IMO

INSTRUCTION MANUAL

# *HD2*

## AC Variable Speed Inverter Drives


IMO Precision Controls Ltd.

*www.imopc.com*

# Preface

Thank you for choosing HD2 series inverter.

If not otherwise specified in this manual, the inverter always indicates HD2 series inverter, which is a high-performance and multi-function inverter aiming to integrate the capability to drive both synchronous motors and asynchronous motors, and support torque control, speed control, and position control. The inverter is armed with advanced vector control technology and the latest digital processor dedicated to motor control, thus enhancing product reliability and adaptability to the environment. The inverter adopts customized and industrialized design to realize excellent control performance through optimized functions and flexible applications.

To meet diversified customer demands, the inverter provides abundant expansion cards including programmable card, PG card, communication card and I/O card to achieve various functions as needed.

The programmable 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 inverter supports multiple types 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 inverter state anywhere any time through mobile APP.

The inverter uses high power density design. Some power ranges carry built-in DC reactors and braking units 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 inverter is installed and operated in a proper manner to give full play to its excellent performance and powerful functions.

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 inverter. If these safety precautions are ignored, physical injury, death, or equipment damage may occur.

Electrical equipment should be installed, operated, service and maintained only by competent personnel. No responsibility is assumed by IMO Precision Controls Ltd for any consequences arising out of the use of this product.

## 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 inverter 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

- ✧ 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 inverter or until the DC bus voltage is less than 36V. The minimum waiting time is listed in the table below.

| Inverter model | | Minimum waiting time |
|---|---|---|
| 380V | 1.5kW–110kW | 5 min |
| 380V | 132kW–315kW | 15 min |
| 380V | Above 355kW | 25 min |

- ✧ Do not refit the inverter unless authorized; otherwise, fire, electric shock or other injuries may occur.
- ✧ The base of the radiator may become hot during running. Do not touch to avoid hurt.
- ✧ The electrical parts and components inside the inverter are electrostatic. Take measures to prevent electrostatic discharge during related operation.

### 1.4.1 Delivery and installation

- ✧ Install the inverter on fire-retardant material and keep the inverter 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 inverter.
- ✧ Do not touch the inverter with wet items or body parts; otherwise, electric shock may occur.

**Note:**

- ✧ Select appropriate tools for delivery and installation to ensure a safe and proper running of the inverter 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 inverter against physical shock or vibration during delivery and installation.
- ✧ Do not carry the inverter by its front cover only as the cover may fall off.
- ✧ Installation site should be away from children and public places.

✧ The inverter 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 inverter.

✧ As leakage current of the inverter 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 inverter may occur.

### 1.4.2 Commissioning and running

| | |
|---|---|
| | ✧ Disconnect all power sources applied to the inverter before terminal wiring and wait for at least the time designated on the inverter after disconnecting the power sources.<br>✧ High voltage presents inside the inverter during running. Do not carry out any operation on the inverter during running except for keypad setup. For products at voltage levels of 4 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.<br>✧ The inverter may start up by itself when P01.21 (restart after power outage) is set to 1. Do not get close to the inverter and motor.<br>✧ The inverter cannot be used as "Emergency-stop device".<br>✧ The inverter cannot act as an emergency brake for the motor; it is a must to install mechanical brake device.<br>✧ During driving permanent magnet synchronous motor, besides above-mentioned items, the following work must be done before installation and maintenance.<br>• Disconnect all the input power sources including main power and control power.<br>• Ensure the permanent-magnet synchronous motor has been stopped, and the voltage on output end of the inverter is lower than 36V.<br>• After the permanent-magnet synchronous motor is stopped, wait for at least the time designated on the inverter, and ensure the voltage between "+" and "-" is lower than 36V.<br>• 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 inverter. |

**Note:**

- ✧ Do not switch on or switch off input power sources of the inverter frequently.
- ✧ If the inverter has been stored for a long time without use, set the capacitance and carry out inspection and pilot run on the inverter 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 inverter.<br>✧ Disconnect all the power sources applied to the inverter before terminal wiring and wait for at least the time designated on the inverter after disconnecting the power sources.<br>✧ Take measures to prevent screws, cables, and other conductive matters from falling into the inverter during maintenance and component replacement. |

**Note:**

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

### 1.4.4 What to do after scrapping

| | |
|---|---|
|  | ✧ The heavy metals inside the inverter 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 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 inverter is damaged or cracked. |
| 4. | Check whether the nameplate of the inverter 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 expansion card units) inside the packing box are complete. |

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

## 2.3 Application confirmation

Check the following items before operating on the inverter.

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

## 2.4 Environment confirmation

Check the following items before use.

| | |
|---|---|
| 1. | Check whether the ambient temperature of the inverter during actual application exceeds 40°C. If yes, derate 1% for every additional 1°C. In addition, do not use the inverter when the ambient temperature exceeds 50°C. |
| 2. | Check whether ambient temperature of the inverter 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 IMO 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 inverter, its ambient temperature is the air temperature inside the cabinet.

## 2.5 Installation confirmation

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

| | |
|---|---|
| 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 inverter are of correct type and installed properly; check whether the installation cables fulfill requirements on current-carrying capacity. |
| 3. | Check whether the inverter 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 inverter installation clearances meet the requirements in the operation manual. |
| 7. | Check whether the inverter installation mode complies with the requirements in the operation manual. Vertical installation should be adopted whenever possible. |
| 8. | Check whether inverter external connection terminals are securely wired with proper moment. |
| 9. | Check whether there are redundant screws, cables, or other conductive objects inside the inverter. If yes, take them out. |

## 2.6 Basic commissioning

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

| | |
|---|---|
| 1. | Select motor type, set motor parameters, and select inverter 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. |

## 2.7 Safety standard related data

| **IEC/EN 61508 (Class A system)** | | | | | | | **ISO 13849**** | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **SIL** | **PFH** | **HFT** | **SFF** | **λdu** | **λdd** | **PTI*** | **PL** | **CCF** | **MTTFd** | **DC** | **Category** |
| 2 | $8.73x10^{-10}$ | 1 | 71.23% | $1.79x10^{-9}$ | 0 | 1 year | d | 57 | 343.76 years | 60% | 3 |

* PTI: Proof test interval

** Depends on the the classification defined on the EN ISO 13849-1.

# 3 Product Overview

## 3.1 What this chapter contains

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

## 3.2 Basic principle

The inverter is used to control asynchronous AC induction motor and permanent-magnet synchronous motor. The figure below shows the main circuit diagram of the inverter. 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.

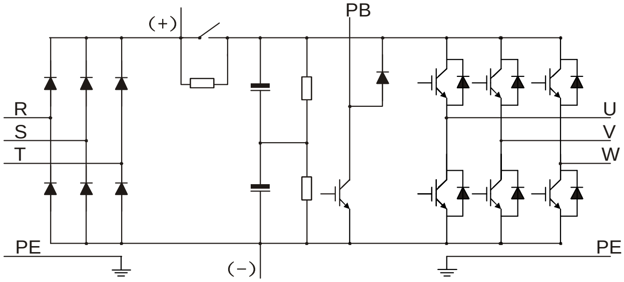



Figure 3-1 380V (15kW and lower) main circuit diagram

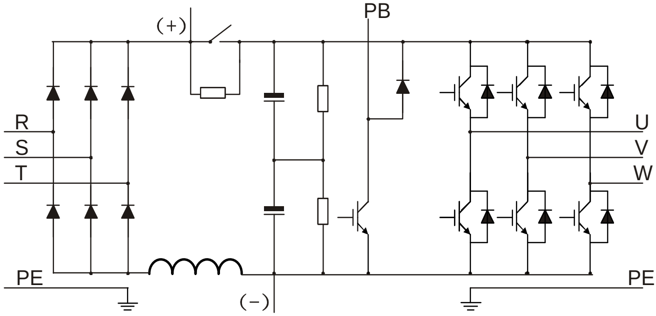



Figure 3-2 380V (18.5kW–110kW, 110kW included) main circuit diagram

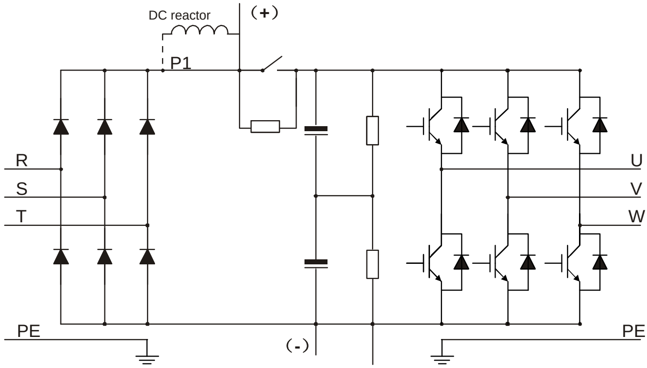



Figure 3-3 380V (132kW and higher) main circuit diagram

**Note:**

- The 380V 132kW and higher inverter models can be connected to external DC reactors. Before connection, remove the copper bar between P1 and (+). The 380V 132kW and higher inverter models can be connected to external braking units. DC reactors and braking units are optional parts.
- The 380V 18.5kW–110kW (inclusive) inverter models are equipped with built-in DC reactors.
- The 380V 37kW and lower inverter 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.

## 3.3 Product specifications

| Function description | | Specification |
|---|---|---|
| Power input | Input voltage (V) | AC 3PH 380V (-15%)–440V (+10%) Rated voltage: 380V<br>AC 3PH 520V (-15%)–690V (+10%) Rated voltage: 660V |
| | Input current (A) | Refer to section 3.6 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 Ratings. |
| | Output power (kW) | Refer to section 3.6 Ratings. |
| | Output frequency (Hz) | 0–400Hz |
| Technical control performance | Control mode | Space voltage vector control, sensorless vector control (SVC), and feedback vector control (FVC) |
| | Motor type | Asynchronous motor, permanent-magnet synchronous motor |
| | Speed regulation ratio | Asynchronous motor 1: 200 (SVC); Synchronous motor 1: 20 (SVC), 1:1000 (FVC) |
| | Speed control precision | ±0.2% (SVC), ±0.02% (FVC) |
| | Speed fluctuation | ± 0.3% (SVC) |

| Function description | | Specification |
|---|---|---|
| | Torque response | < 20ms (SVC); <10ms (FVC) |
| | Torque control precision | 10% (SVC); 5% (FVC) |
| | Starting torque | Asynchronous motor: 0.25Hz/150% (SVC)<br>Synchronous motor: 2.5 Hz/150% (SVC)<br>0Hz/200% (FVC) |
| | Overload capacity | 150% of rated current: 1min<br>180% of rated current: 10s<br>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.<br>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<br>Provides over 30 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.<br>**Note:** Only available for the 4kW and higher inverter models. |
| | Retention at transient voltage drop | Keeps running with regenerative energy when the grid transiently drops. |
| | Motor switchover | Supports two groups of motor parameters to control motor switchover. |
| Peripheral interface | Terminal analog input resolution | No more than 20mV |
| | Terminal digital input resolution | No more than 2ms |
| | Analog input | 2 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<br>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<br>One Y terminal open collector output |

| Function description | | Specification |
|---|---|---|
| | Relay output | Two programmable relay outputs<br>RO1A: NO, RO1B NC, RO1C: common<br>RO2A: NO, RO2B: NC, RO2C: common<br>Contact capacity: 3A/AC250V, 1A/DC30V |
| | Extension interface | Three extension interfaces: SLOT1, SLOT2, and SLOT3 (only on the control boards of 7.5kW and higher inverter models)<br>Expandable PG card, programmable expansion 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 when the ambient temperature exceeds 40°C. |
| | IP rating | IP20 |
| | Pollution degree | Degree 2 |
| | Cooling mode | Forced air cooling |
| | Braking unit | For 380V 37kW and lower: standard part, already built in<br>For 380V 45kW–110kW (inclusive): optional part, built-in only<br>For all 660V models: optional part, externally connected only |
| | EMC filter | The conductivity and transmission of all 380V inverter models can meet the IEC61800-3 C3 requirements.<br>Optional external filters can be used to meet the IEC61800-3 C2 requirements.<br>**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

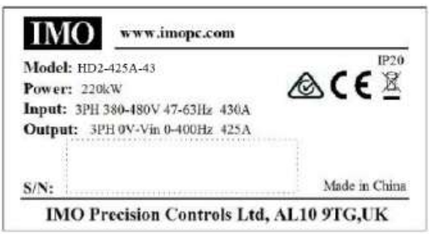



Figure 3-4 Product nameplate

**Note:**

- The preceding nameplate is a standard product nameplate example. The marking such as CE, TUV, and IP20 on the nameplate is marked according to the actual certificate result.
- You can scan the QR code on the nameplate to download the product App and 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 inverter.

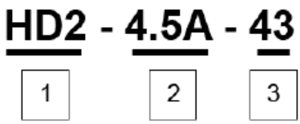



Figure 3-5 Type designation key

| Field | Sign | Description | Contents |
|---|---|---|---|
| Abbreviation of product series | ① | Abbreviation of product series | HD2: HD2 series inverter |
| Rated power | ② | Power range + load type | 4.5A = 4.5Amps continuous rating |
| Voltage class | ③ | Voltage class | 23: AC 3PH 200V (-15%) ~240V (+10%)<br>43: AC 3PH 380V (-15%) ~440V (+10%) |

## 3.6 Ratings of a single inverter

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

| Product model | Output power (kW) | Input current (A) | Output current (A) |
|---|---|---|---|
| HD2-3.7A-43 | 1.5 | 5.0 | 3.7 |
| HD2-5A-43 | 2.2 | 5.8 | 5 |
| HD2-9.5A-43 | 4 | 13.5 | 9.5 |
| HD2-14A-43 | 5.5 | 19.5 | 14 |
| HD2-18.5A-43 | 7.5 | 25 | 18.5 |
| HD2-25A-43 | 11 | 32 | 25 |
| HD2-32A-43 | 15 | 40 | 32 |
| HD2-38A-43 | 18.5 | 47 | 38 |
| HD2-45A-43 | 22 | 51 | 45 |
| HD2-60A-43 | 30 | 70 | 60 |
| HD2-75A-43 | 37 | 80 | 75 |
| HD2-92A-43 | 45 | 98 | 92 |
| HD2-115A-43 | 55 | 128 | 115 |

| Product model | Output power (kW) | Input current (A) | Output current (A) |
|---|---|---|---|
| HD2-150A-43 | 75 | 139 | 150 |
| HD2-180A-43 | 90 | 168 | 180 |
| HD2-215A-43 | 110 | 201 | 215 |

**Note:**

- The input current of the 1.5–500kW inverter 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.

## 3.7 Parallel inverter models

| Power (kW) | 380V parallel inverter requirement | | 660V parallel inverter requirement | |
|---|---|---|---|---|
| | Power (kW) | Quantity | Power (kW) | Quantity |
| 560 | 280 | 2 | - | - |
| 630 | 315 | 2 | - | - |
| 710 | 350 | 2 | 350 | 2 |
| 800 | 400 | 2 | 400 | 2 |
| 1000 | 500 | 2 | 500 | 2 |
| 1200 | 400 | 3 | 630 | 2 |
| 1500 | 500 | 3 | 500 | 3 |
| 2000 | 500 | 4 | 500 | 4 |
| 2500 | 500 | 5 | 630 | 4 |
| 3000 | 500 | 6 | 630 | 5 |

## 3.8 Ratings of parallel products

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

| Rated output power (kW) | Rated input current (A) | Rated output current (A) |
|---|---|---|
| 560 | 1090 | 1060 |
| 630 | 1220 | 1200 |
| 710 | 1250 | 1300 |
| 800 | 1430 | 1440 |
| 1000 | 1780 | 1720 |
| 1200 | 2145 | 2160 |
| 1500 | 2670 | 2580 |
| 2000 | 3560 | 3440 |
| 2500 | 4450 | 4300 |
| 3000 | 5340 | 5160 |

## 3.9 Structure diagram

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

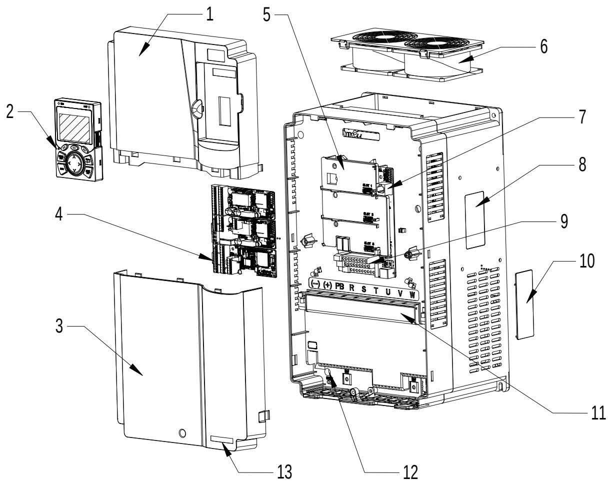



Figure 3-6 Structure diagram

| No. | Item | Description |
|---|---|---|
| 1 | Upper cover | Protects internal components and parts. |
| 2 | Keypad | For details, see section 5.4 Operating the inverter through the keypad. |
| 3 | Lower cover | Protects internal components and parts. |
| 4 | Expansion card | Optional. For details, see Appendix A Expansion Cards. |
| 5 | Baffle of control board | Protects the control board and install expansion 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 | HD2 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 inverter.

- ✧ 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 inverter power is disconnected before installation. If the inverter has been powered on, disconnect the inverter, and wait for at least the time designated on the inverter, and ensure the POWER indicator is off. You are recommended to use a multimeter to check and ensure the inverter DC bus voltage is below 36V.
- ✧ Installation must be designed and done according to applicable local laws and regulations. IMO does not assume any liability whatsoever for any installation which breaches local laws and regulations. If recommendations given by IMO are not followed, the inverter may experience problems that the warranty does not cover.

## 4.2 Mechanical installation

### 4.2.1 Installation environment

Installation environment is essential for the inverter to operate at its best in the long run. The installation environment of the inverter should meet the following requirements.

| Environment | Condition |
|---|---|
| Installation site | Indoors |
| Ambient temperature | ✧ -10–+50°<br>✧ When the ambient temperature exceeds 40°C, derate 1% for every additional 1°C.<br>✧ It is not recommended to use the inverter when the ambient temperature is above 50°C.<br>✧ To improve reliability, do not use the inverter in cases where the temperature changes rapidly.<br>✧ When the inverter 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.<br>✧ When the temperature is too low, if restart a inverter which has been idled for a long time, it is required to install external heating device before use to eliminate the freeze inside the inverter, failing to do so may cause damage to the inverter. |
| Humidity | ✧ The relative humidity (RH) of the air is less than 90%. |

| Environment | Condition |
|---|---|
| | ✧ Condensation is not allowed.<br>✧ 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.<br>✧ Away from electromagnetic radiation sources.<br>✧ Away from oil mist, corrosive gases, and combustible gases.<br>✧ Ensure foreign object like metal powder, dust, oil, and water will not fall into the inverter (do not install the inverter onto combustible object like wood).<br>✧ Away from radioactive substance and combustible objects<br>✧ Away from harmful gases and liquids<br>✧ Low salt content<br>✧ No direct sunlight |
| Altitude | ✧ Below 1000m.<br>✧ When the altitude exceeds 1000m, derate 1% for every additional 100m.<br>✧ When the installation site altitude exceeds 3000m, consult the local IMO dealer or office. |
| Vibration | Max. vibration acceleration: 5.8m/s$^2$ (0.6g) |
| Installation direction | You are recommended to install the inverter vertically to ensure good heat dissipation effect. |

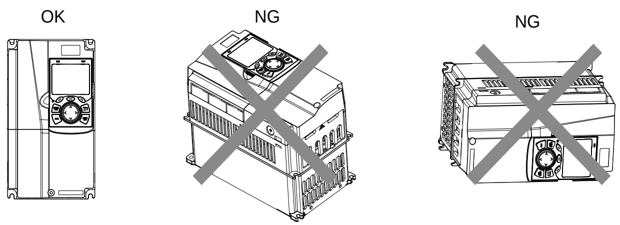
**Note:**

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

### 4.2.2 Installation direction

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

The inverter must be installed vertically. Check the installation position according to following requirements. See Appendix C Dimension Drawings.



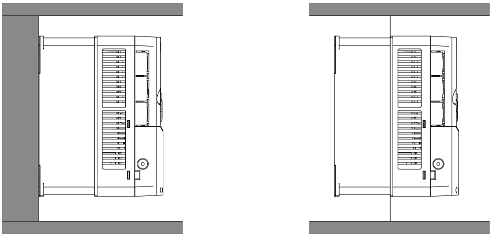

Vertical installation B. Horizontal installation C. Transverse installation

Figure 4-1 Installation direction of the inverter

### 4.2.3 Installation mode

There are three kinds of installation modes based on different inverter 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 220–3000kW, and 660V 250–3000kW



Wall-mounting Flange-mounting

Figure 4-2 Installation mode

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

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

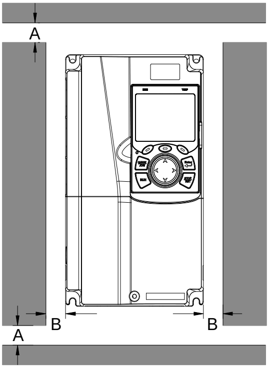
(3) Put the inverter on the wall.

(4) Tighten the fixing screws on the wall.

**Note:**

- The flange-mounting plate is a must for the 380V 1.5–110kW inverter models that adopt flange-mounting mode, while the 380V 132–200kW and 660V 22–220kW models need no flange-mounting plate.
- The optional installation base is available for the 380V 220–315kW and 660V 250–355kW inverter models. The base can hold an input AC reactor (or DC reactor) and an output AC reactor.

#### 4.2.4 Single-unit installation



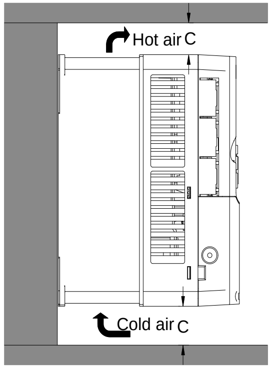
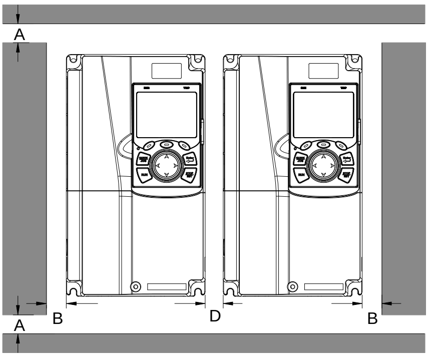




Figure 4-3 Single-unit installation

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

#### 4.2.5 Multiple-unit installation



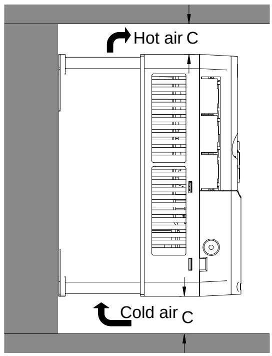




Figure 4-4 Parallel installation

**Note:**

- When you install inverters in different sizes, align the top of each inverter 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

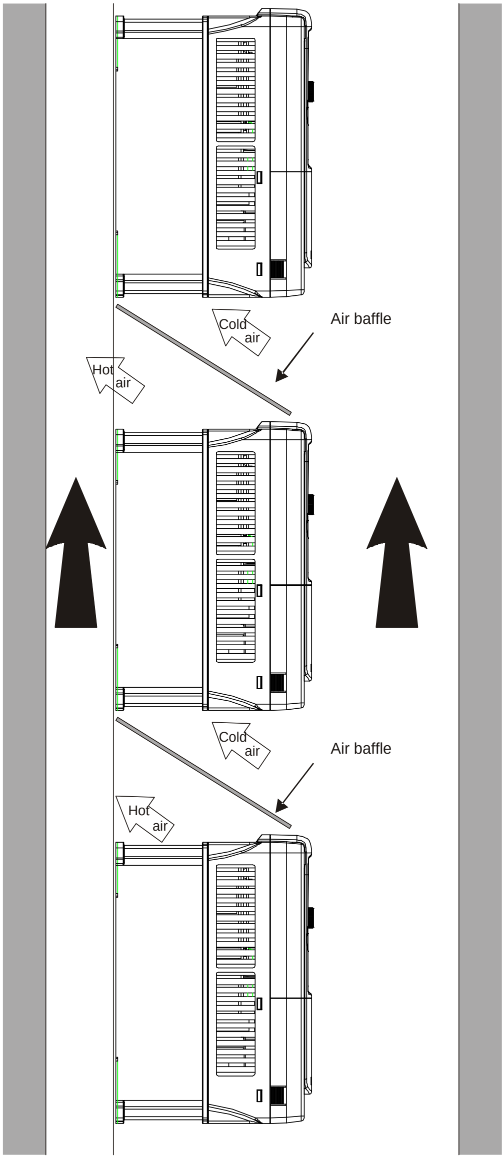



Figure 4-5 Vertical installation

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

### 4.2.7 Tilted installation

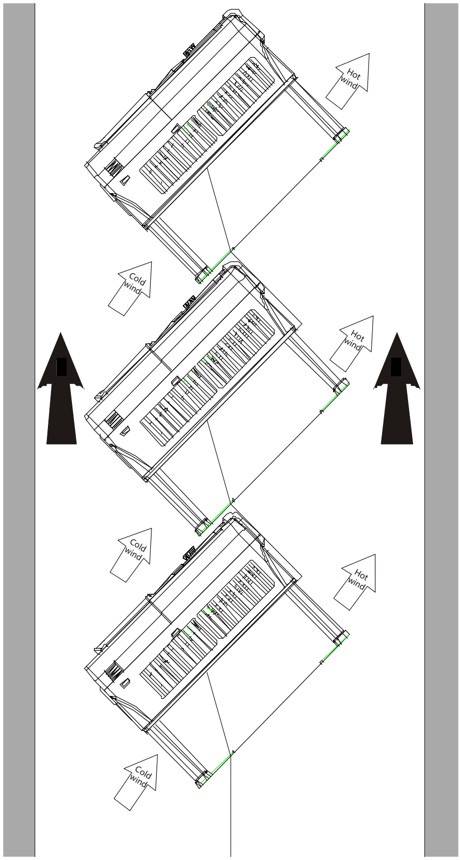



Figure 4-6 Tilted installation

**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 for a single inverter

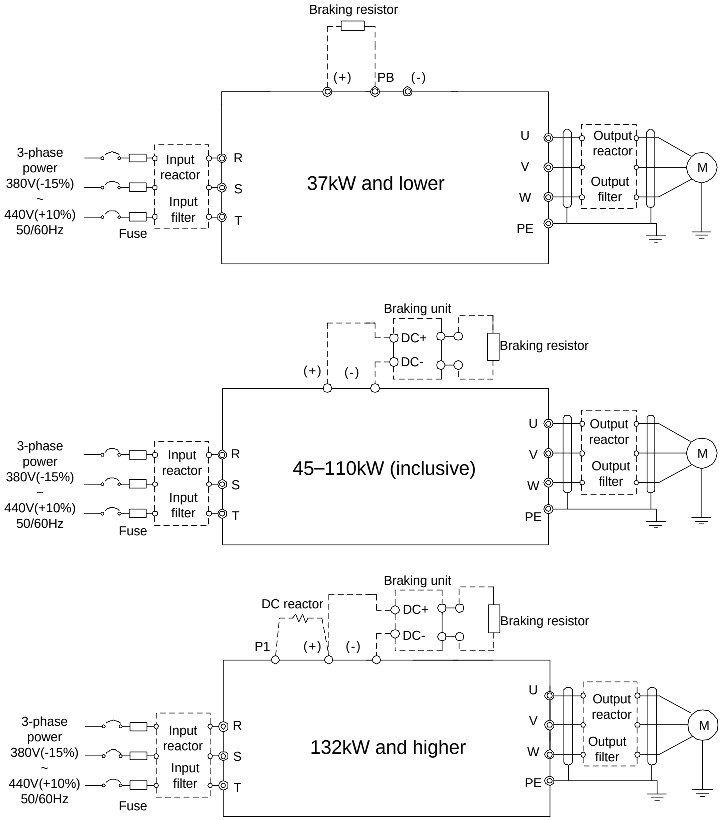
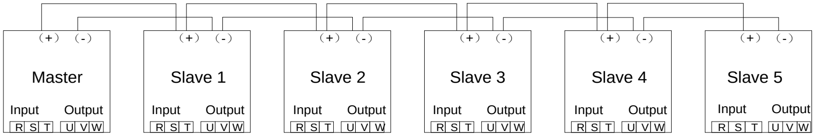



Figure 4-7 Main circuit wiring diagram for AC 3PH 380V (-15%)–440V (+10%)

**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 inverter 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 inverter models.

### 4.3.2 Wiring diagram of main circuit for parallel inverters




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

Note:

- The number of inverters that can be paralleled depends on the actual power. A maximum of six inverters can be paralleled together.
- Both the input side and output side of the master and slave need to be connected with parallel connection cables of the same length.

