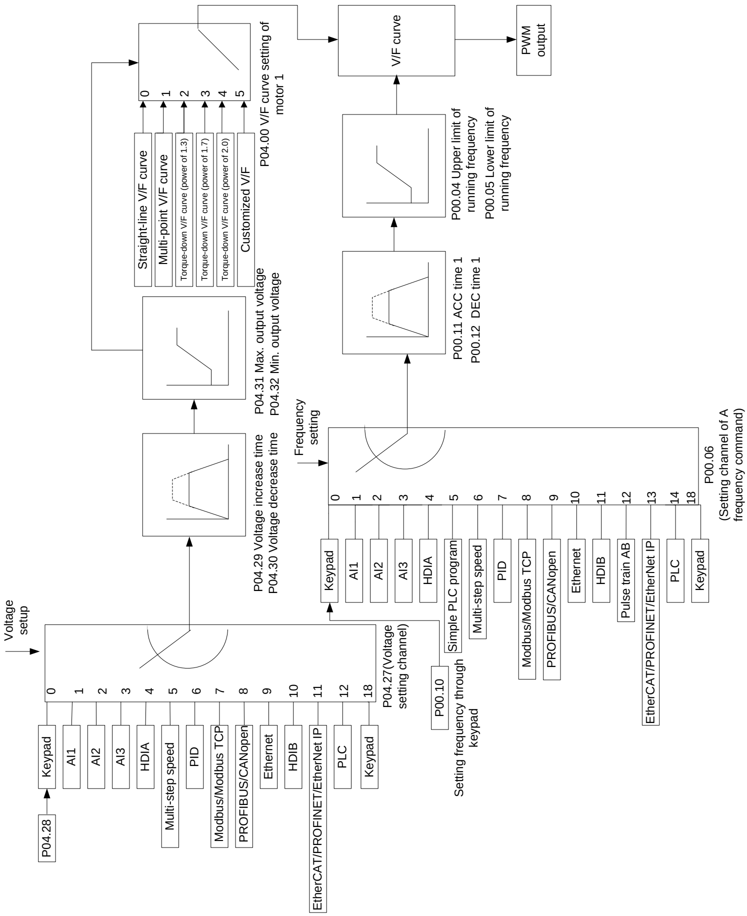
Motor oscillation often occurs in space voltage vector control in large-power driving applications. To solve this problem, the VFD provides two oscillation factor function codes. You can set the function codes based on the oscillation occurrence frequency.

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

4. AM IF control

Generally, the IF control mode is valid for AMs. Therefore, the IF control mode described in this manual is only involved with AMs. IF control is implemented by performing closed-loop control on the total output current of the VFD. The output voltage adapts to the current reference, and open-loop control is separately performed over the frequency of the voltage and current.

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



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

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

Function code	Name	Description	Default
P00.00	Speed control mode	0: SVC mode 0 1: SVC mode 1	2

Function code	Name	Description	Default
		2: Space voltage vector control mode Note: Before using a vector control mode (0 or 1), enable the VFD to perform motor parameter autotuning first.	
P00.03	Max. output frequency	Range: P00.04–400.00Hz	50.00Hz
P00.04	Upper limit of running frequency	Range: P00.05–P00.03	50.00Hz
P00.05	Lower limit of running frequency	Range: 0.00Hz–P00.04	0.00Hz
P00.11	ACC time 1	Range: 0.0–3600.0s	Model depended
P00.12	DEC time 1	Range: 0.0–3600.0s	Model depended
P02.02	Rated frequency of AM 1	Range: 0.01Hz–P00.03 (Max. output frequency)	50.00Hz
P02.04	Rated voltage of AM 1	Range: 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	Range: 0.0% (Automatic) – 10.0% (of the rated voltage of motor 1)	0.0°
P04.02	Torque boost cut-off of motor 1	Range: 0.0%–50.0% (of the rated frequency of motor 1)	20.0°
P04.03	V/F frequency point 1 of motor 1	Range: 0.00Hz–P04.05	0.00Hz
P04.04	V/F voltage point 1 of motor 1	Range: 0.0%–110.0% (of the rated voltage of motor 1)	0.0°
P04.05	V/F frequency point 2 of motor 1	Range: P04.03–P04.07	0.00Hz
P04.06	V/F voltage point 2 of motor 1	Range: 0.0%–110.0% (of the rated voltage of motor 1)	0.0°
P04.07	V/F frequency point 3 of motor 1	Range: P04.05–P02.02 (Hz, P02.00=0)	0.00Hz

Function code	Name	Description	Default
P04.08	V/F voltage point 3 of motor 1	Range: 0.0%–110.0% (of the rated voltage of motor 1)	0.0°
P04.09	V/F slip compensation gain of motor 1	Range: 0.0–200.0%	100.0°
P04.10	Low-frequency oscillation control factor of motor 1	Range: 0–100	10
P04.11	High-frequency oscillation control factor of motor 1	Range: 0–100	10
P04.12	Oscillation control threshold of motor 1	Range: 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	Range: 0.0% (Automatic) – 10.0% (of the rated voltage of motor 2)	0.0°
P04.15	Torque boost cut-off of motor 2	Range: 0.0%–50.0% (of the rated frequency of motor 2)	20.0°
P04.16	V/F frequency point 1 of motor 2	Range: 0.00Hz–P04.18	0.00Hz
P04.17	V/F voltage point 1 of motor 2	Range: 0.0%–110.0% (of the rated voltage of motor 2)	0.0°
P04.18	V/F frequency point 2 of motor 2	Range: P04.16–P04.20	0.00Hz
P04.19	V/F voltage point 2 of motor 2	Range: 0.0%–110.0% (of the rated voltage of motor 2)	0.0°
P04.20	V/F frequency point 3 of motor 2	Range: P04.18–P02.02 (Hz, P02.00=0)	0.00Hz
P04.21	V/F voltage point 3 of motor 2	Range: 0.0%–110.0% (of the rated voltage of motor 2)	0.0°
P04.22	V/F slip compensation gain of motor 2	Range: 0.0–200.0%	100.0°
P04.23	Low-frequency	Range: 0–100	10

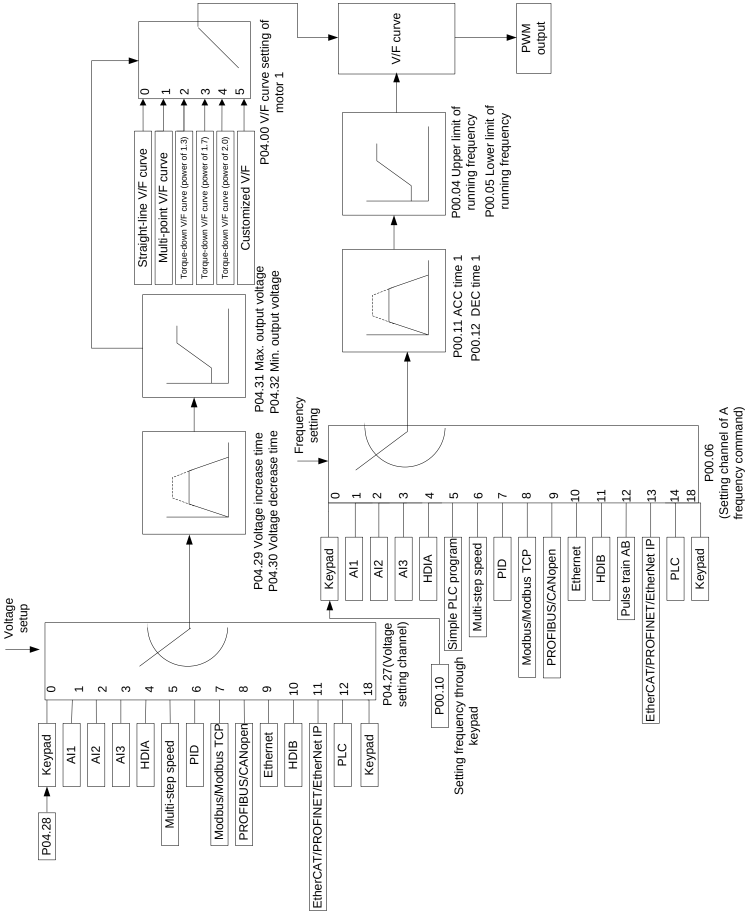
Function code	Name	Description	Default
	oscillation control factor of motor 2		
P04.24	High-frequency oscillation control factor of motor 2	Range: 0–100	10
P04.25	Oscillation control threshold of motor 2	Range: 0.00Hz–P00.03 (Max. output frequency)	30.00Hz
P04.26	Energy-saving run	0: Disable 1: Automatic 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 speed running (The setting is determined by group P10.) 6: PID 7: Modbus/Modbus TCP communication 8: PROFIBUS/CANopen communication 9: Ethernet communication 10: HDIB 11: EtherCAT/PROFINET/EtherNet IP communication 12: Programmable card 13–17: Reserved 18: Keypad analog (valid for VFDs in T1–T4 frames)	0
P04.28	Voltage set through keypad	Range: 0.0%–100.0% (of the motor rated voltage)	100.0°
P04.29	Voltage increase time	Range: 0.0–3600.0s	5.0s
P04.30	Voltage decrease time	Range: 0.0–3600.0s	5.0s
P04.31	Max. output voltage	Setting range: P04.32–100.0% (of the motor rated voltage)	100.0°
P04.32	Min. output voltage	Range: 0.0%–P04.31 (relative to motor rated voltage)	0.0°
P04.33	Weakening coefficient in constant power zone	Range: 1.00–1.30	1.00

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

Function code	Name	Description	Default
P04.51	End frequency point for switching off IF mode for AM 2	Range: P04.49–P00.03	25.00Hz
P04.52	VF energy-saving mode selection	0: Max. efficiency (default) 1: Optimal power factor 2: MTPA	0
P04.53	VF energy-saving gain coefficient	Range: 0.0–400.0%	100.0°
P04.54	VF energy-saving power angle gain coefficient	Range: 0.0–200.0%	80.0°

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 **Note:** Before using a vector control mode (0 or 1), enable the VFD to perform motor parameter autotuning first.	2
P03.32	Enabling torque control	0: Disable 1: Enable	0

Function code	Name	Description	Default
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 communication 9: Ethernet communication 10: Pulse frequency HDIB 11: EtherCAT/PROFINET/EtherNet IP communication 12: Programmable card 13–17: Reserved 18: Keypad analog (valid for VFDs in T1–T4 frames) **Note:** 100% corresponds to the motor rated current.	0
P03.12	Torque set through keypad	Range: -300.0%–300.0% (of the motor rated current)	50.0°
P03.13	Torque reference filter time	Range: 0.000–10.000s	0.010s
P03.14	Setting source of forward rotation upper limit frequency in torque control	0: Keypad (P03.16) 1: AI1 (100% corresponds to the max. frequency) 2: AI2 (same as the above) 3: AI3 (same as the above) 4: Pulse frequency HDIA 5: Multi-step setting 6: Modbus/Modbus TCP communication (same as the above) 7: PROFIBUS/CANopen communication (same as the above) 8: Ethernet communication (same as the above) 9: Pulse frequency HDIB 10: EtherCAT/PROFINET/EtherNet IP communication (same as the above) 11: Programmable card (same as the above) 12–17: Reserved 18: Keypad analog (valid for VFDs in T1–T4 frames)	0
P03.15	Setting source of reverse rotation	0: Keypad (P03.17) 1: AI1 (100% corresponds to the max. frequency)	0

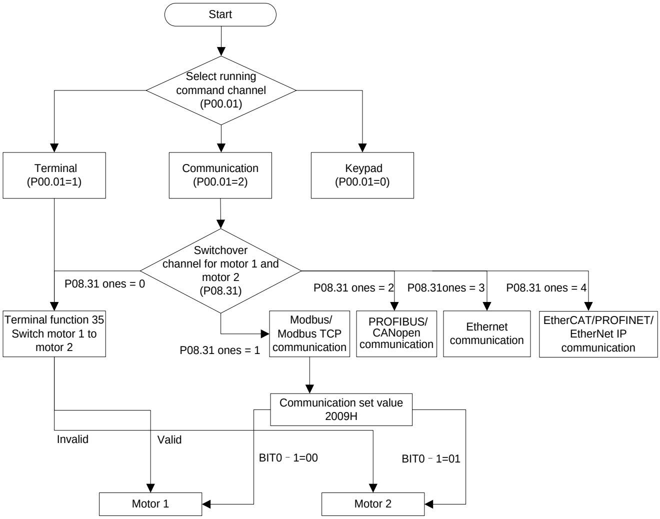
Function code	Name	Description	Default
	upper limit frequency in torque control	2: AI2 (same as the above) 3: AI3 (same as the above) 4: Pulse frequency HDIA 5: Multi-step setting 6: Modbus/Modbus TCP communication (same as the above) 7: PROFIBUS/CANopen communication (same as the above) 8: Ethernet communication (same as the above) 9: Pulse frequency HDIB 10: EtherCAT/PROFINET/EtherNet IP communication (same as the above) 11: Programmable card (same as the above) 12–17: Reserved 18: Keypad analog (valid for VFDs in T1–T4 frames)	
P03.16	Forward rotation upper limit frequency set through keypad in torque control	Range: 0.00Hz–P00.03 (Max. output frequency)	50.00Hz
P03.17	Reverse rotation upper limit frequency set through keypad in torque control	Range: 0.00Hz–P00.03 (Max. output frequency)	50.00Hz
P03.18	Setting source of electromotive torque upper limit	0: Keypad (P03.20) 1: AI1 (100% corresponding to the motor rated current) 2: AI2 (same as the above) 3: AI3 (same as the above) 4: Pulse frequency HDIA 5: Modbus/Modbus TCP communication 6: PROFIBUS/CANopen communication 7: Ethernet communication 8: Pulse frequency HDIB 9: EtherCAT/PROFINET/EtherNet IP communication 10: Programmable card 11–17: Reserved	0

Function code	Name	Description	Default
		18: Keypad analog (valid for VFDs in T1–T4 frames)	
P03.19	Setting source of braking torque upper limit	0: Keypad (P03.21) 1: AI1 2: AI2 3: AI3 4: Pulse frequency HDIA 5: Modbus/Modbus TCP communication 6: PROFIBUS/CANopen communication 7: Ethernet communication 8: Pulse frequency HDIB 9: EtherCAT/PROFINET/EtherNet IP communication 11: Programmable card 12–17: Reserved 18: Keypad analog (valid for VFDs in T1–T4 frames) **Note:** 100% corresponds to the motor rated current.	0
P03.20	Electromotive torque upper limit set through keypad	Range: 0.0–300.0% (of the motor rated current)	180.0°
P03.21	Braking torque upper limit set through keypad	Range: 0.0–300.0% (of the motor rated current)	180.0°
P17.09	Motor output torque	Range: -250.0%–250.0%	0.0°
P17.15	Torque reference value	Range: -300.0%–300.0% (of the motor rated current)	20.0°

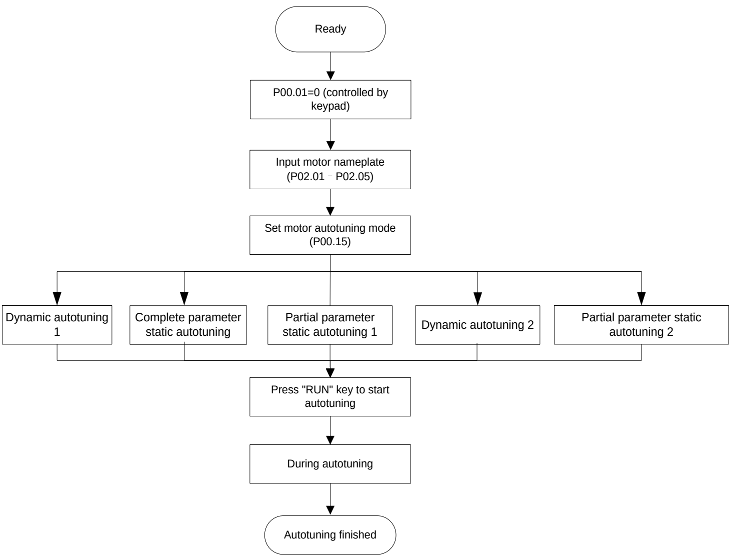
5.5.6 Motor parameters

	✧ 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 supports two sets of motor parameters, which can be switched over using multifunction digital input terminals or communication methods.



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.
- ✧ 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. At this time, parameters P02.06–P02.10 are autotuned for AMs.
- ✧ 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.

Function code	Name	Description	Default
P00.01	Channel of running commands	0: Keypad 1: Terminal 2: Communication	0
P00.15	Motor parameter autotuning	0: No operation 1: Dynamic autotuning 1 Comprehensive motor parameter autotuning. It is recommended to use rotating autotuning when high control accuracy is required. 2: Complete parameter static autotuning Used in scenarios where the motor cannot be disconnected from load. 3: Partial parameter static autotuning 1 When the present motor is motor 1, only P02.06, P02.07, and P02.08 are autotuned; when the present motor is motor 2, only P12.06, P12.07, and P12.08 are autotuned. 4: Dynamic autotuning 2 (similar to dynamic autotuning 1) 5: Partial parameter static autotuning 2	0
P02.01	Rated power of AM 1	Range: 0.1–3000.0kW	Model depended
P02.02	Rated frequency of AM 1	Range: 0.01Hz–P00.03 (Max. output frequency)	50.00Hz
P02.03	Rated speed of AM 1	Range: 1–60000rpm	Model depended
P02.04	Rated voltage of AM 1	Range: 0–1200V	Model

Function code	Name	Description	Default
			depended
P02.05	Rated current of AM 1	Range: 0.8–6000.0A	Model depended
P02.06	Stator resistance of AM 1	Range: 0.001–65.535Ω	Model depended
P02.07	Rotor resistance of AM 1	Range: 0.001–65.535Ω	Model depended
P02.08	Leakage inductance of AM 1	Range: 0.1–6553.5mH	Model depended
P02.09	Mutual inductance of AM 1	Range: 0.1–6553.5mH	Model depended
P02.10	No-load current of AM 1	Range: 0.1–6553.5A	Model depended
P05.01–P05.06	Function selection of multifunction digital input terminals (S1–S4, and HDIA)	35: Switch from motor 1 to motor 2	0
P08.31	Switching between motor 1 and motor 2	Range: 0x00–0x14 Ones place: Switchover channel 0: Terminal 1: Modbus/Modbus TCP communication 2: PROFIBUS/CANopen communication 3: Ethernet communication 4: EtherCAT/PROFINET/EtherNet IP communication Tens place: indicates whether to enable switchover during running 0: Disable 1: Enable	0x00
P12.01	Rated power of AM 2	Range: 0.1–3000.0kW	Model depended
P12.02	Rated frequency of AM 2	Range: 0.01Hz–P00.03 (Max. output frequency)	50.00Hz
P12.03	Rated speed of AM 2	Range: 1–60000rpm	Model depended
P12.04	Rated voltage of AM 2	Range: 0–1200V	Model depended
P12.05	Rated current of AM 2	Range: 0.8–6000.0A	Model

Function code	Name	Description	Default
			depended
P12.06	Stator resistance of AM 2	Range: 0.001–65.535Ω	Model depended
P12.07	Rotor resistance of AM 2	Range: 0.001–65.535Ω	Model depended
P12.08	Leakage inductance of AM 2	Range: 0.1–6553.5mH	Model depended
P12.09	Mutual inductance of AM 2	Range: 0.1–6553.5mH	Model depended
P12.10	No-load current of AM 2	Range: 0.1–6553.5A	Model depended

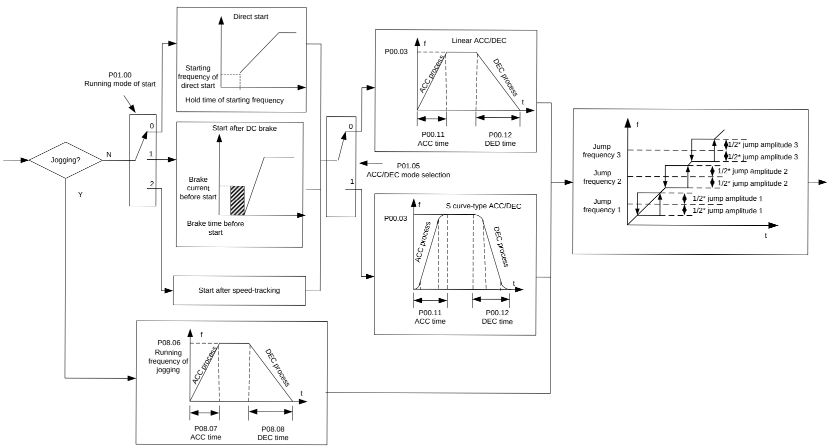
5.5.7 Start/stop control

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.

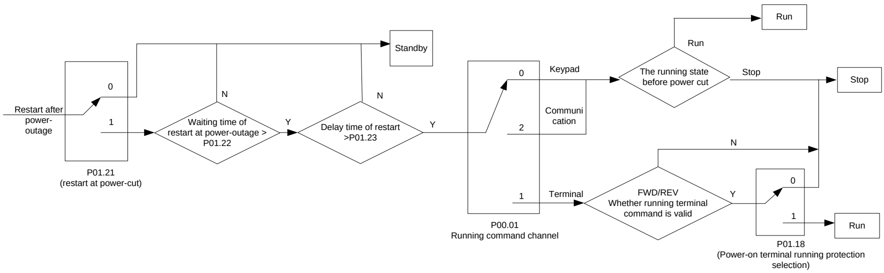
There are three start modes for the VFD, which are start at starting frequency, start after DC braking, and start after speed tracking. You can select the proper start mode based on actual conditions.

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

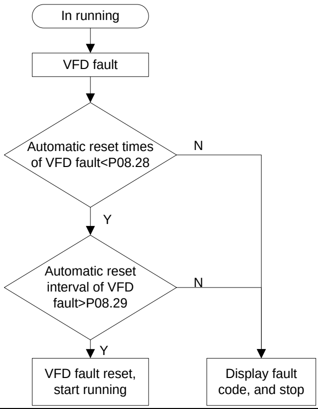
1. Logic diagram for start after a running command is given at power-on



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



3. Logic diagram for start after automatic fault reset



Function code	Name	Description	Default
P00.01	Channel of running commands	0: Keypad 1: Terminal 2: Communication	0
P00.11	ACC time 1	Range: 0.0–3600.0s	Model depended
P00.12	DEC time 1	Range: 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 **Note:** For AMs, speed tracking is not supported in SVC 0, and software speed tracking is supported in other modes. For details, see parameters P01.35–P01.41.	0

Function code	Name	Description	Default
P01.01	Starting frequency of direct start	Range: 0.00–50.00Hz	0.50Hz
P01.02	Starting frequency hold time	Range: 0.0–50.0s	0.0s
P01.03	Braking current before start	Range: 0.0–100.0%	0.0°
P01.04	DC braking time before start	Range: 0.00–50.00s	0.00s
P01.05	ACC/DEC mode	0: Linear 1: S curve **Note:** If mode 1 is selected, set P01.06, P01.07, P01.27, and P01.28 accordingly.	0
P01.08	Stop mode	0: Decelerate to stop 1: Coast to stop	0
P01.09	Starting frequency of braking for stop	Range: 0.00Hz–P00.03 (Max. output frequency)	0.00Hz
P01.10	Wait time before DC braking for stop	Range: 0.00–50.00s	0.00s
P01.11	DC braking current for stop	Range: 0.0–100.0%	0.0°
P01.12	DC braking time for stop	Range: 0.00–50.00s	0.00s
P01.13	FWD/REV run deadzone time	Range: 0.0–3600.0s	0.0s
P01.14	FWD/REV run switching mode	0: Switch at zero frequency 1: Switch at the starting frequency 2: Switch after the speed reaches the stop speed with a delay	0
P01.15	Stop speed	Range: 0.00–100.00Hz	0.50Hz
P01.16	Stop speed detection mode	0: Detect by the set speed (unique in V/F mode) 1: Detect according to speed feedback	1
P01.18	Terminal-based running command protection at power-on	0: The terminal-based running command is invalid at power-on 1: The terminal-based running command is valid at power-on	0
P01.19	Action selected when running frequency less than lower limit frequency (valid when lower limit frequency	0: Run at the lower limit frequency 1: Stop 2: Sleep	0

Function code	Name	Description	Default
	greater than 0)		
P01.20	Wake-up-from-sleep delay	Range: 0.0–3600.0s (valid when P01.19=2)	0.0s
P01.21	Power-off restart selection	0: Disable restart 1: Enable restart	0
P01.22	Wait time for restart after power-off	Range: 0.0–3600.0s (valid when P01.21=1)	1.0s
P01.23	Start delay time	Range: 0.0–60.0s	0.0s
P01.24	Stop speed delay	Range: 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	Range: 0.0–60.0s	2.0s
P01.27	Time of starting segment of DEC S curve	Range: 0.0–50.0s	0.1s
P01.28	Time of ending segment of DEC S curve	Range: 0.0–50.0s	0.1s
P01.29	Short-circuit braking current	Range: 0.0–150.0% (of the VFD rated output current)	0.0°
P01.30	Hold time of short-circuit braking for start	Range: 0.00–50.00s	0.00s
P01.31	Hold time of short-circuit braking for stop	Range: 0.00–50.00s	0.00s
P01.32	Pre-exciting time for jogging	Range: 0.000–10.000s	0.300s
P01.33	Starting frequency of braking for stop in jogging	Range: 0.00Hz–P00.03	0.00Hz
P01.34	Sleep delay	Range: 0.0–3600.0s	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: Fault reset 8: Pause running 21: ACC/DEC time selection 1 22: ACC/DEC time selection 2	

Function code	Name	Description	Default
		30: Disable ACC/DEC	
P08.00	ACC time 2	Range: 0.0–3600.0s	Model depended
P08.01	DEC time 2	Range: 0.0–3600.0s	Model depended
P08.02	ACC time 3	Range: 0.0–3600.0s	Model depended
P08.03	DEC time 3	Range: 0.0–3600.0s	Model depended
P08.04	ACC time 4	Range: 0.0–3600.0s	Model depended
P08.05	DEC time 4	Range: 0.0–3600.0s	Model depended
P08.06	Running frequency of jog	Range: 0.00Hz–P00.03 (Max. output frequency)	5.00Hz
P08.07	ACC time for jogging	Range: 0.0–3600.0s	Model depended
P08.08	DEC time for jogging	Range: 0.0–3600.0s	Model depended
P08.19	Switching frequency of ACC/DEC time	Range: 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
P08.21	Reference frequency of ACC/DEC time	0: Max. output frequency 1: Set frequency 2: 100Hz **Note:** Valid for linear ACC/DEC only.	0
P08.28	Auto fault reset count	Range: 0–10	0
P08.29	Auto fault reset interval	Range: 0.1–3600.0s	1.0s

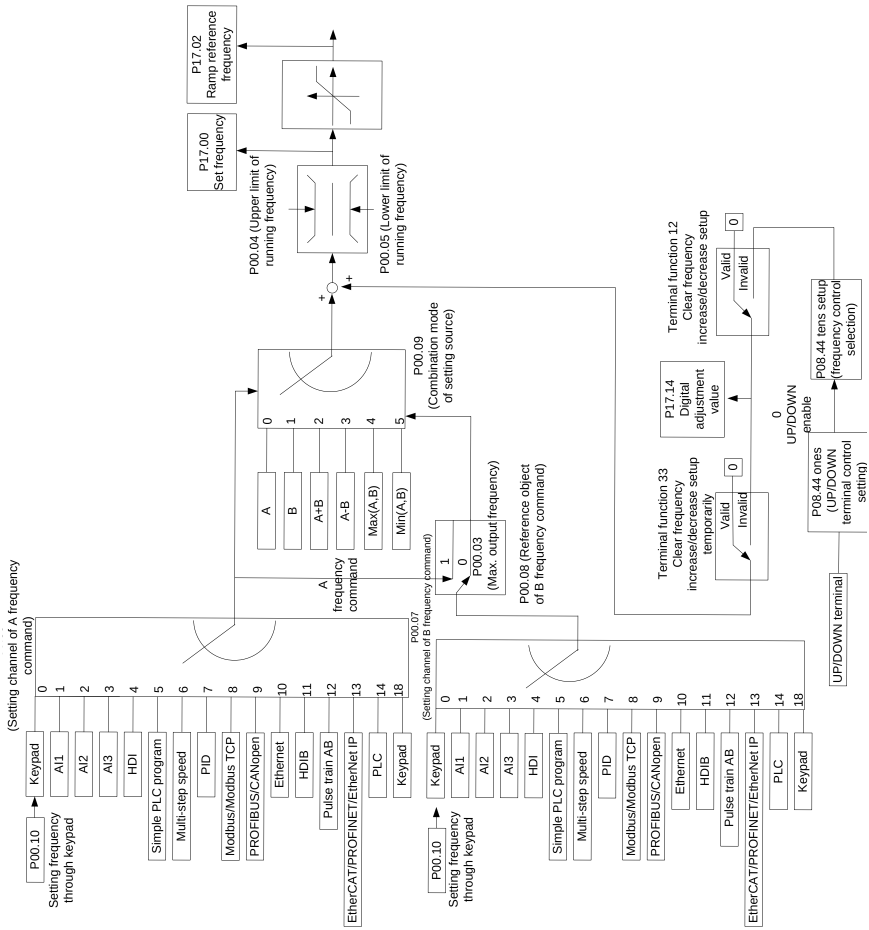
5.5.8 Frequency setting

The VFD supports multiple frequency reference methods, while the reference channels can be categorized into two types: main reference channel and auxiliary reference channel.

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

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

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



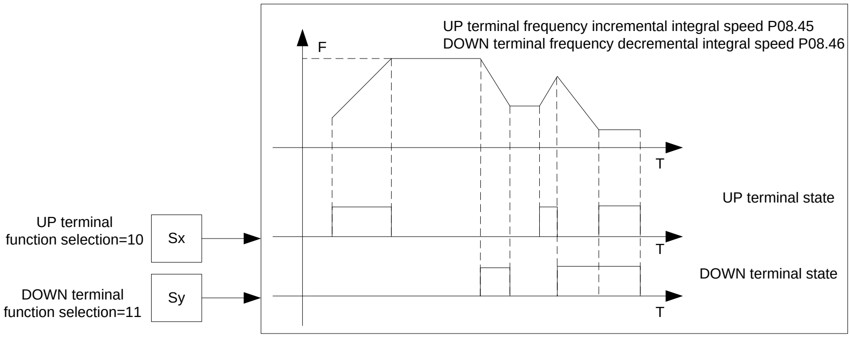
The VFD supports switchover between different reference channels, and the rules for channel switchover are shown as follows.

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

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	/	A	B
Max(A, B)	/	A	B
Min(A, B)	/	A	B

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

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



Function code	Name	Description	Default
P00.03	Max. output frequency	Range: P00.04–400.00Hz	50.00Hz
P00.04	Upper limit of running frequency	Range: P00.05–P00.03	50.00Hz
P00.05	Lower limit of running frequency	Range: 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 5: Simple PLC program 6: Multi-step speed running 7: PID control 8: Modbus/Modbus TCP communication 9: PROFIBUS/CANopen communication	0
P00.07	Setting channel of B frequency command		15

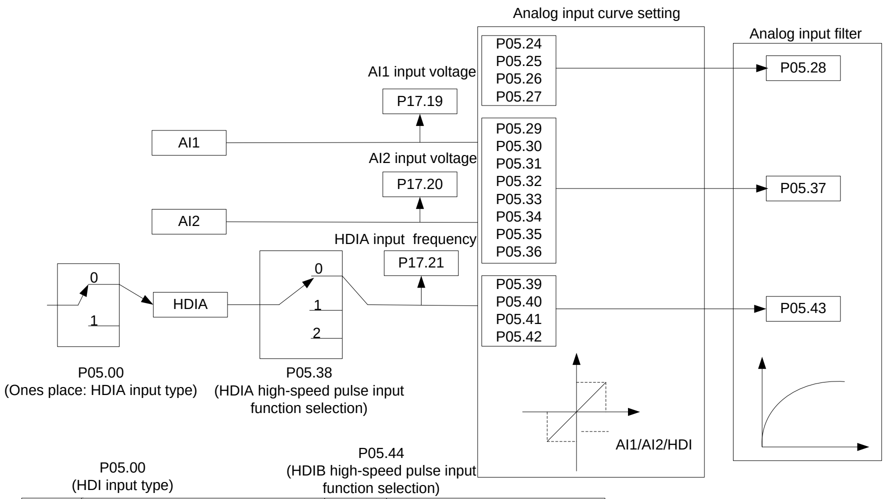
Function code	Name	Description	Default
		10: Ethernet communication 11: High-speed pulse HDIB 12: Pulse train AB 13: EtherCAT/PROFINET/EtherNet IP communication 14: Programmable card 15–17: Reserved 18: Keypad analog (valid for VFDs in T1–T4 frames) **Note:** Options 1–3 are invalid for VFDs in T1–T4 frames.	
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, and HDIA)	10: Increase frequency setting (UP) 11: Decrease frequency setting (DOWN) 12: Clear the frequency increase/decrease setting 13: Switch between A setting and B setting 14: Switch between combination setting and A setting 15: Switch between combination setting and B setting	
P08.42	Keypad digital control setting	Range: 0x0000–0x1223 Ones place: Frequency setting selection 0: Both the UP/DOWN key and digital potentiometer can be used for the control. 1: Only control through the UP/ DOWN key is valid. 2: Only control through the digital potentiometer is valid. 3: Neither the UP/DOWN key nor the digital potentiometer can be used for the control. Tens place: Frequency control selection	0x0000

Function code	Name	Description	Default
		0: Valid only when P00.06=0 or P00.07=0 1: Valid for all frequency setting methods 2: Invalid for multi-step speed running when multi-step speed running has the priority Hundreds place: Action selection for stop 0: Setting is valid. 1: Valid during running, cleared after stop 2: Valid during running, cleared after a stop command is received Thousands place: Indicates whether to enable the integral function through the UP/DOWN key and digital potentiometer. 0: Enable the integral function 1: Disable the integral function **Note:** It is valid for LED keypad.	
P08.43	Keypad digital potentiometer integral rate	Range: 0.01–10.00s	0.10s
P08.44	UP/DOWN terminal control setting	Range: 0x000–0x221 Ones place: Frequency setting selection 0: The setting made through UP/DOWN is valid. 1: The setting made through UP/DOWN is invalid. Tens place: Frequency control selection 0: Valid only when P00.06=0 or P00.07=0 1: Valid for all frequency setting methods 2: Invalid for multi-step speed running when multi-step speed running has the priority Hundreds place: Action selection for stop 0: Setting is valid. 1: Valid during running, cleared after stop 2: Valid during running, cleared after a stop command is received	0x000
P08.45	Frequency increment change rate of the UP terminal	Range: 0.01–50.00Hz/s **Note:** The value is also used as the frequency increment or decrement that is made by pressing the UP/DOWN key on the LCD keypad.	0.50Hz/s
P08.46	Frequency reduce rate of the DOWN terminal	Range: 0.01–50.00Hz/s	0.50Hz/s

Function code	Name	Description	Default
P17.00	Set frequency	Range: 0.00Hz–P00.03 (Max. output frequency)	0.00Hz
P17.02	Ramp reference frequency	Range: 0.00Hz–P00.03 (Max. output frequency)	0.00Hz
P17.14	Digital adjustment value	Range: 0.00Hz–P00.03 (Max. output frequency)	0.00Hz

5.5.9 Analog input

The VFD carries two analog input terminals AI1 and AI2, in which AI1 supports the range of 0(2)–10V/0(4)–20mA (whether AI1 uses voltage input or current input can be set by P05.50; when AI1 uses current input, change the AI1 jumper cap on the control board from V to I) and AI2 supports the range of -10–+10V), and one high-speed pulse input terminal. 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 place: 0: HDIA is high-speed pulse input 1: HDIA is digital input	P05.38	0: Input set through frequency 1: Reserved 2: Reserved
	Tens place: (reserved) 0: HDIB is high-speed pulse input 1: HDIB is digital input	P05.44	0: Input set through frequency 1: Reserved 2: Reserved

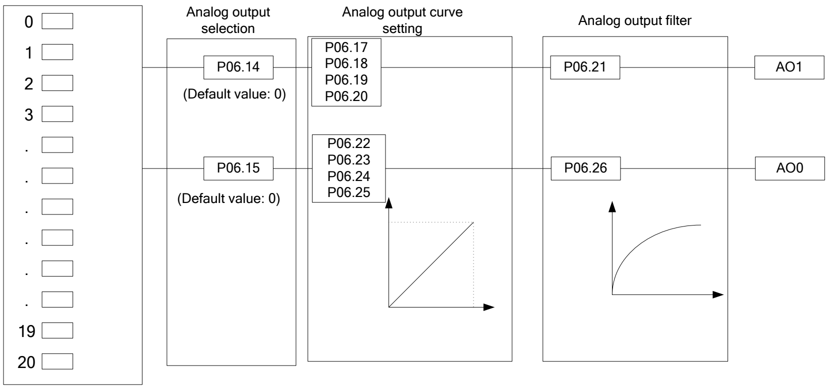
Function code	Name	Description	Default
P05.00	HDI input type	Range: 0x00–0x11 Ones place: HDIA input type 0: HDIA is high-speed pulse input 1: HDIA is digital input	0x00

Function code	Name	Description	Default
		Tens place: HDIB input type (Reserved) 0: HDIB is high-speed pulse input (Reserved) 1: HDIB is digital input (Reserved)	
P05.24	AI1 lower limit	Range: 0.00V–P05.26	0.00V
P05.25	Corresponding setting of AI1 lower limit	Range: -300.0%–300.0%	0.0°
P05.26	AI1 upper limit	Range: P05.24–10.00V	10.00V
P05.27	Corresponding setting of AI1 upper limit	Range: -300.0%–300.0%	100.0°
P05.28	AI1 input filter time	Range: 0.000s–10.000s	0.100s
P05.29	AI2 lower limit	Range: -10.00V–P05.31	-10.00V
P05.30	Corresponding setting of AI2 lower limit	Range: -300.0%–300.0%	-100.0°
P05.31	AI2 middle value 1	Range: P05.29–P05.33	0.00V
P05.32	Corresponding setting of AI2 middle value 1	Range: -300.0%–300.0%	0.0°
P05.33	AI2 middle value 2	Range: P05.31–P05.35	0.00V
P05.34	Corresponding setting of AI2 middle value 2	Range: -300.0%–300.0%	0.0°
P05.35	AI2 upper limit	Range: P05.33–10.00V	10.00V
P05.36	Corresponding setting of AI2 upper limit	Range: -300.0%–300.0%	100.0°
P05.37	AI2 input filter time	Range: 0.000s–10.000s	0.100s
P05.38	HDIA high-speed pulse input function selection	0: Frequency setting input	0
P05.39	HDIA lower limit frequency	Range: 0.000kHz–P05.41	0.000kHz
P05.40	Corresponding setting of HDIA lower limit frequency	Range: -300.0%–300.0%	0.0°
P05.41	HDIA upper limit frequency	Range: P05.39–50.000kHz	50.000kHz
P05.42	Corresponding setting of HDIA upper limit frequency	Range: -300.0%–300.0%	100.0°
P05.43	HDIA frequency input filter time	Range: 0.000s–10.000s	0.030s
P05.50	AI1 input signal type	Range: 0x00–0x11 Ones place: Input signal source 0: Voltage	0x00

Function code	Name	Description	Default
		1: Current Tens place: Input value unit selection 0: All voltage type 1: Voltage for voltage-type input, current for current-type input **Note:** After selecting the voltage or current input through the function code, ensure that the control board selection jumper is installed in the correct position.	

5.5.10 Analog output

The VFD carries two analog output terminals (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

Setting	Function	Description
		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 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 communication	0–1000
15	Value 2 set through Modbus communication	0–1000
16	Value 1 set through PROFIBUS/CANopen communication	0–1000
17	Value 2 set through PROFIBUS/CANopen communication	0–1000
18	Value 1 set through Ethernet communication	0–1000
19	Value 2 set through Ethernet communication	0–1000
20	HDIB input value	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, 100% corresponding to 10V)	0–Three times the motor rated current. A negative value corresponds to 0.0% by default.
23	Exciting current (100% corresponding to 10V)	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

Setting	Function	Description
		default.
27	Value 2 set through EtherCAT/PROFINET/EtherNet IP communication	0–1000
28	C_AO1 from CODESYS (Set P27.00 to 1.)	
29	C_AO2 from CODESYS (Set P27.00 to 1.)	
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	PID1 output	
33	PID2 output	
34	PID1 reference value	
35	PID1 feedback value	
36	PID2 reference value	
37	PID2 feedback value	
40	Value 0 set through PROFIBUS/CANopen communication	
41	Value 0 set through EtherCAT/PROFINET/EtherNet IP communication	

Related function parameters:

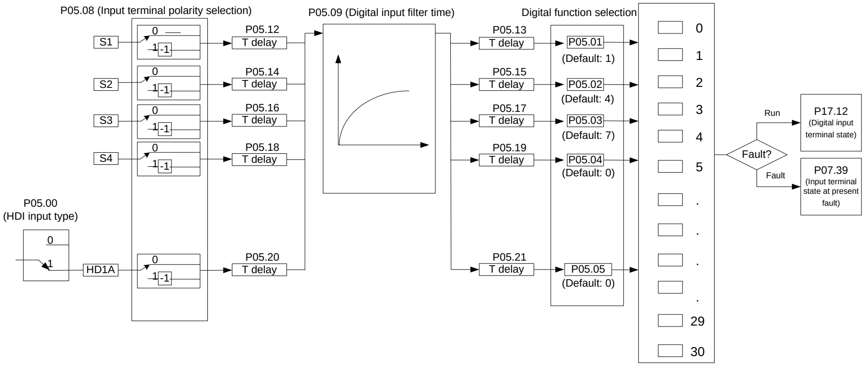
<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th></tr>
<tr><td>P06.14</td><td>AO1 output</td><td rowspan="3">Range: 0–47
0: Running frequency
1: Set frequency
2: Ramp reference frequency
3: Rotational speed
4: Output current (relative to the VFD)
5: Output current (relative to the motor)
6: Output voltage
7: Output power
8: Set torque
9: Output torque
10: AI1 input value
11: AI2 input value</td><td>0</td></tr>
<tr><td>P06.15</td><td>AO0 output selection</td><td>0</td></tr>
<tr><td>P06.16</td><td>Reserved</td><td>0</td></tr>
</table>

Function code	Name	Description	Default
		12: AI3 input value 13: High-speed pulse HDIA input 14: Value 1 set through Modbus communication 15: Value 2 set through Modbus communication 16: Value 1 set through PROFIBUS/CANopen communication 17: Value 2 set through PROFIBUS/CANopen communication 18: Value 1 set through Ethernet communication 19: Value 2 set through Ethernet communication 20: HDIB input value 21: Value 1 set through EtherCAT/PROFINET/EtherNet IP communication 22: Torque current (bipolar, 100% corresponding to 10V) 23: Exciting current (100% corresponding to 10V) 24: Set frequency (bipolar) 25: Ramp reference frequency (bipolar) 26: Rotational speed (bipolar) 27: Value 2 set through EtherCAT/PROFINET/EtherNet IP communication 28: C_AO1 from CODESYS (Set P27.00 to 1.) 29: C_AO2 from CODESYS (Set P27.00 to 1.) 30: Rotational speed 31: Output torque 32: PID1 output 33: PID2 output 34: PID1 reference value 35: PID1 feedback value 36: PID2 reference value 37: PID2 feedback value 38–39: Reserved 40: Value 0 set through PROFIBUS/CANopen communication 41: Value 0 set through EtherCAT/ PROFINET/EtherNet IP communication 42–47: Reserved	
P06.17	AO1 output lower	Range: -300.0%–P06.19	0.0°

Function code	Name	Description	Default
	limit		
P06.18	AO1 output corresponding to lower limit	Range: 0.00V–10.00V	0.00V
P06.19	AO1 output upper limit	Range: P06.17–300.0%	100.0°
P06.20	AO1 output corresponding to upper limit	Range: 0.00V–10.00V	10.00V
P06.21	AO1 output filter time	Range: 0.000s–10.000s	0.000s
P06.22	AO0 output lower limit	Range: -300.0%–P06.24	0.0°
P06.23	AO0 output corresponding to lower limit	Range: 0.00V–10.00V	0.00V
P06.24	AO0 output upper limit	Range: P06.22–300.0%	100.0°
P06.25	AO0 output corresponding to upper limit	Range: 0.00V–10.00V	10.00V
P06.26	AO0 output filter time	Range: 0.000s–10.000s	0.000s

5.5.11 Digital input

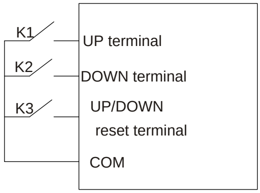
The VFD carries four programmable digital input terminals and two HDI input terminals. The function of all the digital input terminals can be programmed through function codes. HDI input terminal can be set to act as high-speed pulse input terminal or common digital input terminal; if it is set to act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



The function parameters P05.01–P05.05 are used to set the functions of digital multifunction 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 P05.13.
4	Forward jogging	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 reversely	
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 and PID parameters. 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.

<table>
<tr><th>Setting</th><th>Function</th><th>Description</th></tr>
<tr><td>11</td><td>Decrease frequency setting (DOWN)</td><td rowspan="2">

The terminal used to clear frequency-increase/decrease setting can clear the frequency value of auxiliary channel set by UP/DOWN, thus restoring the reference frequency to the frequency given by main reference frequency command channel.</td></tr>
<tr><td>12</td><td>Clear the frequency increase/decrease setting</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.
Function 13 can implement the switchover between A frequency reference channel and B frequency reference channel; function 14 can implement the switchover between the combination channel set by P00.09 and the A frequency reference channel; function 15 can implement the switchover between the combination channel set by P00.09 and the B frequency reference channel.</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>Terminal 1</th><th>Terminal 2</th><th>ACC/DEC time</th><th>Parameter</th></tr>
<tr><td>OFF</td><td>OFF</td><td>ACC/DEC time 1</td><td>P00.11/P00.12</td></tr>
<tr><td>ON</td><td>OFF</td><td>ACC/DEC time 2</td><td>P08.00/P08.01</td></tr>
<tr><td>OFF</td><td>ON</td><td>ACC/DEC time 3</td><td>P08.02/P08.03</td></tr>
<tr><td>ON</td><td>ON</td><td>ACC/DEC time 4</td><td>P08.04/P08.05</td></tr>
</table></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 PID1 control</td><td>PID is ineffective temporarily, and the VFD maintains current</td></tr>
</table>

Setting	Function	Description
		frequency output.
26	Pause wobbling frequency	/
27	Reset wobbling frequency	/
28	Reset the counter	The counter is cleared.
29	Switch between speed control and torque control	The VFD switches from torque control mode to speed control mode, or vice versa.
30	Disable ACC/DEC	Used to ensure the VFD is not impacted by external signals (except for stop command), and maintains the present output frequency.
31	Trigger the counter	Used to enable the counter to count pulses.
33	Clear the frequency increase/decrease setting temporarily	When the terminal is closed, the frequency value set by UP/DOWN can be cleared to restore the reference frequency to the frequency given by frequency command channel; when the terminal is opened, it restores to the frequency value after frequency increase/decrease setting.
34	DC braking	The VFD starts DC brake immediately after the command becomes valid.
35	Switchover between motors 1 and 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.
73	PID2 start	When the command is valid, PID2 starts.

Setting	Function	Description
74	PID2 stop	When the command is valid, PID2 stops.
75	Pause PID2 integral	When the command is valid, PID2 integral is paused.
76	Pause PID2 control	When the command is valid, PID2 control is paused.
77	Switch PID2 polarities	When the command is valid, PID2 polarity is switched.
78	HVAC disabled (Effective only in stopped state)	When the command is valid, HVAC is disabled (only in stopped state).
80	Pause PID1 control	When the command is valid, PID1 control is paused.
81	Pause PID1 integral	When the command is valid, PID1 integral is paused.
82	Switch PID1 polarities	When the command is valid, PID1 polarity is switched.
83	Trigger sleep mode	When the command is valid, the sleep mode is triggered.
84	Trigger wakeup mode	When the command is valid, the wakeup mode is triggered.
85	Manual alternation	When the command is valid, manual alternation is enabled.
104	Disable motor A	When the command is valid, motor A is disabled.
105	Disable motor B	When the command is valid, motor B is disabled.
106	Disable motor C	When the command is valid, motor C is disabled.
107	Disable motor D	When the command is valid, motor D is disabled.
108	Disable motor E	When the command is valid, motor E is disabled.
109	Disable motor F	When the command is valid, motor F is disabled.
110	Disable motor G	When the command is valid, motor G is disabled.
111	Disable motor H	When the command is valid, motor H is disabled.

Related function parameters:

<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>Range: 0x00–0x11
Ones place: HDIA input type
0: HDIA is high-speed pulse input
1: HDIA is digital input
Tens place: Reserved</td><td>0x00</td></tr>
<tr><td>P05.01</td><td>Function of S1</td><td rowspan="7">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: Fault reset
8: Pause running
9: External fault input
10: Increase frequency setting (UP)</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>Reserved</td><td>/</td></tr>
<tr><td>P05.07</td><td>Reserved</td><td>/</td></tr>
</table>

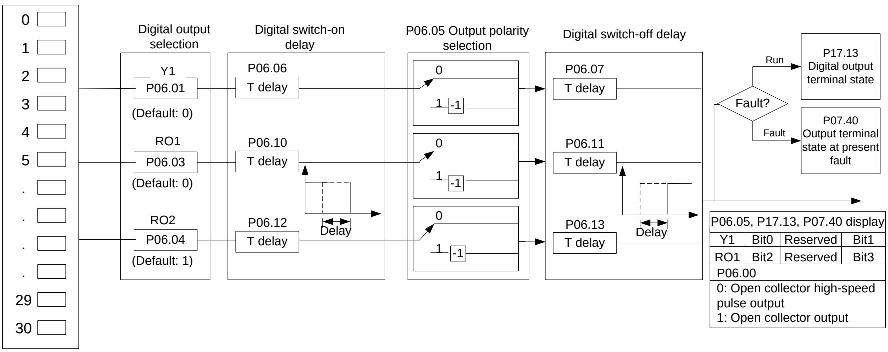
Function code	Name	Description	Default
		11: Decrease frequency setting (DOWN) 12: Clear the frequency increase/decrease setting 13: Switch between A setting and B setting 14: Switch between combination setting and A setting 15: Switch between combination setting and B setting 16: Multi-step speed terminal 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 PID1 control 26: Pause wobbling frequency 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	

Function code	Name	Description	Default
		41: Keep electricity consumption 42: Switch the setting source of braking torque upper limit to keypad 43–72: Reserved 73: PID2 start 74: PID2 stop 75: Pause PID2 integral 76: Pause PID2 control 77: Switch PID2 polarities 78: Disable HVAC (only in stopped state) 79: Reserved 80: Pause PID1 control 81: Pause PID1 integral 82: Switch PID1 polarities 83: Trigger sleep mode 84: Trigger wakeup mode 85: Manual alternation 86–103: Reserved 104: Disable motor A 105: Disable motor B 106: Disable motor C 107: Disable motor D 108: Disable motor E 109: Disable motor F 110: Disable motor G 111: Disable motor H	
P05.08	Input terminal polarity selection	Range: 0x00–0x3F	0x00
P05.09	Digital input filter time	Range: 0.000–1.000s	0.010s
P05.10	Virtual terminal setting	Range: 0x00–0x3F (0: disable; 1: enable) Bit0: S1 virtual terminal Bit1: S2 virtual terminal Bit2: S3 virtual terminal Bit3: S4 virtual terminal Bit 4: HDIA virtual terminal Bit 5: HDIB (Reserved)	0x00
P05.11	Terminal control mode	0: Two-wire control mode 1 1: Two-wire control mode 2 2: Three-wire control mode 1	0

Function code	Name	Description	Default
		3: Three-wire control mode 2	
P05.12	S1 switch-on delay	Range: 0.000–50.000s	0.000s
P05.13	S1 switch-off delay	Range: 0.000–50.000s	0.000s
P05.14	S2 switch-on delay	Range: 0.000–50.000s	0.000s
P05.15	S2 switch-off delay	Range: 0.000–50.000s	0.000s
P05.16	S3 switch-on delay	Range: 0.000–50.000s	0.000s
P05.17	S3 switch-off delay	Range: 0.000–50.000s	0.000s
P05.18	S4 switch-on delay	Range: 0.000–50.000s	0.000s
P05.19	S4 switch-off delay	Range: 0.000–50.000s	0.000s
P05.20	HDIA switch-on delay	Range: 0.000–50.000s	0.000s
P05.21	HDIA switch-off delay	Range: 0.000–50.000s	0.000s
P07.39	Input terminal state at present fault	Range: 0x0000–0xFFFF	0x0000
P17.12	Digital input terminal state	Range: 0x0000–0xFFFF	0x0000

5.5.12 Digital output

The VFD carries two groups of relay output terminals and one open collector Y output terminal. All the digital output terminal functions can be used for programming 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.

