Operation Manual

Goodrive200A Series VFD

SHENZHEN INVT ELECTRIC CO., LTD.

Preface

Thanks for choosing our products.

Goodrive200A series variable-frequency drive (VFD) is newly-designed high-performance open-loop vector-type VFD by our company for controlling asynchronous AC inductance motors. Through adopting the most advanced speed sensor-less vector control technology and DSP control system, as well as enhancing the reliability and adaptability to the environment, our product is armed with optimized functions, flexible applications and stable performances.

The vector control performance of Goodrive200A series VFD is as outstanding as that of the leading sophisticated VFDs in worldwide market. Its integrated speed and torque control can satisfy various application demands, in the meantime, its excellent anti-trip performance and strong adaptability to worse grid, temperature, humidity and dust guarantees its outstanding reliability and stability.

Goodrive200A series VFD adopts modular to fulfill various customized needs. The powerful speed control, torque control, simple PLC, flexible input/output terminals, pulse frequency reference and traverse control can satisfy various requirements from complicated drives to reduce system cost and improve system reliability.

Goodrive200A series VFD adopts electromagnetic compatibility design to ensure strong anti-electromagnetic interference capacity while realizing low noise and weakening electromagnetic interference in the application sites.

This manual instructs you how to install, wire, set parameters for, diagnose and remove faults for, and maintain the VFD, and also lists related precautions. Please read this manual carefully before installation to ensure Goodrive200A series VFD is installed and operated properly to give full play to its excellent performance.

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

The manual is subject to change without prior notice.

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1 Safety precautions

1.1 What this chapter contains

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

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

1.2 Safety definition

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

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

Note: Actions taken to ensure proper running.

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

1.3 Warning

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.	
 Do not touch	Electrostatic sensitive	The PCBA may be damaged if related requirements are not followed.	
 Hot	Hot sides	Do not touch. The VFD pedestal may become hot.	
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>0R7G–110G/132P</td><td>5 minutes</td></tr>
<tr><td>132/160P–315G/355P</td><td>15 minutes</td></tr>
<tr><td>355G/400P 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

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

Note:

✧ Select appropriate tools for VFD delivery and installation to ensure the safe and proper running and avoid physical injury or death. To ensure personal safety, take mechanical protective measures like wearing safety shoes and working uniforms.

✧ Protect the VFD against physical shock or vibration during the delivery and installation.

✧ Do not carry the product only by its front cover as the cover may fall off.

✧ The installation site must be away from children and other public places.

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

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

✧ As leakage current of the 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. For the 030G/037P and higher models, the cross sectional area of the PE grounding conductor can be slightly less than the recommended 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 may start up by itself when P01.21=1. 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 section 8.8 Maintenance and hardware fault diagnosis), 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 VFD nameplate is consistent with the model identifier on the exterior surface of the packing box. If any problems are found, contact the local INVT dealer or office.
5. Whether the accessories (including the manual, keypad, and expansion card) inside the packing box are complete.If any problems are found, contact the local INVT dealer or office.

2.3 Checking before use

Check the following before using the VFD.

1. Mechanical type of the load to be driven by the VFD to verify whether the VFD will be overloaded during work. Whether the power class of the VFD needs to be increased.
2. Whether the actual running current of the motor is less than the rated current of the product.
3. Whether the grid voltage is consistent with the rated voltage of the VFD.
4. Check whether expansion cards are needed for selected communication modes.

2.4 Environment checking

Check the following before installing the VFD:

1. Whether the actual ambient temperature exceeds 40°C. When the temperature exceeds 40°C, derate 1% for every increase of 1°C. Do not use the VFD when the ambient temperature exceeds 50°C. **Note: When the VFD is built in a cabinet, the ambient temperature is the temperature of air in the cabinet.**
2. Whether the actual ambient temperature is lower than -10°C. If the temperature is lower than -10°C, use heating devices. **Note: When the VFD is built in a cabinet, the ambient temperature is the temperature of air in the cabinet.**

3. Whether the altitude of the application site exceeds 1000m. ➢ When the altitude exceeds 1000m, derate by 1% for every additional 100m. ➢ When the installation site altitude exceeds 3000m, consult the local INVT dealer or office.
4. Whether the actual environment humidity exceeds 90% or condensation occurs. If yes, take additional protective measures.
5. Whether there is direct sunlight or biological invasion in the environment where the VFD is to be used. If yes, take additional protective measures.
6. Whether there is dust or inflammable and explosive gas in the environment where the VFD is to be used. If yes, take additional protective measures.

2.5 Checking after installation

Check the following after the VFD installation is complete.

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

2.6 Basic commissioning

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

1. According to the actual motor parameters, select the motor type, set motor parameters, and select the VFD control mode.
2. Check whether autotuning is required. If possible, de-couple the VFD from the motor load to start dynamic parameter autotuning. If the VFD cannot be de-coupled from the load, perform static autotuning.

3. Adjust the ACC/DEC time according to the actual work condition of the load.
4. Perform device commissioning by means of jogging and check whether the motor rotational direction is correct? If not, change the rotation direction by swapping any two phase wires of the motor.
5. Set all control parameters and then perform actual run.

3 Product overview

3.1 What this chapter contains

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

3.2 Basic principles

The VFD is used to control asynchronous AC induction motors. It supports wall-mounting, floor-mounting and flange-mounting.

The following diagram shows the main circuit diagram of the VFD. The rectifier converts 3PH AC voltage into DC voltage, and the capacitor bank of intermediate circuit stabilizes the DC voltage. The inverter converts DC voltage into AC voltage that can be used by an AC motor. When the circuit voltage exceeds the maximum limit value, external braking resistor will be connected to intermediate DC circuit to consume the feedback energy.

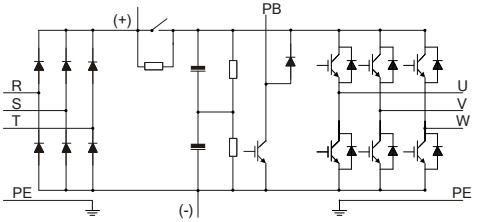


Figure 3-1 380V (030G/037P and lower) main circuit diagram

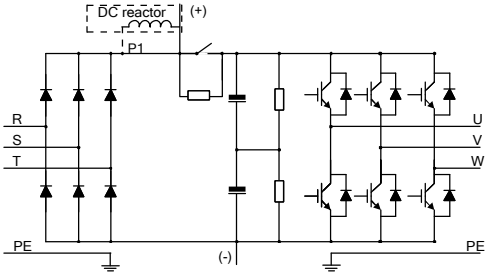


Figure 3-2 380V (037G/045P–315G/355P) main circuit diagram

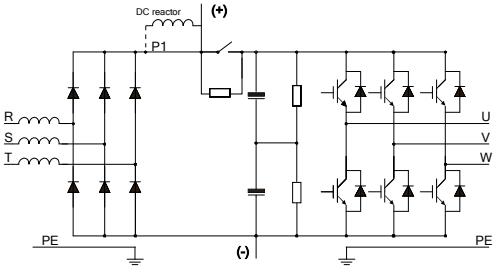


Figure 3-3 380V (355G/ 400P and higher) main circuit diagram

Note:

- ✧ The 380V 037G/045P and higher VFD models can be connected to external DC reactors. Before connection, remove the copper bar between P1 and (+). The DC reactor is an optional part.
- ✧ The 380V 030G/037P and lower models have standard built-in braking units and the braking resistor is optional.
- ✧ The 380V 037G/045P and higher models can be installed with optional braking units and the braking unit and resistor are optional.

3.3 Product specifications

Function		Specifications
Power input	Input voltage (V)	AC 3PH 380V(-15%) – 440V(+10%); rated voltage: 380V
	Input current (A)	See section 3.6 Product ratings.
	Input frequency (Hz)	50Hz or 60Hz; Allowed range: 47–63Hz
Power output	Output voltage (V)	0–Input voltage (V)
	Output current (A)	See section 3.6 Product ratings.
	Output power (kW)	See section 3.6 Product ratings.
	Output frequency (Hz)	0–400Hz
Technical control performance	Control mode	Space voltage vector control, and sensorless vector control (SVC).
	Motor type	Asynchronous motor (AM)
	Speed ratio	AM 1: 100 (SVC)
	Speed control accuracy	± 0.2% (SVC)
	Speed fluctuation	± 0.3% (SVC)
	Torque response	< 20ms (SVC)
	Torque control accuracy	10% (SVC)
	Starting torque	For AMs: 0.5Hz/150% (SVC)
	Overload capacity	Able to run at 150% of the rated current for 1 minute, 180% of the rated current for 10 seconds, and 200% of the rated current for 1 second (G type) Able to run at 120% of the rated current for 1 minute, 150% of the rated current for 10 seconds, and 180% of the rated current for 1 second (P type)
Running control performance	Frequency setting method	Settings can be implemented through digital, analog, pulse frequency, multi-step speed run, simple PLC, PID, and Modbus communication. Settings can be combined and the setting channels can be switched.
	Automatic voltage regulation	The output voltage can be kept constant although the grid voltage changes.
	Fault protection	More than 30 protection functions, such as protection against overcurrent, overvoltage, undervoltage, overtemperature, phase loss, and overload.

Function		Specifications
	Speed tracking restart	Used to implement impact-free smooth startup for rotating motors **Note: The function is available only for 380V 004G/5R5P and higher models.**
Peripheral interface	Terminal analog input resolution	No more than 20mV
	Terminal digital input resolution	No more than 2ms
	Analog input	One input (AI2) 0(2)–10V / 0(4)–20mA; one input (AI3) -10–+10V Note: In the AI2 current input mode, the input impedance is 500Ω. Additionally, when the input current reaches 20mA in this mode, the input source must provide a supply voltage of at least 10V.
	Analog output	Analog output AO ranges from 0(2) to 10V / 0(4) to 20mA, where 100% of the actual AO output corresponds to either twice the selected motor speed or 1.5 times the rated voltage of the VFD.
	Digital input	Eight regular inputs. Max. frequency: 1kHz; internal impedance: 3.3kΩ; One high-speed input. Max frequency: 50kHz.
	Digital output	One high-speed pulse output; max. frequency: 50kHz; One Y terminal open collector output.
	Relay output	Two programmable relay outputs RO1A: NO; RO1B: NC; RO1C: common RO2A: NO; RO2B: NC; RO2C: common Contact capacity: 3A/AC250V, 1A/DC30V
Other	Mounting method	Supports wall-mounting, floor-mounting and flange-mounting.
	Temperature of running environment	-10–50°C, derating is required if the temperature is above 40°C. the ambient temperature is above 40°C, derate 1% for every additional 1°C.
	Ingress protection (IP) rating	IP20
	Pollution level	Level 2
	Cooling method	Forced air cooling
	Braking unit	The braking unit has been built in the 030G/037P and lower models. For other models, it is an optional part.
	EMC filter	All the series meet the IEC61800-3 C3 requirements. Optional external filters can be used to meet the IEC61800-3 C2 requirements.

3.4 Product nameplate

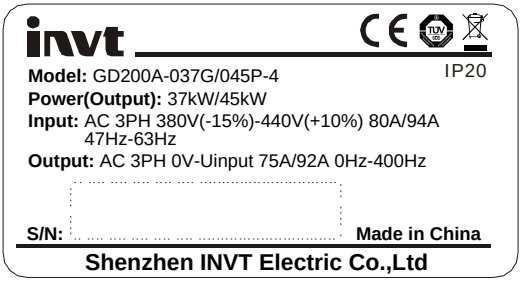


Figure 3-4 Product nameplate

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

3.5 Model designation code

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

GD200A-011 G/015 P-4
① ② ③ ④ ⑤⑥

Figure 3-5 Product model

Field	Description
①	GD200A : abbreviation of Goodrive200A
②, ④	3-digit code indicating the rated output power. "R" means the decimal point. "011": 11kW; "015": 15kW
③, ⑤	G: Constant torque load P: Variable torque load
⑥	Input voltage level: 4: AC 3PH 380V (-15%)–440V (+10%)

3.6 Product ratings

3.6.1 Ratings of single VFD

VFD model	Constant torque			Variable torque		
	Output power (kW)	Input current (A)	Output current (A)	Output power (kW)	Input current (A)	Output current (A)
AC 3PH 380V(-15%) – 440V(+10%)						
GD200A-0R7G-4	0.75	3.4	2.5	/	/	/
GD200A-1R5G-4	1.5	5.0	3.7	/	/	/
GD200A-2R2G-4	2.2	5.8	5	/	/	/
GD200A-004G/5R5P-4	4	13.5	9.5	5.5	19.5	14

VFD model	Constant torque			Variable torque		
	Output power (kW)	Input current (A)	Output current (A)	Output power (kW)	Input current (A)	Output current (A)
GD200A-5R5G/7R5P-4	5.5	19.5	14	7.5	25	18.5
GD200A-7R5G/011P-4	7.5	25	18.5	11	32	25
GD200A-011G/015P-4	11	32	25	15	40	32
GD200A-015G/018P-4	15	40	32	18.5	47	38
GD200A-018G/022P-4	18.5	47	38	22	56	45
GD200A-022G/030P-4	22	56	45	30	70	60
GD200A-030G/037P-4	30	70	60	37	80	75
GD200A-037G/045P-4	37	80	75	45	94	92
GD200A-045G/055P-4	45	94	92	55	128	115
GD200A-055G/075P-4	55	128	115	75	160	150
GD200A-075G/090P-4	75	160	150	90	190	180
GD200A-090G/110P-4	90	190	180	110	225	215
GD200A-110G/132P-4	110	225	215	132	265	260
GD200A-132G/160P-4	132	265	260	160	310	305
GD200A-160G/185P-4	160	310	305	185	345	340
GD200A-185G/200P-4	185	345	340	200	385	380
GD200A-200G/220P-4	200	385	380	220	430	425
GD200A-220G/250P-4	220	430	425	250	485	480
GD200A-250G/280P-4	250	485	480	280	545	530
GD200A-280G/315P-4	280	545	530	315	610	600
GD200A-315G/355P-4	315	610	600	355	625	650
GD200A-355G/400P-4	355	625	650	400	715	720
GD200A-400G-4	400	715	720	/	/	/
GD200A-450G-4	450	840	820	/	/	/
GD200A-500G-4	500	890	860	/	/	/

Note:

- ✧ The input current of the 380V 0R7G–315G/355P VFD models is measured in cases where the input voltage is 380V without DC reactors and input/output reactors.
- ✧ The input current of the 380V 355G/400P–500G VFD models is measured in cases where the input voltage is 380V and there are input reactors.
- ✧ The rated output current is the output current when the output voltage is the rated voltage.
- ✧ Within the allowable input voltage range, the output current/power cannot exceed the rated output current/power.

3.6.2 Ratings of parallel product

VFD model	380V parallel VFD model		Output power (kW)	Input current (A)	Output current (A)
	Power (kW)	Qty			
GD200A-560G-4	280	2	560	1090	1060
GD200A-630G-4	315	2	630	1220	1200

VFD model	380V parallel VFD model		Output power (kW)	Input current (A)	Output current (A)
	Power (kW)	Qty			
GD200A-710G-4	355	2	710	1250	1300
GD200A-800G-4	400	2	800	1430	1440
GD200A-1000G-4	500	2	1000	1780	1720
GD200A-1200G-4	400	3	1200	2145	2160
GD200A-1500G-4	500	3	1500	2670	2580
GD200A-2000G-4	500	4	2000	3560	3440
GD200A-2500G-4	500	5	2500	4450	4300
GD200A-3000G-4	500	6	3000	5340	5160

3.7 Product heat dissipation

VFD model	Entire machine full load power dissipation (W)	Entire machine standby power dissipation (W)	Heat dissipation (BTU/hr)	Air rate (m^3/h)	Air volume (ft^3/min(CFM))
AC 3PH 380V(-15%) – 440V(+10%) for single VFD					
GD200A-0R7G-4	60	25	205	13	8
GD200A-1R5G-4	83	25	282		
GD200A-2R2G-4	96	25	328		
GD200A-004G/5R5P-4	180	30	616	57	33
GD200A-5R5G/7R5P-4	301	30	1027		
GD200A-7R5G/011P-4	338	40	1154	117	69
GD200A-011G/015P-4	511	40	1743		
GD200A-015G/018P-4	525	45	1791		
GD200A-018G/022P-4	589	45	1513	138	81
GD200A-022G/030P-4	745	45	1696	134	79
GD200A-030G/037P-4	959	120	3271		
GD200A-037G/045P-4	1126	120	3843	363	214
GD200A-045G/055P-4	1189	120	4057	340	200
GD200A-055G/075P-4	1473	120	5026		
GD200A-075G/090P-4	1879	120	6412	419	247
GD200A-090G/110P-4	2016	120	6878		
GD200A-110G/132P-4	2587	120	8825		
GD200A-132G/160P-4	3057	300	10429	979	576
GD200A-160G/185P-4	3243	300	11064		
GD200A-185G/200P-4	3335	300	11378		
GD200A-200G/220P-4	3400	300	11601		
GD200A-220G/250P-4	3450	300	11771	1126	663
GD200A-250G/280P-4	3606	300	12303		
GD200A-280G/315P-4	3842	300	13110		

VFD model	Entire machine full load power dissipation (W)	Entire machine standby power dissipation (W)	Heat dissipation (BTU/hr)	Air rate (m^3/h)	Air volume (ft^3/min(CFM))
GD200A-315G/355P-4	4255	300	14518		
GD200A-355G/400P-4	5090	300	17367	1830	1077
GD200A-400G-4	5134	300	17519		
GD200A-450G-4	6000	300	20472		
GD200A-500G-4	6478	300	22101		
AC 3PH 380V(-15%) – 440V(+10%) for parallel VFDs					
GD200A-560G-4	10665	346	36390	1325	779
GD200A-630G-4	12281	406	41903		
GD200A-710G-4	14734	448	50272	2360	1388
GD200A-800G-4	15456	514	52735		
GD200A-1000G-4	18589	528	63426		
GD200A-1200G-4	23183	771	79102	3540	2082
GD200A-1500G-4	27884	792	95139		
GD200A-2000G-4	37178	1056	126852	4720	2776
GD200A-2500G-4	46473	1320	158565	5900	3471
GD200A-3000G-4	55767	1584	190278	7080	4165

3.8 Structure

The VFD structure is shown in the following figure (taking the 380V 030G/037P VFD model as an example).

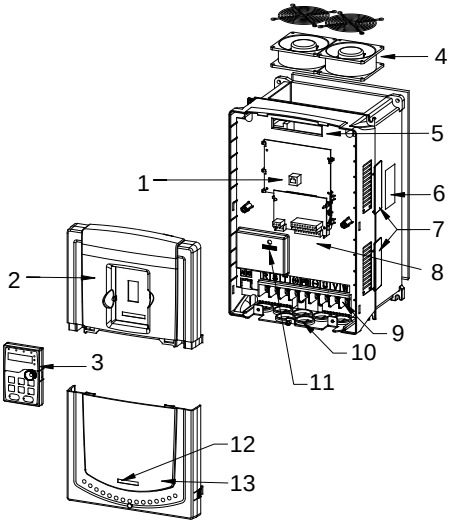


Figure 3-6 Structural diagram

No.	Name	Description
1	Keypad interface	Connects the keypad.
2	Upper cover	Used to protect internal components.
3	Keypad	See section 5 Keypad operation guidelines.
4	Cooling fan	See section 8.8 Maintenance and hardware fault diagnosis.
5	Flat cable interface	Used to connect the control board to the drive board.
6	Nameplate	See section 3.4 Product nameplate.
7	Cover plate of heat emission hole (optional)	Cover plate can upgrade protection level, however, as it will also increase internal temperature, derated use is required.
8	Control terminals	See section 4 Installation guidelines.
9	Main circuit terminals	See section 4 Installation guidelines.
10	Main circuit cable entry	Fix the main circuit cable.
11	POWER indicator	Power supply indicator
12	Simple nameplate	See section 3.5 Model designation code.
13	Lower cover	Used to protect internal components.

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

Installation environment is essential for the VFD to run with best performance in a long period of time. The VFD installation environment must meet the following requirements.

Environment	Condition
Installation site	Indoor
Ambient temperature	✧ -10–+50°C ✧ When the ambient temperature exceeds 40°C, derate 1% for every increase of 1°C. ✧ Do not use the VFD when the ambient temperature exceeds 50°C. ✧ To improve reliability, do not use the VFD in the places where the temperature changes rapidly. ✧ When the VFD is used in a closed space, such as control cabinet, use a cooling fan or air conditioner for cooling, preventing the internal temperature from exceeding the temperature required. ✧ When the temperature is too low, if you want to use the VFD that has been idled for a long time, install an external heating device before the use to eliminate the freeze inside the VFD. Otherwise, the VFD may be damaged.
Relative humidity (RH)	✧ RH: less than 90% ✧ Condensation is not allowed. The max. RH cannot exceed 60% in the

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

Note:

✧ The VFD must be installed in a clean and well-ventilated environment based on the housing IP rating.

✧ The cooling air must be clean enough and free from corrosive gases and conductive dust.

4.2.2 Installation direction

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

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

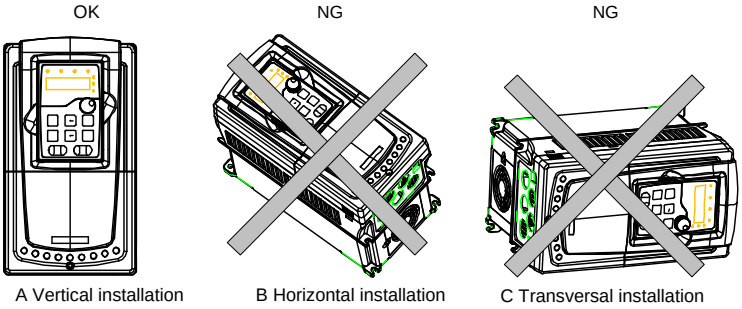


Figure 4-1 Installation direction

4.2.3 Installation method

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

- ✧ Wall-mounting: applicable to 380V 315G/355P and lower models.
- ✧ Flange-mounting: applicable to 380V 200G/220P and lower models. Some models require optional flange mounting plate.
- ✧ Floor-mounting: applicable to 380V 220G/250P–500G models. Some models require optional pedestal.

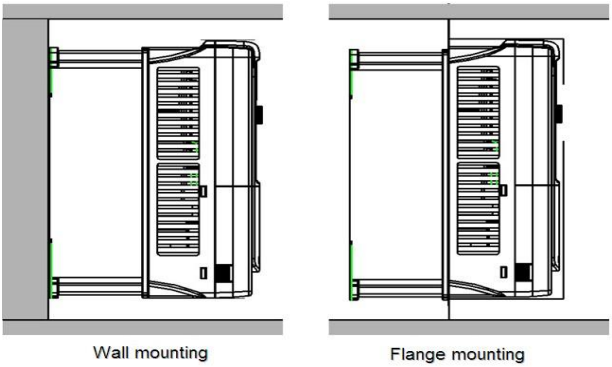


Figure 4-2 Mounting method

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

Note:

✧ When the flange mounting method is used, the (optional part) flange mounting plate is required for the 380V 0R7G–030G/037P VFD models but not required for the 380V 037G/045P–200G/220P VFD models. (For details, see section B.3.2 Flange mounting dimensions.)

✧ When the floor mounting method is used, 380V 220G/250P–315G/355P models require an optional pedestal.

4.2.4 Multiple-product installation

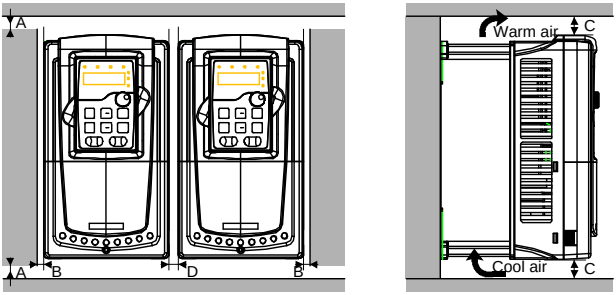


Figure 4-3 Parallel installation

Note:

✧ When you install VFDs in different sizes, align the top of each VFD before installation for the convenience of future maintenance.

✧ For clearances B, C and D, each must be 100mm at least.

4.2.5 Vertical installation

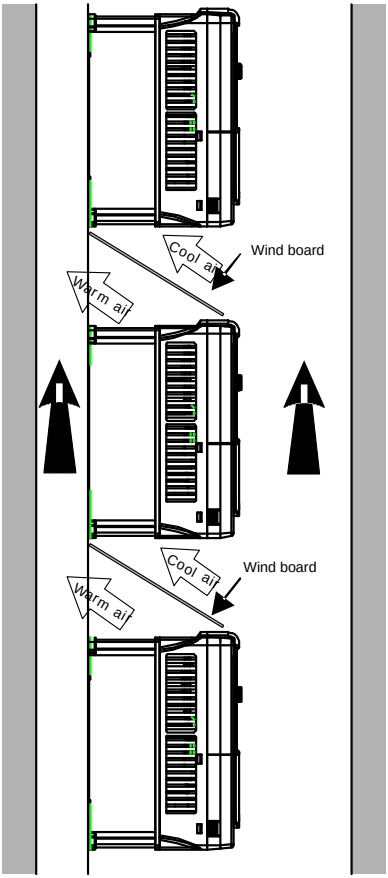


Figure 4-4 Vertical installation

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

4.2.6 Tilted installation

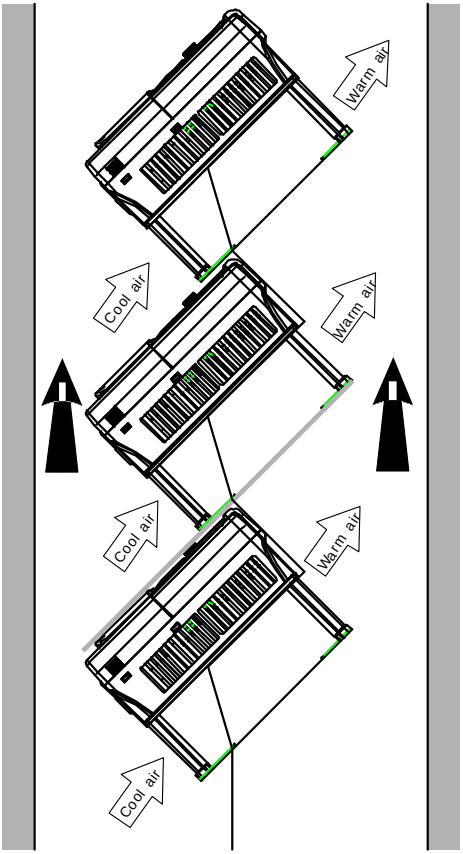


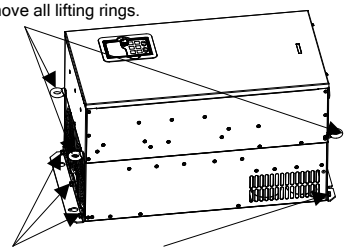
Figure 4-5 Tilted installation

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

4.2.7 Flange mounting instructions

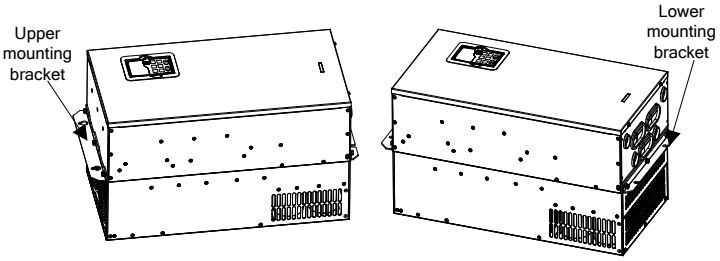
1. Requires removal of lifting rings (075G/090P–200G/220P)

Step 1: Remove all lifting rings.



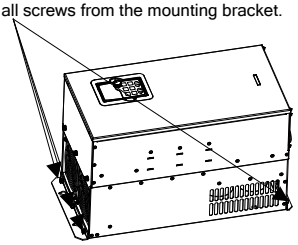
Step 2: Unscrew all screws from the mounting bracket.

Step 3: Secure the removed mounting bracket to the central threaded hole using screws.

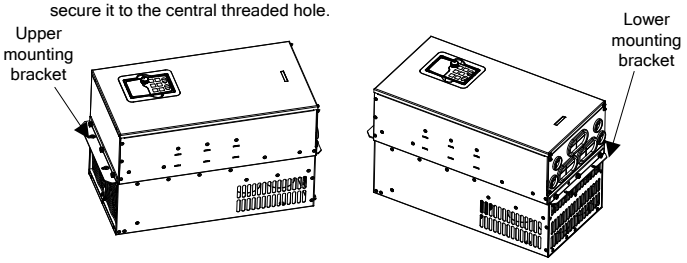


2. Does not require removal of lifting rings (037G/045P–055G/075P)

Step 1: Remove all screws from the mounting bracket.



Step 2: Reattach the removed mounting bracket using screws to secure it to the central threaded hole.



4.3 Electrical installation

4.3.1 Main circuit wiring diagrams

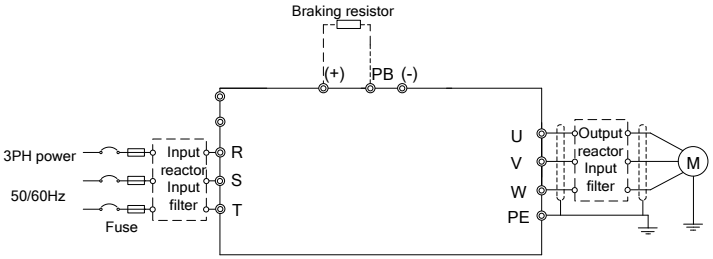


Figure 4-6 Main circuit wiring diagram for the 380V 5R5G/7R5P and lower models

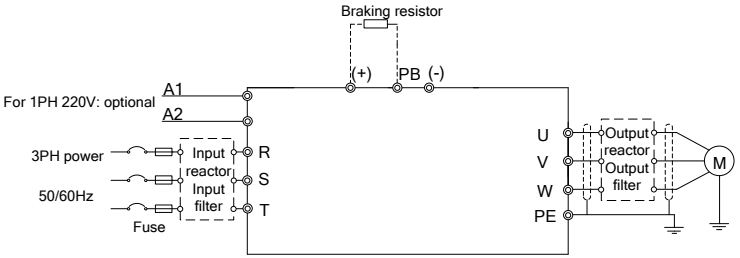


Figure 4-7 Main circuit wiring diagram for the 380V 7R5G/011P–030G/037P models

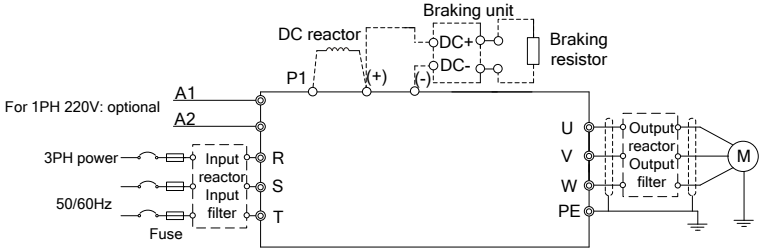


Figure 4-8 Main circuit wiring diagram for the 380V 037G/045P and higher models

Note:

- ✧ The fuse, DC reactor, braking unit, braking resistor, input reactor, input filter, output reactor and output filter are optional parts. For details, see Appendix C Optional peripheral accessories.
- ✧ 380V 7R5G/011P and higher VFD models can be equipped with A1 and A2 (external 220V control power).
- ✧ P1 and (+) have been short connected by default. If you need to connect an external DC reactor, remove the jumper between P1 and (+).
- ✧ Before connecting the braking resistor, remove the yellow warning label with PB, (+) and (-) from the terminal block; otherwise, poor contact may occur.

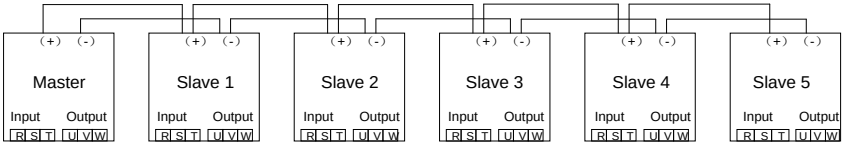


Figure 4-9 Main circuit wiring diagram for parallel VFDs

	Master–Slave 1	Slave 1–Slave 2	Slave 2–Slave 3	Slave 3–Slave 4	Slave 4–Slave 5
(+) bus length	About 1700mm	About 1700mm	About 1700mm	About 1700mm	About 1700mm
(-) bus length	About 1700mm	About 1700mm	About 1700mm	About 1700mm	About 1700mm

Note:

✧ The number of VFDs in parallel connection depends on the actual power. A maximum of 6 VFDs are supported in parallel connection.

✧ Both the input and output terminals of the master and slaves need to be connected with parallel cables of equal length.