### 4.3.3 Main circuit terminal diagram

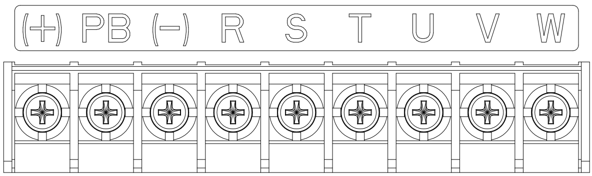



Figure 4-8 3PH 380V 22kW and lower

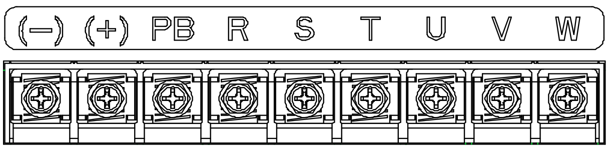



Figure 4-9 3PH 380V 30–37kW

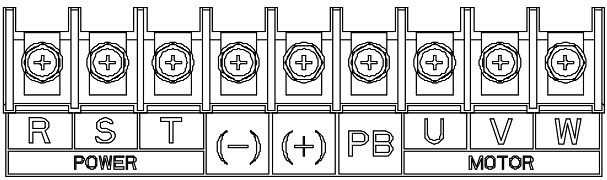



Figure 4-10 3PH 380V 45–110kW (Enabling PB when a braking unit is embedded)

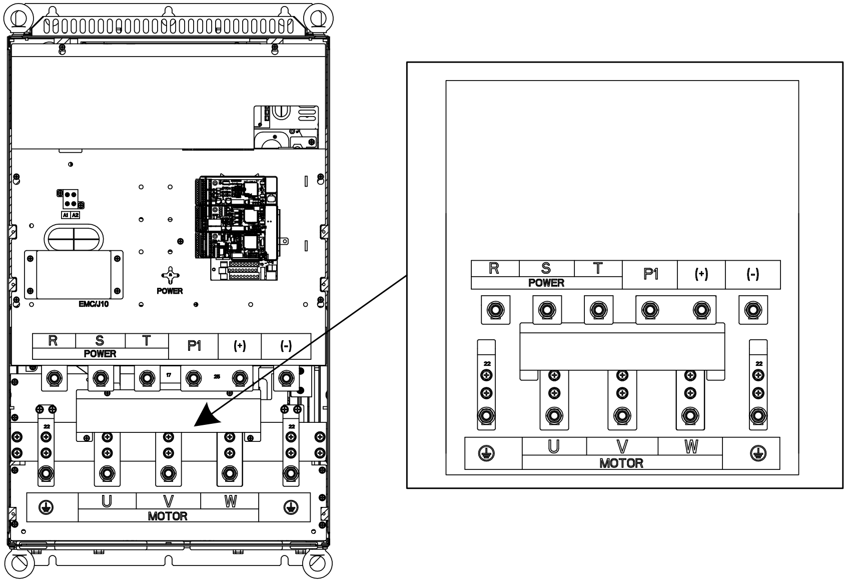



Figure 4-11 380V 132–200kW and 660V 160–220kW

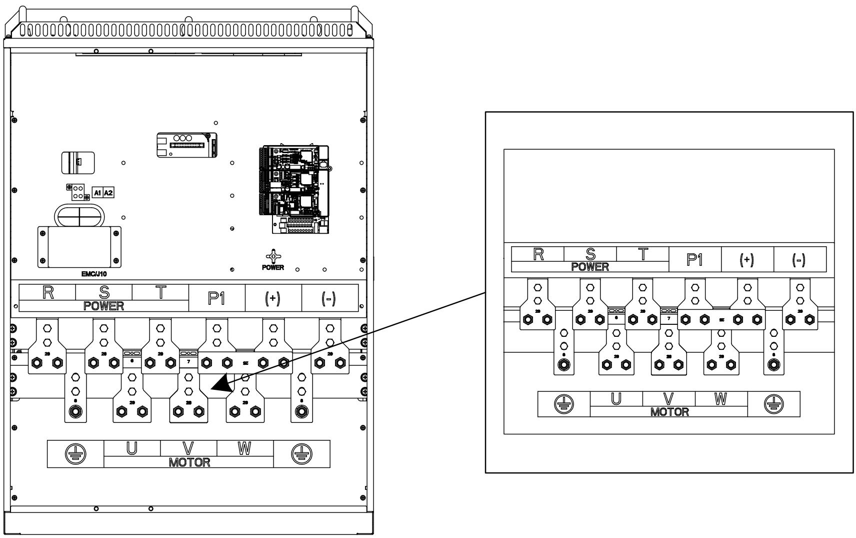



Figure 4-12 380V 220–315kW and 660V 250–355kW

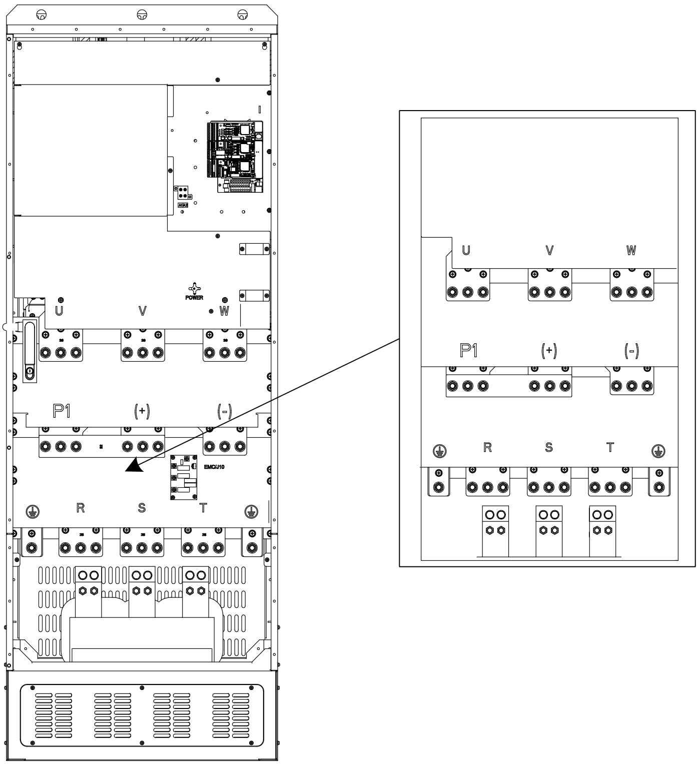



Figure 4-13 380V 355–500kW and 660V 400–630kW

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

| **Terminal** | **Terminal name** | | | **Function description** |
|---|---|---|---|---|
| | **380V 37kW and lower** | **380V 45–110kW (inclusive)** | **380V 132kW and higher** | |
| PE | Safety protection grounding terminal | | | Grounding terminal for safety protection. Each inverter carries 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 inverter 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 provided for external connection.
- HD2 series inverters cannot share the DC bus with CH series inverters.
- When sharing the DC bus, the inverters must be the same in power and must be simultaneously powered on or off.
- In shared DC bus running mode, current balance on the inverter input side must be considered during wiring, and equalizing reactors are recommended to be configured.

### 4.3.4 Wiring procedure of the main circuit terminals

1. Connect the grounding line of the input power cable to the grounding terminal (PE) of the inverter, 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 inverter, 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 inverter mechanically if allowed.

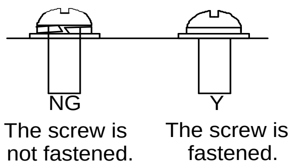



Figure 4-14 Screw installation diagram

## 4.4 Standard wiring of control circuit

### 4.4.1 Wiring diagram of basic control circuit

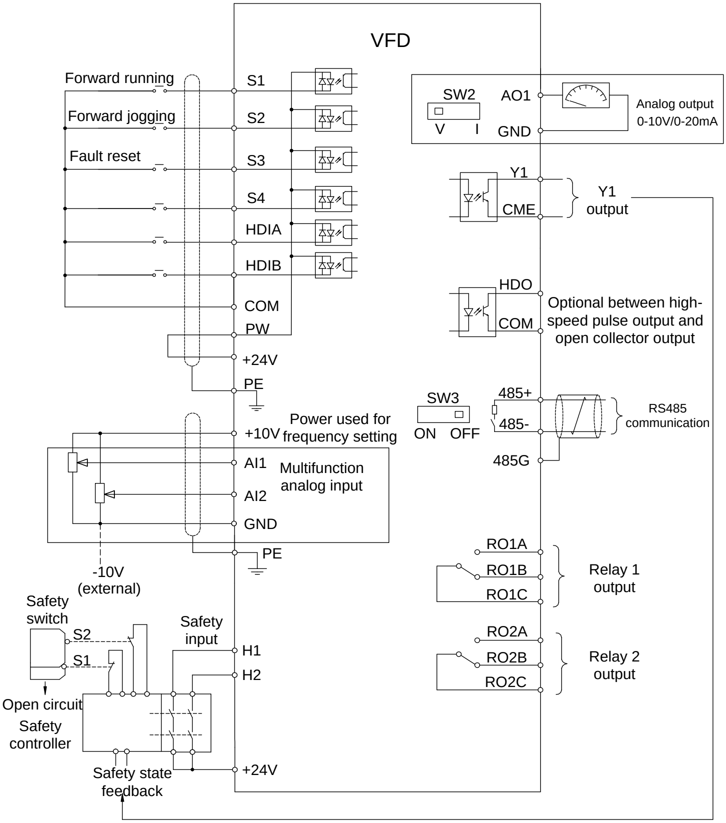



Figure 4-15 Wiring diagram of control circuit

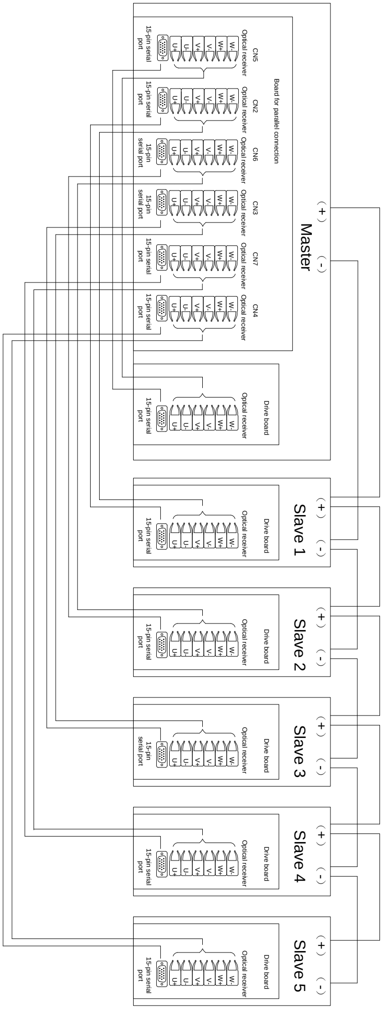
**Note:** If wire-passing board outlet space is insufficient when all terminals on the control board are wired, cut the knock-out hole on the lower cover for wire outlet. If a dangerous situation occurs when the knock-out hole is cut for a purpose but not wire outlet, we will not bear any responsibility.

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

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

### 4.4.2 Wiring diagram of control circuit for parallel inverters

| | Master | Master–Slave 1 | Master–Slave 2 | Master–Slave 3 | Master–Slave 4 | Master–Slave 5 |
|---|---|---|---|---|---|---|
| 15-core serial port cable length | About 1000mm | About 2500mm | About 2500mm | About 3500mm | About 4500mm | About 5500mm |
| Optical fiber cable length | About 1000mm | About 1500mm | About 2600mm | About 3700mm | About 4800mm | About 5900mm |



### 4.4.3 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.

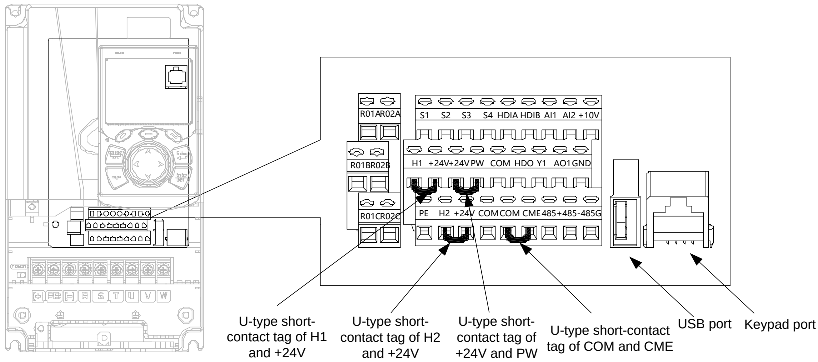



Figure 4-16 Position of U-type short-contact tag

**Note:** As shown in Figure 4-16, 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 inverter 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.

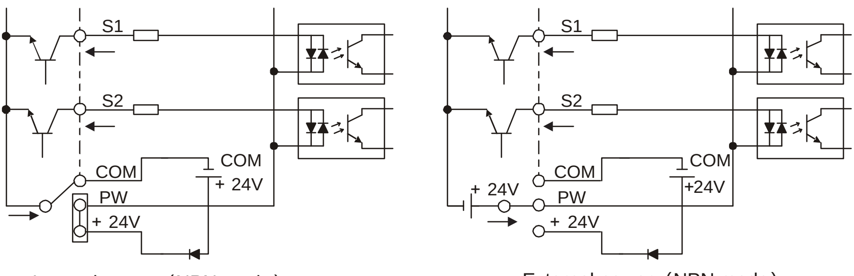
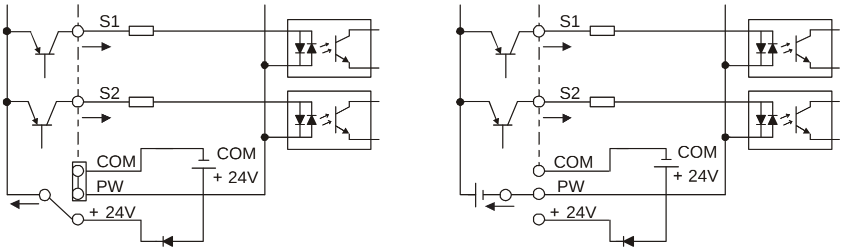



Figure 4-17 NPN mode

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




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

Figure 4-18 PNP mode

## 4.5 Wiring protection

### 4.5.1 Protect the inverter and input power cable in short-circuit

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

Carry out protective measures according to the following requirements.

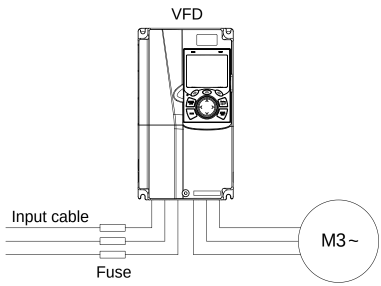



Figure 4-19 Fuse configuration

**Note:** Select the fuse according to operation manual. During short-circuit, the fuse will protect input power cables to avoid damage to the inverter; when internal short-circuit occurred to the inverter, 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 inverter current, the inverter will be able to protect the motor cable and motor during short circuit without other protective devices.

| | |
|---|---|
|  | ✧ If the inverter 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 inverter 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 an inverter 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 inverter output terminals U, V and W. The voltage applied to motor cable may cause permanent damage to the inverter. |

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 inverter output ends simultaneously.

# 5 Basic Operation Guidelines

## 5.1 What this chapter contains

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

## 5.2 Keypad introduction

The inverter has been equipped with an 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 inverter.

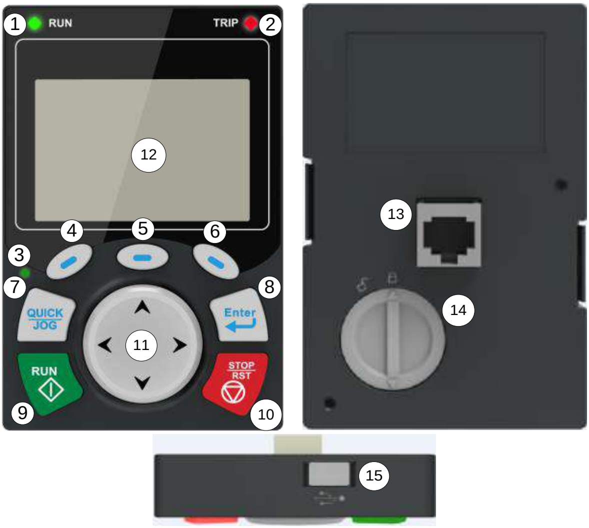


Figure 5-15-25-3 Keypad diagram

**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 inverter), 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.<br>LED off – the inverter is stopped.<br>LED blinking – the inverter is in parameter autotune<br>LED on – the inverter is running |

| Item | Instruction | | | |
|---|---|---|---|---|
| | 2) | TRIP | | Fault indicator.<br>LED on – in fault state<br>LED off – in normal state<br>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.<br>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 P07.02, as shown below.<br>0: No function<br>1: Jogging (linkage indicator (3); logic: NO);<br>2: Reserved<br>3: FWD/REV switchover (linkage indicator (3); logic: NC)<br>4: Clear UP/DOWN setting (linkage indicator (3) logic: NC)<br>5: Coast to stop (linkage indicator (3); logic: NC)<br>6: Switching running command reference mode in order (linkage indicator (3); logic: NC)<br>7: Reserved<br>**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/<br>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<br>UP: <br>DOWN: <br>LEFT: <br>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.<br>DOWN: The function of DOWN key varies with interfaces, such as shifting down the displayed item, shifting down the selected item, changing digits.<br>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.<br>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 inverter. |
| | (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 stops state.

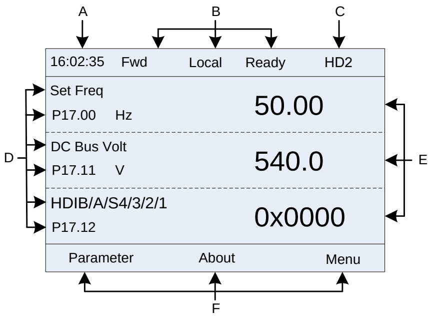



Figure 5-45-55-6 Main interface of LCD

| Area | Name | Used to |
|---|---|---|
| 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 inverter |
| Header B | Inverter running state display area | Display the running state of the inverter:<br>1. Display motor rotating direction: "Forward" – Run forward during operation; Reverse – Run reversely during operation; "Forbid" – Reverse running is forbidden.<br>2. Display inverter running command channel: "Local" – Keypad; "Terminal" – Terminal; "Remote" - Communication<br>3. Display current running state of the inverter: "Ready" – The inverter is in stop state (no fault); "Run" – The inverter is in running state; "Jog" – The inverter is in jogging state; "Pre-alarm" – the inverter is under pre-alarm state during running; "Fault" – inverter fault occurred. |
| Header C | inverter model display area | Inverter model display: "HD2" – current inverter is HD2 series inverter |
| Display D | Parameter names and function codes on the inverter homepage | Display a maximum of three parameter names and function codes on the homepage. The parameters diplayed on the homepage can be managed. |
| Display E | Values of parameters on the inverter homepage | Display the values of parameters on the inverter homepage, which are updated in real time. |
| Footer F | Corresponding menus of function keys (4), (5) and (6) | Indicate the menus corresponding to function keys (4), (5) and (6). The corresponding menus of function keys (4), (5) and (6) vary with interfaces, and the content displayed in this area varies also. |

## 5.3 Keypad display

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

### 5.3.1 Displaying stopped-state parameters

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

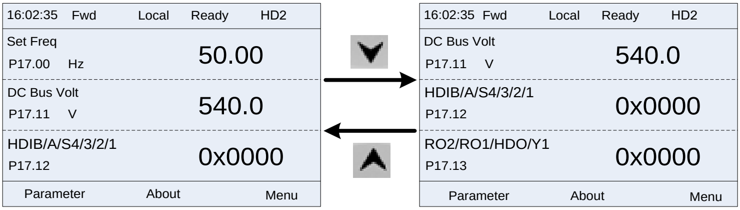



Figure 5-7 Stopped-state parameter display 1

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

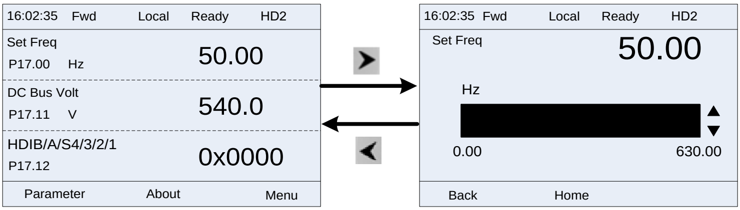



Figure 5-8 Stopped-state parameter display 2

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

### 5.3.2 Displaying running-state parameters

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

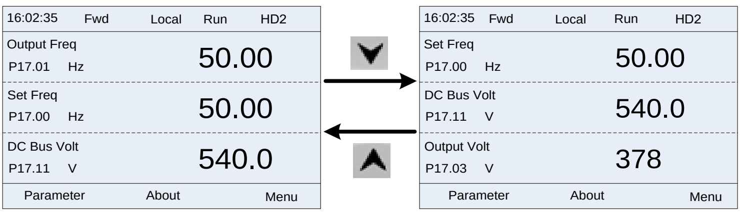



Figure 5-9 Running parameter display state

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

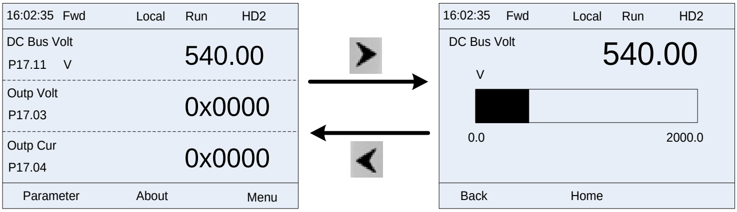



Figure 5-10 Running parameter display state

In 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. A function code which has been added to the running display parameter list can also be deleted or shifted.

### 5.3.3 Displaying fault information

The inverter 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.

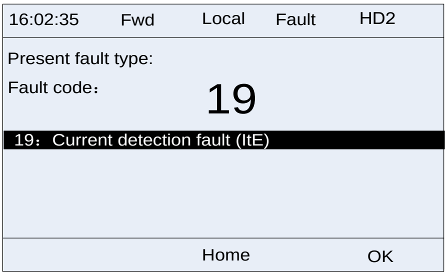



Figure 5-11 Fault alarm display state

## 5.4 Operating the inverter through the keypad

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

### 5.4.1 Enter/exit menu

The keypad displays three main menus at the home interface by default: **Parameter**, **About**, and **Menu**.

The following figure shows how to enter the **Parameter** main menu and how to operate under this main menu.

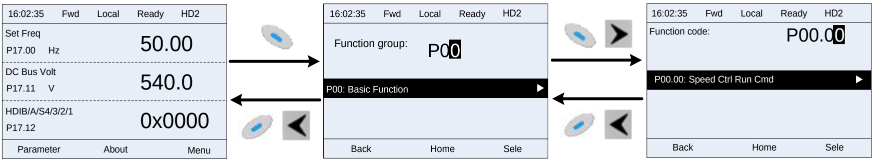



Figure 5-12 Enter/exit menu diagram 1

The following figure shows how to enter the **Menu** main menu and how to operate under this main menu.

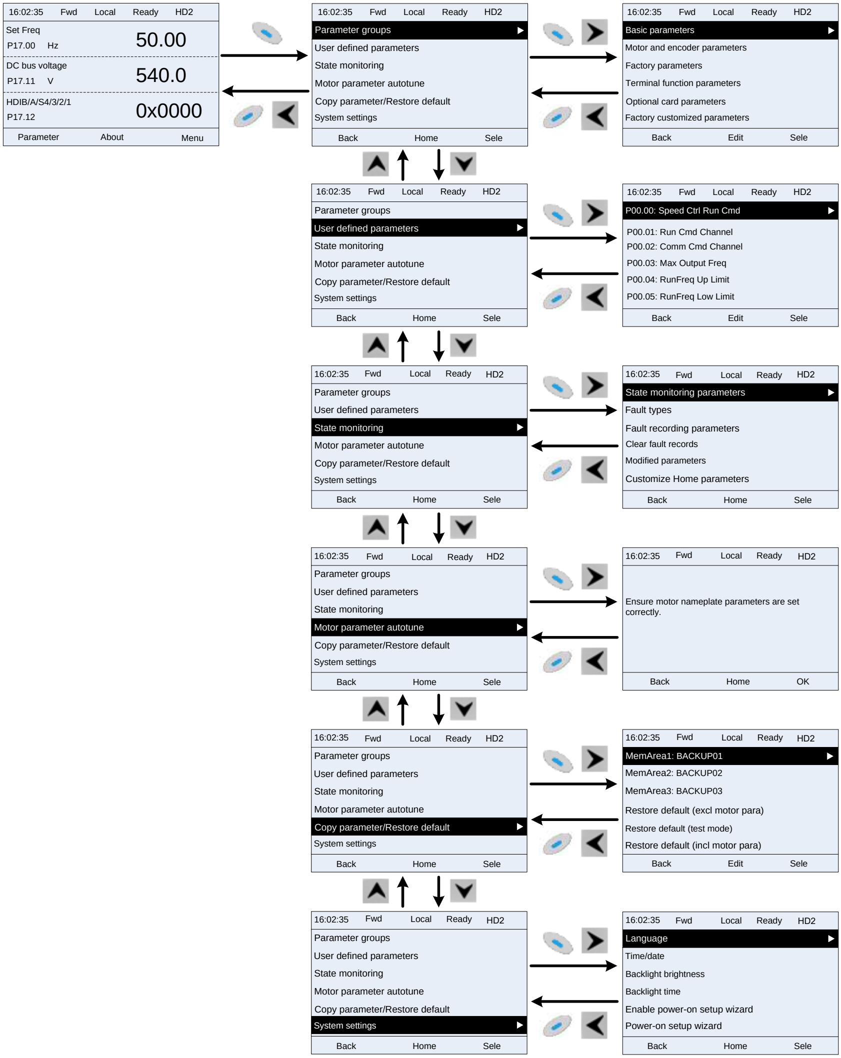



Figure 5-13 Enter/exit menu diagram 2

The keypad menu setup is shown as below.

| Level 1 | Level 2 | Level 3 | Level 4 |
|---|---|---|---|
| Parameter groups | Basic parameters | P00: Basic Function | P00.xx |
| | | P01: Start/stop control | P01.xx |
| | | P03: Motor1 Vector Ctrol | P03.xx |
| | | P04: V/F Control | P04.xx |
| | | P07: HMI | P07.xx |

| Level 1 | Level 2 | Level 3 | Level 4 |
|---|---|---|---|
| | | P08: Enhanced Function | P08.xx |
| | | P09: PID Control | P09.xx |
| | | P10: PLC&Mul-stepSpCtrl | P10.xx |
| | | P11: Protection Param | P11.xx |
| | | P13: SM Ctrl Param | P13.xx |
| | | P14: Serial Comm Func | P14.xx |
| | | P21: Position Ctrl | P21.xx |
| | | P22: Spdl Positioning | P22.xx |
| | | P23: Motor 2 Vector Ctrl | P23.xx |
| | Motor and encoder parameters | P02: Motor 1 Param | P02.xx |
| | | P12: Motor 2 Param | P12.xx |
| | | P20: Motor 1 EEncoder | P20.xx |
| | | P24: Motor 2 Encoder | P24.xx |
| | Factory parameters | P99: Factory Func | P99.xx |
| | Terminal function parameters | P05: Input Terminals | P05.xx |
| | | P06: Output Terminals | P06.xx |
| | | P98: AIAO Calibration | P98.xx |
| | Optional card parameters | P15: Comm Ex-card 1 | P15.xx |
| | | P16: Comm Ex-card 2 | P16.xx |
| | | P25: Ex I/OCard InpFunc | P25.xx |
| | | P26: Ex I/OCard OutpFunc | P26.xx |
| | | P27: PLC Func | P27.xx |
| | | P28: Master/slave Ctrl | P28.xx |
| | Factory customized parameters | P90: Tension control speed mode | P90.xx |
| | | P91: Tension control torque | P91.xx |
| | | P92: Tension control optimization | P92.xx |
| User defined parameters | / | / | Pxx.xx<br>... |
| State monitoring | State monitoring parameters | P07: HMI | P07.xx |

| Level 1 | Level 2 | Level 3 | Level 4 |
|---|---|---|---|
| | | P17: State Viewing Func | P17.xx |
| | | P18: Cl-lpCtrlStateView | P18.xx |
| | | P19: Ex-card StateView | P19.xx |
| | | P93: Tension control state viewing func | P93.xx |
| | Fault types | / | P07.27: TypeofLatelyFault |
| | | | P07.28: Typeof1stLastFault |
| | | | P07.29: Typeof2ndLastFault |
| | | | P07.30: Typeof3rdLastFault |
| | | | P07.31: Typeof4thLastFault |
| | | | P07.32: Typeof5thLastFault |
| | Fault recording parameters | / | P07.33: RunFreq atLatelyFault<br>...<br>P07.xx: xx state of fault xx |
| | Clear fault records | / | Sure to clear fault records? |
| | Modified parameters | / | Pxx.xx: Modified parameter 1 |
| | | | Pxx.xx: Modified parameter 2 |
| | | | Pxx.xx: Modified parameter xx |
| | Customize Home parameters | Stopped-state parameters | / |
| | | Running-state parameters | / |
| Motor parameter autotune | / | Ensure motor nameplate parameters are set correctly. | Complete para rotary autotune |
| | | | Complete para static autotune |
| | | | Partial para static autotune |
| | | | Complete para rotary autotune 2 (for AM) |
| | | | Partial para static autotune 2 (for AM) |
| Copy parameter/Restore | / | MemArea1: BACKUP01 | Upload local func para to keypad |
| | | | Download all func para from |

| Level 1 | Level 2 | Level 3 | Level 4 |
|---|---|---|---|
| default | | | keypad |
| | | | Download NonMotor func para from keypad |
| | | | Download motor func para from keypad |
| | | MemArea2: BACKUP012 | Upload local func para to keypad |
| | | | Download all func para from keypad |
| | | | Download NonMotor func para from keypad |
| | | | Download motor func para from keypad |
| | | MemArea3: BACKUP03 | Upload local func para to keypad |
| | | | Download all func para from keypad |
| | | | Download NonMotor func para from keypad |
| | | | Download motor func para from keypad |
| | | Restore default (excl motor para) | Sure to restore defaults (excl motor para)? |
| | | Restore default (test mode) | Sure to restore default (test mode)? |
| | | Restore default (incl motor para) | Sure to restore default (incl motor para)? |
| System settings | / | / | Language |
| | | | Time/date |
| | | | Backlight brightness |
| | | | Backlight time |
| | | | Enable power-on setup wizard |
| | | | Power-on setup wizard |
| | | | Keypad programming |
| | | | Fault time setting |
| | | | Control board programming |
| | | | Up/Down key sensitivity |

### 5.4.2 Editing a parameter list

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

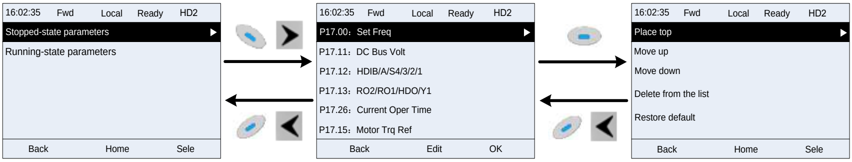



Figure 5-14 List edit diagram 1

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

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

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

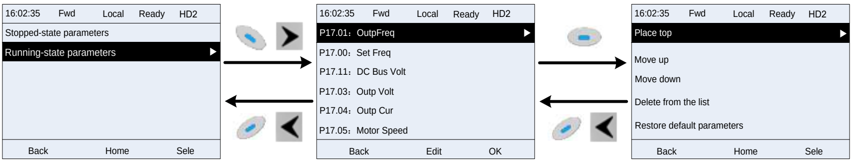



Figure 5-15 List edit diagram 2

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

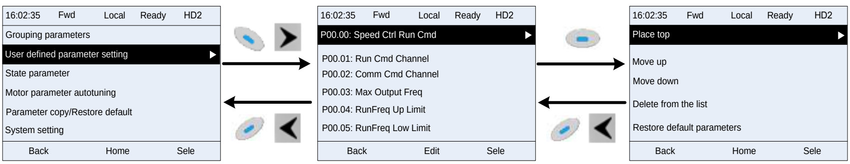



Figure 5-16 List edit diagram 3

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

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

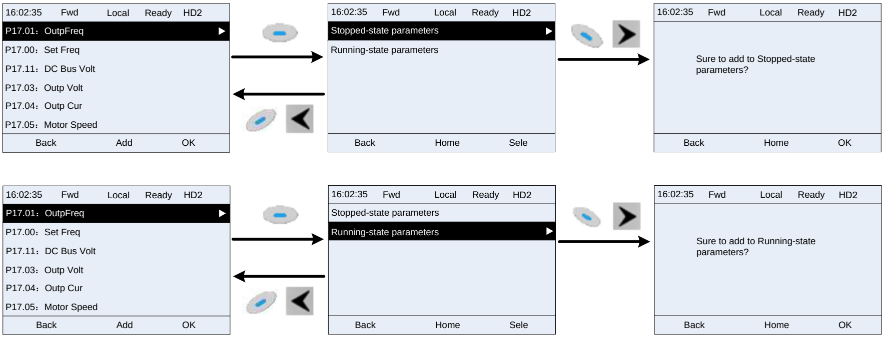



Figure 5-17 Adding parameter diagram 1

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

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

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

### 5.4.4 Adding parameters to the user defined parameter list

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

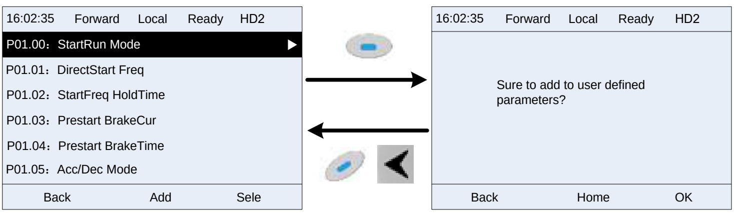



Figure 5-18 Add parameter diagram 2

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 user defined parameter list, the newly added parameter will be at the end of the list; if this parameter is already in the user defined parameter list, the addition operation will be invalid. If key or key is pressed without selecting addition operation, it will return to parameter setup list menu.