Setting	Function	Description
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 and P08.33.
7	Frequency level detection FDT2	Refer to the descriptions for P08.34 and P08.35.
8	Frequency reached	Refer to the description for P08.36.
9	Running in zero speed	The ON signal is output when the VFD output frequency and reference frequency are both zero.
10	Upper limit frequency reached	The ON signal is output when the running frequency reaches the upper limit frequency.
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 after the alarm time elapsed based on the alarm threshold. For details, see the descriptions for P11.08–P11.10.
15	Underload pre-alarm	The ON signal is output after the alarm time elapsed based on the alarm threshold. For details, see the descriptions for P11.11–P11.12.
16	Simple PLC stage completed	When the present state of the simple PLC is completed, it outputs a signal.
17	Simple PLC cycle completed	When a single cycle of the simple PLC is completed, it outputs a signal.
18	Set counting value reached	/
19	Designated counting value reached	/
20	External fault is valid	/
22	Running time reached	/
23	Modbus communication virtual terminal output	A signal is output based on the value set through Modbus communication. When the value is 1, the ON signal is output; when the value is 0, the OFF signal is output.
24	POROFIBUS/CANopen communication virtual terminal output	A signal is output based on the value set through PROFIBUS/CANopen communication. When the value is 1, the ON signal is output; when the value is 0, the OFF signal

Setting	Function	Description
		is output.
25	Ethernet communication virtual terminal output	A signal is output based on the value set through Ethernet communication. When the value is 1, the ON signal is output; when the value is 0, the OFF signal is output.
26	DC bus voltage established	When the bus voltage is above the inverter undervoltage, the output is valid.
33	In speed limit	/
34	PROFINET/EtherNet IP communication virtual terminal output	A signal is output based on the value set through PROFINET/EtherNet IP communication. When the value is 1, the ON signal is output; when the value is 0, the OFF signal is output.
37	Any frequency reached	/
49	Pre-alarm of PID1 feedback too low	/
50	Pre-alarm of PID1 feedback too high	/
51	PID1 in sleep	/
52	PID2 in startup	/
53	PID2 stopped	/
56	Pre-alarm output	/
57	Control variable-frequency circulation motor A	/
58	Control variable-frequency circulation motor B	/
59	Control variable-frequency circulation motor C	/
60	Control variable-frequency circulation motor D	/
61	Control variable-frequency circulation motor E	/
62	Control variable-frequency circulation motor F	/
63	Control variable-frequency circulation motor G	/
64	Control variable-frequency circulation motor H	/
65	Low temperature pre-alarm	/
66	Stall pre-alarm	/
67	Dry-pumping pre-alarm	/

Setting	Function	Description
68	PTC overtemperature pre-alarm	/

Related function parameters:

Function code	Name	Description	Default
P06.01	Y1 output	Range: 0–68	0
P06.02	HDO output	0: Invalid	/
P06.03	RO1 output	1: Running	1
P06.04	RO2 output	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 in zero speed 10: Upper limit frequency reached 11: Lower limit frequency reached 12: Ready for running 13: Pre-exciting 14: Overload alarm 15: Underload alarm 16: Simple PLC stage completed 17: Simple PLC cycle completed 18: Set counting value reached 19: Designated counting value reached 20: External fault is valid 21: Reserved 22: Running time reached 23: Modbus communication virtual terminal output 24: PROFIBUS/CANopen communication virtual terminal output 25: Ethernet communication virtual terminal output 26: DC bus voltage established 27–32: Reserved 33: In speed limit	/

Function code	Name	Description	Default
		34: EtherCAT/PROFINET/EtherNet IP communication virtual terminal output 35–36: Reserved 37: Any frequency reached 38–48: Reserved 49: Pre-alarm of PID1 feedback too low 50: Pre-alarm of PID1 feedback too high 51: PID1 in sleep 52: PID2 in startup 53: PID2 stopped 54–55: Reserved 56: Pre-alarm output 57: Control variable-frequency circulation motor A 58: Control variable-frequency circulation motor B 59: Control variable-frequency circulation motor C 60: Control variable-frequency circulation motor D 61: Control variable-frequency circulation motor E 62: Control variable-frequency circulation motor F 63: Control variable-frequency circulation motor G 64: Control variable-frequency circulation motor H 65: Low-temperature pre-alarm 66: Stalling pre-alarm 67: Dry-pumping pre-alarm 68: PTC overtemperature pre-alarm	
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
P06.10	RO1 switch-on delay	0.000–50.000s	0.000s
P06.11	RO1 switch-off delay	0.000–50.000s	0.000s

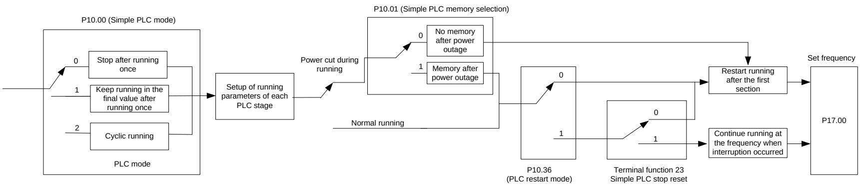
Function code	Name	Description	Default
P07.40	Output terminal state at present fault	0x0000–0xFFFF	0x0000
P17.13	Digital output terminal state	0x0000–0x000F	0x0000

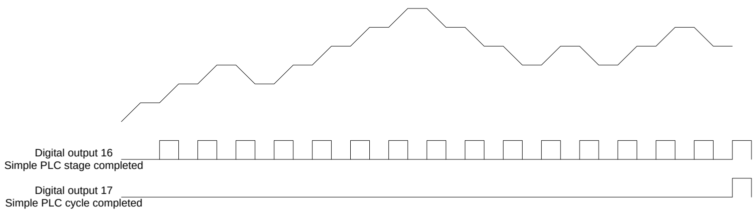
5.5.13 Simple PLC

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.





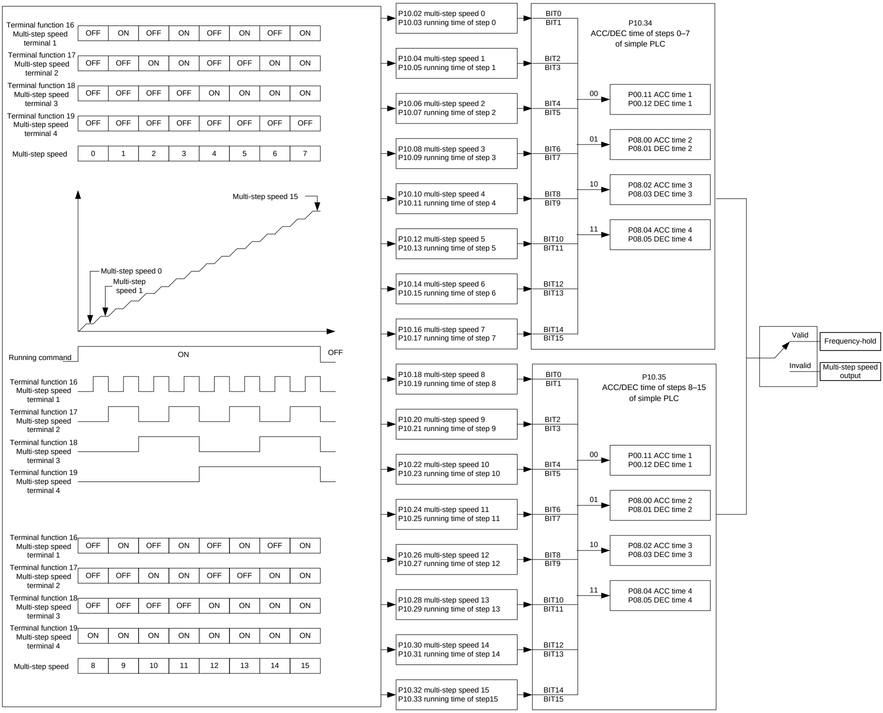
Function code	Name	Description	Default
P05.01–P05.06	Digital input function selection	23: Simple PLC stop reset 24: Pause simple PLC 25: Pause PID control	0
P06.01–P06.04	Digital output function selection	16: Simple PLC stage reached 17: Simple PLC cycle reached	0
P10.00	Simple PLC mode	0: Stop after 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

Function code	Name	Description	Default
P10.02	Multi-step speed 0	Range: -300.0%–300.0%	0.0°
P10.03	Running time of step 0	Range: 0.0–6553.5s (min)	0.0s
P10.04	Multi-step speed 1	Range: -300.0%–300.0%	0.0°
P10.05	Running time of step 1	Range: 0.0–6553.5s (min)	0.0s
P10.06	Multi-step speed 2	Range: -300.0%–300.0%	0.0°
P10.07	Running time of step 2	Range: 0.0–6553.5s (min)	0.0s
P10.08	Multi-step speed 3	Range: -300.0%–300.0%	0.0°
P10.09	Running time of step 3	Range: 0.0–6553.5s (min)	0.0s
P10.10	Multi-step speed 4	Range: -300.0%–300.0%	0.0°
P10.11	Running time of step 4	Range: 0.0–6553.5s (min)	0.0s
P10.12	Multi-step speed 5	Range: -300.0%–300.0%	0.0°
P10.13	Running time of step 5	Range: 0.0–6553.5s (min)	0.0s
P10.14	Multi-step speed 6	Range: -300.0%–300.0%	0.0°
P10.15	Running time of step 6	Range: 0.0–6553.5s (min)	0.0s
P10.16	Multi-step speed 7	Range: -300.0%–300.0%	0.0°
P10.17	Running time of step 7	Range: 0.0–6553.5s (min)	0.0s
P10.18	Multi-step speed 8	Range: -300.0%–300.0%	0.0°
P10.19	Running time of step 8	Range: 0.0–6553.5s (min)	0.0s
P10.20	Multi-step speed 9	Range: -300.0%–300.0%	0.0°
P10.21	Running time of step 9	Range: 0.0–6553.5s (min)	0.0s
P10.22	Multi-step speed 10	Range: -300.0%–300.0%	0.0°
P10.23	Running time of step 10	Range: 0.0–6553.5s (min)	0.0s
P10.24	Multi-step speed 11	Range: -300.0%–300.0%	0.0°
P10.25	Running time of step 11	Range: 0.0–6553.5s (min)	0.0s
P10.26	Multi-step speed 12	Range: -300.0%–300.0%	0.0°
P10.27	Running time of step 12	Range: 0.0–6553.5s (min)	0.0s
P10.28	Multi-step speed 13	Range: -300.0%–300.0%	0.0°
P10.29	Running time of step	Range: 0.0–6553.5s (min)	0.0s

Function code	Name	Description	Default
	13		
P10.30	Multi-step speed 14	Range: -300.0%–300.0%	0.0°
P10.31	Running time of step 14	Range: 0.0–6553.5s (min)	0.0s
P10.32	Multi-step speed 15	Range: -300.0%–300.0%	0.0°
P10.33	Running time of step 15	Range: 0.0–6553.5s (min)	0.0s
P10.34	ACC/DEC time of steps 0–7 of simple PLC	Range: 0x0000–0xFFFF	0x0000
P10.35	ACC/DEC time of steps 8–15 of simple PLC	Range: 0x0000–0xFFFF	0x0000
P10.36	PLC restart mode	0: Restart from multi-step speed 0. 1: Resume from the paused step.	0
P17.00	Set frequency	Range: 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 allows you to 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.

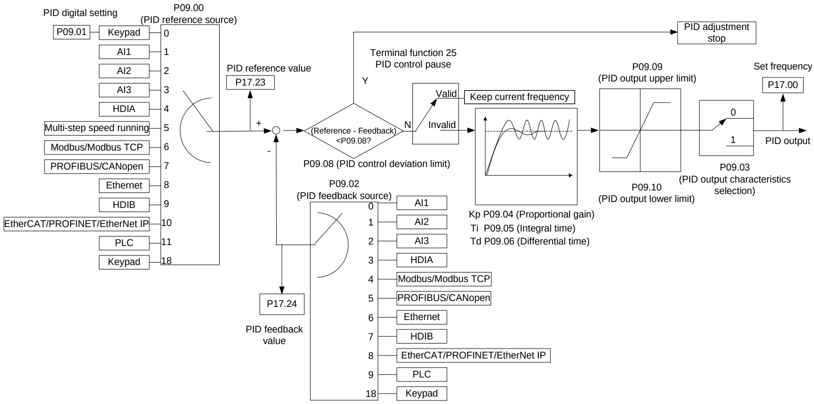


Function code	Name	Description	Default
P05.01–P05.06	Digital input function selection	16: Multi-step speed terminal 1 17: Multi-step speed terminal 2 18: Multi-step speed terminal 3 19: Multi-step speed terminal 4 20: Pause multi-step speed running	0
P10.02	Multi-step speed 0	Range: -300.0%–300.0%	0.0°
P10.03	Running time of step 0	Range: 0.0–6553.5s (min)	0.0s
P10.04	Multi-step speed 1	Range: -300.0%–300.0%	0.0°
P10.05	Running time of step 1	Range: 0.0–6553.5s (min)	0.0s
P10.06	Multi-step speed 2	Range: -300.0%–300.0%	0.0°
P10.07	Running time of step 2	Range: 0.0–6553.5s (min)	0.0s

Function code	Name	Description	Default
P10.08	Multi-step speed 3	Range: -300.0%–300.0%	0.0°
P10.09	Running time of step 3	Range: 0.0–6553.5s (min)	0.0s
P10.10	Multi-step speed 4	Range: -300.0%–300.0%	0.0°
P10.11	Running time of step 4	Range: 0.0–6553.5s (min)	0.0s
P10.12	Multi-step speed 5	Range: -300.0%–300.0%	0.0°
P10.13	Running time of step 5	Range: 0.0–6553.5s (min)	0.0s
P10.14	Multi-step speed 6	Range: -300.0%–300.0%	0.0°
P10.15	Running time of step 6	Range: 0.0–6553.5s (min)	0.0s
P10.16	Multi-step speed 7	Range: -300.0%–300.0%	0.0°
P10.17	Running time of step 7	Range: 0.0–6553.5s (min)	0.0s
P10.18	Multi-step speed 8	Range: -300.0%–300.0%	0.0°
P10.19	Running time of step 8	Range: 0.0–6553.5s (min)	0.0s
P10.20	Multi-step speed 9	Range: -300.0%–300.0%	0.0°
P10.21	Running time of step 9	Range: 0.0–6553.5s (min)	0.0s
P10.22	Multi-step speed 10	Range: -300.0%–300.0%	0.0°
P10.23	Running time of step 10	Range: 0.0–6553.5s (min)	0.0s
P10.24	Multi-step speed 11	Range: -300.0%–300.0%	0.0°
P10.25	Running time of step 11	Range: 0.0–6553.5s (min)	0.0s
P10.26	Multi-step speed 12	Range: -300.0%–300.0%	0.0°
P10.27	Running time of step 12	Range: 0.0–6553.5s (min)	0.0s
P10.28	Multi-step speed 13	Range: -300.0%–300.0%	0.0°
P10.29	Running time of step 13	Range: 0.0–6553.5s (min)	0.0s
P10.30	Multi-step speed 14	Range: -300.0%–300.0%	0.0°
P10.31	Running time of step 14	Range: 0.0–6553.5s (min)	0.0s
P10.32	Multi-step speed 15	Range: -300.0%–300.0%	0.0°
P10.33	Running time of step 15	Range: 0.0–6553.5s (min)	0.0s
P10.34	ACC/DEC time of steps 0–7 of simple PLC	Range: 0x0000–0xFFFF	0x0000
P10.35	ACC/DEC time of steps 8–15 of simple PLC	Range: 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 P00.06 or P00.07 (Setting channel of A/B frequency command) is 7 or P04.27 (Voltage setting channel) is 6, the VFD is process PID controlled.

5.5.15.1 General procedures for PID parameter setup

1. Determine 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. Increase the proportional gain P gradually from 0 until system oscillation occurred. Then decrease the proportional gain P gradually until system oscillation disappears. Record the proportional gain P at this point, and set the PID proportional gain P to 60%–70% of the present value. This is the entire commissioning procedure of proportional gain P.

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.

3. Determine derivative time Td.

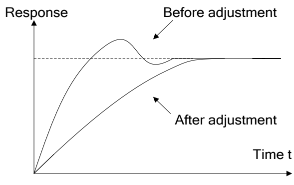
   The differential time Td is generally set to 0. If you need to set Td to another value, the setting method is similar to that for P and Ti, namely, set Td to 30% of the value when there is no oscillation.

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

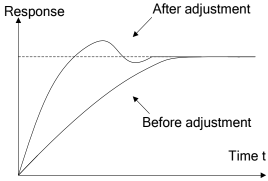
5.5.15.2 How to fine-tune PID

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

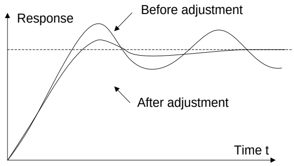
Control overshoot: When overshoot occurred, shorten the derivative time (Td) and prolong integral time (Ti).



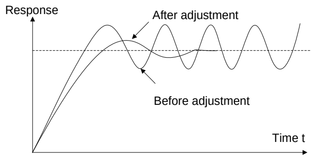
Stabilize the feedback value as fast as possible: When overshoot occurred, shorten integral time (Ti) and prolong derivative time (Td) to stabilize control as fast as possible.



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.



Function code	Name	Description	Default
P09.00	PID reference source	0: Keypad (P09.01) 1: AI1 2: AI2 3: AI3 4: High-speed pulse HDIA 5: Multi-step speed running 6: Modbus/Modbus TCP communication 7: PROFIBUS/CANopen communication 8: Ethernet communication 9: High-speed pulse HDIB 10: EtherCAT/PROFINET/EtherNet IP communication 11: Programmable card 12–17: Reserved 18: Keypad analog setting	0
P09.01	PID digital setting	-100.0%–100.0%	0.0°

Function code	Name	Description	Default
P09.02	PID feedback source	0: AI1 1: AI2 2: AI3 3: High-speed pulse HDIA 4: Modbus/Modbus TCP communication 5: PROFIBUS/CANopen communication 6: Ethernet communication 7: High-speed pulse HDIB 8: EtherCAT/PROFINET/EtherNet IP communication 9: Programmable card 10–17: Reserved 18: Keypad analog setting	0
P09.03	PID output characteristics selection	0: PID output is positive. 1: PID output is negative.	0
P09.04	Proportional gain (Kp)	Range: 0.00–100.00	1.80
P09.05	Integral time (Ti)	Range: 0.01–10.00s	0.90s
P09.06	Differential time (Td)	Range: 0.00–10.00s	0.00s
P09.07	Sampling cycle (T)	Range: 0.000–10.000s	0.100s
P09.08	PID control deviation limit	Range: 0.0–100.0%	0.0°
P09.09	PID output upper limit	Range: P09.10–100.0% (Max. frequency or voltage)	100.0°
P09.10	PID output lower limit	Range: -100.0%–P09.09 (of max. frequency or voltage)	0.0°
P09.11	Feedback offline detection value	Range: 0.0–100.0%	0.0°
P09.12	Feedback offline detection time	Range: 0.0–3600.0s	1.0s
P09.13	PID control selection	Range: 0x0000–0x1111 Ones place: 0: Continue integral control after the frequency reaches upper/lower limit 1: Stop integral control after the frequency reaches upper/lower limit Tens place: 0: Same as the main reference direction 1: Contrary to the main reference direction	0x0001

Function code	Name	Description	Default
		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 pre-charging is invalid. 1: A+B frequency. ACC/DEC of main reference A frequency source pre-charging is valid. **Note:** The ACC/DEC time is determined by P08.04.	
P09.14	Low frequency proportional gain (Kp)	Range: 0.00–100.00	1.00
P09.15	ACC/DEC time of PID command	Range: 0.0–1000.0s	0.0s
P09.16	PID output filter time	Range: 0.000–10.000s	0.000s
P09.18	Low frequency integral time (Ti)	Range: 0.00–10.00s	0.90s
P09.19	Low frequency differential time (Td)	Range: 0.00–10.00s	0.00s
P09.20	Low frequency point for PID parameter switching	Range: 0.00–P09.21	5.00Hz
P09.21	High frequency point for PID parameter switching	Range: P09.20–P00.04	10.00Hz
P17.00	Set frequency	Range: 0.00Hz–P00.03 (Max. output frequency)	0.00Hz
P17.23	PID1 reference value	Range: -100.0%–100.0%	0.0°
P17.24	PID1 feedback value	Range: -100.0%–100.0%	0.0°

5.5.16 Water pump control

The VFD provides the multi-pump control function, applicable to the scenario with the simultaneous operation of up to eight water pumps, capable of balancing fluctuations in water pressure and flow. This function simplifies the control system and controls the start and stop of each pump motor in balance mode to ensure optimal performance of the water system. To use this function, configure the following sub-functions based on requirements:

- ✧ Motor adding or reducing
- ✧ Multi-pump alternation
- ✧ Water pump maintenance
- ✧ Smooth switchover

Function description

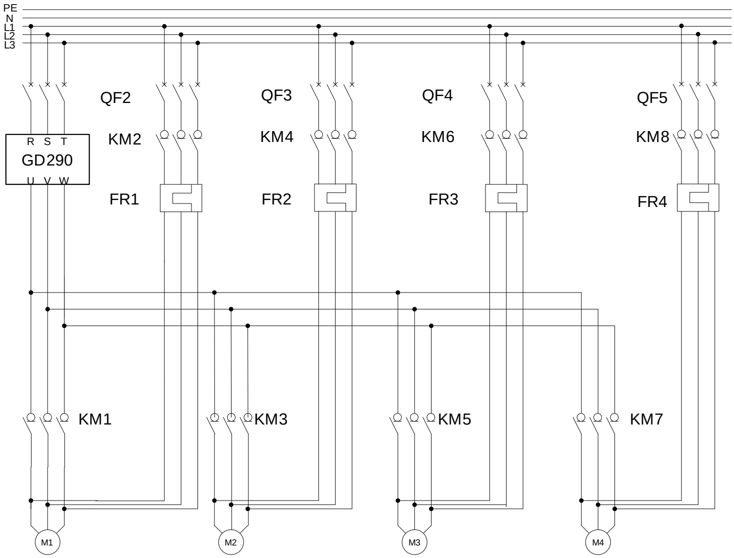
The following describes the function by illustrating a typical case in which one VFD controls four water pump motors.

The VFD must use the four relay function terminals RO5–RO8 (requiring the use of the optional part EC-IO503-00), and also use two groups of contactor KM to switch between the two water pump working states, variable-frequency run mode and power-frequency run mode. All motors are started and stopped at the ramp speed to achieve soft motor switchover to ensure stable water supply pressure and reduce the impact on water pipes. You need to refer to Figure 5-28 and Figure 5-29 to connect the multi-pump variable-frequency control main circuit and external relay control circuit. In addition, make the following settings:

1. Enable the multi-pump control function (P94.00=1).
2. Set the variable-frequency motor run mode to circular (P94.10=1).
3. Set the motor quantity to 4 (P94.11=4).
4. Set RO5–RO8 to control variable-frequency circulation pumps A, B, C, and D (that is, set P26.06–P26.09 to 57–60 respectively).
5. Set the contactor closing delay, which is the interval of switchover between the variable-frequency run mode and power-frequency run mode.
6. Set the S digital input terminal functions to 104–107 to cut out circulation motors M1–M4.

Note:

- ✧ After the multi-pump control function is enabled, the VFD setting frequency can be given only by the water supply dedicated PID—PID1.
- ✧ It is not recommended to use the multi-pump control function on the 30kW or higher VFDs.
- ✧ Connected water pump motors must have the same rated power.



KM1–KM8: Contactors FR1–FR4: Thermal protection overload relays

QF2–QF5: Low-voltage circuit breaker M1–M4: Asynchronous motor

Figure 5-28 Main circuit wiring in variable-frequency control mode of one VFD driving four pumps

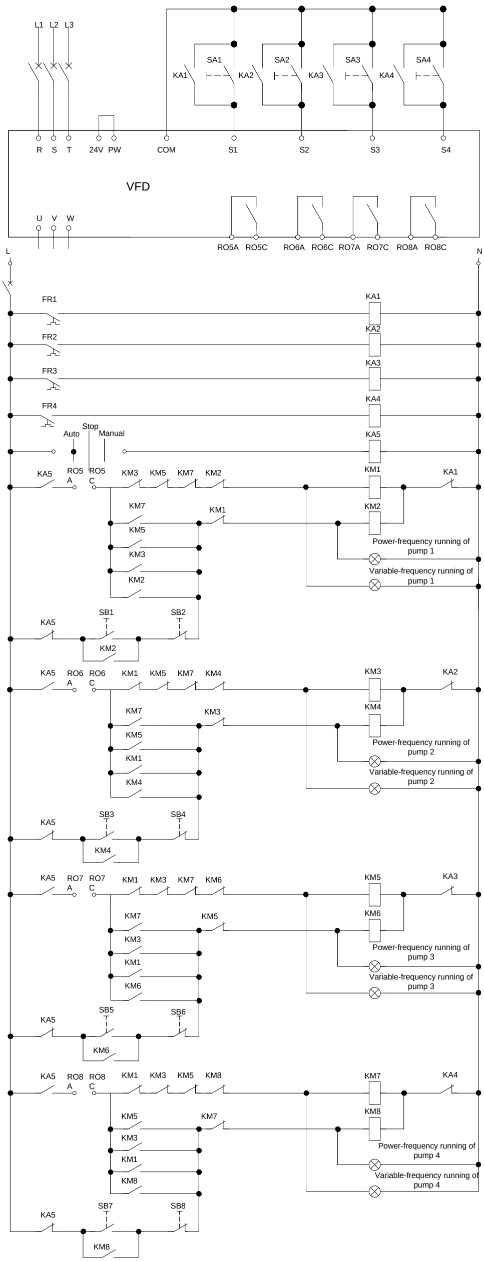


Figure 5-29 External relay control wiring (with four pumps)

If you use one VFD to control three water pump motors for variable-frequency circulation, refer to Figure 5-30 to connect the external relay control circuit.

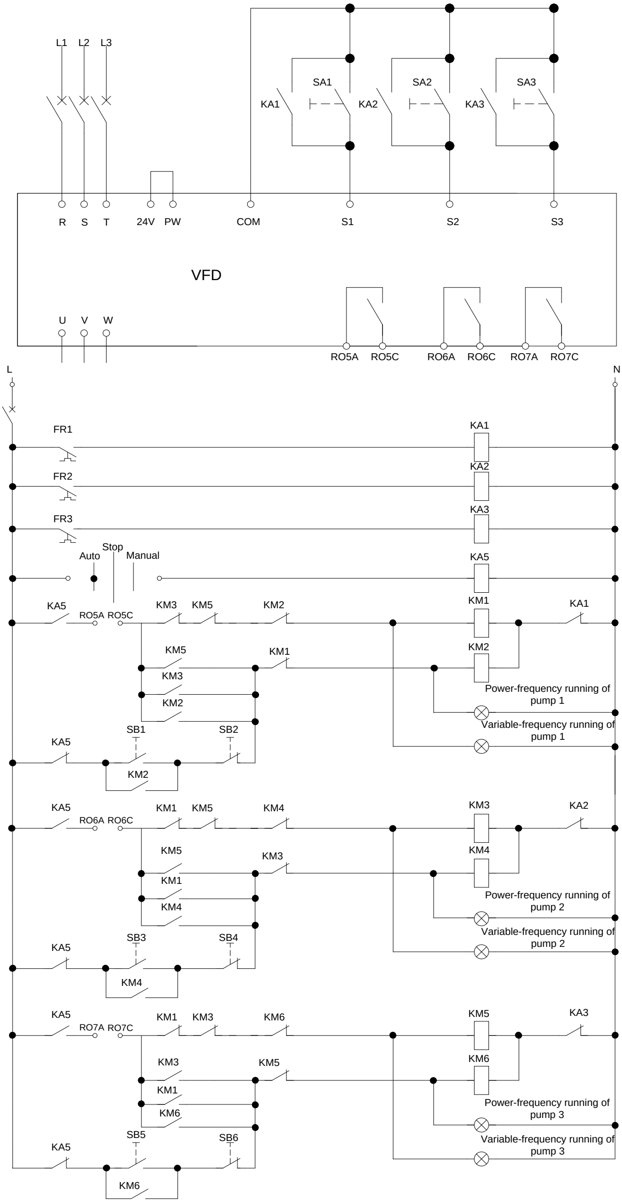


Figure 5-30 External relay control wiring (with three pumps)

If you use one VFD to control two water pump motors for variable-frequency circulation, refer to

Figure 5-31 to connect the external relay control circuit.

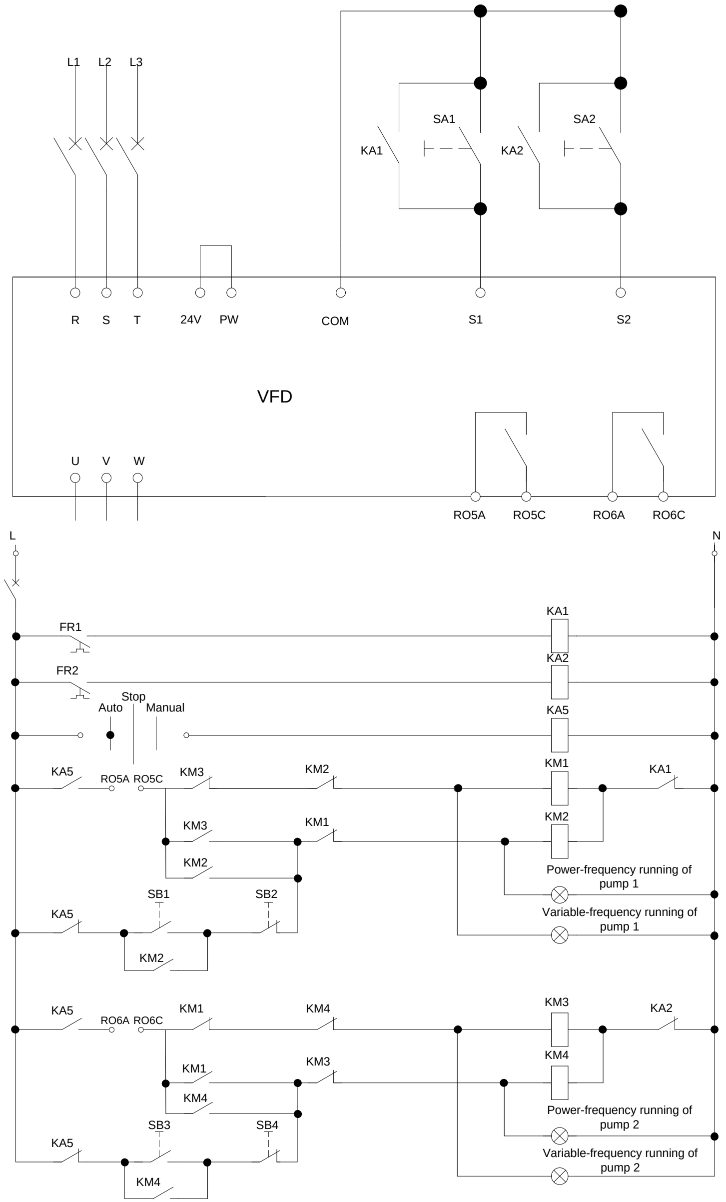


Figure 5-31 External relay control wiring (with two pumps)

Function code	Name	Description	Setting
P94.00	Multi-pump and fan control function enabling	0: Disable 1: Enable	1
P94.10	Variable-frequency motor run mode	0: Fixed 1: Circular	1
P94.11	Number of motors	0–8: corresponding to motors A–H. The sequence numbers must be successive.	4
P26.06	RO5 output selection	0–47: Same as those for standard models 48: Reserved 49: Pre-alarm of PID1 feedback too low 50: Pre-alarm of PID1 feedback too high 51: PID1 in sleep 52: PID2 in startup 53: PID2 stopped 54–55: Reserved 56: Pre-alarm output 57: Control variable-frequency circulation pump A 58: Control variable-frequency circulation pump B 59: Control variable-frequency circulation pump C 60: Control variable-frequency circulation pump D 61: Control variable-frequency circulation motor E 62: Control variable-frequency circulation motor F 63: Control variable-frequency circulation motor G 64: Control variable-frequency circulation motor H 65: Low-temperature pre-alarm 66: Stalling pre-alarm 67: Dry-pumping pre-alarm 68: PTC overtemperature pre-alarm	57
P26.07	RO6 output selection		58
P26.08	RO7 output selection		59
P26.09	RO8 output selection		60
P94.36	Contactor closing delay	Range: 0.0–100.0s	0.5s
P94.37	Contactor opening delay	Range: 0.0–100.0s	0.5s

5.5.16.1 Motor adding or reducing

Motor adding

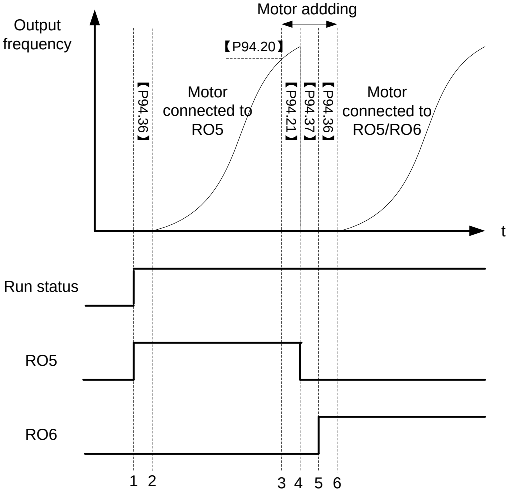


Figure 5-32 Motor adding timing diagram

This figure assumes that the VFD outputs and controls motor M1 and the other motors are in the stopped state. At this time, if the output frequency is equal to or higher than P94.20 (Running frequency for motor adding), PID1 feedback is less than the difference between PID1 reference and P94.19 (Pressure tolerance for motor adding), and this condition lasts a period of time longer than P94.21 (Motor adding delay), the motor adding function is triggered.

If this condition lasts a period of time longer than P94.21 (Motor adding delay), motors are added, and then the VFD coasts to stop and disconnects the contactor with a contactor opening delay (P94.37) to ensure completed disconnection. The VFD closes the relay with a contactor closing delay (P94.36) to ensure completed closing.

The following table lists the relay action logic in the motor adding process.

Table 5-3 Motor adding logic in circular variable-frequency motor run mode

RO5	RO6	RO7	RO8	Motor M1	Motor M2	Motor M3	Motor M4
0	0	0	0	Stop	Stop	Stop	Stop
1	0	0	0	Variable frequency	Stop	Stop	Stop
0	0	0	0	Stop	Stop	Stop	Stop
0	1	0	0	Stop	Variable frequency	Stop	Stop
1	1	0	0	Power frequency	Variable frequency	Stop	Stop

RO5	RO6	RO7	RO8	Motor M1	Motor M2	Motor M3	Motor M4
1	0	0	0	Power frequency	Stop	Stop	Stop
1	0	1	0	Power frequency	Stop	Variable frequency	Stop
1	1	1	0	Power frequency	Power frequency	Variable frequency	Stop
1	1	0	0	Power frequency	Power frequency	Stop	Stop
1	1	0	1	Power frequency	Power frequency	Stop	Variable frequency
1	1	1	1	Power frequency	Power frequency	Power frequency	Variable frequency

Motor reducing

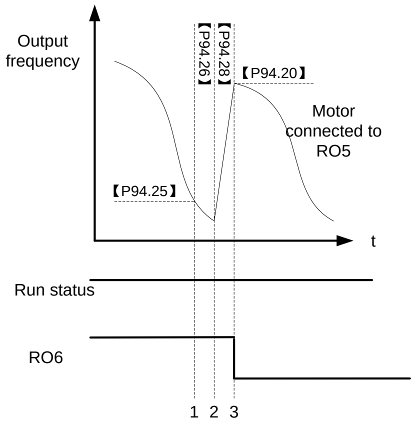


Figure 5-33 Motor reducing timing diagram

This figure assumes that the VFD outputs and controls motor M2, M1 is in power-frequency run mode, and M3–M4 are in the stopped state. At this time, if the VFD output frequency is equal to or lower than P94.25 (Running frequency for motor reducing), PID1 feedback is less than the difference between PID1 reference and P94.24 (Pressure tolerance for motor reducing), and this condition lasts a period of time longer than P94.26 (Motor reducing delay), the motor reducing function is triggered. There are two motor reducing actions for selection, which can be set by P94.27 (Variable-frequency motor action for motor reducing).

If P94.27 (Variable-frequency motor action for motor reducing) is set to 1, the VFD disconnects the relay but also increases the output frequency to P94.20 (Running frequency for motor adding) within the time specified by P94.28 (Variable-frequency motor ACC time for motor reducing).

When the ACC is completed or P94.27 (Variable-frequency motor action for motor reducing) is set to 0 (Keep the frequency unchanged), the VFD disconnects the relay corresponding to the power-frequency motor.

The following table lists the relay action logic in the motor reducing process.

Table 5-4 Motor reducing logic in circular variable-frequency run mode

RO5	RO6	RO7	RO8	Motor M1	Motor M2	Motor M3	Motor M4
1	1	1	1	Power frequency	Power frequency	Variable frequency	Variable frequency
0	1	1	1	Stop	Power frequency	Power frequency	Variable frequency
0	0	1	1	Stop	Stop	Power frequency	Variable frequency
0	0	0	1	Stop	Stop	Stop	Variable frequency
0	0	0	0	Stop	Stop	Stop	Stop

Related function parameters:

Function code	Name	Description	Default
P94.19	Pressure tolerance for motor adding	Range: 0.0–30.0% (relative to PID1 max. value)	5.0°
P94.20	Running frequency for motor adding	Range: P94.25 (Running frequency for motor reducing)–P00.03	50.00Hz
P94.21	Motor adding delay	Range: 0.0–3600.0s	10.0s
P94.22	Switching frequency for variable-frequency motor adding	Range: P00.05 (Lower limit of running frequency)–P00.03	50.00Hz
P94.23	Variable-frequency motor DEC time for power-frequency motor adding	Range: 0.0–300.0s	10.0s
P94.24	Pressure tolerance for motor reducing	Range: 0.0–30.0% (relative to PID1 max. value)	4.0°
P94.25	Running frequency for motor reducing	Range: P00.05–P94.20 (Running frequency for motor adding)	5.00Hz
P94.26	Motor reducing delay	Range: 0.0–3600.0s	10.0s
P94.27	Variable-frequency motor action for motor reducing	0: Keep the frequency unchanged 1: Accelerate to the motor running frequency	1
P94.28	Variable-frequency motor ACC time for motor reducing	Range: 0.0–300.0s	10.0s

5.5.16.2 Alternation function

■ **Automatic alternation**

The VFD supports the automatic pump alternation function. The automatic switching serves two primary purposes:

- To balance the mechanical wear of different motors by keeping the runtime of all pumps approximately equal over time.
- To prevent any pump from remaining idle for an extended period, which may result in blockage. Automatic switching can also be triggered by a timer, that is, by scheduling auxiliary pumps to start at the set interval.

When the runtime of the lead motor exceeds the motor alternation period set by parameter P94.34 (≠0) and the present frequency is less than P94.35 (Alternation running frequency threshold), and there is an idle pump in the present system, the VFD starts automatic alternation in the way of adding a motor first and then reducing a motor. Then the second-run motor becomes the first-run motor, and the alternation time is calculated again. During normal use, the alternation time is also recalculated for motor reducing.

Note: Alternation time recalculation is also triggered by motor adding or reducing that occurs during normal PID adjustment.

Function code	Name	Description	Default
P94.34	Variable-frequency motor alternation cycle	Range: 0.0–6000.0h Automatic alternation is targeted at idle variable-frequency motors. The value 0 indicates no alternation.	0.0h
P94.35	Running frequency threshold for alternation	Range: P00.05–P00.03 When the running frequency is greater than the value of this function code, variable-frequency motor alternation is not performed. Otherwise, great water pressure change impacts water supply.	45.00Hz

Manual alternation

Manual alternation is used for testing to check whether the main circuit wiring and control circuit wiring are correct and motors can run properly. If alternation is completed or terminated, a stop command must be given so that the next alternation mode can be entered after restart.

The function is implemented as follows: When the VFD is in stopped stated, set the terminal input function to 85 (Manual alternation), enable the terminal function, and then send a startup command. The VFD starts all connected motors from motor M1 in alternation mode. During alternation, all motors are started by means of adding motors in sequence. When all motors have been started, motors are automatically reduced in sequence until the end.

Note: During alternation, if the enabling signal of an S terminal is canceled, the alternation persists until the end. If you want to terminate the alternation, you need to trigger a stop signal.

5.5.16.3 Water pump maintenance

You can set the S digital input terminal functions to 104–107 to lock motors M1–M4, which will not be under multi-pump control. You only need to disconnect the motor wiring contactors from the grid to maintain the pumps, without adjusting the onsite wiring.

5.5.16.4 Smooth switchover

When a motor switches from the variable-frequency run mode to the power-frequency run mode, the water pressure fluctuates greatly. You can set P94.22 (Switching frequency for variable-frequency motor adding) to enable the motor runs from a high switching frequency to the power-frequency run mode, preventing the water pressure from dropping too quick so as to ensure water pressure steady.

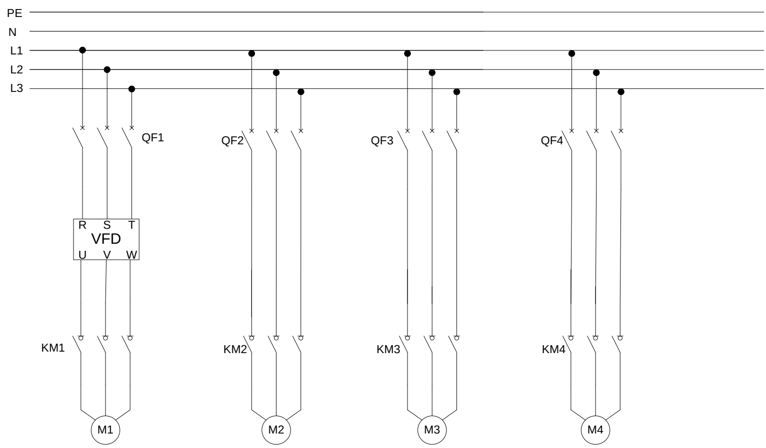
Function code	Name	Description	Default	Modify
P94.22	Switching frequency for variable-frequency motor adding	Range: P00.05–P00.03	50.00Hz	○

5.5.16.5 Fixed variable-frequency run mode

The fixed variable-frequency control logic is relatively simple. The following assumes one VFD drives four motors in fixed variable-frequency run mode. Set the following parameters.

1. Enable the multi-pump control function (P94.00=1).
2. Set the variable-frequency motor run mode to fixed (P94.10=0).
3. Set the motor quantity to 4 (P94.11=4).
4. Set RO5–RO8 to control motors A, B, C, and D respectively (set P26.06–P26.09 to 57–60 respectively).
5. Set the contactor closing delay, which is the interval of switchover between the variable-frequency run mode and power-frequency run mode.

The following figures and tables show the control logic.



KM1–KM4: Contactors QF1–QF4: Low-voltage breakers M1–M4: Asynchronous motors

Figure 5-34 Main circuit wiring in fixed variable-frequency run mode

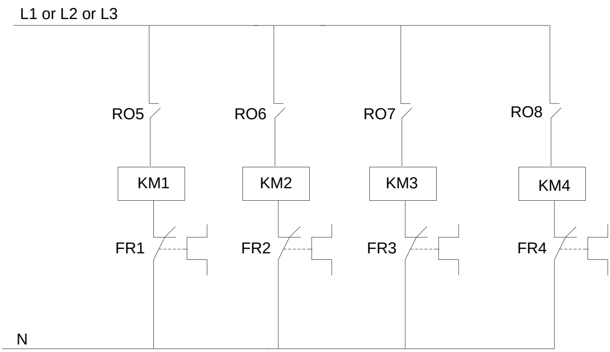


Figure 5-35 Control circuit wiring in fixed variable-frequency run mode

Table 5-5 Motor adding logic in fixed variable-frequency run mode

RO5	RO6	RO7	RO8	Variable-frequency motor	Power-frequency motor 1	Power-frequency motor 2	Power-frequency motor 3
0	0	0	0	Stop	Stop	Stop	Stop
1	0	0	0	Variable frequency	Stop	Stop	Stop
1	1	0	0	Variable frequency	Power frequency	Stop	Stop
1	1	1	0	Variable frequency	Power frequency	Power frequency	Stop
1	1	1	1	Variable frequency	Power frequency	Power frequency	Power frequency

Table 5-6 Motor reducing logic with fixed variable-frequency motors

RO5	RO6	RO7	RO8	Motor 1	Motor 2	Motor 3	Motor 4
1	1	1	1	Variable frequency	Power frequency	Power frequency	Power frequency
1	0	1	1	Variable frequency	Stop	Power frequency	Power frequency
1	0	0	1	Variable frequency	Stop	Stop	Power frequency
1	0	0	0	Variable frequency	Stop	Stop	Stop
0	0	0	0	Stop	Stop	Stop	Stop

5.5.17 PID function only for water supply

The VFD provides two groups of PID only for water supply, only by which HVAC related PID setting can be implemented. The following takes PID1 as an example to describe the function.

The unit of PID1 reference and PID1 feedback can be specified by P90.00. PID source 1 (P90.06 and P90.08, that is, PID reference and feedback) can be set for PID1, and PID source 2 (P90.11 and P90.13, that is, PID reference and feedback) can be set for PID2. P90.16 is the combination method of PID source1 and source 2.

PID1 reference and PID1 feedback can be set to the actual water pressure values but not a percentage. P90.01 can specify the number of decimal places of PID1 reference and PID1 feedback. P90.02 can specify the actual water pressure corresponding to 100% of PID1 reference. P90.03 and P90.04 can specify the upper limit and lower limit of PID1 reference. In most cases, P90.02 and P90.03 are set to the same value. P89.09 and P89.10 can be used to view the percentage of PID1 reference and PID1 feedback.

Note: PID2 differs from PID1: PID2 cannot participate in the running frequency regulation. You can only convert PID2 output to analog signal by setting the AO function (setting 32).

For related function codes, see Group P90—PID1 control and Group P91—PID2 control.

5.5.18 Automatic sleep

Function code P94.01 specifies the sleep method. When the condition specified by P94.02 or P94.03 and the condition lasts the time specified by P94.04, the PID increases by P94.05 (PID boost value for sleep) with a duration specified by P94.06 (PID boost time), and the VFD enters the sleep state. When P94.08 (Wakeup condition) is met and this condition lasts the time specified by P94.09 (Wakeup time), the VFD automatically wakes up from sleep and directly runs at the frequency specified by P94.07, and the frequency is PID regulated later.

Function code	Name	Description	Default	Modify
P94.00	Multi-pump and fan	0: Invalid	0	◎

Function code	Name	Description	Default	Modify
	control function enabling	1: Enable		
P94.01	Sleep method selection	0: Sleep based on terminal input 1: Sleep based on running frequency 2: Sleep based on deviation	0	○
P94.02	Sleep starting frequency	Range: P00.05–P00.04 (Upper limit of running frequency) When the running frequency is less than or equal to the value and this situation lasts the time longer than P94.04, sleep is allowed.	5.00Hz	○
P94.03	Sleep starting deviation	0.0–30.0% (relative to PID1 max. value) When output is positive, if the feedback is greater than the reference, sleep is allowed only when the absolute difference is greater than the value of this function code and the situation lasts the time longer than P94.04. When output is negative, if the feedback is less than the reference, sleep is allowed only when the absolute difference is greater than the value of this function code and this situation lasts the time longer than P94.04.	5.0°	○
P94.04	Sleep delay	Range: P94.49–3600.0s	60.0s	○
P94.05	PID1 reference boost value	Range: -100.0%–100.0% (relative to the reference value of PID1)	10.0°	○
P94.06	Longest boost time	Range: 0.000–6000.0s This function is used for continuous VFD running when the running frequency reaches the upper limit frequency but the feedback value cannot reach the setting after boost. In this situation, the VFD enters the sleep mode at once after the boost time.	10.0s	○
P94.07	Wake-up-from-sleep frequency	Range: P00.05–P00.04 (Upper limit of running frequency) In closed-loop PID, the PID output is superimposed directly from the corresponding value of this frequency when the VFD is woken up.	5.00Hz	○
P94.08	Wake-up-from-sleep deviation	Range: 0.0–30.0% (relative to PID1 max. value) In closed-loop PID, when output is positive, if the	5.0°	○

Function code	Name	Description	Default	Modify
		feedback is less than the reference, wakeup is allowed only when the actual difference is greater than the wake-up-from-sleep deviation and this situation lasts the time longer than P94.09. When output is negative, if the feedback is greater than the reference, wakeup is allowed only when the actual difference is greater than the value of this function code and this situation lasts the time longer than P94.09.		
P94.09	Wake-up-from-sleep delay	Range: P94.49–3600.0s Min. sleep time	40.0s	○

5.5.19 Speed tracking function

Speed-tracking start is valid when P01.00=2.

AM: software speed tracking implementation, currently supporting software in both vector control mode 1 and V/F control mode.

Note: In SVC 0, speed tracking cannot be selected, which indicates P01.00 can be 0 or 1.

The software-based speed tracking provides three modes, applicable in the following scenarios:

- When P01.35=1, it is suitable for most applications.
- When P01.35=2, it is suitable for scenarios where the power outage duration is relatively long and the motor frequency is very low.
- When P01.35=3, it is suitable for regenerative load applications.

Advanced function of speed tracking: The function code P01.39 only requires adjusting bit 10. For some motors using three-phase modulation, oscillation may occur during software speed tracking. In such cases, switch to two-phase modulation.

Function code	Name	Description	Default	Modify
P01.00	Running mode of start	0: Direct start 1: Start after DC braking 2: Speed tracking restart (not supported in SVC 0 for AMs)	0	◎
P01.35	Speed tracking mode	0: Start from stop frequency (Usually selected) 1: Start from low frequency (Applicable to restart after a long time of coasting to stop) 2: Start from max. output frequency P00.03	0	○

Function code	Name	Description	Default	Modify
		(Applicable to common power generation load situation)		
P01.36	Quick/slow selection for speed tracking	Range: 1–100s A great value of this parameter indicates a fast rotation-speed tracking speed, but an excessively great value may result in unreliable tracking.	15s	○
P01.37	Speed tracking current	Range: 30%–200% Closed-loop current reference value (motor) during rotation. A great value of this parameter indicates high reliability of rotation-speed tracking, but an excessively great value may result in VFD overcurrent.	100°	○
P01.38	Demagnetization time for speed tracking	Range: 0.0–10.0s	Model depended	○
P01.39	Advanced control for speed tracking	Range: 0x000–0x111 LED ones place: Current giving mode in vector control 0: 120% of current is given during startup, which is switched to the given value based on P01.35 1: The current is given based on P01.35 LED ones place: PWM mode selection 0: 2PH modulation mode 1: Based on P08.40 LED hundreds place: Search direction for speed tracking 0: Allow both forward and reverse search 1: Disallow reverse search	0x110	○

5.5.20 Motor thermal protection function

The VFD supports temperature measurement using various types of temperature sensors, including PT100, PT1000, KTY84, and PTC. Two detection schemes are provided for different sensor types:

Scheme 1: Implemented using the combination of function terminals AI1 and AO1. In this case, AI1 must be set to voltage type and AO1 to current type. Wiring should be done as shown in the diagram below. This scheme supports all types of temperature sensors.

