Operation Manual

Goodrive350 Series
High-performance Multifunction VFD

SHENZHEN INVT ELECTRIC CO., LTD.

Preface

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

If not otherwise specified in this manual, the VFD always indicates Goodrive350 series VFD, which is a high-performance and multi-function VFD aiming to integrate the capability to drive both synchronous motors and asynchronous motors, and support torque control, speed control, and position control. The VFD is armed with advanced vector control technology and the latest digital processor dedicated for motor control, thus enhancing product reliability and adaptability to the environment. The VFD adopts customized and industrialized design to realize excellent control performance through optimized functions and flexible applications.

In order to meet diversified customer demands, the VFD provides abundant extension cards including programmable extension card, PG card, communication card and I/O extension card to achieve various functions as needed.

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

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

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

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

This operation manual presents installation wiring, parameter setup, fault diagnosis and trouble shooting, and precautions related to daily maintenance. Read through this manual carefully before installation to ensure the VFD is installed and operated in a proper manner to give full play to its excellent performance and powerful functions.

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.

We reserve the right to update the manual information without prior notice and have the final interpretation for the manual content.

Contents

1 Safety precautions

1.1 What this chapter contains

Read this manual carefully and follow all safety precautions before moving, installing, operating and servicing the VFD. If these safety precautions are ignored, physical injury or death may occur, or damage may occur to the equipment.

If any physical injury or death or damage to the equipment occurred due to neglect of the safety precautions in the manual, we will not be responsible for any damages and we are not legally bound in any manner.

1.2 Safety definition

Danger: Serious physical injury or even death may occur if related requirements are not followed.

Warning**:** Physical injury or damage to the equipment may occur if related requirements are not followed.

Note: Actions taken to ensure proper operation.

Qualified electricians**:** People working on the device should take part in professional electrical and safety training, receive the certification and be familiar with all steps and requirements of installing, commissioning, operating and maintaining the device to prevent any emergencies.

1.3 Warning symbols

Warnings caution you about conditions which can result in serious injury or death and/or damage to the equipment, and advice on how to avoid the danger. The following warning symbols are used in this manual.

Symbols	Name	Instruction	Abbreviation
Danger	Danger	Serious physical injury or even death may occur if related requirements are not followed.	
Warning	Warning	Physical injury or damage to the equipment may occur if related requirements are not followed.	
Forbid	Electrostatic discharge	The PCBA may be damaged if related requirements are not followed	
Hot	Hot sides	The VFD base may become hot. Do not touch.	
5 min	Electric shock	As high voltage still presents in the bus capacitor after power off, wait for at least five minutes (or 15 min / 25 min, depending on the warning symbols on the machine) after power off to prevent electric shock.	5 min

Symbols	Name	Instruction	Abbreviation
	Read manual	Read the operation manual before operating on the equipment.	
Note	Note	Actions taken to ensure proper operation.	**Note**

1.4 Safety guidelines

<table>
<tr><td></td><td>
✧ Only trained and qualified electricians 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 are disconnected before wiring and 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 table below.
<table>
<tr><th colspan="2">VFD model</th><th>Minimum waiting time</th></tr>
<tr><td>380V</td><td>1.5kW–110kW</td><td>5 min</td></tr>
<tr><td>380V</td><td>132kW–315kW</td><td>15 min</td></tr>
<tr><td>380V</td><td>Above 355kW</td><td>25 min</td></tr>
<tr><td>660V</td><td>22kW–132kW</td><td>5 min</td></tr>
<tr><td>660V</td><td>160kW–350kW</td><td>15 min</td></tr>
<tr><td>660V</td><td>400kW–630kW</td><td>25 min</td></tr>
</table>
</td></tr>
<tr><td></td><td>✧ Do not refit the VFD unless authorized; otherwise, fire, electric shock or other injuries may occur.</td></tr>
<tr><td></td><td>✧ The base of the radiator may become hot during running. Do not touch to avoid hurt.</td></tr>
<tr><td></td><td>✧ The electrical parts and components inside the VFD are electrostatic. Take measures to prevent electrostatic discharge during related operation.</td></tr>
</table>

1.4.1 Delivery and installation

<table>
<tr><td></td><td>
✧ Install the VFD on fire-retardant material and keep the VFD away from combustible materials.
✧ Connect the optional braking parts (such as braking resistors, braking units or feedback units) according to the wiring diagram.
✧ Do not operate on a damaged or incomplete VFD.
✧ Do not touch the VFD with wet items or body parts; otherwise, electric shock may occur.
</td></tr>
</table>

Note:

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

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

- ✧ Do not carry the VFD by its front cover only as the cover may fall off.
- ✧ Installation site should be away from children and other public places.
- ✧ The VFD should be used in proper environment (see section 4.2.1 Installation environment for details).
- ✧ 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 with that of the phase conductor (with the same cross sectional area).
- ✧ R, S and T are the power input terminals, while U, V and W are 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

	✧ Disconnect all power sources applied to the VFD before terminal wiring, and wait for at least the time designated on the VFD after disconnecting the power sources. ✧ High voltage presents inside the VFD during running. Do not carry out any operation on the VFD during running except for keypad setup. For products at voltage levels of 5 or 6, the control terminals form extra-low voltage circuits. Therefore, you need to prevent the control terminals from connecting to accessible terminals of other devices. ✧ The VFD may start up by itself when P01.21 (restart after power down) is set to 1. Do not get close to the VFD and motor. ✧ The VFD cannot be used as "Emergency-stop device". ✧ The VFD cannot act as an emergency brake for the motor; it is a must to install mechanical brake device. ✧ During driving permanent magnet synchronous motor, besides above-mentioned items, the following work must be done before installation and maintenance. • Disconnect all the input power sources including main power and control power. • Ensure the permanent-magnet synchronous motor has been stopped, and the voltage on output end of the VFD is lower than 36V. • After the permanent-magnet synchronous motor is stopped, wait for at least the time designated on the VFD, and ensure the voltage between "+" and "-" is lower than 36V. • During operation, it is a must to ensure the permanent-magnet synchronous motor cannot run again by the action of external load; it is recommended to install effective external brake device or disconnect the direct electrical connection between permanent-magnet synchronous motor and the VFD.

Note:

- ✧ Do not switch on or switch off input power sources of the VFD frequently;
- ✧ If the VFD has been stored for a long time without use, set the capacitance and carry out inspection and pilot run on the VFD before use. For details about capacitor reforming, see chapter 8 Maintenance and hardware fault diagnosis.
- ✧ Close the front cover before running; otherwise, electric shock may occur.

1.4.3 Maintenance and component replacement

	✧ Only well-trained and qualified professionals are allowed to perform maintenance, inspection, and component replacement on the VFD. ✧ Disconnect all the power sources applied to the VFD before terminal wiring, and wait for at least the time designated on the VFD after disconnecting the power sources. ✧ Take measures to prevent screws, cables and other conductive matters from falling into the VFD during maintenance and component replacement.

Note:

- ✧ Use proper torque to tighten the screws.
- ✧ Keep the VFD and its parts and components away from combustible materials during maintenance and component replacement.
- ✧ Do not carry out insulation voltage-endurance test on the VFD, or measure the control circuits of the VFD with megameter.
- ✧ Take proper anti-static measures on the VFD and its internal parts during maintenance and component replacement.

1.4.4 What to do after scrapping

	✧ The heavy metals inside the VFD should be treated as industrial effluent.
	✧ When the life cycle ends, the product should enter the recycling system. Dispose of it separately at an appropriate collection point instead of placing it in the normal waste stream.

2 Quick startup

2.1 What this chapter contains

This chapter introduces the basic principles required during installation commissioning. You can realize quick installation commissioning by following these principles.

2.2 Unpack inspection

Check as follows after receiving products.

1.	Check whether the packing box is damaged or dampened.
2.	Check the model identifier on the exterior surface of the packing box is consistent with the purchased model.
3.	Check whether the interior surface of packing box is improper, for example, in wet condition, or whether the enclosure of the VFD is damaged or cracked.
4.	Check whether the nameplate of the VFD is consistent with the model identifier on the exterior surface of the packing box.
5.	Check whether the accessories (including user's manual, control keypad and extension card units) inside the packing box are complete.

If any problems are found, contact the local INVT dealer or office.

2.3 Application confirmation

Check the following items before operating on the VFD.

1.	Check the load mechanical type to be driven by the VFD, and check whether the VFD will be overloaded during actual use and whether the VFD power class needs to be enlarged?
2.	Check whether the actual running current of load motor is less than rated VFD current.
3.	Check whether the control precision required by actual load is the same with the control precision provided by the VFD.
4.	Check whether the grid voltage is consistent with rated VFD voltage.
5.	Check whether the functions required need an optional extension card to be realized.

2.4 Environment confirmation

Check the following items before use.

1.	Check whether the ambient temperature of the VFD during actual application exceeds 40°C. If yes, derate 1% for every additional 1°C. In addition, do not use the VFD when the ambient temperature exceeds 50°C.
2.	Check whether ambient temperature of the VFD during actual application is below -10°C. If yes, install heating facility.
3.	Check whether the altitude of the application site exceeds 1000m. If yes, derate 1% for every increase of 100m; when the installation site altitude exceeds 3000m, consult the local INVT dealer or office.
4.	Check whether the humidity of application site exceeds 90%, if yes, check whether

	condensation occurred, if condensation does exist, take additional protective measures.
5.	Check whether there is direct sunlight or animal intrusion in the application site, if yes, take additional protective measures.
6.	Check whether there is dust, explosive or combustible gases in the application site, if yes, take additional protective measures.

Note: For a cabinet-installed VFD, its ambient temperature is the air temperature inside the cabinet.

2.5 Installation confirmation

After the VFD is installed properly, check the installation condition of the VFD.

1.	Check whether the input power cable and current-carrying capacity of the motor cable fulfill actual load requirements.
2.	Check whether peripheral accessories (including input reactors, input filters, output reactors, output filters, DC reactors, braking units and braking resistors) of the VFD are of correct type and installed properly; check whether the installation cables fulfill requirements on current-carrying capacity.
3.	Check whether the VFD is installed on fire-retardant materials; check whether the hot parts (reactors, braking resistors, and so on) are kept away from combustible materials.
4.	Check whether all control cables are routed separately from power cables based on EMC requirements.
5.	Check whether all grounding systems are properly grounded according to requirements.
6.	Check whether VFD installation clearances meet the requirements in the operation manual.
7.	Check whether the VFD installation mode complies with the requirements in the operation manual. Vertical installation should be adopted whenever possible.
8.	Check whether VFD external connection terminals are securely wired with proper moment.
9.	Check whether there are redundant screws, cables or other conductive objects inside the VFD. If yes, take them out.

2.6 Basic commissioning

Carry out basic commissioning according to the following procedures before operating on the VFD.

1.	Select motor type, set motor parameters and select VFD control mode according to actual motor parameters.
2.	Check whether autotuning is needed? If possible, disconnect the motor load to perform dynamic parameter autotuning. If the load cannot be disconnected, perform static autotuning.
3.	Adjust the acceleration and deceleration time based on actual load working conditions.
4.	Perform device commissioning by means of jogging. Check whether the motor runs in the direction required. If no, it is recommended to change the motor running direction by exchanging the motor wiring of any two phases.
5.	Set all the control parameters, and carry out actual operation.

3 Product overview

3.1 What this chapter contains

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

3.2 Basic principle

The VFD is used to control asynchronous AC induction motor and permanent-magnet synchronous motor. The figure below 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 the AC voltage used by 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.

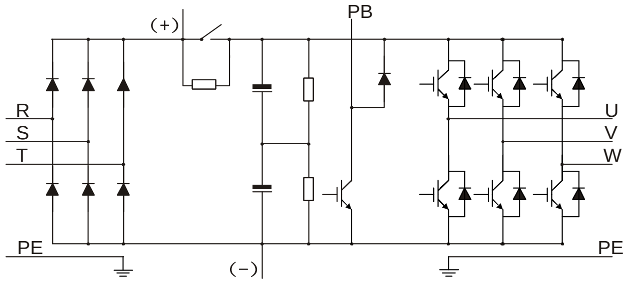


Figure 3-1 380V (15kW and lower) main circuit diagram

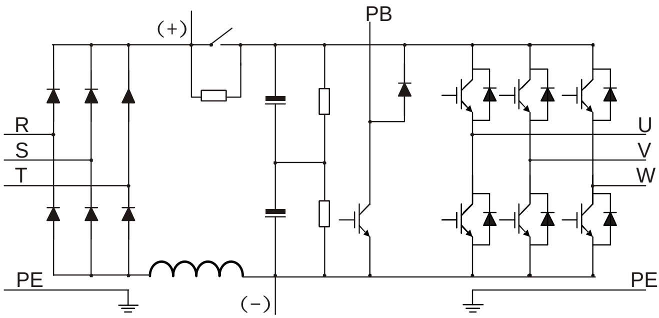


Figure 3-2 380V (18.5kW–110kW, 110kW included) main circuit diagram

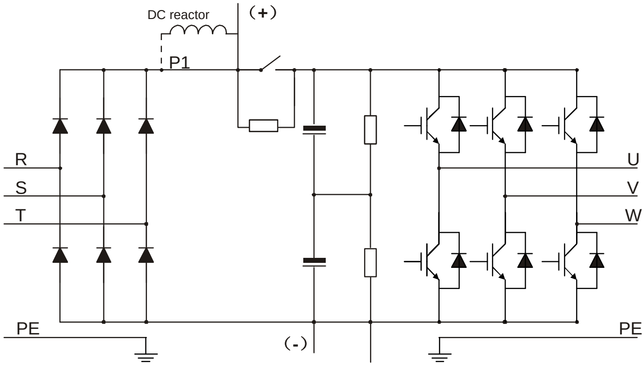


Figure 3-3 380V (132kW and higher) main circuit diagram

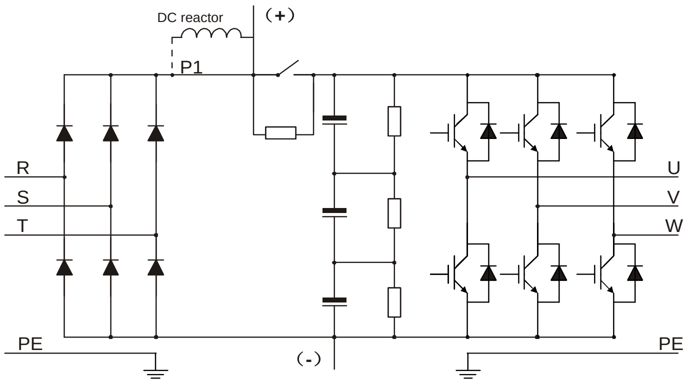


Figure 3-4 660V main circuit diagram

Note:

- The 132kW and higher VFD models can be connected to external DC reactors. Before connection, remove the copper bar between P1 and (+). The 132kW and higher VFD models can be connected to external braking unit. DC reactors and braking units are optional parts.
- The 18.5kW–110kW (inclusive) VFD models are equipped with built-in DC reactors.
- The 37kW and lower VFD models carry built-in braking units, which are optional for the 45kW–110kW (inclusive) models. The models with built-in braking units can also be connected to external braking resistors. Braking resistors are optional parts.
- The 660V VFD models can be connected to external DC reactors. Before connection, remove the copper bar between P1 and (+). These models can be connected to external braking unit. DC reactors and braking units are optional parts.

3.3 Product specifications

Function description		Specification
Power input	Input voltage (V)	AC 3PH 380V (-15%)–440V (+10%) rated voltage: 380V AC 3PH 520V (-15%)–690V (+10%) rated voltage: 660V
	Input current (A)	Refer to section 3.6 Product ratings.
	Input frequency (Hz)	50Hz or 60Hz, allowable range: 47–63Hz
Power output	Output voltage (V)	0–input voltage
	Output current (A)	Refer to section 3.6 Product ratings.
	Output power (kW)	Refer to section 3.6 Product ratings.
	Output frequency (Hz)	0–400Hz
Technical control performance	Control mode	SVPWM control, SVC, VC
	Motor type	Asynchronous motor, permanent-magnet synchronous motor
	Speed regulation ratio	Asynchronous motor 1: 200 (SVC); Synchronous motor 1: 20 (SVC) , 1:1000 (VC)
	Speed control precision	±0.2% (SVC), ±0.02% (VC)
	Speed fluctuation	± 0.3% (SVC)
	Torque response	<20ms (SVC), <10ms (VC)
	Torque control precision	10% (SVC), 5% (VC)
	Starting torque	Asynchronous motor: 0.25Hz/150% (SVC) Synchronous motor: 2.5 Hz/150% (SVC) 0Hz/200% (VC)
	Overload capacity	150% of rated current: 1min 180% of rated current: 10s 200% of rated current: 1s
Running control performance	Frequency setup mode	Digital, analog, pulse frequency, multi-step speed running, simple PLC, PID, Modbus communication, PROFIBUS communication, and so on; Realizes switchover between the set combination and the set channel
	Automatic voltage regulation function	Keeps the output voltage constant when grid voltage changes.
	Fault protection function	Fault protection function Provides over 30 kinds of fault protection functions: overcurrent, overvoltage, undervoltage, over-temperature, phase loss and overload, and so on
	Speed tracking restart function	Realizes impact-free starting of the motor in rotating. **Note:** Only available for the 4kW and higher VFD models.
	Retention at transient voltage drop	Keeps running with regenerative energy when the grid transiently drops.

Function description		Specification
	Motor switchover	Supports two groups of motor parameters to control motor switchover.
Peripheral interface	Terminal analog input resolution	No more than 20mV
	Terminal digital input resolution	No more than 2ms
	Analog input	2 inputs, AI1: 0–10V/0–20mA; AI2: -10–10V
	Analog output	1 output, AO1: 0–10V /0–20mA
	Digital input	Four regular inputs; max. frequency: 1kHz; internal impedance: 3.3kΩ Two high-speed inputs; max. frequency: 50kHz; supports quadrature encoder input; with speed measurement function
	Digital output	One high-speed pulse output; max. frequency: 50kHz One Y terminal open collector output
	Relay output	Two programmable relay outputs RO1A NO, RO1B NC, RO1C common port RO2A NO, RO2B NC, RO2C common port Contact capacity: 3A/AC250V, 1A/DC30V
	Extension interface	Three extension interfaces: SLOT1, SLOT2, SLOT3 (only on the control boards of 7.5kW and higher VFD models) Expandable PG card, programmable extension card, communication card, I/O card, and so on
Others	Installation mode	Supports wall-mounting, floor-mounting and flange-mounting.
	Temperature of running environment	-10–50°C; Derating is required if the ambient temperature exceeds 40°C.
	Protection level	IP20
	Pollution level	Level 2
	Cooling mode	Air cooling
	Braking unit	The braking unit has been built in the 380V 37kW and lower VFD models as standard configuration part. It is optional for the 380V 45kW–110kW (inclusive) models and can be built in the VFD. It is optional for the 660V models and can be externally connected to the VFD.
	EMC filter	The conductivity and transmission of all 380V VFD models can meet the requirements of IEC61800-3 C3. Optional external filters can be used to meet IEC61800-3 C2.

Function description		Specification
		Note: Comply with the EMC regulations in the appendix in the manual, and select the motor and motor cables according to the technical requirements in the appendix in the manual.

3.4 Product nameplate

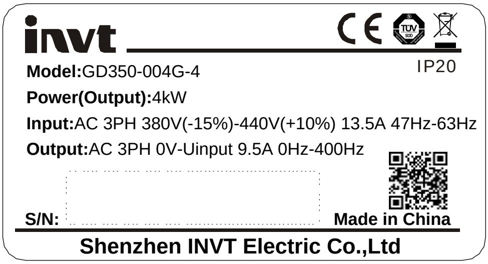


Figure 3-5 Product nameplate

Note:

- This is an example of the nameplate of standard Goodrive350 products. The CE/TUV/IP20 marking on the top right will be marked according to actual certification conditions.
- Scan the QR code on the bottom right to download mobile APP and operation manual.

3.5 Type designation key

The type designation key contains product information. You can find the type designation key on the nameplate and simple nameplate of the VFD.

GD350-5R5G-4

① ② ③

Figure 3-6 Type designation key

Field	Sign	Description	Contents
Abbreviation of product series	①	Abbreviation of product series	GD350: Goodrive350 series high-performance multi-function VFD
Rated power	②	Power range + load type	5R5: 5.5kW G: Constant torque load
Voltage level	③	Voltage level	4: AC 3PH 380V (-15%)–440V (+10%) Rated voltage: 380V 6: AC 3PH 520V (-15%)–690V (+10%) Rated voltage: 660V
Note: The braking unit has been built in the 380V 37kW and lower VFD models as a standard			

Field	Sign	Description	Contents
configuration. The braking unit is not a standard configuration for the 380V 45–110kW VFD models (but you can choose to purchase the built-in braking unit, and then the VFD model has a suffix "B", for example, GD350-045G-4-B).			

3.6 Product ratings

3.6.1 AC 3PH 380V(-15%)–440V(+10%) rated value

Product model	Output power (kW)	Input current (A)	Output current (A)
GD350-1R5G-4	1.5	5.0	3.7
GD350-2R2G-4	2.2	5.8	5
GD350-004G-4	4	13.5	9.5
GD350-5R5G-4	5.5	19.5	14
GD350-7R5G-4	7.5	25	18.5
GD350-011G-4	11	32	25
GD350-015G-4	15	40	32
GD350-018G-4	18.5	47	38
GD350-022G-4	22	51	45
GD350-030G-4	30	70	60
GD350-037G-4	37	80	75
GD350-045G-4	45	98	92
GD350-055G-4	55	128	115
GD350-075G-4	75	139	150
GD350-090G-4	90	168	180
GD350-110G-4	110	201	215
GD350-132G-4	132	265	260
GD350-160G-4	160	310	305
GD350-185G-4	185	345	340
GD350-200G-4	200	385	380
GD350-220G-4	220	430	425
GD350-250G-4	250	460	480
GD350-280G-4	280	500	530
GD350-315G-4	315	580	600
GD350-355G-4	355	625	650
GD350-400G-4	400	715	720
GD350-450G-4	450	840	820
GD350-500G-4	500	890	860

Note:

- The input current of the 1.5–500kW VFD models is measured in cases where the input voltage is 380V without additional reactors.

- The rated output current is the output current when the output voltage is 380V.
- Within allowable input voltage range, the output current/power cannot exceed the rated output current/power.

3.6.2 AC 3PH 520V (-15%)–690V (+10%) rated value

Product model	Output power (kW)	Input current (A)	Output current (A)
GD350-022G-6	22	35	27
GD350-030G-6	30	40	34
GD350-037G-6	37	47	42
GD350-045G-6	45	52	54
GD350-055G-6	55	65	62
GD350-075G-6	75	85	86
GD350-090G-6	90	95	95
GD350-110G-6	110	118	131
GD350-132G-6	132	145	147
GD350-160G-6	160	165	163
GD350-185G-6	185	190	198
GD350-200G-6	200	210	216
GD350-220G-6	220	230	240
GD350-250G-6	250	255	274
GD350-280G-6	280	286	300
GD350-315G-6	315	334	328
GD350-355G-6	355	360	380
GD350-400G-6	400	411	426
GD350-450G-6	450	445	465
GD350-500G-6	500	518	540
GD350-560G-6	560	578	600
GD350-630G-6	630	655	680

Note:

- The input current of the 22–350kW VFD models is measured in cases where the input voltage is 660V without DC reactors and input/output reactors.
- The input current of the 400–630kW VFD models is measured in cases where the input voltage is 660V and there are input reactors.
- Rated output current is the output current when the output voltage is 660V.
- Within allowable input voltage range, the output current/power cannot exceed the rated output current/power.

3.7 Structure diagram

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

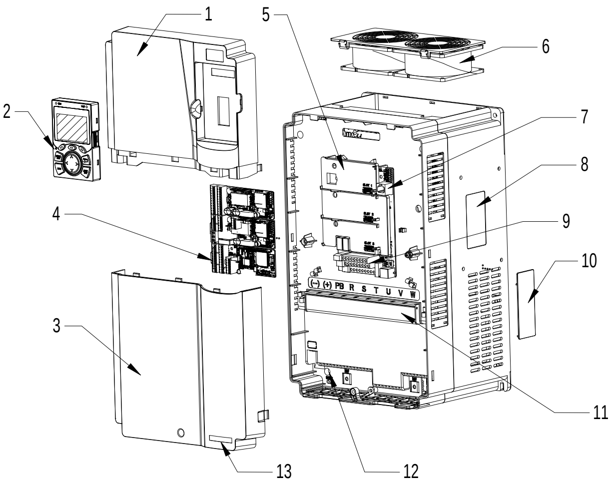


Figure 3-7 Structure diagram

No.	Item	Description
1	Upper cover	Protects internal components and parts.
2	Keypad	For details, see section 5.4 Operating the VFD through the keypad.
3	Lower cover	Protects internal components and parts.
4	Extension card	Optional. For details, see Appendix A Extension cards.
5	Baffle of control board	Protects the control board and install extension card.
6	Cooling fan	For details, see chapter 8 Maintenance and hardware fault diagnosis.
7	Keypad interface	Connects the keypad.
8	Nameplate	For details, see section 3.4 Product nameplate.
9	Control terminals	For details, see chapter 4 Installation guidelines.
10	Cover plate of heat emission hole	Optional. Cover plate can upgrade protection level, however, as it will also increase internal temperature, derated use is required.
11	Main circuit terminal	For details, see chapter 4 Installation guidelines.
12	POWER indicator	Power indicator.
13	GD350 product series label	For details, see section 3.5 Type designation key.

4 Installation guidelines

4.1 What this chapter contains

This chapter introduces the mechanical and electrical installations of the VFD.

- ✧ Only well trained and qualified professionals are allowed to carry out the operations mentioned in this chapter. Please carry out operations according to instructions presented in Safety precautions. Ignoring these safety precautions may lead to physical injury or death, or device damage.
- ✧ Ensure the VFD power is disconnected before installation. If the VFD has been powered on, disconnect the VFD and wait for at least the time designated 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.
- ✧ Installation must be designed and done according to applicable local laws and regulations. INVT does not assume any liability whatsoever for any installation which breaches local laws and 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 operate at its best in the long run. The installation environment of the VFD should meet the following requirements.

Environment	Condition
Installation site	Indoors
Ambient temperature	✧ -10–+50°; ✧ When the ambient temperature exceeds 40°C, derate 1% for every additional 1°C. ✧ It is not recommended to use the VFD when the ambient temperature is above 50°C. ✧ In order to improve reliability, do not use the VFD in cases where the temperature changes rapidly. ✧ When the VFD is used in a closed space such as control cabinet, use cooling fan or air conditioner to prevent internal temperature from exceeding the temperature required. ✧ When the temperature is too low, if restart a VFD which has been idled for a long time, it is required to install external heating device before use to eliminate the freeze inside the VFD, failing to do so may cause damage to the VFD.
Humidity	✧ The relative humidity (RH) of the air is less than 90%.

Environment	Condition
	✧ Condensation is not allowed. ✧ The max RH cannot exceed 60% in the environment where there are corrosive gases.
Storage temperature	-30–+60°C
Running environment	The installation site should meet the following requirements. ✧ Away from electromagnetic radiation sources. ✧ Away from oil mist, corrosive gases and combustible gases. ✧ Ensure foreign object like metal powder, dust, oil and water will not fall into the VFD (do not install the VFD onto combustible object like wood). ✧ Away from radioactive substance and combustible objects ✧ Away from harmful gases and liquids ✧ Low salt content ✧ No direct sunlight
Altitude	✧ Below 1000m. ✧ When the altitude exceeds 1000m, derate 1% for every additional 100m. ✧ When the installation site altitude exceeds 3000m, consult the local INVT dealer or office.
Vibration	The max. amplitude of vibration should not exceed 5.8m/s^2 (0.6g)
Installation direction	You are recommended to install the VFD vertically to ensure good heat dissipation effect.

Note:

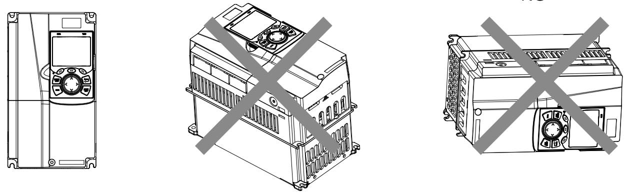
- The VFD must be installed in a clean and well-ventilated environment based on the IP level.
- The cooling air must be clean enough and free from corrosive gases and conductive dust.

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. See Appendix C Dimension drawings.

OK NG NG



Vertical installation B. Horizontal installation C. Transverse installation

Figure 4-1 Installation direction of the VFD

4.2.3 Installation mode

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

1. Wall-mounting: suitable for 380V 315kW and lower, and 660V 355kW and lower
2. Flange-mounting: suitable for 380V 200kW and lower, and 660V 220kW and lower
3. Floor-mounting: suitable for 380V 220–500kW, and 660V 250–630kW

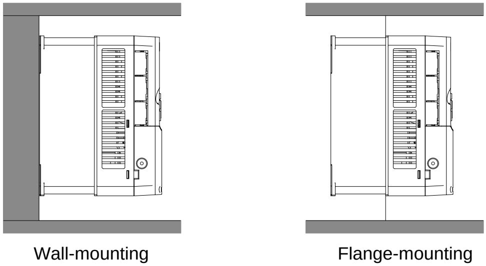


Figure 4-2 Installation mode

(1) Mark the position of the installation hole. See appendix for the position of installation hole.

(2) Mount the screws or bolts onto the designated position.

(3) Put the VFD on the wall.

(4) Tighten the fixing screws on the wall.

Note:

- Flange-mounting plate is a must for the 380V 1.5–75kW VFD models that adopt flange-mounting mode; while the 380V 90–200kW and 660V 22–220kW models need no flange-mounting plate.
- Optional installation base is available for the 380V 220–315kW and 660V 250–355kW VFD models. The base can hold an input AC reactor (or DC reactor) and an output AC reactor.

4.2.4 Single-unit installation

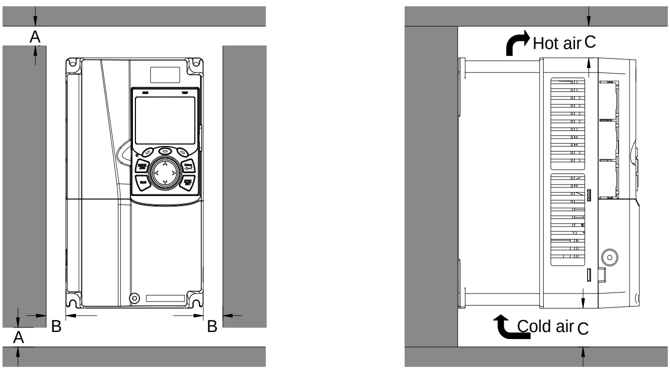


Figure 4-3 Single-unit installation

Note: The min. dimension of B and C is 100mm.

4.2.5 Multiple-unit installation

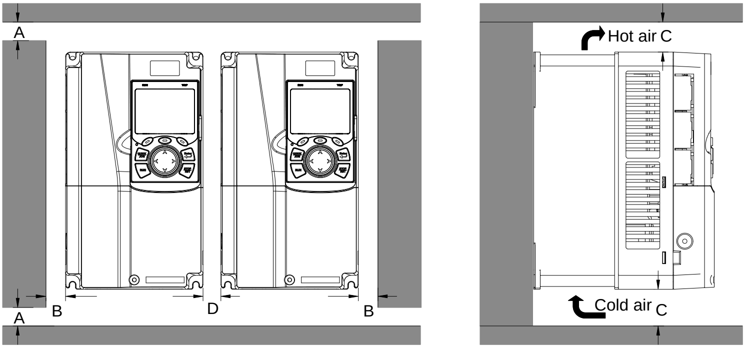


Figure 4-4 Parallel installation

Note:

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

4.2.6 Vertical installation

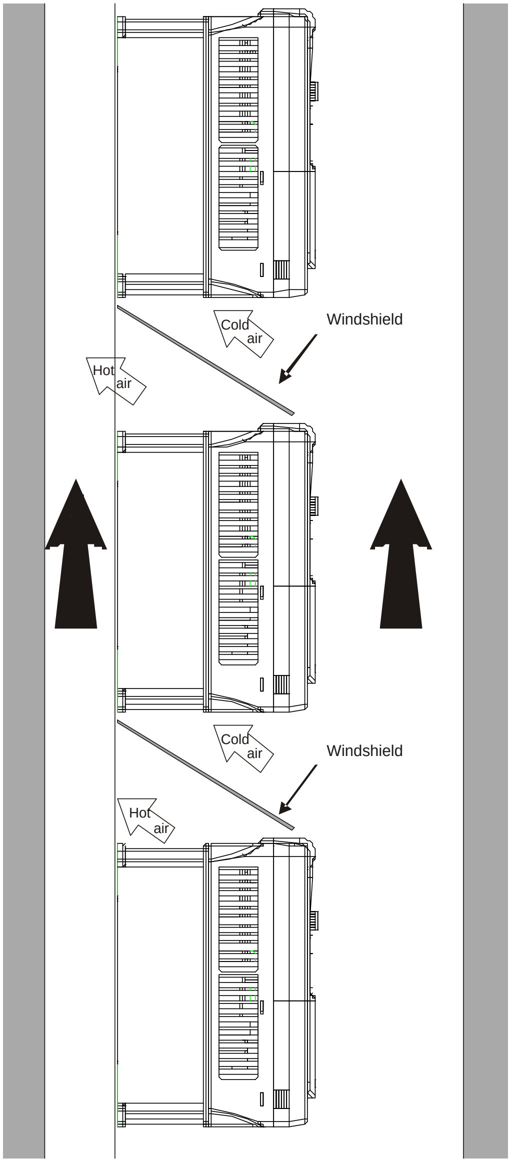


Figure 4-5 Vertical installation

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

4.2.7 Tilted installation

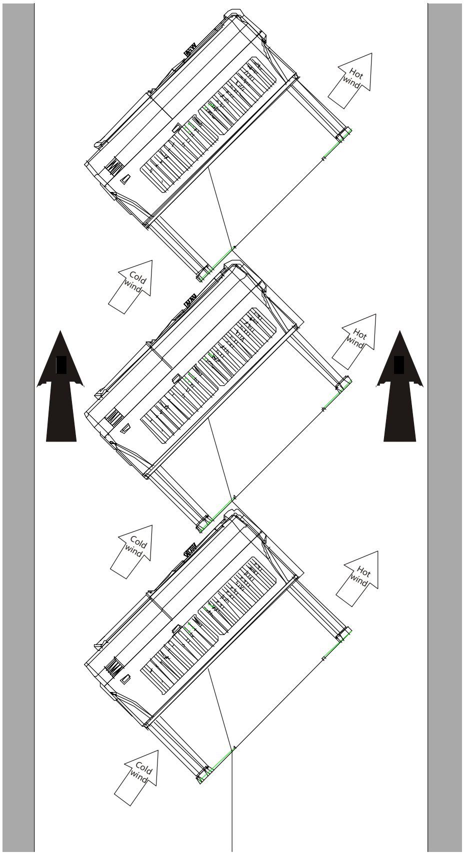


Figure 4-6 Tilted installation

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

4.3 Standard wiring of main circuit

4.3.1 Wiring diagram of main circuit

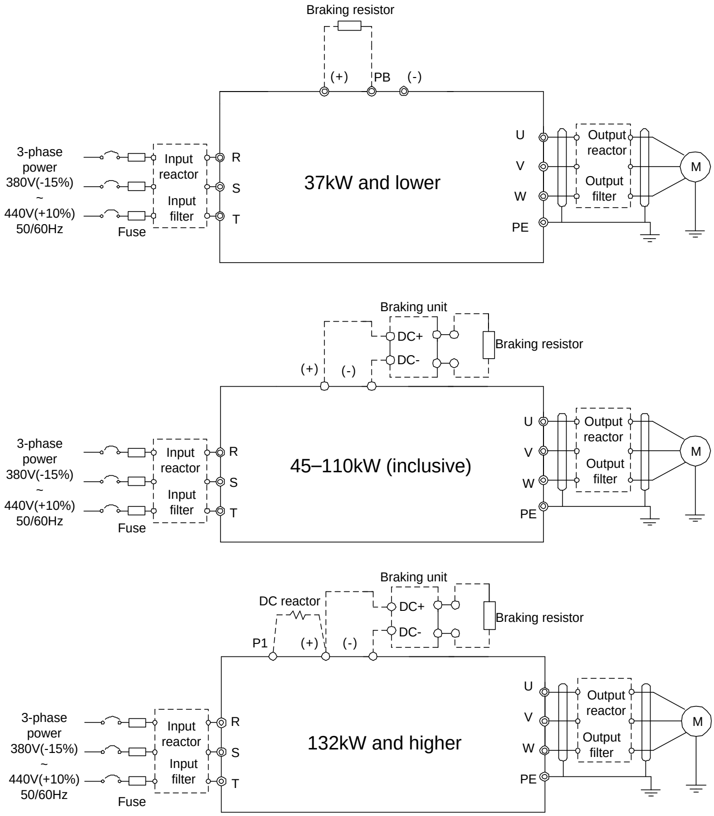


Figure 4-7 Main circuit wiring diagram for AC 3PH 380V(-15%)–440V(+10%)

Note:

- The fuse, DC reactor, braking unit, braking resistor, input reactor, input filter, output reactor and output filter are optional parts. See Appendix D Optional peripheral accessories.
- P1 and (+) have been short connected by default for the 380V 132kW and higher VFD models. If you need to connect to an external DC reactor, take off the short-contact tag of P1 and (+).
- When connecting the braking resistor, take off the yellow warning sign marked with PB, (+) and (-) on the terminal block before connecting the braking resistor wire; otherwise, poor contact may occur.
- Built-in braking unit is optional for the 380V 45kW–110kW VFD models.

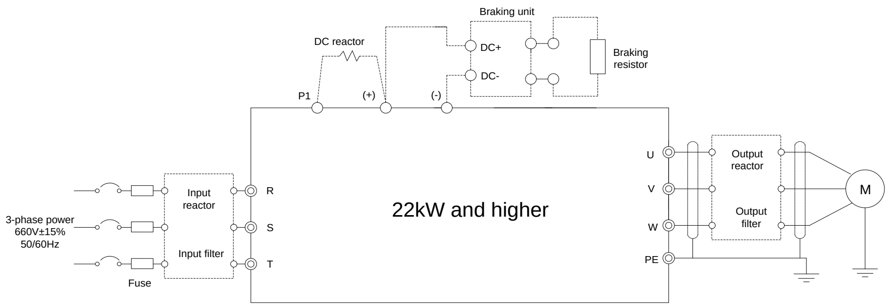


Figure 4-8 Main circuit wiring diagram for AC 3PH 520V(-15%)–690V(+10%)

Note:

- The fuse, DC reactor, braking resistor, input reactor, input filter, output reactor and output filter are optional parts. See Appendix D Optional peripheral accessories.
- P1 and (+) have been short connected by default. If you need to connect to external DC reactor, remove the short-contact tag of P1 and (+).
- Before connecting the braking resistor, remove the yellow warning label with (+) and (-) from the terminal block; otherwise, poor contact may occur.

4.3.2 Main circuit terminal diagram

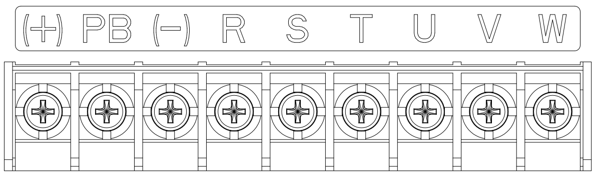


Figure 4-9 3PH 380V 22kW and lower

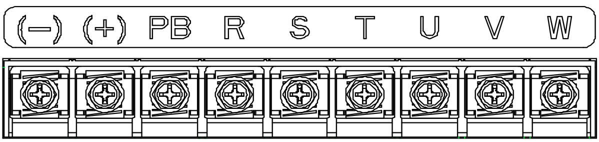


Figure 4-10 3PH 380V 30–37kW

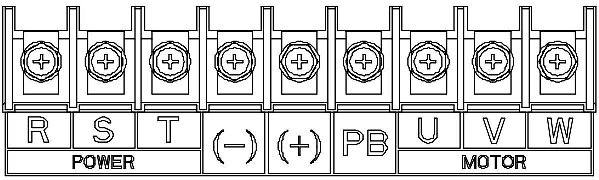


Figure 4-11 3PH 380V 45–110kW (Enabling PB when a braking unit is embedded)

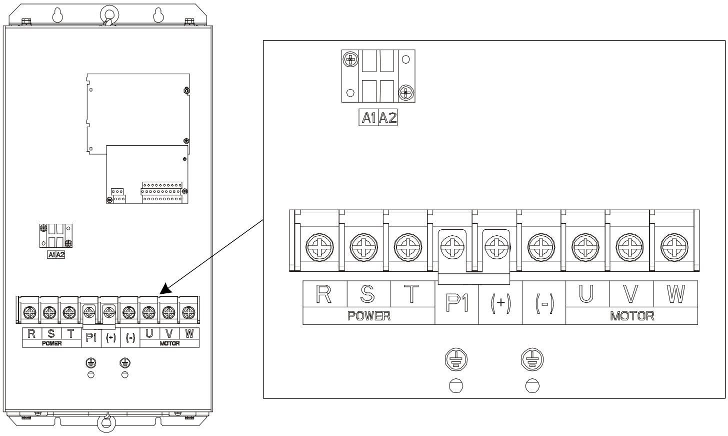


Figure 4-12 660V 22–45kW

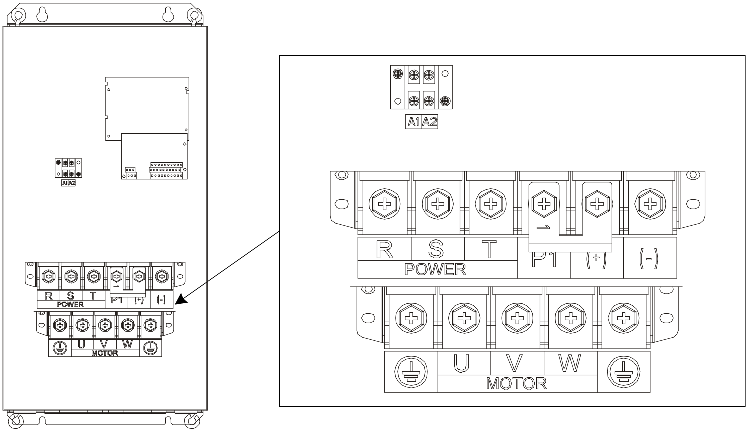


Figure 4-13 660V 55–132kW

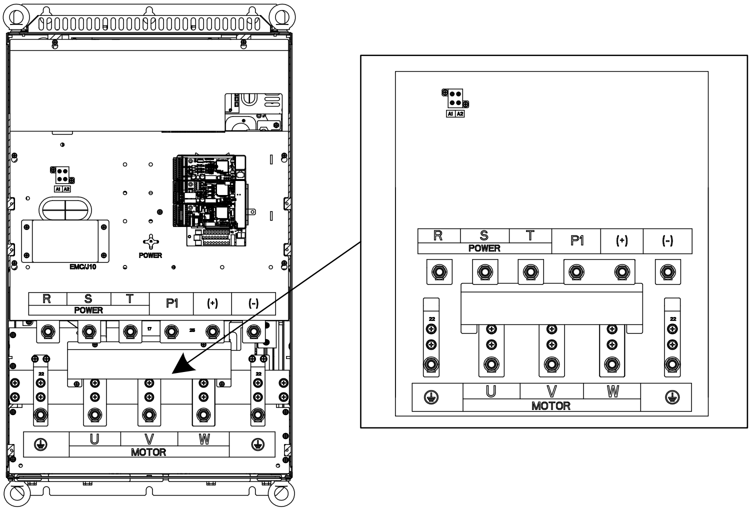


Figure 4-14 380V 132–200kW and 660V 160–220kW

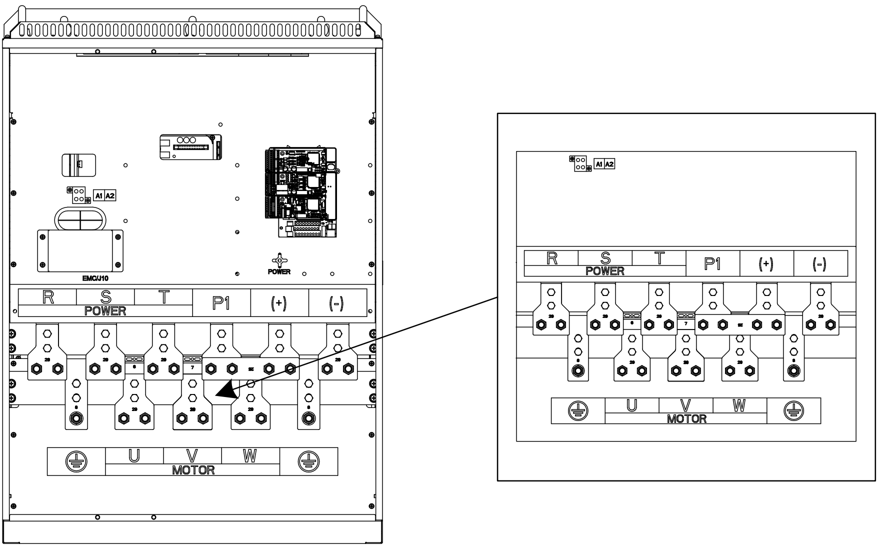


Figure 4-15 380V 220–315kW and 660V 250–355kW

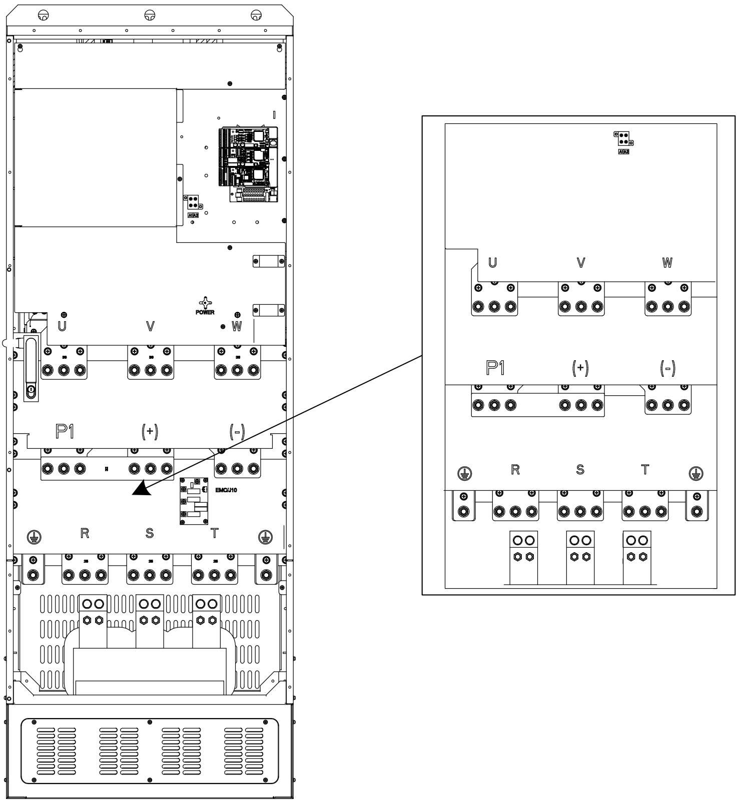


Figure 4-16 380V 355–500kW and 660V 400–630kW

Terminal	Terminal name			Function description
	380V 37kW and lower	380V 45–110kW (inclusive)	380V 132kW and higher	
			660V	
R, S, T	Main circuit power input			3PH AC input terminals, connected to the grid
U, V, W	VFD output			3PH AC output terminals, connected to the motor
P1	Not available	Not available	DC reactor terminal 1	P1 and (+) connect to the external DC reactor.
(+)	Braking resistor terminal 1	Braking unit terminal 1	DC reactor terminal 2, Braking unit terminal 1	(+) and (-) connect to the external braking unit.
(-)	/	Braking unit terminal 2		PB and (+) connect to external

Terminal	Terminal name			Function description
	380V 37kW and lower	380V 45–110kW (inclusive)	380V 132kW and higher	
			660V	
PB	Braking resistor terminal 2	Not available		braking resistor terminal
PE	Grounding resistor is less than 10 ohm			Grounding terminal for safe protection; each machine must carry two PE terminals and proper grounding is required

Note:

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

4.3.3 Wiring procedure of the 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 grounding line of the motor cable to the grounding terminal of the VFD, and connect 3PH motor cable to U, V and W terminals and tighten up.
3. Connect the braking resistor which carries cables to the designated position.
4. Fix all the cables outside the VFD mechanically if allowed.

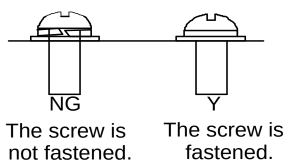


Figure 4-17 Screw installation diagram

4.4 Standard wiring of control circuit

4.4.1 Wiring diagram of basic control circuit

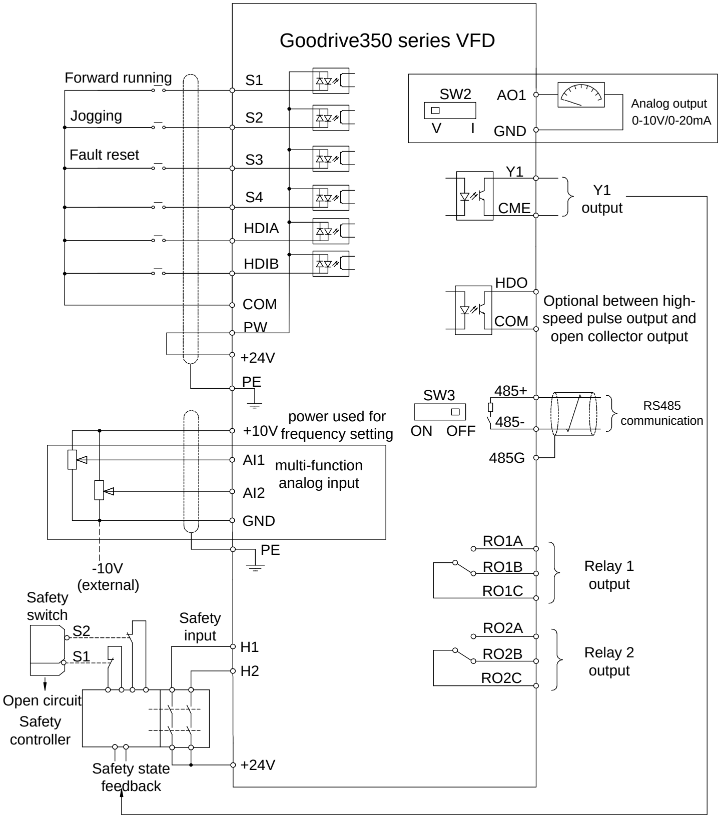


Figure 4-18 Wiring diagram of control circuit

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

Terminal	Description
+10V	The VFD provides +10.5V power
AI1	✧ Input range: AI1: 0–10V/0–20mA; AI2: -10V–+10V ✧ Input impedance: 20kΩ during voltage input; 250Ω during current input ✧ AI1 voltage or current input is set by P05.50. ✧ Resolution ratio: When 10V corresponds to 50Hz, min. resolution ratio is 5mV ✧ Error: ±0.5% at 25°C, when input is above 5V/10mA
AI2	
GND	+10.5V reference zero potential
AO1	✧ Output range: 0–10V voltage or 0–20mA current

Terminal	Description	
	✧ Voltage or current output is set by toggle switch SW2 ✧ Error: ±0.5% at 25°C, when input is above 5V/10mA	
RO1A	RO1 relay output; RO1A is NO, RO1B is NC, RO1C is common Contact capacity: 3A/AC250V, 1A/DC30V	
RO1B		
RO1C		
RO2A	RO2 relay output; RO2A is NO, RO2B is NC, RO2C is common Contact capacity: 3A/AC250V, 1A/DC30V	
RO2B		
RO2C		
HDO	✧ Switch capacity: 50mA/30V ✧ Range of output frequency: 0–50kHz ✧ Duty ratio: 50%	
COM	Common port of +24V	
CME	Common port of open collector output; short connected to COM by default	
Y1	Switch capacity:50mA/30V; Range of output frequency: 0–1kHz	
485+	RS485 communication/differential signal port. The standard 485 communication interface should use twisted shielded pair; the 120ohm terminal matching resistor of RS485 communication is connected by toggle switch SW3.	
485-		
PE	Grounding terminal	
PW	Provides input digital working power from external to internal Voltage range: 12–30V	
24V	The VFD provides user power; the maximum output current is 200mA.	
COM	Common terminal of +24V	
S1	Digital input 1	✧ Internal impedance: 3.3kΩ ✧ Accept 12–30V voltage input ✧ Bi-directional input terminals, supporting NPN/PNP modes ✧ Max. input frequency: 1kHz ✧ All are programmable digital input terminals. You can set the terminal function via function codes.
S2	Digital input 2	
S3	Digital input 3	
S4	Digital input 4	
HDIA	Besides S1–S4 functions, it can also act as high frequency pulse input channel Max. input frequency: 50kHz. Duty ratio: 30%–70% Supports the input of a quadrature encoder with 24V power supply; equipped with speed-measurement function	
HDIB		
+24V—H1	STO input 1	✧ Safe torque off (STO) redundant inputs, connected to external NC contacts. When the contacts open, STO acts and VFD output stops. ✧ Safety input signal cable: shielded, with length within 25m ✧ H1 and H2 terminals are short connected to +24V by default. Remove the short-contact tag on the terminal before using STO function.
+24V—H2	STO input 2	

4.4.2 Input/output signal connection diagram

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

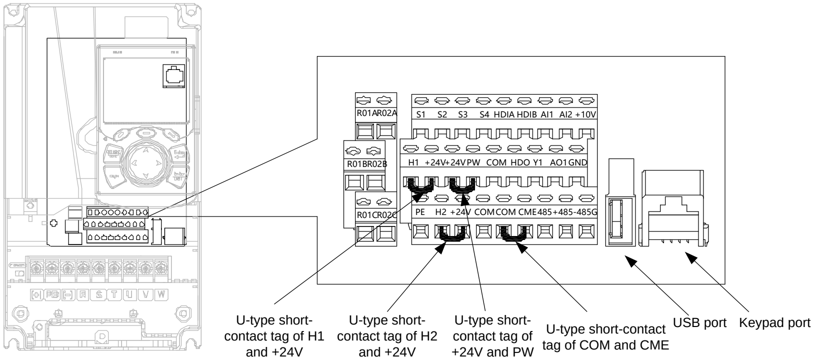


Figure 4-19 Position of U-type short-contact tag

Note: As shown in Figure 4-19, the USB port can be used to upgrade the software, and the keypad port can be used to connect an external keypad. The external keypad cannot be used when the local VFD keypad is used.

If input signal comes from NPN transistors, set the U-type short-contact tag between +24V and PW based on the power used according to the figure below.

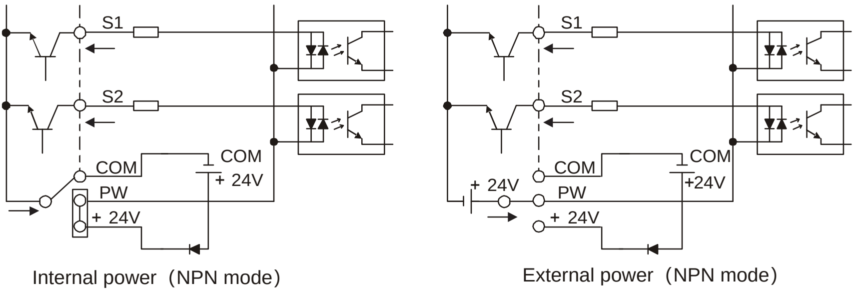


Figure 4-20 NPN mode

If input signal comes from PNP transistor, set the U-type short-contact tag based on the power used according to the figure below.

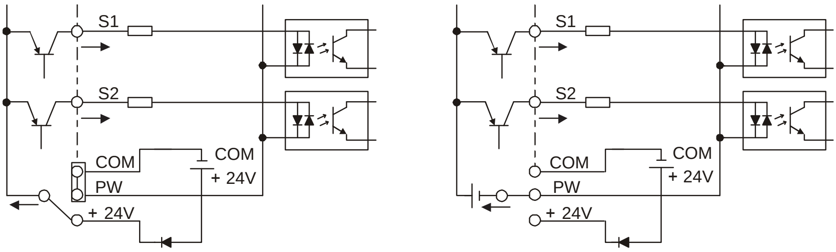


Figure 4-21 PNP mode

4.5 Wiring protection

4.5.1 Protect the VFD and input power cable in short-circuit

Protect the VFD and input power cable during short-circuit to avoid thermal overload.

Carry out protective measures according to the following requirements.

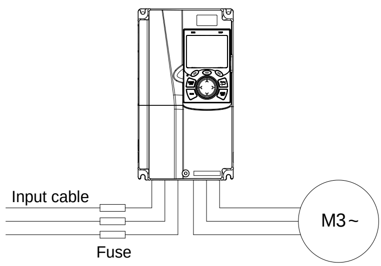


Figure 4-22 Fuse configuration

Note: Select the fuse according to operation manual. During short-circuit, the fuse will protect input power cables to avoid damage to the VFD; when internal short-circuit occurred to the VFD, it can protect neighboring equipment from being damaged.

4.5.2 Protect the motor and motor cable in short circuit

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

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

4.5.3 Protect motor and prevent thermal overload

According to the requirements, the motor must be protected to prevent thermal overload. Once overload is detected, you must cut off the current. The VFD is equipped with motor thermal overload protection function, which will block output and cut off the current (if necessary) to protect the motor.

4.5.4 Bypass connection

In some critical occasions, industrial frequency conversion circuit is necessary to ensure proper operation of the system when a VFD fault occurs.

In some special cases, such as, only soft startup is needed, it will convert to power-frequency operation directly after soft startup, corresponding bypass link is also needed.

	✧ Do not connect any power source to VFD output terminals U, V and W. The voltage applied to 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 will not be connected to input power cables and VFD output ends simultaneously.

5 Basic operation guidelines

5.1 What this chapter contains

This chapter tells you how to use the VFD keypad and the commissioning procedures for common functions of the VFD.

5.2 Keypad introduction

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

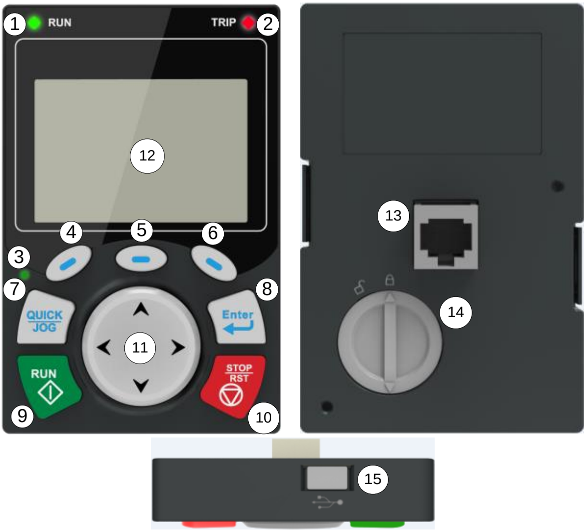


Figure 5-1 Keypad diagram

Note:

- The LCD keypad is equipped with a real-time clock, which can run properly after being installed with batteries even if the power line is disconnected. The clock battery (type: CR2032) is user purchased.
- The LCD keypad has the parameter copying function.
- 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. When installing the keypad externally, use an extension cable with a standard RJ45 crystal head for connection.

Item	Instruction		
State indicator	(1)	RUN	Running indicator; LED off – the VFD is stopped; LED blinking – the VFD is in parameter autotune

Item	Instruction			
				LED on – the VFD is running
	2)	TRIP		Fault indicator; LED on – in fault state LED off – in normal state LED blinking – in pre-alarm state
	(3)	QUICK/JOG		Short-cut key indicator, which displays different state under different functions, see definition of QUICK/JOG key for details
Key area	(4)		Function key	The function of function key varies with the menu; The function of function key is displayed in the footer
	(5)			
	(6)			
	(7)	 	Short-cut key	Re-definable. It is defined as JOG function by default, namely jogging. The function of short-cut key can be set by the ones of P07.12, as shown below. 0: No function ; 1: Jogging (linkage indicator (3); logic : NO); 2: Reserved; 3: FWD/REV switchover (linkage indicator (3); logic: NC) ; 4: Clear UP/DOWN setting (linkage indicator (3) logic: NC) ; 5: Coast to stop (linkage indicator (3); logic: NC) ; 6: Switching running command reference mode in order (linkage indicator (3); logic: NC) ; 7: Reserved; **Note: After restoring to default values, the default function of short-cut key (7) is 1.**
	(8)	 	Confirmation key	The function of confirmation key varies with menus, such as confirming parameter setup, confirming parameter selection, and entering the next menu.
	(9)	 	Running key	Under keypad operation mode, the running key is used for running operation or autotuning operation.

Item	Instruction			
	(10)		Stop/ Reset key	During running state, press the Stop/Reset key can stop running or autotuning; this key is limited by P07.04. During fault alarm state, all the control modes can be reset by this key.
	(11)		Direction key UP:  DOWN:  LEFT:  RIGHT: 	UP: The function of UP key varies with interfaces, such as shifting up the displayed item, shifting up the selected item, and changing digits; DOWN: The function of DOWN key varies with interfaces, such as shifting down the displayed item, shifting down the selected item, changing digits; LEFT: The function of LEFT key varies with interfaces, such as switch over the monitoring interface, such as shifting the cursor leftward, exiting current menu and returning to previous menu; RIGHT: The function of RIGHT key varies with interfaces, such as switch over the monitoring interface, shifting the cursor rightward, enter the next menu etc.
Display area	(12)	LCD	Display screen	240×160 dot-matrix LCD; display three monitoring parameters or six sub-menu items simultaneously
Others	(13)	RJ45 interface	RJ45 interface	RJ45 interface is used to connect to the VFD.
	(14)	Battery cover	Clock battery cover	Remove this cover when replacing or installing clock battery, and close the cover after battery is installed
	(15)	USB terminal	Mini USB terminal	Mini USB terminal is used to connect to the USB flash drive through an adapter.

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

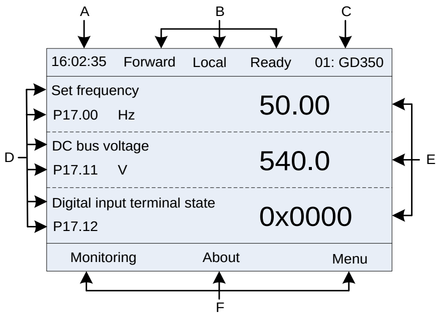


Figure 5-2 Main interface of LCD

Area	Name	Displayed contents
Header A	Real-time display area	Display the real-time; clock battery is not included; the time needs to be reset when powering on the VFD
Header B	VFD running state display area	Display the running state of the VFD: 1. Display motor rotating direction: "Forward" – Run forward during operation; Reverse – Run reversely during operation; "Forbid" – Reverse running is forbidden; 2. Display VFD running command channel: "Local" – Keypad; "Terminal" – Terminal; "Remote" - Communication 3. Display current running state of the VFD : "Ready" – The VFD is in stop state (no fault); "Run" – The VFD is in running state; "Jog" – The VFD is in jogging state; "Pre-alarm" – the VFD is under pre-alarm state during running; "Fault" – VFD fault occurred.
Header C	VFD station no. and model display area	1. Display VFD station no.: 01–99, applied in multi-drive applications (reserved function); 2. VFD model display: "GD350" – current VFD is GD350 series VFD
Display D	The parameter name and function code monitored by the VFD	Display the parameter name and corresponding function code monitored by the VFD; three monitoring parameters can be displayed simultaneously. The monitoring parameter list can be edited.
Display E	Parameter value monitored by the VFD	Display the parameter value monitoring by the VFD, the monitoring value will be refreshed in real time
Footer F	Corresponding menu of function key (4), (5) and (6)	Corresponding menu of function key (4), (5) and (6). The corresponding menu of function key (4), (5) and (6) varies with interfaces, and the contents displayed in this area is also different

5.3 Keypad display

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

5.3.1 Stop parameter display state

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

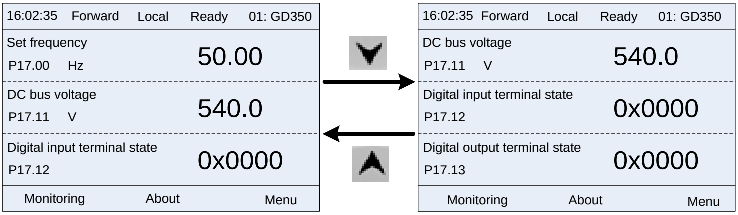


Figure 5-3 Stop parameter display state

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

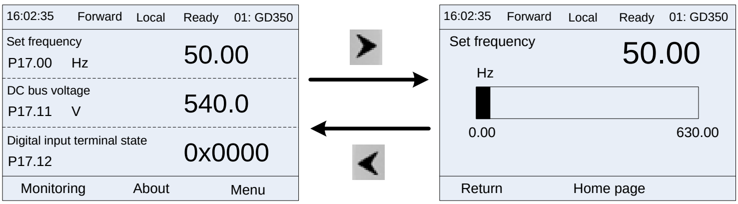


Figure 5-4 Stop parameter display state

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

5.3.2 Running parameter display state

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

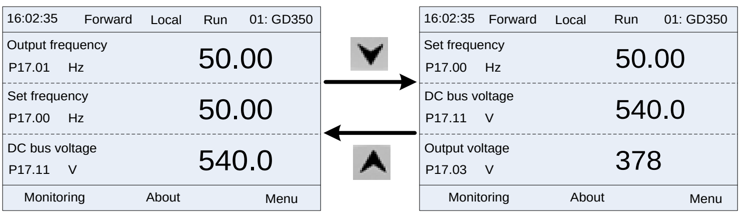


Figure 5-5 Running parameter display state

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

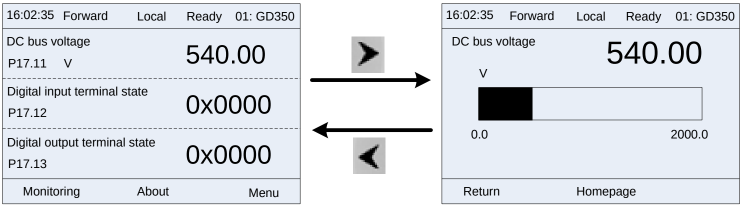


Figure 5-6 Running parameter display state

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

5.3.3 Fault alarm display state

The VFD enters fault alarm display state once fault signal is detected, and the keypad displays fault code and fault information with TRIP indicator on the keypad turning on. Fault reset operation can be carried out via STOP/RST key, control terminal or communication command.

The fault code will be kept displaying until fault is removed.

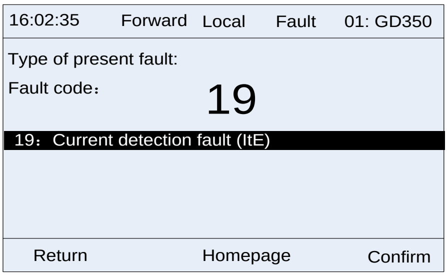


Figure 5-7 Fault alarm display state

5.4 Operating the VFD through the keypad

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

5.4.1 Enter/exit menu

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

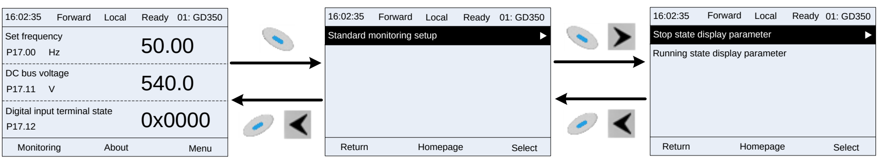


Figure 5-8 Enter/exit menu diagram 1

Regarding the system menu, the operation relation between entering and exiting is shown below.

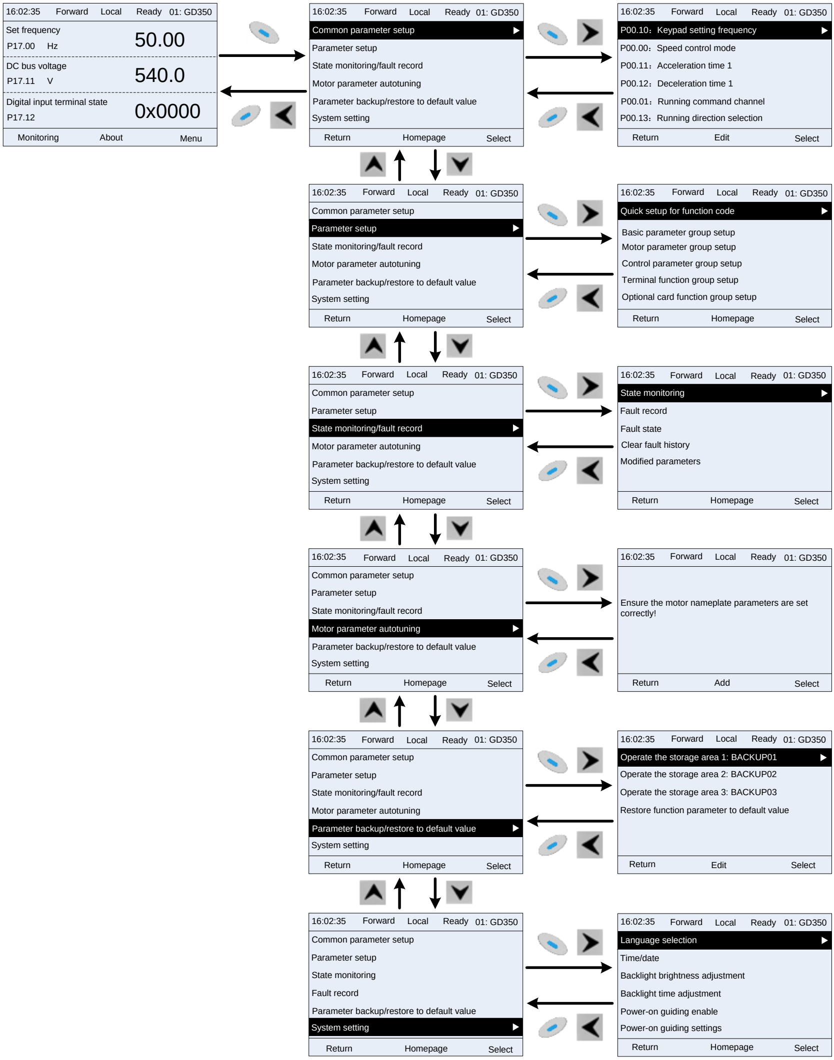


Figure 5-9 Enter/exit menu diagram 2

The keypad menu setup is shown as below.