4.3.2 Main circuit terminal diagram

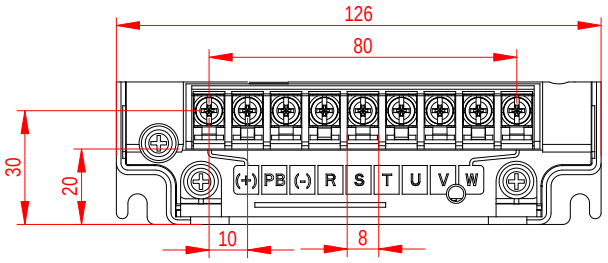


Figure 4-10 Main circuit terminals for the 380V 0R7G–2R2G models

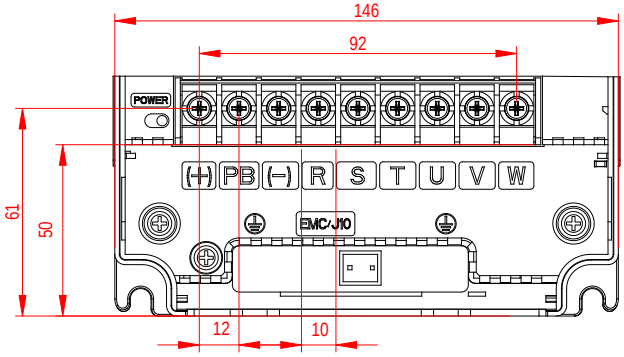


Figure 4-11 Main circuit terminals for the 380V 004G/5R5P–5R5G/7R5P models

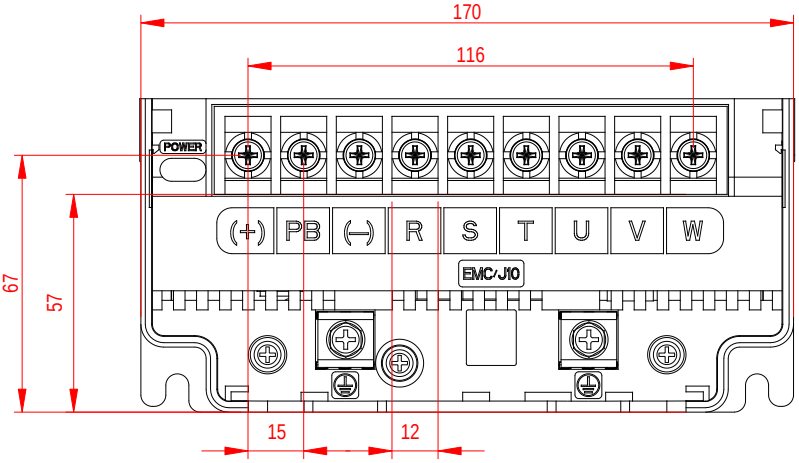


Figure 4-12 Main circuit terminals for the 380V 7R5G/011P–015G/018P models

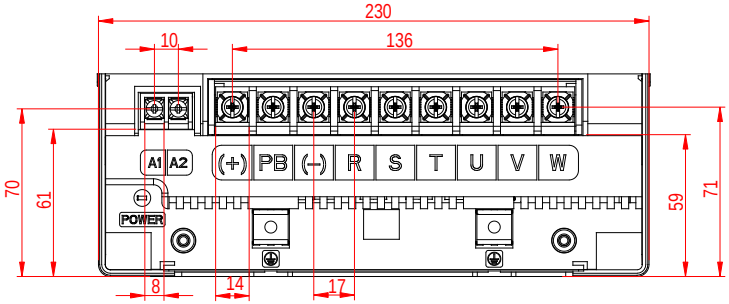


Figure 4-13 Main circuit terminals for the 380V 018G/022P model

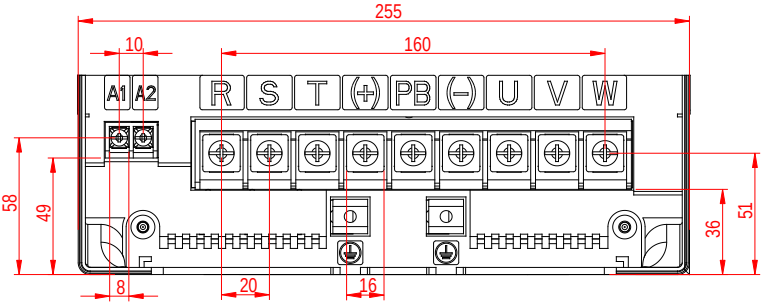


Figure 4-14 Main circuit terminals for the 380V 022G/030P–030G/037P models

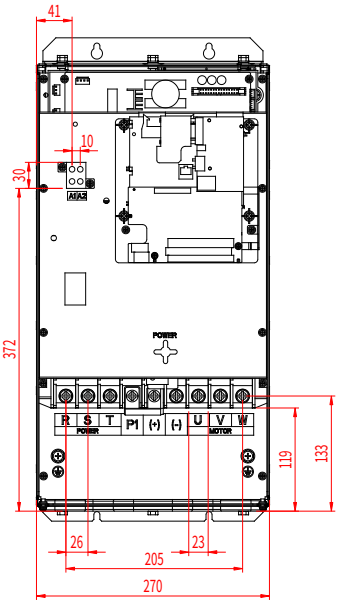


Figure 4-15 Main circuit terminals for the 380V 037G/045P–055G/075P models

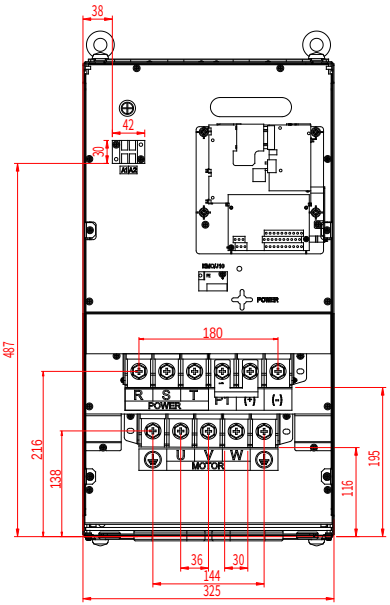


Figure 4-16 Main circuit terminals for the 380V 075G/090P–110G/132P models

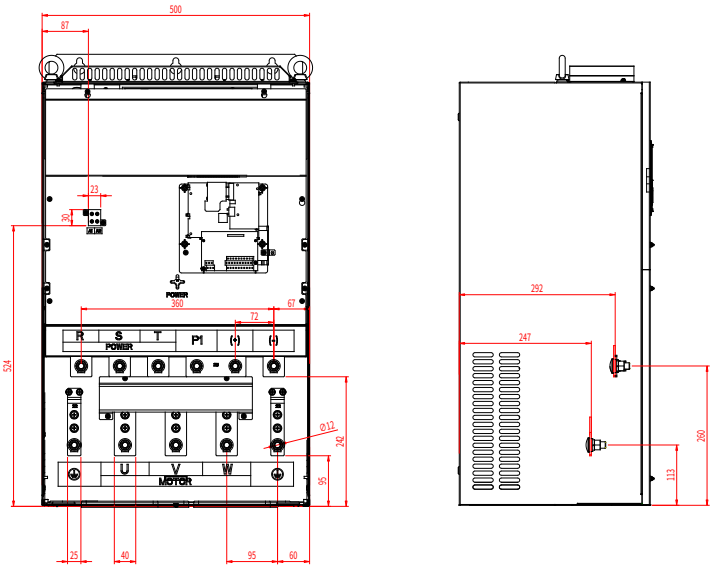


Figure 4-17 Main circuit terminals for the 380V 132G/160P–200G/220P models

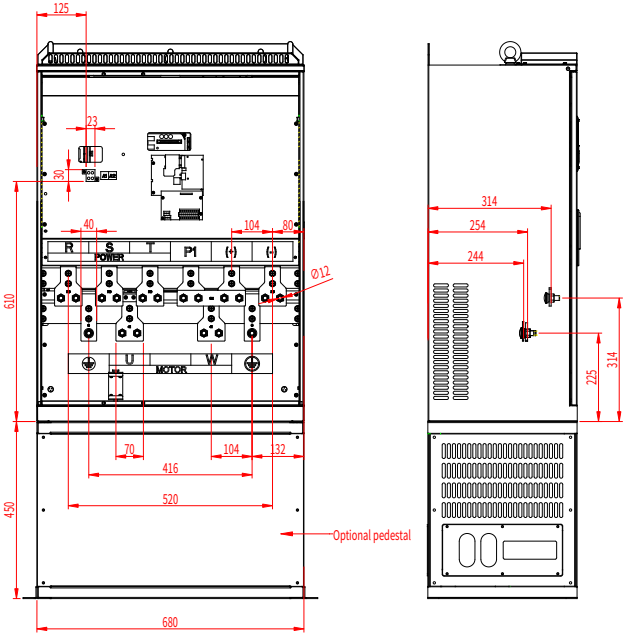


Figure 4-18 Main circuit terminals for the 380V 220G/250P–315G/355P models

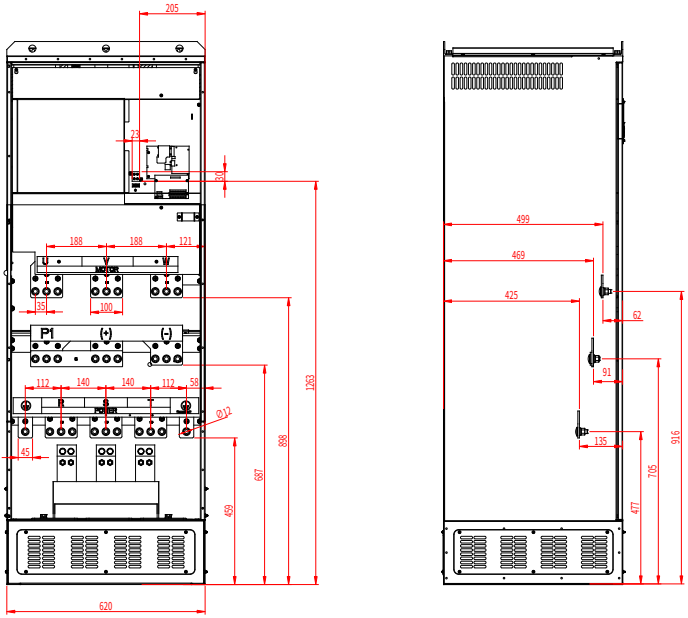


Figure 4-19 Main circuit terminals for the 380V 355G/400P–500G models

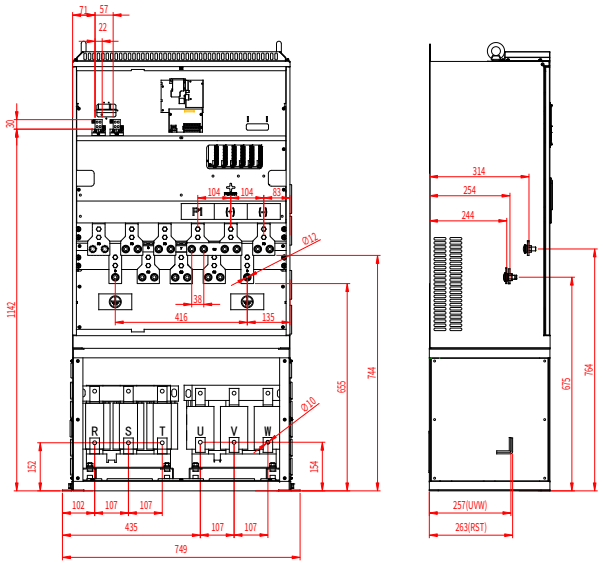


Figure 4-20 Main circuit terminals for the 380V 560G–630G models

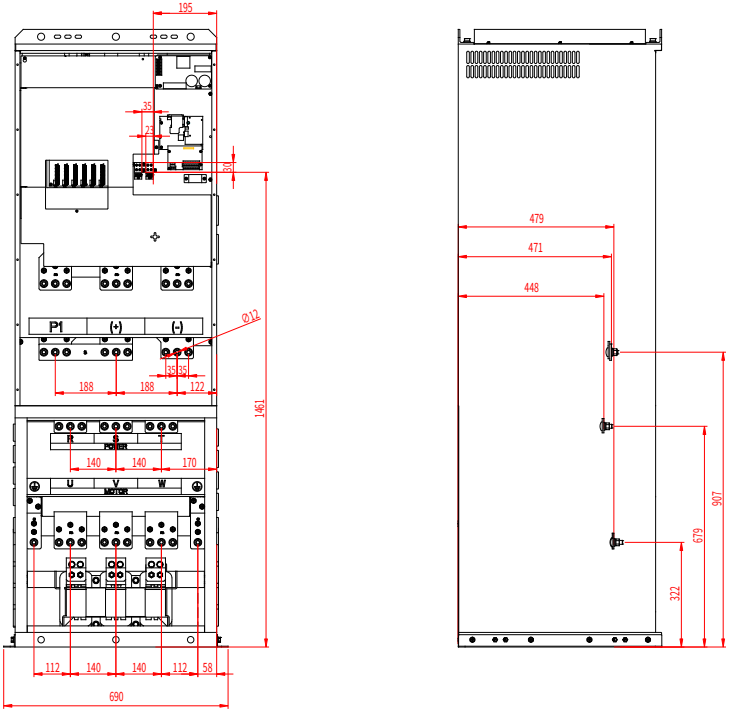


Figure 4-21 Main circuit terminals for the 380V 710G–3000G models

Terminal symbol	Terminal name		Function
	380V 030G/037P and lower	380V 037G/045P and higher	
R, S, T	Main circuit power inputs		3PH AC input terminals, connected to the grid
U, V, W	VFD outputs		3PH AC output terminals, connected to the motor usually
P1	Not available	DC reactor terminal 1	P1 and (+) connect to the external DC reactor. (+) and (-) connect to the external braking unit.
(+)	Braking resistor terminal 1	DC reactor terminal 2, Braking unit terminal 1	
(-)	/	Braking unit terminal 2	
PB	Braking resistor terminal 2	Not available	PB and (+) connect to external braking resistor terminal
PE	Grounding terminal for safe protection		Each VFD carries two PE terminals and proper grounding is required.
A1, A2	Control power supply terminal		Optional for the 380V 7R5G/011P and higher models (connect to external 220V control power). With these terminal, the

Terminal symbol	Terminal name		Function
	380V 030G/037P and lower	380V 037G/045P and higher	
			VFD can be energized by auxiliary power without powering up the input main circuit for easier and safer commissioning.

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.
- ✧ "Not available" means this terminal is not for external connection.
- ✧ When sharing the DC bus, the VFDs must be the same in power and must be simultaneously powered on or off.
- ✧ In shared DC bus running mode, current balance on the VFD input side must be considered during wiring, and equalizing reactors are recommended to be configured.

4.3.3 Wiring procedure of main circuit terminals

1. Connect the grounding line of the input power cable to the grounding terminal (PE) of the VFD, and connect the 3PH input cable to R, S and T terminals and tighten up.
2. Connect the ground wire of the motor cable to the PE terminal of the VFD, connect the motor 3PH cable to the U, V and W terminals, and tighten up.
3. Connect optional parts such as the braking resistor that carries cables to designated positions.
4. Fix all the cables outside the VFD mechanically if allowed.

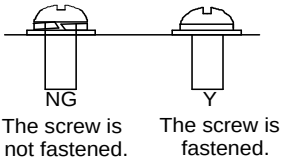


Figure 4-22 Screw installation diagram

4.3.4 Control circuit wiring diagram

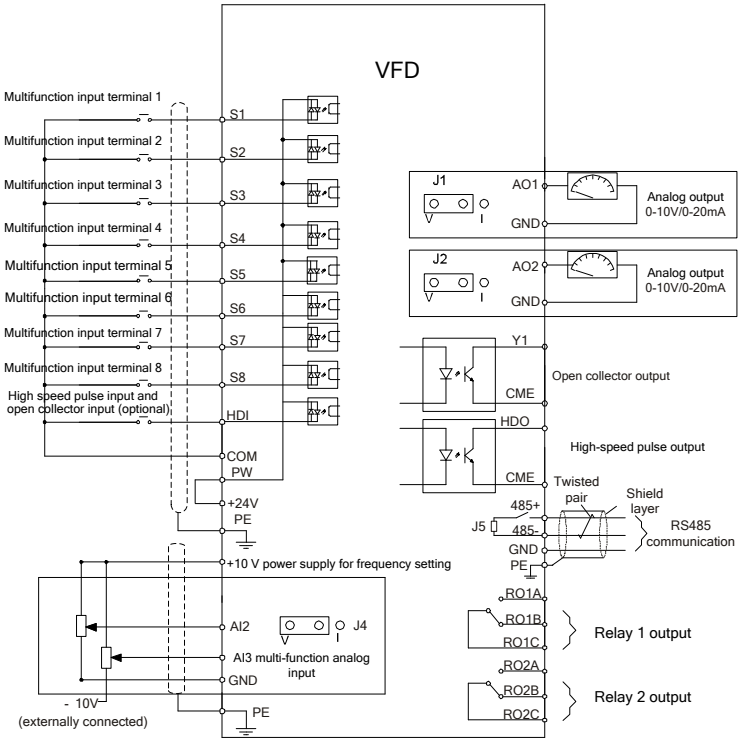


Figure 4-23 Control circuit wiring

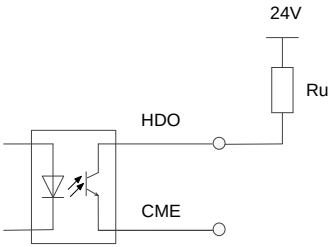


Figure 4-24 HDO wiring

Note: DO is an open collector and requires a resistor (Ru) when connecting to the 24V power. It is recommended to use a resistor with a rated power of 1W or 2W and a resistance of 700Ω–1000Ω.

4.3.5 Control terminal diagram

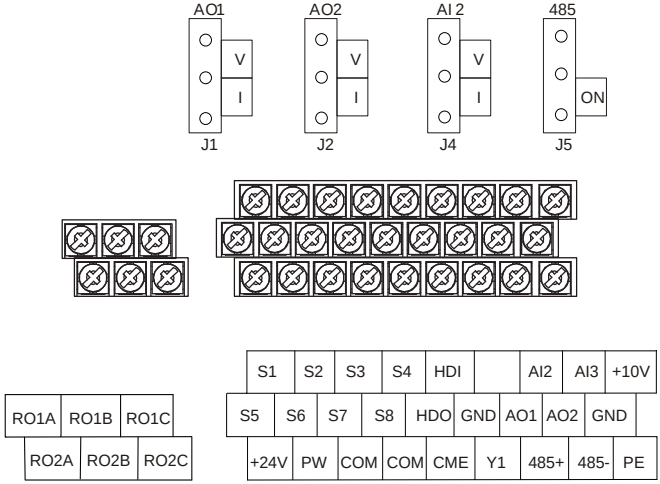


Figure 4-25 Control circuit terminals for the 380V 015G/018P and lower models

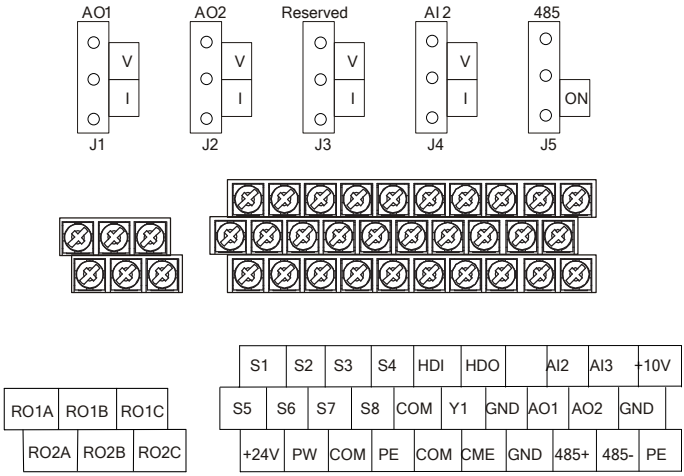


Figure 4-26 Control circuit terminals for the 380V 018G/022P and higher models

Note: The unused terminals on the control terminal are reserved and cannot be utilized.

Terminal	Description
HDO	1. Switch capacity: 50mA/30V 2. Output frequency range: 0–50kHz
COM	+24V reference ground
CME	Common terminal of open collector output

Terminal	Description	
Y1	1. Switch capacity: 50mA/30V 2. Output frequency range: 0–1kHz	
485+	RS485 communication/differential signal port. The standard 485 communication interface should use shielded twisted pairs.	
485-		
+10V	Locally provided +10V power supply	
AI2	1. Input range: AI2 is the voltage/current option 0(2)–10V/0(4)–20mA and can be shifted by jumper J4, while AI3 is the voltage input (-10V–+10V). 2. Input impedance: 20kΩ for voltage input or 500Ω for current input 3. Resolution: 5mV when 10V corresponds to 50Hz 4. Deviation: ±1%, 25°C	
AI3		
GND	+10V reference ground	
AO1	1. Output range: 0 (2)–10V or 0 (4)–20mA; AO1 can be shifted by jumper J1; AO2 can be shifted by jumper J2. 2. Deviation: ±1%, 25°C	
AO2		
PE	Grounding terminal	
PW	External power input terminal for digital input circuits Voltage range: 12–30V	
24V	User power supply provided by the VFD. Max. output current: 200mA	
S1	Digital input 1	1. Internal impedance: 3.3kΩ 2. 12–30V voltage input is acceptable 3. Bi-direction input terminal, supporting both NPN and PNP 4. Max. input frequency: 1kHz 5. Programmable digital input terminals, the functions of which can be set through the related parameters
S2	Digital input 2	
S3	Digital input 3	
S4	Digital input 4	
S5	Digital input 5	
S6	Digital input 6	
S7	Digital input 7	
S8	Digital input 8	
HDI	Channels for both high frequency pulse input and digital input Max. input frequency: 50kHz	
RO1A	RO1 output; RO1A: NO; RO1B: NC; RO1C: common Contact capacity: 3A/AC 250V, 1A/DC 30V	
RO1B		
RO1C		
RO2A	RO2 output; RO2A: NO; RO2B: NC; RO2C: common Contact capacity: 3A/AC 250V, 1A/DC 30V	
RO2B		
RO2C		

4.3.6 Input/output signal connection diagram

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

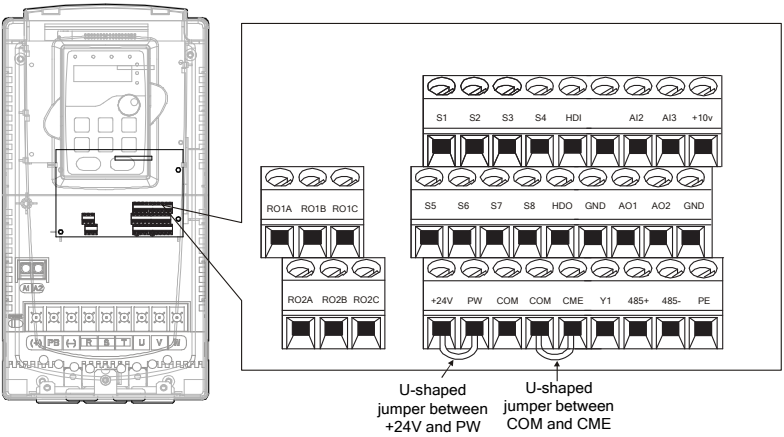


Figure 4-27 Position of U-shaped jumper for 380V 015G/018P and lower models

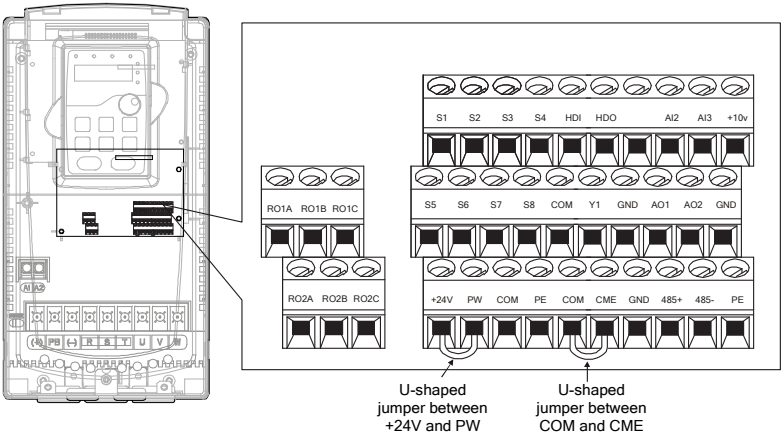


Figure 4-28 Position of U-shaped jumper for 380V 018G/022P and lower models

If the input signal comes from the NPN transistor, set the U-shaped jumper between +24V and PW based on the power used, as shown in Figure 4-29.

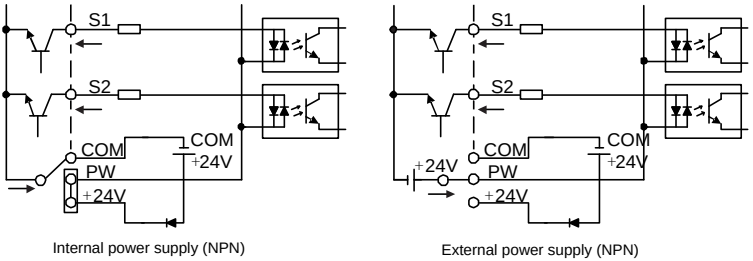


Figure 4-29 NPN mode

If the input signal comes from the PNP transistor, set the U-shaped jumper between COM and PW based on the power used, as shown in Figure 4-30.

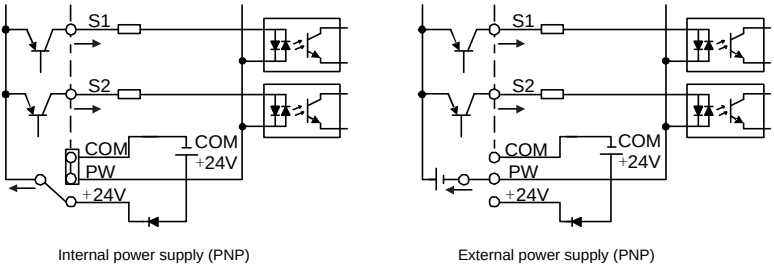


Figure 4-30 PNP mode

4.4 Wiring protection

4.4.1 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.

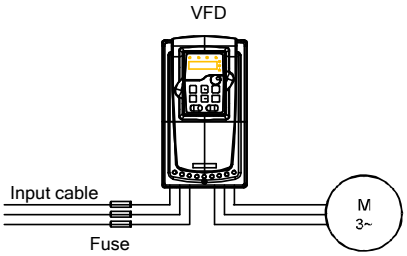


Figure 4-31 Fuse configuration

Note: Select the fuse according to the manual.

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

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

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

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

4.4.3 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.

4.4.4 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 Keypad operation guidelines

5.1 What this chapter contains

This chapter describes the buttons, indicators, and display of the keypad, as well as the method of using the keyboard to view and modify the function code settings.

5.2 Keypad introduction

The VFD has been equipped with a LED keypad as a standard configuration part. You can use the keypad to control the start and stop, read status data, and set parameters of the VFD. An optional LCD keypad is also available, which supports HD display with up to 10 lines in multi language, with parameter copy function. Its overall dimensions are identical to those of the LED keypad.

Figure 5-1 Film keypad

Figure 5-2 LED keypad

Figure 5-3 LCD keypad (optional)

Note:

- ✧ The standard configuration for the 380V 0R7G–015G/018P includes a non-detachable film keypad, as shown in Figure 5-1. For external connections, please consider purchasing a standalone LED keypad and mounting bracket.
- ✧ The standard configuration for the 380V 018G/022P and above includes a LED keypad that can be connected externally, as shown in Figure 5-2.
- ✧ If you need install the keypad externally (that is, on another position rather than on the VFD), use M3 screws to fix the keypad, or use the keypad mounting bracket to install the keypad. For the external extension, please utilize standard RJ45 crystal head network cables.
- ✧ The keypad mounting bracket is an optional part for the 380V 0R7G–030G/037P models, while it is a standard part for the 380V 037G/045P models and above.

5.3 LED keypad display and operation

Table 5-1 Description of LED keypad components

No.	Name	Description	
1	State indicator	RUN/TUNE	Off: The VFD is stopped. Blinking: The VFD is in parameter autotuning. On: The VFD is running.
		FWD/REV	Forward or reverse running indicator

No.	Name	Description		
			Off: The VFD is running forward. On: The VFD is running.	
		LOCAL/REMOT	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.	
		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.	
2	Unit indicator	Unit displayed currently		
			Hz	Frequency unit
			RPM	Rotation speed unit
			A	Current unit
			%	Percentage
			V	Voltage unit
3	Digital display zone	Five-digit LED displays various monitoring data and alarm codes such as the frequency setting and output frequency.		
4	Analog potentiometer	Equivalent to AI1, applicable to the 380V 015G/018P and lower VFD models.		
	Digital potentiometer	For frequency regulation. For details, see the description of P08.42. Applicable to the 380V 018G/022P and higher models.		
5	Keys	PRG ESC	Programming key	Press it to enter or exit level-1 menus or delete a parameter.
		DATA ENT	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.
		SHIFT	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	Run key	Press it to run when using the keypad for control.

No.	Name	Description		
			Stop/ Reset key	Press it to stop the VFD that is running. The function of this key is restricted by P07.04. In fault alarm state, this key can be used for reset in any control modes.
			Short-cut key	The function is determined by P07.02.
6	Keypad interface	Interfaces for an external keypad. The keypad interface is standard configuration for the 380V 015G/018P and lower models.		

5.3.1 Keypad display

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

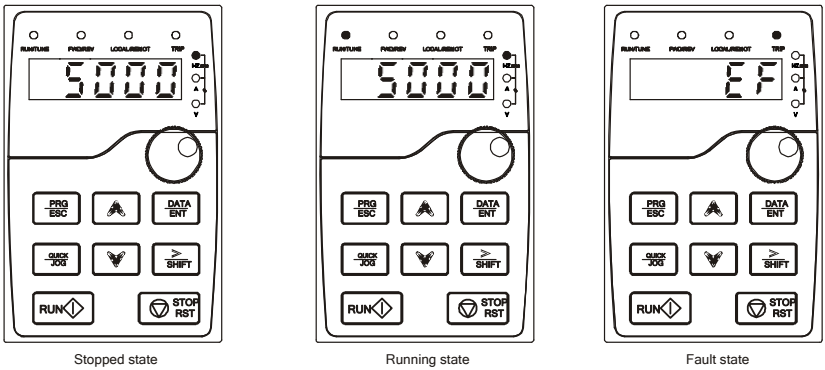


Figure 5-4 Status display

5.3.2 Operation procedure

You can operate the VFD by using the keypad. For details about function code descriptions, see chapter 6 Function parameter list.

5.3.2.1 Modifying function codes

The VFD provides three levels of menus, including:

• Function code group number (level-1 menu)

• Function code number (level-2 menu)

• Function code setting (level-3 menu)

Note:

When performing operations on the level-3 menu, you can press the PRG/ESC or DATA/ENT key to return to the level-2 menu.

If you press the DATA/ENT key, the set value of the parameter is saved to the control board first, and then the level-2 menu is returned, displaying the next function code. If you press the PRG/ESC key, the level-2 menu is returned directly, without saving the set value of the parameter, and the current function code is displayed.

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

1. It is read only. Read-only parameters include actual detection parameters and running record parameters.
2. 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.

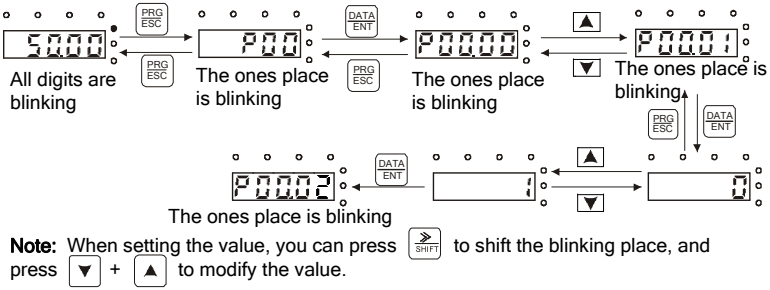


Figure 5-5 Modifying a parameter

5.3.2.2 Setting a password for the VFD

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

To disable the password protection function, you need only to set P07.00 to 0.

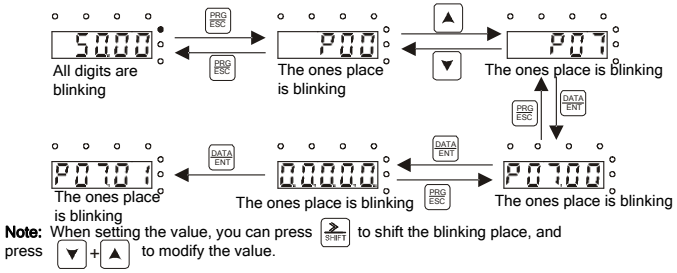


Figure 5-6 Setting a password

5.3.2.3 Viewing VFD status

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

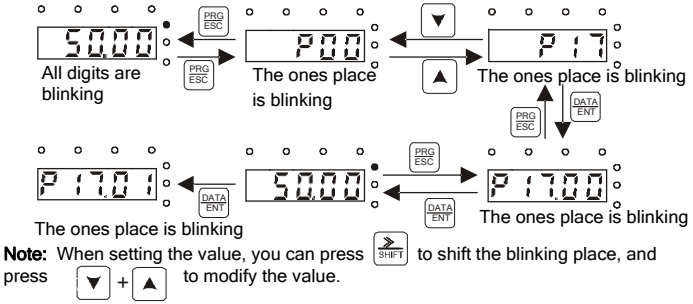


Figure 5-7 Viewing a parameter

5.4 LCD keypad display and operation

Table 5-2 Description of LCD keypad components

No.	Name	Description		
1	State indicator	RUN/TUNE	Off: The VFD is stopped Blinking: The VFD is in parameter autotuning. On: The VFD is running.	
		FWD/REV	Forward or reverse running indicator Off: The VFD is running forward. On: The VFD is running.	
		LOCAL/REMOT	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.	
		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.	
2	Digital display zone	LCD display, displaying the function code information. When entering the function code editing interface, the upper right corner of the LCD displays a letter indicating the current state: "E" for fault state, "S" for stopped state, and "R" for running state.		
3	Keys	PRG ESC	Programming key	Press it to enter or exit level-1 menus or delete a parameter.
		DATA ENT	Confirmation key	Press it to enter menus in cascading mode or confirm the setting of a parameter.

No.	Name	Description		
			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 when using the keypad for control.
			Stop/Reset key	The function is determined by the function code P07.04.
			Multifunction shortcut key	The function is determined by the function code P07.02.

5.4.1 Keypad display

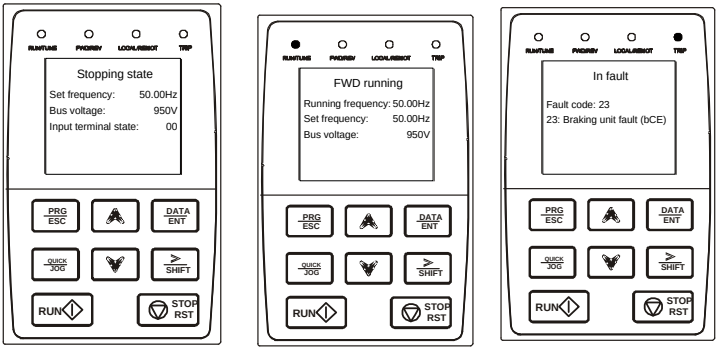


Figure 5-8 Status display

5.4.2 Operation procedure

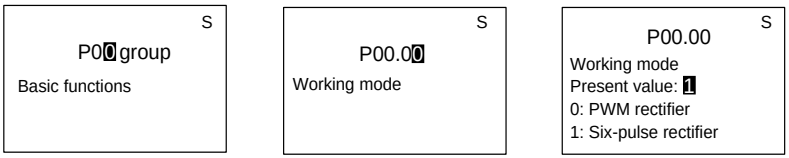
You can operate the VFD by using the keypad.

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)



Level-1 menu Level-2 menu 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.

5.4.2.1 Keypad setting and function menu selection

Press and hold the SHIFT and DOWN keys for 3 seconds when the keypad is powered on. The keypad then enters the function menu selection mode.

Hardware test: used to check the keys, displays and indicators.

Flash date program: used only when the FLASH configuration table is updated.

Language select: used to select the language (English).

Keypad SW ver: used to check the MCU and Flash software versions.

5.4.2.2 Editing function codes

You can press the PRG/ESC key to enter the editing mode in stopped, running, or fault alarm state (if a user password is used, see the description of P07.00). 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.

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 are divided into groups by function, of which P18–P23, P25–P28 are reserved. Each group includes several function codes (each function code identifies a function parameter). A three-level menu style is applied to function codes. For example, "P08.08" indicates the 8th function code in the P08 group. The P29 group consists of factory function parameters, which are user inaccessible.