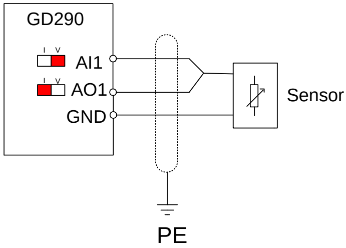
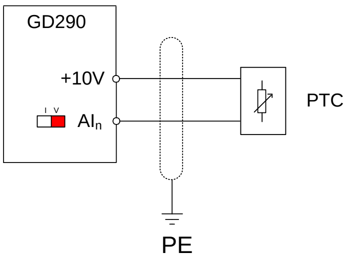


Figure 5-36 Wiring for detecting motor temperature by using AI/AO

Scheme 2: Implemented using A11 or AI2 in combination with the +10V terminal. In this case, AI1 or AI2 must be set to voltage type, and wiring should be done as shown in the diagram below. This scheme only supports triple PTC sensors compliant with DIN 44082, but compared to scheme 1, AO1 is not required.

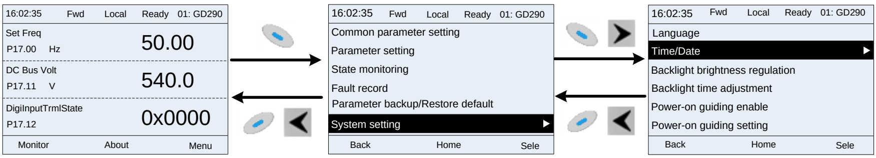


Function code	Name	Description	Default	Modify
P96.11	Temperature sensor type	0: Invalid 1: PT100 2: PT1000 3: KTY84 4: PTC (AO+AI terminal combination) 5: PTC (AI1+10V terminal combination) 6: PTC (AI2+10V terminal combination) Usage of functions 1–4: To select current-type output for AO, connect one end of the temperature resistor to AI1 (voltage-type) and AO1 (current-type), and the other end to GND. Usage of functions 5–6: Connect the PTC sensor between the +10V terminal and AI1 or AI2.	0	○
P96.35	Motor	Range: -20.0–200.0	110.0	○

Function code	Name	Description	Default	Modify
	overtemperature protection threshold			
P96.36	AI/AO detected temperature offset value	Range: -40.0–40.0	0.0	○
P96.37	PTC constant output current setting	Range: 0.000–20.000mA	4.000mA	○
P96.38	PTC resistance alarm threshold	Range: 0–60000Ω	750Ω	○
P96.39	PTC resistance alarm recovery threshold	Range: 0–60000Ω	150Ω	○
P96.40	Actual PTC resistance	Range: 0–60000Ω	0Ω	●

5.5.21 Real-time clock function (Keypad with button battery)

Set the current time according to the following figure and check from P92.00 to P92.03.



Function code	Name	Description	Default	Modify
P92.00	Displaying year	2020–2099 YY	2020 YY	●
P92.01	Displaying month and date	01.01–12.31 MMDD	01.01 MMDD	●
P92.02	Displaying day of a week	1–7: Corresponding to Monday through Sunday	1	●
P92.03	Displaying hour and minute	00.00–23.59 HHMM 00.00 is the earliest hour and time of a day, while 23.59 is the latest hour and time of a day.	00.00 HHMM	●

5.5.22 Fault grading

Trigger condition: This function is enabled when the fire override function (P93.00) is disabled, or when the fire override function is enabled but the fire trigger signal (S-terminal no. 79 function) is not received by the VFD.

The VFD software supports four fault protection levels, where lower levels indicate higher fault severity:

Level 0: Coast to stop

Level 1: Stop according to the stop mode

Level 2: Pre-alarm and run

Level 3: Keep running

Use parameters P11.31 to P11.50 to configure the fault level for each fault type.
P11.51 sets the output frequency during running with pre-alarm.
P11.52 sets the fallback frequency in case of abnormal conditions.

Function code	Name	Description	Default	Modify
P11.31	Fault level group 1	Range: 0x0000–0x3313 Ones place (fault 11=OL1): 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 Tens place (fault 12=OL2): 0: Report a fault 1: Report a fault after deceleration to stop Hundreds place (fault 13=SPI): 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 Thousands place (fault 14=SPO): 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	0x0000	○
P11.32	Fault level group 2	Range: 0x0000–0x3300 Ones place (fault 15=OH1): 0: Report a fault	0x0000	○

Function code	Name	Description	Default	Modify
		Tens place (fault 16=OH2): 0: Report a fault Hundreds place (fault 17=EF): 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 Thousands place (fault 18=CE): 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		
P11.51	Action for fault alarm	0: Run at the set frequency 1: Run at the output frequency at the time of failure 2: Run at the upper limit frequency 3: Run at the lower limit frequency 4: Run at the fallback frequency upon exceptions	0x0000	○
P11.52	Fallback frequency upon exceptions	Range: 0.00Hz–P00.03 (Max. output frequency)	0.00Hz	○

5.5.23 Input phase loss detection

Phase loss on the input side cannot be detected in the stop state or under no-load or light-load conditions.

Detection principle: When there is a phase loss on the input side and a load is carried, the bus voltage fluctuates with an asymmetric triangular waveform containing integer harmonics of the fluctuation frequency (100Hz). Phase loss detection is performed by extracting the amplitude (P11.29) and duration (P11.30) of the 100Hz component. Generally, the factory values do not need to be changed.

Function code	Name	Description	Default	Modify
P11.28	Software input phase loss detection method	0: Sine-wave detection 1: Square-wave detection **Note:** Since input phase loss is detected via software, it cannot be detected when the motor is not connected. It also cannot be detected	1	○

Function code	Name	Description	Default	Modify
		under no-load or light-load conditions. Input phase loss detection only works properly when the load current exceeds 60% of the rated current.		
P11.29	Software input phase loss detection limit value	Range: 0–200.0V **Note:** A higher detection limit value reduces the chance of fault reporting.	40.0V	○
P11.30	Software input phase loss detection time	Range: 0–20.0s **Note:** A longer detection time reduces the chance of fault reporting.	2.0s	○

5.5.24 Carrier frequency reduction with temperature

When this function is enabled, to ensure motor control performance under high output frequency conditions, a certain carrier frequency ratio must be maintained. The reduced carrier frequency must be greater than or equal to both the minimum carrier frequency (see P00.14) and ten times the output frequency (P00.03), that is:

Reduced carrier frequency ≥ Max (Min. carrier frequency, P00.03 × 10)

Example:

For an 11kW VFD, the default carrier frequency is 4 kHz, and the minimum carrier frequency limit is 2kHz. If P00.03 is set to 300Hz and P08.55 is set to 1 to enable the auto carrier frequency derating function, the derated carrier frequency must be no less than Max(2kHz, 300Hz × 10) = 3 kHz.

Function code	Name	Description	Default	Modify
P08.55	Enabling auto carrier frequency reduction	0: Disable 1: Enable **Note:** Automatic carrier frequency reduction indicates that the VFD automatically reduces the carrier frequency when detecting the heat sink temperature exceeds the rated temperature. When the temperature decreases to a specified value, the carrier frequency restores to the setting. This function can reduce the VFD overheat alarm reporting chances.	1	○
P08.56	Temperature point of auto carrier frequency reduction	Range: 40.0–85.0°C	65.0°C	○

Function code	Name	Description	Default	Modify
P08.57	Interval of carrier frequency reduction	Range: 0–30min (Setting it to 0 means carrier frequency reduction is invalid.)	10min	○

5.5.25 Cooling fan noise control

The VFDs in T9–T12 frames use variable-speed cooling fans. When the VFD load is low and the ambient temperature is favorable, the fan speed can be reduced by a percentage set via the tens place of P08.39, which helps appropriately lower the operating noise of the VFD.

Function code	Name	Description	Default	Modify
P08.39	Cooling-fan running mode	Range: 0x0000–0x0161 Ones place: Run mode 0: Normal mode 1: Permanent running after power-on Tens place: Set speed 0: 100% 1: 95% 2: 90% 3: 85% 4: 80% 5: 75% 6: 70% **Note:** Setting this bit can reduce the fan speed, but it may cause the VFD to overheat. Please set it with caution. Hundreds: Speed control method 0: Tens setting of P08.39 1: Automatic speed regulation	0x0100	○

5.5.26 Grid frequency and voltage selection

Use parameter P08.62 to select the grid frequency (50Hz or 60Hz) and voltage level (380V or 460V) applicable to the VFD. The system will automatically adjust related parameter defaults to ensure proper matching with the power grid and optimize operation.

- **Grid frequency setting (P08.62 ones place)**

The table below lists parameters whose default values depend on the ones place of P08.62.

Function code	Name	Default value at 50Hz (P08.62 ones place=0)	Default value at 60Hz (P08.62 ones place=1)
P00.03	Max. output frequency	50Hz	60Hz
P00.04	Upper limit of running frequency	50Hz	60Hz
P00.10	Setting frequency through keypad	50Hz	60Hz
P02.02	Rated frequency of AM 1	50Hz	60Hz
P03.16	Forward rotation upper limit frequency set through keypad in torque control	50Hz	60Hz
P03.17	Reverse rotation upper limit frequency set through keypad in torque control	50Hz	60Hz
P08.32	FDT1 electrical level detection value	50Hz	60Hz
P08.34	FDT2 electrical level detection value	50Hz	60Hz
P12.02	Rated frequency of AM 2	50Hz	60Hz

Note: When it is set to 60Hz, the AM default rated speed will be 300rpm higher than the rated speed at 50Hz.

■ **Grid voltage setting (P08.62 tens place)**

The table below lists parameters whose default values depend on the tens place of P08.62.

Function code	Name	Default value at 380V (P08.62 tens place=1)	Default value at 460V (P08.62 tens place=2)
P02.04	Rated voltage of AM 1	380V: suitable for a voltage range of 380–415V.	460V: suitable for a voltage range of 440–480V.
P11.04	Overvoltage stall protection voltage	136	120

Note:

- After changing P08.62, the default values of related parameters will be automatically updated. However, you may still change them as needed.
- When selecting 60Hz, ensure that the motor's rated speed allows for the increase to avoid overspeed risks.
- Make sure the grid voltage matches the selected setting; otherwise, device protection may be triggered or damage may occur.
- It is recommended to reset P08.62 and verify parameter compatibility during initial commissioning or when the power grid changes.

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

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

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

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

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

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

   Column 4 "Default": Initial value set in factory

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

   "○" indicates that the value of the parameter can be modified when the VFD is in stopped or running state.

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

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

   (The VFD automatically checks and constrains the modification of parameters, which helps prevent incorrect modifications.)

2. The parameters adopt the decimal system (DEC) and hexadecimal system (0–F). If the hexadecimal system is adopted, all bits are mutually independent on data during parameter editing.

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.

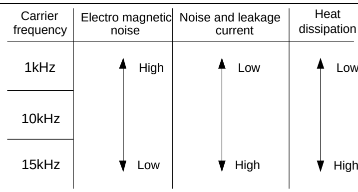
4. To better protect parameters, the VFD provides the password protection function. After a password is set (that is, P07.00 is set to a non-zero value), "0.0.0.0.0" is displayed when you press the PRG/ESC key to enter the function code editing interface. You need to enter the

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 **Note:** Before using a vector control mode (0 or 1), 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	Range: 0–5 0: Modbus/Modbus TCP communication 1: PROFIBUS/CANopen communication 2: Ethernet communication 3: EtherCAT/PROFINET/EtherNet IP communication 4: Programmable card 5: Wireless communication card **Note:** The 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	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 ACC and DEC. Range: Max(P00.04,10.00)–400.00Hz	50.00Hz	◎
P00.04	Upper limit of running frequency	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	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>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.
Range: P00.05–P00.03 (Max. output frequency)</td><td></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
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 communication
10: Ethernet communication
11: High-speed pulse HDIB
12:Pulse train AB setting
13: EtherCAT/PROFINET/EtherNet IP communication
14: Programmable card
15–17: Reserved
18: Keypad analog (valid for VFDs in T1–T4 frames)
Note: Options 1–3 are invalid for VFDs in T1–T4 frames.</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>
<tr><td>P00.08</td><td>Reference object of B frequency command</td><td>0: Max. output frequency
1: A frequency command</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>P00.09</td><td>Combination mode of setting source</td><td>0: A
1: B
2: (A+B)
3: (A-B)
4: Max(A, B)
5: Min(A, B)</td><td>0</td><td>○</td></tr>
<tr><td>P00.10</td><td>Setting frequency through keypad</td><td>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.
Range: 0.00Hz–P00.03 (Max. output frequency)</td><td>50.00Hz</td><td>○</td></tr>
<tr><td>P00.11</td><td>ACC time 1</td><td rowspan="2">ACC time means the time needed for the VFD to speed up from 0Hz to the max. output frequency (P00.03). DEC time means the time needed for the VFD to decelerate 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.
Range: 0.0–3600.0s</td><td>Model depended</td><td>○</td></tr>
<tr><td>P00.12</td><td>DEC time 1</td><td>Model depended</td><td>○</td></tr>
<tr><td>P00.13</td><td>Running direction</td><td>0: Run at the default direction.
1: Run at the opposite direction.
2: Disable reverse running.</td><td>0</td><td>○</td></tr>
<tr><td>P00.14</td><td>Carrier frequency setting</td><td>

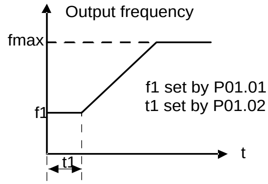
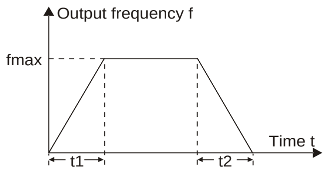
The relationship between models and carrier frequencies is as follows:
<table>
<tr><th>Frequency</th><th>Default carrier frequency</th><th>Minimum carrier frequency limit</th></tr>
<tr><td>1.75–11kW</td><td>4kHz</td><td>2kHz</td></tr>
<tr><td>15kW and higher</td><td>2kHz</td><td>1.5kHz</td></tr>
</table>
Advantage of high carrier frequency: ideal current waveform, little current harmonic wave and motor</td><td>Model depended</td><td>○</td></tr>
</table>

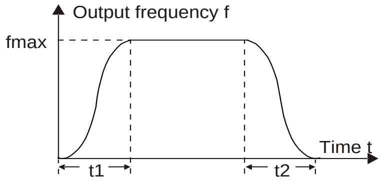
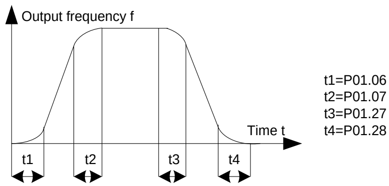
Function code	Name	Description	Default	Modify
		noise. Disadvantage of high carrier frequency: increasing the switch loss, increasing VFD temperature and the impact to the output capacity. The VFD needs to derate on high carrier frequency. At the same time, the leakage and electrical magnetic interference will increase. On the contrary, an extremely-low carrier frequency may cause unstable operation at low frequency, decrease the torque, or even lead to oscillation. The carrier frequency has been properly set in the factory before the VFD is delivered. In general, you do not need to modify it. When the frequency used exceeds the default carrier frequency, the VFD needs to derate by 10% for each increase of 1k carrier frequency. The VFD can be set by P08.55 to enable or disable the function of reducing the carrier frequency with the heatsink temperature (enabled by default). If a consistently high carrier frequency is required for operation, in addition to setting P00.14 to the target value, it is also necessary to set P08.55 to disable. Range: 1.0–15.0kHz		
P00.15	Motor parameter autotuning	0: No operation 1: Dynamic autotuning 1 Comprehensive motor parameter autotuning. It is recommended to use rotating autotuning when high control accuracy is required. 2: Complete parameter static autotuning Used in scenarios where the motor cannot be disconnected from load. 3: Partial parameter static autotuning 1 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.	0	◎

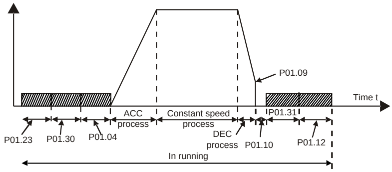
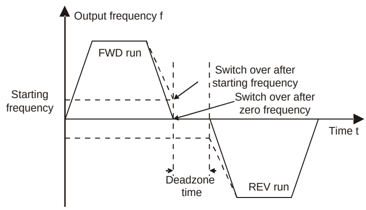
Function code	Name	Description	Default	Modify
		4: Dynamic autotuning 2 (similar to dynamic autotuning 1) 5: Partial parameter static autotuning 2		
P00.16	AVR function selection	0: Invalid 1: Valid during the whole process The auto-adjusting function of the VFD can eliminate the impact on the output voltage of the VFD because of the bus voltage fluctuation.	1	○
P00.17	Reserved	/	/	/
P00.18	Function parameter restoration	0: No operation 1: Restore to default values (excluding motor parameters) 2: Clear fault records 3: Lock keypad parameters 4: Reserved 5: Restore to default values (factory test mode) 6: Restore to default values (including motor parameters) **Note:** After the selected operation is performed, the function code is automatically restored to 0. Restoring the default values may delete the user password. Exercise caution when using this function.	0	◎

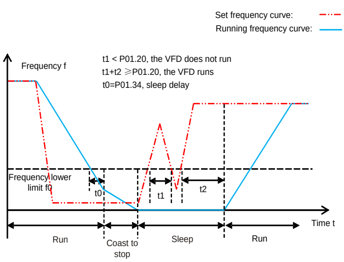
Group P01—Start and stop control

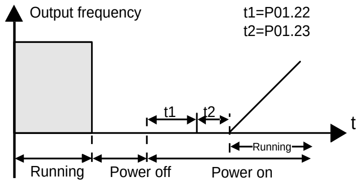
Function code	Name	Description	Default	Modify
P01.00	Running mode of start	0: Direct start 1: Start after DC braking 2: Speed tracking restart (not supported in SVC 0 for AMs) **Note:** For AMs, speed tracking is not supported in SVC 0, and software speed tracking is supported in other modes. For details, see parameters P01.35–P01.41.	0	◎
P01.01	Starting frequency of direct start	Specifies the initial frequency during VFD start. For details, see P01.02 (Starting frequency hold time).	0.50Hz	◎

Function code	Name	Description	Default	Modify
		Range: 0.00–50.00Hz		
P01.02	Starting frequency hold time	 Setting a proper starting frequency can increase the torque during VFD start. During the hold time of the starting frequency, the 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. 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 current. P01.03 range: 0.0–100.0% P01.04 range: 0.00–50.00s	0.0°	◎
P01.04	Braking time before start		0.00s	◎
P01.05	ACC/DEC mode	Used to indicate the changing mode of the frequency during start and running. 0: Linear type. The output frequency increases or decreases linearly.  1: S curve. The output frequency increases or decreases according to the S curve.	0	◎

Function code	Name	Description	Default	Modify
		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.		
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.  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 of braking for stop	Starting frequency of DC braking for stop: During the deceleration to stop, the VFD starts DC braking for stop when running frequency reaches the starting frequency determined by P01.09. 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.	0.00Hz	○
P01.10	Demagnetization time		0.00s	○
P01.11	DC braking current for stop		0.0°	○
P01.12	DC braking time for stop		0.00s	○

Function code	Name	Description	Default	Modify
		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.  P01.09 range: 0.00Hz–P00.03 (Max. output frequency) P01.10 range: 0.00–30.00s P01.11 range: 0.0–100.0% P01.12 range: 0.0–50.00s		
P01.13	FWD/REV run deadzone time	Specifies the transition time of the switching in FWD/REV running switching mode specified by P01.14.  Range: 0.0–3600.0s	0.0s	○
P01.14	FWD/REV run switching mode	0: Switch at zero frequency 1: Switch at the starting frequency 2: Switch after the speed reaches the stop speed with a delay	1	◎
P01.15	Stop speed	Range: 0.00–100.00Hz	0.50Hz	◎
P01.16	Stop speed detection mode	0: Detect by the set speed (unique in V/F mode) 1: Detect according to speed feedback	0	◎
P01.17	Stop speed detection time	Range: 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-based running command is invalid	0	○

Function code	Name	Description	Default	Modify
		at power-on. Even the running command is considered as valid during power-on, the VFD does not run and it keeps the protection state until the running command is canceled and enabled again. 1: The terminal-based running command is valid at power-on. If the running command is considered as valid during power-on, the VFD is started automatically after the initialization. **Note:** Exercise caution before using this function. Otherwise, serious results may follow.		
P01.19	Action selected when running frequency less than lower limit frequency (valid when lower limit frequency greater than 0)	Determines the running state of the VFD when the set frequency is lower than the lower limit. 0: Run at the lower limit frequency 1: Stop 2: Sleep The VFD coasts to stop when the set frequency is lower than the lower limit. If the set frequency is higher than the lower limit once again and it lasts for the time set by P01.20, the VFD resumes the running state automatically.	0	◎
P01.20	Wake-up-from-sleep delay	Determines the wake-up-from-sleep delay time. When the running frequency of the VFD is lower than the lower limit, the VFD becomes standby. When the set frequency is higher than the lower limit once again and it lasts for the time set by P01.20, the VFD runs automatically.  Range: 0.0–3600.0s (valid when P01.19=2)	0.0s	○
P01.21	Power-off restart	Specifies whether the VFD automatically runs	0	○

Function code	Name	Description	Default	Modify
	selection	after re-power on. 0: Disable restart 1: Enable restart If the restart condition is met, the VFD will run automatically after waiting the time defined by P01.22.		
P01.22	Wait time for power-on restart	Specifies the wait time before the automatic running of the VFD that is re-powered on.  Range: 0.0–3600.0s (valid when P01.21=1)	1.0s	○
P01.23	Start delay time	After a VFD running command is given, the VFD is in standby state and restarts with the delay defined by P01.23 to implement brake release. Range: 0.0–600.0s	0.0s	○
P01.24	Stop speed delay	Range: 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	Range: 0.0–60.0s	2.0s	○
P01.27	Time of starting segment of DEC S curve	Range: 0.0–50.0s	0.1s	◎
P01.28	Time of ending segment of DEC S curve	Range: 0.0–50.0s	0.1s	◎
P01.29	Short-circuit braking current	When the VFD starts in direct start mode (P01.00=0), set P01.30 to a non-zero value to enter short-circuit braking. During stop, if the running frequency of VFD is lower than the starting frequency of brake for stop (P01.09), set P01.31 to a non-zero value to enter short-circuit braking for stop, and then carry out DC braking in the time set by P01.12. (Refer to	0.0°	○
P01.30	Hold time of short-circuit braking for start		0.00s	○
P01.31	Hold time of short-circuit braking for stop		0.00s	○

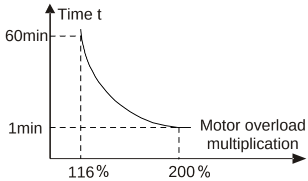
Function code	Name	Description	Default	Modify
		the descriptions for P01.09–P01.12.) P01.29 range: 0.0–150.0% (of the VFD rated output current) P01.30 range: 0.0–50.00s P01.31 range: 0.0–50.00s		
P01.32	Pre-exciting time for jogging	Range: 0.000–10.000s	0.300s	○
P01.33	Starting frequency of braking for stop in jogging	Range: 0.00Hz–P00.03	0.00Hz	○
P01.34	Sleep delay	Range: 0.0–3600.0s	0.0s	○
P01.35	Speed tracking mode	0: Start from stop frequency (Usually selected) 1: Start from low frequency (Applicable to restart after a long time of coasting to stop) 2: Start from max. output frequency P00.03 (Applicable to common power generation load situation)	0	○
P01.36	Quick/slow selection for speed tracking	Range: 1–100s A great value of this parameter indicates a fast rotation-speed tracking speed, but an excessively great value may result in poor tracking effect.	15s	○
P01.37	Speed tracking current	Range: 30%–200% Closed-loop current reference value (motor) during rotation. A great value of this parameter indicates high reliability of rotation-speed tracking, but an excessively great value may result in VFD overcurrent.	100°	○
P01.38	Demagnetization time for speed tracking	Range: 0.0–10.0s	Model depended	○
P01.39	Advanced control for speed tracking	Range: 0x000–0x111 Ones place: Current giving mode in vector control 0: 120% of current is given during startup, which is switched to the given value based on P01.35 1: The current is given based on P01.35 Tens place: PWM mode selection 0: 2PH modulation mode	0x110	○

Function code	Name	Description	Default	Modify
		1: Based on P08.40 Hundreds place: Search direction of speed tracking 0: Allow both forward and reverse search 1: Disallow reverse search		
P01.40	KP regulation coefficient for speed tracking	Range: 0–3000	1500	○
P01.41	KI regulation coefficient for speed tracking	Range: 0–3000	1500	○

Group P02—Parameters of motor 1

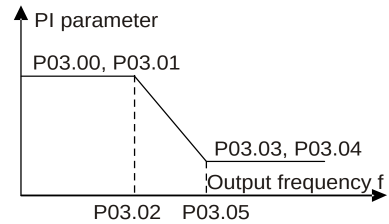
Function code	Name	Description	Default	Modify
P02.00	Reserved	/	/	/
P02.01	Rated power of AM 1	Range: 0.1–3000.0kW	Model depended (0.4)	◎
P02.02	Rated frequency of AM 1	Range: 0.01Hz–P00.03 (Max. output frequency)	50.00Hz	◎
P02.03	Rated speed of AM 1	Range: 1–60000rpm	Model depended (1400)	◎
P02.04	Rated voltage of AM 1	Range: 0–1200V	Model depended (380)	◎
P02.05	Rated current of AM 1	Range: 0.8–6000.0A	Model depended (1.0)	◎
P02.06	Stator resistance of AM 1	Range: 0.001–65.535Ω	Model depended (0.001)	○
P02.07	Rotor resistance of AM 1	Range: 0.001–65.535Ω	Model depended (0.001)	○
P02.08	Leakage inductance of AM 1	Range: 0.1–6553.5mH	Model depended (0.1)	○

Function code	Name	Description	Default	Modify
P02.09	Mutual inductance of AM 1	Range: 0.1–6553.5mH	Model depended (0.1)	○
P02.10	No-load current of AM 1	Range: 0.1–6553.5A	Model depended (0.1)	○
P02.11	Magnetic saturation coefficient 1 of iron core of AM 1	Range: 0.0–100.0%	80.0°	○
P02.12	Magnetic saturation coefficient 2 of iron core of AM 1	Range: 0.0–100.0%	68.0°	○
P02.13	Magnetic saturation coefficient 3 of iron core of AM 1	Range: 0.0–100.0%	57.0°	○
P02.14	Magnetic saturation coefficient 4 of iron core of AM 1	Range: 0.0–100.0%	40.0°	○
P02.15–P02.25	Reserved	/	/	/
P02.26	Overload protection selection of motor 1	0: No protection 1: Common motor (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: Frequency-variable motor (without low-speed compensation) The heat dissipation function for a variable-frequency motor is not impacted by the rotation speed, and therefore it is not necessary to adjust the protection value at low speed running.	2	◎
P02.27	Overload protection coefficient of motor 1	Motor overload multiplication $M = I_{out}/(I_n*K)$ I_n indicates the rated motor current, I_{out} indicates the VFD output current, and K indicates the motor	100.0°	○

Function code	Name	Description	Default	Modify
		overload protection coefficient. A smaller value of "K" indicates a bigger value of "M". When M=116%, protection is performed after motor overload lasts for 1 hour; when M=200%, protection is performed after motor overload lasts for 60 seconds; and when M≥400%, protection is performed immediately.  Range: 20.0–150.0%		
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. 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	Range: 0.000–30.000 kg·m^2	0.000 kg·m^2	○

Group P03—Vector control of motor 1

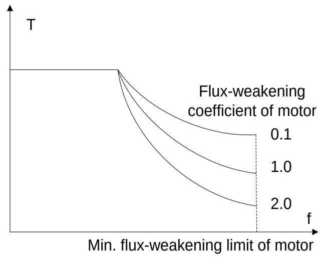
Function code	Name	Description	Default	Modify
P03.00	Speed-loop proportional gain 1	P03.00–P03.05 are applicable only to vector control. When switching frequency 1 (P03.02) is not reached, the speed-loop PI parameters are: P03.00 and P03.01. When switching frequency 2 (P03.05) is exceeded, the speed-loop PI parameters are: P03.03 and P03.04. PI parameters are obtained according to the linear	20.0	○
P03.01	Speed-loop integral time 1		0.200s	○
P03.02	Low-point frequency for switching		5.00Hz	○

Function code	Name	Description	Default	Modify
P03.03	Speed-loop proportional gain 2	change of two groups of parameters. See the following figure: 	20.0	○
P03.04	Speed-loop integral time 2		0.200s	○
P03.05	High-point frequency for switching	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 loads to meet various demands. P03.00 range: 0.0–200.0 P03.01 range: 0.000–10.000s P03.02 range: 0.00Hz–P03.05 P03.03 range: 0.0–200.0 P03.04 range: 0.000–10.000s P03.05 range: P03.02–P00.03	10.00Hz	○
P03.06	Speed-loop output filter	Range: 0–8 (corresponding to 0–2^8/10ms)	0	○
P03.07	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. Range: 50%–200%	100°	○
P03.08	Power-generation slip compensation coefficient of vector control		100°	○

Function code	Name	Description	Default	Modify
P03.09	Current-loop proportional coefficient P	**Note:** ✧ The two function codes impact the dynamic response speed and control accuracy of the system. Generally, you do not need to modify the two function codes. ✧ Applicable to SVC mode 0 (P00.00=0). Range: 0–65535	1000	○
P03.10	Current-loop integral coefficient I		1000	○
P03.11	Torque setting method	Range: 0–18 0: Keypad (invalid) 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 communication 9: Ethernet communication 10: Pulse frequency HDIB 11: EtherCAT/PROFINET/EtherNet IP communication 12: Programmable card 13–17: Reserved 18: Keypad analog (valid for VFDs in T1–T4 frames) **Note:** 100% corresponds to the rated current of motor 1.	0	○
P03.12	Torque set through keypad	Range: -300.0%–300.0% (of the rated current of motor 1)	20.0°	○
P03.13	Torque reference filter time	Range: 0.000–10.000s	0.010s	○
P03.14	Setting source of forward rotation upper limit frequency in torque control	Range: 0–18 0: Keypad (P03.16) 1: AI1 (100% corresponds to the max. frequency) 2: AI2 (same as the above) 3: AI3 (same as the above) 4: Pulse frequency HDIA 5: Multi-step setting (same as the above) 6: Modbus/Modbus TCP communication (same as	0	○

Function code	Name	Description	Default	Modify
		the above) 7: PROFIBUS/CANopen communication (same as the above) 8: Ethernet communication (same as the above) 9: Pulse frequency HDIB 10: EtherCAT/PROFINET/EtherNet IP communication (same as the above) 11: Programmable card (same as the above) 12–17: Reserved 18: Keypad analog (valid for VFDs in T1–T4 frames)		
P03.15	Setting source of reverse rotation upper limit frequency in torque control	Range: 0–18 0: Keypad (P03.17) 1: AI1 (100% corresponds to the max. frequency) 2: AI2 (same as the above) 3: AI3 (same as the above) 4: Pulse frequency HDIA 5: Multi-step setting (same as the above) 6: Modbus/Modbus TCP communication (same as the above) 7: PROFIBUS/CANopen communication (same as the above) 8: Ethernet communication (same as the above) 9: Pulse frequency HDIB (same as the above) 10: EtherCAT/PROFINET/EtherNet IP communication (same as the above) 11: Programmable card (same as the above) 12–17: Reserved 18: Keypad analog (valid for VFDs in T1–T4 frames)	0	○
P03.16	Forward rotation upper limit frequency set through keypad in torque control	Used to set frequency 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. Range: 0.00Hz–P00.03 (Max. output frequency)	50.00Hz	○
P03.17	Reverse rotation upper limit frequency set through keypad in		50.00Hz	○

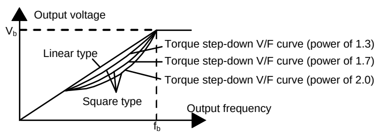
Function code	Name	Description	Default	Modify
	torque control			
P03.18	Setting source of electromotive torque upper limit	0–18 0: Keypad (P03.21) 1: AI1 2: AI2 3: AI3 4: Pulse frequency HDIA 5: Modbus/Modbus TCP communication 6: PROFIBUS/CANopen communication 7: Ethernet communication 8: Pulse frequency HDIB 9: EtherCAT/PROFINET/EtherNet IP communication 10: Programmable card 11–17: Reserved 18: Keypad analog (valid for VFDs in T1–T4 frames) **Note:** 100% corresponds to the rated current of motor 1.	0	○
P03.19	Setting source of braking torque upper limit	0–18 0: Keypad (P03.21) 1: AI1 2: AI2 3: AI3 4: Pulse frequency HDIA 5: Modbus/Modbus TCP communication 6: PROFIBUS/CANopen communication 7: Ethernet communication 8: Pulse frequency HDIB 9: EtherCAT/PROFINET/EtherNet IP communication 10: Programmable card 11–17: Reserved 18: Keypad analog (valid for VFDs in T1–T4 frames) **Note:** 100% corresponds to the rated current of motor 1.	0	○
P03.20	Electromotive	Used to set torque limits.	180.0°	○

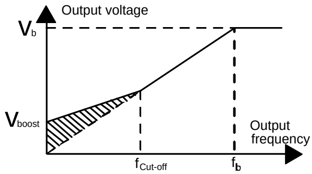
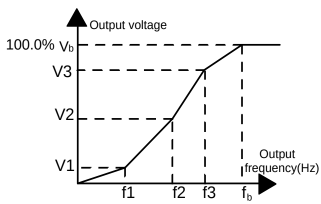
Function code	Name	Description	Default	Modify
	torque upper limit set through keypad	Range: 0.0–300.0% (of the rated voltage of motor 1)		
P03.21	Braking torque upper limit set through keypad		180.0°	○
P03.22	Weakening coefficient in constant power zone	Used when the AM is in flux-weakening control.  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. P03.22 range: 0.1–2.0 P03.23 range: 10%–100.0%	0.3	○
P03.23	Lowest weakening point in constant power zone		20°	○
P03.24	Max. voltage limit	P03.24 sets the max. output voltage of the VFD, which is the percentage of motor rated voltage. Set the value according to onsite conditions. 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. 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	○

Function code	Name	Description	Default	Modify
P03.28	Static friction compensation coefficient	0.0–100.0°	0.0°	○
P03.29	Corresponding frequency point of static friction	0.50Hz–P03.31	1.00Hz	○
P03.30	High speed friction compensation coefficient	0.0–100.0°	0.0°	○
P03.31	Corresponding frequency of high speed friction torque	P03.29–400.00Hz	50.00Hz	○
P03.32	Enabling torque control	0: Disable 1: Enable	0	◎
P03.33	Flux-weakening integral gain	0–8000	1200	○
P03.34	Reserved	/	/	/
P03.35	Control mode optimization selection	Range: 0x0000–0x1111 Ones place: Torque command selection 0: Torque reference 1: Torque current reference Tens place: Reserved Hundreds place: indicates whether to enable speed-loop integral separation 0: Disable 1: Enable Thousands place: Reserved	0x0000	○
P03.36	Speed-loop differential gain	0.00–10.00s	0.00s	○
P03.37	Proportional coefficient of high-frequency current loop	P03.37 range: 0–65535 P03.38 range: 0–65535 P03.39 range: 0.0–100.0% (of the max. frequency)	1000	○
P03.38	Integral coefficient of high-frequency current loop		1000	○

Function code	Name	Description	Default	Modify
P03.39	Current-loop high-frequency switching threshold		100.0°	○
P03.40	Enabling inertia compensation	0: Disable 1: Enable	0	○
P03.41	Upper limit of inertia compensation torque	The max. inertia compensation torque is limited to prevent inertia compensation torque from being too large. Range: 0.0–150.0% (of the motor rated torque)	10.0°	○
P03.42	Inertia compensation filter times	Filter times of inertia compensation torque, used to smooth inertia compensation torque. 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 rated motor torque)	10.0°	○
P03.44	Enabling motor inertia identification	0: No operation 1: Enable	0	◎
P03.45	Current-loop proportional coefficient after autotuning	0–65535	0	○
P03.46	Current-loop integral coefficient after autotuning	0–65535	0	○

Group P04—V/F control

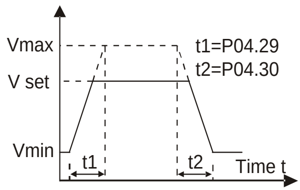
<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td>P04.00</td><td>V/F curve setting of motor 1</td><td>Defines the V/F curve of motor 1 to meet the needs of different loads.
0: Straight-line V/F curve (applicable to constant torque loads)
1: Multi-point V/F curve
2: Torque-down V/F curve (power of 1.3)
3: Torque-down V/F curve (power of 1.7)
4: Torque-down V/F curve (power of 2.0)
Curves 2–4 are applicable for torque-variable loads such as fan, pump and similar equipment. You can make adjustment based on load characteristics to achieve optimal energy-saving effect.
5: Customized V/F curve (V/F separation)
In this mode, V can be separated from F; and you can change the characteristics of the curve by adjusting F through the frequency setting channel specified by P00.06 or by adjusting V through the voltage setting channel specified by P04.27.
Note: In the following figure, V_b is the motor rated voltage and f_b is the motor rated frequency.

</td><td>0</td><td>◎</td></tr>
<tr><td>P04.01</td><td>Torque boost of motor 1</td><td rowspan="2">In order to compensate for low-frequency torque characteristics, you can make some boost compensation for the output voltage. P04.01 is relative to the max. output voltage V_b.
P04.02 defines the percentage of cut-off frequency of manual torque boost to the rated motor frequency f_b. Torque boost can improve the low-frequency torque characteristics of V/F.
You need to select torque boost based on the load. For example, larger load requires larger torque boost, however, if the torque boost is too</td><td>0.0°</td><td>○</td></tr>
<tr><td>P04.02</td><td>Torque boost cut-off of motor 1</td><td>20.0°</td><td>○</td></tr>
</table>

Function code	Name	Description	Default	Modify
		large, the motor will run at over-excitation, which may cause increased output current and motor overheating, thus decreasing the efficiency. When torque boost is set to 0.0%, the VFD uses automatic torque boost. Torque boost cut-off threshold: Below this frequency threshold, torque boost is valid; exceeding this threshold will invalidate torque boost.  P04.01 range: 0.0% (Automatic) – 10.0% (of the rated voltage of motor 1) P04.02 range: 0.0%–50.0% (of the rated frequency of motor 1)		
P04.03	V/F frequency point 1 of motor 1	When P04.00=1 (multi-dot V/F curve), you can set the V/F curve through P04.03–P04.08. The V/F curve is generally set according to the load characteristics of the motor. **Note:** V1< V2 < V3, f1< f2 < f3 Too high voltage for low frequency will cause motor overheat or damage and cause VFD overcurrent stall or overcurrent protection.  P04.03 range: 0.00Hz–P04.05 P04.04 range: 0.0%–110.0% (of the rated voltage of motor 1) P04.05 range: P04.03–P04.07 P04.06 range: 0.0%–110.0% (of the rated voltage	0.00Hz	○
P04.04	V/F voltage point 1 of motor 1		00.0°	○
P04.05	V/F frequency point 2 of motor 1		0.00Hz	○
P04.06	V/F voltage point 2 of motor 1		0.0°	○
P04.07	V/F frequency point 3 of motor 1		0.00Hz	○
P04.08	V/F voltage point 3 of motor 1		0.0°	○

Function code	Name	Description	Default	Modify
		of motor 1) P04.07 range: P04.05–P02.02 (Rated frequency of AM 1) P04.08 range: 0.0%–110.0% (of the rated voltage of motor 1)		
P04.09	V/F slip compensation gain of motor 1	Used to compensate for the motor rotating speed change caused by load change in the space voltage vector mode, and thus improve the rigidity of the mechanical characteristics of the motor. You need to calculate the rated slip frequency of the motor as follows: $\triangle f=f_b-n*p/60$ Of which, f_b is the rated frequency of the motor, corresponding to function code P02.02. n is the rated rotating speed of the motor, corresponding to function code P02.03. p is the number of pole pairs of the motor. 100.0% corresponds to the rated slip frequency △f of motor 1. Range: 0.0–200.0%	0.0°	○
P04.10	Low-frequency oscillation control factor of motor 1	In space voltage vector control mode, the motor, especially the large-power motor, may experience current oscillation at certain frequencies, which may cause unstable motor running, or even VFD overcurrent. You can adjust the function codes properly to eliminate such phenomenon. P04.10 range: 0–100 P04.11 range: 0–100 P04.12 range: 0.00Hz–P00.03	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	Defines the V/F curve of motor 2 to meet the requirements of different loads. Range: 0–5 0: Straight-line V/F curve 1: Multi-point V/F curve 2: Torque-down V/F curve (power of 1.3) 3: Torque-down V/F curve (power of 1.7) 4: Torque-down V/F curve (power of 2.0) 5: Customized V/F curve (V/F separation) **Note:** See the description for P04.00.	0	◎

Function code	Name	Description	Default	Modify
P04.14	Torque boost of motor 2	P04.14 range: 0.0% (Automatic) – 10.0% (of the rated voltage of motor 2) P04.15 range: 0.0–50.0% (of the rated frequency of motor 2) **Note:** See the descriptions for P04.01 and P04.02.	0.0°	○
P04.15	Torque boost cut-off of motor 2		20.0°	○
P04.16	V/F frequency point 1 of motor 2	P04.16 range: 0.00Hz–P04.18 P04.17 range: 0.0%–110.0% (of the rated voltage of motor 2) P04.18 range: P04.16–P04.20 P04.19 range: 0.0%–110.0% (of the rated voltage of motor 2) P04.20 range: P04.18–P12.02 (Rated frequency of AM 2) P04.21 range: 0.0%–110.0% (of the rated voltage of motor 2) **Note:** See the descriptions for P04.03 and P04.08.	0.00Hz	○
P04.17	V/F voltage point 1 of motor 2		0.0°	○
P04.18	V/F frequency point 2 of motor 2		0.00Hz	○
P04.19	V/F voltage point 2 of motor 2		0.0°	○
P04.20	V/F frequency point 3 of motor 2		0.00Hz	○
P04.21	V/F voltage point 3 of motor 2		0.0°	○
P04.22	V/F slip compensation gain of motor 2	Used to compensate for the motor rotating speed change caused by load change in the space voltage vector mode, and thus improve the rigidity of the mechanical characteristics of the motor. You need to calculate the rated slip frequency of the motor as follows: $\triangle f=f_b-n*p/60$ Of which, f_b is the rated frequency of motor 2, corresponding to function code P12.02. n is the rated rotating speed of motor 2, corresponding to function code P12.03. p is the number of motor pole pairs. 100.0% corresponds to the rated slip frequency $\triangle f$ of motor 2. Range: 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. You can adjust the function codes properly to eliminate such phenomenon.	10	○
P04.24	High-frequency oscillation control factor of motor 2		10	○
P04.25	Oscillation control		30.00Hz	○

Function code	Name	Description	Default	Modify
	threshold of motor 2	P04.23 range: 0–100 P04.24 range: 0–100 P04.25 range: 0.00Hz–P00.03		
P04.26	Energy-saving run	0: Disable 1: Automatic energy-saving run In light-load state, the motor can adjust the output voltage automatically to achieve energy saving.	0	○
P04.27	Voltage setting channel	0–18 0: Keypad (The output voltage is determined by P04.28.) 1: AI1 2: AI2 3: AI3 4: HDIA 5: Multi-step speed running (The setting is determined by group P10.) 6: PID 7: Modbus/Modbus TCP communication 8: PROFIBUS/CANopen communication 9: Ethernet communication 10: HDIB 11: EtherCAT/PROFINET/EtherNet IP communication 12: Programmable card 13–17: Reserved 18: Keypad analog (valid for VFDs in T1–T4 frames)	0	○
P04.28	Voltage set through keypad	The function code is the voltage digital setting when "keypad" is selected as the voltage setting channel. Range: 0.0%–100.0% (of the rated voltage of motor 1)	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.	5.0s	○

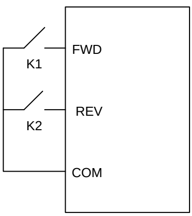
Function code	Name	Description	Default	Modify
		Range: 0.0–3600.0s		
P04.31	Max. output voltage	The function codes are used to set the upper and lower limits of output voltage.	100.0°	◎
P04.32	Min. output voltage	 P04.31 range: P04.32–100.0% (of the the motor rated voltage) P04.32 range: 0.0%–P04.31 (of the motor rated voltage)	0.00Hz	◎
P04.33	Weakening coefficient in constant power zone	1.00–1.30 **Note:** P04.33 is only valid for V/F mode.	1.00	○
P04.34–P04.39	Reserved	/	/	/
P04.40	Enabling IF mode for AM 1	0: Invalid 1: Enable	0	◎
P04.41	Current setting in IF mode for AM 1	When IF control is adopted for AM 1, the function code is used to set the output current. The value is a percentage in relative to the rated current of the motor. Range: 0.0–200.0%	120.0°	○
P04.42	Proportional coefficient in IF mode for AM 1	When IF control is adopted for AM 1, the function code is used to set the proportional coefficient of the output current closed-loop control. 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. Range: 0–5000	150	○
P04.44	Starting frequency point for motor 1 switching off IMVF mode	Range: 0.00–P04.50	10.00Hz	○

Function code	Name	Description	Default	Modify
P04.45	Enabling IF mode for AM 2	0: Invalid 1: Enable	0	◎
P04.46	IMVF current setting	Range: 0.0–200.0% (of the motor rated current)	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. 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. Range: 0–5000	150	○
P04.49	Starting frequency point for motor 2 switching off IMVF mode	Range: 0.00–P04.51	10.00Hz	○
P04.50	End frequency point for switching off IMVF mode for motor 1	Range: P04.44–P00.03	25.00Hz	○
P04.51	End frequency point for switching off IMVF mode for motor 2	Range: P04.49–P00.03	25.00Hz	○
P04.52	VF energy-saving mode selection	Range: 0–2 0: Max. efficiency (default) 1: Optimal power factor 2: MTPA	0	○
P04.53	VF energy-saving gain coefficient	Range: 0.0%–400.0%	100.0	○
P04.54	VF energy-saving power angle gain coefficient	Range: 0.0%–200.0% **Note:** A small value of this parameter increases energy saving control effect, but this also reduces the load carrying capability for sudden load.	80.0°	○

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>Range: 0x00–0x11
Ones place: HDIA input type
0: HDIA is high-speed pulse input
1: HDIA is digital input
Tens place: HDIB input type (Reserved)
0: HDIB is high-speed pulse input (Reserved)
1: HDIB is digital input (Reserved)</td><td>0x00</td><td>◎</td></tr>
<tr><td>P05.01</td><td>Function of S1</td><td rowspan="7">Range: 0–111
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: Fault reset
8: Pause running
9: External fault input
10: Increase frequency setting (UP)
11: Decrease frequency setting (DOWN)
12: Clear the frequency increase/decrease setting
13: Switch between A setting and B setting
14: Switch between combination setting and A setting
15: Switch between combination setting and B setting
16: Multi-step speed terminal 1
17: Multi-step speed terminal 2
18: Multi-step speed terminal 3
19: Multi-step speed terminal 4
20: Pause multi-step speed running
21: ACC/DEC time selection 1
22: ACC/DEC time selection 2
23: Simple PLC stop reset
24: Pause simple PLC
25: Pause PID control
26: Pause wobbling frequency</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>/</td><td>/</td></tr>
<tr><td>P05.07</td><td>Reserved</td><td></td><td></td></tr>
</table>

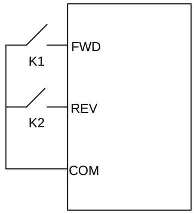
Function code	Name	Description	Default	Modify
		27: Reset wobbling frequency 28: Counter reset 29: Switch between speed control and torque control 30: Disable ACC/DEC 31: Trigger the counter 32: Reserved 33: Clear the frequency increase/decrease setting temporarily 34: DC braking 35: Switch from motor 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 43–72: Reserved 73: PID2 start 74: PID2 stop 75: Pause PID2 integral 76: Pause PID2 control 77: Switch PID2 polarities 78: Disable HVAC (only in stopped state) 79: Reserved 80: Pause PID1 control 81: Pause PID1 integral 82: Switch PID1 polarities 83: Trigger sleep mode 84: Trigger wakeup mode 85: Manual alternation 86–103: Reserved 104: Motor A inactive		

<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>105: Motor B inactive
106: Motor C inactive
107: Motor D inactive
108: Motor E inactive
109: Motor F inactive
110: Motor G inactive
111: Motor H inactive
Note: The output of S4 and Y1 is mutually exclusive, meaning only one can be selected. Functions 104–111 are effective only in fixed variable frequency mode.</td><td></td><td></td></tr>
<tr><td>P05.08</td><td>Input terminal polarity selection</td><td>Specifies 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.
Range: 0x00–0x3F
<table>
<tr><th>Bit0</th><th>Bit1</th><th>Bit2</th><th>Bit3</th><th>Bit4</th><th>Bit5</th></tr>
<tr><td>S1</td><td>S2</td><td>S3</td><td>S4</td><td>HDIA</td><td>Reserved</td></tr>
</table></td><td>0x00</td><td>○</td></tr>
<tr><td>P05.09</td><td>Digital input filter time</td><td>Specifies the sampling filter time of the S1–S4, and HDIA terminals. In strong interference cases, increase the value to avoid mal-operation.
Range: 0.000–1.000s</td><td>0.010s</td><td>○</td></tr>
<tr><td>P05.10</td><td>Virtual terminal setting</td><td>Range: 0x00–0x3F (0: disable; 1: enable)
<table>
<tr><th>Bit0</th><th>Bit1</th><th>Bit2</th><th>Bit3</th><th>Bit4</th><th>Bit5</th></tr>
<tr><td>S1</td><td>S2</td><td>S3</td><td>S4</td><td>HDIA</td><td>Reserved</td></tr>
</table></td><td>0x00</td><td>◎</td></tr>
<tr><td>P05.11</td><td>Terminal control mode</td><td>Specifies the mode of terminal control.
0: Two-wire control 1, the enabling consistent with the direction. This mode is widely used. The defined FWD/REV terminal command determines the motor rotation direction.


<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</td><td>0</td><td>◎</td></tr>
</table>

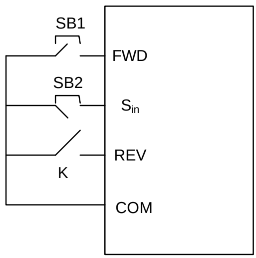
Function code	Name	Description	Default	Modify

terminal. The direction depends on the defined REV state.



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

2: Three-wire control 1. This mode defines S_{In} as the enabling terminal, and the running command is generated by FWD, while the direction is controlled by REV. During running, the S_{in} terminal needs to be closed, and when terminal FWD generates a rising edge signal, the VFD starts to run in the direction set by the state of terminal REV; the VFD needs to be stopped by disconnecting terminal S_{in}.



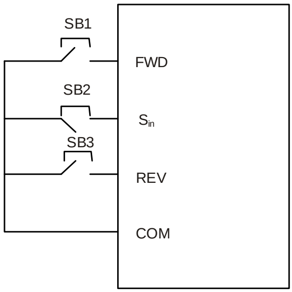
The direction control is as follows during running:

S_{in}	REV	Previous direction	Present direction
ON	OFF→ON	FWD run	REV run
		REV run	FWD run
ON	ON→OFF	REV run	FWD run
		FWD run	REV run
ON→OFF	ON	Decelerate to stop	
	OFF		

S_{in}: Three-wire control; FWD: Forward running; REV: Reverse running

3: Three-wire control 2. This mode defines S_{In} as the enabling terminal, and the running command

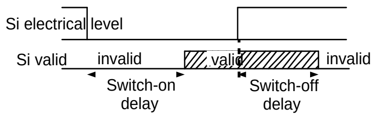
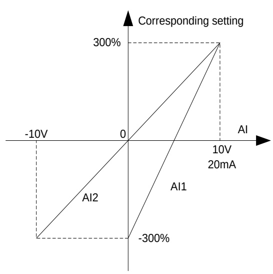
<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td></td><td></td><td>is generated by FWD or REV, but the direction is controlled by both FWD and REV. During running, the S_{in} terminal needs to be closed, and terminal FWD or REV generates a rising edge signal to control the running and direction of the VFD; the VFD needs to be stopped by disconnecting terminal S_{in}.