<table>
<tr><th>Level 1</th><th>Level 2</th><th>Level 3</th><th>Level 4</th></tr>
<tr><td rowspan="3">Common parameter setup</td><td rowspan="3">/</td><td rowspan="3">/</td><td>P00.10: Set frequency via keypad</td></tr>
<tr><td>P00.00: Speed control mode</td></tr>
<tr><td>Pxx.xx : Common parameter</td></tr>
</table>

Level 1	Level 2	Level 3	Level 4
			setup xx
	Quick setup for function code	/	Pxx.xx
Parameter setup	Basic parameter group setup	P00: Basic functions	P00.xx
		P07: HMI	P07.xx
		P08: Enhance functions	P08.xx
		P11: Protection parameters	P11.xx
		P14: Serial communication function group	P14.xx
		P99: Factory function group	P99.xx
	Motor parameter group setup	P02: Motor 1 parameters	P02.xx
		P12: Motor 2 parameters	P12.xx
		P20: Motor 1 encoder group	P20.xx
		P24: Motor 2 encoder group	P24.xx
	Control parameter group setup	P01: Start/stop control	P01.xx
		P03: Motor 1 vector control	P03.xx
		P04: V/F control	P04.xx
		P09: PID control	P09.xx
		P10: Simple PLC and multi-step speed control	P10.xx
		P13: Synchronous motor control parameters	P13.xx
		P21: Position control	P21.xx
		P22: Spindle positioning	P22.xx
		P23: Motor 2 vector control	P23.xx
	Terminal function group setup	P05: Input terminal group	P05.xx
		P06: Output terminal group	P06.xx
		P98: AIAO calibration functions	P98.xx
	Optional card function group setup	P15: Communication extension card 1 functions	P15.xx
		P16: Communication extension card 2 functions	P16.xx
		P25: Extension I/O card input functions	P25.xx
		P26: Extension I/O card output functions	P26.xx
		P27: PLC functions	P27.xx

Level 1	Level 2	Level 3	Level 4
		P28: Master/slave functions	P28.xx
	Default function group setup	P90: Customized function group 1	P90.xx
		P91: Customized function group 2	P91.xx
		P92: Customized function group 3	P92.xx
		P93: Customized function group 4	P93.xx
State monitoring/fault record	State monitoring	P07: HMI	P07.xx
		P17: State-check functions	P17.xx
		P18: Closed-loop vector state check functions	P18.xx
		P19: Extension card state check functions	P19.xx
	Fault record	/	P07.27: Type of present fault
			P07.28: Type of the last fault
			P07.29: Type of the 2nd-last fault
			P07.30: Type of the 3rd-last fault
			P07.31: Type of the 4th-last fault
			P07.32: Type of the 5th-last fault
	Fault state	/	P07.33: Running frequency of present fault
			P07.34: Ramp frequency of present fault
			P07.xx: xx state of the last but xx fault
	Clear fault history	/	Are you sure to clear fault history?
	Modified parameter	/	Pxx.xx has modified parameter 1
			Pxx.xx has modified parameter 2
			Pxx.xx has modified parameter xx
Motor parameter autotuning	/	/	Complete parameter rotary autotuning
			Complete parameter static autotuning
			Partial parameter static autotuning

Level 1	Level 2	Level 3	Level 4
Parameter backup/restore default value	/	Operate the storage area 1: BACKUP01	Upload local function parameter to keypad
			Download complete keypad function parameter
			Download key function parameters which are not in motor group
			Download keypad function parameters which are in motor group
		Operate the storage area 2: BACKUP012	
		Operate the storage area 3: BACKUP03	
		Restore function parameter to default value	Ensure to restore function parameters to default value?
System setup	/	/	Language selection
			Time/date
			Backlight brightness regulation
			Backlight time adjustment
			Power-on guiding enable
			Power-on guiding settings
			Keyboard burning selection
			Fault time enable
			Control board burning selection

5.4.2 List edit

The monitoring items displayed in the parameter list of stop state can be added as needed (through the menu of the function code in state check group), and the list can also be edited such as "shift up", "shift down" and "delete from the list". The edit function is shown in the following.

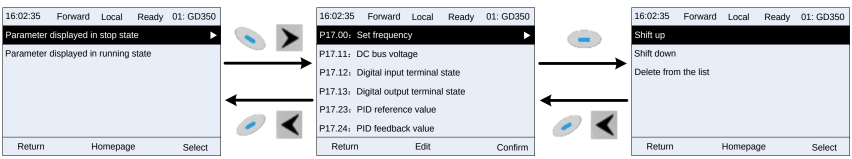


Figure 5-10 List edit diagram 1

Press key to enter edit interface, select the operation needed, and press key, key or key to confirm the edit operation and return to the previous menu (parameter list), the returned list is the edited. If key or key is pressed in edit interface wihouth selecting edit operation, it will return to the previous menu (parameter list remain unchanged).

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

The monitoring items displayed in the parameter list of running state can be added as needed (through the menu of the function code in state check group), and the list can also be edited such as "shift up", "shift down" and "delete from the list". The edit function is shown in the interface below.

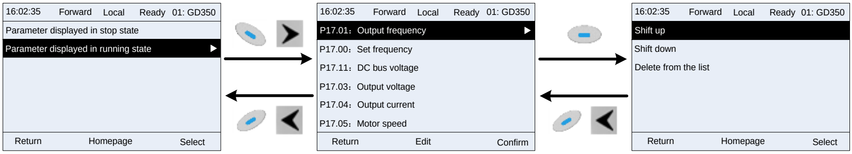


Figure 5-11 List edit diagram 2

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

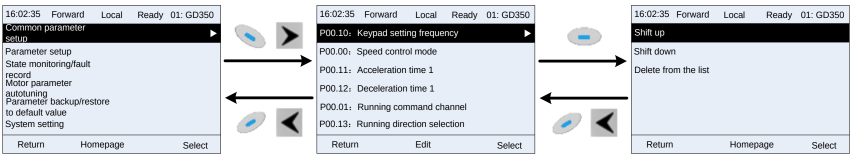


Figure 5-12 List edit diagram 3

5.4.3 Add parameters to the parameter list displayed in stop/running state

In the fourth-level menu of "State monitoring", the parameters in the list can be added to the "parameter displayed in stop state" list or "parameter displayed in running state" list as shown below.

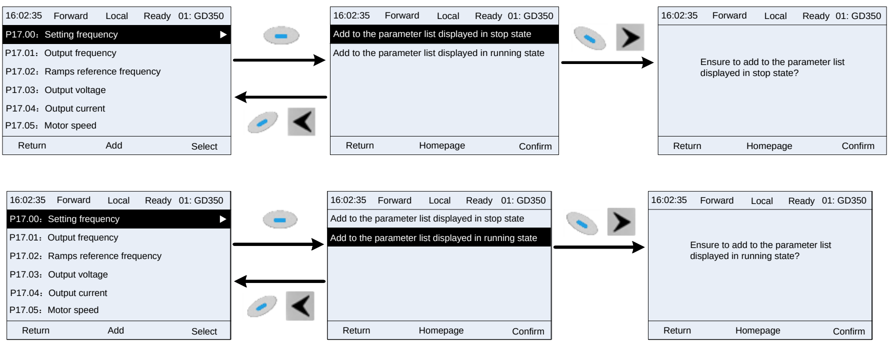


Figure 5-13 Add parameter diagram 1

Press  key to enter parameter addition interface, select the operation needed, and press key, key or key to confirm the addition operation. If this parameter is not included in the "parameter displayed in stop state" list or "parameter displayed in running state" list, the parameter added will be at the end of the list; if the parameter is already in the "parameter displayed in stop state" list or "parameter displayed in running state" list, the addition operation will be invalid. If key or key is pressed without selecting addition operation in "Addition" interface, it will return to monitoring parameter list menu.

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

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

5.4.4 Add parameter to common parameter setup list

In fourth-level menu of "parameter setup" menu, the parameter in the list can be added to the "common parameter setup" list as shown below.

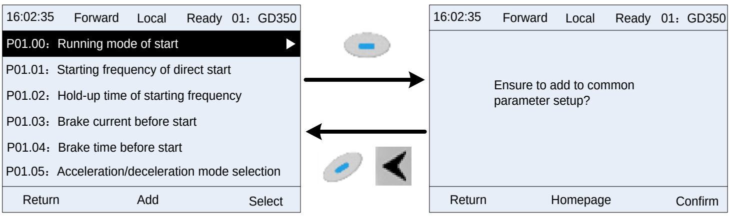


Figure 5-14 Add parameter diagram 2

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

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

5.4.5 Parameter selection edit interface

In the fourth-level menu of "parameter setup" menu, press key, key or key to enter parameter selection edit interface. After entering edit interface, current value will be highlighted. Press key and key to edit current parameter value, and the corresponding parameter item of current value will be highlighted automatically. After parameter selection is done, press key or key to save the selected parameter and return to the previous menu. In parameter selection edit interface, press key to maintain the parameter value and return to the previous menu.

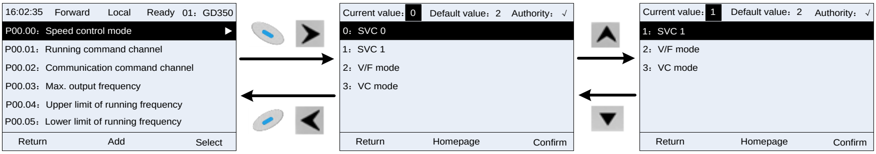


Figure 5-15 Parameter selection edit interface

In parameter selection edit interface, the "authority" on the top right indicates whether this parameter is editable or not.

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

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

"Current value" indicates the value of current option.

"Default value" indicates the default value of this parameter.

5.4.6 Parameter setup edit interface

In the fourth-level menu in "parameter setup" menu, press  key,  key or  key to enter parameter setup edit interface. After entering edit interface, set the parameter from low bit to high bit, and the bit under setting will be highlighted. Press  key or  key to increase or decrease the parameter value (this operation is valid until the parameter value exceeds the max. value or min. value); press  or  to shift the edit bit. After parameters are set, press  key or  key to save the set parameters and return to the previous parameter. In parameter setup edit interface, press  to maintain the original parameter value and return to the previous menu.

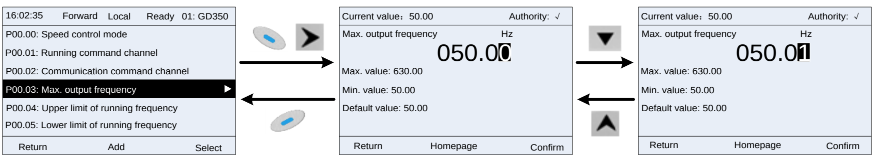


Figure 5-16 Parameter setup edit interface

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

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

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

"Current value" indicates the value saved last time.

"Default value" indicates the default value of this parameter.

5.4.7 State monitoring interface

In the fourth-level menu of "state monitoring/fault record" menu, press  key,  key or 

key to enter state monitoring interface. After entering state monitoring interface, the current parameter value will be displayed in real time, this value is the actually detected value which cannot be modified.

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

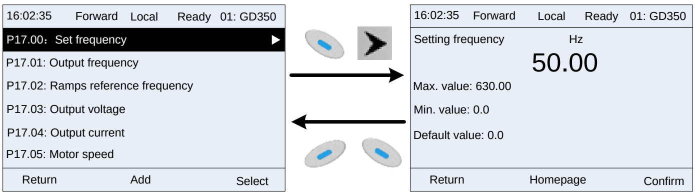


Figure 5-17 State monitoring interface

5.4.8 Motor parameter autotuning

In "Motor parameter autotuning" menu, press key, key or key to enter motor parameter autotuning selection interface, however, before entering motor parameter autotuning interface, you must set the motor nameplate parameters correctly. After entering the interface, select motor autotuning type to carry out motor parameter autotuning. In motor parameter autotuning interface, press key or key to return to the previous menu.

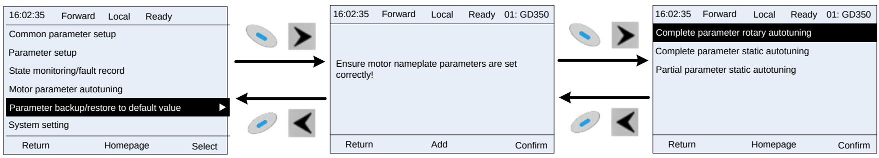


Figure 5-18 Parameter autotuning operation diagram

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

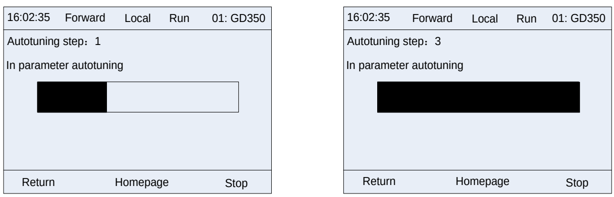


Figure 5-19 Parameter autotuning finished

5.4.9 Parameter backup

In "parameter backup" menu, press key, key or key to enter function parameter backup setting interface and function parameter restoration setup interface to upload/download VFD parameters, or restore VFD parameters to default value. The keypad has three different storage areas for parameter backup, and each storage area can save the parameters of one VFD, namely it can save parameters of three VFDs in total.

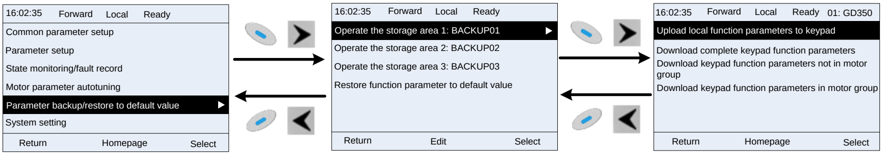


Figure 5-20 Parameter backup operation diagram

5.4.10 System setup

In "System setup" menu, press  key,  key or  key to enter system setup interface to set keypad language, time/date, backlight brightness, backlight time and restore parameters.

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

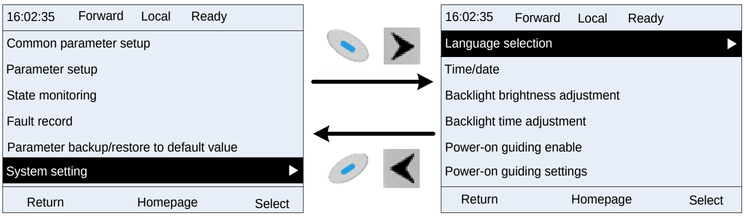


Figure 5-21 System setup diagram

5.4.11 Power-on guiding settings

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

The power-on guide is shown as below.

Level 1		Level 2		Level 3		Level 4	
Language	0: Simplified Chinese	Power-on guiding selection	0: Always	Whether to enter the power-on guiding settings?	0: Yes	Whether to test the motor rotation direction?	Yes
	1: English		1: Only once		1: No		No
				P00.06 A frequency command selection	0: Keypad	Press the JOG button first. It is currently forward. Is it consistent with the expectations?	Yes
					1: AI1		No

Level 1		Level 2		Level 3		Level 4	
					2: AI2	P02.00 Type of motor 1	0: Asynchronous
					3: AI3		1: Synchronous
					4: High-speed pulse HDIA	P02.01 Rated power of asynchronous motor 1	
					5: Simple PLC program	P02.02: Rated frequency of asynchronous motor 1	
					6: Multi-step speed running	P02.03 Rated speed of asynchronous motor 1	
					7: PID control	P02.04 Rated voltage of asynchronous motor 1	
					8: Modbus communication	P02.05 Rated current of asynchronous motor 1	
					9: PROFIBUS/ CANopen/ DeviceNet communication	P02.15 Rated power of synchronous motor 1	
					10: Ethernet communication	P02.16 Rated frequency of synchronous motor 1	
					11: Set via high-speed pulse HDIB	P02.17 Number of pole pairs of synchronous motor 1	
					12: Pulse string AB	P02.18 Rated voltage of synchronous motor 1	
					13: Set via EtherCAT/ PROFINET communication	P02.19 Rated current of synchronous motor 1	
					14: PLC card	Whether to	Yes

Level 1		Level 2		Level 3		Level 4	
					15: Reserved	conduct autotuning?	No
				P00.01 Running command channel	0: Keypad	Motor parameter autotuning interface	
					1: Terminal		
					2: Communication		
				P00.02 Communication running command channel	0: Modbus		
					1: PROFIBUS/ CANopen/ DeviceNet		
					2: Ethernet		
					3: EtherCAT/PROFINET		
					4: PLC programmable card		
					5: Bluetooth card		
				P08.37 Enable/disable energy-consumption brake	0: Disable energy-consumption		
					1: Enable energy consumption		
				P00.00 Speed control mode	0: SVC 0		
					1: SVC 1		
					2: VF control		
					3: VC		
				P01.08 Stop mode	0: Decelerate to stop		
					1: Coast to stop		
				P00.11 Acceleration time			
				P00.12 Deceleration time			

5.5 Basic operations

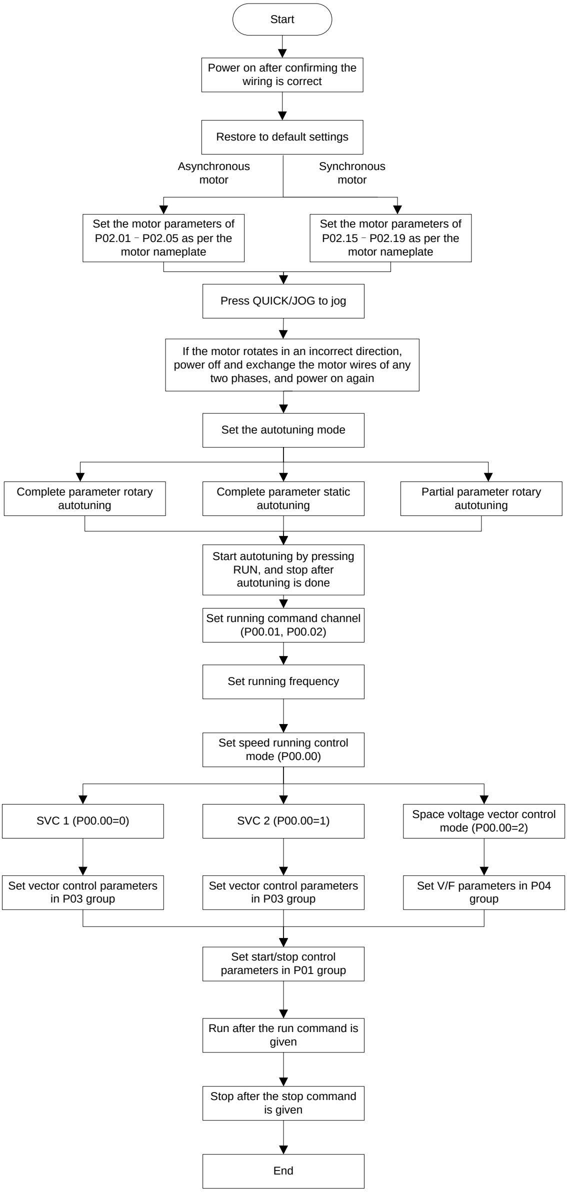
5.5.1 What this section contains

This section introduces the function modules inside the VFD.

✧ Ensure all the terminals are fixed and tightened firmly.
✧ Ensure the motor matches with the VFD power.

5.5.2 Common commissioning procedures

The common operation procedures are shown below (taking motor 1 as an example).



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

The running command channel can be set by terminal commands besides P00.01 and P00.02.

Current running command channel P00.01	Multi-function terminal function (36) Command switches to keypad	Multi-function terminal function (37) Command switches to terminal	Multi-function terminal function (38) Command switches to communication
Keypad	/	Terminal	Communication
Terminal	Keypad	/	Communication
Communication	Keypad	Terminal	/

Note: "/" means this multi-function terminal is invalid under current reference channel.

Related parameter list:

Function code	Name	Description	Default value
P00.00	Speed control mode	0: SVC 0 1: SVC 1 2: SVPWM 3: VC **Note: If 0, 1 or 3 is selected, it is required to carry out motor parameter autotuning first.**	2
P00.01	Running command channel	0: Keypad 1: Terminal 2: Communication	0
P00.02	Communication running command channel	0: Modbus 1: PROFIBUS/CANopen/DeviceNet 2: Ethernet 3: EtherCAT/PROFINET 4: PLC programmable card 5: Bluetooth card	0
P00.15	Motor parameter autotuning	0: No operation 1: Rotary autotuning 1; carry out comprehensive motor parameter autotuning; rotary autotuning is used in cases where high control precision is required; 2: Static autotuning 1 (comprehensive autotuning); static autotuning 1 is used in cases where the motor cannot be disconnected from load; 3: Static autotuning 2 (partial autotuning) ; when current motor is motor 1, only P02.06,	0

Function code	Name	Description	Default value
		P02.07 and P02.08 will be autotuned; when current motor is motor 2, only P12.06, P12.07 and P12.08 will be autotuned. 4: Rotary autotuning 2, which is similar to rotary autotuning 1 but is only applicable to asynchronous motors. 5: Rotary autotuning 3 (partial autotuning), which is only applicable to asynchronous motors.	
P00.18	Function parameter restoration	0: No operation 1: Restore to default value 2: Clear fault history **Note: After the selected function operations are done, this function code will be restored to 0 automatically. Restoration to default value will clear the user password, this function should be used with caution.**	0
P02.00	Type of motor 1	0: Asynchronous motor 1: Synchronous motor	0
P02.01	Rated power of asynchronous motor 1	0.1–3000.0kW	Depends on model
P02.02	Rated frequency of asynchronous motor 1	0.01Hz–P00.03 (Max. output frequency)	50.00Hz
P02.03	Rated speed of asynchronous motor 1	1–60000rpm	Depends on model
P02.04	Rated voltage of asynchronous motor 1	0–1200V	Depends on model
P02.05	Rated current of asynchronous motor 1	0.8–6000.0A	Depends on model
P02.15	Rated power of synchronous motor 1	0.1–3000.0kW	Depends on model
P02.16	Rated frequency of synchronous motor 1	0.01Hz–P00.03 (Max. output frequency)	50.00Hz
P02.17	Number of pole pairs of synchronous motor 1	1–50	2
P02.18	Rated voltage of synchronous motor 1	0–1200V	Depends on model

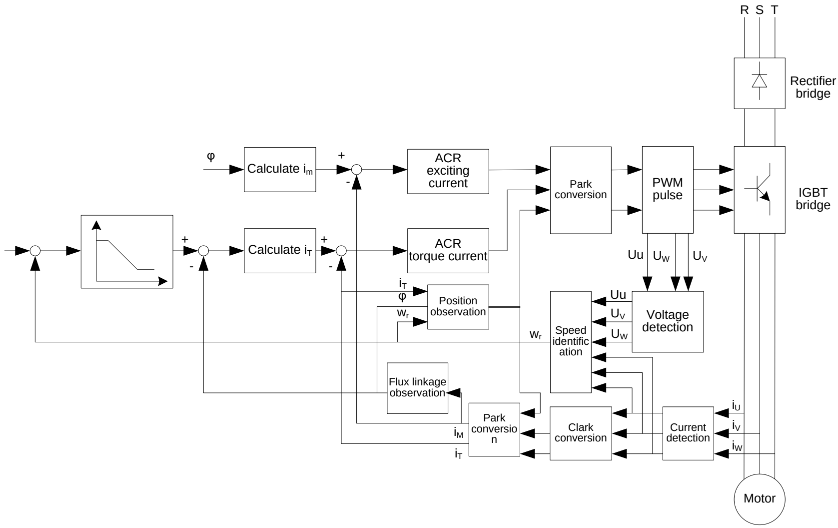
Function code	Name	Description	Default value
P02.19	Rated current of synchronous motor 1	0.8–6000.0A	Depends on model
P05.01–P05.06	Function of multi-function digital input terminal (S1–S4, HDIA, HDIB)	36: Command switches to keypad 37: Command switches to terminal 38: Command switches to communication	/
P07.01	Reserved	/	/
P07.02	QUICK/JOG key function	Range: 0x00–0x27 Ones: QUICK/JOG key function selection 0: No function 1: Jogging 2: Reserved 3: Switching between forward/reverse rotation 4: Clear UP/DOWN setting 5: Coast to stop 6: Switch running command reference mode by sequence 7: Reserved Tens: Reserved	0x01

5.5.3 Vector control

Asynchronous motors are featured with high order, non-linear, strong coupling and multi-variables, which makes it very difficult to control asynchronous motors during actual application. The vector control theory aims to solve this problem through measuring and controlling the stator current vector of asynchronous motor, and decomposing the stator current vector into exciting current (current component which generates internal magnet field) and torque current (current component which generates torque) based on field orientation principle, and then controlling the amplitude value and phase position of these two components (namely, control the stator current vector of motor) to realize decoupling control of exciting current and torque current, thus achieving high-performance speed regulation of asynchronous motor.

The VFD carries built-in speed sensor-less vector control algorithm, which can be used to drive the asynchronous motor and permanent-magnet synchronous motor simultaneously. As the core algorithm of vector control is based on accurate motor parameter model, the accuracy of motor parameters will impact the control performance of vector control. It is recommended to input accurate motor parameters and carry out motor parameter autotuning before vector operation.

As vector control algorithm is complicated, you should be cautious of regulation on dedicated function parameters of vector control.



Function code	Name	Description	Default value
P00.00	Speed control mode	0:SVC 0 1:SVC 1 2:SVPWM 3:VC **Note: If 0, 1 or 3 is selected, it is required to carry out motor parameter autotuning first.**	2
P00.15	Motor parameter autotuning	0: No operation 1: Rotary autotuning 1; carry out comprehensive motor parameter autotuning; rotary autotuning is used in cases where high control precision is required; 2: Static autotuning 1 (comprehensive autotuning); static autotuning 1 is used in cases where the motor cannot be disconnected from load; 3: Static autotuning 2 (partial autotuning); when current motor is motor 1, only P02.06, P02.07 and P02.08 will be autotuned; when current motor is motor 2,	0

Function code	Name	Description	Default value
		only P12.06, P12.07 and P12.08 will be autotuned. 4: Rotary autotuning 2, which is similar to rotary autotuning 1 but is only applicable to asynchronous motors. 5: Rotary autotuning 3 (partial autotuning), which is only applicable to asynchronous motors.	
P02.00	Type of motor 1	0: Asynchronous motor 1: Synchronous motor	0
P03.00	Speed loop proportional gain 1	0–200.0	20.0
P03.01	Speed loop integral time 1	0.000–10.000s	0.200s
P03.02	Switching low point frequency	0.00Hz–P03.05	5.00Hz
P03.03	Speed loop proportional gain 2	0–200.0	20.0
P03.04	Speed loop integral time 2	0.000–10.000s	0.200s
P03.05	Switching high point frequency	P03.02–P00.03 (Max. output frequency)	10.00Hz
P03.06	Speed loop output filter	0–8 (corresponds to 0–2^8/10ms)	0
P03.07	Electromotion slip compensation coefficient of vector control	50%–200%	100%
P03.08	Brake slip compensation coefficient of vector control	50%–200%	100%
P03.09	Current loop proportional coefficient P	0–65535	1000
P03.10	Current loop integral coefficient I	0–65535	1000
P03.11	Torque setup source selection	1: Keypad (P03.12) 2: AI1 3: AI2 4: AI3 5: Pulse frequency HDIA 6: Multi-step torque 7: Modbus communication 8: PROFIBUS/CANopen/DeviceNet	1

Function code	Name	Description	Default value
		communication 9: Ethernet communication 10: Pulse frequency HDIB 11: EtherCAT/PROFINET communication 12: PLC **Note:** For setting sources 2–6 and 10, 100% corresponds to three times the rated motor current.	
P03.12	Torque set by keypad	-300.0%–300.0% (of rated motor current)	50.0%
P03.13	Torque reference filter time	0.000–10.000s	0.010s
P03.14	Source of upper limit frequency setup of forward rotation in torque control	0: Keypad (P03.16) 1: AI1 (100% corresponds to max. frequency) 2: AI2 (the same as above) 3: AI3 (the same as above) 4: Pulse frequency HDIA (the same as above) 5: Multi-step (the same as above) 6: Modbus communication (the same as above) 7: PROFIBUS /CANopen/ DeviceNet communication (the same as above) 8: Ethernet communication (the same as above) 9: Pulse frequency HDIB (the same as above) 10: EtherCAT/PROFINET communication 11: PLC 12: Reserved **Note: For sources 1–11, 100% relative to the max. frequency**	0
P03.15	Source of upper limit frequency setup of reverse rotation in torque control	0: Keypad (P03.17) 1–11: the same as P03.14	0
P03.16	Keypad limit value of upper limit frequency of forward rotation in torque control	Value range: 0.00 Hz–P00.03 (Max. output frequency)	50.00Hz
P03.17	Keypad limit value of upper limit frequency of reverse		50.00Hz

Function code	Name	Description	Default value
	rotation in torque control		
P03.18	Source of upper limit setup of the torque when motoring	0: Keypad (P03.20) 1: AI1 2: AI2 3: AI3 4: Pulse frequency HDIA 5: Modbus communication 6: PROFIBUS/CANopen/DeviceNet communication 7: Ethernet communication 8: Pulse frequency HDIB 9: EtherCAT/PROFINET communication 10: PLC 11: Reserved **Note:** For setting sources 1–4 and 8, 100% corresponds to three times the rated motor current.	0
P03.19	Source of upper limit setup of braking torque	0: Keypad (P03.21) 1–10: the same as P03.18	0
P03.20	Set upper limit of the torque when motoring via keypad	0.0–300.0% (rated motor current)	180.0%
P03.21	Set upper limit of braking torque via keypad		180.0%
P03.22	Flux-weakening coefficient in constant power area	0.1–2.0	0.3
P03.23	Min. flux-weakening point in constant power area	10%–100%	20%
P03.24	Max. voltage limit	0.0–120.0%	100.0%
P03.25	Pre-exciting time	0.000–10.000s	0.300s
P03.32	Torque control enable	0:Disable 1:Enable	0
P03.33	Flux weakening integral gain	0–8000	1200
P03.35	Control optimization setting	0x0000–0x1111 Ones place: Torque command selection 0: Torque reference 1: Torque current reference Tens place: Reserved	0x0000

Function code	Name	Description	Default value
		0: Reserved 1: Reserved Hundreds place: Whether to enable ASR integral separation 0: Disable 1: Enable Thousands place: Reserved 0: Reserved 1: Reserved	
P03.36	ASR differential gain	0.00–10.00s	0.00s
P03.37	High-frequency ACR proportional coefficient	In the closed-loop vector control mode (P00.00=3), when the frequency is lower than the ACR high-frequency switching threshold (P03.39), the ACR PI parameters are P03.09 and P03.10; and when the frequency is higher than the ACR high-frequency switching threshold (P03.39), the ACR PI parameters are P03.37 and P03.38. Setting range of P03.37: 0–65535 Setting range of P03.38: 0–65535 Setting range of P03.39: 0.0–100.0% (in relative to the maximum frequency)	1000
P03.38	High-frequency ACR integral coefficient		1000
P03.39	ACR high-frequency switching threshold		100.0%
P17.32	Flux linkage	0.0–200.0%	0.0%

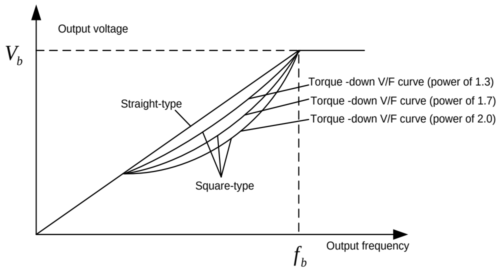
5.5.4 SVPWM control mode

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

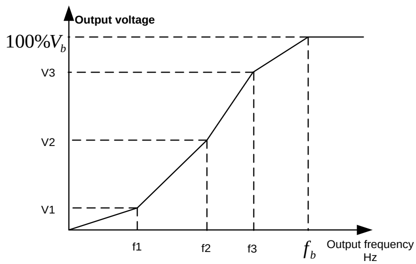
The VFD provides multiple kinds of V/F curve modes to meet different field needs. You can select corresponding V/F curve or set the V/F curve as needed.

Suggestions:

- For the load featuring constant moment, such as conveyor belt which runs in straight line, as the moment should be constant during the whole running process, it is recommended to adopt straight-type V/F curve.
- For the load featuring decreasing moment, such as fan and water pump, as the relation between its actual torque and speed is squared or cubed, it is recommended to adopt the V/F curve corresponds to power 1.3, 1.7 or 2.0.



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



The VFD provides dedicated function codes for SVPWM control mode. You can improve the performance of SVPWM through settings.

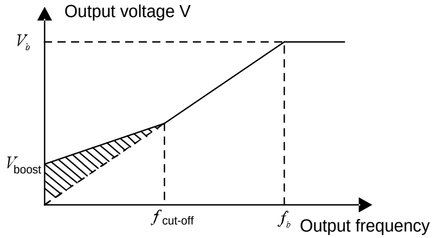
1. Torque boost

Torque boost function can effectively compensate for the low-speed torque performance during SVPWM control. Automatic torque boost has been set by default to enable the VFD to adjust the torque boost value based on actual load conditions.

Note:

(1) Torque boost is effective only under torque boost cut-off frequency;

(2) If the torque boost is too large, low-frequency vibration or overcurrent may occur to the motor, if such situation occurs, lower the torque boost value.



2. Energy-saving run

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

Note:

- This function is generally used in light load or no-load cases.
- This function does for fit in cases where load transient is required.

3. V/F slip compensation gain

SVPWM control belongs to open-loop mode, which will cause motor speed to fluctuate when motor load transients. In cases where strict speed requirement is needed, you can set the slip compensation gain to compensate for the speed variation caused by load fluctuation through VFD internal output adjustment.

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

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

4. Oscillation control

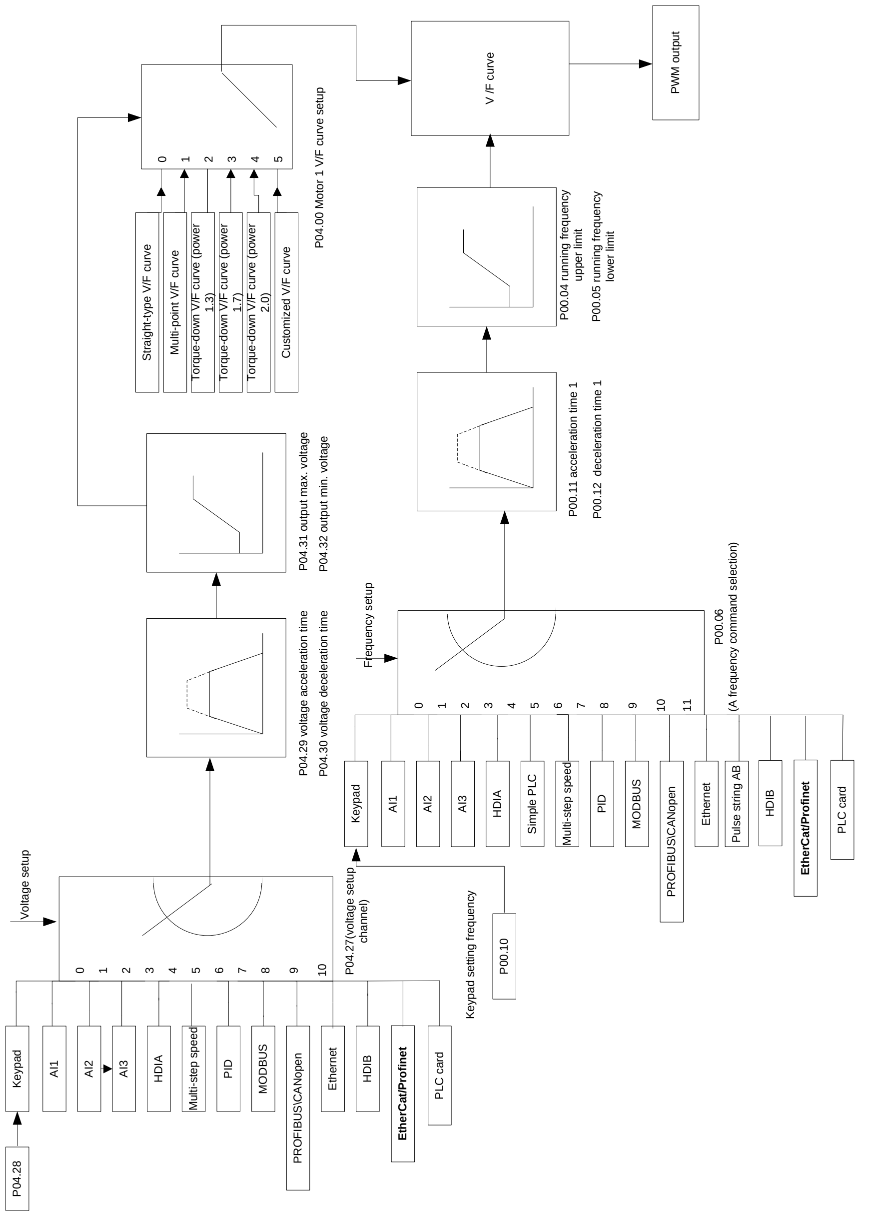
Motor oscillation often occurs in space voltage vector control in large-power driving applications. To solve this problem, the VFD provides two oscillation factor function codes. You can set the function codes based on the oscillation occurrence frequency.

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

5. Asynchronous motor IF control

Generally, the IF control mode is valid for asynchronous motors. It can be used for a synchronous motor only when the frequency of the synchronous motor is extremely low. Therefore, the IF control described in this manual is only involved with asynchronous motors. IF control is implemented by performing closed-loop control on the total output current of the VFD. The output voltage adapts to the current reference, and open-loop control is separately performed over the frequency of the voltage and current.

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



When selecting customized V/F curve function, you can set the reference channels and acceleration/deceleration time of voltage and frequency respectively, which will form a real-time V/F curve through combination.

Note: This kind of V/F curve separation can be applied in various frequency-conversion power sources, however, you should be cautious of parameter setup as improper setup may damage the machine.

Function code	Name	Description	Default value
P00.00	Speed control mode	0:SVC 0 1:SVC 1 2:SVPWM 3:VC **Note:** If 0, 1 or 3 is selected, it is required to carry out motor parameter autotuning first.	2
P00.03	Max. output frequency	P00.04–400.00Hz	50.00Hz
P00.04	Upper limit of running frequency	P00.05–P00.03	50.00Hz
P00.05	Lower limit of running frequency	0.00Hz–P00.04	0.00Hz
P00.11	Acceleration time 1	0.0–3600.0s	Depends on model
P00.12	Deceleration time 1	0.0–3600.0s	Depends on model
P02.00	Type of motor 1	0: Asynchronous motor 1: Synchronous motor	0
P02.02	Rated power of asynchronous motor 1	0.01Hz–P00.03 (Max. output frequency)	50.00Hz
P02.04	Rated voltage of asynchronous motor 1	0–1200V	Depends on model
P04.00	V/F curve setting of motor 1	0: Straight-type V/F curve 1: Multi-point V/F curve 2: Torque-down V/F curve (power of 1.3) 3: Torque-down V/F curve (power of 1.7) 4: Torque-down V/F curve (power of 2.0) 5: Customized V/F (V/F separation)	0
P04.01	Torque boost of motor 1	0.0%: (automatic) 0.1%–10.0%	0.0%
P04.02	Motor 1 torque boost cut-off	0.0%–50.0% (rated frequency of motor 1)	20.0%
P04.03	V/F frequency point 1 of motor 1	0.00Hz–P04.05	0.00Hz
P04.04	V/F voltage point 1 of	0.0%–110.0%	0.0%

Function code	Name	Description	Default value
	motor 1		
P04.05	V/F frequency point 2 of motor 1	P04.03– P04.07	0.00Hz
P04.06	V/F voltage point 2 of motor 1	0.0%–110.0%	0.0%
P04.07	V/F frequency point 3 of motor 1	P04.05– P02.02 or P04.05– P02.16	0.00Hz
P04.08	V/F voltage point 3 of motor 1	0.0%–110.0%	0.0%
P04.09	V/F slip compensation gain of motor 1	0.0–200.0%	100.0%
P04.10	Low-frequency oscillation control factor of motor 1	0–100	10
P04.11	High-frequency oscillation control factor of motor 1	0–100	10
P04.12	Oscillation control threshold of motor 1	0.00Hz–P00.03 (Max. output frequency)	30.00Hz
P04.13	V/F curve setup of motor 2	0: Straight V/F curve; 1: Multi-point V/F curve 2: Torque-down V/F curve (power of 1.3) 3: Torque-down V/F curve (power of 1.7) 4: Torque-down V/F curve (power of 2.0) 5: Customize V/F (V/F separation)	0
P04.14	Torque boost of motor 2	0.0%: (automatic) 0.1%–10.0%	0.0%
P04.15	Motor 2 torque boost cut-off	0.0%–50.0% (rated frequency of motor 1)	20.0%
P04.16	V/F frequency point 1 of motor 2	0.00Hz–P04.18	0.00Hz
P04.17	V/F voltage point 1 of motor 2	0.0%–110.0%	0.0%
P04.18	V/F frequency point 2 of motor 2	P04.16– P04.20	0.00Hz
P04.19	V/F voltage point 2 of motor 2	0.0%–110.0%	0.0%
P04.20	V/F frequency point 3	P04.18–P02.02 or P04.18–P02.16	0.00Hz

Function code	Name	Description	Default value
	of motor 2		
P04.21	V/F voltage point 3 of motor 2	0.0%–110.0%	0.0%
P04.22	V/F slip compensation gain of motor 2	0.0–200.0%	100.0%
P04.23	Low-frequency oscillation control factor of motor 2	0–100	10
P04.24	High-frequency oscillation control factor of motor 2	0–100	10
P04.25	Oscillation control threshold of motor 2	0.00Hz–P00.03 (Max. output frequency)	30.00Hz
P04.26	Energy-saving run	0: No 1: Automatic energy-saving run	0
P04.27	Channel of voltage setup	0: Keypad; output voltage is determined by P04.28 1: AI1 2: AI2 3: AI3 4: HDIA 5: Multi-step 6: PID 7: Modbus communication 8: PROFIBUS/CANopen communication 9: Ethernet communication 10: HDIB 11: EtherCAT/PROFINET communication 12: PLC card 13: Reserved	0
P04.28	Set voltage value via keypad	0.0%–100.0% (rated motor voltage)	100.0%
P04.29	Voltage increase time	0.0–3600.0s	5.0s
P04.30	Voltage decrease time	0.0–3600.0s	5.0s
P04.31	Output max. voltage	P04.32–100.0% (rated motor voltage)	100.0%
P04.32	Output min. voltage	0.0%–P04.31 (rated motor voltage)	0.0%
P04.33	Flux-weakening coefficient in the	1.00–1.30	1.00

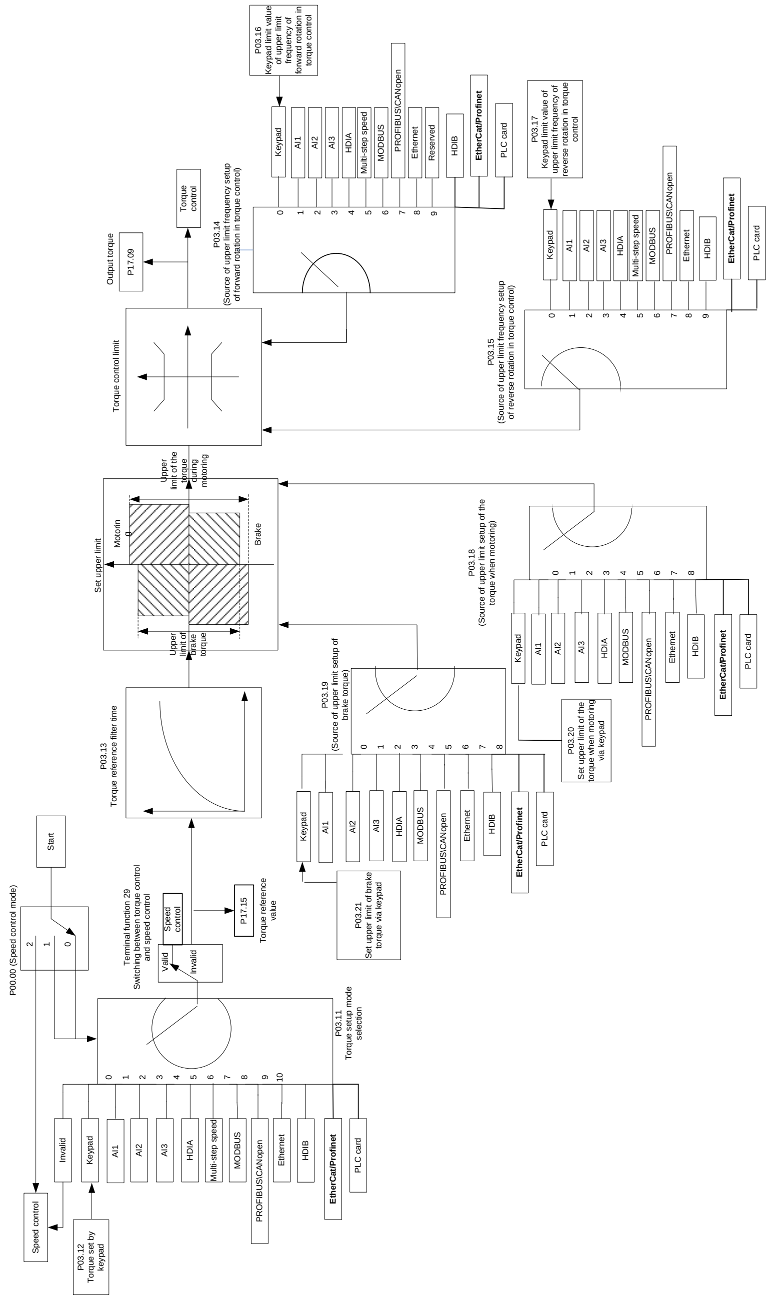
Function code	Name	Description	Default value
	constant power zone		
P04.34	Input current 1 in synchronous motor VF control	When the synchronous motor VF control mode is enabled, this parameter is used to set the reactive current of the motor when the output frequency is lower than the frequency set in P04.36. Setting range: -100.0%–+100.0% (of the rated current of the motor)	20.0%
P04.35	Input current 2 in synchronous motor VF control	When the synchronous motor VF control mode is enabled, this parameter is used to set the reactive current of the motor when the output frequency is higher than the frequency set in P04.36. Setting range: -100.0%–+100.0% (of the rated current of the motor)	10.0%
P04.36	Frequency threshold for input current switching in synchronous motor VF control	When the synchronous motor VF control mode is enabled, this parameter is used to set the frequency threshold for the switching between input current 1 and input current 2. Setting range: 0.00 Hz–P00.03 (Max. output frequency)	50.00Hz
P04.37	Reactive current closed-loop proportional coefficient in synchronous motor VF control	When the synchronous motor VF control mode is enabled, this parameter is used to set the proportional coefficient of the reactive current closed-loop control. Setting range: 0–3000	50
P04.38	Reactive current closed-loop integral time in synchronous motor VF control	When the synchronous motor VF control mode is enabled, this parameter is used to set the integral coefficient of the reactive current closed-loop control. Setting range: 0–3000	30
P04.39	Reactive current closed-loop output limit in synchronous motor VF control	When the synchronous motor VF control mode is enabled, this parameter is used to set the output limit of the reactive current closed-loop control. A greater value indicates a higher reactive closed-loop compensation voltage and higher output power of the motor. In general, you do not need to modify this parameter. Setting range: 0–16000	8000
P04.40	Enable/disable IF	0: Disabled	0

Function code	Name	Description	Default value
	mode for asynchronous motor 1	1: Enabled	
P04.41	Current setting in IF mode for asynchronous motor 1	When IF control is adopted for asynchronous motor 1, this parameter is used to set the output current. The value is a percentage in relative to the rated current of the motor. Setting range: 0.0–200.0%	120.0%
P04.42	Proportional coefficient in IF mode for asynchronous motor 1	When IF control is adopted for asynchronous motor 1, this parameter is used to set the proportional coefficient of the output current closed-loop control. Setting range: 0–5000	650
P04.43	Integral coefficient in IF mode for asynchronous motor 1	When IF control is adopted for asynchronous motor 1, this parameter is used to set the integral coefficient of the output current closed-loop control. Setting range: 0–5000	350
P04.44	Starting frequency point for switching off IF mode for asynchronous motor 1	0.00–P04.50	10.00Hz
P04.45	Enable/disable IF mode for asynchronous motor 2	0: Disable 1: Enable	0
P04.46	Current setting in IF mode for asynchronous motor 2	When IF control is adopted for asynchronous motor 2, this parameter is used to set the output current. The value is a percentage in relative to the rated current of the motor. Setting range: 0.0–200.0%	120.0%
P04.47	Proportional coefficient in IF mode for asynchronous motor 2	When IF control is adopted for asynchronous motor 2, this parameter is used to set the proportional coefficient of the output current closed-loop control. Setting range: 0–5000	650
P04.48	Integral coefficient in IF mode for asynchronous motor 2	When IF control is adopted for asynchronous motor 2, this parameter is used to set the integral coefficient of the output current closed-loop control. Setting range: 0–5000	350
P04.49	Starting frequency point for switching off IF mode for asynchronous motor 2	0.00–P04.51	10.00Hz

Function code	Name	Description	Default value
P04.50	End frequency point for switching off IF mode for asynchronous motor 1	P04.44–P00.03	25.00Hz
P04.51	End frequency point for switching off IF mode for asynchronous motor 2	P04.49–P00.03	25.00Hz

5.5.5 Torque control

The VFD supports torque control and speed control. Speed control mode 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 torque limit. Torque control mode aims to stabilize the torque to keep the set torque consistent with the actual output torque, meanwhile, the output frequency is restricted by upper/lower limit.


P00.00 (Speed control mode)
Start
Speed control
P03.12 Torque set by keypad
Invalid
Keypad
AI1
AI2
AI3
HDIA
Multi-step speed
MODBUS
PROFIBUS\CANopen
Ethernet
HDIB
EtherCat/Profinet
PLC card
P03.11 Torque setup mode selection
Terminal function 29 Switching between torque control and speed control
Valid
Invalid
Speed control
P17.15
Torque reference value
P03.13 Torque reference filter time
Set upper limit
Motoring
Brake
Upper limit of the torque during motoring
Upper limit of brake torque
P03.19 (Source of upper limit setup of brake torque)
P03.21 Set upper limit of brake torque via keypad
P03.18 (Source of upper limit setup of the torque when motoring)
P03.20 Set upper limit of the torque when motoring via keypad
Torque control limit
Output torque
P17.09
Torque control
P03.14 (Source of upper limit frequency setup of forward rotation in torque control)
P03.16 Keypad limit value of upper limit frequency of forward rotation in torque control
Reserved
P03.15 (Source of upper limit frequency setup of reverse rotation in torque control)
P03.17 Keypad limit value of upper limit frequency of reverse rotation in torque control

Function code	Name	Description	Default value
P00.00	Speed control mode	0:SVC 0 1:SVC 1 2:SVPWM 3:VC **Note:** If 0, 1 or 3 is selected, it is required to carry out motor parameter autotuning first.	2
P03.32	Torque control enable	0:Disable 1:Enable	0
P03.11	Torque setup source selection	0: Keypad (P03.12) 1: Keypad (P03.12) 2: AI1 3: AI2 4: AI3 5: Pulse frequency HDIA 6: Multi-step torque 7: Modbus communication 8: PROFIBUS/CANopen/DeviceNet communication 9: Ethernet communication 10: Pulse frequency HDIB 11: EtherCAT/PROFINET communication 12: PLC **Note:** For setting sources 2–6 and 10, 100% corresponds to three times the rated motor current.	0
P03.12	Torque set by keypad	-300.0%–300.0% (rated motor current)	50.0%
P03.13	Torque reference filter time	0.000–10.000s	0.010s
P03.14	Source of upper limit frequency setup of forward rotation in torque control	0: Keypad (P03.16) 1: AI1 (100% corresponds to max. frequency) 2: AI2 (the same as above) 3: AI3 (the same as above) 4: Pulse frequency HDIA (the same as above) 5: Multi-step (the same as above) 6: Modbus communication (the same as above) 7: PROFIBUS /CANopen/ DeviceNet communication (the same as above) 8: Ethernet communication (the same as above)	0

Function code	Name	Description	Default value
		9: Pulse frequency HDIB (the same as above) 10: EtherCAT/PROFINET communication 11: PLC 12: Reserved **Note:** For setting sources 1–11, 100% is relative to the max. frequency.	
P03.15	Source of upper limit frequency setup of reverse rotation in torque control	0: Keypad (P03.17) 1: AI1 (100% corresponds to max. frequency) 2: AI2 (the same as above) 3: AI3 (the same as above) 4: Pulse frequency HDIA (the same as above) 5: Multi-step (the same as above) 6: Modbus communication (the same as above) 7: PROFIBUS /CANopen/ DeviceNet communication (the same as above) 8: Ethernet communication (the same as above) 9: Pulse frequency HDIB (the same as above) 10: EtherCAT/PROFINET communication 11: PLC 12: Reserved **Note:** For setting sources 1–11, 100% is relative to the max. frequency.	0
P03.16	Keypad limit value of upper limit frequency of forward rotation in torque control	0.00Hz–P00.03 (Max. output frequency)	50.00 Hz
P03.17	Keypad limit value of upper limit frequency of reverse rotation in torque control	0.00Hz–P00.03 (Max. output frequency)	50.00 Hz
P03.18	Source of upper limit setup of the torque during motoring	0: Keypad (P03.20) 1: AI1 2: AI2 3: AI3 4: Pulse frequency HDIA 5: Modbus communication 6: PROFIBUS/CANopen/DeviceNet	0

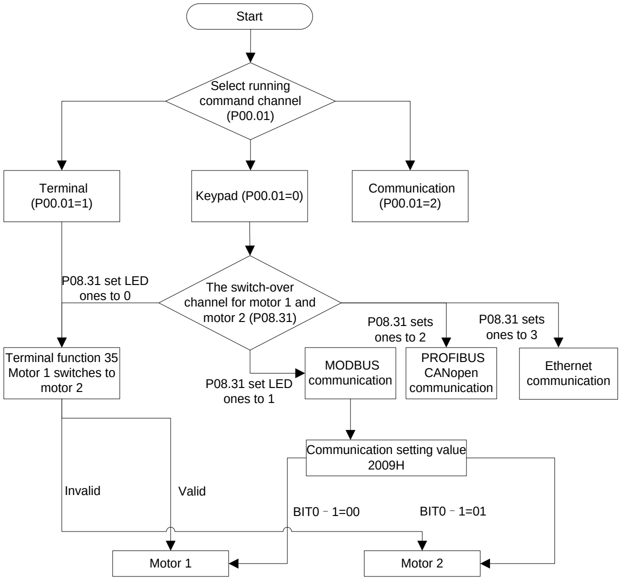
Function code	Name	Description	Default value
		communication 7: Ethernet communication 8: Pulse frequency HDIB 9: EtherCAT/PROFINET communication 10: PLC 11: Reserved **Note:** For setting sources 1–4 and 8, 100% corresponds to three times the rated motor current.	
P03.19	Source of upper limit setup of braking torque	0: Keypad (P03.21) 1: AI1 2: AI2 3: AI3 4: Pulse frequency HDIA 5: Modbus communication 6: PROFIBUS/CANopen/DeviceNet communication 7: Ethernet communication 8: Pulse frequency HDIB 9: EtherCAT/PROFINET communication 10: PLC 11: Reserved **Note:** For setting sources 1–4 and 8, 100% corresponds to three times the rated motor current.	0
P03.20	Set upper limit of the torque when motoring via keypad	0.0–300.0% (rated motor current)	180.0%
P03.21	Set upper limit of braking torque via keypad	0.0–300.0% (rated motor current)	180.0%
P17.09	Motor output torque	-250.0–250.0%	0.0%
P17.15	Torque reference value	-300.0–300.0% (rated motor current)	0.0%

5.5.6 Motor parameter

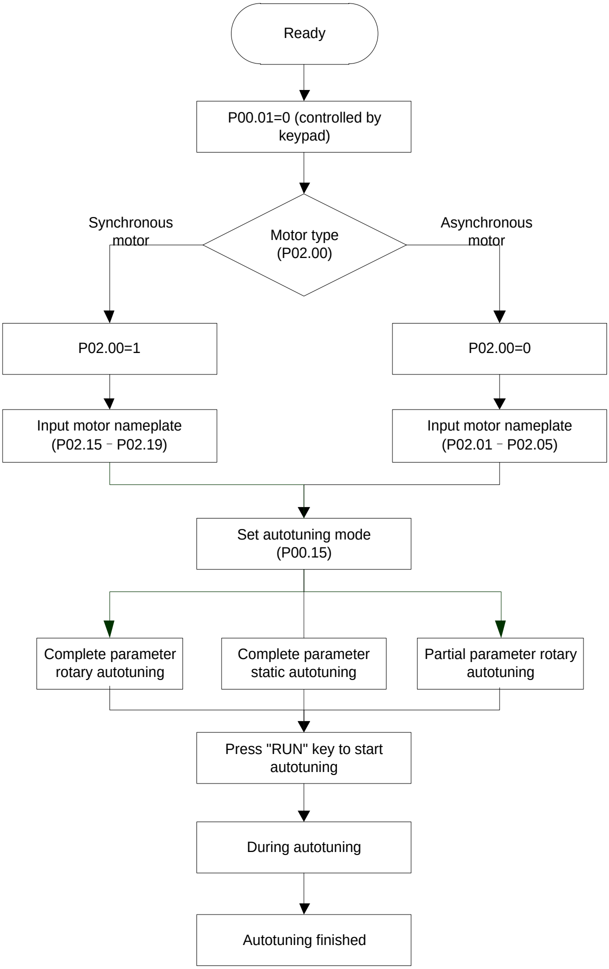
	✧ Check the safety conditions surrounding the motor and load machineries before autotuning as physical injury may occur due to sudden start of motor during

	autotuning. ✧ Although the motor does not run during static autotuning, the motor is stilled supplied with power, do not touch the motor during autotuning; otherwise, electric shock may occur.
⚠	✧ If the motor has been connected to load, do not carry out rotary autotuning; otherwise, misact or damage may occur to the VFD. If rotary autotuning is carried out on a motor which has been connected to load, wrong motor parameters and motor misacts may occur. Disconnect the load to carry out autotuning if necessary.

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



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



Note:

1. Motor parameters must be set correctly according to motor nameplate;
2. If rotary autotuning is selected during motor autotuning, it is a must to disconnect the motor from load to put the motor in static and no-load state, failed to do so may lead to inaccurate autotuned results. At this time, the asynchronous motor can autotune P02.06–P02.10, and synchronous motor can autotune P02.20–P02.23
3. If static autotuning is selected during motor autotuning, there is no need to disconnect the motor from load, as only part of the motor parameters have been autotuned, the control performance may be impacted, under such situation, the asynchronous motor can autotune P02.06–P02.10, while synchronous motor can autotune P02.20–P02.22, P02.23 (counter-emf constant of

synchronous motor 1) can be obtained via calculation.

4. Motor autotuning can be carried out on current motor only, if you need to perform autotuning on the other motor, switch over the motor through selecting the switchover channel of motor 1 and motor 2 by setting the ones of P08.31.

Related parameter list:

Function code	Name	Description	Default value
P00.01	Running command channel	0: Keypad 1: Terminal 2: Communication	0
P00.15	Motor parameter autotuning	0: No operation 1: Rotary autotuning 1; carry out comprehensive motor parameter autotuning; rotary autotuning is used in cases where high control precision is required; 2: Static autotuning 1 (comprehensive autotuning); static autotuning 1 is used in cases where the motor cannot be disconnected from load; 3: Static autotuning 2 (partial autotuning) ; when current motor is motor 1, only P02.06, P02.07 and P02.08 will be autotuned; when current motor is motor 2, only P12.06, P12.07 and P12.08 will be autotuned. 4: Rotary autotuning 2, which is similar to rotary autotuning 1 but is only applicable to asynchronous motors. 5: Rotary autotuning 3 (partial autotuning), which is only applicable to asynchronous motors.	0
P02.00	Type of motor 1	0: Asynchronous motor 1: Synchronous motor	0
P02.01	Rated power of asynchronous motor 1	0.1–3000.0kW	Depends on model
P02.02	Rated frequency of asynchronous motor 1	0.01Hz–P00.03 (Max. output frequency)	50.00Hz
P02.03	Rated speed of asynchronous motor 1	1–60000rpm	Depends on model

Function code	Name	Description	Default value
P02.04	Rated voltage of asynchronous motor 1	0–1200V	Depends on model
P02.05	Rated current of asynchronous motor 1	0.8–6000.0A	Depends on model
P02.06	Stator resistance of asynchronous motor 1	0.001–65.535Ω	Depends on model
P02.07	Rotor resistance of asynchronous motor 1	0.001–65.535Ω	Depends on model
P02.08	Leakage inductance of asynchronous motor 1	0.1–6553.5mH	Depends on model
P02.09	Mutual inductance of asynchronous motor 1	0.1–6553.5mH	Depends on model
P02.10	No-load current of asynchronous motor 1	0.1–6553.5A	Depends on model
P02.15	Rated power of synchronous motor 1	0.1–3000.0kW	Depends on model
P02.16	Rated frequency of synchronous motor 1	0.01Hz–P00.03 (Max. output frequency)	50.00Hz
P02.17	Number of pole pairs of synchronous motor 1	1–50	2
P02.18	Rated voltage of synchronous motor 1	0–1200V	Depends on model
P02.19	Rated current of synchronous motor 1	0.8–6000.0A	Depends on model
P02.20	Stator resistance of synchronous motor 1	0.001–65.535Ω	Depends on model
P02.21	Direct-axis inductance of synchronous motor 1	0.01–655.35mH	Depends on model
P02.22	Quadrature-axis inductance of synchronous motor 1	0.01–655.35mH	Depends on model
P02.23	Counter-emf constant of synchronous motor 1	0–10000	300
P05.01–P05.06	Function of multi-function digital input terminal (S1–S4, HDIA,HDIB)	35: Switch from motor 1 to motor 2	/
P08.31	Switching between motor 1 and motor 2	0x00–0x14 Ones: Switchover channel 0: Switch over by terminal	00

Function code	Name	Description	Default value
		1: Switch over by Modbus communication 2: Switch over by PROFIBUS / CANopen /DeviceNet 3: Switch over by Ethernet communication 4: Switch over by EtherCAT/PROFINET communication Tens: Motor switchover during running 0: Disable switchover during running 1: Enable switchover during running	
P12.00	Type of motor 2	0: Asynchronous motor 1: Synchronous motor	0
P12.01	Rated power of asynchronous motor 2	0.1–3000.0kW	Depends on model
P12.02	Rated frequency of asynchronous motor 2	0.01Hz–P00.03 (Max. output frequency)	50.00Hz
P12.03	Rated speed of asynchronous motor 2	1–60000rpm	Depends on model
P12.04	Rated voltage of asynchronous motor 2	0–1200V	
P12.05	Rated current of asynchronous motor 2	0.8–6000.0A	
P12.06	Stator resistance of asynchronous motor 2	0.001–65.535Ω	
P12.07	Rotor resistance of asynchronous motor 2	0.001–65.535Ω	
P12.08	Leakage inductance of asynchronous motor 2	0.1–6553.5mH	
P12.09	Mutual inductance of asynchronous motor 2	0.1–6553.5mH	
P12.10	No-load current of asynchronous motor 2	0.1–6553.5A	
P12.15	Rated power of synchronous motor 2	0.1–3000.0kW	
P12.16	Rated frequency of synchronous motor 2	0.01Hz–P00.03 (Max. output frequency)	50.00Hz
P12.17	Number of pole pairs of	1–50	2

Function code	Name	Description	Default value
	synchronous motor 2		
P12.18	Rated voltage of synchronous motor 2	0–1200V	Depends on model
P12.19	Rated current of synchronous motor 2	0.8–6000.0A	Depends on model
P12.20	Stator resistance of synchronous motor 2	0.001–65.535Ω	Depends on model
P12.21	Direct-axis inductance of synchronous motor 2	0.01–655.35mH	Depends on model
P12.22	Quadrature-axis inductance of synchronous motor 2	0.01–655.35mH	Depends on model
P12.23	Counter-emf constant of synchronous motor 2	0–10000	300

5.5.7 Start/stop control

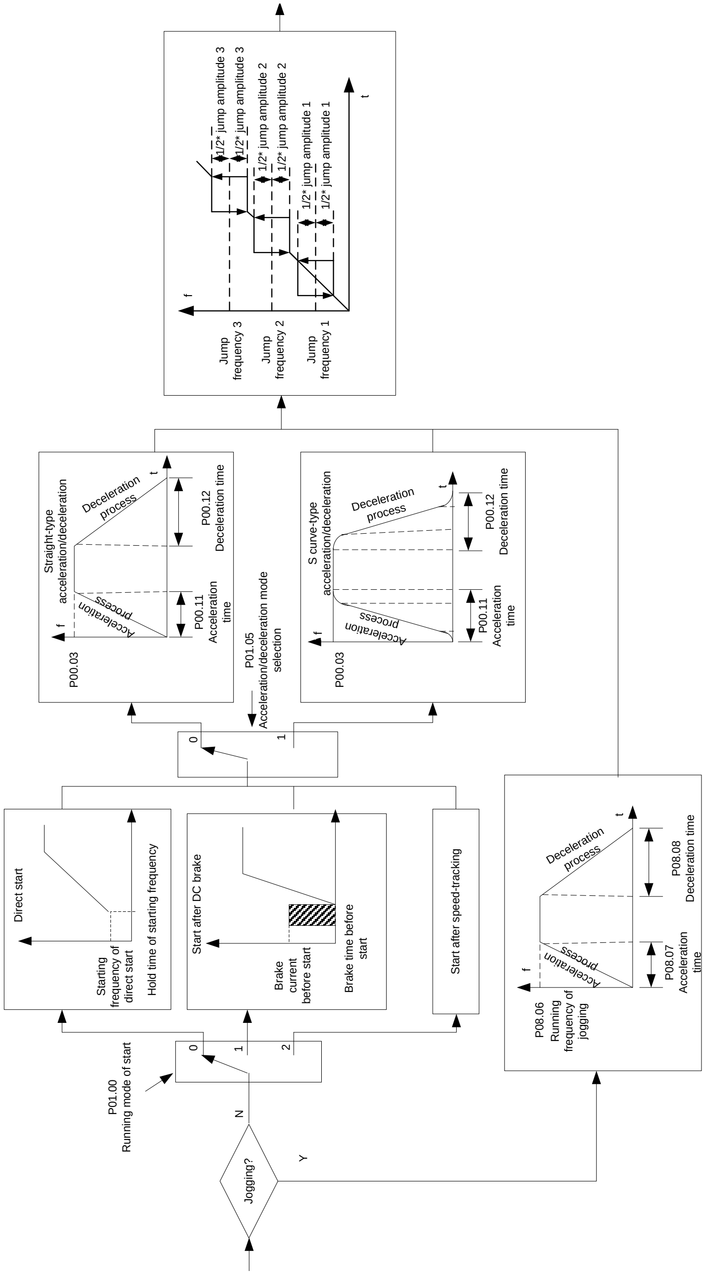
The start/stop control of the VFD is divided into three states: start after running command at power-on; start after restart-at-power-cut function is effective; start after automatic fault reset. Descriptions for these three start/stop control states are presented below.

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

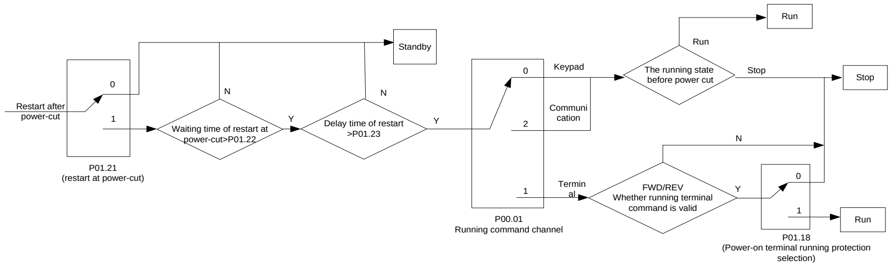
For large-inertia load, especially in cases where reversal may occur, you can choose to start after DC brake or start after speed-racking.

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

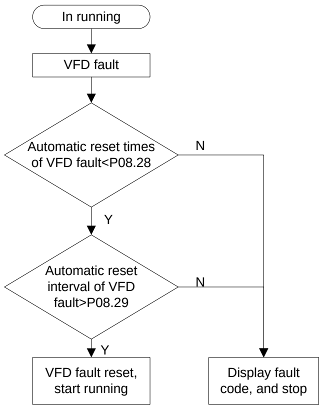
1. Logic diagram for running command after power-on



2. Logic diagram for restart after power-off



3. Logic diagram for restart after automatic fault reset



Related parameter list:

Function code	Name	Description	Default value
P00.01	Running command channel	0: Keypad 1: Terminal 2: Communication	0
P00.11	Acceleration time 1	0.0–3600.0s	Depends on model
P00.12	Deceleration time 1	0.0–3600.0s	Depends on model
P01.00	Running mode of start	0: Direct start 1: Start after DC brake 2: Start after speed-track 1 3: Start after speed-track 2	0
P01.01	Starting frequency of direct start	0.00–50.00Hz	0.50Hz
P01.02	Hold time of starting	0.0–50.0s	0.0s

Function code	Name	Description	Default value
	frequency		
P01.03	DC brake current before start	0.0–100.0%	0.0%
P01.04	DC brake time before start	0.00–50.00s	0.00s
P01.05	Acceleration/deceleration mode	0: Straight line 1: S curve Note: If mode 1 is selected, it is required to set P01.07, P01.27 and P01.08 accordingly	0
P01.08	Stop mode	0: Decelerate to stop 1: Coast to stop	0
P01.09	Starting frequency of DC brake after stop	0.00Hz–P00.03 (Max. output frequency)	0.00Hz
P01.10	Waiting time of DC brake after stop	0.00–50.00s	0.00s
P01.11	DC brake current of stop	0.0–100.0%	0.0%
P01.12	DC brake time of stop	0.00–50.00s	0.00s
P01.13	Deadzone time of forward/reverse rotation	0.0–3600.0s	0.0s
P01.14	Forward/reverse rotation switchover mode	0: switch over after zero frequency 1: switch over after starting frequency 2: switch over after passing stop speed and delay	1
P01.15	Stop speed	0.00–100.00Hz	0.50 Hz
P01.16	Stop speed detection mode	0: Set value of speed (the only detection mode valid in SVPWM mode) 1: Detection value of speed	1
P01.18	Power-on terminal running protection selection	0: Terminal running command is invalid at power-on 1: Terminal running command is valid at power-on	0
P01.19	Action selection when the running frequency is below lower limit (lower limit should be larger than 0)	0: Run at the lower limit frequency 1: Stop 2: Sleep	0
P01.20	Wake-up-from-sleep delay	0.0–3600.0s (valid when P01.19 is 2)	0.0s
P01.21	Restart after power cut	0: Restart is disabled 1: Restart is enabled	0

Function code	Name	Description	Default value
P01.22	Waiting time of restart after power cut	0.0–3600.0s (valid when P01.21 is 1)	1.0s
P01.23	Start delay	0.0–60.0s	0.0s
P01.24	Stop speed delay	0.0–100.0s	0.0s
P01.25	Open-loop 0Hz output selection	0: No voltage output 1: With voltage output 2: Output as per DC brake current of stop	0
P01.26	Deceleration time of emergency-stop	0.0–60.0s	2.0s
P01.27	Time of starting section of deceleration S curve	0.0–50.0s	0.1s
P01.28	Time of ending section of deceleration S curve	0.0–50.0s	0.1s
P01.29	Short-circuit brake current	0.0–150.0% (of rated VFD output current)	0.0%
P01.30	Hold time of short-circuit brake at startup	0.00–50.00s	0.00s
P01.31	Hold time of short-circuit brake at stop	0.00–50.00s	0.00s
P01.32	Pre-exciting time of jogging	0–10.000s	0.000s
P01.33	Starting frequency of braking for jogging to stop	0–P00.03	0.00Hz
P01.34	Delay to enter sleep	0–3600.0s	0.0s
P05.01–P05.06	Digital input function selection	1: Forward running 2: Reverse running 4: Forward jogging 5: Reverse jogging 6: Coast to stop 7: Fault reset 8: Running pause 21: Acceleration/deceleration time selection 1 22: Acceleration/deceleration time selection 2 30: Acceleration/deceleration disabled	/
P08.06	Running frequency of jog	0.00Hz–P00.03 (Max. output frequency)	5.00Hz
P08.07	Acceleration time at jogging	0.0–3600.0s	Depends on model

Function code	Name	Description	Default value
P08.08	Deceleration time at jogging	0.0–3600.0s	Depends on model
P08.00	Acceleration time 2	0.0–3600.0s	Depends on model
P08.01	Declaration time 2	0.0–3600.0s	Depends on model
P08.02	Acceleration time 3	0.0–3600.0s	Depends on model
P08.03	Declaration time 3	0.0–3600.0s	Depends on model
P08.04	Acceleration time 4	0.0–3600.0s	Depends on model
P08.05	Declaration time 4	0.0–3600.0s	Depends on model
P08.19	Switching frequency of acceleration/deceleration time	0.00–P00.03 (Max. output frequency) 0.00Hz: No switch over If the running frequency is larger than P08.19, switch to acceleration /deceleration time 2	0
P08.21	Reference frequency of acceleration/deceleration time	0: Max. output frequency 1: Set frequency 2: 100Hz Note: Valid for straight-line acceleration/deceleration only	0
P08.28	Automatic fault reset times	0–10	0
P08.29	Automatic fault reset time interval	0.1–3600.0s	1.0s

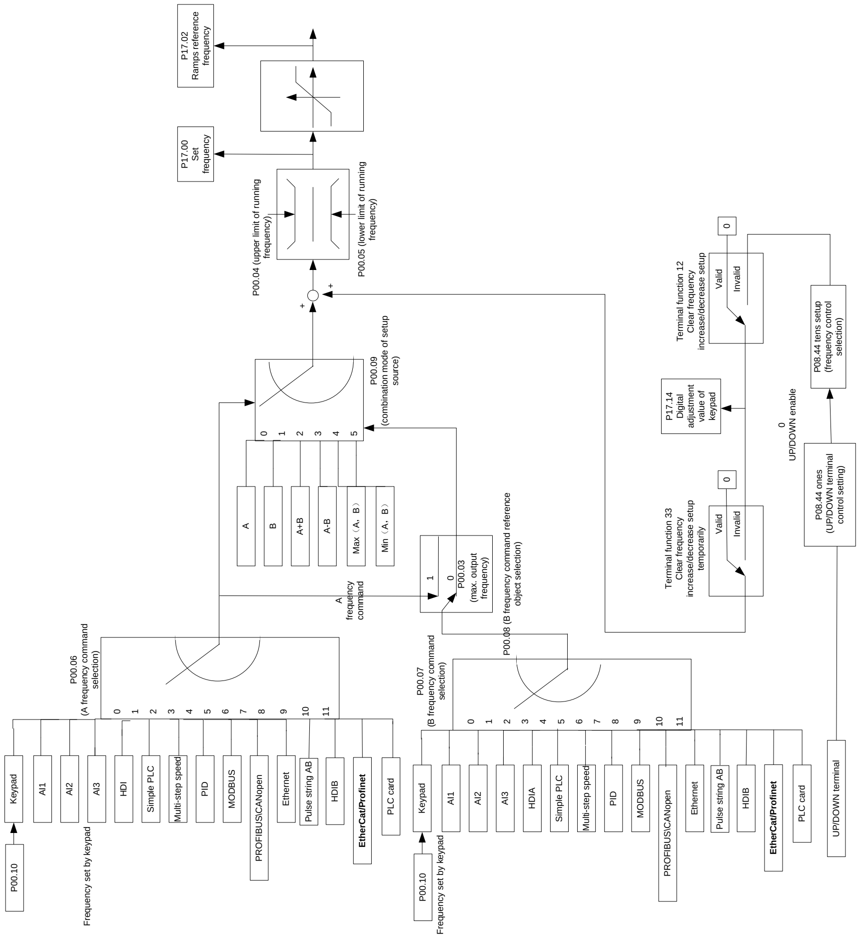
5.5.8 Frequency setup

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 A frequency reference channel and B frequency reference channel. These two channels support simple arithmetical operation between each other, and they can be switched dynamically by setting multi-function terminals.