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

### 5.4.5 Editing user defined parameters

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

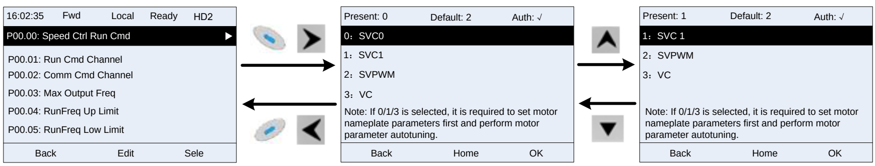



Figure 5-19 Editing user defined parameters

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

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

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

"Present" indicates the present value.

"Default" indicates the default value of this parameter.

### 5.4.6 Editing parameters in parameter groups

You can choose **Menu** > **Parameter groups**, enter a specific function group and then a specific function code, and then press key, key or key to edit the parameter setting interface. After entering edit interface, set the parameter from low bit to high bit,

and the bit under setting will be highlighted. Press key or key to increase or decrease the parameter value (this operation is valid until the parameter value exceeds the max. value or min. value); press or to shift the editing bit. After parameters are set, press key or key to save the set parameters and return to the previous menu; press to maintain the original parameter value and return to the previous menu.

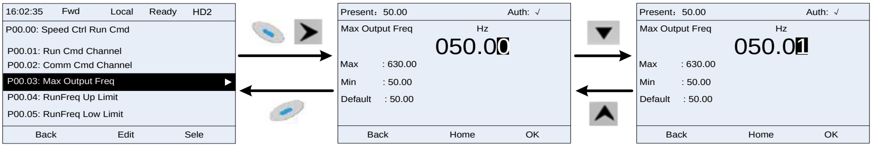



Figure 5-20 Editing parameters in parameter groups

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

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

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

"Present" indicates the present value.

"Default" indicates the default value of this parameter.

### 5.4.7 Monitoring states

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

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

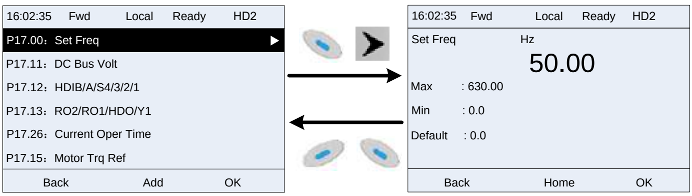



Figure 5-21 State monitoring interface

### 5.4.8 Autotuning motor parameters

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

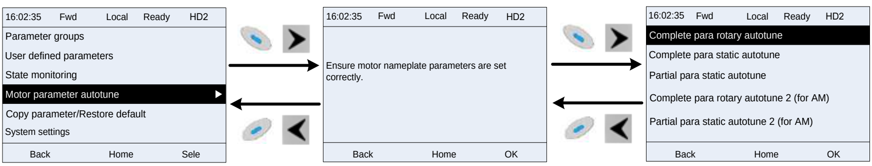



Figure 5-22 Selecting a parameter autotuning type

After selecting a motor autotuning type, enter motor parameter autotuning interface, and press RUN key to start motor parameter autotuning. After autotuning is done, a 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 occurs during autotuning, the keypad will display a fault interface.

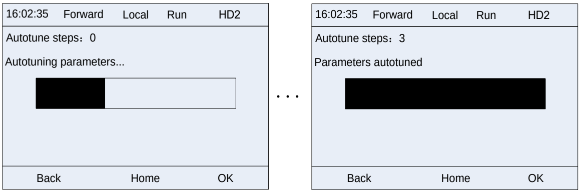



Figure 5-23
Figure 5-24 Parameter autotuning

### 5.4.9 Backing up parameters

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

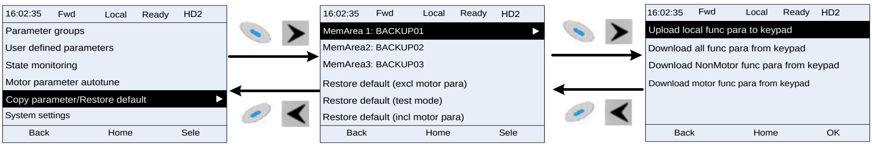



Figure 5-25 Parameter backup

### 5.4.10 System settings

You can choose **Menu** > **System settings**, and press key, key or key to enter system setting interface to

set the keypad language, time/date, backlight brightness, backlight time and restore parameters.

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

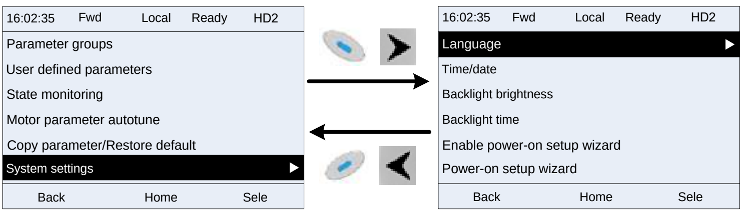
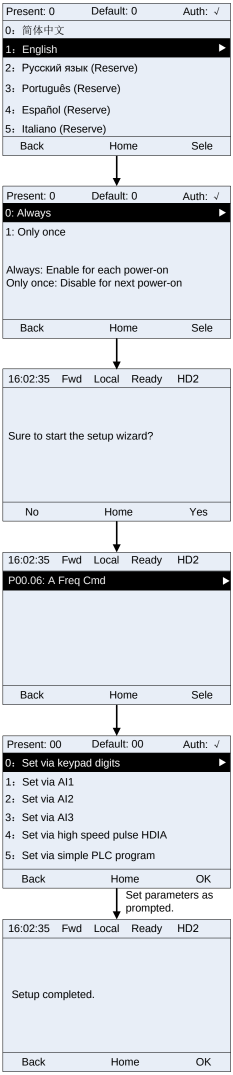



Figure 5-26 System setting diagram

### 5.4.11 Power-on setup wizard

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

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




If you want to change the guiding settings, you can choose **Menu** > **System settings**, and then choose **Enable power-on setup wizard** or **Power-on setup wizard**, and then make changes.

## 5.5 Basic operations

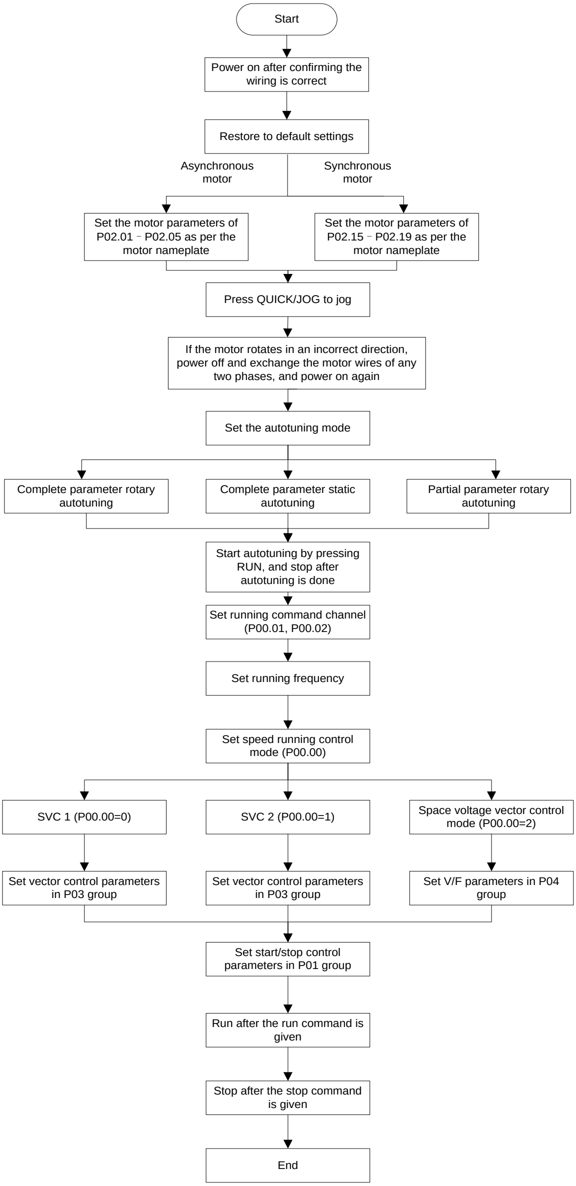
### 5.5.1 What this section contains

This section introduces the function modules inside the inverter.

| | |
|---|---|
| ⚠ | ✧ Ensure all the terminals are fixed and tightened firmly.<br>✧ Ensure the motor matches with the inverter 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: Sensorless vector control (SVC) mode 0<br>1: SVC 1<br>2: Space voltage vector control mode<br>3: FVC<br>**Note:** To select 0, 1, or 3 as the control mode, enable the inverter to perform motor parameter autotuning first | 2 |
| P00.01 | Channel of running commands | 0: Keypad<br>1: Terminal<br>2: Communication | 0 |
| P00.02 | Communication mode of running commands | 0: Modbus/Modbus TCP<br>1: PROFIBUS/CANopen/DeviceNet<br>2: Ethernet<br>3: EtherCAT/PROFINET/EtherNet IP<br>4: Programmable card<br>5: Bluetooth card<br>6: Reserved | 0 |
| P00.15 | Motor parameter autotuning | 0: No operation<br>1: Rotary autotuning 1; carry out comprehensive motor parameter autotuning; rotary autotuning is used in cases where high control precision is required.<br>2: Static autotuning 1 (comprehensive autotuning); static autotuning 1 is used in cases where the motor cannot be disconnected from load.<br>3: Static autotuning 2 (partial autotuning); | 0 |

| Function code | Name | Description | Default value |
|---|---|---|---|
| | | 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.<br>4: Rotary autotuning 2, which is like rotary autotuning 1 but is only applicable to asynchronous motors.<br>5: Rotary autotuning 3 (partial autotuning), which is only applicable to asynchronous motors. | |
| P00.18 | Function parameter restoration | 0: No operation<br>1: Restore default values (excluding motor parameters)<br>2: Clear fault records<br>3: Reserved<br>4: Reserved<br>5: Restore default values (for factory test mode)<br>6: Restore default values (including motor parameters)<br>**Note:** After the selected operation is done, this parameter is automatically restored to 0. Restoring the default values may delete the user password. Exercise caution when using this function. The option 5 can be used only for factory testing. | 0 |
| P02.00 | Type of motor 1 | 0: Asynchronous motor<br>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 | 0.1–3000.0kW | Depends |

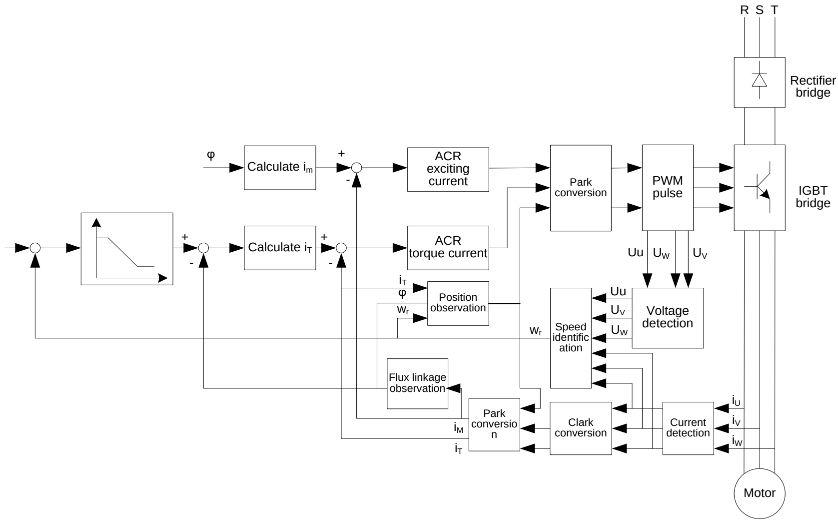
| Function code | Name | Description | Default value |
|---|---|---|---|
| | synchronous motor 1 | | on model |
| P02.16 | Rated frequency of synchronous motor 1 | 0.01Hz–P00.03 (Max. output frequency) | 50.00Hz |
| P02.17 | Number of pole pairs of synchronous motor 1 | 1–50 | 2 |
| P02.18 | Rated voltage of synchronous motor 1 | 0–1200V | Depends on model |
| P02.19 | Rated current of synchronous motor 1 | 0.8–6000.0A | Depends on model |
| P05.01–P05.06 | Function of multi-function digital input terminal (S1–S4, HDIA, HDIB) | 36: Command switches to keypad<br>37: Command switches to terminal<br>38: Command switches to communication | / |
| P07.01 | Reserved | / | / |
| P07.02 | QUICK/JOG key function | Range: 0x00–0x27<br>Ones: QUICK/JOG key function selection<br>0: No function<br>1: Jogging<br>2: Reserved<br>3: Switching between forward/reverse rotation<br>4: Clear UP/DOWN setting<br>5: Coast to stop<br>6: Switch running command reference mode by sequence<br>7: Reserved<br>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 inverter 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: Sensorless vector control (SVC) mode 0<br>1: SVC 1<br>2: Space voltage vector control mode<br>3: FVC<br>**Note:** To select 0, 1, or 3 as the control mode, enable the inverter to perform motor parameter autotuning first | 2 |
| P00.15 | Motor parameter autotuning | 0: No operation<br>1: Rotary autotuning 1; carry out comprehensive motor parameter autotuning; rotary autotuning is used in cases where high control precision is required.<br>2: Static autotuning 1 (comprehensive autotuning); static autotuning 1 is used in cases where the motor cannot be | 0 |

| Function code | Name | Description | Default value |
|---|---|---|---|
| | | disconnected from load.<br>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.<br>4: Rotary autotuning 2, which is like rotary autotuning 1 but is only applicable to asynchronous motors.<br>5: Rotary autotuning 3 (partial autotuning), which is only applicable to asynchronous motors. | |
| P02.00 | Type of motor 1 | 0: Asynchronous motor<br>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 setting method | 1: Keypad (P03.12)<br>2: AI1<br>3: AI2 | 1 |

| **Function code** | **Name** | **Description** | **Default value** |
|---|---|---|---|
| | | 4: AI3<br>5: Pulse frequency HDIA<br>6: Multi-step torque<br>7: Modbus/Modbus TCP communication<br>8: PROFIBUS/CANopen/DeviceNet communication<br>9: Ethernet communication<br>10: Pulse frequency HDIB<br>11: EtherCAT/PROFINET/EtherNet IP communication<br>12: Programmable card<br>**Note:** For these settings, 100% corresponds to the motor rated current. | |
| P03.12 | Torque set through keypad | -300.0%–300.0% (of the motor rated current) | 50.0% |
| P03.13 | Torque reference filter time | 0.000–10.000s | 0.010s |
| P03.14 | Setting source of FWD rotation frequency upper limit in torque control | 0: Keypad (P03.16)<br>1: AI1<br>2: AI2<br>3: AI3<br>4: Pulse frequency HDIA<br>5: Multi-step setting<br>6: Modbus/Modbus TCP communication<br>7: PROFIBUS/CANopen/DeviceNet communication<br>8: Ethernet communication<br>9: Pulse frequency HDIB<br>10: EtherCAT/PROFINET/EtherNet IP communication<br>11: Programmable card<br>12: Reserved<br>**Note:** For these settings, 100% corresponds to the max. frequency. | 0 |
| P03.15 | Setting source of REV rotation frequency upper limit in torque control | 0: Keypad (P03.17)<br>1–11: Same as those of P03.14 | 0 |
| P03.16 | FWD rotation frequency upper limit set through keypad in torque control | Value range: 0.00 Hz–P00.03 (Max. output frequency) | 50.00Hz |

| Function code | Name | Description | Default value |
|---|---|---|---|
| P03.17 | REV rotation frequency upper limit set through keypad in torque control | | 50.00Hz |
| P03.18 | Setting source of electromotive torque upper limit | 0: Keypad (P03.20)<br>1: AI1<br>2: AI2<br>3: AI3<br>4: Pulse frequency HDIA<br>5: Modbus/Modbus TCP communication<br>6: PROFIBUS/CANopen/DeviceNet communication<br>7: Ethernet communication<br>8: Pulse frequency HDIB<br>9: EtherCAT/PROFINET/EtherNet IP communication<br>10: Programmable card<br>11: Reserved<br>**Note:** For these settings, 100% corresponds to the motor rated current. | 0 |
| P03.19 | Setting source of braking torque upper limit | 0: Keypad (P03.21)<br>1–10: Same as those for P03.18 | 0 |
| P03.20 | Electromotive torque upper limit set through keypad | 0.0–300.0% (of the motor rated current) | 180.0% |
| P03.21 | Braking torque upper limit set through keypad | | 180.0% |
| P03.22 | 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 | Enabling torque control | 0: Disable<br>1: Enable | 0 |
| P03.33 | Flux weakening integral gain | 0–8000 | 1200 |
| P03.35 | Control optimization setting | 0x0000–0x1111<br>Ones place: Torque command selection<br>0: Torque reference | 0x0000 |

| Function code | Name | Description | Default value |
|---|---|---|---|
| | | 1: Torque current reference<br>Tens place: Reserved<br>0: Reserved<br>1: Reserved<br>Hundreds place: Whether to enable ASR integral separation<br>0: Disable<br>1: Enable<br>Thousands place: Reserved<br>0: Reserved<br>1: Reserved | |
| P03.36 | ASR differential gain | 0.00–10.00s | 0.00s |
| P03.37 | High-frequency ACR proportional coefficient | In the FVC (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.<br>Setting range of P03.37: 0–65535<br>Setting range of P03.38: 0–65535<br>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

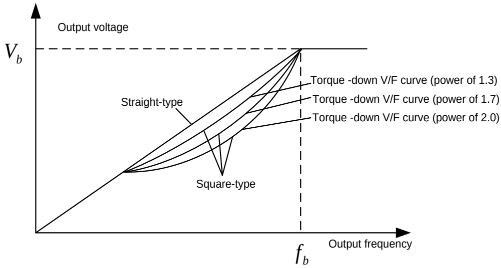
The inverter also carries built-in SVPWM control function. SVPWM mode can be used in cases where mediocre control precision is enough. In cases where an inverter needs to drive multiple motors, it is also recommended to adopt SVPWM control mode.

The inverter 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.

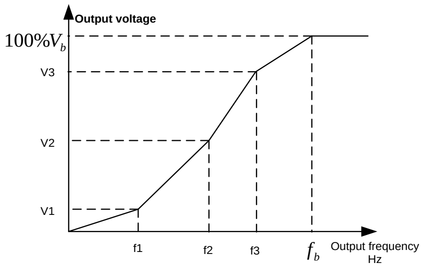
**Suggestions:**

- 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 inverter also provides multi-point V/F curve. You can alter the V/F curve outputted by inverter 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 inverter provides dedicated function codes for SVPWM control mode. You can improve the performance of SVPWM through settings.

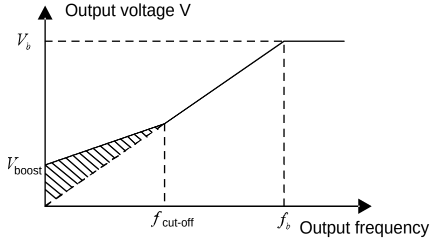
**1. Torque boost**

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 inverter 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 inverter 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 inverter 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

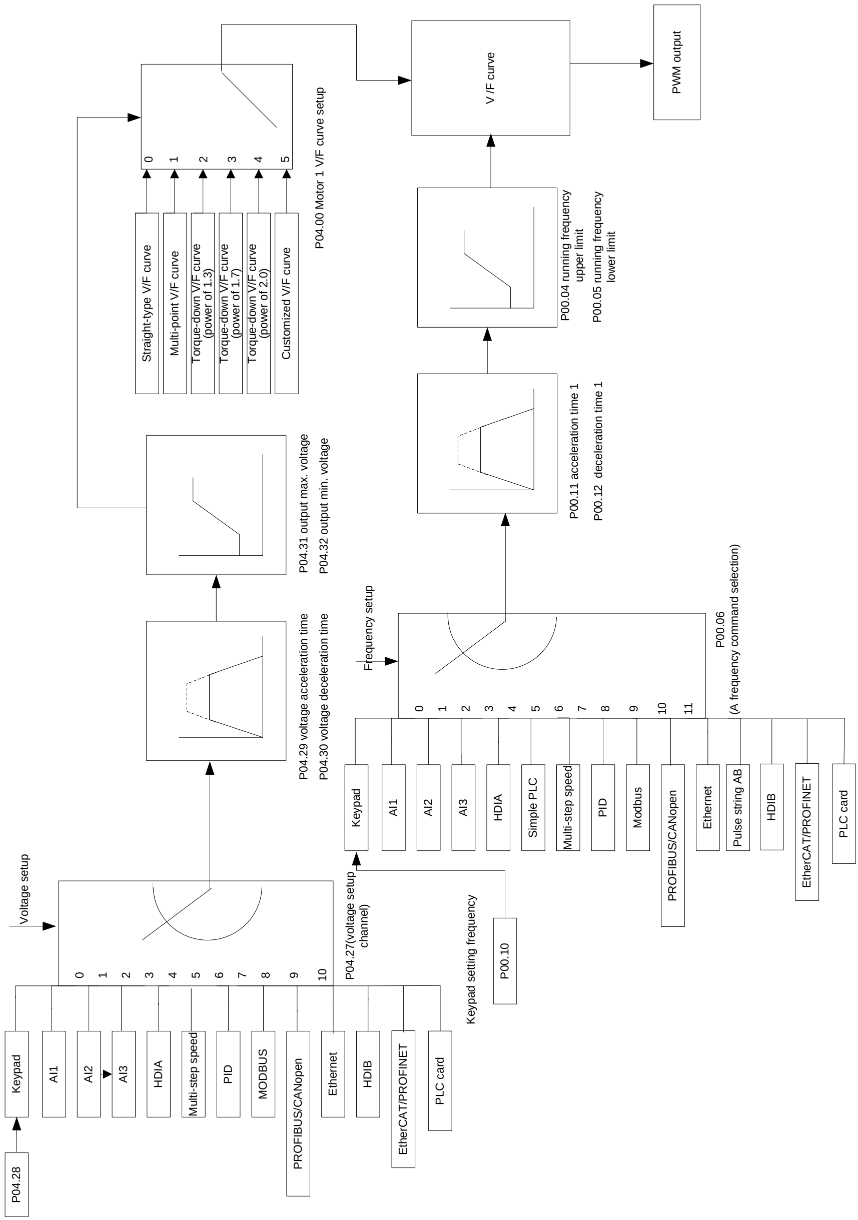
Motor oscillation often occurs in space voltage vector control in large-power driving applications. To solve this problem, the inverter provides two oscillation factor function codes. You can set the function codes based on the oscillation occurrence frequency.