<table>
<tr><th>S_{in}</th><th>FWD</th><th>REV</th><th>Running direction</th></tr>
<tr><td rowspan="2">ON</td><td rowspan="2">OFF→ON</td><td>ON</td><td>FWD run</td></tr>
<tr><td>OFF</td><td>FWD run</td></tr>
<tr><td rowspan="2">ON</td><td>ON</td><td rowspan="2">OFF→ON</td><td>REV run</td></tr>
<tr><td>OFF</td><td>REV run</td></tr>
<tr><td>ON→OFF</td><td></td><td></td><td>Decelerate to stop</td></tr>
</table>

S_{in}: Three-wire control; FWD: Forward running; REV: Reverse running

Note: For two-wire controlled running mode, when the FWD/REV terminal is valid, if the VFD stops due to a stop command given by another source, the VFD does not run again after the stop command disappears even if the control terminal FWD/REV is still valid. To make the VFD run, you need to trigger FWD/REV again, **f**or 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="2">These function codes specify the delay time corresponding to the electrical level changes</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>
</table>

Function code	Name	Description	Default	Modify
P05.14	S2 switch-on delay	when the programmable input terminals switch on or switch off.  Range: 0.000–50.000s **Note:** After a virtual terminal is enabled, the state of the terminal can be changed only in communication mode. The communication address is 0x200A.	0.000s	○
P05.15	S2 switch-off delay		0.000s	○
P05.16	S3 switch-on delay		0.000s	○
P05.17	S3 switch-off delay		0.000s	○
P05.18	S4 switch-on delay		0.000s	○
P05.19	S4 switch-off delay		0.000s	○
P05.20	HDIA switch-on delay		0.000s	○
P05.21	HDIA switch-off delay		0.000s	○
P05.22	HDIB switch-on delay (Reserved)		0.000s	○
P05.23	HDIB switch-off delay (Reserved)		0.000s	○
P05.24	AI1 lower limit	The function codes define the relationship between the analog input voltage and its corresponding setting. When the analog input voltage exceeds the range from the upper limit to the lower limit, the upper limit or lower limit is used. When the analog input is current input, 0mA–20mA current corresponds to 0V–10V voltage. In different applications, 100.0% of the analog setting corresponds to different nominal values. See the description in each application section for details. The following figure illustrates the cases of several settings: 	0.00V	○
P05.25	Corresponding setting of AI1 lower limit		0.0°	○
P05.26	AI1 upper limit		10.00V	○
P05.27	Corresponding setting of AI1 upper limit		100.0°	○
P05.28	AI1 input filter time		0.030s	○
P05.29	AI2 lower limit		-10.00V	○
P05.30	Corresponding setting of AI2 lower limit		-100.0°	○
P05.31	AI2 middle value 1		0.00V	○
P05.32	Corresponding setting of AI2 middle value 1		0.0°	○
P05.33	AI2 middle value 2		0.00V	○
P05.34	Corresponding setting of AI2 middle value 2		0.0°	○
P05.35	AI2 upper limit		10.00V	○
P05.36	Corresponding		100.0°	○

Function code	Name	Description	Default	Modify
	setting of AI2 upper limit	Input filter time: to adjust the sensitivity of analog input. Increasing the value properly can enhance analog input anti-interference but may reduce the sensitivity of analog input. Note: AI1 supports the 0–10V/0–20mA input. When AI1 selects the 0–20mA input, the corresponding voltage of 20mA is 10V. AI2 supports the -10–+10V input. See section 5.5.9 Analog input for function description. P05.24 range: 0.00V–P05.26 P05.25 range: -300.0%–300.0% P05.26 range: P05.24–10.00V P05.27 range: -300.0%–300.0% P05.28 range: 0.000s–10.000s P05.29 range: -10.00V–P05.31 P05.30 range: -300.0%–300.0% P05.31 range: P05.29–P05.33 P05.32 range: -300.0%–300.0% P05.33 range: P05.31–P05.35 P05.34 range: -300.0%–300.0% P05.35 range: P05.33–10.00V P05.36 range: -300.0%–300.0% P05.37 range: 0.000s–10.000s		
P05.37	AI2 input filter time		0.030s	○
P05.38	HDIA high-speed pulse input function selection	Range: 0–2 0: Frequency setting input 1–2: Reserved	0	◎
P05.39	HDIA lower limit frequency	Range: 0.000kHz–P05.41	0.000kHz	○
P05.40	Corresponding setting of HDIA lower limit frequency	Range: -300.0%–300.0%	0.0°	○
P05.41	HDIA upper limit frequency	Range: P05.39–50.000kHz	50.000kHz	○
P05.42	Corresponding setting of HDIA upper limit	Range: -300.0%–300.0%	100.0°	○

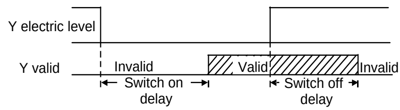
Function code	Name	Description	Default	Modify
	frequency			
P05.43	HDIA frequency input filter time	Range: 0.000s–10.000s	0.030s	○
P05.44	HDIB high-speed pulse input function selection (Reserved)	Range: 0–2 0: Frequency setting input 1–2: Reserved	0	◎
P05.45	HDIB lower limit frequency (Reserved)	Range: 0.000kHz–P05.47	0.000kHz	○
P05.46	Corresponding setting of HDIB lower limit frequency (Reserved)	Range: -300.0%–300.0%	0.0°	○
P05.47	HDIB upper limit frequency (Reserved)	Range: P05.45–50.000kHz	50.000kHz	○
P05.48	Corresponding setting of HDIB upper limit frequency (Reserved)	Range: -300.0%–300.0%	100.0°	○
P05.49	HDIB frequency input filter time (Reserved)	Range: 0.000–10.000s	0.030s	○
P05.50	AI1 input signal type	Range: 0x00–0x11 Ones place: Input signal source 0: Voltage 1: Current Tens place: Input value unit selection 0: All voltage type 1: Voltage for voltage-type input, current for current-type input **Note:** After selecting the voltage or current input through the function code, ensure that the control board selection jumper is installed in the correct position.	0	◎

Function code	Name	Description	Default	Modify
P05.51–P05.52	Reserved	/	/	/
P05.53	Keypad analog lower limit	Range: 0.00V–P05.54	0.00V	○
P05.54	Corresponding setting of keypad analog lower limit	Range: -300.0%–300.0%	0.0°	○
P05.55	Keypad analog upper limit	Range: P05.56–10.00V	10.00V	○
P05.56	Corresponding setting of keypad analog upper limit	Range: -300.0%–300.0%	100.0°	○
P05.57	Keypad analog input filter time	Range: 0.000s–10.000s	0.030s	○

Group P06—Output terminal functions

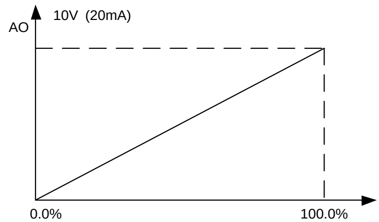
Function code	Name	Description	Default	Modify
P06.00	HDO output type (Reserved)	Range: 0–1 0: Open collector high-speed pulse output 1: Open collector output	0	◎
P06.01	Y1 output	Range: 0–68 0: Invalid 1: Running 2: Running forward 3: Running reversely 4: Jogging 5: VFD in fault 6: Frequency level detection FDT1 7: Frequency level detection FDT2 8: Frequency reached 9: Running in zero speed 10: Upper limit frequency reached 11: Lower limit frequency reached 12: Ready for running 13: Pre-exciting 14: Overload alarm 15: Underload alarm 16: Simple PLC stage completed 17: Simple PLC cycle completed	0	○
P06.02	HDO output		0	○
P06.03	Relay RO1 output		1	○
P06.04	RO2 output		5	○

Function code	Name	Description	Default	Modify
		18: Set counting value reached 19: Designated counting value reached 20: External fault is valid 21: Reserved 22: Running time reached 23: Modbus communication virtual terminal output 24: PROFIBUS/CANopen communication virtual terminal output 25: Ethernet communication virtual terminal output 26: DC bus voltage established 27–32: Reserved 33:In speed final limit 34: EtherCAT/PROFINET/EtherNet IP communication virtual terminal output 35: Reserved 36: Speed/position control switchover completed 37: Any frequency reached 38–47: Reserved 48: Reserved 49: Pre-alarm of PID1 feedback too low 50: Pre-alarm of PID1 feedback too high 51: PID1 in sleep 52: PID2 in startup 53: PID2 stopped 54–55: Reserved 56: Pre-alarm output 57: Control variable-frequency circulation motor A 58: Control variable-frequency circulation motor B 59: Control variable-frequency circulation motor C 60: Control variable-frequency circulation motor D 61: Control variable-frequency circulation motor E 62: Control variable-frequency circulation motor F 63: Control variable-frequency circulation motor G 64: Control variable-frequency circulation motor H 65: Low temperature pre-alarm 66: Stalling pre-alarm 67: Dry-pumping pre-alarm 68: PTC overtemperature pre-alarm		

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td>P06.05</td><td>Output terminal polarity selection</td><td>Specifies the output terminal polarity.
When a bit is 0, the output terminal is positive.
When a bit is 1, the output terminal is negative.
<table><tr><td>Bit3</td><td>Bit2</td><td>Bit1</td><td>Bit0</td></tr><tr><td>Reserved</td><td>RO1</td><td>Reserved</td><td>Y1</td></tr></table>Range: 0x00–0x0F</td><td>0x00</td><td>○</td></tr>
<tr><td>P06.06</td><td>Y1 switch-on delay</td><td rowspan="8">The function codes specify the delay time corresponding to the electrical level changes when the programmable output terminals switch on or switch off.


Range: 0.000–50.000s
Note: P06.08 and P06.09 are valid only when P06.00=1.</td><td>0.000s</td><td>○</td></tr>
<tr><td>P06.07</td><td>Y1 switch-off delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P06.08</td><td>Reserved</td><td>/</td><td>/</td></tr>
<tr><td>P06.09</td><td>Reserved</td><td>/</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>Reserved</td><td>/</td><td>/</td></tr>
<tr><td>P06.13</td><td>Reserved</td><td>/</td><td>/</td></tr>
<tr><td>P06.14</td><td>AO1 output</td><td rowspan="3">0: Running frequency
1: Set frequency
2: Ramp reference frequency
3: Rotational speed (10V corresponds to the speed corresponding to the max. output frequency)
4: Output current (10V corresponds to twice the VFD rated current)
5: Output current (10V corresponds to twice the motor rated current)
6: Output voltage (10V corresponds to 1.5 times the VFD rated voltage)
7: Output power (10V corresponds to twice the motor rated power)
8: Set torque (10V corresponds to twice the motor rated torque)
9: Output torque (Absolute value, 10V corresponds to 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 communication</td><td>0</td><td>○</td></tr>
<tr><td>P06.15</td><td>AO0 output selection</td><td>0</td><td>○</td></tr>
<tr><td>P06.16</td><td>HDO high-speed pulse output (Reserved)</td><td>0</td><td>○</td></tr>
</table>

Function code	Name	Description	Default	Modify
		(0–1000) 15: Value 2 set through Modbus communication (0–1000) 16: Value 1 set through PROFIBUS/CANopen communication (0–1000) 17: Value 2 set through PROFIBUS/CANopen communication (0–1000) 18: Value 1 set through Ethernet communication (0–1000) 19: Value 2 set through Ethernet communication (0–1000) 20: HDIB input value 21: Value 1 set through EtherCAT/PROFINET/EtherNet IP communication (0–1000) 22: Torque current (bipolar, 100% corresponding to 10V) 23: Exciting current (100% corresponding to 10V) 24: Set frequency (bipolar) 25: Ramp reference frequency (bipolar) 26: Rotational speed (bipolar) 27: Value 2 set through PROFINET communication (0–1000) 28: C_AO1 from CODESYS (Set P27.00 to 1.) 29: C_AO2 from CODESYS (Set P27.00 to 1.) 30: Rotational speed (10V corresponds to the speed corresponding to twice the motor rated frequency) 31: Output torque 32: PID1 output 33: PID2 output 34: PID1 reference value 35: PID1 feedback value 36: PID2 reference value 37: PID2 feedback value 38–39: Reserved 40: Value 0 set through PROFIBUS/CANopen communication 41: Value 0 set through EtherCAT/		

Function code	Name	Description	Default	Modify
		PROFINET/EtherNet IP communication 42–47: Reserved		
P06.17	AO1 output lower limit	The function codes define the relationship between the output value and analog output. When the output value exceeds the allowed range, the output uses the lower limit or upper limit. When the analog output is current output, 1mA equals 0.5V. In different cases, the corresponding analog output of 100% of the output value is different.  P06.17 range: -300.0%–P06.19 P06.18 range: 0.00V–10.00V P06.19 range: P06.17–300.0% P06.20 range: 0.00V–10.00V P06.21 range: 0.000s–10.000s	0.0°	○
P06.18	AO1 output corresponding to lower limit		0.00V	○
P06.19	AO1 output upper limit		100.0°	○
P06.20	AO1 output corresponding to upper limit		10.00V	○
P06.21	AO1 output filter time		0.000s	○
P06.22	AO0 output lower limit	Range: -300.0%–P06.24	0.0°	○
P06.23	AO0 output corresponding to lower limit	Range: 0.00–10.00V	0.00V	○
P06.24	AO0 output upper limit	Range: P06.22–300.0%	100.0°	○
P06.25	AO0 output corresponding to upper limit	Range: 0.00–10.00V	10.00V	○
P06.26	AO0 output filter time	Range: 0.000s–10.000s	0.000s	○
P06.27–P06.32	Reserved	/	/	/
P06.33	Detection value for	Range: 0.00Hz–P00.03	1.00Hz	○

Function code	Name	Description	Default	Modify
	frequency being reached			
P06.34	Frequency reaching detection time	Range: 0.0–3600.0s	0.5s	○

Group P07—Human-machine interface

Function code	Name	Description	Default	Modify
P07.00	User password	Range: 0–65535 When you set the function code to a non-zero number, password protection is enabled. If you set the function code to 00000, the previous user password is cleared and password protection is disabled. After the user password is set and takes effect, you cannot enter the parameter menu if you enter an incorrect password. Please remember your password and save it in a secure place. After you exit the function code editing interface, the password protection function is enabled 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	Parameter copy	Used to set the parameter copy mode. 0: No operation 1: Parameter upload to keypad 2: Download all parameters (including motor parameters) 3: Download non-motor parameters 4: Download motor parameters **Note:** After any operation among 1–4 is completed, the parameter restores to 0. The upload and download functions are not applicable	0	◎

Function code	Name	Description	Default	Modify
		to group P29.		
P07.02	Key function selection	Range: 0x00–0x28 Ones place: Function of QUICK/JOG 0: No function 1: Jog 2: Reserved 3: Switch between forward and reverse rotation 4: Clear the UP/DOWN setting 5: Coast to stop 6: Switch command channels in sequence 7: Quick commissioning mode 8: Sequential switching of the run command reference modes + frequency switching **Note:** When switched to the key mode, the frequency setting is determined by P00.10, and in other cases, it is determined by P00.06. Tens place: Reserved	0x01	◎
P07.03	Sequence of switching running-command channels by pressing QUICK	When P07.02=6, set the sequence of switching running-command channels by pressing this key. 0: Keypad→Terminal→Communication 1: Keypad←→Terminal 2: Keypad←→Communication 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 only for keypad control 1: Valid both for keypad and terminal control 2: Valid both for keypad and communication control 3: Valid for all control modes	0	○
P07.05	Selection 1 of parameters displayed in running state	Range: 0x0000–0xFFFF Bit 0: Running frequency (HZ on) Bit 1: Set frequency (HZ blinking) Bit 2: Bus voltage (V on) Bit 3: Output voltage (V on) Bit 4: Output current (A on) Bit 5: Running speed (RPM on)	0x03FF	○

Function code	Name	Description	Default	Modify
		Bit 6: Output power (% on) Bit 7: Output torque (% on) Bit 8: PID reference value (% blinking) Bit 9: PID feedback value (% on) Bit 10: Input terminal state Bit 11: Output terminal state Bit 12: Set torque (% on) Bit 13: Pulse counting value Bit 14: Motor overload percentage (% on) Bit 15: PLC and actual step of multi-step speed		
P07.06	Selection 2 of parameters displayed in running state	Range: 0x0000–0xFFFF Bit 0: AI1 (V on) Bit 1: AI2 (V on) Bit 2: AI3 (V on) Bit 3: High-speed pulse HDIA frequency Bit 4: Reserved Bit 5: VFD overload percentage (% on) Bit 6: Ramp frequency reference (HZ on) Bit 7: Linear speed Bit 8: AC incoming current Bit 9: Upper limit frequency Bit 10: AI0 (V on) Bit 11–Bit 15: Reserved	0x0000	○
P07.07	Selection of parameters displayed in stopped state	Range: 0x0000–0xFFFF Bit 0: Set frequency (Hz on, blinking slowly) Bit 1: Bus voltage (V on) Bit 2: Input terminal state Bit 3: Output terminal state Bit 4: PID reference value (% blinking) Bit 5: PID feedback value (% on) Bit 6: Set torque (% on) Bit 7: AI1 (V on) Bit 8: AI2 (V on) Bit 9: AI3 (V on) Bit 10: High-speed pulse HDIA frequency Bit 11: High-speed pulse HDIB frequency Bit 12: Counting value Bit 13: PLC and current step number of multi-step	0x00FF	○

Function code	Name	Description	Default	Modify
		speed Bit 14: Upper limit frequency Bit 15: AI0 (V on)		
P07.08	Frequency display coefficient	Range: 0.01–10.00 Display frequency = Running frequency× P07.08	1.00	○
P07.09	Rotational speed display coefficient	Range: 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	Range: 0.1–999.9% Linear speed = (Mechanical rotation speed) × P07.10	1.0°	○
P07.11	Rectifier bridge temperature	Range: -20.0–120.0°C	0.0°C	●
P07.12	Inverter module temperature	Range: -20.0–120.0°C	0.0°C	●
P07.13	Control board software version	Range: 1.00–655.35	Version depended	●
P07.14	Local accumulative running time	Range: 0–65535h	0h	●
P07.15	VFD electricity consumption MSB	Used to display the electricity consumption of the VFD. VFD electricity consumption = P07.15 × 1000 + P07.16 P07.15 range: 0–65535kWh (×1000) P07.16 range: 0.0–999.9kWh	0kWh	●
P07.16	VFD electricity consumption LSB		0.0kWh	●
P07.17	VFD model	Range: 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 Bit 12–Bit 15: Reserved	0x0000	●
P07.18	VFD rated power	Range: 0.4–3000.0kW	0.4kW	●

Function code	Name	Description	Default	Modify
P07.19	VFD rated voltage	Range: 50–1200V	380V	●
P07.20	VFD rated current	Range: 0.1–6000.0A	0.1A	●
P07.21	Factory bar code 1	Range: 0x0000–0xFFFF	0xFFFF	●
P07.22	Factory bar code 2	Range: 0x0000–0xFFFF	0xFFFF	●
P07.23	Factory bar code 3	Range: 0x0000–0xFFFF	0xFFFF	●
P07.24	Factory bar code 4	Range: 0x0000–0xFFFF	0xFFFF	●
P07.25	Factory bar code 5	Range: 0x0000–0xFFFF	0xFFFF	●
P07.26	Factory bar code 6	Range: 0x0000–0xFFFF	0xFFFF	●
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 acceleration (OC1) 5: Overcurrent during deceleration (OC2) 6: Overcurrent during constant speed running (OC3) 7: Overvoltage during acceleration (OV1) 8: Overvoltage during deceleration (OV2) 9: Overvoltage during constant speed running (OV3) 10: Bus undervoltage fault (UV) 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 overheating (OH2) 17: External fault (EF) 18: Modbus/Modbus TCP communication fault (CE) 19: Current detection fault (ItE) 20: Motor autotuning fault (tE) 21: EEPROM operation error (EEP) 22: PID feedback offline fault (PIDE) 23: Braking unit fault (bCE) 24: Running time reached (END) 25: Electronic overload (OL3) 26: Keypad communication error (PCE)	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	●

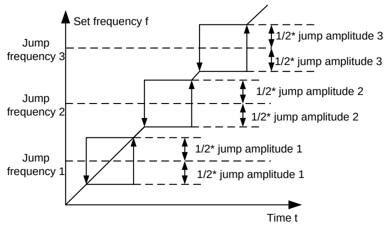
Function code	Name	Description	Default	Modify
		27: Parameter upload error (UPE) 28: Parameter download error (DNE) 29: PROFIBUS communication fault (E-DP) 30: Ethernet communication fault (E-NET) 31: CANopen communication fault (E-CAN) 32: To-ground short-circuit fault 1 (ETH1) 33: To-ground short-circuit fault 2 (ETH2) 34: Speed deviation fault (dEu) 35: Offset fault (STo) 36: Underload fault (LL) 37–54: Reserved 55:Duplicate expansion card type (E-Err) 56: Reserved 57: PROFINET communication fault (E-PN) 58: CAN communication timeout (ESCAN) 59: Motor overtemperature fault (OT) 60: Failure to identify the card in slot 1 (F1-Er) 61: Failure to identify the card in slot 2 (F2-Er) 62: Reserved 63: Communication timeout of the card in slot 1 (C1-Er) 64: Communication timeout of the card in slot 2 (C2-Er) 65: Reserved 66: EtherCAT communication timeout fault (E-CAT) 67–68: Reserved 69: CAN slave fault in master/slave synchronization (S-Err) 70: EtherNet IP communication timeout fault (E-EIP) 71: Braking transistor overcurrent fault (bOC) 72: Braking transistor overload (boL) 73–74: Reserved 75: Dry pumping fault (Dry) 76: AI1 disconnection (E-AI1) 77: AI2 disconnection (E-AI2) 78: AI3 disconnection (E-AI3)		

Function code	Name	Description	Default	Modify
		79: Reserved 78: Power underload (E-LLP)		
P07.33	Running frequency at present fault	Range: 0.00Hz–P00.03	0.00Hz	●
P07.34	Ramp reference frequency at present fault	Range: 0.00Hz–P00.03	0.00Hz	●
P07.35	Output voltage at present fault	Range: 0–1200V	0V	●
P07.36	Output current at present fault	Range: 0.0–6300.0A	0.0A	●
P07.37	Bus voltage at present fault	Range: 0.0–2000.0V	0.0V	●
P07.38	Temperature at present fault	Range: -20.0–120.0°C	0.0°C	●
P07.39	Input terminal state at present fault	Range: 0x0000–0xFFFF	0x0000	●
P07.40	Output terminal state at present fault	Range: 0x0000–0xFFFF	0x0000	●
P07.41	Running frequency at last fault	Range: 0.00Hz–P00.03	0.00Hz	●
P07.42	Ramp reference frequency at last fault	Range: 0.00Hz–P00.03	0.00Hz	●
P07.43	Output voltage at last fault	Range: 0–1200V	0V	●
P07.44	Output current at last fault	Range: 0.0–6300.0A	0.0A	●
P07.45	Bus voltage at last fault	Range: 0.0–2000.0V	0.0V	●
P07.46	Temperature at last fault	Range: -20.0–120.0°C	0.0°C	●
P07.47	Input terminal state at last fault	Range: 0x0000–0xFFFF	0x0000	●
P07.48	Output terminal state at last fault	Range: 0x0000–0xFFFF	0x0000	●
P07.49	Running frequency at 2nd-last fault	Range: 0.00Hz–P00.03	0.00Hz	●

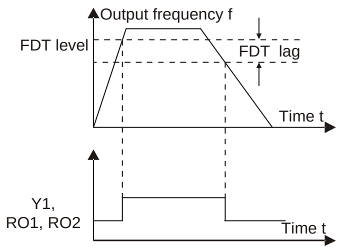
Function code	Name	Description	Default	Modify
P07.50	Ramp reference frequency at 2nd-last fault	Range: 0.00Hz–P00.03	0.00Hz	●
P07.51	Output voltage at 2nd-last fault	Range: 0–1200V	0V	●
P07.52	Output current at 2nd-last fault	Range: 0.0–6300.0A	0.0A	●
P07.53	Bus voltage at 2nd-last fault	Range: 0.0–2000.0V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

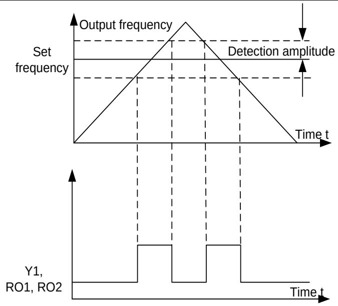
Group P08—Enhanced functions

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. Range: 0.0–3600.0s	Model depended (20.0)	○
P08.01	DEC time 2		Model depended (20.0)	○
P08.02	ACC time 3		Model depended (20.0)	○
P08.03	DEC time 3		Model depended (20.0)	○
P08.04	ACC time 4		Model depended (20.0)	○
P08.05	DEC time 4		Model depended (20.0)	○
P08.06	Running frequency of jogging	Specifies the reference frequency during jogging. Range: 0.00Hz–P00.03 (Max. output frequency)	5.00Hz	○

Function code	Name	Description	Default	Modify
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).	Model depended (20.0s)	○
P08.08	DEC time for jogging	DEC time for jogging means the time needed for the VFD to decelerate from the max. output frequency (P00.03) to 0Hz. Range: 0.0–3600.0s	Model depended (20.0s)	○
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.	0.00Hz	○
P08.10	Jump frequency amplitude 1		0.00Hz	○
P08.11	Jump frequency 2	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	○
P08.12	Jump frequency amplitude 2		0.00Hz	○
P08.13	Jump frequency 3		0.00Hz	○
P08.14	Jump frequency amplitude 3	 Range: 0.00Hz–P00.03 (Max. output frequency)	0.00Hz	○
P08.15	Amplitude of wobbling frequency	Range: 0.0–100.0% (of the set frequency)	0.0°	○
P08.16	Amplitude of sudden jump frequency	Range: 0.0–50.0% (of the amplitude of wobbling frequency)	0.0°	○
P08.17	Rise time of wobbling frequency	Range: 0.1–3600.0s	5.0s	○
P08.18	Fall time of wobbling frequency	Range: 0.1–3600.0s	5.0s	○
P08.19	Switching frequency of ACC/DEC time	Range: 0.00Hz–P00.03 (Max. output frequency) 0.00: no switchover. If the running frequency is greater than P08.19, switch to ACC/DEC time 2.	0.00Hz	○

Function code	Name	Description	Default	Modify
P08.20	Frequency threshold of the start of droop control	Range: 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 linear 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 places of frequency	0: Two 1: One	0	○
P08.24	Number of decimal places of linear speed	0: No decimal place 1: One 2: Two 3: Three	0	○
P08.25	Set counting value	Range: P08.26–65535	0	○
P08.26	Designated counting value	Range: 0–P08.25	0	○
P08.27	Set running time	Range: 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. P08.28 range: 0–10 P08.29 range: 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. Range: 0.00–50.00Hz	0.00Hz	○
P08.31	Channel for	Range: 0x00–0x14	0x00	◎

Function code	Name	Description	Default	Modify
	switching between motor 1 and motor 2	Ones place: Switchover channel 0: Terminal 1: Modbus/Modbus TCP communication 2: PROFIBUS/CANopen communication 3: Ethernet communication 4: EtherCAT/PROFINET/EtherNet IP communication Tens place: indicates whether to enable switchover during running 0: Disable 1: Enable		
P08.32	FDT1 electrical level detection value	When the output frequency exceeds the corresponding frequency of FDT electrical level, the multifunction digital output terminal continuously outputs the signal of "Frequency level detection FDT". The signal is invalid only when the output frequency decreases to a value lower than the frequency corresponding to (FDT electrical level—FDT lagging detection value).	50.00Hz	○
P08.33	FDT1 lagging detection value		5.0°	○
P08.34	FDT2 electrical level detection value		50.00Hz	○
P08.35	FDT2 lagging detection value	 P08.32 range: 0.00Hz–P00.03 P08.33 range: 0.0–100.0% (relative to FDT1 electrical level) P08.34 range: 0.00Hz–P00.03 P08.35 range: 0.0–100.0% (relative to FDT2 electrical level)	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".	0.00Hz	○

Function code	Name	Description	Default	Modify
		 Range: 0.00Hz–P00.03 (Max. output frequency)		
P08.37–P08.38	Reserved	/	/	/
P08.39	Cooling-fan running mode	Range: 0x0000–0x0161 Ones place: Run mode 0: Normal mode 1: Permanent running after power-on Tens place: Set speed 0:100% 1:95% 2:90% 3:85% 4:80% 5:75% 6:70% **Note:** Setting the tens place can reduce the fan speed, but it may cause the VFD to overheat. Exercise caution before the setting. Hundreds place: Speed control method 0:Tens setting of P08.39 1: Automatic speed regulation	0x0100	○
P08.40	PWM selection	Range: 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 carrier frequency limit 0: Low-speed carrier frequency limit mode 1	0x1101	◎

Function code	Name	Description	Default	Modify
		1: Low-speed carrier frequency limit mode 2 2: No limit on 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 For carrier limit mode 1 and carrier limit mode 2 set in the tens place, the output frequency must be below 3.00 Hz. Mode 2 is limited to 4 kHz. In Mode 1 under open-loop vector control, if the output frequency is ≥ 0.40Hz, it is limited to 2kHz, and if < 0.40Hz, it is limited to 1kHz. In Mode 1 under closed-loop vector control for motors over 45kW, if the current exceeds 110%, it is limited to 1kHz; if the current is less than 100%, it is limited to 2kHz. For power ratings between 11kW and 45kW, if the current exceeds 110%, it is limited to 2kHz, and if less than 100%, it is limited to 4kHz. The compensation method for the hundreds place: Method 1 is rectangular compensation, and Method 2 is trapezoidal compensation.		
P08.41	Overmodulation selection	Range: 0x0000–0x1111 Ones place: 0: Overmodulation disabled 1: Overmoulation enabled Tens place: 0: Mild overmodulation 1: Deepened overmodulation Hundreds place: Carrier frequency limit 0:Yes 1: No limit Thousands place: Output voltage compensation 0: No compensation 1: Compensation enabled	0x1000	◎

Function code	Name	Description	Default	Modify
P08.42	Keypad digital control setting	Range: 0x0000–0x1223 Ones place: 0: Both the ∧/∨ key and digital potentiometer can be used for the control. 1: Only the ∧/∨ key can be used for the control. 2: Only the digital potentiometer can be used for the control. 3: Both the ∧/∨ key and digital potentiometer can be used for the control. Tens place: Frequency control selection 0: Valid only when P00.06=0 or P00.07=0 1: Valid for all frequency setting methods 2: Invalid for multi-step speed running when multi-step speed running has the priority Hundreds place: Action selection for stop 0: Setting is valid. 1: Valid during running, cleared after stop 2: Valid during running, cleared after a stop command is received Thousands place: Integral function of the ∧/∨ key and digital potentiometer 0: Disable the integral function 1: Enable the integral function	0x0000	○
P08.43	Keypad digital potentiometer integral rate	Range: 0.01–10.00s	0.10s	○
P08.44	UP/DOWN terminal control setting	Range: 0x000–0x221 Ones place: Frequency setting selection 0: The setting made through UP/DOWN is valid. 1: The setting made through UP/DOWN is invalid. Tens place: Frequency control selection 0: Valid only when P00.06=0 or P00.07=0 1: Valid for all frequency setting methods 2: Invalid for multi-step speed running when multi-step speed running has the priority Hundreds place: Action selection for stop 0: Setting is valid. 1: Valid during running, cleared after stop 2: Valid during running, cleared after a stop	0x000	○

Function code	Name	Description	Default	Modify
		command is received		
P08.45	Frequency increment integral rate of the UP terminal	Range: 0.01–50.00Hz/s **Note:** The value is also used as the frequency increment or decrement that is made by pressing the UP/DOWN key on the LCD keypad.	0.50Hz/s	○
P08.46	Frequency integral rate of the DOWN terminal	Range: 0.01–50.00Hz/s	0.50Hz/s	○
P08.47	Action selection at power-off during frequency setting	Range: 0x0000–0x1111 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 adjusting through Modbus communication 0: Save the setting at power-off. 1: Clear the setting at power-off. Hundreds place: Action selection at power-off during frequency setting through DP communication 0: Save the setting at power-off. 1: Clear the setting at power-off. Thousands place: Frequency selection for superimposing when switching between A and B sources 0: Enable 1: Disable	0x0000	○
P08.48	Initial electricity consumption high bit	Used to set the initial electricity consumption. Initial electricity consumption = P08.48*1000 + P08.49 P08.48 range: 0–59999kWh (k) P08.49 range: 0.0–999.9kWh	0kWh	○
P08.49	Initial electricity consumption low bit		0.0kWh	○
P08.50	Magnetic flux braking	Range: 0–150 (Used to enable magnetic flux braking.) 0: Invalid 100–150: A larger coefficient indicates stronger braking. The VFD can quickly slow down the motor by	0	○

Function code	Name	Description	Default	Modify
		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.		
P08.51	VFD input power factor	Used to adjust the current display value on the AC input side. Range: 0.00–1.00	0.56	○
P08.52	Reserved	/	/	/
P08.53	Upper limit frequency bias value in torque control	Range: 0.00Hz–P00.03 (Max. output frequency) **Note:** Valid only for torque control.	0.00Hz	○
P08.54	Upper limit frequency ACC/DEC selection in torque control	0: No limit on acceleration or deceleration 1: ACC/DEC time 1 2: ACC/DEC time 2 3: ACC/DEC time 3 4: ACC/DEC time 4	0	○
P08.55	Enabling auto carrier frequency reduction	0: Disable 1: Enable **Note:** Automatic carrier frequency reduction indicates that the VFD automatically reduces the carrier frequency when detecting the heat sink temperature exceeds the rated temperature. When the temperature decreases to a specified value, the carrier frequency restores to the setting. This function can reduce the VFD overheat alarm	1	○

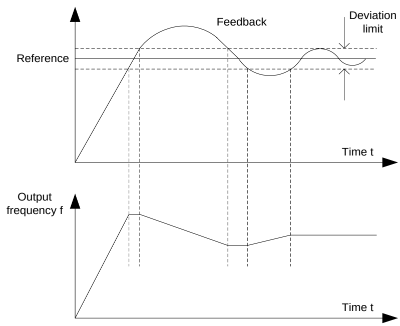
Function code	Name	Description	Default	Modify
		reporting chances.		
P08.56	Temperature point of auto carrier frequency reduction	Range: 40.0–85.0°C	65.0°C	○
P08.57	Interval of carrier frequency reduction	Range: 0–30min (Setting it to 0 means carrier frequency reduction is invalid.)	10	○
P08.58	Output phase loss detection delay	Range: 0.0–360.0s **Note:** When the run time exceeds the delay, the VFD detects for output phase loss.	5.0s	○
P08.59	AI1 disconnection detection threshold	Range: 0–100% (100% corresponds to 10V)	0°	○
P08.60	AI2 disconnection detection threshold	Range: 0–100% (100% corresponds to 10V)	0°	○
P08.61	AI3 disconnection detection threshold	Range: 0–100% (100% corresponds to 10V)	0°	○
P08.62	Grid voltage and frequency selection	Range: 0x00–0x21 Ones place: Frequency selection 0: 50Hz 1: 60Hz Tens place: Voltage selection 0: Indicates the 220V range, suitable for the voltage range of 208– 240V. 1: Indicates the 380V range, suitable for the voltage range of 380– 415V. 2: Indicates the 460V range, suitable for the voltage range of 440– 480V. For VFDs of the -2 model, the tens place of P08.62 automatically becomes 0; changing it to 1 or 2 will not take effect. When the VFD model is -4, the tens place of P08.62 defaults to 1. If changed to 0, it will not take effect.	0x10	◎

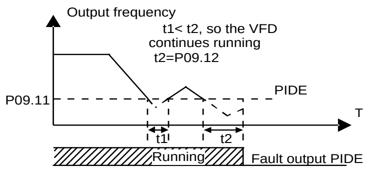
Group P09—PID control

Function code	Name	Description	Default	Modify
P09.00	PID reference source	When P00.06 or P00.07 (Setting channel of A/B frequency command) is 7 or P04.27 (Voltage	0	○

Function code	Name	Description	Default	Modify
		setting channel) is 6, the VFD is process PID controlled. The function code determines the target given channel during the PID process. Range: 0–18 0: Keypad (P09.01) 1: AI1 2: AI2 3: AI3 4: High-speed pulse HDIA 5: Multi-step speed running 6: Modbus/Modbus TCP communication 7: PROFIBUS/CANopen communication 8: Ethernet communication 9: High-speed pulse HDIB 10: EtherCAT/PROFINET/EtherNet IP communication 11: Programmable card 12–17: Reserved 18: Keypad analog (valid for VFDs in T1–T4 frames) The set target of process PID is a relative value, for which 100% equals 100% of the feedback signal of the controlled system. The system always performs calculation by using a relative value (0.0–100.0%).		
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. Range: -100.0%–100.0%	0.0°	○
P09.02	PID feedback source	Used to select the PID feedback channel. Range: 0–18 0: AI1 1: AI2 2: AI3 3: High-speed pulse HDIA 4: Modbus/Modbus TCP communication 5: PROFIBUS/CANopen communication	0	○

Function code	Name	Description	Default	Modify
		6: Ethernet communication 7: High-speed pulse HDIB 8: EtherCAT/PROFINET/EtherNet IP communication 9: Programmable card 10–17: Reserved 18: Keypad analog (valid for VFDs in T1–T4 frames) **Note:** The reference channel and feedback channel cannot be duplicated. 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 tension during winding. 1: PID output is negative. When the feedback signal is greater than the PID reference value, the output frequency of the VFD will increase to balance the PID. Example: PID control on tension during unwinding	0	○
P09.04	Proportional gain (Kp)	The function is applied to the proportional gain P of PID input. P determines the strength of the whole PID adjuster. The larger the value of P, the stronger the adjustment intensity. The value 100 indicates that when the 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). Range: 0.00–100.00	1.80	○
P09.05	Integral time (Ti)	Used to determine the speed of the integral adjustment on the deviation of PID feedback and reference from the PID regulator. When the deviation of PID feedback and reference is 100%, the integral regulator works	0.90s	○

Function code	Name	Description	Default	Modify
		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. Range: 0.00–10.00s		
P09.06	Differential time (Td)	Used to determine the strength of the change ratio adjustment on the deviation of PID feedback and reference from the PID regulator. If the PID feedback changes 100% during the time, the adjustment of the differential regulator (ignoring proportional and integral function) is the max. output frequency (P00.03) or the max. voltage (P04.31). (Ignore proportional and integral functions.) Longer differential time indicates stronger adjustment. 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. 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.  Range: 0.0–100.0%	0.0°	○

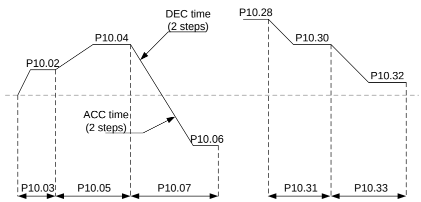
<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td>P09.09</td><td>PID output upper limit</td><td rowspan="2">Used to set the upper and lower limits of PID regulator output values.
100.0% corresponds to the max. output frequency (P00.03) or max. voltage (P04.31).
P09.09 range: P09.10–100.0%
P09.10 range: -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">The function code is used to set the PID feedback offline detection value. When the feedback value is smaller than or equal to the feedback offline detection value, and the duration exceeds the value specified by P09.12, the VFD reports "PID feedback offline fault" and the keypad displays PIDE.


P09.11 range: 0.0–100.0%
P09.12 range: 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>Range: 0x0000–0x1111
Ones place:
0: Continue integral control after the frequency reaches upper/lower limit
1: Stop integral control after the frequency reaches upper/lower limit
Tens place:
0: Same as the main reference direction
1: Contrary to the main reference direction
Hundreds place:
0: Limit 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 pre-charging is invalid.
1: A+B frequency. ACC/DEC of main reference A frequency source pre-charging is valid.
Note: The ACC/DEC time is determined by P08.04.</td><td>0x0001</td><td>○</td></tr>
</table>

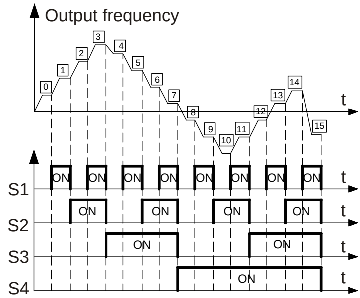
Function code	Name	Description	Default	Modify
P09.14	Low frequency proportional gain (Kp)	Range: 0.00–100.00 Low-frequency switching point: 5.00Hz, high-frequency switching point: 10.00Hz (P09.04 corresponds to high-frequency parameter), and the middle is the linear interpolation between these two points.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

Group P10—Simple PLC and multi-step speed control

Function code	Name	Description	Default	Modify
P10.00	Simple PLC mode	0: Stop after running once The VFD stops automatically after running for one cycle, and it can be started only after receiving the running command. 1: Keep running with the final value after running once The VFD keeps the running frequency and direction of the last section after a single cycle. 2: Cyclic running The VFD enters the next cycle after completing one cycle until receiving the stop command.	0	○

Function code	Name	Description	Default	Modify
P10.01	Simple PLC memory selection	0: Do not memorize at power outage 1: Memory at power-off. The PLC memories its running stage and running frequency before power-off.	0	○
P10.02	Multi-step speed 0	Frequency setting range for steps from step 0 to step 15: -300.0% –300.0%. 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 (s: P10.37=0, min: P10.37=1). When simple PLC operation is selected, you need to set P10.02–P10.33 to determine the running frequency and running time of each step. **Note:** The symbol of multi-step speed determines the running direction of simple PLC, and a negative value indicates reverse running.  When multi-step speed running is selected, the speed values can be continuously set within the range of $-f_{max}$–f_{max}. The start-up and stop of multi-step speed running is determined by P00.01. The VFD supports 16 speed steps, selected through the input combinations of multi-step terminals 1–4 (S terminals, whose functions are defined by P05.01–P05.06), corresponding to speed 0 to speed 15.	0.0°	○
P10.03	Running time of step 0		0.0s (min)	○
P10.04	Multi-step speed 1		0.0°	○
P10.05	Running time of step 1		0.0s (min)	○
P10.06	Multi-step speed 2		0.0°	○
P10.07	Running time of step 2		0.0s (min)	○
P10.08	Multi-step speed 3		0.0°	○
P10.09	Running time of step 3		0.0s (min)	○
P10.10	Multi-step speed 4		0.0°	○
P10.11	Running time of step 4		0.0s (min)	○
P10.12	Multi-step speed 5		0.0°	○
P10.13	Running time of step 5		0.0s (min)	○
P10.14	Multi-step speed 6		0.0°	○
P10.15	Running time of step 6		0.0s (min)	○
P10.16	Multi-step speed 7		0.0°	○
P10.17	Running time of step 7		0.0s (min)	○
P10.18	Multi-step speed 8		0.0°	○
P10.19	Running time of step 8		0.0s (min)	○
P10.20	Multi-step speed 9		0.0°	○
P10.21	Running time of step 9		0.0s (min)	○
P10.22	Multi-step speed 10		0.0°	○
P10.23	Running time of step 10		0.0s (min)	○

Function code	Name	Description	Default	Modify
P10.24	Multi-step speed 11		0.0°	○
P10.25	Running time of step 11		0.0s (min)	○
P10.26	Multi-step speed 12		0.0°	○
P10.27	Running time of step 12		0.0s (min)	○
P10.28	Multi-step speed 13		0.0°	○
P10.29	Running time of step 13		0.0s (min)	○
P10.30	Multi-step speed 14		0.0°	○
P10.31	Running time of step 14		0.0s (min)	○
P10.32	Multi-step speed 15		0.0°	○
P10.33	Running time of step 15		0.0s (min)	○



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 4 are shown in the following:

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

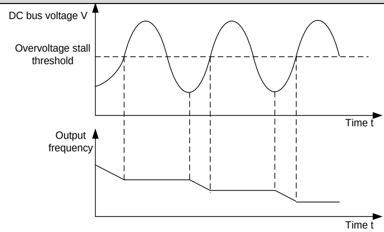
Function code	Name	Description	Default	Modify
P10.34	ACC/DEC time for steps 0–7	The description is as follows:	0x0000	○
P10.35	ACC/DEC time for steps 8–15		0x0000	○

Function code	Binary		Step	ACC/ DEC time1	ACC/ DEC time2	ACC/ DEC time3	ACC/ DEC time4
P10.34	Bit1	Bit0	0	00	01	10	11
	Bit3	Bit2	1	00	01	10	11
	Bit5	Bit4	2	00	01	10	11
	Bit7	Bit6	3	00	01	10	11
	Bit9	Bit8	4	00	01	10	11
	Bit11	Bit10	5	00	01	10	11
	Bit13	Bit12	6	00	01	10	11
	Bit15	Bit14	7	00	01	10	11

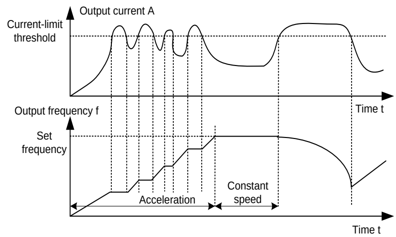
<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td></td><td></td><td>
<table>
<tr><td rowspan="8">P10.35</td><td>Bit1</td><td>Bit0</td><td>8</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>Bit3</td><td>Bit2</td><td>9</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>Bit5</td><td>Bit4</td><td>10</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>Bit7</td><td>Bit6</td><td>11</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>Bit9</td><td>Bit8</td><td>12</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>Bit11</td><td>Bit10</td><td>13</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>Bit13</td><td>Bit12</td><td>14</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>Bit15</td><td>Bit14</td><td>15</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
</table>
Select corresponding acceleration/deceleration time, and then convert 16-bit binary number into hexadecimal number, finally, and then set corresponding function codes.
ACC/DEC time 1 is set by P00.11 and P00.12;
ACC/DEC time 2 is set by P08.00 and P08.01;
ACC/DEC time 3 is set by P08.02 and P08.03;
ACC/DEC time 4 is set by P08.04 and P08.05.
Range: 0x0000–0xFFFF</td><td></td><td></td></tr>
<tr><td>P10.36</td><td>PLC restart mode</td><td>0: Restart from multi-step speed 0.
Restart from the first step, namely if the VFD stops during running (caused by stop command, fault or power down), it will run from the first step after restart.
1: Resume from the paused step.
If the VFD stops during running (caused by stop command or fault), it records the running time of current step. It enters this step automatically after restart, and then continues running at the frequency defined by this step in the remaining time.</td><td>0</td><td>◎</td></tr>
<tr><td>P10.37</td><td>Multi-step speed running time unit</td><td>0: second; the running time of each step is counted in seconds
1: minute; the running time of each step is counted in minutes</td><td>0</td><td>◎</td></tr>
<tr><td>P10.38</td><td>Multi-step speed ACC/DEC time selection</td><td>Range: 0–1
0:P00.11 and P00.12
1:According to P10.34 and P10.35</td><td>0</td><td>◎</td></tr>
</table>

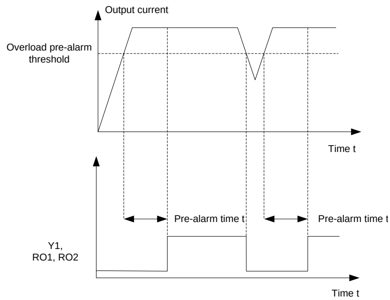
Group P11—Protection parameters

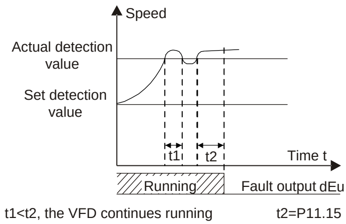
<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td>P11.00</td><td>Phase loss protection</td><td>Range: 0x000–0x111
Ones place:
0: Disable software input phase loss protection.
1: Enable software input phase loss protection.
Tens place:
0: Disable output phase loss protection.
1: Enable output phase loss protection.
Hundreds place: Reserved</td><td>0x011</td><td>○</td></tr>
<tr><td>P11.01</td><td>Frequency decrease at sudden power loss</td><td>0: Disable
1: Enable
If the bus voltage drops to the sudden frequency decreasing point due to power failure, the VFD decreases the running frequency by using the constant bus voltage control method, which makes the motor in power generation state. The regenerative power can maintain the bus voltage to ensure normal running of the VFD until the recovery of power.
<table>
<tr><th>Voltage class</th><td>220V</td><td>380V</td><td>660V</td></tr>
<tr><th>Threshold for frequency decrease at sudden power loss</th><td>260V</td><td>460V</td><td>800V</td></tr>
</table>
Note:
✧ This function can avoid VFD stop that is made for the purpose of protection in grid switchover.
✧ The input phase loss protection function must be disabled before enabling this function.</td><td>0</td><td>○</td></tr>
<tr><td>P11.02</td><td>Reserved</td><td>/</td><td>/</td><td>/</td></tr>
<tr><td>P11.03</td><td>Overvoltage stall protection</td><td>0: Disable
1: Enable</td><td>1</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>

If the bus voltage exceeds the overvoltage stalling point, the motor is in power generation state, and the overvoltage stalling protection function takes effect to regulate output frequency (that is, consume unnecessary regenerative electricity).</td><td></td><td></td></tr>
<tr><td rowspan="2">P11.04</td><td rowspan="2">Overvoltage stall protection voltage</td><td>For 380V: 120–150% (relative to standard bus voltage)</td><td>136°</td><td rowspan="2">○</td></tr>
<tr><td>For 220V: 120–150% (relative to standard bus voltage)</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.
Range: 0x00–0x11
Ones place: Current limit action selection
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">The current-limit protection function detects output current during running, and compares it with the current-limit level specified by P11.06. If it exceeds the current-limit level, the VFD will run at stable frequency during accelerated running, or the VFD will run at decreased frequency during constant-speed running; if it exceeds the current-limit level continuously, the VFD output frequency will drop continuously until reaching the lower limit frequency. When the output current is detected to be lower than the current-limit level</td><td>Model depended</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
		again, it will continue accelerated running.  P11.06 range: 50.0–200.0% (default value for the G type: 160.0%; default value for the P type: 120.0%) P11.07 range: 0.00–50.00Hz/s		
P11.08	VFD/motor OL/UL alarm selection	Range: 0x000–0x1134 Ones place: 0:Motor OL/UL pre-alarm. The overload is relative to the motor's rated current, while the underload is also relative to the motor's rated current. 1:VFD OL/UL pre-alarm. The overload is relative to the VFD's rated current, while the underload is relative to the motor's rated current. 2:Motor output torque OL/UL pre-alarm. relative to the motor rated current. The overload is relative to the motor's rated torque, while the underload is relative to the motor's 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	0x0000	○

Function code	Name	Description	Default	Modify
		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: Unrelated to current calibration coefficient		
P11.09	Overload pre-alarm detection threshold	If the VFD or motor output current is larger than the overload alarm detection level (P11.09), and the duration exceeds the overload alarm detection time (P11.10), the overload alarm signal will be output.  P11.09 range: P11.11–200.0% (default value for the G type: 150%; default value for the P type: 120%) P11.10 range: 0.1–3600.0s	Model depended	○
P11.10	Overload pre-alarm detection time		1.0s	○
P11.11	Underload pre-alarm detection threshold	Underload pre-alarm signal will be outputted if the output current of the VFD or motor is lower than underload pre-alarm detection level (P11.11), and the duration exceeds underload pre-alarm detection time (P11.12). P11.11 range: 0%–P11.09 P11.12 range: 0.1–3600.0s	50°	○
P11.12	Underload pre-alarm detection time		1.0s	○
P11.13	Fault output terminal action upon fault occurring	Used to set the action of fault output terminals at undervoltage and fault reset. Range: 0x00–0x11 Ones place:	0x00	○

Function code	Name	Description	Default	Modify
		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		
P11.14	Speed deviation detection value	Range: 0.0–50.0% Used to set the speed deviation detection value.	10.0°	○
P11.15	Speed deviation detection time	Range: 0.0–10.0s **Note:** Speed deviation protection is invalid when P11.15=0.0.  	2.0s	○
P11.16	Automatic frequency-reduction during voltage drop	Range: 0–1 0: Invalid 1: Enable	0	○
P11.17	Proportional coefficient of voltage regulator during undervoltage stall	Specifies the proportional coefficient of the bus voltage regulator during undervoltage stall. Range: 0–1000	100	○
P11.18	Integral coefficient of voltage regulator during undervoltage stall	Specifies the integral coefficient of the bus voltage regulator during undervoltage stall. Range: 0–1000	40	○
P11.19	Proportional coefficient of current regulator during undervoltage stall	Specifies the proportional coefficient of the active current regulator during undervoltage stall. Range: 0–1000	25	○
P11.20	Integral coefficient of current regulator during undervoltage stall	Specifies the integral coefficient of the active current regulator during undervoltage stall. Range: 0–2000	150	○