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

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

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

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

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

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

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

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

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

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

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

2. The parameters adopt the decimal system (DEC) 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.

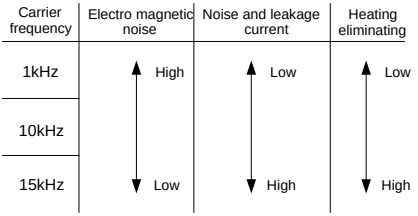
Group P00—Basic functions

Function code	Name	Description	Default	Modify
P00.00	Speed control mode	1: SVC mode 1 (for AMs) No need to install encoders. Applicable to scenarios with requirements for low frequency, great torque, and high speed control accuracy at all power ratings. 2: Space voltage vector control mode (for AMs) Applicable to scenarios without demanding requirements on control accuracy, such as fan and pump. One VFD can drive multiple motors. **Note:** ✧ AM: Asynchronous motor ✧ Before using a vector control mode, enable the VFD to perform motor parameter autotuning first.	2	◎
P00.01	Channel of running commands	The function code is used to select the channel of running VFD control commands. The VFD control commands include the start, stop, forward run, reverse run, jogging, and fault reset commands. 0: Keypad (LOCAL/REMOT off) The commands are controlled through keypad keys, such as the RUN and STOP/RST keys. Set the short-cut key QUICK/JOG as FWD/REV shifting function (P07.02=3) to change the running direction; press RUN and STOP/RST simultaneously in running state to make the VFD coast to stop. 1: Terminal (LOCAL/REMOT blinking) The running commands are controlled through multifunction input terminals. 2: Communication (LOCAL/REMOT on) The running commands are controlled by the upper computer in communication mode.	0	○

Function code	Name	Description	Default	Modify
P00.02	Communication mode of running commands	0: Modbus	0	○
P00.03	Max. output frequency	The function code is used to set the max. output frequency of the VFD. Pay attention to the function code because it is the foundation of the frequency setting and the speed of acceleration (ACC) and deceleration (DEC). Setting range: P00.04–400.00Hz	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 frequency. When the set frequency is higher than the upper limit of the running frequency, the upper limit of the running frequency is used for running. Setting range: P00.05–P00.03 (Max. output frequency)	50.00Hz	◎
P00.05	Lower limit of running frequency	The lower limit of the running frequency is the lower limit of the output frequency of the VFD, When the set frequency is lower than the lower limit of the running frequency, the lower limit of the running frequency is used for running. **Note: Max. output frequency ≥ Upper limit of frequency ≥ Lower limit of frequency** Setting range: 0.00Hz–P00.04 (Upper limit of running frequency)	0.00Hz	◎
P00.06	Setting channel of A frequency command	**Note: A frequency and B frequency cannot be set to the same frequency reference mode. Frequency source can be set by P00.09.**	0	○
P00.07	Setting channel of B frequency command	0: Keypad Modify the value P00.10 (Frequency set through keypad) to set the frequency by keypad. 1: AI1 (implemented through the analog potentiometer on the keypad for the 380V 0150G/018P and lower models; not available for the 380V 018G/022P and higher models.) 2: AI2 3: AI3	2	○

Function code	Name	Description	Default	Modify
		Set the frequency by analog input terminals. The VFD provides 3 channel analog input terminals. Among these, AI1 can be adjusted using an analog potentiometer; AI2 is the voltage/current option (0(2)–10V/0(4)–20mA) and can be shifted by jumpers; AI3 is the voltage input (-10V–+10V). **Note: When AI2 selects 0 (4)–20mA input, the corresponding voltage of 20mA is 10V.** 100.0% of the analog input setting corresponds to the maximum frequency in forward direction and -100.0% corresponds to the maximum frequency in reverse direction. 4: High-speed pulse HDI Set the frequency by high-speed pulse terminals. The VFD provides 1 channel high-speed pulse input in the range of 0.00–50.00kHz. Pulse frequency range: 0.00–50.00kHz. 100.0% of the high-speed pulse input setting corresponds to Max. output frequency in forward direction and -100.0% corresponds to Max. output frequency in reverse direction. **Note: The pulse setting can be only input by HDI. Set P05.00 (HDI input selection) to high speed pulse input.** 5: Simple PLC program When P00.06 or P00.07 is equal to 5, the VFD runs at simple PLC program mode. Set parameters of P10 group (Simple PLC and multi-step speed control group) to select corresponding running frequency, running direction, time of acceleration and deceleration, and duration. See Group P10—Simple PLC and multi-step speed control. 6: Multi-step speed running When P00.06 or P00.07 is equal to 6, the VFD runs at multi-step speed mode. Set multi-step speed terminals by P05 to select the current running step and select the current running frequency by parameters of P10. When P00.06 or P00.07 is not equal to 6, the multi-step speed setting has the priority, but the set step can be only 1–15. When P00.06 or P00.07 is		

Function code	Name	Description	Default	Modify
		equal to 6, the set step is 0–15. 7: PID control When P00.06 or P00.07 is equal to 7, the running mode of the VFD is process PID control. It is necessary to set P09 (PID control). The running frequency of the VFD is the value after PID effect. As for PID preset source, preset value and feedback source, refer to the description of Group P09—PID control. 8: Modbus communication The frequency is set through Modbus communication. See Group P14—Serial communication.		
P00.08	Reference object of B frequency command	0: Max. output frequency 100% of the B frequency setting corresponds to the maximum output frequency. 1: A frequency command 100% of the B frequency setting corresponds to the maximum output frequency. If it is necessary to adjust on basis of A frequency command, select this setting.	0	○
P00.09	Combination mode of setting source	0: A. The present frequency is set to A frequency command. 1: B. The present frequency is set to B frequency command. 2: A+B. The present frequency is set to A+B frequency command. 3: A-B. The present frequency is set to A-B frequency command. 4: Max(A, B). Take the larger value between A and B frequency commands as the set frequency. 5: Min(A, B). Take the smaller value between A and B frequency commands as the set frequency. **Note: The combination can be shifted by terminal functions (P05).**	0	○
P00.10	Frequency set through keypad	When A and B frequency commands select the keypad for setting, the value of the function code is the original setting one of the frequency data of the VFD.	50.00Hz	○

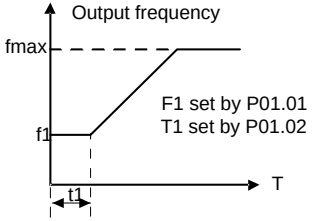
Function code	Name	Description	Default	Modify
		Setting range: 0.00Hz–P00.03 (Max. output frequency)		
P00.11	ACC time 1	ACC time means the time needed if the VFD speeds up from 0Hz to the max. output frequency (P00.03). DEC time means the time needed if the VFD speeds down from the max. output frequency (P00.03) to 0Hz. The VFD has four groups of ACC/DEC time, which can be selected by P05. The factory default ACC/DEC time of the VFD is the first group. P00.11 and P00.12 setting range: 0.0–3600.0s	Model depended	○
P00.12	DEC time 1		Model depended	○
P00.13	Running direction	0: Run at the default direction. The VFD runs in the forward direction. FWD/REV is off. 1: Run at the opposite direction. The VFD runs in the reverse direction. FWD/REV is on. The rotation direction of the motor can be shifted by changing the function code. The effect is equivalent to the switchover of the rotation directions by adjusting arbitrary two motor lines (U, V and W). When the running channel is set under the keypad control, the rotation direction can be changed by QUICK/JOG on the keypad. Refer to P07.02 for detailed information. Note: When the parameter is restored to the default value, the motor's running direction is restored to the default one. Exercise caution before using this function if the change of motor rotation direction is disallowed after commissioning. 2: Disable reverse running. It can be used in some special scenarios where reverse running is disallowed.	0	○
P00.14	Carrier frequency setting	 The relationship between models and carrier	Model depended	○

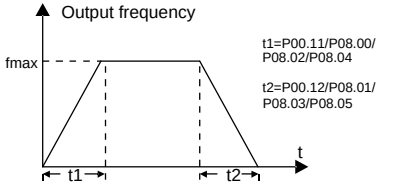
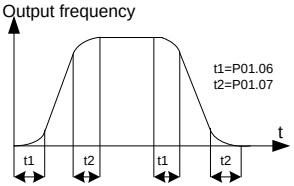
<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td></td><td></td><td>frequencies is as follows:
<table><tr><th>VFD model</th><th>Default carrier frequency</th></tr><tr><td>380V 0R7G–011G/015P</td><td>8kHz</td></tr><tr><td>380V 015G/018P–055G/075P</td><td>4kHz</td></tr><tr><td>380V 075G/090P and higher</td><td>2kHz</td></tr></table>Advantage of high carrier frequency: ideal current waveform, little current harmonic wave and motor noise.
Disadvantage of high carrier frequency: increasing the switch loss, increasing VFD temperature and the impact to the output capacity. The VFD needs to derate on high carrier frequency. At the same time, the leakage and electrical magnetic interference will increase.
On the contrary, an extremely-low carrier frequency may cause unstable operation at low frequency, decrease the torque, or even lead to oscillation.
The carrier frequency has been properly set in the factory before the VFD is delivered. In general, you do not need to modify it.
When the frequency used exceeds the default carrier frequency, the VFD needs to derate by 10% for each increase of 1k carrier frequency.
Setting range: 1.0–15.0kHz</td><td></td><td></td></tr>
<tr><td>P00.15</td><td>Motor parameters Autotuning</td><td>0: No operation
1: Rotary autotuning
Comprehensive motor parameter autotuning. It is recommended to use rotating autotuning when high control accuracy is required.
2: Static autotuning 1
Used in scenarios where the motor cannot be disconnected from load.
3: Static autotuning 2
Used in scenarios where the motor cannot be disconnected from load. However, it can only acquire a subset of the motor parameters.</td><td>0</td><td>◎</td></tr>
<tr><td>P00.16</td><td>AVR function</td><td>0: Invalid</td><td>1</td><td>○</td></tr>
</table>

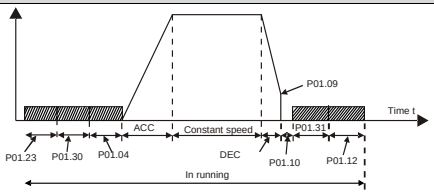
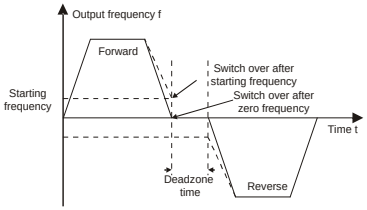
Function code	Name	Description	Default	Modify
	selection	1: Valid during the whole process The auto-adjusting function of the VFD can eliminate the impact on the output voltage of the VFD because of the bus voltage fluctuation.		
P00.17	VFD type	0: G type, applicable to the constant torque load of rated parameters. 1: P type, applicable to the variable torque load of rated parameters (fans and water pumps) The VFD employs a G/P integrated approach, wherein the motor power rating for constant torque loads (G type) is one level smaller than that for fan and pump-type loads (P type).	0	◎
P00.18	Function parameter restoration	0: No operation 1: Restore default values 2: Clear fault records 3: Lock keypad 4: Reserved 5: Restore default values (standard version) 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. ✧ When P00.18=3, all other function codes except P00.18 are read only and no other operations can be performed. ✧ For non-standard version, select value 1 to restore only the non-standard parameters and select 5 to restore to the corresponding standard version. For standard version, value 1 and value 5 have the same function.	0	◎

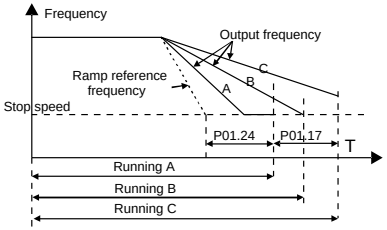
Group P01—Start and stop control

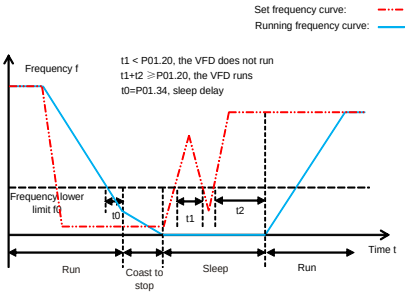
Function code	Name	Description	Default	Modify
P01.00	Start mode	0: Direct start Start from the starting frequency specified by P01.01.	0	◎

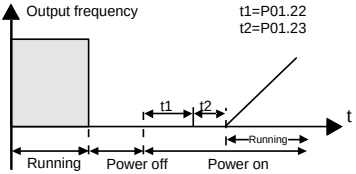
Function code	Name	Description	Default	Modify
		1: Start after DC braking DC braking (setting parameters P01.03 and P01.04) before starting the motor from the starting frequency. This mode is applicable to the scenarios where small inertial loads may rotate reversely at startup. 2: Speed tracking restart 1 3: Speed tracking restart 2 It automatically tracks the speed and direction of the motor, providing a smooth and impact-free start when the motor is rotating. This mode is applicable to the scenarios where high inertia loads may rotate reversely at startup. **Note: This function is available for the 380V 004G/5R5P and higher models.**		
P01.01	Starting frequency of direct start	The function code indicates the initial frequency during VFD start. See P01.02 (Starting frequency hold time) for detailed information. Setting range: 0.00–50.00Hz	0.50Hz	◎
P01.02	Starting frequency hold time	Setting a proper starting frequency can increase the torque during VFD start. During the hold time of the starting frequency, the output frequency of the VFD is the starting frequency. And then, the VFD runs from the starting frequency to the set frequency. If the set frequency is lower than the starting frequency, the VFD stops running and keeps in the standby state. The starting frequency is not limited in the lower limit frequency.  Setting range: 0.0–50.0s	0.0s	◎
P01.03	Braking current before start	The VFD performs DC braking with the braking current before start and it speeds up after the DC braking time. If the set DC braking time is 0, DC braking is invalid.	0.0%	◎
P01.04	Braking time		0.00s	◎

Function code	Name	Description	Default	Modify
	before start	Stronger braking current indicates larger braking power. The DC braking current before start is a percentage of the VFD rated output current. Setting range of P01.03: 0.0–100.0% Setting range of P01.04: 0.00–50.00s		
P01.05	ACC and DEC mode	Used to indicate the changing mode of the frequency during start and running. 0: Linear type. The output frequency increases or decreases linearly.  1: S curve. The output frequency increases or decreases according to the S curve. The S curve is generally applied to elevators, conveyors, and other application scenarios where smoother start or stop is required. 	0	◎
P01.06	ACC time of S curve starting segment	Setting range: 0.0–50.0s **Note: Effective when P01.05 = 1.**	0.1s	○
P01.07	DEC time of S curve ending segment		0.1s	○
P01.08	Stop mode	0: Decelerate to stop. When a stop command takes effect, the VFD lowers output frequency based on the DEC mode and the defined DEC time; when the frequency drops to 0Hz, the VFD stops. 1: Coast to stop. After a stop command takes effect, the VFD ceases the output immediately, and the load coasts to stop according to mechanical inertia.	0	○

Function code	Name	Description	Default	Modify
P01.09	Starting frequency of DC braking for stop		0.00Hz	○
P01.10	Wait time before DC 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.	0.00s	○
P01.11	DC braking current for stop	Wait time before DC braking: The VFD blocks the output before starting DC braking. After this wait time, DC braking is started so as to prevent overcurrent caused by DC braking at high speed.	0.0%	○
P01.12	DC braking time for stop	DC braking current for stop: It indicates the applied DC braking energy. Stronger current indicates greater DC braking effect. DC braking time for stop: It indicates the hold time of DC braking. If the time is 0, DC braking is invalid, and the VFD decelerates to stop within the specified time. Setting range of P01.09: 0.00Hz–P00.03 (Max. output frequency) Setting range of P01.10: 0.00–50.00s Setting range of P01.11: 0.0–100.0% (of the rated VFD output current) Setting range of P01.12: 0.00–50.00s	0.00s	○
P01.13	FWD/REV running deadzone time	This function code specifies the transition time of the switching in FWD/REV running switching mode specified by P01.14.  Setting range: 0.0–3600.0s	0.0s	○
P01.14	FWD/REV run switching	Used to set the threshold point of the VFD. 0: Switch at zero frequency	1	◎

Function code	Name	Description	Default	Modify
	mode	1: Switch at the starting frequency 2: Switch at the stop speed		
P01.15	Stop speed	0.00–100.00Hz	0.50 Hz	◎
P01.16	Stop speed detection mode	0: Detect by the speed setting (without speed delay) 1: Detect by speed feedback (valid only for vector control)	1	◎
P01.17	Feedback speed detection time	When P01.16 is set to 1, if the feedback frequency is less than or equal to the set value of P01.15 and it is detected within the time set in P01.17, the VFD will coast to stop immediately; Otherwise, the VFD stops after the time set by P01.17.  Setting range: 0.00–100.00s (only valid when P01.16=1)	0.50s	◎
P01.18	Terminal-based running command protection at power-on	When the channel of running commands is terminal control, the system detects the state of the running terminal during power-on. 0: The terminal running command is invalid at power-on. Even the running command is considered as valid during power-on, the VFD does not run and it keeps the protection state until the running command is canceled and enabled again. 1: The terminal running command is valid at power-on. If the running command is considered as valid during power-on, the VFD is started automatically after the initialization. **Note: Exercise caution before using this function. Otherwise, serious result may follow.**	0	○
P01.19	Action selected when running frequency	The function code determines the running state of the VFD when the set frequency is lower than the lower-limit one. Ones place:	0x00	◎

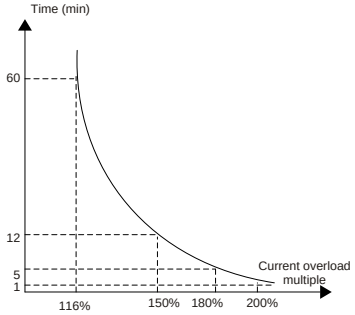
Function code	Name	Description	Default	Modify
	less than frequency lower limit (valid when frequency lower limit greater than 0)	0: Run at the frequency lower limit 1: Stop 2: Sleep The VFD will stop as set in Tens place when the set frequency is lower than the lower-limit one and the sleep delay set in P08.22 is reached. If the set frequency exceeds the lower limit one again and it lasts for the time set by P01.20, the VFD resumes the running state automatically. 3: Sleep 2 When Sleep 2 is selected, i.e. the operating frequency ≤ the lower frequency limit (P00.05), the system will enter sleep mode after continuously judging the time set in P24.05. Tens place: Stop mode 0: Coast to stop 1: Decelerate to stop Setting range: 0x00–0x13		
P01.20	Wake-up-from-sleep delay	Specifies the wake-up-from-sleep delay time. When the running frequency of the VFD is lower than the lower limit, the VFD becomes standby. When the set frequency exceeds the lower limit one again and it lasts for the time set by P01.20, the VFD runs automatically.  Setting range: 0.0–3600.0s (Valid only when P01.19=2)	0.0s	○
P01.21	Restart after power off	The function code indicates whether the VFD automatically runs after re-power on. 0: Disable 1: Enable. If the restart condition is met, the VFD will	0	○

Function code	Name	Description	Default	Modify
		run automatically after waiting the time defined by P01.22.		
P01.22	Wait time for restart after power-off	The function code indicates the wait time before the automatic running of the VFD that is re-powered on.  Setting range: 0.0–3600.0s (Valid only when P01.21=1)	1.0s	○
P01.23	Start delay	After a VFD running command is given, the VFD restarts running output with the delay defined by P01.23 from the standby state, to implement brake release. Setting range: 0.0–60.0s	0.0s	○
P01.24	Stop speed delay	Setting range: 0.0–100.0s	0.0s	○
P01.25	0Hz output selection	The function code is used to select the output type of the VFD at 0Hz. 0: Output without voltage 1: Output with voltage 2: Output with the DC braking current for stop	0	○

Group P02—Parameters of motor 1

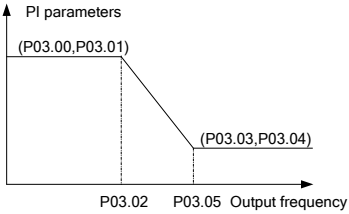
Function code	Name	Description	Default	Modify
P02.01	Rated power of AM 1	The function codes are used to set the parameters for the controlled AM. To ensure the control performance, set P02.01–P02.05 correctly according to the information on the nameplate of the AM. The VFD provides the parameter autotuning function. Whether parameter autotuning can be performed properly depends on the settings of the motor nameplate parameters. In addition, you need to configure a motor according to the standard motor configuration of the VFD. If the	Model depended	◎
P02.02	Rated frequency of AM 1		50.00Hz	◎
P02.03	Rated speed of AM 1		Model depended	◎
P02.04	Rated voltage of AM 1		Model depended	◎
P02.05	Rated current of AM 1		Model depended	◎

Function code	Name	Description	Default	Modify
P02.06	Stator resistance of AM 1	power of the motor is greatly different from that of the standard motor configuration, the control performance of the VFD degrades significantly.	Model depended	○
P02.07	Rotor resistance of AM 1	Setting range of P02.01: 0.1–3000.0kW Setting range of P02.02: 0.01Hz–P00.03 (Max. output frequency)	Model depended	○
P02.08	Leakage inductance of AM 1	Setting range of P02.03: 1–36000rpm Setting range of P02.04: 0–1200V Setting range of P02.05: 0.8–6000.0A	Model depended	○
P02.09	Mutual inductance of AM 1	**Note: Resetting the rated power of the motor (P02.01) can initialize the parameters P02.02–P02.10.**	Model depended	○
P02.10	No-load current of AM 1	In both the rotary auto-tuning and static autotuning 1, the set values (of P02.06–P02.10) can be automatically updated upon the successful completion of motor parameter auto-tuning. In static autotuning 2, the set values (of P02.06–P02.08) can be automatically updated. These parameters are the benchmark parameters for VFD control, directly affecting the control performance. Setting range of P02.06: 0.001–65.535Ω Setting range of P02.07: 0.001–65.535Ω Setting range of P02.08: 0.1–6553.5mH Setting range of P02.09: 0.1–6553.5mH Setting range of P02.05: 0.1–6553.5A **Note: Do not modify these parameters unless it is necessary.**	Model depended	○
P02.26	Overload protection of motor 1	0: No protection 1: Common motor protection (with low-speed compensation). As the cooling effect of a common motor is degraded at low speed running, the corresponding electronic thermal protection value needs to be adjusted properly. The low compensation indicates lowering the overload protection threshold of the motor whose running frequency is lower than 30Hz. 2: Variable-frequency motor protection (without low speed compensation). Because the heat dissipation function for a variable-frequency motor is not	2	◎

Function code	Name	Description	Default	Modify
		impacted by the rotation speed, it is not necessary to adjust the protection value at low speed running.		
P02.27	Overload protection coefficient of motor 1	Motor overload multiplication M = $I_{out}/(I_n*K)$ I_n indicates the rated motor current, I_{out} indicates the VFD output current, and K indicates the motor overload protection coefficient. A smaller value of "K" indicates a bigger value of "M". When M=116%, protection is performed after motor overload lasts for 1 hour; when M=150%, protection is performed after motor overload lasts for 12 minutes; when M=200%, protection is performed after motor overload lasts for 60 seconds; and when M≥400%, protection is performed immediately.  Setting range: 20.0%–120.0%	100.0%	○
P02.28	Power display calibration coefficient of motor 1	The function code can be used to adjust the power display value of motor 1. However, it does not affect the control performance of the VFD. Setting range: 0.00–3.00	1.00	○

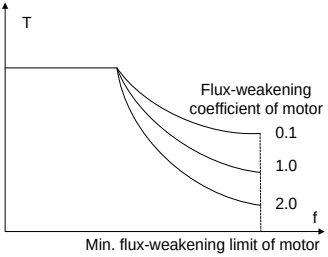
Group P03—Vector control

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	20.0	○
P03.01	Speed-loop integral time 1		0.200s	○
P03.02	Low-point		5.00Hz	○

Function code	Name	Description	Default	Modify
	frequency for switching	according to the linear change of two groups of parameters. See the following figure:  		
P03.03	Speed-loop proportional gain 2		20.0	○
P03.04	Speed-loop integral time 2		0.200s	○
P03.05	High-point frequency for switching	The speed loop dynamic response characteristics of vector control can be adjusted by setting the proportional coefficient and integral time of speed regulator. Increasing proportional gain or reducing integral time can accelerate dynamic response of speed loop; however, if the proportional gain is too large or integral time is too small, system oscillation and overshoot may occur; if proportional gain is too small, stable oscillation or speed offset may occur. PI parameters have a close relationship with the inertia of the system. Adjust PI parameters depending on different loads to meet various demands. Setting range of P03.00: 0–200.0 Setting range of P03.01: 0.000–10.000s Setting range of P03.02: 0.00Hz–P03.05 Setting range of P03.03: 0–200.0 Setting range of P03.04: 0.000–10.000s Setting range of P03.05: P03.02–P00.03 (Max. output frequency)	10.00Hz	○
P03.06	Speed-loop output filter	0–8 (0–2^8/10ms)	0	○
P03.07	Electromotive slip compensation coefficient of vector control	Slip compensation coefficient is used to adjust the slip frequency of the vector control and improve the speed control accuracy of the system. Adjusting the parameter properly can control the speed steady-state error. Setting range: 50–200%	100%	○
P03.08	Vector control slip compensation		100%	○

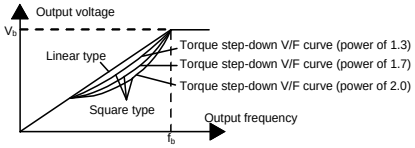
Function code	Name	Description	Default	Modify
	coefficient (for power generation)			
P03.09	Current-loop proportional coefficient P	**Note:** ✧ The two function codes impact the dynamic response speed and control accuracy of the system. Generally, you do not need to modify the two function codes. ✧ Applicable to SVC mode 0 (P00.00=0) only. Setting range: 0–65535	1000	○
P03.10	Current-loop integral coefficient I		1000	○
P03.11	Torque setting method selection	The function code is used to enable the torque control mode and set the torque setting method. 0: Torque control is invalid 1: Keypad (P03.12) 2: AI1 (implemented through the analog potentiometer on the keypad for the 380V 0150G/018P and lower models; not available for the 380V 018G/022P and higher models.) 3: AI2 4: AI3 5: Pulse frequency HDI 6: Multi-step torque 7: Modbus communication **Note: For setting methods 2–5, 100% corresponds to triple the motor rated current.**	0	○
P03.12	Torque set through keypad	Setting range: -300.0%–300.0% (of the motor rated current)	50.0%	○
P03.13	Torque reference filter time	0.000–10.000s	0.010s	○
P03.14	Setting source of forward rotation frequency upper limit in torque control	0: Keypad (Set P03.16 for P03.14, and set P03.17 for P03.15) 1: AI1 (implemented through the analog potentiometer on the keypad for the 380V 0150G/018P and lower models; not available for the 380V 018G/022P and higher models.) 2: AI2 3: AI3	0	○
P03.15	Setting source of reverse		0	○

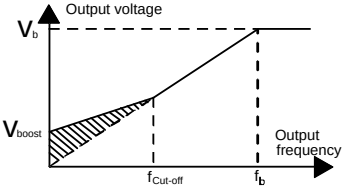
Function code	Name	Description	Default	Modify
	rotation upper-limit frequency in torque control	4: Pulse frequency HDI 5: Multi-step setting 6: Modbus communication **Note: For setting sources 1–6, 100% corresponds to the maximum frequency.**		
P03.16	Forward rotation upper-limit frequency set through keypad in torque control	The function code is used to set the frequency upper limits. 100% corresponds to the max. frequency. P03.16 sets the value when P03.14=1; P03.17 sets the value when P03.15=1. Setting range: 0.00Hz–P00.03 (Max. output frequency)	50.00Hz	○
P03.17	Reverse rotation upper-limit frequency set through keypad in torque control		50.00Hz	○
P03.18	Setting source of electromotive torque upper limit	The function code is used to set the source of electromotive torque upper limit. 0: Keypad (Set P03.20 for P03.18, and set P03.21 for P03.19)	0	○
P03.19	Setting source of braking torque upper limit	1: AI1 (implemented through the analog potentiometer on the keypad for the 380V 0150G/018P and lower models; not available for the 380V 018G/022P and higher models.) 2: AI2 3: AI3 4: Pulse frequency HDI 5: Modbus communication **Note: For setting methods 1–4, 100% corresponds to triple the motor rated current.**	0	○
P03.20	Electromotive torque upper limit set through keypad	Used to set torque limits. Setting range: 0.0–300.0% (of the motor rated current)	180.0%	○
P03.21	Braking torque upper limit set through keypad		180.0%	○

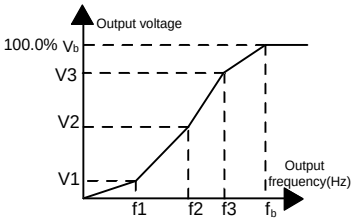
Function code	Name	Description	Default	Modify
P03.22	Weakening coefficient in constant power zone	The function code is used when the motor is in flux-weakening control.  	0.3	○
P03.23	Lowest weakening point in constant power zone	The function codes P03.22 and P03.23 are valid at constant power. The motor enters the flux-weakening state when the motor runs above the rated speed. Change the flux-weakening curvature by modifying the flux-weakening control coefficient. The larger the coefficient, the steeper the curve, the smaller the coefficient, the smoother the curve. Setting range of P03.22 (only valid for vector mode 1): 0.1–2.0 P03.23 setting range: 10% –100.0%	20%	○
P03.24	Max. voltage limit	It sets the max. output voltage of the VFD. Set the value according to onsite conditions. Setting range: 0.0–120.0%	100.0%	◎
P03.25	Pre-exciting time	Pre-exciting is performed for the motor when the VFD starts up. A magnetic field is built up inside the motor to improve the torque performance during the start process. Setting range: 0.000–10.000s	0.300s	○
P03.26	Flux-weakening proportional gain	Setting range: 0–8000 **Note:** P03.24**–**P03.26 **are invalid for vector mode 1.**	1000	○
P03.27	Speed display selection in vector control	Setting range: 0–1 0: Display the actual value 1: Display the set value	0	○
P03.28	Static friction compensation coefficient	Setting range: 0.0–100.0% You can adjust P03.28 to perform low-frequency torque compensation. The value is valid only within 1Hz.	0.0%	○
P03.29	Dynamic friction	Setting range: 0.0–100.0%	0.0%	○

Function code	Name	Description	Default	Modify
	compensation coefficient	You can adjust the P03.29 to perform torque compensation during running. The value is valid only when the running frequency is higher than 1Hz.		

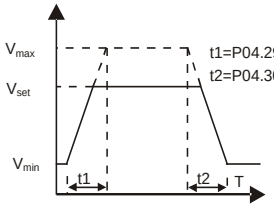
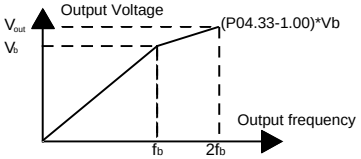
Group P04—Space voltage vector control

Function code	Name	Description	Default	Modify
P04.00	V/F curve setting of motor 1	This group of function code defines the V/F curve of motor 1 to meet the needs of different loads. 0: Straight-line V/F curve, applicable to constant torque loads 1: Multi-point V/F curve 2: Torque-down V/F curve (power of 1.3) 3: Torque-down V/F curve (power of 1.7) 4: Torque-down V/F curve (power of 2.0) Curves 2 – 4 are applicable to the torque loads such as fans and water pumps. You can adjust according to the characteristics of the loads to achieve best performance. 5: Customized V/F (V/F separation); in this mode, V can be separated from F and F can be adjusted through the frequency setting channel set by P00.06 or the voltage setting channel set by P04.27 to change the characteristics of the curve. **Note: In the following figure, V_b is the motor rated voltage and f_b is the motor rated frequency.** 	0	◎
P04.01	Torque boost of motor 1	In order to compensate for low-frequency torque characteristics, you can make some boost compensation for the output voltage. P04.01 is relative to the max. output voltage V_b.	0.0%	○
P04.02	Torque boost cut-off of motor 1		20.0%	○

Function code	Name	Description	Default	Modify
		 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 in space voltage vector. You need to select torque boost based on the load. For example, larger load requires larger torque boost, however, if the torque boost is too large, the motor will run at over-excitation, which may cause increased output current and motor overheating, thus decreasing the efficiency. When torque boost is set to 0.0%, the VFD uses automatic torque boost. Torque boost cut-off threshold: Below this frequency threshold, torque boost is valid; exceeding this threshold will invalidate torque boost. Setting range of P04.01: 0.0%: Automatic, 0.1%–10.0% Setting range of P04.02: 0.0%–50.0%		
P04.03	V/F frequency point 1 of motor 1	When P04.00=1 (multi-dot V/F curve), you can set the V/F curve through P04.03–P04.08. The V/F curve is generally set according to the load characteristics of the motor. **Note: V1< V2 < V3, f1< f2 < f3 Too high voltage for low frequency will cause motor overheat or damage and cause VFD overcurrent stall or overcurrent protection.**	0.00Hz	○
P04.04	V/F voltage point 1 of motor 1		0.0%	○
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		0.00Hz	○

Function code	Name	Description	Default	Modify
	1			
P04.08	V/F voltage point 3 of motor 1	Setting range of P04.03: 0.00Hz–P04.05 Setting range of P04.04: 0.0%–110.0% (of the rated voltage of motor 1) Setting range of P04.05: P04.03–P04.07 Setting range of P04.06: 0.0%–110.0% (of the rated voltage of motor 1) Setting range of P04.07: P04.05–P02.02 Setting range of P04.08: 0.0%–110.0% (of the rated voltage of motor 1)	0.0%	○
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 control, and thus improve the rigidity of the mechanical characteristics of the motor. You need to calculate the rated slip frequency of the motor as follows: $\Delta f=f_b-n*p/60$ Of which, f_b is the rated frequency of the motor, corresponding to function code P02.02. n is the rated rotating speed of the motor, corresponding to the function code P02.03. p is the number of pole pairs of the motor. 100.0% corresponds to the rated slip frequency Δf of the motor. Setting range: 0.0–200%	100.0%	○
P04.10	Low-frequency oscillation control factor of motor 1	In space voltage vector control mode, the motor, especially the large-power motor, may experience current oscillation at certain frequencies, which may cause unstable motor running, or even VFD overcurrent. You can adjust the two function codes properly to eliminate such phenomenon. P04.10 setting range: 0–100 P04.11 setting range: 0–100	10	○
P04.11	High-frequency oscillation control factor of motor 1		10	○

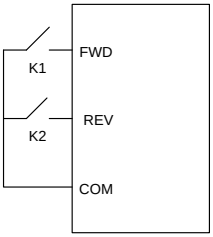
Function code	Name	Description	Default	Modify
P04.12	Oscillation control threshold of motor 1	Setting range of P04.12: 0.00Hz–P00.03 (Max. output frequency)	30.00 Hz	○
P04.26	Energy-saving run	0: Disable 1: Automatic energy-saving run In light-load state, the motor can adjust the output voltage automatically to achieve energy saving.	0	◎
P04.27	Voltage setting channel selection	When the V/F curve is separated, select the channel for the output voltage setting. 0: Keypad. Output voltage is determined by P04.28. 1: AI1 (implemented through the analog potentiometer on the keypad for the 380V 0150G/018P and lower models; not available for the 380V 018G/022P and higher models.) 2: AI2 3: AI3 4: HDI1 5: Multi-step running 6: PID 7: Modbus communication **Note: 100% corresponds to the motor rated voltage.**	0	○
P04.28	Voltage set through keypad	The function code is the voltage digital setting when "keypad" is selected as the voltage setting channel. Setting range: 0.0%–100.0%	100.0%	○
P04.29	Voltage increase time	Voltage increase time means the time needed for the VFD to accelerate from min. output voltage to the max. output frequency. Voltage decrease time means the time needed for the VFD to decelerate from the max. output frequency to min. output voltage. Setting range: 0.0–3600.0s	5.0s	○
P04.30	Voltage decrease time		5.0s	○
P04.31	Max. output voltage	The function codes are used to set the upper and lower limits of output voltage. Setting range of P04.31: P04.32–100.0% (of the motor rated voltage) Setting range of P04.32: 0.0%–P04.31 (of the motor rated voltage)	100.0%	◎
P04.32	Min. output voltage		0.0%	◎

Function code	Name	Description	Default	Modify
				
P04.33	Weakening coefficient in constant power zone	Used to adjust the output voltage of VFD in SVPWM mode during flux weakening. **Note: It is invalid in constant torque mode.**  Setting range of P04.33: 1.00–1.30	1.00	○
P04.34	Reserved	/	/	/

Group P05—Input terminal functions

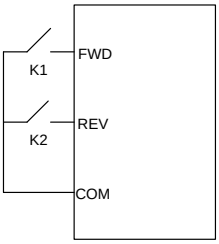
Function code	Name	Description	Default	Modify
P05.00	HDI input type	0: HDIA is high-speed pulse input See P05.50–P05.54. 1: HDI is digital input	0	◎
P05.01	Function of S1	0: No function 1: Run forward (FWD) 2: Run reversely (REV) 3: Three-wire running control (S_{in}) 4: Jog forward 5: Jog reversely 6: Coast to stop 7: Reset faults 8: Pause running	1	◎
P05.02	Function of S2		4	◎
P05.03	Function of S3		7	◎
P05.04	Function of S4		0	◎
P05.05	Function of S5		0	◎
P05.06	Function of S6		0	◎
P05.07	Function of S7		0	◎
P05.08	Function of S8		0	◎
P05.09	Function of HDI terminal	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	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>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 terminal 1
22: ACC/DEC time selection terminal 2
23: Simple PLC stop reset
24: Pause simple PLC
25: Pause PID control
26: Pause wobbling frequency (stopped at the present frequency)
27: Reset wobbling frequency (returned to the center frequency)
28: Counter reset
29: Disable torque control
30: Disable ACC/DEC
31: Trigger the counter
33: Clear the frequency increase/decrease setting temporarily
34: DC braking
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
61: Switch PID polarities
When the terminal acts as acceleration/ deceleration time selection function, The status of the two terminals (select 21 for terminal 1 and select 22 for terminal 2) can be combined to select four groups of ACC/DEC time.
<table>
<tr><th>Terminal 1 (21)</th><th>Terminal 2 (22)</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><td></td><td></td></tr>
</table>

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td>P05.10</td><td>Input terminal polarity</td><td>The function code is used to set the polarity of input terminals.
When a bit is 0, the input terminal is positive.
When a bit is 1, the input terminal is negative.
<table><tr><td>Bit0</td><td>Bit1</td><td>Bit2</td><td>Bit3</td><td>Bit4</td></tr><tr><td>S1</td><td>S2</td><td>S3</td><td>S4</td><td>S5</td></tr><tr><td>Bit5</td><td>Bit6</td><td>Bit7</td><td>Bit8</td><td>/</td></tr><tr><td>S6</td><td>S7</td><td>S8</td><td>HDI</td><td>/</td></tr></table>Setting range: 0x000–0x1FF</td><td>0x000</td><td>○</td></tr>
<tr><td>P05.11</td><td>Digital input filter time</td><td>Used to specify the sampling filter time of the S1–S8 and HDI terminals. In strong interference cases, increase the value to avoid maloperation.
0.000–1.000s</td><td>0.010s</td><td>○</td></tr>
<tr><td>P05.12</td><td>Virtual terminal setting</td><td>0x000–0x1FF (0: Disable. 1: Enable)
Bit0: S1 virtual terminal enabling
Bit1: S2 virtual terminal enabling
Bit2: S3 virtual terminal enabling
Bit3: S4 virtual terminal enabling
Bit4: S5 virtual terminal enabling
Bit5: S6 virtual terminal enabling
Bit6: S7 virtual terminal enabling
Bit7: S8 virtual terminal enabling
Bit8: S9 virtual terminal enabling
Note: After a virtual terminal is enabled, the state of the terminal can be changed only in communication mode. The communication address is 0x200A.</td><td>0x000</td><td>◎</td></tr>
<tr><td>P05.13</td><td>Terminal control mode</td><td>Used to set the terminal control mode.
0: Two-wire control 1, the enabling consistent with the direction. This mode is widely used. The defined FWD/REV terminal command determines the motor rotation direction.
 

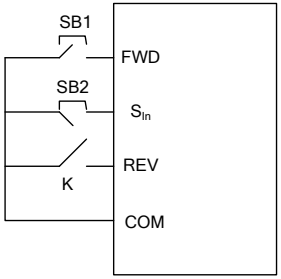
<table><tr><td>FWD</td><td>REV</td><td>Running command</td></tr><tr><td>OFF</td><td>OFF</td><td>Stop</td></tr><tr><td>ON</td><td>OFF</td><td>Forward running</td></tr><tr><td>OFF</td><td>ON</td><td>Reverse running</td></tr><tr><td>ON</td><td>ON</td><td>Hold</td></tr></table></td><td>0</td><td>◎</td></tr>
</table>

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



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}.

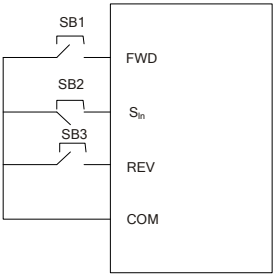


The direction control is as follows during running:

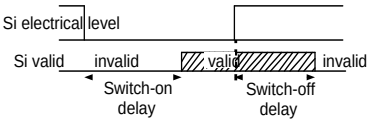
S_{In}	REV	Previous direction	Present direction
ON	OFF→ON	FWD run	REV run
		REV run	FWD run
ON	ON→OFF	REV run	FWD run
		FWD run	REV run
ON→OFF	ON	Decelerate to stop	
	OFF		

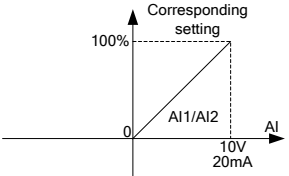
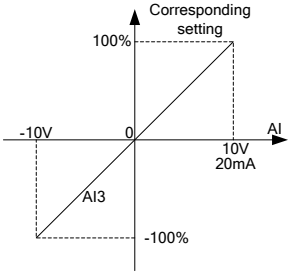
S_{in}: Three-wire control; FWD: Forward running; REV: Reverse running

3: Three-wire control 2. This mode defines S_{In} as the

<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>enabling terminal, and the running command is generated by FWD or REV, but the direction is controlled by both FWD and REV. During running, the S_{in} terminal needs to be closed, and terminal FWD or REV generates a rising edge signal to control the running and direction of the VFD; the VFD needs to be stopped by disconnecting terminal S_{in}.
 