**Note:** A greater value indicates better control effect. However, if the value is too large, the inverter 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 inverter. 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: Sensorless vector control (SVC) mode 0<br>1: SVC 1<br>2: Space voltage vector control mode<br>3: FVC<br>**Note:** To select 0, 1, or 3 as the control mode, enable the inverter to perform 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<br>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<br>1: Multi-point V/F curve<br>2: Torque-down V/F curve (power of 1.3)<br>3: Torque-down V/F curve (power of 1.7)<br>4: Torque-down V/F curve (power of 2.0)<br>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 | 0.00Hz–P04.05 | 0.00Hz |

| Function code | Name | Description | Default value |
|---|---|---|---|
| | of motor 1 | | |
| P04.04 | V/F voltage point 1 of motor 1 | 0.0%–110.0% | 0.0% |
| 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<br>1: Multi-point V/F curve<br>2: Torque-down V/F curve (power of 1.3)<br>3: Torque-down V/F curve (power of 1.7)<br>4: Torque-down V/F curve (power of 2.0)<br>5: Customize V/F (V/F separation) | 0 |
| P04.14 | Torque boost of motor 2 | 0.0%: (automatic)<br>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 | 0.0%–110.0% | 0.0% |

| Function code | Name | Description | Default value |
|---|---|---|---|
| | motor 2 | | |
| P04.20 | V/F frequency point 3 of motor 2 | P04.18–P02.02 or P04.18–P02.16 | 0.00Hz |
| 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<br>1: Automatic energy-saving run | 0 |
| P04.27 | Voltage setting channel | 0: Keypad; output voltage is determined by P04.28<br>1: AI1<br>2: AI2<br>3: AI3<br>4: HDIA<br>5: Multi-step<br>6: PID<br>7: Modbus/Modbus TCP communication<br>8: PROFIBUS/CANopen communication<br>9: Ethernet communication<br>10: HDIB<br>11: EtherCAT/PROFINET/EtherNet IP communication<br>12: Programmable card<br>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% |

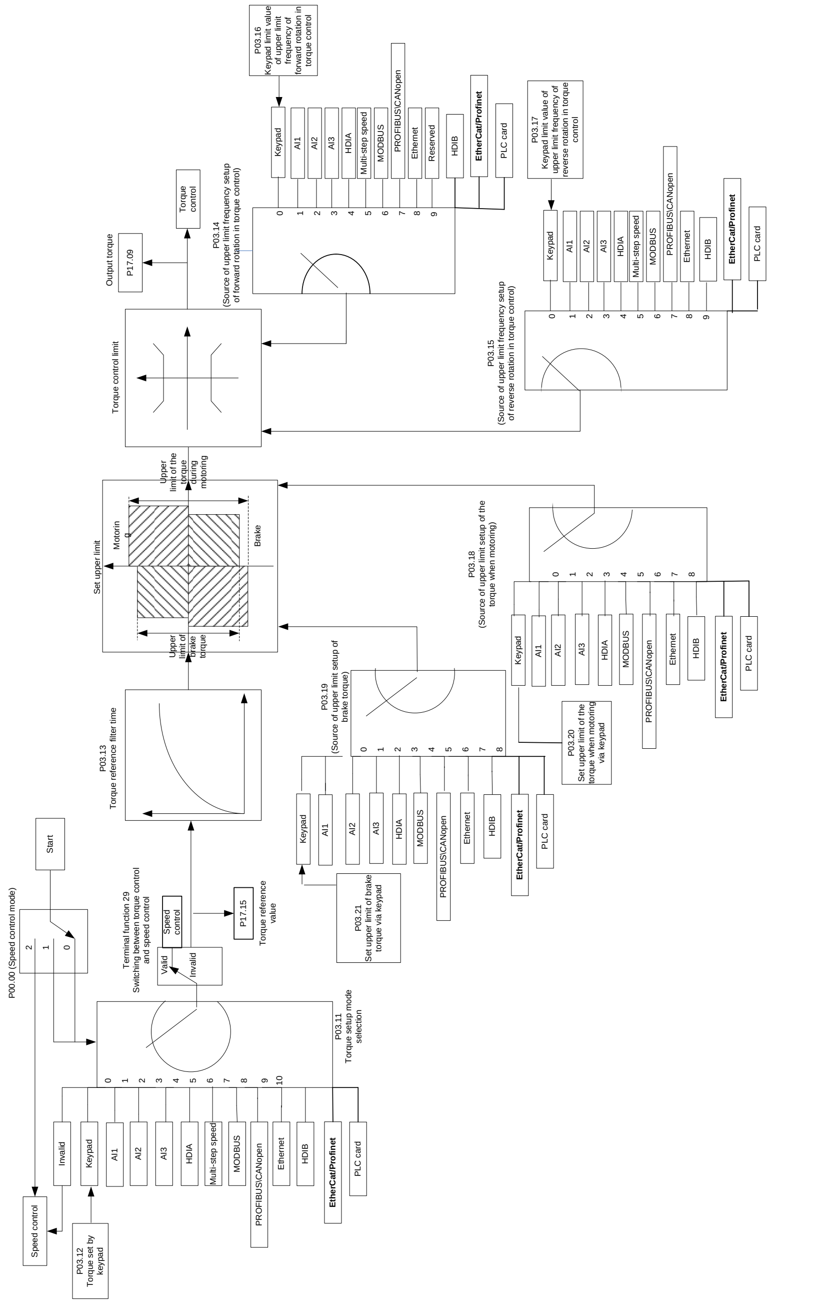
| Function code | Name | Description | Default value |
|---|---|---|---|
| P04.32 | Output min. voltage | 0.0%–P04.31 (rated motor voltage) | 0.0% |
| P04.33 | Flux-weakening coefficient in the constant power zone | 1.00–1.30 | 1.00 |
| P04.34 | Injection current 1 in synchronous motor VF control | When 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.<br>Setting range: -100.0%–+100.0% (of the motor rated current) | 20.0% |
| P04.35 | Injection 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.<br>Setting range: -100.0%–+100.0% (of the motor rated current) | 10.0% |
| P04.36 | Frequency threshold for injection 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 injection current 2.<br>Setting range: 0.0%–200.0% (of the motor rated frequency) | 20.0% |
| 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.<br>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.<br>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 | 8000 |

| Function code | Name | Description | Default value |
|---|---|---|---|
| | | need to modify this parameter.<br>Setting range: 0–16000 | |
| P04.40 | Enable/disable IF mode for asynchronous motor 1 | 0: Disabled<br>1: Enabled | 0 |
| 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.<br>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.<br>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.<br>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<br>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.<br>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.<br>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.<br>Setting range: 0–5000 | 350 |

| Function code | Name | Description | Default value |
|---|---|---|---|
| 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 |

### 5.5.5 Torque control

The inverter 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)
2
1
0
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
0
1
2
3
4
5
6
7
8
9
10
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
Torque control limit
Output torque
P17.09
Torque control
P03.14
(Source of upper limit frequency setup of forward rotation in torque control)
Keypad
AI1
AI2
AI3
HDIA
Multi-step speed
MODBUS
PROFIBUS\CANopen
Ethernet
Reserved
HDIB
EtherCat/Profinet
PLC card
P03.16
Keypad limit value of upper limit frequency of forward rotation in torque control
P03.15
(Source of upper limit frequency setup of reverse rotation in torque control)
Keypad
AI1
AI2
AI3
HDIA
Multi-step speed
MODBUS
PROFIBUS\CANopen
Ethernet
HDIB
EtherCat/Profinet
PLC card
P03.17
Keypad limit value of upper limit frequency of reverse rotation in torque control
P03.18
(Source of upper limit setup of the torque when motoring)
Keypad
AI1
AI2
AI3
HDIA
MODBUS
PROFIBUS\CANopen
Ethernet
HDIB
EtherCat/Profinet
PLC card
P03.20
Set upper limit of the torque when motoring via keypad
P03.19
(Source of upper limit setup of brake torque)
Keypad
AI1
AI2
AI3
HDIA
MODBUS
PROFIBUS\CANopen
Ethernet
HDIB
EtherCat/Profinet
PLC card
P03.21
Set upper limit of brake torque via keypad

| Function code | Name | Description | Default value |
|---|---|---|---|
| P00.00 | Speed control mode | 0: Sensorless vector control (SVC) mode 0<br>1: SVC 1<br>2: Space voltage vector control mode<br>3: FVC<br>**Note:** To select 0, 1, or 3 as the control mode, enable the inverter to perform motor parameter autotuning first | 2 |
| P03.32 | Enabling torque control | 0: Disable<br>1: Enable | 0 |
| P03.11 | Torque setting method | 0–1: Keypad (P03.12)<br>2: AI1<br>3: AI2<br>4: AI3<br>5: Pulse frequency HDIA<br>6: Multi-step torque<br>7: Modbus/Modbus TCP communication<br>8: PROFIBUS/CANopen/DeviceNet communication<br>9: Ethernet communication<br>10: Pulse frequency HDIB<br>11: EtherCAT/PROFINET/EtherNet IP communication<br>12: Programmable card<br>**Note:** For these settings, 100% corresponds to the motor rated current. | 0 |
| P03.12 | Torque set through keypad | -300.0%–300.0% (of the motor rated current) | 50.0% |
| P03.13 | Torque reference filter time | 0.000–10.000s | 0.010s |
| P03.14 | Setting source of FWD rotation frequency upper limit in torque control | 0: Keypad (P03.16)<br>1: AI1<br>2: AI2<br>3: AI3<br>4: Pulse frequency HDIA<br>5: Multi-step setting<br>6: Modbus/Modbus TCP communication<br>7: PROFIBUS/CANopen/DeviceNet communication<br>8: Ethernet communication | 0 |

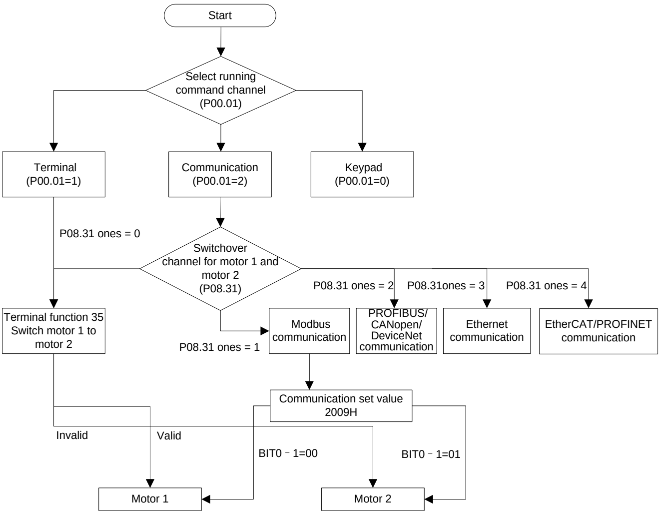
| Function code | Name | Description | Default value |
|---|---|---|---|
| | | 9: Pulse frequency HDIB<br>10: EtherCAT/PROFINET/EtherNet IP communication<br>11: Programmable card<br>12: Reserved<br>Note: For these settings, 100% corresponds to the max. frequency. | |
| P03.15 | Setting source of REV rotation frequency upper limit in torque control | 0: Keypad (P03.17)<br>1: AI1<br>2: AI2<br>3: AI3<br>4: Pulse frequency HDIA<br>5: Multi-step setting<br>6: Modbus/Modbus TCP communication<br>7: PROFIBUS/CANopen/DeviceNet communication<br>8: Ethernet communication<br>9: Pulse frequency HDIB<br>10: EtherCAT/PROFINET/EtherNet IP communication<br>11: Programmable card<br>12: Reserved<br>**Note:** For these settings, 100% corresponds to the max. frequency. | 0 |
| P03.16 | FWD rotation frequency upper limit set through keypad in torque control | 0.00Hz–P00.03 (Max. output frequency) | 50.00 Hz |
| P03.17 | REV rotation frequency upper limit set through keypad in torque control | 0.00Hz–P00.03 (Max. output frequency) | 50.00 Hz |
| P03.18 | Setting source of electromotive torque upper limit | 0: Keypad (P03.20)<br>1: AI1<br>2: AI2<br>3: AI3<br>4: Pulse frequency HDIA | 0 |

| Function code | Name | Description | Default value |
|---|---|---|---|
| | | 5: Modbus/Modbus TCP communication<br>6: PROFIBUS/CANopen/DeviceNet communication<br>7: Ethernet communication<br>8: Pulse frequency HDIB<br>9: EtherCAT/PROFINET/EtherNet IP communication<br>10: Programmable card<br>11: Reserved<br>**Note:** For these settings, 100% corresponds to the motor rated current. | |
| P03.19 | Setting source of braking torque upper limit | 0: Keypad (P03.21)<br>1: AI1<br>2: AI2<br>3: AI3<br>4: Pulse frequency HDIA<br>5: Modbus/Modbus TCP communication<br>6: PROFIBUS/CANopen/DeviceNet communication<br>7: Ethernet communication<br>8: Pulse frequency HDIB<br>9: EtherCAT/PROFINET/EtherNet IP communication<br>10: Programmable card<br>11: Reserved<br>**Note:** For these settings, 100% corresponds to the motor rated current. | 0 |
| P03.20 | Electromotive torque upper limit set through keypad | 0.0–300.0% (of the motor rated current) | 180.0% |
| P03.21 | Braking torque upper limit set through keypad | 0.0–300.0% (of the motor rated current) | 180.0% |
| P17.09 | Motor output torque | -250.0–250.0% | 0.0% |
| P17.15 | Torque reference value | -300.0–300.0% (of the motor rated current) | 0.0% |

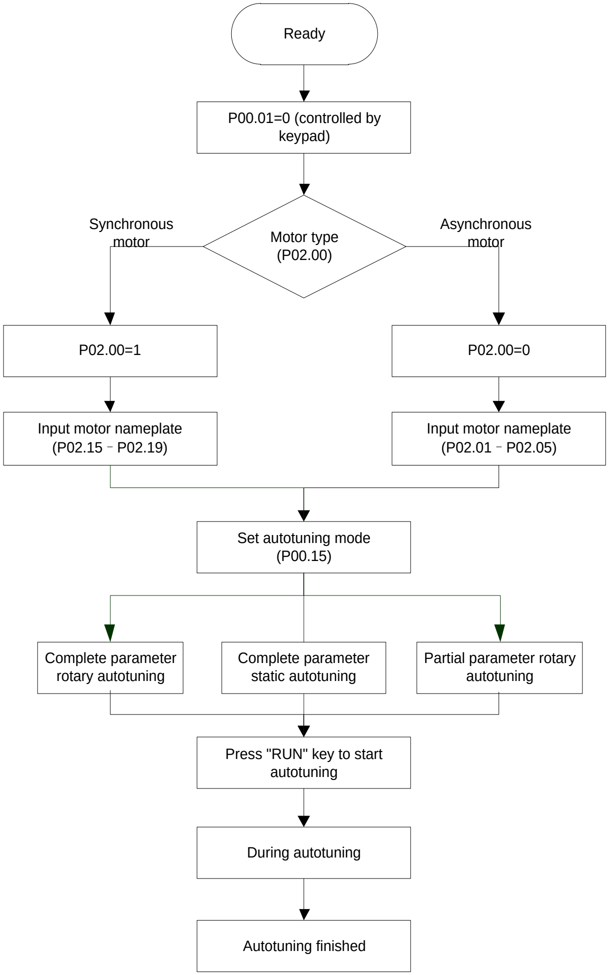
### 5.5.6 Motor parameter

| | |
|---|---|
| | ✧ 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.<br>✧ 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 inverter. 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 inverter 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 inverter 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 | Channel of running commands | 0: Keypad<br>1: Terminal<br>2: Communication | 0 |
| P00.15 | Motor parameter autotuning | 0: No operation<br>1: Rotary autotuning 1; carry out comprehensive motor parameter autotuning; rotary autotuning is used in cases where high control precision is required.<br>2: Static autotuning 1 (comprehensive autotuning); static autotuning 1 is used in cases where the motor cannot be disconnected from load.<br>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.<br>4: Rotary autotuning 2, which is like rotary autotuning 1 but is only applicable to asynchronous motors.<br>5: Rotary autotuning 3 (partial autotuning), which is only applicable to asynchronous motors. | 0 |
| P02.00 | Type of motor 1 | 0: Asynchronous motor<br>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<br>Ones: Switchover channel<br>0: Switch over by | 0x00 |

| Function code | Name | Description | Default value |
|---|---|---|---|
| | | terminal<br>1: Switch over by Modbus/Modbus TCP communication<br>2: Switch over by PROFIBUS / CANopen /DeviceNet<br>3: Switch over by Ethernet communication<br>4: Switch over by EtherCAT/PROFINET/EtherNet IP communication<br>Tens: Motor switchover during running<br>0: Disable switchover during running<br>1: Enable switchover during running | |
| P12.00 | Type of motor 2 | 0: Asynchronous motor<br>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 | 0.01Hz–P00.03 (Max. output frequency) | 50.00Hz |

| Function code | Name | Description | Default value |
|---|---|---|---|
| | synchronous motor 2 | | |
| P12.17 | Number of pole pairs of synchronous motor 2 | 1–50 | 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

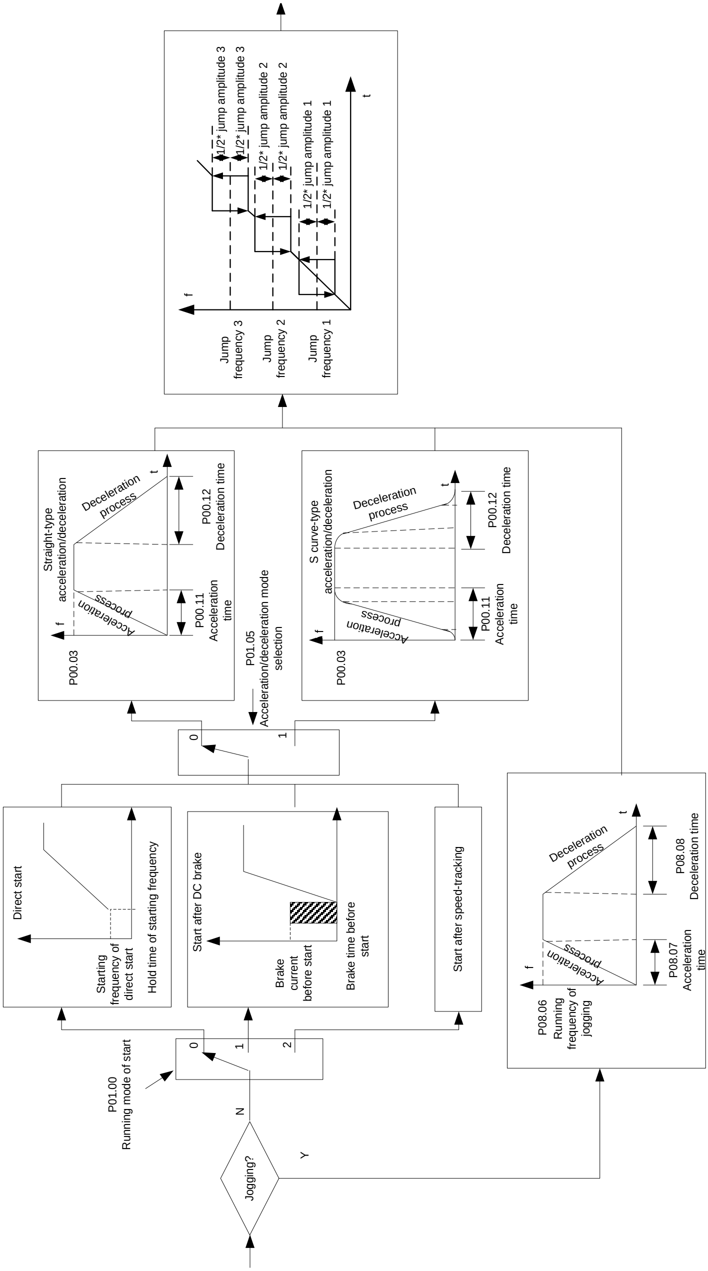
The start/stop control of the inverter is divided into three states: start after running command at power-on; start after restart-at-power-cut function is effective; start after automatic fault reset. Descriptions for these three start/stop control states are presented below.

There are three start modes for the inverter, 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.

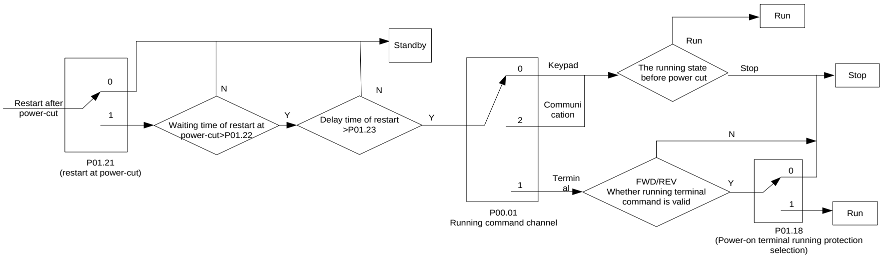
For large-inertia load, especially in cases where reversal may occur, you can choose to start after DC brake or start after speed-racking.

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

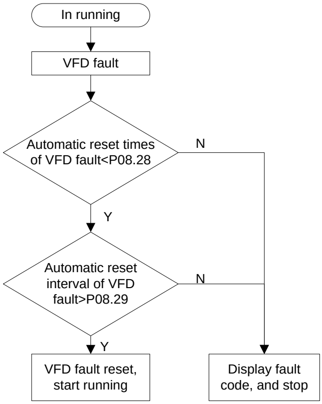
1. Logic diagram for running command after power-on



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 | Channel of running commands | 0: Keypad<br>1: Terminal<br>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<br>1: Start after DC brake<br>2: Start after speed tracking | 0 |
| P01.01 | Starting frequency of direct start | 0.00–50.00Hz | 0.50Hz |
| P01.02 | Hold time of starting frequency | 0.0–50.0s | 0.0s |

| Function code | Name | Description | Default value |
|---|---|---|---|
| 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<br>1: S curve<br>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<br>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<br>1: switch over after starting frequency<br>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)<br>1: Detection value of speed | 1 |
| P01.18 | Power-on terminal running protection selection | 0: Terminal running command is invalid at power-on<br>1: Terminal running command is valid at power-on | 0 |
| P01.19 | Action selected when running frequency less than frequency lower limit (valid when frequency lower limit greater than 0) | Ones place: Action selection<br>0: Run at the frequency lower limit<br>1: Stop<br>2: Sleep<br>Tens place: Stop mode<br>0: Coast to stop<br>1: Decelerate to stop | 0x00 |
| P01.20 | Wake-up-from-sleep delay | 0.0–3600.0s (valid when P01.19 is 2) | 0.0s |
| P01.21 | Restart after power outage | 0: Restart is disabled | 0 |

| Function code | Name | Description | Default value |
|---|---|---|---|
| | | 1: Restart is enabled | |
| P01.22 | Waiting time of restart after power outage | 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<br>1: With voltage output<br>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 inverter 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<br>2: Reverse running<br>4: Forward jogging<br>5: Reverse jogging<br>6: Coast to stop<br>7: Fault reset<br>8: Running pause<br>21: Acceleration/deceleration time selection 1<br>22: Acceleration/deceleration time selection 2<br>30: Acceleration/deceleration disabled | / |
| P08.06 | Running frequency of jog | 0.00Hz–P00.03 (Max. output frequency) | 5.00Hz |

| Function code | Name | Description | Default value |
|---|---|---|---|
| P08.07 | Acceleration time at jogging | 0.0–3600.0s | Depends on model |
| 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)<br>0.00Hz: No switch over<br>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<br>1: Set frequency<br>2: 100Hz<br>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 |

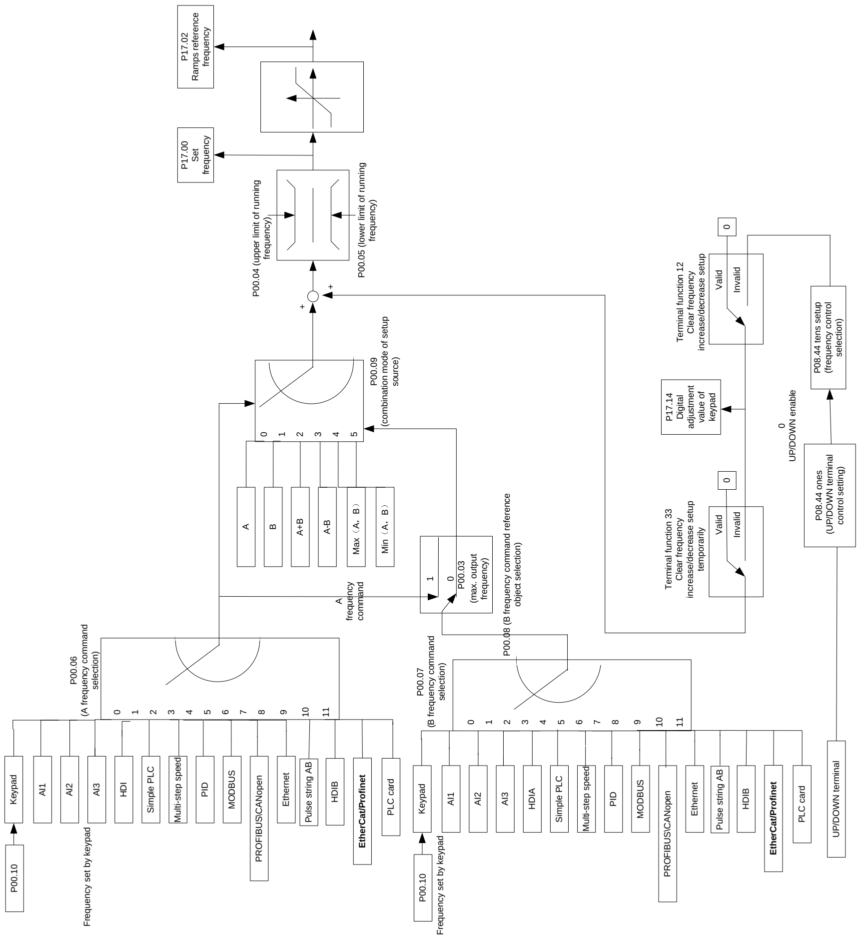
### 5.5.8 Frequency setup

The inverter 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 inverter frequency reference by this reference mode.

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



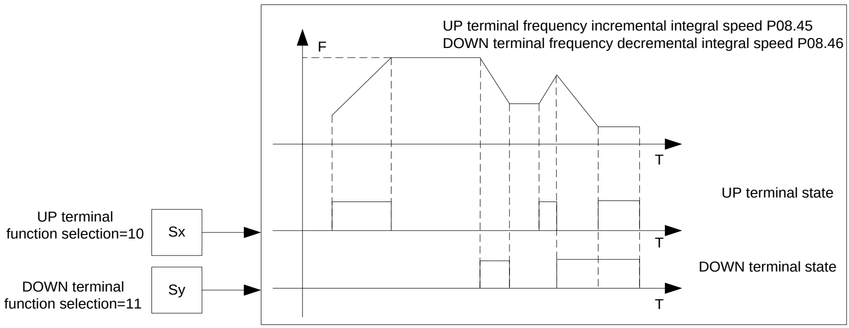

The inverter supports switchover between different reference channels, and the rules for channel switchover are shown below.

| 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 | / | / |

| 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 |
| 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 inverter 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:

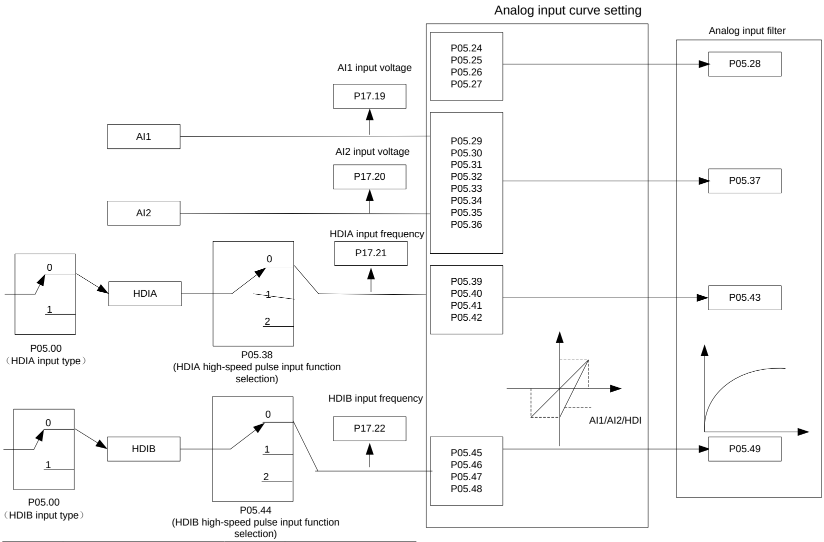
| Function code | Name | Description | Default value |
|---|---|---|---|
| P00.03 | Max. output frequency | P00.04–400.00Hz | 50.00Hz |
| P00.04 | Upper limit of running frequency | P00.05–P00.03 | 50.00Hz |
| P00.05 | Lower limit of running frequency | 0.00Hz–P00.04 | 0.00Hz |
| P00.06 | A frequency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

| Function code | Name | Description | Default value |
|---|---|---|---|
| | | 7: PID control<br>8: Modbus/Modbus TCP communication<br>9: PROFIBUS/CANopen/DeviceNet communication<br>10: Ethernet communication<br>11: High speed pulse HDIB<br>12: Pulse string AB<br>13: EtherCAT/PROFINET/EtherNet IP communication<br>14: Programmable card<br>15: Reserved | |
| P00.08 | Reference object of B frequency command | 0: Max. output frequency<br>1: A frequency command | 0 |
| P00.09 | Combination mode of setup source | 0: A<br>1: B<br>2: (A+B)<br>3: (A-B)<br>4: Max (A, B)<br>5: Min (A, B) | 0 |
| P05.01–P05.06 | Function of multi-function digital input terminal (S1–S4, HDIA, HDIB) | 10: Frequency increase (UP)<br>11: Frequency decrease (DOWN)<br>12: Clear frequency increase/decrease setting<br>13: Switchover between setup A and setup B<br>14: Switchover between combination setup and setup A<br>15: Switchover between combination setup and setup B | / |
| P08.42 | Reserved | / | / |
| P08.43 | Reserved | / | / |
| P08.44 | UP/DOWN terminal control | 0x000–0x221<br>Ones: Frequency enabling selection<br>0: UP/DOWN terminal setting is valid<br>1: UP/DOWN terminal setting is invalid<br>Tens: Frequency control selection<br>0: Valid only when P00.06=0 or P00.07=0<br>1: Valid for all frequency modes | 0x000 |

| Function code | Name | Description | Default value |
|---|---|---|---|
| | | 2: Invalid for multi-step speed when multi-step speed takes priority<br>Hundreds: Action selection at stop<br>0: Valid<br>1: Valid during running, clear after stop<br>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 inverter 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：<br>0: HDIA is high-speed pulse input<br>1: HDIA is digital input | P05.38 | 0: Set input via frequency<br>1: Reserved<br>2: Input via encoder |
| P05.00 | Tens：<br>0: HDIB is high-speed pulse input<br>1: HDIB is digital input | P05.44 | 0: Set input via frequency<br>1: Reserved<br>2: Input via encoder |

Related parameter list:

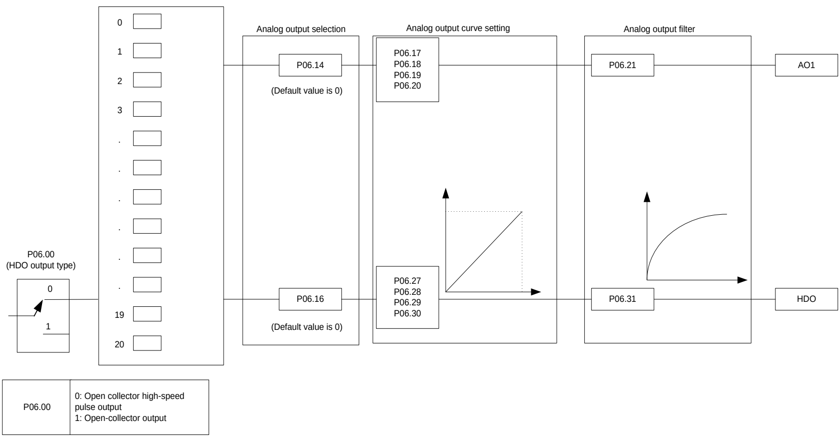
| Function code | Name | Description | Default value |
|---|---|---|---|
| P05.00 | HDI input type | 0x00–0x11<br>Ones: HDIA input type<br>0: HDIA is high-speed pulse input<br>1: HDIA is digital input<br>Tens: HDIB input type<br>0: HDIB is high-speed pulse input<br>1: HDIB is digital input | 0x00 |
| 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 |

| Function code | Name | Description | Default value |
|---|---|---|---|
| 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<br>1: Reserved<br>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% |
| 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<br>1: Reserved<br>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 |

| Function code | Name | Description | Default value |
|---|---|---|---|
| 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<br>0: Voltage type<br>1: Current type | 0 |

**5.5.10 Analog output**

The inverter 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.)

| Setting | Function | Description |
|---|---|---|
| 0 | Running frequency | 0–Max. output frequency |
| 1 | Set frequency | 0–Max. output frequency |
| 2 | Ramp reference frequency | 0–Max. output frequency |
| 3 | Running speed | 0–Synchronous speed corresponding to max. output frequency |

| Setting | Function | Description |
|---|---|---|
| 4 | Output current (relative to inverter) | 0–Twice the inverter rated current |
| 5 | Output current (relative to motor) | 0–Twice the motor rated current |
| 6 | Output voltage | 0–1.5 times the inverter rated voltage |
| 7 | Output power | 0–Twice the motor rated power |
| 8 | Set torque value (bipolar) | 0–Twice the motor rated current. A negative value corresponds to 0.0% by default. |
| 9 | Output torque (absolute value) | 0 – +/- (Twice the motor rated torque) |
| 10 | AI1 input 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 | High-speed pulse HDIA input | 0.00–50.00kHz |
| 14 | Value 1 set through Modbus/Modbus TCP communication | 0–1000 |
| 15 | Value 2 set through Modbus/Modbus TCP communication | 0–1000 |
| 16 | Value 1 set through PROFIBUS/CANopen/DeviceNet communication | 0–1000 |
| 17 | Value 2 set through PROFIBUS/CANopen/DeviceNet communication | 0–1000 |
| 18 | Value 1 set through Ethernet communication | 0–1000 |
| 19 | Value 2 set through Ethernet communication | 0–1000 |
| 20 | High-speed pulse HDIB input | 0.00–50.00kHz |
| 21 | Value 1 set through EtherCAT/PROFINET/ EtherNET IP communication | 0–1000. A negative value corresponds to 0.0% by default. |
| 22 | Torque current (bipolar) | 0–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 |

| Setting | Function | Description |
|---|---|---|
| | | 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 | Value 2 set through EtherCAT/PROFINET/EtherNet IP communication | 0–1000 |
| 28 | AO1 from the Programmable card | 0–1000 |
| 29 | AO2 from the Programmable card | 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. |
| 32 | AI/AO temperature detection output | AO value of AI/AO temperature detection |
| 33–63 | Reserved | |