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

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



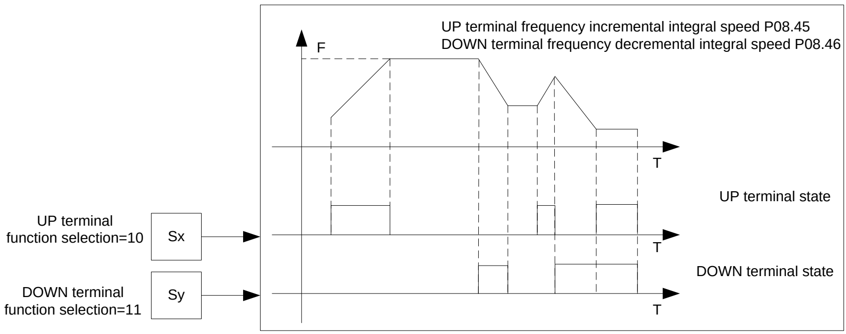
The VFD supports switchover between different reference channels, and the rules for channel switchover are shown below.

Present reference channel P00.09	Multi-function terminal function 13 Channel A switches to channel B	Multi-function terminal function 14 Combination setup switches to channel A	Multi-function terminal function 15 Combination setup switches to channel B
A	B	/	/
B	A	/	/
A+B	/	A	B

Present reference channel P00.09	Multi-function terminal function 13 Channel A switches to channel B	Multi-function terminal function 14 Combination setup switches to channel A	Multi-function terminal function 15 Combination setup switches to channel B
A-B	/	A	B
Max (A, B)	/	A	B
Min (A, B)	/	A	B

Note: "/" indicates this multi-function 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 (UP terminal frequency incremental change rate) and P08.46 (DOWN terminal frequency decremental change rate).



Related parameter list:

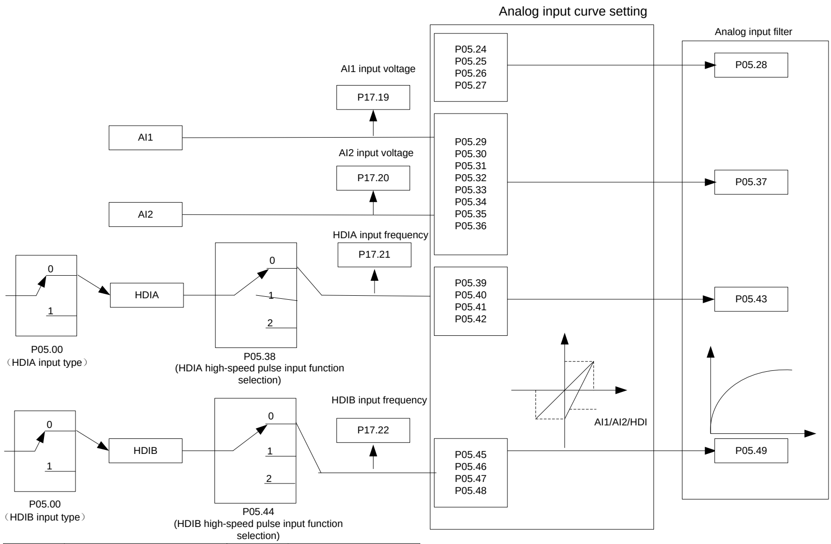
Function code	Name	Description	Default value
P00.03	Max. output frequency	P00.04–400.00Hz	50.00Hz
P00.04	Upper limit of running frequency	P00.05–P00.03	50.00Hz
P00.05	Lower limit of running frequency	0.00Hz–P00.04	0.00Hz
P00.06	A frequency command selection	0: Keypad 1: AI1 2: AI2 3: AI3 4: High speed pulse HDIA 5: Simple PLC program 6: Multi-step speed running 7: PID control 8: Modbus communication	0
P00.07	B frequency command selection		15

Function code	Name	Description	Default value
		9: PROFIBUS/CANopen/DeviceNet communication 10: Ethernet communication 11: High speed pulse HDIB 12: Pulse string AB 13: EtherCAT/PROFINET communication 14: PLC card 15: Reserved	
P00.08	Reference object of B frequency command	0: Max. output frequency 1: A frequency command	0
P00.09	Combination mode of setup source	0: A 1: B 2: (A+B) 3: (A-B) 4: Max (A, B) 5: Min (A, B)	0
P05.01–P05.06	Function of multi-function digital input terminal (S1–S4, HDIA, HDIB)	10: Frequency increase (UP) 11: Frequency decrease (DOWN) 12: Clear frequency increase/decrease setting 13: Switchover between setup A and setup B 14: Switchover between combination setup and setup A 15: Switchover between combination setup and setup B	/
P08.42	Reserved	/	/
P08.43	Reserved	/	/
P08.44	UP/DOWN terminal control	0x000–0x221 Ones: Frequency enabling selection 0: UP/DOWN terminal setting is valid 1: UP/DOWN terminal setting is invalid Tens: Frequency control selection 0: Valid only when P00.06=0 or P00.07=0 1: Valid for all frequency modes 2: Invalid for multi-step speed when multi-step speed takes priority	0x000

Function code	Name	Description	Default value
		Hundreds: Action selection at stop 0: Valid 1: Valid during running, clear after stop 2: Valid during running, clear after receiving stop command	
P08.45	UP terminal frequency incremental change rate	0.01–50.00 Hz/s	0.50 Hz/s
P08.46	DOWN terminal frequency decremental change rate	0.01–50.00 Hz/s	0.50 Hz/s
P17.00	Set frequency	0.00Hz–P00.03 (Max. output frequency)	0.00Hz
P17.02	Ramp reference frequency	0.00Hz–P00.03 (Max. output frequency)	0.00Hz
P17.14	Digital adjustment value	0.00Hz–P00.03	0.00Hz

5.5.9 Analog input

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



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

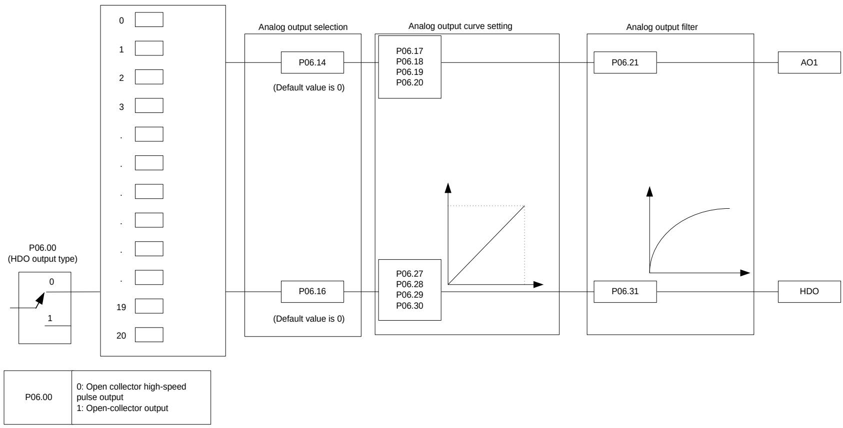
Related parameter list:

Function code	Name	Description	Default value
P05.00	HDI input type	0x00–0x11 Ones: HDIA input type 0: HDIA is high-speed pulse input 1: HDIA is digital input Tens: HDIB input type 0: HDIB is high-speed pulse input 1: HDIB is digital input	0x00
P05.24	Lower limit value of AI1	0.00V–P05.26	0.00V
P05.25	Corresponding setting of lower limit of AI1	-300.0%–300.0%	0.0%
P05.26	Upper limit value of AI1	P05.24–10.00V	10.00V
P05.27	Corresponding setting of upper limit of AI1	-300.0%–300.0%	100.0%
P05.28	Input filter time of AI1	0.000s–10.000s	0.100s
P05.29	Lower limit value of AI2	-10.00V–P05.31	-10.00V
P05.30	Corresponding setting of lower limit of AI2	-300.0%–300.0%	-100.0%
P05.31	Intermediate value 1 of AI2	P05.29–P05.33	0.00V
P05.32	Corresponding setting of intermediate value 1 of AI2	-300.0%–300.0%	0.0%
P05.33	Intermediate value 2 of AI2	P05.31–P05.35	0.00V
P05.34	Corresponding setting of intermediate value 2 of AI2	-300.0%–300.0%	0.0%
P05.35	Upper limit value of AI2	P05.33–10.00V	10.00V
P05.36	Corresponding setting of upper limit of AI2	-300.0%–300.0%	100.0%
P05.37	Input filter time of AI2	0.000s–10.000s	0.100s
P05.38	HDIA high-speed pulse input function	0: Set input via frequency 1: Reserved 2: Input via encoder, used in combination with HDIB	0
P05.39	Lower limit frequency of HDIA	0.000 kHz – P05.41	0.000kHz
P05.40	Corresponding setting of lower limit frequency of HDIA	-300.0%–300.0%	0.0%

Function code	Name	Description	Default value
P05.41	Upper limit frequency of HDIA	P05.39 –50.000kHz	50.000kHz
P05.42	Corresponding setting of upper limit frequency of HDIA	-300.0%–300.0%	100.0%
P05.43	HDIA frequency input filter time	0.000s–10.000s	0.030s
P05.44	HDIB high-speed pulse input function selection	0: Set input via frequency 1: Reserved 2: Input via encoder, used in combination with HDIA	0
P05.45	Lower limit frequency of HDIB	0.000 kHz – P05.47	0.000kHz
P05.46	Corresponding setting of lower limit frequency of HDIB	-300.0%–300.0%	0.0%
P05.47	Upper limit frequency of HDIB	P05.45 –50.000kHz	50.000kHz
P05.48	Corresponding setting of upper limit frequency of HDIB	-300.0%–300.0%	100.0%
P05.49	HDIB frequency input filter time	0.000s–10.000s	0.030s
P05.50	AI1 input signal type	0–1 0: Voltage type 1: Current type	0

5.5.10 Analog output

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



AO output relationship description:

(The min. value and max. value of the output correspond to 0.% and 100.00% of the pulse or analog default output. The actual output voltage or pulse frequency corresponds to the actual percentage, which can be through function codes.)

Set value	Function	Description
0	Running frequency	0–Max. output frequency
1	Set frequency	0–Max. output frequency
2	Ramp reference frequency	0–Max. output frequency
3	Running speed	0–Synchronous speed corresponding to max. output frequency
4	Output current (relative to VFD)	0–Twice the VFD rated current
5	Output current (relative to motor)	0–Twice the motor rated current
6	Output voltage	0–1.5 times the VFD rated voltage
7	Output power	0–Twice the motor rated power
8	Set torque value	0–Twice the motor rated current. A negative value corresponds to 0.0% by default.
9	Output torque	0 – +/-(Twice the motor rated torque)
10	AI1 input value	0–10V/0–20mA
11	AI2 input value	0V–10V. A negative value corresponds to 0.0% by default.
12	AI3 input value	0–10V/0–20mA
13	Input value of high-speed pulse HDIA	0.00–50.00kHz

Set value	Function	Description
14	Set value 1 of Modbus communication	0–1000
15	Set value 2 of Modbus communication	0–1000
16	Set value 1 of PROFIBUS/CANopen/DeviceNet communication	0–1000
17	Set value 2 of PROFIBUS/CANopen/DeviceNet communication	0–1000
18	Set value 1 of Ethernet communication	0–1000
19	Set value 2 of Ethernet communication	0–1000
20	Input value of high-speed pulse HDIB	0.00–50.00kHz
21	Set value 1 of EtherCAT/PROFINET communication	0–1000. A negative value corresponds to 0.0% by default.
22	Torque current (bipolar)	0–Triple the motor rated current. A negative value corresponds to 0.0% by default.
23	Exciting current	0–Triple the motor rated current. A negative value corresponds to 0.0% by default.
24	Set frequency (bipolar)	0–Max. output frequency. A negative value corresponds to 0.0% by default.
25	Ramp reference frequency (bipolar)	0–Max. output frequency. A negative value corresponds to 0.0% by default.
26	Running speed (bipolar)	0–Synchronous speed corresponding to max. output frequency. A negative value corresponds to 0.0% by default.
27	Set value 2 of EtherCAT/PROFINET communication	0–1000
28	C_AO1 from PLC	0–1000
29	C_AO2 from PLC	0–1000
30	Running speed	0–Twice the motor rated synchronous speed.
31	Output torque (bipolar)	0–Twice the motor rated torque. A negative value corresponds to 0.0% by default.

Set value	Function	Description
32–47	Reserved	

Related parameter list:

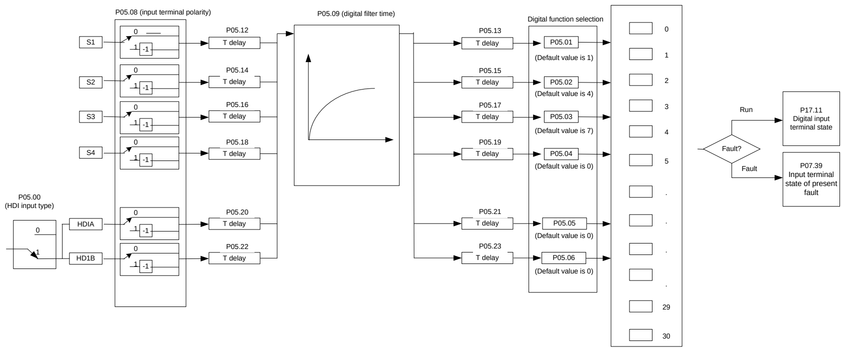
Function code	Name	Description	Default value
P06.00	HDO output type	0: Open collector high-speed pulse output 1: Open collector output	0
P06.14	AO1 output selection	0: Running frequency (0–Max. output frequency) 1: Set frequency (0–Max. output frequency) 2: Ramp reference frequency (0–Max. output frequency) 3: Rotational speed (0–Speed corresponding to max. output frequency) 4: Output current (0–Twice the VFD rated current) 5: Output current (0–Twice the motor rated current) 6: Output voltage (0–1.5 times the VFD rated voltage) 7: Output power (0–Twice the motor rated power) 8: Set torque (0–Twice the motor rated current) 9: Output torque (Absolute value, 0–+/-Twice the motor rated torque) 10: AI1 input (0–10V/0–20mA) 11: AI2 input (0–10V) 12: AI3 input (0–10V/0–20mA) 13: HDIA input (0.00–50.00kHz) 14: Value 1 set through Modbus (0–1000) 15: Value 2 set through Modbus (0–1000) 16: Value 1 set through PROFIBUS/CANopen/DeviceNet (0–1000)	0
P06.15	Reserved		0
P06.16	HDO high-speed pulse output		0

Function code	Name	Description	Default value
		17: Value 2 set through PROFIBUS/CANopen/DeviceNet (0–1000) 18: Value 1 set through Ethernet 1 (0–1000) 19: Value 2 set through Ethernet 2 (0–1000) 20: HDIB input (0.00–50.00kHz) 21: Value 1 set through EtherCat/Profinet/EtherNetIP (0–1000) 22: Torque current (bipolar, 0–Triple the motor rated current) 23: Exciting current (bipolar, 0–Triple the motor rated current) 24: Set frequency (bipolar, 0–Max. output frequency) 25: Ramp reference frequency (bipolar, 0–Max. output frequency) 26: Rotational speed (bipolar, 0–Speed corresponding to max. output frequency) 27: Value 2 set through EtherCat/Profinet/EtherNetIP (0–1000) 28: C_AO1 (Set P27.00 to 1. 0–1000) 29: C_AO2 (Set P27.00 to 1. 0–1000) 30: Rotational speed (0–Twice the motor rated synchronous speed) 31: Output torque (Actual value, 0–Twice the motor rated torque) 32–47: Reserved	
P06.17	Lower limit of AO1 output	-300.0%–P06.19	0.0%
P06.18	Corresponding AO1 output of lower limit	0.00V–10.00V	0.00V
P06.19	Upper limit of AO1 output	P06.17–300.0%	100.0%
P06.20	Corresponding AO1 output of upper limit	0.00V–10.00V	10.00V
P06.21	AO1 output filter time	0.000s–10.000s	0.000s
P06.22–	Reserved variable	0–65535	0

Function code	Name	Description	Default value
P06.26			
P06.27	Lower limit of HDO output	-300.0%–P06.29	0.0%
P06.28	Corresponding HDO output of lower limit	0.00–50.00kHz	0.0kHz
P06.29	Upper limit of HDO output	P06.27–300.0%	100.0%
P06.30	Corresponding HDO output of upper limit	0.00–50.00kHz	50.00kHz
P06.31	HDO output filter time	0.000s–10.000s	0.000s

5.5.11 Digital input

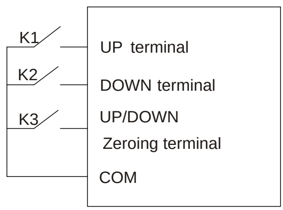
The VFD carries four programmable digital input terminals and two HDI input terminals. The function of all the digital input terminals can be programmed by function codes. HDI input terminal can be set to act as high-speed pulse input terminal or common digital input terminal; if it is set to act as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



The parameters are used to set the corresponding function of digital multi-function input terminals.

Note: Two different multi-function input terminals cannot be set to the same function.

Set value	Function	Description
0	No function	The VFD does not act even if there is signal input; you can set the unused terminals to "no function" to avoid misacts.
1	Forward running (FWD)	Control the forward/reverse running of the VFD by external terminals.
2	Reverse running (REV)	
3	3-wire control/Sin	Set the VFD running mode to 3-wire control mode by this terminal. See P05.13 for details.

<table>
<tr><th>Set value</th><th>Function</th><th>Description</th></tr>
<tr><td>4</td><td>Forward jogging</td><td rowspan="2">Frequency when jogging, see P08.06, P08.07 and P08.08 for jogging acceleration/deceleration time.</td></tr>
<tr><td>5</td><td>Reverse jogging</td></tr>
<tr><td>6</td><td>Coast to stop</td><td>The VFD blocks output, and the stop process of motor is uncontrolled by the VFD. This mode is applied in cases of large-inertia load and free stop time; its definition is the same with P01.08, and it is mainly used in remote control.</td></tr>
<tr><td>7</td><td>Fault reset</td><td>External fault reset function, its function is the same with the STOP/RST key on the keypad. This function can be used in remote fault reset.</td></tr>
<tr><td>8</td><td>Running pause</td><td>The VFD decelerates to stop, however, all the running parameters are in memory state, such as PLC parameter, wobbling frequency, and PID parameter. After this signal disappears, the VFD will revert to the state before stop.</td></tr>
<tr><td>9</td><td>External fault input</td><td>When external fault signal is transmitted to the VFD, the VFD releases fault alarm and stops.</td></tr>
<tr><td>10</td><td>Frequency increase (UP)</td><td rowspan="3">Used to change the frequency-increase/decrease command when the frequency is given by external terminals.

The terminal used to clear frequency-increase/decrease setting can clear the frequency value of auxiliary channel set by UP/DOWN, thus restoring the reference frequency to the frequency given by main reference frequency command channel.</td></tr>
<tr><td>11</td><td>Frequency decrease (DOWN)</td></tr>
<tr><td>12</td><td>Clear frequency increase/decrease setting</td></tr>
<tr><td>13</td><td>Switching between A setting and B setting</td><td rowspan="3">This function is used to switch between the frequency setting channels.
A frequency reference channel and B frequency reference channel can be switched by no. 13 function; the combination channel set by P00.09 and the A frequency reference channel can be switched by no. 14 function; the combination channel set by P00.09 and the</td></tr>
<tr><td>14</td><td>Switching between combination setting and A setting</td></tr>
<tr><td>15</td><td>Switching between combination setting and B</td></tr>
</table>

<table>
<tr><th>Set value</th><th>Function</th><th>Description</th></tr>
<tr><td></td><td>setting</td><td>B frequency reference channel can be switched by no. 15 function.</td></tr>
<tr><td>16</td><td>Multi-step speed terminal 1</td><td rowspan="4">16-step speeds can be set by combining digital states of these four terminals.
Note: Multi-step speed 1 is low bit, multi-step speed 4 is high bit.<table><tr><th>Multi-step speed 4</th><th>Multi-step speed 3</th><th>Multi-step speed 2</th><th>Multi-step speed 1</th></tr><tr><td>BIT3</td><td>BIT2</td><td>BIT1</td><td>BIT0</td></tr></table></td></tr>
<tr><td>17</td><td>Multi-step speed terminal 2</td></tr>
<tr><td>18</td><td>Multi-step speed terminal 3</td></tr>
<tr><td>19</td><td>Multi-step speed terminal 4</td></tr>
<tr><td>20</td><td>Multi-step speed pause</td><td>Pause multi-step speed selection function to keep the set value in present state.</td></tr>
<tr><td>21</td><td>Acceleration/deceleration time selection 1</td><td rowspan="2">Use these two terminals to select four groups of acceleration/decoration time.<table><tr><th>Terminal 1</th><th>Terminal 2</th><th>Acceleration or deceleration time selection</th><th>Corresponding parameter</th></tr><tr><td>OFF</td><td>OFF</td><td>Acceleration/ deceleration time 1</td><td>P00.11/P00.12</td></tr><tr><td>ON</td><td>OFF</td><td>Acceleration/ deceleration time 2</td><td>P08.00/P08.01</td></tr><tr><td>OFF</td><td>ON</td><td>Acceleration/ deceleration time 3</td><td>P08.02/P08.03</td></tr><tr><td>ON</td><td>ON</td><td>Acceleration/ deceleration time 4</td><td>P08.04/P08.05</td></tr></table></td></tr>
<tr><td>22</td><td>Acceleration/deceleration time selection 2</td></tr>
<tr><td>23</td><td>Simple PLC stop reset</td><td>Restart simple PLC process and clear previous PLC state information.</td></tr>
<tr><td>24</td><td>Simple PLC pause</td><td>The program pauses during PLC execution, and keeps running in current speed step. After this function is cancelled, simple PLC keeps running.</td></tr>
<tr><td>25</td><td>PID control pause</td><td>PID is ineffective temporarily, and the VFD maintains current frequency output.</td></tr>
<tr><td>26</td><td>Wobbling frequency pause (stop at current frequency)</td><td>The VFD pauses at current output. After this function is canceled, it continues wobbling-frequency operation at current frequency.</td></tr>
<tr><td>27</td><td>Wobbling frequency reset (revert to center frequency)</td><td>The set frequency of VFD reverts to center frequency.</td></tr>
<tr><td>28</td><td>Counter reset</td><td>Zero out the counter state.</td></tr>
<tr><td>29</td><td>Switching between speed</td><td>The VFD switches from torque control mode to speed</td></tr>
</table>

Set value	Function	Description
	control and torque control	control mode, or vice versa.
30	Acceleration/deceleration disabled	Ensure the VFD will not be impacted by external signals (except for stop command), and maintains current output frequency.
31	Counter trigger	Enable pulse counting of the counter.
33	Clear frequency increase/decrease setting temporarily	When the terminal is closed, the frequency value set by UP/DOWN can be cleared to restore to the frequency given by frequency command channel; when the terminal is disconnected, it will revert to the frequency value after frequency increase/decrease setting.
34	DC brake	The VFD starts DC brake immediately after the command becomes valid.
35	Switching between motor 1 and motor 2	When this terminal is valid, you can realize switchover control of two motors.
36	Command switches to keypad	When this terminal is valid, the running command channel will switch to keypad compulsorily. If this function becomes invalid, the running command channel will revert to the original state.
37	Command switches to terminal	When this terminal is valid, the running command channel will switch to terminal compulsorily. If this function becomes invalid, the running command channel will revert to the original state.
38	Command switches to communication	When this terminal is valid, the running command channel will switch to communication compulsorily. If this function becomes invalid, the running command channel will revert to the original state.
39	Pre-exciting command	When this terminal is valid, motor pre-exciting will be started until this terminal becomes invalid.
40	Zero out power consumption quantity	After this command becomes valid, the power consumption quantity of the VFD will be zeroed out.
41	Maintain power consumption quantity	When this command is valid, current operation of the VFD will not impact the power consumption quantity.
42	Source of upper torque limit switches to keypad	When this command is valid, the upper limit of the torque will be set by keypad
43	Position reference point input	Valid only for S1, S2, and S3
44	Disable spindle orientation	Spindle orientation is invalid.
45	Spindle zeroing/local	Spindle positioning is triggered.

Set value	Function	Description
	position zeroing	
46	Spindle zero position selection 1	Spindle zero position selection 1
47	Spindle zero position selection 2	Spindle zero position selection 2
48	Spindle scale division selection 1	Spindle scale division selection 1
49	Spindle scale division selection 2	Spindle scale division selection 2
50	Spindle scale division selection 3	Spindle scale division selection 3
51	Position/speed control switchover terminal	Terminal for switching between position control and speed control
52	Disable pulse input	Pulse input is invalid when the terminal is valid.
53	Clear position deviation	Used to clear the input deviation of position loop
54	Switch position proportional gains	Used to switch position proportional gains
55	Enable cyclic digital positioning	Cyclic positioning can be enabled when digital positioning is valid.
56	Emergency stop	When this command is valid, the motor decelerate to emergency stop as per the time set by P01.26.
57	Motor overtemperature fault input	Motor stops at motor over-temperature fault input.
59	Switch from FVC to SVPWM control	When this terminal is valid in stop state, switch to SVPWM control.
60	Switch to FVC control	When this terminal is valid in stop state, switch to FVC (closed-loop vector) control.
61	PID polarity switchover	Switching the output polarity of PID, this terminal should be used in conjunction with P09.03
62	Reserved	
63	Enable servo	When the thousands place of P21.00 is set to enable the servo, the servo enabling terminal is valid, which controls the VFD to enter zero servo control. At this situation, no startup command is needed.
64	FWD max. limit	Max frequency limit on forward rotation
65	REV max limit	Max frequency limit on reverse rotation
66	Zero out the counter	Zero out the position counting value

Set value	Function	Description
67	Pulse increase	When the terminal function is valid, the pulse input is increased according to the P21.27 pulse speed.
68	Enable pulse superimposition	When the pulse superimposition is enabled, pulse increase and pulse decrease are effective.
69	Pulse decrease	When the terminal function is valid, the pulse input is decreased according to the P21.27 pulse speed.
70	Electronic gear selection	When the terminal is valid, the proportional numerator is switched to the P21.30 numerator of the 2nd command ratio.
71	Switch to mater	In stopped state, if the function is valid, the master is used.
72	Switch to slave	In stopped state, if the function is valid, the slave is used.
73–79	Reserved	

Related parameter list:

Function code	Name	Description	Default value
P05.00	HDI input type	0x00–0x11 Ones: HDIA input type 0: HDIA is high-speed pulse input 1: HDIA is digital input Tens: HDIB input type 0: HDIB is high-speed pulse input 1: HDIB is digital input	0x00
P05.01	Function of S1 terminal	0: No function 1: Forward running 2: Reverse running 3: 3-wire control/Sin 4: Forward jogging 5: Reverse jogging 6: Coast to stop 7: Fault reset 8: Running pause 9: External fault input 10: Frequency increase (UP) 11: Frequency decrease (DOWN) 12: Clear frequency increase/decrease setting 13: Switchover between setup A and	1
P05.02	Function of S2 terminal		4
P05.03	Function of S3 terminal		7
P05.04	Function of S4 terminal		0
P05.05	Function of HDIA terminal		0
P05.06	Function of HDIB terminal		0
P05.07	Reserved		0

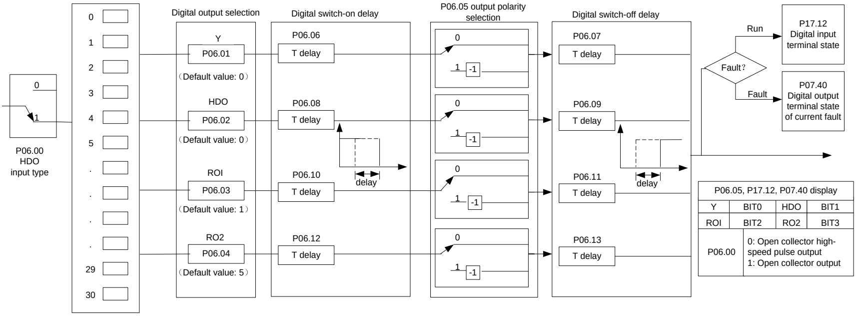
Function code	Name	Description	Default value
		setup B 14: Switchover between combination setting and A setting 15: Switchover between combination setting and setup B 16: Multi-step speed terminal 1 17: Multi-step speed terminal 2 18: Multi-step speed terminal 3 19: Multi-step speed terminal 4 20: Multi-step speed pause 21: Acceleration/deceleration time selection 1 22: Acceleration/deceleration time selection 2 23: Simple PLC stop reset 24: Simple PLC pause 25: PID control pause 26: Wobbling frequency pause 27: Wobbling frequency reset 28: Counter reset 29: Switching between speed control and torque control 30: Acceleration/deceleration disabled 31: Counter trigger 32: Reserved 33: Clear frequency increase/decrease setting temporarily 34: DC brake 35: Switching between motor 1 and motor 2 36: Command switches to keypad 37: Command switches to terminal 38: Command switches to communication 39: Pre-exciting command 40: Zero out power consumption quantity	

Function code	Name	Description	Default value
		41: Maintain power consumption quantity 42: Source of upper torque limit switches to keypad 43: Position reference point input (only valid for S1, S2 and S3) 44: Disable spindle orientation 45: Spindle zeroing/local positioning zeroing 46: Spindle zero position selection 1 47: Spindle zero position selection 2 48: Spindle scale division selection 1 49: Spindle scale division selection 2 50: Spindle scale division selection 3 51: Position/speed control switchover terminal 52: Disable pulse input 53: Clear position deviation 54: Switch position proportional gains 55: Enable cyclic digital positioning 56: Emergency stop 57: Motor overtemperature fault input 59: Switch to V/F control 60: Switch to FVC control 61: PID polarity switchover 62: Reserved 63: Enable servo 64: FWD max. limit 65: REV max limit 66: Zero out the counter 67: Pulse increase 68: Enable pulse superimposition 69: Pulse decrease 70: Electronic gear selection 71: Switch to master 72: Switch to slave 73–79: Reserved	
P05.08	Polarity of input terminal	0x00–0x3F	0x00

Function code	Name	Description	Default value
P05.09	Digital filter time	0.000–1.000s	0.010s
P05.10	Virtual terminal setting	0x00–0x3F (0: disable, 1: enable) BIT0: S1 virtual terminal BIT1: S2 virtual terminal BIT2: S3 virtual terminal BIT3: S4 virtual terminal BIT4: HDIA virtual terminal BIT8: HDIB virtual terminal	0x00
P05.11	2/3-wire control mode	0: 2-wire control 1 1: 2-wire control 2 2: 3-wire control 1 3: 3-wire control 2	0
P05.12	S1 terminal switch-on delay	0.000–50.000s	0.000s
P05.13	S1 terminal switch-off delay	0.000–50.000s	0.000s
P05.14	S2 terminal switch-on delay	0.000–50.000s	0.000s
P05.15	S2 terminal switch-off delay	0.000–50.000s	0.000s
P05.16	S3 terminal switch-on delay	0.000–50.000s	0.000s
P05.17	S3 terminal switch-off delay	0.000–50.000s	0.000s
P05.18	S4 terminal switch-on delay	0.000–50.000s	0.000s
P05.19	S4 terminal switch-off delay	0.000–50.000s	0.000s
P05.20	HDIA terminal switch-on delay	0.000–50.000s	0.000s
P05.21	HDIA terminal switch-off delay	0.000–50.000s	0.000s
P05.22	HDIB terminal switch-on delay	0.000–50.000s	0.000s
P05.23	HDIB terminal switch-off delay	0.000–50.000s	0.000s
P07.39	Input terminal state of present fault	/	0
P17.12	Digital input terminal state	/	0

5.5.12 Digital output

The VFD carries two groups of relay output terminals, one open collector Y output terminal and one high-speed pulse output (HDO) terminal. The function of all the digital output terminals can be programmed by function codes, of which the high-speed pulse output terminal HDO can also be set to high-speed pulse output or digital output by function code.



The table below lists the options for the above four function parameters, and you are allowed to select the same output terminal functions repetitively.

Set value	Function	Description
0	Invalid	Output terminal has no function
1	In running	Output ON signal when there is frequency output during running
2	In forward running	Output ON signal when there is frequency output during forward running
3	In reverse running	Output ON signal when there is frequency output during reverse running
4	In jogging	Output ON signal when there is frequency output during jogging
5	VFD fault	Output ON signal when VFD fault occurred
6	Frequency level detection FDT1	Refer to P08.32 and P08.33
7	Frequency level detection FDT2	Refer to P08.34 and P08.35
8	Frequency reached	Refer to P08.36
9	Running in zero speed	Output ON signal when the VFD output frequency and reference frequency are both zero.
10	Reach upper limit frequency	Output ON signal when the running frequency reaches upper limit frequency
11	Reach lower limit frequency	Output ON signal when the running frequency reached lower limit frequency
12	Ready to run	Main circuit and control circuit powers are established, the protection functions do not act; when the VFD is ready to run, output ON signal.
13	In pre-exciting	Output ON signal during pre-exciting of the VFD
14	Overload pre-alarm	Output ON signal after the pre-alarm time elapsed based

Set value	Function	Description
		on the pre-alarm threshold; see P11.08–P11.10 for details.
15	Underload pre-alarm	Output ON signal after the pre-alarm time elapsed based on the pre-alarm threshold; see P11.11–P11.12 for details.
16	Simple PLC state completed	Output signal when current stage of simple PLC is completed
17	Simple PLC cycle completed	Output signal when a single cycle of simple PLC operation is completed
23	Virtual terminal output of Modbus communication	Output corresponding signal based on the set value of Modbus; output ON signal when it is set to 1, output OFF signal when it is set to 0
24	Virtual terminal output of POROFIBUS/CANopen communication	Output corresponding signal based on the set value of PROFIBUS/CANopen; output ON signal when it is set to 1, output OFF signal when it is set to 0
25	Virtual terminal output of Ethernet communication	Output corresponding signal based on the set value of Ethernet; output ON signal when it is set to 1, output OFF signal when it is set to 0.
26	DC bus voltage established	Output is valid when the bus voltage is above the undervoltage threshold of the inverter
27	Z pulse output	Output is valid when the encoder Z pulse is arrived, and is invalid after 10 ms.
28	During pulse superposition	Output is valid when the pulse superposition terminal input function is valid
29	STO action	Output when STO fault occurred
30	Positioning completed	Output is valid when position control positioning is completed
31	Spindle zeroing completed	Output is valid when spindle zeroing is completed
32	Spindle scale-division completed	Output is valid when spindle scale-division is completed
33	In speed limit	Output is valid when the frequency is limited
34	Virtual terminal output of EtherCAT/PROFINET communication	The corresponding signal is output according to the set value of PROFINET communication. When it is set to 1, the ON signal is output, and when it is set to 0, the OFF signal is output.
35	Reserved	
36	Speed/position control switchover completed	Output is valid when the mode switchover is completed

Set value	Function	Description
37–40	Reserved	
41	C_Y1	C_Y1 from PLC (You need to set P27.00 to 1.)
42	C_Y2	C_Y2 from PLC (You need to set P27.00 to 1.)
43	C_HDO	C_HDO from PLC (You need to set P27.00 to 1.)
44	C_RO1	C_RO1 from PLC(You need to set P27.00 to 1.)
45	C_RO2	C_RO2 from PLC (You need to set P27.00 to 1.)
46	C_RO3	C_RO3 from PLC (You need to set P27.00 to 1.)
47	C_RO4	C_RO4 from PLC (You need to set P27.00 to 1.)
48–63	Reserved	/

Related parameter list:

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th></tr>
<tr><td>P06.00</td><td>HDO output type</td><td>0: Open collector high-speed pulse output
1: Open collector output</td><td>0</td></tr>
<tr><td>P06.01</td><td>Y1 output selection</td><td rowspan="4">0: Invalid
1: In running
2: In forward running
3: In reverse running
4: In jogging
5: VFD fault
6: Frequency level detection FDT1
7: Frequency level detection FDT2
8: Frequency reached
9: Running in zero speed
10: Reach upper limit frequency
11: Reach lower limit frequency
12: Ready to run
13: In pre-exciting
14: Overload pre-alarm
15: Underload pre-alarm
16: Simple PLC stage completed
17: Simple PLC cycle completed
18: Reach set counting value
19: Reach designated counting value
20: External fault is valid
21: Reserved
22: Reach running time
23: Virtual terminal output of Modbus</td><td>0</td></tr>
<tr><td>P06.02</td><td>HDO output selection</td><td>0</td></tr>
<tr><td>P06.03</td><td>Relay RO1 output selection</td><td>1</td></tr>
<tr><td>P06.04</td><td>Relay RO2 output selection</td><td>5</td></tr>
</table>

Function code	Name	Description	Default value
		communication 24: Virtual terminal output of POROFIBUS/CANopen communication 25: Virtual terminal output of Ethernet communication 26: DC bus voltage established 27: Z pulse output 28: During pulse superposition 29: STO action 30: Positioning completed 31: Spindle zeroing completed 32: Spindle scale-division completed 33: In speed limit 34: Virtual terminal output of EtherCAT/PROFINET communication 35: Reserved 36: Speed/position control switchover completed 37: Any frequency reached 38–40: Reserved 41: C_Y1 from PLC (You need to set P27.00 to 1.) 42: C_Y2 from PLC (You need to set P27.00 to 1.) 43: C_HDO from PLC (You need to set P27.00 to 1.) 44: C_RO1 from PLC (You need to set P27.00 to 1.) 45: C_RO2 from PLC (You need to set P27.00 to 1.) 46: C_RO3 from PLC (You need to set P27.00 to 1.) 47: C_RO4 from PLC (You need to set P27.00 to 1.) 48–63: Reserved	
P06.05	Output terminal polarity selection	0x00–0x0F	0x00
P06.06	Y switch-on delay	0.000–50.000s	0.000s

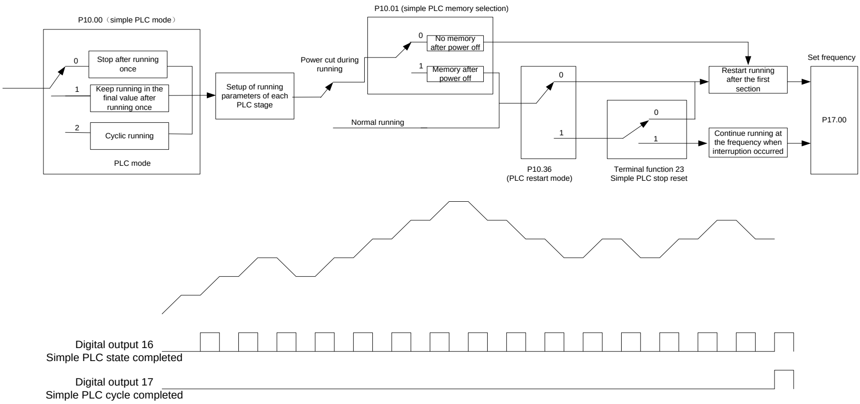
Function code	Name	Description	Default value
P06.07	Y switch-off delay	0.000–50.000s	0.000s
P06.08	HDO switch-on delay	0.000–50.000s (valid only when P06.00=1)	0.000s
P06.09	HDO switch-off delay	0.000–50.000s (valid only when P06.00=1)	0.000s
P06.10	Relay RO1 switch-on delay	0.000–50.000s	0.000s
P06.11	Relay RO1 switch-off delay	0.000–50.000s	0.000s
P06.12	Relay RO2 switch-on delay	0.000–50.000s	0.000s
P06.13	Relay RO2 switch-off delay	0.000–50.000s	0.000s
P07.40	Output terminal state of present fault	/	0
P17.13	Digital output terminal state	/	0

5.5.13 Simple PLC

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

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

After the configured PLC completes a cycle (or stage), an ON signal can be output by the multi-function relay.



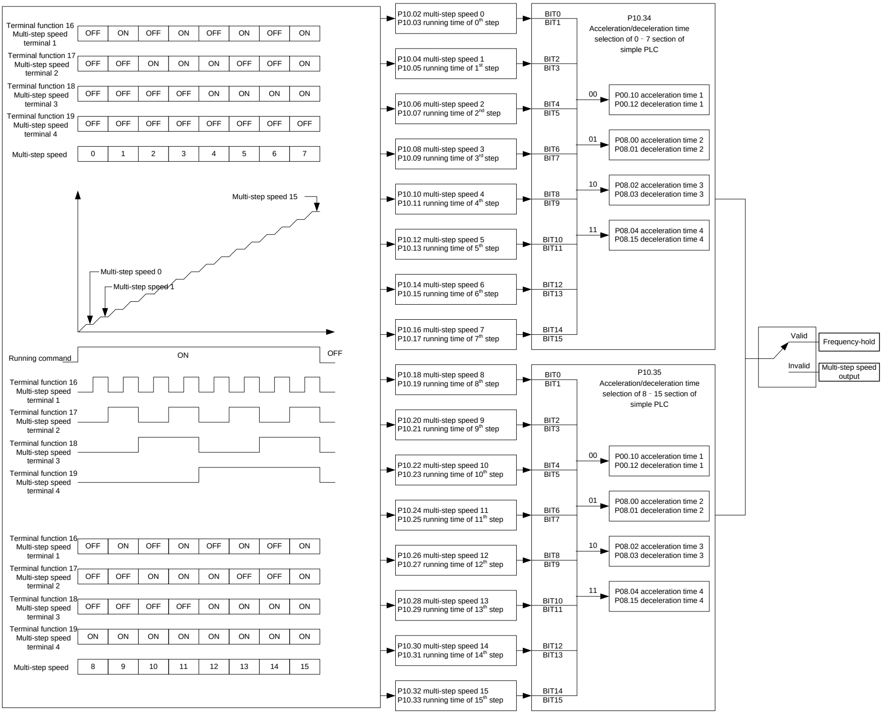
Related parameter list:

Function code	Name	Description	Default value
P05.01–P05.06	Digital input function selection	23: Simple PLC stop reset 24: Pause simple PLC 25: Pause PID control	
P06.01–P06.04	Digital output function selection	16: Simple PLC stage reached 17: Simple PLC cycle reached	
P10.00	Simple PLC mode	0: Stop after running once 1: Keep running in the final value after running once 2: Cyclic running	0
P10.01	Simple PLC memory selection	0: No memory after power down 1: Memory after power down	0
P10.02	Multi-step speed 0	-100.0–100.0%	0.0%
P10.03	Running time of step 0	0.0–6553.5s (min)	0.0s
P10.04	Multi-step speed 1	-100.0–100.0%	0.0%
P10.05	Running time of step 1	0.0–6553.5s (min)	0.0s
P10.06	Multi-step speed 2	-100.0–100.0%	0.0%
P10.07	Running time of step 2	0.0–6553.5s (min)	0.0s
P10.08	Multi-step speed 3	-100.0–100.0%	0.0%
P10.09	Running time of step 3	0.0–6553.5s (min)	0.0s
P10.10	Multi-step speed 4	-100.0–100.0%	0.0%
P10.11	Running time of step 4	0.0–6553.5s (min)	0.0s
P10.12	Multi-step speed 5	-100.0–100.0%	0.0%
P10.13	Running time of step 5	0.0–6553.5s (min)	0.0s
P10.14	Multi-step speed 6	-100.0–100.0%	0.0%
P10.15	Running time of step 6	0.0–6553.5s (min)	0.0s
P10.16	Multi-step speed 7	-100.0–100.0%	0.0%
P10.17	Running time of step 7	0.0–6553.5s (min)	0.0s
P10.18	Multi-step speed 8	-100.0–100.0%	0.0%
P10.19	Running time of step 8	0.0–6553.5s (min)	0.0s
P10.20	Multi-step speed 9	-100.0–100.0%	0.0%
P10.21	Running time of step 9	0.0–6553.5s (min)	0.0s
P10.22	Multi-step speed 10	-100.0–100.0%	0.0%
P10.23	Running time of step 10	0.0–6553.5s (min)	0.0s

Function code	Name	Description	Default value
P10.24	Multi-step speed 11	-100.0–100.0%	0.0%
P10.25	Running time of step 11	0.0–6553.5s (min)	0.0s
P10.26	Multi-step speed 12	-100.0–100.0%	0.0%
P10.27	Running time of step 12	0.0–6553.5s (min)	0.0s
P10.28	Multi-step speed 13	-100.0–100.0%	0.0%
P10.29	Running time of step 13	0.0–6553.5s (min)	0.0s
P10.30	Multi-step speed 14	-100.0–100.0%	0.0%
P10.31	Running time of step 14	0.0–6553.5s (min)	0.0s
P10.32	Multi-step speed 15	-100.0–100.0%	0.0%
P10.33	Running time of step 15	0.0–6553.5s (min)	0.0s
P10.36	PLC restart mode	0: Restart from the first section 1: Continue running at the frequency when interruption occurred	0
P10.34	Acceleration/deceleration time of steps 0–7 of simple PLC	0x0000–0XFFFF	0000
P10.35	Acceleration/deceleration time of steps 8–15 of simple PLC	0x0000–0XFFFF	0000
P05.01–P05.09	Digital input function	23: Simple PLC stop reset 24: Simple PLC pause 25: PID control pause	
P06.01–P06.04	Digital output function	16: Simple PLC stage reached 17: Simple PLC cycle reached	
P17.00	Set frequency	0.00Hz–P00.03 (Max. output frequency)	0.00Hz
P17.27	Acutal stage of simple PLC	Displays the actual stage of the simple PLC function.	0

5.5.14 Multi-step speed running

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



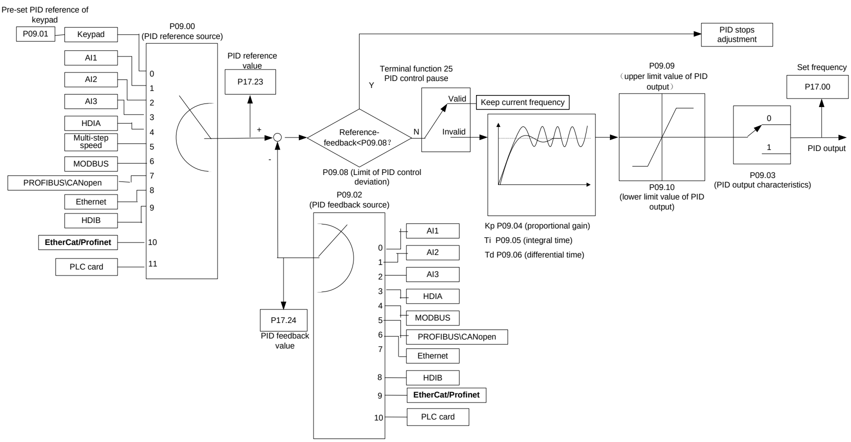
Related parameter list:

Function code	Name	Description	Default value
P05.01–P05.06	Digital input function selection	16: Multi-step speed terminal 1 17: Multi-step speed terminal 2 18: Multi-step speed terminal 3 19: Multi-step speed terminal 4 20: Pause multi-step speed running	
P10.02	Multi-step speed 0	-100.0–100.0%	0.0%
P10.03	Running time of step 0	0.0–6553.5s (min)	0.0s
P10.04	Multi-step speed 1	-100.0–100.0%	0.0%
P10.05	Running time of step 1	0.0–6553.5s (min)	0.0s
P10.06	Multi-step speed 2	-100.0–100.0%	0.0%
P10.07	Running time of step 2	0.0–6553.5s (min)	0.0s
P10.08	Multi-step speed 3	-100.0–100.0%	0.0%
P10.09	Running time of step 3	0.0–6553.5s (min)	0.0s
P10.10	Multi-step speed 4	-100.0–100.0%	0.0%
P10.11	Running time of step 4	0.0–6553.5s (min)	0.0s

Function code	Name	Description	Default value
P10.12	Multi-step speed 5	-100.0–100.0%	0.0%
P10.13	Running time of step 5	0.0–6553.5s (min)	0.0s
P10.14	Multi-step speed 6	-100.0–100.0%	0.0%
P10.15	Running time of step 6	0.0–6553.5s (min)	0.0s
P10.16	Multi-step speed 7	-100.0–100.0%	0.0%
P10.17	Running time of step 7	0.0–6553.5s (min)	0.0s
P10.18	Multi-step speed 8	-100.0–100.0%	0.0%
P10.19	Running time of step 8	0.0–6553.5s (min)	0.0s
P10.20	Multi-step speed 9	-100.0–100.0%	0.0%
P10.21	Running time of step 9	0.0–6553.5s (min)	0.0s
P10.22	Multi-step speed 10	-100.0–100.0%	0.0%
P10.23	Running time of step 10	0.0–6553.5s (min)	0.0s
P10.24	Multi-step speed 11	-100.0–100.0%	0.0%
P10.25	Running time of step 11	0.0–6553.5s (min)	0.0s
P10.26	Multi-step speed 12	-100.0–100.0%	0.0%
P10.27	Running time of step 12	0.0–6553.5s (min)	0.0s
P10.28	Multi-step speed 13	-100.0–100.0%	0.0%
P10.29	Running time of step 13	0.0–6553.5s (min)	0.0s
P10.30	Multi-step speed 14	-100.0–100.0%	0.0%
P10.31	Running time of step 14	0.0–6553.5s (min)	0.0s
P10.32	Multi-step speed 15	-100.0–100.0%	0.0%
P10.33	Running time of step 15	0.0–6553.5s (min)	0.0s
P10.34	Acceleration/decoration time of steps 0–7 of simple PLC	0x0000–0XFFFF	0000
P10.35	Acceleration/decoration time of steps 8–15 of simple PLC	0x0000–0XFFFF	0000
P17.27	Acutal stage of simple PLC	Displays the present stage of the simple PLC function.	0

5.5.15 PID control

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



Introduction to the working principles and control methods for PID control

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

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

Derivative time (Td): When the deviation between feedback and reference changes, output the regulating variable which is proportional to the deviation variation rate, and this regulating variable is only related to the direction and magnitude of the deviation variation rather than the direction and magnitude of the deviation itself. Differential control is used to control the feedback signal variation based on the variation trend. Differential regulator should be used with caution as it may easily enlarge the system interferences, especially those with high variation frequency.

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.

5.5.15.1 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 whole commissioning process of proportional gain P.

b. Determine integral time Ti

After proportional gain P is determined, set the initial value of a larger integral time Ti, and decrease Ti gradually until system oscillation occurred, and then in turn, increase Ti until system oscillation disappears, record the Ti at this point, and set the integral time constant Ti of PID to 150%–180% of current value. This is the commissioning process of integral time constant Ti.

c. Determining derivative time Td

The derivative time Td is generally set to 0.

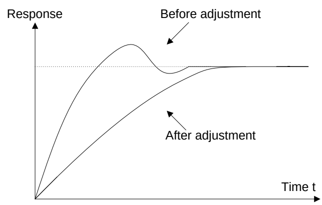
If you need to set Td to another value, set in the same way with P and Ti, namely set Td to 30% of the value when there is no oscillation.

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

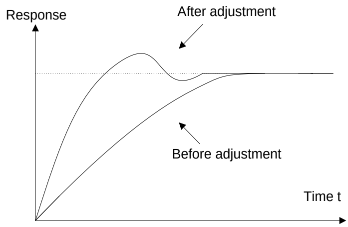
5.5.15.2 PID adjusting method

After setting the parameters controlled by PID, you can fine-tune these parameters by the following means.

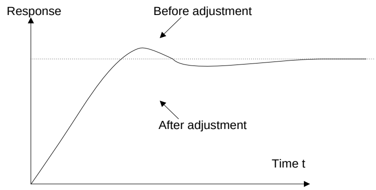
Control overmodulation: When overmodulation occurred, shorten the derivative time (Td) and prolong integral time (Ti).



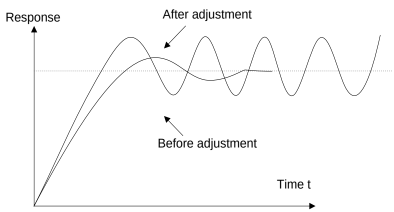
Stabilize the feedback value as fast as possible: when overmodulation occurred, shorten integral time (Ti) and prolong derivative time (Td) to stabilize control as fast as possible.



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 short is almost the same with the set value of derivative time (Td), it indicates derivative action is too strong, shorten the derivative time (Td) to control vibration. When derivative time (Td) is set to 0.00 (namely no derivative control), and there is no way to control vibration, decrease the proportional gain.



Related parameter list:

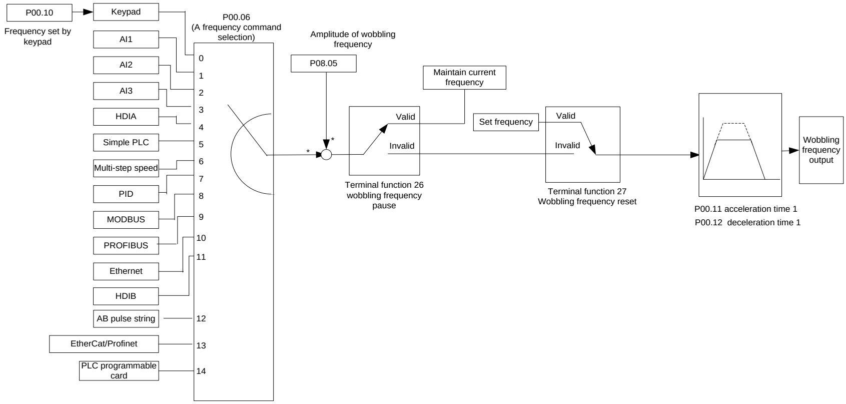
Function code	Name	Description	Default value
P09.00	PID reference source	0: Keypad (P09.01) 1: AI1 2: AI2 3: AI3 4: High-speed pulse HDIA 5: Multi-step 6: Modbus communication 7: PROFIBUS/CANopen/DeviceNet communication 8: Ethernet communication 9: High-speed pulse HDIB	0

Function code	Name	Description	Default value
		10: EtherCAT/PROFINET communication 11: Programmable extension card 12: Reserved	
P09.01	Pre-set PID reference of keypad	-100.0%–100.0%	0.0%
P09.02	PID feedback source	0: AI1 1: AI2 2: AI3 3: High-speed pulse HDIA 4: Modbus communication 5: PROFIBUS/CANopen/DeviceNet communication 6: Ethernet communication 7: High-speed pulse HDIB 8: EtherCAT/PROFINET communication 9: Programmable extension card 10: Reserved	0
P09.03	PID output characteristics	0: PID output is positive characteristic 1: PID output is negative characteristic	0
P09.04	Proportional gain (Kp)	0.00–100.00	1.80
P09.05	Integral time (Ti)	0.01–10.00s	0.90s
P09.06	Derivative time (Td)	0.00–10.00s	0.00s
P09.07	Sampling cycle (T)	0.000–10.000s	0.100s
P09.08	Limit of PID control deviation	0.0–100.0%	0.0%
P09.09	Upper limit value of PID output	P09.10–100.0% (max. frequency or voltage)	100.0%
P09.10	Lower limit value of PID output	-100.0%–P09.09 (max. frequency or voltage)	0.0%
P09.11	Feedback offline detection value	0.0–100.0%	0.0%
P09.12	Feedback offline detection time	0.0–3600.0s	1.0s
P09.13	PID control selection	0x0000–0x1111 Ones: 0: Continue integral control after the frequency reaches upper/lower limit	0x0001

Function code	Name	Description	Default value
		1: Stop integral control after the frequency reaches upper/lower limit Tens: 0: The same with the main reference direction 1: Contrary to the main reference direction Hundreds: 0: Limit as per the max. frequency 1: Limit as per A frequency Thousands: 0: A+B frequency, acceleration /deceleration of main reference A frequency source buffering is invalid 1: A+B frequency, acceleration/ deceleration of main reference A frequency source buffering is valid, acceleration/deceleration is determined by P08.04 (acceleration 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
P09.17	Reserved	-100.0–100.0%	0.0%
P09.18	Low frequency integral time (Ti)	0.00–10.00s	0.90s
P09.19	Low frequency differential time (Td)	0.00–10.00s	0.00s
P09.20	Low frequency point for PID parameter switching	0.00–P09.21	5.00Hz
P09.21	High frequency point for PID parameter switching	P09.20–P00.04	10.00Hz
P17.00	Set frequency	0.00Hz–P00.03 (Max. output frequency)	0.00Hz
P17.23	PID reference value	-100.0–100.0%	0.0%
P17.24	PID feedback value	-100.0–100.0%	0.0%

5.5.16 Run at wobbling frequency

Wobbling frequency is mainly applied in cases where transverse movement and winding functions are needed like textile and chemical fiber industries. The typical working process is shown as below.



Function code	Name	Description	Default value
P00.03	Max. output frequency	P00.03–400.00Hz	50.00Hz
P00.06	A frequency command selection	0: Keypad 1: AI1 2: AI2 3: AI3 4: High speed pulse HDIA 5: Simple PLC program 6: Multi-step speed running 7: PID control 8: Modbus communication 9: PROFIBUS/CANopen/DeviceNet communication 10: Ethernet communication 11: High speed pulse HDIB 12: Pulse string AB 13: EtherCAT/PROFINET communication 14: PLC card	0
P00.11	Acceleration time 1	0.0–3600.0s	Depends on model
P00.12	Deceleration time 1	0.0–3600.0s	Depends on model
P05.01–P05.06	Digital input function selection	26: Wobbling frequency pause (stop at current frequency)	/

Function code	Name	Description	Default value
		27: Wobbling frequency reset (revert to center frequency)	
P08.15	Amplitude of wobbling frequency	0.0–100.0% (relative to set frequency)	0.0%
P08.16	Amplitude of jump frequency	0.0–50.0% (relative to amplitude of wobbling frequency)	0.0%
P08.17	Wobbling frequency rise time	0.1–3600.0s	5.0s
P08.18	Wobbling frequency fall time	0.1–3600.0s	5.0s

5.5.17 Local encoder input

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

Function code	Name	Description	Default value
P05.00	HDI input type	0x00–0x11 Ones: HDIA input type 0: HDIA is high-speed pulse input 1: HDIA is digital input Tens: HDIB input type 0: HDIB is high-speed pulse input 1: HDIB is digital input	0x00
P05.38	HDIA high-speed pulse input function	0: Set input via frequency 1: Reserved 2: Input via encoder, used in combination with HDIB	0
P05.44	HDIB high-speed pulse input function selection	0: Set input via frequency 1: Reserved 2: Input via encoder, used in combination with HDIA	0
P20.15	Speed measurement mode	0: PG card 1: local; realized by HDIA and HDIB; supports incremental 24V encoder only	0
P18.00	Actual frequency of encoder	-999.9–3276.7Hz	0.0Hz

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

1. Commissioning procedure for closed-loop vector control of asynchronous motor

Step 1: Restore to default value via keypad

Step 2: Set P00.03, P00.04 and P02 group motor nameplate parameters

Step 3: Motor parameter autotuning

Carry out rotary parameter autotuning or static parameter autotuning via keypad. If the motor can be disconnected from load, then you can carry out rotary parameter autotuning; otherwise, carry out static parameter autotuning, the parameter obtained from autotuning will be saved in P02 motor parameter group automatically.

Step 4: Verify whether the encoder is installed and set properly

a) Confirm the encoder direction and parameter setup

Set P20.01 (encoder pulse-per-revolution), set P00.00=2 and P00.10=20Hz, and run the VFD, at this point, the motor rotates at 20Hz, observe whether the speed measurement value of P18.00 is correct, if the value is negative, it indicates the encoder direction is reversed, under such situation, set P20.02 to 1; if the speed measurement value deviates greatly, it indicates P20.01 is set improperly. Observe whether P18.02 (encoder Z pulse count value) fluctuates, if yes, it indicates the encoder suffers interference or P20.01 is set improperly, requiring the check of the wiring and the shielding layer.

b) Determine Z pulse direction

Set P00.10=20Hz, and set P00.13 (running direction) to forward and reverse direction respectively to observe whether the difference value of P18.02 is less than 5, if the difference value remains to be larger than 5 after setting Z pulse reversal function of P20.02, power off and exchange phase A and phase B of the encoder, and then observe the difference between the value of P18.02 during forward and reverse rotation. Z pulse direction only affects the forward/reverse positioning precision of the spindle positioning carried out with Z pulse.

Step 5: Closed-loop vector pilot-run

Set P00.00=3, and carry out closed-loop vector control, adjust P00.10 and speed loop and current loop PI parameter in P03 group to make it run stably in the whole range.

Step 6: Flux-weakening control

Set flux-weakening regulator gain P03.26=0–8000, and observe the flux-weakening control effect. P03.22–P03.24 can be adjusted as needed.

2. Commissioning procedure for closed-loop vector control of synchronous motor

Step 1: Set P00.18=1, restore to default value

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

Step 3: Set P20.01.

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

Step 4: Ensure the encoder is installed and set correctly

When motor stops, observe whether P18.21 (resolver angle) fluctuates, if it fluctuates sharply, check the wiring and grounding. Rotates the motor slowly, observe whether P18.21 changes accordingly. If yes, it indicates motor is connected correctly; if the value of P18.02 keeps constant at a non-zero value after rotating for multiple circles, it indicates encoder Z signal is correct.

Step 5: Autotuning of initial position of magnetic pole

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

a) Rotary autotuning (P20.11 = 3)

Detect the position of current magnetic pole when autotuning starts, and then accelerates to 10Hz, autotuning corresponding magnetic pole position of encoder Z pulse, and decelerate to stop.

During running, if ENC1O or ENC1D fault occurred, set P20.02=1 and carry out autotuning again.

After autotuning is done, the angle obtained from autotuning will be saved in P20.09 and P20.10 automatically.

b) Static autotuning

In cases where the load can be disconnected, it is recommended to adopt rotary autotuning (P20.11=3) as it has high angle precision. If the load cannot be disconnected, you can adopt static autotuning (P20.11=2). The magnetic pole position obtained from autotuning will be saved in P20.09 and P20.10.

Step 6: Closed-loop vector pilot-run

Adjust P00.10 and speed loop and current loop PI parameter in P03 group to make it run stably in the whole range. If oscillation occurred, reduce the value of P03.00, P03.03, P03.09 and P03.10. If current oscillation noise occurred during low speed, adjust P20.05.

Note: It is necessary to re-determine P20.02 (encoder direction) and carry out magnetic pole position autotuning again if the wiring of motor or encoder is changed.

3. Commissioning procedure for pulse string control

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

Step 1: Restore to default value by keypad

Step 2: Set P00.03, P00.04 and motor nameplate parameters in P02 group

Step 3: Motor parameter autotuning: rotary parameter autotuning or static parameter autotuning

Step 4: Verity the installation and settings of encoder. Set P00.00=3 and P00.10=20Hz to run the system, and check the control effect and performance of the system.

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

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

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

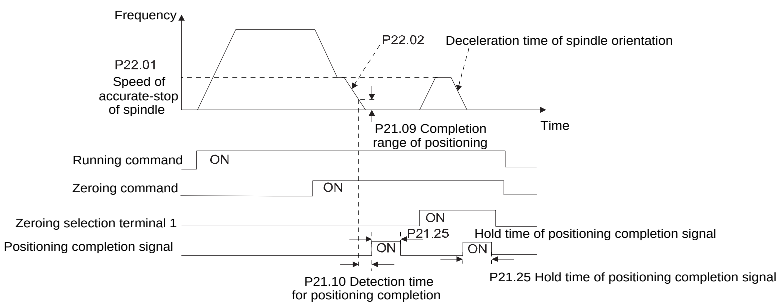
Step 7: When P21.08 (output limit of position controller) is set to 0, the position control will be invalid, and at this point, the pulse string acts as frequency source, P21.13 (position feedforward gain) should be set to 100%, and the speed acceleration/deceleration time is determined by the acceleration /deceleration time of pulse string, the pulse string acceleration/deceleration time of the system can be adjusted. If the pulse string acts as the frequency source in speed control, you can also set P21.00 to 0000, and set the frequency source reference P00.06 or P00.07 to 12 (set by pulse string AB), at this point, the acceleration/deceleration time is determined by the acceleration/deceleration time of the VFD, meanwhile, the parameters of pulse string AB is still set by P21 group. In speed mode, the filter time of pulse string AB is determined by P21.29.

Step 8: The input frequency of pulse string is the same with the feedback frequency of encoder pulse, the relation between them can be changed by altering P21.11 (numerator of position command ratio) and P21.12 (denominator of position command ratio)

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

4. Commissioning procedure for spindle positioning

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



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

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

Step 6: Spindle zeroing operation

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

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

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

Step 7: Spindle division operation

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

Step 8: Priority level of speed control, position control and zeroing

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

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

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

Step 9: Hold positioning

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

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

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

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

Encoder Z pulse positioning supports the following spindle positioning modes:

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

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

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

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

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

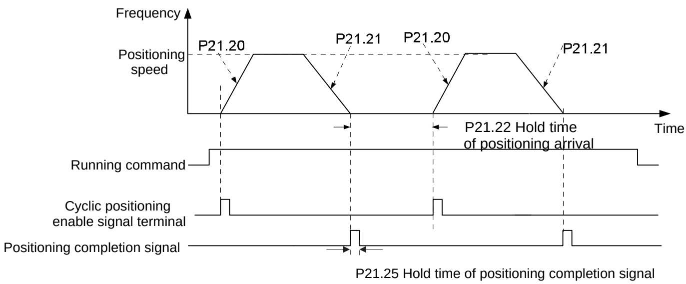
Proximity switch positioning supports the following spindle positioning modes:

a) The encoder is installed on the motor shaft, the drive ratio between motor shaft and spindle is not necessarily 1:1;

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

5. Commissioning procedure for digital positioning

The diagram for digital positioning is shown below.



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

Step 5: Set P21.00=0011 to enable digital positioning. Set P21.17, P21.11 and P21.12 (set positioning displacement) according to actual needs ; set P21.18 and P21.19 (set positioning speed); set P21.20 and P21.21 (set acceleration/deceleration time of positioning).

Step 6: Single positioning operation

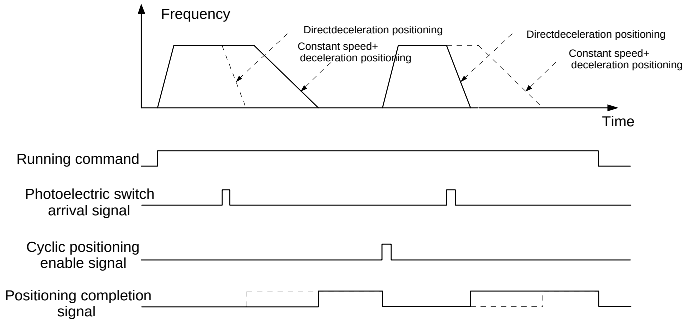
Set P21.16.bit1=0, and the motor will carry out single positioning action and stay in the positioning position according to the setup in step 5.

Step 7: Cyclic positioning operation

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

6. Commissioning procedure for positioning of photoelectric switch

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



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

Step 5: Set P21.00=0021 to enable photoelectric switch positioning, the photoelectric switch signal can be connected to S8 terminal only, and set P05.08=43, meanwhile, set P21.17, P21.11 and P21.12 (set positioning displacement) based on actual needs; set P21.21 (deceleration time of positioning), however, when present running speed is too fast or the set positioning displacement is too small, the deceleration time of positioning will be invalid, and it will enter direct deceleration positioning mode.

Step 6: Cyclic positioning

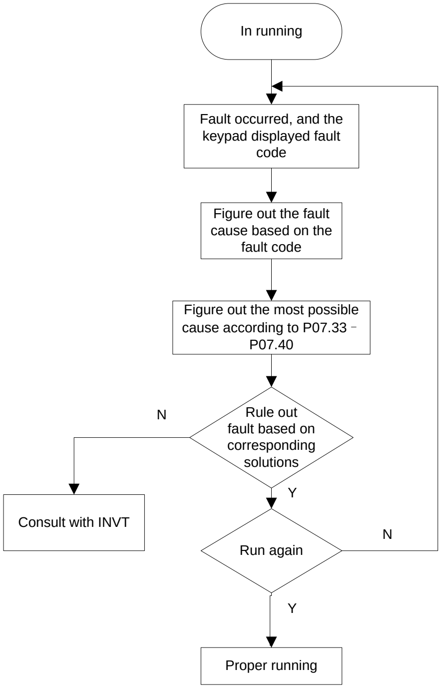
After positioning is done, the motor will stay in current position. You can set cyclic positioning through input terminal function selection (55: enable cyclic digital positioning) in P05 group; when the terminal receives cyclic positioning enable signal (pulse signal), the motor will continue running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

7 Hold positioning

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

5.5.19 Fault handling

The following provides fault handling information.