<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 rowspan="2">ON→OFF</td><td>/</td><td>/</td><td rowspan="2">Decelerate to stop</td></tr>
<tr><td>/</td><td>/</td></tr>
</table>
S_{In}: Three-wire control; FWD: Forward running; REV: Reverse running
For two-wire controlled running mode, when the FWD/REV terminal is valid, if the VFD stops due to a stop command given by another source, the VFD does not run again after the stop command disappears even if the control terminal FWD/REV is still valid. To make the VFD run, you need to trigger FWD/REV again, for example, PLC single-cycle stop, fixed-length stop, and valid STOP/RST stop during terminal control. (See P07.04.)</td><td></td><td></td></tr>
<tr><td>P05.14</td><td>S1 switch-on delay</td><td rowspan="2">The function codes specify the delay time corresponding to the electrical level changes when the programmable input terminals switch on or switch off.</td><td>0.000s</td><td>○</td></tr>
<tr><td>P05.15</td><td>S1 switch-off delay</td><td>0.000s</td><td>○</td></tr>
</table>

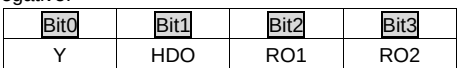
Function code	Name	Description	Default	Modify
P05.16	S2 switch-on delay		0.000s	○
P05.17	S2 switch-off delay		0.000s	○
P05.18	S3 switch-on delay	Setting range: 0.000–50.000s	0.000s	○
P05.19	S3 switch-off delay		0.000s	○
P05.20	S4 switch-on delay		0.000s	○
P05.21	S4 switch-off delay		0.000s	○
P05.22	S5 switch-on delay		0.000s	○
P05.23	S5 switch-off delay		0.000s	○
P05.24	S6 switch-on delay		0.000s	○
P05.25	S6 switch-off delay		0.000s	○
P05.26	S7 switch-on delay		0.000s	○
P05.27	S7 switch-off delay		0.000s	○
P05.28	S8 switch-on delay		0.000s	○
P05.29	S8 switch-off delay		0.000s	○
P05.30	HDI switch-on delay		0.000s	○
P05.31	HDI switch-off delay		0.000s	○
P05.32	AI1 lower limit	AI1 setting is implemented through the analog potentiometer on the keypad for the 380V 0150G/018P and lower models, but not available for the 380V 018G/022P and higher models. AI2 setting is implemented through the control terminal AI2. AI3 setting is implemented through the control terminal AI3.	0.00V	○
P05.33	Corresponding setting of AI1 lower limit		0.0%	○
P05.34	AI1 upper limit		10.00V	○
P05.35	Corresponding setting of AI1		100.0%	○

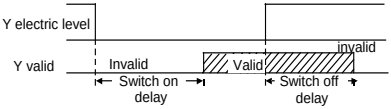
Function code	Name	Description	Default	Modify
	upper limit	The function codes define the relationship between the analog input voltage and its corresponding setting. When the analog input voltage exceeds the range from the upper limit to the lower limit, the upper limit or lower limit is used. When the 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 descriptions of 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: AI1 supports the 0–10V input; AI2 supports the 0(2)–10V/0(4)–20mA input. When AI2 selects the 0(4)–20mA input, the corresponding voltage of 20mA is 10V. AI3 supports the -10–+10V input.** Setting range of P05.32: 0.00V–P05.34 Setting range of P05.33: -100.0%–100.0%		
P05.36	AI1 input filter time		0.100s	○
P05.37	AI2 lower limit		0.00V	○
P05.38	Corresponding setting of AI2 lower limit		0.0%	○
P05.39	AI2 upper limit		10.00V	○
P05.40	Corresponding setting of AI2 upper limit		100.0%	○
P05.41	AI2 input filter time		0.100s	○
P05.42	AI3 lower limit		-10.00V	○
P05.43	Corresponding setting of AI3 lower limit		-100.0%	○
P05.44	AI3 middle value		0.00V	○
P05.45	Corresponding setting of AI3 middle value		0.0%	○
P05.46	AI3 upper limit		10.00V	○
P05.47	Corresponding setting of AI3 upper limit		100.0%	○
P05.48	AI3 input filter time		0.100s	○

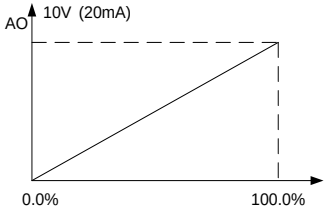
Function code	Name	Description	Default	Modify
		Setting range of P05.34: P05.32–10.00V Setting range of P05.35: -100.0%–100.0% Setting range of P05.36: 0.000s–10.000s Setting range of P05.37: 0.00V–P05.39 Setting range of P05.38: -100.0%–100.0% Setting range of P05.39: P05.37–10.00V Setting range of P05.40: -100.0%–100.0% Setting range of P05.41: 0.000s–10.000s Setting range of P05.42: -10.00V–P05.44 Setting range of P05.43: -100.0%–100.0% Setting range of P05.44: P05.42–P05.46 Setting range of P05.45: -100.0%–100.0% Setting range of P05.46: P05.44–10.00V Setting range of P05.47: -100.0%–100.0% Setting range of P05.48: 0.000s–10.000s		
P05.50	HDI frequency lower limit	0.000kHz–P05.52	0.000kHz	○
P05.51	Corresponding setting of HDI lower limit frequency	-100.0%–100.0%	0.0%	○
P05.52	HDI frequency upper limit	P05.50–50.000kHz	50.000 kHz	○
P05.53	Corresponding setting of HDI upper limit frequency	-100.0%–100.0%	100.0%	○
P05.54	HDI frequency input filter time	0.000s–10.000s	0.100s	○

Group P06—Output terminals

Function code	Name	Description	Default	Modify
P06.00	HDO output type	Used to select the high-speed pulse terminal function. 0: Open collector high-speed pulse output. The max. frequency of pulse is 50.0kHz. For details about the related functions, see P06.27–P06.31. 1: Open collector output. For details about the related functions, see P06.02.	0	◎

Function code	Name	Description	Default	Modify
P06.01	Y1 output	0: Invalid	0	○
P06.02	HDO output	1: Running	0	○
P06.03	RO1 output	2: Running forward	1	○
P06.04	RO2 output	3: Running reversely 4: Jogging 5: VFD in fault 6: Frequency level detection FDT1 7: Frequency level detection FDT2 8: Frequency reached 9: Running at zero speed (output in the running state) 10: Frequency upper limit reached 11: Frequency lower limit reached 12: Ready for running 13: Pre-exciting 14: Overload pre-alarm 15: Underload pre-alarm 16: Simple PLC stage completed 17: Simple PLC cycle completed 18: Set counting value reached 19: Designated counting value reached 20: External fault is valid 21: Running at zero speed (with output in both running and stopped state) 22: Running time reached 23: MODBUS communication virtual terminal output 24: To-ground short-circuit output pre-alarm (only effective when P08.23 is enabled) 26: DC bus voltage established 27: Auxiliary motor 1 startup 28: Auxiliary motor 2 startup	5	○
P06.05	Output terminal polarity selection	The function code is used to set the polarity of output terminals. When the current bit is set to 0, the output terminal is positive. When the current bit is set to 1, the output terminal is negative.  Setting range: 0–F	0	○
P06.06	Y switch-on	Used to specify the delay time corresponding to the	0.000s	○

Function code	Name	Description	Default	Modify
	delay	electrical level changes when the programmable output terminals switch on or switch off.  Setting range: 0.000–50.000s **Note: P06.08 and P06.09 are valid only when P06.00=1.**		
P06.07	Y switch-off delay		0.000s	○
P06.08	HDO switch-on delay		0.000s	○
P06.09	HDO switch-off delay		0.000s	○
P06.10	RO1 switch-on delay		0.000s	○
P06.11	RO1 switch-off delay		0.000s	○
P06.12	RO2 switch-on delay		0.000s	○
P06.13	RO2 switch-off delay		0.000s	○
P06.14	AO1 output	0: Running frequency	0	○
P06.15	AO2 output	1: Set frequency	0	○
P06.16	HDO high-speed pulse output	2: Ramp reference frequency 3: Rotational speed (relative to twice the motor rated synchronous speed) 4: Output current (relative to twice the VFD rated current) 5: Output current (relative to twice the motor rated current) 6: Output voltage (relative to 1.5 times the VFD rated voltage. When P06.14=6, AO1 output current 0–20mA corresponds to 0–1.5 times of the VFD rated voltage.) 7: Output power (Relative to twice the motor rated power) 8: Set torque (relative to twice the motor rated torque) 9: Output torque (relative to twice the motor rated torque)	0	○

Function code	Name	Description	Default	Modify
		10: AI1 input value (implemented through the analog potentiometer on the keypad for the 380V 0150G/018P and lower models; not available for the 380V 018G/022P and higher models.) 11: AI2 input value 12: AI3 input value 13: High-speed pulse HDI input 14: Value 1 set through Modbus communication 15: Value 2 set through Modbus communication 22: Torque current (relative to triple the motor rated current) 23: Ramp reference frequency (signed)		
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. Reder to section 7.10 PID control.  Setting range of P06.17: -100.0%–P06.19 Setting range of P06.18: 0.00V–10.00V Setting range of P06.19: P06.17–100.0% Setting range of P06.20: 0.00V–10.00V Setting range of P06.21: 0.000s–10.000s Setting range of P06.22: -100.0%–P06.24 Setting range of P06.23: 0.00V–10.00V Setting range of P06.24: P06.22–100.0% Setting range of P06.25: 0.00V–10.00V Setting range of P06.26: 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	AO2 output lower limit		0.0%	○
P06.23	AO2 output corresponding to lower limit		0.00V	○
P06.24	AO2 output upper limit		100.0%	○
P06.25	AO2 output corresponding to upper limit		10.00V	○
P06.26	AO2 output filter time		0.000s	○
P06.27	HDO output lower limit		0.00%	○

Function code	Name	Description	Default	Modify
P06.28	HDO output corresponding to lower limit	Setting range of P06.27: -100.0%–P06.29 Setting range of P06.28: 0.00–50.00kHz Setting range of P06.29: P06.27–100.0%	0.00kHz	○
P06.29	HDO output upper limit	Setting range of P06.30: 0.00–50.00kHz Setting range of P06.31: 0.000s–10.000s	100.0%	○
P06.30	HDO output corresponding to upper limit		50.00 kHz	○
P06.31	HDO output filter time		0.000s	○

Group P07—Human-machine interface

Function code	Name	Description	Default	Modify
P07.00	User password	Setting range: 0–65535 When you set the function code to a non-zero number, password protection is enabled. If you set the function code to 00000, the previous user password is cleared and password protection is disabled. After the user password is set and takes effect, you cannot enter the parameter menu if you enter an incorrect password. Please remember your password and save it in a secure place. After you exit the function code editing interface, the password protection function is enabled 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. Setting range: 0–4 0: No operation 1: Upload parameters from the local address to the	0	◎

Function code	Name	Description	Default	Modify
		keypad 2: Download parameters (including motor parameters) from the keypad to the local address 3: Download parameters (excluding group P02) from the keypad to the local address 4: Download parameters (only including group P02) from the keypad to the local address **Note: After any operation among 1–4 is complete, the parameter restores to 0. The upload and download functions are not applicable to group P29.**		
P07.02	Function of QUICK/JOG	Ones place: Function of QUICK/JOG 0: No function 1: Jog run. Press the QUICK/JOG key for jog run. 2: Shift key to switch the display state Press **QUICK/JOG** to shift the displayed function code from right to left. 3: Forward and reverse run switching. Press the QUICK/JOG key to switch the direction of the frequency command. It is valid only when the keypad is used as the command channel. 4: Clear the UP/DOWN setting. Press the QUICK/JOG key to clear the UP/DOWN setting. 5: Coast to stop. Press the QUICK/JOG key to coast to stop. 6: Switch command channels in sequence. Press QUICK/ JOG to switch command channels in sequence. 7: Quick commissioning mode (based on non-factory parameter settings) Note: When QUICK/JOG is used to shift between forward rotation and reverse rotation, the VFD does not record the state after shifting during power off. The VFD will run according to the running direction set by P00.13 during next power on. Tens place: Keypad key lock selection 0: Do not lock 1: Lock all 2: Lock only the PRG/ESC key	0x01	◎

Function code	Name	Description	Default	Modify
		Note: ✧ If the tens place is 1, press the PRG+DAT keys simultaneously three times to lock all keypad keys. ✧ To unlock the keypad keys, you need to continuously press the DAT key and then press the ▽ key three times. Setting range: 0x00–0x27		
P07.03	Sequence of switching running-command channels by pressing QUICK/JOG	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 to be displayed in the running state	Setting range: 0x0000–0xFFFF Bit0: Running frequency (Hz on) Bit1: Set frequency (Hz blinking) Bit2: Bus voltage (V on) Bit3: Output voltage (V on) Bit4: Output current (A on) Bit 5: Running speed (RPM on) Bit6: Output power (% on) Bit7: Output torque (% on) Bit8: PID reference value (% blinking) Bit9: PID feedback value (% on) Bit10: Input terminal status Bit11: Output terminal status Bit12: Set torque (% on) Bit13: Pulse count value Bit15: PLC and actual step of multi-step speed	0x03FF	○
P07.06	Selection 2 of	Setting range: 0x0000–0xFFFF	0x0000	○

Function code	Name	Description	Default	Modify
	parameters to be displayed in the running state	Bit0: AI1 value (V on) (implemented through the analog potentiometer on the keypad for the 380V 0150G/018P and lower models; not available for the 380V 018G/022P and higher models.) Bit 1: AI2 value (V on) Bit2: AI3 (V on) Bit3: HDI frequency Bit 4: Motor overload percentage (% on) Bit5: VFD overload percentage (% on) Bit6: Ramp frequency reference (Hz on) Bit7: Linear speed Bit8: AC incoming current (A on) Bit9: Upper limit frequency (Hz on)		
P07.07	Selection of parameters displayed in stopped state	Setting range: 0x0000–0xFFFF Bit0: Set frequency (Hz on, blinking slowly) Bit1: Bus voltage (V on) Bit2: Input terminal state Bit3: Output terminal state Bit4: PID reference value (% blinking) Bit5: PID feedback value (% on) Bit7: AI1 value (V on) (implemented through the analog potentiometer on the keypad for the 380V 0150G/018P and lower models; not available for the 380V 018G/022P and higher models.) Bit 8: AI2 value (V on) Bit9: AI3 (V on) Bit10: HDI frequency Bit11: PLC and actual step of multi-step speed Bit12: Pulse count value Bit14: Upper limit frequency (Hz on)	0x00FF	○
P07.08	Frequency display coefficient	Setting range: 0.01–10.00 Display frequency = Running frequency × P07.08	1.00	○
P07.09	Rotational speed display coefficient	Setting range: 0.1–999.9% Mechanical rotation speed = 120 × (Displayed running frequency) × P07.09/(Number of motor pole pairs)	100.0%	○
P07.10	Linear speed display	Setting range: 0.1–999.9% Linear speed = Mechanical rotation speed × P07.10	1.0%	○

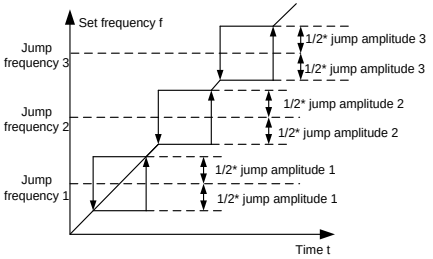
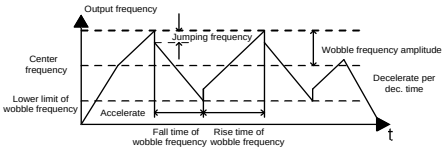
Function code	Name	Description	Default	Modify
	coefficient			
P07.11	Rectifier bridge temperature	Setting range: 0–100.0°C	/	●
P07.12	Inverter module temperature	Setting range: 0–100.0°C	/	●
P07.13	Control board software version	Setting range: 1.00–655.35	/	●
P07.14	Local accumulative running time	Setting range: 0–65535h	/	●
P07.15	VFD electricity consumption MSB	Used to display the electricity consumption of the VFD. VFD electricity consumption = P07.15 × 1000 + P07.16 Setting range of P07.15: 0–65535 kWh (*1000) Setting range of P07.16: 0.0–999.9 kWh	/	●
P07.16	VFD electricity consumption LSB		/	●
P07.17	VFD model	0: G type 1: P type	/	●
P07.18	VFD rated power	Setting range: 0.4–3000.0kW	/	●
P07.19	VFD rated voltage	Setting range: 50–1200V	/	●
P07.20	VFD rated current	Setting range: 0.1–6000.0A	/	●
P07.21	Factory bar code 1	Setting range: 0x0000–0xFFFF	/	●
P07.22	Factory bar code 2	Setting range: 0x0000–0xFFFF	/	●
P07.23	Factory bar code 3	Setting range: 0x0000–0xFFFF	/	●
P07.24	Factory bar code 4	Setting range: 0x0000–0xFFFF	/	●
P07.25	Factory bar code 5	Setting range: 0x0000–0xFFFF	/	●
P07.26	Factory bar	Setting range: 0x0000–0xFFFF	/	●

Function code	Name	Description	Default	Modify
	code 6			
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 overheat (OH2) 17: External fault (EF) 18: RS485 communication fault (CE) 19: Current detection fault (ItE) 20: Motor autotuning fault (tE) 21: EEPROM operation error (EEP) 22: PID feedback offline fault (PIDE) 23: Braking unit fault (bCE) 24: Running time reached (END) 25: Electronic overload (OL3) 26: Keypad communication error (PCE) 27: Parameter upload error (UPE) 28: Parameter download error (DNE) 32: To-ground short-circuit fault 1 (ETH1) 33: To-ground short-circuit fault 2 (ETH2) 36: Underload fault (LL)	/	●
P07.28	Last fault type		/	●
P07.29	2nd-last fault type		/	●
P07.30	3rd-last fault type		/	●
P07.31	4th-last fault type		/	●
P07.32	5th-last fault type		/	●
P07.33	Running frequency at present fault		0.00Hz	●
P07.34	Ramp reference frequency at present fault		0.00Hz	●
P07.35	Output voltage at present fault		0V	●
P07.36	Output current at present fault		0.0A	●
P07.37	Bus voltage at present fault		0.0V	●
P07.38	Max. temperature at present fault		0.0°C	●
P07.39	Input terminal status at present fault		0	●

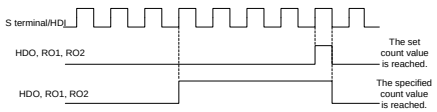
Function code	Name	Description	Default	Modify
P07.40	Output terminal status at present fault		0	●
P07.41	Running frequency at last fault		0.00Hz	●
P07.42	Ramp reference frequency at last fault		0.00Hz	●
P07.43	Output voltage at last fault		0V	●
P07.44	Output current at last fault		0.0A	●
P07.45	Bus voltage at last fault		0.0V	●
P07.46	Max. temperature at last fault		0.0°C	●
P07.47	Input terminal status at last fault		0	●
P07.48	Output terminal status at last fault		0	●
P07.49	Running frequency at 2nd-last fault		0.00Hz	●
P07.50	Ramp reference frequency at 2nd-last fault		0.00Hz	●
P07.51	Output voltage at 2nd-last fault		0V	●
P07.52	Output current at 2nd-last fault		0.0A	●
P07.53	Bus voltage at 2nd-last fault		0.0V	●
P07.54	Max. temperature at last 2 fault		0.0°C	●
P07.55	Input terminal status at 2nd-last fault		0	●
P07.56	Output terminal status at 2nd-last fault		0	●

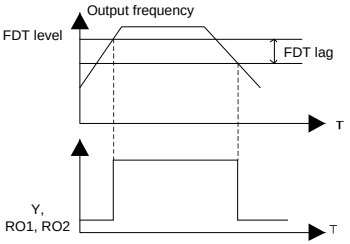
Group P08—Enhanced functions

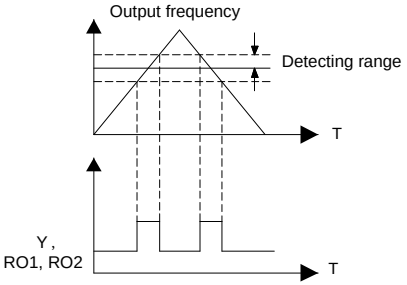
Function code	Name	Description	Default	Modify
P08.00	ACC time 2	For details, see P00.11 and P00.12. The VFD has four groups of ACC/DEC time, which can be selected by P05. The factory default ACC/DEC time of the VFD is the first group. Setting range: 0.0–3600.0s	Model depended	○
P08.01	DEC time 2		Model depended	○
P08.02	ACC time 3		Model depended	○
P08.03	DEC time 3		Model depended	○
P08.04	ACC time 4		Model depended	○
P08.05	DEC time 4		Model depended	○
P08.06	Running frequency of jog	The function code is used to define the reference frequency during jogging. Setting range: 0.00Hz–P00.03 (Max. output frequency)	5.00Hz	○
P08.07	ACC time for jogging	ACC time for jogging means the time needed for the VFD to accelerate from 0Hz to the max. output	Model depended	○

Function code	Name	Description	Default	Modify
P08.08	DEC time for jogging	frequency (P00.03). DEC time for jogging means the time needed for the VFD to decelerate from the max. output frequency (P00.03) to 0Hz. Setting range: 0.0–3600.0s	Model depended	○
P08.09	Jump frequency 1	When the set frequency is within the range of jump frequency, the VFD runs at the boundary of jump frequency. The VFD can avoid mechanical resonance points by setting jump frequencies. The VFD supports the setting of three jump frequencies. If the jump frequency points are set to 0, this function is invalid.  Setting range: 0.00Hz–P00.03 (Max. output frequency)	0.00Hz	○
P08.10	Jump frequency amplitude 1		0.00Hz	○
P08.11	Jump frequency 2		0.00Hz	○
P08.12	Jump frequency amplitude 2		0.00Hz	○
P08.13	Jump frequency 3		0.00Hz	○
P08.14	Jump frequency amplitude 3		0.00Hz	○
P08.15	Wobbling frequency amplitude percentage	Wobbling frequency is mainly applied in the scenarios where transverse movement and winding functions are needed such as textile and chemical fiber industries. Wobbling frequency function means that the VFD output frequency swings up and down with the set frequency as the center. The following figure shows the relation between running frequency and time, where the amplitude of wobbling frequency is set by P08.15. When P08.15 is set to 0, the wobbling frequency does not work.  Amplitude of wobbling frequency: wobbling frequency	0.0%	○
P08.16	Amplitude of sudden jump frequency		0.0%	○
P08.17	Rise time of wobbling frequency		5.0s	○
P08.18	Fall time of wobbling frequency		5.0s	○

Function code	Name	Description	Default	Modify
		is restricted by the upper limit and lower limit frequency. The amplitude of wobbling frequency is relative to the center frequency (set frequency): amplitude of wobbling frequency (AW) = center frequency × wobbling frequency amplitude percentage (P08.15) Sudden jump frequency = AW × amplitude of sudden jump frequency (P08.16) P08.16 indicates the value that the sudden jump frequency relative to the amplitude of wobbling frequency when the VFD runs at wobbling frequency. Rise time of wobbling frequency: time taken to run from the lower limit frequency of the wobbling frequency to the upper limit frequency. Fall time of wobbling frequency: time taken to run from the upper limit frequency of the wobbling frequency to the lower limit frequency. Setting range of P08.15: 0.0–100.0% (of the set frequency) Setting range of P08.16: 0.0–50.0% (of the amplitude of wobbling frequency) Setting range of P08.17: 0.1–3600.0s Setting range of P08.18: 0.1–3600.0s		
P08.19	Number of displayed decimal places	Ones place: Number of decimal places of linear speed 0: None 1: One 2: Two 3: Three Tens place: Number of decimal places of frequency 0: Two 1: One Setting range: 0x00–0x13	0x00	○
P08.20	AI/AO calibration	0: Enabled 1: Disabled	0	◎
P08.21	Grid voltage and frequency selection	P17.38–P17.39 Ones place: Grid voltage selection 0: 220V range, suitable for voltages between 208 and 240V. 1: 380V range, suitable for voltages between 380 and	0x00	○

Function code	Name	Description	Default	Modify
		415V. 2: 460V range, suitable for voltages between 440 and 480V. Tens place: Grid frequency selection 0: 50Hz 1: 60Hz It is used with P29.04, and different voltage levels of the power grid can be selected under different voltages of P29.04.		
P08.22	Sleep delay	Setting range: 0.0–3600.0s It is valid when the ones place of P01.19 is set to 2.	2.0s	○
P08.23	To-ground short circuit detection during running	0: Disable 1: Enable	0	○
P08.24	Power-on to-ground short-circuit detection threshold	0%–100%	50%	○
P08.25	Set counting value	The counter counts the input pulse signals through the S terminals (set to "Trigger the counter") or HDI (P05.00=1). When the counting value reaches the designated counting value, the multifunction digital output terminal outputs the signal of "Designated counting value reached" and the counting continues. When the counting value reaches the set counting value, the multifunction digital output terminal outputs the signal of "Set counting value reached" and the counting is cleared. The counter will restart counting at next pulse arrival. P08.26 should not be greater than P08.25. The function is shown in the following figure:  Setting range of P08.25: P08.26–65535 Setting range of P08.26: 0–P08.25	0	○
P08.26	Designated counting value		0	○

Function code	Name	Description	Default	Modify
P08.27	Set running time	The function code is used to preset the running tine of the VFD. When the accumulative running time achieves the set time, the multi-function digital output terminal will output the signal of "running time reached". Setting 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. Setting range of P08.28: 0–10 Setting range of P08.29: 0.1–3600.0s	0	○
P08.29	Auto fault reset interval		1.0s	○
P08.30	Frequency decrease ratio in drop control	The output frequency of the VFD changes as the load changes. The function code is mainly used to balance the power when several motors drive a same load. Setting range: 0.00–10.00Hz	0.00Hz	○
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).  Setting range of P08.32: 0.00Hz–P00.03 (Max. output frequency) Setting range of P08.33: 0.0–100.0% (FDT1 electrical level)	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		5.0%	○

Function code	Name	Description	Default	Modify
		Setting range of P08.34: 0.00Hz–P00.03 (Max. output frequency) Setting range of P08.35: 0.0–100.0% (FDT2 electrical level)		
P08.36	Frequency reaching detection amplitude value	When the output frequency is within the detection range, the multifunction digital output terminal outputs the signal of "Frequency reached".  Setting range: 0.00Hz–P00.03 (Max. output frequency)	0.00Hz	○
P08.37	Enabling dynamic braking	Used to enable the operation of the internal braking transistor in the VFD. 0: Disable 1: Enable **Note: The parameter is only applicable to the type with built-in braking pipe.**	0	○
P08.38	Dynamic braking threshold voltage	The function code is used to set the starting bus voltage of dynamic braking. Adjust this value properly to achieve effective braking for the load. The default value varies depending on the voltage class. Setting range: 200.0–2000.0V	For 220V: 380.0V For 380V: 700.0V For 660V: 1120.0V	○
P08.39	Cooling-fan running mode	The function code is used to set the running mode of the cooling fan. 0: Normal running mode: after the module receives the running command or the detection temperature of the rectifier is higher than 45°C or the current of the module is higher than 20% of the rated current, the cooling fan will run. 1: Permanent running after power-on: applicable to high temperature and humidity situations. 2: The fan runs when the VFD frequency is greater	0	○

Function code	Name	Description	Default	Modify
		than 0Hz. The fan stops 1 minute later when the frequency is 0Hz or the VFD transitions from the running state to the stopped state. Setting range: 0–2		
P08.40	PWM selection	Setting range: 0x00–0x21 Ones place: PWM mode selection 0: PWM mode 1, 3PH modulation and 2PH modulation 1: PWM mode 2, 3PH modulation Tens place: Low-speed carrier frequency limit mode 0: Low-speed carrier frequency limit mode 1. At low speeds, when the carrier frequency is higher than 2kHz, it is limited to 2kHz. 1: Low-speed carrier frequency limit mode 2. At low speeds, when the carrier frequency is higher than 4kHz, it is limited to 4kHz. 2: Unlimited low-speed carrier frequency	0x00	◎
P08.41	Overmodulation selection	Setting range: 0x00–0x11 Ones place: 0: Disable 1: Enable Tens place 0: Mild overmodulation. The depth of overmodulation is confined within the range of Zone 1. 1: Deepened overmodulation. the depth of overmodulation is confined within the range of Zone 2.	0x01	◎
P08.42	Keypad digit control setting	Setting range: 0x0000–0x1223 Ones place: Frequency setting selection 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 control through the digital potentiometer is valid. 3: Both the ∧/∨ key and digital potentiometer can be used for the control. Tens place: Frequency control selection 0: Valid only when P00.06=0 or P00.07=0 1: Valid for all frequency setting methods 2: Invalid for multi-step speed running when multi-step speed running has the priority	0x0000	○

Function code	Name	Description	Default	Modify
		Hundreds place: Action selection for stop 0: Setting is valid. 1: Valid during running, cleared after stop 2: Valid during running, cleared after a stop command is received Thousands place: Integral function of the △/▽ key and digital potentiometer 0: Enable the integral function 1: Disable the integral function		
P08.43	Keypad digital potentiometer integral rate	0.01–10.00s	0.10s	○
P08.44	UP/DOWN terminal control setting	Setting range: 0x000–0x221 Ones place: Frequency setting selection 0: The setting made through UP/DOWN is valid. 1: The setting made through UP/DOWN is invalid. Tens place: Frequency control selection 0: Valid only when P00.06=0 or P00.07=0 1: Valid for all frequency setting methods 2: Invalid for multi-step speed running when multi-step speed running has the priority Hundreds place: Action selection for stop 0: Setting is valid. 1: Valid during running, cleared after stop 2: Valid during running, cleared after a stop command is received	0x000	○
P08.45	Frequency increment change rate of the UP terminal	0.01–50.00Hz/s	0.50Hz/s	○
P08.46	Frequency increment change rate of the DOWN terminal	0.01–50.00Hz/s	0.50Hz/s	○
P08.47	Action selection at power-off during	Setting range: 0x000–0x111 Ones place: Action selection at power-off during frequency adjusting through digitals. 0: Save the setting at power-off.	0x000	○

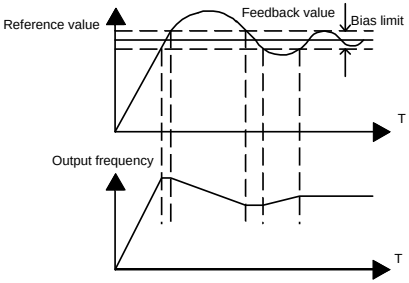
Function code	Name	Description	Default	Modify
	frequency setting	1: Clear the setting at power-off. Action selection at power-off during frequency adjusting through Modbus communication 0: Save the setting at power-off. 1: Clear the setting at power-off. Hundreds place: Action selection at power-off during frequency adjusting through other communication methods 0: Save the setting at power-off. 1: Clear the setting at power-off.		
P08.48	Initial electricity consumption MSB	Used to set the initial electricity consumption. Initial electricity consumption = (P08.48*1000 + P08.49) kWh Setting range of P08.48: 0–59999 Setting range of P08.49: 0.0–999.9	0	○
P08.49	Initial electricity consumption LSB		0.0	○
P08.50	Magnetic flux braking coefficient	The function code is used to enable magnetic flux braking. 0: Invalid 100–150: A greater coefficient indicates greater braking strength. The VFD can quickly slow down the motor by increasing the magnetic flux. The energy generated by the motor during braking can be transformed into heat energy by increasing the magnetic flux. The VFD monitors the state of the motor continuously even during the magnetic flux period. Magnetic flux braking can be used for motor stop, as well as for motor rotation speed change. The other advantages include: Braking is performed immediately after the stop command is given. The braking can be started without waiting for magnetic flux weakening. The cooling is better. The current of the stator other than the rotor increases during magnetic flux braking, while the cooling of the stator is more effective than the rotor.	0	○
P08.51	Current	This function code is used to adjust the current	0.56	○

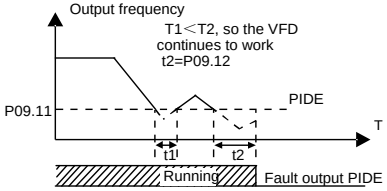
Function code	Name	Description	Default	Modify
	regulation coefficient on input side	display value on the AC input side. Setting range: 0.00–1.00		

Group P09—PID control

Function code	Name	Description	Default	Modify
P09.00	PID reference source	When frequency command selection (P00.06, P00.07) is 7, or channel of voltage setup (P04.27) is 6, the running mode of VFD is process PID control. The function code determines the target given channel during the PID process. 0: Set by P09.01 1: AI1 (implemented through the analog potentiometer on the keypad for the 380V 0150G/018P and lower models; not available for the 380V 018G/022P and higher models.) 2: AI2 3: AI3 4: High-speed pulse HDI 5: Multi-step running 6: Modbus communication The set target of process PID is a relative value, for which 100% equals 100% of the feedback signal of the controlled system. The system always performs calculation by using a relative value (0–100.0%). **Note: Multi-step speed reference can be realized by setting parameters of P10 group.**	0	○
P09.01	PID digital setting	The function code is mandatory when P09.00=0. The base value of The function code is the feedback of the system. Setting range: -100.0%–100.0%	0.0%	○
P09.02	PID feedback source	The function code is used to select the PID feedback channel. 0: AI1 (implemented through the analog potentiometer on the keypad for the 380V 0150G/018P and lower models; not available for the 380V 018G/022P and higher models.) 1: AI2 2: AI3	0	○

Function code	Name	Description	Default	Modify
		3: High-speed pulse HDI 4: Modbus communication 5: Max(AI2, AI3) **Note: The reference channel and feedback channel cannot be duplicate. Otherwise effective PID control cannot be achieved.**		
P09.03	PID output characteristics selection	0: PID output is positive. When the feedback signal is greater than the PID reference value, the output frequency of the VFD will decrease to balance the PID. Example: PID control on strain during 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 strain during unwinding.	0	○
P09.04	Proportional gain (Kp)	The function is applied to the proportional gain P of PID input. P determines the strength of the whole PID adjuster. The value 100 indicates that when the difference between the PID feedback value and given value is 100%, the range within which the PID regulator can regulate the output frequency command is the max. frequency (ignoring integral function and differential function). Setting range: 0.00–100.00	1.00	○
P09.05	Integral time (Ti)	Used to determine the speed of the integral adjustment on the deviation of PID feedback and reference from the PID regulator. When the deviation of PID feedback and reference is 100%, the integral adjuster works continuously during the time (ignoring proportional and differential function) to achieve the max. output frequency (P00.03) or the max. voltage (P04.31). Shorter integral time indicates stronger adjustment. Setting range: 0.00–10.00s	0.00s	○
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	0.00s	○

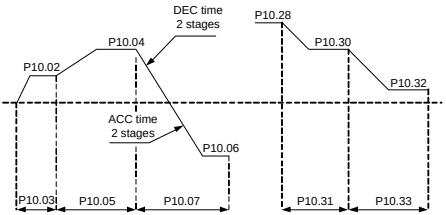
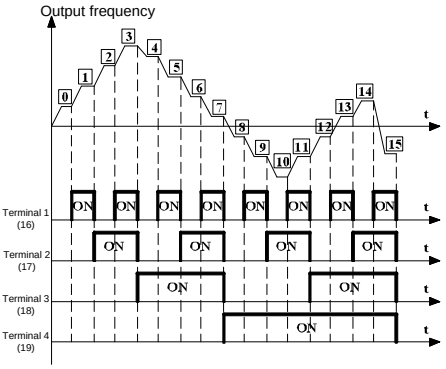
Function code	Name	Description	Default	Modify
		frequency (P00.03) or the max. voltage (P04.31). Longer differential time indicates stronger adjustment. Setting range: 0.00–10.00s		
P09.07	Sampling cycle (T)	Used to indicate the sampling cycle of feedback. The regulator calculates in each sampling cycle. A longer sampling cycle indicates slower response. When the sampling cycle is set to 0.00s, the actual sampling cycle is 1ms. Setting range: 0.00–10.000s	0.100s	○
P09.08	PID control deviation limit	 The output of the PID system is relative to the max. deviation of the closed loop reference. As shown in the following figure, the PID regulator stops regulating in the range of deviation limit. Set the function parameter properly to adjust the accuracy and stability of the PID system. Setting range: 0.0–100.0%	0.0%	○
P09.09	PID output upper limit	The function codes are used to set the upper and lower limits of PID regulator output values. 100.0% corresponds to the max. output frequency (P00.03) or max. voltage (P04.31). Setting range of P09.09: P09.10—100.0% Setting range of P09.10: -100.0%–P09.09	100.0%	○
P09.10	PID output lower limit		0.0%	○
P09.11	Feedback offline detection value	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.	0.0%	○
P09.12	Feedback offline detection time		1.0s	○