Related parameter list:

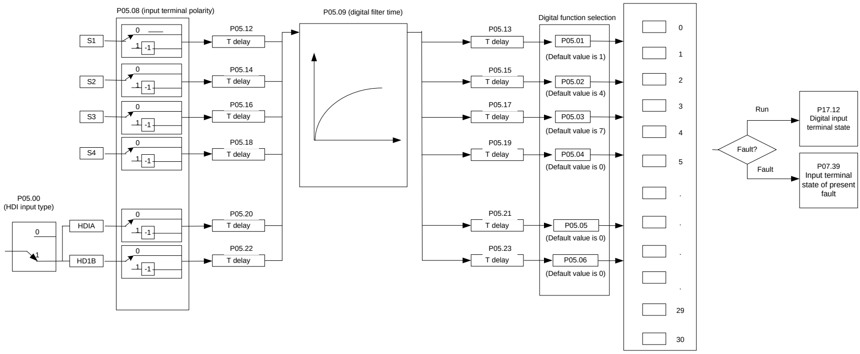
| Function code | Name | Description | Default value |
|---|---|---|---|
| P06.00 | HDO output type | 0: Open collector high-speed pulse output<br>1: Open collector output | 0 |
| P06.14 | AO1 output selection | 0: Running frequency (0–Max. output frequency)<br>1: Set frequency (0–Max. output frequency)<br>2: Ramp reference frequency (0–Max. output frequency)<br>3: Rotational speed (0–Speed corresponding to max. output frequency)<br>4: Output current (0–Twice the inverter rated current) | 0 |
| P06.15 | Reserved | | 0 |
| P06.16 | HDO high-speed pulse output | | 0 |

| Function code | Name | Description | Default value |
|---|---|---|---|
| | | 5: Output current (0–Twice the motor rated current)<br>6: Output voltage (0–1.5 times the inverter rated voltage)<br>7: Output power (0–Twice the motor rated power)<br>8: Set torque (0–Twice the motor rated torque)<br>9: Output torque (Absolute value, 0–+/- Twice the motor rated torque)<br>10: AI1 input (0–10V/0–20mA)<br>11: AI2 input (0–10V)<br>12: AI3 input (0–10V/0–20mA)<br>13: HDIA input (0.00–50.00kHz)<br>14: Value 1 set through Modbus/Modbus TCP communication (0–1000)<br>15: Value 2 set through Modbus/Modbus TCP communication (0–1000)<br>16: Value 1 set through PROFIBUS/CANopen/DeviceNet communication (0–1000)<br>17: Value 2 set through PROFIBUS/CANopen/DeviceNet communication (0–1000)<br>18: Value 1 set through Ethernet communication (0–1000)<br>19: Value 2 set through Ethernet communication (0–1000)<br>20: HDIB input (0.00–50.00kHz)<br>21: Value 1 set through EtherCAT/PROFINET/EtherNet IP communication (0–1000)<br>22: Torque current (bipolar, 0–Triple the motor rated current)<br>23: Exciting current (bipolar, 0–Triple the motor rated current)<br>24: Set frequency (bipolar, 0–Max. | |

| Function code | Name | Description | Default value |
|---|---|---|---|
| | | output frequency)<br>25: Ramp reference frequency (bipolar, 0–Max. output frequency)<br>26: Rotational speed (bipolar, 0–Speed corresponding to max. output frequency)<br>27: Value 2 set through EtherCAT/PROFINET/EtherNet IP communication (0–1000)<br>28: AO1 from the programmable card (0–1000)<br>29: AO2 from the programmable card (0–1000)<br>30: Rotational speed (0–Twice the motor rated synchronous speed)<br>31: Output torque (Actual value, 0–Twice the motor rated torque)<br>32: AI/AO temperature detection output | |
| 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–P06.26 | Reserved variable | 0–65535 | 0 |
| 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

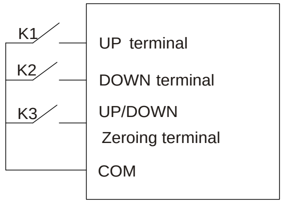
The inverter carries four programmable digital input terminals and two HDI input terminals. The function of all the digital input terminals can be programmed by function codes. HDI input terminal can be set to act as high-speed pulse input terminal or common digital input terminal; if it is set to act 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.**

| Setting | Function | Description |
|---|---|---|
| 0 | No function | The inverter 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 inverter by external terminals. |
| 2 | Reverse running (REV) | |
| 3 | 3-wire control/Sin | Set the inverter running mode to 3-wire control mode by this terminal. See P05.13 for details. |
| 4 | Forward jogging | Frequency when jogging, see P08.06, P08.07 and P08.08 for jogging acceleration/deceleration time. |
| 5 | Reverse jogging | |
| 6 | Coast to stop | The inverter blocks output, and the stop process of motor is uncontrolled by the inverter. 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. |
| 7 | Fault reset | 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. |
| 8 | Running pause | The inverter 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 inverter will revert to the |

<table>
<tr><th>Setting</th><th>Function</th><th>Description</th></tr>
<tr><td></td><td></td><td>state before stop.</td></tr>
<tr><td>9</td><td>External fault input</td><td>When external fault signal is transmitted to the inverter, the inverter 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.<br><br><br>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.<br>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 B frequency reference channel can be switched by no. 15 function.</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 setting</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.<br>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>Use these two terminals to select four groups of acceleration/decoration time.</td></tr>
</table>

<table>
<tr><th>Setting</th><th>Function</th><th>Description</th></tr>
<tr><td>22</td><td>Acceleration/deceleration time selection 2</td><td>
<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>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 inverter maintains current frequency output.</td></tr>
<tr><td>26</td><td>Wobbling frequency pause (stop at current frequency)</td><td>The inverter 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 inverter 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 control and torque control</td><td>The inverter switches from torque control mode to speed control mode, or vice versa.</td></tr>
<tr><td>30</td><td>Acceleration/deceleration disabled</td><td>Ensure the inverter will not be impacted by external signals (except for stop command) and maintains current output frequency.</td></tr>
<tr><td>31</td><td>Counter trigger</td><td>Enable pulse counting of the counter.</td></tr>
<tr><td>33</td><td>Clear frequency increase/decrease setting temporarily</td><td>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.</td></tr>
<tr><td>34</td><td>DC brake</td><td>The inverter starts DC brake immediately after the command becomes valid.</td></tr>
<tr><td>35</td><td>Switching between motor 1 and motor 2</td><td>When this terminal is valid, you can realize switchover control of two motors.</td></tr>
</table>

| Setting | Function | Description |
|---|---|---|
| 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 inverter will be zeroed out. |
| 41 | Maintain power consumption quantity | When this command is valid, current operation of the inverter 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 position zeroing | Spindle positioning is triggered. |
| 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. |

| Setting | Function | Description |
|---|---|---|
| 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 inverter 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 |
| 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 | If the terminal is valid, the proportional numerator is switched to the P21.30 numerator of the 2$^{nd}$ command ratio. |
| 71 | Switch to mater | In stopped state, if the terminal is valid, the master is used. |
| 72 | Switch to slave | In stopped state, if the terminal is valid, the slave is used. |
| 73 | Reset roll diameter | Used to reset the roll diameter when the tension control function is enabled. |
| 74 | Switch winding/unwinding | Used to switch winding/unwinding modes when the tension control function is enabled. |

| Setting | Function | Description |
|---|---|---|
| 75 | Tension control pre-drive | If the terminal is valid when the tension control function is enabled, tension control pre-drive is performed. |
| 76 | Disable roll diameter calculation | If the terminal is valid when the tension control function is enabled, roll diameter calculation is disabled. |
| 77 | Clear alarm display | Used to clear the alarm display when the tension control function is enabled. |
| 78 | Manual braking of tension control | If the terminal is valid when the tension control function is enabled, manual braking is activated. |
| 79 | Trigger forced feeding interrupt | If the terminal is valid when the tension control function is enabled, a feeding interrupt signal is triggered forcibly. |
| 80 | Initial roll diameter 1 | Used to select different initial roll diameters by combining with the initial roll diameter 2 when the tension control function is enabled. |
| 81 | Initial roll diameter 2 | Used to select different initial roll diameters by combining with the initial roll diameter 1 when the tension control function is enabled. |
| 82 | Trigger fire mode control | In fire mode, if the terminal is valid, the fire mode control signal is triggered. |
| 83 | Switch tension PID parameters | Used to switch two PID parameter groups when the tension control function is enabled. The first group is used by default. If the terminal is valid, the second group is used. |
| 84–95 | Reserved | |

Related parameter list:

| Function code | Name | Description | Default value |
|---|---|---|---|
| P05.00 | HDI input type | 0x00–0x11<br>Ones: HDIA input type<br>0: HDIA is high-speed pulse input<br>1: HDIA is digital input<br>Tens: HDIB input type<br>0: HDIB is high-speed pulse input<br>1: HDIB is digital input | 0x00 |
| P05.01 | Function of S1 terminal | 0: No function<br>1: Forward running<br>2: Reverse running<br>3: 3-wire control/Sin<br>4: Forward jogging<br>5: Reverse jogging | 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 |

| Function code | Name | Description | Default value |
|---|---|---|---|
| | | 6: Coast to stop | 0 |
| P05.06 | Function of HDIB terminal | 7: Fault reset<br>8: Running pause<br>9: External fault input<br>10: Frequency increase (UP)<br>11: Frequency decrease (DOWN)<br>12: Clear frequency increase/decrease setting<br>13: Switchover between setup A and setup B<br>14: Switchover between combination setting and A setting<br>15: Switchover between combination setting and setup B<br>16: Multi-step speed terminal 1<br>17: Multi-step speed terminal 2<br>18: Multi-step speed terminal 3<br>19: Multi-step speed terminal 4<br>20: Multi-step speed pause<br>21: Acceleration/deceleration time selection 1<br>22: Acceleration/deceleration time selection 2<br>23: Simple PLC stop reset<br>24: Simple PLC pause<br>25: PID control pause<br>26: Wobbling frequency pause<br>27: Wobbling frequency reset<br>28: Counter reset<br>29: Switching between speed control and torque control<br>30: Acceleration/deceleration disabled<br>31: Counter trigger<br>32: Reserved<br>33: Clear frequency increase/decrease setting temporarily<br>34: DC brake | 0 |

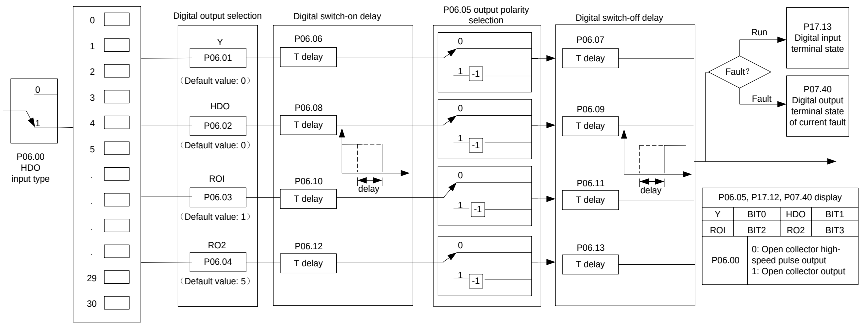
| Function code | Name | Description | Default value |
|---|---|---|---|
| | | 35: Switching between motor 1 and motor 2<br>36: Command switches to keypad<br>37: Command switches to terminal<br>38: Command switches to communication<br>39: Pre-exciting command<br>40: Zero out power consumption quantity<br>41: Maintain power consumption quantity<br>42: Source of upper torque limit switches to keypad<br>43: Position reference point input (only valid for S1, S2 and S3)<br>44: Disable spindle orientation<br>45: Spindle zeroing/local positioning zeroing<br>46: Spindle zero position selection 1<br>47: Spindle zero position selection 2<br>48: Spindle scale division selection 1<br>49: Spindle scale division selection 2<br>50: Spindle scale division selection 3<br>51: Position/speed control switchover terminal<br>52: Disable pulse input<br>53: Clear position deviation<br>54: Switch position proportional gains<br>55: Enable cyclic digital positioning<br>56: Emergency stop<br>57: Motor overtemperature fault input<br>59: Switch to V/F control<br>60: Switch to FVC control<br>61: PID polarity switchover<br>62: Reserved<br>63: Enable servo<br>64: FWD max. limit<br>65: REV max limit<br>66: Zero out the counter | |

| Function code | Name | Description | Default value |
|---|---|---|---|
| | | 67: Pulse increase<br>68: Enable pulse superimposition<br>69: Pulse decrease<br>70: Electronic gear selection<br>71: Switch to master<br>72: Switch to slave<br>73: Reset the roll diameter<br>74: Switch winding/unwinding<br>75: Pre-drive<br>76: Disable roll diameter calculation<br>77: Clear alarm display<br>78: Manual braking<br>79: Trigger forced feeding interrupt<br>80: Initial roll diameter 1<br>81: Initial roll diameter 2<br>82: Trigger fire mode control<br>83: Switch tension PID parameters<br>84–95: Reserved | |
| P05.07 | Reserved | | |
| P05.08 | Polarity of input terminal | 0x00–0x3F | 0x00 |
| P05.09 | Digital filter time | 0.000–1.000s | 0.010s |
| P05.10 | Virtual terminal setting | 0x00–0x3F (0: disable, 1: enable)<br>BIT0: S1 virtual terminal<br>BIT1: S2 virtual terminal<br>BIT2: S3 virtual terminal<br>BIT3: S4 virtual terminal<br>BIT4: HDIA virtual terminal<br>BIT8: HDIB virtual terminal | 0x00 |
| P05.11 | 2/3-wire control mode | 0: 2-wire control 1<br>1: 2-wire control 2<br>2: 3-wire control 1<br>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 |

| Function code | Name | Description | Default value |
|---|---|---|---|
| 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 | 0.000–50.000 s | 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 status at present fault | / | 0x0000 |
| P17.12 | Digital input terminal state | / | 0x0000 |

### 5.5.12 Digital output

The inverter 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 |

| Set value | Function | Description |
|---|---|---|
| | | reverse running |
| 4 | In jogging | Output ON signal when there is frequency output during jogging |
| 5 | Inverter fault | Output ON signal when inverter 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 inverter 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 inverter is ready to run, output ON signal. |
| 13 | In pre-exciting | Output ON signal during pre-exciting of the inverter |
| 14 | Overload pre-alarm | Output ON signal after the pre-alarm time elapsed based 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/Modbus TCP communication | Output corresponding signal based on the set value of Modbus/Modbus TCP; 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. |

| Set value | Function | Description |
|---|---|---|
| 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/ EtherNet IP 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 |
| 37 | Any frequency reached | The frequency reached signal is output when the present ramp reference frequency is greater than the detection value for frequency being reached. |
| 38–40 | Reserved | |
| 41 | Y1 | Y1 from the programmable card |
| 42 | Y2 | Y2 from the programmable card |
| 43 | HDO | HDO from the programmable card |
| 44 | RO1 | RO1 from the programmable card |
| 45 | RO2 | RO2 from the programmable card |
| 46 | RO3 | RO3 from the programmable card |
| 47 | RO4 | RO4 from the programmable card |
| 48 | EC PT100 detected OH pre-alarm | Pre-alarm of overheating (OH) detected by the expansion card (EC) with PT100. |
| 49 | EC PT1000 detected OH pre-alarm | Pre-alarm of OH detected by the EC with PT1000. |
| 50 | AI/AO detected OH pre-alarm | Pre-alarm of OH detected by AI/AO. |
| 51 | Stopped or running at zero | The inverter is in stopped state or running at zero speed. |

| Set value | Function | Description |
|---|---|---|
| | speed | |
| 52 | Disconnection detected in tension control | Disconnection is detected when the disconnection detection is enabled in tension control. |
| 53 | Roll diameter setting reached | The set roll diameter is reached during running in tension control. |
| 54 | Max. roll diameter reached | The max. roll diameter is reached during running in tension control. |
| 55 | Min. roll diameter reached | The min. roll diameter is reached during running in tension control. |
| 56 | Fire control mode enabled | The fire mode is turned on. |
| 57–63 | 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<br>1: Open collector output</td><td>0</td></tr>
<tr><td>P06.01</td><td>Y1 output selection</td><td rowspan="4">0: Invalid<br>1: In running<br>2: In forward running<br>3: In reverse running<br>4: In jogging<br>5: Inverter fault<br>6: Frequency level detection FDT1<br>7: Frequency level detection FDT2<br>8: Frequency reached<br>9: Running in zero speed<br>10: Reach upper limit frequency<br>11: Reach lower limit frequency<br>12: Ready to run<br>13: In pre-exciting<br>14: Overload pre-alarm<br>15: Underload pre-alarm<br>16: Simple PLC stage completed<br>17: Simple PLC cycle completed<br>18: Reach set counting value<br>19: Reach designated counting value<br>20: External fault is valid<br>21: Reserved</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 |
|---|---|---|---|
| | | 22: Reach running time<br>23: Virtual terminal output of Modbus/Modbus TCP communication<br>24: Virtual terminal output of POROFIBUS/CANopen communication<br>25: Virtual terminal output of Ethernet communication<br>26: DC bus voltage established<br>27: Z pulse output<br>28: During pulse superposition<br>29: STO action<br>30: Positioning completed<br>31: Spindle zeroing completed<br>32: Spindle scale-division completed<br>33: In speed limit<br>34: Virtual terminal output of EtherCAT/PROFINET/EtherNet IP communication<br>35: Reserved<br>36: Speed/position control switchover completed<br>37: Any frequency reached<br>38–40: Reserved<br>41: Y1 from the programmable card<br>42: Y2 from the programmable card<br>43: HDO from the programmable card<br>44: RO1 from the programmable card<br>45: RO2 from the programmable card<br>46: RO3 from the programmable card<br>47: RO4 from the programmable card<br>48: EC PT100 detected OH pre-alarm<br>49: EC PT1000 detected OH pre-alarm<br>50: AI/AO detected OH pre-alarm<br>51: Stopped or running at zero speed<br>52: Disconnection detected in tension control<br>53: Roll diameter setting reached<br>54: Max. roll diameter reached<br>55: Min. roll diameter reached | |

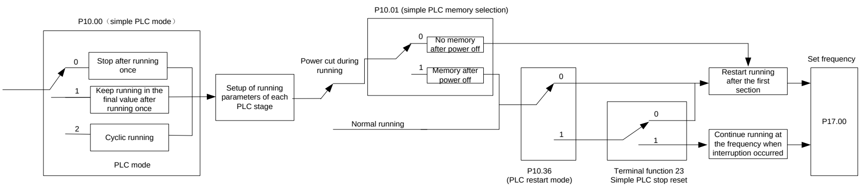
| Function code | Name | Description | Default value |
|---|---|---|---|
| | | 56: Fire control mode enabled<br>57–63: Reserved | |
| P06.05 | Output terminal polarity selection | 0x00–0x0F | 0x00 |
| P06.06 | Y switch-on delay | 0.000–50.000s | 0.000s |
| P06.07 | Y switch-off delay | 0.000–50.000s | 0.000s |
| P06.08 | HDO switch-on delay | 0.000–50.000s (valid 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 status at present fault | / | 0 |
| P17.13 | Digital output terminal state | / | 0 |

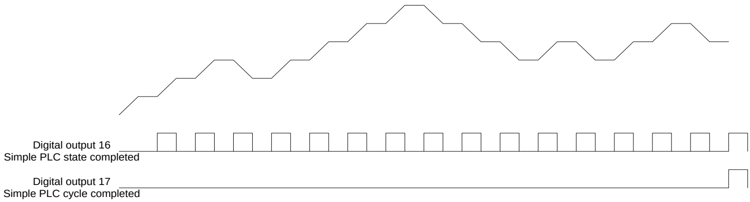
### 5.5.13 Simple PLC

Simple PLC is a multi-step speed generator, and the inverter 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 inverter itself can achieve this function.

The inverter 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.





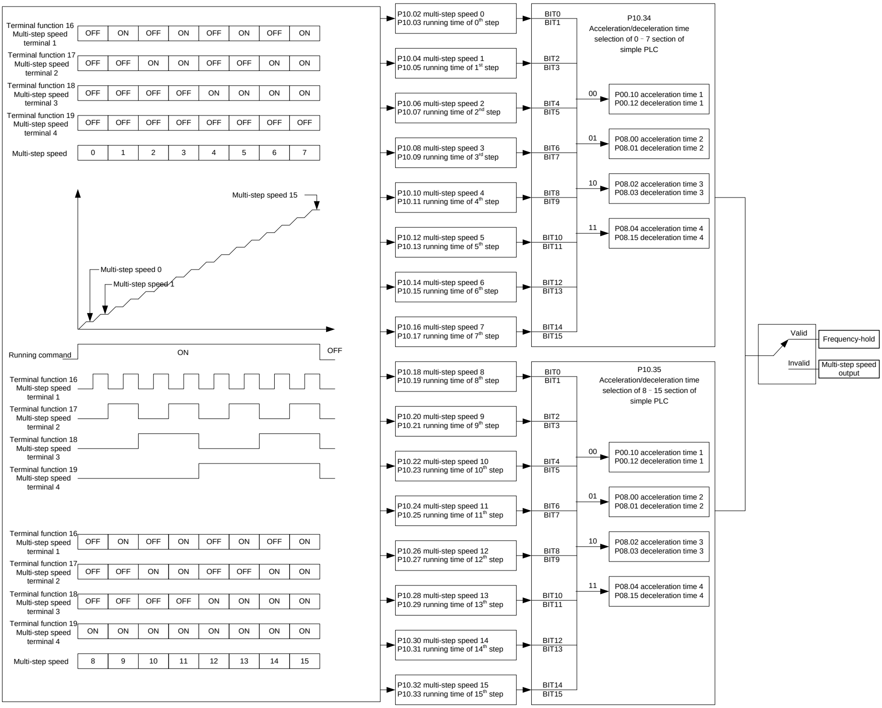

Related parameter list:

| Function code | Name | Description | Default value |
|---|---|---|---|
| P05.01–P05.06 | Digital input function selection | 23: Simple PLC stop reset<br>24: Pause simple PLC<br>25: Pause PID control | |
| P06.01–P06.04 | Digital output function selection | 16: Simple PLC stage reached<br>17: Simple PLC cycle reached | |
| P10.00 | Simple PLC mode | 0: Stop after running once<br>1: Keep running in the final value after running once<br>2: Cyclic running | 0 |
| P10.01 | Simple PLC memory selection | 0: No memory after power down<br>1: Memory after power down | 0 |
| P10.02 | Multi-step speed 0 | -300.0–300.0% | 0.0% |
| P10.03 | Running time of step 0 | 0.0–6553.5s (min) | 0.0s |
| P10.04 | Multi-step speed 1 | -300.0–300.0% | 0.0% |
| P10.05 | Running time of step 1 | 0.0–6553.5s (min) | 0.0s |
| P10.06 | Multi-step speed 2 | -300.0–300.0% | 0.0% |
| P10.07 | Running time of step 2 | 0.0–6553.5s (min) | 0.0s |
| P10.08 | Multi-step speed 3 | -300.0–300.0% | 0.0% |
| P10.09 | Running time of step 3 | 0.0–6553.5s (min) | 0.0s |
| P10.10 | Multi-step speed 4 | -300.0–300.0% | 0.0% |
| P10.11 | Running time of step 4 | 0.0–6553.5s (min) | 0.0s |
| P10.12 | Multi-step speed 5 | -300.0–300.0% | 0.0% |
| P10.13 | Running time of step 5 | 0.0–6553.5s (min) | 0.0s |
| P10.14 | Multi-step speed 6 | -300.0–300.0% | 0.0% |
| P10.15 | Running time of step 6 | 0.0–6553.5s (min) | 0.0s |
| P10.16 | Multi-step speed 7 | -300.0–300.0% | 0.0% |
| P10.17 | Running time of step 7 | 0.0–6553.5s (min) | 0.0s |

| Function code | Name | Description | Default value |
|---|---|---|---|
| P10.18 | Multi-step speed 8 | -300.0–300.0% | 0.0% |
| P10.19 | Running time of step 8 | 0.0–6553.5s (min) | 0.0s |
| P10.20 | Multi-step speed 9 | -300.0–300.0% | 0.0% |
| P10.21 | Running time of step 9 | 0.0–6553.5s (min) | 0.0s |
| P10.22 | Multi-step speed 10 | -300.0–300.0% | 0.0% |
| P10.23 | Running time of step 10 | 0.0–6553.5s (min) | 0.0s |
| P10.24 | Multi-step speed 11 | -300.0–300.0% | 0.0% |
| P10.25 | Running time of step 11 | 0.0–6553.5s (min) | 0.0s |
| P10.26 | Multi-step speed 12 | -300.0–300.0% | 0.0% |
| P10.27 | Running time of step 12 | 0.0–6553.5s (min) | 0.0s |
| P10.28 | Multi-step speed 13 | -300.0–300.0% | 0.0% |
| P10.29 | Running time of step 13 | 0.0–6553.5s (min) | 0.0s |
| P10.30 | Multi-step speed 14 | -300.0–300.0% | 0.0% |
| P10.31 | Running time of step 14 | 0.0–6553.5s (min) | 0.0s |
| P10.32 | Multi-step speed 15 | -300.0–300.0% | 0.0% |
| P10.33 | Running time of step 15 | 0.0–6553.5s (min) | 0.0s |
| P10.36 | PLC restart mode | 0: Restart from the first section<br>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<br>24: Simple PLC pause<br>25: PID control pause | |
| P06.01–P06.04 | Digital output function | 16: Simple PLC stage reached<br>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 inverter 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.



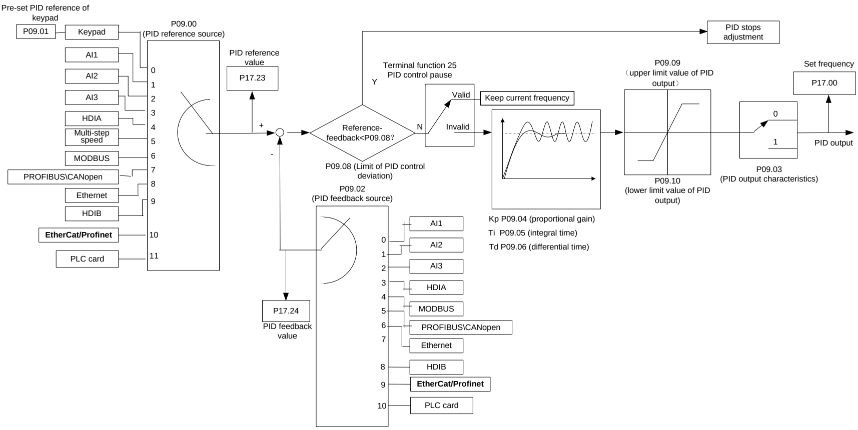

Related parameter list:

| Function code | Name | Description | Default value |
|---|---|---|---|
| P05.01–P05.06 | Digital input function selection | 16: Multi-step speed terminal 1<br>17: Multi-step speed terminal 2<br>18: Multi-step speed terminal 3<br>19: Multi-step speed terminal 4<br>20: Pause multi-step speed running | |
| P10.02 | Multi-step speed 0 | -300.0–300.0% | 0.0% |
| P10.03 | Running time of step 0 | 0.0–6553.5s (min) | 0.0s |
| P10.04 | Multi-step speed 1 | -300.0–300.0% | 0.0% |
| P10.05 | Running time of step 1 | 0.0–6553.5s (min) | 0.0s |
| P10.06 | Multi-step speed 2 | -300.0–300.0% | 0.0% |
| P10.07 | Running time of step 2 | 0.0–6553.5s (min) | 0.0s |
| P10.08 | Multi-step speed 3 | -300.0–300.0% | 0.0% |
| P10.09 | Running time of step 3 | 0.0–6553.5s (min) | 0.0s |

| Function code | Name | Description | Default value |
|---|---|---|---|
| P10.10 | Multi-step speed 4 | -300.0–300.0% | 0.0% |
| P10.11 | Running time of step 4 | 0.0–6553.5s (min) | 0.0s |
| P10.12 | Multi-step speed 5 | -300.0–300.0% | 0.0% |
| P10.13 | Running time of step 5 | 0.0–6553.5s (min) | 0.0s |
| P10.14 | Multi-step speed 6 | -300.0–300.0% | 0.0% |
| P10.15 | Running time of step 6 | 0.0–6553.5s (min) | 0.0s |
| P10.16 | Multi-step speed 7 | -300.0–300.0% | 0.0% |
| P10.17 | Running time of step 7 | 0.0–6553.5s (min) | 0.0s |
| P10.18 | Multi-step speed 8 | -300.0–300.0% | 0.0% |
| P10.19 | Running time of step 8 | 0.0–6553.5s (min) | 0.0s |
| P10.20 | Multi-step speed 9 | -300.0–300.0% | 0.0% |
| P10.21 | Running time of step 9 | 0.0–6553.5s (min) | 0.0s |
| P10.22 | Multi-step speed 10 | -300.0–300.0% | 0.0% |
| P10.23 | Running time of step 10 | 0.0–6553.5s (min) | 0.0s |
| P10.24 | Multi-step speed 11 | -300.0–300.0% | 0.0% |
| P10.25 | Running time of step 11 | 0.0–6553.5s (min) | 0.0s |
| P10.26 | Multi-step speed 12 | -300.0–300.0% | 0.0% |
| P10.27 | Running time of step 12 | 0.0–6553.5s (min) | 0.0s |
| P10.28 | Multi-step speed 13 | -300.0–300.0% | 0.0% |
| P10.29 | Running time of step 13 | 0.0–6553.5s (min) | 0.0s |
| P10.30 | Multi-step speed 14 | -300.0–300.0% | 0.0% |
| P10.31 | Running time of step 14 | 0.0–6553.5s (min) | 0.0s |
| P10.32 | Multi-step speed 15 | -300.0–300.0% | 0.0% |
| P10.33 | Running time of step 15 | 0.0–6553.5s (min) | 0.0s |
| P10.34 | 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 inverter 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 the voltage setting channel (P04.27) is 6, the running mode of inverter 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.