Related parameter list:

Function code	Name	Description	Default value
P07.27	Type of present fault	0: No fault	0
P07.28	Type of the last fault	1: Inverter unit U phase protection (OUt1)	/
P07.29	Type of the 2nd-last fault	2: Inverter unit V phase protection (OUt2)	/
P07.30	Type of the 3rd-last fault	3: Inverter unit W phase protection (OUt3)	/
P07.31	Type of the 4th-last fault	4: Overcurrent during acceleration (OC1)	/
P07.32	Type of the 5th-last fault	5: Overcurrent during deceleration (OC2) 6: Overcurrent during constant speed (OC3) 7: Overvoltage during acceleration (OV1) 8: Overvoltage during deceleration (OV2) 9: Overvoltage during constant speed (OV3) 10: Bus undervoltage fault (UV) 11: Motor overload (OL1) 12: VFD overload (OL2)	

Function code	Name	Description	Default value
		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: 485 communication fault (CE) 19: Current detection fault (ItE) 20: Motor autotuning fault (tE) 21: EEPROM operation fault (EEP) 22: PID feedback offline fault (PIDE) 23: Braking unit fault (bCE) 24: Running time reached (END) 25: Electronic overload (OL3) 26: Keypad communication error (PCE) 27: Parameter upload error (UPE) 28: Parameter download error (DNE) 29: Profibus DP communication fault (E-DP) 30: Ethernet communication fault (E-NET) 31: CANopen communication fault (E-CAN) 32: To-ground short-circuit fault 1 (ETH1) 33: To-ground short-circuit fault 2 (ETH2) 34: Speed deviation fault (dEu) 35: Mal-adjustment fault (STo) 36: Underload fault (LL) 37: Encoder offline fault (ENC1O) 38: Encoder reversal fault (ENC1D) 39: Encoder Z pulse offline fault (ENC1Z) 40: Safe torque off (STO) 41: Channel H1 safety circuit exception (STL1) 42: Channel H2 safety circuit exception (STL2) 43: Channel H1 and H2 exception (STL3) 44: Safety code FLASH CRC check fault (CrCE) 55: Repetitive extension card type fault (E-Err)	

Function code	Name	Description	Default value
		56: Encoder UVW loss fault (ENCUV) 57: PROFINET communication timeout fault (E-PN) 58: CAN communication fault (SECAN) 59: Motor over-temperature fault (OT) 60: Card slot 1 card identification failure (F1-Er) 61: Card slot 2 card identification failure (F2-Er) 62: Card slot 3 card identification failure (F3-Er) 63: Card slot 1 card communication timeout fault (C1-Er) 64: Card slot 2 card communication timeout fault (C2-Er) 65: Card slot 3 card communication timeout fault (C3-Er) 66: EtherCAT communication fault (E-CAT) 67: Bacnet communication fault (E-BAC) 68: DeviceNet communication fault (E-DEV) 69: Master-slave synchronous CAN slave fault (S-Err)	
P07.33	Running frequency of present fault	0.00Hz–P00.03	0.00Hz
P07.34	Ramp reference frequency of present fault	0.00Hz–P00.03	0.00Hz
P07.35	Output voltage of present fault	0–1200V	0V
P07.36	Output current of present fault	0.0–6300.0A	0.0A
P07.37	Bus voltage of present fault	0.0–2000.0V	0.0V
P07.38	Max. temperature of present fault	-20.0–120.0°C	0.0°C
P07.39	Input terminal state of present fault	0x0000–0xFFFF	0
P07.40	Output terminal state of present fault	0x0000–0xFFFF	0

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

6 Function parameter list

6.1 What this chapter contains

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

6.2 Function parameter list

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

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

1. The function list is divided into the following columns.

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 value": Initial value set in factory

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

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

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

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

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

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

3. "Default value" 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.

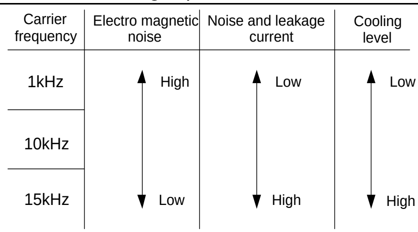
4. In order to enhance parameter protection, the VFD provides the password protection function. After a user password is set (that is, P07.00 is set to a non-zero value), "0.0.0.0.0" is displayed when you press the PRG/ESC key to enter the function code editing interface, and

you can enter the interface only with the correct user password. 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.

P00—Basic functions

Function code	Name	Description	Default value	Modify
P00.00	Speed control mode	0:SVC 0 1:SVC 1 2:SVPWM 3:VC **Note:** If 0, 1 or 3 is selected, it is required to carry out motor parameter autotuning first.	2	◎
P00.01	Running command channel	0: Keypad 1: Terminal 2: Communication	0	○
P00.02	Communication running command channel	0: Modbus 1: PROFIBUS/CANopen/DeviceNet 2: Ethernet 3: EtherCAT/PROFINET 4: PLC programmable card 5: Wireless communication card **Note:** 1, 2, 3, 4 and 5 are extended functions which are applicable with corresponding cards.	0	○
P00.03	Max. output frequency	Used to set the maximum output frequency of the VFD. It is the basis of frequency setup and the acceleration/deceleration. Setting range: Max. (P00.04, 10.00) –630.00Hz	50.00Hz	◎
P00.04	Upper limit of running frequency	Used to set the upper limit of VFD output frequency. This value cannot be more than the maximum output frequency. When the set frequency is higher than the upper limit, the VFD runs at the upper limit frequency. Setting range: P00.05–P00.03 (Max. output frequency)	50.00Hz	◎

Function code	Name	Description	Default value	Modify
P00.05	Lower limit of running frequency	The lower limit of running frequency is the lower limit value of VFD output frequency. When the set frequency is lower than the lower limit, the VFD runs at the lower limit frequency. **Note: Max. output frequency ≥ upper limit frequency ≥ lower limit frequency.** Setting range: 0.00Hz–P00.04 (upper limit of running frequency)	0.00Hz	◎
P00.06	A frequency command selection	0: Keypad 1: AI1 2: AI2 3: AI3 4: High speed pulse HDIA 5: Simple PLC program 6: Multi-step speed running 7: PID control 8: Modbus communication 9: PROFIBUS/CANopen/DeviceNet communication 10: Ethernet communication 11: High speed pulse HDIB 12: Pulse string AB 13: EtherCAT/PROFINET communication 14: PLC card 15: Reserved	0	○
P00.07	B frequency command selection		15	○
P00.08	Reference object of B frequency command	0: Max. output frequency 1: A frequency command	0	○
P00.09	Combination mode of setting source	0: A 1: B 2: (A+B) 3: (A-B) 4: Max. (A, B) 5: Min. (A, B)	0	○
P00.10	Set frequency via keypad	When A and B frequency commands are set by keypad, the value is the initial digital set value of the VFD frequency. Setting range: 0.00 Hz–P00.03 (Max. output frequency)	50.00Hz	○

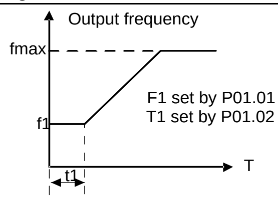
<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th><th>Modify</th></tr>
<tr><td>P00.11</td><td>Acceleration time 1</td><td>Acceleration time is the time needed for accelerating from 0Hz to Max. output frequency (P00.03).</td><td>Depends on model</td><td>○</td></tr>
<tr><td>P00.12</td><td>Deceleration time 1</td><td>Deceleration time is the time needed from decelerating from Max. output frequency (P00.03) to 0Hz.
Goodrive350 series VFD defines four groups of acceleration and deceleration time, which can be selected via multi-function digital input terminals (P05 group). The acceleration/deceleration time of the VFD is the first group by default.
Setting range of P00.11 and P00.12: 0.0–3600.0s</td><td>Depends on model</td><td>○</td></tr>
<tr><td>P00.13</td><td>Running direction</td><td>0: Run in default direction
1: Run in reverse direction
2: Reverse running is prohibited</td><td>0</td><td>○</td></tr>
<tr><td>P00.14</td><td>Carrier frequency setup</td><td>

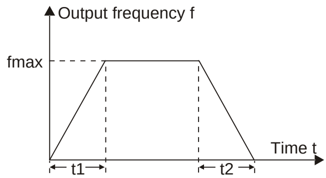
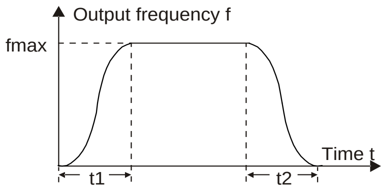
The relation between the model and carrier frequency is shown below.
<table>
<tr><th colspan="2">Model</th><th>Default value of carrier frequency</th></tr>
<tr><td rowspan="3">380V</td><td>1.5–11kW</td><td>8kHz</td></tr>
<tr><td>15–55kW</td><td>4kHz</td></tr>
<tr><td>Above 75kW</td><td>2kHz</td></tr>
<tr><td rowspan="2">660V</td><td>22–55kW</td><td>4kHz</td></tr>
<tr><td>Above 75kW</td><td>2kHz</td></tr>
</table>
Advantages of high carrier frequency are as follows: ideal current waveform, few current harmonics and small motor noise.
Disadvantages of high carrier frequency are as follows: growing switch consumption, enlarged temperature rise, impacted output capacity; under</td><td>Depends on model</td><td>○</td></tr>
</table>

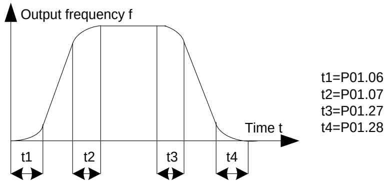
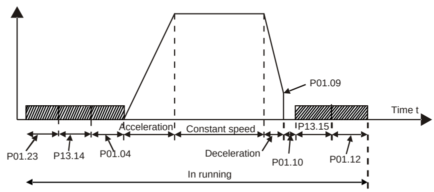
Function code	Name	Description	Default value	Modify
		high carrier frequency, the VFD needs to be derated for use, meanwhile, the leakage current will increase, which increases electromagnetic interference to the surroundings. While low carrier frequency is the contrary. Low carrier frequency will cause unstable operation at low frequency, decrease the torque, or even lead to oscillation. The carrier frequency of VFD is set properly by default, and it should not be changed at will. If the default carrier frequency is exceeded during use, derating is required, derate by 10% for every additional 1k carrier frequency. Setting range: 1.2–15.0kHz		
P00.15	Motor parameter autotuning	0: No operation 1: Rotary autotuning 1; carry out comprehensive motor parameter autotuning; rotary autotuning is used in cases where high control precision is required; 2: Static autotuning 1 (comprehensive autotuning); static autotuning 1 is used in cases where the motor cannot be disconnected from load; 3: Static autotuning 2 (partial autotuning) ; when current motor is motor 1, only P02.06, P02.07 and P02.08 will be autotuned; when current motor is motor 2, only P12.06, P12.07 and P12.08 will be autotuned. 4: Rotary autotuning 2, which is similar to rotary autotuning 1 but is only applicable to asynchronous motors. 5: Rotary autotuning 3 (partial autotuning), which is only applicable to asynchronous motors.	0	◎
P00.16	AVR function	0: Invalid 1: Valid during the whole process Automatic voltage regulation function is used to eliminate the impact on the output voltage of VFD when bus voltage fluctuates.	1	○
P00.17	Reserved	Reserved		

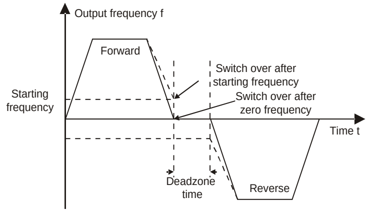
Function code	Name	Description	Default value	Modify
P00.18	Function parameter restoration	0: No operation 1: Restore to default value 2: Clear fault history Note: After the selected function operations are done, this function code will be restored to 0 automatically. Restoration to default value will clear the user password, this function should be used with caution.	0	◎

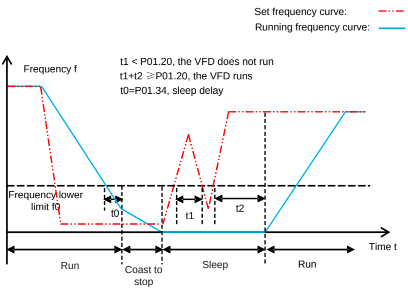
P01—Start/stop control

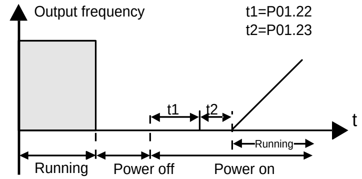
Function code	Name	Description	Default value	Modify
P01.00	Running mode of start	0: Direct start 1: Start after DC brake 2: Start after speed-tracking 1 3: Start after speed-tracking 2	0	◎
P01.01	Starting frequency of direct start	Starting frequency of direct startup is the initial frequency when the VFD starts. See P01.02 (hold time of starting frequency) for details. Setting range: 0.00–50.00Hz	0.50Hz	◎
P01.02	Hold time of starting frequency	 A proper starting frequency can increase the torque during startup. Within the hold time of starting frequency, the output frequency of VFD is the starting frequency, and then it runs from the starting frequency to the target frequency, if the target frequency (frequency command) is below the starting frequency, the VFD will be standby rather than running. The starting frequency value is unlimited by the lower limit frequency. Setting range: 0.0–50.0s	0.0s	◎
P01.03	DC brake current before start	During starting, the VFD will first perform DC brake based on the set DC brake current before startup, and then it will accelerate after the set DC brake	0.0%	◎
P01.04	DC brake time		0.00s	◎

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th><th>Modify</th></tr>
<tr><td></td><td>before start</td><td>time before startup elapses. If the set DC brake time is 0, DC brake will be invalid.
The larger the DC brake current, the stronger the brake force. The DC brake current before startup refers to the percentage relative to rated VFD output current.
Setting range of P01.03: 0.0–100.0%
Setting range of P01.04: 0.00–50.00s</td><td></td><td></td></tr>
<tr><td>P01.05</td><td>Acceleration/deceleration mode</td><td>This function code is used to select the frequency variation mode during starting and running.
0: Straight line; the output frequency increases or decreases in straight line;

1: S curve; the output frequency increases or decreases in S curve;
S curve is generally used in cases where smooth start/stop is required, eg, elevator, conveyer belt, etc.

Note: When set to 1, it is required to set P01.06, P01.07, P01.27 and P01.28 accordingly.</td><td>0</td><td>◎</td></tr>
<tr><td>P01.06</td><td>Time of starting section of acceleration S curve</td><td>The curvature of S curve is determined by acceleration range and acceleration and deceleration time.</td><td>0.1s</td><td>◎</td></tr>
</table>

Function code	Name	Description	Default value	Modify
P01.07	Time of ending section of acceleration S curve	 Setting range: 0.0–50.0s	0.1s	◎
P01.08	Stop mode	0: Decelerate to stop; after stop command is valid, the VFD lowers output frequency based on the deceleration mode and the defined deceleration time, after the frequency drops to the stop speed (P01.15), the VFD stops. 1: Coast to stop; after stop command is valid, the VFD stops output immediately, and the load coasts to stop as per mechanical inertia.	0	○
P01.09	Starting frequency of DC brake after stop	Starting frequency of DC brake after stop; during decelerating to stop, when this frequency is reached, DC brake will be performed after stop. Demagnetization time (waiting time of DC brake after stop): Before the DC brake, the VFD will block output, and after the demagnetization time elapses, DC brake will start. This function is used to prevent overcurrent fault caused by DC brake during high speed. DC brake current after stop: it means the DC brake force applied, the larger the current, the stronger the DC brake effect.  Setting range of P01.09: 0.00Hz–P00.03 (Max. output frequency) Setting range of P01.10: 0.00–30.00s Setting range of P01.11: 0.0–100.0% (of the rated VFD output current) Setting range of P01.12: 0.0–50.0s	0.00Hz	○
P01.10	Waiting time of DC brake after stop		0.00s	○
P01.11	DC brake current of stop		0.0%	○
P01.12	DC brake time of stop		0.00s	○

Function code	Name	Description	Default value	Modify
P01.13	Deadzone time of forward/reverse rotation	This function code refers to the transition time of the threshold set by P01.14 during setting forward/reverse rotation of the VFD, as shown below.  Setting range: 0.0–3600.0s	0.0s	○
P01.14	Forward/reverse rotation switchover mode	0: Switch over after zero frequency 1: Switch over after starting frequency 2: Switch over after passing stop speed and delay	1	◎
P01.15	Stop speed	0.00–100.00Hz	0.50Hz	◎
P01.16	Stop speed detection mode	0: Set value of speed (the only detection mode valid in SVPWM mode) 1: Detection value of speed	0	◎
P01.17	Stop speed detection time	0.00–100.00s	0.50s	◎
P01.18	Running protection of power-on terminal	When the running command channel is controlled by terminals, the system will detect running terminal state automatically during power-on. 0: Terminal running command is invalid during power-on. The VFD will not run during power-on even if the running command terminal is detected to be valid, and the system is in running protection state. The VFD will run only after this terminal is cancelled and enabled again. 1: Terminal running command is valid during power-on. The system will start the VFD automatically after initialization is done if the running command terminal is detected to be valid during power-on. Note: This function must be set with caution, otherwise, serious consequences may occur.	0	○
P01.19	Action selection when the running	This function code is used to set the running state of VFD when the set frequency is below lower limit	0	◎

Function code	Name	Description	Default value	Modify
	frequency is below lower limit (lower limit should be larger than 0)	frequency. 0: Run in lower limit of the frequency 1: Stop 2: Sleep When the set frequency is below lower limit frequency, the VFD coasts to stop; when the set frequency is above lower limit again and continues to be so after the time set by P01.20 elapses, the VFD will be restored to running state automatically.		
P01.20	Wake-up-from-sleep delay	This function code is used to set the sleep delay. When the running frequency of VFD is below the lower limit frequency, the VFD enters sleep state; when the set frequency is above the lower limit again and continues to be so after the time set by P01.20 elapses, the VFD will run automatically.  Setting range: 0.0–3600.0s (valid when P.01.19 is 2)	0.0s	○
P01.21	Restart after power cut	This function code sets the automatic running of the VFD at next power-on after power down. 0: Disabled restart 1: Enable restart, namely the VFD will run automatically after the time set by P01.22 elapses if the starting conditions are met.	0	○
P01.22	Waiting time of restart after power cut	This function code sets the waiting time before automatically running at next power-on after power down.	1.0s	○

Function code	Name	Description	Default value	Modify
		 Setting range: 0.0–3600.0s (valid when P01.21=1)		
P01.23	Start delay	This function code sets the delay of the VFD's wake-up-from-sleep after running command is given, the VFD will start to run and output after the time set by P01.23 elapses to realize brake release. Setting range: 0.0–600.0s	0.0s	○
P01.24	Stop speed delay	0.0–600.0s	0.0s	○
P01.25	Open-loop 0Hz output selection	0: No voltage output 1: With voltage output 2: Output as per DC brake current of stop	0	○
P01.26	Deceleration time of emergency-stop	0.0–60.0s	2.0s	○
P01.27	Time of starting section of deceleration S curve	0.0–50.0s	0.1s	◎
P01.28	Time of ending section of deceleration S curve	0.0–50.0s	0.1s	◎
P01.29	Short-circuit brake current	When the VFD starts in direct start mode (P01.00=0), set P01.30 to a non-zero value to enter short-circuit brake. During stop, if the running frequency of VFD is below the starting frequency of brake after stop, set P01.31 to a non-zero value to enter short-circuit brake after stop, and then carry out DC brake in the time set by P01.12 (refer to P01.09–P01.12). Setting range of P01.29: 0.0–150.0% (of the rated VFD output current)	0.0%	○
P01.30	Hold time of short-circuit brake at startup		0.00s	○
P01.31	Hold time of short-circuit brake at stop		0.00s	○

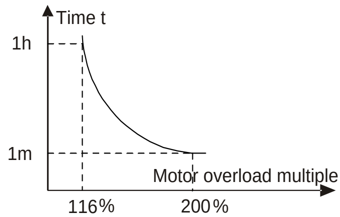
Function code	Name	Description	Default value	Modify
		Setting range of P01.30: 0.0–50.0s Setting range of P01.31: 0.0–50.0s		
P01.32	Pre-exciting time of jogging	0–10.000s	0.000s	○
P01.33	Starting frequency of braking for jogging to stop	0–P00.03	0.00Hz	○
P01.34	Delay to enter sleep	0–3600.0s	0.0s	○

P02—Parameters of motor 1

Function code	Name	Description	Default value	Modify
P02.00	Type of motor 1	0: Asynchronous motor 1: Synchronous motor	0	◎
P02.01	Rated power of asynchronous motor 1	0.1–3000.0kW	Depends on model	◎
P02.02	Rated frequency of asynchronous motor 1	0.01Hz–P00.03 (Max. output frequency)	50.00Hz	◎
P02.03	Rated speed of asynchronous motor 1	1–60000rpm	Depends on model	◎
P02.04	Rated voltage of asynchronous motor 1	0–1200V	Depends on model	◎
P02.05	Rated current of asynchronous motor 1	0.8–6000.0A	Depends on model	◎
P02.06	Stator resistance of asynchronous motor 1	0.001–65.535Ω	Depends on model	○
P02.07	Rotor resistance of asynchronous motor 1	0.001–65.535Ω	Depends on model	○
P02.08	Leakage inductance of	0.1–6553.5Mh	Depends on model	○

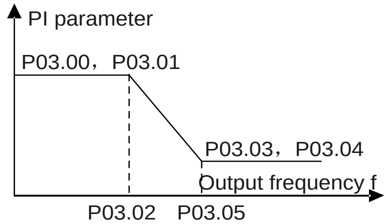
Function code	Name	Description	Default value	Modify
	asynchronous motor 1			
P02.09	Mutual inductance of asynchronous motor 1	0.1–6553.5Mh	Depends on model	○
P02.10	No-load current of asynchronous motor 1	0.1–6553.5A	Depends on model	○
P02.11	Magnetic saturation coefficient 1 of iron core of asynchronous motor 1	0.0–100.0%	80.0%	○
P02.12	Magnetic saturation coefficient 2 of iron core of asynchronous motor 1	0.0–100.0%	68.0%	○
P02.13	Magnetic saturation coefficient 3 of iron core of asynchronous motor 1	0.0–100.0%	57.0%	○
P02.14	Magnetic saturation coefficient 4 of iron core of asynchronous motor 1	0.0–100.0%	40.0%	○
P02.15	Rated power of synchronous motor 1	0.1–3000.0KW	Depends on model	◎
P02.16	Rated frequency of synchronous motor 1	0.01Hz–P00.03 (Max. output frequency)	50.00Hz	◎

Function code	Name	Description	Default value	Modify
P02.17	Number of pole pairs of synchronous motor 1	1–128	2	◎
P02.18	Rated voltage of synchronous motor 1	0–1200V	Depends on model	◎
P02.19	Rated current of synchronous motor 1	0.8–6000.0A	Depends on model	◎
P02.20	Stator resistance of synchronous motor 1	0.001–65.535Ω	Depends on model	○
P02.21	Direct-axis inductance of synchronous motor 1	0.01–655.35Mh	Depends on model	○
P02.22	Quadrature-axis inductance of synchronous motor 1	0.01–655.35Mh	Depends on model	○
P02.23	Counter-emf constant of synchronous motor 1	0–10000	300	○
P02.24	Reserved	0x0000–0xFFFF	0	●
P02.25	Reserved	0%–50% (rated motor current)	10%	●
P02.26	Overload protection of motor 1	0: No protection 1: Common motor (with low-speed compensation). As the cooling effect of common motor will be degraded in low speed, the corresponding electronic thermal protection value should also be adjusted properly, the low compensation here means to lower the overload protection threshold of the motor whose running frequency is below 30Hz. 2: Frequency-variable motor (without low speed compensation). As the cooling effect of	2	◎

Function code	Name	Description	Default value	Modify
		frequency-variable motor is not affected by the rotating speed, there is no need to adjust the protection value during low speed running.		
P02.27	Overload protection coefficient of motor 1	Motor overload multiples M=Iout/(In×K) In is rated motor current, Iout is VFD output current, K is motor overload protection coefficient. The smaller the K, the larger the value of M, and the easier the protection. M=116%: protection will be applied when motor overloads for 1h; M=200%: protection will be applied when motor overloads for 60s; M>=400%: protection will be applied immediately.  Setting range: 20.0%–120.0%	100.0%	○
P02.28	Power display calibration coefficient of motor 1	This function adjusts the power display value of motor 1 only, and it does not affect the control performance of the VFD. Setting range: 0.00–3.00	1.00	○
P02.29	Parameter display of motor 1	0: Display as per motor type; under this mode, only parameters related to current motor type will be displayed. 1: Display all; under this mode, all the motor parameters will be displayed.	0	○
P02.30	System inertia of motor 1	0–30.000kgm^2	0	○
P02.31–P02.32	Reserved	0–65535	0	○

P03—Vector control of motor 1

Function code	Name	Description	Default value	Modify
P03.00	Speed loop proportional gain 1	Parameters of P03.00–P03.05 fit for vector control mode only. Below P03.02, speed loop PI	20.0	○

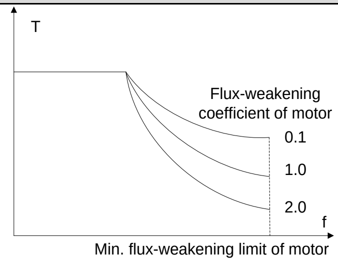
<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th><th>Modify</th></tr>
<tr><td>P03.01</td><td>Speed loop integral time 1</td><td rowspan="5">parameter is P03.00 and P03.01; above P03.06, speed loop PI parameter is P03.03 and P03.04; in between, PI parameter is obtained by linear variation between two groups of parameters, as shown below.


The speed loop dynamic response characteristics of vector control can be adjusted by setting the proportional coefficient and integral time of speed regulator. Increase proportional gain or decrease 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.
Speed loop PI parameter is closely related to the system inertial, you should make adjustment based on default PI parameter according to different load characteristics to fulfill different needs.
Setting range of P03.00:0.0–200.0;
Setting range of P03.01: 0.000–10.000s
Setting range of P03.02: 0.00Hz–P03.05
Setting range of P03.03: 0.0–200.0
Setting range of P03.04: 0.000–10.000s
Setting range of P03.05: P03.02–P00.03 (Max. output frequency)</td><td>0.200s</td><td>○</td></tr>
<tr><td>P03.02</td><td>Switch low point frequency</td><td>5.00Hz</td><td>○</td></tr>
<tr><td>P03.03</td><td>Speed loop proportional gain 2</td><td>20.0</td><td>○</td></tr>
<tr><td>P03.04</td><td>Speed loop integral time 2</td><td>0.200s</td><td>○</td></tr>
<tr><td>P03.05</td><td>Switch over high point frequency</td><td>10.00Hz</td><td>○</td></tr>
<tr><td>P03.06</td><td>Speed loop output filter</td><td>0–8 (corresponds to 0–2^8/10ms)</td><td>0</td><td>○</td></tr>
<tr><td>P03.07</td><td>Vector control slip compensation</td><td>Slip compensation coefficient is used to adjust the slip frequency of vector control to improve speed control precision. This parameter can be used to</td><td>100%</td><td>○</td></tr>
</table>

Function code	Name	Description	Default value	Modify
	coefficient (motoring)	control speed offset. Setting range: 50–200%		
P03.08	Vector control slip compensation coefficient (generating)		100%	○
P03.09	Current loop proportional coefficient P	**Note:** 1. These two parameters are used to adjust PI parameters of current loop; it affects dynamic response speed and control precision of the system directly. The default value needs no adjustment under common conditions; 2. Applicable to SVC mode 0 (P00.00=0), SVC mode 1 (P00.00=1), and closed-loop vector control mode (P00.00=3) Setting range: 0–65535	1000	○
P03.10	Current loop integral coefficient I		1000	○
P03.11	Torque setup mode selection	0–1: Keypad (P03.12) 2: AI1 3: AI2 4: AI3 5: Pulse frequency HDIA 6: Multi-step torque 7: Modbus communication 8: PROFIBUS/CANopen/DeviceNet communication 9: Ethernet communication 10: Pulse frequency HDIB 11: EtherCAT/PROFINET communication 12: PLC **Note:** For setting sources 2–6 and 10, 100% corresponds to three times the rated motor current.	0	○
P03.12	Torque set by keypad	-300.0%–300.0% (rated motor current)	20.0%	○
P03.13	Torque reference filter time	0.000–10.000s	0.010s	○
P03.14	Source of upper limit frequency	0: Keypad (P03.16) 1: AI1 (100% corresponds to max. frequency)	0	○

Function code	Name	Description	Default value	Modify
	setup of forward rotation in torque control	2: AI2 (the same as above) 3: AI3 (the same as above) 4: Pulse frequency HDIA (the same as above) 5: Multi-step (the same as above) 6: Modbus communication (the same as above) 7: PROFIBUS /CANopen/ DeviceNet communication (the same as above) 8: Ethernet communication (the same as above) 9: Pulse frequency HDIB (the same as above) 10: EtherCAT/PROFINET communication 11: PLC 12: Reserved		
P03.15	Source of upper limit frequency setup of reverse rotation in torque control	0: Keypad (P03.17) 1: AI1 (100% corresponds to max. frequency) 2: AI2 (the same as above) 3: AI3 (the same as above) 4: Pulse frequency HDIA (the same as above) 5: Multi-step (the same as above) 6: Modbus communication (the same as above) 7: PROFIBUS /CANopen/ DeviceNet communication (the same as above) 8: Ethernet communication (the same as above) 9: Pulse frequency HDIB (the same as above) 10: EtherCAT/PROFINET communication 11: PLC 12: Reserved **Note:** For sources 1–11, 100% is relative to the max. frequency	0	○
P03.16	Keypad limit value of upper limit frequency of forward rotation in torque control	This function code is used to set frequency limit. 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	Max. output frequency		50.00Hz	○
P03.18	Source of upper limit setup of the torque during motoring	0: Keypad (P03.20) 1: AI1 2: AI2 3: AI3	0	○

Function code	Name	Description	Default value	Modify
		4: Pulse frequency HDIA 5: Modbus communication 6: PROFIBUS/CANopen/DeviceNet communication 7: Ethernet communication 8: Pulse frequency HDIB 9: EtherCAT/PROFINET communication 10: PLC 11: Reserved **Note:** For setting sources 1–4 and 8, 100% corresponds to three times the rated motor current.		
P03.19	Source of upper limit setup of braking torque	0: Keypad (P03.21) 1: AI1 2: AI2 3: AI3 4: Pulse frequency HDIA 5: Modbus communication 6: PROFIBUS/CANopen/DeviceNet communication 7: Ethernet communication 8: Pulse frequency HDIB 9: EtherCAT/PROFINET communication 10: PLC 11: Reserved **Note:** For setting sources 1–4 and 8, 100% corresponds to three times the rated motor current.	0	○
P03.20	Set upper limit of the torque when motoring via keypad	This function code is used to set torque limit. Setting range: 0.0–300.0% (rated motor current)	180.0%	○
P03.21	Set upper limit of braking torque via keypad		180.0%	○
P03.22	Flux-weakening coefficient of constant-power zone	Used when asynchronous motor is in flux-weakening control.	0.3	○

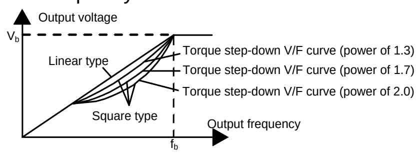
Function code	Name	Description	Default value	Modify
P03.23	Min. flux-weakening point of constant-power zone	 P03.22 and P03.23 are valid during constant power. When motor speed is above rated speed, motor enters flux-weakening running state. The flux-weakening control coefficient can change the flux-weakening curvature, the larger the coefficient, the steeper the curve, the smaller the coefficient, the smoother the curve. Setting range of P03.22: 0.1–2.0 Setting range of P03.23: 10%–100%	20%	○
P03.24	Max. voltage limit	P03.24 sets the maximum output voltage of the VFD, which is the percentage of rated motor voltage. Set the value according to onsite conditions. Setting range:0.0–120.0%	100.0%	○
P03.25	Pre-exciting time	Carry out motor pre-exciting during starting to build a magnetic field inside the motor to improve the torque characteristics of motor during starting. Setting range: 0.000–10.000s	0.300s	○
P03.26	Flux-weakening proportional gain	0–8000	1000	○
P03.27	Vector control speed display	0: Display as per actual value 1: Display as per the set value	0	○
P03.28	Static friction compensation coefficient	0.0–100.0%	0.0%	○
P03.29	Corresponding frequency point of static friction	0.50– P03.31	1.00Hz	○
P03.30	High speed friction compensation	0.0–100.0%	0.0%	○

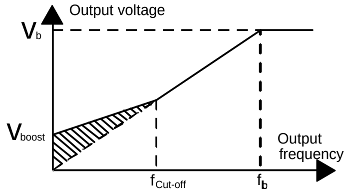
Function code	Name	Description	Default value	Modify
	coefficient			
P03.31	Corresponding frequency of high speed friction torque	P03.29–400.00Hz	50.00Hz	○
P03.32	Torque control enable	0:Disable 1:Enable	0	◎
P03.33	Flux weakening integral gain	0–8000	1200	○
P03.34	Reserved	0–65535	0	●
P03.35	Control optimization setting	0x0000–0x1111 Ones place: Torque command selection 0: Torque reference 1: Torque current reference Tens place: Reserved 0: Reserved 1: Reserved Hundreds place: Whether to enable ASR integral separation 0: Disable 1: Enable Thousands place: Reserved 0: Reserved 1: Reserved	0x0000	○
P03.36	Speed loop differential gain	0.00–10.00s	0.00s	○
P03.37	High-frequency current loop proportional coefficient	Under closed-loop vector control mode (P00.00=3) and P03.39, the current loop PI parameters are P03.09 and P03.10; above P03.39, the PI parameters are P03.37 and P03.38. Setting range of P03.37: 0–65535 Setting range of P03.38: 0–65535 Setting range of P03.39: 0.0–100.0% (relative to max. frequency)	1000	○
P03.38	High-frequency current loop integral coefficient		1000	○
P03.39	Current loop high-frequency switchover point		100.0%	○
P03.40	Inertia	0: Disable	0	○

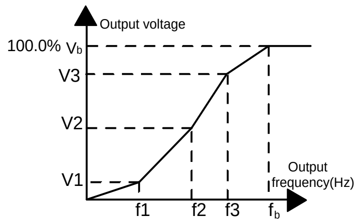
Function code	Name	Description	Default value	Modify
	compensation enabling	1: Enable		
P03.41	Upper limit of inertia compensation torque	Limit the max. inertia compensation torque to prevent inertia compensation torque from being too large. Setting range: 0.0–150.0% (rated motor torque)	10.0%	○
P03.42	Inertia compensation filter times	Filter times of inertia compensation torque, used to smooth inertia compensation torque. Setting range: 0–10	7	○
P03.43	Inertia identification torque value	Due to friction force, it is required to set certain identification torque for the inertia identification to be performed properly. 0.0–100.0% (rated motor torque)	10.0%	○
P03.44	Enable inertia identification	0: No operation 1: Start identification	0	◎
P03.45	Current loop proportional coefficient after autotuning	Automatic update will be performed after motor parameter autotuning. In the closed-loop vector control mode for synchronous motors, you can set the value of this function code to P03.09. Range: 0–65535 **Note: Set the value to 0 if motor parameter autotuning is not performed.**	0	●
P03.46	Current integral proportional coefficient after autotuning	Automatic update will be performed after motor parameter autotuning. In the closed-loop vector control mode for synchronous motors, you can set the value of this function code to P03.10. Range: 0–65535 **Note: Set the value to 0 if motor parameter autotuning is not performed.**	0	●

P04—V/F control

Function code	Name	Description	Default value	Modify
P04.00	V/F curve setup of motor 1	This group of function code defines the V/F curve of motor 1 to satisfy different load characteristics needs. 0: Straight V/F curve; fit for constant-torque load 1: Multi-point V/F curve 2: Torque down V/F curve (1.3^{th} order)	0	◎

Function code	Name	Description	Default value	Modify
		3: Torque down V/F curve (1.7th order) 4: Torque down V/F curve (2.0nd order) Curve 2–4 are suitable for torque-variable load of fan pump and similar equipment. You can make adjustment based on load characteristics to achieve optimal energy-saving effect. 5: Customized V/F (V/F separation); under this mode, V is separated from f. You can adjust f through the frequency reference channel set by P00.06 to change the curve characteristic, or adjust V through the voltage reference channel set by P04.27 to change the curve characteristics. **Note:** The V_b in the figure below corresponds to rated motor voltage, and f_b corresponds to rated motor frequency.  		
P04.01	Torque boost of motor 1	In order to compensate for low-frequency torque characteristics, you can make some boost compensation to the output voltage. P04.01 is relative to the maximum output voltage V_b. P04.02 defines the percentage of cut-off frequency of manual torque boost to the rated motor frequency f_b. Torque boost can improve the low-frequency torque characteristics of V/F. You should select torque boost based on the load, eg, larger load requires larger torque boost, however, if the torque boost is too large, the motor will run at over-excitation, which will cause increased output current and motor heat-up, thus degrading the efficiency. When torque boost is set to 0.0%, the VFD is automatic torque boost. Torque boost cut-off threshold: Below this frequency threshold, the torque boost is valid, exceeding this threshold will nullify torque boost.	0.0%	○
P04.02	Motor 1 torque boost cut-off		20.0%	○

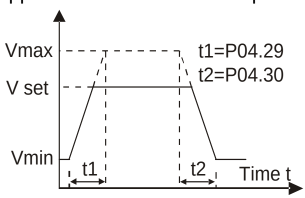
<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th><th>Modify</th></tr>
<tr><td></td><td></td><td>

Setting range of P04.01: 0.0%: (automatic) 0.1%–10.0%
Setting range of P04.02: 0.0%–50.0%</td><td></td><td></td></tr>
<tr><td>P04.03</td><td>V/F frequency point 1 of motor 1</td><td rowspan="6">When P04.00 =1 (multi-point V/F curve), you can set V/F curve via P04.03–P04.08.
V/F curve is usually set according to the characteristics of motor load.
Note: V1<V2<V3, f1<f2<f3. If low-frequency voltage is set too high, motor overheat or burnt-down may occur, and overcurrent stall or overcurrent protection may occur to the VFD.


Setting range of P04.03: 0.00Hz–P04.05
Setting range of P04.04: 0.0%–110.0% (rated voltage of motor 1)
Setting range of P04.05: P04.03–P04.07
Setting range of P04.06: 0.0%–110.0% (rated voltage of motor 1)
Setting range of P04.07: P04.05–P02.02 (rated frequency of asynchronous motor 1) or P04.05–P02.16 (rated frequency of synchronous motor 1)
Setting range of P04.08: 0.0%–110.0% (rated voltage of motor 1)</td><td>0.00Hz</td><td>○</td></tr>
<tr><td>P04.04</td><td>V/F voltage point 1 of motor 1</td><td>00.0%</td><td>○</td></tr>
<tr><td>P04.05</td><td>V/F frequency point 2 of motor 1</td><td>0.00Hz</td><td>○</td></tr>
<tr><td>P04.06</td><td>V/F voltage point 2 of motor 1</td><td>0.0%</td><td>○</td></tr>
<tr><td>P04.07</td><td>V/F frequency point 3 of motor 1</td><td>0.00Hz</td><td>○</td></tr>
<tr><td>P04.08</td><td>V/F voltage point 3 of motor 1</td><td>00.0%</td><td>○</td></tr>
<tr><td>P04.09</td><td>V/F slip compensation gain of motor 1</td><td>This parameter is used to compensate for the motor rotating speed change caused by load change in the SVPWM mode, and thus improve</td><td>0.0%</td><td>○</td></tr>
</table>

Function code	Name	Description	Default value	Modify
		the rigidity of the mechanical characteristics of the motor. You need to calculate the rated slip frequency of the motor as follows: △f=fb-n×p/60 where fb is the rated frequency of motor 1, corresponding to P02.02; n is the rated speed of motor 1, corresponding to P02.03; p is the number of pole pairs of motor 1. 100% corresponds to the rated slip frequency △f of motor 1. Setting range: 0.0–200.0%		
P04.10	Low-frequency oscillation control factor of motor 1	Under SVPWM control mode, the motor, especially the large-power motor may experience current oscillation during certain frequencies, which may lead to unstable motor operation, or even VFD overcurrent, you can adjust these two parameters properly to eliminate such phenomenon. Setting range of P04.10: 0–100 Setting range of P04.11: 0–100 Setting range of P04.12: 0.00Hz–P00.03 (Max. output frequency)	10	○
P04.11	High-frequency oscillation control factor of motor 1		10	○
P04.12	Oscillation control threshold of motor 1		30.00Hz	○
P04.13	V/F curve setup of motor 2	This parameter defines the V/F curve of motor 2 of the Goodrive350 series to meet various load characteristic requirements. 0: Straight V/F curve; 1: Multi-point V/F curve 2: Torque-down V/F curve (power of 1.3) 3: Torque-down V/F curve (power of 1.7) 4: Torque-down V/F curve (power of 2.0) 5: Customize V/F (V/F separation)	0	◎
P04.14	Torque boost of motor 2	**Note:** Refer to the parameter description of P04.01 and P04.02. Setting range of P04.14: 0.0%: (automatic) 0.1%–10.0% Setting range of 0.0%–50.0% (relative to rated frequency of motor 2)	0.0%	○
P04.15	Motor 2 torque boost cut-off		20.0%	○
P04.16	V/F frequency point 1 of motor 2	**Note:** Refer to the parameter description of P04.03–P04.08 Setting range of P04.16: 0.00Hz–P04.18 Setting range of P04.17:0.0%–110.0% (rated	0.00Hz	○
P04.17	V/F voltage point 1 of motor 2		00.0%	○

Function code	Name	Description	Default value	Modify
P04.18	V/F frequency point 2 of motor 2	voltage of motor 2) Setting range of P04.18: P04.16–P04.20	0.00Hz	○
P04.19	V/F voltage point 2 of motor 2	Setting range of P04.19: 0.0%–110.0% (rated voltage of motor 2)	00.0%	○
P04.20	V/F frequency point 3 of motor 2	Setting range of P04.20: P04.18–P12.02 (rated frequency of asynchronous motor 2) or P04.18–P12.16 (rated frequency of synchronous motor 2)	0.00Hz	○
P04.21	V/F voltage point 3 of motor 2	Setting range of P04.21:0.0%–110.0%(rated voltage of motor 2)	00.0%	○
P04.22	V/F slip compensation gain of motor 2	This parameter is used to compensate for the motor rotating speed change caused by load change in the SVPWM mode, and thus improve the rigidity of the mechanical characteristics of the motor. You need to calculate the rated slip frequency of the motor as follows: △f=fb-n*p/60 where fb is the rated frequency of motor 2, corresponding to P12.02; n is the rated speed of motor 2, corresponding to P12.03; p is the number of pole pairs of motor 2. 100% corresponds to the rated slip frequency △f of motor 2. Setting range: 0.0–200.0%	0.0%	○
P04.23	Low-frequency oscillation control factor of motor 2	In the SVPWM mode, current oscillation may easily occur on motors, especially large-power motors, at some frequency, which may cause unstable running of motors or even overcurrent of VFDs. You can modify this parameter to prevent current oscillation. Setting range of P04.23: 0–100 Setting range of P04.24: 0–100 Setting range of P04.25: 0.00 Hz–P00.03 (Max. output frequency)	10	○
P04.24	High-frequency oscillation control factor of motor 2		10	○
P04.25	Oscillation control threshold of motor 2		30.00Hz	○
P04.26	Energy-saving run	0: No action 1: Automatic energy-saving operation Under light-load state, the motor can adjust the output voltage automatically to achieve energy-saving purpose	0	◎
P04.27	Channel of voltage setup	0: Keypad; output voltage is determined by P04.28 1: AI1	0	○

Function code	Name	Description	Default value	Modify
		2: AI2 3: AI3 4: HDIA 5: Multi-step (the set value is determined by P10 group) 6: PID 7: Modbus communication 8: PROFIBUS/CANopen/DeviceNet communication 9: Ethernet communication 10: HDIB 11: EtherCAT/PROFINET communication 12: PLC programmable card 13: Reserved		
P04.28	Set voltage value via keypad	When the channel for voltage setup is set to "keypad", the value of this function code is digital voltage set value. Setting range: 0.0%–100.0%	100.0%	○
P04.29	Voltage increase time	Voltage increase time means the time needed from outputting the min. voltage to accelerating to output the max. voltage. Voltage decrease time means the time needed from outputting max. voltage to outputting the min. voltage Setting range: 0.0–3600.0s	5.0s	○
P04.30	Voltage decrease time		5.0s	○
P04.31	Output max. voltage	Set the upper/lower limit value of output voltage.  Setting range of P04.31: P04.32–100.0% (rated motor voltage) Setting range of P04.32: 0.0%–P04.31	100.0%	◎
P04.32	Output min. voltage		0.0%	◎
P04.33	Flux-weakening coefficient in the constant power zone	1.00–1.30	1.00	○

Function code	Name	Description	Default value	Modify
P04.34	Input current 1 in synchronous motor VF control	When the synchronous motor VF control mode is enabled, this parameter is used to set the reactive current of the motor when the output frequency is lower than the frequency set in P04.36. Setting range: -100.0%–+100.0% (of the rated current of the motor)	20.0%	○
P04.35	Input current 2 in synchronous motor VF control	When the synchronous motor VF control mode is enabled, this parameter is used to set the reactive current of the motor when the output frequency is higher than the frequency set in P04.36. Setting range: -100.0%–+100.0% (of the rated current of the motor)	10.0%	○
P04.36	Frequency threshold for input current switching in synchronous motor VF control	When the synchronous motor VF control mode is enabled, this parameter is used to set the frequency threshold for the switching between input current 1 and input current 2. Setting range: 0.00 Hz–P00.03 (Max. output frequency)	50.00Hz	○
P04.37	Reactive current closed-loop proportional coefficient in synchronous motor VF	When the synchronous motor VF control mode is enabled, this parameter is used to set the proportional coefficient of the reactive current closed-loop control. Setting range: 0–3000	50	○
P04.38	Reactive current closed-loop integral time in synchronous motor VF control	When the synchronous motor VF control mode is enabled, this parameter is used to set the integral coefficient of the reactive current closed-loop control. Setting range: 0–3000	30	○
P04.39	Reactive current closed-loop output limit in synchronous motor VF control	When the synchronous motor VF control mode is enabled, this parameter is used to set the output limit of the reactive current in the closed-loop control. A greater value indicates a higher reactive closed-loop compensation voltage and higher output power of the motor. In general, you do not need to modify this parameter. Setting range: 0–16000	8000	○
P04.40	Enable/disable IF mode for	0: Disabled 1: Enabled	0	◎

Function code	Name	Description	Default value	Modify
	asynchronous motor 1			
P04.41	Current setting in IF mode for asynchronous motor 1	When IF control is adopted for asynchronous motor 1, this parameter is used to set the output current. The value is a percentage in relative to the rated current of the motor. Setting range: 0.0–200.0%	120.0%	○
P04.42	Proportional coefficient in IF mode for asynchronous motor 1	When IF control is adopted for asynchronous motor 1, this parameter is used to set the proportional coefficient of the output current closed-loop control. Setting range: 0–5000	650	○
P04.43	Integral coefficient in IF mode for asynchronous motor 1	When IF control is adopted for asynchronous motor 1, this parameter is used to set the integral coefficient of the output current closed-loop control. Setting range: 0–5000	350	○
P04.44	Starting frequency point for switching off IF mode for asynchronous motor 1	0.00–P04.50	10.00Hz	○
P04.45	Enable/disable IF mode for asynchronous motor 2	0: Disabled 1: Enabled	0	◎
P04.46	Current setting in IF mode for asynchronous motor 2	When IF control is adopted for asynchronous motor 2, this parameter is used to set the output current. The value is a percentage in relative to the rated current of the motor. Setting range: 0.0–200.0%	120.0%	○
P04.47	Proportional coefficient in IF mode for asynchronous motor 2	When IF control is adopted for asynchronous motor 2, this parameter is used to set the proportional coefficient of the output current closed-loop control. Setting range: 0–5000	650	○
P04.48	Integral coefficient in IF	When IF control is adopted for asynchronous motor 2, this parameter is used to set the integral	350	○

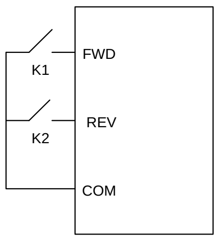
Function code	Name	Description	Default value	Modify
	mode for asynchronous motor 2	coefficient of the output current closed-loop control. Setting range: 0–5000		
P04.49	Starting frequency point for switching off IF mode for asynchronous motor 2	0.00–P04.51	10.00Hz	○
P04.50	End frequency point for switching off IF mode for asynchronous motor 1	P04.44–P00.03	25.00Hz	○
P04.51	End frequency point for switching off IF mode for asynchronous motor 2	P04.49–P00.03	25.00Hz	○

P05—Input terminals

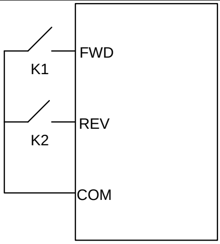
Function code	Name	Description	Default value	Modify
P05.00	HDI input type	0x00–0x11 Ones: HDIA input type 0: HDIA is high-speed pulse input 1: HDIA is digital input Tens: HDIB input type 0: HDIB is high-speed pulse input 1: HDIB is digital input	0	◎
P05.01	Function of S1 terminal	0: No function 1: Forward running 2: Reverse running 3: 3-wire control/Sin 4: Forward jogging 5: Reverse jogging 6: Coast to stop	1	◎
P05.02	Function of S2 terminal		4	◎
P05.03	Function of S3 terminal		7	◎
P05.04	Function of S4		0	◎

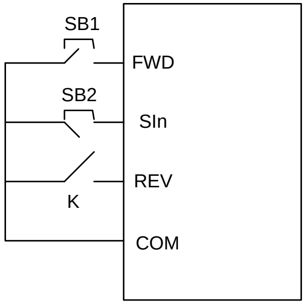
Function code	Name	Description	Default value	Modify
	terminal	7: Fault reset		
P05.05	Function of HDIA terminal	8: Running pause 9: External fault input	0	◎
P05.06	Function of HDIB terminal	10: Frequency increase (UP) 11: Frequency decrease (DOWN) 12: Clear frequency increase/decrease setting 13: Switchover between setup A and setup B 14: Switchover between combination setup and setup A 15: Switchover between combination setup and setup B 16: Multi-step speed terminal 1 17: Multi-step speed terminal 2 18: Multi-step speed terminal 3 19: Multi-step speed terminal 4 20: Multi-step speed pause 21: Acceleration/deceleration time selection 1 22: Acceleration/deceleration time selection 2 23: Simple PLC stop reset 24: Simple PLC pause 25: PID control pause 26: Wobbling frequency pause 27: Wobbling frequency reset 28: Counter reset 29: Switchover between speed control and torque control 30: Acceleration/deceleration disabled 31: Counter trigger 32: Reserved 33: Clear frequency increase/decrease setting temporarily 34: DC brake 35: Switchover between motor 1 and motor 2 36: Command switches to keypad 37: Command switches to terminal 38: Command switches to communication 39: Pre-exciting command 40: Zero out power consumption quantity 41: Maintain power consumption quantity	0	◎

Function code	Name	Description	Default value	Modify
		42: Source of upper torque limit switches to keypad 43: Position reference point input (only S6, S7 and S8 are valid) 44: Spindle orientation disabled 45: Spindle zeroing/local positioning zeroing 46: Spindle zero position selection 1 47: Spindle zero position selection 2 48: Spindle scale division selection 1 49: Spindle scale division selection 2 50: Spindle scale division selection 3 51: Position control and speed control switchover terminal 52: Pulse input disabled 53: Clear position deviation cleared 54: Switch over position proportional gain 55: Enable cyclic positioning of digital position positioning 56: Emergency stop 57: Motor over-temperature fault input 58: Enable rigid tapping 59: Switch to V/F control 60: Switch to FVC control 61: PID polarity switchover 62: Reserved 63: Enable servo 64: Limit of forward run 65: Limit of reverse run 66: Zero out encoder counting 67: Pulse increase 68: Enable pulse superimposition 69: Pulse decrease 70: Electronic gear selection 71: Switch to master 72: Switch to slave 73–79: Reserved		
P05.07	Reserved	0–65535	0	●
P05.08	Polarity of input terminal	This function code is used to set the polarity of input terminals.	0x000	○

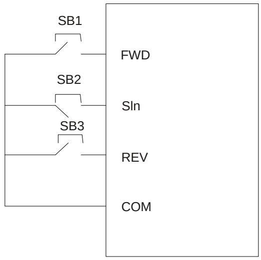
<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th><th>Modify</th></tr>
<tr><td></td><td></td><td>When the bit is set to 0, input terminal polarity is positive;
When the bit is set to 1, input terminal polarity is negative;
0x000–0x3F</td><td></td><td></td></tr>
<tr><td>P05.09</td><td>Digital filter time</td><td>Set S1–S4, filter time of HDI terminal sampling. In cases where interference is strong, increase the value of this parameter to avoid mal-operation.
0.000–1.000s</td><td>0.010s</td><td>○</td></tr>
<tr><td>P05.10</td><td>Virtual terminal setting</td><td>0x000–0x3F (0: disable, 1: enable)
BIT0: S1 virtual terminal
BIT1: S2 virtual terminal
BIT2: S3 virtual terminal
BIT3: S4 virtual terminal
BIT4: HDIA virtual terminal
BIT5: HDIB virtual terminal</td><td>0x00</td><td>◎</td></tr>
<tr><td>P05.11</td><td>2/3 Wire control mode</td><td>This function code is used to set the 2/3 Wire control mode.
0: 2-Wire control 1; integrate enabling function with direction. This mode is the most popular dual-line mode. Direction of motor rotation is determined by the defined FWD/REV terminal command.


<table>
<tr><th>FWD</th><th>REV</th><th>Running command</th></tr>
<tr><td>OFF</td><td>OFF</td><td>Stop</td></tr>
<tr><td>ON</td><td>OFF</td><td>Forward running</td></tr>
<tr><td>OFF</td><td>ON</td><td>Reverse running</td></tr>
<tr><td>ON</td><td>ON</td><td>Hold</td></tr>
</table>
1: 2-wire control 2; separate enabling function with direction. In this mode, the defined FWD is enabling terminal, and the direction is determined by the state of REV.</td><td>0</td><td>◎</td></tr>
</table>

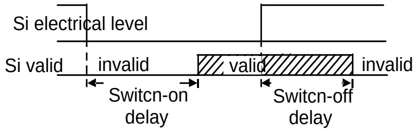
<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th><th>Modify</th></tr>
<tr><td></td><td></td><td>


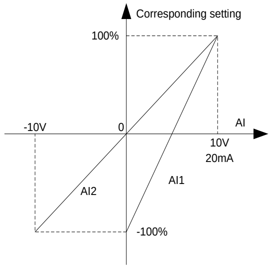
<table>
<tr><th>FWD</th><th>REV</th><th>Running command</th></tr>
<tr><td>OFF</td><td>OFF</td><td>Stop</td></tr>
<tr><td>ON</td><td>OFF</td><td>Forward running</td></tr>
<tr><td>OFF</td><td>ON</td><td>Stop</td></tr>
<tr><td>ON</td><td>ON</td><td>Reverse running</td></tr>
</table>
2: 3-wire control 1; This mode defines Sin as enabling terminal, and the running command is generated by FWD, the direction is controlled by REV. During running, the Sin terminal should be closed, and terminal FWD generates a rising edge signal, then the VFD starts to run in the direction set by the state of terminal REV; the VFD should be stopped by disconnecting terminal Sin.


The direction control during running is shown below.
<table>
<tr><th>SIn</th><th>REV</th><th>Previous running direction</th><th>Current running direction</th></tr>
<tr><td rowspan="2">ON</td><td rowspan="2">OFF→ON</td><td>Forward</td><td>Reverse</td></tr>
<tr><td>Reverse</td><td>Forward</td></tr>
<tr><td rowspan="2">ON</td><td rowspan="2">ON→OFF</td><td>Reverse</td><td>Forward</td></tr>
<tr><td>Forward</td><td>Reverse</td></tr>
<tr><td rowspan="2">ON→OFF</td><td>ON</td><td colspan="2" rowspan="2">Decelerate to stop</td></tr>
<tr><td>OFF</td></tr>
</table>
SIn: 3-wire control/Sin, FWD: Forward running, REV: Reverse running
</td><td></td><td></td></tr>
</table>

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th><th>Modify</th></tr>
<tr><td></td><td></td><td>3: 3-wire control 2; This mode defines Sin as enabling terminal. The running command is generated by FWD or REV, and they control the running direction. During running, the terminal Sin should be closed, and terminal FWD or REV generates a rising edge signal to control the running and direction of VFD; the VFD should be stopped by disconnecting terminal Sin.


<table>
<tr><th>SIn</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>Forward</td></tr>
<tr><td>OFF</td><td>Forward</td></tr>
<tr><td rowspan="2">ON</td><td>ON</td><td rowspan="2">OFF→ON</td><td>Reverse</td></tr>
<tr><td>OFF</td><td>Reverse</td></tr>
<tr><td>ON→OFF</td><td></td><td></td><td>Decelerate to stop</td></tr>
</table>
SIn: 3-wire control/Sin, FWD: Forward running, REV: Reverse running
Note: For dual-line running mode, when FWD/REV terminal is valid, if the VFD stops due to stop command given by other sources, it will not run again after the stop command disappears even if the control terminals FWD/REV are still valid. To make the VFD run again, you need to trigger FWD/REV again, eg, PLC single-cycle stop, fixed-length stop, and valid STOP/RST stop during terminal control. (see P07.04)</td><td></td><td></td></tr>
<tr><td>P05.12</td><td>S1 terminal</td><td>These function codes define corresponding delay</td><td>0.000s</td><td>○</td></tr>
</table>

Function code	Name	Description	Default value	Modify
	switch-on delay	of the programmable input terminals during level variation from switch-on to switch-off .  Setting range: 0.000–50.000s **Note:** After a virtual terminal is enabled, the state of the terminal can be changed only in communication mode. The communication address is 0x200A.		
P05.13	S1 terminal switch-off delay		0.000s	○
P05.14	S2 terminal switch-on delay		0.000s	○
P05.15	S2 terminal switch-off delay		0.000s	○
P05.16	S3 terminal switch-on delay		0.000s	○
P05.17	S3 terminal switch-off delay		0.000s	○
P05.18	S4 terminal switch-on delay		0.000s	○
P05.19	S4 terminal switch-off delay		0.000s	○
P05.20	HDIA terminal switch-on delay		0.000s	○
P05.21	HDIA terminal switch-off delay		0.000s	○
P05.22	HDIB terminal switch-on delay		0.000s	○
P05.23	HDIB terminal switch-off delay		0.000s	○
P05.24	Lower limit value of AI1	These function codes define the relation between analog input voltage and corresponding set value of analog input. When the analog input voltage exceeds the range of max./min. input, the max. input or min. input will be adopted during calculation. When analog input is current input, 0–20mA current corresponds to 0–10V voltage. In different applications, 100% of analog setting corresponds to different nominal values. The figure below illustrates several settings.	0.00V	○
P05.25	Corresponding setting of lower limit of AI1		0.0%	○
P05.26	Upper limit value of AI1		10.00V	○
P05.27	Corresponding setting of upper limit of AI1		100.0%	○
P05.28	Input filter time of AI1		0.030s	○
P05.29	Lower limit value of AI2		-10.00V	○
P05.30	Corresponding		-100.0%	○

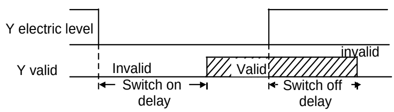
<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th><th>Modify</th></tr>
<tr><td></td><td>setting of lower limit of AI2</td><td rowspan="8">

Input filter time: Adjust the sensitivity of analog input, increase this value properly can enhance the anti-interference capacity of analog variables; however, it will also degrade the sensitivity of analog input.
Note: AI1 can support 0–10V/0–20mA input, when AI1 selects 0–20mA input; the corresponding voltage of 20mA is 10V; AI2 supports -10V–+10V input.
Setting range of P05.24: 0.00V–P05.26
Setting range of P05.25: -300.0%–300.0%
Setting range of P05.26: P05.24–10.00V
Setting range of P05.27: -300.0%–300.0%
Setting range of P05.28: 0.000s–10.000s
Setting range of P05.29: -10.00V–P05.31
Setting range of P05.30: -300.0%–300.0%
Setting range of P05.31: P05.29–P05.33
Setting range of P05.32: -300.0%–300.0%
Setting range of P05.33: P05.31–P05.35
Setting range of P05.34: -300.0%–300.0%
Setting range of P05.35: P05.33–10.00V
Setting range of P05.36: -300.0%–300.0%
Setting range of P05.37: 0.000s–10.000s</td><td></td><td></td></tr>
<tr><td>P05.31</td><td>Intermediate value 1 of AI2</td><td>0.00V</td><td>○</td></tr>
<tr><td>P05.32</td><td>Corresponding setting of intermediate value 1 of AI2</td><td>0.0%</td><td>○</td></tr>
<tr><td>P05.33</td><td>Intermediate value 2 of AI2</td><td>0.00V</td><td>○</td></tr>
<tr><td>P05.34</td><td>Corresponding setting of intermediate value 2 of AI2</td><td>0.0%</td><td>○</td></tr>
<tr><td>P05.35</td><td>Upper limit value of AI2</td><td>10.00V</td><td>○</td></tr>
<tr><td>P05.36</td><td>Corresponding setting of upper limit of AI2</td><td>100.0%</td><td>○</td></tr>
<tr><td>P05.37</td><td>Input filter time of AI2</td><td>0.030s</td><td>○</td></tr>
<tr><td>P05.38</td><td>HDIA high-speed pulse input function</td><td>0: Set input via frequency
1: Reserved
2: Input via encoder, used in combination with HDIB</td><td>0</td><td>◎</td></tr>
<tr><td>P05.39</td><td>Lower limit frequency of HDIA</td><td>0.000 kHz – P05.41</td><td>0.000 kHz</td><td>○</td></tr>
</table>

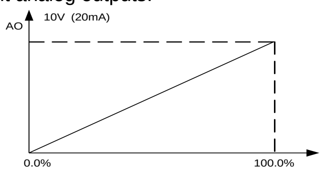
Function code	Name	Description	Default value	Modify
P05.40	Corresponding setting of lower limit frequency of HDIA	-300.0%–300.0%	0.0%	○
P05.41	Upper limit frequency of HDIA	P05.39 –50.000kHz	50.000 kHz	○
P05.42	Corresponding setting of upper limit frequency of HDIA	-300.0%–300.0%	100.0%	○
P05.43	HDIA frequency input filter time	0.000s–10.000s	0.030s	○
P05.44	HDIB high-speed pulse input function selection	0: Set input via frequency 1: Reserved 2: Encoder input, used in combination with HDIA	0	◎
P05.45	Lower limit frequency of HDIB	0.000 kHz – P05.47	0.000 kHz	○
P05.46	Corresponding setting of lower limit frequency of HDIB	-300.0%–300.0%	0.0%	○
P05.47	Upper limit frequency of HDIB	P05.45–50.000kHz	50.000 kHz	○
P05.48	Corresponding setting of upper limit frequency of HDIB	-300.0%–300.0%	100.0%	○
P05.49	HDIB frequency input filter time	0.000s–10.000s	0.030s	○
P05.50	AI1 input signal type	0: Voltage type 1: Current type **Note:** You can set the AI1 input signal type through the corresponding function code.	0	◎
P05.51–P05.52	Reserved	0–65535	0	●

P06—Output terminals

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th><th>Modify</th></tr>
<tr><td>P06.00</td><td>HDO output type</td><td>0: Open collector high-speed pulse output: Max. frequency of the pulse is 50.00kHz. For details about the related functions, see P06.27–P06.31.
1: Open collector output: For details about the related functions, see P06.02.</td><td>0</td><td>◎</td></tr>
<tr><td>P06.01</td><td>Y1 output selection</td><td rowspan="4">0: Invalid
1: In running
2: In forward running
3: In reverse running
4: In jogging
5: VFD fault
6: Frequency level detection FDT1
7: Frequency level detection FDT2
8: Frequency reached
9: Running in zero speed
10: Reach upper limit frequency
11: Reach lower limit frequency
12: Ready to run
13: In pre-exciting
14: Overload pre-alarm
15: Underload pre-alarm
16: Simple PLC stage completed
17: Simple PLC cycle completed
18: Reach set counting value
19: Reach designated counting value
20: External fault is valid
21: Reserved
22: Reach running time
23: Virtual terminal output of Modbus communication
24: Virtual terminal output of POROFIBUS /CANopen communication
25: Virtual terminal output of Ethernet communication
26: DC bus voltage established
27: z pulse output
28: During pulse superposition
29: STO act</td><td>0</td><td>○</td></tr>
<tr><td>P06.02</td><td>HDO output selection</td><td>0</td><td>○</td></tr>
<tr><td>P06.03</td><td>Relay RO1 output selection</td><td>1</td><td>○</td></tr>
<tr><td>P06.04</td><td>Relay RO2 output selection</td><td>5</td><td>○</td></tr>
</table>

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th><th>Modify</th></tr>
<tr><td></td><td></td><td>30: Positioning completed
31: Spindle zeroing completed
32: Spindle scale-division completed
33: In speed limit
34–35: Reserved
36: Speed/position control switchover completed
37: Any frequency reached
38–40: Reserved
41: C_Y1 from PLC (You need to set P27.00 to 1.)
42: C_Y2 from PLC (You need to set P27.00 to 1.)
43: C_HDO from PLC (You need to set P27.00 to 1.)
44: C_RO1 from PLC (You need to set P27.00 to 1.)
45: C_RO2 from PLC (You need to set P27.00 to 1.)
46: C_RO3 from PLC (You need to set P27.00 to 1.)
47: C_RO4 from PLC (You need to set P27.00 to 1.)
48–63: Reserved</td><td></td><td></td></tr>
<tr><td>P06.05</td><td>Output terminal polarity selection</td><td>This function code is used to set the polarity of output terminals.
When the bit is set to 0, input terminal polarity is positive;
When the bit is set to 1 input terminal polarity is negative.<table><tr><td>BIT3</td><td>BIT2</td><td>BIT1</td><td>BIT0</td></tr><tr><td>RO2</td><td>RO1</td><td>HDO</td><td>Y</td></tr></table>Setting range: 0x0–0xF</td><td>00</td><td>○</td></tr>
<tr><td>P06.06</td><td>Y switch-on delay</td><td rowspan="5">This function code defines the corresponding delay of the level variation from switch-on to switch-off.