Function code	Name	Description	Default	Modify
P11.21	Proportional coefficient of voltage regulator during overvoltage stall	Specifies the proportional coefficient of the bus voltage regulator during overvoltage stall. Range: 0–1000	60	○
P11.22	Integral coefficient of voltage regulator during overvoltage stall	Specifies the integral coefficient of the bus voltage regulator during overvoltage stall. Range: 0–1000	10	○
P11.23	Proportional coefficient of current regulator during overvoltage stall	Specifies the proportional coefficient of the active current regulator during overvoltage stall. Range: 0–1000	60	○
P11.24	Integral coefficient of current regulator during overvoltage stall	Specifies the integral coefficient of the active current regulator during overvoltage stall. 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.	1	◎
P11.26	Reserved	/	/	/
P11.27	VF oscillation control method	Range: 0x00–0x11 Ones place: 0: Method 1 1: Method 2 Tens place: Reserved	0x11	◎
P11.28	Software input phase loss detection method	Range: 0–1 0: Sine-wave detection 1: Square-wave detection	1	○

Function code	Name	Description	Default	Modify
		Note: Since input phase loss detection is implemented through software, when the load on the product is below 60% of the rated current, there is a risk that the input phase loss protection may not function correctly. The input phase loss protection can only operate normally when the load current is above 60% of the rated current.		
P11.29	Software input phase loss detection limit value	Range: 0–200.0V **Note:** Larger values are less likely to report a fault.	40.0V	○
P11.30	Software input phase loss detection time	Range: 0–20.0s **Note:** Larger values are less likely to report a fault.	2.0s	○
P11.31	Fault level group 1	Range: 0x0000–0x3313 Ones place (fault 11=OL1): 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 Tens place (fault 12=OL2): 0: Report a fault 1: Report a fault after deceleration to stop Hundreds place (fault 13=SPI): 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 Thousands place (fault 14=SPO): 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	0x0000	○

Function code	Name	Description	Default	Modify
		right to left in hexadecimal format. Group 1: Faults 11 to 14 Group 2: Faults 15 to 18 Group 3: Faults 19 to 22 Group 4: Faults 23 to 26 Group 5: Faults 27 to 30 Group 6: Faults 31 to 34 Group 7: Faults 35 to 38 Group 8: Faults 39 to 42 Group 9: Faults 43 to 46 Group 10: Faults 47 to 50 Group 11: Faults 51 to 54 Group 12: Faults 55 to 58 Group 13: Faults 59 to 62 Group 14: Faults 63 to 66 Group 15: Faults 67 to 70 Group 16: Faults 71 to 75 Group 17: Faults 75 to 78 Group 18: Faults 79 to 82 Group 19: Faults 83 to 86 Group 20: Faults 87 to 90		
P11.32	Fault level group 2	Range: 0x0000–0x3300 Ones place (fault 15=OH1): 0: Report a fault Tens place (fault 16=OH2): 0: Report a fault Hundreds place (fault 17=EF): 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 Thousands place (fault 18=CE): 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	0x0000	○

Function code	Name	Description	Default	Modify
P11.33	Fault level group 3	Range: 0x0000–0x3000 Ones place (fault 19=ItE): 0: Report a fault Tens place (fault 20=tE): 0: Report a fault Hundreds place (fault 21=EEP): 0: Report a fault Thousands place (fault 22=PIDE): 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	0x0000	○
P11.34	Fault level group 4	Range: 0x0000–0x3301 Ones place (fault 23=bCE): 0: Report a fault 1: Report a fault after deceleration to stop Hundreds place (fault 24=END): 0: Report a fault Hundreds place (fault 25=OL3): 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 Thousands place (fault 26=PCE): 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	0x0000	○
P11.35	Fault level group 5	Range: 0x0000–0x0300 Ones place (fault 27=UPE): 0: Report a fault Hundreds place (fault 28=DNE): 0: Report a fault Hundreds place (fault 29=E-DP): 0: Report a fault	0x0000	○

Function code	Name	Description	Default	Modify
		1: Report a fault after deceleration to stop 2: Pre-alarm, with the action executed according to P11.51 3: Screen out fault Thousands place (fault 30=Reserved): 0: Reserved		
P11.36	Fault level group 6	Range: 0x0000–0x3003 Ones place (fault 31=E-CAN): 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 Tens place (fault 32=ETH1): 0: Report a fault Hundreds place (fault 33=ETH2): 0: Report a fault Thousands place (fault 34=dEu): 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	0x0000	○
P11.37	Fault level group 7	Range: 0x0000–0x0011 Ones place (fault 35= STo): 0: Report a fault 1: Report a fault after deceleration to stop Hundreds place (fault 36=LL): 0: Report a fault 1: Report a fault after deceleration to stop Hundreds place (fault 37=Reserved): Thousands place (fault 38=Reserved):	0x0000	○
P11.38	Fault level group 8	Range: 0x0000–0x0000 Ones place (fault 39=Reserved): Tens place (fault 40=Reserved): Hundreds place (fault 41=Reserved): Thousands place (fault 42=Reserved):	0x0000	○
P11.39	Fault level group 9	Range: 0x0000–0x0000	0x0000	○

Function code	Name	Description	Default	Modify
		Ones place (fault 43=Reserved): Tens place (fault 44=Reserved): Hundreds place (fault 45=Reserved): Thousands place (fault 46=Reserved):		
P11.40	Fault level group 10	Range: 0x0000–0x0000 Ones place (fault 47=Reserved): Tens place (fault 48=Reserved): Hundreds place (fault 49=Reserved): Thousands place (fault 50=Reserved):	0x0000	○
P11.41	Fault level group 11	Range: 0x0000–0x0000 Ones place (fault 51=Reserved): Tens place (fault 52=Reserved): Hundreds place (fault 53=Reserved): Thousands place (fault 54=Reserved):	0x0000	○
P11.42	Fault level group 12	Range: 0x0000–0x3303 Ones place (fault 55=E-Err): 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 Tens place (fault 56=Reserved): Hundreds place (fault 57=E-PN): 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 Thousands place (fault 58=SECAN): 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	0x0000	○
P11.43	Fault level group 13	Range: 0x0000–0x0333 Ones place (fault 59=OT): 0: Report a fault 1: Report a fault after deceleration to stop	0x0000	○

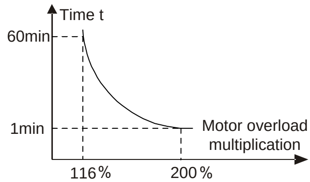
Function code	Name	Description	Default	Modify
		2: Pre-alarm, with the action executed according to P11.51 3: Screen out fault Tens place (fault 60=F1-Er): 0: Report a fault 1: Report a fault after deceleration to stop 2: Pre-alarm, with the action executed according to P11.51 3: Screen out fault Hundreds place (fault 61=F2-Er): 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 Thousands place (fault 62=Reserved):		
P11.44	Fault level group 14	Range: 0x0000–0x0033 Ones place (fault 63=C1-Er): 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 Tens place (fault 64=C2-Er): 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 Hundreds place (fault 65=Reserved): Thousands place (fault 66=Reserved):	0x0000	○
P11.45	Fault level group 15	Range: 0x0000–0x0300 Ones place (fault 67=Reserved): Tens place (fault 68=Reserved): Hundreds place (fault 69= S-Err): 0: Report a fault 1: Report a fault after deceleration to stop 2: Pre-alarm, with the action executed according	0x0000	○

Function code	Name	Description	Default	Modify
		to P11.51 3: Screen out fault Thousands place (fault 70=Reserved):		
P11.46	Fault level group 16	Range: 0x0000–0x3300 Ones place (fault 71=Reserved): Tens place (fault 72=Reserved): Hundreds place (fault 73=Freezing fault): 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 Thousands place (fault 74=Stalling): 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	0x0000	○
P11.47	Fault level group 17	Range: 0x0000–0x3333 Ones place (fault 75=Dry pumping): 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 Tens place (fault 76=AI1 disconnection): 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 Tens (fault 77=AI2 disconnection) 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 Thousands (fault 78=AI3 disconnection)	0x0000	○

Function code	Name	Description	Default	Modify
		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		
P11.48	Fault level group 18	Range: 0x0000–0x0003 Ones place (fault 79=Water pipe breaking): 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 Tens place (fault 80=Reserved): 0: Report a fault Hundreds place (fault 81=Reserved): 0: Reserved Thousands place (fault 82=Reserved): 0: Report a fault	0x0000	○
P11.49	Fault level group 19	Range: 0x0000–0x0000 Ones place (fault 83=Reserved): Tens place (fault 84=Reserved): Hundreds place (fault 85=Reserved): Thousands place (fault 86=Reserved):	0x0000	○
P11.50	Fault level group 20	Range: 0x0000–0x0000 Ones place (fault 87=Reserved): Tens place (fault 88=Reserved): Hundreds place (fault 89=Reserved): Thousands place (fault 90=Reserved):	0x0000	○
P11.51	Action for fault alarm	Range: 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 fallback frequency upon exceptions	0x0000	○
P11.52	Fallback frequency upon exceptions	Range: 0.00Hz–P00.03 (Max. output frequency)	0.00Hz	○

Group P12—Parameters of motor 2

Function code	Name	Description	Default	Modify
P12.00	Reserved	/	/	/
P12.01	Rated power of AM 2	Range: 0.1–3000.0kW	Model depended (0.4)	◎
P12.02	Rated frequency of AM 2	Range: 0.01Hz–P00.03 (Max. output frequency)	50.00Hz	◎
P12.03	Rated speed of AM 2	Range: 1–60000rpm	Model depended (1400)	◎
P12.04	Rated voltage of AM 2	Range: 0–1200V	Model depended (380)	◎
P12.05	Rated current of AM 2	Range: 0.8–6000.0A	Model depended (1.0)	◎
P12.06	Stator resistance of AM 2	Range: 0.001–65.535Ω	Model depended (0.001)	○
P12.07	Rotor resistance of AM 2	Range: 0.001–65.535Ω	Model depended (0.001)	○
P12.08	Leakage inductance of AM 2	Range: 0.1–6553.5mH	Model depended (0.1)	○
P12.09	Mutual inductance of AM 2	Range: 0.1–6553.5mH	Model depended (0.1)	○
P12.10	No-load current of AM 2	Range: 0.1–6553.5A	Model depended (0.1)	○
P12.11	Magnetic saturation coefficient 1 of iron core of AM 2	Range: 0.0–100.0%	80°	○
P12.12	Magnetic saturation coefficient 2 of iron core of AM 2	Range: 0.0–100.0%	68°	○
P12.13	Magnetic saturation	Range: 0.0–100.0%	57°	○

Function code	Name	Description	Default	Modify
	coefficient 3 of iron core of AM 2			
P12.14	Magnetic saturation coefficient 4 of iron core of AM 2	Range: 0.0–100.0%	40°	○
P12.15–P12.25	Reserved	/	/	/
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 $M=I_{out}/(In*K)$ I_n indicates the rated motor current, I_{out} indicates the VFD output current, and K indicates the motor overload protection coefficient. A smaller value of "K" indicates a bigger value of "M". When M=116%, protection is performed after motor overload lasts for 1 hour; when M=200%, protection is performed after motor overload lasts for 60 seconds; and when M≥400%, protection is performed immediately.  Range: 20.0%–150.0%	100.0°	○
P12.28	Power display calibration coefficient of motor 2	Range: 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	Range: 0.000–30.000 kg·m^2	0.000 kg·m^2	○

Group P14—Serial communication

Function code	Name	Description	Default	Modify
P14.00	Local communication address	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 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 slave address 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: 1200 bps 1: 2400bps 2: 4800bps 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.	4	○
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	Range: 0–200ms Specifies the communication response delay, that is, the interval from the time when the VFD completes receiving data to the time when it sends response data to the upper computer. If the	5ms	○

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

Function code	Name	Description	Default	Modify
	running command address			
P14.08	User-defined frequency setting address	Range: 0x0000–0xFFFF	0x2001	○
P14.09	Modbus TCP communication timeout time	Range: 0.0–60.0s	5.0s	○
P14.10	Enabling 485 upgrade program	Range: 0–1 0: Disable 1: Enable	0	◎
P14.11	Bootload software version	Range: 0.00–655.35	0.00	●
P14.12–P14.18	Reserved	/	/	/
P14.19	Address mapping function control	Range: 0x00–0x11 Ones: Read address mapping function 0: Disable 1: Enabled Tens: Write address mapping function 0: Disable 1: Enabled	0x00	○
P14.20	2200H read mapped address	Range: 0x0000–0xFFFF Used to set the register address mapped to 2200H.	0x0000	○
P14.21	2201H read mapped address	Range: 0x0000–0xFFFF Used to set the register address mapped to 2201H.	0x0000	○
P14.22	2202H read mapped address	Range: 0x0000–0xFFFF Used to set the register address mapped to 2200H.	0x0000	○
P14.23	2203H read mapped address	Range: 0x0000–0xFFFF Used to set the register address mapped to 2203H.	0x0000	○
P14.24	2204H read mapped address	Range: 0x0000–0xFFFF Used to set the register address mapped to 2204H.	0x0000	○
P14.25	2205H read	Range: 0x0000–0xFFFF	0x0000	○

Function code	Name	Description	Default	Modify
	mapped address	Used to set the register address mapped to 2205H.		
P14.26	2206H read mapped address	Range: 0x0000–0xFFFF Used to set the register address mapped to 2206H.	0x0000	○
P14.27	2207H read mapped address	Range: 0x0000–0xFFFF Used to set the register address mapped to 2207H.	0x0000	○
P14.28	2208H read mapped address	Range: 0x0000–0xFFFF Used to set the register address mapped to 2208H.	0x0000	○
P14.29	2209H read mapped address	Range: 0x0000–0xFFFF Used to set the register address mapped to 2209H.	0x0000	○
P14.30	220AH read mapped address	Range: 0x0000–0xFFFF Used to set the register address mapped to 220AH.	0x0000	○
P14.31	220BH read mapped address	Range: 0x0000–0xFFFF Used to set the register address mapped to 220BH.	0x0000	○
P14.32	2300H write mapped address	Range: 0x0000–0xFFFF Used to set the register address mapped to 2300H.	0x0000	○
P14.33	2301H write mapped address	Range: 0x0000–0xFFFF Used to set the register address mapped to 2301H.	0x0000	○
P14.34	2302H write mapped address	Range: 0x0000–0xFFFF Used to set the register address mapped to 2302H.	0x0000	○
P14.35	2303H write mapped address	Range: 0x0000–0xFFFF Used to set the register address mapped to 2303H.	0x0000	○
P14.36	2304H write mapped address	Range: 0x0000–0xFFFF Used to set the register address mapped to 2304H.	0x0000	○
P14.37	2305H write mapped address	Range: 0x0000–0xFFFF Used to set the register address mapped to 2305H.	0x0000	○

Function code	Name	Description	Default	Modify
P14.38	2306H write mapped address	Range: 0x0000–0xFFFF Used to set the register address mapped to 2306H.	0x0000	○
P14.39	2307H write mapped address	Range: 0x0000–0xFFFF Used to set the register address mapped to 2307H.	0x0000	○
P14.40	2308H write mapped address	Range: 0x0000–0xFFFF Used to set the register address mapped to 2308H.	0x0000	○
P14.41	2309H write mapped address	Range: 0x0000–0xFFFF Used to set the register address mapped to 2309H.	0x0000	○
P14.42	230AH write mapped address	Range: 0x0000–0xFFFF Used to set the register address mapped to 230AH.	0x0000	○
P14.43	230BH write mapped address	Range: 0x0000–0xFFFF Used to set the register address mapped to 230BH.	0x0000	○

Group P15—Functions of communication expansion card 1

Function code	Name	Description	Default	Modify
P15.00	Reserved	/	/	●
P15.01	Module address	Range: 0–127	2	◎
P15.02	Received PZD2	Range: 0–31 0: Invalid 1: Set frequency (0–Fmax, unit: 0.01Hz) 2: PID reference (-1000–1000, in which 1000 corresponds to 100.0%) 3: PID feedback (-1000–1000, in which 1000 corresponds to 100.0%) 4: Torque setting (-3000–+3000, in which 1000 corresponds to 100.0% of the motor rated current) 5: Setting of the upper limit of forward running frequency (0–Fmax, unit: 0.01Hz) 6: Setting of the upper limit of reverse running frequency (0–Fmax, unit: 0.01Hz) 7: Upper limit of the electromotive torque (0–3000,	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
		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 100.0% of the motor rated current) 9: Virtual input terminal command. Range: 0x000–0x3FF 10: Virtual output terminal command. Range: 0x00–0x0F 11:Voltage setting (used when V/F separation is implemented) (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%) 14–18: Reserved 19: PID1 reference source 1, range (0–1000, in which 1000 corresponds to 100.0%) 20: PID1 feedback source 1, range (0–1000, in which 1000 corresponds to 100.0%) 21: PID1 reference source 2, range (0–1000, in which 1000 corresponds to 100.0%) 22: PID1 feedback source 2, range (0–1000, in which 1000 corresponds to 100.0%) 23: PID2 reference source, range (0–1000, in which 1000 corresponds to 100.0%) 24: PID2 feedback source, range (0–1000, in which 1000 corresponds to 100.0%) 25: Intake tank water level value, range (0–1000, in which 1000 corresponds to 100.0%) 26: AO0 output setting 0 (-1000–+1000, in which 1000 corresponds to 100.0%) 27–31: Reserved		
P15.13	Sent PZD2	Range: 0–37	0	○
P15.14	Sent PZD3	0: Invalid	0	○
P15.15	Sent PZD4	1: Running frequency (×100, Hz)	0	○
P15.16	Sent PZD5	2: Set frequency (×100, Hz)	0	○

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td>P15.17</td><td>Sent PZD6</td><td rowspan="7">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 (×1000, kHz)
16: Terminal input state
17: Terminal output status
18: PID reference (×100, %)
19: PID feedback (×100, %)
20: Motor rated torque
21–24: Reserved
25: Status word
26: HDIB frequency value (×1000, kHz) (Reserved)
27: PID1 reference
28: PID1 feedback
29: PID1 output
30: PID2 reference value
31: PID2 feedback value
32: PID2 output
33–37: Reserved</td><td>0</td><td>○</td></tr>
<tr><td>P15.18</td><td>Sent PZD7</td><td>0</td><td>○</td></tr>
<tr><td>P15.19</td><td>Sent PZD8</td><td>0</td><td>○</td></tr>
<tr><td>P15.20</td><td>Sent PZD9</td><td>0</td><td>○</td></tr>
<tr><td>P15.21</td><td>Sent PZD10</td><td>0</td><td>○</td></tr>
<tr><td>P15.22</td><td>Sent PZD11</td><td>0</td><td>○</td></tr>
<tr><td>P15.23</td><td>Sent PZD12</td><td>0</td><td>○</td></tr>
<tr><td>P15.24</td><td>Reserved</td><td>/</td><td>/</td><td>/</td></tr>
<tr><td>P15.25</td><td>DP communication timeout period</td><td>Range: 0.0–60.0s</td><td>5.0s</td><td>○</td></tr>
<tr><td>P15.26</td><td>CANopen communication timeout period</td><td>Range: 0.0–60.0s</td><td>5.0s</td><td>○</td></tr>
<tr><td>P15.27</td><td>CANopen communication baud rate</td><td>Range: 0–7
0: 1000kbps
1: 800kbps</td><td>3</td><td>◎</td></tr>
</table>

Function code	Name	Description	Default	Modify
		2: 500kbps 3: 250Kbps 4: 125kbps 5: 100kbps 6: 50kbps 7: 20kbps		
P15.28	CAN communication address	Range: 0–127	1	◎
P15.29	Master/slave CAN communication baud rate	Range: 0–5 0: 50kbps 1: 100kbps 2: 125kbps 3: 250Kbps 4: 500kbps 5: 1Mbps	2	◎
P15.30	Master/slave CAN communication timeout period	Range: 0.0 (Invalid)–60.0s	5.0s	○
P15.31	DeviceNET communication timeout period (Reserved)	Range: 0.0 (Invalid)–60.0s	5.0s	○
P15.32	Display node baud rate (Reserved)	/	/	●
P15.33	Enabling alternation (Reserved)	Range: 0–1	1	○
P15.34	Alternation output instance number (Reserved)	Range: 0–27 0–18: Reserved 19: INVT VFD output 20: ODVA basic speed control output 21: ODVA extended speed control output 22: ODVA speed and torque control output 23: ODVA extended speed and torque control output 24: INVT basic speed control output 25: INVT extended speed control output 26: INVT speed and torque control output 27: INVT extended speed and torque control	19	○

Function code	Name	Description	Default	Modify
		output		
P15.35	Alternation input instance number (Reserved)	Range: 0–77 0–68: Reserved 69: INVT VFD input 70: ODVA basic speed control input 71: ODVA extended speed control input 72: ODVA speed and torque control input 73: ODVA extended speed and torque control input 74: INVT basic speed control input 75: INVT extended speed control input 76: INVT speed and torque control input 77: INVT extended speed and torque control input	69	○
P15.36	State change/cycle enable (Reserved)	Range: 0–1	0	○
P15.37	State change/cycle output instance (Reserved)	Range: 0–27 0–18: Reserved 19: INVT VFD output 20: ODVA basic speed control output 21: ODVA extended speed control output 22: ODVA speed and torque control output 23: ODVA extended speed and torque control output 24: INVT basic speed control output 25: INVT extended speed control output 26: INVT speed and torque control output 27: INVT extended speed and torque control output	19	○
P15.38	State change/cycle input instance (Reserved)	Range: 0–77 0–68: Reserved 69: INVT VFD input 70: ODVA basic speed control input 71: ODVA extended speed control input 72: ODVA speed and torque control input 73: ODVA extended speed and torque control input 74: INVT basic speed control input 75: INVT extended speed control input	69	○

Function code	Name	Description	Default	Modify
		76: INVT speed and torque control input 77: INVT extended speed and torque control input		

Group P16—Functions of communication expansion card 2

Function code	Name	Description	Default	Modify
P16.00–P16.01	Reserved	/	/	/
P16.02	Ethernet monitoring card IP address 1	Range: 0–255	192	◎
P16.03	Ethernet monitoring card IP address 2	Range: 0–255	168	◎
P16.04	Ethernet monitoring card IP address 3	Range: 0–255	0	◎
P16.05	Ethernet monitoring card IP address 4	Range: 0–255	1	◎
P16.06	Ethernet monitoring card subnet mask 1	Range: 0–255	255	◎
P16.07	Ethernet monitoring card subnet mask 2	Range: 0–255	255	◎
P16.08	Ethernet monitoring card subnet mask 3	Range: 0–255	255	◎
P16.09	Ethernet monitoring card subnet mask 4	Range: 0–255	0	◎
P16.10	Ethernet monitoring card gateway 1	Range: 0–255	192	◎
P16.11	Ethernet monitoring card gateway 2	Range: 0–255	168	◎
P16.12	Ethernet monitoring card gateway 3	Range: 0–255	0	◎
P16.13	Ethernet monitoring card gateway 4	Range: 0–255	1	◎
P16.14	Ethernet card monitoring variable address 1	Range: 0x0000–0xFFFF	0x0000	○
P16.15	Ethernet card monitoring variable address 2	Range: 0x0000–0xFFFF	0x0000	○

Function code	Name	Description	Default	Modify
P16.16	Ethernet card monitoring variable address 3	Range: 0x0000–0xFFFF	0x0000	○
P16.17	Ethernet card monitoring variable address 4	Range: 0x0000–0xFFFF	0x0000	○
P16.18	Ethernet monitoring card communication timeout period (Reserved)	Range: 0.0 (Invalid)–60.0s	0.0s	○
P16.19–P16.23	Reserved	/	/	/
P16.24	Time to identify expansion card in slot 1	Range: 0.0 (Invalid)–600.0s	0.0s	○
P16.25	Time to identify expansion card in slot 2	Range: 0.0 (Invalid)–600.0s	0.0s	○
P16.26	Time to identify expansion card in slot 3 (Reserved)	Range: 0.0 (Invalid)–600.0s	0.0s	●
P16.27	Communication timeout period of expansion card in slot 1	Range: 0.0 (Invalid)–600.0s	0.0s	○
P16.28	Communication timeout period of expansion card in slot 2	Range: 0.0 (Invalid)–600.0s	0.0s	○
P16.29	Communication timeout period of expansion card in slot 3 (Reserved)	Range: 0.0 (Invalid)–600.0s	0.0s	●
P16.30	Reserved	/	/	/
P16.32	Received PZD2	Range: 0–31	0	○
P16.33	Received PZD3	0: Invalid	0	○
P16.34	Received PZD4	1: Set frequency (0–Fmax, unit: 0.01Hz)	0	○

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td>P16.35</td><td>Received PZD5</td><td rowspan="9">2: PID reference source 1 (-1000–+1000, in which 1000 corresponds to 100.0%)
3: PID feedback source 1 (-1000–1000, in which 1000 corresponds to 100.0%)
4: Torque setting (-3000–+3000, in which 1000 corresponds to 100.0% of the motor rated current)
5: Setting of the upper limit of forward running frequency (0–Fmax, unit: 0.01Hz)
6: Setting of the upper limit of reverse running frequency (0–Fmax, unit: 0.01Hz)
7: Upper limit of the electromotive torque (0–3000, in which 1000 corresponds to 100.0% of the motor rated current)
8: Upper limit of braking torque (0–3000, in which 1000 corresponds to 100.0% of the motor rated current)
9: Virtual input terminal command (0x000–0x3FF)
10: Virtual output terminal command (0x00–0x0F)
11:Voltage setting (used when V/F separation is implemented) (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%)
14–18: Reserved
19: PID1 reference source 1 (0–1000, in which 1000 corresponds to 100.0%)
20: PID1 feedback source 1 (0–1000, in which 1000 corresponds to 100.0%)
21: PID1 reference source 2 (0–1000, in which 1000 corresponds to 100.0%)
22: PID1 feedback source 2 (0–1000, in which 1000 corresponds to 100.0%)
23: PID2 reference source (0–1000, in which 1000 corresponds to 100.0%)
24: PID2 feedback source (0–1000, in which 1000 corresponds to 100.0%)</td><td>0</td><td>○</td></tr>
<tr><td>P16.36</td><td>Received PZD6</td><td>0</td><td>○</td></tr>
<tr><td>P16.37</td><td>Received PZD7</td><td>0</td><td>○</td></tr>
<tr><td>P16.38</td><td>Received PZD8</td><td>0</td><td>○</td></tr>
<tr><td>P16.39</td><td>Received PZD9</td><td>0</td><td>○</td></tr>
<tr><td>P16.40</td><td>Received PZD10</td><td>0</td><td>○</td></tr>
<tr><td>P16.41</td><td>Received PZD11</td><td>0</td><td>○</td></tr>
<tr><td>P16.42</td><td>Received PZD12</td><td>0</td><td>○</td></tr>
<tr><td>P16.32</td><td>Received PZD2</td><td>0</td><td>○</td></tr>
</table>

Function code	Name	Description	Default	Modify
		25: Intake tank water level value (0–1000, in which 1000 corresponds to 100.0%) 26: AO0 output setting 0 (-1000–+1000, in which 1000 corresponds to 100.0%) 27–31: Reserved		
P16.43	Sent PZD2	Range: 0–37 0: Invalid 1: Running frequency (×100, Hz) 2: Set frequency (×100, Hz) 3: Bus voltage (×10, V) 4: Output voltage (×1, V) 5: Output current (×10, A) 6: Actual output torque (×10, %) 7: Actual output power (×10, %) 8: Rotation speed of running (×1, RPM) 9: Linear speed of running (×1, m/s) 10: Ramp reference frequency 11: Fault code 12: AI1 input (×100, V) 13: AI2 input (×100, V) 14: AI3 input (×100, V) 15: HDIA frequency value (×1000, kHz) 16: Terminal input state 17: Terminal output status 18: PID reference (×100, %) 19: PID feedback (×100, %) 20: Motor rated torque 21–24: Reserved 25: Status word 26: Reserved 27: PID1 reference 28: PID1 feedback 29: PID1 output 30: PID2 reference value 31: PID2 feedback value 32: PID2 output 33–37: Reserved	0	○
P16.44	Sent PZD3		0	○
P16.45	Sent PZD4		0	○
P16.46	Sent PZD5		0	○
P16.47	Sent PZD6		0	○
P16.48	Sent PZD7		0	○
P16.49	Sent PZD8		0	○
P16.50	Sent PZD9		0	○
P16.51	Sent PZD10		0	○
P16.52	Sent PZD11		0	○
P16.53	Sent PZD12		0	○
P16.54	EtherNet IP communication	Range: 0.0 (Invalid)–60.0s **Note:** When an EtherNet IP communication fault	5.0s	○

Function code	Name	Description	Default	Modify
	timeout time	occurs, the VFD reports the EtherNet IP communication fault (E-EIP).		
P16.55	EtherNet IP communication rate (Reserved)	Range: 0–4 0: Self adaptive 1: 100M full duplex 2: 100M half duplex 3: 10M full duplex 4: 10M half duplex	0	●
P16.56–P16.57	Reserved	/	/	/
P16.58	Industrial Ethernet communication card IP address 1	Range: 0–255	192	◎
P16.59	Industrial Ethernet communication card IP address 2	Range: 0–255	168	◎
P16.60	Industrial Ethernet communication card IP address 3	Range: 0–255	0	◎
P16.61	Industrial Ethernet communication card IP address 4	Range: 0–255	20	◎
P16.62	Industrial Ethernet communication card subnet mask 1	Range: 0–255	255	◎
P16.63	Industrial Ethernet communication card subnet mask 2	Range: 0–255	255	◎
P16.64	Industrial Ethernet communication card subnet mask 3	Range: 0–255	255	◎
P16.65	Industrial Ethernet communication card subnet mask 4	Range: 0–255	0	◎
P16.66	Industrial Ethernet communication card gateway 1	Range: 0–255	192	◎
P16.67	Industrial Ethernet	Range: 0–255	168	◎

Function code	Name	Description	Default	Modify
	communication card gateway 2			
P16.68	Industrial Ethernet communication card gateway 3	Range: 0–255	0	◎
P16.69	Industrial Ethernet communication card gateway 4	Range: 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	50.00Hz	●
P17.01	Output frequency	Displays the present output frequency of the VFD. Range: 0.00Hz–P00.03	0.00Hz	●
P17.02	Ramp reference frequency	Displays the present ramp reference frequency of the VFD. Range: 0.00Hz–P00.03	0.00Hz	●
P17.03	Output voltage	Displays the present output voltage of the VFD. Range: 0–1200V	0V	●
P17.04	Output current	Displays the valid value of present output current of the VFD. Range: 0.0–5000.0A	0.0A	●
P17.05	Motor rotation speed	Displays the present motor rotation speed. Range: 0–65535RPM	0 RPM	●
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 motor rated power. A positive value indicates the motoring state while a negative value indicates the generating state. Range: -300.0%–300.0% (of the motor rated power)	0.0°	●
P17.09	Motor output torque	Displays the present output torque of the VFD. 100% corresponds to the motor rated torque.	0.0°	●

Function code	Name	Description	Default	Modify
		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%		
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: 0.0–2000.0V	0V	●
P17.12	Digital input terminal state	Displays the present digital input terminal state of the VFD. Range: 0x0000–0x003F Corresponds to Reserved, HDIA, S4, S3, S2 and S1 respectively.	0x0000	●
P17.13	Digital output terminal state	Displays the present digital output terminal state of the VFD. Range: 0x0000–0x000F The bits correspond to reserved, RO1, reserved, and Y1 respectively.	0x0000	●
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%	0.0°	●
P17.16	Linear speed	Range: 0–65535	0	●
P17.17	Reserved	/	/	/
P17.18	Count value	Range: 0–65535	0	●
P17.19	AI1 input voltage	Displays the AI1 input signal. Range: 0.00–10.00V **Note:** When P05.50=0x11, P17.19 will display without units, with a range of 0.00 to 20.00.	0.00V	●
P17.20	AI2 input voltage	Displays the AI2 input signal. Range: -10.00V–10.00V	0.00V	●
P17.21	HDIA input	Display HDIA input frequency.	0.000kHz	●

Function code	Name	Description	Default	Modify
	frequency	Range: 0.000–50.000kHz		
P17.22	HDIB input frequency (Reserved)	Range: 0.000–50.000kHz	0.000kHz	●
P17.23	PID reference value	Displays the PID reference value. Range: -100.0%–100.0%	0.0°	●
P17.24	PID feedback value	Displays the PID feedback value. Range: -100.0%–100.0%	0.0°	●
P17.25	Motor power factor	Displays the power factor of the current motor. Range: -1.00–1.00	1.00	●
P17.26	Duration of this run	Displays the duration of this run of the VFD. Range: 0–65535min	0min	●
P17.27	Present step of simple PLC	Used to display the present step of the simple PLC function. Range: 0–15	0	●
P17.28	Motor ASR controller output	Displays the ASR controller output value under the vector control mode. Range: -300.0%–300.0% (of the motor rated current)	0.0°	●
P17.29–P17.31	Reserved	/	/	/
P17.32	Motor flux linkage	Range: 0.0%–200.0%	0.0°	●
P17.33	Exciting current reference	Displays the exciting current reference value under the vector control mode. Range: -3000.0–3000.0A	0.0A	●
P17.34	Torque current reference	Displays the torque current reference value under the vector control mode. Range: -3000.0–3000.0A	0.0A	●
P17.35	AC incoming current	Displays the valid value of incoming current on AC side. Range: 0.0–5000.0A	0.0A	●
P17.36	Actual output torque	Displays the actual output torque value of the VFD. During forward running, the positive value is the motoring state while the negative value is generating state. During reverse running, the positive value is the generating state while the negative value is the motoring state. Range: -3000.0N·m–3000.0N·m	0.0 N•m	●

Function code	Name	Description	Default	Modify
P17.37	Motor overload count value	Range: 0–65535	0	●
P17.38	Process PID output	Range: -100.0%–100.0%	0.00°	●
P17.39	Function codes in parameter download error	Range: 0.00–99.99	0.00	●
P17.40	Motor control mode	Range: 0x000–0x123 Ones place: Control mode 0: Vector 0 1: Vector 1 2: VF control 3: Reserved Tens place: Control status 0: Speed control 1: Torque control 2: Reserved Hundreds place: Motor number 0: Motor 1 1: Motor 2	0x000	●
P17.41	Electromotive torque upper limit	Range: 0.0%–300.0% (of the motor rated current)	0.0°	●
P17.42	Braking torque upper limit	Range: 0.0%–300.0% (of the motor rated current)	0.0°	●
P17.43	Forward rotation upper limit frequency in torque control	Range: 0.00Hz–P00.03	0.00Hz	●
P17.44	Reverse rotation upper limit frequency in torque control	Range: 0.00Hz–P00.03	0.00Hz	●
P17.45	Inertia compensation torque	Range: -100.0%–100.0%	0.0°	●
P17.46	Friction compensation torque	Range: -100.0%–100.0%	0.0°	●
P17.47	Motor pole pairs	Range: 0–65535	0	●

Function code	Name	Description	Default	Modify
P17.48	VFD overload count value	Range: 0–65535	0	●
P17.49	Frequency set by A source	Range: 0.00Hz–P00.03	0.00Hz	●
P17.50	Frequency set by B source	Range: 0.00Hz–P00.03	0.00Hz	●
P17.51	PID1 proportional output	Range: -100.0%–100.0%	0.00°	●
P17.52	PID1 integral output	Range: -100.0%–100.0%	0.00°	●
P17.53	PID1 differential output	Range: -100.0%–100.0%	0.00°	●
P17.54	Present proportional gain	Range: 0.00–100.00%	0.00°	●
P17.55	Present integral time	Range: 0.00–10.00s	0.00s	●
P17.56	Present differential time	Range: 0.00–10.00s	0.00s	●
P17.57	Actual steps of multi-step speed	Range: 0–15	0	●
P17.58	100Hz component peak value (square waves quadrature)	Range: 0.0–300.0V **Note:** Peak-to-peak value of bus voltage fluctuation at 100Hz frequency component, which is detected by using a square-wave orthogonal function.	0.0V	●
P17.59	100Hz component peak value (sine quadrature)	Range: 0.0–300.0V Note: The peak-to-peak value of bus voltage fluctuation at 100Hz frequency component, is detected by using a sin-wave orthogonal function.	0.0V	•
P17.60	Keypad analog voltage	Range: 0.00–10.00	0.00	●
P17.63	VFD status word 3	0x0000–0xFFFF Bit 0: Running protection flag Bit 1: Running Bit 2: Running direction (1=REV, 0=FWD) Bit 3: Jogging Bit 4: Alarming Bit 5: In fault Bit 6: Running paused	0x0000	●

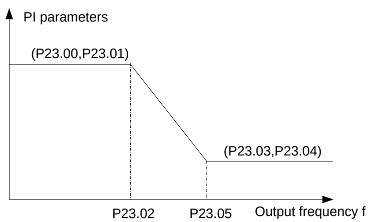
Function code	Name	Description	Default	Modify
		Bit 7: In sleep Bit 8: In PoFF state Bit 9: Undervoltage due to transient power loss Bit 10: Overvoltage stall Bit 11: Pre-exciting Bit 12: DC braking Bit 13: Identifying parameters Bit 14: Flux weakening (Reserved) Bit15: Reserved		

Group P19—Expansion card status viewing

Function code	Name	Description	Default	Modify
P19.00	Expansion card type of card slot 1	Range: 0–80 0: No card 1: Reserved 2: I/O card 3–4: Reserved 5: Ethernet communication card 6: DP communication card 7–8: Reserved 9: CANopen communication card 10: Reserved 11: PROFINET communication card 12–14: Reserved 15: CAN master/slave communication card 16: Modbus TCP communication card 17–20: Reserved 21: Ethernet/IP communication card 22–24: Reserved 25: Water supply card 26–80: Reserved	0	●
P19.01	Expansion card type of card slot 2		0	●
P19.02	Reserved		/	/
P19.03	Software version of expansion card in slot 1	Range: 0.00–655.35	0.00	●
P19.04	Software version of expansion card in slot 2	Range: 0.00–655.35	0.00	●
P19.05	Reserved	/	/	/

Function code	Name	Description	Default	Modify
P19.06	Terminal input status of I/O card	Range: 0x0000–0xFFFF	0x0000	●
P19.07	Terminal output status of I/O card	Range: 0x0000–0xFFFF	0x0000	●
P19.08	Reserved	/	/	/
P19.09	AI3 input voltage of I/O card	Range: 0.00–10.00V	0.00V	●

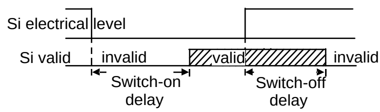
Group P23—Vector control of motor 2

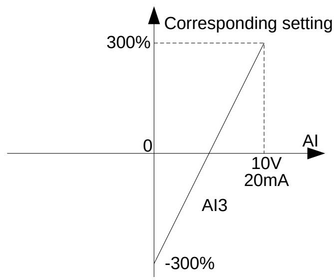
Function code	Name	Description	Default	Modify
P23.00	Speed-loop proportional gain 1	P23.00–P23.05 are applicable only to vector control mode. When switching frequency 1 (P23.02) is not reached, the speed-loop PI parameters are: P23.00 and P23.01. When switching frequency 2 (P23.05) is exceeded, the speed-loop PI parameters are: P23.03 and P23.04. PI parameters are obtained according to the linear change of two groups of parameters. See the following figure:  The speed loop dynamic response characteristics of vector control can be adjusted by setting the proportional coefficient and integral time of speed regulator. Increasing proportional gain or reducing integral time can accelerate dynamic response of speed loop; however, if the proportional gain is too large or integral time is too small, system oscillation and overshoot may occur; If proportional gain is too small, stable oscillation or speed offset may occur.	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
		PI parameters have a close relationship with the inertia of the system. Adjust PI parameters depending on different loads to meet various demands. P23.00 range: 0.0–200.0 P23.01 range: 0.000–10.000s P23.02 range: 0.00Hz–P23.05 P23.03 range: 0.0–200.0 P23.04 range: 0.000–10.000s P23.05 range: P23.02–P00.03		
P23.06	Speed-loop output filter	Range: 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. Range: 50–200%	100°	○
P23.08	Power-generation slip compensation coefficient of vector control		100°	○
P23.09	Current-loop proportional coefficient P	**Note:** ✧ The two function codes impact the dynamic response speed and control accuracy of the system. Generally, you do not need to modify the two function codes. ✧ Applicable to SVC mode 0 (P00.00=0). Range: 0–65535	1000	○
P23.10	Current-loop integral coefficient I		1000	○
P23.11	Speed-loop differential gain	Range: 0.00–10.00s	0.00s	○
P23.12	Proportional coefficient of high-frequency current loop	In the vector control mode (P00.00=3), when the frequency is lower than the current-loop high-frequency switching threshold (P23.14), the current-loop PI parameters are P23.09 and P23.10; and when the frequency is higher than the current-loop high-frequency switching threshold, the current-loop PI parameters are P23.12 and P23.13. P23.12 range: 0–65535 P23.13 range: 0–65535	1000	○
P23.13	Integral coefficient of high-frequency current loop		1000	○
P23.14	Current-loop high-frequency switching threshold		100.0°	○

Function code	Name	Description	Default	Modify
		P23.14 range: 0.0–100.0% (of the max. frequency)		

Group P25—I/O card input functions

Function code	Name	Description	Default	Modify
P25.00	HDI3 input type	Range: 0–1 0: HDI3 is high-speed pulse input 1: HDI3 is digital input	0	◎
P25.01	Function of S5	Same as group 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 selection	Range: 0x00–0x7F When a bit is 0, the input terminal is positive. When a bit is 1, the input terminal is negative. Bit0 / Bit1 / Bit2 / Bit3 / Bit4 / Bit5 / Bit6 S5 / S6 / S7 / S8 / S9 / S10 / HDI3	0x00	○
P25.09	Expansion card virtual terminal setting	Range: 0x00–0x7F (0: disable; 1: enable) Bit0 / Bit1 / Bit2 / Bit3 / Bit4 / Bit5 / Bit6 S5 / S6 / S7 / S8 / S9 / S10 / HDI3	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.  Range: 0.000–50.000s	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	○
P25.15	S6 switch-off delay		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	○

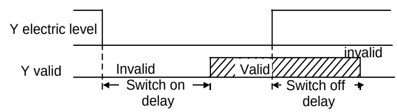
<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td>P25.22</td><td>S10 switch-on delay</td><td rowspan="2"></td><td>0.000s</td><td>○</td></tr>
<tr><td>P25.23</td><td>S10 switch-off delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P25.24</td><td>AI3 lower limit</td><td rowspan="5">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 description in each application section for details.
The following figure illustrates the cases of several settings:


Input filter time: to adjust the sensitivity of analog input. Increasing the value properly can enhance analog input anti-interference but may reduce the sensitivity of analog input.
Note: AI3 can support 0–10V/0–20mA input. When AI3 selects 0–20mA input, the corresponding voltage of 20mA is 10V.
P25.24 range: 0.00V–P25.26
P25.25 range: -300.0%–300.0%
P25.26 range: P25.24–10.00V
P25.27 range: -300.0%–300.0%</td><td>0.00V</td><td>○</td></tr>
<tr><td>P25.25</td><td>Corresponding setting of AI3 lower limit</td><td>0.0°</td><td>○</td></tr>
<tr><td>P25.26</td><td>AI3 upper limit</td><td>10.00V</td><td>○</td></tr>
<tr><td>P25.27</td><td>Corresponding setting of AI3 upper limit</td><td>100.0°</td><td>○</td></tr>
<tr><td>P25.28</td><td>AI3 input filter time</td><td>0.030s</td><td>○</td></tr>
</table>

Function code	Name	Description	Default	Modify
		P25.28 range: 0.000s–10.000s		
P25.29	AI4 lower limit	Range: 0.00V–P25.31	0.00V	○
P25.30	Corresponding setting of AI4 lower limit	Range: -300.0%–300.0%	0.0°	○
P25.31	AI4 upper limit	Range: P25.29–10.00V	10.00V	○
P25.32	Corresponding setting of AI4 upper limit	Range: -300.0%–300.0%	100.0°	○
P25.33	AI4 input filter time	Range: 0.000–10.000s	0.030s	○
P25.34	HDI3 high-speed pulse input function selection	Range: 0–1 0: Frequency setting input 1: Counting function	0	◎
P25.35	HDI3 lower limit frequency	Range: 0.000kHz–P25.37	0.000kHz	○
P25.36	Corresponding setting of HDI3 lower limit frequency	Range: -300.0%–300.0%	0.0°	○
P25.37	HDI3 upper limit frequency	Range: P25.35–50.000kHz	50.000kHz	○
P25.38	Corresponding setting of HDI3 upper limit frequency	Range: -300.0%–300.0%	100.0°	○
P25.39	HDI3 frequency input filter time	Range: 0.000–10.000s	0.030s	○
P25.40	AI3 input signal type selection	Range: 0–1 0: Voltage 1: Current	0	○
P25.41	AI4 input signal type selection	Range: 0–1 0: Voltage 1: Current	0	○

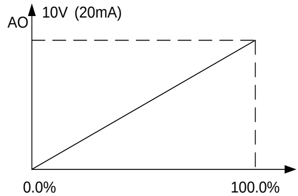
Group P26—I/O card output functions

Function code	Name	Description	Default	Modify
P26.00	HDO2 output type	Range: 0–1 0: Open collector high-speed pulse output	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>1: Open collector output</td><td></td><td></td></tr>
<tr><td>P26.01</td><td>HDO2 output selection</td><td rowspan="11">Same as the description for P06.01</td><td>0</td><td>○</td></tr>
<tr><td>P26.02</td><td>Y2 output</td><td>0</td><td>○</td></tr>
<tr><td>P26.03</td><td>Y3 output</td><td>0</td><td>○</td></tr>
<tr><td>P26.04</td><td>RO3 output</td><td>0</td><td>○</td></tr>
<tr><td>P26.05</td><td>RO4 output</td><td>0</td><td>○</td></tr>
<tr><td>P26.06</td><td>RO5 output</td><td>0</td><td>○</td></tr>
<tr><td>P26.07</td><td>RO6 output</td><td>0</td><td>○</td></tr>
<tr><td>P26.08</td><td>RO7 output</td><td>0</td><td>○</td></tr>
<tr><td>P26.09</td><td>RO8 output</td><td>0</td><td>○</td></tr>
<tr><td>P26.10</td><td>RO9 output</td><td>0</td><td>○</td></tr>
<tr><td>P26.11</td><td>RO10 output</td><td>0</td><td>○</td></tr>
<tr><td>P26.12</td><td>Expansion card output terminal polarity selection</td><td>Range: 0x0000–0x1FFF
When a bit is 0, the output terminal is positive.
When a bit is 1, the output terminal is negative.
<table>
<tr><td>Bit0</td><td>Bit1</td><td>Bit2</td><td>Bit3</td><td>Bit4</td><td>Bit5</td><td>Bit6</td></tr>
<tr><td>Y2</td><td>Y3</td><td>HDO2</td><td>RO3</td><td>RO4</td><td>RO5</td><td>RO6</td></tr>
<tr><td>Bit7</td><td>Bit8</td><td>Bit9</td><td>Bit10</td><td>Bit11</td><td>Bit12</td><td>/</td></tr>
<tr><td>RO7</td><td>RO8</td><td>RO9</td><td>RO10</td><td>RO11</td><td>RO12</td><td>/</td></tr>
</table></td><td>0x0000</td><td>○</td></tr>
<tr><td>P26.13</td><td>HDO2 switch-on delay</td><td rowspan="11">The function codes specify the delay time corresponding to the electrical level changes when the programmable output terminals switch on or switch off.