Function code	Name	Description	Default	Modify
		 Setting range of P09.11: 0.0–100.0% Setting range of P09.12: 0.0–3600.0s		
P09.13	PID control selection	0x0000–0x1111 Ones place: 0: Continue integral control after the frequency reaches upper/lower limit: the integration responses the changes between the reference and feedback unless it reaches the internal integral limit. When the size between the reference and feedback changes, it needs more time to offset the impact of continuous working integration and the integration can change with the trend. 1: Stop integral control after the frequency reaches upper/lower limit: if the integration keeps stable and the size between the reference and feedback changes, the integration will change along with the trend quickly. Tens place: 0: Same as the set direction. When PID regulated output is inconsistent with the present running direction, the output is forced to 0. 1: Contrary to the set direction. When PID regulated output is inconsistent with the present running direction, the closed-loop regulation output is executed at the direction opposite to the present running direction. Hundreds place: 0: Limit as per the max. frequency 1: Limit as per A frequency Thousands place: 0: A+B frequency. ACC/DEC of main reference A frequency source precharging is invalid.	0x0001	○

Function code	Name	Description	Default	Modify
		1: A+B frequency. ACC/DEC of main reference A frequency source precharging is valid. The ACC/DEC is determined by P08.04 (ACC time 4).		
P09.14	Low frequency proportional gain (Kp)	0.00–100.00	1.00	○
P09.15	ACC/DEC time of PID command	0.0–1000.0s	0.0s	○
P09.16	PID output filter time	0.000–10.000s	0.000s	○

Group P10—Simple PLC and multi-step speed control

Function code	Name	Description	Default	Modify
P10.00	Simple PLC mode	0: Stop after running once The VFD stops automatically after running for one cycle, and it can be started only after receiving the running command. 1: Keep running with the final value after running once The VFD keeps the running frequency and direction of the last section after a single cycle. 2: Cyclic running The VFD enters the next cycle after completing one cycle until receiving the stop command.	0	○
P10.01	Simple PLC memory selection	0–1 0: Do not memorize at power outage 1: Memorize at power outage The PLC memories its running stage and running frequency before power-off.	0	○
P10.02	Multi-step speed 0	The setting 100.0% corresponds to the max. output frequency (P00.03). When simple PLC operation is selected, it is required to set P10.02–P10.33 to determine the running frequency and direction of each step. **Note: The symbol of multi-step speed determines the running direction of simple PLC, and the negative value means reverse running.**	0.0%	○
P10.03	Running time of step 0		0.0s	○
P10.04	Multi-step speed 1		0.0%	○
P10.05	Running time of step 1		0.0s	○

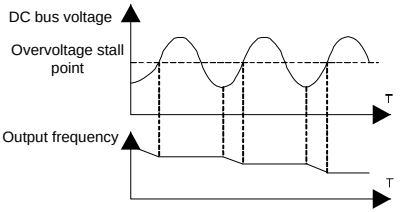
Function code	Name	Description	Default	Modify
P10.06	Multi-step speed 2		0.0%	○
P10.07	Running time of step 2		0.0s	○
P10.08	Multi-step speed 3		0.0%	○
P10.09	Running time of step 3		0.0s	○
P10.10	Multi-step speed 4	Multi-step speed can be set continuously in the range of $-f_{max}$–f_{max}. The VFD can set 16-step speeds, which are selectable by multi-step speed terminals 1–4, corresponding to multi-step speed 0 to multi-step speed 15.	0.0%	○
P10.11	Running time of step 4		0.0s	○
P10.12	Multi-step speed 5		0.0%	○
P10.13	Running time of step 5		0.0s	○
P10.14	Multi-step speed 6		0.0%	○
P10.15	Running time of step 6		0.0s	○
P10.16	Multi-step speed 7		0.0%	○
P10.17	Running time of step 7		0.0s	○
P10.18	Multi-step speed 8	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 VFD runs at multi-step speed and the multi-step speed has the priority over the keypad, analog values, high-speed pulse, PLC and communication frequency input. Select at most 16-step speed via the the combined codes of terminal 1, terminal 2, terminal 3, and terminal 4. The start/stop of multi-step stop running is also determined by P00.06. The relation between terminal 1 (16), terminal 2 (17), terminal 3 (18), and terminal 4 (19) are shown in the following (T indicates terminal).	0.0%	○
P10.19	Running time of step 8		0.0s	○
P10.20	Multi-step speed 9		0.0%	○
P10.21	Running time of step 9		0.0s	○
P10.22	Multi-step speed 10		0.0%	○
P10.23	Running time of step 10		0.0s	○
P10.24	Multi-step speed 11		0.0%	○

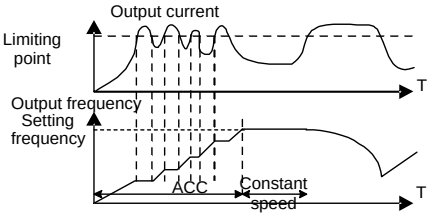
<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td>P10.25</td><td>Running time of step 11</td><td rowspan="11">
<table>
<tr><td>T1</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td></tr>
<tr><td>T2</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td></tr>
<tr><td>T3</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td></tr>
<tr><td>T4</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td></tr>
<tr><td>Step</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr>
<tr><td>T1</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td></tr>
<tr><td>T2</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td></tr>
<tr><td>T3</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td></tr>
<tr><td>T4</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td></tr>
<tr><td>Step</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td></tr>
</table>
Setting range of P10.(2n,1<n<17): -100.0–100.0%
Setting range of P10.(2n+1,1<n<17): 0.0–6553.5s(min)</td><td>0.0s</td><td>○</td></tr>
<tr><td>P10.26</td><td>Multi-step speed 12</td><td>0.0%</td><td>○</td></tr>
<tr><td>P10.27</td><td>Running time of step 12</td><td>0.0s</td><td>○</td></tr>
<tr><td>P10.28</td><td>Multi-step speed 13</td><td>0.0%</td><td>○</td></tr>
<tr><td>P10.29</td><td>Running time of step 13</td><td>0.0s</td><td>○</td></tr>
<tr><td>P10.30</td><td>Multi-step speed 14</td><td>0.0%</td><td>○</td></tr>
<tr><td>P10.31</td><td>Running time of step 14</td><td>0.0s</td><td>○</td></tr>
<tr><td>P10.32</td><td>Multi-step speed 15</td><td>0.0%</td><td>○</td></tr>
<tr><td>P10.33</td><td>Running time of step 15</td><td>0.0s</td><td>○</td></tr>
<tr><td>P10.34</td><td>ACC/DEC time of steps 0–7 of simple PLC</td><td rowspan="2">The description is as follows:
<table>
<tr><th>Function code</th><th colspan="2">Binary</th><th>Step</th><th>ACC/ DEC time 1</th><th>ACC/ DEC time 2</th><th>ACC/ DEC time 3</th><th>ACC/ DEC time 4</th></tr>
<tr><td rowspan="8">P10.34</td><td>Bit1</td><td>Bit0</td><td>0</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>Bit3</td><td>Bit2</td><td>1</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>Bit5</td><td>Bit4</td><td>2</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>Bit7</td><td>Bit6</td><td>3</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>Bit9</td><td>Bit8</td><td>4</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>Bit11</td><td>Bit10</td><td>5</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>Bit13</td><td>Bit12</td><td>6</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>Bit15</td><td>Bit14</td><td>7</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td rowspan="8">P10.35</td><td>Bit1</td><td>Bit0</td><td>8</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>Bit3</td><td>Bit2</td><td>9</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>Bit5</td><td>Bit4</td><td>10</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>Bit7</td><td>Bit6</td><td>11</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>Bit9</td><td>Bit8</td><td>12</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>Bit11</td><td>Bit10</td><td>13</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>Bit13</td><td>Bit12</td><td>14</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>Bit15</td><td>Bit14</td><td>15</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
</table>
Select corresponding acceleration/deceleration time, and then convert 16-bit binary number into decimal</td><td>0x0000</td><td>○</td></tr>
<tr><td>P10.35</td><td>ACC/DEC time of steps 8–15 of simple PLC</td><td>0x0000</td><td>○</td></tr>
</table>

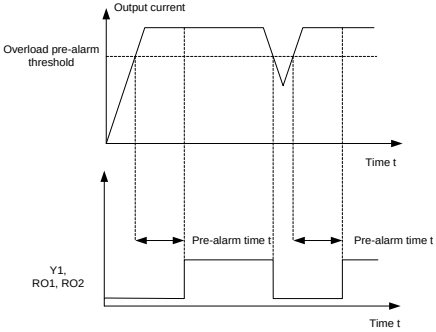
Function code	Name	Description	Default	Modify
		number, finally, and then set corresponding function codes. Setting range: 0x0000–0xFFFF		
P10.36	PLC restart mode	0: Restart from the first step, namely if the VFD stops during running (caused by stop command, fault or power down), it will run from the first step after restart. 1: Continue running from the step frequency when interruption occurred, namely if the VFD stops during running (caused by stop command or fault), it will record the running time of current step, and enters this step automatically after restart, then continue running at the frequency defined by this step in the remaining time.	0	◎
P10.37	Multi-step time unit	0: second; the running time of each step is counted in seconds 1: minute; the running time of each step is counted in minutes	0	◎

Group P11—Protection parameters

Function code	Name	Description	Default	Modify
P11.00	Protection against phase loss	0x000–0x111 LED ones place: 0: Protection against input phase loss disabled 1: Enable input phase loss protection LED tens place: 0: Disable protection against output phase loss. 1: Enable protection against output phase loss. LED hundreds place: 0: Disable hardware protection against input phase loss 1: Enable hardware protection against input phase loss **Note: For model -4, the input phase loss is ineffective for power ratings ranging from 0.75 to 2.2 kW.**	0x111	○
P11.01	Frequency drop at	0: Disable 1: Enable	0	○

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td></td><td>transient power-off</td><td></td><td></td><td></td></tr>
<tr><td>P11.02</td><td>Frequency drop rate at transient power-off</td><td>Setting range: 0.00Hz/s–P00.03/s
If the bus voltage drops to the sudden frequency decreasing point due to the power loss of the grid, the VFD begins to decrease the running frequency according to P11.02 to make the motor in power generation state. The feedback power can maintain the bus voltage to ensure the continuous 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>Frequency decrease at sudden power failure</th><td>260V</td><td>460V</td><td>800V</td></tr></table>Note:
✧ Adjusting the parameter properly can prevent the stop caused by the VFD protection during shifting the grid.
✧ This function can be enabled only when the input phase loss protection function is disabled.</td><td>10.00 Hz/s</td><td>○</td></tr>
<tr><td>P11.03</td><td>Overvoltage stalling protection</td><td>0: Disable
1: Enable
  </td><td>1</td><td>○</td></tr>
<tr><td rowspan="2">P11.04</td><td rowspan="2">Overvoltage stalling protection voltage</td><td>120–150% (standard bus voltage) (380V)</td><td>136%</td><td rowspan="2">○</td></tr>
<tr><td>120–150% (standard bus voltage) (220V)</td><td>120%</td></tr>
<tr><td>P11.05</td><td>Current limit mode</td><td rowspan="2">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.</td><td>0x01</td><td>◎</td></tr>
<tr><td>P11.06</td><td>Automatic current limit</td><td>Model depende</td><td>◎</td></tr>
</table>

Function code	Name	Description	Default	Modify
	threshold	Current-limit protection function detects output current	d	
P11.07	Frequency decrease ratio in current limiting	during running, and compares it with the current-limit level defined by P11.06, if it exceeds the current-limit level, the VFD will run at stable frequency during accelerated running, or run in decreased frequency during constant-speed running; if it exceeds the current-limit level continuously, the VFD output frequency will drop continuously until reaching lower limit frequency. When the output current is detected to be lower than the current-limit level again, it will continue accelerated running.  Setting range of P11.05: 0x00–0x11 Ones place: Current limit action 0: Invalid 1: Always valid Tens place: Hardware current limit overload alarm 0: Valid 1: Invalid Setting range of P11.06: 50.0–200.0% (default value for G-type machine: 160.0%, default value for P-type machine: 120.0%) Setting range of P11.07: 0.00–50.00Hz/s	10.00 Hz/s	◎
P11.08	Pre-alarm selection for VFD/motor OL/UL	If the VFD or motor output current is larger than the overload pre-alarm detection level (P11.09), and the duration exceeds the overload pre-alarm delay time (P11.10), overload pre-alarm signal will be outputted.	0x0000	○
P11.09	Overload pre-alarm detection threshold		G type: 150% P type: 120%	○
P11.10	Overload pre-alarm detection time		1.0s	○

Function code	Name	Description	Default	Modify
		 P11.08 enables and defines overload pre-alarm function of the VFD and motor. Ones place: 0: Motor OL/UL pre-alarm, relative to the motor rated current. 1: VFD OL/UL pre-alarm, relative to rated VFD output current. 2: Motor output torque OL/UL pre-alarm, relative to motor rated torque. Tens place: 0: The VFD continues to work for an OL/UL alarm. 1: The VFD continues to work for a UL alarm but stops running for an OL fault 2: The VFD continues to work for an OL alarm but stops running for a UL fault 3. The VFD stops running for an OL/UL alarm Hundreds place: 0: Detect all the time. 1: Detect during constant speed running. Thousands place: Overload integral selection 0: Overload integral is invalid 1: Overload integral is valid Setting range of P11.08: 0x0000 –0x1131 Setting range of P11.09: P11.11–200% (relative value determined by the ones place of P11.08) Setting range of P11.10: 0.1–3600.0s		
P11.11	Underload pre-alarm	Underload pre-alarm signal will be outputted if the output current of the VFD or motor is lower than	50%	○

Function code	Name	Description	Default	Modify
	detection threshold	underload pre-alarm detection level (P11.11), and the duration exceeds underload pre-alarm delay time (P11.12).		
P11.12	Underload pre-alarm detection time	Setting range of P11.11: 0 –P11.09 (relative value determined by the ones place of P11.08) Setting range of P11.12: 0.1–3600.0s	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. Ones place: 0: Act at undervoltage 1: Do not act at undervoltage Tens place: 0: Act during automatic reset 1: Do not act during the automatic reset period	0x00	○
P11.16	Extended function selection	0x00–0x11 One place: Automatic frequency-reduction during voltage drop 0: Invalid 1: Valid Tens place: Second ACC/DEC time selection 0: Invalid 1: Valid. When the running frequency exceeds P08.36, ACC/DEC time is switched to the second ACC/DEC time.	0x00	○

Group P13—Enhanced function parameter group 2

Function code	Name	Description	Default	Modify
P13.13	Short-circuit braking current	When the VFD starts in direct start mode (P01.00=0), set P13.14 to a non-zero value to enter short-circuit braking.	0.0%	○
P13.14	Hold time of short-circuit braking for start	During stop, if the running frequency of VFD is lower than the starting frequency of brake for stop (P01.09), set P13.15 to a non-zero value to enter short-circuit braking for stop, and then carry out DC braking in the time specified by P01.12. (See descriptions for P01.09–P01.12.)	0.00s	○
P13.15	Hold time of short-circuit braking for stop	P13.13 setting range: 0.0–150.0% (of the rated VFD output current) Setting range of P13.14: 0.00–50.00s Setting range of P13.15: 0.00–50.00s	0.00s	○

Group P14—Serial communication

Function code	Name	Description	Default	Modify
P14.00	Local communication address	Setting range: 1–247 When the master writes the slave communication address to 0 indicating a broadcast address in a frame, all the salves on the Modbus bus receive the frame but do not respond to it. The communication addresses on the communication network are unique, which is the basis of the point-to-point communication. **Note: The communication address of a slave cannot be set to 0.**	1	○
P14.01	Communication baud rate setting	The function code is used to set the rate of data transmission between the upper computer and the VFD. 0: 1200bps 1: 2400 bps 2: 4800 bps 3: 9600 bps 4: 19200 bps 5: 38400 bps 6: 57600 bps **Note: The baud rate set on the VFD must be consistent with that on the upper computer. Otherwise, the communication fails. A greater baud rate indicates faster communication.**	4	○
P14.02	Data bit check	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 6: No check (N, 7, 1) for ASCII 7: Even check (E, 7, 1) for ASCII 8: Odd check (O, 7, 1) for ASCII 9: No check (N, 7, 2) for ASCII 10: Even check (E, 7, 2) for ASCII	1	○

Function code	Name	Description	Default	Modify
		11: Odd check (O, 7, 2) for ASCII 12: No check (N, 8, 1) for ASCII 13: Even check (E, 8, 1) for ASCII 14: Odd check (O, 8, 1) for ASCII 15: No check (N, 8, 2) for ASCII 16: Even check (E, 8, 2) for ASCII 17: Odd check (O, 8, 2) for ASCII		
P14.03	Communication response delay	0–200ms The function code indicates the communication response delay, that is, the interval from when the VFD completes receiving data to when it sends response data to the upper computer. If the response delay is shorter than the rectifier processing time, the rectifier sends response data to the host controller after processing data. If the delay is longer than the rectifier processing time, the rectifier does not send response data to the host controller until the delay is reached although data has been processed.	5	○
P14.04	Communication timeout time	0.0: Invalid; 0.1–60.0s When the function code is set to 0.0, the communication timeout time is invalid. When the function code is set to a non-zero value, the system reports the "485 communication fault" (CE) if the communication interval exceeds the value. In general, the function code is set to 0.0. When continuous communication is required, you can set the function code to monitor communication status.	0.0s	○
P14.05	Transmission error processing	0: Report an alarm and coast to stop 1: Keep running without reporting an alarm 2: Stop in enabled stop mode without reporting an alarm (applicable only to communication mode) 3: Stop in enabled stop mode without reporting an alarm (applicable to any mode)	0	○
P14.06	Communication processing action	Ones place: 0: Respond to write operations. The VFD responds to both read and write commands from the host controller. 1: Do not respond to write operations. The VFD does not respond to the write commands, but responds only to the read commands from the upper computer. This	0x000	○

Function code	Name	Description	Default	Modify
		setting can improve the communication efficiency. Tens place: Communication encryption 0: Disable 1: Enable Hundreds place: RS485 communication device type 0: GD200A 1: GD200A user-defined address 2: CHF100A **Note: When the hundreds place is set to 1, P14.07 and P14.08 are valid.**		
P14.07	User-defined address for running commands	0x0000–0xFFFF	0x1000	○
P14.08	User-defined address for frequency setting	0x0000–0xFFFF	0x2000	○

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	/	●
P17.01	Output frequency	Displays the present output frequency of the VFD. Range: 0.00Hz–P00.03	/	●
P17.02	Ramp reference frequency	Displays the present ramp reference frequency of the VFD. Range: 0.00Hz–P00.03	/	●
P17.03	Output voltage	Displays the present output voltage of the VFD. Range: 0–1200V	/	●
P17.04	Output current	Displays the valid value of current output current of the VFD. Range: 0.0–3000.0A	/	●
P17.05	Motor rotation speed	Displays the present motor rotation speed. Range: 0–65535rpm	/	●
P17.08	Motor power	Displays the present motor power. The positive value is the motoring state while the negative value is the generating state.	/	●

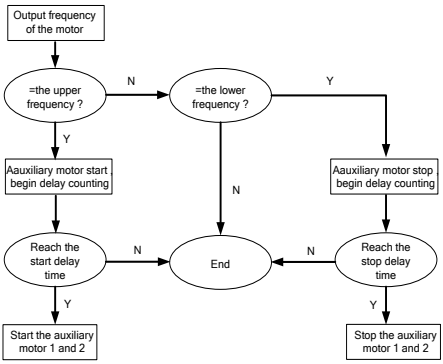
<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default</th><th>Modify</th></tr>
<tr><td></td><td></td><td>Range: -300.0–300.0% (100% corresponds to the rated motor power.)</td><td></td><td></td></tr>
<tr><td>P17.09</td><td>Output torque</td><td>Displays the present output torque of the VFD. The positive value is the motoring state while the negative value is the generating state.
Range: -250.0–250.0% (100% corresponds to the motor rated torque.)</td><td>/</td><td>●</td></tr>
<tr><td>P17.10</td><td>Estimated motor frequency</td><td>Displays the estimated motor rotor frequency.
Range: 0.00Hz–P00.03</td><td>/</td><td>●</td></tr>
<tr><td>P17.11</td><td>DC bus voltage</td><td>Displays the present DC bus voltage of the VFD.
Range: 0.0–2000.0 V</td><td>/</td><td>●</td></tr>
<tr><td>P17.12</td><td>Digital input terminal status</td><td>Displays the present digital input terminal state of the VFD.<table><tr><td>/</td><td>Bit8</td><td>Bit7</td><td>Bit6</td><td>Bit5</td></tr><tr><td>/</td><td>HDI</td><td>S8</td><td>S7</td><td>S6</td></tr><tr><td>Bit4</td><td>Bit3</td><td>Bit2</td><td>Bit1</td><td>Bit0</td></tr><tr><td>S5</td><td>S4</td><td>S3</td><td>S2</td><td>S1</td></tr></table>Range: 0x0000–0x01FF</td><td>/</td><td>●</td></tr>
<tr><td>P17.13</td><td>Digital output terminal status</td><td>Displays the present digital output terminal state of the VFD.<table><tr><td>Bit3</td><td>Bit2</td><td>Bit1</td><td>Bit0</td></tr><tr><td>RO2</td><td>RO1</td><td>HDO</td><td>Y</td></tr></table>Range: 0x0000–0x000F</td><td>/</td><td>●</td></tr>
<tr><td>P17.14</td><td>Digital adjustment value</td><td>Displays the adjustment on the VFD through the keypad.
Range: 0.00Hz–P00.03</td><td>/</td><td>●</td></tr>
<tr><td>P17.15</td><td>Torque reference value</td><td>Relative to the percentage of the rated torque of the present motor, displaying the torque reference.
Range: -300.0%–300.0% (of the motor rated current)</td><td>/</td><td>●</td></tr>
<tr><td>P17.16</td><td>Linear speed</td><td>Displays the present linear speed of the VFD.
Range: 0–65535</td><td>/</td><td>●</td></tr>
<tr><td>P17.18</td><td>Count value</td><td>Displays the present count value of the VFD.
Range: 0–65535</td><td>/</td><td>●</td></tr>
<tr><td>P17.19</td><td>AI1 input voltage</td><td>Displays the AI1 input signal. It is implemented through the analog potentiometer on the keypad for the 380V 0150G/018P and lower models; not available for the 380V 018G/022P and higher models.
Range: 0.00–10.00V</td><td>/</td><td>●</td></tr>
</table>

Function code	Name	Description	Default	Modify
P17.20	AI2 input voltage	Displays the AI2 input signal. Range: 0.00–10.00V	/	●
P17.21	AI3 input voltage	Displays the AI3 input signal. Range: -10.00–10.00V	/	●
P17.22	HDI input frequency	Display HDI input frequency. Range: 0.000–50.000kHz	/	●
P17.23	PID reference value	Displays the PID reference value. Range: -100.0–100.0%	/	●
P17.24	PID feedback value	Displays the PID feedback value. Range: -100.0–100.0%	/	●
P17.25	Motor power factor	Displays the power factor of the current motor. Range: -1.00–1.00	/	●
P17.26	Duration of this run	Displays the duration of this run of the VFD. Range: 0–65535min	/	●
P17.27	Simple PLC and actual step of multi-step speed	Used to display simple PLC and actual step of multi-step speed. Range: 0–15	/	●
P17.35	AC incoming current	Displays the valid value of incoming current on AC side. Range: 0.0–5000.0A	/	●
P17.36	Output torque	Displays the output torque. The positive value is the motoring state while the negative value is generating state. Range: -3000.0Nm–3000.0Nm	/	●
P17.37	Motor overload count value	0–100 (When the value is 100, OL1 is reported.)	/	●
P17.38	Lower limit for voltage and frequency selection settings	0x00–0x12 Ones place: Grid voltage selection 0: 220V range, suitable for voltages between 208 and 240V. 1: 380V range, suitable for voltages between 380 and 415V. 2: 460V range, suitable for voltages between 440 and 480V. Tens place: Grid frequency selection 0: 50Hz 1: 60Hz	0x00	●

Function code	Name	Description	Default	Modify
		Note: This function code is read-only and is determined jointly by P29.04 and P08.23. Users do not need to pay attention to it.		
P17.39	Upper limit for voltage and frequency selection settings	0x10–0x12 Ones place: Grid voltage selection 0: 220V range, suitable for voltages between 208 and 240V. 1: 380V range, suitable for voltages between 380 and 415V. 2: 460V range, suitable for voltages between 440 and 480V. Tens place: Grid frequency selection 0: 50Hz 1: 60Hz **Note: This function code is read-only and is determined jointly by P29.04 and P08.23. Users do not need to pay attention to it.**	0x00	●

Group P24—Water supply functions

Function code	Name	Description	Default	Modify
P24.00	Sleep function for water supply	0: Invalid 1: Valid	0	◎
P24.01	Pressure feedback source	0: AI1 set value (implemented through the analog potentiometer on the keypad for the 380V 0150G/018P and lower models; not available for the 380V 018G/022P and higher models.) 1: AI2 set value 2: AI3 set value 3: HDI set value	0	○
P24.02	Sleep check mode	0: At a set frequency less than P24.03 (Sleep start frequency) 1: At a feedback pressure greater than P24.04 (Sleep start pressure)	0	◎
P24.03	Sleep start frequency	0.00Hz–P00.03 (Max. output frequency)	10.00Hz	○
P24.04	Sleep start pressure	0.00–100.0%	50.0%	○

Function code	Name	Description	Default	Modify
P24.05	Sleep delay time	0.0–3600.0s	5.0s	○
P24.06	Sleep wakeup mode	0: At a set frequency greater than P24.07 (Sleep wakeup frequency) 1: At a feedback pressure less than P24.08 (Set value of sleep wakeup pressure)	0	◎
P24.07	Sleep wakeup frequency	0.00Hz–P00.03	20.00Hz	○
P24.08	Set value of sleep wakeup pressure	0.00–100.0%	10.0%	○
P24.09	Min. sleep time	0.0–3600.0s	5.0s	○
P24.10	Auxiliary motor selection	P24.10–P24.12 are used to configure the simple water supply system, which accomplishes the constant pressure water supply with one-drive-three function, i.e. one VFD driving one converter pump and two power frequency pumps. See the following figure for its logic principle.  P24.10 is used to select the effective auxiliary motor. 0: No auxiliary motor 1: Auxiliary motor 1 2: Auxiliary motor 2 3: Auxiliary motor 1 and 2 Setting range of P24.11: 0.0–3600.0s Setting range of P24.12: 0.0–3600.0s	0	○
P24.11	Auxiliary motor 1 start/stop delay time		5.0s	○
P24.12	Auxiliary motor 2 start/stop delay time		5.0s	○

7 Basic operation description

7.1 What this chapter contains

This chapter introduces the function modules inside the VFD.

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

7.2 First power-on

1. Check before power-on

Please check according to the installation list in section 0

Checking after installation.

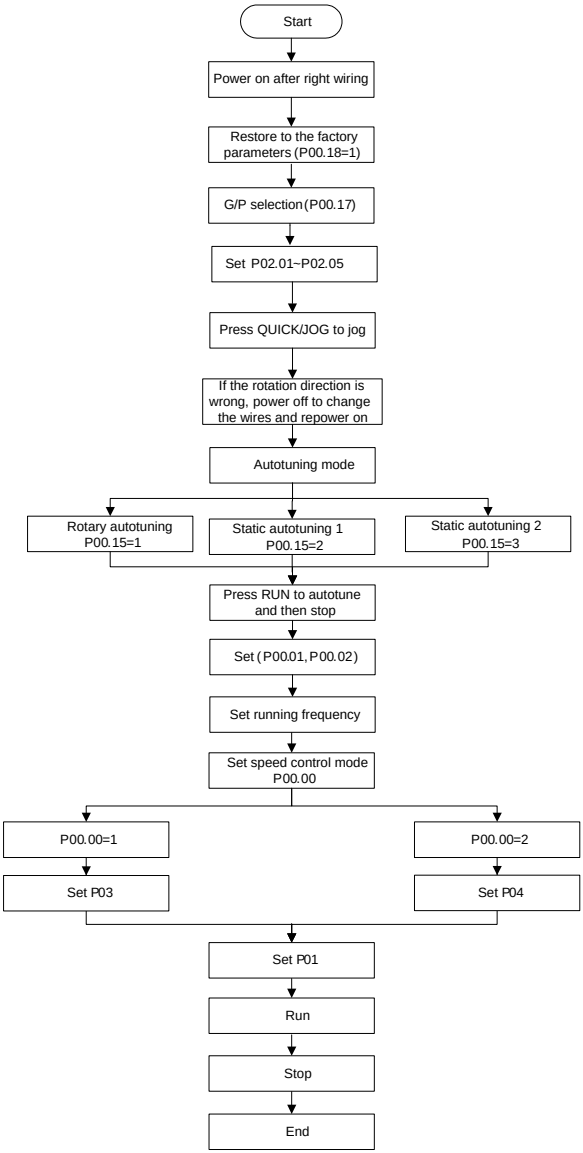
2. Operating upon first power-on

After confirming the wiring and power are correct, close the air switch of the AC power supply at the VFD input side to power on the VFD. The VFD keypad displays 8.8.8.8.8., and the contactor closes normally. If the displayed character changes to the set frequency, indicating that the VFD is ready for run.

LED displays "8.8.8.8.8" and 7 LEDs are on

Standby state

The first operation procedure is as follows (taking motor 1 as an example).



Note: If a fault occurred, find out the fault cause and remove the fault according to chapter 8 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	/

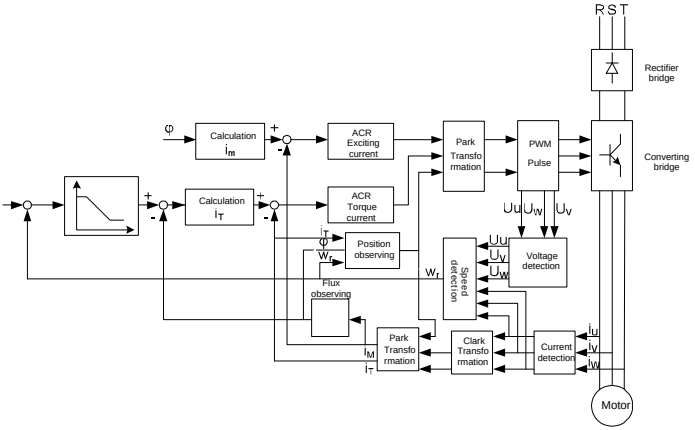
Note: "/" indicates this multifunction terminal is invalid under present reference channel.

7.3 Vector control

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

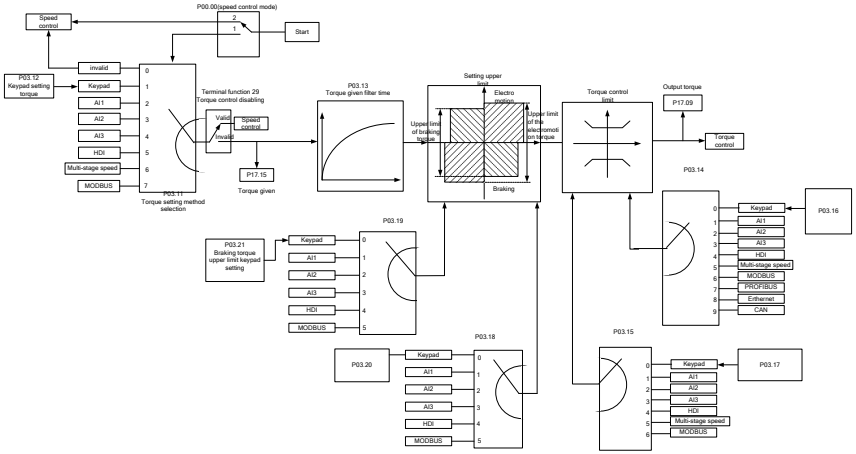
The VFD uses the sensor-less vector control algorithm. As the core algorithm of vector control is based on accurate motor parameter models, the accuracy of motor parameters affects vector control performance. It is recommended to enter accurate motor parameters and autotune motor parameters before executing vector control.

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



7.4 Torque control

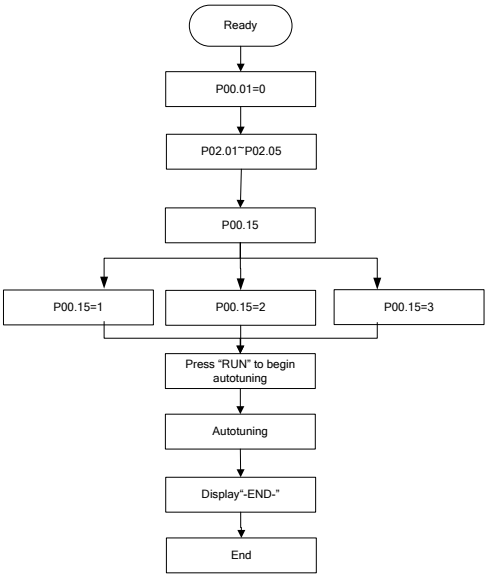
The VFD supports torque control and speed control. Speed control aims to stabilize the speed to keep the set speed consistent with the actual running speed, meanwhile, the max. load-carrying capacity is restricted by the torque limit. Torque control aims to stabilize the torque to keep the set torque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



7.5 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 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.



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. At this time, the asynchronous motor can autotune P02.06–P02.10.
- ✧ If static autotuning 1 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, the asynchronous motor can autotune P02.06–P02.10.
- ✧ If static autotuning 2 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, the asynchronous motor can autotune P02.06–P02.08.

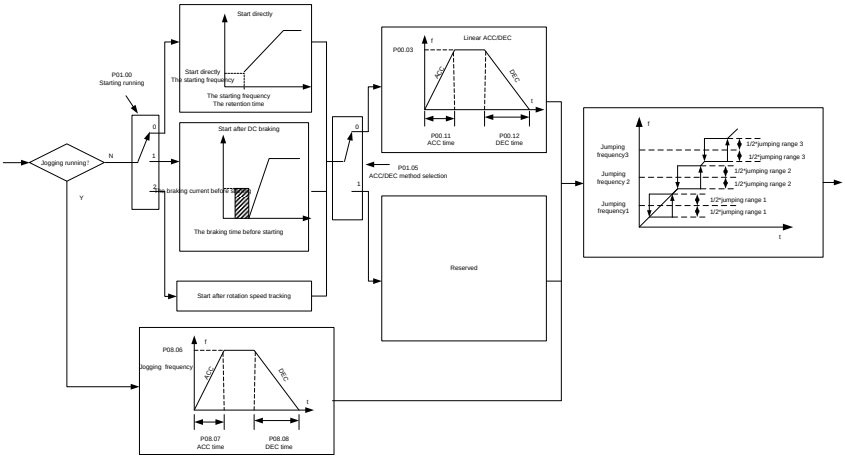
7.6 Start/stop control

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

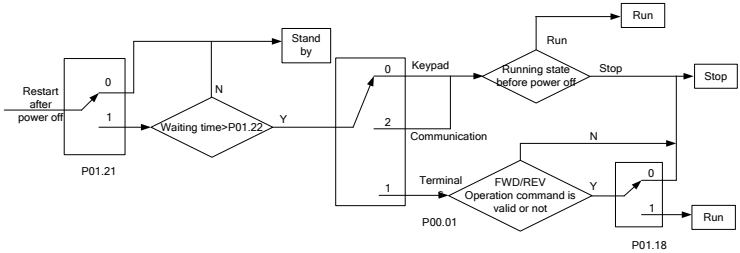
There are three start modes for the VFD, which are start at starting frequency, start after DC braking, and start after speed tracking. You can select the proper start mode based on actual conditions.

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

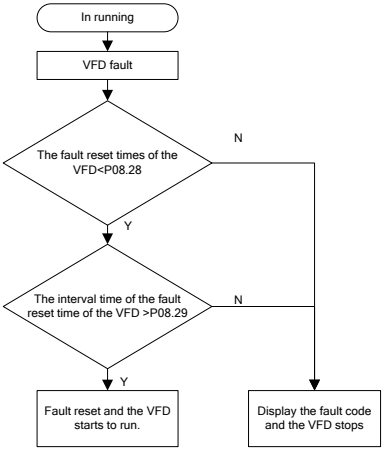
1. Logic diagram for start after a running command is given at power-on.