Setting range: 0.000–50.000s</td><td>0.000s</td><td>○</td></tr>
<tr><td>P06.07</td><td>Y switch-off delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P06.08</td><td>HDO switch-on delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P06.09</td><td>HDO switch-off delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P06.10</td><td>Relay RO1 switch-on delay</td><td>0.000s</td><td>○</td></tr>
</table>

Function code	Name	Description	Default value	Modify
P06.11	Relay RO1 switch-off delay	**Note: P06.08 and P06.09 are valid only when P06.00=1.**	0.000s	○
P06.12	Relay RO2 switch-on delay		0.000s	○
P06.13	Relay RO2 switch-off delay		0.000s	○
P06.14	AO1 output selection	0: Running frequency (0–Max. output frequency) 1: Set frequency (0–Max. output frequency) 2: Ramp reference frequency (0–Max. output frequency) 3: Rotational speed (0–Speed corresponding to max. output frequency) 4: Output current (0–Twice the VFD rated current) 5: Output current (0–Twice the motor rated current) 6: Output voltage (0–1.5 times the VFD rated voltage) 7: Output power (0–Twice the motor rated power) 8: Set torque (0–Twice the motor rated current) 9: Output torque (Absolute value, 0–+/- Twice the motor rated torque) 10: AI1 input (0–10V/0–20mA) 11: AI2 input (0–10V) 12: AI3 input (0–10V/0–20mA) 13: HDIA input(0.00–50.00kHz) 14: Value 1 set through Modbus (0–1000) 15: Value 2 set through Modbus (0–1000) 16: Value 1 set through PROFIBUS/CANopen/DeviceNet (0–1000) 17: Value 2 set through PROFIBUS/CANopen/DeviceNet (0–1000) 18: Value 1 set through Ethernet 1 (0–1000) 19: Value 2 set through Ethernet 2 (0–1000) 20: HDIB input (0.00–50.00kHz) 21: Value 1 set through EtherCat/Profinet/EtherNetIP (0–1000) 22: Torque current (bipolar, 0–Triple the motor rated current) 23: Exciting current (bipolar, 0–Triple the motor	0	○
P06.15	Reserved		0	○
P06.16	HDO high-speed pulse output		0	○

Function code	Name	Description	Default value	Modify
		rated current) 24: Set frequency (bipolar, 0–Max. output frequency) 25: Ramp reference frequency (bipolar, 0–Max. output frequency) 26: Rotational speed (bipolar, 0–Speed corresponding to max. output frequency) 27: Value 2 set through EtherCat/Profinet/EtherNetIP (0–1000) 28: C_AO1 (Set P27.00 to 1. 0–1000) 29: C_AO2 (Set P27.00 to 1. 0–1000) 30: Rotational speed (0–Twice the motor rated synchronous speed) 31: Output torque (Actual value, 0–Twice the motor rated torque) 32–47: Reserved		
P06.17	Lower limit of AO1 output	Above function codes define the relation between output value and analog output. When the output value exceeds the set max./min. output range, the upper/low limit of output will be adopted during calculation. When analog output is current output, 1mA corresponds to 0.5V voltage. In different applications, 100% of output value corresponds to different analog outputs.  Setting range of P06.17: -300.0%–P06.19 Setting range of P06.18: 0.00V–10.00V Setting range of P06.19: P06.17–300.0% Setting range of P06.20: 0.00V–10.00V Setting range of P06.21: 0.000s–10.000s	0.0%	○
P06.18	Corresponding AO1 output of lower limit		0.00V	○
P06.19	Upper limit of AO1 output		100.0%	○
P06.20	Corresponding AO1 output of upper limit		10.00V	○
P06.21	AO1 output filter time		0.000s	○
P06.22–P06.26	Reserved	0–65535	0	●
P06.27	Lower limit of	-300.0%–P06.29	0.00%	○

Function code	Name	Description	Default value	Modify
	HDO output			
P06.28	Corresponding HDO output of lower limit	0.00–50.00kHz	0.00kHz	○
P06.29	Upper limit of HDO output	P06.27–300.0%	100.0%	○
P06.30	Corresponding HDO output of upper limit	0.00–50.00kHz	50.00 kHz	○
P06.31	HDO output filter time	0.000s–10.000s	0.000s	○
P06.32	Reserved	0–65535	0	●
P06.33	Frequency reach detection value	0–P00.03	1.00Hz	○
P06.34	Frequency reach detection time	0–3600.0s	0.5s	○

P07—HMI

Function code	Name	Description	Default value	Modify
P07.00	User password	0–65535 Set it to any non-zero value to enable password protection. 00000: Clear the previous user password and disable password protection. 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	○

Function code	Name	Description	Default value	Modify
P07.01	Reserved		/	/
P07.02	Function of keys	Range: 0x00–0x27 Ones: Function selection of QUICK/JOG key 0: No function 1: Jogging 2: Reserved 3: Forward/reverse rotation switchover 4: Clear UP/DOWN setting 5: Coast to stop 6: Switch over the running command reference mode in sequence 7: Reserved Tens: Reserved	0x01	◎
P07.03	Running command channel switchover sequence of QUICK key	When P07.02=6, set the switchover sequence of running command channel. 0: keypad control→terminal control→ communication control 1: keypad control←→terminal control 2: keypad control←→communication control 3: terminal control←→communication control	0	○
P07.04	Stop function selection of STOP/RST key	Validness selection of stop function of STOP/RST. For fault reset, STOP/RST is valid under any situation. 0: valid only for panel control only 1: valid for both panel and terminal control 2: valid for both panel and communication control 3: valid for all control modes	0	○
P07.05–P07.07	Reserved		/	/
P07.08	Frequency display coefficient	0.01–10.00 Display frequency=running frequency× P07.08	1.00	○
P07.09	Speed display coefficient	0.1–999.9% Mechanical speed=120×display running frequency×P07.09/number of motor pole pairs	100.0%	○
P07.10	Linear speed display coefficient	0.1–999.9% Linear speed=mechanical speed×P07.10	1.0%	○

Function code	Name	Description	Default value	Modify
P07.11	Temperature of rectifier bridge module	-20.0–120.0°C	/	●
P07.12	Temperature of inverter module	-20.0–120.0°C	/	●
P07.13	Software version of control board	1.00–655.35	/	●
P07.14	Accumulated running time	0–65535h	/	●
P07.15	High bit of VFD power consumption	Display the power consumption of the VFD. VFD power 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	Low bit of VFD power consumption		/	●
P07.17	Reserved		/	/
P07.18	Rated power of VFD	0.4–3000.0kW	/	●
P07.19	Rated voltage of VFD	50–1200V	/	●
P07.20	Rated current of VFD	0.1–6000.0A	/	●
P07.21	Factory barcode 1	0x0000–0xFFFF	/	●
P07.22	Factory barcode 2	0x0000–0xFFFF	/	●
P07.23	Factory barcode 3	0x0000–0xFFFF	/	●
P07.24	Factory barcode 4	0x0000–0xFFFF	/	●
P07.25	Factory barcode 5	0x0000–0xFFFF	/	●
P07.26	Factory barcode 6	0x0000–0xFFFF	/	●
P07.27	Type of present fault	0: No fault 1: Inverter unit U phase protection (OUt1) 2: Inverter unit V phase protection (OUt2) 3: Inverter unit W phase protection (OUt3) 4: Overcurrent during acceleration (OC1) 5: Overcurrent during deceleration (OC2) 6: Overcurrent during constant speed (OC3) 7: Overvoltage during acceleration (OV1) 8: Overvoltage during deceleration (OV2) 9: Overvoltage during constant speed (OV3)	/	●
P07.28	Type of the last fault		/	●
P07.29	Type of the 2nd-last fault		/	●
P07.30	Type of the 3rd-last fault		/	●
P07.31	Type of the 4th-last fault		/	●

Function code	Name	Description	Default value	Modify
P07.32	Type of the 5th-last fault	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: 485 communication fault (CE) 19: Current detection fault (ItE) 20: Motor autotuning fault (tE) 21: EEPROM operation fault (EEP) 22: PID feedback offline fault (PIDE) 23: Braking unit fault (bCE) 24: Running time reached (END) 25: Electronic overload (OL3) 26: Keypad communication error (PCE) 27: Parameter upload error (UPE) 28: Parameter download error (DNE) 29: Profibus communication fault (E-DP) 30: Ethernet communication fault (E-NET) 31: CANopen communication fault (E-CAN) 32: To-ground short-circuit fault 1 (ETH1) 33: To-ground short-circuit fault 2 (ETH2) 34: Speed deviation fault (dEu) 35: Mal-adjustment fault (STo) 36: Underload fault (LL) 37: Encoder offline fault (ENC1O) 38: Encoder reversal fault (ENC1D) 39: Encoder Z pulse offline fault (ENC1Z) 40: Safe torque off (STO) 41: Channel H1 safety circuit exception (STL1) 42: Channel H2 safety circuit exception (STL2) 43: Channel H1 and H2 exception (STL3) 44: Safety code FLASH CRC fault (CrCE) 45: PLC card customized fault 1 (P-E1) 46: PLC card customized fault 2 (P-E2) 47: PLC card customized fault 3 (P-E3) 48: PLC card customized fault 4 (P-E4)	/	●

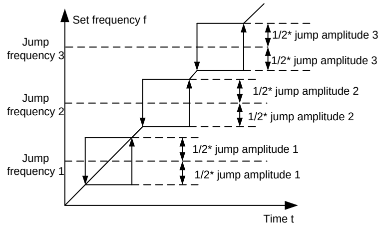
Function code	Name	Description	Default value	Modify
		49: PLC card customized fault 5 (P-E5) 50: PLC card customized fault 6 (P-E6) 51: PLC card customized fault 7 (P-E7) 52: PLC card customized fault 8 (P-E8) 53: PLC card customized fault 9 (P-E9) 54: PLC card customized fault 10 (P-E10) 55: Repetitive extension card type fault (E-Err) 56: Encoder UVW loss fault (ENCUV) 57: Profibus communication fault (E-PN) 58: CANopen communication fault (ESCAN) 59: Motor over-temperature fault (OT) 60: Card slot 1 card identification failure (F1-Er) 61: Card slot 2 card identification failure (F2-Er) 62: Card slot 3 card identification failure (F3-Er) 63: Card slot 1 card communication timeout fault (C1-Er) 64: Card slot 2 card communication timeout fault (C2-Er) 65: Card slot 3 card communication timeout fault (C3-Er) 66: EtherCAT communication fault (E-CAT) 67: Bacnet communication fault (E-BAC) 68: DeviceNet communication fault (E-DEV) 69: Master-slave synchronous CAN slave fault (S-Err)		
P07.33	Running frequency of present fault	0.00Hz–P00.03	0.00Hz	●
P07.34	Ramp reference frequency of present fault	0.00Hz–P00.03	0.00Hz	●
P07.35	Output voltage of present fault	0–1200V	0V	●
P07.36	Output current of present fault	0.0–6300.0A	0.0A	●
P07.37	Bus voltage of present fault	0.0–2000.0V	0.0V	●
P07.38	Max. temperature of present fault	-20.0–120.0°C	0.0°C	●

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

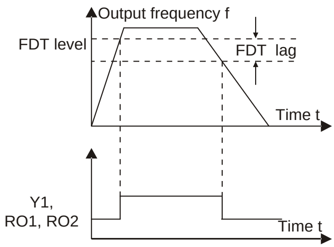
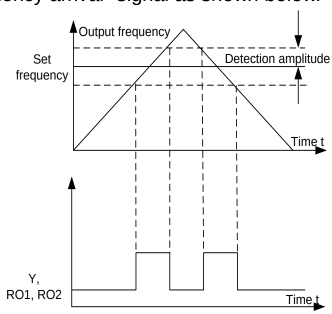
Function code	Name	Description	Default value	Modify
P07.54	Max. temperature of the 2nd-last fault	-20.0–120.0°C	0.0°C	●
P07.55	Input terminal state of the 2nd-last fault	0x0000–0xFFFF	0	●
P07.56	Output terminal state of the 2nd-last fault	0x0000–0xFFFF	0	●

P08—Enhanced functions

Function code	Name	Description	Default value	Modify
P08.00	Acceleration time 2	See P00.11 and P00.12 for detailed definitions. Goodrive350 series VFD defines four groups of acceleration/deceleration time, which can be selected by multi-function digital input terminal (P05 group). The acceleration/deceleration time of the VFD is the first group by default. Setting range: 0.0–3600.0s	Depends on model	○
P08.01	Deceleration time 2		Depends on model	○
P08.02	Acceleration time 3		Depends on model	○
P08.03	Deceleration time 3		Depends on model	○
P08.04	Acceleration time 4		Depends on model	○
P08.05	Deceleration time 4		Depends on model	○
P08.06	Running frequency of jogging	This function code is used to define the reference frequency of the VFD during jogging. Setting range: 0.00Hz–P00.03 (Max. output frequency)	5.00Hz	○
P08.07	Acceleration time of jogging	Jogging acceleration time is the time needed for the VFD to accelerate from 0Hz to Max. output frequency (P00.03). Jogging deceleration time is the time needed from decelerating from Max. output frequency (P00.03) to 0Hz. Setting range: 0.0–3600.0s	Depends on model	○
P08.08	Deceleration time of jogging			○
P08.09	Jump frequency 1	When the set frequency is within the range of jump frequency, the VFD will run at the boundary of jump frequency.	0.00Hz	○
P08.10	Jump frequency amplitude 1		0.00Hz	○

Function code	Name	Description	Default value	Modify
P08.11	Jump frequency 2	The VFD can avoid mechanical resonance point by setting the jump frequency, and three jump frequency points can be set. If the jump frequency points are set to 0, this function will be invalid.	0.00Hz	○
P08.12	Jump frequency amplitude 2		0.00Hz	○
P08.13	Jump frequency 3		0.00Hz	○
P08.14	Jump frequency amplitude 3	 Setting range: 0.00Hz–P00.03 (Max. output frequency)	0.00Hz	○
P08.15	Amplitude of wobbling frequency	0.0–100.0% (relative to set frequency)	0.0%	○
P08.16	Amplitude of jump frequency	0.0–50.0% (relative to amplitude of wobbling frequency)	0.0%	○
P08.17	Rise time of wobbling frequency	0.1–3600.0s	5.0s	○
P08.18	Descend time of wobbling frequency	0.1–3600.0s	5.0s	○
P08.19	Switching frequency of acceleration/deceleration time	0.00–P00.03 (Max. output frequency) 0.00Hz: no switchover Switch to acceleration/deceleration time 2 if the running frequency is larger than P08.19	0.00Hz	○
P08.20	Frequency threshold of the start of droop control	0.00–50.00Hz	2.00Hz	○
P08.21	Reference frequency of acceleration/ deceleration time	0: Max. output frequency 1: Set frequency 2: 100Hz **Note: Valid for straight acceleration/deceleration only**	0	◎
P08.22	Output torque	0: Calculated based on torque current	0	○

Function code	Name	Description	Default value	Modify
	calculation mode			
P08.23	Number of decimal points of frequency	0: Two decimal points 1: One decimal point	0	○
P08.24	Number of decimal points of linear speed	0: No decimal point 1: One 2: Two 3: Three	0	○
P08.25	Set count value	P08.26–65535	0	○
P08.26	Designated count value	0–P08.25	0	○
P08.27	Set running time	0–65535min	0min	○
P08.28	Automatic fault reset times	Automatic fault reset times: When the VFD selects automatic fault reset, it is used to set the times of automatic reset, if the continuous reset times exceeds the value set by P08.29, the VFD will report fault and stop to wait for repair. Interval of automatic fault reset: select the interval time from when fault occurred to automatic fault reset actions. After VFD starts, if no fault occurred during 60s, the fault reset times will be zeroed out. Setting range of P08.28: 0–10 Setting range of P08.29: 0.1–3600.0s	0	○
P08.29	Automatic fault reset time interval		1.0s	○
P08.30	Reduction ratio of droop control	This function code sets the variation rate of the VFD output frequency based on the load; it is mainly used in balancing the power when multiple motors drive the same load. Setting range: 0.00–50.00Hz	0.00Hz	○
P08.31	Switchover between motor 1 and motor 2	0x00–0x14 Ones: Switchover channel 0: Switch over by terminal 1: Switch over by Modbus communication 2: Switch over by PROFIBUS/CANopen/DeviceNet 3: Switch over by Ethernet communication 4: Switch over by EtherCAT/PROFINET communication	0x00	◎

Function code	Name	Description	Default value	Modify
		Tens: Motor switch over during running 0: Disable switch over during running 1: Enable switch over during running		
P08.32	FDT1 level detection value	When the output frequency exceeds the corresponding frequency of FDT level, multi-function digital output terminal outputs "frequency level detection FDT" signal, this signal will be valid until the output frequency lowers to below the corresponding frequency (FDT level-FDT lag detection value), the waveform is shown in the figure below.  Setting range of P08.32: 0.00Hz–P00.03 (Max. output frequency) Setting range of P08.33: 0.0–100.0% (FDT1 level) Setting range of P08.34: 0.00Hz–P00.03 (Max. output frequency) Setting range of P08.35: 0.0–100.0% (FDT2 level)	50.00Hz	○
P08.33	FDT1 lag detection value		5.0%	○
P08.34	FDT2 level detection value		50.00Hz	○
P08.35	FDT2 lag detection value		5.0%	○
P08.36	Detection value for frequency arrival	When the output frequency is within the positive /negative detection range of the set frequency, the multi-function digital output terminal outputs "frequency arrival" signal as shown below.  	0.00Hz	○

Function code	Name	Description	Default value	Modify
		Setting range: 0.00Hz–P00.03 (Max. output frequency)		
P08.37	Enable/disable energy-consumption brake	0: Disable energy-consumption 1: Enable energy-consumption	1	○
P08.38	Energy-consumption brake threshold voltage	Set the starting bus voltage of energy-consumption brake, adjust this value properly can brake the load effectively. The default value will change with the change of voltage class. Setting range: 200.0–2000.0V	220V voltage: 380.0V; 380V voltage: 700.0V; 660V voltage: 1120.0V	○
P08.39	Running mode of cooling fan	0: Common running mode 1: The fan keeps running after power-on 2: Running mode 2	0	○
P08.40	PWM selection	0x0000–0x1121 Ones place: PWM mode selection 0: PWM mode 1, 3PH modulation and 2PH modulation 1: PWM mode 2, 3PH modulation Tens place: PWM low-speed carrier limit 0: Low-speed carrier limit mode 1 1: Low-speed carrier limit mode 2 2: No limit Hundreds place: Deadzone compensation method 0: Compensation method 1 1: Compensation method 2 Thousands place: PWM loading mode selection 0: Interruptive loading 1: Normal loading	0x1101	◎
P08.41	Overmodulation selection	0x00–0x1111 Ones place: 0: Disable overmodulation 1: Enable overmodulation Tens place 0: Mild overmodulation	0001	◎

Function code	Name	Description	Default value	Modify
		1: Deepened overmodulation Hundreds: Carrier frequency limit 0: Yes 1: No Thousands: Output voltage compensation 0: No 1: Yes		
P08.42	Reserved			
P08.43	Reserved			
P08.44	UP/DOWN terminal control setup	0x000–0x221 Ones: Frequency control selection 0: UP/DOWN terminal setup is valid 1: UP/DOWN terminal setup is invalid Tens: Frequency control selection 0: Valid only when P00.06=0 or P00.07=0 1: All frequency modes are valid 2: Invalid for multi-step speed when multi-step speed takes priority Hundreds: Action selection during stop 0: Valid 1: Valid during running, clear after stop 2: Valid during running, clear after receiving stop command	0x000	○
P08.45	UP terminal frequency incremental integral rate	0.01–50.00Hz/s	0.50Hz/s	○
P08.46	DOWN terminal frequency decremental change rate	0.01–50.00Hz/s	0.50Hz/s	○
P08.47	Action selection for frequency setup during power down	0x000–0x111 Ones place: Action selection at power-off during frequency adjusting through digitals. 0: Save the setting at power-off. 1: Clear the setting at power-off. Action selection at power-off during frequency adjusting through Modbus communication	0x000	○

Function code	Name	Description	Default value	Modify
		0: Save the setting at power-off. 1: Clear the setting at power-off. Hundreds place: Action selection at power-off during frequency adjusting through DP communication 0: Save the setting at power-off. 1: Clear the setting at power-off.		
P08.48	High bit of initial value of power consumption	Set the initial value of power consumption. Initial value of power consumption=P08.48×1000+ P08.49 Setting range of P08.48: 0–59999 kWh (k) Setting range of P08.49: 0.0–999.9 kWh	0kWh	○
P08.49	Low bit of initial value of power consumption		0.0kWh	○
P08.50	Flux braking	This function code is used to enable flux braking function. 0: Invalid 100–150: The larger the coefficient, the stronger the brake intensity The VFD enables motor to decelerate quickly by increasing the motor flux which converts energy generated during braking into thermal energy. The VFD monitors motor state continuously even during flux braking, thus flux braking can be applied in motor stop or used to change motor speed. The flux braking also carries the following advantages. 1) Brake immediately after sending stop command, removing the need to wait for flux to attenuate. 2) Better cooling effect. During flux braking, the stator current of the motor increases, while the rotor current does not change, while the cooling effect of stator is much more effective than that of the rotor.	0	○
P08.51	Current regulation coefficient on input side	This function code is used to adjust the current display value on the AC input side. 0.00–1.00	0.56	○
P08.52	STO lock	0: STO alarm lock	0	○

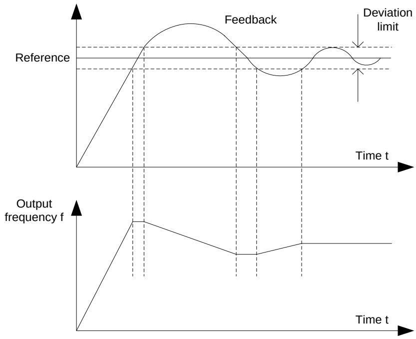
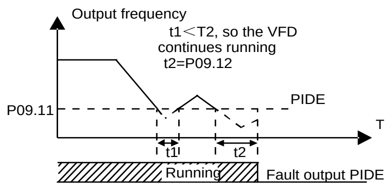
Function code	Name	Description	Default value	Modify
		Alarm-lock means STO alarm must be reset after state restoration when STO occurs. 1: STO alarm unlock Alarm-unlock means when STO occurs, after state restoration, STO alarm will disappear automatically.		
P08.53	Bias value of upper limit frequency of torque control	0.00 Hz–P00.03 (Max. output frequency) **Note:** This parameter is valid only for the torque control mode.	0.00Hz	○
P08.54	Acceleration/deceleration selection of upper limit frequency of torque control	0: No limit on acceleration or deceleration 1: Acceleration/deceleration time 1 2: Acceleration/deceleration time 2 3: Acceleration/deceleration time 3 4: Acceleration/deceleration time 4	0	○

P09—PID control

Function code	Name	Description	Default value	Modify
P09.00	PID reference source	When frequency command (P00.06, P00. 07) is set to 7, or channel of voltage setup (P04.27) is set to 6, the VFD running mode is process PID control. This parameter determines the target reference channel of process PID. 0: Keypad (P09.01) 1: AI1 2: AI2 3: AI3 4: High-speed pulse HDIA 5: Multi-step 6: Modbus communication 7: PROFIBUS/CANopen/DeviceNet communication 8: Ethernet communication 9: High-speed pulse HDIB 10: EtherCAT/PROFINET communication 11: Programmable extension card 12: Reserved	0	○

Function code	Name	Description	Default value	Modify
		The set target value of process PID is relative value, the set 100% corresponds to 100% of the feedback signal of controlled system. The system operates based on the relative value (0–100.0%)		
P09.01	Pre-set PID reference of keypad	You need to set this parameter when P09.00 is set to 0, the reference value of this parameter is the feedback variable of the system. Setting range: -100.0%–100.0%	0.0%	○
P09.02	PID feedback source	This parameter is used to select PID feedback channel. 0: AI1 1: AI2 2: AI3 3: High-speed pulse HDIA 4: Modbus communication 5: PROFIBUS/CANopen/DeviceNet communication 6: Ethernet communication 7: High-speed pulse HDIB 8: EtherCAT/PROFINET communication 9: Programmable extension card 10: Reserved **Note: The reference channel and feedback channel cannot overlap; otherwise, PID cannot be controlled effectively.**	0	○
P09.03	PID output characteristics	0: PID output is positive characteristic: namely, the feedback signal is larger than the PID reference, which requires the VFD output frequency to decrease for PID to reach balance, eg, tension PID control of winding 1: PID output is negative characteristics: namely the feedback signal is less than PID reference, which requires VFD output frequency to increase for PID to reach balance, eg, tension PID control of unwinding.	0	○
P09.04	Proportional gain (Kp)	This function code is suitable for proportional gain P of PID input. It determines the regulation intensity of the whole	1.80	○

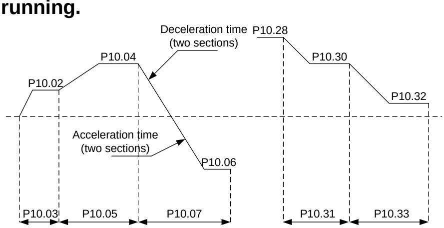
Function code	Name	Description	Default value	Modify
		PID regulator, the larger the value of P, the stronger the regulation intensity. If this parameter is 100, it means when the deviation between PID feedback and reference is 100%, the regulation amplitude of PID regulator (ignoring integral and differential effect) on output frequency command is the max. frequency (ignoring integral and differential actions). Setting range: 0.00–100.00		
P09.05	Integral time (Ti)	It determines the speed of integral regulation made on the deviation between PID feedback and reference by PID regulator. When the deviation between PID feedback and reference is 100%, the regulation of integral regulator (ignoring integral and differential actions), after undergoing continuous regulation during this time period, can reach Max. output frequency (P00.03) The shorter the integral time, the stronger the regulation intensity. Setting range: 0.00–10.00s	0.90s	○
P09.06	Derivative time (Td)	It determines the intensity of the regulation made on the change rate of deviation between PID feedback and reference by PID regulator. If feedback changes by 100% during this period, the regulation of differential regulator (ignoring integral and differential actions) is Max. output frequency (P00.03) The longer the derivative time, the stronger the regulation intensity. Setting range: 0.00–10.00s	0.00s	○
P09.07	Sampling cycle (T)	It means the sampling cycle of feedback. The regulator operates once during each sampling cycle. The larger the sampling cycle, the slower the response. Setting range: 0.001–10.000s	0.001s	○
P09.08	Limit of PID control deviation	It is the max. allowable deviation of PID system output value relative to closed-loop reference value. Within this limit, PID regulator stops regulation. Set this function code properly to	0.0%	○

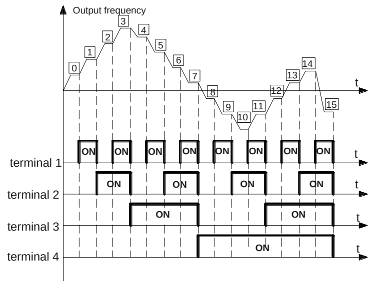
Function code	Name	Description	Default value	Modify
		regulate the precision and stability of PID system. Setting range: 0.0–100.0% 		
P09.09	Upper limit value of PID output	These two function codes are used to set the upper/lower limit value of PID regulator. 100.0% corresponds to Max. output frequency (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	Lower limit value of PID output		0.0%	○
P09.11	Feedback offline detection value	Set PID feedback offline detection value, when the detection value is no more than the feedback offline detection value, and the duration exceeds the value set in P09.12, the VFD will report "PID feedback offline fault", and keypad displays PIDE.  Setting range of P09.11: 0.0–100.0% Setting range of P09.12: 0.0–3600.0s	0.0%	○
P09.12	Feedback offline detection time		1.0s	○
P09.13	PID control selection	0x0000–0x1111 Ones: 0: Continue integral control after the frequency reaches upper/lower limit 1: Stop integral control after the frequency reaches upper/lower limit Tens:	0x0001	○

Function code	Name	Description	Default value	Modify
		0: The same with the main reference direction 1: Contrary to the main reference direction Hundreds: 0: Limit based on the max. frequency 1: Limit based on A frequency Thousands: 0: A+B frequency, acceleration /deceleration of main reference A frequency source buffering is invalid 1: A+B frequency, acceleration/ deceleration of main reference A frequency source buffering is valid, acceleration and deceleration are determined by P08.04 (acceleration time 4).		
P09.14	Low-frequency proportional gain (Kp)	0.00–100.00 Low-frequency switching point: 5.00Hz, high-frequency switching point: 10.00Hz (P09.04 corresponds to high-frequency parameter), and the middle is the linear interpolation between these two points	1.00	○
P09.15	Acceleration/ deceleration time of PID command	0.0–1000.0s	0.0s	○
P09.16	Filter time of PID output	0.000–10.000s	0.000s	○
P09.17	Reserved	-100.0–100.0%	0.0%	○
P09.18	Low-frequency integral time (Ti)	0.00–10.00s	0.90s	○
P09.19	Low-frequency differential time (Td)	0.00–10.00s	0.00s	○
P09.20	Low-frequency point of PID parameter switching	0.00–P09.21	5.00Hz	○
P09.21	High-frequency point of PID parameter switching	P09.20–P00.04	10.00Hz	○

Function code	Name	Description	Default value	Modify
P09.22–P09.28	Reserved	0–65536	0	○

P10—Simple PLC and multi-step speed control

Function code	Name	Description	Default value	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 running command. 1: Keep running in 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 stop command and stops.	0	○
P10.01	Simple PLC memory selection	0: No memory after power down 1: Memory after power down; PLC memories its running stage and running frequency before power down.	0	○
P10.02	Multi-step speed 0	Setting range of the frequency in 0th –15th sections are -100.0–100.0%, 100% corresponds to Max. output frequency P00.03. Setting range of the running time in 0th –15th sections are 0.0–6553.5s (min), the time unit is determined by P10.37. When simple PLC operation is selected, it is required to set P10.02–P10.33 to determine the running frequency and running time of each section. **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(min)	○
P10.04	Multi-step speed 1		0.0%	○
P10.05	Running time of step 1		0.0s(min)	○
P10.06	Multi-step speed 2		0.0%	○
P10.07	Running time of step 2		0.0s(min)	○
P10.08	Multi-step speed 3		0.0%	○
P10.09	Running time of step 3		0.0s(min)	○
P10.10	Multi-step speed 4		0.0%	○
P10.11	Running time of step 4		0.0s(min)	○
P10.12	Multi-step speed 5		0.0%	○
P10.13	Running time of step 5		0.0s(min)	○
P10.14	Multi-step speed 6		0.0%	○

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th><th>Modify</th></tr>
<tr><td>P10.15</td><td>Running time of step 6</td><td rowspan="19">When selecting multi-step speed running, the multi-step speed is within the range of -fmax–fmax, and it can be set continuously. The start/stop of multi-step stop is also determined by P00.01. Goodrive350 series VFD can set 16-step speed, which are set by combined codes of multi-step terminals 1–4 (set by S terminal, correspond to function code P05.01–P05.06) and correspond to multi-step speed 0 to multi-step speed 15.


When terminal 1, terminal 2, terminal 3 and terminal 4 are OFF, the frequency input mode is set by P00.06 or P00.07. When terminal 1, terminal 2, terminal 3 and terminal 4 are not all OFF, the frequency set by multi-step speed will prevail, and the priority of multi-step setting is higher than that of the keypad, analog, high-speed pulse, PID, and communication settings.
The relationship between terminals 1–4 are shown in the table below.
<table>
<tr><td>Terminal 1</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td></tr>
<tr><td>Terminal 2</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td></tr>
<tr><td>Terminal 3</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td></tr>
<tr><td>Terminal 4</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td></tr>
<tr><td>Step</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr>
<tr><td>Terminal 1</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td></tr>
<tr><td>Terminal 2</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td></tr>
<tr><td>Terminal 3</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td></tr>
<tr><td>Terminal 4</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td></tr>
<tr><td>Step</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td></tr>
</table></td><td>0.0s(min)</td><td>○</td></tr>
<tr><td>P10.16</td><td>Multi-step speed 7</td><td>0.0%</td><td>○</td></tr>
<tr><td>P10.17</td><td>Running time of step 7</td><td>0.0s(min)</td><td>○</td></tr>
<tr><td>P10.18</td><td>Multi-step speed 8</td><td>0.0%</td><td>○</td></tr>
<tr><td>P10.19</td><td>Running time of step 8</td><td>0.0s(min)</td><td>○</td></tr>
<tr><td>P10.20</td><td>Multi-step speed 9</td><td>0.0%</td><td>○</td></tr>
<tr><td>P10.21</td><td>Running time of step 9</td><td>0.0s(min)</td><td>○</td></tr>
<tr><td>P10.22</td><td>Multi-step speed 10</td><td>0.0%</td><td>○</td></tr>
<tr><td>P10.23</td><td>Running time of step 10</td><td>0.0s(min)</td><td>○</td></tr>
<tr><td>P10.24</td><td>Multi-step speed 11</td><td>0.0%</td><td>○</td></tr>
<tr><td>P10.25</td><td>Running time of step 11</td><td>0.0s(min)</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(min)</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(min)</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(min)</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(min)</td><td>○</td></tr>
</table>

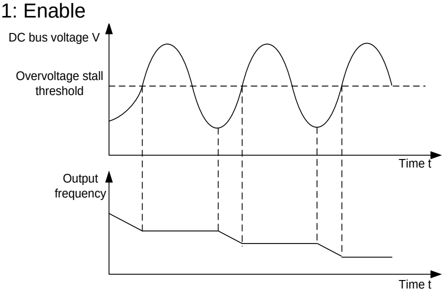
Function code	Name	Description	Default value	Modify
P10.34	Acceleration/ deceleration time of steps 0–7 of simple PLC	Detailed illustration is shown in the table below.	0x0000	○

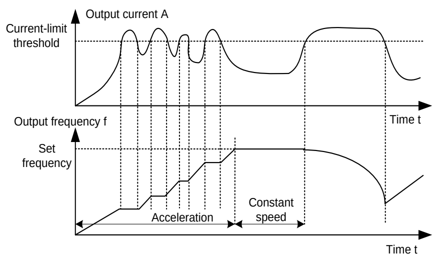
Function code	Binary		Step no.	ACC/ DEC time 1	ACC/ DEC time 2	ACC/ DEC time 3	ACC/ DEC time 4
P10.34	BIT1	BIT0	0	00	01	10	11
	BIT3	BIT2	1	00	01	10	11
	BIT5	BIT4	2	00	01	10	11
	BIT7	BIT6	3	00	01	10	11
	BIT9	BIT8	4	00	01	10	11
	BIT11	BIT10	5	00	01	10	11
	BIT13	BIT12	6	00	01	10	11
	BIT15	BIT14	7	00	01	10	11
P10.35	BIT1	BIT0	8	00	01	10	11
	BIT3	BIT2	9	00	01	10	11
	BIT5	BIT4	10	00	01	10	11
	BIT7	BIT6	11	00	01	10	11
	BIT9	BIT8	12	00	01	10	11
	BIT11	BIT10	13	00	01	10	11
	BIT13	BIT12	14	00	01	10	11
	BIT15	BIT14	15	00	01	10	11

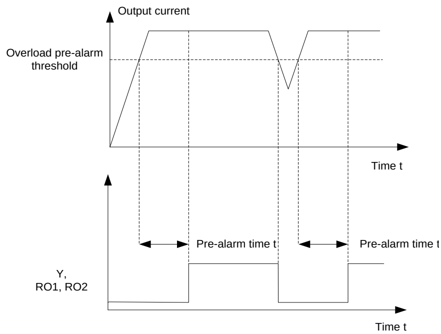
Function code	Name	Description	Default value	Modify
P10.35	Acceleration/ deceleration time of steps 8– 5 of simple PLC	Select corresponding acceleration/deceleration time, and then convert 16-bit binary number into hexadecimal number, finally, set corresponding function code. Acceleration/deceleration time 1 is set by P00.11 and P00.12; Acceleration/deceleration time 2 is set by P08.00 and P08.01; Acceleration/deceleration time 3 is set by P08.02 and P08.03; Acceleration /deceleration time 4 is set by P08.04 and P08.05. Setting range: 0x0000–0xFFFF	0x0000	○
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	0	◎

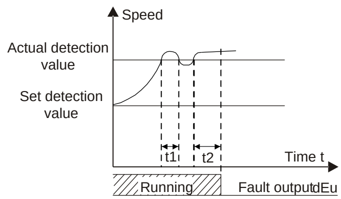
Function code	Name	Description	Default value	Modify
		enters this step automatically after restart, then continue running at the frequency defined by this step in the remaining time.		
P10.37	Multi-step time unit	0: s; the running time of each step is counted in seconds. 1: min; the running time of each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

P11—Protection parameters

Function code	Name	Description	Default value	Modify
P11.00	Phase-loss protection	0x000–0x111 Ones: 0: Disable software input phase loss protection 1: Enable software input phase loss protection Tens: 0: Disable output phase loss protection 1: Enable output phase loss protection Hundreds: 0: Disable hardware input phase loss protection 1: Enable hardware input phase loss protection	0x110	○
P11.01	Frequency-drop at transient power down	0: Disable 1: Enable	0	○
P11.02	Energy braking for stop	0: Enable 1: Disable	0	◎
P11.03	Overvoltage stall protection	0: Disable 1: Enable 	1	○
P11.04	Overvoltage stall protection voltage	120–150% (standard bus voltage) (380V)	136%	○
		120–150% (standard bus voltage) (220V)	120%	

Function code	Name	Description	Default value	Modify
P11.05	Current-limit selection	During accelerated running, as the load is too large, the actual acceleration rate of motor is lower than that of output frequency, if no measures are taken, the VFD may trip due to overcurrent during acceleration. 0x00–0x11 Ones: Current-limit action selection 0: Invalid 1: Always valid Tens: Hardware current-limit overload alarm selection 0: Valid 1: Invalid	01	◎
P11.06	Automatic current-limit level	Current-limit protection function detects output current during running, and compares it with the current-limit level defined by P11.06, if it exceeds the current-limit level, the VFD will run at stable frequency during accelerated running, or run in decreased frequency during constant-speed running; if it exceeds the current-limit level continuously, the VFD output frequency will drop continuously until reaching lower limit frequency. When the output current is detected to be lower than the current-limit level again, it will continue accelerated running.	G type: 160.0% P type: 120.0%	◎
P11.07	Frequency-drop rate during current limit	 Setting range of P11.06: 50.0–200.0% (of the rated VFD output current) Setting range of P11.07: 0.00–50.00Hz/s	10.00 Hz/s	◎
P11.08	VFD or motor overload/underlo	0x000–0x1132 Ones place:	0x000	○

Function code	Name	Description	Default value	Modify
	ad pre-alarm	0: Motor overload/underload pre-alarm, relative to rated motor current 1: VFD overload/underload pre-alarm, relative to rated VFD output current 2: VFD output torque overload/underload pre-alarm, relative to rated motor torque Tens place: 0: The VFD continues running after overload/underload alarm. 1: The VFD continues running after underload alarm, and stops running after overload fault. 2: The VFD continues running after overload alarm, and stops running after underload fault. 3: The VFD stops running after overload/underload fault. Hundreds place: 0: Always detect 1: Detect during constant-speed running Thousands place: VFD overload current reference selection 0: Related to current calibration coefficient 1: Irrelated to current calibration coefficient		
P11.09	Overload pre-alarm detection level	If the VFD or motor output current is larger than the overload pre-alarm detection level (P11.09), and the duration exceeds the overload pre-alarm detection time (P11.10), overload pre-alarm signal will be outputted.	G type: 150% P type: 120%	○
P11.10	Overload pre-alarm detection time	 Setting range of P11.09: P11.11–200% (relative	1.0s	○

Function code	Name	Description	Default value	Modify
		value determined by the ones place of P11.08) Setting range of P11.10: 0.1–3600.0s		
P11.11	Underload pre-alarm detection level	Underload pre-alarm signal will be outputted if the output current of the VFD or motor is lower than underload pre-alarm detection level (P11.11), and the duration exceeds underload pre-alarm detection time (P11.12). Setting range of P11.11: 0– P11.09 (relative value determined by the ones place of P11.08) Setting range of P11.12: 0.1–3600.0s	50%	○
P11.12	Underload pre-alarm detection time		1.0s	○
P11.13	Fault output terminal action during fault	Used to set the action of fault output terminals during undervoltage and fault reset. 0x00–0x11 Ones: 0: Act during undervoltage fault 1: Do not act during undervoltage fault Tens: 0: Act during fault reset 1: Do not act during fault reset	0x00	○
P11.14	Speed deviation detection value	0.0–50.0% This parameter is used to set the speed deviation detection value.	10.0%	○
P11.15	Speed deviation detection time	Used to set the speed deviation detection time. **Note: Speed deviation protection is invalid when P11.15 is set to 0.0.**  t1<t2, so the VFD continues running t2=P11.15 Setting range: 0.0–10.0s	2.0s	○
P11.16	Automatic frequency-reduction during voltage drop	0–1 0: Invalid 1: Valid	0	○
P11.17	Proportional	This parameter is used to set the proportional	100	○

Function code	Name	Description	Default value	Modify
	coefficient of voltage regulator during undervoltage stall	coefficient of the bus voltage regulator during undervoltage stall. Setting range: 0–1000		
P11.18	Integral coefficient of voltage regulator during undervoltage stall	This parameter is used to set the integral coefficient of the bus voltage regulator during undervoltage stall. Setting range: 0–1000	40	○
P11.19	Proportional coefficient of current regulator during undervoltage stall	This parameter is used to set the proportional coefficient of the active current regulator during undervoltage stall. Setting range: 0–1000	25	○
P11.20	Integral coefficient of current regulator during undervoltage stall	This parameter is used to set the integral coefficient of the active current regulator during undervoltage stall. Setting range: 0–2000	150	○
P11.21	Proportional coefficient of voltage regulator during overvoltage stall	This parameter is used to set the proportional coefficient of the bus voltage regulator during overvoltage stall. Setting range: 0–1000	60	○
P11.22	Integral coefficient of voltage regulator during overvoltage stall	This parameter is used to set the integral coefficient of the bus voltage regulator during overvoltage stall. Setting range: 0–1000	10	○
P11.23	Proportional coefficient of current regulator during overvoltage stall	This parameter is used to set the proportional coefficient of the active current regulator during overvoltage stall. Setting range: 0–1000	60	○
P11.24	Integral coefficient of current regulator during overvoltage stall	This parameter is used to set the integral coefficient of the active current regulator during overvoltage stall. Setting range: 0–2000	250	○

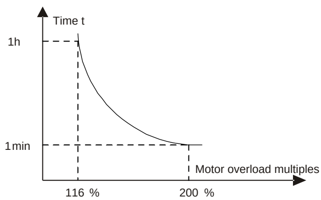
Function code	Name	Description	Default value	Modify
P11.25	Enable VFD overload integral	0: Disabled 1: Enabled When this parameter is set to 0, the overload timing value is reset to zero after the VFD is stopped. In this case, the determination of VFD overload takes more time, and therefore the effective protection over the VFD is weakened. When this parameter is set to 1, the overload timing value is not reset, and the overload timing value is accumulative. In this case, the determination of VFD overload takes less time, and therefore the protection over the VFD can be performed more quickly.	0	◎
P11.26	Reserved	0–65536	0	○
P11.27	VF vibration control method	0x00–0x11 Ones place: 0: Method 1 1: Method 2 Tens place: 0–1: Reserved	0x00	◎

P12—Parameters of motor 2

Function code	Name	Description	Default value	Modify
P12.00	Type of motor 2	0: Asynchronous motor 1: Synchronous motor	0	◎
P12.01	Rated power of asynchronous motor 2	0.1–3000.0kW	Depends on model	◎
P12.02	Rated frequency of asynchronous motor 2	0.01Hz–P00.03 (Max. output frequency)	50.00Hz	◎
P12.03	Rated speed of asynchronous motor 2	1–60000rpm	Depends on model	◎
P12.04	Rated voltage of asynchronous motor 2	0–1200V	Depends on model	◎

Function code	Name	Description	Default value	Modify
P12.05	Rated current of asynchronous motor 2	0.8–6000.0A	Depends on model	◎
P12.06	Stator resistance of asynchronous motor 2	0.001–65.535Ω	Depends on model	○
P12.07	Rotor resistance of asynchronous motor 2	0.001–65.535Ω	Depends on model	○
P12.08	Leakage inductance of asynchronous motor 2	0.1–6553.5mH	Depends on model	○
P12.09	Mutual inductance of asynchronous motor 2	0.1–6553.5mH	Depends on model	○
P12.10	No-load current of asynchronous motor 2	0.1–6553.5A	Depends on model	○
P12.11	Magnetic saturation coefficient 1 of iron core of asynchronous motor 2	0.0–100.0%	80%	○
P12.12	Magnetic saturation coefficient 2 of iron core of asynchronous motor 2	0.0–100.0%	68%	○
P12.13	Magnetic saturation coefficient 3 of iron core of asynchronous motor 2	0.0–100.0%	57%	○

Function code	Name	Description	Default value	Modify
P12.14	Magnetic saturation coefficient 4 of iron core of asynchronous motor 2	0.0–100.0%	40%	○
P12.15	Rated power of synchronous motor 2	0.1–3000.0kW	Depends on model	◎
P12.16	Rated frequency of synchronous motor 2	0.01Hz–P00.03 (Max. output frequency)	50.00Hz	◎
P12.17	Number of pole pairs of synchronous motor 2	1–128	2	◎
P12.18	Rated voltage of synchronous motor 2	0–1200V	Depends on model	◎
P12.19	Rated voltage of synchronous motor 2	0.8–6000.0A	Depends on model	◎
P12.20	Stator resistance of synchronous motor 2	0.001–65.535Ω	Depends on model	○
P12.21	Direct-axis inductance of synchronous motor 2	0.01–655.35mH	Depends on model	○
P12.22	Quadrature-axis inductance of synchronous motor 2	0.01–655.35mH	Depends on model	○
P12.23	Counter-emf constant of synchronous motor 2	0–10000V	300	○
P12.24	Reserved	0–0xFFFF	0x0000	●

Function code	Name	Description	Default value	Modify
P12.25	Reserved	0%–50% (of the rated current of the motor)	10%	●
P12.26	Overload protection of motor 2	0: No protection 1: Common motor (with low-speed compensation) 2: Frequency-variable motor (without low-speed compensation)	2	◎
P12.27	Overload protection coefficient of motor 2	Motor overload multiples M = Iout/(In×K) In is rated motor current, Iout is VFD output current, K is motor overload protection coefficient. The smaller the K, the larger the value of M, the easier the protection. if M is 116%, protection will be applied when motor overloads for 1h; if M is 200%, protection will be applied when motor overloads for 60s; if M is no less than 400%, protection will be applied immediately.  Setting range: 20.0%–120.0%	100.0%	○
P12.28	Power display calibration coefficient of motor 2	0.00–3.00	1.00	○
P12.29	Parameter display of motor 2	0: Display based on the motor type; under this mode, only parameters related to current motor type will be displayed. 1: Display all; under this mode, all the parameters will be displayed.	0	○
P12.30	System inertia of motor 2	0–30.000kgm^2	0.000	○
P12.31–P12.32	Reserved	0–65535	0	○

P13—Control parameters of synchronous motor

Function code	Name	Description	Default value	Modify
P13.00	Reduction rate of the injection current of synchronous motor	This parameter is used to set the reduction rate of the input reactive current. When the active current of the synchronous motor increases to some extent, the input reactive current can be reduced to improve the power factor of the motor. Setting range: 0.0%–100.0% (of the rated current of the motor)	80.0%	○
P13.01	Initial pole detection mode	0: No detection 1: High-frequency current injection 2: Pulse superimposition	0	◎
P13.02	Pull-in current 1	Input current is the pole position orientation current; input current 1 is valid within the lower limit of input current switchover frequency threshold. If you need to increase the starting torque, increase the value of this function code properly. Setting range: 0.0%–100.0% (rated motor current)	20.0%	○
P13.03	Pull-in current 2	Input current is the pole position orientation current; input current 2 is valid within the upper limit of input current switchover frequency threshold, and you do not need to change input current 2 under common situations. Setting range: 0.0%–100.0% (rated motor current)	10.0%	○
P13.04	Switchover frequency of input current	0.00Hz–P00.03 (Max. output frequency)	10.00Hz	○
P13.05	High-frequency superposition frequency (reserved)	200Hz–1000Hz	500Hz	◎
P13.06	Pulse current setting	This parameter is used to set the pulse current threshold when the initial magnetic pole position is detected in the pulse mode. The value is a percentage in relative to the rated current of the motor. Setting range: 0.0–300.0% (of the rated voltage of the motor)	100.0%	◎

Function code	Name	Description	Default value	Modify
P13.07	Reserved	0.0–400.0	0.0	○
P13.08	Control parameter 1	0–0xFFFF	0	○
P13.09	Control parameter 2	This parameter is used to set the frequency threshold for enabling the counter-electromotive force phase-locked loop in SVC 0. When the running frequency is lower than the value of this parameter, the phase-locked loop is disabled; and when the running frequency is higher than that, the phase-locked loop is enabled. Setting range: 0–655.35	2.00	○
P13.10	Reserved	0.0–359.9	0.0	○
P13.11	Maladjustment detection time	This parameter is used to adjust the responsiveness of anti-maladjustment function. If the load inertia is large, increase the value of this parameter properly, however, the responsiveness may slow down accordingly. Setting range: 0.0–10.0s	0.5s	○
P13.12	High-frequency compensation coefficient of synchronous motor	This parameter is valid when the motor speed exceeds the rated speed. If motor oscillation occurred, adjust this parameter properly. Setting range: 0.0–100.0%	0.0	○
P13.13	High-frequency injection current	0–300.0% (of the rated VFD output current)	20.0%	◎
P13.19	Reserved	0–65535	0	○

P14—Serial communication function

Function code	Name	Description	Default value	Modify
P14.00	Local communication address	Setting range: 1–247 When the master is writing frames, and the slave communication address is set to 0, it is the broadcast communication address, and all the slaves on the Modbus bus will accept this frame, but the slave never responds. Local communication address is unique in the communication network, which is the basis for point-to-point communication between the upper	1	○

Function code	Name	Description	Default value	Modify
		computer and the VFD. **Note: The slave address cannot be set to 0.**		
P14.01	Communication baud rate setup	This parameter is used to set the data transmission speed between upper computer and the VFD. 0: 1200BPS 1: 2400BPS 2: 4800BPS 3: 9600BPS 4: 19200BPS 5: 38400BPS 6: 57600BPS 7: 115200BPS **Note: Baud rate of the upper computer must be the same with the VFD; otherwise, communication cannot be performed. The larger the baud rate, the faster the communication speed.**	4	○
P14.02	Data bit check setup	The data format of upper computer must be the same with the VFD; otherwise, communication cannot be performed. 0: No parity check (N, 8, 1) for RTU 1: Even parity (E, 8, 1) for RTU 2: Odd parity (O, 8, 1) for RTU 3: No parity check (N, 8, 2) for RTU 4: Even parity (E, 8, 2) for RTU 5: Odd parity (O, 8, 2) for RTU	1	○
P14.03	Communication response delay	0–200ms It refers to the time interval from when the data is received by the VFD to the moment when the data is sent to the upper computer. If the response delay is less than the system processing time, the response delay will be subject to system processing time; if the response delay is longer than the system processing time, data will be sent to the upper computer at a delay after data process is done by system.	5	○
P14.04	Communication timeout period	0.0 (invalid)–60.0s This parameter will be invalid if it is set to 0.0;	0.0s	○

Function code	Name	Description	Default value	Modify
		When it is set to a non-zero value, if the time interval between current communication and the next communication exceeds the communication timeout period, the system will report "485 communication fault" (CE). In common situations, it is set to 0.0. In systems with continuous communication, you can monitor communication status through this parameter.		
P14.05	Transmission error processing	0: Alarm and coast to stop 1: Do not alarm and continue running 2: Do not alarm and stop as per the stop mode (under communication control mode only) 3: Do not alarm and stop as per the stop mode (under all control modes)	0	○
P14.06	Communication processing action	0x00–0x11 Ones: 0: Write operation has response 1: Write operation has no response Tens: 0: Communication password protection is invalid 1: Communication password protection is valid	0x00	○
P14.07–P14.24	Reserved	0–65535	0	●

P15—Functions of communication extension card 1

Function code	Name	Description	Default value	Modify
P15.00–P15.27	See the operation manual of communication extension card for details			
P15.28	Master/slave CAN communication address	0–127	1	◎
P15.29	Master/slave CAN communication baud rate selection	0: 50Kbps 1: 100 Kbps 2: 125Kbps 3: 250Kbps 4: 500Kbps 5: 1M bps	2	◎

Function code	Name	Description	Default value	Modify
P15.30	Master/slave CAN communication timeout period	0.0 (invalid)–300.0s	0.0s	○
P15.31–P15.69	See the operation manual of communication extension card for details			

P16—Functions of communication extension card 2

Function code	Name	Description	Default value	Modify
P16.00–P16.23	See the operation manual of communication extension card for details			
P16.24	Identification time for the extension card in card slot 1	0.0–600.0s If it is set to 0.0, identification fault will not be detected	0.0s	○
P16.25	Identification time for the extension card in card slot 2	0.0–600.0s If it is set to 0.0, offline fault will not be detected	0.0s	○
P16.26	Identification time for the extension card in card slot 3	0.0–600.0s If it is set to 0.0, offline fault will not be detected	0.0s	○
P16.27	Communication timeout period of extension card in card slot 1	0.0–600.0s If it is set to 0.0, offline fault will not be detected	0.0s	○
P16.28	Communication timeout period of extension card in card slot 2	0.0–600.0s If it is set to 0.0, offline fault will not be detected	0.0s	○
P16.29	Communication timeout period of extension card in card slot 3	0.0–600.0s If it is set to 0.0, offline fault will not be detected	0.0s	○
P16.30–P16.69	See the operation manual of communication extension card for details			

P17—Status viewing

Function code	Name	Description	Default value	Modify
P17.00	Set frequency	Display current set frequency of the VFD. Range: 0.00Hz–P00.03	50.00Hz	●
P17.01	Output frequency	Display current output frequency of the VFD. Range: 0.00Hz–P00.03	0.00Hz	●
P17.02	Ramp reference frequency	Display current Ramp reference frequency of the VFD. Range: 0.00Hz–P00.03	0.00Hz	●
P17.03	Output voltage	Display current output voltage of the VFD. Range: 0–1200V	0V	●
P17.04	Output current	Display the valid value of current output current of the VFD. Range: 0.0–5000.0A	0.0A	●
P17.05	Motor speed	Display current motor speed. Range: 0–65535RPM	0 RPM	●
P17.06	Torque current	Display current torque current of the VFD. Range: -3000.0–3000.0A	0.0A	●
P17.07	Exciting current	Display current exciting current of the VFD. Range: -3000.0–3000.0A	0.0A	●
P17.08	Motor power	Display current motor power; 100% relative to rated motor power, positive value is motoring state, negative value is generating state. Range: -300.0–300.0% (relative to rated motor power)	0.0%	●
P17.09	Motor output torque	Display current output torque of the VFD; 100% relative to rated motor torque, during forward running, positive value is motoring state, negative value is generating state, during reverse running, positive value is generating state, negative value is motoring state. Range: -250.0–250.0%	0.0%	●
P17.10	Estimated motor frequency	The estimated motor rotor frequency under open-loop vector condition. Range: 0.00– P00.03	0.00Hz	●
P17.11	DC bus voltage	Display current DC bus voltage of the VFD. Range: 0.0–2000.0V	0V	●
P17.12	Digital input terminal state	Display current digital input terminal state of the VFD.	0	●

Function code	Name	Description	Default value	Modify
		0000–03F Corresponds to HDIB, HDIA, S4, S3, S2 and S1 respectively		
P17.13	Digital output terminal state	Display current digital output terminal state of the VFD. 0000–000F Corresponds to RO2, RO1, HDO and Y1 respectively	0	●
P17.14	Digital adjustment variable	Display the regulating variable by UP/DOWN terminals of the VFD. Range: 0.00Hz–P00.03	0.00Hz	●
P17.15	Torque reference value	Relative to percentage of the rated torque of current motor, display torque reference. Range: -300.0%–300.0% (rated motor current)	0.0%	●
P17.16	Linear speed	0–65535	0	●
P17.17	Reserved	0–65535	0	●
P17.18	Count value	0–65535	0	●
P17.19	AI1 input voltage	Display input signal of AI 1 Range: 0.00–10.00V	0.00V	●
P17.20	AI2 input voltage	Display input signal of AI2 Range: -10.00V–10.00V	0.00V	●
P17.21	HDIA input frequency	Display input frequency of HDIA Range: 0.000–50.000kHz	0.000 kHz	●
P17.22	HDIB input frequency	Display input frequency of HDIB Range: 0.000–50.000kHz	0.000 kHz	●
P17.23	PID reference value	Display PID reference value Range: -100.0–100.0%	0.0%	●
P17.24	PID feedback value	Display PID feedback value Range: -100.0–100.0%	0.0%	●
P17.25	Motor power factor	Display the power factor of current motor. Range: -1.00–1.00	1.00	●
P17.26	Current running time	Display current running time of the VFD. Range: 0–65535min	0m	●
P17.27	Acutal stage of simple PLC	Displays the present stage of the simple PLC function. Range: 0–15	0	●
P17.28	Motor ASR controller output	Display the speed loop ASR controller output value under vector control mode, relative to the	0.0%	●

Function code	Name	Description	Default value	Modify
		percentage of rated torque of the motor. Range: -300.0%–300.0% (rated motor current)		
P17.29	Pole angle of open-loop synchronous motor	Display initial identification angle of synchronous motor Range: 0.0–360.0	0.0	●
P17.30	Phase compensation of synchronous motor	Display phase compensation of synchronous motor Range: -180.0–180.0	0.0	●
P17.31	High-frequency superposition current of synchronous motor	0.0%–200.0% (rated motor current)	0.0	●
P17.32	Motor flux linkage	0.0%–200.0%	0.0%	●
P17.33	Exciting current reference	Display the exciting current reference value under vector control mode Range: -3000.0–3000.0A	0.0A	●
P17.34	Torque current reference	Display torque current reference value under vector control mode Range: -3000.0–3000.0A	0.0A	●
P17.35	AC incoming current	Display the valid value of incoming current on AC side Range: 0.0–5000.0A	0.0A	●
P17.36	Output torque	Display output torque value, during forward running, positive value is motoring state, negative value is generating state; during reverse running, positive value is generating state, negative value is motoring state. Range: -3000.0Nm–3000.0Nm	0.0Nm	●
P17.37	Motor overload count value	0–65535	0	●
P17.38	Process PID output	-100.0%–100.0%	0.00%	●
P17.39	Parameter download wrong function code	0.00–99.00	0.00	●

Function code	Name	Description	Default value	Modify
P17.40	Motor control mode	Ones: Control mode 0: Vector 0 1: Vector 1 2: VF control 3: Closed-loop vector control Tens: Control state 0: Speed control 1: Torque control 2: Position control Hundreds: Motor number 0: Motor 1 1: Motor 2	0x2	●
P17.41	Upper limit of the torque when motoring	0.0%–300.0% (rated motor current)	180.0%	●
P17.42	Upper limit of braking torque	0.0%–300.0% (rated motor current)	180.0%	●
P17.43	Upper limit frequency of forward running of torque control	0.00–P00.03	50.00Hz	●
P17.44	Upper limit frequency of reverse running of torque control	0.00–P00.03	50.00Hz	●
P17.45	Inertia compensation torque	-100.0%–100.0%	0.0%	●
P17.46	Friction compensation torque	-100.0%–100.0%	0.0%	●
P17.47	Motor pole pairs	0–65535	0	●
P17.48	VFD overload count value	0–65535	0	●
P17.49	Frequency set by A source	0.00–P00.03	0.00Hz	●
P17.50	Frequency set by B source	0.00–P00.03	0.00Hz	●

Function code	Name	Description	Default value	Modify
P17.51	PID proportional output	-100.0%–100.0%	0.00%	●
P17.52	PID integral output	-100.0%–100.0%	0.00%	●
P17.53	PID differential output	-100.0%–100.0%	0.00%	●
P17.54	Actual PID proportional gain	0.00–100	0.00%	●
P17.55	Actual PID integral time	0.00–10.00s	0.00%	●
P17.56	Actual PID differential time	0.00–10.00s	0.00%	●
P17.57–P17.63	Reserved	0–65535	0	●

P18—Closed-loop control state check

Function code	Name	Description	Default value	Modify
P18.00	Actual frequency of encoder	The actual-measured encoder frequency; the value of forward running is positive; the value of reverse running is negative. Range: -999.9–3276.7Hz	0.0Hz	●
P18.01	Encoder position count value	Encoder count value, quadruple frequency, Range: 0–65535	0	●
P18.02	Encoder Z pulse count value	Corresponding count value of encoder Z pulse. Range: 0–65535	0	●
P18.03	High bit of position reference value	High bit of position reference value, zero out after stop. Range: 0–30000	0	●
P18.04	Low bit of position reference value	Low bit of position reference value, zero out after stop. Range: 0–65535	0	●
P18.05	High bit of position feedback value	High bit of position feedback value, zero out after stop. Range: 0–30000	0	●
P18.06	Low bit of position feedback value	Low bit of position feedback value, zero out after stop. Range: 0–65535	0	●
P18.07	Position deviation	Deviation between current reference position and	0	●

Function code	Name	Description	Default value	Modify
		actual running position. Range: -32768–32767		
P18.08	Position of position reference point	Position of reference point of Z pulse when the spindle stops accurately. Range: 0–65535	0	●
P18.09	Current position setup of spindle	Current position setup when the spindle stops accurately. Range: 0–359.99	0.00	●
P18.10	Current position when spindle stops accurately	Current position when spindle stops accurately. Range: 0–65535	0	●
P18.11	Encoder Z pulse direction	Z pulse direction display. When the spindle stops accurately, there may be a couple of pulses' error between the position of forward and reverse orientation, which can be eliminated by adjusting Z pulse direction of P20.02 or exchanging phase AB of encoder. 0: Forward 1: Reverse	0	●
P18.12	Encoder Z pulse angle	Reserved. Range: 0.00–359.99	0.00	●
P18.13	Encoder Z pulse error times	Reserved. Range: 0–65535	0	●
P18.14	High bit of encoder pulse count value	0–65535	0	●
P18.15	Low bit of encoder pulse count value	0–65535	0	●
P18.16	Main control board measured speed value	-3276.8–3276.7Hz	0.0Hz	●
P18.17	Pulse command frequency	Pulse command (A2, B2 terminal) is converted to the set frequency, and it is valid under pulse position mode and pulse speed mode. Range: 0–655.35Hz	0.00Hz	●
P18.18	Pulse command feedforward	Pulse command (A2, B2 terminal) is converted to the set frequency, and it is valid under pulse	0.00Hz	●

Function code	Name	Description	Default value	Modify
		position mode and pulse speed mode. Range: 0–655.35Hz		
P18.19	Position regulator output	-327.68–327.67Hz	0.00Hz	●
P18.20	Count value of resolver	Count value of resolver. Range: 0–65535	0	●
P18.21	Resolver angle	The pole position angle read according to the resolver-type encoder. Range: 0.00–359.99	0.00	●
P18.22	Pole angle of closed-loop synchronous motor	Current pole position. Range: 0.00–359.99	0.00	●
P18.23	State control word 3	0–65535	0	●
P18.24	High bit of count value of pulse reference	0–65535	0	●
P18.25	Low bit of count value of pulse reference	0–65535	0	●
P18.26	PG card measured speed value	-3276.8–3276.7Hz	0.0Hz	●
P18.27	Encoder UVW sector	0–7	0	●
P18.28	Encoder PPR (pulse-per-revolution) display	0–65535	0	●
P18.29	Angle compensation value of synchronous motor	-180.0–180.0	0.00	●
P18.30	Reserved	0–65535	0	●
P18.31	Pulse reference Z pulse value	0–65535	0	●

Function code	Name	Description	Default value	Modify
P18.32	Pulse-given main control board measured speed value	-3276.8–3276.7Hz	0.0Hz	●
P18.33	Pulse-given PG card measured speed value	-3276.8–3276.7Hz	0.0Hz	●
P18.34	Present encoder filter width	0–63	0	●
P18.35	Reserved	0–65535	0	●

P19—Extension card state check

Function code	Name	Description	Default value	Modify
P19.00	Type of card at slot 1	0–65535 0: No card 1: PLC programmable card 2: I/O card 3: Incremental PG card 4: Incremental PG card with UVW 5: Ethernet communication card 6: DP communication card 7: Bluetooth card 8: Resolver PG card 9: CANopen communication card 10: WIFI card 11: PROFINET communication card 12: Sine/Cosine PG card without CD signal 13: Sine/Cosine PG card with CD signal 14: Absolute encoder PG card 15: CAN master/slave communication card 16: Modbus communication card 17: EtherCAT communication card 18: BacNet communication card 19: DeviceNet communication card	0	●
P19.01	Type of card at slot 2		0	●
P19.02	Type of card at slot 3		0	●
P19.03	Software version of the extension card in card slot 1	0.00–655.35	0.00	●
P19.04	Software version	0.00–655.35	0.00	●

Function code	Name	Description	Default value	Modify
	of the extension card in card slot 2			
P19.05	Software version of the extension card in card slot 3	0.00–655.35	0.00	●
P19.06	Input state of extension I/O card terminals	0–0xFFFF	0	●
P19.07	Output state of extension I/O card terminals	0–0xFFFF	0	●
P19.08	HDI3 input frequency of extension I/O card	0.000–50.000kHz	0.000 kHz	●
P19.09	AI3 input voltage of extension I/O card	0.00–10.00V	0.00V	●
P19.10–P19.39	Reserved	0–65535	0	●

P20—Encoder of motor 1

Function code	Name	Description	Default value	Modify
P20.00	Encoder type display	0: Incremental encoder 1: Resolver-type encoder 2: Sin/Cos encoder 3: Endat absolute encoder	0	●
P20.01	Encoder pulse number	Number of pulses generated when the encoder revolves for one circle. Setting range: 0–60000	1024	◎
P20.02	Encoder direction	Ones: AB direction 0: Forward 1: Reverse Tens: Z pulse direction (reserved) 0: Forward 1: Reverse Hundreds: CD/UVW pole signal direction	0x000	◎

Function code	Name	Description	Default value	Modify
		0: Forward 1: Reverse		
P20.03	Detection time of encoder offline fault	0.0–10.0s	2.0s	○
P20.04	Detection time of encoder reversal fault	0.0–100.0s	0.8s	○
P20.05	Filter times of encoder detection	Setting range: 0x00–0x99 Ones: Low-speed filter time, corresponds to 2^(0–9)×125μs. Tens: High-speed filter times, corresponds to2^(0–9)×125μs.	0x33	○
P20.06	Speed ratio between encoder mounting shaft and motor	You need to set this parameter when the encoder is not installed on the motor shaft and the drive ratio is not 1. Setting range: 0.001–65.535	1.000	○
P20.07	Control parameters of synchronous motor	Bit0: Enable Z pulse calibration Bit1: Enable encoder angle calibration Bit2: Enable SVC speed measurement Bit3: Select resolver speed measurement mode Bit4: Z pulse capture mode Bit5: Do not detect encoder initial angle in v/f control Bit6: Enable CD signal calibration Bit7: Disable sin/cos sub-division speed measurement Bit8: Do not detect encoder fault during autotuning Bit9: Enable Z pulse detection optimization Bit10: Enable initial Z pulse calibration optimization Bit12: Clear Z pulse arrival signal after stop	0x3	○
P20.08	Enable Z pulse offline detection	0x00–0x11 Ones: Z pulse 0: Do not detect 1: Enable Tens: UVW pulse (for synchronous motor) 0: Do not detect 1: Enable	0x10	○

Function code	Name	Description	Default value	Modify
P20.09	Initial angle of Z pulse	Relative electric angle of encoder Z pulse and motor pole position. Setting range: 0.00–359.99	0.00	○
P20.10	Initial angle of the pole	Relative electric angle of encoder position and motor pole position. Setting range: 0.00–359.99	0.00	○
P20.11	Autotuning of initial angle of pole	0–3 1: Rotary autotuning (DC brake) 2: Static autotuning (suitable for resolver-type encoder, sin/cos with CD signal feedback) 3: Rotary autotuning (initial angle identification)	0	◎
P20.12	Speed measurement optimization selection	0: No optimization 1: Optimization mode 1 2: Optimization mode 2	1	◎
P20.13	CD signal zero offset gain	0–65535	0	○
P20.14	Encoder type selection	Ones: Incremental encoder 0: without UVW 1: with UVW Tens: Sin/Cos encoder 0: without CD signal 1: with CD signal	0x00	◎
P20.15	Speed measurement mode	0: PG card 1: local; realized by HDIA and HDIB; supports incremental 24V encoder only	0	◎
P20.16	Frequency-division coefficient	0–255 When this parameter is set to 0 or 1, frequency division of 1:1 is implemented.	0	○
P20.17	Pulse filer processing	0x0000–0xffff Bit0: Enable/disable encoder input filter 0: No filter 1: Filter Bit1: Encoder signal filter mode (set Bit0 or Bit2 to 1) 0: Self-adaptive filter 1: Use P20.18 filter parameters Bit2: Enable/disable encoder frequency-division output filter	0x0033	○

Function code	Name	Description	Default value	Modify
		0: No filter 1: Filter Bit3: Reserved Bit4: Enable/disable pulse reference filter 0: No filter 1: Filter Bit5: Pulse reference filter mode (valid when Bit4 is set to 1) 0: Self-adaptive filter 1: Use P20.19 filter parameters Bit6: Frequency-divided output source setting 0: Encoder signals 1: Pulse reference signals Bits7–15: Reserved		
P20.18	Encoder pulse filter width	0–63 The filtering time is P20.18×0.25 μs. The value 0 or 1 indicates 0.25 μs.	2	○
P20.19	Pulse reference filter width	0–63 The filtering time is P20.19×0.25 μs. The value 0 or 1 indicates 0.25 μs.	2	○
P20.20	Pulse number of pulse reference	0–65535	1024	◎
P20.21	Enable angle compensation of synchronous motor	0–1	0	○
P20.22	Switchover frequency threshold of speed measurement mode	0–630.00Hz **Note:** This parameter is valid only when P20.12 is set to 0.	1.00Hz	○
P20.23	Synchronous motor angle compensation coefficient	-200.0–200.0%	100.0%	○
P20.24	Reserved	0–65535	0	○

P21—Position control

Function code	Name	Description	Default value	Modify
P21.00	Positioning mode	Ones: Control mode selection 0: Speed control 1: Position control Tens: Position command source 0: Pulse string 1: Digital position 2: Positioning of photoelectric switch during stop Hundreds: Position feedback source (reserved, fixed to channel P) 0: PG1 1: PG2 Thousands: servo mode Bit0: Position deviation mode 0: No deviation 1: With deviation Bit1: Enable/disable servo 0: Disable (The servo can be enabled by terminals.) 1: Enable Bit2: (reserved) **Note:** In the pulse string or spindle positioning mode, the VFD enters the servo operation mode when there is a valid servo enabling signal. If there is no servo enabling signal, the VFD enter the servo operation mode only after it receives a forward running or reverse running command.	0x0000	○
P21.01	Pulse command mode	Ones: Pulse mode 0: A/B quadrature pulse; A precedes B 1: A: PULSE; B: SIGN If channel B is of low electric level, the edge counts up; if channel B is of high electric level, the edge counts down. 2: A: Positive pulse Channel A is positive pulse; channel B needs no wiring 3: A/B dual-channel pulse; channel A pulse edge counts up, channel B pulse edge counts down Tens: Pulse direction	0x0000	◎

Function code	Name	Description	Default value	Modify
		Bit0: Set pulse direction 0: Forward 1: Reverse Bit1: Set pulse direction by running direction 0: Disable, and BIT0 is valid; 1: Enable Hundreds: Pulse/direction frequency-doubling selection (reserved) 0: No frequency-doubling 1: Frequency-doubling Thousands: Pulse control selection Bit0: Pulse filter selection 0: Inertia filter 1: Average moving filter Bit1: Overspeed control 0: No control 1: Control		
P21.02	APR gain 1	The two automatic position regulator (APR) gains are switched based on the switching mode set in P21.04. When the spindle orientation function is used, the gains are switched automatically, regardless of the setting of P21.04. P21.03 is used for dynamic running, and P21.02 is used for maintaining the locked state. Setting range: 0.0–400.0	20.0	○
P21.03	APR gain 2		30.0	○
P21.04	Switching mode of position loop gain	This parameter is used to set the APR gain switching mode. To use torque command-based switching, you need to set P21.05; and to use speed command-based switching, you need to set P21.06. 0: No switching 1: Torque command 2: Speed command 3–5: Reserved	0	○
P21.05	Torque command level during position gain switchover	0.0–100.0% (rated motor torque)	10.0%	○
P21.06	Speed command	0.0–100.0% (rated motor speed)	10.0%	○

Function code	Name	Description	Default value	Modify
	level during position gain switchover			
P21.07	Smooth filter coefficient during gain switchover	The smooth filter coefficient during position gain switchover. Setting range: 0–15	5	○
P21.08	Output limit of position controller	The output limit of position regulator, if the limit value is 0, position regulator will be invalid, and no position control can be performed, however, speed control is available. Setting range: 0.0–100.0% (Max. output frequency P00.03)	20.0%	○
P21.09	Completion range of positioning	When the position deviation is less than P21.09, and the duration is larger than P21.10, positioning completion signal will be outputted. Setting range: 0–1000	10	○
P21.10	Detection time for positioning completion	0.0–1000.0ms	10.0ms	○
P21.11	Numerator of position command ratio	Electronic gear ratio, used to adjust the corresponding relation between position command and actual running displacement. Setting range: 1–65535	1000	○
P21.12	Denominator of position command ratio	Setting range: 1–65535	1000	○
P21.13	Position feedforward gain	0.00–120.00% For pulse string reference only (position control)	100.00	○
P21.14	Position feedforward filter time constant	0.0–3200.0ms For pulse string reference only (position control)	3.0ms	○
P21.15	Position command filter time constant	The position feedforward filter time constant during pulse string positioning. 0.0–3200.0ms	0.0ms	◎
P21.16	Digital positioning mode	Bit0: Positioning mode selection 0: Relative position 1: Absolute position (home) (reserved) Bit1: Positioning cycle selection	0	○

Function code	Name	Description	Default value	Modify
		0: Cyclic positioning by terminals 1: Automatic cyclic positioning Bit2: Cycle mode 0: Continuous 1: Repetitive (supported by automatic cyclic positioning only) Bit3: P21.17 digital setting mode 0: Incremental 1: Position type (do not support continuous mode) Bit4: Home searching mode 0: Search for the home just once 1: Search for the home during each run Bit5: Home calibration mode 0: Calibrate in real time 1: Single calibration Bit6: Positioning completion signal selection 0: Valid during the time set by P21.25 (Hold time of positioning completion signal) 1: Always valid Bit7: Initial positioning selection (for cyclic positioning by terminals) 0: Invalid (do not rotate) 1: Valid Bit8: Positioning enable signal selection (for cyclic positioning by terminals only; positioning function is always enabled for automatic cyclic positioning) 0: Pulse signal 1: Level signal Bit9: Position source 0: P21.17 setting 1: PROFIBUS/CANopen setting Bit10: Whether to save the encoder pulse counting value at power failure 0: Do not save 1: Save Bit 11: Reserved Bit12: Positioning curve selection (reserved) 0: Straight line 1: S curve		

Function code	Name	Description	Default value	Modify
P21.17	Position digital reference	Set digital positioning position; Actual position=P21.17×P21.11/P21.12 0–65535	0	○
P21.18	Positioning speed setup selection	0: Set by P21.19 1: Set by AI1 2: Set by AI2 3: Set by AI3 4: Set by high speed pulse HDIA 5: Set by high speed pulse HDIB	0	○
P21.19	Positioning speed digits	0–100.0% max. frequency	20.0%	○
P21.20	Acceleration time of positioning	Set the acceleration/deceleration time of positioning process. Acceleration time of positioning means the time needed for the VFD to accelerate from 0Hz to Max. output frequency (P00.03). Deceleration time of positioning means the time needed for the VFD to decelerate from Max. output frequency (P00.03) to 0hz. Setting range of P21.20: 0.01–300.00s Setting range of P21.21: 0.01–300.00s	3.00s	○
P21.21	Deceleration time of positioning		3.00s	○
P21.22	Hold time of positioning arrival	Set the hold time of waiting when target positioning position is reached. Setting range: 0.000–60.000s	0.100s	○
P21.23	Home search speed	0.00–50.00Hz	2.00Hz	○
P21.24	Home position offset	0–65535	0	○
P21.25	Hold time of positioning completion signal	The hold time of positioning completion signal, this parameter is also valid for positioning completion signal of spindle orientation. Setting range: 0.000–60.000s	0.200s	○
P21.26	Pulse superposition value	P21.26: -9999–32767 P21.27: 0–3000.0/ms This function is enabled in the pulse speed reference (P00.06=12) or pulse position mode (P21.00=1): 1. Input terminal function #68 (enable pulse	0	○
P21.27	Pulse superposition speed		8.0/ms	○

Function code	Name	Description	Default value	Modify
P21.28	Acceleration/ deceleration time after disabling pulse	superposition) When the rising edge of the terminal is detected, the pulse setting is increased to the value of P21.26, and the pulse reference channel is compensated by the pulse superposition rate set in P21.27. 2. Input terminal function #67 (progressive increase of pulses) When this terminal is enabled, the pulse reference channel is compensated by the pulse superposition rate set in P21.27. **Note:** Terminal filtering set in P05.09 may slightly affect the actual superposition. **Example:** P21.27 = 1.0/ms; P05.05 = 67 If the input signal of terminal S5 is 0.5s, the actual number of superposed pulses is 500. 3. Input terminal function #69 (progressive decrease of pulses) The sequence of this function is the same as those described above. The difference lies in that this terminal indicates that negative pulses are superposed. **Note:** All the pulses described here are superposed on the pulse reference channel (A2, B2). Pulse filtering, electronic gear, and other functions are valid for superposed pulses. 4. Output terminal function #28 (pulse superposing) When pulses are superposed, the output terminal operates. After pulses are superposed, the terminal does not operate.	5.0s	○
P21.29	Speed feedforward filter time constant (pulse string speed mode)	It is the filter time constant detected by pulse string when the speed reference source is set to pulse string (P0.06=12 or P0.07=12). Setting range: 0–3200.0ms	10.0ms	○
P21.30	Numerator of the 2nd command ratio	1–65535	1000	○

Function code	Name	Description	Default value	Modify
P21.31–P21.33	Reserved	0–65535	0	○

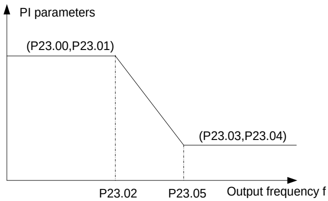
P22—Spindle positioning

Function code	Name	Description	Default value	Modify
P22.00	Spindle positioning mode selection	Bit0: Enable spindle positioning 0: Disable 1: Enable Bit1: Select spindle positioning reference point 0: Z pulse input 1: S2/S3/S4 terminal input Bit2: Search for reference point 0: Search the reference point only once 1: Search the reference point every time Bit3: Enable reference point calibration 0: Disable 1: Enable Bit4: Positioning mode selection 1 0: Set direction positioning 1: Near-by direction positioning Bit5: Positioning mode selection 2 0: Forward positioning 1: Reverse positioning Bit6: Zeroing command selection 0: Electric level mode 1: Pulse mode Bit7: Reference point calibration mode 0: Calibrate at the first time 1: Calibrate in real time Bit8: Action selection after zeroing signal cancellation (electric level type) 0: Switch to speed mode 1: Position lock mode Bit9: Positioning completion signal selection 0: Electric level signal 1: Pulse signal Bit10: Z pulse signal source 0: Motor	0	○

Function code	Name	Description	Default value	Modify
		1: Spindle Bits 11–15: Reserved		
P22.01	Speed of spindle orientation	During spindle orientation, the speed of the position point of orientation will be searched, and then it will switch over to position control orientation. Setting range: 0.00–100.00Hz	10.00Hz	○
P22.02	Deceleration time of spindle orientation	Deceleration time of spindle orientation. Spindle orientation deceleration time means the time needed for the VFD to decelerate from Max. output frequency (P00.03) to 0Hz. Setting range: 0.0–100.0s	3.0s	○
P22.03	Spindle zeroing position 0	You can select the zeroing positions of four spindles by terminals (functions 46 and 47). Setting range: 0–39999	0	○
P22.04	Spindle zeroing position 1	Setting range: 0–39999	0	○
P22.05	Spindle zeroing position 2	Setting range: 0–39999	0	○
P22.06	Spindle zeroing position 3	Setting range: 0–39999	0	○
P22.07	Spindle scale-division angle 1	You can select seven spindle scale-division values by terminals (functions 48, 49 and 50). Setting range: 0.00–359.99	15.00	○
P22.08	Spindle scale-division angle 2	Setting range: 0.00–359.99	30.00	○
P22.09	Spindle scale-division angle 3	Setting range: 0.00–359.99	45.00	○
P22.10	Spindle scale-division angle 4	Setting range: 0.00–359.99	60.00	○
P22.11	Spindle scale-division angle 5	Setting range: 0.00–359.99	90.00	○
P22.12	Spindle scale-division	Setting range: 0.00–359.99	120.00	○

Function code	Name	Description	Default value	Modify
	angle 6			
P22.13	Spindle scale-division angle 7	Setting range: 0.00–359.99	180.00	○
P22.14	Spindle drive ratio	This function code sets the reduction ratio of the spindle and the mounting shaft of the encoder. Setting range: 0.000–30.000	1.000	○
P22.15	Zero-point communication setup of spindle	P22.15 sets spindle zero-point offset, if the selected spindle zero point is P22.03, the final spindle zero point will be the sum of P22.03 and P22.15. Setting range: 0–39999	0	○
P22.16	Reserved	0–65535	0	○
P22.17	Reserved	0–65535	0	○
P22.18	Rigid tapping selection	Ones: Enable/disable 0: Disable 1: Enable Tens: Analog port selection 0: Invalid 1: AI1 2: AI2 3: AI3	0x00	◎
P22.19	Analog filter time of rigid tapping	0.0ms–1000.0ms	1.0ms	○
P22.20	Max. frequency of rigid tapping	0.00–400.00Hz	50.00Hz	○
P22.21	Corresponding frequency of analog zero drift of rigid tapping	0.00–10.00Hz	0.00Hz	○
P22.22	Pulse reference speed measuring method	0: Main control board 1: PG card 2: Hybrid method	0	○
P22.23	Reserved	0–65535	0	○
P22.24	Setting of clearing the encoder counting value	0–65535	0	○

P23—Vector control of motor 2

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th><th>Modify</th></tr>
<tr><td>P23.00</td><td>Speed loop proportional gain 1</td><td rowspan="6">P23.00–P23.05 fit for vector control mode only. Below switchover frequency 1 (P23.02), the speed loop PI parameters are P23.00 and P23.01. Above switchover frequency 2 (P23.05), the speed loop PI parameters are P23.03 and P23.04; in between them, the PI parameters are obtained by linear variation between two groups of parameters, as shown in the figure below.