Range: 0.000–50.000s</td><td>0.000s</td><td>○</td></tr>
<tr><td>P26.14</td><td>HDO2 switch-off delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P26.15</td><td>Y2 switch-on delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P26.16</td><td>Y2 switch-off Delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P26.17</td><td>Y3 switch-on delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P26.18</td><td>Y3 switch-off delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P26.19</td><td>RO3 switch-on delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P26.20</td><td>RO3 switch-off delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P26.21</td><td>RO4 switch-on delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P26.22</td><td>RO4 switch-off delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P26.23</td><td>RO5 switch-on</td><td>0.000s</td><td>○</td></tr>
</table>

Function code	Name	Description	Default	Modify
	delay			
P26.24	RO5 switch-off delay		0.000s	○
P26.25	RO6 switch-on delay		0.000s	○
P26.26	RO6 switch-off delay		0.000s	○
P26.27	RO7 switch-on delay		0.000s	○
P26.28	RO7 switch-off delay		0.000s	○
P26.29	RO8 switch-on delay		0.000s	○
P26.30	RO8 switch-off delay		0.000s	○
P26.31	RO9 switch-on delay		0.000s	○
P26.32	RO9 switch-off delay		0.000s	○
P26.33	RO10 switch-on delay		0.000s	○
P26.34	RO10 switch-off delay		0.000s	○
P26.35	AO2 output	Same as the description for P06.14	0	○
P26.36	AO3 output		0	○
P26.37	Reserved		/	/
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 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.	0.0°	○
P26.39	AO2 output corresponding to lower limit		0.00V	○
P26.40	AO2 output upper limit		100.0°	○
P26.41	AO2 output corresponding to upper limit		10.00V	○
P26.42	AO2 output filter time		0.000s	○

Function code	Name	Description	Default	Modify
P26.43	AO3 output lower limit	 P26.38 range: -300.0%–P26.40 P26.39 range: 0.00V–10.00V P26.40 range: P26.38–100.0% P26.41 range: 0.00V–10.00V P26.42 range: 0.000s–10.000s P26.43 range: -300.0%–P26.45 P26.44 range: 0.00V–10.00V P26.45 range: P26.43–300.0% P26.46 range: 0.00V–10.00V P26.47 range: 0.000s–10.000s	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	○

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	Range: 0x000–0x112 Ones place: Master/slave running mode selection 0: Master/slave mode 0 The master and slave use speed control, with power balanced through droop control. 1: Master/slave mode 1 The master and slave must be in the same type of vector control. When the master is in speed control, the slave is forced into torque control. 2: Master/slave mode 2 The slave switches from speed mode (master/slave mode 0) to torque mode (master/slave mode 1) at a frequency point.	0x001	◎

Function code	Name	Description	Default	Modify
		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	Range: 0.0–500.0%	100.0°	○
P28.04	Slave torque gain	Range: 0.0–500.0%	100.0°	○
P28.05	Frequency point for switching between speed mode and torque mode	Range: 0.00–10.00Hz **Note:** Valid in master-slave mode 2.	5.00Hz	○
P28.06	Number of slaves	Range: 0–15	1	◎

Group P89—HVAC status viewing

Function code	Name	Description	Default	Modify
P89.00	HVAC function status	0: Invalid 1: Enable	0	●
P89.01	Variable-frequency motor run sequence	Range: 1–8 The sequences 1–8 correspond to motors A–F. For fixed variable-frequency motors, the value is 255.	1	●
P89.02	Multi-motor validity status	Range: 0x00–0xFF Bit 0–Bit 7 correspond to motor A–motor H. 0: The corresponding motor is invalid and cannot be put into service. 1: The corresponding motor is valid and can be put into service.	0x00	●
P89.03	Power-frequency motor run status	Range: 0x00–0xFF Bit 0–Bit 7 correspond to motor A–motor H. 0: The corresponding motor stops. 1: The corresponding motor is running.	0x00	●
P89.04	SN of power-frequency motor to be alternated	Range: 1–8	1	●

Function code	Name	Description	Default	Modify
P89.05	Left time of power-frequency motor to be alternated	Range: 0.00–600.00h	0.00h	●
P89.06	SN of variable-frequency motor to be alternated	Range: 1–8	1	●
P89.07	Left time of variable-frequency motor to be alternated	Range: 0.00–600.00h	0.00h	●
P89.08	PID1 status	Bit 0: Stop Bit 1: Pause Bit 2: Deviation deadzone Bit 3: Polarity reversal	0x0	●
P89.09	PID1 present reference value	Range: -100.0%–100.0%	0.0°	●
P89.10	PID1 feedback value	Range: -100.0%–100.0%	0.0°	●
P89.11	PID1 deviation input	Range: -100.0%–100.0%	0.0°	●
P89.12	PID1 proportional output	Range: -1000.0%–1000.0%	0.0°	●
P89.13	PID1 integral output	Range: -100.00%–100.00%	0.00°	●
P89.14	PID1 differential output	Range: -1000.0%–1000.0%	0.0°	●
P89.15	PID1 comprehensive output	Range: -100.00%–100.00%	0.00°	●
P89.16	PID2 status	Bit 0: Stop Bit 1: Pause Bit 2: Deviation deadzone Bit 3: Polarity reversal	0x0	●
P89.17	PID2 present reference value	Range: -100.0%–100.0%	0.0°	●
P89.18	PID2 feedback value	Range: -100.0%–100.0%	0.0°	●

Function code	Name	Description	Default	Modify
P89.19	PID2 deviation input	Range: -100.0%–100.0%	0.0°	●
P89.20	PID2 proportional output	Range: -1000.0%–1000.0%	0.0°	●
P89.21	PID2 integral output	Range: -100.00%–100.00%	0.00°	●
P89.22	PID2 differential output	Range: -1000.0%–1000.0%	0.0°	●
P89.23	PID2 comprehensive output	Range: -100.0%–100.0%	0.0°	●
P89.24	Accumulative run time of motor A	Range: 0–65535h	0h	●
P89.25	Accumulative run time of motor B	Range: 0–65535h	0h	●
P89.26	Accumulative run time of motor C	Range: 0–65535h	0h	●
P89.27	Accumulative run time of motor D	Range: 0–65535h	0h	●
P89.28	Accumulative run time of motor E	Range: 0–65535h	0h	●
P89.29	Accumulative run time of motor F	Range: 0–65535h	0h	●
P89.30	Accumulative run time of motor G	Range: 0–65535h	0h	●
P89.31	Accumulative run time of motor H	Range: 0–65535h	0h	●
P89.32	AI/AO temperature measurement	Range: -20.0–200.0°C	0°C	●

Group P90—PID1 control

Function code	Name	Description	Default	Modify
P90.00	Unit selection	Range: 0–21 0: MPa 1: kPa 2: Pa 3: A 4: V	0	◎

Function code	Name	Description	Default	Modify
		5: % 6: m/s 7: m/min 8: m/h 9: m^3/s 10: m^3/min 11: m^3/h 12: kg/s 13: kg/min 14: kg/h 15: °C 16: °F 17: bar 18: mbar 19: L/s 20: L/min 21: L/h		
P90.01	Number of decimal places	Range: 0–3	2	◎
P90.02	PID1 given max. value	Range: 0.00–30.00 It is displayed with two decimal places by default. If P90.01 is changed, the number of decimal places changes.	10.00	○
P90.03	PID1 reference upper limit	Range: P90.04–P90.02	10.00	○
P90.04	PID1 reference lower limit	Range: 0.00–P90.03	0.00	○
P90.05	ACC/DEC time of PID1 reference value	Range: 0.0–1000.0s	0.0s	○
P90.06	PID1 reference source 1	Range: 0–6 0: Keypad (P90.07) 1: AI1 2: AI2 3: AI3 4: HDIA 5: Reserved 6: Communication card	0	○

Function code	Name	Description	Default	Modify
P90.07	PID1 reference value 1 through keypad	Range: P90.04–P90.03	0.100	○
P90.08	PID1 feedback source 1	Range: 0–6 0: Keypad (P90.09) 1: AI1 2: AI2 3: AI3 4: HDIA 5: Reserved 6: Communication card	0	○
P90.09	PID1 feedback value 1 through keypad	Range: P90.04–P90.03	0.100	○
P90.10	Gain of PID1 feedback source 1	Range: 0.000–3.000	1.000	○
P90.11	PID1 reference source 2	Range: 0–6 0: Keypad (P90.12) 1: AI1 2: AI2 3: AI3 4: HDIA 5: Reserved 6: Communication card	0	○
P90.12	PID1 reference value 2 through keypad	Range: P90.04–P90.03	0.100	○
P90.13	PID1 feedback source 2	Range: 0–6 0: Keypad (P90.14) 1: AI1 2: AI2 3: AI3 4: HDIA 5: Reserved 6: Communication card	0	○
P90.14	PID1 feedback value 2 through keypad	Range: P90.04–P90.03	0.100	○

Function code	Name	Description	Default	Modify
P90.15	Gain of PID1 feedback source 2	Range: 0.000–3.000	1.000	○
P90.16	Feedback function combination	Range: 0–7 0: No combination, feedback source 1 1: Sum of feedback sources 1 and 2 1: Difference between feedback sources 1 and 2 3: Average of feedback sources 1 and 2 4: Minimum of feedback sources 1 and 2 5: Maximum of feedback sources 1 and 2 6: Min. positive difference or max. negative difference among multiple reference values When calculating the difference between reference source 1 and feedback source 1 and the difference between reference source 2 and feedback source 2, give priority to the condition in which the feedback is greater than the reference. If there are some feedback values that are greater than the reference values, select the group with the max. negative difference as the PID reference and feedback. If all feedback values are less than the reference values, select the group with the min. positive difference as the PID reference and feedback. 7: Max. positive difference or min. negative difference among multiple reference values When calculating the difference between reference source 1 and feedback source 1 and the difference between reference source 2 and feedback source 2, give priority to the condition in which the feedback is less than the reference. If there are some feedback values that are less than the reference values, select the group with the max. positive difference as the PID reference and feedback. If all feedback values are greater than the reference values, select the group with the min. negative difference as the PID reference and feedback.	0	○
P90.17	Feedback upper	Range: 0–100.0%	100.0°	○

Function code	Name	Description	Default	Modify
	limit detection value			
P90.18	Feedback lower limit detection value	Range: 0–100.0%	0.0°	○
P90.19	Feedback out-of-range detection time	Range: 0.0–3600.0s	1.0s	○
P90.20	PID1 feedback filter time	Range: 0.000–60.000s	0.000s	○
P90.21	PID1 deviation input limit value	Range: 0.0–100.0%	100.0°	○
P90.22	Output characteristics selection	0: PID output is positive. 1: PID output is negative.	0	○
P90.23	PID1 output gain	Range: 0.000–3.000	1.000	○
P90.24	PID1 output filter time	Range: 0.000–60.000s	0.100s	○
P90.25	PID1 output upper limit	Range: P90.26–100.0%	100.0°	○
P90.26	PID1 output lower limit	Range: -100.0%–P90.25	0.0°	○
P90.27	Proportional gain	Range: 0.000–60.000	1.000	○
P90.28	Integral time	Range: 0.000–60.000s	5.000s	○
P90.29	Differential time	Range: 0.000–60.000s	0.000s	○
P90.30	Sampling period	Range: 0.001–60.000s	0.100s	○
P90.31	PID1 control deadzone	Range: 0.0–100.0%	0.0°	◎
P90.32	Deadzone delay	Range: 0.0–300.0s The PID suspends the regulation when the PID input deviation is kept for the deadzone retaining delay time.	1.0s	●
P90.33	Integral separation threshold	Range: 0.0–100.0%	100.0°	○
P90.34	Differential filter times	Range: 0–40	10	○
P90.35	Prior differential processing	0: Perform differential processing on feedback with priority 1: Perform differential processing on deviation	0	○

Function code	Name	Description	Default	Modify
		with priority		

Group P91—PID2 control

Function code	Name	Description	Default	Modify
P91.00	Unit selection	Range: 0–21 0: MPa 1: kPa 2: Pa 3: A 4: V 5: % 6: m/s 7: m/min 8: m/h 9: m^3/s 10: m^3/min 11: m^3/h 12: kg/s 13: kg/min 14: kg/h 15: °C 16: °F 17: bar 18: mbar 19: L/s 20: L/min 21: L/h	0	◎
P91.01	Number of decimal places	Range: 0–3	2	◎
P91.02	PID2 given max. value	Range: 0.00–30.00 It is displayed with two decimal places by default. If P90.01 is changed, the number of decimal places changes.	10.00	○
P91.03	PID2 reference upper limit	Range: P91.04–P91.02	10.00	○
P91.04	PID2 reference lower limit	Range: 0.000–P91.03	0	○

Function code	Name	Description	Default	Modify
P91.05	ACC/DEC time of PID2 reference value	Range: 0.0–1000.0s	0.0s	○
P91.06	PID2 reference source 1	0: Keypad (P91.07) 1: AI1 2: AI2 3: AI3 4: HDIA 5: Reserved 6: Communication card	0	○
P91.07	PID2 reference value 1 through keypad	Range: P91.04–P91.03	0.100	○
P91.08	PID2 feedback source 1	0: Keypad (P91.09) 1: AI1 2: AI2 3: AI3 4: HDIA 5: Reserved 6: Communication card	0	○
P91.09	PID2 feedback value 1 through keypad	Range: P91.04–P91.03	0.100	○
P91.10	Gain of PID2 feedback source 1	Range: 0.000–3.000	1.000	○
P91.11	PID2 startup feedback value	Range: 0.00–P91.02 It is displayed with two decimal places by default. If P90.01 is changed, the number of decimal places changes. When P91.15 is set to 1 or the enabling terminal is valid, if the output is positive, the feedback is less than the value of this function code; if the output is negative, the feedback is greater than the value of this function code. After the situation lasts for the time specified by P91.12, PID2 automatically starts.	10.00	○
P91.12	PID2 startup delay	Range: 0.0–300.0s	1.0s	○
P91.13	PID2 stop feedback	Range: 0.00–P91.02	10.00	○

Function code	Name	Description	Default	Modify
	value	It is displayed with two decimal places by default. If P90.01 is changed, the number of decimal places changes.		
P91.14	PID2 stop delay	Range: 0.0–300.0s	1.0s	○
P91.15	Enabling PID2	0: Invalid 1: Enable	0	○
P91.16	Reserved	/	/	/
P91.17	Feedback upper limit detection value	Range: 0–100.0%	100.0°	○
P91.18	Feedback lower limit detection value	Range: 0–100.0%	0.0°	○
P91.19	Feedback out-of-range detection time	Range: 0.0–3600.0s	1.0s	○
P91.20	PID2 feedback filter time	Range: 0.000–60.000s	0.000s	○
P91.21	PID2 deviation input limit value	Range: 0.0–100.0%	100.0°	○
P91.22	Output characteristics selection	0: PID output is positive. 1: PID output is negative.	0	○
P91.23	PID2 output gain	Range: 0.000–3.000	1.000	○
P91.24	PID2 output filter time	Range: 0.000–60.000s	0.000s	○
P91.25	PID2 output upper limit	Range: P91.26–100.0%	100.0°	○
P91.26	PID2 output lower limit	Range: -100.0–P91.25	0.0°	○
P91.27	Proportional gain	Range: 0.000–60.000	1.000	○
P91.28	Integral time	Range: 0.000–60.000s	5.000s	○
P91.29	Differential time	Range: 0.000–60.000s	0.000s	○
P91.30	Sampling period	Range: 0.001–60.000s	0.100s	○
P91.31	PID2 control deadzone	Range: 0.0–100.0%	0.0°	◎
P91.32	Deadzone delay	Range: 0.0–300.0s After the PID input deviation remains within the deadband for a sustained delay time, the PID	1.0s	○

Function code	Name	Description	Default	Modify
		regulation is paused.		
P91.33	Integral separation threshold	Range: 0.0–200.0%	200.0°	○
P91.34	Differential filter times	Range: 0–40	10	○
P91.35	Prior differential processing	0: Perform differential processing on feedback with priority 1: Perform differential processing on deviation with priority	0	○

Group P92—Real-time clock and timer (available at use of LCD keypad)

Function code	Name	Description	Default	Modify
P92.00	Display year	Range: 2020–2099 YY	2020 YY	●
P92.01	Display month and date	Range: 01.01–12.31 MMDD	01.01 MMDD	●
P92.02	Display day of a week	Range: 1–7 (Corresponding to Monday through Sunday)	1	●
P92.03	Display hour and minute	Range: 00.00–23.59 HHMM 00.00 is the earliest hour and time of a day, while 23.59 is the latest hour and time of a day.	00.00 HHMM	●
P92.04	Setting working days	Bit 0–bit 6 correspond to Monday–Sunday. Setting instances: Monday: 0x01 Wednesday: 0x04 From Monday to Friday: 0x1F From Saturday to Sunday: 0x60	0	○
P92.05	VFD startup hour and minute	Range: 00.00–23.59 HH.MM	00.00 HH.MM	○
P92.06	VFD startup second	Range: 0–59s	0s	○
P92.07	VFD stop hour and minute	Range: 00.00–23.59 HH.MM	00.00 HH.MM	○
P92.08	VFD stop second	Range: 0–59s	0s	○
P92.09	Clock fault	0: Disable 1: Enable	0	○
P92.10	Actual second	Range: 0–59s	0s	●

Group P94—Multi-pump and fan control functions

Function code	Name	Description	Default	Modify
P94.00	Multi-pump and fan control function enabling	Range: 0–1 0: Disable 1: Enable	0	◎
P94.01	Sleep method selection	Range: 0–2 0: Sleep based on terminal input 1: Sleep based on running frequency 2: Sleep based on deviation	0	○
P94.02	Sleep starting frequency	Range: P00.05–P00.04 (Upper limit frequency) Sleep is allowed only when the running frequency is less than or equal to this value and the duration exceeds P94.04.	5.00Hz	○
P94.03	Sleep starting deviation	Range: 0.0–30.0% (relative to PID1 max. value) When output is positive, if the feedback is greater than the reference, sleep is allowed only when the absolute difference is greater than the value of this function code and the situation lasts the time longer than P94.04. When output is negative, if the feedback is less than the reference, sleep is allowed only when the absolute difference is greater than the value of this function code and this situation lasts the time longer than P94.04.	5.0°	○
P94.04	Sleep delay	Range: P94.49–3600.0s	60.0s	○
P94.05	PID1 reference boost value	Range: -100.0%–100.0% (relative to the reference value of PID1)	10.0°	○
P94.06	Longest boost time	Range: 0.0–6000.0s This function is used to prevent the VFD from continuing to run when the output frequency has reached the upper limit but the feedback value still fails to reach the boosted set value. In this case, the VFD will automatically enter sleep mode after the specified boost time.	10.0s	○
P94.07	Wake-up-from-sleep frequency	Range: P00.05–P00.04 (Upper limit frequency) In closed-loop PID, the PID output is superimposed directly from the corresponding value of this frequency when the VFD is woken up.	5.00Hz	○
P94.08	Wake-up-from-	Range: 0.0–30.0% (relative to PID1 max. value)	5.0°	○

Function code	Name	Description	Default	Modify
	sleep deviation	In closed-loop PID, when output is positive, if the feedback is less than the reference, wakeup is allowed only when the actual difference is greater than the value of this function code and this situation lasts the time longer than P94.09. When output is negative, if the feedback is greater than the reference, wakeup is allowed only when the actual difference is greater than the value of this function code and this situation lasts the time longer than P94.09.		
P94.09	Wake-up-from-sleep delay	Range: 0.0–3600.0s Min. sleep time	5.0s	○
P94.10	Variable-frequency motor run mode	0: Fixed Motor A is a variable-frequency motor. The other motors are power-frequency motors. When a fixed VF motor is selected, if motors A to D are set as variable-frequency motors, this setting becomes invalid. If multiple motors are used, the corresponding motors can only be set as power frequency motors. At this time, the VFD can form a system with a maximum of 1 fixed variable-frequency motor and 4 power-frequency motors. 1: Circular According to the wiring method in the appendix, use the relays and motors with the same quantity to achieve cyclic power/variable frequency switchover. When set as a cyclic VF motor, at least two of the motors A to D must be set as VF motors. In this case, the VFD can form a system with a maximum of 4 variable-frequency motors.	1	◎
P94.11	Total number of motors	Range: 0–8 The enabled motor numbers must follow a continuous sequence from A to H.	1	◎
P94.12–P94.18	Reserved	/	/	/
P94.19	Pressure tolerance	Range: 0.0–30.0% (relative to PID1 max. value)	5.0°	○

Function code	Name	Description	Default	Modify
	for motor adding			
P94.20	Running frequency for motor adding	Range: P94.25 (Running frequency for motor reducing)–P00.03	50.00Hz	○
P94.21	Motor adding delay	Range: 0.0–3600.0s	10.0s	○
P94.22	Switching frequency for variable-frequency motor adding	Range: P00.05 (Lower limit frequency)–P00.03	50.00Hz	○
P94.23	Variable-frequency motor DEC time for power-frequency motor adding	Range: 0.0–300.0s	10.0s	○
P94.24	Pressure tolerance for motor reducing	Range: 0.0–30.0% (relative to PID1 max. value)	4.0°	○
P94.25	Running frequency for motor reducing	Range: P00.05–P94.20 (Running frequency for motor adding)	5.00Hz	○
P94.26	Motor reducing delay	Range: 0.0–3600.0s	10.0s	○
P94.27	Variable-frequency motor action for motor reducing	0: Keep the frequency unchanged 1: Accelerate to the motor running frequency	1	○
P94.28	Variable-frequency motor ACC time for motor reducing	Range: 0.0–300.0s	10.0s	○
P94.29	Multi-motor pressure loss compensation	0: No compensation 1: Compensation enabled	0	○
P94.30	Pressure reference boost value for one auxiliary motor	Range: 0.0–100.0% (relative to PID1 reference value)	5.0°	○
P94.31	Pressure reference boost value for two auxiliary motors	Range: 0.0–100.0% (relative to PID1 reference value)	10.0°	○
P94.32	Pressure reference boost value for three auxiliary motors	Range: 0.0–100.0% (relative to PID1 reference value)	15.0°	○
P94.33	Reserved	/	/	/

Function code	Name	Description	Default	Modify
P94.34	Motor alternation cycle	Range: 0.0–6000.0h Automatic alternation is targeted at idle variable-frequency motors. The value 0 indicates no alternation.	0.0h	○
P94.35	Running frequency threshold for alternation	Range: P00.05–P00.03 When the running frequency is greater than the value of this function code, variable-frequency motor alternation is not performed. Otherwise, great water pressure change impacts water supply.	45.00Hz	○
P94.36	Contactor closing delay	Range: 0.2–100.0s The delay starts after the contactor closing command is given. The VFD startup command is given after the delay since actual contactor closing also takes some time.	0.5s	○
P94.37	Contactor opening delay	Range: 0.2–100.0s Some time is taken from giving the contactor opening command to actual contactor opening. After the delay, the VFD controls the motor to switch to power frequency.	0.5s	○
P94.38	Manual soft startup switching frequency	Range: 0.00Hz–P00.03 Used to check whether a motor can run properly.	50.00Hz	○
P94.39–P94.43	Reserved	/	/	/
P94.44	Protection value for PID1 feedback too low	Range: 0.0–100.0% (relative to PID1 max. value)	10.0°	○
P94.45	Delay of PID1 feedback too low	Range: 0.0–3600.0s Corresponding terminal output that is set when PID1 feedback value is less than P94.44 and this situation lasts the time longer than P94.45.	500.0s	○
P94.46	Protection value for PID1 feedback too high	Range: 0.0–100.0% (relative to PID1 max. value)	80.0°	○
P94.47	Delay of PID1 feedback too high	Range: 0.0–3600.0s Corresponding terminal output that is set when PID1 feedback value is greater than P94.46 and this situation lasts the time longer than P94.47.	500.0s	○

Function code	Name	Description	Default	Modify
P94.48	DEC time of emergency stop	Range: 0.0–600.0s	2.0s	○
P94.49	ACC time with water pump frequency	Range: 0.0s–P94.04	Model depended (2.0s)	○
P94.50	DEC time with water pump frequency	Range: 0.0s–P94.04	Model depended (2.0s)	○

Group P96—Multi-pump and fan protection function

Function code	Name	Description	Default	Modify
P96.01–P96.10	Reserved	/	/	/
P96.11	Temperature sensor type	Range: 0–6 0: Invalid 1: PT100 2: PT1000 3: KTY84 4: PTC (AO+AI terminal combination) 5: PTC (AI1+10V terminal combination) 6: PTC (AI2+10V terminal combination) Usage of functions 1–4: To select current-type output for AO, connect one end of the temperature resistor to AI1 (voltage-type) and AO1 (current-type), and the other end to GND. Usage of functions 5–6: Connect the PTC sensor between the +10V terminal and AI1 or AI2.	0	○
P96.12–P96.34	Reserved	/	/	/
P96.35	Motor overtemperature protection threshold	Range: -20.0–200.0	110.0	○
P96.36	AI/AO detected temperature offset value	Range: -40.0–40.0	0.0	○
P96.37	PTC constant output current	Range: 0.000–20.000mA	4.000mA	○

Function code	**Name**	**Description**	**Default**	**Modify**
	setting			
P96.38	PTC resistance alarm threshold	Range: 0–60000Ω	750Ω	○
P96.39	PTC resistance alarm recovery threshold	Range: 0–60000Ω	150Ω	○
P96.40	Actual PTC resistance	Range: 0–60000Ω	0Ω	●
P96.41	PTC AI1 temperature compensation coefficient	Range: 0–100	50	○
P96.42	PTC AI2 temperature compensation coefficient	Range: 0–100	50	○

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

Faults are indicated by indicators. See section 5.3 LED keypad (BOP-270) display and operation. 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 the 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, P07.49–P07.56 record the running data of VFD at the last three faults.

7.5 Faults and solutions

When a fault occurred, handle the fault as follows:

Step 1 Check whether keypad display is improper. If yes, contact the local INVT office.

Step 2 If no, check the function codes in P07 group to determine the real state when the fault occurred.

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

Step 4 Rectify the fault or ask for help.

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

7.5.1 Faults and solutions

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

Fault code	Fault type	Possible cause	Solution
OUt1	[1] Inverter unit U-phase protection	● ACC is too fast. ● IGBT module damaged. ● Malfunction caused by interference. ● Drive wires are poorly connected. ● To-ground short circuit occurred.	● 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		
OV1	[7] Overvoltage during ACC	● Deceleration time too short. ● Abnormal input voltage. ● Large energy feedback. ● Lack of braking units. ● Dynamic brake is not enabled.	● Check the input power. ● Check whether load DEC time is too short or the motor starts during rotating. ● Install dynamic brake components ● Check the setting of related function codes.
OV2	[8] Overvoltage during DEC		
OV3	[9] Overvoltage during constant speed running		
OC1	[4] Overcurrent during ACC	● ACC/DEC is too fast. ● Grid voltage is too low. ● VFD power is too small. ● Load transient or exception occurred. ● To-ground short circuit or output phase loss occurred. ● There is strong external interference. ● Overcurrent stalling protection disabled.	● Increase ACC/DEC time. ● Check the input power. ● Select 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 related function code settings.
OC2	[5] Overcurrent during DEC		
OC3	[6] Overcurrent during constant speed running		
UV	[10] Bus undervoltage	● Grid voltage is too low. ● Overvoltage stall protection disabled.	● Check the grid input power. ● Check the related function code settings.
OL1	[11] Motor overload	● Grid voltage is too low. ● Motor rated current is set incorrectly.	● Check the grid voltage. ● Set the motor rated current. ● Check the load and adjust

Fault code	Fault type	Possible cause	Solution
		● Motor stall or load jumps violently.	torque boost.
OL2	[12] VFD overload	● ACC is too fast. ● The motor is restarted during rotating. ● Grid voltage is too low. ● Load is too heavy. ● Power is too small.	● Increase ACC time. ● 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 inputs R, S, and T.	● Check the input power. ● Check the installation wiring.
SPO	[14] Phase loss on output side	● Phase loss occurred to U, V, W output (or the three phases of motor is asymmetrical).	● Check the output wiring. ● Check the motor and cable.
OH1	[15] Rectifier module overheating	● Air duct is blocked or fan is damaged. ● Ambient temperature is too high. ● Long-time overload running.	● Ventilate the air duct or replace the fan. ● Lower the ambient temperature.
OH2	[16] Inverter module overheating Fault		
EF	[17] External fault	● SI external fault input terminal acts.	● Check external device input.
CE	[18] RS485 communication fault	● Incorrect baud rate ● Communication line fault. ● Incorrect communication address. ● Communication suffers from strong interference.	● Set a proper baud rate. ● Check the communication port cable. ● Set the communication address correctly. ● Replace or change the wiring to enhance the anti-interference capacity.
ItE	[19] Current detection fault	● Poor contact of the connector of control board. ● The Hall component is damaged.	● Check the connector and re-plug. ● Replace the hall component. ● Replace the main control board.

Fault code	Fault type	Possible cause	Solution
		● Exception occurred to amplification circuit.	
tE	[20] Motor autotuning fault	● Motor capacity does not match with the VFD capacity. This fault may occur if the capacity difference exceeds five power classes. ● Incorrect motor parameter setting. ● The parameters gained from autotuning deviate sharply from the standard parameters. ● Autotuning timeout.	● 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 parameter settings. ● Check whether the upper limit frequency is larger than 2/3 of the rated frequency.
EEP	[21] EEPROM operation fault	● Error in reading or writing control parameters ● EEPROM 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.
End	[24] Running time reached	● Actual VFD running time longer than internally set running time.	● Ask the supplier to adjust the preset running time.
OL3	[25] Electronic overload fault	● The VFD reports the overload 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.	● Check the keypad cable to determine whether a fault occurs. ● Check the surroundings to rule out interference source ● Replace the hardware and

Fault code	Fault type	Possible cause	Solution
		● Keypad or mainboard communication circuit error.	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 surroundings to rule out interference source ● Replace the hardware and seek maintenance services. ● Replace the hardware and seek maintenance services.
DNE	[28] Parameter download error	● Keypad cable connected improperly or disconnected. ● Keypad cable too long, causing strong interference. ● Keypad data storage error	● Check the surroundings to rule out interference source ● Replace the hardware and seek maintenance services. ● Re-back up the data on the keypad.
ETH1	[32] To-ground short-circuit fault 1	● The output of the VFD is short circuited to the ground. ● Current detection circuit fault. ● Actual motor power setup deviates sharply from the VFD power.	● Check whether the motor 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 fault. ● 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

Fault code	Fault type	Possible cause	Solution
			detection time. ● Check whether the control parameters are set properly.
STo	[35] Mal-adjustment fault	● Autotuned parameters are not accurate. ● The VFD is not connected to the motor.	● Check the load and ensure the load is normal. ● Check whether control parameters are set correctly. ● Increase the maladjustment detection time.
LL	[36] Electronic underload fault	● The VFD reports the underload alarm according to the setting.	● Check the load and underload pre-alarm thresholds.
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.
E-Err	[55] Duplicate expansion card type	● The two inserted expansion cards are of the same type	● You should not insert two cards with the same type. Check the type of expansion card, and remove one card after power-off.
F1-Er	[60] Failed to identify the expansion card in card slot 1	● There is data transmission in interfaces of card slot 1, however, it cannot read the card type.	● Check whether the expansion card in this slot is 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] Failed to identify	● There is data	● Check whether the expansion

Fault code	Fault type	Possible cause	Solution
	the expansion card in card slot 2	transmission in interfaces of card slot 2, however, it cannot read the card type.	card in this slot is 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 expansion card in slot 1	● There is no data transmission in interface at card slot 1.	● Check whether the expansion card in this slot is 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 expansion card in slot 2	● There is no data transmission in interface at card slot 2.	● Check whether the expansion card in this slot is 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-DP	[29] PROFIBUS card communication timeout fault	● No data transmission between the communication card and the upper computer (or PLC).	● Check whether the communication card wiring is loose or disconnected.
E-NET	[30] Ethernet card communication timeout fault	● There is no data transmission between the communication card and the upper	● Check whether the communication card wiring is loose or disconnected.

Fault code	Fault type	Possible cause	Solution
		computer.	
E-CAN	[31] CANopen card communication timeout fault	● No data transmission between the communication card and the upper computer (or PLC).	● Check whether the communication card wiring is loose or disconnected.
ETH1	[32] To-ground short-circuit fault 1	● The output of the VFD is short circuited to the ground. ● Current detection circuit fault. ● Actual motor power setup deviates sharply from the VFD power.	● Check whether the motor is short circuited to the ground and wiring is normal. ● Check whether the motor wiring is normal. ● Replace the hall component. ● Replace the main control board. ● Reset the motor parameters properly.
ETH2	[33] To-ground short-circuit fault 2		
dEu	[34] Speed deviation fault	● The load is too heavy or stalled.	● Check for overload, increase speed deviation detection time, or prolong ACC/DEC time. ● Check motor parameter settings and re-perform motor parameter autotuning. ● Check speed loop control parameter settings.
STo	[35] Mal-adjustment fault	● Load exception. ● Incorrect SM parameter settings. ● Autotuned motor parameters are inaccurate. ● The VFD is not connected to the motor. ● Flux weakening application.	● Check for overload or stalling. ● Check motor parameter and counter EMF settings. ● Re-perform motor parameter autotuning. ● Increase the maladjustment detection time. ● Adjust flux weakening coefficient and current loop parameters.
LL	[36] Underload fault	● The VFD reports the underload alarm	● Check the load and underload pre-alarm thresholds.

Fault code	Fault type	Possible cause	Solution
		according to the setting.	
E-Err	[55] Duplicate expansion card type	● The two inserted expansion cards are of the same type	● You should not insert two cards with the same type. Check the type of expansion card, and remove one card after power-off.
E-PN	[57] PROFINET card communication timeout fault	● No data transmission between the communication card and the upper computer (or PLC).	● Check whether the communication card wiring is loose or disconnected.
ESCAN	[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 disconnected.
OT	[59] Motor overtemperature fault	● External terminal input overtemperature fault.	● Check the motor temperature.
F1-Er	[60] Failure to identify the card in card slot 1	● There is data transmission in interfaces of card slot 1, however, it cannot read the card type.	● Check whether the expansion card in the slot is supported. ● Stabilize the expansion card interface after power-off, and check whether the fault persists at next power-on. ● Check whether the insertion port or card slot is damaged. If yes, replace the insertion port or card slot after power-off.
F2-Er	[61] Card recognition failure in slot 2	● There is data transmission in interfaces of card slot 2, however, it cannot read the card type.	
C1-Er	[63] Card communication timeout fault in slot 1	● There is no data transmission in interface of card slot 1.	
C2-Er	[64] Card communication timeout fault in slot 2	● There is no data transmission in interface of card slot 2.	
E-CAT	[66] EtherCAT communication timeout	● No data transmission between the communication card	● Check whether the communication card wiring is loose or disconnected.

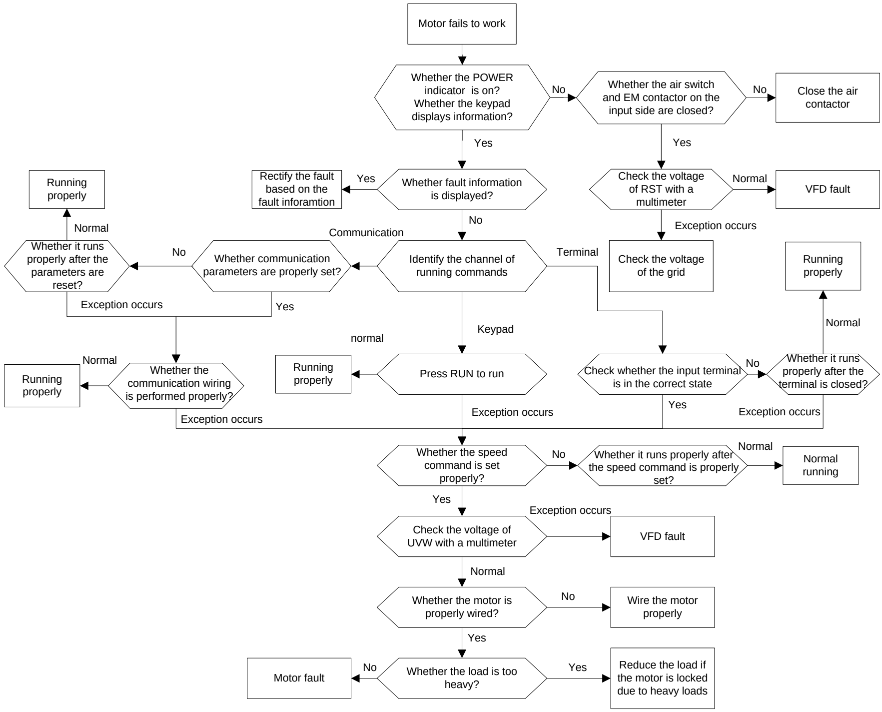
Fault code	Fault type	Possible cause	Solution
		and the upper computer (or PLC).	
S-Err	[69] CAN slave fault in master/slave synchronization	● Fault occurred to one of the CAN slave VFDs.	● Detect the CAN slave VFD and analyze the corresponding fault cause.
E-EIP	[70] EtherNet IP communication timeout	● Check whether the communication card wiring is loose or disconnected.	● Check whether the communication card wiring is loose or disconnected.
E-AI1	[76] AI1 disconnection	● AI1 input too low. ● AI1 wiring disconnected.	● Connect a 5V or 10mA power source to check whether the input is normal. ● Check the wiring or replace the cable.
E-AI2	[77] AI2 disconnection	● AI2 input too low. ● AI2 wiring disconnected.	
E-AI3	[78] AI3 disconnection	● AI3 input too low. ● AI3 wiring disconnected.	
E-LLP	[80] Power underload	● The VFD reports the underload alarm according to the set power.	● Check the load and underload pre-alarm thresholds.

7.5.2 Other status

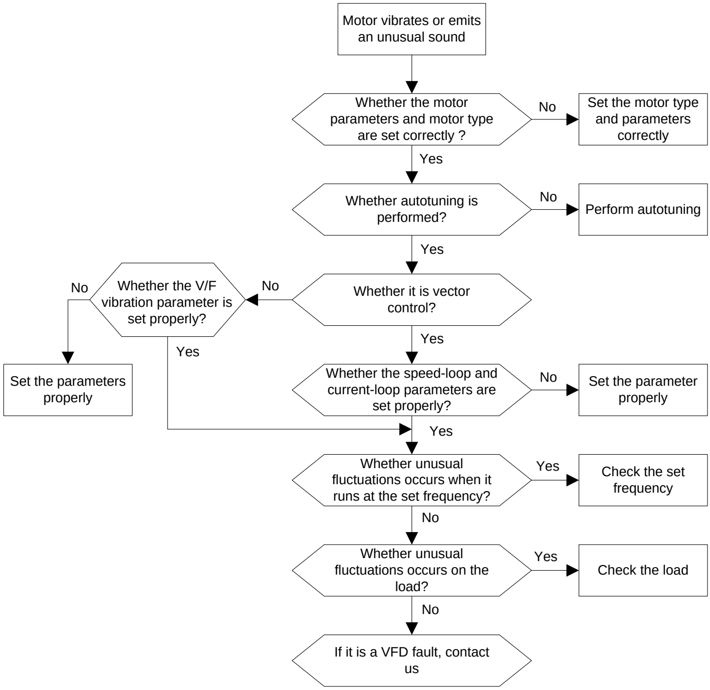
Displayed code	Status type	Possible cause	Solution
PoFF	System power failure	The system is powered off or the bus voltage is too low.	Check the grid conditions.

7.6 Analysis on common faults

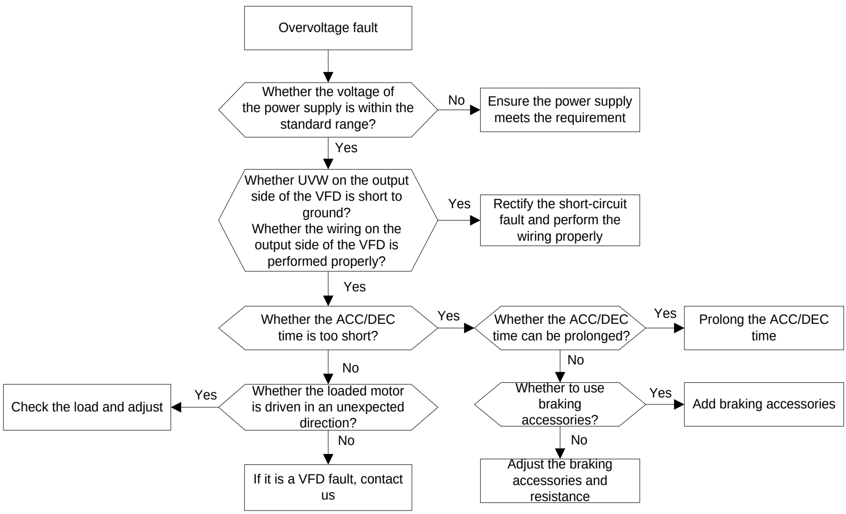
7.6.1 Motor fails to work



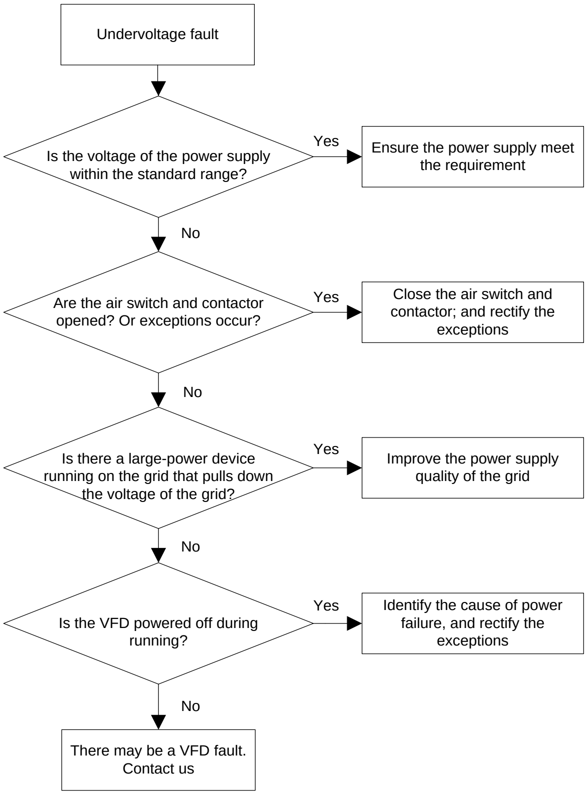
7.6.2 Motor vibrates



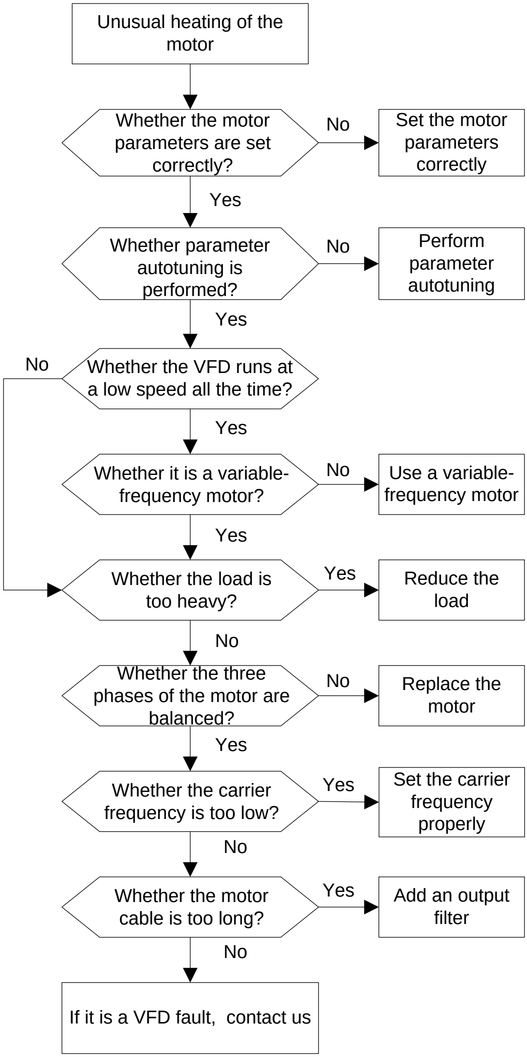
7.6.3 Overvoltage



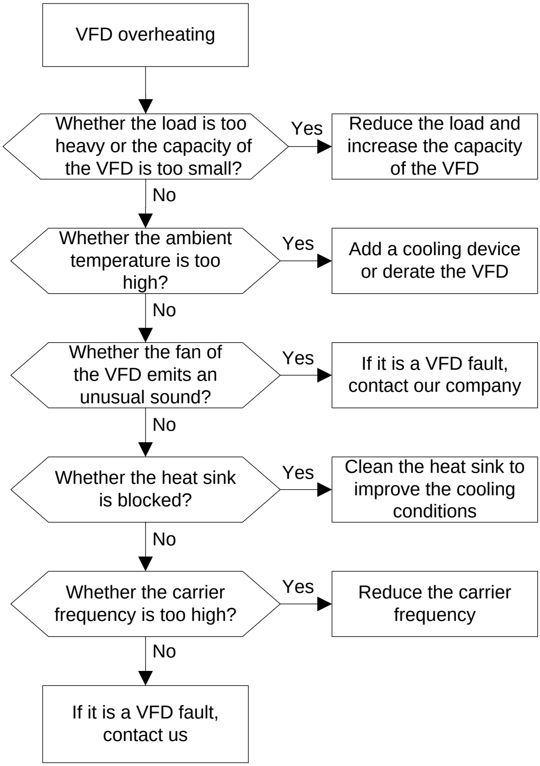
7.6.4 Undervoltage



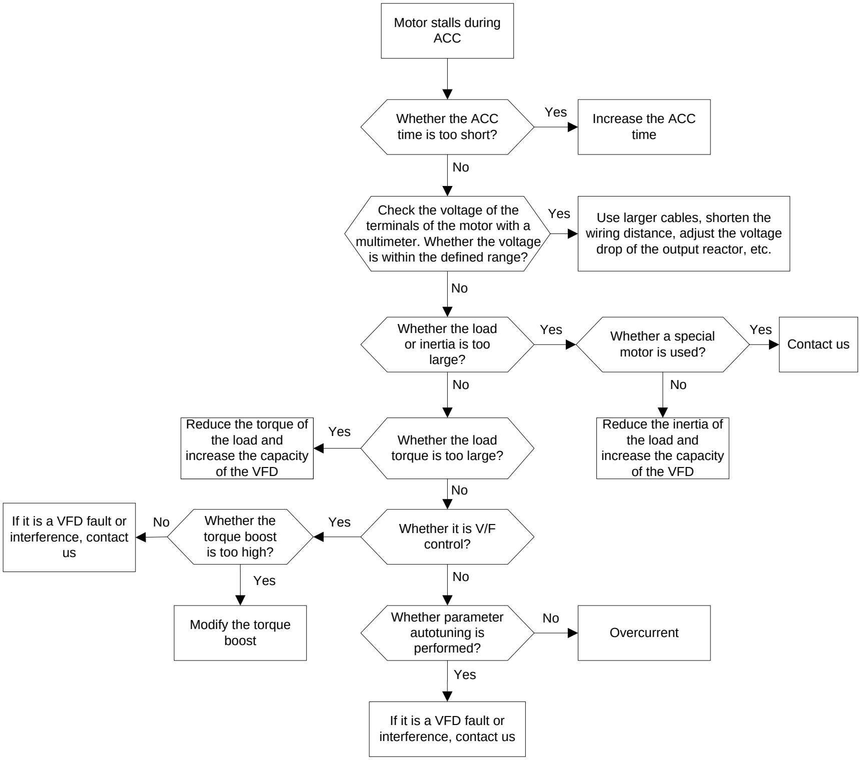
7.6.5 Motor overheating



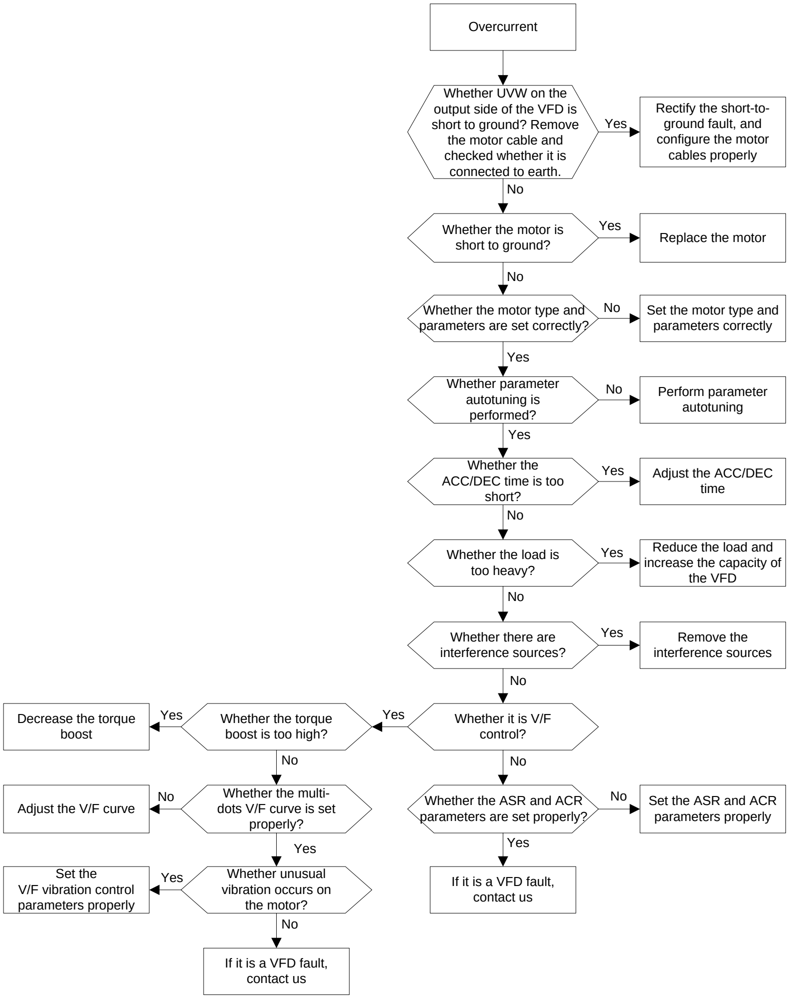
7.6.6 VFD overheating



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 grounding bar and PE terminal is lower than 1.5 Ω).
3. Try to add a safety capacitor of 0.1μF to the signal end of the feedback signal terminal of the sensor.
4. Try to add a safety capacitor of 0.1μF to the power end of the sensor meter (pay attention to the voltage of the power supply and the voltage endurance of the capacitor).
5. For interference on meters connected to the AO terminal of the VFD, if the AO uses 0–20mA current signal, add a capacitor of 0.47μF between the AO and GND terminals; if the AO uses 0–10V voltage signal, add a capacitor of 0.1μF between the AO and GND terminals.

Note:

- ✧ When a decoupling capacitor is required, add it to the terminal of the device connected to the sensor. For example, if a thermocouple is to transmit signals of 0 to 20 mA to a temperature meter, the capacitor needs to be added on the terminal of the temperature meter; if an electronic ruler is to transmit signals of 0 to 30 V to a PLC signal terminal, the capacitor needs to be added on the terminal of the PLC.
- ✧ If a large number of meters or sensors are disturbed, it is recommended that you configure an external C2 filter on the VFD input power end. For details, see section D.5 Harmonic 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 two ends of line A or B are connected reversely.
3. Check whether the communication protocol of the VFD is consistent with that of the upper computer. Check whether the communication protocol (such as the baud rate, data bits, and check bit) of the VFD is consistent with that of the host computer.

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

1. Simple inspection**:**
2. Arrange the communication cables and motor cables in different cable trays.
3. In multi-VFD application scenarios, adopt the 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 grounding bar and PE terminal is lower than 1.5 Ω).
2. Do not connect the VFD and motor to the same ground terminal as the 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 change the short-connection cap of jumper J9 on the VFD control board from 1/2 pins to 2/3 pins.
5. Try to add a safety capacitor of 0.1μF 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. Failure to stop

   In a VFD system where an S terminal is used to control the start and stop, the motor cable and control cable are arranged in the same cable tray. After the system is started properly, the S terminal cannot be used for the stop.

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 abnormal operation of the 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 200mA, 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, and 0.2s.

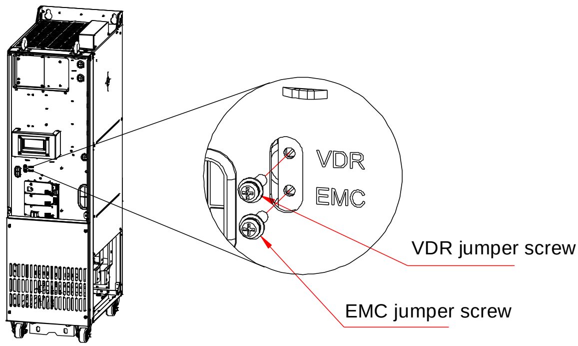
   C. For circuits in VFD systems, electromagnetic RCDs are recommended. Electromagnetic

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 abnormal operation (handling the VFD)

   A. Try to remove the EMC screw or jumper at "EMC/VDR" 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 mal-operation of RCD (on the part of system 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 spliced.

   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 lines 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 housing

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 casing to the VFD grounding terminal PE, and ensure that the jumper at "EMC/ VDR" 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 instrument measurement	The requirements stated in this manual are met.
		Check whether there are foreign matters, such as tools, or dangerous substances placed nearby.	Visual inspection	There are no tools or dangerous substances placed nearby.
Voltage		Check the voltage of the main circuit and control circuit.	Use multimeters or other instruments for measurement.	The requirements stated in this manual are met.
Keypad		Check the display of information.	Visual inspection	The characters are displayed properly.
		Check whether characters are not completely displayed.	Visual inspection	The requirements stated in this manual are met.
Main circuit	Common	Check whether bolts are loose or fall off.	Screw them up.	No exception occurs.
		Check whether the machine is deformed, cracked, or damaged, or their color changes due to overheating and aging.	Visual inspection	No exception occurs.
		Check whether there are stains and dust attached.	Visual inspection	No exception occurs. **Note:** Discoloration of copper bars does not mean that they

Check scope		Check item	Method	Expected result
				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 × 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.

Check scope		Check item	Method	Expected result
	Electromagnetic contactor and relay	Check whether there are vibration sounds in the workshop.	Auditory inspection	No exception occurs.
		Check whether the contacts are in good contact.	Visual inspection	No exception occurs.
Control circuit	Control PCB and connector	Check whether the screws and connectors are loose.	Screw them up.	No exception occurs.
		Check whether there is unusual smell or discoloration.	Olfactory and visual inspection	No exception occurs.
		Check whether there are cracks, damage, deformation, or rust.	Visual inspection	No exception occurs.
		Check whether there is electrolyte leakage or deformation.	Visual inspection, and determine the service life based on the maintenance information.	No exception occurs.
Cooling system	Cooling fan	Check whether there are unusual sounds or vibration.	Auditory and visual inspection, and turn the fan blades with your hand.	The rotation is smooth.
		Check whether the bolts loose.	Screw them up.	No exception occurs.
		Check whether there is discoloration caused due to overheat.	Visual inspection, and determine the service life based on the maintenance information.	No exception occurs.
	Ventilation duct	Check whether there are foreign matters blocking or attached to the cooling fan, air inlets, or air outlets. Check whether there are foreign objects attached.	Visual inspection	No exception occurs.

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

8.3 Cooling fan

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

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

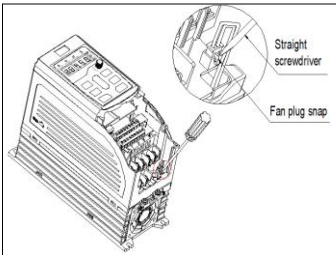
The increase of the bearing noise indicates a fan fault. If the VFD is applied in a key position, replace the fan once the fan starts to generate unusual noise. You can purchase spares of fans from INVT.

Cooling fan replacement:

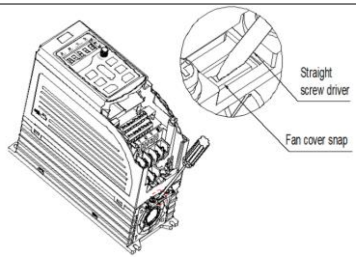
⚠	Read chapter 1 Safety precautions carefully and follow the instructions to perform operations. Ignoring these safety precautions may lead to physical injury or death, or device damage.

1. Stop the VFD, disconnect the AC power supply, and wait for a time no shorter than the waiting time designated on the VFD.
2. Open the cable clamp to loosen the fan cable.
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 the following.

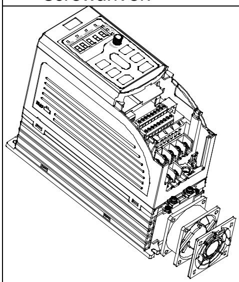
For VFDs in T1–T2 frames:



1. Remove the fan cable through the straight screwdriver.



2. Remove the fan cover through the straight screwdriver.



3. Take out of the fan and replace it.

Note: GD290-0R7G/1R5P-4 uses a fanless natural cooling design that requires no fan maintenance.