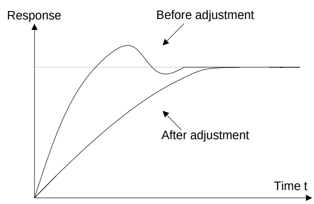
If you need to set Td to another value, set in the same way with P and Ti, namely set Td to 30% of the value when there is no oscillation.

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

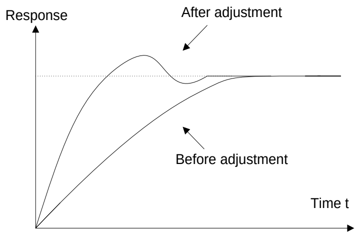
#### 5.5.15.2 PID adjusting method

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

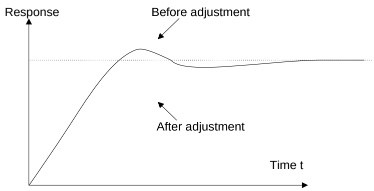
**Control overmodulation: When overmodulation occurred, shorten the derivative time (Td) and prolong integral time (Ti).**



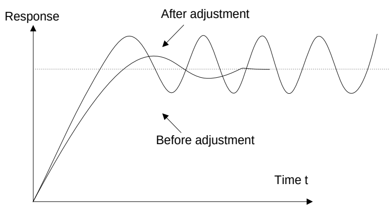

**Stabilize the feedback value as fast as possible:** when overmodulation occurred, shorten integral time (Ti) and prolong derivative time (Td) to stabilize control as fast as possible.




**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:

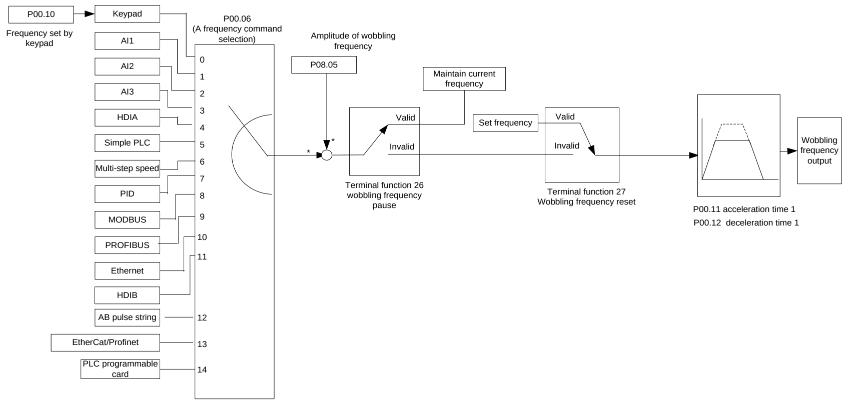
| Function code | Name | Description | Default value |
|---|---|---|---|
| P09.00 | PID reference source | 0: Set by P09.01<br>1: AI1<br>2: AI2<br>3: AI3<br>4: High-speed pulse HDIA<br>5: Multi-step<br>6: Modbus/Modbus TCP communication<br>7: PROFIBUS/CANopen/DeviceNet communication<br>8: Ethernet communication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

| Function code | Name | Description | Default value |
|---|---|---|---|
| | | 10: EtherCAT/PROFINET/EtherNet IP communication<br>11: Programmable expansion card<br>12: Reserved | |
| P09.01 | PID digital setting | -100.0%–100.0% | 0.0% |
| P09.02 | PID feedback source | 0: AI1<br>1: AI2<br>2: AI3<br>3: High-speed pulse HDIA<br>4: Modbus/Modbus TCP communication<br>5: PROFIBUS/CANopen/DeviceNet communication<br>6: Ethernet communication<br>7: High-speed pulse HDIB<br>8: EtherCAT/PROFINET/EtherNet IP communication<br>9: Programmable expansion card<br>10: Reserved | 0 |
| P09.03 | PID output characteristics | 0: PID output is positive characteristic<br>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<br>Ones:<br>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<br>Tens:<br>0: The same with the main reference direction<br>1: Contrary to the main reference direction<br>Hundreds:<br>0: Limit as per the max. frequency<br>1: Limit as per A frequency<br>Thousands:<br>0: A+B frequency, acceleration /deceleration of main reference A frequency source buffering is invalid<br>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 | | |
| 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<br>1: AI1<br>2: AI2<br>3: AI3<br>4: High speed pulse HDIA<br>5: Simple PLC program<br>6: Multi-step speed running<br>7: PID control<br>8: Modbus/Modbus TCP communication<br>9: PROFIBUS/CANopen/DeviceNet communication<br>10: Ethernet communication<br>11: High speed pulse HDIB<br>12: Pulse string AB<br>13: EtherCAT/PROFINET/EtherNet IP communication<br>14: Programmable 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 inverter 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<br>Ones: HDIA input type<br>0: HDIA is high-speed pulse input<br>1: HDIA is digital input<br>Tens: HDIB input type<br>0: HDIB is high-speed pulse input<br>1: HDIB is digital input | 0x00 |
| P05.38 | HDIA high-speed pulse input function | 0: Set input via frequency<br>1: Reserved<br>2: Input via encoder, used in combination with HDIB | 0 |
| P05.44 | HDIB high-speed pulse input function selection | 0: Set input via frequency<br>1: Reserved<br>2: Input via encoder, used in combination with HDIA | 0 |
| P18.00 | Actual frequency of encoder | -999.9–3276.7Hz | 0.0Hz |
| P20.15 | Speed measurement mode | 0: PG card<br>1: local; realized by HDIA and HDIB; supports incremental 24V encoder only | 0 |

### 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 inverter, 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 inverter.

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.

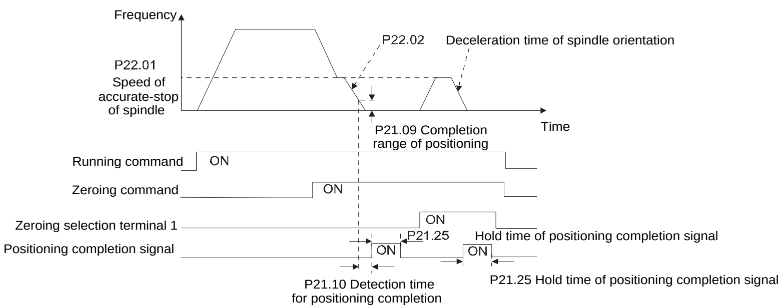
Step 7: When P21.08 (output limit of position controller) is set to 0, the position control will be invalid, and at this point, the pulse string acts as frequency source, P21.13 (position feedforward gain) should be set to 100%, and the speed acceleration/deceleration time is determined by the acceleration /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 inverter, 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. 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 are 1:1 rigid connection.

b) the encoder is installed on the motor shaft; the motor shaft and spindle are 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.

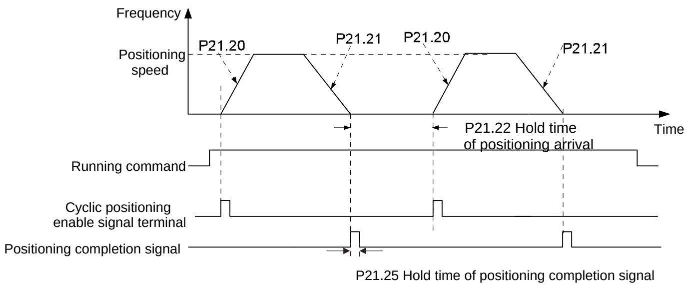
Proximity switch positioning supports the following spindle positioning modes:

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

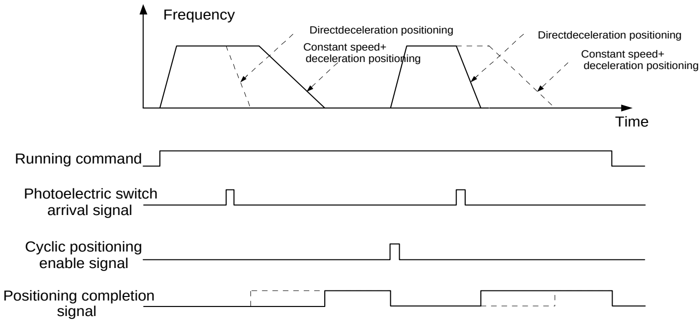
Set P21.16. bit1=0, and the motor will carry out single positioning action and stay in the positioning position according to the setup in step 5.

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

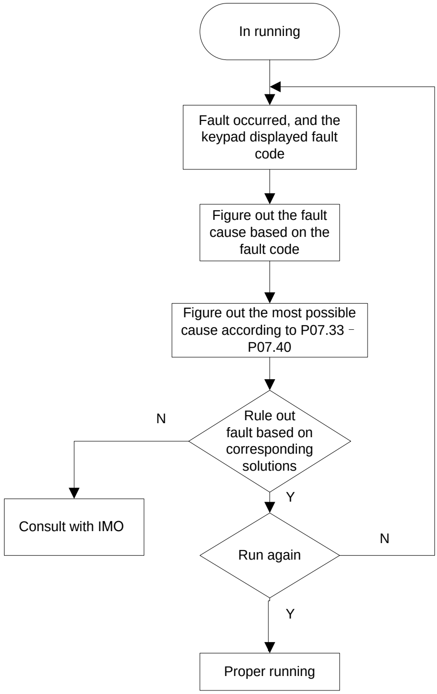
After positioning is done, the motor will stay in current position. You can set cyclic positioning through input terminal function selection (55: enable cyclic digital positioning) in P05 group; when the terminal receives cyclic positioning enable signal (pulse signal), the motor will continue running 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. 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 | Present fault type | 0: No fault | 0 |
| P07.28 | Last fault type | 1: Inverter unit U phase protection (OUt1) | 0 |
| P07.29 | 2nd-last fault type | 2: Inverter unit V phase protection (OUt2) | 0 |
| P07.30 | 3rd-last fault type | 3: Inverter unit W phase protection (OUt3) | 0 |
| P07.31 | 4th-last fault type | 4: Overcurrent during acceleration (OC1) | 0 |
| P07.32 | 5th-last fault type | 5: Overcurrent during deceleration (OC2)<br>6: Overcurrent during constant speed (OC3)<br>7: Overvoltage during acceleration (OV1)<br>8: Overvoltage during deceleration (OV2)<br>9: Overvoltage during constant speed (OV3)<br>10: Bus undervoltage fault (UV)<br>11: Motor overload (OL1)<br>12: inverter overload (OL2) | 0 |

| Function code | Name | Description | Default value |
|---|---|---|---|
| | | 13: Phase loss on input side (SPI)<br>14: Phase loss on output side (SPO)<br>15: Rectifier module overheat (OH1)<br>16: Inverter module overheat (OH2)<br>17: External fault (EF)<br>18: Modbus/Modbus TCP communication fault (CE)<br>19: Current detection fault (ItE)<br>20: Motor autotuning fault (tE)<br>21: EEPROM operation fault (EEP)<br>22: PID feedback offline fault (PIDE)<br>23: Braking unit fault (bCE)<br>24: Running time reached (END)<br>25: Electronic overload (OL3)<br>26: Keypad communication error (PCE)<br>27: Parameter upload error (UPE)<br>28: Parameter download error (DNE)<br>29: Profibus DP communication fault (E-DP)<br>30: Ethernet communication fault (E-NET)<br>31: CANopen communication fault (E-CAN)<br>32: To-ground short-circuit fault 1 (ETH1)<br>33: To-ground short-circuit fault 2 (ETH2)<br>34: Speed deviation fault (dEu)<br>35: Mal-adjustment fault (STo)<br>36: Underload fault (LL)<br>37: Encoder offline fault (ENC1O)<br>38: Encoder reversal fault (ENC1D)<br>39: Encoder Z pulse offline fault (ENC1Z)<br>40: Safe torque off (STO)<br>41: Channel H1 safety circuit exception (STL1)<br>42: Channel H2 safety circuit exception (STL2)<br>43: Channel H1 and H2 exception (STL3)<br>44: Safety code FLASH CRC check fault (CrCE)<br>55: Duplicate expansion card type (E-Err) | |

| Function code | Name | Description | Default value |
|---|---|---|---|
| | | 56: Encoder UVW loss fault (ENCUV)<br>57: PROFINET communication timeout fault (E-PN)<br>58: CAN communication fault (SECAN)<br>59: Motor over-temperature fault (OT)<br>60: Failure to identify the card at slot 1 (F1-Er)<br>61: Failure to identify the card at slot 2 (F2-Er)<br>62: Failure to identify the card at slot 3 (F3-Er)<br>63: Communication timeout of the card at slot 1 (C1-Er)<br>64: Communication timeout of the card at slot 2 (C2-Er)<br>65: Communication timeout of the card at slot 3 (C3-Er)<br>66: EtherCAT communication fault (E-CAT)<br>67: Bacnet communication fault (E-BAC)<br>68: DeviceNet communication fault (E-DEV)<br>69: CAN slave fault in master/slave synchronization (S-Err)<br>70: EC PT100 detected overheating (OtE1)<br>71: EC PT1000 detected overheating (OtE2)<br>72: EtherNet/IP communication timeout (E-EIP)<br>73: No upgrade bootload (E-PAO)<br>74: AI1 disconnected (E-AI1)<br>75: AI2 disconnected (E-AI2)<br>76: AI3 disconnected (E-AI3) | |
| P07.33 | Running frequency at present fault | 0.00Hz–P00.03 | 0.00Hz |
| P07.34 | Ramp reference frequency at present fault | 0.00Hz–P00.03 | 0.00Hz |
| P07.35 | Output voltage at present | 0–1200V | 0V |

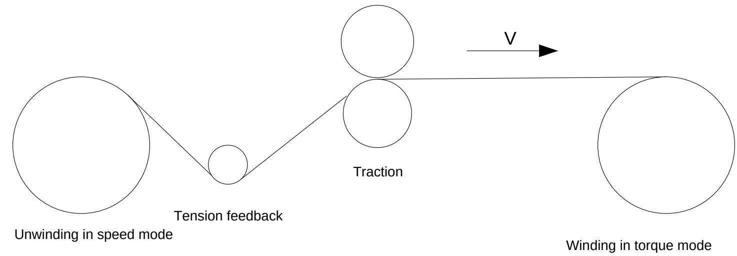
| Function code | Name | Description | Default value |
|---|---|---|---|
| | fault | | |
| P07.36 | Output current at present fault | 0.0–6300.0A | 0.0A |
| P07.37 | Bus voltage at present fault | 0.0–2000.0V | 0.0V |
| P07.38 | Max. temperature at present fault | -20.0–120.0°C | 0.0°C |
| P07.39 | Input terminal status at present fault | 0x0000–0xFFFF | 0x0000 |
| P07.40 | Output terminal status at present fault | 0x0000–0xFFFF | 0x0000 |
| P07.41 | Running frequency at last fault | 0.00Hz–P00.03 | 0.00Hz |
| P07.42 | Ramp reference frequency at last fault | 0.00Hz–P00.03 | 0.00Hz |
| P07.43 | Output voltage at last fault | 0–1200V | 0V |
| P07.44 | Output current at last fault | 0.0–6300.0A | 0.0A |
| P07.45 | Bus voltage at last fault | 0.0–2000.0V | 0.0V |
| P07.46 | Max. temperature at last fault | -20.0–120.0°C | 0.0°C |
| P07.47 | Input terminal status at last fault | 0x0000–0xFFFF | 0x0000 |
| P07.48 | Output terminal state at last fault | 0x0000–0xFFFF | 0x0000 |
| P07.49 | Running frequency at 2nd-last fault | 0.00Hz–P00.03 | 0.00Hz |
| P07.50 | Ramp reference frequency at 2nd-last fault | 0.00Hz–P00.03 | 0.00Hz |
| P07.51 | Output voltage at 2nd-last fault | 0–1200V | 0V |
| P07.52 | Output current at 2nd-last fault | 0.0–6300.0A | 0.0A |
| P07.53 | Bus voltage at 2nd-last fault | 0.0–2000.0V | 0.0V |
| P07.54 | Max. temperature at 2nd-last fault | -20.0–120.0°C | 0.0°C |
| P07.55 | Input terminal status at 2nd-last fault | 0x0000–0xFFFF | 0x0000 |
| P07.56 | Output terminal status at 2nd-last fault | 0x0000–0xFFFF | 0x0000 |

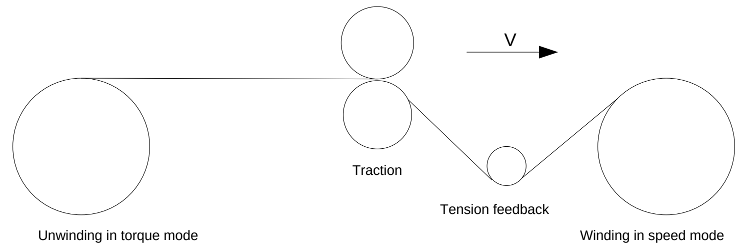
### 5.5.20 Tension control solutions

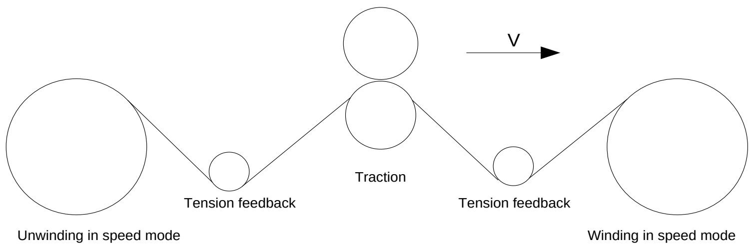
In many fields of industrial production, precise tension control is needed to maintain a constant output tension of the drive equipment, to improve the quality of the products. In the winding and unwinding of some industries such as paper processing, printing, and dyeing, packing, wire and cable manufacturing,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

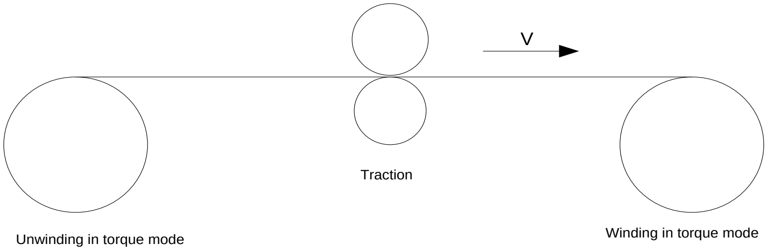
The inverter controls the tension by regulating the motor output torque or speed. There are three modes to control the tension: speed mode, open-loop torque mode and closed-loop torque mode.

#### 5.5.20.1 Typical tension control applications for winding/unwinding





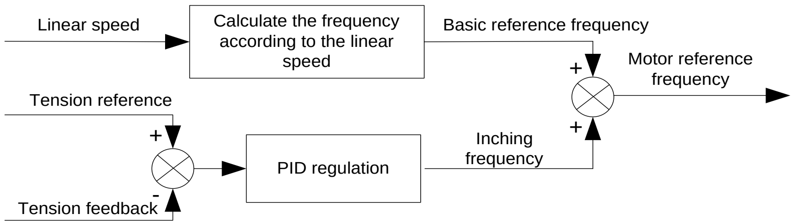

In some special situations, if the roll diameter can be counted through thickness, the following applications can be implemented:



**5.5.20.2 Speed control**

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

The control principle is as follows.




Related modules:

(1) Linear speed input module: It is important for the calculation of the basic setting frequency according to the linear speed and the calculation of roll diameter according to the linear speed.

(2) Real-time roll diameter calculation module: The calculation accuracy of roll diameter determines the control performance. The roll diameter can be calculated according to the inverter output frequency and the linear speed. In addition, it can also be calculated through the thickness or sensor. The linear speed is widely used for the calculation. If the set linear speed is used for the calculation, you you choose whether to enable the function of roll diameter change limiting.

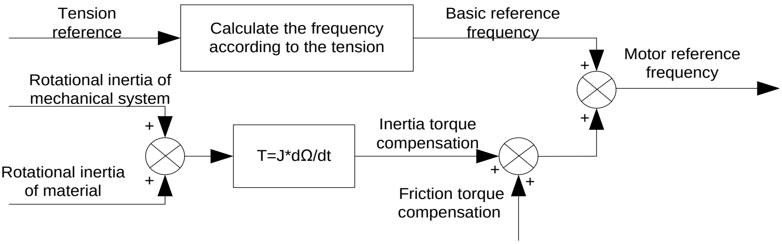
(3) PID regulation module: There are two groups of PID parameters in P09. The linear speed synchronization and stable tension can be kept through PID regulation. PID parameters can be modified based on site commissioning. The two groups of PID parameters can be switched for PID regulation improvement.

(4) Material feeding interrupt detection and processing module: The function is valid when material feeding interrupt detection has been enabled.

(5) Pre-drive: This function is applied to automatic reel change. After the inverter is started if the pre-drive function terminal is valid, the roller runs at the set linear speed. When the terminal is invalid, the inverter will automatically switch to the corresponding control mode after a period.

**5.5.20.3 Open-loop torque mode**

Open loop means there is no tension feedback signal. In this mode, stable tension can be achieved by means of motor torque control. The rotation speed automatically changes with the linear speed of material. The control basis is as follows: For a reel control system, the relationship between the tension F of the roller with materials, present roll diameter D and output torque of the shaft is: $T = F \times D/2$. If the output torque can be adjusted according to the variation of roll diameter, the tension can be controlled. To ensure the constant tension in the process of acceleration and deceleration, the internal friction compensation module and inertia compensation module have been built in the inverter to calculate the real time rotation inertia and compensate the torque according to the actual speed change rate. The control principle is shown in the following figure.




Relevant modes:

(1) Linear speed input module: It has two functions: calculating the synchronous frequency in torque control according to the linear speed and calculating the roll diameter according to the linear speed.

(2) Tension setting module: Used to set the tension adapting to the control system. It needs to be adjusted according to the actual situation. After confirmation, the value remains the same. In some scenarios where the forming effect after winding needs to be improved, the tension taper function can be used so that the tension decreases as the roll diamter increases.

(3) Real-time roll diameter calculation module: The calculation accuracy of roll diameter determines the control performance. The roll diameter can be calculated according to the inverter output frequency and the linear speed. In addition, it can also be calculated through the thickness or sensor. The linear speed is widely used for the calculation. If the set linear speed is used for the calculation, you you choose whether to enable the function of roll diameter change limiting.

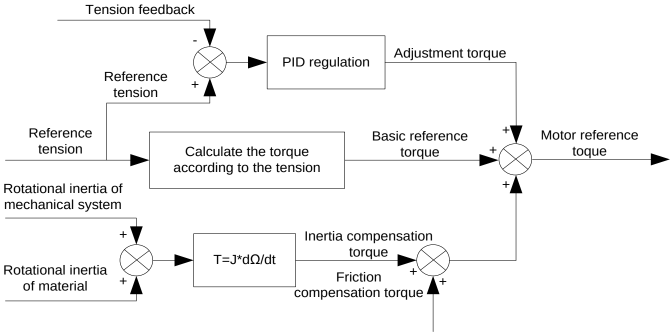
(4) Torque compensation module: Torque compensation includes friction torque compensation and inertia torque compensation. Friction torque compensation is used to eliminate the impact of friction on tension, and it needs to be adjusted according to actual requirements. rRotation inertia includes inertial of mechanical systems and that of materials. To keep the tension stable in ACC/DEC, compensation torque is required. In some cases, without strict tension control requirements, disabling rotation inertia torque compensation can also achieve the control.

(5) Material feeding interrupt detection and processing module: The function is valid when material feeding interrupt detection has been enabled.

(6) This function is applied to automatic reel change. After the inverter is started if the pre-drive function terminal is valid, the roller runs at the set linear speed. When the terminal is invalid, the inverter will automatically switch to the corresponding control mode after a period.

#### 5.5.20.4 Closed-loop torque mode

Similar to the open-loop torque mode, the closed-loop torque mode has only the difference that tension detection sensors are installed on the winding/unwinding side. In addition to all the function modules supported in open-loop torque mode, this mode supports an additional tension feedback PID closed-loop regulation module. The control principle is shown in the following figure.


Tension feedback
-
PID regulation
Adjustment torque
Reference
tension
+
Reference
tension
Calculate the torque
according to the tension
Basic reference
torque
+
+
+
Motor reference
toque
Rotational inertia of
mechanical system
+
T=J*dΩ/dt
Inertia compensation
torque
Rotational inertia
of material
+
Friction
compensation torque
+
+

# 6 Function Parameter List

## 6.1 What this chapter contains

This chapter lists all the function codes and corresponding descriptions.

## 6.2 Function parameter list

The function parameters of the inverter 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 inverter is in stopped or running state.

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

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

(The inverter 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.

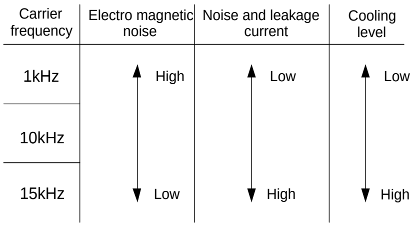
4. To enhance parameter protection, the inverter provides the password protection function. After a user password is set (that is, P07.00 is set to a non-zero value), "0.0.0.0.0" is displayed when you press the PRG/ESC key to enter the function code editing interface, and you can enter the

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 inverter.) 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: Sensorless vector control (SVC) mode 0<br>1: SVC 1<br>2: Space voltage vector control mode<br>3: FVC<br>**Note:** To select 0, 1, or 3 as the control mode, enable the inverter to perform motor parameter autotuning first | 2 | ◎ |
| P00.01 | Channel of running commands | 0: Keypad<br>1: Terminal<br>2: Communication | 0 | ○ |
| P00.02 | Communication mode of running commands | 0: Modbus/Modbus TCP<br>1: PROFIBUS/CANopen/DeviceNet<br>2: Ethernet<br>3: EtherCAT/PROFINET/EtherNet IP<br>4: Programmable card<br>5: Wireless communication card<br>6: Reserved<br>**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 inverter. It is the basis of frequency setup and the acceleration/deceleration.<br>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 inverter output frequency. This value cannot be more than the maximum output frequency.<br>When the set frequency is higher than the upper limit, the inverter runs at the upper limit frequency.<br>Setting range: P00.05–P00.03 (Max. output | 50.00Hz | ◎ |

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

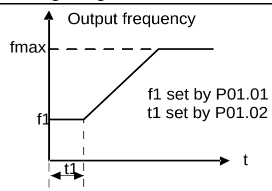
<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th><th>Modify</th></tr>
<tr><td></td><td></td><td>Setting range: 0.00 Hz–P00.03 (Max. output frequency)</td><td></td><td></td></tr>
<tr><td>P00.11</td><td>Acceleration time 1</td><td>Acceleration time is the time needed 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.<br>The inverter 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 inverter is the first group by default.<br>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<br>1: Run in reverse direction<br>2: Reverse running is prohibited</td><td>0</td><td>○</td></tr>
<tr><td>P00.14</td><td>Carrier frequency setup</td><td>

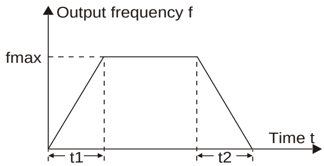
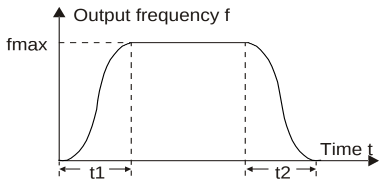
The relation between the model and carrier frequency is shown below.
<table>
<tr><th colspan="2">Model</th><th>Default carrier frequency</th></tr>
<tr><td rowspan="3">380V</td><td>1.5–11kW</td><td>8kHz</td></tr>
<tr><td>15–55kW</td><td>4kHz</td></tr>
<tr><td>Above 75kW</td><td>2kHz</td></tr>
<tr><td 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.<br>Disadvantages of high carrier frequency are as follows: growing switch consumption, enlarged</td><td>Depends on model</td><td>○</td></tr>
</table>

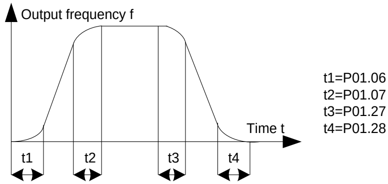
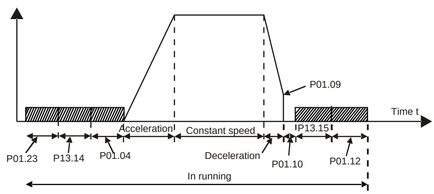
| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | | temperature rise, impacted output capacity; under high carrier frequency, the inverter needs to be derated for use, meanwhile, the leakage current will increase, which increases electromagnetic interference to the surroundings.<br>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.<br>The carrier frequency of inverter is set properly by default, and it should not be changed at will.<br>If the default carrier frequency is exceeded during use, derating is required, derate by 10% for every additional 1k carrier frequency.<br>Setting range: 1.2–15.0kHz | | |
| P00.15 | Motor parameter autotuning | 0: No operation<br>1: Rotary autotuning 1; carry out comprehensive motor parameter autotuning; rotary autotuning is used in cases where high control precision is required.<br>2: Static autotuning 1 (comprehensive autotuning); static autotuning 1 is used in cases where the motor cannot be disconnected from load.<br>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.<br>4: Rotary autotuning 2, which is like rotary autotuning 1 but is only applicable to asynchronous motors.<br>5: Rotary autotuning 3 (partial autotuning), which is only applicable to asynchronous motors. | 0 | ◎ |
| P00.16 | AVR function | 0: Invalid<br>1: Valid during the whole process<br>Automatic voltage regulation function is used to eliminate the impact on the output voltage of inverter when bus voltage fluctuates. | 1 | ○ |
| P00.17 | Reserved | Reserved | | |