The speed loop dynamic response characteristics of vector control can be adjusted by setting the proportional coefficient and integral time of speed regulator. Increase proportional gain or decrease 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 large overshoot may occur; if proportional gain is too small, stable oscillation or speed offset may occur.
Speed loop PI parameter is closely related to the system inertia, you should make adjustment according to different load characteristics based on the default PI parameter to fulfill different needs.
Setting range of P23.00: 0.0–200.0
Setting range of P23.01: 0.000–10.000s
Setting range of P23.02: 0.00Hz–P23.05
Setting range of P23.03: 0.0–200.0
Setting range of P23.04: 0.000–10.000s
Setting range of P23.05: P23.02–P00.03 (Max. output frequency)</td><td>20.0</td><td>○</td></tr>
<tr><td>P23.01</td><td>Speed loop integral time 1</td><td>0.200s</td><td>○</td></tr>
<tr><td>P23.02</td><td>Switch over low point frequency</td><td>5.00Hz</td><td>○</td></tr>
<tr><td>P23.03</td><td>Speed loop proportional gain 2</td><td>20.0</td><td>○</td></tr>
<tr><td>P23.04</td><td>Speed loop integral time 2</td><td>0.200s</td><td>○</td></tr>
<tr><td>P23.05</td><td>Switch over high point frequency</td><td>10.00Hz</td><td>○</td></tr>
<tr><td>P23.06</td><td>Speed loop</td><td>0–8 (corresponds to 0–2^8/10ms)</td><td>0</td><td>○</td></tr>
</table>

Function code	Name	Description	Default value	Modify
	output filter			
P23.07	Slip compensation coefficient of vector control (motoring)	Slip compensation coefficient is used to adjust the slip frequency of vector control to improve system speed control precision. You can effectively control the static error of speed by adjusting this parameter properly. Setting range: 50–200%	100%	○
P23.08	Slip compensation coefficient of vector control (generating)		100%	○
P23.09	Current loop proportional coefficient P	**Note:** 1. These two parameters are used to adjust PI parameters of current loop; it affects dynamic response speed and control precision of the system directly. The default value needs no adjustment under common conditions; 2. Applicable to SVC mode 0 (P00.00=0), SVC mode 1 (P00.00=1), and closed-loop vector control mode (P00.00=3) Setting range: 0–65535	1000	○
P23.10	Current loop integral coefficient I		1000	○
P23.11	Speed loop differential gain	0.00–10.00s	0.00s	○
P23.12	Proportional coefficient of high-frequency current loop	In the closed-loop vector control mode (P00.00=3), when the frequency is lower than the current-loop high-frequency switching threshold (P23.14), the current-loop PI parameters are P23.09 and P23.10; and when the frequency is higher than the current-loop high-frequency switching threshold, the current-loop PI parameters are P23.12 and P23.13. Setting range of P23.12: 0–65535 Setting range of P23.13: 0–65535 Setting range of P23.14: 0.0–100.0% (relative to max. frequency)	1000	○
P23.13	Integral coefficient of high-frequency current loop		1000	○
P23.14	High-frequency switchover threshold of current loop		100.0%	○
P23.15–P23.19	Reserved	0–65535	0	●

P24—Encoder of motor 2

Function code	Name	Description	Default value	Modify
P24.00	Encoder type display	0: Incremental encoder 1: Resolver-type encoder 2: Sin/Cos encoder 3: Endat absolute encoder	0	●
P24.01	Encoder pulse number	Number of pulses generated when the encoder revolves for one circle. Setting range: 0–60000	1024	◎
P24.02	Encoder direction	Ones: AB direction 0: Forward 1: Reverse Tens: Z pulse direction (reserved) 0: Forward 1: Reverse Hundreds: CD/UVW pole signal direction 0: Forward 1: Reverse	0x000	◎
P24.03	Detection time of encoder offline fault	0.0–10.0s	2.0s	○
P24.04	Detection time of encoder reversal fault	0.0–100.0s	0.8s	○
P24.05	Filter times of encoder detection	Setting range: 0x00–0x99 Ones: Low-speed filter times, corresponds to $2^{(0–9)}$×125μs. Tens: High-speed filter times; corresponds to $2^{(0–9)}$×125μs.	0x33	○
P24.06	Speed ratio between encoder mounting shaft and motor	You need to set this parameter when the encoder is not installed on the motor shaft and the drive ratio is not 1. Setting range: 0.001–65.535	1.000	○
P24.07	Control parameters of synchronous motor	Bit0: Enable Z pulse calibration Bit1: Enable encoder angle calibration Bit2: Enable SVC speed measurement Bit3: Select resolver speed measurement mode Bit4: Z pulse capture mode Bit5: Do not detect encoder initial angle in v/f control	0x3	○

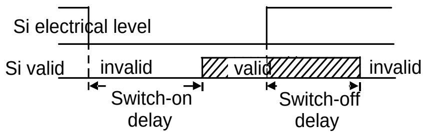
Function code	Name	Description	Default value	Modify
		Bit6: Enable CD signal calibration Bit7: Disable sin/cos sub-division speed measurement Bit8: Do not detect encoder fault during autotuning Bit9: Enable Z pulse detection optimization Bit10: Enable initial Z pulse calibration optimization Bit12: Clear Z pulse arrival signal after stop		
P24.08	Enable Z pulse offline detection	0x00–0x11 Ones: Z pulse Reserved Tens: UVW pulse 0: Do not detect 1: Enable	0x10	○
P24.09	Initial angle of Z pulse	Relative electric angle of encoder Z pulse and motor pole position. Setting range: 0.00–359.99	0.00	○
P24.10	Initial angle of the pole	Relative electric angle of encoder position and motor pole position. Setting range: 0.00–359.99	0.00	○
P24.11	Autotuning of initial angle of pole	0–3 1: Rotary autotuning (DC brake) 2: Static autotuning (suitable for resolver-type encoder, sin/cos with CD signal feedback) 3: Rotary autotuning (initial angle identification)	0	◎
P24.12	Speed measurement optimization selection	0: No optimization 1: Optimization mode 1 2: Optimization mode 2	1	◎
P24.13	CD signal zero offset gain	0–65535	0	○
P24.14	Encoder type selection	Ones: Incremental encoder 0: without UVW 1: with UVW Tens: Sin/Cos encoder 0: without CD signal 1: with CD signal	0x00	◎
P24.15	Speed measurement mode	0: PG card 1: local; realized by HDIA and HDIB; supports incremental 24V encoder only	0	◎

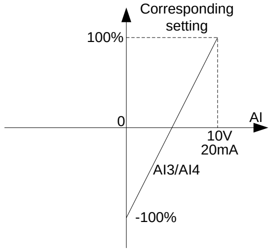
Function code	Name	Description	Default value	Modify
P24.16	Frequency-division coefficient	0–255 When this parameter is set to 0 or 1, frequency division of 1:1 is implemented.	0	○
P24.17	Pulse filer processing	0x0000–0xFFFF Bit0: Enable/disable encoder input filter 0: No filter 1: Filter Bit1: Encoder signal filter mode 0: Self-adaptive filter 1: Use P24.18 filter parameters Bit2: Enable/disable encoder frequency-division output filter 0: No filter 1: Filter Bit3: Reserved Bit4: Enable/disable pulse reference filter 0: No filter 1: Filter Bit5: Pulse reference filter mode 0: Self-adaptive filter 1: Use P24.19 filter parameters Bit6: Frequency-divided output source setting 0: Encoder signals 1: Pulse reference signals Bits7–15: Reserved	0x0033	○
P24.18	Encoder pulse filter width	0–63 The filtering time is P24.18×0.25 μs. The value 0 or 1 indicates 0.25 μs.	2	○
P24.19	Pulse reference filter width	0–63 The filtering time is P24.19×0.25 μs. The value 0 or 1 indicates 0.25 μs.	2	○
P24.20	Pulse number of pulse reference	0–65535	1024	◎
P24.21	Enable angle compensation of synchronous motor	0–1	0	○
P24.22	Switchover frequency	0–630.00Hz	1.00Hz	○

Function code	Name	Description	Default value	Modify
	threshold of speed measurement mode			
P24.23	Synchronous motor angle compensation coefficient	-200.0–200.0%	100.0%	○
P24.24	Reserved	0–65535	0	○

P25—Extension I/O card input functions

Function code	Name	Description	Default value	Modify
P25.00	HDI3 input type selection	0: HDI3 is high-speed pulse input 1: HDI3 is digital input	0	◎
P25.01	S5 terminal function	The same with P05 group	0	◎
P25.02	S6 terminal function		0	◎
P25.03	S7 terminal function		0	◎
P25.04	S8 terminal function		0	◎
P25.05	S9 terminal function		0	◎
P25.06	S10 terminal function		0	◎
P25.07	HDI3 terminal function		0	◎
P25.08	Input terminal polarity of extension card	0x00–0x7F	0x00	○
P25.09	Virtual terminal setup of extension card	0x000–0x7F (0: disable, 1: enable) BIT0: S5 virtual terminal BIT1: S6 virtual terminal BIT2: S7 virtual terminal BIT3: S8 virtual terminal BIT4: S9 virtual terminal	0x00	◎

Function code	Name	Description	Default value	Modify
		BIT5: S10 virtual terminal BIT6: HDI3 virtual terminal		
P25.10	HDI3 terminal switch-on delay	These function codes define corresponding delay of the programmable input terminals during level variation from switch-on to switch-off .  Setting range: 0.000–50.000s	0.000s	○
P25.11	HDI3 terminal switch-off delay		0.000s	○
P25.12	S5 terminal switch-on delay		0.000s	○
P25.13	S5 switch-off delay		0.000s	○
P25.14	S6 terminal switch-on delay		0.000s	○
P25.15	S6 switch-off delay		0.000s	○
P25.16	S7 terminal switch-on delay		0.000s	○
P25.17	S7 switch-off delay		0.000s	○
P25.18	S8 terminal switch-on delay		0.000s	○
P25.19	S8 switch-off delay		0.000s	○
P25.20	S9 terminal switch-on delay		0.000s	○
P25.21	S9 switch-off delay		0.000s	○
P25.22	S10 terminal switch-on delay		0.000s	○
P25.23	S10 switch-off delay		0.000s	○
P25.24	Lower limit value of AI3	These function codes define the relation between analog input voltage and corresponding set value of analog input. When the analog input voltage exceeds the range of max./min. input, the max. input or min. input will be adopted during calculation. When analog input is current input, 0–20mA current corresponds to 0–10V voltage.	0.00V	○
P25.25	Corresponding setting of lower limit of AI3		0.0%	○
P25.26	Upper limit value of AI3		10.00V	○
P25.27	Corresponding		100.0%	○

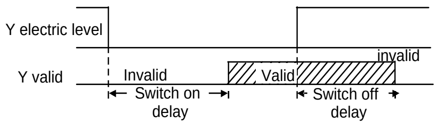
<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th><th>Modify</th></tr>
<tr><td></td><td>setting of upper limit of AI3</td><td rowspan="7">In different application cases, 100% of the analog setting corresponds to different nominal values. The figure below illustrates several settings.


Input filter time: Adjust the sensitivity of analog input, increase this value properly can enhance the anti-interference capacity of analog variables; however, it will also degrade the sensitivity of analog input.
Note: AI3 and AI4 can support 0–10V/0–20mA input, when AI3 and AI4 select 0–20mA input, the corresponding voltage of 20mA is 10V;
Setting range of P25.24: 0.00V–P25.26
Setting range of P25.25: -300.0%–300.0%
Setting range of P25.26: P25.24–10.00V
Setting range of P25.27: -300.0%–300.0%
Setting range of P25.28: 0.000s–10.000s
Setting range of P25.29: 0.00V–P25.31
Setting range of P25.30: -300.0%–300.0%
Setting range of P25.31: P25.29–10.00V
Setting range of P25.32: -300.0%–300.0%
Setting range of P25.33: 0.000s–10.000s</td><td></td><td></td></tr>
<tr><td>P25.28</td><td>Input filter time of AI3</td><td>0.030s</td><td>○</td></tr>
<tr><td>P25.29</td><td>Lower limit value of AI4</td><td>0.00V</td><td>○</td></tr>
<tr><td>P25.30</td><td>Corresponding setting of lower limit of AI4</td><td>0.0%</td><td>○</td></tr>
<tr><td>P25.31</td><td>Upper limit value of AI4</td><td>10.00V</td><td>○</td></tr>
<tr><td>P25.32</td><td>Corresponding setting of upper limit of AI4</td><td>100.0%</td><td>○</td></tr>
<tr><td>P25.33</td><td>Input filter time of AI4</td><td>0.030s</td><td>○</td></tr>
<tr><td>P25.34</td><td>HDI3 high-speed pulse input function</td><td>0: Set input via frequency
1: Count</td><td>0</td><td>◎</td></tr>
<tr><td>P25.35</td><td>Lower limit frequency of HDI3</td><td>0.000 kHz – P25.37</td><td>0.000 kHz</td><td>○</td></tr>
<tr><td>P25.36</td><td>Corresponding setting of lower limit frequency of HDI3</td><td>-300.0%–300.0%</td><td>0.0%</td><td>○</td></tr>
</table>

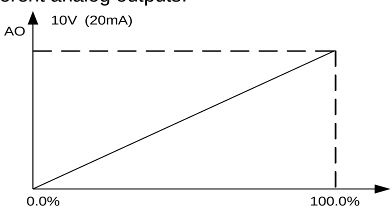
Function code	Name	Description	Default value	Modify
P25.37	Upper limit frequency of HDI3	P25.35 –50.000kHz	50.000 kHz	○
P25.38	Corresponding setting of upper limit frequency of HDI3	-300.0%–300.0%	100.0%	○
P25.39	HDI3 frequency input filter time	0.000s–10.000s	0.030s	○
P25.40	AI3 input signal type	Range: 0–1 0: Voltage type 1: Current type	0	○
P25.41	AI4 input signal type	Range: 0–1 0: Voltage type 1: Current type	0	○
P25.42–P25.45	Reserved	0–65535	0	○

P26—Extension I/O card output functions

Function code	Name	Description	Default value	Modify
P26.00	HDO2 output type	0: Open collector high-speed pulse output 1: Open collector output	0	◎
P26.01	HDO2 output selection	The same with P06.01	0	○
P26.02	Y2 output selection		0	○
P26.03	Y3 output selection		0	○
P26.04	Relay RO3 output selection		0	○
P26.05	Relay RO4 output selection		0	○
P26.06	Relay RO5 output selection		0	○
P26.07	Relay RO6 output selection		0	○
P26.08	Relay RO7 output selection		0	○

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th><th>Modify</th></tr>
<tr><td>P26.09</td><td>Relay RO8 output selection</td><td rowspan="3"></td><td>0</td><td>○</td></tr>
<tr><td>P26.10</td><td>Relay RO9 output selection</td><td>0</td><td>○</td></tr>
<tr><td>P26.11</td><td>Relay RO10 output selection</td><td>0</td><td>○</td></tr>
<tr><td>P26.12</td><td>Output terminal polarity of extension card</td><td>0x0000–0x7FF
RO10, RO9…RO3, HDO2,Y3, Y2 in sequence</td><td>0x000</td><td>○</td></tr>
<tr><td>P26.13</td><td>HDO2 switch-on delay</td><td rowspan="15">This function code defines the corresponding delay of the level variation from switch-on to switch-off.


Setting range: 0.000–50.000s
Note: P26.13 and P26.14 are valid only when P26.00 is set to 1.</td><td>0.000s</td><td>○</td></tr>
<tr><td>P26.14</td><td>HDO2 switch-off delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P26.15</td><td>Y2 switch-on delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P26.16</td><td>Y2 switch-off delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P26.17</td><td>Y3 switch-on delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P26.18</td><td>Y3 switch-off delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P26.19</td><td>Relay RO3 switch-on delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P26.20</td><td>Relay RO3 switch-off delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P26.21</td><td>Relay RO4 switch-on delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P26.22</td><td>Relay RO4 switch-off delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P26.23</td><td>Relay RO5 switch-on delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P26.24</td><td>Relay RO5 switch-off delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P26.25</td><td>Relay RO6 switch-on delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P26.26</td><td>Relay RO6 switch-off delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P26.27</td><td>Relay RO7</td><td>0.000s</td><td>○</td></tr>
</table>

Function code	Name	Description	Default value	Modify
	switch-on delay			
P26.28	Relay RO7 switch-off delay		0.000s	○
P26.29	Relay RO8 switch-on delay		0.000s	○
P26.30	Relay RO8 switch-off delay		0.000s	○
P26.31	Relay RO9 switch-on delay		0.000s	○
P26.32	Relay RO9 switch-off delay		0.000s	○
P26.33	Relay RO10 switch-on delay		0.000s	○
P26.34	Relay RO10 switch-off delay		0.000s	○
P26.35	AO2 output selection	The same with P06.14	0	○
P26.36	AO3 output selection		0	○
P26.37	Reserved		0	○
P26.38	Lower limit of AO2 output	Above function codes define the relation between output value and analog output. When the output value exceeds the set max./min. output range, the upper/low limit of output will be adopted during calculation. When analog output is current output, 1mA corresponds to 0.5V voltage. In different applications, 100% of output value corresponds to different analog outputs.  Setting range of P26.38: -300.0%–P26.40 Setting range of P26.39: 0.00V–10.00V	0.0%	○
P26.39	Corresponding AO2 output of lower limit		0.00V	○
P26.40	Upper limit of AO2 output		100.0%	○
P26.41	Corresponding AO2 output of upper limit		10.00V	○
P26.42	AO2 output filter time		0.000s	○
P26.43	Lower limit of AO3 output		0.0%	○
P26.44	Corresponding AO3 output of lower limit		0.00V	○
P26.45	Upper limit of		100.0%	○

Function code	Name	Description	Default value	Modify
	AO3 output	Setting range of P26.40: P26.38–100.0%		
P26.46	Corresponding AO3 output of upper limit	Setting range of P26.41: 0.00V–10.00V Setting range of P26.42: 0.000s–10.000s Setting range of P26.43: -300.0%–P26.45	10.00V	○
P26.47	AO3 output filter time	Setting range of P26.44: 0.00V–10.00V Setting range of P26.45: P26.43–300.0% Setting range of P26.46: 0.00V–10.00V Setting range of P26.47: 0.000s–10.000s	0.000s	○
P26.48–P26.52	Reserved	0–65535	0	○

P28—Master/slave control functions

Function code	Name	Description	Default value	Modify
P28.00	Master/slave mode selection	0: The master/slave control is invalid 1: This machine is a master 2: This machine is a slave	0	◎
P28.01	Master/slave communication data selection	0: CAN 1: Reserved	0	◎
P28.02	Master/slave control mode	Ones: Master/slave running mode selection 0: Master/slave mode 0 (The master and slave adopt speed control and maintain the power balance by droop control) 1: Master/slave mode 1 (The master and slave must be in the same type of vector control mode. If the master is in speed control, the slave is forced in torque control.) 2: Master/slave mode 2 Start in the slave first speed mode (master/slave mode 0) and then switch to torque mode at a certain frequency point (master/slave mode 1) Tens: Slave start command source selection 0: Follow the master to start 1: Determined by P00.01 Hundreds: Slave transmitting/master receiving data enable 0: Enable 1: Disable	0x001	◎

Function code	Name	Description	Default value	Modify
P28.03	Slave speed gain	0.0–500.0%	100.0%	○
P28.04	Slave torque gain	0.0–500.0%	100.0%	○
P28.05	Speed/torque control switching frequency point in master/slave mode 2	0.00–10.00Hz	5.00Hz	○
P28.06	Number of slaves	0–15	1	◎
P28.07–P28.29	Reserved	0–65535	0	○

P90—Customized function group 1

Function code	Name	Description	Default value	Modify
P90.00–P90.39	Reserved	0–65535	0	○

P91—Customized function group 2

Function code	Name	Description	Default value	Modify
P91.00–P91.39	Reserved	0–65535	0	○

P92 —Customized function group 3

Function code	Name	Description	Default value	Modify
P92.00–P92.39	Reserved	0–65535	0	○

P93—Customized function group 4

Function code	Name	Description	Default value	Modify
P93.00–P93.39	Reserved	0–65535	0	○

7 Troubleshooting

7.1 What this chapter contains

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

	✧ Only well-trained and qualified professionals are allowed to carry out the work described in this chapter. Operations should be carried out according to the instructions presented in Safety precautions.

7.2 Indications of alarms and faults

Faults are indicated by indicators (you can refer to 5.4 Operating the VFD through the keypad). When the TRIP indicator is on, the alarm or fault code displayed in 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 figure out the alarm or fault causes, contact local INVT office.

7.3 Fault reset

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

7.4 Fault history

P07.27–P07.32 record the types of last six faults; P07.33–P07.40, P07.41–P07.48, and P07.49–P07.56 record the running data of the VFD when the latest three faults occurred.

7.5 VFD faults and solutions

When fault occurred, process the fault as shown below.

1. When VFD fault occurred, confirm whether keypad display is improper? If yes, contact INVT.
2. If keypad works properly, check the function codes in P07 group to confirm the corresponding fault record parameters, and determine the real state when current fault occurred through parameters.
3. Check the table below to see whether corresponding exception states exist based on the corresponding corrective measures.
4. Rule out the faults or ask for help from professionals.
5. After confirming faults are removed, reset the fault and start running.

7.5.1 Details of faults and solutions

Fault code	Fault type	Possible cause	Corrective measures
OUt1	Inverter unit phase-U protection	Acceleration is too fast; IGBT module is damaged; Misacts caused by interference; drive wires are poorly connected; Shorted to ground.	Increase acceleration time; Replace the power unit; Check drive wires; Check whether there is strong interference surrounds the peripheral equipment
OUt2	Inverter unit phase-V protection		
OUt3	Inverter unit phase-W protection		

Fault code	Fault type	Possible cause	Corrective measures
OV1	Over-voltage during acceleration	Deceleration time is too short; Exception occurred to input voltage; Large energy feedback; Lack of braking units; Dynamic brake is not enabled	Check input power; Check whether load deceleration time is too short; or the motor starts during rotating; Install dynamic braking units; Check the setup of related function codes
OV2	Over-voltage during deceleration		
OV3	Over-voltage during constant speed running		
OC1	Over-current during acceleration	Acceleration is too fast; Grid voltage is too low; VFD power is too small; Load transient or exception occurred; To-ground short circuit or output phase loss occur; Strong external interference sources; Overcurrent stall protection is not enabled	Increase acceleration /deceleration time; Check input power; Select the VFD with larger power; Check if the load is short circuited (to-ground short circuit or line-to-line short circuit) or the rotation is not smooth; Check the output wiring; Check if there is strong interference; Check the setup of related function codes.
OC2	Over-current during deceleration		
OC3	Over-current during constant speed running		
UV	Bus undervoltage fault	Grid voltage is too low; Overvoltage stall protection is not enabled	Check grid input power; Check the setup of related function codes
OL1	Motor overload	Grid voltage is too low; Rated motor current is set improperly; Motor stall or load jumps violently	Check grid voltage; Reset rated motor current; Check the load and adjust torque boost
OL2	VFD overload	Acceleration is too fast; The motor in rotating is restarted; Grid voltage is too low; Load is too large; Power is too small;	Increase acceleration time; Avoid restart after stop; Check grid voltage; Select the VFD with larger power; Select proper motor
SPI	Phase loss on input side	Phase loss or violent fluctuation occurred to R, S and T input	Check the input power; Check installation wiring

Fault code	Fault type	Possible cause	Corrective measures
SPO	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	Overheat of rectifier module	Air duct is blocked or fan is damaged; Ambient temperature is too high; Long-time overload running	Ventilate the air duct or replace the fan; Lower the ambient temperature
OH2	Overheat of inverter module		
EF	External fault	SI external fault input terminal acts	Check external device input
CE	485 communication fault	Baud rate is set improperly; Communication line fault; Communication address error; Communication suffers from strong interference	Set proper baud rate; Check the wiring of communication interfaces; Set proper communication address; Replace or change the wiring to enhance anti-interference capacity
ItE	Current detection fault	Poor contact of the connector of control board; 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	Motor autotuning fault	Motor capacity does not match with the VFD capacity, this fault may occur easily if the difference between them is exceeds five power classes; Motor parameter is set improperly; The parameters gained from autotuning deviate sharply from the standard parameters; Autotuning timeout	Change the VFD model, or adopt V/F mode for control; Set proper motor type and nameplate parameters; Empty the motor load and carry out autotuning again; Check motor wiring and parameter setup; Check whether upper limit frequency is larger than 2/3 of the rated frequency
EEP	EEPROM fault	R/W error occurred to the control parameters;	Press STOP/RST to reset; Replace the main control board

Fault code	Fault type	Possible cause	Corrective measures
		EEPROM is damaged	
PIDE	PID feedback offline fault	PID feedback offline; PID feedback source disappears;	Check PID feedback signal wires; Check PID feedback source
bCE	Braking unit fault	Braking circuit fault or braking tube is damaged; The resistance of external braking resistor is too small	Check the braking unit, replace with new brake tubes; Increase brake resistance
END	Running time is up	The actual running time of the VFD is larger than the set running time	Ask help from the supplier, adjust the set running time
OL3	Electronic overload fault	The VFD releases overload pre-alarm based on the set value	Check the load and overload pre-alarm threshold
PCE	Keypad communication fault	The keypad wire is poorly contacted or disconnected; The keypad wire is too long and suffers strong interference; Circuit fault occurred to the keypad or communication part of the main board	Check the keypad wires to confirm whether fault exists; Check the surroundings to rule out interference source; Replace the hardware and ask for maintenance service
UPE	Parameter upload error	The keypad wire is poorly contacted or disconnected; The keypad wire is too long and suffers strong interference; Circuit fault occurred to the keypad or communication part of the main board	Check the surroundings to rule out interference source; Replace the hardware and ask for maintenance service; Replace the hardware and ask for maintenance service
DNE	Parameter download error	The keypad wire is poorly contacted or disconnected; The keypad wire is too long and suffers strong interference; Data storage error occurred to the keypad	Check the surroundings to rule out interference source; Replace the hardware and ask for maintenance service; Re-backup keypad data
ETH1	To-ground short	VFD output is short	Check whether motor wiring is

Fault code	Fault type	Possible cause	Corrective measures
	circuit fault 1	connected to the ground; Current detection circuit is faulty; Actual motor power setup deviates sharply from the VFD power	proper; Replace the hall component; Replace the main control board; Reset the motor parameters properly
ETH2	To-ground short circuit fault 1	VFD output is short connected to ground; Current detection circuit is faulty; Actual motor power setup deviates sharply from the VFD power	Check whether motor wiring is proper; Replace the hall component; Replace the main control board; Reset the motor parameters properly
dEu	Speed deviation fault	Load is too heavy, or stall occurred	Check the load to ensure it is proper, increase the detection time; Check whether control parameters are set properly
STo	Maladjustment fault	Control parameters of synchronous motor is set improperly; The parameter gained from autotuning is inaccurate; The VFD is not connected to motor	Check the load to ensure it is proper, Check whether load is proper; Check whether control parameters are set correctly; Increase maladjustment detection time
LL	Electronic underload fault	The VFD performs underload pre-alarm based on the set value	Check the load and overload pre-alarm threshold
ENC1O	Encoder offline fault	Encoder line sequence is wrong, or signal wires are poorly connected	Check the encoder wiring
ENC1D	Encoder reversal fault	The encoder speed signal is contrary to the motor running direction	Reset encoder direction
ENC1Z	Encoder Z pulse offline fault	Z signal wires are disconnected	Check the wiring of Z signal
OT	Motor over-temperature fault	Motor over-temperature input terminal is valid; Exception occurred to t	Check the wiring of motor over-temperature input terminal (terminal function 57);

Fault code	Fault type	Possible cause	Corrective measures
		temperature detection Exception occurred to resistor; Long-time overload running or exception occurred	Check whether temperature sensor is proper; Check the motor and perform maintenance on the motor
STO	Safe torque off	Safe torque off function is enabled by external forces	/
STL1	Exception occurred to safe circuit of channel H1	The wiring of STO is improper; Fault occurred to external switch of STO; Hardware fault occurred to safety circuit of channel H1	Check whether terminal wiring of STO is proper and firm enough; Check whether external switch of STO can work properly; Replace the control board
STL2	Exception occurred to channel H2 safe circuit	The wiring of STO is improper; Fault occurred to external switch of STO; Hardware fault occurred to safety circuit of channel H2	Check whether terminal wiring of STO is proper and firm enough; Check whether external switch of STO can work properly; Replace the control board
STL3	Exception occurred to channel H1 and channel H2	Hardware fault occurred to STO circuit	Replace the control board
CrCE	Safety code FLASH CRC check fault	Control board is faulty	Replace the control board
E-Err	Repetitive extension card type	The two inserted extension cards are of the same type	You should not insert two cards with the same type; check the type of extension card, and remove one card after power down
ENCUV	Encoder UVW loss fault	No electric level variation occurred to UVW signal	Check the wiring of UVW; Encoder is damaged
F1-Er	Failed to identify the extension card in card slot 1	There is data transmission in interfaces of card slot 1, however, it cannot read the card type	Confirm whether the extension card inserted can be supported; Stabilize the extension card interfaces after power down, and confirm whether fault still occurs at next power-on; Check whether the insertion

Fault code	Fault type	Possible cause	Corrective measures
			port is damaged, if yes, replace the insertion port after power down
F2-Er	Failed to identify the extension card in card slot 2	There is data transmission in interfaces of card slot 2, however, it cannot read the card type	Confirm whether the extension card inserted can be supported; Stabilize the extension card interfaces after power down, and confirm whether fault still occurs at next power-on; Check whether the insertion port is damaged, if yes, replace the insertion port after power down
F3-Er	Failed to identify the extension card in card slot 3	There is data transmission in interfaces of card slot 3, however, it cannot read the card type	Confirm whether the extension card inserted can be supported; Stabilize the extension card interfaces after power down, and confirm whether fault still occurs at next power-on; Check whether the insertion port is damaged, if yes, replace the insertion port after power down
C1-Er	Communication timeout occurred to the extension card in card slot 1	There is no data transmission in interfaces of card slot 1	Confirm whether the extension card inserted can be supported; Stabilize the extension card interfaces after power down, and confirm whether fault still occurs at next power-on; Check whether the insertion port is damaged, if yes, replace the insertion port after power down
C2-Er	Communication timeout occurred to the extension card in card slot 2	There is no data transmission in interfaces of card slot 2	Confirm whether the extension card inserted can be supported; Stabilize the extension card interfaces after power down, and confirm whether fault still occurs at next power-on;

Fault code	Fault type	Possible cause	Corrective measures
			Check whether the insertion port is damaged, if yes, replace the insertion port after power down
C3-Er	Communication timeout occurred to the extension card in card slot 3	There is no data transmission in interfaces of card slot 3	Confirm whether the extension card inserted can be supported; Stabilize the extension card interfaces after power down, and confirm whether fault still occurs at next power-on; Check whether the insertion port is damaged, if yes, replace the insertion port after power down
E-DP	Profibus card communication timeout fault	There is no data transmission between the communication card and the host computer (or PLC)	Check whether the communication card wiring is loose or dropped
E-NET	Ethernet card communication timeout fault	There is no data transmission between the communication card and the host computer	Check whether the communication card wiring is loose or dropped
E-CAN	CANopen card communication timeout fault	There is no data transmission between the communication card and the host computer (or PLC)	Check whether the communication card wiring is loose or dropped
E-PN	PROFINET card communication timeout fault	There is no data transmission between the communication card and the host computer (or PLC)	Check whether the communication card wiring is loose or dropped
E-CAT	EtherCAT card communication timeout fault	There is no data transmission between the communication card and the host computer (or PLC)	Check whether the communication card wiring is loose or dropped
E-BAC	BACNet card communication timeout fault	There is no data transmission between the communication card and the host computer (or PLC)	Check whether the communication card wiring is loose or dropped

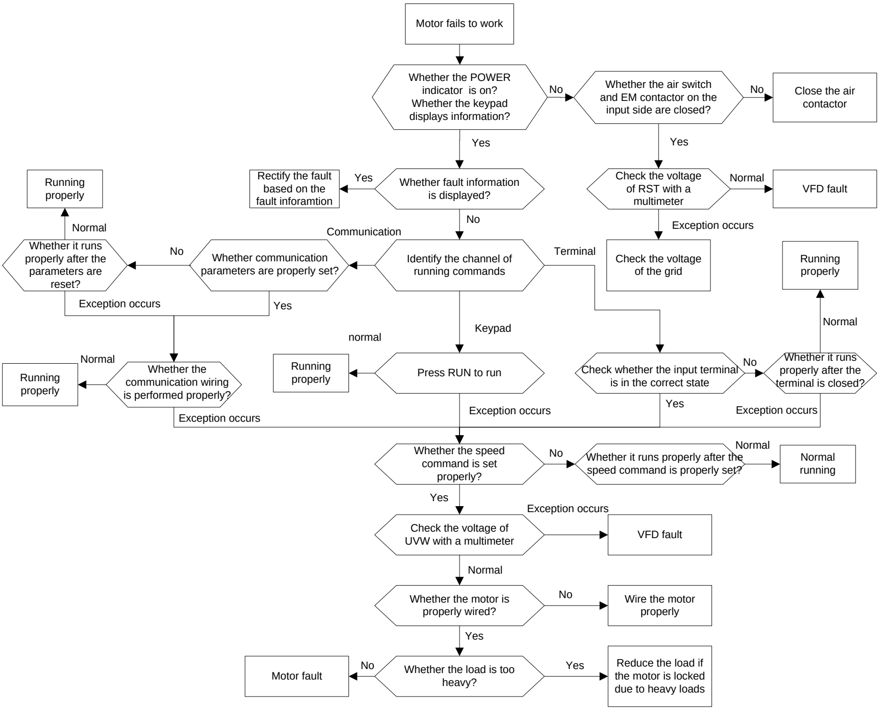
Fault code	Fault type	Possible cause	Corrective measures
E-DEV	DeviceNet card communication timeout fault	There is no data transmission between the communication card and the host computer (or PLC)	Check whether the communication card wiring is loose or dropped
ESCAN	CAN master/slave communication card communication timeout fault	There is no data transmission between the CAN master and slave communication cards	Check whether the communication card wiring is loose or dropped
S-Err	Master-slave synchronous CAN slave fault	Fault occurred to one of the CAN slave VFDs	Detect the CAN slave VFD and analyze the corresponding fault cause of the VFD

7.5.2 Other state

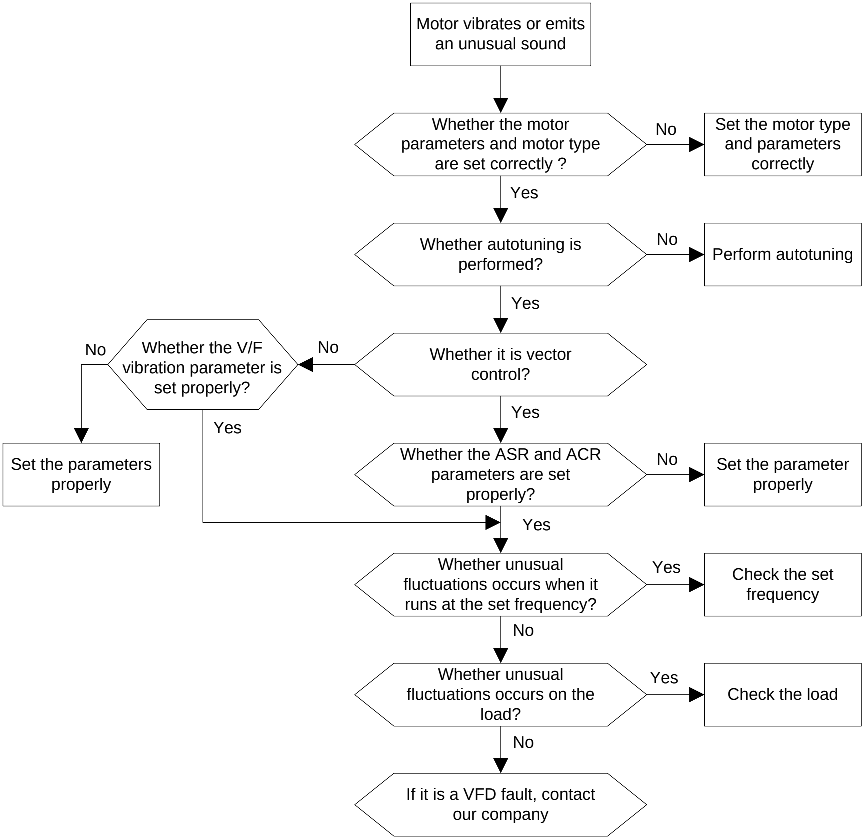
Displayed code	State type	Possible cause	Solution
PoFF	System power failure	The system is powered off or the bus voltage is too low.	Check the grid conditions.

7.6 Analysis on common faults

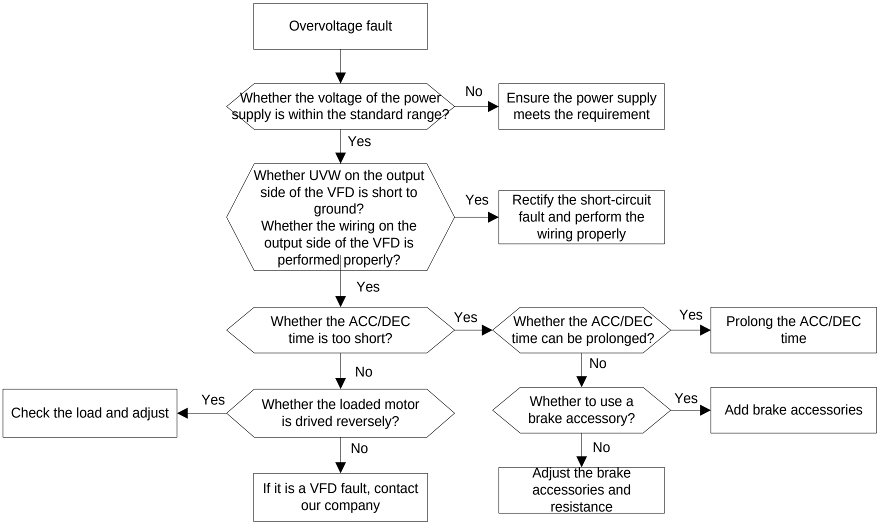
7.6.1 Motor fails to work



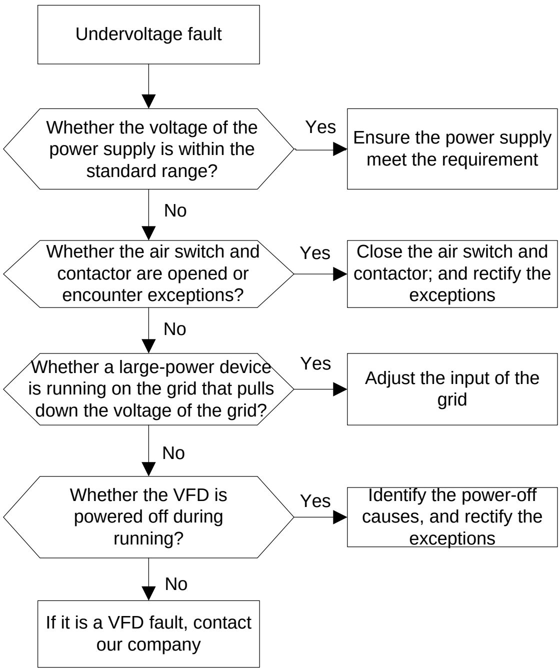
7.6.2 Motor vibrates



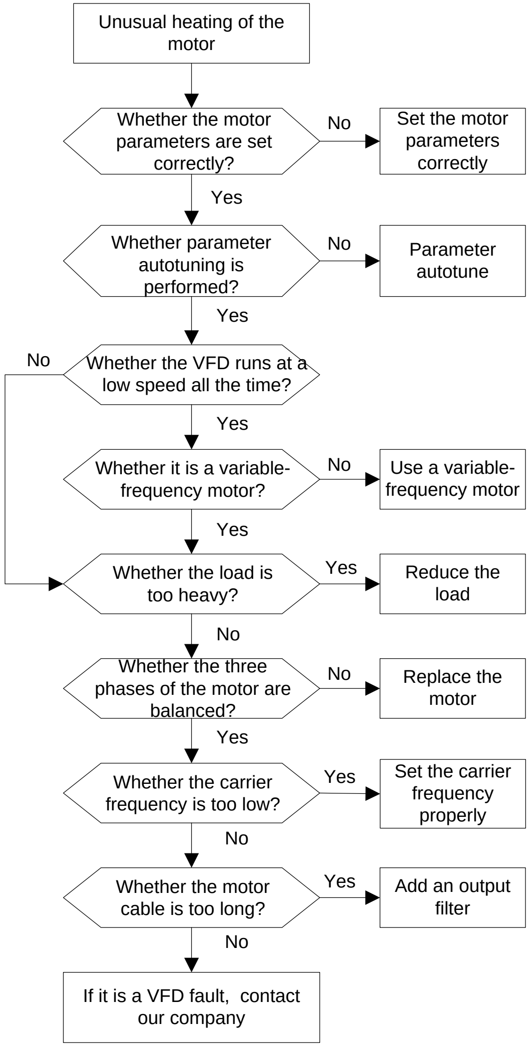
7.6.3 Overvoltage



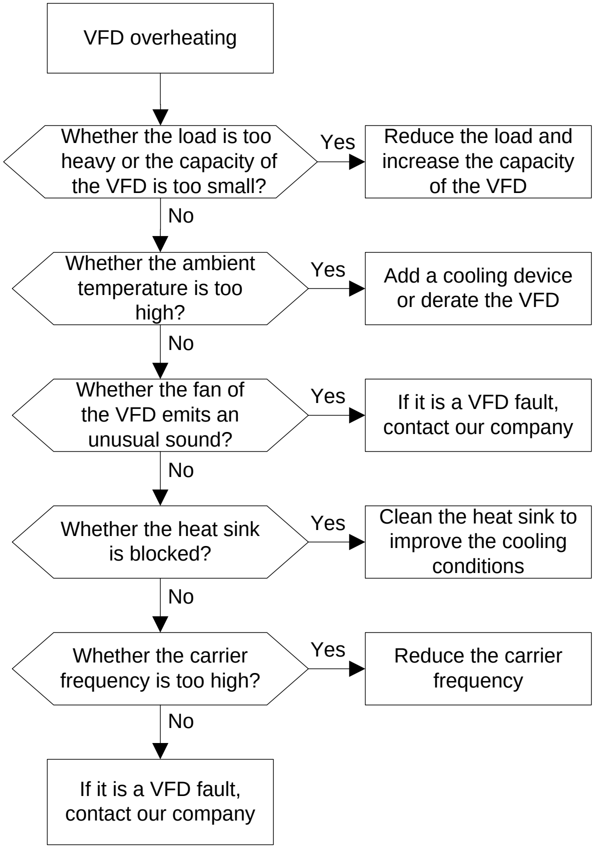
7.6.4 Undervoltage



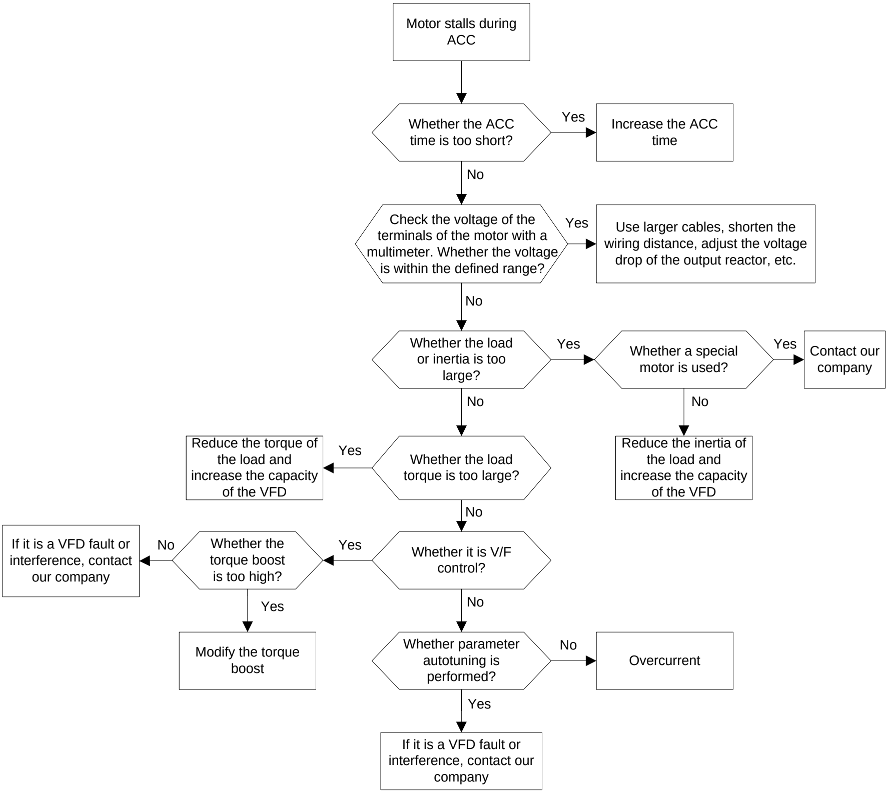
7.6.5 Unusual heating of motor



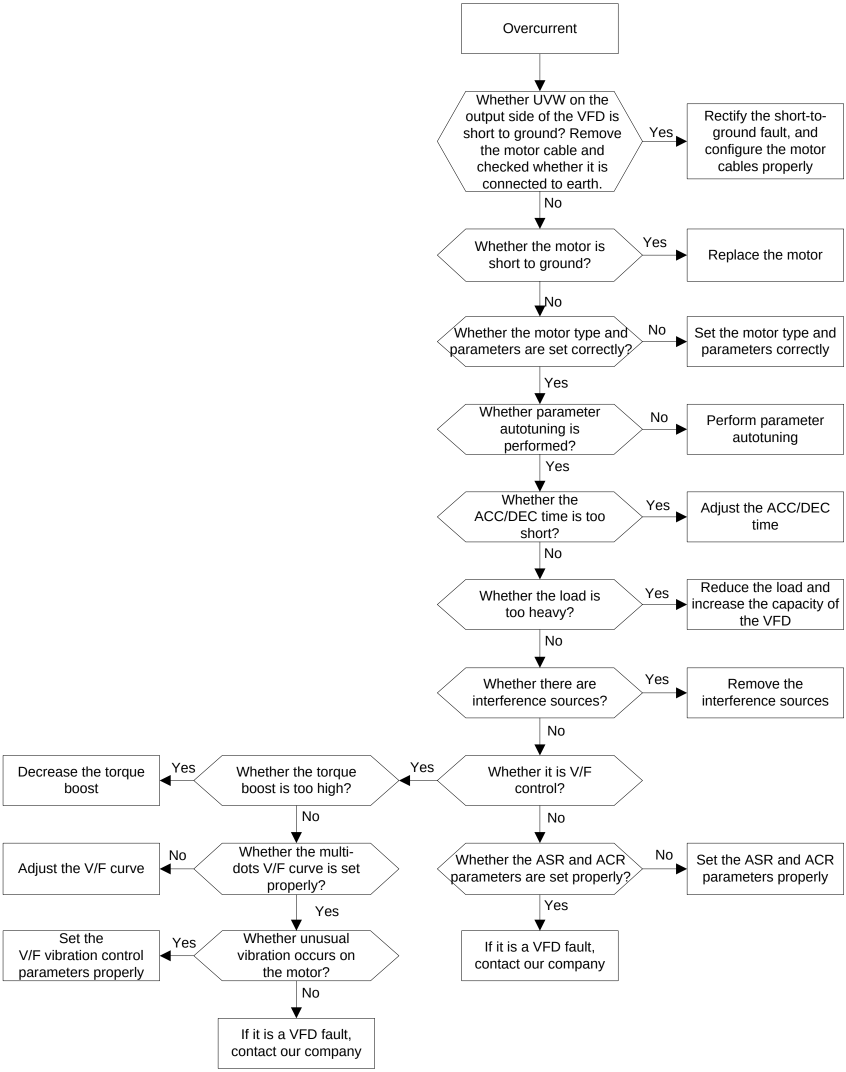
7.6.6 VFD overheating



7.6.7 Motor stalls during ACC



7.6.8 Overcurrent



7.7 Countermeasures on common interference

7.7.1 Interference on meter switches and sensors

Interference phenomenon

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

1. The upper or lower limit is wrongly displayed, for example, 999 or -999.
2. The display of values jumps (usually occurring on pressure transmitters).
3. The display of values is stable, but there is a large deviation, for example, the temperature is dozens of degrees higher than the common temperature (usually occurring on thermocouples).
4. A signal collected by a sensor is not displayed but functions as a drive system running feedback signal. For example, a VFD is expected to decelerate when the upper pressure limit of the compressor is reached, but in actual running, it starts to decelerate before the upper pressure limit is reached.
5. After a VFD is started, the display of all kinds of meters (such as frequency meter and current meter) that are connected to the analog output (AO) terminal of the VFD is severely affected, displaying the values incorrectly.
6. Proximity switches are used in the system. After a VFD is started, the indicator of a proximity switch flickers, and the output level flips.

Solution

1. Check and ensure that the feedback cable of the sensor is 20 cm or farther away from the motor cable.
2. Check and ensure that the ground wire of the motor is connected to the PE terminal of the VFD (if the ground wire of the motor has been connected to the ground block, you need to use a multimeter to measure and ensure that the resistance between the ground block and PE terminal is lower than 1.5 Ω).
3. Try to add a safety capacitor of 0.1 μF to the signal end of the feedback signal terminal of the sensor.
4. Try to add a safety capacitor of 0.1 μF to the power end of the sensor meter (pay attention to the voltage of the power supply and the voltage endurance of the capacitor).
5. For interference on meters connected to the AO terminal of a VFD, if AO uses current signals of 0 to 20 mA, add a capacitor of 0.47 μF between the AO and GND terminals; and if AO uses voltage signals of 0 to 10 V, add a capacitor of 0.1 μF between the AO and GND terminals.

Note:

1. When a decoupling capacitor is required, add it to the terminal of the device connected to the sensor. For example, if a thermocouple is to transmit signals of 0 to 20 mA to a temperature meter,

the capacitor needs to be added on the terminal of the temperature meter.; if an electronic ruler is to transmit signals of 0 to 30 V to a PLC signal terminal, the capacitor needs to be added on the terminal of the PLC.

2. If a large number of meters or sensors are disturbed. It is recommended that you configure an external C2 filter on the input power end of the VFD. For models of filters, see section D.7 Filters.

7.7.2 Interference on communication

Interference phenomenon

The interference described in this section on 485 communication mainly includes communication delay, out of sync, occasional power-off, or complete power-off that occurs after a VFD is started.

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

1. Check whether the 485 communication bus is disconnected or in poor contact.
2. Check whether the two ends of line A or B are connected reversely.
3. Check whether the communication protocol (such as the baud rate, data bits, and check bit) of the VFD is consistent with that of the upper computer.

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

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

Solution

1. Check and ensure that the ground wire of the motor is connected to the PE terminal of the VFD (if the ground wire of the motor has been connected to the ground block, you need to use a multimeter to measure and ensure that the resistance between the ground block and PE terminal is lower than 1.5 Ω).
2. Do not connect the VFD and motor to the same ground terminal as the upper computer. It is recommended that you connect the VFD and motor to the power ground, and connect the upper computer separately to a ground stud.
3. Try to short the signal reference ground terminal (GND) of the VFD with that of the upper computer controller to ensure that ground potential of the communication chip on the control board of the VFD is consistent with that of the communication chip of the upper computer.

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

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

Interference phenomenon

1. Failure to stop

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

2. Indicator shimmering

After a VFD is started, the relay indicator, power distribution box indicator, PLC indicator, and indication buzzer shimmers, blinks, or emits unusual sounds unexpectedly.

Solution

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

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

7.7.4 Leakage current and interference on RCD

VFDs output high-frequency PWM voltage to drive motors. In this process, the distributed capacitance between the internal IGBT of a VFD and the heat sink and that between the stator and rotor of a motor may inevitably cause the VFD to generate high-frequency leakage current to the ground. A residual current operated protective device (RCD) is used to detect the power-frequency leakage current when a grounding fault occurs on a circuit. The application of a VFD may cause misoperation of a RCD.

1. Rules for selecting RCDs

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

(2) For RCDs, the time limit of an action needs to be longer than that of a next action, and the time difference between two actions need to be longer than 20 ms. For example, 1s, 0.5s, and 0.2s.

(3) For circuits in VFD systems, electromagnetic RCDs are recommended. Electromagnetic RCDs

have strong anti-interference capability, and thus can prevent the impact of high-frequency leakage current.

Electronic RCD	Electromagnetic RCD
Low cost, high sensitivity, small in volume, susceptible to voltage fluctuation of the grid and ambient temperature, weak anti-interference capability	Requiring highly sensitive, accurate, and stable zero-phase sequence current transformer, using permalloy high-permeability materials, complex process, high cost, not susceptible to voltage fluctuation of the power supply and ambient temperature, strong anti- interference capability

2. Solution to RCD misoperation (handling the VFD)

(1) Try to remove the jumper cap at "EMC/J10" on the middle casing of the VFD.

(2) Try to reduce the carrier frequency to 1.5 kHz (P00.14=1.5).

(3) Try to modify the modulation mode to "3PH modulation and 2PH modulation" (P8.40=0).

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

(1) Check and ensure that the power cable is not soaking in water.

(2) Check and ensure that the cables are not damaged or spliced.

(3) Check and ensure that no secondary grounding is performed on the neutral wire.

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

(5) Check 1PH powered devices, and ensure that no earth lines are used as neutral wires by these devices.

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

7.7.5 Live device chassis

Phenomenon

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

Solution

1. If there is power distribution grounding or ground stud on the site, ground the cabinet chassis of the drive system through the power ground or stud.
2. If there is no grounding on the site, you need to connect the motor chassis to the ground terminal PE of the VFD, and ensure that the jumper at "EMC/J10" on the middle casing of the VFD is shorted.

8 Maintenance and hardware fault diagnosis

8.1 What this chapter contains

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

8.2 Periodical inspection

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

Subject		Item	Method	Criterion
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 bars does not mean that they cannot work properly.

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

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

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

8.3 Cooling fan

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

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

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

Cooling fan replacement:

⚠	✧ Read the safety precautions carefully and follow the instructions to perform operations. Otherwise, physical injuries or damage to the device may be caused.

1. Stop the device, disconnect the AC power supply, and wait for a time no shorter than the waiting time designated on the VFD.
2. Open the cable clamp to loose the fan cable (for the 380V 1.5–30 kW VFD models, the middle casing needs to be removed).
3. Remove the fan cable.
4. Remove the fan with a screwdriver.
5. Install a new fan in the VFD in the reverse steps. Assemble the VFD. Ensure that the air direction of the fan is consistent with that of the VFD, as shown in the following figure.

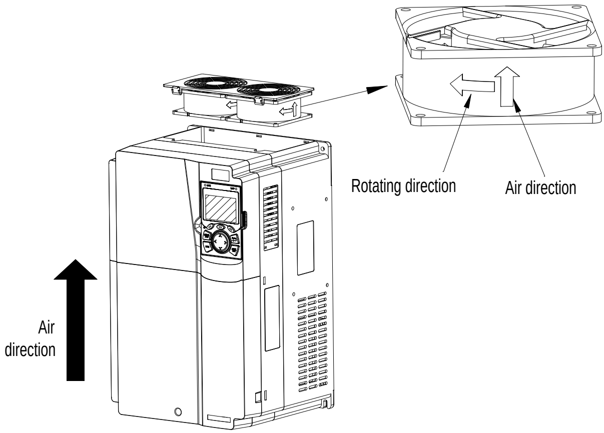


Figure 8-1 Fan maintenance for 7.5 kW and higher VFD models

6. Power on the VFD.

8.4 Capacitor

8.4.1 Capacitor reforming

If the VFD has been left unused for a long time, you need to follow the instructions to reform the DC bus capacitor before using it. The storage time is calculated from the date the VFD is delivered.

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

Storage time	Operation principle
	Charge the VFD at 25% of the rated voltage for 30 minutes, and then charge it at 50% of the rated voltage for 30 minutes, at 75% for another 30 minutes, and finally charge it at 100% of the rated voltage for 30 minutes.
More than 3 years	Use a voltage controlled power supply to charge the VFD: Charge the VFD at 25% of the rated voltage for 2 hours, and then charge it at 50% of the rated voltage for 2 hours, at 75% for another 2 hours, and finally charge it at 100% of the rated voltage for 2 hours.

The method for using a voltage controlled power supply to charge the VFD is described as follows:

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

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

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

If you directly connect the drive device to a power supply to charge the DC bus capacitor, it needs to be charged for a minimum of 60 minutes. The charging operation must be performed at a normal indoor temperature without load, and you must connect a resistor in series mode in the 3PH circuit of the power supply.

For a 380 V 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.

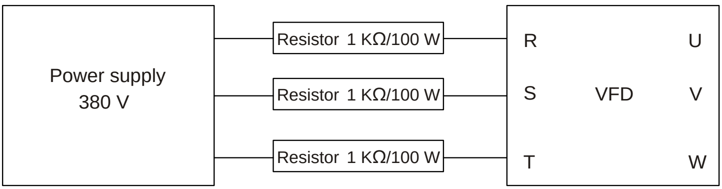


Figure 8-2 380V driving-device charging circuit exmaple

8.4.2 Electrolytic capacitor replacement

⚠	✧ Read the safety precautions carefully and follow the instructions to perform operations. Otherwise, physical injuries or damage to the device may be caused.

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

8.5 Power cable

⚠	✧ Read the safety precautions carefully and follow the instructions to perform operations. Otherwise, physical injuries or damage to the device may be caused.

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. Power on the VFD.

9 Communication

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 software protocol, a common language used in 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 one slave or broadcast messages to all the 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 VFD uses the Modbus RTU mode and communicates through RS485 interfaces.

9.3.1 RS485

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

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

The communication baud rate (P14.01) indicates the number of bits transmitted 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 0.56 mm (24 AWG) is used, the maximum transmission distance varies according to the baud rate, as described in the following table.

Baud rate (bps)	Max. transmission distance	Baud rate (bps)	Max. transmission distance
2400	1800 m	9600	800 m
4800	1200 m	19200	600 m

When RS485 interfaces are used for long-distance communication, it is recommended that you use shielded cables, and use the shield layer as the ground wires.

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 120 Ω terminal resistor when the transmission distance is long.

9.3.1.1 Application to one VFD

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

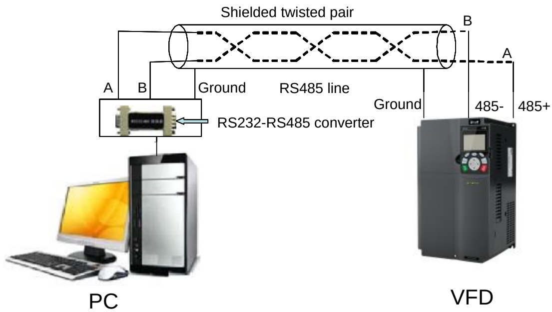


Figure 9-1 Wiring of RS485 applied to one VFD

9.3.1.2 Application to multiple VFDs

In practical application to multiple VFDs, chrysanthemum connection and star connection are commonly used.

According to the requirements of the RS485 industrial bus standards, all the devices need to be connected in chrysanthemum mode with one 120 Ω terminal resistor on each end, as shown in Figure 9-2. Figure 9-3 is the simplified wiring diagram, and Figure 9-4 is the practical application diagram.

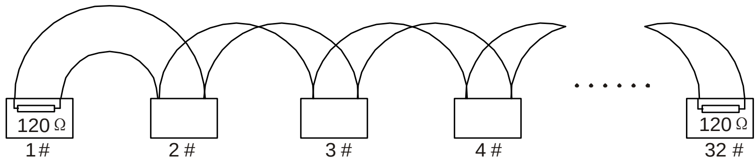


Figure 9-2 On-site chrysanthemum connection diagram

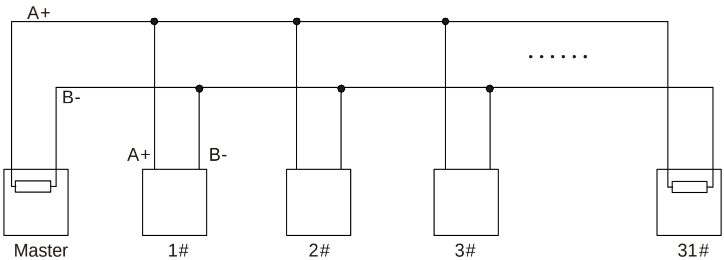


Figure 9-3 Simplified chrysanthemum connection diagram

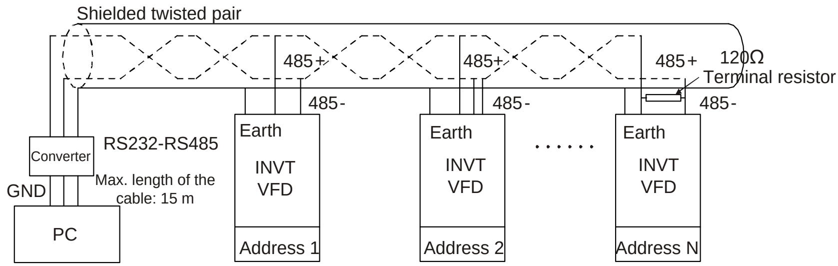


Figure 9-4 Practical application diagram of chrysanthemum connection

Figure 9-5 shows the start connection diagram. When this connection mode is adopted, the two devices that are farthest away from each other on the line must be connected with a terminal resistor (in Fig 9.5, the two devices are devices 1# and 15#).

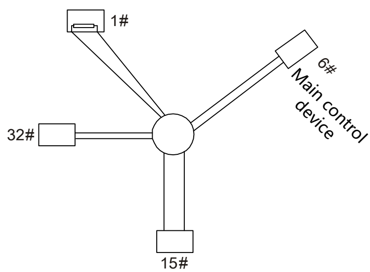


Figure 9-5 Star connection

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

9.3.2 RTU mode

9.3.2.1 RTU communication frame structure

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

Code system

• 1 start bit

• 7 or 8 data bits; the minimum valid bit is transmitted first. Each frame domain of 8 bits includes 2 hexadecimal characters (0–9, A–F).

• 1 odd/even check bit; this bit is not provided if no check is needed.

• 1 end bit (with check performed), 2 bits (without check)

Error detection domain

• Cyclic redundancy check (CRC)

The following table describes the data format.

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

Start bit	BIT1	BIT2	BIT3	BIT4	BIT5	BIT6	BIT7	BIT8	Check bit	End bit

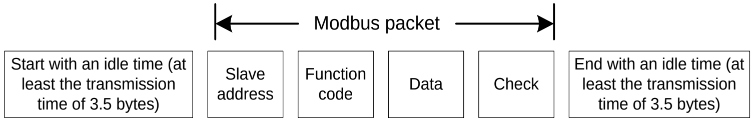
10-bit character frame (Bits 1 to 7 are data bits)

Start bit	BIT1	BIT2	BIT3	BIT4	BIT5	BIT6	BIT7	Check bit	End bit

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

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

RTU data frame format



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

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

START (frame header)	T1-T2-T3-T4 (transmission time of 3.5 bytes)
ADDR (slave address domain)	Communication address: 0–247 (decimal system) (0 is the broadcast address)
CMD (function domain)	03H: read slave parameters 06H: write slave parameters
DATA (N-1) ... DATA (0) (data domain)	Data of 2×N bytes, main content of the communication as well as the core of data exchanging
CRC CHK (LSBs)	Detection value: CRC (16 bits)
CRC CHK high bit (MSBs)	
END (frame tail)	T1-T2-T3-T4 (transmission time of 3.5 bytes)

9.3.2.2 RTU communication frame error check modes

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

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

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

Bit check on individual bytes (odd/even check)

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

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

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

For example, the data bits to be transmitted 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.

CRC check mode

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, end, and check bits.

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

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

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

```
unsigned int crc_cal_value(unsigned char×data_value,unsigned char data_length)

{

    int i;

    unsigned int crc_value=0xffff;
```

```
    while(data_length--)
    {
        crc_value^=×data_value++;
        for(i=0;i<8;i++)
        {
            if(crc_value&0x0001)
                crc_value=(crc_value>>1)^0xa001;
            else
                crc_value=crc_value>>1;
        }
    }
    return(crc_value);
}
```

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

9.4 RTU command code and communication data

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

The command code 03H is used by the master to read data from the VFD. The quantity of data to be read depends on the "data quantity" 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 operation state of the VFD.

For example, starting from the data address of 0004H, to read two contiguous pieces of data (that is, to read content from the data addresses 0004H and 0005H), the structure of the frame is described in the following table.

RTU master command (transmitted by the master to the VFD)

START	T1-T2-T3-T4 (transmission time of 3.5 bytes)
ADDR (address)	01H
CMD (command code)	03H
Most significant byte (MSB) of the start address	00H
Least significant byte (LSB) of	04H

the start address	
MSB of data quantity	00H
LSB of data quantity	02H
LSB of CRC	85H
MSB of CRC	CAH
END	T1-T2-T3-T4 (transmission time of 3.5 bytes)

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

The value of ADDR is 01H, indicating that the command is transmitted to the VFD whose address is 01H. The ADDR information occupies one byte.