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



3. Logic diagram for start after automatic fault reset.



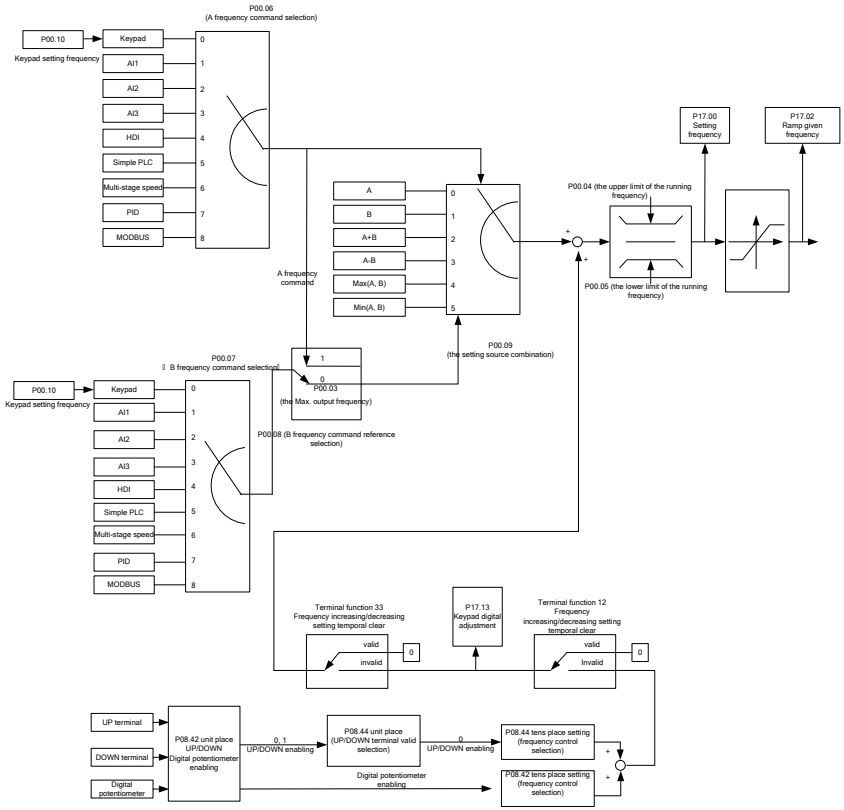
7.7 Frequency setting

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

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

There are three input modes for auxiliary reference channel: keypad UP/DOWN key input, terminal UP/DOWN switch input, and digital potentiometer input. These input modes are all equivalent to the internal auxiliary reference, namely input UP/DOWN reference. By setting function codes, you can enable the corresponding reference mode and the impact made on the VFD frequency reference by this reference mode.

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

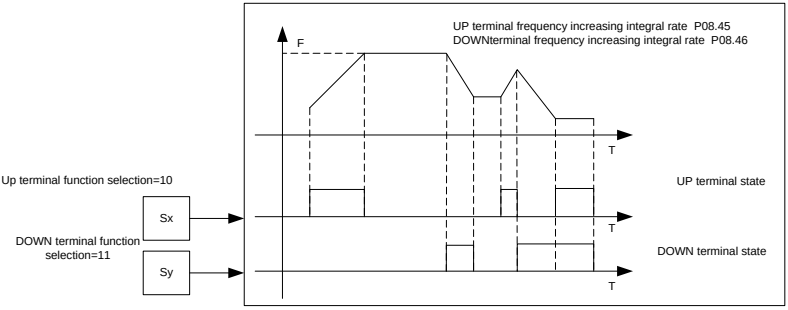


The VFD supports switch-over between different reference channels, and the rules for channel switch-over are shown as follows.

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

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

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

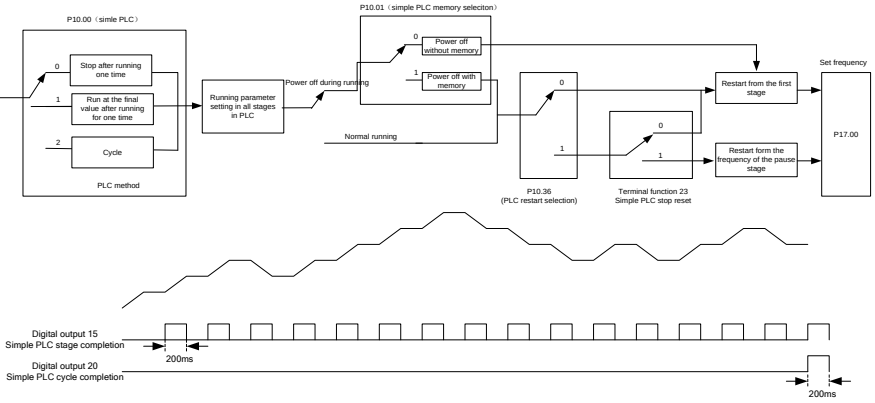


7.8 Simple PLC

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.

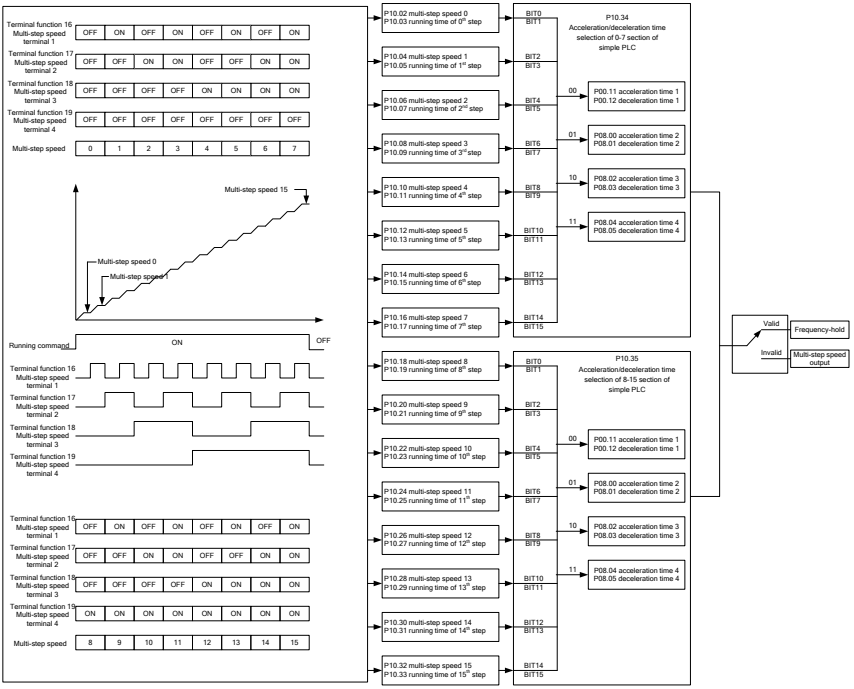
The VFD can realize 16-step speeds control, and provide four groups of acceleration/deceleration time for choose.

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



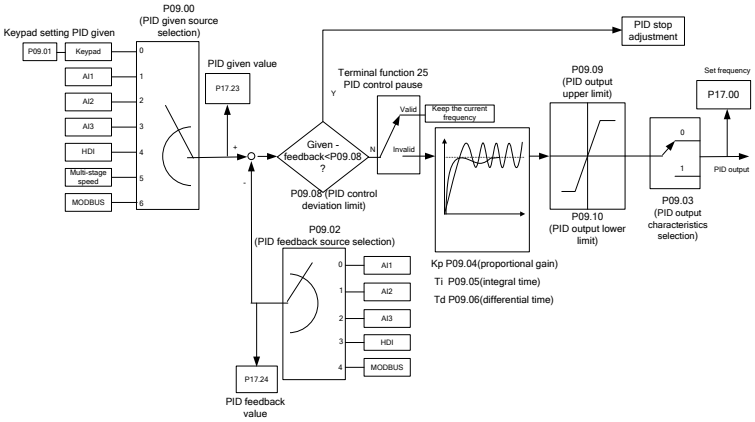
7.9 Multi-step speed running

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



7.10 PID control

PID control, a common mode for process control, is mainly used to adjust the VFD output frequency 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 suitable for process control such as flow control, pressure control, and temperature control. The basic control principle block diagram is shown below.



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

7.10.1 General procedures for PID parameter setup

a. Determining proportional gain P

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

b. 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.

c. Determining derivative time Td

The differential time Td is generally set to 0.

If you need to set Td to another value, the setting method is similar to that for P and Ti, namely, set Td

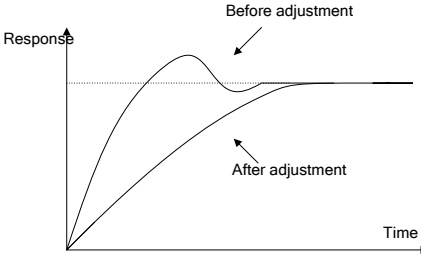
to 30% of the value when there is no oscillation.

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

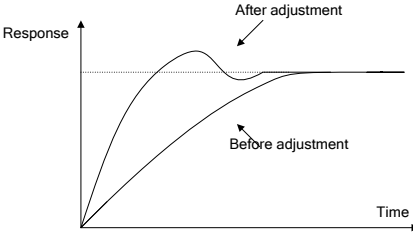
7.10.2 How to fine-tune PID

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

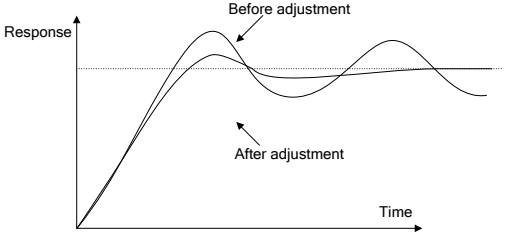
Control overshoot: When overshoot occurred, shorten the derivative time (Td) and prolong integral time (Ti).



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.

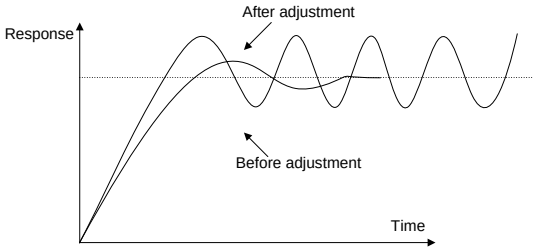


Control long-term vibration: If the cycle of periodic vibration is longer than the set value of integral time (Ti), it indicates the integral action is too strong, prolong the integral time (Ti) to control vibration.



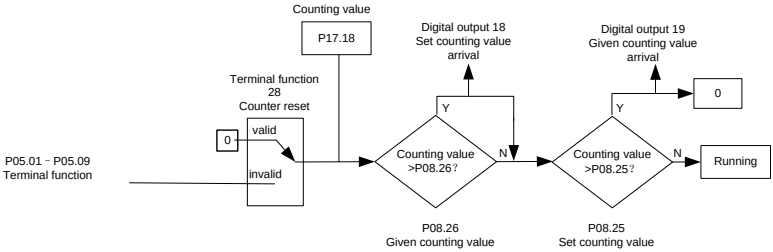
Control short-term vibration: If the vibration cycle is as short almost the same as the set value of differential time (Td), it indicates the differential action is too strong. Shorten the differential time (Td)

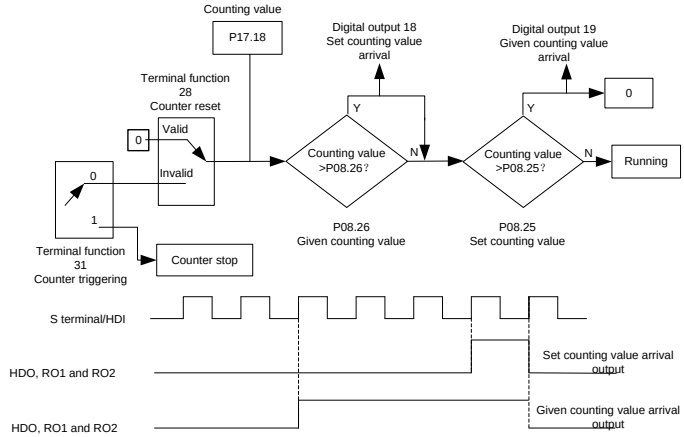
to control vibration. When the differential time (Td) is set to 0.00 (namely no differential control), and there is no way to control vibration, decrease the proportional gain.



7.11 Pulse counter

The VFD supports the counting function.





8 Troubleshooting

8.1 What this chapter contains

The chapter tells you how to reset faults and check faults history. A complete list of alarms and fault information as well as possible causes and corrective measures are presented in this chapter.

	Only trained and qualified professionals are allowed to carry out the operations mentioned in this chapter. Please carry out operations according to instructions presented in chapter 1 Safety precautions.

8.2 Indications of alarms and faults

The fault is indicated by indicators. See chapter 5 Keypad operation guidelines. When the TRIP indicator is on, the alarm or fault code displayed on the keypad indicates the VFD is in exception state. This chapter covers most of the alarms and faults, and their possible causes and corrective measures. If you cannot find out the causes of alarms or faults, contact local INVT office.

8.3 Fault reset

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

8.4 Fault history

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

8.5 Faults and solutions

When a fault occurred, handle the fault as follows:

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

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

Step 3 Check the following table for the exception and solution.

Step 4 Rectify the fault or ask for help.

Step 5 After confirming the fault is removed, perform fault reset, and start running.

8.5.1 Faults and solutions

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

Fault code	Fault type	Possible cause	Solution
OUt1	[1] Inverter unit U-phase protection	ACC is too fast. IGBT module is damaged.	Increase ACC time. Replace the power unit.
OUt2	[2] Inverter unit V-phase	Misoperation caused by	Check drive wires.

Fault code	Fault type	Possible cause	Solution
	protection	interference.	Check whether there is strong interference surrounding the peripheral device.
OUt3	[3] Inverter unit W-phase protection	Drive wires are poorly connected. To-ground short circuit occurs.	
OV1	[7] Overvoltage during ACC	Exception occurred to 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. The voltage of the grid is too low. VFD power too small. Load transient or exception occurred. To-ground short circuit or output phase loss occurred. Strong external interference sources existed. Overvoltage stall protection is not enabled.	Increase ACC/DEC time. Check the input power. Select a VFD with larger power. Check whether the load is short circuited (to-ground short circuit or line-to-line short circuit) or the rotation is not smooth. Check the output wiring. Check whether there is strong interference. Check the related function code settings.
OC2	[5] Overcurrent during DEC		
OC3	[6] Overcurrent during constant speed running		
UV	[10] Bus undervoltage	The voltage of the grid is too low. The overvoltage stall protection is not enabled.	Check the grid input power. Check the setting of related function codes.
OL1	[11] Motor overload	Grid voltage too low. Motor rated current set incorrectly. Motor stall or load jumps violently.	Check the grid voltage. Reset the rated current of the motor. Check the load and adjust torque boost.
OL2	[12] VFD overload	ACC is too fast. The motor in rotating is restarted. Grid voltage too low.	Increase ACC time. Avoid restart after stop. Check the grid voltage; Select the VFD with larger

Fault code	Fault type	Possible cause	Solution
		Load too heavy. Power is too small.	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 too high. Long-time overload running.	Ventilate the air duct or replace the fan. Lower the ambient temperature.
OH2	[16] Inverter module overheat		
EF	[17] External fault	SI external faulty input terminal 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 proper baud rate; Check the wiring of communication interfaces; Set the communication address correctly. Replace or change the wiring to enhance the anti-interference capacity.
ItE	[19] Current detection fault	Poor contact of the connector of control board. The Hall component is damaged. Exception occurred to amplification circuit.	Check the connector and re-plug. Replace the hall component. Replace the main control board.
tE	[20] Motor autotuning fault	Motor capacity and VFD capacity mismatched. Improper motor parameter setting. Autotuned parameter settings deviate sharply from the standard ones. Autotuning timeout.	Change the VFD model. Set the motor type and nameplate parameters correctly. Empty the motor load and re-perform autotuning. Check motor wiring and parameter settings. Check whether the upper limit

Fault code	Fault type	Possible cause	Solution
			frequency is larger than 2/3 of the rated frequency.
EEP	[21] EEPROM operation fault	Control parameter reading/writing error. EEPROM damaged.	Press STOP/RST to reset. Replace the main control board.
PIDE	[22] PID feedback offline fault	PID feedback offline. PID feedback source disappears.	Check PID feedback signal wires; Check PID feedback source.
bCE	[23] Braking unit fault	Fault occurred to the brake circuit or the braking pipe is damaged. Resistance of the external braking resistor is small.	Check the braking unit, and replace with new braking pipe; Increase the brake resistance.
END	[24] Running time reached	Actual VFD running time longer than internally set running time.	Ask the supplier to adjust the preset running time.
OL3	[25] Electronic overload fault	The VFD reports overload pre-alarm according to the setting.	Check the load and overload pre-alarm threshold.
PCE	[26] Keypad communication fault	Keypad cable connected improperly or disconnected. Keypad cable too long, causing strong interference. Keypad or mainboard communication circuit error.	Check the keypad cable to determine whether a fault occurs. Check for and remove the external interference source. Replace the hardware and seek maintenance services.
UPE	[27] Parameter upload error	Keypad cable connected improperly or disconnected. Keypad cable too long, causing strong interference. Keypad or mainboard communication circuit error.	Check for and remove the external 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 for and remove the external interference source. Replace the hardware and seek maintenance services. Re-back up the data on the keypad.

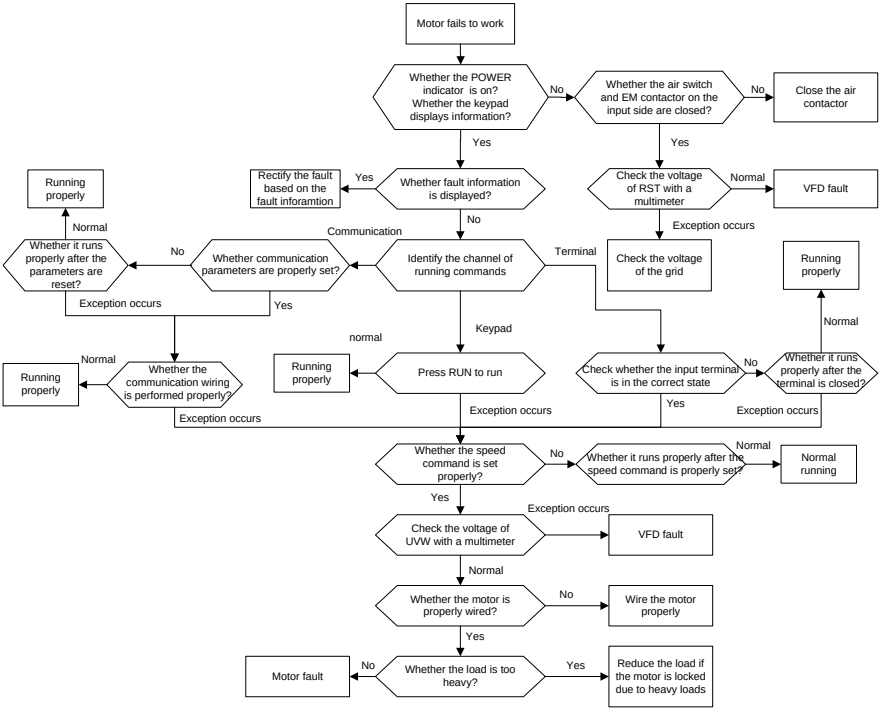
Fault code	Fault type	Possible cause	Solution
ETH1	[32] To-ground short-circuit fault 1	VFD output is short connected to the ground. Current detection circuit is faulty. Actual motor power setup deviates sharply from the VFD power.	Check whether the motor wiring is normal. Replace the hall component; Replace the main control board. Reset the motor parameters properly.
ETH2	[33] To-ground short-circuit fault 2		
LL	[36] Electronic underload fault	The VFD reports underload pre-alarm according to the setting.	Check the load and underload pre-alarm thresholds.

8.5.2 Other status

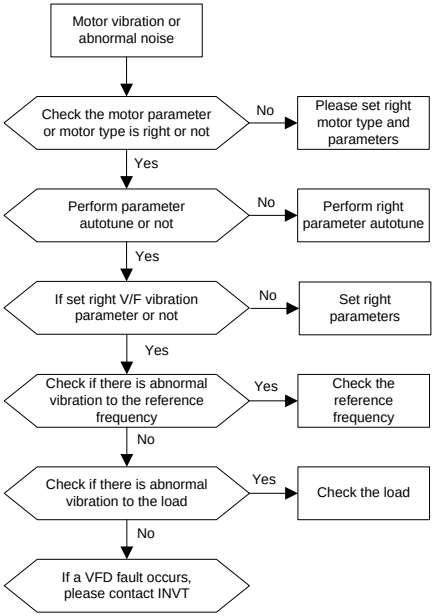
Displayed code	Status type	Possible cause	Solution
PoFF	System power failure	The system is powered off or the bus voltage is too low.	Check the grid conditions.
/	Communication between the keypad and main control board failed.	The keypad is not properly connected.	Check the installation environment of the keypad.

8.6 Analysis on common faults

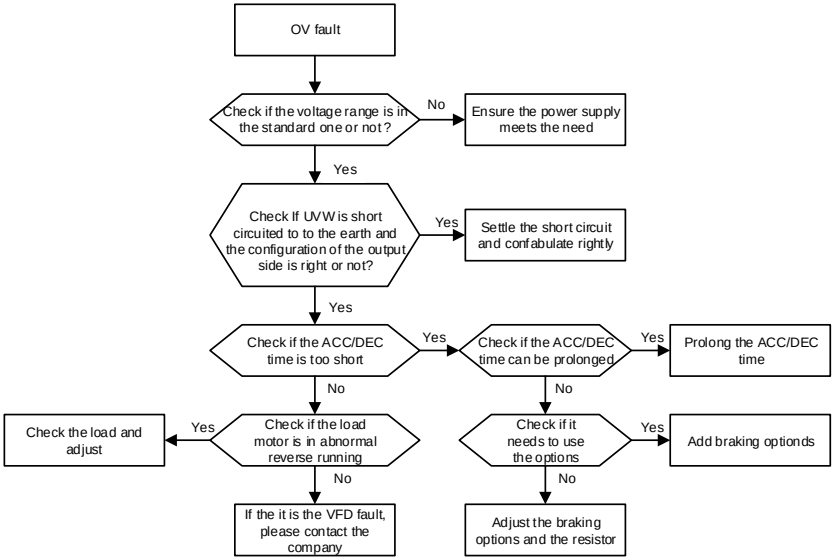
8.6.1 Motor fails to work



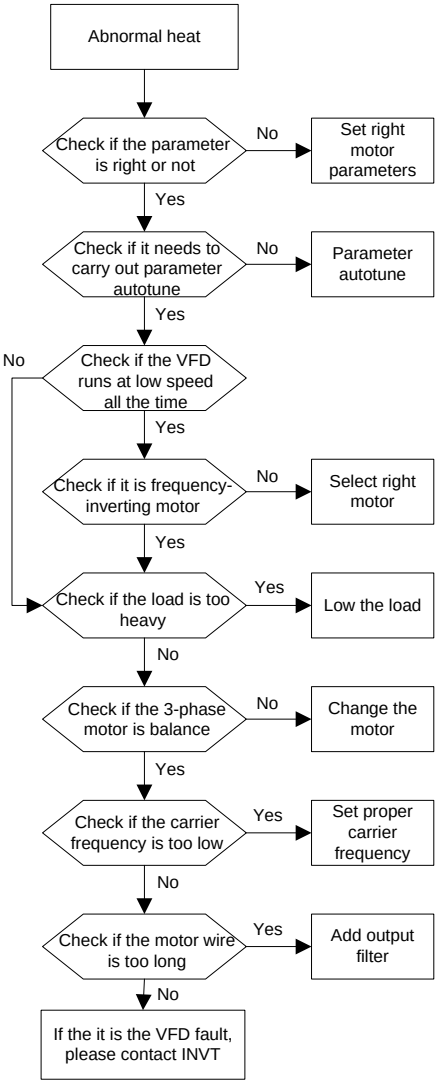
8.6.2 Motor vibrates



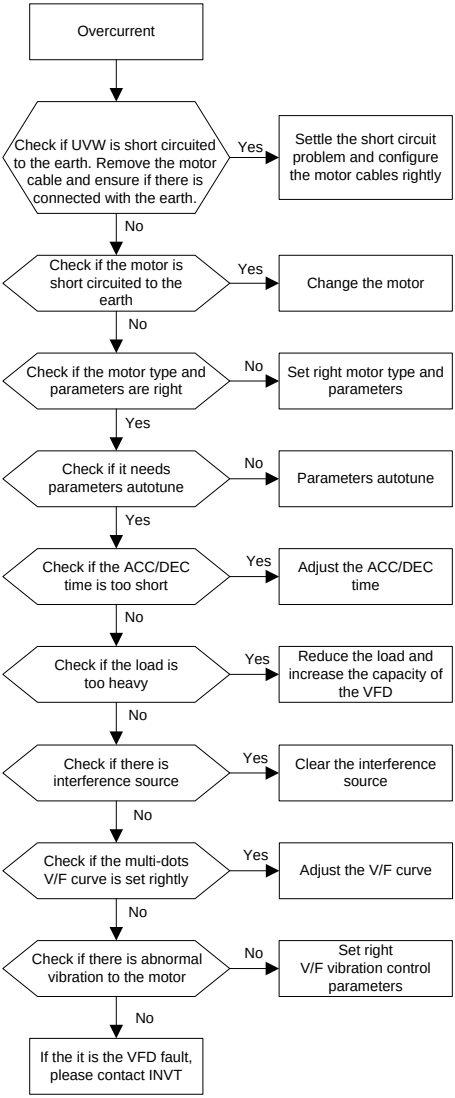
8.6.3 Overvoltage



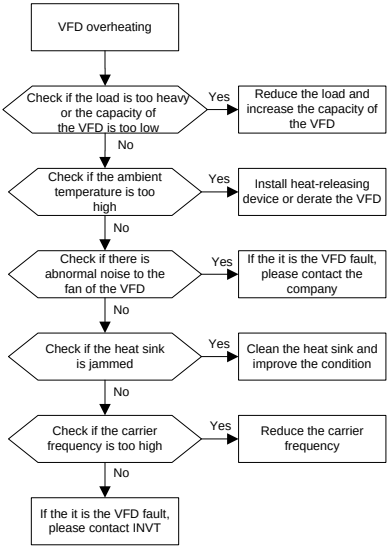
8.6.4 Motor overheating



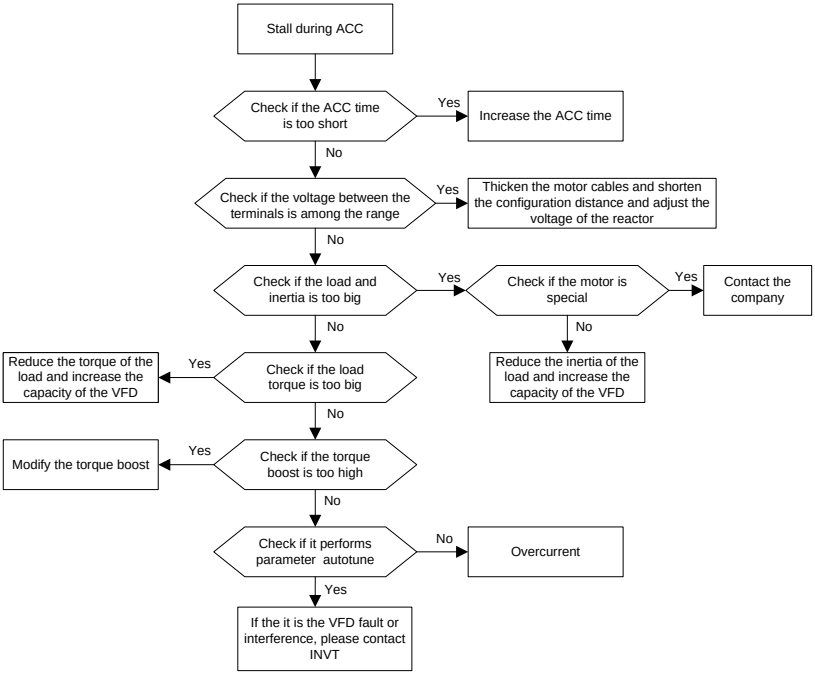
8.6.5 Overcurrent



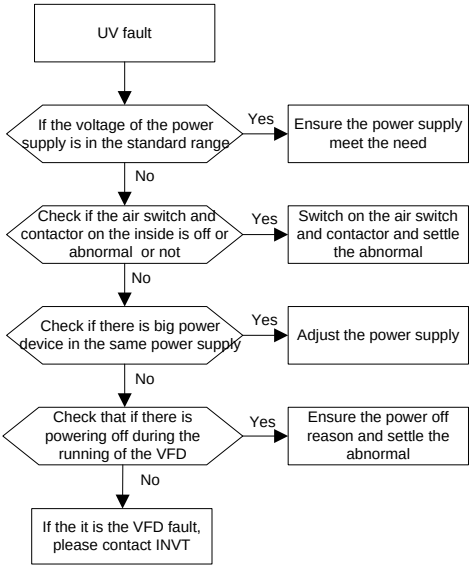
8.6.6 VFD overheating



8.6.7 Motor stalls during ACC



8.6.8 Undervoltage



8.7 VFD system interference troubleshooting

If interference problems occurred to sensitive equipment (PLC, host computer, sensors, detection equipment, etc.) during system operation, you can resolve the problem through the following measures:

- Try connecting or disconnecting the C3 filter's short-circuit cap to verify whether the interference has been eliminated.
- Check whether the power cable of the VFD and the signal cable and communication cable of sensitive equipment are arranged in the same cable tray. If it exists, route these cables separately.
- If the sensitive equipment and the VFD take power from the same grid, it is recommended to add an isolation transformer and filter to the distribution of the sensitive equipment side.
- Conduct trials by grounding both ends, grounding one end, and leaving ungrounded for the shielding wires related to sensitive equipment respectively. Verify whether the interference has been eliminated.
- Attempt to isolate the grounded connection or float the ground of the sensitive equipment that is being interfered with, from the ground of the VFD. Verify if the interference has been eliminated.

8.8 Maintenance and hardware fault diagnosis

8.8.1 Periodical inspection

Little maintenance is required when the VFD is installed in an environment that meets requirements.

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

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

Check scope		Check item	Method	Expected result
	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, Reactor	Check whether there is unusual vibration sounds or smells.	Auditory, olfactory, and visual inspection	No exception occurs.
	Electromagnetic contactor and Relay	Check whether there are vibration sounds in the workshop.	Auditory inspection	No exception occurs.
		Check whether the contacts are in good contact.	Visual inspection	No exception occurs.
Control circuit	Control PCB and connector	Check whether the screws and connectors 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 scope		Check item	Method	Expected result
		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 inspection, visual inspection, or rotate with hand	The rotation is smooth.
		Check whether the bolts loose.	Screw them up.	No exception occurs.
		Check whether there is decoloration caused due to overheat.	Visual inspection, and determine the service life based on the maintenance information.	No exception occurs.
	Ventilation duct	Check whether there are foreign matters blocking or attached to the cooling fan, air inlets, or air outlets. Check whether there are foreign objects attached.	Visual inspection	No exception occurs.

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

8.8.2 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. Use a screwdriver to pry the fan mounting plate up from the cabinet and lift the fan mounting plate upward.
3. Open the cable clamp to loose the fan cable.
4. Disconnect the fan cable.
5. Remove the fan installation plate.
6. Install a new fan in the VFD in the reverse steps.
7. Power on the VFD.

8.8.3 Capacitor

8.8.3.1 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 an adjustable power supply depends on the power supply of the VFD. For VFDs with incoming voltage of 1PH or 3PH 220 VAC, you can use a 1PH 220VAC/2A voltage regulator. Both 1PH and 3PH VFDs can be charged with a 1PH voltage controlled power supply (connect L+ to R, and N to S or T). All the DC bus capacitors share one rectifier, and therefore they are all charged.

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

The method for using a resistor (incandescent lamp) to charge the drive is described as follows:

If you directly connect the drive device to a power supply to charge the DC bus capacitor, it needs to be charged for a minimum of 60 minutes. The charging operation must be performed at a normal

indoor temperature without load, and you must connect a resistor in series mode in the 3PH circuit of the power supply (the distance between resistors of each phase should be ≥ 5.5mm):

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.

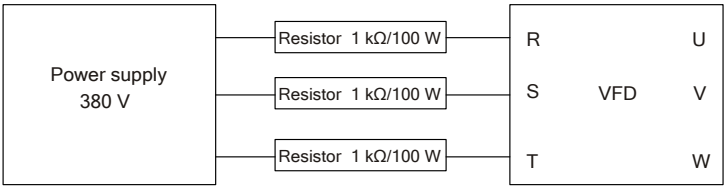


Figure 8-1 380V driving-device charging circuit example

8.8.3.2 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.

8.8.4 Power cable

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

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

9 Communication protocol

9.1 What this chapter contains

This chapter describes the communication of the VFD.

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

9.2 Modbus protocol introduction

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

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

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

9.3 Application of Modbus

The communication data format of the Modbus protocol used in the VFD is divided into two modes: RTU (Remote Terminal Unit) mode and ASCII (American Standard Code for Information International Interchange) mode.

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

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

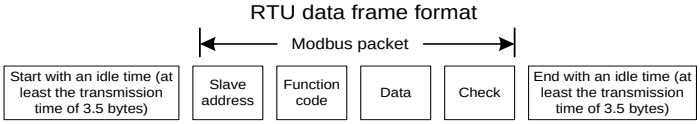
When there are fewer devices and the transmission distance is short, the whole network works well without terminal load resistors. The performance, however, degrades as the distance increases. Therefore, it is recommended that you use a 120Ω terminal resistor when the transmission distance is long.

9.3.2 RTU mode

Name	Definition
Code system	Each frame domain of 8 bits includes 2 hexadecimal characters (0–9, A–F).
Data format	Start bit, 8 data bits, check bit, and stop bit The following table describes the data format. 11-bit character frame

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

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 sent, a similar transmission interval (with a minimum transmission time of 3.5 bytes) is used to indicate that the frame transmission ends. Then, the transmission of a new frame starts.



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

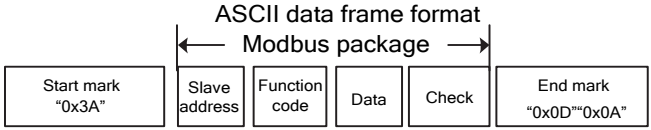
The following table describes the standard structure of an RTU frame.

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

9.3.3 ASCII mode

<table>
<tr><th>Name</th><th>Definition</th></tr>
<tr><td>Code system</td><td>The communication protocol belongs to the hexadecimal system, and the meaning of ASCII information characters is: "0" to "9", "A" to "F". Each hexadecimal digit is represented by the ASCII information of the corresponding character:
<table>
<tr><td>Character</td><td>'0'</td><td>'1'</td><td>'2'</td><td>'3'</td><td>'4'</td><td>'5'</td><td>'6'</td><td>'7'</td></tr>
<tr><td>ASCII CODE</td><td>0x30</td><td>0x31</td><td>0x32</td><td>0x33</td><td>0x34</td><td>0x35</td><td>0x36</td><td>0x37</td></tr>
<tr><td>Character</td><td>'8'</td><td>'9'</td><td>'A'</td><td>'B'</td><td>'C'</td><td>'D'</td><td>'E'</td><td>'F'</td></tr>
<tr><td>ASCII CODE</td><td>0x38</td><td>0x39</td><td>0x41</td><td>0x42</td><td>0x43</td><td>0x44</td><td>0x45</td><td>0x46</td></tr>
</table></td></tr>
<tr><td>Data format</td><td>Start bit, 7/8 data bits, check bit, and stop bit The following table describes the data format.
11-bit character frame:
<table>
<tr><td>Start bit</td><td>Bit1</td><td>Bit2</td><td>Bit3</td><td>Bit4</td><td>Bit5</td><td>Bit6</td><td>Bit7</td><td>Bit8</td><td>Check bit</td><td>Stop bit</td></tr>
</table>10-bit character frame:
<table>
<tr><td>Start bit</td><td>Bit1</td><td>Bit2</td><td>Bit3</td><td>Bit4</td><td>Bit5</td><td>Bit6</td><td>Bit7</td><td>Check bit</td><td>Stop bit</td></tr>
</table></td></tr>
</table>

In ASCII mode, the frame header is represented by ": " ("0x3A"), while the default frame tail is "CRLF" ("0x0D", "0x0A"). In ASCII mode, aside from the frame header and frame tail, all other data bytes are transmitted in ASCII code format, with the high nibble sent first, followed by the low nibble. In ASCII mode, the data length is 8 bits. For the characters 'A' to 'F', the ASCII codes of their uppercase letters are utilized. At this point, the data employs LRC (Longitudinal Redundancy Check) for error detection, which encompasses the information from the slave address to the data segment. The checksum is equivalent to the complement of the sum of all characters involved in the verification process, discarding any carry bits.



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

START	':' (0x3A)
Address Hi	Communication address: An 8-bit address is formed by the combination of two ASCII characters.
Address Lo	
Function Hi	Function code: An 8-bit address is formed by the combination of two ASCII characters.
Function Lo	
DATA (N-1) ... DATA (0)	Data content: The nx8-bit data content is constituted by the combination of 2n ASCII characters. n≤16, up to 32 ASCII characters.
LRC CHK Hi	LRC check code: An 8-bit check code is formed by the combination of two ASCII characters.
LRC CHK Lo	
END Hi	End character: END Hi=CR(0x0D), END Lo=LF(0x0A)
END Lo	

9.3.4 RTU communication frame error check modes

The error check of a frame includes two parts, namely, bit check on bytes (odd/even check), and whole data check (CRC check or LRC check).