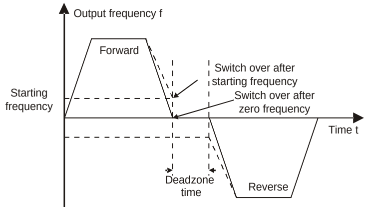
| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| P00.18 | Function parameter restoration | 0: No operation<br>1: Restore default values (excluding motor parameters)<br>2: Clear fault records<br>3: Reserved<br>4: Reserved<br>5: Restore default values (for factory test mode)<br>6: Restore default values (including motor parameters)<br>**Note:** After the selected operation is performed, this parameter is automatically restored to 0. Restoring the default values may delete the user password. Exercise caution when using this function. The option 5 can be used only for factory testing. | 0 | ◎ |

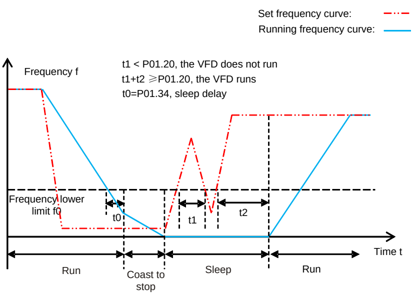
**P01—Start/stop control**

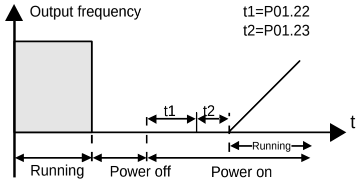
| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| P01.00 | Running mode of start | 0: Direct start<br>1: Start after DC brake<br>2: Start after speed-tracking tracking | 0 | ◎ |
| P01.01 | Starting frequency of direct start | Starting frequency of direct startup is the initial frequency when the inverter starts. See P01.02 (hold time of starting frequency) for details.<br>Setting range: 0.00–50.00Hz | 0.50Hz | ◎ |
| P01.02 | Hold time of starting frequency | <br>A proper starting frequency can increase the torque during startup. Within the hold time of starting frequency, the output frequency of inverter 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 inverter will be standby rather than running. The starting frequency value is unlimited by the lower limit frequency. | 0.0s | ◎ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | | Setting range: 0.0–50.0s | | |
| P01.03 | DC brake current before start | During starting, the inverter will first perform DC brake based on the set DC brake current before startup, and then it will accelerate after the set DC brake time before startup elapses. If the set DC brake time is 0, DC brake will be invalid.<br>The larger the DC brake current, the stronger the brake force. The DC brake current before startup refers to the percentage relative to rated inverter output current.<br>Setting range of P01.03: 0.0–100.0%<br>Setting range of P01.04: 0.00–50.00s | 0.0% | ◎ |
| P01.04 | DC brake time before start | | 0.00s | ◎ |
| P01.05 | Acceleration/deceleration mode | This function code is used to select the frequency variation mode during starting and running.<br>0: Straight line; the output frequency increases or decreases in straight line.<br><br>1: S curve; the output frequency increases or decreases in S curve.<br>S curve is generally used in cases where smooth start/stop is required, such as elevator, conveyer belt, and so on.<br><br>**Note: When set to 1, it is required to set P01.06, P01.07, P01.27 and P01.28 accordingly.** | 0 | ◎ |
| P01.06 | Time of starting section of acceleration S curve | The curvature of S curve is determined by acceleration range and acceleration and deceleration time. | 0.1s | ◎ |

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th><th>Modify</th></tr>
<tr><td>P01.07</td><td>Time of ending section of acceleration S curve</td><td>
<br>Setting range: 0.0–50.0s</td><td>0.1s</td><td>◎</td></tr>
<tr><td>P01.08</td><td>Stop mode</td><td>0: Decelerate to stop; after stop command is valid, the inverter lowers output frequency based on the deceleration mode and the defined deceleration time, after the frequency drops to the stop speed (P01.15), the inverter stops.<br>1: Coast to stop; after stop command is valid, the inverter stops output immediately, and the load coasts to stop as per mechanical inertia.</td><td>0</td><td>○</td></tr>
<tr><td>P01.09</td><td>Starting frequency of DC brake after stop</td><td rowspan="4">Starting frequency of DC brake after stop; during decelerating to stop, when this frequency is reached, DC brake will be performed after stop.<br>Demagnetization time (waiting time of DC brake after stop): Before the DC brake, the inverter 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.<br>DC brake current after stop: it means the DC brake force applied, the larger the current, the stronger the DC brake effect.<br>
<br>Setting range of P01.09: 0.00Hz–P00.03 (Max. output frequency)<br>Setting range of P01.10: 0.00–30.00s<br>Setting range of P01.11: 0.0–100.0% (of the rated inverter output current)<br>Setting range of P01.12: 0.0–50.0s</td><td>0.00Hz</td><td>○</td></tr>
<tr><td>P01.10</td><td>Waiting time of DC brake after stop</td><td>0.00s</td><td>○</td></tr>
<tr><td>P01.11</td><td>DC brake current of stop</td><td>0.0%</td><td>○</td></tr>
<tr><td>P01.12</td><td>DC brake time of stop</td><td>0.00s</td><td>○</td></tr>
</table>

| 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 inverter, as shown below.<br><br>Setting range: 0.0–3600.0s | 0.0s | ○ |
| P01.14 | Forward/reverse rotation switchover mode | 0: Switch over after zero frequency<br>1: Switch over after starting frequency<br>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)<br>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.<br>0: Terminal running command is invalid during power-on. The inverter 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 inverter will run only after this terminal is cancelled and enabled again.<br>1: Terminal running command is valid during power-on. The system will start the inverter automatically after initialization is done if the running command terminal is detected to be valid during power-on.<br>Note: This function must be set with caution, otherwise, serious consequences may occur. | 0 | ○ |
| P01.19 | Action selected when running | This parameter specifies the running status of inverter when the set frequency is below the lower | 0 | ◎ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | frequency less than frequency lower limit (valid when frequency lower limit greater than 0) | limit.<br>Ones place: Action selection<br>0: Run in lower limit of the frequency<br>1: Stop<br>2: Sleep<br>Tens place: Stop mode<br>0: Coast to stop<br>1: Decelerate to stop<br>The inverter stops as set in the tens place if the action selection is stop or sleep when the set frequency is below the lower limit. The inverter resumes the running state automatically when the set frequency is above the lower limit again and this situation lasts for the time set by P01.20. | | |
| P01.20 | Wake-up-from-sleep delay | This parameter specifies the sleep delay. When the running frequency of inverter is below the lower limit frequency, the inverter 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 inverter will run automatically.<br><br>Setting range: 0.0–3600.0s (valid when P.01.19 is 2) | 0.0s | ○ |
| P01.21 | Restart after power down | This parameter specifies the automatic running of the inverter at next power-on after power down.<br>0: Disabled restart<br>1: Enable restart, namely the inverter will run automatically after the time set by P01.22 elapses if the starting conditions are met. | 0 | ○ |
| P01.22 | Waiting time of | This parameter specifies the waiting time before | 1.0s | ○ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | restart after power down | automatically running at next power-on after power down.   Setting range: 0.0–3600.0s (valid when P01.21=1) | | |
| P01.23 | Start delay | This parameter specifies the delay of the inverter's wake-up-from-sleep after running command is given, the inverter will start to run and output after the time set by P01.23 elapses to realize brake release.<br>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<br>1: With voltage output<br>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 inverter starts in direct start mode (P01.00=0), set P01.30 to a non-zero value to enter short-circuit brake.<br>During stop, if the running frequency of inverter 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 | 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 | ○ |

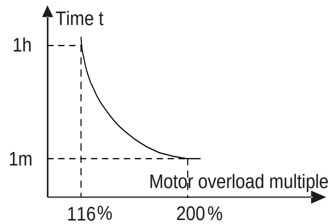
| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | | P01.09–P01.12).<br>Setting range of P01.29: 0.0–150.0% (of the rated inverter output current)<br>Setting range of P01.30: 0.0–50.0s<br>Setting range of P01.31: 0.0–50.0s | | |
| P01.32 | Pre-exciting time of jogging | 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**

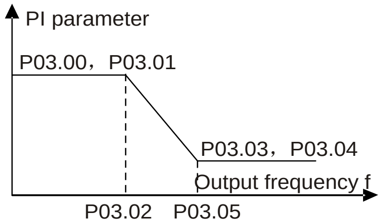
| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| P02.00 | Type of motor 1 | 0: Asynchronous motor<br>1: Synchronous motor | 0 | ◎ |
| P02.01 | Rated power of asynchronous motor 1 | 0.1–3000.0kW | Depends on model | ◎ |
| P02.02 | Rated frequency of asynchronous 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 | 0.001–65.535Ω | Depends on model | ○ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | motor 1 | | | |
| 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 | ○ |
| P02.11 | 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 | 0.1–3000.0kW | Depends on model | ◎ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | motor 1 | | | |
| 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 | 1–128 | 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% (of the motor rated current) | 10% | ● |
| P02.26 | Overload protection of motor 1 | 0: No protection<br>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 | 2 | ◎ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | | of the motor whose running frequency is below 30Hz.<br>2: Frequency-variable motor (without low-speed compensation). As the cooling effect of 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)<br>In is rated motor current, lout is inverter output current, K is motor overload protection coefficient. The smaller the K, the larger the value of M, and the easier the protection.<br>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.<br><br>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 inverter.<br>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.<br>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 | ○ |

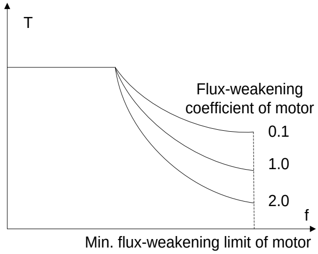
**P03—Vector control of motor 1**

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th><th>Modify</th></tr>
<tr><td>P03.00</td><td>Speed loop proportional gain 1</td><td rowspan="6">Parameters of P03.00–P03.05 fit for vector control mode only. Below P03.02, speed loop PI 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.<br><br><br>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.<br>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.<br>Setting range of P03.00:0.0–200.0.<br>Setting range of P03.01: 0.000–10.000s<br>Setting range of P03.02: 0.00Hz–P03.05<br>Setting range of P03.03: 0.0–200.0<br>Setting range of P03.04: 0.000–10.000s<br>Setting range of P03.05: P03.02–P00.03 (Max. output frequency)</td><td>20.0</td><td>○</td></tr>
<tr><td>P03.01</td><td>Speed loop integral time 1</td><td>0.200s</td><td>○</td></tr>
<tr><td>P03.02</td><td>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>
</table>

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| P03.07 | Vector control slip compensation coefficient (motoring) | Slip compensation coefficient is used to adjust the slip frequency of vector control to improve speed control precision. This parameter can be used to control speed offset.<br>Setting range: 50–200% | 100% | ○ |
| P03.08 | Vector control slip compensation coefficient (generating) | | 100% | ○ |
| P03.09 | Current loop proportional coefficient P | **Note:**<br>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.<br>2. Applicable to SVC mode 0 (P00.00=0), SVC mode 1 (P00.00=1), and FVC (P00.00=3)<br>Setting range: 0–65535 | 1000 | ○ |
| P03.10 | Current loop integral coefficient I | | 1000 | ○ |
| P03.11 | Torque setting method | 0–1: Keypad (P03.12)<br>2: AI1<br>3: AI2<br>4: AI3<br>5: Pulse frequency HDIA<br>6: Multi-step torque<br>7: Modbus/Modbus TCP communication<br>8: PROFIBUS/CANopen/DeviceNet communication<br>9: Ethernet communication<br>10: Pulse frequency HDIB<br>11: EtherCAT/PROFINET/EtherNet IP communication<br>12: Programmable card<br>**Note:** For these settings, 100% corresponds to the motor rated current. | 0 | ○ |
| P03.12 | Torque set through keypad | -300.0%–300.0% (of the motor rated current) | 20.0% | ○ |
| P03.13 | Torque reference filter time | 0.000–10.000s | 0.010s | ○ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| P03.14 | Setting source of FWD rotation frequency upper limit in torque control | 0: Keypad (P03.16)<br>1: AI1<br>2: AI2<br>3: AI3<br>4: Pulse frequency HDIA<br>5: Multi-step setting<br>6: Modbus/Modbus TCP communication<br>7: PROFIBUS/CANopen/DeviceNet communication<br>8: Ethernet communication<br>9: Pulse frequency HDIB<br>10: EtherCAT/PROFINET/EtherNet IP communication<br>11: Programmable card<br>12: Reserved<br>**Note:** For these settings, 100% corresponds to the max. frequency. | 0 | ○ |
| P03.15 | Setting source of REV rotation frequency upper limit in torque control | 0: Keypad (P03.17)<br>1: AI1<br>2: AI2<br>3: AI3<br>4: Pulse frequency HDIA<br>5: Multi-step setting<br>6: Modbus/Modbus TCP communication<br>7: PROFIBUS/CANopen/DeviceNet communication<br>8: Ethernet communication<br>9: Pulse frequency HDIB<br>10: EtherCAT/PROFINET/EtherNet IP communication<br>11: Programmable card<br>12: Reserved<br>**Note:** For these settings, 100% corresponds to the max. frequency. | 0 | ○ |
| P03.16 | FWD rotation frequency upper limit set through keypad in torque control | Used to specify frequency limits. 100% corresponds to the max. frequency. P03.16 specifies the upper-limit frequency when P03.14=1; P03.17 specifies the upper-limit frequency when P03.15=1. | 50.00Hz | ○ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| P03.17 | Max. output frequency | Setting range: 0.00Hz–P00.03 (Max. output frequency) | 50.00Hz | ○ |
| P03.18 | Setting source of electromotive torque upper limit | 0: Keypad (P03.20)<br>1: AI1<br>2: AI2<br>3: AI3<br>4: Pulse frequency HDIA<br>5: Modbus/Modbus TCP communication<br>6: PROFIBUS/CANopen/DeviceNet communication<br>7: Ethernet communication<br>8: Pulse frequency HDIB<br>9: EtherCAT/PROFINET/EtherNet IP communication<br>10: Programmable card<br>11: Reserved<br>**Note:** For these settings, 100% corresponds to the motor rated current. | 0 | ○ |
| P03.19 | Setting source of braking torque upper limit | 0: Keypad (P03.21)<br>1: AI1<br>2: AI2<br>3: AI3<br>4: Pulse frequency HDIA<br>5: Modbus/Modbus TCP communication<br>6: PROFIBUS/CANopen/DeviceNet communication<br>7: Ethernet communication<br>8: Pulse frequency HDIB<br>9: EtherCAT/PROFINET/EtherNet IP communication<br>10: Programmable card<br>11: Reserved<br>**Note:** For these settings, 100% corresponds to the motor rated current. | 0 | ○ |
| P03.20 | Electromotive torque upper limit set through keypad | Used to set torque limits.<br>Setting range: 0.0–300.0% (of the motor rated current) | 180.0% | ○ |
| P03.21 | Braking torque | | 180.0% | ○ |

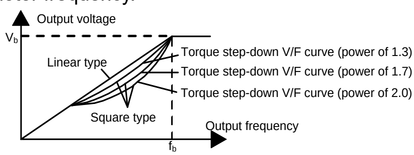
| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | upper limit set through keypad | | | |
| P03.22 | Flux-weakening coefficient of constant-power zone | Used when asynchronous motor is in flux-weakening control.<br><br>P03.22 and P03.23 are valid during constant 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.<br>Setting range of P03.22: 0.1–2.0<br>Setting range of P03.23: 10%–100% | 0.3 | ○ |
| P03.23 | Min. flux-weakening point of constant-power zone | | 20% | ○ |
| P03.24 | Max. voltage limit | P03.24 sets the maximum output voltage of the inverter, which is the percentage of rated motor voltage. Set the value according to onsite conditions.<br>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.<br>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 the actual value<br>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 | 0.50–P03.31 | 1.00Hz | ○ |

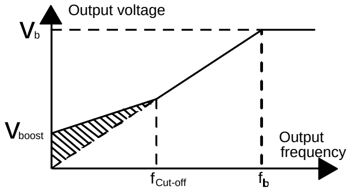
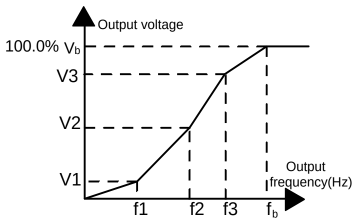
| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | of static friction | | | |
| P03.30 | High speed friction compensation coefficient | 0.0–100.0% | 0.0% | ○ |
| P03.31 | Corresponding frequency of high-speed friction torque | P03.29–400.00Hz | 50.00Hz | ○ |
| P03.32 | Enabling torque control | 0: Disable<br>1: Enable | 0 | ◎ |
| P03.33 | Flux weakening integral gain | 0–8000 | 1200 | ○ |
| P03.34 | Flux-weakening control mode | 0x000–0x112<br>Ones place: Control mode<br>0: Mode 0<br>1: Mode 1<br>2: Mode 2<br>Tens place: Compensation of inductance saturation coefficient<br>0: Enable<br>1: Disable<br>Hundreds place: Reserved<br>0: Reserved<br>1: Reserved | 0x000 | ○ |
| P03.35 | Control optimization setting | 0x0000–0x1111<br>Ones place: Torque command selection<br>0: Torque reference<br>1: Torque current reference<br>Tens place: Reserved<br>0: Reserved<br>1: Reserved<br>Hundreds place: Whether to enable ASR integral separation<br>0: Disable<br>1: Enable<br>Thousands place: Reserved<br>0: Reserved | 0x0000 | ○ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | | 1: Reserved | | |
| P03.36 | Speed loop differential gain | 0.00–10.00s | 0.00s | ○ |
| P03.37 | High-frequency current loop proportional coefficient | Under FVC (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.<br>Setting range of P03.37: 0–65535<br>Setting range of P03.38: 0–65535<br>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 | Enabling inertia compensation | 0: Disable<br>1: Enable | 0 | ○ |
| P03.41 | Upper limit of inertia compensation torque | Limit the max. inertia compensation torque to prevent inertia compensation torque from being too large.<br>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.<br>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.<br>0.0–100.0% (rated motor torque) | 10.0% | ○ |
| P03.44 | Enable inertia identification | 0: No operation<br>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.<br>Range: 0–65535<br>**Note: Set the value to 0 if motor parameter autotuning is not performed.** | 0 | ● |
| P03.46 | Current integral proportional | Automatic update will be performed after motor parameter autotuning. In the closed-loop vector | 0 | ● |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | coefficient after autotuning | control mode for synchronous motors, you can set the value of this function code to P03.10.<br>Range: 0–65535<br>**Note: Set the value to 0 if motor parameter autotuning is not performed.** | | |

**P04—V/F control**

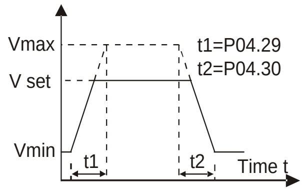
| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| P04.00 | V/F curve setting of motor 1 | This group of function code defines the V/F curve of motor 1 to satisfy different load characteristics needs.<br>0: Straight V/F curve; fit for constant-torque load<br>1: Multi-point V/F curve<br>2: Torque down V/F curve (power of 1.3)<br>3: Torque down V/F curve (power of 1.7)<br>4: Torque down V/F curve (power of 2.0)<br>Curve 2–4 is 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.<br>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.<br>**Note:** The $V_b$ in the figure below corresponds to rated motor voltage, and $f_b$ corresponds to rated motor frequency.<br> | 0 | ◎ |
| P04.01 | Torque boost of motor 1 | 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 $V_b$.<br>P04.02 defines the percentage of cut-off frequency | 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>of manual torque boost to the rated motor frequency $f_b$. Torque boost can improve the low-frequency torque characteristics of V/F.<br>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.<br>When torque boost is set to 0.0%, the inverter is automatic torque boost.<br>Torque boost cut-off threshold: Below this frequency threshold, the torque boost is valid, exceeding this threshold will nullify torque boost.<br><br><br>Setting range of P04.01: 0.0%: (automatic) 0.1%–10.0%<br>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.<br>V/F curve is usually set according to the characteristics of motor load.<br>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 inverter.<br><br></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>
</table>

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | | Setting range of P04.03: 0.00Hz–P04.05<br>Setting range of P04.04: 0.0%–110.0% (rated voltage of motor 1)<br>Setting range of P04.05: P04.03–P04.07<br>Setting range of P04.06: 0.0%–110.0% (rated voltage of motor 1)<br>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)<br>Setting range of P04.08: 0.0%–110.0% (rated voltage of motor 1) | | |
| P04.09 | V/F slip compensation gain of motor 1 | 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:<br>△f=fb-n×p/60<br>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.<br>Setting range: 0.0–200.0% | 0.0% | ○ |
| 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 inverter overcurrent, you can adjust these two parameters properly to eliminate such phenomenon.<br>Setting range of P04.10: 0–100<br>Setting range of P04.11: 0–100<br>Setting range of P04.12: 0.00Hz–P00.03 (Max. output frequency) | 10 | ○ |
| P04.11 | High-frequency oscillation control factor of motor 1 | | 10 | ○ |
| P04.12 | Oscillation control threshold of motor 1 | | 30.00Hz | ○ |
| P04.13 | V/F curve setting of motor 2 | This parameter defines the V/F curve of motor 2 of the HD2 series to meet various load characteristic requirements.<br>0: Straight V/F curve.<br>1: Multi-point V/F curve | 0 | ◎ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | | 2: Torque-down V/F curve (power of 1.3)<br>3: Torque-down V/F curve (power of 1.7)<br>4: Torque-down V/F curve (power of 2.0)<br>5: Customize V/F (V/F separation) | | |
| P04.14 | Torque boost of motor 2 | **Note:** Refer to the parameter description of P04.01 and P04.02.<br>Setting range of P04.14: 0.0%: (automatic) 0.1%–10.0%<br>Setting range of 0.0%–50.0% (relative to rated frequency of motor 2) | 0.0% | ○ |
| P04.15 | Torque boost cut-off of motor 2 | | 20.0% | ○ |
| P04.16 | V/F frequency point 1 of motor 2 | **Note:** Refer to the parameter description of P04.03–P04.08<br>Setting range of P04.16: 0.00Hz–P04.18<br>Setting range of P04.17:0.0%–110.0% (rated voltage of motor 2)<br>Setting range of P04.18: P04.16–P04.20<br>Setting range of P04.19: 0.0%–110.0% (rated voltage of motor 2)<br>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)<br>Setting range of P04.21: 0.0%–110.0% (of the rated voltage of motor 2) | 0.00Hz | ○ |
| P04.17 | V/F voltage point 1 of motor 2 | | 00.0% | ○ |
| P04.18 | V/F frequency point 2 of motor 2 | | 0.00Hz | ○ |
| P04.19 | V/F voltage point 2 of motor 2 | | 00.0% | ○ |
| P04.20 | V/F frequency point 3 of motor 2 | | 0.00Hz | ○ |
| P04.21 | V/F voltage point 3 of motor 2 | | 00.0% | ○ |
| P04.22 | V/F slip compensation gain of motor 2 | 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:<br>△f=fb-n*p/60<br>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.<br>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 | 10 | ○ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| P04.24 | High-frequency oscillation control factor of motor 2 | unstable running of motors or even overcurrent of inverters. You can modify this parameter to prevent current oscillation.<br>Setting range of P04.23: 0–100<br>Setting range of P04.24: 0–100<br>Setting range of P04.25: 0.00 Hz–P00.03 (Max. output frequency) | 10 | ○ |
| P04.25 | Oscillation control threshold of motor 2 | | 30.00Hz | ○ |
| P04.26 | Energy-saving run | 0: No action<br>1: Automatic energy-saving operation<br>Under light-load state, the motor can adjust the output voltage automatically to achieve energy-saving purpose | 0 | ◎ |
| P04.27 | Voltage setting channel | 0: Keypad; output voltage is determined by P04.28<br>1: AI1<br>2: AI2<br>3: AI3<br>4: HDIA<br>5: Multi-step (the set value is determined by P10 group)<br>6: PID<br>7: Modbus/Modbus TCP communication<br>8: PROFIBUS/CANopen/DeviceNet communication<br>9: Ethernet communication<br>10: HDIB<br>11: EtherCAT/PROFINET/EtherNet IP communication<br>12: Programmable card<br>13: Reserved | 0 | ○ |
| P04.28 | Voltage value set through keypad | When the channel for voltage setup is set to "keypad", the value of this function code is digital voltage set value.<br>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.<br>Voltage decrease time means the time needed from outputting max. voltage to outputting the min. voltage | 5.0s | ○ |
| P04.30 | Voltage decrease time | | 5.0s | ○ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | | Setting range: 0.0–3600.0s | | |
| P04.31 | Output max. voltage | Set the upper/lower limit value of output voltage.<br><br><br>Setting range of P04.31: P04.32–100.0% (rated motor voltage)<br>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 | ○ |
| P04.34 | Injection 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.<br>Setting range: -100.0%–+100.0% (of the motor rated current) | 20.0% | ○ |
| P04.35 | Injection 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.<br>Setting range: -100.0%–+100.0% (of the motor rated current) | 10.0% | ○ |
| P04.36 | Frequency threshold for injection 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 injection current 1 and injection current 2.<br>Setting range: 0.0%–200.0% (of the motor rated frequency) | 20.0% | ○ |
| P04.37 | Reactive current closed-loop proportional coefficient in synchronous | 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.<br>Setting range: 0–3000 | 50 | ○ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | motor VF | | | |
| 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.<br>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.<br>Setting range: 0–16000 | 8000 | ○ |
| P04.40 | Enable/disable IF mode for asynchronous motor 1 | 0: Disabled<br>1: Enabled | 0 | ◎ |
| 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.<br>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.<br>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.<br>Setting range: 0–5000 | 350 | ○ |
| P04.44 | Starting frequency point for switching off IF mode for asynchronous | 0.00–P04.50 | 10.00Hz | ○ |

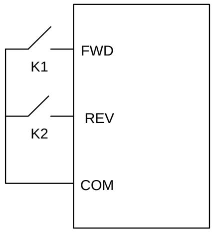
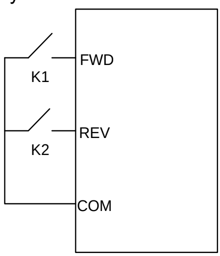
| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | motor 1 | | | |
| P04.45 | Enable/disable IF mode for asynchronous motor 2 | 0: Disabled<br>1: Enabled | 0 | ◎ |
| P04.46 | Current setting in IF mode for asynchronous motor 2 | When IF control is adopted for asynchronous 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.<br>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.<br>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.<br>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 | ○ |
| 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 | ○ |

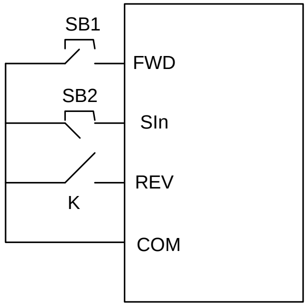
**P05—Input terminals**

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th><th>Modify</th></tr>
<tr><td>P05.00</td><td>HDI input type</td><td>0x00–0x11<br>Ones: HDIA input type<br>0: HDIA is high-speed pulse input<br>1: HDIA is digital input<br>Tens: HDIB input type<br>0: HDIB is high-speed pulse input<br>1: HDIB is digital input</td><td>0</td><td>◎</td></tr>
<tr><td>P05.01</td><td>Function of S1 terminal</td><td rowspan="6">0: No function<br>1: Forward running<br>2: Reverse running<br>3: 3-wire control/Sin<br>4: Forward jogging<br>5: Reverse jogging<br>6: Coast to stop<br>7: Fault reset<br>8: Running pause<br>9: External fault input<br>10: Frequency increase (UP)<br>11: Frequency decrease (DOWN)<br>12: Clear frequency increase/decrease setting<br>13: Switchover between setup A and setup B<br>14: Switchover between combination setup and setup A<br>15: Switchover between combination setup and setup B<br>16: Multi-step speed terminal 1<br>17: Multi-step speed terminal 2<br>18: Multi-step speed terminal 3<br>19: Multi-step speed terminal 4<br>20: Multi-step speed pause<br>21: Acceleration/deceleration time selection 1<br>22: Acceleration/deceleration time selection 2<br>23: Simple PLC stop reset<br>24: Simple PLC pause<br>25: PID control pause<br>26: Wobbling frequency pause<br>27: Wobbling frequency reset<br>28: Counter reset</td><td>1</td><td>◎</td></tr>
<tr><td>P05.02</td><td>Function of S2 terminal</td><td>4</td><td>◎</td></tr>
<tr><td>P05.03</td><td>Function of S3 terminal</td><td>7</td><td>◎</td></tr>
<tr><td>P05.04</td><td>Function of S4 terminal</td><td>0</td><td>◎</td></tr>
<tr><td>P05.05</td><td>Function of HDIA terminal</td><td>0</td><td>◎</td></tr>
<tr><td>P05.06</td><td>Function of HDIB terminal</td><td>0</td><td>◎</td></tr>
</table>

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | | 29: Switchover between speed control and torque control<br>30: Acceleration/deceleration disabled<br>31: Counter trigger<br>32: Reserved<br>33: Clear frequency increase/decrease setting temporarily<br>34: DC brake<br>35: Switchover between motor 1 and motor 2<br>36: Command switches to keypad<br>37: Command switches to terminal<br>38: Command switches to communication<br>39: Pre-exciting command<br>40: Zero out power consumption quantity<br>41: Maintain power consumption quantity<br>42: Source of upper torque limit switches to keypad<br>43: Position reference point input (only S6, S7 and S8 are valid)<br>44: Spindle orientation disabled<br>45: Spindle zeroing/local positioning zeroing<br>46: Spindle zero position selection 1<br>47: Spindle zero position selection 2<br>48: Spindle scale division selection 1<br>49: Spindle scale division selection 2<br>50: Spindle scale division selection 3<br>51: Position control and speed control switchover terminal<br>52: Pulse input disabled<br>53: Clear position deviation cleared<br>54: Switch over position proportional gain<br>55: Enable cyclic positioning of digital position positioning<br>56: Emergency stop<br>57: Motor over-temperature fault input<br>58: Enable rigid tapping<br>59: Switch to V/F control<br>60: Switch to FVC control<br>61: PID polarity switchover | | |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | | 62: Reserved<br>63: Enable servo<br>64: Limit of forward run<br>65: Limit of reverse run<br>66: Zero out encoder counting<br>67: Pulse increase<br>68: Enable pulse superimposition<br>69: Pulse decrease<br>70: Electronic gear selection<br>71: Switch to master<br>72: Switch to slave<br>73: Reset the roll diameter<br>74: Switch winding/unwinding<br>75: Pre-drive<br>76: Disable roll diameter calculation<br>77: Clear alarm display<br>78: Manual braking<br>79: Trigger forced feeding interrupt<br>80: Initial roll diameter 1<br>81: Initial roll diameter 2<br>82: Trigger fire mode control<br>83: Switch tension PID parameters<br>84–95: Reserved | | |
| P05.07 | Reserved | 0–65535 | 0 | ● |
| P05.08 | Polarity of input terminal | This parameter specifies the polarity of input terminals.<br>When the bit is set to 0, input terminal polarity is positive.<br>When the bit is set to 1, input terminal polarity is negative.<br>0x000–0x3F | 0x000 | ○ |
| P05.09 | Digital filter time | 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.<br>0.000–1.000s | 0.010s | ○ |
| P05.10 | Virtual terminal setting | 0x000–0x3F (0: disable, 1: enable)<br>BIT0: S1 virtual terminal<br>BIT1: S2 virtual terminal<br>BIT2: S3 virtual terminal | 0x00 | ◎ |

<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>BIT3: S4 virtual terminal<br>BIT4: HDIA virtual terminal<br>BIT5: HDIB virtual terminal</td><td></td><td></td></tr>
<tr><td>P05.11</td><td>2/3 Wire control mode</td><td>This parameter specifies the 2/3 Wire control mode.<br>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.<br><br>
<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.<br><br>
<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 inverter starts to run in the direction set by the state of terminal REV; the inverter should be stopped by disconnecting terminal Sin.</td><td>0</td><td>◎</td></tr>
</table>

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | |  | | |

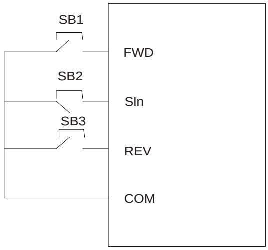


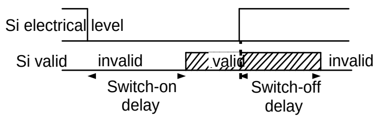
The direction control during running is shown below.