The value of CMD is 03H, indicating that the command is used to read data from the VFD. The CMD information occupies one byte.

"Start address" indicates that data reading is started from this address. It occupies two bytes, with the MSB on the left and LSB on the right.

"Data quantity" indicates the quantity of data to be read (unit: word).

The value of "Start address" is 0004H, and that of "Data quantity" is 0002H, indicating that data is to be read from the data addresses of 0004H and 0005H.

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

RTU slave response (transmitted by the VFD to the master)

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

The definition of the response information is described as follows:

The value of ADDR is 01H, indicating that the message is transmitted by the VFD whose address is 01H. The ADDR information occupies one byte.

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

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

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

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

9.4.2 Command code 06H, writing a word

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

For example, to write 5000 (1388H) to 0004H of the VFD whose address is 02H, the structure of the frame is described in the following table.

RTU master command (transmitted by the master to the VFD)

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

RTU slave response (transmitted by the VFD to the master)

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

Note: The sections 9.4.1 and 9.4.2 mainly describe the command formats. For the detailed application, see the examples in section 9.4.8 Read/Write operation example.

9.4.3 Command code 08H, diagnosis

Sub-function code description:

Sub-function code	Description
0000	Return data based on query requests

For example, to query about the circuit detection information about the VFD whose address is 01H, the query and return strings are the same, and the format is described in the following tables.

RTU master command:

START	T1-T2-T3-T4 (transmission time of 3.5 bytes)
ADDR	01H
CMD	08H
MSB of the sub-function code	00H
LSB of the sub-function code	00H
MSB of data	12H
LSB of data	ABH
LSB of CRC CHK	ADH
MSB of CRC CHK	14H
END	T1-T2-T3-T4 (transmission time of 3.5 bytes)

RTU slave response:

START	T1-T2-T3-T4 (transmission time of 3.5 bytes)
ADDR	01H
CMD	08H
MSB of the sub-function code	00H
LSB of the sub-function code	00H
MSB of data	12H
LSB of data	ABH
LSB of CRC CHK	ADH
MSB of CRC CHK	14H
END	T1-T2-T3-T4 (transmission time of 3.5 bytes)

9.4.4 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 structure of the frame is described in the following table.

RTU master command (transmitted by the master to the VFD):

START	T1-T2-T3-T4 (transmission time of 3.5 bytes)
ADDR	02H
CMD	10H
MSB of data writing address	00H
LSB of data writing address	04H
MSB of data quantity	00H

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

RTU slave response (transmitted by the VFD to the master):

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

9.4.5 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.

9.4.5.1 Function code address representation rules

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

Function code	Name	Description	Setting range	Default value	Modify
P10.00	Simple PLC mode	0: Stop after running once 1: Keep running in the final value after running once 2: Cyclic running	0–2	0	○
P10.01	Simple PLC memory selection	0: No memory after power down 1: Memory after power down	0–1	0	○

Note:

- The parameters in the P99 group are set by the manufacturer. They cannot be read or modified. Some parameters cannot be modified when the VFD is running; some cannot be modified regardless of the state of the VFD. Pay attention to the setting range, unit, and related description of a parameter when modifying it.
- The service life of the Electrically Erasable Programmable Read-Only Memory (EEPROM) may be reduced if it is frequently used for storage. Some function codes do not need to be stored during communication. The application requirements can be met by modifying the value of the on-chip RAM, that is, modifying the MSB of the corresponding function code address from 0 to 1. For example, if P00.07 is not to be stored in the EEPROM, you need only to modify the value of the RAM, that is, set the address to 8007H. The address can be used only for writing data to the on-chip RAM, and it is invalid when used for reading data.

9.4.5.2 Description of other Modbus function addresses

In addition to modifying the parameters of the VFD, the master can also control the VFD, such as start and stop it, and monitor the operation state of the VFD. The following table describes other function parameters.

Function	Address	Data description	R/W
Communication-based control command	2000H	0001H: Forward running	R/W
		0002H: Reverse running	
		0003H: Forward jogging	
		0004H: Reverse jogging	
		0005H: Stop	
		0006H: Coast to stop	
		0007H: Fault reset	
		0008H: Jogging to stop	
Communication-based value setting	2001H	Communication-based frequency setting (0–Fmax, unit: 0.01 Hz)	R/W
	2002H	PID setting, range (0–1000, 1000 corresponding to 100.0%)	
	2003H	PID feedback, range (0–1000, 1000 corresponding to 100.0%)	R/W
	2004H	Torque setting (-3000–+3000, 1000 corresponding to 100.0% of the rated current of the motor)	R/W
	2005H	Setting of the upper limit of the forward running frequency (0–Fmax, unit: 0.01 Hz)	R/W
	2006H	Setting of the upper limit of the reverse running frequency (0–Fmax, unit: 0.01 Hz)	R/W
	2007H	Upper limit of the electromotion torque (0–3000,	R/W

Function	Address	Data description	R/W
		1000 corresponding to 100.0% of the rated current of the VFD)	
	2008H	Upper limit of the braking torque (0–3000, 1000 corresponding to 100.0% of the rated current of the motor)	R/W
	2009H	Special control command word: Bit0–1: =00: Motor 1 =01: Motor 2 =10: Motor 3 =11: Motor 4 Bit2: =1 Torque control disabled =0: Torque control cannot be disabled Bit3: =1 Power consumption reset to 0 =0: Power consumption not reset Bit4: =1 Pre-excitation =0: Pre-excitation disabled Bit5: =1 DC brake =0: DC brake disabled	R/W
	200AH	Virtual input terminal command, range: 0x000–0x3FF Corresponding to S8/S7/S6/S5/HDIB/HDIA/S4/ S3/ S2/S1	R/W
	200BH	Virtual output terminal command, range: 0x00–0x0F Corresponding to local RO2/RO1/HDO/Y1	R/W
	200CH	Voltage setting (used when V/F separation is implemented) (0–1000, 1000 corresponding to 100.0% of the rated voltage of the motor)	R/W
	200DH	AO output setting 1 (-1000–+1000, 1000 corresponding to 100.0%)	R/W
	200EH	AO output setting 2 (-1000–+1000, 1000 corresponding to 100.0%)	R/W
VFD state word 1	2100H	0001H: Forward running 0002H: Reverse running 0003H: Stopped 0004H: Faulty 0005H: POFF 0006H: Pre-excited	R
VFD state word 2	2101H	Bit0: =0: Not ready to run =1: Ready to run Bi1–2: =00: Motor 1 =01: Motor 2 =10: Motor 3 =11: Motor 4	R

Function	Address	Data description		R/W
		Bit3: =0: Asynchronous machine =1: Synchronous machine Bit4: =0: No overload alarm =1: Overload alarm Bit5–Bit6: =00: Keypad-based control =01: Terminal-based control =10: Communication-based control Bit7: Reserved Bit8: =0: Speed control =1: Torque control Bit9: =0: Non-position control =1: Position control Bit10–bit11: =0: Vector 0 =1: Vector 1 =2: Closed-loop vector =3: Space voltage vector		
VFD fault code	2102H	See the description of fault types.		R
VFD identification code	2103H	GD350-----0x01A0		R
Running frequency	3000H	0–Fmax (unit: 0.01Hz)	Compatible with CHF100A and CHV100 communication addresses	R
Set frequency	3001H	0–Fmax (unit: 0.01Hz)		R
Bus voltage	3002H	0.0–2000.0 V (unit: 0.1V)		R
Output voltage	3003H	0–1200V (unit: 1V)		R
Output current	3004H	0.0–3000.0A (unit: 0.1A)		R
Rotating speed	3005H	0–65535 (unit: 1RPM)		R
Output power	3006H	-300.0–+300.0% (unit: 0.1%)		R
Output torque	3007H	-250.0–+250.0% (unit: 0.1%)		R
Closed-loop setting	3008H	-100.0–+100.0% (unit: 0.1%)		R
Closed-loop feedback	3009H	-100.0–+100.0% (unit: 0.1%)		R
Input state	300AH	000–3F Corresponding to the local HDIB/ HDIA/S4/S3/S2/S1		R
Output state	300BH	000–0F Corresponding to the local RO2/RO1/HDO/Y1		R
Analog input 1	300CH	0.00–10.00V (unit: 0.01V)		R
Analog input 2	300DH	0.00–10.00V (unit: 0.01V)		R
Analog input 3	300EH	-10.00–10.00V (unit: 0.01V)		R
Analog input 4	300FH			R
Read input of high-speed pulse 1	3010H	0.00–50.00kHz (unit: 0.01Hz)		R
Read input of high-speed pulse 2	3011H			R

Function	Address	Data description		R/W
Read current step of multi-step speed	3012H	0–15		R
External length	3013H	0–65535		R
External count value	3014H	0–65535		R
Torque setting	3015H	-300.0–+300.0% (unit: 0.1%)		R
Identification code	3016H			R
Fault code	5000H			R

The Read/Write (R/W) characteristics indicate whether a function can be read and written. For example, "Communication-based control command" can be written, and therefore the command code 6H is used to control the VFD. The R characteristic indicates that a function can only be read, and W indicates that a function 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 running command channel" (P00.02) to the Modbus communication channel. For another example, when modifying "PID setting", you need to set "PID reference source" (P09.00) to Modbus communication.

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

8 MSBs	Meaning	8 LSBs	Meaning
01	GD	0x08	GD35 vector VFD
		0x09	GD35-H1 vector VFD
		0x0a	GD300 vector VFD
		0xa0	GD350 vector VFD

9.4.6 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, we can multiply 50.12 by 100 to obtain an integer 5012, and then 50.12 can be represented as 1394H (5012 in the decimal form) in the hexadecimal 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 decimals in the value specified in "Description" or "Default value". If there are *n* decimals in the value, the fieldbus scale m is the n^{th}-power of 10. Take the following table as an example, m is 10.

Function code	Name	Description	Default value
P01.20	Wake-up-from-sleep delay	0.0–3600.0s (valid when P01.19 is 2)	0.0s
P01.21	Restart after power cut	0: Restart is disabled 1: Restart is enabled	0

The value specified in "Description" or "Default value" contains one decimal, so the fieldbus scale is 10. If the value received by the upper computer is 50, the value of "Wake-up-from-sleep delay" of the VFD is 5.0 (5.0=50/10).

To set the "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 transmit the following write command:

01	**06**	**01 14**	**00 32**	**49 E7**
VFD address	Write command	Parameter address	Parameter data	CRC

After receiving the command, the VFD converts 50 into 5.0 based on the fieldbus scale, and then sets "Wake-up-from-sleep delay" to 5.0s.

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

01	**03**	**02**	**00 32**	**39 91**
VFD address	Read command	2-byte data	Parameter data	CRC

The parameter data is 0032H, that is, 50, so 5.0 is obtained based on the fieldbus scale (50/10=5.0). In this case, the master identifies that the "Wake-up-from-sleep delay" is 5.0s.

9.4.7 Error message response

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

Error message responses are transmitted by the VFD to the master. The following table describes the codes and definitions of the error message responses.

Code	Name	Definition
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-transmitted bytes is invalid.
03H	Invalid data bit	The received data domain contains a value that is not allowed. The

Code	Name	Definition
		value indicates the error of the remaining structure in the combined request. **Note:** It does not mean that the data item submitted for storage in the register includes a value unexpected by the program.
04H	Operation failure	The parameter is set to an invalid value in the write operation. For example, a function input terminal cannot be set repeatedly.
05H	Password error	The password entered in the password verification address is different from that set in P07.00.
06H	Data frame error	The length of the data frame transmitted by the upper computer is incorrect, 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 upper computer is a read-only parameter.
08H	Parameter cannot be modified in running	The parameter to be modified in the write operation of the upper computer cannot be modified during the running of the VFD.
09H	Password protection	A user password is set, and the upper computer does not provide the password to unlock the system when performing a read or write operation. The error of "system locked" is reported.

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

For example, if the master device transmits a request message to a slave device for reading a group of function code address data, the code is generated as follows:

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

For a normal response, the same code is returned.

For an exception response, the following code is returned:

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 device is to transmit 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, the command is as follows:

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

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

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

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

9.4.8 Read/Write operation example

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

9.4.8.1 Read command 03H examples

Example 1: Read state word 1 of the VFD whose address is 01H. According to the table of other Modbus function addresses in section 9.4.5 Data address definition, the parameter address of state word 1 of the VFD is 2100H.

The read command transmitted to the VFD is as follows:

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

Assume that the following response is returned:

01	**03**	**02**	**00 03**	**F8 45**
VFD address	Read command	Number of bytes	Data content	CRC

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

Example 2: View information about the VFD whose address is 03H, including "Type of current fault" (P07.27) to "Type of 5th-last fault" (P07.32) of which the parameter addresses are 071BH to 0720H (contiguous 6 parameter addresses starting from 071BH).

The command transmitted to the VFD is as follows:

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

Assume that the following response is returned:

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

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

9.4.8.2 Write command 06H examples

Example 1: Set the VFD whose address is 03H to be forward running. Refer to the table of other function parameters, the address of "Communication-based control command" is 2000H, and 0001H indicates forward running, as shown in the following table.

Function	Address	Data description	R/W
Communication-based control command	2000H	0001H: Forward running	W
		0002H: Reverse running	
		0003H: Forward jogging	
		0004H: Reverse jogging	
		0005H: Stop	
		0006H: Coast to stop	
		0007H: Fault reset	
		0008H: Jogging to stop	

The command transmitted by the master is as follows:

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

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

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

Example 2: Set the "Max. output frequency" of the VFD whose address is 03H to 100 Hz.

Function code	Name	Description	Default value	Modify
P00.03	Max. output frequency	Used to set the maximum output frequency of the VFD. It is the basis of frequency setup and the acceleration/deceleration. Setting range: Max (P00.04, 10.00) –630.00Hz	50.00Hz	◎

From the number of decimals, we can see that the fieldbus scale of the "Max. output frequency" (P00.03) is 100. Multiply 100 Hz by 100. The value 10000 is obtained, and it is 2710H in the hexadecimal form.

The command transmitted by the master is as follows:

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

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

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

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

9.4.8.3 Continuously write command 10H examples

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

Function	Address	Data description	R/W
Communication-based control command	2000H	0001H: Forward running	R/W
		0002H: Reverse running	
		0003H: Forward jogging	
		0004H: Reverse jogging	
		0005H: Stop	
		0006H: Coast to stop	
		0007H: Fault reset	
		0008H: Jogging to stop	
Communication-based value setting	2001H	Communication-based frequency setting (0–Fmax, unit: 0.01 Hz)	R/W
	2002H	PID setting, range (0–1000, 1000 corresponding to 100.0%)	

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

The command transmitted by the master is as follows:

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

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

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

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

Function code	Name	Description	Default value	Modify
P00.11	Acceleration time 1	Acceleration time is the time needed for accelerating from 0Hz to Max. output frequency (P00.03).	Depends on model	○
P00.12	Deceleration time 1	Deceleration time is the time needed from decelerating from Max. output frequency (P00.03) to 0Hz. Goodrive350 series VFD defines four groups of acceleration and deceleration time, which can be selected via multi-function digital input terminals (P05 group). The acceleration/deceleration time of the VFD is the first group by default. Setting range of P00.11 and P00.12: 0.0–3600.0s	Depends on model	○

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

The command transmitted by the master is as follows:

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

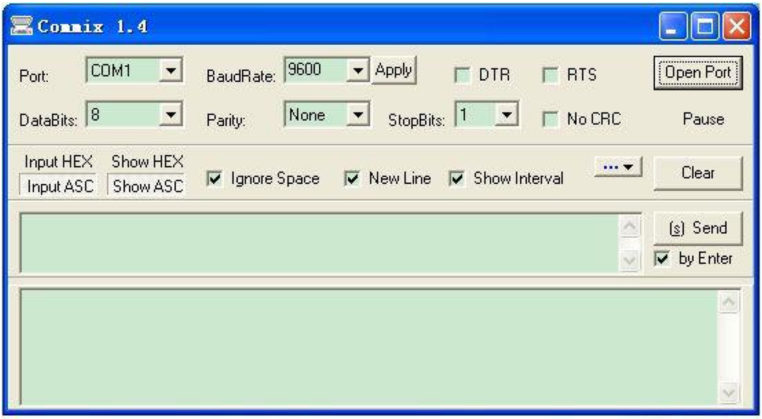
If the operation is successful, the following response is returned:

01	10	00 0B	00 02	30 0A
VFD address	Continuous write command	Parameter address	Parameter quantity	CRC

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

9.4.8.4 Modbus communication commissioning example

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



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

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

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

Note:

1. Set the address (P14.00) of the VFD to 03.
2. Set "Channel of running commands" (P00.01) to "Communication", and set "Communication channel of running commands" (P00.02) to the Modbus communication channel.
3. Click **Send**. If the line configuration and settings are correct, a response transmitted by the VFD is received as follows:

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

9.5 Common communication faults

Common communication faults include the following:

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

Possible causes of no response include the following:

- The serial port is set incorrectly. For example, the converter 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 Extension cards

A.1 Model definition

EC-PG 5 01-05

① ② ③ ④ ⑤

Field identifier	Field description	Naming example
①	Product category	EC: Extension card
②	Card category	PG: PG card PC: PLC programmable card IO: IO extension card TX: Communication extension card
③	Technical version	Indicates the generation of a technical version by using odd numbers, for example, 1, 3, and 5 indicate the 1st, 2nd, and 3rd generations of the technical version.
④	Distinguishing code	01: Incremental PG card + frequency-divide output
		02: Sine/Cosine PG card + pulse direction setting + frequency-divide output
		03: UVW PG interface + pulse direction setting + frequency-divide output
		04: Resolver PG interface + pulse direction setting + frequency-divide output
		05: Incremental PG card + pulse direction setting + frequency-divide output
		06: Absolute PG interface + pulse direction setting + frequency-divide output
		07: Simplified incremental PG card
⑤	Working power	00: Passive
		05: 5V
		12: 12–15 V
		24: 24 V

EC-PC 5 01-00

① ② ③ ④ ⑤

Field identifier	Field description	Naming example
①	Product category	EC: Extension card
②	Card category	IO: IO extension card TX: Communication extension card PG: PG card PC: PLC programmable card
③	Technical version	Indicates the generation of a technical version by using odd numbers, for example, 1, 3, and 5 indicate the 1st, 2nd, and 3rd generations of the technical version.
④	Distinguishing code	01: 10 points, with 6 inputs and 4 outputs (2 transistor outputs + 2 relay outputs)
		02: 14 points, with 8 inputs and 6 outputs (relay outputs)
		03: Reserved
⑤	Special requirement	Reserved

EC-TX 5 01

① ② ③ ④

Field identifier	Field description	Naming example
①	Product category	EC: Extension card
②	Card category	TX: Communication extension card PG: PG card PC: PLC programmable card IO: IO extension card
③	Technical version	Indicates the generation of a technical version by using odd numbers, for example, 1, 3, and 5 indicate the 1st, 2nd, and 3rd generations of the technical version.
④	Distinguishing code	01: Bluetooth communication card
		02: WIFI communication card
		03: PROFIBUS communication card
		05: Canopen communication card

Field identifier	Field description	Naming example
		06: DeviceNet communication card
		07: BACnet communication card
		08: EtherCAT communication card
		09: PROFINET communication card
		10: Ethernet/IP communication card
		11: CAN master/slave control communication card

EC-IO 5 01-00

① ② ③ ④ ⑤

Field identifier	Field description	Naming example
①	Product category	EC: Extension card
②	Card category	IO: IO extension card TX: Communication extension card PG: PG card PC: PLC programmable card
③	Technical version	Indicates the generation of a technical version by using odd numbers, for example, 1, 3, and 5 indicate the 1st, 2nd, and 3rd generations of the technical version.
④	Distinguishing code	01: Multiple-function I/O extension card (4 digital inputs, 1 digital output, 1 analog input, 1 analog output, and 2 relay outputs)
		02: Digital I/O card
		03: Analog I/O card
		04: Reserved 1
		05: Reserved 2
⑤	Special requirement	

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

Name	Model	Specification
IO extension card	EC-IO501-00	✧ 4 digital inputs ✧ 1 digital output ✧ 1 analog input ✧ 1 analog output ✧ 2 relay outputs: 1 double-contact output, and 1 single-contact output

Name	Model	Specification
Programmable extension card	EC-PC501-00	✧ Adopting the global mainstream development environment PLC, supporting multiple types of programming languages, such as the instruction language, structural text, function block diagram, ladder diagram, continuous function chart, and sequential function chart ✧ Supporting breakpoint commissioning ✧ Providing user program storage space of 128 kB, and data storage space of 64 kB ✧ 6 digital inputs ✧ 2 digital outputs ✧ 2 relay outputs: 1 double-contact output, and 1 single-contact output
Bluetooth communication card	EC-TX501-1 EC-TX501-2	✧ Supporting Bluetooth 4.0 ✧ With INVT's mobile phone APP, you can set the parameters and monitor the states of the VFD through Bluetooth ✧ The maximum communication distance in open environments is 30 m. ✧ EC-TX501-1 is equipped with a built-in antenna and applicable to molded case machines. ✧ EC-TX501-2 is configured with an external sucker antenna and applicable to sheet metal machines.
WIFI communication card	EC-TX502-1 EC-TX502-2	✧ Meeting IEEE802.11b/g/n ✧ With INVT's mobile phone APP, you can monitor the VFD locally or remotely through WIFI communication ✧ The maximum communication distance in open environments is 30 m. ✧ EC-TX501-1 is equipped with a built-in antenna and applicable to molded case machines. ✧ EC-TX501-2 is configured with an external sucker antenna and applicable to sheetmetal machines.
PROFIBUS-DP communication card	EC-TX503	✧ Supporting the PROFIBUS-DP protocol
Ethernet communication card	EC-TX504	✧ Supporting Ethernet communication with INVT's internal protocol ✧ Can be used in combination with INVT's upper computer monitoring software INVT Workshop
CANopen communication card	EC-TX505	✧ Based on the CAN2.0A physical layer ✧ Supporting the CANopen protocol

Name	Model	Specification
CAN master/slave control communication card	EC-TX511	✧ Based on the CAN2.0B physical layer ✧ Adopting INVT's master-slave control proprietary protocol
PROFINET communication card	EC-TX509	✧ Supporting the PROFINET protocol
Sin/Cos PG card	EC-PG502	✧ Applicable to Sin/Cos encoders with or without CD signals ✧ Supporting A, B, Z frequency-divided output ✧ Supporting pulse string reference input
UVW incremental PG card	EC-PG503-05	✧ Applicable to differential encoders of 5 V ✧ Supporting the orthogonal input of A, B, and Z ✧ Supporting pulse input of phase U, V, and W ✧ Supporting the frequency-divided output of A, B, and Z ✧ Supporting the input of pulse string reference
Resolver PG card	EC-PG504-00	✧ Applicable to resolver encoders ✧ Supporting frequency-divided output of resolver-simulated A, B, Z
Multi-function incremental PG card	EC-PG505-12	✧ Applicable to OC encoders of 5 V or 12 V ✧ Applicable to push-pull encoders of 5 V or 12 V ✧ Applicable to differential encoders of 5 V ✧ Supporting the orthogonal input of A, B, and Z ✧ Supporting the frequency-divided output of A, B, and Z ✧ Supporting pulse string setting
24V incremental PG card	EC-PG505-24	✧ Applicable to 24V OC encoders ✧ Applicable to 24 V push-pull encoders ✧ Applicable to 5 V differential encoders ✧ Supporting A, B, Z orthogonal input ✧ Supporting A, B, Z frequency-divided output ✧ Supporting pulse string reference input
Simplified incremental PG card	EC-PG507-12	✧ Applicable to 5V or 12V OC encoders ✧ Applicable to 5V or 12V push-pull encoders ✧ Applicable to 5V differential encoders

IO extension card

EC-IO501-00

Programmable extension card

EC-PC501-00

Bluetooth/WIFI communication card

EC-TX501-1/502

PROFIBUS-DP communication card

EC-TX503

Ethernet communication card

EC-TX504

CANopen/CAN master-slave communication card

EC-TX505/511

PROFINET communication card

EC-TX509

Sin/Cos PG card

EC-PG502

UVW incremental PG card
EC-PG503-05

Resolver PG card
EC-PG504-00

Multi-function incremental PG card
EC-PG505-12

24V incremental PG card EC-PG505-24

Simplified incremental PG card
EC-PG507-12

A.2 Dimensions and installation

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

Comply with the following operation principles when installing or removing an extension card:

1. Ensure that no power is applied before installing the extension card.
2. The extension card can be installed in any one of the SLOT1, SLOT2, and SLOT3 card slots.

3. The 5.5 kW and lower VFD models can be configured with two extension cards at the same time, and the 7.5 kW and higher VFD models can be configured with three extension cards.
4. If interference occurs on the external wires after extension cards are installed, change their installation card slots flexibly to facilitate the wiring. For example, the connector of the connection cable of the DP card is large, so it is recommended to be installed in the SLOT1 card slot.
5. To ensure high anti-interference capability in closed-loop control, you need to use a shielding wire in the encoder cable and ground the two ends of the shielding wire, that is, connect the shielding layer to the housing of the motor on the motor side, and connect the shielding layer to the PE terminal on the PG card side.

The following shows the installation diagrams for different VFD models with extension cards installed.

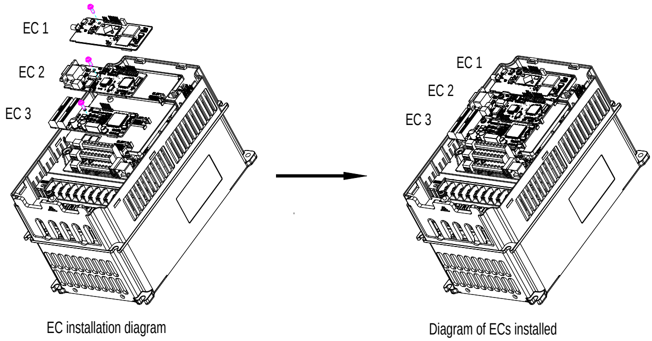


Figure A-1 7.5kW or higher VFD with extension cards installed

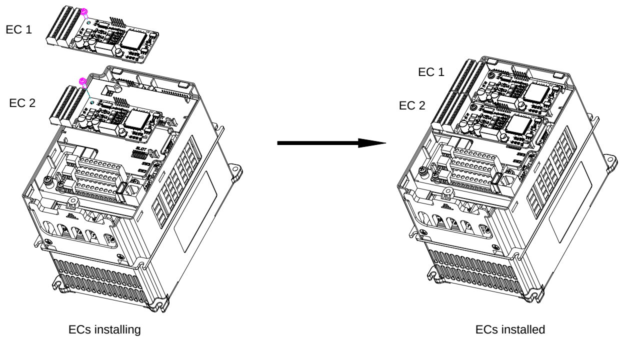


Figure A-2 5.5kW or lower VFD with extension cards installed

Extension card installation process:

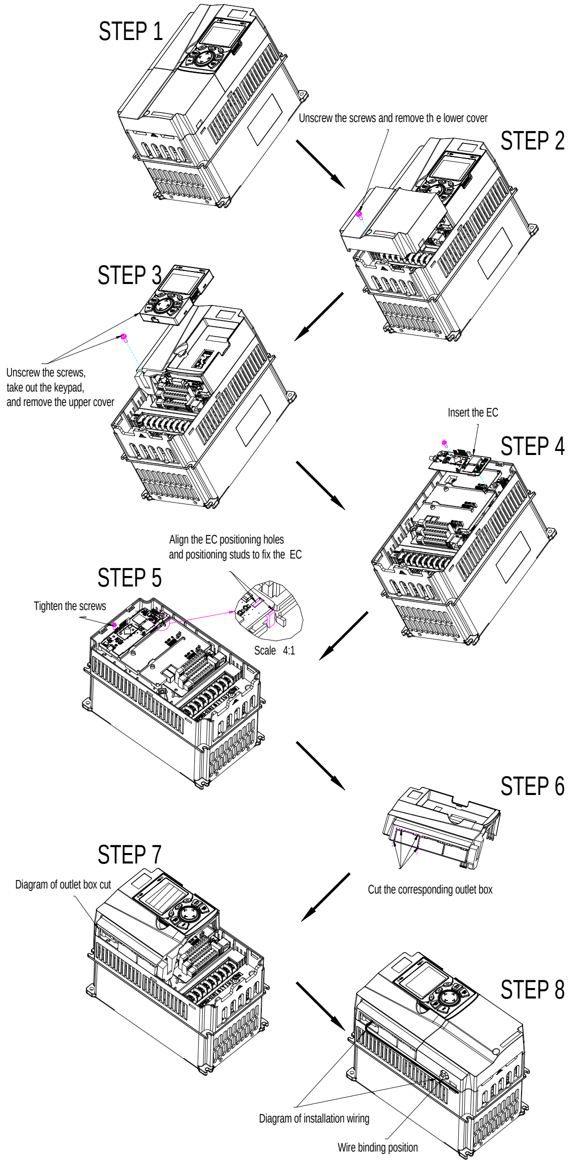


Figure A-3 Extension card installation process diagram

A.3 Wiring

1. Ground a shielded cable as follows:

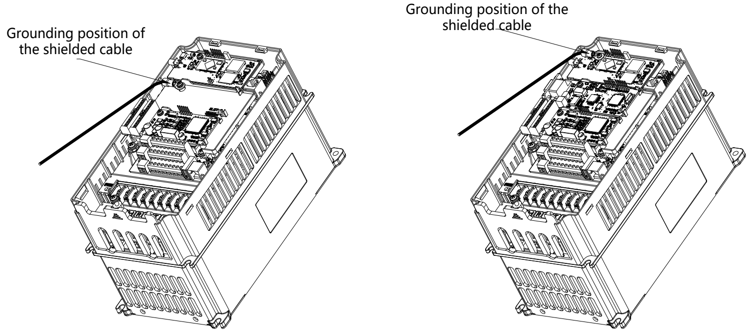


Figure A-4 Extension card grounding diagram

2. Wire an extension card as follows:

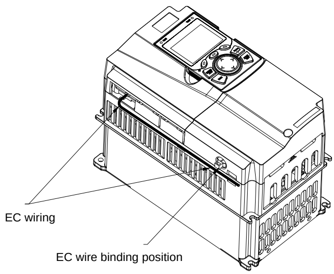
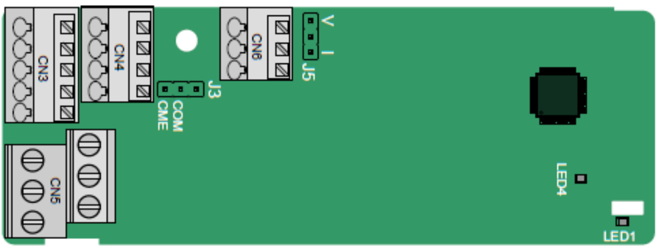


Figure A-5 Extension card wiring

A.4 IO extension card—EC-IO501-00



The terminals are arranged as follows:

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

AI3	AO2	GND

COM	CME	Y2	S5	
PW	+24V	S6	S7	S8

RO3A	RO3B	RO3C
RO4A		RO4C

Indicator definition:

Indicator No.	Definition	Function
LED1	State indicator	This indicator is on when the extension card is establishing a connection with the control board; it blinks periodically after the extension card is properly connected to the control board (the period is 1s, on for 0.5s, and off for the other 0.5s); and it is off when the extension card is disconnected from the control board.
LED4	Power indicator	This indicator is on after the IO extension card is powered on by the control board.

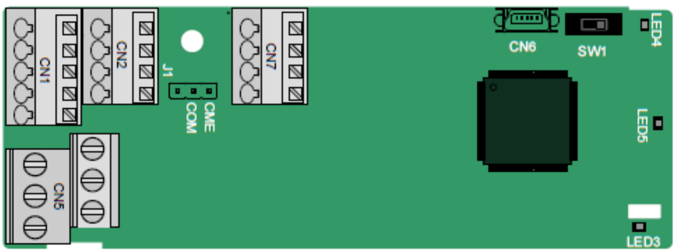
The EC-IO501-00 extension card can be used in scenarios where the I/O interfaces of a Goodrive350 VFD cannot meet the application requirements. It can provide 4 digital inputs, 1 digital output, 1 analog input, 1 analog output, and two relay outputs. It is user-friendly, providing relay outputs through European-type screw terminals and other inputs and outputs through spring terminals.

EC-IO501-00 terminal function description:

Category	Symbol	Name	Function description
Power	PW	External power supply	The working power of digital input is provided by an external power supply. Voltage range: 12–30 V The terminals PW and +24V are shorted before delivery.
Analog input/output	AI3—GND	Analog input 1	1. Input range: 0–10 V, 0–20 mA 2. Input impedance: 20 kΩ for voltage input; 250 Ω for current input 3. Set it to be voltage or current input through the corresponding function code. 4. Resolution: When 10 V corresponds to 50 Hz, the minimum resolution is 5 mV. 5. Deviation:±0.5%; output of 5 V or 10 mA or higher at the temperature of 25°C
	AO2—GND	Analog output 1	1. Output range: 0–10 V, 0–20 mA 2. Whether it is voltage or current output is determined by J5.

Category	Symbol	Name	Function description
			3. Deviation ±0.5%; input of 5 V or 10 mA or higher at the temperature of 25°C
Digital input/output	S5—COM	Digital input 1	1. Internal impedance: 3.3 kΩ 2. Power input range: 12–30 V 3. Bidirectional input terminal 4. Max. input frequency: 1 kHz
	S6—COM	Digital input 2	
	S7—COM	Digital input 3	
	S8—COM	Digital input 4	
	Y2—CME	Digital output	1. Switch capacity: 50 mA/30 V 2. Output frequency range: 0–1 kHz 3. The terminals CME and COM are shorted through J3 before delivery.
Relay output	RO3A	NO contact of relay 3	1. Contact capacity: 3A/AC 250 V, 1 A/DC 30 V 2. Do not use them as high-frequency digital outputs.
	RO3B	NC contact of relay 3	
	RO3C	Common contact of relay 3	
	RO4A	NO contact of relay 4	
	RO4C	Common contact of relay 4	

A.5 Programmable extension card EC-PC501-00



The terminals are arranged as follows:

SW1 is the start/stop switch of the programmable extension card. CN6 is the program download port, and you can connect to a computer by using a standard USB cable. COM and CME are shorted through J1 before delivery.

PY1	PY2	CME	COM

COM	PS1	PS2	PS3	
PW	+24V	PS4	PS5	PS6

PRO1A	PRO1B	PRO1C
PRO2A		PRO2C

Indicator definition:

Indicator No.	Definition	Function
LED3	State indicator	This indicator is on when the extension card is establishing a connection with the control board; it blinks periodically after the extension card is properly connected to the control board (the period is 1s, on for 0.5s, and off for the other 0.5s); and it is off when the extension card is disconnected from the control board.
LED4	PLC running state indicator	This indicator is on when the DIP switch is turned to RUN (run the PLC); and it is off when the switch is turned to STOP (stop the PLC).
LED5	Power indicator	This indicator is on after the control board feeds power to the communication card.

The EC-PC501-00 programmable extension card can replace some micro PLC applications. It adopts the global mainstream development environment PLC, supporting six types of programming languages, namely the instruction language (IL), structural text (ST), function block diagram (FBD), ladder diagram (LD), continuous function chart (CFC), and sequential function chart (SFC). It provides a user program storage space of 128 kB and data storage space of 64 kB, which facilitates customers' secondary development and meets the customization requirements.

The EC-PC501-00 programmable extension card provides 6 digital inputs, 2 digital outputs, and 2 relay outputs. It is user-friendly, providing relay outputs through European-type screw terminals and other inputs and outputs through spring terminals.

EC-PC501-00 terminal function description:

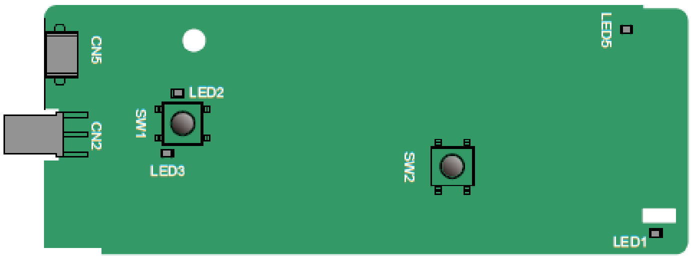
Category	Symbol	Name	Function description
Power	PW	External power	The working power of digital input is provided by an external power supply. Voltage range: 12–30 V The terminals PW and +24V are shorted before delivery.
Digital input/output	PS1—COM	Digital input 1	1. Internal impedance: 3.3 kΩ 2. Allowable voltage input: 12–30 V 3. Bidirectional terminal 4. Max. input frequency: 1 kHz
	PS2—COM	Digital input 2	
	PS3—COM	Digital input 3	
	PS4—COM	Digital input 4	
	PS5—COM	Digital input 5	
	PS6—COM	Digital input 6	
	PY1—CME	Digital output 1	1. Switch capacity: 50 mA/30 V 2. Output frequency range: 0–1 kHz 3. The terminals CME and COM are shorted through J1 before delivery.
	PY2—CME	Digital output 2	
Relay	PRO1A	NO contact of relay 1	1. Contact capacity: 3A/AC 250V,

Category	Symbol	Name	Function description
output	PRO1B	NC contact of relay 1	1A/DC 30V 2. Do not use them as high-frequency digital outputs.
	PRO1C	Common contact of relay 1	
	PRO2A	NO contact of relay 2	
	PRO2C	Common contact of relay 2	

For details about the operation of programmable extension cards, see the *Goodrive350 Series VFD Communication Extension Card Operation Manual*.

A.6 Communication cards

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

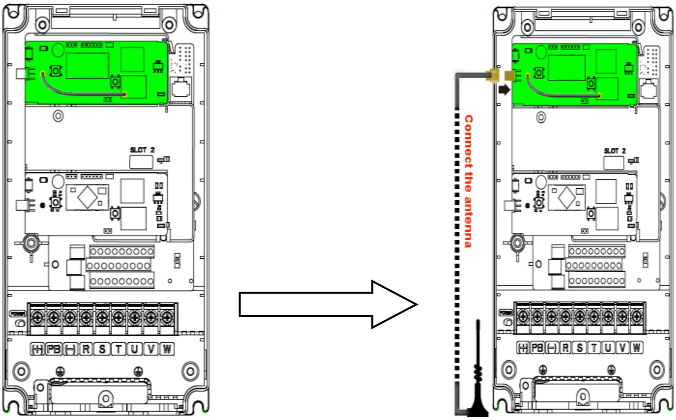


Indicator definition:

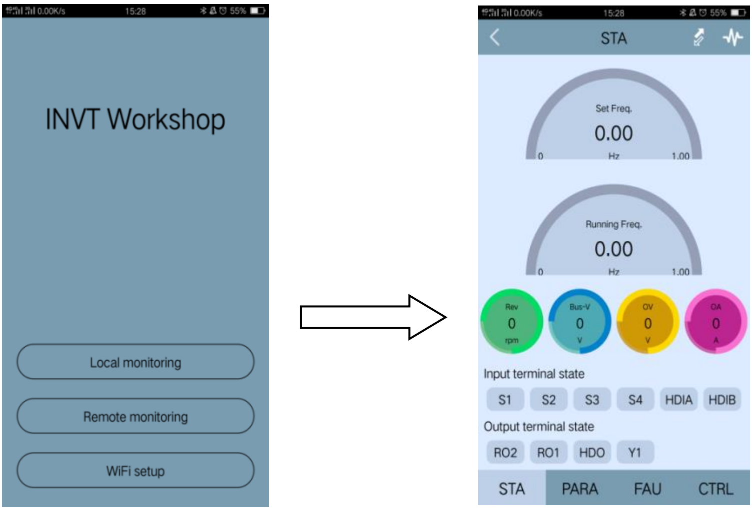
Indicator No.	Definition	Function
LED1/LED3	Bluetooth/WIFI state indicator	This indicator is on when the extension card is establishing a connection with the control board; it blinks periodically after the extension card is properly connected to the control board (the period is 1s, on for 0.5s, and off for the other 0.5s); and it is off when the extension card is disconnected from the control board.
LED2	Bluetooth communication state indicator	This indicator is on when Bluetooth communication is online and data exchange can be performed. It is off when Bluetooth communication is not in the online state.
LED5	Power indicator	This indicator is on after the control board feeds power to the Bluetooth card.
SW1	WIFI factory reset button	It is restored to default values and returned to the local monitoring mode.
SW2	WIFI hardware reset button	It is used to reboot the extension card.

The wireless communication card is especially useful for scenarios where you cannot directly use the keypad to operate the VFD due to the restriction of the installation space. With a mobile phone APP, you can operate the VFD in a maximum distance of 30 m. You can choose a PCB antenna or an external sucker antenna. If the VFD is located in an open space and is a molded case machine, you can use a built-in PCB antenna; and if it is a sheetmetal machine and located in a metal cabinet, you need to use an external sucker antenna.

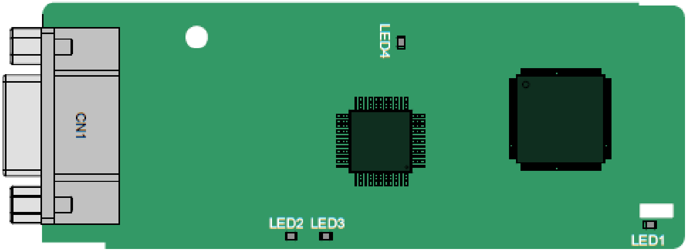
When installing a sucker antenna, install a wireless communication card on the VFD first, and then lead the SMA connector of the sucker antenna into the VFD and screw it to CN2, as shown in the following figure. Place the antenna base on the chassis and expose the upper part. Try to keep it unblocked.



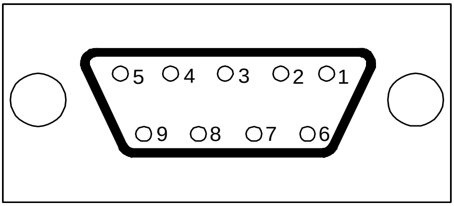
The wireless communication card must be used with the INVT VFD APP. Scan the QR code of the VFD nameplate to download it. For details, refer to the wireless communication card manual provided with the extension card. The main interface is shown as follows.



A.6.2 PROFIBUS-DP communication card—EC-TX503



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



Connector pin		Description
1	-	Unused
2	-	Unused
3	B-Line	Data+ (twisted pair 1)
4	RTS	Request sending
5	GND_BUS	Isolation ground
6	+5V BUS	Isolated power supply of 5V DC
7	-	Unused
8	A-Line	Data- (twisted pair 2)
9	-	Unused
Housing	SHLD	PROFIBUS cable shielding line

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

On some devices, the transmission and receiving directions are determined by RTS. In normal applications, only A-Line, B-Line, and the shield layer need to be used.

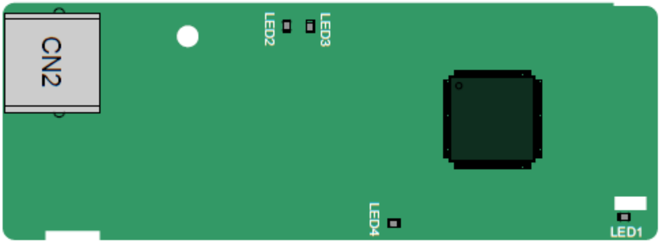
Indicator definition:

Indicator No.	Definition	Function
LED1	State indicator	This indicator is on when the extension card is establishing a connection with the control board; it blinks periodically after the extension card is properly connected to the control board (the period is 1s, on for 0.5s, and off for the other

Indicator No.	Definition	Function
		0.5s); and it is off when the extension card is disconnected from the control board.
LED2	Online indicator	This indicator is on when the communication card is online and data exchange can be performed. It is off when the communication card is not in the online state.
LED3	Offline/Fault indicator	This indicator is on when the communication card is offline and data exchange cannot be performed. It blinks when the communication card is not in the offline state. It blinks at the frequency of 1 Hz when a configuration error occurs: The length of the user parameter data set during the initialization of the communication card is different from that during the network configuration. It blinks at the frequency of 2 Hz when user parameter data is incorrect: The length or content of the user parameter data set during the initialization of the communication card is different from that during the network configuration. It blinks at the frequency of 4 Hz when an error occurs in the ASIC initialization of PROFIBUS communication. It is off when the diagnosis function is disabled.
LED4	Power indicator	This indicator is on after the control board feeds power to the communication card.

For details about the operation, see the *Goodrive350 Series VFD Communication Extension Card Operation Manual*.

A.6.3 Ethernet communication card—EC-TX504

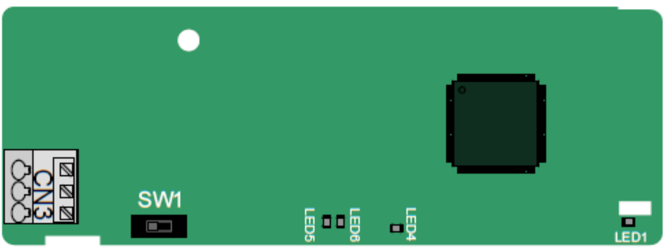


The EC-TX504 communication card adopts standard RJ45 terminals.

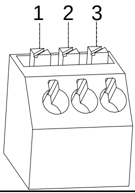
Indicator definition:

Indicator No.	Definition	Function
LED1	State indicator	This indicator is on when the extension card is establishing a connection with the control board; it blinks periodically after the extension card is properly connected to the control board (the period is 1s, on for 0.5s, and off for the other 0.5s); and it is off when the extension card is disconnected from the control board.
LED2	Network connection status indicator	This indicator is on when the physical connection to the upper computer is normal; it is off when the upper computer is disconnected.
LED3	Network communication status indicator	This indicator is on when there is data exchange with the upper computer; it blinks when there is no data exchange with the upper computer.
LED4	Power indicator	This indicator is on after the control board feeds power to the communication card.

A.6.4 CANopen communication card—EC-TX505 and CAN master/slave control communication card EC-TX511



The EC-TX505/511 communication card is user-friendly, adopting spring terminals.

3-pin spring terminal	Pin	Function	Description
	1	CANH	CANopen bus high level signal
	2	CANG	CANopen bus shielding
	3	CANL	CANopen bus low level signal

Terminal resistor switch function description:

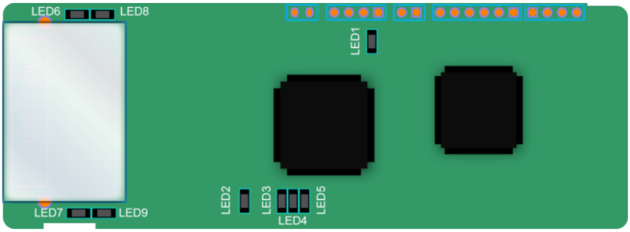
Terminal resistor switch	Position	Function	Description
	Left	OFF	CAN_H and CAN_L are not connected to a terminal resistor.
	Right	ON	CAN_H and CAN_L are connected to a terminal resistor of 120 Ω.

Indicator definition:

Indicator No.	Definition	Function
LED1	State indicator	This indicator is on when the extension card is establishing a connection with the control board; it blinks periodically after the extension card is properly connected to the control board (the period is 1s, on for 0.5s, and off for the other 0.5s); and it is off when the extension card is disconnected from the control board.
LED4	Power indicator	This indicator is on after the control board feeds power to the communication card.
LED5	Running indicator	This indicator is on when the communication card is in the working state. It is off when a fault occurs. Check whether the reset pin of the communication card and the power supply are properly connected. It blinks when the communication card is in the pre-operation state. It blinks once when the communication card is in the stopped state.
LED6	Error indicator	This indicator is on when the CAN controller bus is off or a fault occurs on the VFD. It is off when the communication card is in the working state. It blinks when the address setting is incorrect. It blinks once when a received frame is missed or an error occurs during frame receiving.

For details about the operation, see the *Goodrive350 Series VFD Communication Extension Card Operation Manual*.

A.6.5 PROFINET communication card——EC-TX509



The terminal CN2 adopts standard dual RJ45 interfaces, and the two RJ45 interfaces are not distinguished from each other and can be interchangeably inserted. They are arranged as follows:

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

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

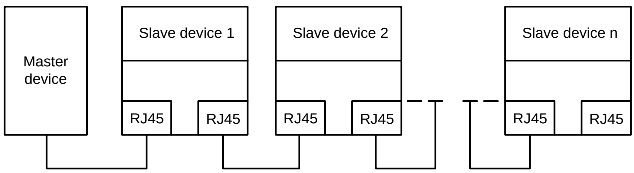
Indicator definition:

LED	Color	State	Description
LED1	Green		3.3V power indicator.
LED2 (Bus state indicator)	Red	On	No network connection.
		Blinking	The connection to the network cable between the PROFINET controller is OK, but the communication is not established.
		Off	Communication with the PROFINET controller has been established.
LED3 (System fault indicator)	Green	On	PROFINET diagnosis exists.
		Off	No PROFINET diagnosis.
LED4 (Slave ready indicator)	Green	On	TPS-1 protocol stack has started.
		Blinking	TPS-1 waits for MCU initialization.

LED	Color	State	Description
		Off	TPS-1 protocol stack does not start.
LED5 (Maintenance state indicator)	Green		Manufacturer-specific - depending on the characteristics of the device.
LED6/7 (Network port state indicator)	Green	On	PROFINET communication card and PC/PLC have been connected with a network cable.
		Off	PROFINET communication card and PC/PLC have not been connected yet.
LED8/9 (Network port communication indicator)	Green	On	PROFINET communication card and PC/PLC are communicating.
		Off	PROFINET communication card and PC/PLC are not yet communicating.

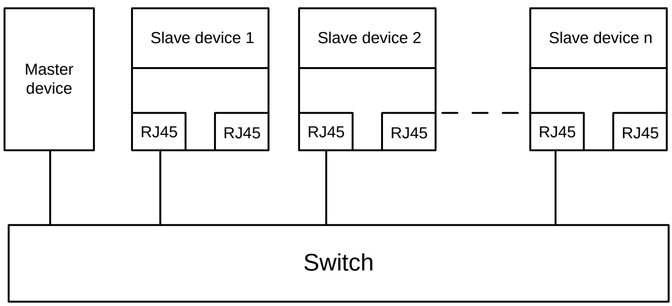
Electrical connection:

The PROFINET communication card adopts a standard RJ45 interface, which can be used in a linear network topology and a star network topology. The linear network topology electrical connection diagram is shown below.



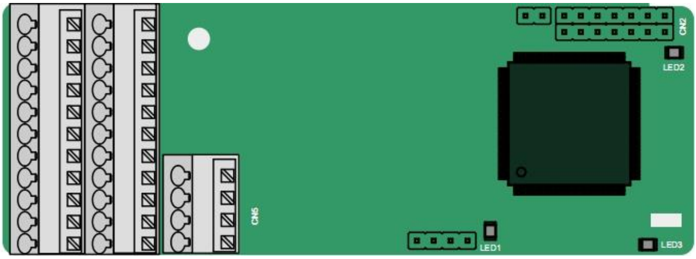
Note: For the star network topology, you need to prepare PROFINET switches.

The star network topology electrical connection diagram is shown below:



A.7 PG extension cards

A.7.1 Sin/Cos PG card——EC-PG502



The terminals are arranged as follows:

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

Indicator definition

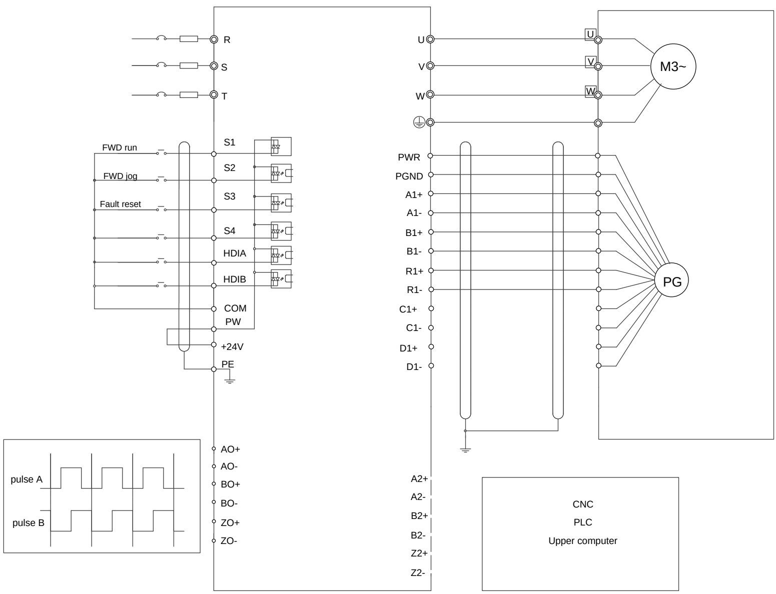
Indicator No.	Definition	Function
LED1	Disconnection indicator	This indicator is off when A1 and B1 of the encoder are disconnected; it blinks when C1 and D1 of the encoder are disconnected; and it is on when the encoder signals are normal.
LED2	Power indicator	This indicator is on after the control board feeds power to the PG card.
LED3	State indicator	This indicator is on when the extension card is establishing a connection with the control board; it blinks periodically after the extension card is properly connected to the control board (the period is 1s, on for 0.5s, and off for the other 0.5s); and it is off when the extension card is disconnected from the control board.

EC-PG502 terminal function description:

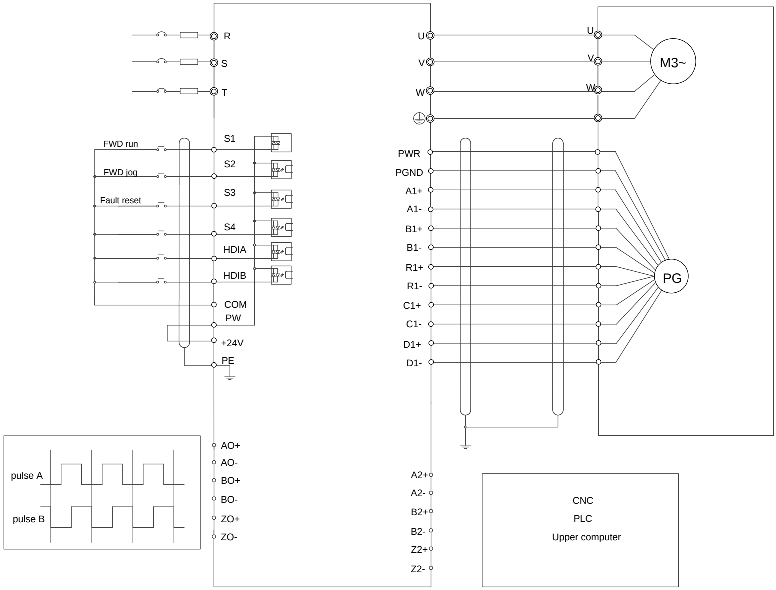
Signal	Port	Function
PWR	Encoder power	Voltage: 5 V ± 5% Max. output current: 150 mA
GND		
A1+	Encoder interface	1. Supporting Sin/Cos encoders 2. SINA/SINB/SINC/SIND 0.6–1.2Vpp; SINR 0.2–0.85Vpp 3. Max. frequency response of A/B signals: 200 kHz Max. frequency response of C/D signals: 1 kHz
A1-		
B1+		
B1-		
R1+		

Signal	Port	Function
R1-		
C1+		
C1-		
D1+		
D1-		
A2+	Pulse reference	1. Supporting 5V differential signal 2. Frequency response: 200 kHz
A2-		
B2+		
B2-		
Z2+		
Z2-		
AO+	Frequency-divided output	1. Differential output of 5 V 2. Supporting frequency division of 2^N, which can be set through P20.16 or P24.16; Max. output frequency: 200 kHz
AO-		
BO+		
BO-		
ZO+		
ZO-		

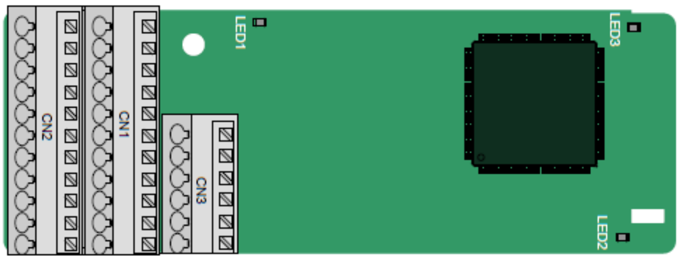
The following figure shows the external wiring of the PG card when it is used in combination with an encoder without CD signals.



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



A.7.2 UVW incremental PG card—EC-PG503-05



The terminals are arranged as follows:

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

Indicator definition:

Indicator No.	Definition	Function
LED1	Disconnection indicator	This indicator is off only when A1 or B1 signal is disconnected during encoder rotating; and it is on in other cases.
LED2	State indicator	This indicator is on when the extension card is establishing a connection with the control board; it blinks periodically after the extension card is properly connected to the control board (the period is 1s, on for 0.5s, and off for the other 0.5s); and it is off when the extension card is disconnected from the control board.
LED3	Power indicator	This indicator is on after the control board feeds power to the PG card.

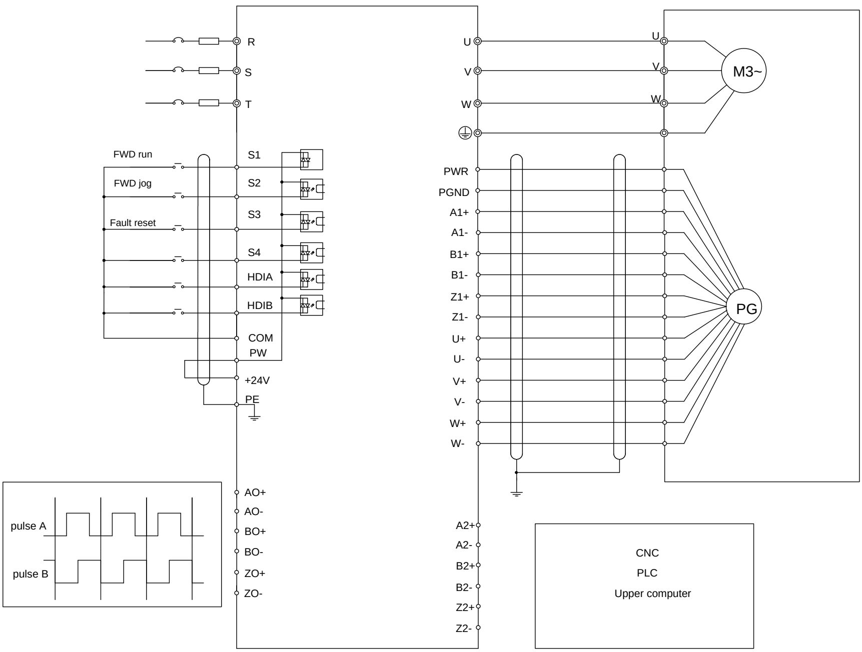
The EC-PG503-05 extension card supports the input of absolute position signals and integrates the advantages of absolute and incremental encoders. It is user-friendly, adopting spring terminals.

EC-PG503-05 terminal function description:

Signal	Port	Function
PWR	Encoder power	Voltage: 5 V±5% Max. current: 200 mA
PGND		
A1+	Encoder interface	1. Differential incremental PG interface of 5 V 2. Response frequency: 400 kHz
A1-		
B1+		
B1-		
Z1+		
Z1-		
A2+	Pulse setting	1. Differential input of 5 V 2. Response frequency: 200 kHz
A2-		
B2+		
B2-		
Z2+		
Z2-		
AO+	Frequency-divided output	1. Differential output of 5 V 2. Supporting frequency division of 1–255, which
AO-		

Signal	Port	Function
BO+		can be set through P20.16 or P24.16
BO-		
ZO+		
ZO-		
U+	UVW encoder interface	1. Absolute position (UVW information) of the hybrid encoder, differential input of 5 V 2. Response frequency: 40 kHz
U-		
V+		
V-		
W+		
W-		

The following figure shows the external wiring of the EC-PG503-05 extension card.



A.7.3 Resolver PG card—EC-PG504-00

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

Indicator definition:

Indicator No.	Definition	Function
LED1	State indicator	This indicator is on when the extension card is establishing a connection with the control board; it blinks periodically after the extension card is properly connected to the control board (the period is 1s, on for 0.5s, and off for the other 0.5s); and it is off when the extension card is disconnected from the control board.
LED2	Disconnection indicator	This indicator is off when the encoder is disconnected; it is on when the encoder signals are normal; and it blinks when the encoder signals are not stable.
LED3	Power indicator	This indicator is on after the control board feeds power to the PG card.

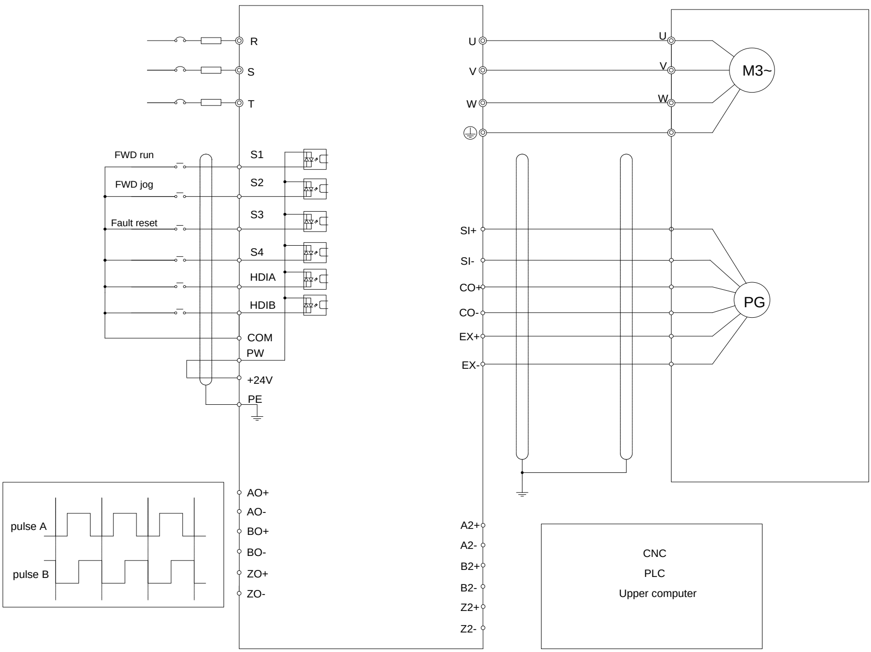
The EC-PG504-00 extension card can be used in combination with a resolver of excitation voltage 7 Vrms. It is user-friendly, adopting spring terminals.

EC-PG504-00 terminal function description:

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

Signal	Port	Function
A2-		2. Response frequency: 200 kHz
B2+		
B2-		
Z2+		
Z2-		
AO+	Frequency-divided output	1. Differential output of 5 V 2. Frequency-divided output of resolver simulated A1, B1, and Z1, which is equal to an incremental PG card of 1024 pps. 3. Supporting frequency division of 2^N, which can be set through P20.16 or P24.16 4. Max. output frequency: 200 kHz
AO-		
BO+		
BO-		
ZO+		
ZO-		

The following figure shows the external wiring of the EC-PG504-00 extension card.



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

The terminals are arranged as follows:

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

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

Indicator definition:

Indicator No.	Definition	Function
LED1	State indicator	This indicator is on when the extension card is establishing a connection with the control board; it blinks periodically after the extension card is properly connected to the control board (the period is 1s, on for 0.5s, and off for the other 0.5s); and it is off when the extension card is disconnected from the control board.
LED2	Disconnection indicator	This indicator blinks only when A1 or B1 signal is disconnected during encoder rotating; and it is on in other cases.
LED3	Power indicator	This indicator is on after the control board feeds power to the PG card.

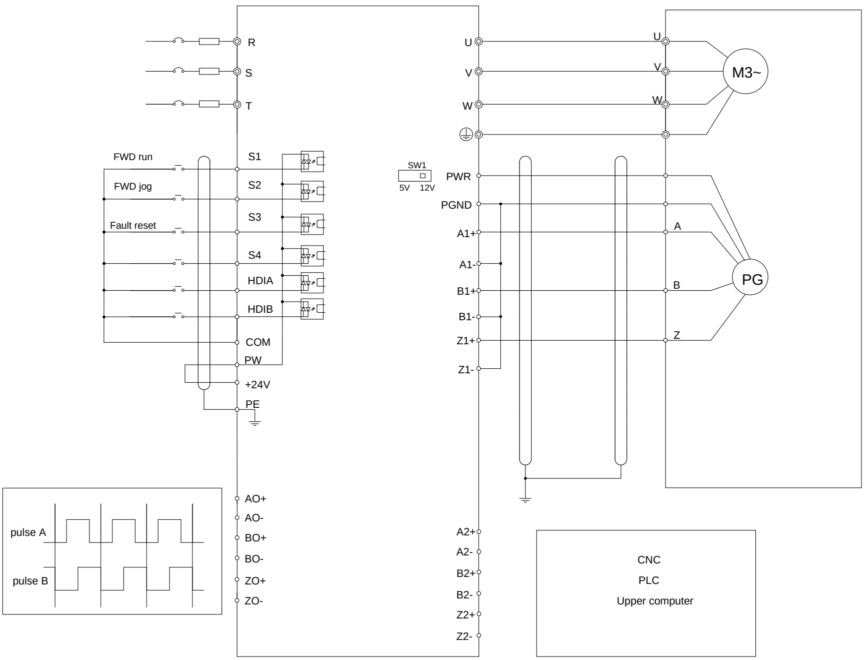
The EC-PG505-12 extension card can be used in combination with multiple types of incremental encoders through different modes of wiring. It is user-friendly, adopting spring terminals.

EC-PG505-12 terminal function description:

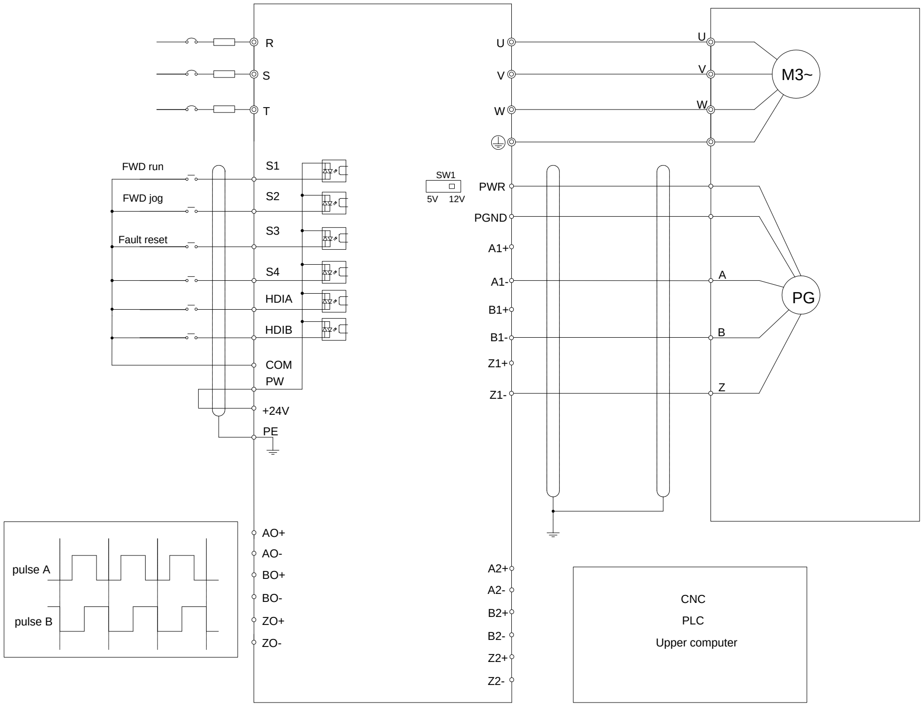
Signal	Port	Function
PWR	Encoder power	Voltage: 5 V/12 V ±5% Max. output: 150 mA Select the voltage class through the DIP switch SW1 based on the voltage class of the used encoder.
PGND		
A1+	Encoder interface	1. Supporting push-pull interfaces of 5 V/12 V 2. Supporting open collector interfaces of 5 V/12 V
A1-		

Signal	Port	Function
B1+		3. Supporting differential interfaces of 5 V 4. Response frequency: 200 kHz
B1-		
Z1+		
Z1-		
A2+	Pulse setting	1. Supporting the same signal types as the encoder signal types 2. Response frequency: 200 kHz
A2-		
B2+		
B2-		
Z2+		
Z2-		
AO+	Frequency-divided output	1. Differential output of 5 V 2. Supporting frequency division of 1–255, which can be set through P20.16 or P24.16
AO-		
BO+		
BO-		
ZO+		
ZO-		

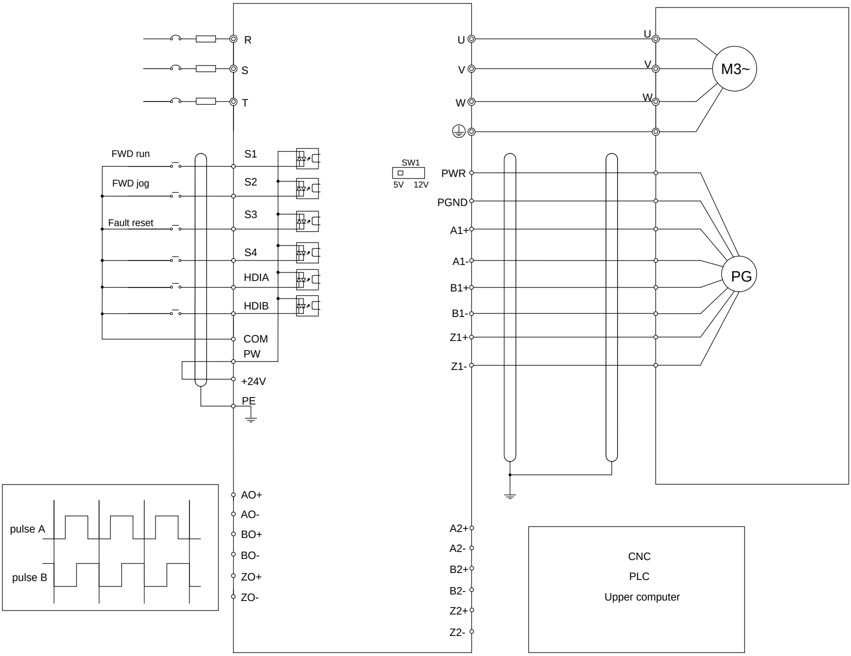
The following figure shows the external wiring of the extension card used in combination with an open collector encoder. A pull-up resistor is configured inside the PG card.



The following figure shows the external wiring of the extension card used in combination with a push-pull encoder.



The following figure shows the external wiring of the extension card used in combination with a differential encoder.



A.7.5 24V multi-function incremental PG card——EC-PG505-24

The terminals are arranged as follows:

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

Indicator definition:

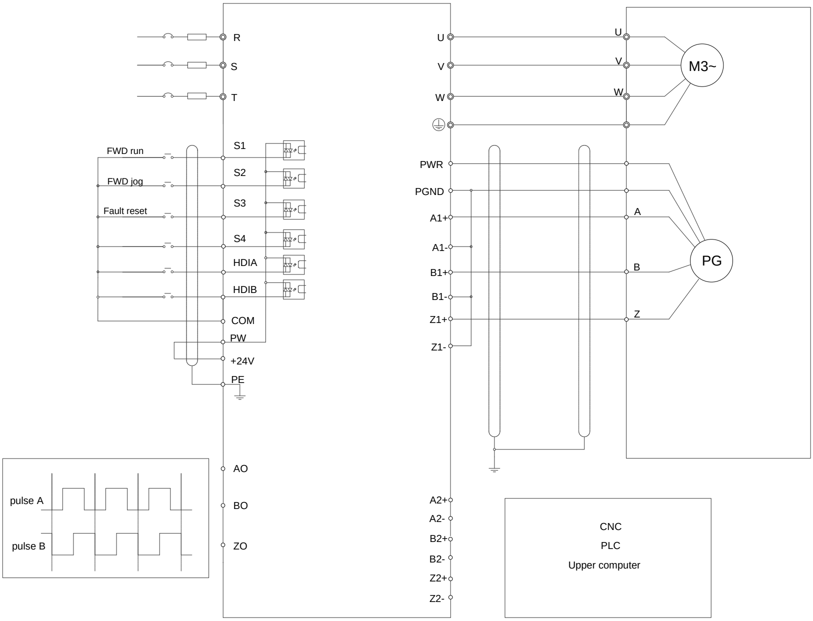
Indicator No.	Definition	Function
LED1	State indicator	This indicator is on when the extension card is establishing a connection with the control board; it blinks periodically after the extension card is properly connected to the control board (the period is 1s, on for 0.5s, and off for the other 0.5s); and it is off when the extension card is disconnected from the control board.
LED2	Disconnection indicator	This indicator blinks only when A1 or B1 signal is disconnected during encoder rotating; and it is on in other cases.
LED3	Power indicator	This indicator is on after the control board feeds power to the PG card.