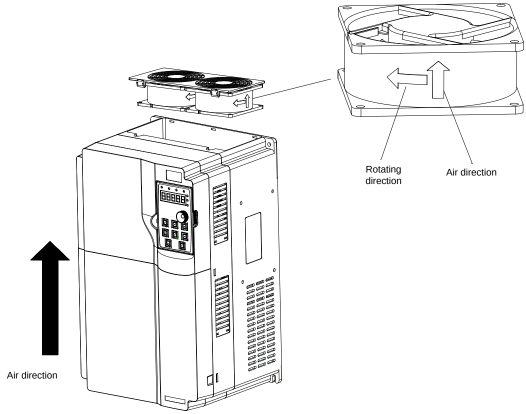


Figure 8-1 Fan maintenance for VFDs in T3–T9 frames

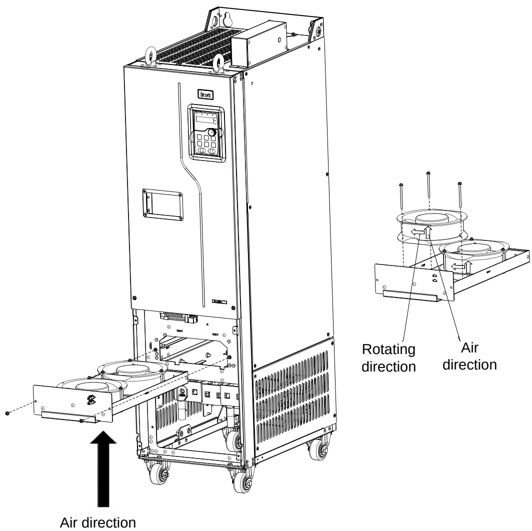


Figure 8-2 Fan maintenance for VFDs in T10–T12 frames

6. Connect to the power supply.

8.4 Capacitor

8.4.1 Capacitor reforming

If the VFD has been left unused for a long time, you need to follow the instructions to reform the DC bus capacitor before using it. The storage time is calculated from the date the 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 1 kΩ/100W. If the voltage of the power supply is no higher than 380 V, you can also use an incandescent lamp of 100W. If an incandescent lamp is used, it may go off or the light may become very weak.

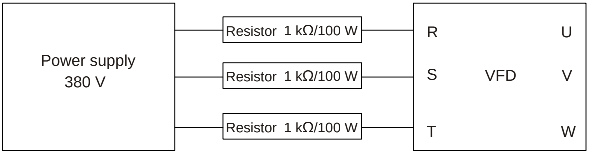


Figure 8-3 380V driving-device charging circuit example

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 implements 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. An RS485 interface uses a twisted pair, where one wire is defined as A (+), and the other B (-). Generally, if the positive electrical level between the transmission drives A and B ranges from +2V to +6V, the logic is "1"; and if it ranges from -6V to -2V, the logic is "0".

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

The communication baud rate (P14.01) indicates the number of bits sent in a second, and the unit Bit/s (bps). A higher baud rate indicates faster transmission and poorer anti-interference capability. When a twisted pair of 0.56mm (24 AWG) is used, the maximum transmission distance varies according to the baud rate, as described in the following table.

Baud rate	Max. transmission distance	Baud rate	Max. transmission distance
2400bps	1800m	9600bps	800m
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, so you need to convert an RS232 or USB interface of a PC to an RS485 interface through an adapter. Connect end A of the RS485 interface to the 485+ port on the terminal block of the VFD, and connect end B to the 485- port. It is recommended that you use shielded twisted pairs. When an RS232-RS485 converter is used, the cable used to connect the RS232 interface of the PC and the converter cannot be longer than 15 m. Use a short cable when possible. It is recommended that you insert the converter directly into the PC. Similarly, when a USB-RS485 converter is used, use a short cable when possible.

After wiring, select the correct port (such as COM1 to connect the RS232-RS485 converter) on the upper computer, and set the basic parameters such as baud rate and data bit check consistent with those of the VFD.

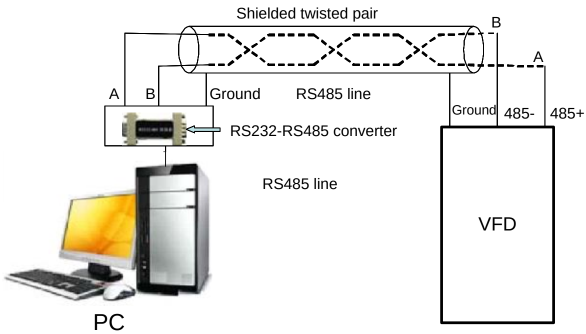


Figure 9-1 RS485 wiring of one VFD

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 120Ω terminal resistor on each end, as shown in Figure 9-2. Figure 9-3Wiring diagram Figure 9-4 shows the actual application.

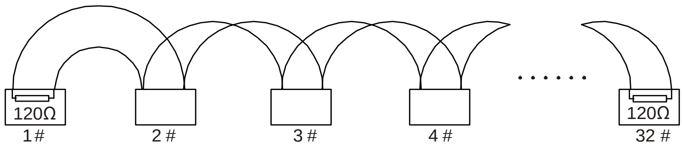


Figure 9-2 Onsite chrysanthemum connection

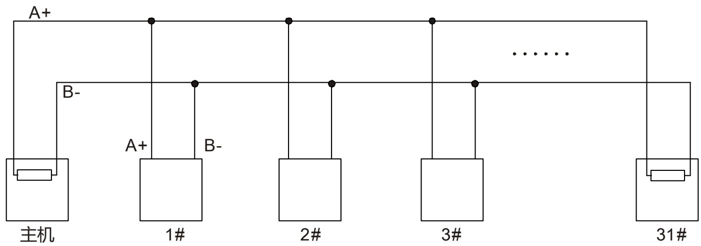


Figure 9-3 Simplified chrysanthemum connection

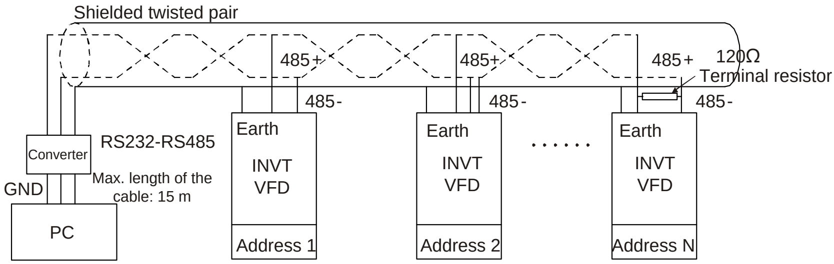


Figure 9-4 Practical chrysanthemum connection application

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).

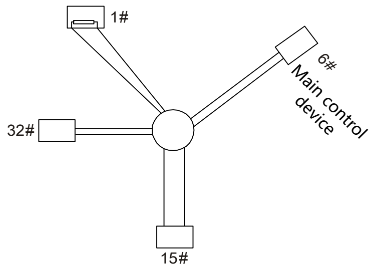


Figure 9-5 Star connection

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

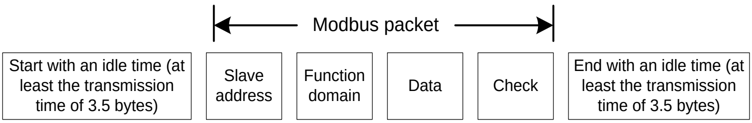
10-bit character frame (bits 1 to 7 are data bits):

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

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

START (frame header)	T1-T2-T3-T4 (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 bytes, main content of the communication as well as the core of data exchanging
CRC CHK LSB	Detection value: CRC verification value (16 bits)
CRC CHK MSB	
END (frame trailer)	T1-T2-T3-T4 (transmission time of 3.5 bytes)

9.3.2.2 RTU communication frame error check methods

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

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

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

Bit check on individual bytes (odd/even check)

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

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

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

For example, the data bits to be sent are "11001110", including five "1". If the even check is applied, the even check bit is set to "1"; and if the odd check is applied, the odd check bit is set to "0". During the transmission of the data, the odd/even check bit is calculated and placed in the check bit of the frame. The receiving device performs the odd/even check after receiving the data. If it finds that the odd/even parity of the data is inconsistent with the preset information, it determines that a communication error occurs.

Cyclic redundancy check (CRC)

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

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

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

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

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

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

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

9.4 RTU command code and communication data

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

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

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

For example, if the master reads two contiguous pieces of data (that is, to read content from the data addresses 0004H and 0005H) from the VFD whose address is 01H, the frame structures are 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. The ADDR information occupies one byte.

"CMD" is "03H", indicating that the command is sent to read data from the VFD. The CMD information 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, indicating that data is to be read from the data addresses of 0004H and 0005H.

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

RTU slave response (from the VFD to the master)

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

The definition of the response information is described as follows:

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

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

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

"LSB of data in 0005H".

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

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

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

RTU master command (from the master to the VFD)

START	T1-T2-T3-T4 (transmission time of 3.5 bytes)
ADDR	02H
CMD	06H
Write data address MSB	00H
Write data address LSB	04H
Data content MSB	13H
Data content LSB	88H
CRC LSB	C5H
CRC MSB	6EH
End	T1-T2-T3-T4 (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
Write data address MSB	00H
Write data address LSB	04H
Data content MSB	13H
Data content LSB	88H
CRC LSB	C5H
CRC MSB	6EH
End	T1-T2-T3-T4 (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, to write 5000 (1388H) and 50 (0032H) respectively to 0004H and 0005H of the VFD whose slave address is 02H, the frame structure is as follows.

RTU master command (from the master to the VFD)

START	T1-T2-T3-T4 (transmission time of 3.5 bytes)
ADDR	02H
CMD	10H
Write data address MSB	00H
Write data address LSB	04H
Data count MSB	00H
Data count LSB	02H
Number of bytes	04H
MSB of data to be written to 0004H	13H
LSB of data to be written to 0004H	88H
MSB of data to be written to 0005H	00H
LSB of data to be written to 0005H	32H
CRC LSB	C5H
CRC MSB	6EH
End	T1-T2-T3-T4 (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
Write data address MSB	00H
Write data address LSB	04H
Data count MSB	00H
Data count LSB	02H
CRC LSB	C5H
CRC MSB	6EH
End	T1-T2-T3-T4 (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 MSB on the left and LSB on the right. The MSB ranges from 00 to ffH, and the LSB also ranges from 00 to ffH. The high-order byte is the hexadecimal form of the group number before the dot mark, and low-order byte is that of the number behind the dot mark. Take P05.06 as an example: The group number is 05, that is, the MSB of the parameter address is the hexadecimal form of 05; and the number behind the dot mark is 06, that is, the LSB is the hexadecimal form of 06. Therefore, the function code address is 0506H in the hexadecimal form. For P10.01, the parameter address is 0A01H.

Function code	Name	Description	Setting range	Default	Modify
P10.00	Simple PLC mode	0: Stop after running once 1: Keep running with the final value after running once 2: Cyclic running	0–2	0	○
P10.01	Simple PLC 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 it, and monitoring the operation status of the VFD.

Table 9-1 Addresses of other function parameters

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

Function description	Address definition	Data description	R/W
		0008H: Stop jogging	
Communication-based setting address	2001H	Communication-based frequency setting (0–Fmax, unit: 0.01Hz)	R/W
	2002H	PID reference (0–1000, in which 1000 corresponds to 100.0%)	
	2003H	PID feedback (0–1000, in which 1000 corresponds to 100.0%)	R/W
	2004H	Torque setting (-3000–3000, in which 1000 corresponds to 100.0% of the motor rated current)	R/W
	2005H	Upper limit setting of forward running frequency (0–Fmax; unit: 0.01Hz)	R/W
	2006H	Upper limit setting of reverse running frequency (0–Fmax; unit: 0.01Hz)	R/W
	2007H	Upper limit of the electromotive torque (0–3000, in which 1000 corresponds to 100.0% of the motor rated current)	R/W
	2008H	Upper limit of the braking torque (0–3000, in which 1000 corresponds to 100.0% of the motor rated current)	R/W
	2009H	Special CW Bit1–bit0=00: Motor 1 =01: Motor 2 Bit2=1: Enable speed/torque control switchover =0: Disable speed/torque control switchover Bit3=1: Clear electricity consumption data =0: Keep electricity consumption data Bit4=1: Enable pre-excitation =0: Disable pre-excitation Bit5=1: Enable DC braking =0: Disable DC braking	R/W
	200AH	Virtual input terminal command (0x000–0x3FF) Corresponding to the local S8/S7/S6/S5/Reserved/HDIA/S4/S3/S2/S1 in sequence.	R/W
	200BH	Virtual output terminal command (0x00–0x0F) The bits correspond to the local terminals: RO2/RO1/Reserved/Y1 in sequence.	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

Function description	Address definition	Data description		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: VFD in fault 0005H: VFD in POFF state 0006H: Pre-exciting		R
VFD status word 2	2101H	Bit0=0: Not ready to run =1: Ready to run Bit2–bit1=00: Motor 1 =01: Motor 2 Bit3=0: AM =1: Reserved Bit4=0: No pre-alarm upon overload =1: Pre-alarm upon overload Bit5–Bit6=0: Keypad-based control =1: Terminal-based control =2: Communication-based control Bit7: Reserved Bit8=0: Speed control =1: Torque control Bit9: =0: Non position control =1: Position control Bit11–Bit10: =00: Vector 0 =01: Vector 1 =10: Closed-loop vector =11: Space voltage vector		R
VFD fault code	2102H	See the description of fault types.		R
VFD identification code	2103H	GD290-----0x01C1		R
Running frequency	3000H	0–Fmax(Unit: 0.01Hz)	Compatible with CHF100A and CHV100 communication addresses	R
Set frequency	3001H	0–Fmax (Unit: 0.01Hz)		R
Bus voltage	3002H	0.0–2000.0V (Unit: 0.1V)		R
Output voltage	3003H	0–1200V (Unit: 1V)		R
Output current	3004H	0.0–3000.0A (Unit: 0.1A)		R
Rotational speed	3005H	0–65535 (Unit: 1RPM)		R
Output power	3006H	-300.0%–300.0% (Unit: 0.1%)		R
Output torque	3007H	-250.0–250.0% (Unit: 0.1%)		R
Closed-loop setting	3008H	-100.0%–100.0% (Unit: 0.1%)		R
Closed-loop feedback	3009H	-100.0%–100.0% (Unit: 0.1%)		R
Input I/O status	300AH	00–3F Corresponding to the local Reserved/HDIA/S4/S3/S2/S1		R

Function description	Address definition	Data description		R/W
Output I/O status	300BH	00–0F The bits correspond to the local terminals: RO2/RO1/Reserved/Y1 in sequence.		R
Analog input 1	300CH	0.00–10.00V (Unit: 0.01V)		R
Analog input 2	300DH	0.00–10.00V (Unit: 0.01V)		R
Analog input 3	300EH	-10.00–10.00V (Unit: 0.01V)		R
Analog input 4	300FH	/		R
Read input of HDIA high-speed pulse	3010H	0.00–50.00kHz (Unit: 0.01Hz)		R
Reserved	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 setting	3015H	-300.0%–300.0% (Unit: 0.1%)		R
VFD identification code	3016H	/		R
Fault code	5000H	/		R

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

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

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

8 MSBs	Meaning	8 LSBs	Meaning
0x01	GD	0xC1	GD290 Series Low-Voltage Multifunction General-Purpose 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, 50.12Hz cannot be represented in the hexadecimal form. In such cases, multiply 50.12 by 100 to obtain an integer 5012, and then 50.12 can be represented as 1394H in the hexadecimal form (5012 in the decimal form).

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

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

Function code	Name	Description	Setting range	Default	Modify
P01.20	Wake-up-from-sleep delay	0.0–3600.0s (valid when P01.19 is 2)	0.00–3600.0	0.0s	○
P01.21	Power-off restart selection	0: Disable 1: Enable	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, the value of "Wake-up-from-sleep delay" of the VFD is 5.0 (5.0=50/10).

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

01	06	01 14	00 32	49 E7
VFD 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	Meaning
01H	Invalid command	The command code received by the upper computer is not allowed to be executed. The possible causes are as follows: ● The function code is applicable only on new devices and is not implemented on this device. ● The slave is in 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 setting is invalid in the write operation. For example, a function input terminal cannot be set repeatedly.
05H	Incorrect password	The password entered in the password verification address is different from that is specified by P07.00.
06H	Incorrect data frame	The data frame sent from the upper computer 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 downstream device.
07H	Parameter read-only	The parameter to be modified in the write operation of the upper computer is a read-only parameter.
08H	Parameter cannot be modified in running	The parameter to be modified in the write operation of the upper computer cannot be modified during the running of the VFD.
09H	Password protection	If the upper computer does not provide the correct password to unlock the system to perform a read or write operation, the error of "system being locked" is reported.

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

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

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

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

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

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

For example, to set the "Channel of running commands" (P00.01, the parameter address is 0000H) to 03 for the VFD whose address is 01H, the command is as follows:

01	**06**	**00 01**	**00 03**	**98 0B**
VFD address	Write command	Parameter address	Parameter data	CRC

However, the "Running command channel" ranges from 0 to 2. The value 3 is out of the setting range. In this case, the VFD returns an error message response.

01	**86**	**04**	**43 A3**
VFD address	Exception response code	Error code	CRC

The exception response code 86H (generated based on the MSB "1" of the write command 06H) indicates that it is an exception response to the write command (06H). The error code is 04H that indicates the error "Operation failure", which means "The parameter is set to an invalid value in the write operation".

9.4.7 Read/Write operation examples

For the formats of the read and write commands, see sections 9.4.1 Command code 03H, reading N words (continuously up to 16 words) and 9.4.2 Command code 06H, writing a word.

9.4.7.1 Example of read command 03H

Example 1: Read SW 1 of the VFD whose address is 01H. According to the addresses of other function parameters in Table 9-1, the parameter address of status word 1 of the VFD is 2100H, the read command sent to the VFD is as follows:

01	**03**	**21 00**	**00 01**	**8E 36**
VFD address	Read command	Parameter address	Data count	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	Type of present fault	Type of last fault	Type of 2nd-last fault	Type of 3rd-last fault	Type of 4th-last fault	Type of 5th-last fault	CRC

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

9.4.7.2 Example of write command 06H

Example 1: Set the VFD whose address is 03H to be forward running. According to the address description of other function parameters in Table 9-1, the address of "Communication-based control command" is 2000H, and 0001H indicates forward running.

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

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 100 Hz for the VFD with the address of 03H.

Function code	Name	Description	Setting range	Default	Modify
P00.03	Max. output frequency	P00.04–400Hz	100.00–400.00	50.00Hz	◎

According to the number of decimal places, the fieldbus scale of max. output frequency (P00.03) is 100. Multiply 100Hz 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 write command 10H

Example 1: Set the VFD whose address is 01H to be forward running at the frequency of 10Hz. According to the addresses of other function parameters in Table 9-1, the address of "Communication-based control command" is 2000H, 0001H indicates forward running, and the address of "Communication-based value setting" is 2001H, as shown in the following figure. 10 Hz is 03E8H in the hexadecimal form.

Function description	Address definition	Data description	R/W
Communication-based control command	2000H	0001H: Run forward	R/W
		0002H: Run reversely	
		0003H: Jog forward	
		0004H: Jog reversely	
		0005H: Stop	
		0006H: Coast to stop	
		0007H: Fault reset	
		0008H: Stop jogging	
Communication-based setting address	2001H	Communication-based frequency setting (0–Fmax, unit: 0.01Hz)	R/W
	2002H	PID reference (0–1000, in which 1000 corresponds to 100.0%)	

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	Data count	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	Data count	CRC

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

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

The address of P00.11 is 000B; 10s and 20s correspond to 0064H and 00C8H in 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	Data count	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	Data count	CRC

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

9.4.7.4 Example of Modbus communication commissioning

A PC is used as the host, an RS232-RS485 converter is used for signal conversion, and the PC serial port used by the converter is COM1 (an RS232 port). The upper computer 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:

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

Note:

✧ Set the address (P14.00) of the VFD to 03.

✧ Set "Channel of running commands" (P00.01) to "Communication", and set "Communication channel of running commands" (P00.02) to the Modbus communication channel.

✧ Click **Send**. If the line configuration and settings are correct, a response from the VFD is received.

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.

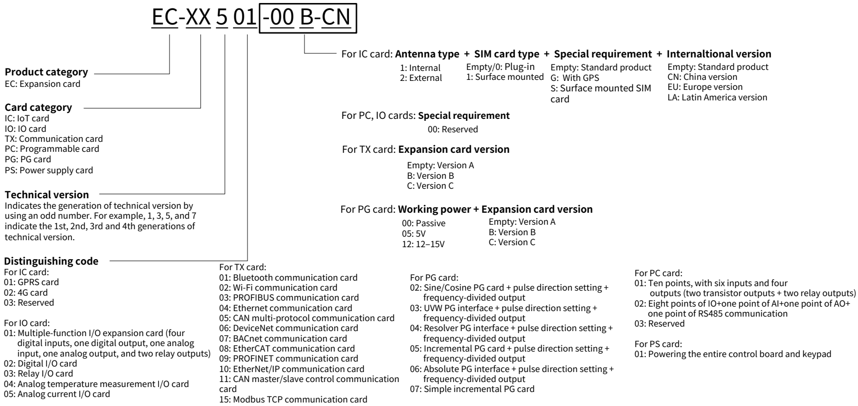
2. The settings of the baud rates, data bits, end bits, and check bits are inconsistent with those set on the VFD.

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



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

Name	Model	Specification	Ordering information
I/O 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
	EC-IO503-00	● Two digital inputs ● Six relay outputs	11023- 00136
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 physical layer ● Supporting the CANopen protocol ● Adopting INVT master-slave control proprietary protocol	11023- 00164
PROFINET communication card	EC-TX509C	● Supporting the PROFINET protocol	11023- 00149
EtherNet IP/	EC-TX510B	When the switch selects EtherNet IP:	11023- 00197

Name	Model	Specification	Ordering information
Modbus TCP protocol communication card		● Supporting the EtherNet IP protocol and EtherNet IP ● Equipped with two EtherNet IP ports, supporting 10M/100M half/full duplex operating. ● Equipped with two RJ45 interfaces, which do not distinguish the direction and can be swappable ● Supporting star and line IP network topologies When the switch selects Modbus TCP: ● Supporting the Modbus TCP protocol and Modbus TCP secondary nodes ● Equipped with two Modbus TCP ports, supporting 10M/100M half/full duplex operating ● Supporting star and line TCP network topologies When the switch selects Ethernet: ● Supporting INVT Ethernet protocol ● Supporting the connection to INVT's upper computer monitoring software INVT Workshop for monitoring and oscillography, allowing multi-card networking monitoring	
24V power supply expansion card	EC-PS501-24	● Input voltage range: DC18–30V(Rated 24Vdc)/2A ● Three channels of output voltage: +5V/1A (±5%), +15V/0.2A (±10%), -15V/0.2A (±10%)	11023-00135

A.2 Dimensions and installation

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

All the VFD models provide two expansion card slots. Note the following when installing or uninstalling an expansion card:

1. Ensure that no power is applied before installing the expansion card.
2. To ease wiring, comply with the following although any supported expansion card at either slot

can be identified:

VFD power range	Installation precautions
1.5kW–7.5kW	Install a communication card in SLOT2. Before installing a DP communication card, remove the middle casing and lower casing.
11kW–500kW	It is recommended to install a DP communication card in SLOT1.

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

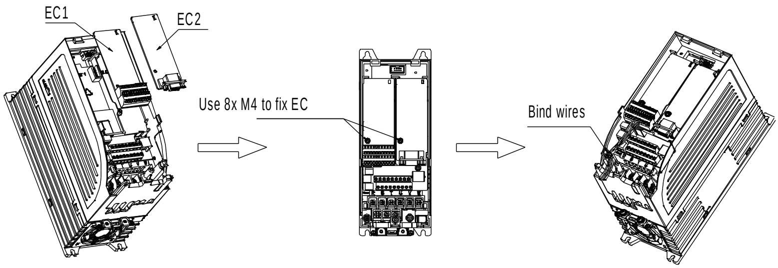


Figure A-1 1.5kW–7.5kW VFDs with expansion cards installed

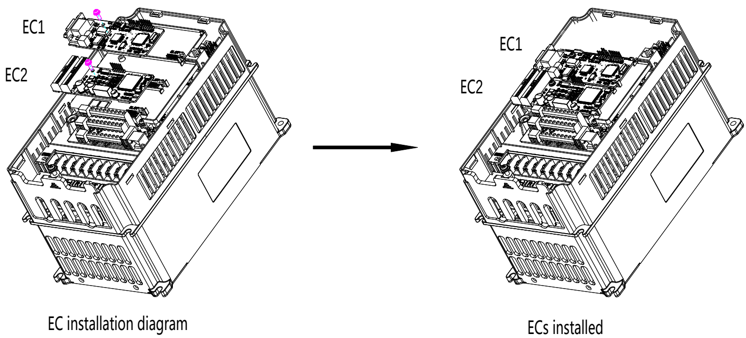


Figure A-2 11kW–500kW VFDs with expansion cards installed

Figure A-3 shows the expansion card installation procedure.

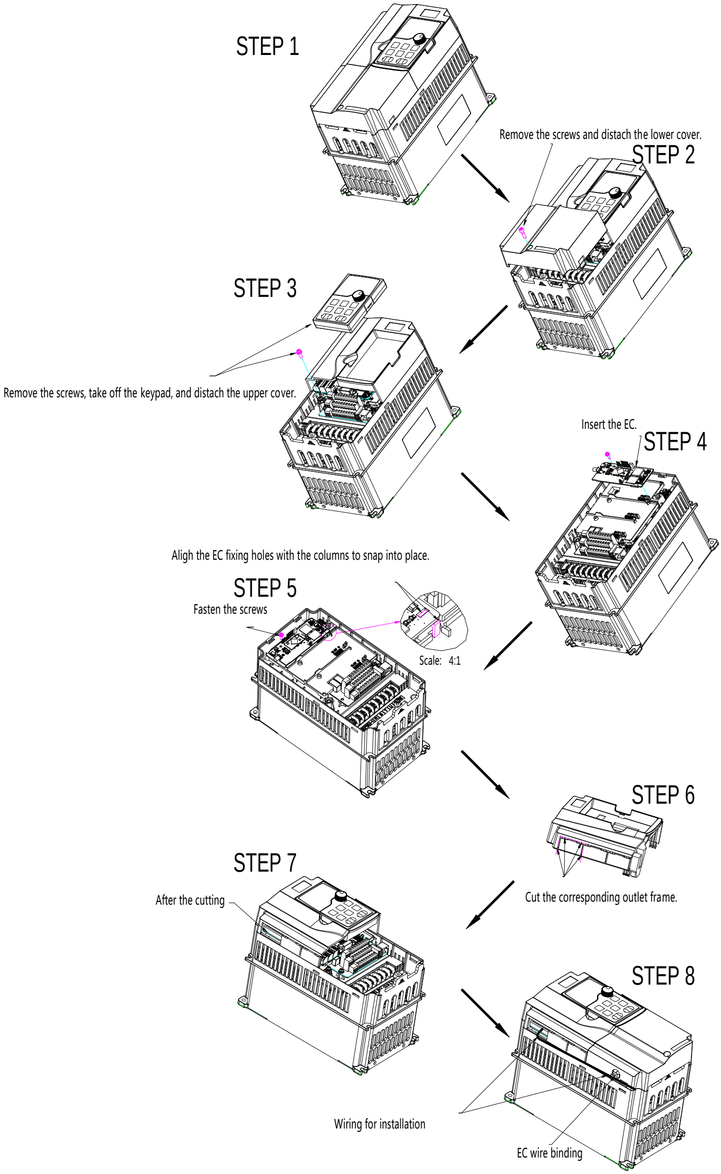


Figure A-3 Expansion card installation procedure

A.3 Wiring

1. Ground a shielded cable as follows.

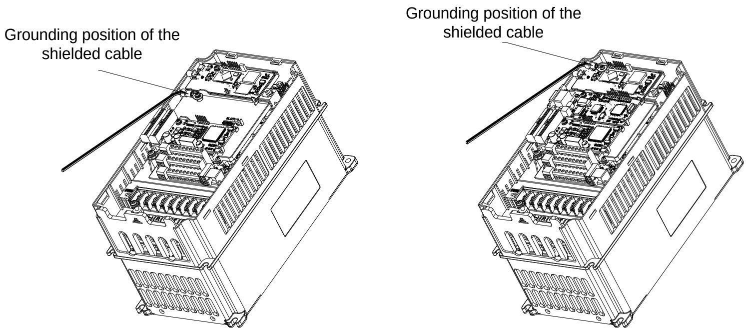


Figure A-4 Expansion card grounding cable connection

2. Wire an expansion card as follows:

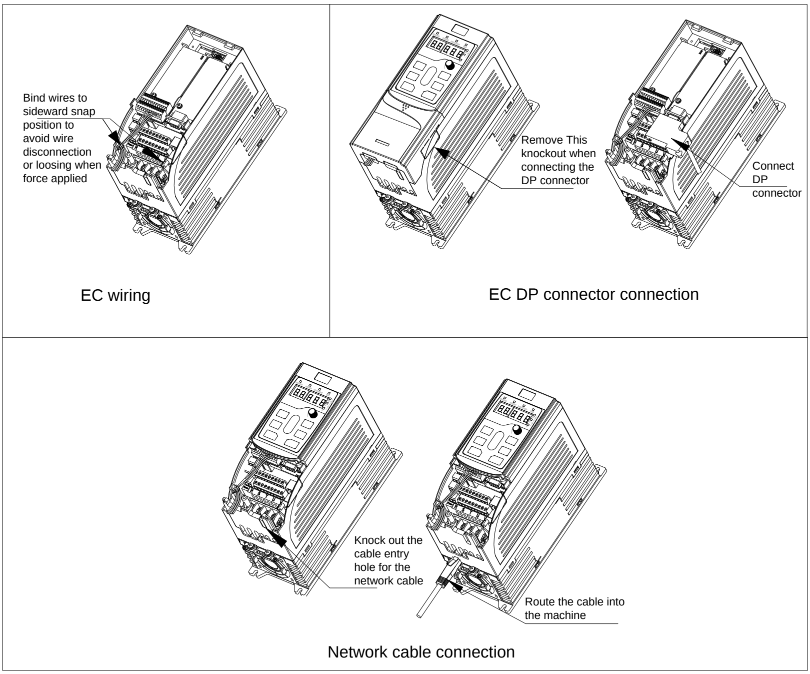


Figure A-5 Expansion card wiring for 1.5kW–7.5kW VFDs

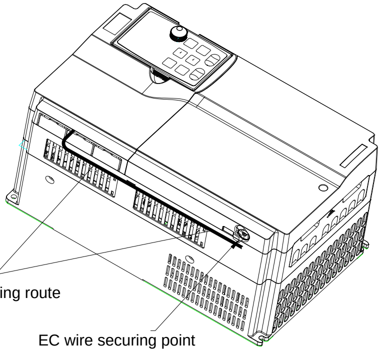
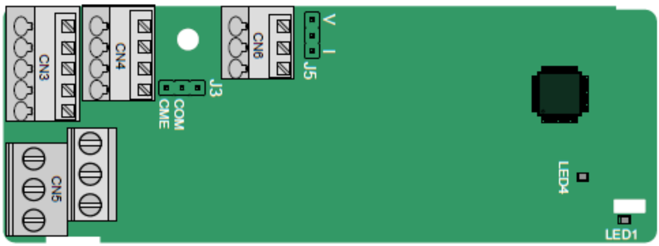


Figure A-6 Expansion card wiring for 11kW–500kW VFDs

A.4 I/O expansion cards

A.4.1 EC-IO501-00



The terminals are arranged as follows:

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

AI3	AO2	GND

COM	CME	Y2	S5	
PW	+24V	S6	S7	S8

RO3A	RO3B	RO3C	
	RO4A		RO4C

Indicator definition:

Indicator	Definition	Function
LED1	Status indicator	On: The expansion card is connecting with the control board. Blinking (On: 500ms; Off: 500ms): The expansion card is properly connected to the control board. Off: The expansion card is disconnected from the control board.
LED4	Power indicator	On: The expansion card is powered on.

Indicator	Definition	Function
		Off: The expansion card is not powered on.

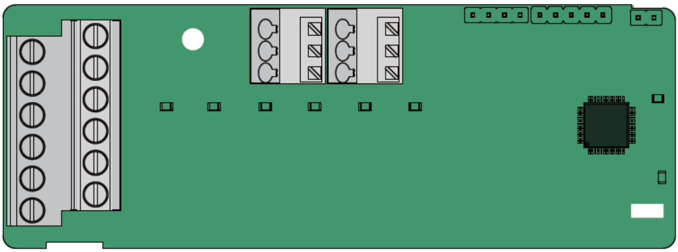
The EC-IO501-00 extension card can be used in scenarios where the I/O interfaces of a VFD cannot meet the application requirements. It can provide 4 digital inputs, 1 digital output, 1 analog input, 1 analog output, and two relay outputs. It is user-friendly, providing relay outputs through European-type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

EC-IO501-00 terminal functions:

Category	Terminal symbol	Terminal name	Description
Power supply	PW	External power supply	Used to provide input digital working power from the external to the internal Voltage range: 12–24V PW and +24V have been short connected before delivery.
Analog input and output	AI3—GND	Analog input 1	1. Input range: For AI3, 0(2)–10V or 0(4)–20mA 2. Input impedance: 20kΩ for voltage input; 250Ω for current input 3. Whether voltage or current is used for input is set through the corresponding function code. 4. Resolution: 5mV when 10V corresponds to 50Hz 5. Deviation: ±0.5%; input of 5V or 10mA or higher at the temperature of 25°C
	AO2—GND	Analog output 1	1. Output range: 0(2)–10V or 0(4)–20mA 2. Whether voltage or current is used for output is set through the jumper J5. 3. Deviation: ±0.5%; output of 5V or 10mA or higher at the temperature of 25°C
Digital input/output	S5—COM	Digital input 1	1. Internal impedance: 3.3kΩ 2. 12–30V voltage input is acceptable. 3. Bi-direction input terminal 4. Max. input frequency: 1kHz
	S6—COM	Digital input 2	
	S7—COM	Digital input 3	
	S8—COM	Digital input 4	
	Y2—CME	Digital output	1. Switch capacity: 200mA/30V 2. Output frequency range: 0–1kHz 3. The terminals CME and COM are shorted through J3 before delivery.
Relay output	RO3A	NO contact of relay 3	1. Contact capacity: 3A/AC250V, 1A/DC30V 2. Cannot be used as high frequency digital

Category	Terminal symbol	Terminal name	Description
	RO3B	NC contact of relay 3	output.
	RO3C	Common contact of relay 3	
	RO4A	NO contact of relay 4	
	RO4C	Common contact of relay 4	

A.4.2 EC-IO503-00



The terminals of EC-IO503-00 are arranged as follows:

COM	S9	S10

COM	PW	+24V

RO5A	RO5C	RO6A	RO6C	RO7A	RO7C
RO8A	RO8C	RO9A	RO9C	RO10A	RO10C

Indicator definition:

Indicator	Definition	Function
LED1	Status indicator	On: RO5 is switched on. Off: RO5 is switched off.
LED2	Status indicator	On: RO6 is switched on. Off: RO6 is switched off.
LED3	Status indicator	On: RO7 is switched on. Off: RO7 is switched off.
LED4	Status indicator	On: RO8 is switched on. Off: RO8 is switched off.
LED5	Status indicator	On: RO9 is switched on. Off: RO9 is switched off.

Indicator	Definition	Function
LED6	Status indicator	On: RO10 is switched on. Off: RO10 is switched off.
LED7	Power indicator	On: The expansion card is powered on. Off: The expansion card is not powered on.
LED8	Status indicator	On: The expansion card is connecting with the control board. Blinking (On: 500ms; Off: 500ms): The expansion card is properly connected to the control board. Off: The expansion card is disconnected from the control board.

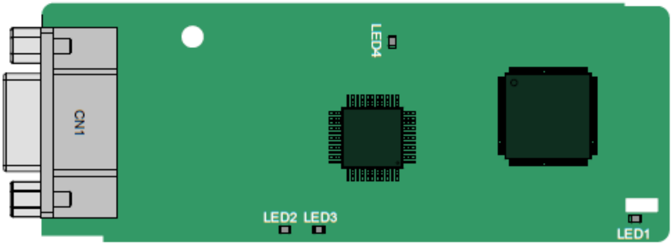
EC-IO503-00 can be used in scenarios where the I/O interfaces of VFD cannot meet the application requirements. It can provide 2 analog inputs and 6 analog outputs. It is user-friendly, providing relay outputs through European-style screw terminals and other inputs and outputs through spring terminals.

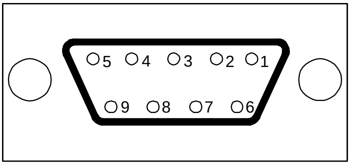
EC-IO503-00 terminal function description

Category	Terminal symbol	Terminal name	Description
Power supply	COM	External power supply	Used to provide I/O expansion card working power from the external to the internal Voltage: +24V PW and +24V are shorted during use
	PW		
	+24V		
Digital input	S9—COM	Digital input 1	Internal impedance: 3.3kΩ 12–30V voltage input is acceptable. Max. input frequency: 1kHz
	S10—COM	Digital input 2	
Relay output	RO5A	NO contact of relay 5	Contact capacity: 3A/AC250V, 1A/DC30V Cannot be used as high frequency digital output.
	RO5C	NO contact of relay 5	
	RO6A	NO contact of relay 6	
	RO6C	NO contact of relay 6	
	RO7A	NO contact of relay 7	
	RO7C	NO contact of relay 7	
	RO8A	NO contact of relay 8	
	RO8C	NO contact of relay 8	
	RO9A	NO contact of relay 9	
	RO9C	NO contact of relay 9	
	RO10A	NO contact of relay 10	
	RO10C	NO contact of relay 10	

A.5 Communication cards

A.5.1 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 connecting with the control board. Blinking (On: 500ms; Off: 500ms): The expansion card is properly connected to the control board. Off: The expansion card is disconnected from the control board.
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. Blinking: The communication card is not in the offline state. Blinking at the frequency of 1 Hz: A configuration error occurs. The length of the user parameter data set during the initialization of the communication card is different from that during the network configuration. Blinking at the frequency of 2 Hz: User parameter data is incorrect. The length or content of the user parameter data set during the initialization of the communication card is different from that during the network configuration. It blinks at the frequency of 4Hz when an error occurs in the ASIC initialization of PROFIBUS communication. Off: The diagnosis function is disabled.
LED4	Power indicator	On: The expansion card is powered on. Off: The expansion card is not powered on.

Note: For details, see the communication card manual.

A.5.2 CAN multi-protocol communication card (EC-TX505D)

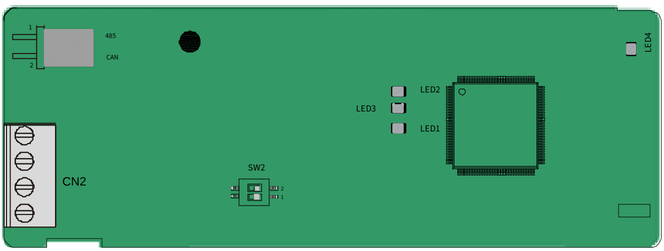


Table A-1 Parts on the EC-TX505D expansion card

Symbol	Name	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-.
		A 120 Ω terminal resistor is connected between RS485+ and RS485-.

Symbol	Name	Description
CAN	CAN terminal resistor switch	No terminal resistor is connected between CAN_H and CAN_L.
		A 120 Ω terminal resistor is connected between CAN_H and CAN_L.

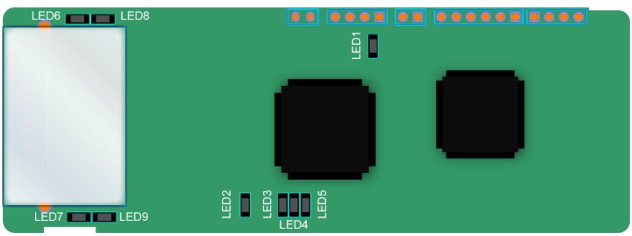
Note: For this card, before power-on, set the SW2 switch according to the mapping between protocols and positions.

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

Indicator	Definition	Function
LED1	Status indicator	On: The expansion card is connecting with the control board. Blinking (On: 500ms; Off: 500ms): The expansion card is properly connected to the control board. Off: The expansion card is disconnected from the control board.
LED2	Run indicator	On: The communication card is in the operating state. Blinking (On: 250ms; Off: 250ms): The communication card is in the pre-operation state. Off: A fault occurs; the reset pin of the communication card and the power supply are not properly connected; the expansion card is in a stopped state.
LED3	Fault indicator	On: The CAN controller bus is off; a fault occurs on the VFD; received frame lost or incorrect. Off: The communication card is in the working state.
LED4	Power indicator	On: The expansion card is powered on. Off: The expansion card is not powered on.

Note: For details, see the communication card manual.

A.5.3 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	TX+	Transmit Data+
2	TX-	Transmit Data-
3	RX+	Receive Data+
4	n/c	Not connected
5	n/c	Not connected
6	RX-	Receive Data-
7	n/c	Not connected
8	n/c	Not connected

Indicator definition:

The PROFINET communication card has 9 indicators, among which LED1 is the power indicator, LED2–LED5 are the communication status indicators of the communication card, and LED6–LED9 are the status indicators of the network port.

Indicator	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 OK, but the communication is not established.
		Off	Communication with the PROFINET controller has been established.
LED3 (System fault indicator)	Green	On	PROFINET diagnosis exists.
		Off	No PROFINET diagnosis.
LED4 (Slave ready indicator)	Green	On	TPS-1 protocol stack has started.
		Blinking	TPS-1 waits for MCU initialization.
		Off	TPS-1 protocol stack does not start.
LED5 (Maintenance status indicator)	Green	/	Manufacturer-specific, depending on the characteristics of the device.
LED6/7 (Network port status indicator)	Green	On	The PROFINET communication card and PC/PLC have been connected by using a network cable.
		Off	The connection between the PROFINET communication card and PC/PLC has not been established.
LED8/9	Green	On	The PROFINET communication card and PC/PLC

Indicator	Color	State	Description
(Network port communication indicator)			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 in Figure A-7.

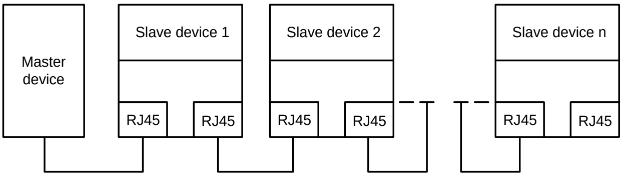


Figure A-7 Linear network topology electrical connection diagram

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

The star network topology electrical connection diagram is shown in Figure A-8.

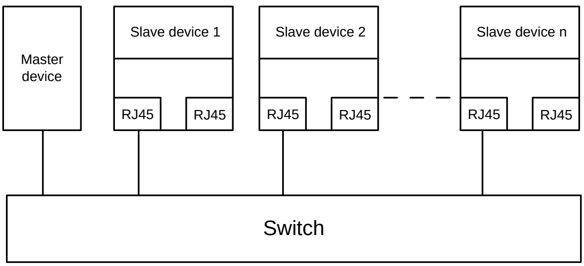
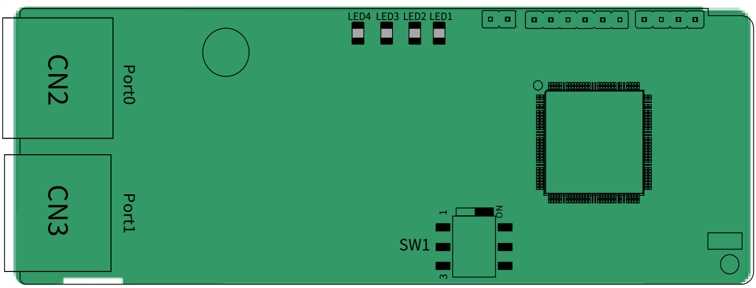


Figure A-8 Star network topology electrical connection diagram

A.5.4 EtherNet IP and Modbus TCP protocol communication card (EC-TX510B)



The expansion card has two communication ports, both of which adopt standard RJ45 interfaces and can be interchangeably inserted. It supports selecting the protocol via the DIP switch before power-on. The default selection is EtherNet IP, with Modbus TCP and INVT's own Ethernet UDP protocol as optional choices.

Note: For this card, before power-on, set the SW2 switch according to the mapping between protocols and positions.

Table A-2 Switch definition

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

Table A-3 EtherNet IP indicator description

Indicator	Color	Definition	Function
LED1	Green	On	The expansion card is shaking hands with the VFD.
		Blinking (1Hz)	The expansion card and VFD communicate normally.
		Off	The expansion card and VFD communicate improperly.
LED2	Green	On	The communication between the expansion card and the PLC is online and data exchange is allowed.
		Off	The communication between the expansion card and PLC is offline.
LED3	Red	On	Failed to set up I/O between the expansion card and the PLC.
		Blinking (1Hz)	Incorrect PLC configuration.
		Blinking (2Hz)	The expansion card failed to send data to the PLC.
		Blinking (4Hz)	The connection between the expansion card and PLC timed out.
		Off	No fault
LED4	Red	On	3.3V power indicator

Table A-4 Modbus TCP indicator description

Indicator	Color	Definition	Function
LED1	Green	On	The expansion card is shaking hands with the VFD.
		Blinking (1Hz)	The expansion card and VFD communicate normally.
		Off	The expansion card and VFD communicate improperly.
LED2	Green	On	The communication between the expansion card and the PLC is online and data exchange is allowed.
		Off	The communication between the expansion card and PLC is offline.
LED3	Red	On	Expansion card has no valid data received.

Indicator	Color	Definition	Function
		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-5 Ethernet indicator description

Indicator	Color	Definition	Function
LED1	Green	On	The expansion card is shaking hands with the VFD.
		Blinking (1Hz)	The expansion card and VFD communicate normally (handshake successful).
		Off	The expansion card and VFD communicate improperly.
LED2	Green	On	The connection between the expansion card and PC is successful.
		Off	The connection between the expansion card and PC has failed (abnormal network cable).
LED3	Red	Blinking (4Hz)	The expansion card is successfully connected to the PC but communication fails (abnormal IP address).
		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, star, and ring 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.

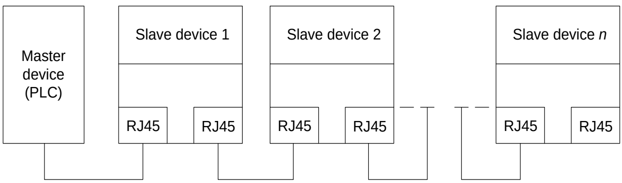


Figure A-9 Linear network topology electrical connection

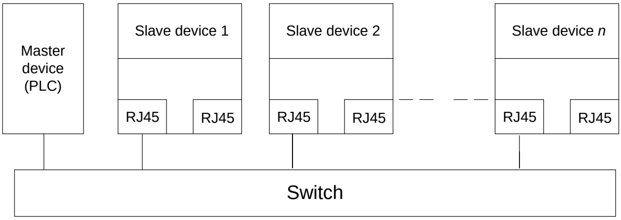


Figure A-10 Star network topology electrical connection

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

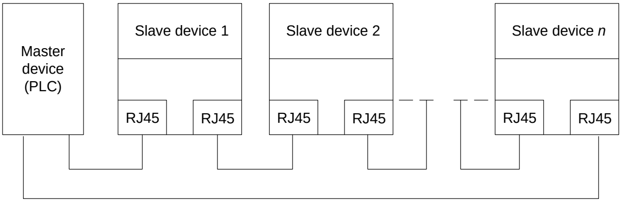


Figure A-11 Ring network topology electrical connection

A.5.5 24V power supply expansion card (EC-PS501-24)

Indicator definition:

Indicator	Definition	Function
LED1	24V power indicator	Indicator for the external 24V power.
LED2	5V power indicator	Indicator for the 5V power that is provided for the control board after the switch power converts external power.

The 24V power supply card is mainly used to connect to external 24V power to power the control board, avoiding to apply electricity for independent control board commissioning. During wiring, connect to +24V and COM according to the CN2 sign.

Appendix B Technical data

B.1 What this chapter contains

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

B.2 Derated application

B.2.1 Capacity

Choose a VFD model based on the rated current and power of the motor. To endure the rated power of the motor, the rated output current of the VFD must be larger or equal to the rated current of the motor. The rated power of the VFD must be higher or equal to that of the motor.

Note:

✧ The rated capacity is the capacity at the ambient temperature of 40°C.

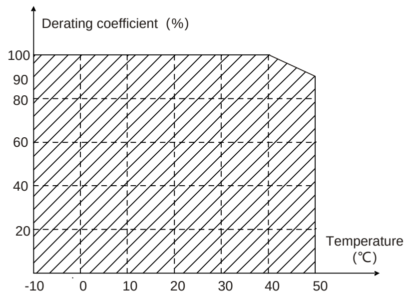
✧ You need to check and ensure that the power flowing through the common DC connection in the common DC system does not exceed the rated power of the motor.

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.



Note: It is not recommended to use the VFD at an environment with the temperature higher than 50°C. If you do, you shall be held accountable for the consequences caused.

B.2.2.2 Derating due to altitude

The VFD does not need to be derated when it is used below an altitude of 1000m. When it is used in the altitude range of 1000–4800m, the capacity is reduced by 1% for every increase of 100m.

Note: When the VFD is used at altitudes above 2000 meters and with a corner-grounded system, special considerations are required. For more information, contact the local INVT representative.

B.2.2.3 Derating due to carrier frequency

The carrier frequency of the VFD varies with power class. The VFD rated power is defined based on the carrier frequency factory setting. If the carrier frequency exceeds the factory setting, the VFD power is derated by 10% for each increased 1 kHz.

B.3 Grid specifications

Grid voltage	AC 3PH 380V–480V
Short-circuit capacity	According to the definition in IEC 61439-1, the maximum allowable short-circuit current at the incoming end is 100kA. Therefore, the VFD is applicable to scenarios where the transmitted current in the circuit is no larger than 100 kA when the VFD runs at the maximum rated voltage.
Frequency	50/60Hz±5%, with a maximum change rate of 20%/s

B.4 Motor connection data

Motor type	Asynchronous motor (AM)
Voltage	0–U_1 (motor rated voltage), 3PH symmetrical, U_{max} (VFD rated voltage) at the field-weakening point
Short-circuit protection	The motor output short-circuit protection meets the requirements of IEC 61800-5-1.
Frequency	0–400Hz
Frequency resolution	0.01Hz
Current	See section 3.6 Product ratings.
Power limit	1.1 times of the motor rated power
Field-weakening point	10–400Hz
Carrier frequency	2, 4, 8, 12, or 15 kHz

B.4.1 EMC compatibility and motor cable length

The 132G/160P and high VFDs are equipped with a built-in filter as standard, meeting the EN 61800-3 C3 requirements and supporting a motor cable length (with the shield layer) of up to 50 meters.

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

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 618003) describes the EMC standards and specific test methods for adjustable speed electrical power drive systems. Our products have been compliant with these EMC regulations.

B.6 EMC regulations

The EMC product standard (EN 61800-3) describes the EMC requirements on VFDs.

Application environment categories:

First environment: Civilian environment, including application scenarios where VFDs are directly connected to the civil power supply low-voltage grids without intermediate transformers.

Second environment: All environments other than those directly connected to low-voltage power supply networks serving civilian applications.

VFD categories:

C1: VFD of rated voltage lower than 1000V, applied to the first environment.

C2: VFD of rated voltage lower than 1000V, which is neither a non-plug, socket, nor mobile devices and must be installed and commissioned by a professional person when used in the first environment.

Note: The EMC standard IEC/EN 61800-3 no longer restricts the power distribution of the VFD, but defines the use, installation, and commissioning of the VFD. Specialized personnel or organizations must have the necessary skills (including the EMC-related knowledge) for installing and/or performing commissioning on the electrical drive systems.

C3: VFD of rated voltage lower than 1000V, applied to the second environment. They cannot be applied to the first environment.

C4: VFD of rated voltage higher than 1000V, or rated current higher or equal to 400A, applied to complex systems in the second environment.