9.3.4.1 Byte-wise 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.

9.3.4.2 Cyclic redundancy check (CRC)

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

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

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

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

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

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

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

9.3.4.3 LRC check in ASCII mode

The checksum (LRC Check) is the sum of values from the Address to the Data Content. For instance, in the communication information outlined above, the checksum is calculated as follows:

0x02+0x06+0x00+0x08+0x13+0x88=0xAB, and then the two's complement of this result is taken, which equals 0x55.

Here is a reference for calculating the LRC and a simple function provided for users, written in C:

```
Static unsigned char
LRC(auchMsg,usDataLen)
unsigned char *auchMsg;
unsigned short usDataLen;
{
unsigned char uchLRC=0;
while(usDataLen--)
uchLRC+=*auchMsg++;
return((unsigned char)(-((char)uchLRC)));
}
```

9.4 Command code and communication data

9.4.1 RTU mode

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

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

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

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

RTU master command (from the master to the VFD)		RTU slave response (from the VFD to the master)	
START	T1-T2-T3-T4 (transmission time of 3.5 bytes)	START	T1-T2-T3-T4 (transmission time of 3.5 bytes)

RTU master command (from the master to the VFD)		RTU slave response (from the VFD to the master)	
ADDR (address)	01H	ADDR	01H
CMD (command code)	03H	CMD	03H
Start address MSB	00H	Number of bytes	04H
Start address LSB	04H	MSB of data in 0004H	13H
Data count MSB	00H	LSB of data in 0004H	88H
Data count LSB	02H	MSB of data in 0005H	00H
CRC LSB	85H	LSB of data in 0005H	00H
CRC MSB	CAH	CRC LSB	7EH
END	T1-T2-T3-T4 (transmission time of 3.5 bytes)	CRC MSB	9DH
/	/	END	T1-T2-T3-T4 (transmission time of 3.5 bytes)

9.4.1.2 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) is as follows:		RTU slave response (from the VFD to the master)	
START	T1-T2-T3-T4 (transmission time of 3.5 bytes)	START	T1-T2-T3-T4 (transmission time of 3.5 bytes)
ADDR	02H	ADDR	02H
CMD	06H	CMD	06H
MSB of data writing address	00H	MSB of data writing address	00H
LSB of data writing address	04H	LSB of data writing address	04H
MSB of data content	13H	MSB of data content	13H
LSB of data content	88H	LSB of data content	88H
CRC LSB	C5H	CRC LSB	C5H
CRC MSB	6EH	CRC MSB	6EH
END	T1-T2-T3-T4 (transmission time of 3.5 bytes)	END	T1-T2-T3-T4 (transmission time of 3.5 bytes)

Note: The section 9.4.1.1 mainly describe the command formats. For the detailed application, see the description in section 9.6 Read/Write operation examples.

9.4.1.3 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) is as follows:		RTU slave response (from the VFD to the master)	
START	T1-T2-T3-T4 (transmission time of 3.5 bytes)	START	T1-T2-T3-T4 (transmission time of 3.5 bytes)
ADDR	02H	ADDR	02H
CMD	10H	CMD	10H
MSB of data writing address	00H	MSB of data writing address	00H
LSB of data writing address	04H	LSB of data writing address	04H
Data count MSB	00H	Data count MSB	00H
Data count LSB	02H	Data count LSB	02H
Number of bytes	04H	CRC LSB	C5H
MSB of data to be written to 0004H	13H	CRC MSB	6EH
LSB of data to be written to 0004H	88H	END	T1-T2-T3-T4 (transmission time of 3.5 bytes)
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)	/	/

9.4.2 ASCII mode

9.4.2.1 Command code 03H (0000 0011), reading N words (continuously reading a maximum of 16 words)

For example, for a VFD with a slave address of 01H, and a memory starting address of 0004, when reading 2 consecutive words, the structure of the frame is described as follows:

ASCII master command from the master to the VFD		ASCII slave response from the VFD to the master	
START	':'	START	':'
ADDR	'0'	ADDR	'0'
	'1'		'1'
CMD	'0'	CMD	'0'
	'3'		'3'
Start address MSB	'0'	Number of bytes	'0'
	'0'		'4'
Start address LSB	'0'	MSB of the data address 0004H	'1'
	'4'		'3'
Data count MSB	'0'	LSB of the data address 0004H	'8'
	'0'		'8'
Data count LSB	'0'	MSB of the data address 0005H	'0'
	'2'		'0'
LRC CHK Hi	'F'	LSB of the data address 0005H	'0'
LRC CHK Lo	'6'		'0'
END Hi	CR	LRC CHK Hi	'5'
END Lo	LF	LRC CHK Lo	'D'
/	/	END Hi	CR
/	/	END Lo	LF

9.4.2.2 Command word 06H (0000 0110), writing a word

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

ASCII master command from the master to the VFD		ASCII slave response from the VFD to the master	
START	':'	START	':'
ADDR	'0'	ADDR	'0'
	'2'		'2'
CMD	'0'	CMD	'0'
	'6'		'6'
MSB of data writing address	'0'	MSB of data writing address	'0'
	'0'		'0'
LSB of data writing address	'0'	LSB of data writing address	'0'
	'4'		'4'
MSB of data content	'1'	MSB of data content	'1'
	'3'		'3'
LSB of data content	'8'	LSB of data content	'8'
	'8'		'8'
LRC CHK Hi	'5'	LRC CHK Hi	'5'
LRC CHK Lo	'9'	LRC CHK Lo	'9'

ASCII master command from the master to the VFD		ASCII slave response from the VFD to the master	
END Hi	CR	END Hi	CR
END Lo	LF	END Lo	LF

9.4.2.3 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.

ASCII master command from the master to the VFD		ASCII slave response from the VFD to the master	
START	':'	START	':'
ADDR	'0'	ADDR	'0'
	'2'		'2'
CMD	'1'	CMD	'1'
	'0'		'0'
Start address MSB	'0'	Start address MSB	'0'
	'0'		'0'
Start address LSB	'0'	Start address LSB	'0'
	'4'		'4'
Data count MSB	'0'	Data count MSB	'0'
	'0'		'0'
Data count LSB	'0'	Data count LSB	'0'
	'2'		'2'
Bytes	'0'	LRC CHK Hi	'E'
	'4'	LRC CHK Lo	'8'
MSB of data to be written to 0004H	'1'	END Hi	CR
	'3'	END Lo	LF
LSB of data to be written to 0004H	'8'	/	/
	'8'	/	/
MSB of data to be written to 0005H	'0'	/	/
	'0'	/	/
LSB of data to be written to 0005H	'3'	/	/
	'2'	/	/
LRC CHK Hi	'1'	/	/
LRC CHK Lo	'7'	/	/
END Hi	CR	/	/
END Lo	LF	/	/

9.5 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.

9.5.1 Function code address format rules

The address of a function code consists of two bytes, with the MSB on the left and LSB on the right. The high-order byte ranges from 00 to ffH, and the low-order byte also ranges from 00 to ffH. The MSB is the hexadecimal form of the group number before the dot mark, and LSB is that of the number behind the dot mark. Take P05.06 as an example: The group number is 05, that is, the MSB of the parameter address is the hexadecimal form of 05; and the number behind the dot mark is 06, that is, the LSB is the hexadecimal form of 05. Therefore, the function code address is 0506H in the hexadecimal form. For P10.01, the parameter address is 0A01H.

Function code	Name	Description	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	○
P10.01	Simple PLC memory selection	0: Do not memorize at power outage 1: Memorize at power outage	0	○

Note:

- ✧ The parameters in the P29 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 in 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.

9.5.2 Addresses of other Modbus functions

In addition to modifying the parameters of the VFD, the master can also control the VFD, such as starting and stopping the VFD, and monitoring the running status of the VFD.

The following table lists other function parameters.

Function description	Address 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: Jogging stop	
Communication-based setting address	2001H	Communication-based frequency setting (0–Fmax, unit: 0.01Hz)	R/W
	2002H	PID reference (0–1000, in which 1000 corresponds to 100.0%)	
	2003H	PID feedback (0–1000, in which 1000 corresponds to 100.0%)	R/W
	2004H	Torque setting (-3000–3000, in which 1000 corresponds to 100.0% of the motor rated current)	R/W
	2005H	Upper limit setting of forward running frequency (0–Fmax; unit: 0.01Hz)	R/W
	2006H	Upper limit setting of reverse running frequency (0–Fmax; unit: 0.01Hz)	R/W
	2007H	Electromotive torque upper limit (0–3000, in which 1000 corresponds to 100.0% of the motor rated current)	R/W
	2008H	Braking torque upper limit. (0–3000, in which 1000 corresponds to 100.0% of the motor rated current)	R/W
	2009H	Special control command word Bit0–bit1=00: Motor 1 =01: Motor 2 =10: Motor 3 =11: Motor 4 Bit2: =1: Torque control =0: Speed control	R/W
	200AH	Virtual input terminal command. Range: 0x000–0x1FF	R/W
	200BH	Virtual output terminal command (range: 0x00–0x0F)	R/W
	200CH	Voltage setting (used when V/F separation is implemented) (0–1000, in which 1000 corresponds to 100.0% of the motor rated voltage)	R/W
	200DH	AO setting 1 (-1000–+1000, in which 1000	R/W

Function description	Address definition	Data description	R/W
		corresponding to 100.0%)	
	200EH	AO setting 2 (-1000–+1000, in which 1000 corresponding to 100.0%)	R/W
VFD status word 1	2100H	0001H: Forward running	R
		0002H: Reverse running	
		0003H: Stopped	
		0004H: Faulty	
		0005H: POFF	
VFD status word 2	2101H	Bit0: =0: Not ready to run =1: Ready to run Bit1–bit2=00: Motor 1 =01: Motor 2 =10: Motor 3 =11: Motor 4 Bit3: =0: AM =1: SM Bit4: = 0: No pre-alarm upon overload =1: Overload pre-alarm Bit5–bit6: =00: Keypad control =01: terminal control =10: Communication-based control	R
VFD fault code	2102H	See the description of fault types.	R
VFD identification code	2103H	GD200A-----0x0107	R
Running frequency	3000H	Setting range: 0.00Hz–P00.03	R
Set frequency	3001H	Setting range: 0.00Hz–P00.03	R
Bus voltage	3002H	Setting range: 0–1200V	R
Output voltage	3003H	Setting range: 0–1200V	R
Output current	3004H	Setting range: 0.0–5000.0A	R
Rotational speed	3005H	Setting range: 0–65535rpm	R
Output power	3006H	Setting range: -300.0–300.0%	R
Output torque	3007H	Setting range: -250.0–250.0%	R
Closed-loop setting	3008H	Setting range: -100.0%–100.0%	R
Closed-loop feedback	3009H	Setting range: -100.0%–100.0%	R
Input IO state	300AH	Setting range: 0000–00FF	R
Output IO state	300BH	Setting range: 0000–00FF	R
Analog input 1	300CH	Setting range: 0.00–10.00V	R
Analog input 2	300DH	Setting range: 0.00–10.00V	R
Analog input 3	300EH	Setting range: 0.00–10.00V	R
Analog input 4	300FH	Reserved	R
Read high-speed pulse 1 input	3010H	Setting range: 0.00–50.00Hz	R
Read high-speed pulse 2 input	3011H	Reserved	R

Function description	Address definition	Data description	R/W
Read the actual step of multi-step speed	3012H	Setting range: 0–15	R
External length value	3013H	Setting range: 0–65535	R
External counting value	3014H	Setting range: 0–65535	R
Torque setting	3015H	Setting range: 0–65535	R
VFD identification code	3016H	/	R
Fault code	5000H	/	R

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

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

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

8 MSBs	Meaning	8 LSBs	Meaning
0x01	Goodrive	0x07	Goodrive200A general VFD

Note: A device code consists of 16 bits, with 8 MSBs and 8 LSBs. The 8 MSBs indicate the model series, and the 8 LSBs indicate the derivative model.

9.5.3 Fieldbus scale

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

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

The fieldbus scale depends on the number of decimal places in the value specified in "Setting range" or "Default". If there are *n* decimal places in the value, the fieldbus scale *m* is the *n*th-power of 10. Take the following as an example, where *m* is 10.

Function code	Name	Description	Default	Modify
P01.20	Wake-up-from-sleep delay	Setting range: 0.0–3600.0s (valid when P01.19=2)	0.0s	○

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

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

01	06	01 14	00 32	49 E7
VFD address	Write command	Parameters address	Data number	CRC check

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	Parameters data	CRC check

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.

9.5.4 Error message response

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

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

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

Code	Name	Meaning
		Note: It does not mean that the data item submitted for storage in the register includes a value unexpected by the program.
04H	Operation failure	The parameter setting is invalid in the write operation. For example, a function input terminal cannot be set repeatedly.
05H	Incorrect password	The password entered in the password verification address is different from that set in P07.00.
06H	Incorrect data frame	The data frame sent from the host controller is incorrect in the length, or in the RTU format, the value of the CRC check bit is inconsistent with the CRC value calculated by the lower computer.
07H	Parameter read-only	The parameter to be modified in the write operation of the host controller is a read-only parameter.
08H	Parameter cannot be modified in running	The parameter to be modified in the write operation of the host controller cannot be modified during the running of the VFD.
09H	Password protection	If the host controller does not provide the correct password to unlock the system to perform a read or write operation, the error of “system being locked” is reported.

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

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

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

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

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

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

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

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

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

01	86	04	43 A3
VFD address	Abnormal response code	Fault code	CRC check

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

9.6 Read/Write operation examples

For the formats of the read and write commands, see section 9.4 Command code and communication data.

9.6.1 Example of reading command 03H

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

RTU mode:

The read command transmitted to the VFD is as follows:

01	03	21 00	00 01	8E 36
VFD address	Read command	Parameters address	Data number	CRC check

Assume that the following response is returned:

01	03	02	00 03	F8 45
VFD address	Read command	Data address	Data content	CRC check

ASCII mode:

The read command transmitted to the VFD is as follows:

:	01	03	21 00	00 01	DA	CR LF
START	VFD address	Read command	Parameters address	Data number	LRC check	END

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

:	01	03	02	00 03	F7	CR LF
START	VFD address	Read command	Byte number	Data content	LRC check	END

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

9.6.2 Example of writing command 06H

Example 1: Set the VFD whose address is 03H to be forward running. According to the other function parameter table, 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: Jogging stop	

RTU mode:

The command sent from the master is as follows:

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

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	Parameters address	Forward running	CRC check

ASCII mode:

The command sent from the master is as follows:

:	01	06	20 00	00 01	D6	CR LF
START	VFD address	Write command	Parameters address	Data number	LRC check	END

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

:	01	06	20 00	00 01	D6	CR LF
START	VFD address	Write command	Parameters address	Data number	LRC check	END

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

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

See the figures behind the radix point, the fieldbus ratio value of max. output frequency (P00.03) is

100. 100Hz timed by 100 is 10000 and the corresponding hex is 2710H.

RTU mode:

The command sent from the master is as follows:

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

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	Parameters address	Parameter data	CRC check

ASCII mode:

The command sent from the master is as follows:

:	03	06	00 03	27 10	BD	CR LF
START	VFD address	Write command	Parameters address	Data number	LRC check	END

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

:	03	06	00 03	27 10	BD	CR LF
START	VFD address	Write command	Parameters address	Data number	LRC check	END

9.6.3 Example of continuous writing command 10H

Example 1: Set the VFD whose address is 01H to be forward running at the frequency of 10Hz. According to the other function parameter table, the address of "Communication-based control command" is 2000H, and 0001H indicates forward running. The address of "Communication-set frequency" is 2001H and 10Hz corresponds to 03E8H.

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: Jogging stop	
Communication-based setting address	2001H	Communication-based frequency setting (0–Fmax, unit: 0.01Hz)	R/W
	2002H	PID reference (0–1000, in which 1000 corresponds to 100.0%)	

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

RTU mode:

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 writing command	Parameters address	Data number	Byte number	Forward running	10Hz	CRC check

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

01	10	20 00	00 02	4A 08
VFD address	Continuous writing command	Parameters address	Data number	CRC check

ASCII mode:

The command sent from the master is as follows:

:	01	10	20 00	00 02	04	00 01	03 E8	BD	CR LF
START	VFD address	Continuous writing command	Parameters address	Data number	Byte number	Forward running	10Hz	LRC check	END

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

:	01	10	20 00	00 02	CD	CR LF
START	VFD address	Continuous writing command	Parameters address	Data number	LRC check	END

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

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

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

RTU mode:

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 writing command	Parameters address	Data number	Byte number	10s	20s	CRC check

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

01	10	00 0B	00 02	30 0A
VFD address	Continuous writing command	Parameters address	Data number	CRC check

ASCII mode:

The command sent from the master is as follows:

:	01	10	00 0B	00 02	04	00 64	00 C8	B2	CR LF
START	VFD address	Continuous writing command	Parameters address	Data number	10s	20s	LRC check		END

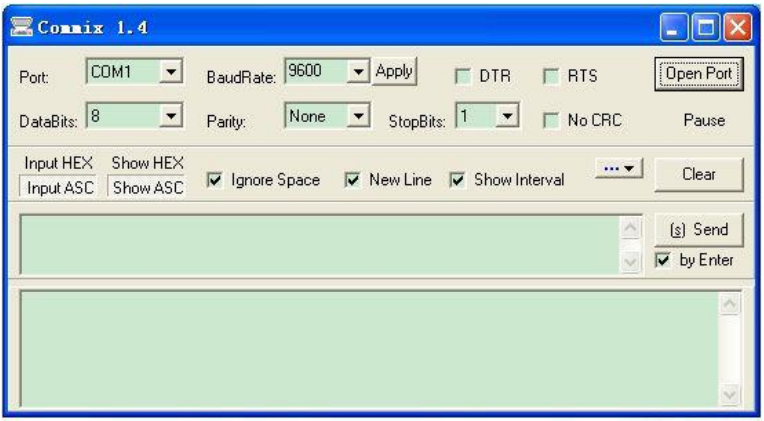
If the operation is successful, the following response is returned:

:	01	10	00 0B	00 02	E2	CR LF
START	VFD address	Continuous writing command	Parameters address	Data number	LRC check	END

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.

9.6.4 Example of Modbus communication commissioning

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



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

commands. Otherwise, command errors may occur due to repeated CRC check.

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

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

Note:

- ✧ The VFD address (P14.00) must be set to 03.
- ✧ "Channel of running commands" (P00.01) must be set to "Communication", and "Communication channel of running commands" (P00.02) to the Modbus channel.

After you click Send, if the line configuration and settings are correct, a response transmitted by the VFD is received.

9.7 Common communication faults

Common communication faults include the following:

• No response is returned.

• The VFD returns an exception response.

Possible causes of no response include the following:

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

Appendix A Technical data

A.1 What this chapter contains

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

A.2 Derated application

A.2.1 Capacity

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

Note:

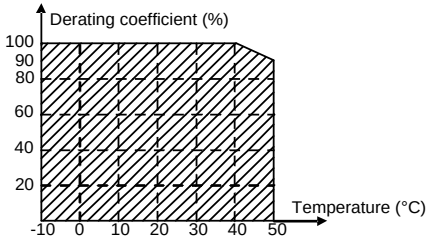
- ✧ The maximum allowable shaft power of the motor is limited to 1.5 times the rated power of the motor. If the limit is exceeded, the VFD automatically restricts the torque and current of the motor. This function effectively protects the input shaft against overload.
- ✧ The rated capacity is the capacity at the ambient temperature of 40°C.
- ✧ You need to check and ensure that the power flowing through the common DC connection in the common DC system does not exceed the rated power of the motor.

A.2.2 Derating

If the ambient temperatue on the site where the VFD is installed exceeds 40°C, the altitude exceeds 1000m, or the switching frequency is changed from 4 kHz to 8, 12, or 15 kHz, the VFD needs to be derated.

A.2.2.1 Derating due to temperature

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



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

A.2.2.2 Derating due to altitude

When the altitude exceeds 1000m, derate by 1% for each increase of 100m. When the altitude exceeds 3000m, consult the local INVT dealer or office for details.

A.2.2.3 Derating due to carrier frequency

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

A.3 Grid specifications

Grid voltage	AC 3PH 380(-15%)–440(+10%)
Short-circuit capacity	According to the definition in IEC 61439-1, the maximum allowable short-circuit current at the incoming end is 100 kA. Therefore, the VFD is applicable to scenarios where the transmitted current in the circuit is no larger than 100kA when the VFD runs at the maximum rated voltage.
Frequency	50/60Hz±5%, with a maximum change rate of 20%/s

A.4 Motor connection data

Motor type	Asynchronous induction motor
Voltage	0–U1 (motor rated voltage), 3PH symmetrical, Umax (VFD rated voltage) at the field-weakening point
Short-circuit protection	The motor output short-circuit protection meets the requirements of IEC 61800-5-1.
Frequency	0–400Hz
Frequency resolution	0.01Hz
Current	See section 3.6 Product ratings.
Power limit	1.5 times of the motor rated power
Carrier frequency	4, 8, 12, or 15kHz

A.4.1 EMC compatibility and motor cable length

The following table describes the maximum motor cable lengths that meet the requirements of the EU EMC directive (2014/30/EU).

All models (with external EMC filters)	Maximum motor cable length (m)
Environment category II (C3)	30

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

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

A.5 Application standards

The following table describes the standards that VFDs comply with.

EN/ISO 13849-1	Safety of machinery—Safety-related parts of control systems—Part 1: General principles for design
IEC/EN 60204-1	Safety of machinery—Electrical equipment of machines—Part 1:General requirements

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

A.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).

A.5.2 EMC compliance declaration

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

A.6 EMC regulations

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

Application environment categories:

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

Second environment: All environments except those in Category I.

VFD categories:

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

C2: Rated voltage lower than 1000V, non-plug, socket, or mobile devices; power drive systems that must be installed and operated by specialized personnel when applied to environments of Category I.

Note: The EMC standard IEC/EN 61800-3 no longer restricts the power distribution of 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: Rated voltage lower than 1000 V, applied to environments of Category II. They cannot be applied to environments of Category I.

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

A.6.1 VFD category of C2

The induction disturbance limit meets the following stipulations:

1. Select an optional EMC filter according to Appendix C Optional peripheral accessories and install it following the description in the EMC filter manual. See section C.7 EMC filter.
2. Select the motor and control cables according to the description in the manual. See section C.7 EMC filter.
3. Install the VFD according to the description in the manual. See chapter 1 Safety precautions.
4. For the maximum length of the motor cable, see section A.4.1 "EMC compatibility and motor cable length".

The product may generate radio interference in some environments, and you need to take measures to reduce the interference.

A.6.2 VFD category of C3

The anti-interference performance of the VFD meets the requirements of the second environment in the IEC/EN 61800-3 standard.

The induction disturbance limit meets the following stipulations:

1. Select an optional EMC filter according to Appendix C Optional peripheral accessories and install it following the description in the EMC filter manual. See section C.7 EMC filter.
2. Select the motor and control cables according to the description in the manual. See section C.7 EMC filter.
3. Install the VFD according to the description in the manual. See chapter 1 Safety precautions.
4. For the maximum length of the motor cable, see section A.4.1 "EMC compatibility and motor cable length".

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

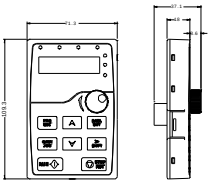
Appendix B Dimension drawings

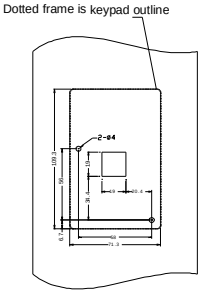
B.1 What this chapter contains

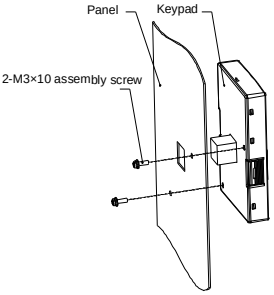
This chapter provides the VFD dimension drawings, which use millimeter (mm) as the unit.

B.2 LED keypad structure

B.2.1 Structure diagram





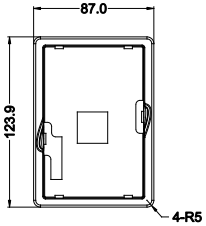


Hole dimension and diagram for keypad installation without bracket

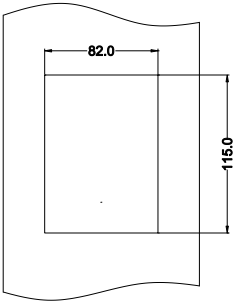
B.2.2 Keypad mounting bracket

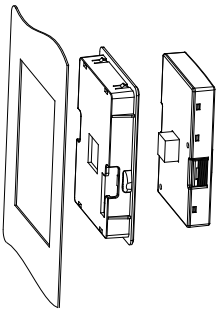
Note: The external keypad can be mounted directly with M3 threaded screws or with a keypad mounting bracket.

For VFDs of 380V 0R7G–030G/037P models, the keypad mounting bracket is an optional part. For those of 380V 037G/045P and above models, you can use optional brackets or use the standard keypad brackets externally.



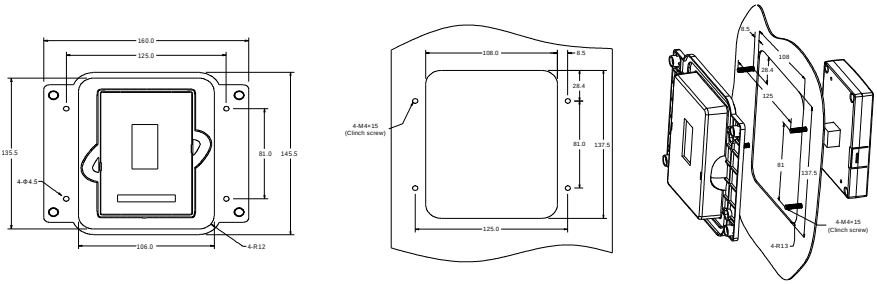
Keypad bracket





Customer installation dimension

Figure B-1 Keypad mounting bracket (optional)



Keypad adapter bracket Installation dimensions

Figure B-2 Keypad mounting bracket (standard configuration) for the 380V 037G/045P and above models

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

Name	Length (m)	Ordering code	Applied to
Flat keypad cable	1	67004-00053	380V 037G/045P–200G/220P
	2	67004-00010	
	3	67004-00013	
	5	67004-00052	

B.3 VFD dimensions

B.3.1 Wall-mounting dimensions

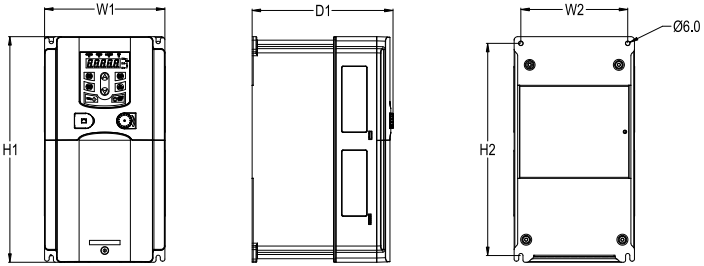


Figure B-3 Wall mounting for 0R7G–015G/018P models

VFD model	W1	W2	H1	H2	D1	Hole diameter	Net weight (kg)
0R7G–2R2G	126	115	186	175	155	ø5	1.8
004G/5R5P–5R5G/7R5P	146	131	256	243.5	171	ø6	3.0
7R5G/011P	170	151	320	301	199.6	ø6	5.0
011G/015P	170	151	320	301	199.6	ø6	5.9
015G/018P	170	151	320	301	199.6	ø6	5.7

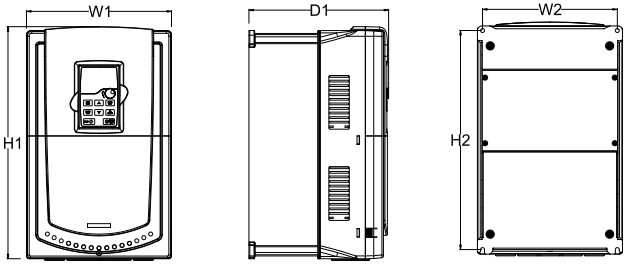


Figure B-4 Wall mounting for 018G/022P–030G/037P models

VFD model	W1	W2	H1	H2	D1	Hole diameter	Net weight (kg)
018G/022P	230	210	342	311	219.4	ø6	7.6
022G/030P–030G/037P	255	237	407	384	245.6	ø7	11

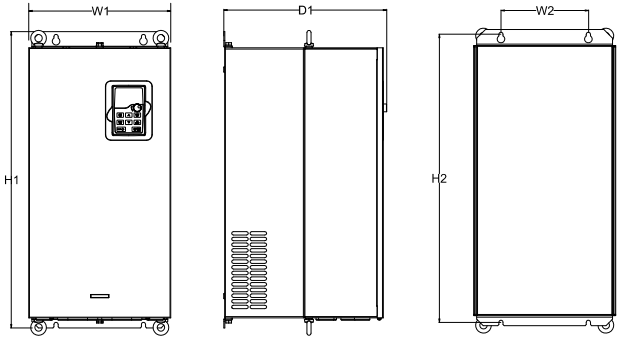


Figure B-5 Wall mounting for 037G/045P–110G/132P models

VFD model	W1	W2	H1	H2	D1	Hole diameter	Net weight (kg)
037G/045P	270	130	557	540	332.6	ø7	23
045G/055P	270	130	557	540	332.6	ø7	25
055G/075P	270	130	557	540	332.6	ø7	26.5
075G/090P–110G/132P	325	200	682	661	373.6	ø9.5	44

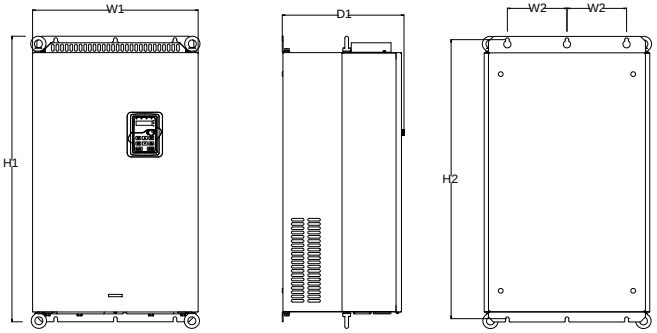


Figure B-6 Wall mounting for 132G/160P–200G/220P models

VFD model	W1	W2	H1	H2	D1	Hole diameter	Net weight (kg)
132G/160P–200G/220P	500	180	872	850	368.4	ø11	85

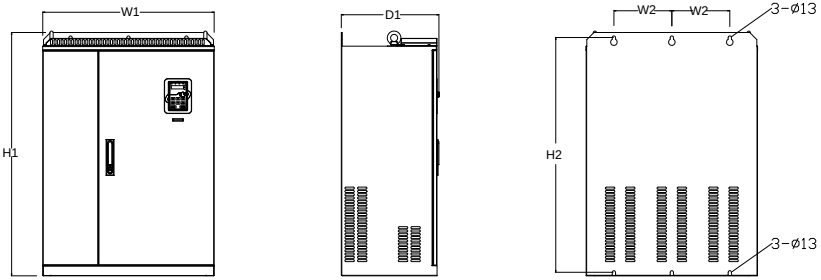


Figure B-7 Wall mounting for 220G/250P–315G/355P models

VFD model	W1	W2	H1	H2	D1	Hole diameter	Net weight (kg)
220G/250P–315G/355P	680	230	960	926	387.9	ø13	121

B.3.2 Flange mounting dimensions

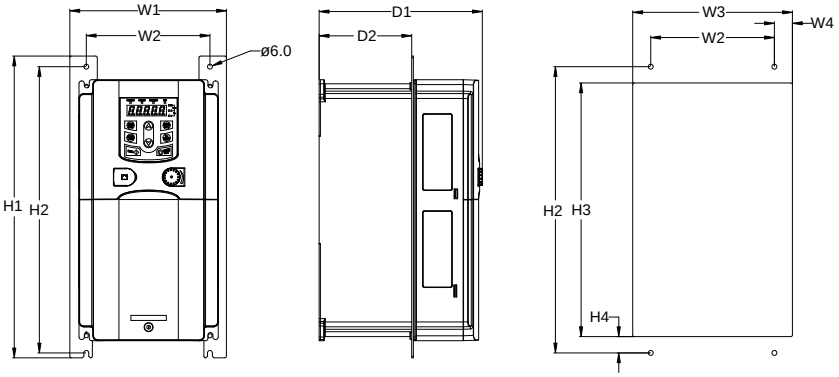


Figure B-8 Flange mounting for 0R7G–015G/018P

VFD model	W1	W2	W3	W4	H1	H2	H3	H4	D1	D2	Hole diameter	Net weight (kg)
0R7G–2R2G	150.2	115	130	7.5	234	220	190	13.5	155	65.5	ø5	1.8
004G/5R5P–5R5G/7R5P	170.2	131	150	9.5	292	276	260	6	171	84.5	ø6	3.0
7R5G/011P	191.2	151	174	11.5	370	351	324	12	199.6	113	ø6	5.0
011G/015P	191.2	151	174	11.5	370	351	324	12	199.6	113	ø6	5.9
015G/018P	191.2	151	174	11.5	370	351	324	12	199.6	113	ø6	5.7

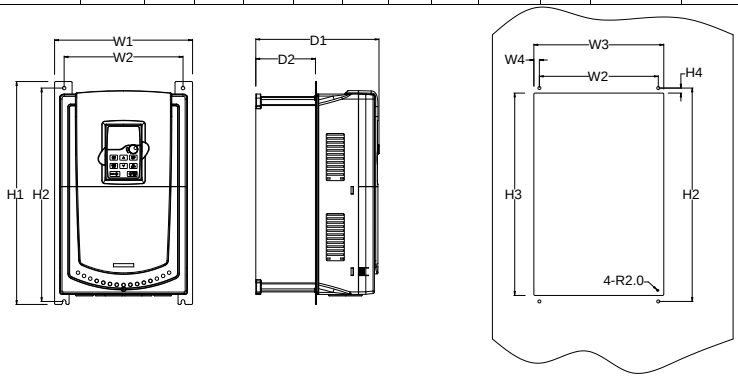


Figure B-9 Flange mounting for 018G/022P–030G/037P

VFD model	W1	W2	W3	W4	H1	H2	H3	H4	D1	D2	Hole diameter	Net weight (kg)
018G/022P	250	210	234	12	375	356	334	10	219.4	108	ø6	7.6
022G/030P–030G/037P	275	237	259	11	445	426	404	10	245.6	119	ø7	11

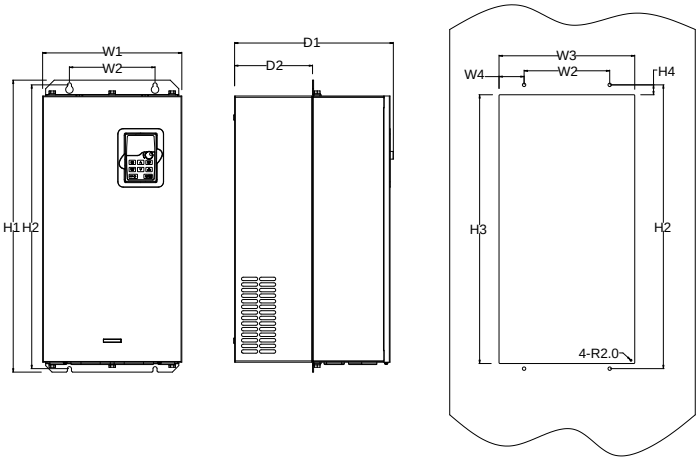


Figure B-10 Flange mounting for 037G/045P–110G/132P

VFD model	W1	W2	W3	W4	H1	H2	H3	H4	D1	D2	Hole diameter	Net weight (kg)
037G/045P	270	130	261	65.5	557	540	516	17.5	332.6	167	ø7	23
045G/055P	270	130	261	65.5	557	540	516	17.5	332.6	167	ø7	25
055G/075P	270	130	261	65.5	557	540	516	17.5	332.6	167	ø7	26.5
075G/090P–110G/132P	325	200	317	58.5	682	661	626	23.5	373.6	182	ø9.5	44

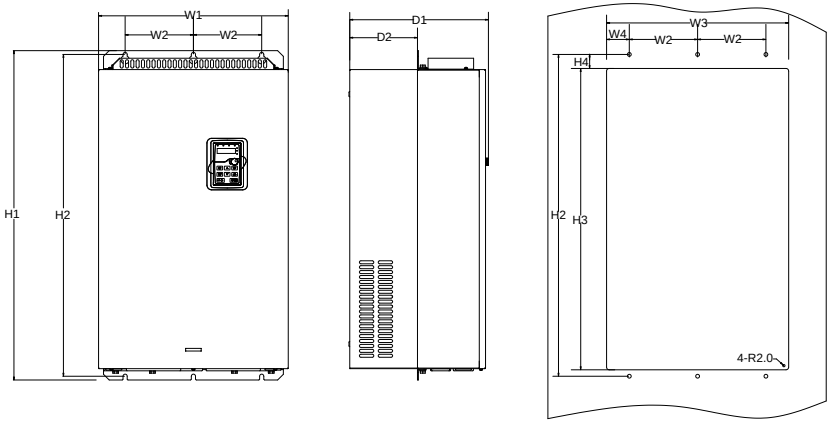


Figure B-11 Flange mounting for 132G/160P–200G/220P

VFD model	W1	W2	W3	W4	H1	H2	H3	H4	D1	D2	Hole diameter	Net weight (kg)
132G/160P–200G/220P	500	180	480	60	872	850	796	37	368.4	178.5	ø11	85

Note: For flange mounting of 037G/045P–200G/220P, it is not necessary to select and install a flange mounting plate. Simply remove the upper and lower mounting beams from the VFD back, and then move them to the VFD middle position as shown in the preceding figure. After tightening screws to fix the mounting beams, you can perform flange mounting for the VFD.