EC-PG505-24 can work in combination with multiple types of incremental encoders through various external wiring modes. It is user-friendly, adopting spring terminals.

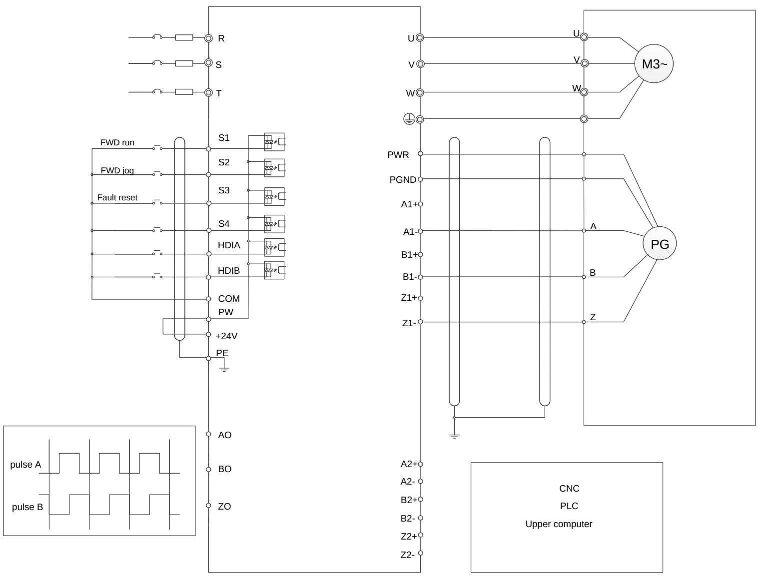
EC-PG505-24 terminal function description:

Signal	Port	Function
PWR	Encoder power supply	Voltage: 24 V ± 5% Max. output current: 150 mA
PGND		
A1+	Encoder interface	1. Supporting 24 V push-pull interfaces 2. Supporting 24 V open collector interfaces 3. Frequency response: 200 kHz
A1-		
B1+		
B1-		
Z1+		
Z1-		
A2+	Pulse reference	1. Supporting interfaces whose signal type is the same as the encoder 2. Frequency response: 200 kHz
A2-		
B2+		
B2-		
Z2+		
Z2-		
AO	Frequency-divided output	1. Open collector output 2. Supporting frequency division of 1–255, which can be set through P20.16 or P24.16
BO		
ZO		

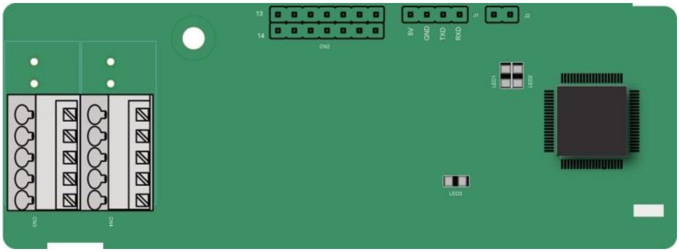
The following figure shows the external wiring of the PG card when it is used in combination with an open collector encoder. A pull-up resistor is configured in the PG card.



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



A.7.6 Simplified incremental PG card——EC-PG507-12



The terminals are arranged as follows:

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

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

Indicator definition:

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

EC-PG507-12 can work in combination with multiple types of incremental encoders through various external wiring modes, which are similar to the wiring modes of EC-PG505-12.

EC-PG507-12 terminal function description:

Signal	Port	Function
PWR	Encoder power	Voltage: 5V/12V ± 5% Max. current: 150 mA The voltage class can be selected through SW1, depending on the encoder voltage class.
PGND		
A1+	Encoder interface	1. Supporting push-pull interfaces of 5 V/12 V 2. Supporting open collector interfaces of 5 V/12 V 3. Supporting differential interfaces of 5 V 4. Response frequency: 400 kHz 5. Supporting the encoder cable length of up to 50 m
A1-		
B1+		
B1-		
Z1+		
Z1-		

Appendix B Technical data

B.1 What this chapter contains

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

B.2 Derated application

B.2.1 Capacity

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

Note:

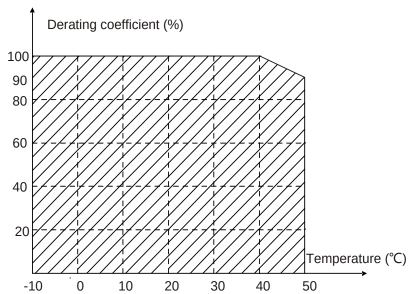
- The maximum allowable shaft power of the motor is limited to 1.5 times the rated power of the motor. If the limit is exceeded, the VFD automatically restricts the torque and current of the motor. This function effectively protects the input shaft against overload.
- The rated capacity is the capacity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

B.2.2 Derating

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

B.2.2.1 Derating due to temperature

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



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

B.2.2.2 Derating due to altitude

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

B.2.2.3 Derating due to carrier frequency

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

B.3 Grid specifications

Grid voltage	AC 3PH 380V (-15%)–440V (+10%) AC 3PH 520V (-15%)–690V (+10%)
Short-circuit capacity	According to the definition in IEC 60439-1, 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 100 kA when the VFD runs at the maximum rated voltage.
Frequency	50/60 Hz±5%, with a maximum change rate of 20%/s

B.4 Motor connection data

Motor type	asynchronous induction motor or permanent-magnet synchronous motor
Voltage	0–U1 (rated voltage of the motor), 3PH symmetrical, Umax (rated voltage of the VFD) at the field-weakening point
Short-circuit protection	The short-circuit protection for the motor output meets the requirements of IEC 61800-5-1.
Frequency	0–400 Hz
Frequency resolution	0.01 Hz
Current	See section 3.6 Product ratings.
Power limit	1.5 times of the rated power of the motor
Field-weakening point	10–400 Hz
Carrier frequency	4, 8, 12, or 15 kHz

B.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 description about the environments category II (C3), see section B.6 EMC regulations.

B.5 Application standards

The following table describes the standards that the 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

B.5.1 CE marking

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

B.5.2 EMC compliance declaration

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

B.6 EMC regulations

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

Application environment categories

Category I: Civilian environments, including application scenarios where VFDs are directly connected to the civil power supply low-voltage grids without intermediate transformers

Category II: All environments except those in Category I.

VFD categories

C1: Rated voltage lower than 1000 V, applied to environments of Category I.

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

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

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

C4: Rated voltage higher than 1000 V, or rated current higher or equal to 400 A, applied to complex systems in environments of Category II.

B.6.1 VFD category of C2

The induction disturbance limit meets the following stipulations:

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

	✧ Currently in environments in China, the VFD may generate radio interference, you need to take measures to reduce the interference.

B.6.2 VFD category of C3

The anti-interference performance of the VFD meets the requirements of environments Category II in the IEC/EN 61800-3 standard.

The induction disturbance limit meets the following stipulations:

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

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

Appendix C Dimension drawings

C.1 What this chapter contains

This chapter describes the dimension drawings of Goodrive350 series VFDs. The dimension unit used in the drawings is mm.

C.2 Keypad structure

C.2.1 Structure diagram

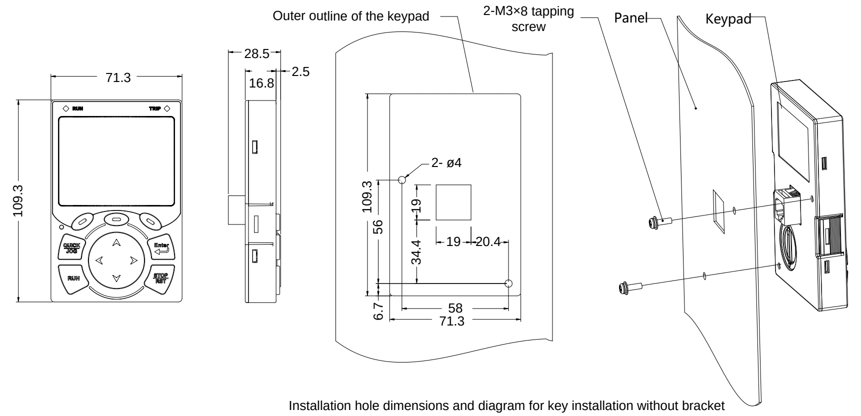


Figure C-1 Keypad structure diagram

C.2.2 Keypad installation bracket

Note: When installing an external keypad, you can directly use M3 threaded screws or a keypad bracket. For VFDs of 380 V, 1.5 to 75 kW, you need to use optional keypad installation brackets. For those of 380 V, 90 to 500 kW and 660 V, 22 to 630 kW, you can use optional brackets or use the standard keypad brackets externally.

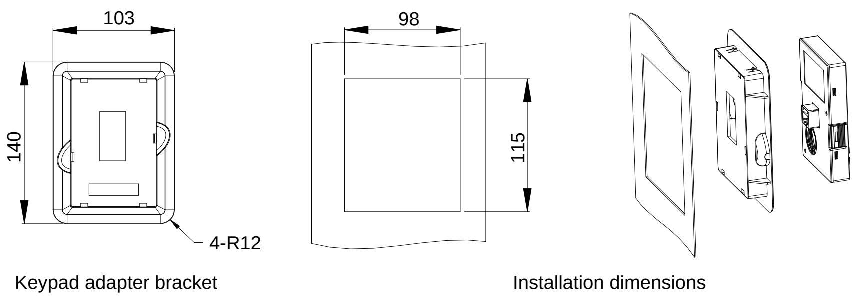


Figure C-2 Keypad installation bracket (optional) for 380V 1.5–500kW and 660V 22–630kW models

C.3 VFD structure

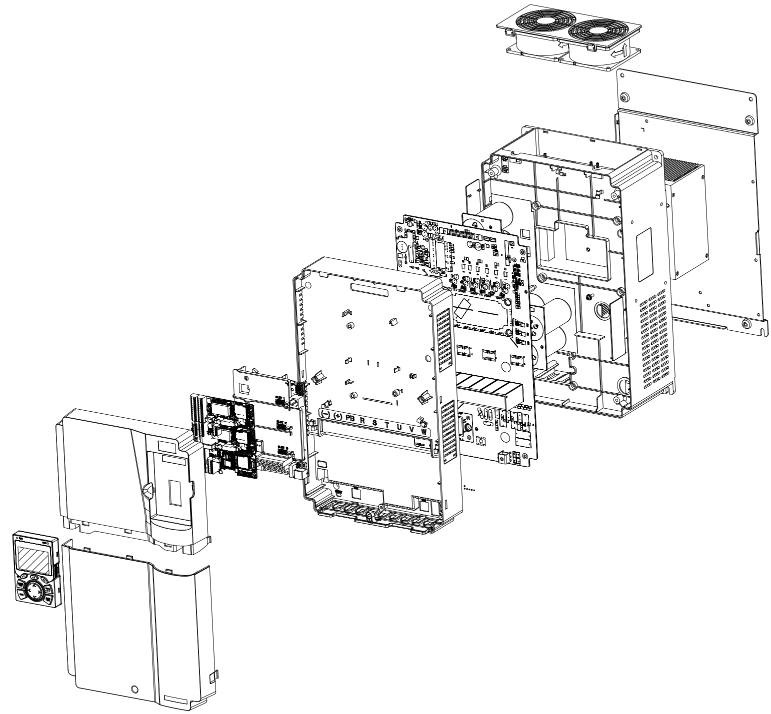


Figure C-3 VFD structure diagram

C.4 Dimensions of AC 3PH 380V (-15%)–440V (+10%)

C.4.1 Wall-mounting dimensions

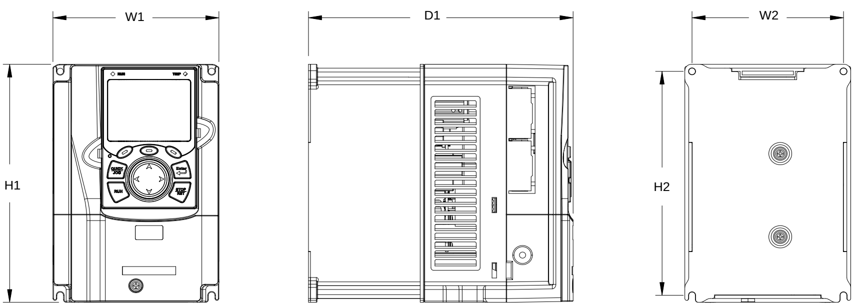


Figure C-4 Wall-mounting diagram for 380V 1.5–37kW models

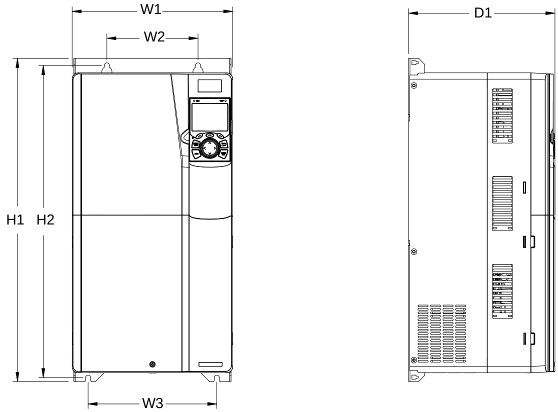


Figure C-5 Wall-mounting diagram for 380V 45–75kW models

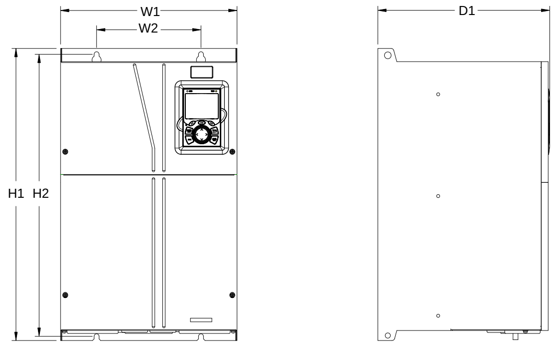


Figure C-6 Wall-mounting diagram for 380V 90–110kW models

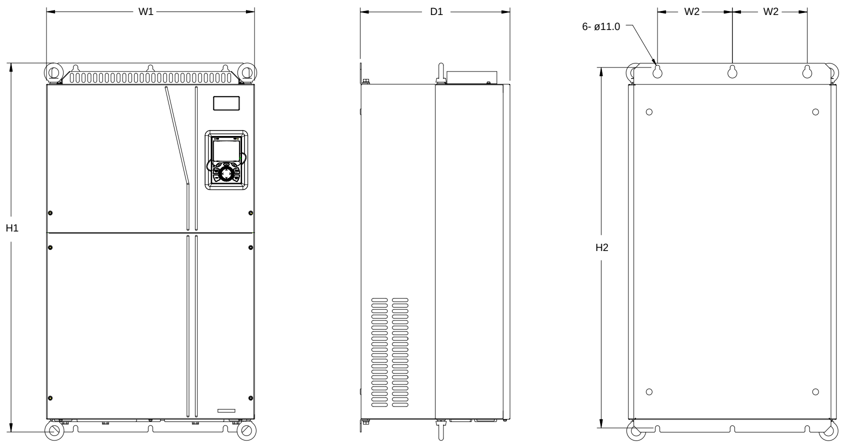


Figure C-7 Wall-mounting diagram for 380V 132–200kW models

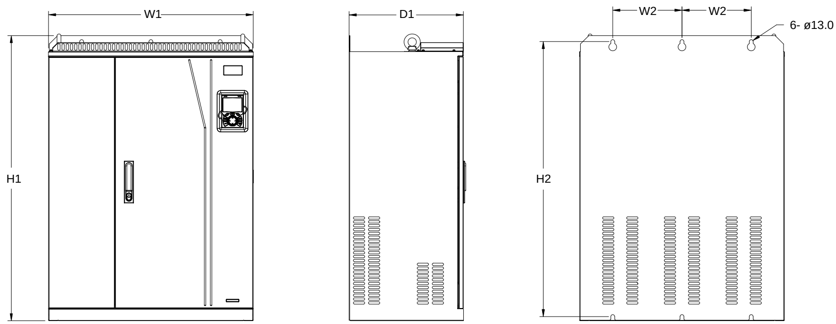


Figure C-8 Wall-mounting diagram for 380V 220–315kW models

Table C-1 Wall-mounting dimensions of 380V VFD models (unit: mm)

VFD model	W1	W2	W3	H1	H2	D1	Installation hole	Fixing screw
1.5kW–2.2kW	126	115	-	186	175	185	Ø 5	M4
4kW–5.5kW	126	115	-	186	175	201	Ø 5	M4
7.5kW	146	131	-	256	243.5	192	Ø 6	M5
11kW–15kW	170	151	-	320	303.5	220	Ø 6	M5
18.5kW–22kW	200	185	-	340.6	328.6	208	Ø 6	M5
30kW–37kW	250	230	-	400	380	223	Ø 6	M5
45kW–75kW	282	160	226	560	542	258	Ø 9	M8
90kW–110kW	338	200	-	554	535	330	Ø 10	M8
132kW–200kW	500	180	-	870	850	360	Ø 11	M10
220kW–315kW	680	230	-	960	926	380	Ø 13	M12

C.4.2 Flange installation dimensions

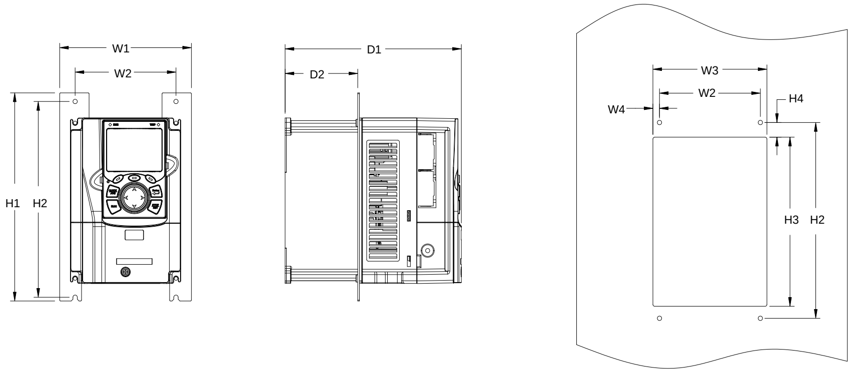


Figure C-9 Flange installation diagram for 380V 1.5–75kW models

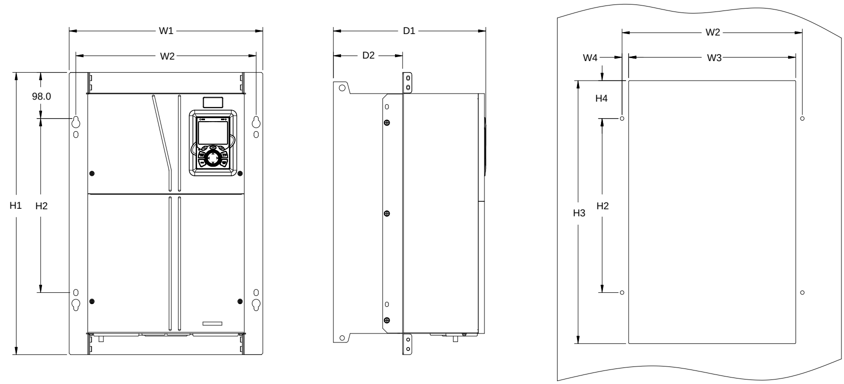


Figure C-10 Flange installation diagram for 380V 90–110kW models

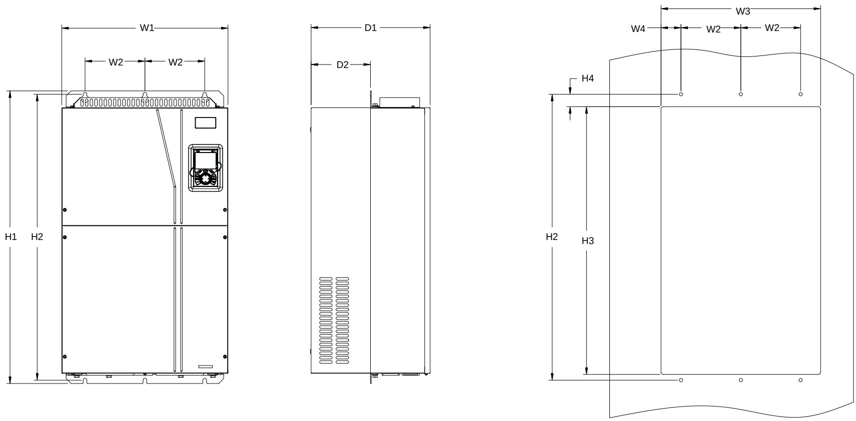


Figure C-11 Flange installation diagram for 380V 132–200kW models

Table C-2 Flange installation dimensions of 380 V VFDs (unit: mm)

VFD model	W1	W2	W3	W4	H1	H2	H3	H4	D1	D2	Installation hole	Fixing screw
1.5kW–2.2kW	150.2	115	130	7.5	234	220	190	13.5	185	65.5	Ø 5	M4
4kW–5.5kW	150.2	115	130	7.5	234	220	190	13.5	201	83	Ø 5	M4
7.5kW	170.2	131	150	9.5	292	276	260	6	192	84.5	Ø 6	M5
11kW–15kW	191.2	151	174	11.5	370	351	324	12	220	113	Ø 6	M5
18.5kW–22kW	266	250	224	13	371	250	350.6	20.3	208	104	Ø 6	M5
30kW–37kW	316	300	274	13	430	300	410	55	223	118.3	Ø 6	M5
45kW–75kW	352	332	306	12	580	400	570	80	258	133.8	Ø 9	M8
90kW–110kW	418.5	389.5	361	14.2	600	370	559	108.5	330	149.5	Ø 10	M8
132kW–200kW	500	180	480	60	870	850	796	37	360	178.5	Ø 11	M10

C.4.3 Floor installation dimensions

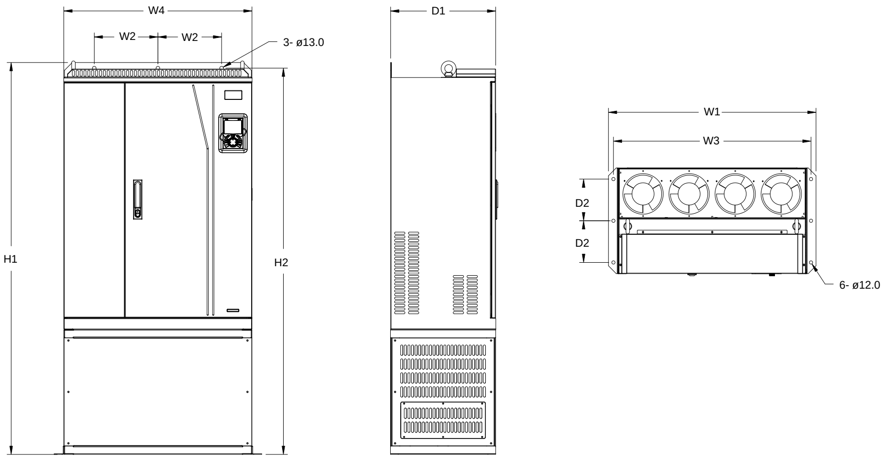


Figure C-12 Floor installation diagram for 380V 220–315kW models

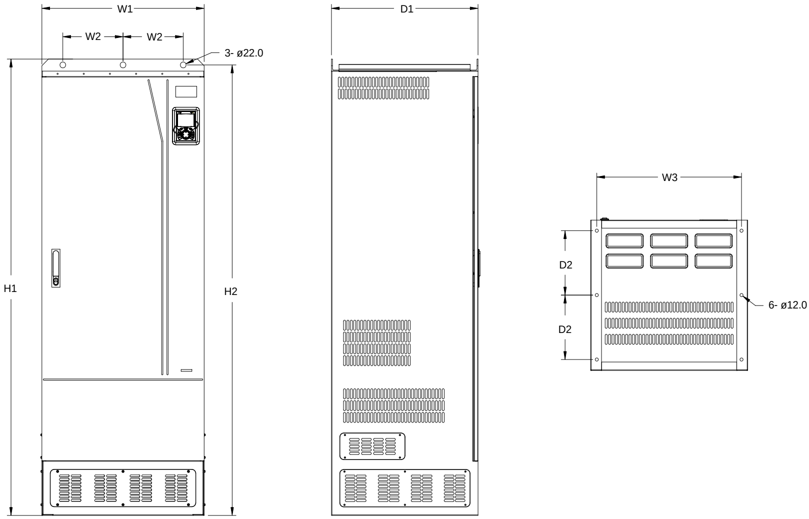


Figure C-13 Floor installation diagram for 380V 355–500kW models

Table C-3 Floor installation dimensions of 380V VFD models (unit: mm)

VFD model	W1	W2	W3	W4	H1	H2	D1	D2	Installation hole	Fixing screw
220kW–315kW	750	230	714	680	1410	1390	380	150	Ø 13/12	M12/M10
355kW–500kW	620	230	572	-	1700	1678	560	240	Ø 22/12	M20/M10

C.5 Dimensions of AC 3PH 520V (-15%)–690V (+10%)

C.5.1 Wall-mounting dimensions

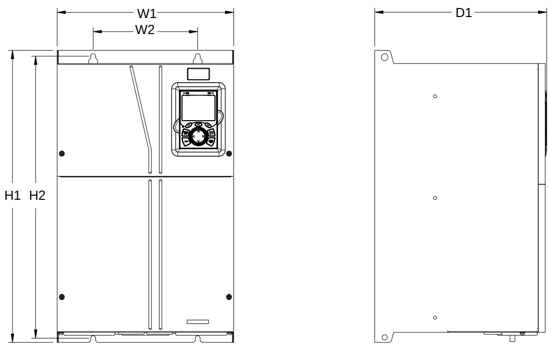


Figure C-14 Wall-mounting diagram for 660V 22–132kW models

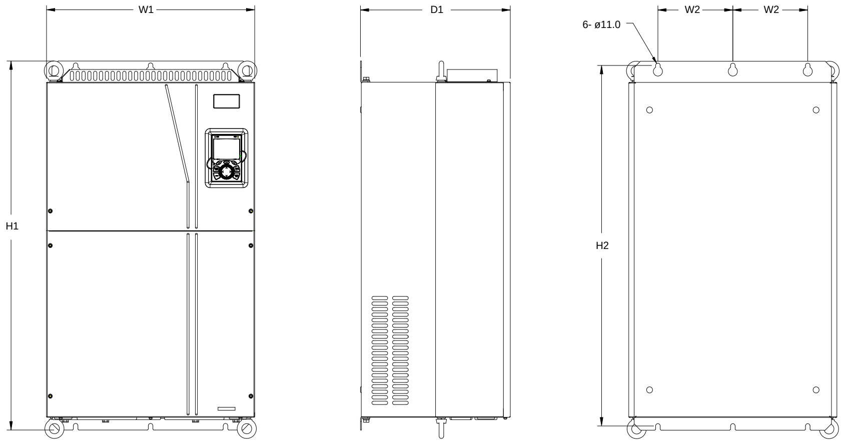


Figure C-15 Wall-mounting diagram for 660V 160–220kW models

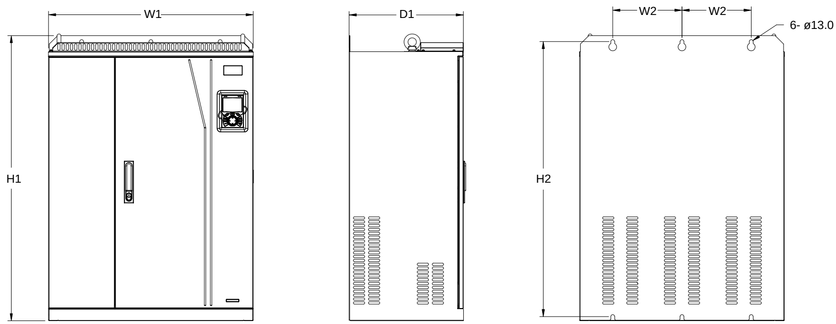


Figure C-16 Wall-mounting diagram for 660V 250–355kW models

Table C-4 Wall-mounting dimensions of 660V VFD models (unit: mm)

VFD model	W1	W2	H1	H2	D1	Installation hole	Fixing screw
22kW–45kW	270	130	555	540	325	Ø 7	M6
55kW–132kW	325	200	680	661	365	Ø 9.5	M8
160kW–220kW	500	180	870	850	360	Ø 11	M10
250kW–355kW	680	230	960	926	380	Ø 13	M12

C.5.2 Flange installation dimensions

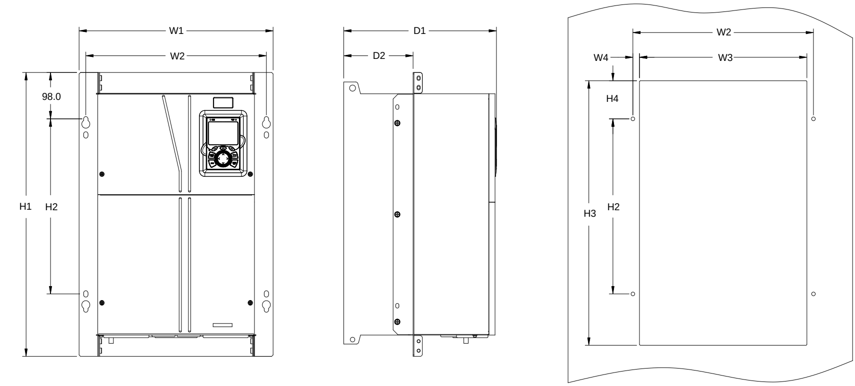


Figure C-17 Flange installation diagram for 660V 22–132kW models

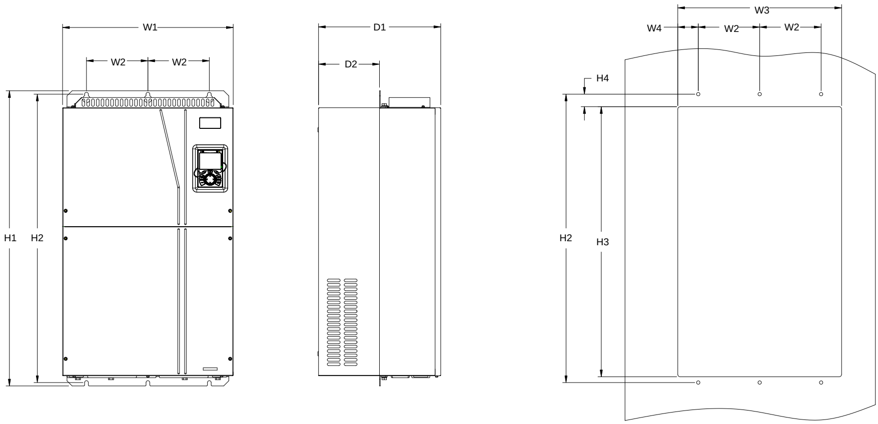


Figure C-18 Flange installation diagram for 660V 160–220kW models

Table C-5 Flange installation dimensions of 660V VFD models (unit: mm)

VFD model	W1	W2	W3	W4	H1	H2	H3	H4	D1	D2	Installation hole	Fixing screw
22kW–45kW	270	130	261	65.5	555	540	516	17	325	167	Ø 7	M6
55kW–132kW	325	200	317	58.5	680	661	626	23	363	182	Ø 9.5	M8
160kW–220kW	500	180	480	60	870	850	796	37	358	178.5	Ø 11	M10

C.5.3 Floor installation dimensions

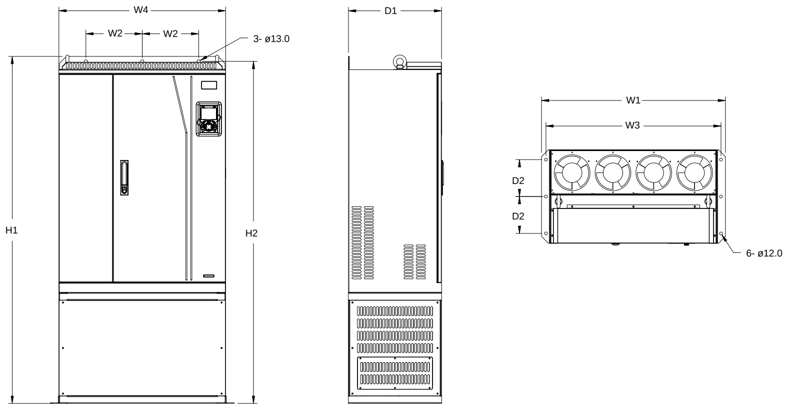


Figure C-19 Floor installation diagram for 660V 250–355kW models

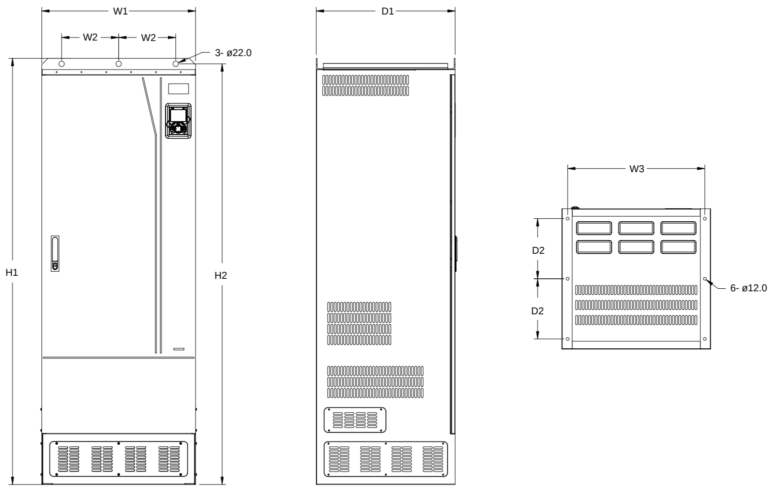


Figure C-20 Floor installation diagram for 660V 400–630kW models

Table C-6 Floor installation dimensions of 660V VFD models (unit: mm)

VFD model	W1	W2	W3	W4	H1	H2	D1	D2	Installation hole	Fixing screw
250kW–355kW	750	230	714	680	1410	1390	380	150	Ø 13/12	M12/M10
400kW–630kW	620	230	572	/	1700	1678	560	240	Ø 22/12	M20/M10

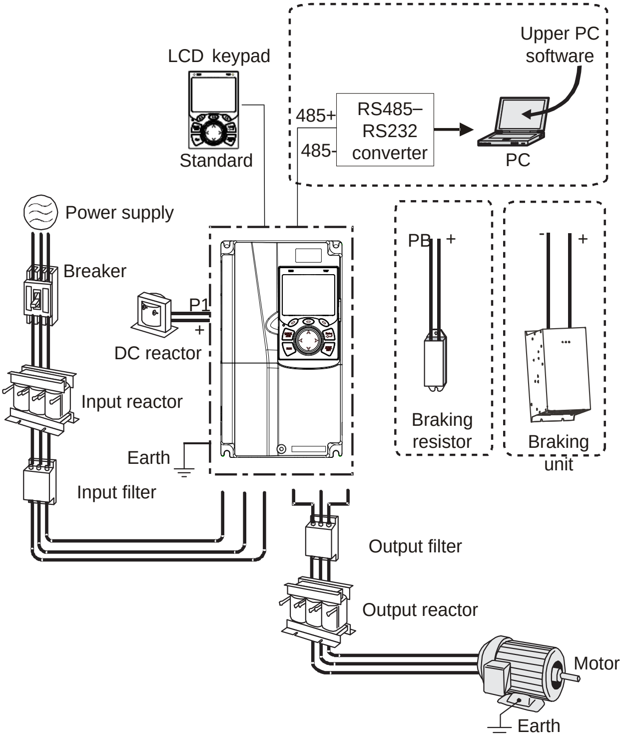
Appendix D Optional peripheral accessories

D.1 What this chapter contains

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

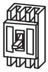
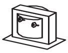
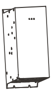
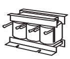
D.2 Wiring of peripheral accessories

The following figure shows the external wiring of the VFD.



Note:

- The 380V 37kW and lower models are equipped with built-in braking units, and the 45–110kW models can be configured with optional built-in braking units.
- The 380V 18.5–110kW models are equipped with built-in DC reactors.
- P1 terminals are equipped only for the 380V 132kW and higher models, which enable the VFDs to be directly connected to external DC reactors.
- P1 terminals are equipped for all 660V models, which enable the VFDs to be directly connected to external DC reactors.
- The braking units are INVT DBU series standard braking units. For details, see the DBU operation manual.

Image	Name	Description
	Cable	Accessory for signal transmission
	Breaker	Device for electric shock prevention and protection against short-to-ground that may cause current leakage and fire. Select residual-current circuit breakers (RCCBs) that are applicable to VFDs and can restrict high-order harmonics, and of which the rated sensitive current for one VFD is larger than 30mA.
	Input reactor	Accessories used to improve the current adjustment coefficient on the input side of the VFD, and thus restrict high-order harmonic currents. VFDs of 380V, 132kW or higher and 660V series can be directly connected to external DC reactors.
	DC reactor	
	Input filter	Accessory that restricts the electromagnetic interference generated by the VFD and transmitted to the public grid through the power cable. Try to install the input filter near the input terminal side of the VFD.
 or 	Braking unit or braking resistor	Accessories used to consume the regenerative energy of the motor to reduce the deceleration time. VFDs of 380V, 37kW or lower need only to be configured with braking resistors, those of 380V, 132kW or higher and 660V series also need to be configured with braking units, and those of 380V, 45kW to 110kW can be configured with optional built-in braking units.
	Output filter	Accessory used to restrict interference generated in the wiring area on the output side of the VFD. Try to install the output filter near the output terminal side of the VFD.
	Output reactor	Accessory used to lengthen the valid transmission distance of the VFD, which effectively restrict the transient high voltage generated during the switch-on and switch-off of the IGBT module of the VFD.

D.3 Power supply

Refer to chapter 4 Installation guide.

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

D.4 Cables

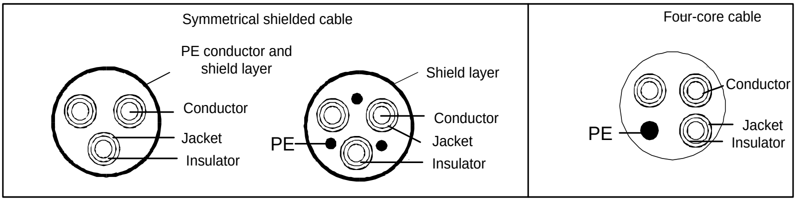
D.4.1 Power cables

The sizes of the input power cables and motor cables must meet the local regulation.

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

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

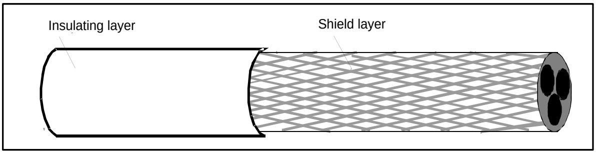
Four-core cables can be used as input cables, but symmetrical shielded cables are recommended. Compared with four-core cables, symmetrical shielded cables can reduce electromagnetic radiation as well as the current and loss of the motor cables.



Note: If the conductivity of the shield layer of the motor cables cannot meet the requirements, separate PE conductors 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.

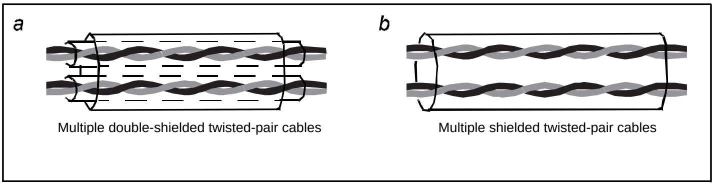
To effectively restrict the emission and conduction of radio frequency (RF) interference, the conductivity of the shielded cable must at least be 1/10 of the conductivity of the phase conductor. This requirement can be well met by a copper or aluminum shield layer. The following figure shows the minimum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



Cross-section of the cable

D.4.2 Control cables

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.



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.

Do not perform any voltage endurance or insulation resistance tests, such as high-voltage insulation tests or using a megameter to measure the insulation resistance, on the VFD or its components. Insulation and voltage endurance tests have been performed between the main circuit and chassis of each VFD before delivery. In addition, voltage limiting circuits that can automatically cut off the test voltage are configured inside the VFDs.

Note: Check the insulation conditions of the input power cable of a VFD according to the local regulations before connecting it.

D.4.3 Recommended cable sizes

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

VFD model	Recommended cable size (mm²)				Screw	
	R, S, T U, V, W	PE	P1, (+)	PB, (+), (-)	Terminal screw	Fastening torque (Nm)
GD350-1R5G-4	1.0	1.0	1.0	1.0	M4	1.2–1.5
GD350-2R2G-4	1.0	1.0	1.0	1.0	M4	1.2–1.5

VFD model	Recommended cable size (mm²)				Screw	
	R, S, T U, V, W	PE	P1, (+)	PB, (+), (-)	Terminal screw	Fastening torque (Nm)
GD350-004G-4	1.5	1.5	1.5	1.5	M4	1.2–1.5
GD350-5R5G-4	1.5	1.5	1.5	1.5	M5	2–2.5
GD350-7R5G-4	2.5	2.5	2.5	2.5	M5	2–2.5
GD350-011G-4	4	4	4	4	M5	2–2.5
GD350-015G-4	6	6	6	6	M5	2–2.5
GD350-018G-4	10	10	10	10	M6	4–6
GD350-022G-4	10	10	10	10	M6	4–6
GD350-030G-4	16	16	16	16	M8	9–11
GD350-037G-4	25	16	25	25	M8	9–11
GD350-045G-4	25	16	25	25	M8	9–11
GD350-055G-4	35	16	35	35	M10	18–23
GD350-075G-4	50	25	50	50	M10	18–23
GD350-090G-4	70	35	70	70	M10	18–23
GD350-110GP-4	95	50	95	95	M12	31–40
GD350-132G-4	95	50	95	95	M12	31–40
GD350-160G-4	150	70	150	150	M12	31–40
GD350-185G-4	185	95	185	185	M12	31–40
GD350-200G-4	185	95	185	185	M12	31–40
GD350-220G-4	2×95	95	2×95	2×95	M12	31–40
GD350-250G-4	2×95	95	2×95	2×95	M12	31–40
GD350-280G-4	2×150	150	2×150	2×150	M12	31–40
GD350-315G-4	2×150	150	2×150	2×150	M12	31–40
GD350-355G-4	2×185	185	2×185	2×185	M12	31–40
GD350-400G-4	3×150	2×120	3×150	3×150	M12	31–40
GD350-450G-4	3×185	2×150	3×185	3×185	M12	31–40
GD350-500G-4	3×185	2×150	3×185	3×185	M12	31–40

Note:

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

Table D-2 AC 3PH 520V(-15%)–690V(+10%)

VFD model	Recommended cable size (mm²)				Screw	
	R, S, T U, V, W	PE	P1, (+)	PB, (+), (-)	Terminal screw	Fastening torque (Nm)
GD350-022G-6	4	4	4	4	M8	9–11
GD350-030G-6	6	6	6	6	M8	9–11
GD350-037G-6	6	6	6	6	M8	9–11
GD350-045G-6	10	10	10	10	M8	9–11
GD350-055G-6	16	16	16	16	M10	18–23
GD350-075G-6	16	16	16	16	M10	18–23
GD350-090G-6	16	16	16	16	M10	18–23
GD350-110G-6	25	16	25	25	M10	18–23
GD350-132G-6	35	16	35	35	M10	18–23
GD350-160G-6	50	25	50	50	M12	31–40
GD350-185G-6	70	35	70	70	M12	31–40

VFD model	Recommended cable size (mm²)				Screw	
	R, S, T U, V, W	PE	P1, (+)	PB, (+), (-)	Terminal screw	Fastening torque (Nm)
GD350-200G-6	70	35	70	70	M12	31–40
GD350-220G-6	95	50	95	95	M12	31–40
GD350-250G-6	95	50	95	95	M12	31–40
GD350-280G-6	120	70	120	120	M12	31–40
GD350-315G-6	150	70	150	150	M12	31–40
GD350-355G-6	185	95	185	185	M12	31–40
GD350-400G-6	2×70	70	2×70	2×70	M12	31–40
GD350-450G-6	2×95	95	2×95	2×95	M12	31–40
GD350-500G-6	2×120	120	2×120	2×120	M12	31–40
GD350-560G-6	2×150	150	2×150	2×150	M12	31–40
GD350-630G-6	2×150	150	2×150	2×150	M12	31–40

Note:

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

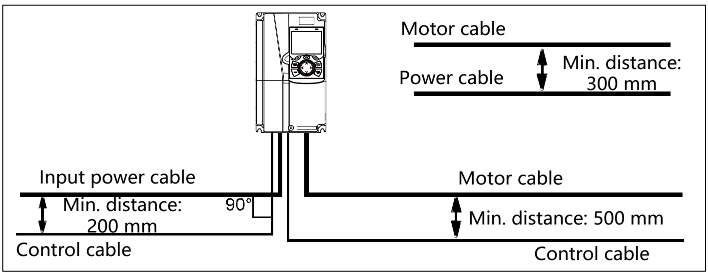
D.4.4 Cable arrangement

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

If a control cable and power cable must cross each other, ensure that the angle between them is 90 degrees.

The cable trays must be connected properly and well grounded. Aluminum trays can implement local equipotential.

The following figure shows the cable arrangement distance requirements.



Cable arrangement distances

D.4.5 Insulation inspection

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

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

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

D.5 Breaker and electromagnetic contactor

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 D-3 AC 3PH 380V(-15%)–440V(+10%)

VFD model	Breaker rated current (A)	Fast-acting fuse rated current (A)	Contactor rated current (A)
GD350-1R5G-4	6	10	9
GD350-2R2G-4	10	10	9
GD350-004G-4	20	20	18
GD350-5R5G-4	25	35	25
GD350-7R5G-4	32	40	32
GD350-011G-4	50	50	38
GD350-015G-4	63	60	50
GD350-018G-4	63	70	65
GD350-022G-4	80	90	80
GD350-030G-4	100	125	80
GD350-037G-4	125	125	98
GD350-045G-4	140	150	115
GD350-055G-4	180	200	150
GD350-075G-4	225	250	185
GD350-090G-4	250	300	225
GD350-110G-4	315	350	265
GD350-132G-4	400	400	330
GD350-160G-4	500	500	400
GD350-185G-4	500	600	400
GD350-200G-4	630	600	500
GD350-220G-4	630	700	500
GD350-250G-4	700	800	630
GD350-280G-4	800	1000	630

VFD model	Breaker rated current (A)	Fast-acting fuse rated current (A)	Contactor rated current (A)
GD350-315G-4	1000	1000	800
GD350-355G-4	1000	1000	800
GD350-400G-4	1000	1200	1000
GD350-450G-4	1250	1200	1000
GD350-500G-4	1250	1400	1000

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

Table D-4 AC 3PH 520V(-15%)–690V(+10%)

VFD model	Breaker rated current (A)	Fast-acting fuse rated current (A)	Contactor rated current (A)
GD350-022G-6	50	50	50
GD350-030G-6	63	60	50
GD350-037G-6	63	70	65
GD350-045G-6	80	80	65
GD350-055G-6	100	100	80
GD350-075G-6	125	125	115
GD350-090G-6	140	150	115
GD350-110G-6	180	200	150
GD350-132G-6	225	250	185
GD350-160G-6	225	250	225
GD350-185G-6	250	300	225
GD350-200G-6	315	350	265
GD350-220G-6	315	350	265
GD350-250G-6	350	400	330
GD350-280G-6	400	500	330
GD350-315G-6	500	600	400
GD350-355G-6	500	600	500
GD350-400G-6	630	700	500
GD350-450G-6	700	800	630
GD350-500G-6	800	900	630
GD350-560G-6	800	900	800
GD350-630G-6	900	1000	800

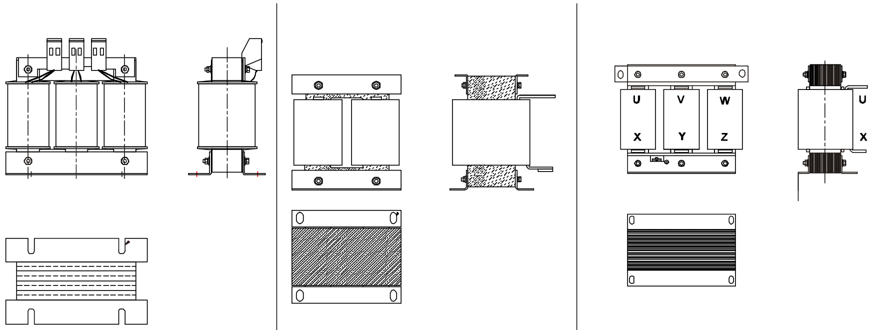
Note: The accessory specifications described in the preceding table are ideal values. You can select accessories based on the actual market conditions, but try not to use those with lower values.

D.6 Reactors

When the voltage of the grid is high, the transient large current that flows into the input power circuit may damage rectifier components. You need to configure an AC reactor on the input side, which can also improve the current adjustment coefficient on the input side.

When the distance between the VFD and motor is longer than 50m, the parasitic capacitance between the long cable and ground may cause large leakage current, and overcurrent protection of the VFD may be frequently triggered. To prevent this from happening and avoid damage to the motor insulator, compensation must be made by adding an output reactor. When a VFD is used to drive multiple motors, take the total length of the motor cables (that is, sum of the lengths of the motor cables) into account. When the total length is longer than 50m, an output reactor must be added on the output side of the VFD. If the distance between the VFD and motor is 50m to 100m, select the reactor according to the following table. If the distance is longer than 100m, contact INVT's technical support technicians.

DC reactors can be directly connected to VFDs of 380V, 132kW 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.



Input reactor DC reactor Output reactor

Table D-5 Reactors for AC 3PH 380V (-15%)–440V (+10%)

VFD model	Input reactor	DC reactor	Output reactor
GD350-1R5G-4	ACL2-1R5-4	/	OCL2-1R5-4
GD350-2R2G-4	ACL2-2R2-4	/	OCL2-2R2-4
GD350-004G-4	ACL2-004-4	/	OCL2-004-4
GD350-5R5G-4	ACL2-5R5-4	/	OCL2-5R5-4
GD350-7R5G-4	ACL2-7R5-4	/	OCL2-7R5-4
GD350-011G-4	ACL2-011-4	/	OCL2-011-4
GD350-015G-4	ACL2-015-4	/	OCL2-015-4
GD350-018G-4	ACL2-018-4	/	OCL2-018-4
GD350-022G-4	ACL2-022-4	/	OCL2-022-4
GD350-030G-4	ACL2-037-4	/	OCL2-037-4
GD350-037G-4	ACL2-037-4	/	OCL2-037-4
GD350-045G-4	ACL2-045-4	/	OCL2-045-4
GD350-055G-4	ACL2-055-4	/	OCL2-055-4
GD350-075G-4	ACL2-075-4	/	OCL2-075-4
GD350-090G-4	ACL2-0110-4	/	OCL2-110-4
GD350-110G-4	ACL2-110-4	/	OCL2-110-4
GD350-132G-4	ACL2-160-4	DCL2-132-4	OCL2-200-4
GD350-160G-4	ACL2-160-4	DCL2-160-4	OCL2-200-4
GD350-185G-4	ACL2-200-4	DCL2-200-4	OCL2-200-4

VFD model	Input reactor	DC reactor	Output reactor
GD350-200G-4	ACL2-200-4	DCL2-220-4	OCL2-200-4
GD350-220G-4	ACL2-280-4	DCL2-280-4	OCL2-280-4
GD350-250G-4	ACL2-280-4	DCL2-280-4	OCL2-280-4
GD350-280G-4	ACL2-280-4	DCL2-280-4	OCL2-280-4
GD350-315G-4	ACL2-350-4	DCL2-315-4	OCL2-350-4
GD350-350G-4	Standard	DCL2-400-4	OCL2-350-4
GD350-400G-4	Standard	DCL2-400-4	OCL2-400-4
GD350-450G-4	Standard	DCL2-500-4	OCL2-500-4
GD350-500G-4	Standard	DCL2-500-4	OCL2-500-4

Note:

- The rated input voltage drop of input reactors is 2%±15%.
- The current adjustment coefficient on the input side of the VFD is higher than 90% after a DC reactor is configured.
- The rated output voltage drop of output reactors is 1%±15%.
- The preceding table describes external accessories. You need to specify the ones you choose when purchasing accessories.

Table D-6 Reactors for AC 3PH 520V (-15%)–690V (+10%)

VFD model	Input reactor	DC reactor	Output reactor
GD350-022G-6	ACL2-030G-6	DCL2-030G-6	OCL2-030G-6
GD350-030G-6	ACL2-030G-6	DCL2-030G-6	OCL2-030G-6
GD350-037G-6	ACL2-055G-6	DCL2-055G-6	OCL2-055G-6
GD350-045G-6	ACL2-055G-6	DCL2-055G-6	OCL2-055G-6
GD350-055G-6	ACL2-055G-6	DCL2-055G-6	OCL2-055G-6
GD350-075G-6	ACL2-110G-6	DCL2110G-6	OCL2-110G-6
GD350-090G-6	ACL2-110G-6	DCL2-110G-6	OCL2-110G-6
GD350-110G-6	ACL2-110G-6	DCL2-110G-6	OCL2-110G-6
GD350-132G-6	ACL2-185G-6	DCL2-185G-6	OCL2-185G-6
GD350-160G-6	ACL2-185G-6	DCL2-185G-6	OCL2-185G-6
GD350-185G-6	ACL2-185G-6	DCL2-185G-6	OCL2-185G-6
GD350-200G-6	ACL2-250G-6	DCL2-250G-6	OCL2-250G-6
GD350-220G-6	ACL2-250G-6	DCL2-250G-6	OCL2-250G-6
GD350-250G-6	ACL2-250G-6	DCL2-250G-6	OCL2-250G-6
GD350-280G-6	ACL2-350G-6	DCL2-350G-6	OCL2-350G-6
GD350-315G-6	ACL2-350G-6	DCL2-350G-6	OCL2-350G-6
GD350-350G-6	ACL2-350G-6	DCL2-350G-6	OCL2-350G-6
GD350-400G-6	Standard	DCL2-400G-6	OCL2-400G-6
GD350-450G-6	Standard	DCL2-560G-6	OCL2-560G-6

VFD model	Input reactor	DC reactor	Output reactor
GD350-500G-6	Standard	DCL2-560G-6	OCL2-560G-6
GD350-560G-6	Standard	DCL2-560G-6	OCL2-560G-6
GD350-630G-6	Standard	DCL2-630G-6	OCL2-630G-6

Note:

- The rated input voltage drop of input reactors is 2%±15%.
- The current adjustment coefficient on the input side of the VFD is higher than 90% after a DC reactor is configured.
- The rated output voltage drop of output reactors is 1%±15%.
- The preceding table describes external accessories. You need to specify the ones you choose when purchasing accessories.

D.7 Filters

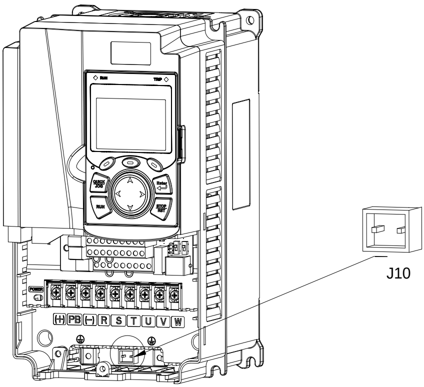
J10 is not connected in factory for the 380V 110kW and lower VFD models. Connect the J10 packaged with the manual if the requirements of level C3 need to be met.

J10 is connected in factory for the 380V 132kW and higher VFD models, all of which meet the requirements of level C3.

Note:

Disconnect J10 in the following situations:

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



Note: Do not connect C3 filters in IT power systems.

Interference filters on the input side can reduce the VFD interference on the surrounding devices.

Noise filters on the output side can decrease the radio noise caused by the cables between VFDs and motors and the leakage current of conducting wires.

INVT provides some of the filters for you to choose.

D.7.1 Filter model description

FLT – P 04 045 L – B

A B C D E F

Field identifier	Field description
A	FLT: Name of the VFD filter series
B	Filter type P: Power input filter L: Output filter
C	Voltage class 04: AC 3PH 380V (-15%)–440V (+10%) 06: AC 3PH 520V (-15%)–690V (+10%)
D	3-digit code indicating the rated current. For example, 015 indicates 15A.
E	Filter performance L: General H: High-performance
F	Filter application environment A: Environment Category I (IEC61800-3), C1 (EN 61800-3) B: Environment Category I (IEC61800-3), C2 (EN 61800-3) C: Environment Category II (IEC61800-3), C3 (EN 61800-3)

D.7.2 Filter model selection

Table D-7 AC 3PH 380V(-15%)–440V(+10%)

VFD model	Input filter	Output filter
GD350-1R5G-4	FLT-P04006L-B	FLT-L04006L-B
GD350-2R2G-4		
GD350-004G-4	FLT-P04016L-B	FLT-L04016L-B
GD350-5R5G-4		
GD350-7R5G-4	FLT-P04032L-B	FLT-L04032L-B
GD350-011G-4		
GD350-015G-4	FLT-P04045L-B	FLT-L04045L-B
GD350-018G-4		
GD350-022G-4	FLT-P04065L-B	FLT-L04065L-B
GD350-030G-4		
GD350-037G-4	FLT-P04100L-B	FLT-L04100L-B
GD350-045G-4		
GD350-055G-4	FLT-P04150L-B	FLT-L04150L-B

VFD model	Input filter	Output filter
GD350-075G-4		
GD350-090G-4	FLT-P04240L-B	FLT-L04240L-B
GD350-110G-4		
GD350-132G-4		
GD350-160G-4	FLT-P04400L-B	FLT-L04400L-B
GD350-185G-4		
GD350-200G-4		
GD350-220G-4	FLT-P04600L-B	FLT-L04600L-B
GD350-250G-4		
GD350-280G-4		
GD350-315G-4	FLT-P04800L-B	FLT-L04800L-B
GD350-350G-4		
GD350-400G-4		
GD350-450G-4	FLT-P041000L-B	FLT-L041000L-B
GD350-500G-4		

Note:

- The input EMI meets the C2 requirements after an input filter is configured.
- The preceding table describes external accessories. You need to specify the ones you choose when purchasing accessories.

Table D-8 AC 3PH 520V(-15%)–690V(+10%)

VFD model	Input filter	Output filter
GD350-022G-6	FLT-P06050H-B	FLT-L06050H-B
GD350-030G-6		
GD350-037G-6		
GD350-045G-6	FLT-P06100H-B	FLT-L06100H-B
GD350-055G-6		
GD350-075G-6		
GD350-090G-6		
GD350-110G-6	FLT-P06200H-B	FLT-L06200H-B
GD350-132G-6		
GD350-160G-6		
GD350-185G-6		
GD350-200G-6	FLT-P06300H-B	FLT-L06300H-B
GD350-220G-6		
GD350-250G-6		
GD350-280G-6		
GD350-315G-6	FLT-P06400H-B	FLT-L06400H-B
GD350-350G-6		

VFD model	Input filter	Output filter
GD350-400G-6	FLT-P061000H-B	FLT-L061000H
GD350-450G-6		
GD350-500G-6		
GD350-560G-6		
GD350-630G-6		

Note:

- The input EMI meets the C2 requirements after an input filter is configured.
- The preceding table describes external accessories. You need to specify the ones you choose when purchasing accessories.

D.8 Braking system

D.8.1 Braking component selection

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

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

The 380V 37kW and lower VFD models are equipped with built-in braking units, and the 380V 45kW and higher VFD models need to be configured with external braking units. The 380V 45kW–110kW VFD models can be configured with optional built-in braking units. After a built-in braking unit is configured for the VFD, the VFD model is added with a suffix "-B", for example, GD350-045G-4-B. Select braking resistors according to the specific requirements (such as the braking torque and braking usage requirements) on site.

Table D-9 Braking units for AC 3PH 380V(-15%)–440V(+10%)

VFD model	Braking unit model	Resistance applicable for 100% braking torque (Ω)	Dissipated power of braking resistor (kW)	Dissipated power of braking resistor (kW)	Dissipated power of braking resistor (kW)	Min. allowable brake resistance (Ω)
			10% braking usage	50% braking usage	80% braking usage	
GD350-1R5G-4	Built-in braking unit	326	0.23	1.1	1.8	170
GD350-2R2G-4		222	0.33	1.7	2.6	130
GD350-004G-4		122	0.6	3	4.8	80
GD350-5R5G-4		89	0.75	4.1	6.6	60
GD350-7R5G-4		65	1.1	5.6	9	47
GD350-011G-4		44	1.7	8.3	13.2	31
GD350-015G-4		32	2	11	18	23
GD350-018G-4		27	3	14	22	19
GD350-022G-4		22	3	17	26	17
GD350-030G-4		17	5	23	36	17
GD350-037G-4		13	6	28	44	11.7
GD350-045G-4	DBU100H-110-4	10	7	34	54	6.4
GD350-055G-4		8	8	41	66	
GD350-075G-4		6.5	11	56	90	
GD350-090G-4	DBU100H-160-4	5.4	14	68	108	4.4
GD350-110G-4		4.5	17	83	132	
GD350-132G-4	DBU100H-220-4	3.7	20	99	158	3.2
GD350-160G-4	DBU100H-320-4	3.1	24	120	192	2.2
GD350-185G-4		2.8	28	139	222	
GD350-200G-4		2.5	30	150	240	
GD350-220G-4	DBU100H-400-4	2.2	33	165	264	1.8
GD350-250G-4		2.0	38	188	300	
GD350-280G-4	DBU100H-320-4 Quantity: Two	3.6×2	21×2	105×2	168×2	2.2×2
GD350-315G-4		3.2×2	24×2	118×2	189×2	
GD350-355G-4		2.8×2	27×2	132×2	210×2	
GD350-400G-4		2.4×2	30×2	150×2	240×2	

VFD model	Braking unit model	Resistance applicable for 100% braking torque (Ω)	Dissipated power of braking resistor (kW) 10% braking usage	Dissipated power of braking resistor (kW) 50% braking usage	Dissipated power of braking resistor (kW) 80% braking usage	Min. allowable brake resistance (Ω)
GD350-450G-4	DBU100H-400-4 Quantity: Two	2.2×2	34×2	168×2	270×2	1.8×2
GD350-500G-4		2.0×2	38×2	186×2	300×2	

Note:

- Select braking resistors according to the resistance and power data provided by our company.
- The braking resistor may increase the braking torque of the VFD. The preceding table describes the resistance and power for 100% braking torque, 10% braking usage, 50% braking usage, and 80% braking usage. 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.

	✧ Do not use braking resistors whose resistance is lower than the specified minimum resistance. VFDs do not provide protection against overcurrent caused by resistors with low resistance.
	✧ In scenarios where braking is frequently implemented, that is, the braking usage is greater than 10%, you need to select a braking resistor with higher power as required by the operation conditions according to the preceding table.

External braking units need to be configured for the 660V models. Select braking resistors according to the specific requirements (such as the braking torque and braking usage requirements) on site.

Table D-10 Braking units for AC 3PH 520V(-15%)–690V(+10%)

VFD model	Braking unit model	Resistance applicable for 100% braking torque (Ω)	Braking resistor dissipated power (kW)			Min. allowable braking resistance (Ω)
			10% braking usage	50% braking usage	80% braking usage	
GD350-022G-6	DBU100H-110-6	55	4	17	27	10.0
GD350-030G-6		40.3	5	23	36	
GD350-037G-6		32.7	6	28	44	
GD350-045G-6		26.9	7	34	54	
GD350-055G-6		22.0	8	41	66	
GD350-075G-6		16.1	11	56	90	
GD350-090G-6		13.4	14	68	108	
GD350-110G-6		11.0	17	83	132	
GD350-132G-6	DBU100H-160-6	9.2	20	99	158	6.9
GD350-160G-6		7.6	24	120	192	
GD350-185G-6	DBU100H-220-6	6.5	28	139	222	5.0
GD350-200G-6		6.1	30	150	240	
GD350-220G-6		5.5	33	165	264	
GD350-250G-6	DBU100H-320-6	4.8	38	188	300	3.4
GD350-280G-6		4.3	42	210	336	
GD350-315G-6		3.8	47	236	378	
GD350-355G-6		3.5	53	263	420	
GD350-400G-6	DBU100H-400-6	3.0	60	300	480	2.8
GD350-450G-6	DBU100H-320-6 Quantity: Two	5.5×2	34×2	168×2	270×2	3.4×2
GD350-500G-6		4.8×2	38×2	188×2	300×2	
GD350-560G-6		4.3×2	42×2	210×2	336×2	
GD350-630G-6		3.8×2	47×2	236×2	378×2	

Note:

- Select braking resistors according to the resistance and power data provided by our company.
- The braking resistor may increase the braking torque of the VFD. The preceding table describes the resistance and power for 100% braking torque, 10% braking usage, 50% braking usage, and 80% braking usage. 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.

✧ Do not use braking resistors whose resistance is lower than the specified minimum resistance. The VFD does not provide protection against overcurrent caused by resistors with low resistance.

	✧ In scenarios where braking is frequently implemented, that is, the braking usage exceeds 10%, you need to select a braking resistor with higher power as required by the operation conditions according to the preceding table.

D.8.2 Braking resistor cable selection

Braking resistor cables should be shielded cables.

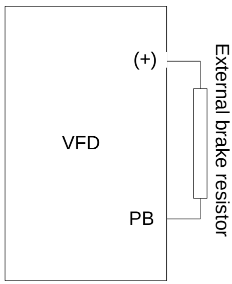
D.8.3 Braking resistor installation

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

	The materials near the braking resistor or unit must be non-flammable. The resistor surface temperature high. Air flowing from the resistor is of hundreds of degrees Celsius. Prevent any materials from contacting the resistor.

Installation of braking resistors

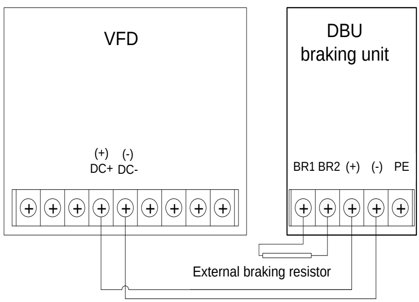
	✧ The 380V 37kW and lower VFD models need only external braking resistors. ✧ PB and (+) are the terminals for connecting braking resistors.



Installation of braking units

	✧ All 660V VFD models need external braking units. ✧ (+) and (-) are the terminals for connecting braking units. ✧ The connection cables between the (+) and (-) terminals of a VFD and those of a braking unit must be shorter than 5m, and the connection cables between the BR1 and BR2 terminals of a braking unit and the terminals of a braking resistor must be shorter than 10m.

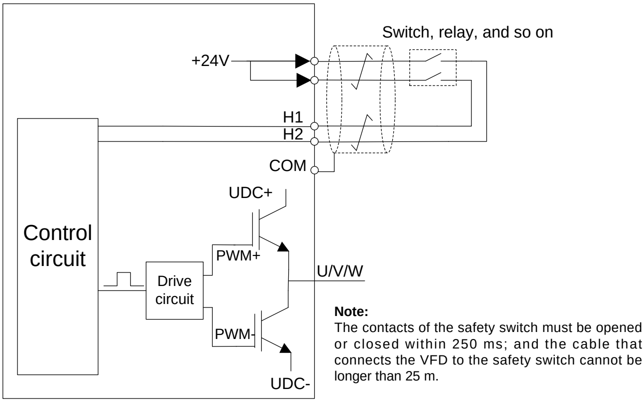
The following figure shows the connection of one VFD to a dynamic braking unit.



Appendix E STO function description

Reference standards: IEC 61508-1, IEC 61508-2, IEC 61508-3, IEC 61508-4, IEC 62061, ISO 13849-1, and IEC 61800-5-2

You can enable the safe torque off (STO) function to prevent unexpected startups when the main power supply of the drive is not switched off. The STO function switches off the drive output by turning off the drive signals to prevent unexpected startups of the motor (see the following figure). After the STO function is enabled, you can perform some-time operations (such as non-electrical cleaning in the lathe industry) and maintain the non-electrical components of the device without switching off the drive.



E.1 STO function logic table

The following table describes the input states and corresponding faults of the STO function.

STO input state	Corresponding fault
H1 and H2 opened simultaneously	The STO function is triggered, and the drive stops running. Fault code: 40: Safe torque off (STO)
H1 and H2 closed simultaneously	The STOP function is not triggered, and the drive runs properly.
One of H and H2 opened, and the other closed	The STL1, STL2, or STL3 fault occurs. Fault code: 41: Channel H1 exception (STL1) 42: Channel H2 exception (STL2) 43: Channel H1 and H2 exceptions (STL3)

E.2 STO channel delay description

The following table describes the trigger and indication delay of the STO channels.

STO mode	STO trigger and indication delay[1, 2]
STO fault: STL1	Trigger delay < 10 ms Indication delay < 280 ms
STO fault: STL2	Trigger delay < 10 ms Indication delay < 280 ms
STO fault: STL3	Trigger delay < 10 ms Indication delay < 280 ms
STO fault: STO	Trigger delay < 10 ms Indication delay < 100 ms

1. STO trigger delay: Time interval between trigger the STO function and switching off the drive output
2. STO instruction delay: Time interval between trigger the STO function and STO output state indication

E.3 STO function installation checklist

Before installing the STO, check the items described in the following table to ensure that the STO function can be properly used.

	Item
□	Ensure that the drive can be run or stopped randomly during commissioning.
□	Stop the drive (if it is running), disconnect the input power supply, and isolate the drive from the power cable through the switch.
□	Check the STO circuit connection according to the circuit diagram.
□	Check whether the shielding layer of the STO input cable is connected to the +24 V reference ground COM.
□	Connect the power supply.
□	Test the STO function as follows after the motor stops running: ✧ If the drive is running, send a stop command to it and wait until the shaft of the motor stops rotating. ✧ Activate the STO circuit and send a start command to the drive. Ensure that the motor does not start. ✧ Deactivate the STO circuit.
□	Restart the drive, and check whether the motor is running properly.
□	Test the STO function as follows when the motor is running: ✧ Start the drive. Ensure that the motor is running properly. ✧ Activate the STO circuit. ✧ The drive reports an STO fault (for details, see section 5.5.19 Fault handling). Ensure that the motor coasts to stop rotating. ✧ Deactivate the STO circuit.
□	Restart the drive, and check whether the motor is running properly.

Appendix F Further information

F.1 Product and service queries

Should you have any queries about the product, contact the local INVT office. Provide the model and serial number of the product you query about. You can visit www.invt.com to find a list of INVT offices.

F.2 Feedback on INVT VFD manuals

Your comments on our manuals are welcome. Visit www.invt.com, directly contact online service personnel or choose **Contact Us** to obtain contact information.

F.3 Documents on the Internet

You can find manuals and other product documents in the PDF format on the Internet. Visit www.invt.com and choose **Support** > **Download**.

Service line: 86-755-23535967 E-mail: overseas@invt.com.cn Website: www.invt.com

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Two companies are commissioned to manufacture: (For product code, refer to the 2nd/3rd place of S/N on the name plate.)

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