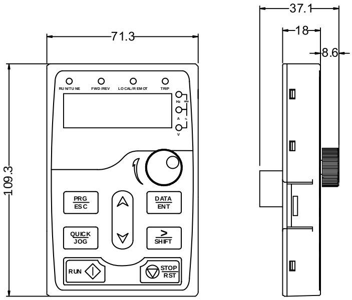
Appendix C Dimension drawings

C.1 What this chapter contains

This chapter provides VFD dimensions, which use millimeter (mm) as the unit.

C.2 Keypad structure

C.2.1 Structure diagram



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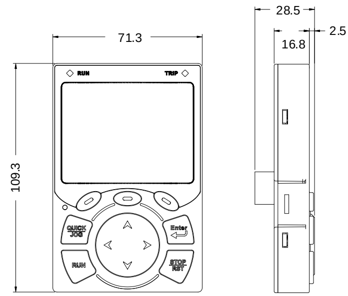
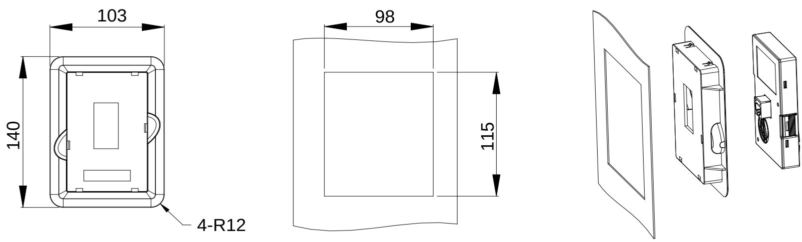


SOP-290

C.2.2 External mounting method of keypad

When you need to externally mount the optional LED or LCD keypad of the VFD on a cabinet door, two installation methods are available:

Method 1: Cut an opening in the cabinet door according to the specified dimensions shown in Figure C-1, and use an optional external mounting bracket (Model: GD350-JPZJ) for flush mounting. Then install the keypad into the bracket.

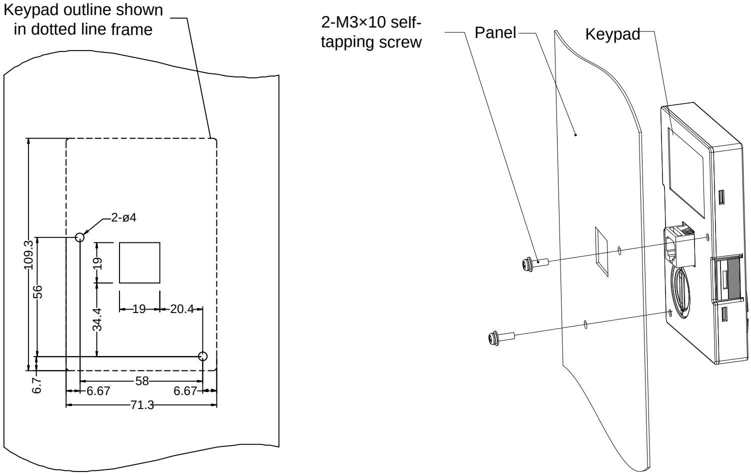


Keypad adapter bracket

Installation dimensions

Figure C-1 (Optional) Keypad mounting bracket

Method 2: Drill the keypad cutout and mounting holes as specified in Figure C-2, and directly fasten the keypad using the two included M3 self-tapping screws.



Dimensions and hole sizes for keypad without mounting bracket

Figure C-2Opening dimensions for keypad without mounting bracket

Note:

✧ When the keypad of VFDs in T5–T12 frames is externally mounted, the local keypad port is more likely to be exposed to dust and foreign objects. It is recommended to purchase and install a keypad protection cover (Model: GD270-JPFH) to seal the opening, as shown in Figure C-3.

✧ The network cable outlet on the protection cover for this series is not used. For details, refer to the external keypad wiring requirements in 4.3.6 External optional keypad wiring.

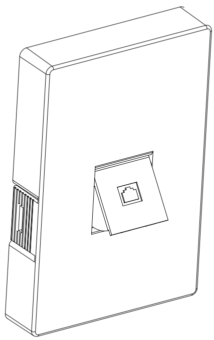
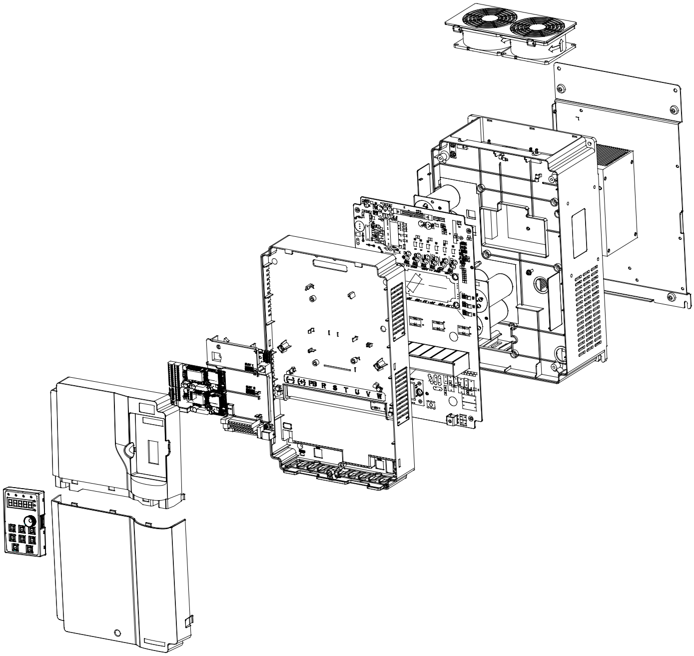


Figure C-3 Keypad protection cover

C.3 VFD structure



C.4 Product dimensions

C.4.1 Wall mounting dimensions

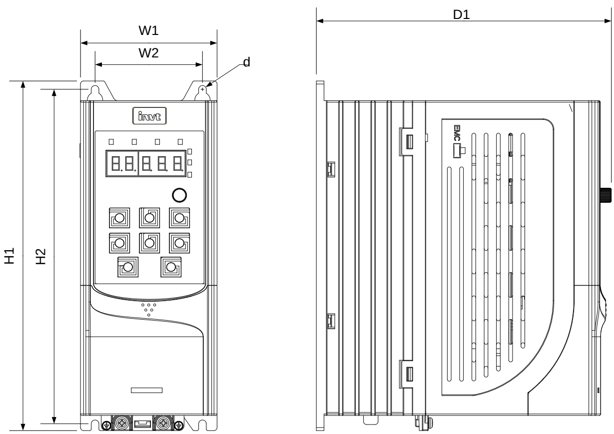


Figure C-4 Wall mounting for VFDs in T1–T2 frames

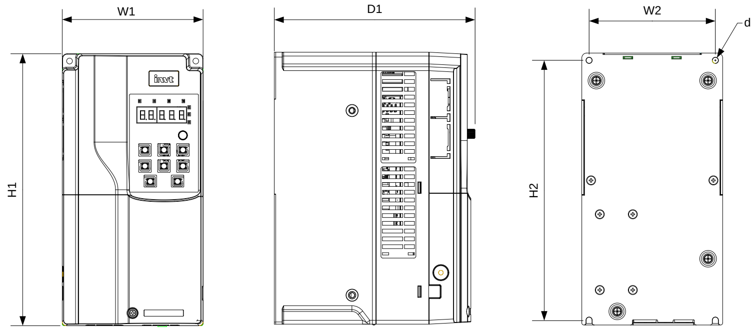


Figure C-5 Wall mounting for VFDs in T3–T6 frames

Table C-1 Wall mounting dimensions for VFDs in T1–T6 frames

Frame	Outline dimensions (mm)			Hole distance (mm)			Hole diameter	Fixing screw
	W1	H1	D1	H2	W2	D2		
T1	89	231	193	221	70	/	ø5	M4
T2	89	259	211.5	248	70	/	ø6	M5
T3	145	280	207	268	130	/	ø6	M5
T4	169	320	214	308	154	/	ø6	M5
T5	200	341	214	328.5	185	/	ø6	M5
T6	250	400	228	380	230	/	ø6	M5

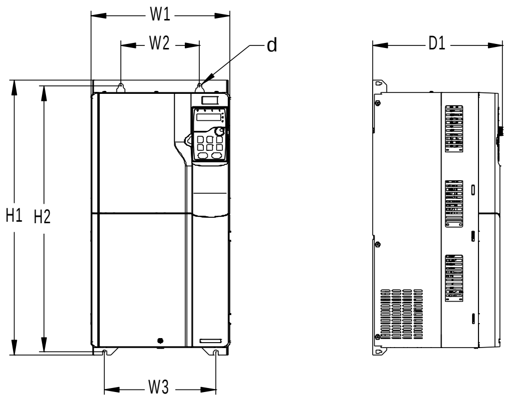


Figure C-6 Wall mounting for VFDs in T7 frame

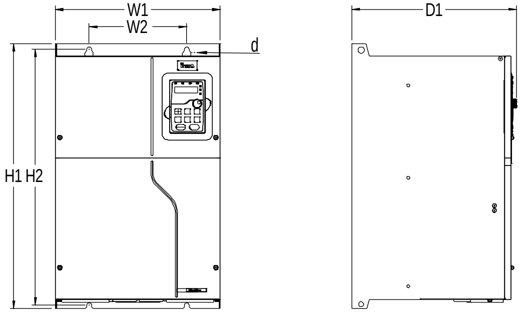


Figure C-7 Wall mounting for VFDs in T8–T9 frames

Table C-2 Wall mounting dimensions for VFDs in T7–T9 frames

Frame	Outline dimensions (mm)			Hole distance (mm)			Hole diameter	Fixing screw
	W1	H1	D1	H2	W2	W3		
T7	282	560	264	542	160	226	ø9	M8
T8	338	554	338	534	200	/	ø9.5	M8
T9	338	825	398	800	260	/	ø11	M10

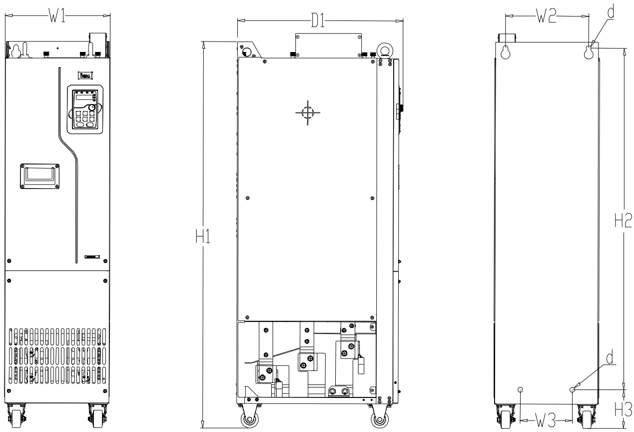


Figure C-8 Wall mounting for VFDs in T10 frame

Table C-3 Wall mounting dimensions for VFDs in T10 frame

Frame	Outline dimensions (mm)			Hole distance (mm)			Hole diameter	Fixing screw
	W1	H1	D1	H2	W2	W3		
T10	303	1108	477	980	240	150	ø14	M12

C.4.2 Flange mounting dimensions

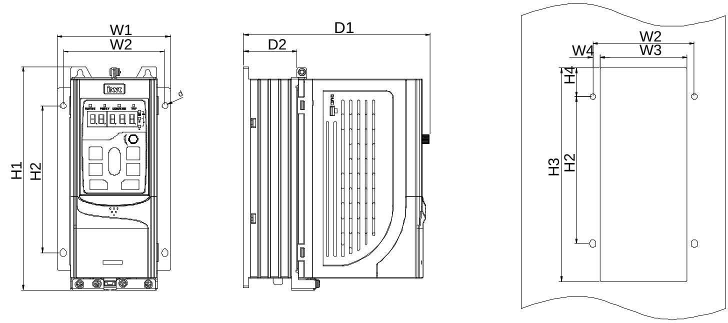


Figure C-9 Flange mounting for VFDs in T1–T2 frames

Table C-4 Flange mounting dimensions for VFDs in T1–T2 frames

Frame	Outline dimensions (mm)			Hole distance (mm)							Hole diameter	Screw
	W1	H1	D1	H2	H3	H4	W2	W3	W4	D2		
T1	117	233.5	193	153.5	225	30	105	92.5	6.5	55	ø6	M5
T2	117	261	211.5	180	250	30	105	92.5	6.5	75	ø6	M5

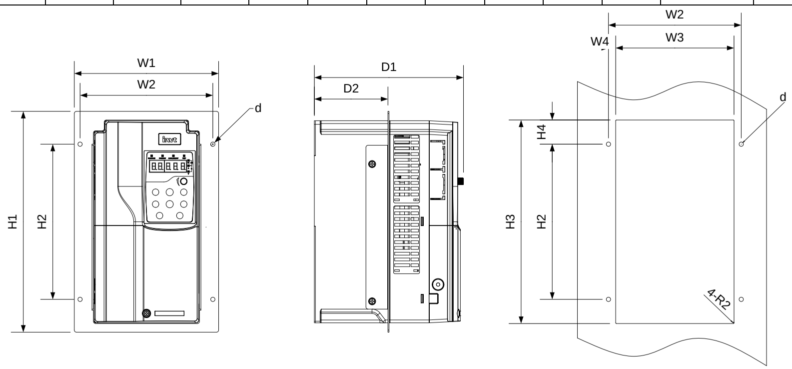


Figure C-10 Flange mounting for VFDs in T3–T4 frames

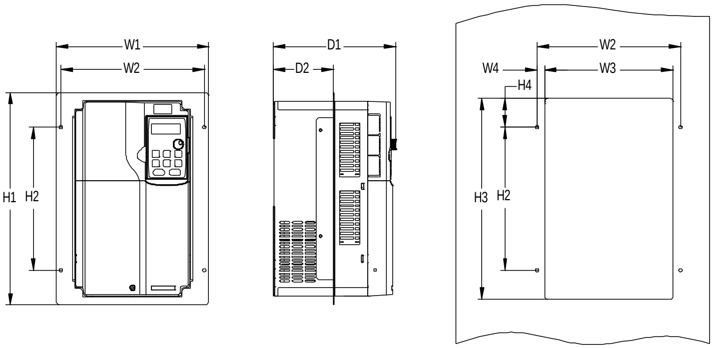


Figure C-11 Flange mounting for VFDs in T5–T7 frames

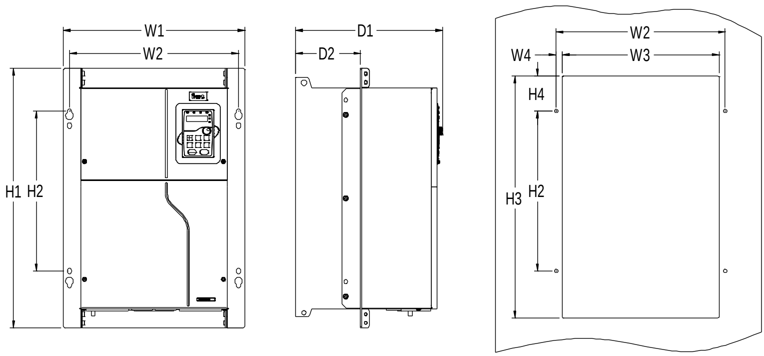


Figure C-12 Flange mounting for VFDs in T8–T9 frames

Table C-5 Flange mounting dimensions for VFDs in T3–T9 frames

Frame	Outline dimensions (mm)			Hole distance (mm)							Hole diameter	Screw
	W1	H1	D1	H2	H3	H4	W2	W3	W4	D2		
T3	200	306	207	215	282	33.5	184	164	10	102	ø6	M5
T4	224	346	214	255	322	33.5	208	189	9.5	108	ø6	M5
T5	266	371	214	250	350.5	50.5	250	224	13	104	ø6	M5
T6	316	430	228	300	410	55	300	274	13	118.5	ø6	M5
T7	352	580	264	400	570	90	332	306	13	134	ø9	M8
T8	418.5	600	338	370	559	80.5	389.5	361	14	149.5	ø10	M8
T9	428	868	398.5	625	830	80	394	345	24.5	183	ø11	M10

C.4.3 Floor mounting dimensions

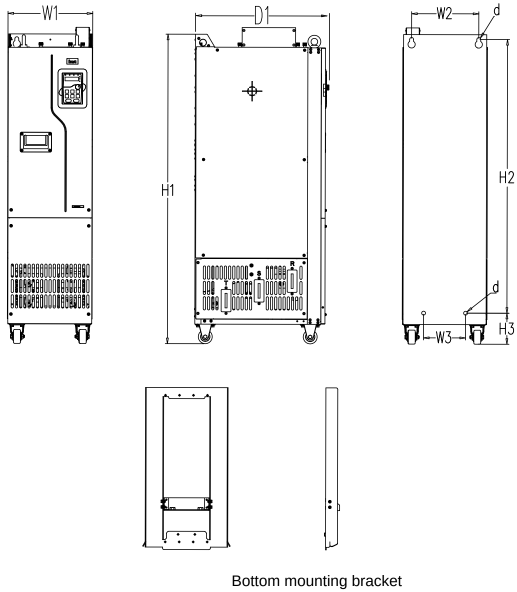
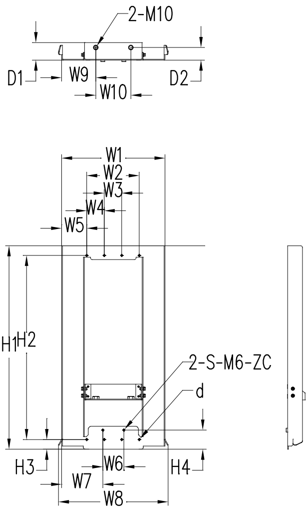


Figure C-13 Floor mounting for VFDs in T10–T12 frames

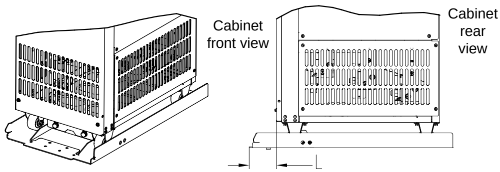
Table C-6 Floor mounting dimensions for VFDs in T10–T12 frames

Frame	Outline dimensions (mm)			Hole distance (mm)				Hole diameter	Screw
	W1	H1	D1	H2	H3	W2	W3		
T10	303	1108	477	980	111	240	150	ø14	M12
T11	330	1288	552	1150	122	225	185	ø13	M10
T12	330	1398	552	1280	101	240	200	ø13	M10

Note: For details about the base mounting bracket, see Figure C-14 and Table C-7.



Bottom mounting bracket dimensions



Mating position diagram between bottom mounting bracket and cabinet

Figure C-14 Cabinet bottom mounting bracket dimensions and installation for VFDs in T10–T12 frames

Table C-7 Cabinet bottom mounting bracket dimensions for VFDs in T10–T12 frames

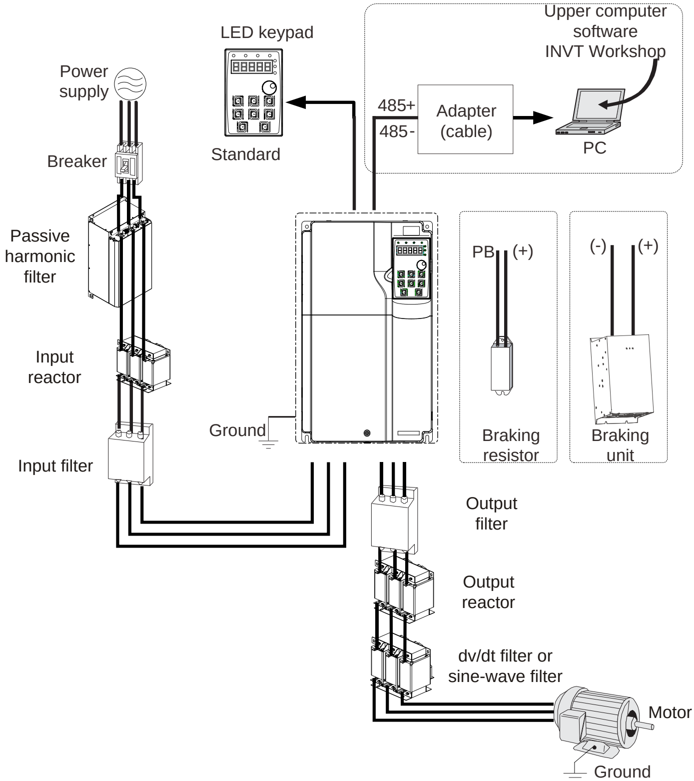
<table>
<tr><th>Frame</th><th>W1</th><th>W2</th><th>W3</th><th>W4</th><th>W5</th><th>W6</th><th>W7</th><th>W8</th><th>W9</th><th>W10</th><th>H1</th><th>H2</th><th>H3</th><th>H4</th><th>D1</th><th>D2</th><th>d</th><th>Screw</th><th>L</th></tr>
<tr><td>T10</td><td>295</td><td>150</td><td>50</td><td>50</td><td>71.5</td><td>60</td><td>117.5</td><td>313</td><td>97.5</td><td>100</td><td>580</td><td>525</td><td>27.5</td><td>54.5</td><td>50</td><td>36</td><td>6</td><td>M5</td><td>77.5</td></tr>
<tr><td>T11</td><td rowspan="2">321</td><td rowspan="2">150</td><td rowspan="2">50</td><td rowspan="2">50</td><td rowspan="2">84.5</td><td rowspan="2">60</td><td rowspan="2">130.5</td><td rowspan="2">339</td><td rowspan="2">110.5</td><td rowspan="2">100</td><td rowspan="2">580</td><td rowspan="2">525</td><td rowspan="2">27.5</td><td rowspan="2">54.5</td><td rowspan="2">46</td><td rowspan="2">33.5</td><td rowspan="2">6</td><td rowspan="2">self-tapping screw</td><td>25.5</td></tr>
<tr><td>T12</td><td>25</td></tr>
</table>

Appendix D Peripheral accessories

This chapter describes how to select accessories for the VFD.

D.1 External wiring

The following figure shows the external wiring of the VFD.



Note:

- VFDs in T1–T5 frames are equipped with a built-in braking unit as standard; VFDs in T6–T8 frames support the use of an optional built-in braking unit.
- You can choose the optional built-in DC reactor, which will be installed at the factory before delivery.
- The braking units are INVT DBU series standard braking units. For details, see the DBU operation manual.

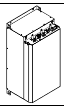
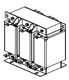
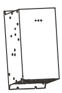
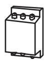
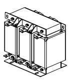
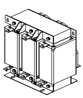
Image	Name	Description
	Cable	Medium for signal transmission.
	Breaker	Device for electric shock prevention and protection against short-to-ground that may cause current leakage and fire. Select residual-current circuit breakers (RCCBs) that are applicable to VFDs and can restrict high-order harmonics, and of which the rated sensitive current for one VFD is larger than 30mA.
	Passive harmonic filters	Device used to reduce the current distortion rate and harmonic content, thereby improving the power factor.
	Input reactor	Device used to prevent instantaneous high currents from flowing into the input power circuit and damaging rectifier components when high voltage is input from the power grid. Additionally, it can improve the power factor on the input side.
	Input filter	Device that restricts the electromagnetic interference generated by the VFD and transmitted to the public grid through the power cable. Install as close to the input terminal of the VFD as possible.
 or 	Braking unit or braking resistor	Device used to consume the regenerative energy of the motor to reduce the DEC time. T1–T6 frames only require the configuration of braking resistor. T1–T5 frames are equipped with a built-in braking unit as standard. T6–T8 frames support the use of an optional built-in braking unit.
	Output filter	Device used to suppress interference generated from the wiring on the output side of the VFD. Install as close to the output terminal of the VFD as possible.
	Output reactor	Device used to extend the effective transmission distance of the VFD and effectively suppress instantaneous high voltage generated when the IGBT module of the VFD switches.
	dv/dt filter	Device used to suppress voltage spikes, reduce traveling waves in long cables, and reflect dv/dt transient voltages, thereby reducing motor eddy current losses and noise, and providing motor insulation protection.
	Sine-wave filter	Device used to suppress and absorb high-order harmonic currents derived from switching frequency ripple currents, correcting the waveform to approximate a sine wave, significantly extending the length of the output cable, reducing

Image	Name	Description
		motor eddy current losses and noise, and protecting motor insulation.

D.2 Power supply

See chapter 4 Installation guidelines.

	Ensure that the voltage class of the VFD is consistent with that of the grid.

D.3 Cable

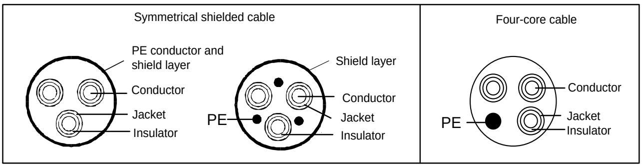
D.3.1 Power cable

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

- ✧ The input power cables and motor cables must be able to carry the corresponding load currents.
- ✧ The maximum temperature margin of the motor cables in continuous operation cannot be lower than 70°C.
- ✧ The conductivity of the PE grounding conductor is the same as that of the phase conductor, that is, the cross-sectional areas are the same.
- ✧ For details about the EMC requirements, see Appendix B Technical data.

To meet the EMC requirements stipulated in the CE standards, you must use symmetrical shielded cables as motor cables (as shown in the following figure).

Four-core cables can be used as input cables, but symmetrical shielded cables are recommended. Compared with four-core cables, symmetrical shielded cables can reduce electromagnetic radiation as well as the current and loss of the motor cables.



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

To protect the conductors, the cross-sectional area of the shielded cables must be the same as that of the phase conductors if the cable and conductor are made of materials of the same type. This reduces grounding resistance, and thus improves impedance continuity.

To effectively restrict the emission and conduction of radio frequency (RF) interference, the conductivity of the shielded cable must be at least 1/10 of the conductivity of the phase conductor. This requirement can be well met by a copper or aluminum shield layer. Figure D-1 shows the min.

requirement on motor cables of VFD. The cable must consist of a layer of spiral-shaped copper strips. The denser the shield layer is, the more effectively the electromagnetic interference is restricted.

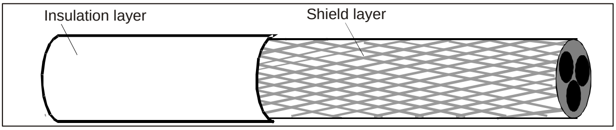


Figure D-1 Cable cross section

D.3.2 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 in Figure D-2). Use one separate shielded twisted pair for each signal. Do not use the same ground wire for different analog signals.

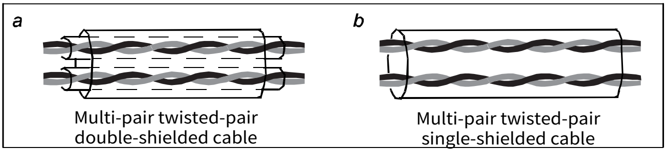


Figure D-2 Power cable arrangement

For low-voltage digital signals, double-shielded cables are recommended, but shielded or unshielded twisted pairs (as shown in figure b in Figure D-2) 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.

Keypads need to be connected by using network cables. In complicated electromagnetic environments, shielded network cables are recommended.

Note: Analog signals and digital signals cannot use the same cables, and their cables must be arranged separately.

Before delivery, each VFD undergoes an insulation withstand voltage test between the main circuit and the housing. In addition, the VFD has the internal voltage limiting circuit, which can automatically cut off the test voltage. Do not perform any voltage withstand or insulation resistance tests, such as high-voltage insulation tests or using a megohmmeter to measure the insulation resistance, on the VFD or its components.

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

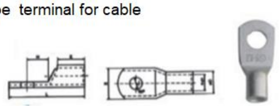
D.3.3 Recommended cable size

Table D-1 Recommended cable size

VFD model	R, S, T / U, V, W / (+), (-)		PE		Fastening torque (N·m)
	Recommended cable (BVR) mm^2	Recommended connection terminal model	Recommended cable (BVR) mm^2	Recommended connection terminal model	
GD290-0R7G/1R5P-4	1	TNR1.25-4	1	TNR1.25-4	1.2–1.5
GD290-1R5G/2R2P-4	1	TNR1.25-4	1	TNR1.25-4	1.2–1.5
GD290-2R2G/003P-4	1.5	TNR1.25-4	1.5	TNR1.25-4	1.2–1.5
GD290-003G/004P-4	1.5	TNR1.25-4	1.5	TNR1.25-4	1.2–1.5
GD290-004G/5R5P-4	2.5	TNR2-4	2.5	TNR2-4	1.2–1.5
GD290-5R5G/7R5P-4	2.5	TNR2-4	2.5	TNR2-4	1.2–1.5
GD290-7R5G/011P-4	4	TNR3.5-5	4	TNR3.5-5	2–2.5
GD290-011G/015P-4	6	TNR5.5-5	6	TNR5.5-5	2–2.5
GD290-015G/018P-4	10	TNR8-5	10	TNR8-5	2–2.5
GD290-018G/022P-4	16	TNR14-5	16	TNR14-5	2–2.5
GD290-022G/030P-4	16	GTNR16-6	16	GTNR16-5	3.5
GD290-030G/037P-4	25	GTNR25-6	16	GTNR16-5	3.5
GD290-037G/045P-4(-B)	25	GTNR25-6	16	GTNR16-5	3.5
GD290-045G/055P-4(-B)	35	GTNR35-8	16	GTNR16-6	9–11
GD290-055G/075P-4(-B)	50	GTNR50-8	25	GTNR25-6	9–11
GD290-075G/090P-4(-B)	70	GTNR70-8	35	GTNR35-6	9–11
GD290-090G/110P-4(-B)	95	GTNR95-12	50	GTNR50-8	31–40
GD290-110G/132P-4(-B)	95	GTNR95-12	50	GTNR50-8	31–40
GD290-132G/160P-4	150	GTNR150-12	70	GTNR70-8	31–40
GD290-160G-4	185	GTNR185-12	95	GTNR95-8	31–40
GD290-185P-4	185	GTNR185-12	95	GTNR95-8	31–40
GD290-200P-4	185	GTNR185-12	95	GTNR95-8	31–40
GD290-185G-4	2×95	GTNR95-12	95	GTNR95-12	31–40
GD290-220P-4	2×95	GTNR95-12	95	GTNR95-12	31–40
GD290-200G-4	2×95	GTNR95-12	95	GTNR95-12	31–40
GD290-250P-4	2×95	GTNR95-12	95	GTNR95-12	31–40
GD290-220G-4	2×150	GTNR150-12	150	GTNR150-12	31–40
GD290-280P-4	2×150	GTNR150-12	150	GTNR150-12	31–40
GD290-250G-4	2×150	GTNR150-12	150	GTNR150-12	31–40
GD290-315P-4	2×150	GTNR150-12	150	GTNR150-12	31–40
GD290-280G-4	2×185	GTNR185-12	185	GTNR185-12	31–40
GD290-355P-4	2×185	GTNR185-12	185	GTNR185-12	31–40
GD290-315G-4	2×185	GTNR185-16	2×120	GTNR120-12	92–100
GD290-400P-4	2×185	GTNR185-16	2×120	GTNR120-12	92–100

VFD model	R, S, T / U, V, W / (+), (-)		PE		Fastening torque (N·m)
	Recommended cable (BVR) mm^2	Recommended connection terminal model	Recommended cable (BVR) mm^2	Recommended connection terminal model	
GD290-355G-4	2×240	GTNR240-16	2×150	GTNR150-12	92–100
GD290-450P-4	2×240	GTNR240-16	2×150	GTNR150-12	92–100
GD290-400G-4	2×300	GTNR300-16	2×150	GTNR150-12	92–100
GD290-500P-4	2×300	GTNR300-16	2×150	GTNR150-12	92–100

Copper tube terminal for cable (GTNR)



Ring-type bare terminal (TNR)

GTNR terminal brand: Suzhou Yuanli (The model varies with the brand.)

TNR terminal brand: Suzhou Yuanli (The model varies with the brand.)

Table D-2 Recommended cable size (Compliant with UL standards)

VFD model	R, S, T / U, V, W / (+), (-)		PE		Fastening torque (N·m)
	Recommended cable (UL) AWG/Kcmil	Recommended connection terminal model	Recommended cable (UL) AWG/Kcmil	Recommended connection terminal model	
GD290-0R7G/1R5P-4	16	TLK1.5-4	16	TLK1.5-4	1.2–1.5
GD290-1R5G/2R2P-4	16	TLK1.5-4	16	TLK1.5-4	1.2–1.5
GD290-2R2G/003P-4	14	TLK2.5-4	14	TLK2.5-4	1.2–1.5
GD290-003G/004P-4	14	TLK2.5-4	14	TLK2.5-4	1.2–1.5
GD290-004G/5R5P-4	14	TLK2.5-4	14	TLK2.5-4	1.2–1.5
GD290-5R5G/7R5P-4	12	TLK4-4	12	TLK4-4	1.2–1.5
GD290-7R5G/011P-4	10	TLK6-5	10	TLK6-5	2–2.5
GD290-011G/015P-4	8	TLK10-5	8	TLK10-5	2–2.5
GD290-015G/018P-4	6	TLK16-5	6	TLK16-5	2–2.5
GD290-018G/022P-4	4	TLK25-5	4	TLK25-5	2–2.5
GD290-022G/030P-4	4	TLK25-6	4	TLK25-5	3.5
GD290-030G/037P-4	3	TLK25-6	4	TLK25-5	3.5
GD290-037G/045P-4(-B)	3	TLK25-6	4	TLK25-5	3.5
GD290-045G/055P-4(-B)	2	TLK35-8	4	TLK25-6	9–11
GD290-055G/075P-4(-B)	1/0	TLK50-8	3	TLK25-6	9–11
GD290-075G/090P-4(-B)	3/0	TLK95-8	2	TLK35-6	9–11
GD290-090G/110P-4(-B)	4/0	TLK120-12	1/0	TLK50-8	31–40
GD290-110G/132P-4(-B)	4/0	TLK120-12	1/0	TLK50-8	31–40

VFD model	R, S, T / U, V, W / (+), (-)		PE		Fastening torque (N·m)
	Recommended cable (UL) AWG/Kcmil	Recommended connection terminal model	Recommended cable (UL) AWG/Kcmil	Recommended connection terminal model	
GD290-132G/160P-4	300	TLK150-12	3/0	TLK95-8	31–40
GD290-160G-4	400	TLK240-12	4/0	TLK120-8	31–40
GD290-185P-4	400	TLK240-12	4/0	TLK120-8	31–40
GD290-200P-4	400	TLK240-12	4/0	TLK120-8	31–40
GD290-185G-4	2×4/0	2×TLK120-12	4/0	TLK120-12	31–40
GD290-220P-4	2×4/0	2×TLK120-12	4/0	TLK120-12	31–40
GD290-200G-4	2×4/0	2×TLK120-12	4/0	TLK120-12	31–40
GD290-250P-4	2×4/0	2×TLK120-12	4/0	TLK120-12	31–40
GD290-220G-4	2×300	2×TLK150-12	300	TLK150-12	31–40
GD290-280P-4	2×300	2×TLK150-12	300	TLK150-12	31–40
GD290-250G-4	2×300	2×TLK150-12	300	TLK150-12	31–40
GD290-315P-4	2×300	2×TLK150-12	300	TLK150-12	31–40
GD290-280G-4	2×400	2×TLK240-12	400	TLK240-12	31–40
GD290-355P-4	2×400	2×TLK240-12	400	TLK240-12	31–40
GD290-315G-4	2×400	2×SQNBS200-16	2×250	2×TLK150-12	96
GD290-400P-4	2×400	2×SQNBS200-16	2×250	2×TLK150-12	96
GD290-355G-4	2×500	2×SQNBS250-16	2×300	2×TLK150-12	96
GD290-450P-4	2×500	2×SQNBS250-16	2×300	2×TLK150-12	96
GD290-400G-4	2×600	2×SQNBS325-16	2×300	2×TLK150-12	96
GD290-500P-4	2×600	2×SQNBS325-16	2×300	2×TLK150-12	96

TLK terminal

SQNBS narrow-head terminal

TLK terminal brand: KST (The model varies with the brand.)

SQNBS narrow-head terminal brand: KST (The model varies with the brand.)

Note:

- ✧ If you select a cable model larger than a recommended model in the table, check whether the wiring terminal width exceeds the allowed width in 4.3.2 Main circuit terminals.
- ✧ If yes, select an SG narrow-head terminal and matching cable since an SG narrow-head terminal has smaller width.
- ✧ 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 (+) and (-) are used by multiple VFDs to share the DC bus.

D.3.4 Cable arrangement

Motor cables must be arranged away from other cables. The motor cables of several VFDs can be arranged in parallel. It is recommended that you arrange the motor cables, input power cables, and control cables separately in different trays. The output dv/dt of the VFDs may increase electromagnetic interference on other cables. Do not arrange other cables and the motor cables in parallel.

If a control cable and power cable must cross each other, ensure that the crossing angle between them is 90°.

The cable trays must be connected properly and well grounded. Aluminum trays can implement local equipotential.

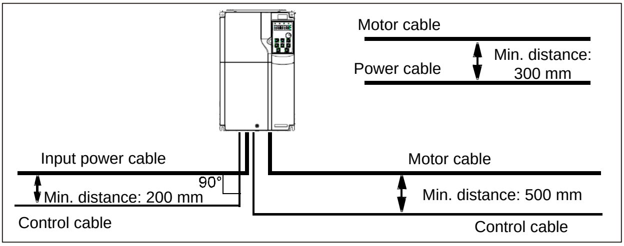


Figure D-3 Cable routing distance

D.3.5 Insulation inspection

Check the motor and the insulation conditions of the motor cable before running the motor.

✧ 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.

✧ Use a megohmmeter of 500V DC to measure the insulation resistance between each phase conductor and the protection grounding conductor. For details about the insulation resistance of the motor, see the description provided by the manufacturer.

Note: The insulation resistance is reduced if it is damp inside the motor. If moisture is suspected, dry and re-measure the motor.

D.4 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-3 Selection for AC 3PH 380V VFD models

VFD power (kW)	Breaker rated current (A)	Fast-acting fuse rated current (A)	Contactor rated current (A)
0.75	6	10	9
1.5	6	10	9
2.2	10	10	9
3	20	20	18
4	20	20	18
5.5	25	32	25
7.5	32	40	32
11	50	50	38
15	50	63	50
18.5	63	80	65
22	80	80	80
30	100	125	80
37	125	125	98
45	140	150	115
55	180	200	150
75	225	250	185
90	250	300	225
110	315	350	265
132	400	400	330
160	500	500	400
185	500	600	400
200	630	600	500
220	630	700	500
250	700	800	630
280	800	1000	630
315	1000	1000	800
355	1000	1000	800
400	1000	1200	1000
450	1250	1200	1000
500	1250	1400	1000

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

D.5 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.

Table D-4 Reactor selection

VFD power (kW)	Input reactor	Output reactor
0.75	GDL-ACL0005-4CU	GDL-OCL0005-4CU
1.5	GDL-ACL0005-4CU	GDL-OCL0005-4CU
2.2	GDL-ACL0006-4CU	GDL-OCL0006-4CU
4	GDL-ACL0014-4CU	GDL-OCL0010-4CU
5.5	GDL-ACL0020-4CU	GDL-OCL0014-4CU
7.5	GDL-ACL0025-4CU	GDL-OCL0020-4CU
11	GDL-ACL0035-4AL	GDL-OCL0025-4CU
15	GDL-ACL0040-4AL	GDL-OCL0035-4AL
18.5	GDL-ACL0051-4AL	GDL-OCL0040-4AL
22	GDL-ACL0051-4AL	GDL-OCL0050-4AL
30	GDL-ACL0070-4AL	GDL-OCL0060-4AL
37	GDL-ACL0090-4AL	GDL-OCL0075-4AL
45	GDL-ACL0110-4AL	GDL-OCL0092-4AL
55	GDL-ACL0150-4AL	GDL-OCL0115-4AL
75	GDL-ACL0150-4AL	GDL-OCL0150-4AL
90	GDL-ACL0220-4AL	GDL-OCL0220-4AL
110	GDL-ACL0220-4AL	GDL-OCL0220-4AL
132	GDL-ACL0265-4AL	GDL-OCL0265-4AL
160	GDL-ACL0330-4AL	GDL-OCL0330-4AL
185	GDL-ACL0390-4AL	GDL-OCL0400-4AL
200	GDL-ACL0390-4AL	GDL-OCL0400-4AL
220	GDL-ACL0450-4AL	GDL-OCL0450-4AL
250	GDL-ACL0500-4AL	GDL-OCL0500-4AL
280	GDL-ACL0500-4AL	GDL-OCL0560-4AL
315	GDL-ACL0580-4AL	GDL-OCL0660-4AL
355	GDL-ACL0660-4AL	GDL-OCL0660-4AL
400	GDL-ACL0715-4AL	GDL-OCL0720-4AL
450	GDL-ACL0840-4AL	GDL-OCL0820-4AL
500	GDL-ACL1000-4AL	GDL-OCL1000-4AL

Note:

✧ The rated input voltage drop of input reactor is designed to ≥1.5%.

✧ The rated output voltage drop of output reactor is designed to 1%.

✧ The preceding table lists only external accessories. You need to specify whether external or built-in accessories are needed in your purchase order.

✧ 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.

Table D-5 Filter selection

VFD power (kW)	Input filter	Output filter	
	Passive harmonic filter	dv/dt filter	Sine-wave filter
0.75	GDL-H0006-4AL	GDL-DUL0005-4CU	GDL-OSF0005-4AL
1.5	GDL-H0006-4AL	GDL-DUL0005-4CU	GDL-OSF0005-4AL
2.2	GDL-H0006-4AL	GDL-DUL0005-4CU	GDL-OSF0005-4AL
4	GDL-H0014-4AL	GDL-DUL0010-4CU	GDL-OSF0010-4AL
5.5	GDL-H0020-4AL	GDL-DUL0014-4CU	GDL-OSF0014-4AL
7.5	GDL-H0025-4AL	GDL-DUL0020-4CU	GDL-OSF0020-4AL
11	GDL-H0032-4AL	GDL-DUL0025-4CU	GDL-OSF0025-4AL
15	GDL-H0040-4AL	GDL-DUL0032-4CU	GDL-OSF0032-4AL
18.5	GDL-H0047-4AL	GDL-DUL0040-4AL	GDL-OSF0040-4AL
22	GDL-H0056-4AL	GDL-DUL0045-4AL	GDL-OSF0045-4AL
30	GDL-H0070-4AL	GDL-DUL0060-4AL	GDL-OSF0060-4AL
37	GDL-H0080-4AL	GDL-DUL0075-4AL	GDL-OSF0075-4AL
45	GDL-H0100-4AL	GDL-DUL0100-4AL	GDL-OSF0095-4AL
55	GDL-H0130-4AL	GDL-DUL0120-4AL	GDL-OSF0120-4AL
75	GDL-H0160-4AL	GDL-DUL0150-4AL	GDL-OSF0150-4AL
90	GDL-H0190-4AL	GDL-DUL0180-4AL	GDL-OSF0180-4AL
110	GDL-H0225-4AL	GDL-DUL0220-4AL	GDL-OSF0220-4AL
132	GDL-H0265-4AL	GDL-DUL0260-4AL	GDL-OSF0260-4AL
160	GDL-H0320-4AL	GDL-DUL0320-4AL	GDL-OSF0320-4AL
185	GDL-H0400-4AL	GDL-DUL0400-4AL	GDL-OSF0400-4AL
200	GDL-H0400-4AL	GDL-DUL0400-4AL	GDL-OSF0400-4AL
220	GDL-H0485-4AL	GDL-DUL0480-4AL	GDL-OSF0480-4AL
250	GDL-H0485-4AL	GDL-DUL0480-4AL	GDL-OSF0480-4AL
280	GDL-H0545-4AL	GDL-DUL0540-4AL	GDL-OSF0600-4AL
315	GDL-H0610-4AL	GDL-DUL0600-4AL	GDL-OSF0600-4AL
355	GDL-H0800-4AL	GDL-DUL0800-4AL	GDL-OSF0800-4AL
400	GDL-H0800-4AL	GDL-DUL0800-4AL	GDL-OSF0800-4AL
450	GDL-H1000-4AL	GDL-DUL1000-4AL	GDL-OSF1000-4AL
500	GDL-H1000-4AL	GDL-DUL1000-4AL	GDL-OSF1000-4AL

Note:

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

D.6 EMC filter

Table D-6 EMC filter selection

VFD power (kW)	Input filter	Output filter
0.75	FLT-P04006L-B	FLT-L04006L-B
1.5	FLT-P04006L-B	FLT-L04006L-B
2.2	FLT-P04006L-B	FLT-L04006L-B
4	FLT-P04016L-B	FLT-L04016L-B
5.5	FLT-P04032L-B	FLT-L04032L-B
7.5	FLT-P04032L-B	FLT-L04032L-B
11	FLT-P04045L-B	FLT-L04045L-B
15	FLT-P04045L-B	FLT-L04045L-B
18.5	FLT-P04065L-B	FLT-L04065L-B
22	FLT-P04065L-B	FLT-L04065L-B
30	FLT-P04100L-B	FLT-L04065L-B
37	FLT-P04100L-B	FLT-L04100L-B
45	FLT-P04100L-B	FLT-L04100L-B
55	FLT-P04150L-B	FLT-L04150L-B
75	FLT-P04240L-B	FLT-L04150L-B
90	FLT-P04240L-B	FLT-L04240L-B
110	FLT-P04240L-B	FLT-L04240L-B
132	FLT-P04400L-B	FLT-L04400L-B
160	FLT-P04400L-B	FLT-L04400L-B
185	FLT-P04400L-B	FLT-L04400L-B
200	FLT-P04400L-B	FLT-L04400L-B
220	FLT-P04600L-B	FLT-L04600L-B
250	FLT-P04600L-B	FLT-L04600L-B
280	FLT-P04600L-B	FLT-L04600L-B
315	FLT-P04800L-B	FLT-L04800L-B
355	FLT-P04800L-B	FLT-L04800L-B
400	FLT-P04800L-B	FLT-L04800L-B
450	FLT-P041000L-B	FLT-L041000L-B
500	FLT-P041000L-B	FLT-L041000L-B

D.7 Braking system

D.7.1 Braking component selection

When the VFD driving a high-inertia load decelerates or needs to decelerate abruptly, the motor runs in the power generation state and transmits the load-carrying energy to the DC circuit of the VFD, causing the bus voltage of the VFD to rise. If the bus voltage exceeds a specific value, the VFD reports an overvoltage fault. To prevent this from happening, you need to configure braking components.

	✧ The design, installation, commissioning, and operation of the device must be performed by trained and qualified professionals. ✧ Follow all the "Warning" instructions during the operation. Otherwise, major physical injuries or property loss may be caused. ✧ Only qualified electricians are allowed to perform the wiring. Otherwise, damage to the VFD or braking components may be caused. ✧ Read the braking resistor or unit instructions carefully before connecting them to the VFD. ✧ Connect braking resistors only to the terminals PB and (+), and braking units only to the terminals (+) and (-). Do not connect them to other terminals. Otherwise, damage to the braking circuit and VFD and fire may be caused.
	✧ Connect the braking components to the VFD according to the wiring diagram. If the wiring is not properly performed, damage to the VFD or other devices may be caused.

The 380V 030G/037P and lower, and 380V 037G/045P(-B)–110G/132P(-B) models are equipped with built-in braking units. Select braking resistors according to the specific requirements (such as the braking torque and braking usage) on site.

Table D-7 Braking unit selection

VFD model	Braking unit model	Resistance applicable for 100% braking torque (Ω)	Braking resistor dissipation power (kW)			Min. allowed braking resistance (Ω)
			10% braking utilization	50% braking utilization	80% braking utilization	
GD290-0R7G/1R5P-4	Built-in	653	0.1	0.6	0.9	130
GD290-1R5G/2R2P-4		326	0.23	1.1	1.8	
GD290-2R2G/003P-4		222	0.33	1.7	2.6	
GD290-003G/004P-4		163	0.45	2.5	4	
GD290-004G/5R5P-4		122	0.6	3	4.8	80
GD290-5R5G/7R5P-4		89	0.75	4.1	6.6	
GD290-7R5G/011P-4		65	1.1	5.6	9	47
GD290-011G/015P-4		44	1.7	8.3	13.2	
GD290-015G/018P-4		32	2	11	18	

VFD model	Braking unit model	Resistance applicable for 100% braking torque (Ω)	Braking resistor dissipation power (kW)			Min. allowed braking resistance (Ω)
			10% braking utilization	50% braking utilization	80% braking utilization	
GD290-018G/022P-4		27	3	14	22	31
GD290-022G/030P-4		22	3	17	26	17
GD290-030G/037P-4		17	5	23	36	11.7
GD290-037G/045P-4(-B)		13	6	28	44	
GD290-045G/055P-4(-B)		10	7	34	54	6.4
GD290-055G/075P-4(-B)		8	8	41	66	
GD290-075G/090P-4(-B)		6.5	11	56	90	
GD290-090G/110P-4(-B)		5.4	14	68	108	4.4
GD290-110G/132P-4(-B)		4.5	17	83	132	
GD290-132G/160P-4	DBU100H-220-4	3.7	20	99	158	3.2
GD290-160G/185P-4	DBU100H-320-4	3.1	24	120	192	2.2
GD290-185G/200P-4		2.8	28	139	222	
GD290-200G/220P-4		2.5	30	150	240	
GD290-220G/250P-4	DBU100H-400-4	2.2	33	165	264	1.8
GD290-250G/280P-4		2.0	38	188	300	
GD290-280G/315P-4	Two DBU100H-320-4	3.6*2	21*2	105*2	168*2	2.2*2
GD290-315G/355P-4		3.2*2	24*2	118*2	189*2	
GD290-355G/400P-4		2.8*2	27*2	132*2	210*2	
GD290-400G/450P-4		2.4*2	30*2	150*2	240*2	
GD290-450G/500P-4	Two DBU100H-400-4	2.2*2	34*2	168*2	270*2	1.8*2
GD290-500G-4		2.0*2	38*2	186*2	300*2	

Note:

✧ Select braking resistors according to the resistance and power data provided by INVT.

✧ The braking resistor may increase the braking torque of the VFD. The preceding table provides the resistor power ratings designed based on 100% braking torque and braking utilization levels of 10%, 50%, and 80%. You can select the braking system based on the actual operating conditions.

✧ When using an external braking unit, set the brake voltage class of the braking unit properly by referring to the manual of the dynamic braking unit. If the voltage class is set incorrectly, the VFD may not run properly.

⚠	✧ Do not use braking resistors whose resistance is lower than the specified minimum resistance. The VFD does not provide protection against overcurrent

		caused by resistors with low resistance.
⚠	✧	In scenarios where braking is frequently implemented, that is, the braking utilization is greater than 10%, you need to select a braking resistor with higher power as required by the operating conditions according to the preceding table.

D.7.2 Braking resistor cable selection

Braking resistor cables should be shielded cables.

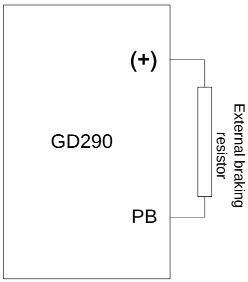
D.7.3 Braking resistor installation

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:

⚡	✧	For 380V 030G/037P and lower, as well as 380V 037G/045P(-B) to 110G/132P(-B), only an external braking resistor is required.
	✧	PB and (+) are the terminals for connecting braking resistors.



D.8 List of other optional accessories

Accessory	Model	Function	Remarks
External LED keypad	BOP-270	Externally connected LED display and operation panel	Applicable to: VFDs in T1–T4 frames
External LCD keypad	SOP-290	Externally connected LCD display and operation panel	Applicable to all series For details about how to operate the keypad, see chapter 5 in the operation manual for GD350 series high-performance multifunction VFD.
Keypad bracket	GD350-JPZJ	Used to fix the LED or LCD keypad for external connection	Applicable to all series

Accessory	Model	Function	Remarks
		to the electrical cabinet	
Keypad protective cover	GD270-JPFH	When the local keypad is externally mounted, this protective cover prevents dust and foreign objects from entering through the keypad port.	Applicable to: VFDs in T5–T12 frames
Rail assembly for cabinet mounting	GD270-DGZJ	Used to mount a VFD in a cabinet, improving mounting efficiency and safety	Applicable to: VFDs in T10–T12 frames. For detailed operation instructions, see section 4.2.3 Cabinet design.
Flange mounting bracket	Consult the manufacturer.	Used to meet the flange mounting needs	Applicable to: VFDs in T1–T9 frames

Appendix E Further information

E.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.

E.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.

E.3 Documents on the Internet

You can find manuals and other product documents in the PDF format on the Internet. Visit www.invt.com and choose **Support** > **Download**.

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