B.3.3 Floor mounting dimensions

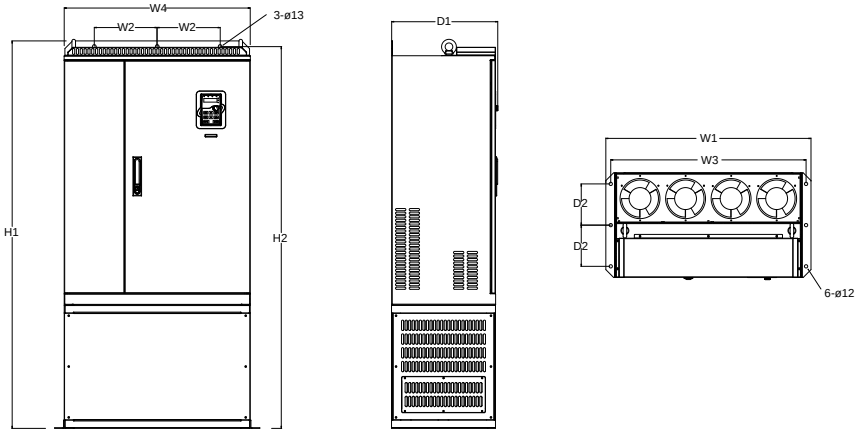


Figure B-12 Floor mounting (with pedestal) for 220G/250P–315G/355P

VFD model	W1	W2	W3	W4	H1	H2	D1	D2	Hole diameter	Net weight (kg)
220G/250P–315G/355P	750	230	714	680	1410	1390	387.9	150	ø13/12	121

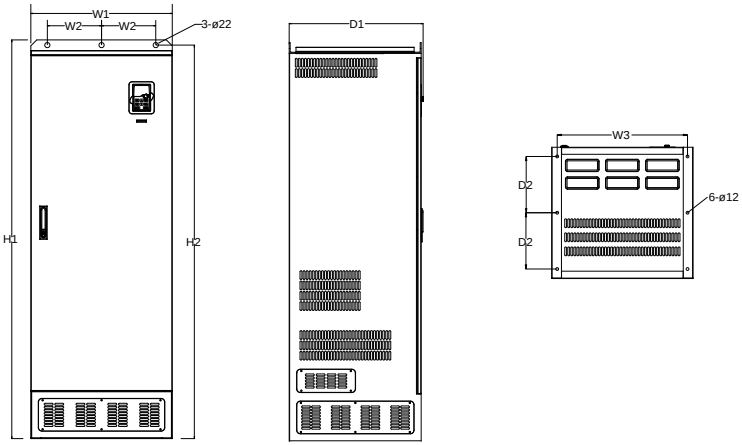


Figure B-13 Floor mounting for 355G/400P–500G

VFD model	W1	W2	W3	W4	H1	H2	D1	D2	Hole diameter	Net weight (kg)
355G/400P–500G	620	230	573	/	1700	1678	568.4	240	ø22/12	328

B.4 Installation dimension of VFDs in parallel connection (recommended)

The recommended parallel installation method facilitates air intake inside the product and dissipates heat better, but requires a relatively large installation space.

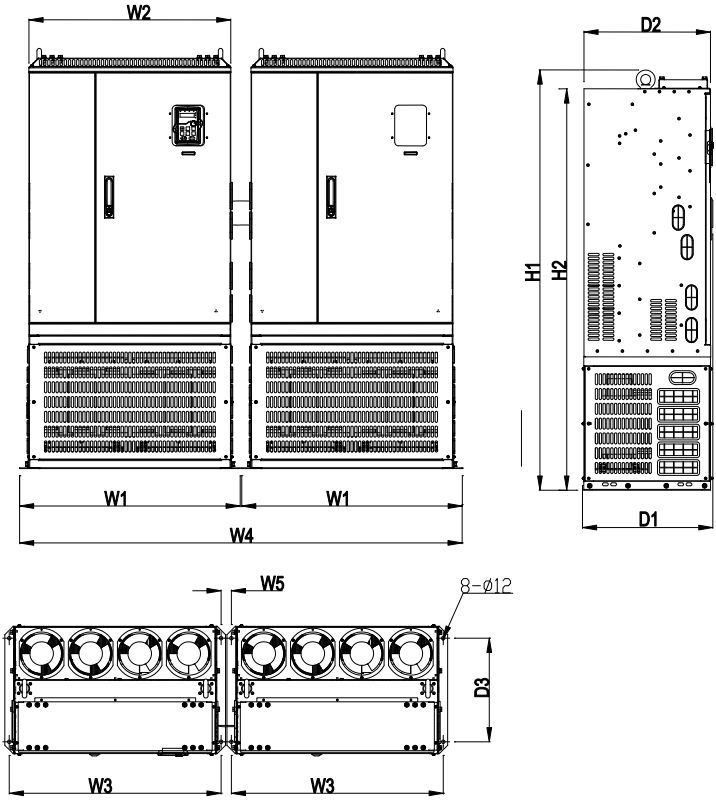


Figure B-14 Parallel installation for 380V 560–630kW

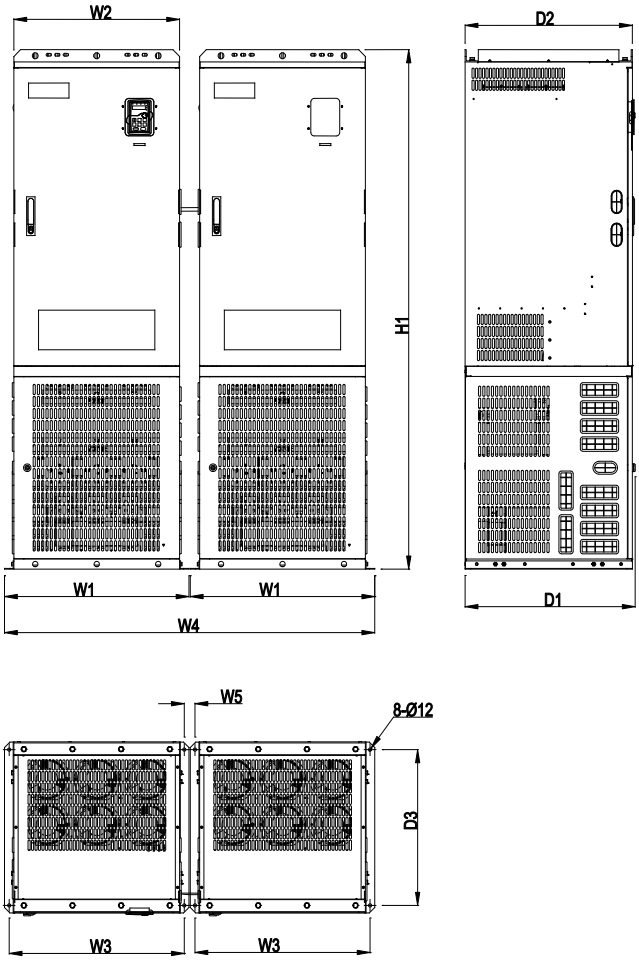


Figure B-15 Parallel installation for 380V 710–3000kW

Power (kW)	W1	W2	W3	W4	W5	H1	H2	D1	D2	D3	Hole diameter
560–630	749	685	719	1503	35	1419.9	1356	442.5	429.5	350	Ø 12
710–1000	690	620	655	1385	40	1900	/	636.3	625.5	570	Ø 12
1200–1500	690	620	655	2080	40	1900	/	636.3	625.5	570	Ø 12
2000	690	620	655	2775	40	1900	/	636.3	625.5	570	Ø 12
2500	690	620	655	3470	40	1900	/	636.3	625.5	570	Ø 12
3000	690	620	655	4165	40	1900	/	636.3	625.5	570	Ø 12

B.5 Installation dimension of VFDs in parallel connection (installed closely)

The closely installed method of VFD parallel connection has a smaller installation dimension, which may affect the product's internal air intake but meet the product's heat dissipation.

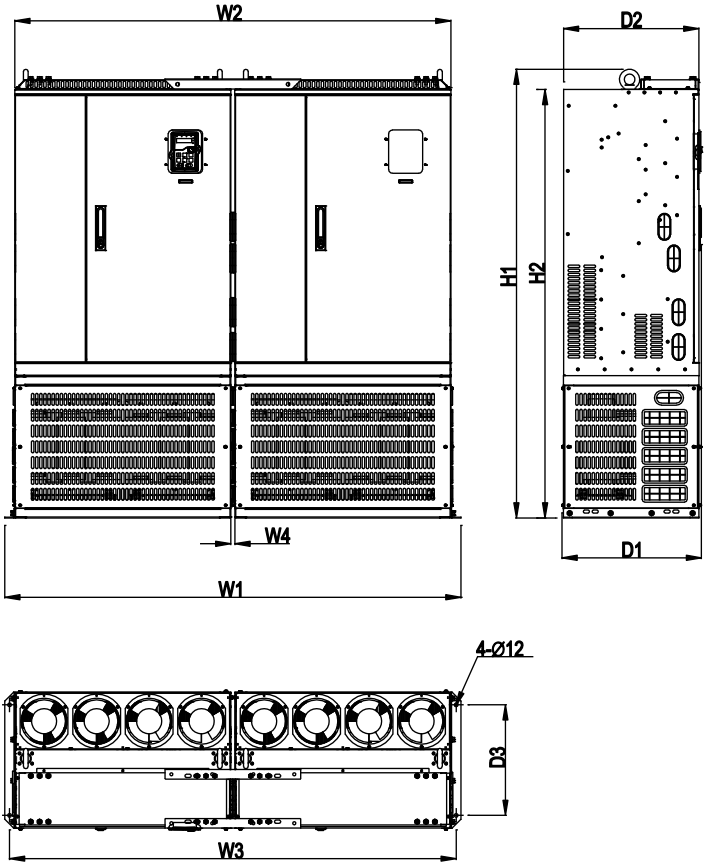


Figure B-16 Parallel installation for 380V 560–630kW

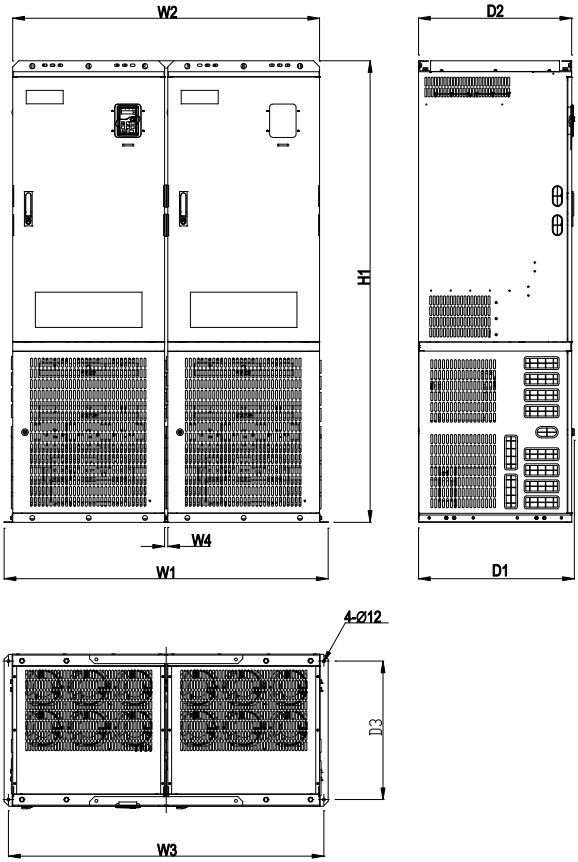


Figure B-17 Parallel installation for 380V 710–3000kW

Power (kW)	W1	W2	W3	W4	H1	H2	D1	D2	D3	Hole diameter
560–630	1447	1383	1417	13	1419.9	1356	442.5	429.5	350	Ø 12
710–1000	1323	1253	1288	13	1900	/	636.3	625.5	570	Ø 12
1200–1500	1956	1886	1921	13	1900	/	636.3	625.5	570	Ø 12
2000	2589	2519	2554	13	1900	/	636.3	625.5	570	Ø 12
2500	3222	3152	3187	13	1900	/	636.3	625.5	570	Ø 12
3000	3855	3785	3820	13	1900	/	636.3	625.5	570	Ø 12

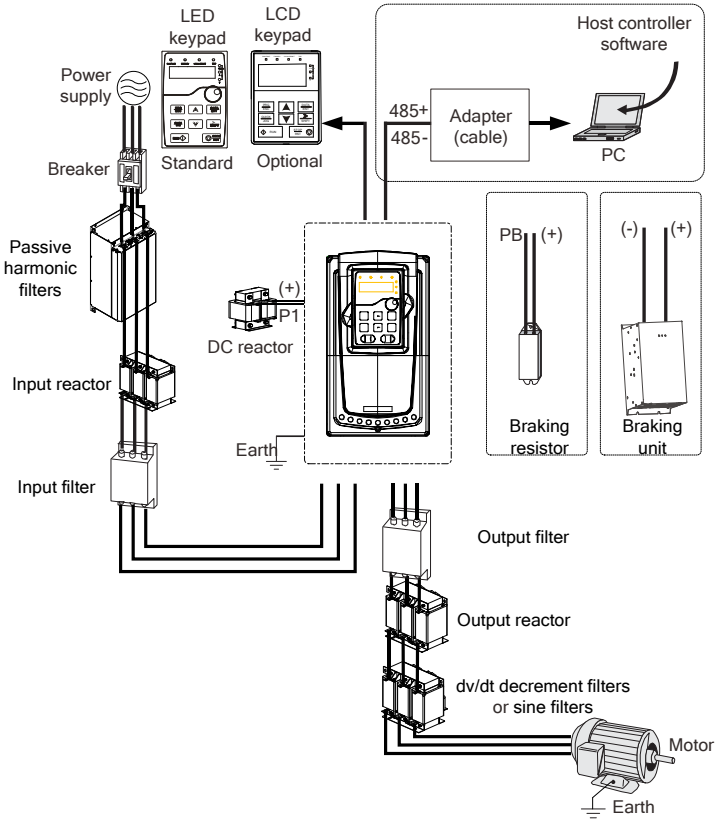
Appendix C Optional peripheral accessories

C.1 What this chapter contains

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

C.2 External wiring

The following figure shows the external wiring of the VFD.



Note:

- ✧ The 380V 030G/037P and lower VFD models are equipped with built-in braking units.
- ✧ P1 terminals are equipped only for 380V 037G/045P and higher models, which enable the VFDs to be directly connected to external DC reactors.
- ✧ The braking units are INVT DBU100H series standard braking units. For details, see the DBU100H operation manual.

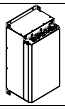
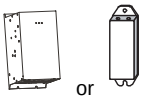
Image	Name	Description
	Cable	Accessory for signal transmission.
	Breaker	Device for electric shock prevention and protection against short-to-ground that may cause current leakage and fire. Select residual-current circuit breakers (RCCBs) that are applicable to VFDs and can restrict high-order harmonics, and of which the rated sensitive current for one VFD is larger than 30 mA.
	Passive harmonic filters	Device used to reduce the current distortion rate and harmonic content, thereby improving the power factor.
	Input 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.
	DC reactor	DC reactors can be directly connected to VFDs of 380V 037G/045P or higher and the 660V series. DC reactors can improve the power factor, avoid damage to bridge rectifiers caused due to large input current of the VFD when large-capacity transformers are connected, and also avoid damage to the rectification circuit caused due to harmonics generated by grid voltage transients or phase-control loads.
 or	Braking unit or braking resistor	Accessories used to consume the regenerative energy of the motor to reduce the DEC time. For the 380V 030G/037P and lower VFD models, only the installation of a braking resistor is required. For the 380V 037G/045P models and above VFD models, the installation of a braking unit is additionally required.
	Output filter	Device used to suppress interference generated from the wiring on the output side of the VFD. Install as close to the output terminal of the VFD as possible.
	Output reactor	Device used to extend the effective transmission distance of the VFD and effectively suppress instantaneous high voltage generated when the IGBT module of the VFD switches.

Image	Name	Description
	dv/dt decrement filters	Device used to suppress voltage spikes, reduce traveling waves in long cables, and reflect dv/dt transient voltages, thereby reducing motor eddy current losses and noise, and providing motor insulation protection.
	Sine filters	Device used to suppress and absorb high-order harmonic currents derived from switching frequency ripple currents, correcting the waveform to approximate a sine wave, significantly extending the length of the output cable, reducing motor eddy current losses and noise, and protecting motor insulation.

C.3 Power supply

Please see Electrical installation.

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

C.4 Cable

C.4.1 Power cable

1. The sizes of the input power cables and motor cables must comply with local regulations.
2. The input power cables and motor cables must be able to carry the corresponding load currents.
3. The maximum temperature margin of the motor cables in continuous operation cannot be lower than 70°C.
4. The conductivity of the PE grounding conductor is the same as that of the phase conductor. For the 380V 030G/037P and higher models, the cross sectional area of the PE grounding conductor can be slightly less than the recommended area.
5. For details about the EMC requirements, see Appendix A Technical data.

To meet the EMC requirements stipulated in the CE standards, you must use symmetrical shielded cables as motor cables (as shown in Figure C-1).

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.

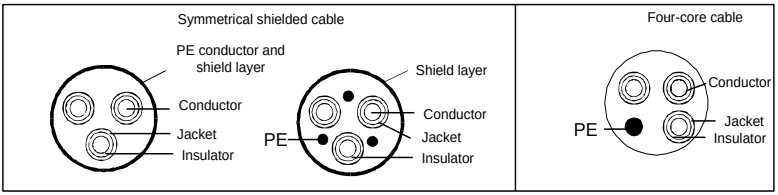


Figure C-1 Symmetrical shielded cable

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

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

To effectively restrict the emission and conduction of radio frequency (RF) interference, the conductivity of the shielded cable must at least be 1/10 of the conductivity of the phase conductor. This requirement can be well met by a copper or aluminum shield layer. The following figure shows the minimum requirement on motor cables of a VFD. The cable must consist of a layer of spiral-shaped copper strips. The denser the shield layer is, the more effectively the electromagnetic interference is restricted.

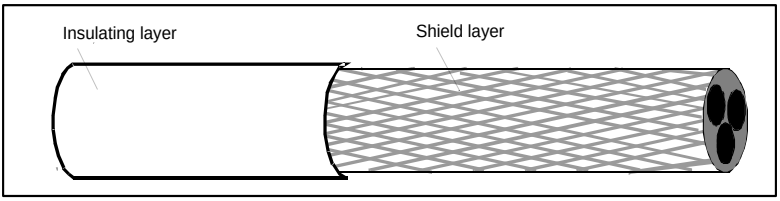


Figure C-2 Cross-section of the cable

C.4.2 Control cable

All analog control cables and cables used for frequency input must be shielded cables. Analog signal cables need to be double-shielded twisted-pair cables (as shown in figure a). Use one separate shielded twisted pair for each signal. Do not use the same ground wire for different analog signals.

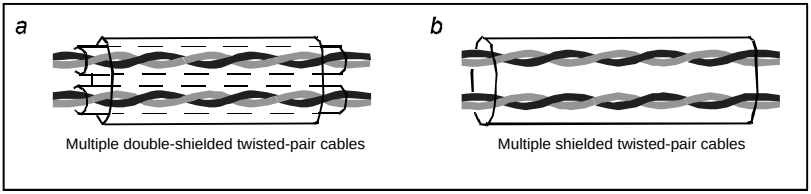


Figure C-3 Power cable arrangement

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

Relay cables need to be those with metal braided shield layers.

Keypads need to be connected by using network cables. In complicated electromagnetic environments, shielded network cables are recommended.

Note: Analog signals and digital signals cannot use the same cables, and their cables must be arranged separately.

Dielectric withstand tests have been performed between the main circuit and housing of each VFD before delivery. In addition, the VFD has the internal voltage limiting circuit, which can automatically cut off the test voltage. Do not perform any voltage withstand or insulation resistance tests, such as high-voltage insulation tests or using a megameter to measure the insulation resistance, on the VFD or its components.

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

Table C-1 Cable selection for AC 3PH 380V (-15%)–440V(+10%)

Rated power (kW)	Recommended cable size (mm²)				Fixing screw	
	R, S, T U, V, W	PE	P1, (+)	PB, (+), (-)	Terminal screw	Fastening torque (Nm)
0.75	1.0	1.0	1.0	1.0	M4	1.2–1.5
1.5	1.0	1.0	1.0	1.0	M4	1.2–1.5
2.2	1.0	1.0	1.0	1.0	M4	1.2–1.5
4	1.5	1.5	1.5	1.5	M4	1.2–1.5
5.5	1.5	1.5	1.5	1.5	M4	1.2–1.5
7.5	2.5	2.5	2.5	2.5	M5	2–2.5
11	4	4	4	4	M5	2–2.5
15	6	6	6	6	M5	2–2.5
18.5	10	10	10	10	M5	2–2.5
22	10	10	10	10	M6	3.5–3.8
30	16	16	16	16	M6	3.5–3.8
37	25	16	25	25	M8	6–7
45	25	16	25	25	M8	6–7
55	35	16	35	35	M8	6–7
75	50	25	50	50	M10	9–10
90	70	35	70	70	M10	9–10
110	95	50	95	95	M10	9–10
132	95	50	95	95	M12	31–40
160	150	70	150	150	M12	31–40

Rated power (kW)	Recommended cable size (mm²)				Fixing screw	
	R, S, T U, V, W	PE	P1, (+)	PB, (+), (-)	Terminal screw	Fastening torque (Nm)
185	185	95	185	185	M12	31–40
200	185	95	185	185	M12	31–40
220	2×95	95	2×95	2×95	M12	31–40
250	2×95	95	2×95	2×95	M12	31–40
280	2×150	150	2×150	2×150	M12	31–40
315	2×150	150	2×150	2×150	M12	31–40
355	2×185	185	2×185	2×185	M12	31–40
400	3×150	2×120	3×150	3×150	M12	31–40
450	3×185	2×150	3×185	3×185	M12	31–40
500	3×185	2×150	3×185	3×185	M12	31–40

Note:

✧ The cables recommended for the main circuit can be used in scenarios where the ambient temperature is lower than 40°C, the wiring distance is shorter than 100m, and the current is the rated current.

✧ The terminals P1, (+), PB, and (-) are used to connect to DC reactors and braking accessories.

C.4.3 Cable arrangement

Motor cables must be arranged away from other cables. The motor cables of several VFDs can be arranged in parallel. It is recommended that you arrange the motor cables, input power cables, and control cables separately in different trays. The output dU/dt of the VFDs may increase electromagnetic interference on other cables. Do not arrange other cables and the motor cables in parallel.

If a control cable and power cable must cross each other, ensure that the angle between them is 90°. The cable trays must be connected properly and well grounded. Aluminum trays can implement local equipotential. Figure C-4 shows the cable routing.

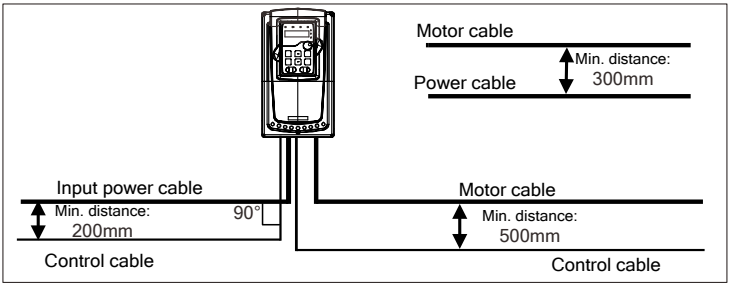


Figure C-4 Cable routing distance

C.4.4 Insulation inspection

Check the motor and the insulation conditions of the motor cable before running the motor.

1. Ensure that the motor cable is connected to the motor, and then remove the motor cable from the U, V, and W output terminals of the VFD.
2. Use a megohmmeter of 500V DC to measure the insulation resistance between each phase conductor and the protection grounding conductor. For details about the insulation resistance of the motor, see the description provided by the manufacturer.

Note: The insulation resistance is reduced if it is damp inside the motor. If it may be damp, you need to dry the motor and then measure the insulation resistance again.

C.5 Breaker, electromagnetic contactor and leakage protection switch

Due to the high-frequency PWM voltage waveform output by the VFD, and the inherent distributed capacitance between the IGBT and the heat sink, as well as between the motor stator and rotor, the VFD may inevitably cause the VFD drive inevitably generates high-frequency leakage currents. This portion of high-frequency leakage current may return to the power grid through the ground, thereby interfering with the leakage protection switch and resulting in erroneous tripping. This phenomenon is determined by the inherent voltage characteristics of the VFD output.

To ensure the stability of the system operation, it is recommended to utilize a dedicated leakage protection switch for VFDs with a rated leakage tripping current of 30mA or higher (for instance, one corresponding to Type B under IEC 60755). In the event of erroneous tripping due to the absence of a dedicated leakage protection switch, consider reducing the carrier frequency or replacing it with an electromagnetic leakage protection switch that has a rated leakage tripping current of 200mA or higher.

You need to add a fuse to prevent overload.

You need to configure a manually manipulated molded case circuit breaker (MCCB) between the AC power supply and VFD. The breaker must be locked in the open state to facilitate installation and inspection. The capacity of the breaker needs to be 1.5 to 2 times the VFD rated input current.

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.

To ensure safety, you can configure an electromagnetic contactor on the input side to control the switch-on and switch-off of the main circuit power, so that the input power supply of the VFD can be effectively cut off when a system fault occurs.

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

Rated power (kW)	Breaker rated current (A)	High speed fuse (A)	Recommended contactor rated current (A)
0.75	4	5	9
1.5	6	10	9
2.2	10	10	9
4	20	20	18
5.5	25	35	25
7.5	32	40	32
11	50	50	38
15	63	60	50
18.5	63	70	65
22	80	90	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

C.6 Harmonic filter

To enhance grid protection, reduce harmonic interference from the VFD to the grid, and improve input power factor, consider configuring external DC reactors, input reactors, or passive harmonic filters based on your specific application needs.

If you want to use long cables between the VFD and the motor, select external output reactors, dv/dt attenuation filters, or sine-wave filters based on the motor cable length. This helps mitigate excessive dv/dt, reducing voltage stress on the motor windings as well as protecting them, and extending the motor's lifespan. Refer to the following table for recommended output filter selections according to motor cable length.

Table C-3 Output filter selection for motor cable lengths

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

Table C-4 Reactors for AC 3PH 380V (-15%)–440V (+10%)

Rated power (kW)	Input reactor	Output reactor	DC 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	GDL-DCL0100-4AL
45	GDL-ACL0110-4AL	GDL-OCL0092-4AL	GDL-DCL0125-4AL
55	GDL-ACL0150-4AL	GDL-OCL0115-4AL	GDL-DCL0160-4AL
75	GDL-ACL0150-4AL	GDL-OCL0150-4AL	GDL-DCL0210-4AL
90	GDL-ACL0220-4AL	GDL-OCL0220-4AL	GDL-DCL0210-4AL
110	GDL-ACL0220-4AL	GDL-OCL0220-4AL	GDL-DCL0255-4AL
132	GDL-ACL0265-4AL	GDL-OCL0265-4AL	GDL-DCL0300-4AL
160	GDL-ACL0330-4AL	GDL-OCL0330-4AL	GDL-DCL0365-4AL
185	GDL-ACL0390-4AL	GDL-OCL0400-4AL	GDL-DCL0455-4AL
200	GDL-ACL0390-4AL	GDL-OCL0400-4AL	GDL-DCL0455-4AL
220	GDL-ACL0450-4AL	GDL-OCL0450-4AL	GDL-DCL0505-4AL
250	GDL-ACL0500-4AL	GDL-OCL0500-4AL	GDL-DCL0550-4AL
280	GDL-ACL0500-4AL	GDL-OCL0560-4AL	GDL-DCL0675-4AL
315	GDL-ACL0580-4AL	GDL-OCL0660-4AL	GDL-DCL0675-4AL
355	Standard	GDL-OCL0660-4AL	GDL-DCL0810-4AL
400	Standard	GDL-OCL0720-4AL	GDL-DCL0810-4AL
450	Standard	GDL-OCL0820-4AL	GDL-DCL1000-4AL
500	Standard	GDL-OCL1000-4AL	GDL-DCL1000-4AL

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. If the 380V 220G/250P to 315G/355P models are equipped with a pedestal, it is possible to configure two reactors.
- ✧ 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 C-5 Filters for AC 3PH 380V (-15%)–440V (+10%)

Rated power (kW)	Input filter	Output filter	
	Passive harmonic filters	dv/dt decrement filters	Sine filters
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

C.7 EMC filter

J10 is not connected in factory for the 380V 110G/132P and lower product models. Connect the J10 packaged with the manual if the requirements of level C3 need to be met. J10 is connected in factory for the 380V 132G/160P and higher product models, all of which meet the requirements of level C3.

Disconnect J10 in any of the following situations:

1. The EMC filter is applicable to the neutral-grounded grid system. If it is used for the IT grid system (that is, non-neutral grounded grid system), disconnect J10.
2. If leakage protection occurs during configuration of a residual-current circuit breaker, disconnect J10.

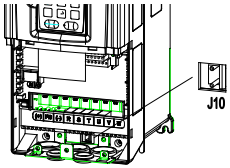


Table C-6 Filters for AC 3PH 380V (-15%)–440V (+10%)

Rated 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-P04032L-B	FLT-L04032L-B
15	FLT-P04045L-B	FLT-L04045L-B
18.5	FLT-P04045L-B	FLT-L04045L-B
22	FLT-P04065L-B	FLT-L04065L-B
30	FLT-P04065L-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-P04150L-B	FLT-L04150L-B
90	FLT-P04240L-B	FLT-L04240L-B
110	FLT-P04240L-B	FLT-L04240L-B
132	FLT-P04240L-B	FLT-L04240L-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

Rated power (kW)	Input filter	Output filter
315	FLT-P04800L-B	FLT-L04800L-B
355	FLT-P04800L-B	FLT-L04800L-B
400	FLT-P04800L-B	FLT-L04800L-B
450	FLT-L041000L-B	FLT-L041000L-B
500	FLT-L041000L-B	FLT-L041000L-B

Note: The input EMI meets the C2 requirements after an input filter is configured.

C.8 Braking system

C.8.1 Braking component selection

When the VFD driving a high-inertia load decelerates or needs to decelerate abruptly, the motor runs in the power generation state and transmits the load-carrying energy to the DC circuit of the VFD, causing the bus voltage of the VFD to rise. If the bus voltage exceeds a specific value, the VFD reports an overvoltage fault. To prevent this from happening, you need to configure braking components.

	✧ The design, installation, commissioning, and operation of the device must be performed by trained and qualified professionals. ✧ Follow all the "Warning" instructions during the operation. Otherwise, major physical injuries or property loss may be caused. ✧ Only qualified electricians are allowed to perform the wiring. Otherwise, damage to the VFD or braking components may be caused. ✧ Read the braking resistor or unit instructions carefully before connecting them to the VFD. ✧ Connect braking resistors only to the terminals PB and (+), and braking units only to the terminals (+) and (-). Do not connect them to other terminals. Otherwise, damage to the braking circuit and VFD and fire may be caused.
	✧ Connect the braking components to the VFD according to the wiring diagram. If the wiring is not properly performed, damage to the VFD or other devices may be caused.

The 380V 030G/037P and lower VFD models are equipped with built-in braking units. External braking units need to be configured for the 380V 037G/045P and above VFD models. Select braking resistors according to the specific requirements (such as the braking torque and braking usage) on site.

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. Table C-7 describes the resistance and power for 100% braking torque, 10% braking ratio, 50% braking ratio and 80% braking ratio. You can select the braking system based on the actual operation conditions.

✧ When using an external braking unit, set the brake voltage class of the braking unit properly by referring to the manual of the dynamic braking unit. If the voltage class is set incorrectly, the VFD may not run properly.

Table C-7 Braking unit for AC 3PH 380V (-15%)–440V(+10%)

VFD power (kW)	Braking unit model	Resistance applicable for 100% braking torque(Ω)	Braking resistor dissipation power (kW)			Min. allowed braking resistance (Ω)
			10% braking ratio	50% braking ratio	80% braking ratio	
0.75	Built-in braking unit	653	0.1	0.6	0.9	240
1.5		326	0.23	1.1	1.8	170
2.2		222	0.33	1.7	2.6	130
4		122	0.6	3	4.8	80
5.5		89	0.75	4.1	6.6	60
7.5		65	1.1	5.6	9	47
11		44	1.7	8.3	13.2	31
15		32	2	11	18	23
18.5		27	3	14	22	19
22		22	3	17	26	17
30		17	5	23	36	17
37	DBU100H-060-4	13	6	28	44	11.7
45	DBU100H-110-4	10	7	34	54	6.4
55		8	8	41	66	
75		6.5	11	56	90	
90	DBU100H-160-4	5.4	14	68	108	4.4
110		4.5	17	83	132	
132	DBU100H-220-4	3.7	20	99	158	3.2
160	DBU100H-320-4	3.1	24	120	192	2.2
185		2.8	28	139	222	
200		2.5	30	150	240	
220	DBU100H-400-4	2.2	33	165	264	1.8
250		2.0	38	188	300	
280	Quantity: Two DBU100H-320-4	3.6*2	21*2	105*2	168*2	2.2*2
315		3.2*2	24*2	118*2	189*2	
355		2.8*2	27*2	132*2	210*2	
400		2.4*2	30*2	150*2	240*2	
450	Quantity: Two DBU100H-400-4	2.2*2	34*2	168*2	270*2	1.8*2
500		2*2	38*2	186*2	300*2	

	✧ 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 ratio is greater than 10%, you need to select a braking resistor with higher power as required by the operation conditions according to the preceding table.

C.8.2 Braking resistor cable selection

Braking resistor cables should be shielded cables.

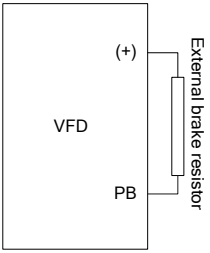
C.8.3 Braking resistor installation

All resistors must be installed in places with good cooling conditions.

	✧ The materials near the braking resistor or braking unit must be flame resistant. since the surface temperature of the resistor is high and air flowing from the resistor is of hundreds of degrees Celsius. Prevent any materials from coming into contact with the resistor.

Braking resistor installation

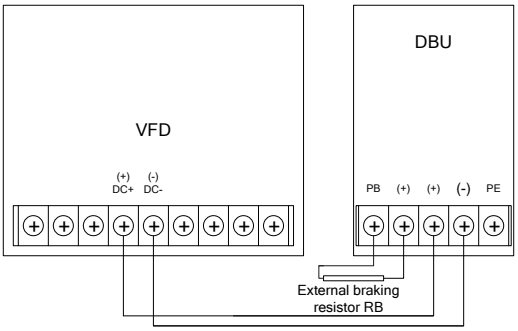
	✧ The 380V 030G/037P and lower VFD models need only external braking resistors. ✧ PB and (+) are the terminals for connecting braking resistors.



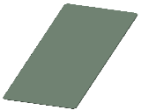
Braking unit installation

	✧ The 380V 037G/045P and higher models need to be configured with external braking units. ✧ (+) and (-)are the terminals for connecting braking units. ✧ The connection cable length between the (+) and (-) terminals of the VFD and those of a braking unit must be shorter than 5m, and the connection cable length between the BR1 and BR2 terminals of a braking unit and the terminals of a braking resistor must be shorter than 10m.

Single unit connection:



C.9 Other optional accessories

No.	Accessory name	Description	Image
1	Flange mounting plate	Required for the flange installation of 380V 030G/037P and lower models. Not required for the flange installation of 380V 037G/045P–200G/220P models.	
2	Installation pedestal	The 380V 220G/250P–315G/355P VFD models support the (optional part) installation pedestal, which can house an input AC reactor (or DC reactor) and an output AC reactor.	
3	Keypad mounting bracket	If you need install the keypad externally (that is, on another position rather than on the VFD), you can use M3 screws to fix the keypad, or you can use the keypad installation bracket to install the keypad. The keypad mounting bracket is an optional part for the 380V 030G/037P and lower models, while it is a standard part for the 380V 037G/045P and above models.	
4	Cover plate of heat emission hole	Optional for use in extreme environmental conditions to prevent external contaminants from entering the internal control circuit area of the VFD. When selecting and installing an optional cover plate, the VFD must be derated. For specific circumstances, please consult the INVT technical support professionals.	
5	LCD keypad	Optional for the entire series. The keypad supports multiple languages, parameter copying function, and ten-row high-definition display. The installation size of the LCD is compatible with the LED keypad.	
6	LED keypad	It is optional for the 380V 0R7G–015G/018P VFD models, while it is provided as standard for the 380V 018G/022P and above models.	

Appendix D Further information

D.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.

D.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.

D.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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