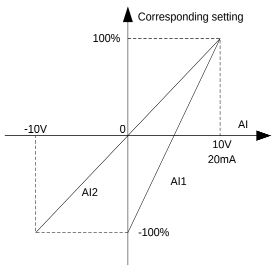
| SIn | REV | Previous running direction | Current running direction |
|---|---|---|---|
| ON | OFF→ON | Forward | Reverse |
| | | Reverse | Forward |
| ON | ON→OFF | Reverse | Forward |
| | | Forward | Reverse |
| ON→OFF | ON | Decelerate to stop | |
| | OFF | | |

SIn: 3-wire control/Sin, FWD: Forward running, REV: Reverse running

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 inverter; the inverter should be stopped by disconnecting terminal Sin.



<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>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<br>
Note: For dual line running mode, when FWD/REV terminal is valid, if the inverter 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 inverter run again, you need to trigger FWD/REV again, such as 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 switch-on delay</td><td rowspan="9">These function codes define corresponding delay of the programmable input terminals during level variation from switch-on to switch-off.<br>

<br>
Setting range: 0.000–50.000s<br>
Note: After a virtual terminal is enabled, the state of the terminal can be changed only in communication mode. The communication address is 0x200A.</td><td>0.000s</td><td>○</td></tr>
<tr><td>P05.13</td><td>S1 terminal switch-off delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P05.14</td><td>S2 terminal switch-on delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P05.15</td><td>S2 terminal switch-off delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P05.16</td><td>S3 terminal switch-on delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P05.17</td><td>S3 terminal switch-off delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P05.18</td><td>S4 terminal switch-on delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P05.19</td><td>S4 terminal switch-off delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P05.20</td><td>HDIA terminal</td><td>0.000s</td><td>○</td></tr>
</table>

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | switch-on delay | | | |
| 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.<br>When analog input is current input, 0–20mA current corresponds to 0–10V voltage.<br>In different applications, 100% of analog setting corresponds to different nominal values.<br>The figure below illustrates several settings.<br><br>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.<br>**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.<br>Setting range of P05.24: 0.00V–P05.26<br>Setting range of P05.25: -300.0%–300.0%<br>Setting range of P05.26: P05.24–10.00V | 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 setting of lower limit of AI2 | | -100.0% | ○ |
| P05.31 | Intermediate value 1 of AI2 | | 0.00V | ○ |
| P05.32 | Corresponding setting of intermediate value 1 of AI2 | | 0.0% | ○ |
| P05.33 | Intermediate value 2 of AI2 | | 0.00V | ○ |
| P05.34 | Corresponding setting of intermediate value 2 of AI2 | | 0.0% | ○ |
| P05.35 | Upper limit value of AI2 | | 10.00V | ○ |

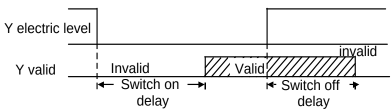
| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| P05.36 | Corresponding setting of upper limit of AI2 | Setting range of P05.27: -300.0%–300.0%<br>Setting range of P05.28: 0.000s–10.000s<br>Setting range of P05.29: -10.00V–P05.31 | 100.0% | ○ |
| P05.37 | Input filter time of AI2 | Setting range of P05.30: -300.0%–300.0%<br>Setting range of P05.31: P05.29–P05.33<br>Setting range of P05.32: -300.0%–300.0%<br>Setting range of P05.33: P05.31–P05.35<br>Setting range of P05.34: -300.0%–300.0%<br>Setting range of P05.35: P05.33–10.00V<br>Setting range of P05.36: -300.0%–300.0%<br>Setting range of P05.37: 0.000s–10.000s | 0.030s | ○ |
| P05.38 | HDIA high-speed pulse input function | 0: Set input via frequency<br>1: Reserved<br>2: Input via encoder, used in combination with HDIB | 0 | ◎ |
| P05.39 | Lower limit frequency of HDIA | 0.000 kHz – P05.41 | 0.000 kHz | ○ |
| 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<br>1: Reserved<br>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 | -300.0%–300.0% | 0.0% | ○ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | limit frequency of HDIB | | | |
| 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<br>1: Current type<br>**Note:** You can set the AI1 input signal type through the corresponding function code. | 0 | ◎ |
| P05.51–P05.52 | Reserved | 0–65535 | 0 | ● |

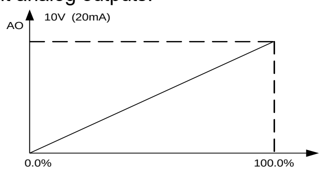
**P06—Output terminals**

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| P06.00 | HDO output type | 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.<br>1: Open collector output: For details about the related functions, see P06.02. | 0 | ◎ |
| P06.01 | Y1 output selection | 0: Invalid<br>1: In running<br>2: In forward running<br>3: In reverse running<br>4: In jogging<br>5: inverter fault<br>6: Frequency level detection FDT1<br>7: Frequency level detection FDT2<br>8: Frequency reached<br>9: Running in zero speed<br>10: Reach upper limit frequency<br>11: Reach lower limit frequency<br>12: Ready to run | 0 | ○ |
| P06.02 | HDO output selection | | 0 | ○ |
| P06.03 | Relay RO1 output selection | | 1 | ○ |
| P06.04 | Relay RO2 output selection | | 5 | ○ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | | 13: In pre-exciting<br>14: Overload pre-alarm<br>15: Underload pre-alarm<br>16: Simple PLC stage completed<br>17: Simple PLC cycle completed<br>18: Reach set counting value<br>19: Reach designated counting value<br>20: External fault is valid<br>21: Reserved<br>22: Reach running time<br>23: Virtual terminal output of Modbus/Modbus TCP communication<br>24: Virtual terminal output of POROFIBUS/CANopen communication<br>25: Virtual terminal output of Ethernet communication<br>26: DC bus voltage established<br>27: Z pulse output<br>28: During pulse superposition<br>29: STO action<br>30: Positioning completed<br>31: Spindle zeroing completed<br>32: Spindle scale-division completed<br>33: In speed limit<br>34: Virtual terminal output of EtherCAT/PROFINET/EtherNet IP communication<br>35: Reserved<br>36: Speed/position control switchover completed<br>37: Any frequency reached<br>38–40: Reserved<br>41: Y1 from the programmable card<br>42: Y2 from the programmable card<br>43: HDO from the programmable card<br>44: RO1 from the programmable card<br>45: RO2 from the programmable card<br>46: RO3 from the programmable card<br>47: RO4 from the programmable card<br>48: EC PT100 detected OH pre-alarm<br>49: EC PT1000 detected OH pre-alarm | | |

<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>50: AI/AO detected OH pre-alarm<br>51: Stopped or running at zero speed<br>52: Disconnection detected in tension control<br>53: Roll diameter setting reached<br>54: Max. roll diameter reached<br>55: Min. roll diameter reached<br>56: Fire control mode enabled<br>57–63: Reserved</td><td></td><td></td></tr>
<tr><td>P06.05</td><td>Output terminal polarity selection</td><td>This parameter specifies the polarity of output terminals.<br>When the bit is set to 0, input terminal polarity is positive.<br>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="8">This function code defines the corresponding delay of the level variation from switch-on to switch-off.<br><br>Setting range: 0.000–50.000s<br>Note: P06.08 and P06.09 are valid only when P06.00=1.</td><td>0.000s</td><td>○</td></tr>
<tr><td>P06.07</td><td>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>
<tr><td>P06.11</td><td>Relay RO1 switch-off delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P06.12</td><td>Relay RO2 switch-on delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P06.13</td><td>Relay RO2 switch-off delay</td><td>0.000s</td><td>○</td></tr>
<tr><td>P06.14</td><td>AO1 output selection</td><td rowspan="3">0: Running frequency (0–Max. output frequency)<br>1: Set frequency (0–Max. output frequency)<br>2: Ramp reference frequency (0–Max. output frequency)<br>3: Rotational speed (0–Speed corresponding to max. output frequency)<br>4: Output current (0–Twice the inverter rated</td><td>0</td><td>○</td></tr>
<tr><td>P06.15</td><td>Reserved</td><td>0</td><td>○</td></tr>
<tr><td>P06.16</td><td>HDO high-speed pulse output</td><td>0</td><td>○</td></tr>
</table>

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | | current)<br>5: Output current (0–Twice the motor rated current)<br>6: Output voltage (0–1.5 times the inverter rated voltage)<br>7: Output power (0–Twice the motor rated power)<br>8: Set torque (0–Twice the motor rated torque)<br>9: Output torque (Absolute value, 0–+/- Twice the motor rated torque)<br>10: AI1 input (0–10V/0–20mA)<br>11: AI2 input (0–10V)<br>12: AI3 input (0–10V/0–20mA)<br>13: HDIA input (0.00–50.00kHz)<br>14: Value 1 set through Modbus/Modbus TCP communication (0–1000)<br>15: Value 2 set through Modbus/Modbus TCP communication (0–1000)<br>16: Value 1 set through PROFIBUS/CANopen/DeviceNet communication (0–1000)<br>17: Value 2 set through PROFIBUS/CANopen/DeviceNet communication (0–1000)<br>18: Value 1 set through Ethernet communication (0–1000)<br>19: Value 2 set through Ethernet communication (0–1000)<br>20: HDIB input (0.00–50.00kHz)<br>21: Value 1 set through EtherCAT/PROFINET/EtherNet IP communication (0–1000)<br>22: Torque current (bipolar, 0–Triple the motor rated current)<br>23: Exciting current (bipolar, 0–Triple the motor rated current)<br>24: Set frequency (bipolar, 0–Max. output frequency)<br>25: Ramp reference frequency (bipolar, 0–Max. output frequency) | | |

<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>26: Rotational speed (bipolar, 0–Speed corresponding to max. output frequency)<br>27: Value 2 set through EtherCAT/PROFINET/EtherNet IP communication (0–1000)<br>28: AO1 from the programmable card (0–1000)<br>29: AO2 from the programmable card (0–1000)<br>30: Rotational speed (0–Twice the motor rated synchronous speed)<br>31: Output torque (Actual value, 0–Twice the motor rated torque)<br>32: AI/AO temperature detection output<br>33–63: Reserved</td><td></td><td></td></tr>
<tr><td>P06.17</td><td>Lower limit of AO1 output</td><td rowspan="5">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.<br>When analog output is current output, 1mA corresponds to 0.5V voltage. In different applications, 100% of output value corresponds to different analog outputs.<br><br><br>Setting range of P06.17: -300.0%–P06.19<br>Setting range of P06.18: 0.00V–10.00V<br>Setting range of P06.19: P06.17–300.0%<br>Setting range of P06.20: 0.00V–10.00V<br>Setting range of P06.21: 0.000s–10.000s</td><td>0.0%</td><td>○</td></tr>
<tr><td>P06.18</td><td>Corresponding AO1 output of lower limit</td><td>0.00V</td><td>○</td></tr>
<tr><td>P06.19</td><td>Upper limit of AO1 output</td><td>100.0%</td><td>○</td></tr>
<tr><td>P06.20</td><td>Corresponding AO1 output of upper limit</td><td>10.00V</td><td>○</td></tr>
<tr><td>P06.21</td><td>AO1 output filter time</td><td>0.000s</td><td>○</td></tr>
<tr><td>P06.22–P06.26</td><td>Reserved</td><td>0–65535</td><td>0</td><td>●</td></tr>
<tr><td>P06.27</td><td>Lower limit of HDO output</td><td>-300.0%–P06.29</td><td>0.00%</td><td>○</td></tr>
<tr><td>P06.28</td><td>Corresponding HDO output of</td><td>0.00–50.00kHz</td><td>0.00kHz</td><td>○</td></tr>
</table>

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | lower limit | | | |
| 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<br>Set it to any non-zero value to enable password protection.<br>00000: Clear the previous user password and disable password protection.<br>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.<br>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.<br>**Note:** Restoring the default values may delete the user password. Exercise caution when using this function. | 0 | ○ |
| P07.01 | Reserved | | / | / |
| P07.02 | Function of keys | Range: 0x00–0x27<br>Ones: Function selection of QUICK/JOG key | 0x01 | ◎ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | | 0: No function<br>1: Jogging<br>2: Reserved<br>3: Forward/reverse rotation switchover<br>4: Clear UP/DOWN setting<br>5: Coast to stop<br>6: Switch over the running command reference mode in sequence<br>7: Reserved<br>Tens: Reserved | | |
| P07.03 | Running command channel switchover sequence of QUICK key | When P07.02=6, set the switchover sequence of running command channel.<br>0: keypad control→terminal control→ communication control<br>1: keypad control←→terminal control<br>2: keypad control←→communication control<br>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.<br>0: valid only for panel control only<br>1: valid for both panel and terminal control<br>2: valid for both panel and communication control<br>3: valid for all control modes | 0 | ○ |
| P07.05–P07.07 | Reserved | | / | / |
| P07.08 | Frequency display coefficient | 0.01–10.00<br>Display frequency=running frequency× P07.08 | 1.00 | ○ |
| P07.09 | Speed display coefficient | 0.1–999.9%<br>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%<br>Linear speed=mechanical speed×P07.10 | 1.0% | ○ |
| P07.11 | Temperature of rectifier bridge module | -20.0–120.0°C | / | ● |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| 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 inverter power consumption | Display the power consumption of the inverter.<br>inverter power consumption=P07.15×1000+P07.16<br>Setting range of P07.15: 0–65535 kWh (×1000)<br>Setting range of P07.16: 0.0–999.9 kWh | / | ● |
| P07.16 | Low bit of inverter power consumption | | / | ● |
| P07.17 | Reserved | | / | / |
| P07.18 | Rated power of inverter | 0.4–3000.0kW | / | ● |
| P07.19 | Rated voltage of inverter | 50–1200V | / | ● |
| P07.20 | Rated current of inverter | 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 | Present fault type | 0: No fault<br>1: Inverter unit U phase protection (OUt1)<br>2: Inverter unit V phase protection (OUt2)<br>3: Inverter unit W phase protection (OUt3)<br>4: Overcurrent during acceleration (OC1)<br>5: Overcurrent during deceleration (OC2)<br>6: Overcurrent during constant speed (OC3)<br>7: Overvoltage during acceleration (OV1)<br>8: Overvoltage during deceleration (OV2)<br>9: Overvoltage during constant speed (OV3)<br>10: Bus undervoltage fault (UV)<br>11: Motor overload (OL1)<br>12: inverter overload (OL2) | / | ● |
| P07.28 | Last fault type | | / | ● |
| P07.29 | 2nd-last fault type | | / | ● |
| P07.30 | 3rd-last fault type | | / | ● |
| P07.31 | 4th-last fault type | | / | ● |
| P07.32 | 5th-last fault type | | / | ● |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | | 13: Phase loss on input side (SPI)<br>14: Phase loss on output side (SPO)<br>15: Rectifier module overheat (OH1)<br>16: Inverter module overheat (OH2)<br>17: External fault (EF)<br>18: Modbus/Modbus TCP communication fault (CE)<br>19: Current detection fault (ItE)<br>20: Motor autotuning fault (tE)<br>21: EEPROM operation fault (EEP)<br>22: PID feedback offline fault (PIDE)<br>23: Braking unit fault (bCE)<br>24: Running time reached (END)<br>25: Electronic overload (OL3)<br>26: Keypad communication error (PCE)<br>27: Parameter upload error (UPE)<br>28: Parameter download error (DNE)<br>29: PROFIBUS communication fault (E-DP)<br>30: Ethernet communication fault (E-NET)<br>31: CANopen communication fault (E-CAN)<br>32: To-ground short-circuit fault 1 (ETH1)<br>33: To-ground short-circuit fault 2 (ETH2)<br>34: Speed deviation fault (dEu)<br>35: Mal-adjustment fault (STo)<br>36: Underload fault (LL)<br>37: Encoder offline fault (ENC1O)<br>38: Encoder reversal fault (ENC1D)<br>39: Encoder Z pulse offline fault (ENC1Z)<br>40: Safe torque off (STO)<br>41: Channel H1 safety circuit exception (STL1)<br>42: Channel H2 safety circuit exception (STL2)<br>43: Channel H1 and H2 exception (STL3)<br>44: Safety code FLASH CRC fault (CrCE)<br>45: Programmable card customized fault 1 (P-E1)<br>46: Programmable card customized fault 2 (P-E2)<br>47: Programmable card customized fault 3 (P-E3)<br>48: Programmable card customized fault 4 (P-E4)<br>49: Programmable card customized fault 5 (P-E5)<br>50: Programmable card customized fault 6 (P-E6) | | |

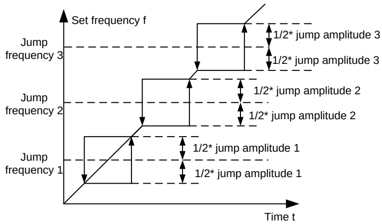
| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | | 51: Programmable card customized fault 7 (P-E7)<br>52: Programmable card customized fault 8 (P-E8)<br>53: Programmable card customized fault 9 (P-E9)<br>54: Programmable card customized fault 10 (P-E10)<br>55: Duplicate card type(E-Err)<br>56: Encoder UVW loss fault (ENCUV)<br>57: PROFIBUS communication fault (E-PN)<br>58: CANopen communication fault (ESCAN)<br>59: Motor over-temperature fault (OT)<br>60: Failure to identify the card at slot 1 (F1-Er)<br>61: Failure to identify the card at slot 2 (F2-Er)<br>62: Failure to identify the card at slot 3 (F3-Er)<br>63: Communication timeout of the card at slot 1 (C1-Er)<br>64: Communication timeout of the card at slot 2 (C2-Er)<br>65: Communication timeout of the card at slot 3 (C3-Er)<br>66: EtherCAT communication fault (E-CAT)<br>67: Bacnet communication fault (E-BAC)<br>68: DeviceNet communication fault (E-DEV)<br>69: CAN slave fault in master/slave synchronization (S-Err)<br>70: EC PT100 detected overheating (OtE1)<br>71: EC PT1000 detected overheating (OtE2)<br>72: EtherNet/IP communication timeout (E-EIP)<br>73: No upgrade bootload (E-PAO)<br>74: AI1 disconnected (E-AI1)<br>75: AI2 disconnected (E-AI2)<br>76: AI3 disconnected (E-AI3) | | |
| P07.33 | Running frequency at present fault | 0.00Hz–P00.03 | 0.00Hz | ● |
| P07.34 | Ramp reference frequency at present fault | 0.00Hz–P00.03 | 0.00Hz | ● |
| P07.35 | Output voltage at present fault | 0–1200V | 0V | ● |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| P07.36 | Output current at present fault | 0.0–6300.0A | 0.0A | ● |
| P07.37 | Bus voltage at present fault | 0.0–2000.0V | 0.0V | ● |
| P07.38 | Max. temperature at present fault | -20.0–120.0°C | 0.0°C | ● |
| P07.39 | Input terminal status at present fault | 0x0000–0xFFFF | 0x0000 | ● |
| P07.40 | Output terminal status at present fault | 0x0000–0xFFFF | 0x0000 | ● |
| P07.41 | Running frequency at last fault | 0.00Hz–P00.03 | 0.00Hz | ● |
| P07.42 | Ramp reference frequency at last fault | 0.00Hz–P00.03 | 0.00Hz | ● |
| P07.43 | Output voltage at last fault | 0–1200V | 0V | ● |
| P07.44 | Output current at last fault | 0.0–6300.0A | 0.0A | ● |
| P07.45 | Bus voltage at last fault | 0.0–2000.0V | 0.0V | ● |
| P07.46 | Max. temperature at last fault | -20.0–120.0°C | 0.0°C | ● |
| P07.47 | Input terminal status at last fault | 0x0000–0xFFFF | 0x0000 | ● |
| P07.48 | Output terminal state at last fault | 0x0000–0xFFFF | 0x0000 | ● |
| P07.49 | Running frequency at 2nd-last fault | 0.00Hz–P00.03 | 0.00Hz | ● |
| P07.50 | Ramp reference frequency at 2nd-last fault | 0.00Hz–P00.03 | 0.00Hz | ● |
| P07.51 | Output voltage at 2nd-last fault | 0–1200V | 0V | ● |

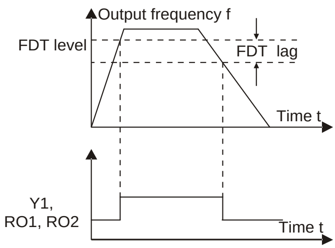
| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| P07.52 | Output current at 2nd-last fault | 0.0–6300.0A | 0.0A | ● |
| P07.53 | Bus voltage at 2nd-last fault | 0.0–2000.0V | 0.0V | ● |
| P07.54 | Max. temperature at 2nd-last fault | -20.0–120.0°C | 0.0°C | ● |
| P07.55 | Input terminal status at 2nd-last fault | 0x0000–0xFFFF | 0x0000 | ● |
| P07.56 | Output terminal status at 2nd-last fault | 0x0000–0xFFFF | 0x0000 | ● |

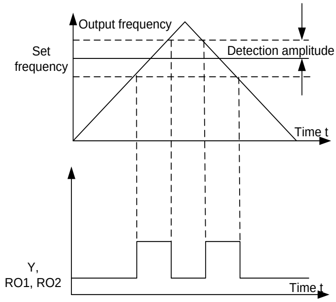
**P08—Enhanced functions**

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| P08.00 | Acceleration time 2 | See P00.11 and P00.12 for detailed definitions.<br>HD2 series inverter 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 inverter is the first group by default.<br>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 inverter during jogging.<br>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 inverter to accelerate from 0Hz to Max. output frequency (P00.03).<br>Jogging deceleration time is the time needed from decelerating from Max. output frequency (P00.03) to 0Hz.<br>Setting range: 0.0–3600.0s | Depends on model | ○ |
| P08.08 | Deceleration time of jogging | | | ○ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| P08.09 | Jump frequency 1 | When the set frequency is within the range of jump frequency, the inverter will run at the boundary of jump frequency.<br>The inverter 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 | ○ |
| P08.10 | Jump frequency amplitude 1 | | 0.00Hz | ○ |
| P08.11 | Jump frequency 2 | | 0.00Hz | ○ |
| P08.12 | Jump frequency amplitude 2 | | 0.00Hz | ○ |
| P08.13 | Jump frequency 3 | | 0.00Hz | ○ |
| P08.14 | Jump frequency amplitude 3 | <br>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)<br>0.00Hz: no switchover<br>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 | 0: Max. output frequency<br>1: Set frequency | 0 | ◎ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | acceleration/ deceleration time | 2: 100Hz<br>**Note: Valid for straight acceleration/deceleration only** | | |
| P08.22 | Output torque calculation mode | 0: Calculated based on torque current<br>1: Calculated based on output power | 0 | ○ |
| P08.23 | Number of decimal points of frequency | 0: Two decimal points<br>1: One decimal point | 0 | ○ |
| P08.24 | Number of decimal points of linear speed | 0: No decimal point<br>1: One<br>2: Two<br>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 inverter 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 inverter will report fault and stop to wait for repair.<br>Interval of automatic fault reset: select the interval time from when fault occurred to automatic fault reset actions.<br>After inverter starts, if no fault occurred during 60s, the fault reset times will be zeroed out.<br>Setting range of P08.28: 0–10<br>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 parameter specifies the variation rate of the inverter output frequency based on the load; it is mainly used in balancing the power when multiple motors drive the same load.<br>Setting range: 0.00–50.00Hz | 0.00Hz | ○ |
| P08.31 | Switchover selection for motor 1 and motor 2 | 0x00–0x14<br>Ones: Switchover channel<br>0: Terminal<br>1: Modbus/Modbus TCP communication<br>2: PROFIBUS/CANopen/DeviceNet | 0x00 | ◎ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | | communication<br>3: Ethernet communication<br>4: EtherCAT/PROFINET/EtherNet IP communication<br>Tens: indicates whether to enable switchover during running<br>0: Disable<br>1: Enable | | |
| 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.<br><br><br>Setting range of P08.32: 0.00Hz–P00.03 (Max. output frequency)<br>Setting range of P08.33: 0.0–100.0% (FDT1 level)<br>Setting range of P08.34: 0.00Hz–P00.03 (Max. output frequency)<br>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 |
|---|---|---|---|---|
| | | <br>Setting range: 0.00Hz–P00.03 (Max. output frequency) | | |
| P08.37 | Enable/disable energy-consumption brake | 0: Disable energy-consumption<br>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.<br>Setting range: 200.0–2000.0V | 220V voltage: 380.0V.<br>380V voltage: 700.0V.<br>660V voltage: 1120.0V | ○ |
| P08.39 | Running mode of cooling fan | 0: Common running mode<br>1: The fan keeps running after power-on<br>2: Running mode 2 | 0 | ○ |
| P08.40 | PWM selection | 0x0000–0x1121<br>Ones place: PWM mode selection<br>0: PWM mode 1, 3PH modulation and 2PH modulation<br>1: PWM mode 2, 3PH modulation<br>Tens place: PWM low-speed carrier limit<br>0: Low-speed carrier limit mode 1<br>1: Low-speed carrier limit mode 2<br>2: No limit<br>Hundreds place: Deadzone compensation method<br>0: Compensation method 1 | 0x1101 | ◎ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | | 1: Compensation method 2<br>Thousands place: PWM loading mode selection<br>0: Interruptive loading<br>1: Normal loading | | |
| P08.41 | Overmodulation selection | 0x00–0x1111<br>Ones place:<br>0: Disable overmodulation<br>1: Enable overmodulation<br>Tens place<br>0: Mild overmodulation<br>1: Deepened overmodulation<br>Hundreds: Carrier frequency limit<br>0: Yes<br>1: No<br>Thousands: Output voltage compensation<br>0: No<br>1: Yes | 0x1001 | ◎ |
| P08.42 | Reserved | | | |
| P08.43 | Reserved | | | |
| P08.44 | UP/DOWN terminal control setup | 0x000–0x221<br>Ones: Frequency control selection<br>0: UP/DOWN terminal setup is valid<br>1: UP/DOWN terminal setup is invalid<br>Tens: Frequency control selection<br>0: Valid only when P00.06=0 or P00.07=0<br>1: All frequency modes are valid<br>2: Invalid for multi-step speed when multi-step speed takes priority<br>Hundreds: Action selection during stop<br>0: Valid<br>1: Valid during running, clear after stop<br>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 | 0.01–50.00Hz/s | 0.50Hz/s | ○ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | frequency decremental change rate | | | |
| P08.47 | Action selection for frequency setup during power down | 0x000–0x111<br>Ones place: Action selection at power-off during frequency adjusting through digitals.<br>0: Save the setting at power-off.<br>1: Clear the setting at power-off.<br>Action selection at power-off during frequency adjusting through Modbus/Modbus TCP communication<br>0: Save the setting at power-off.<br>1: Clear the setting at power-off.<br>Hundreds place: Action selection at power-off during frequency adjusting through DP communication<br>0: Save the setting at power-off.<br>1: Clear the setting at power-off. | 0x000 | ○ |
| P08.48 | High bit of initial value of power consumption | Set the initial value of power consumption.<br>Initial value of power consumption=P08.48×1000+P08.49<br>Setting range of P08.48: 0–59999 kWh (k)<br>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.<br>0: Invalid<br>100–150: The larger the coefficient, the stronger the brake intensity<br>The inverter enables motor to decelerate quickly by increasing the motor flux which converts energy generated during braking into thermal energy.<br>The inverter 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.<br>1) Brake immediately after sending stop command, removing the need to wait for flux to | 0 | ○ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | | attenuate.<br>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. | | |
| P08.51 | Current regulation coefficient on input side | This function code is used to adjust the current display value on the AC input side.<br>0.00–1.00 | 0.56 | ○ |
| P08.52 | STO lock | 0: STO alarm lock<br>Alarm-lock means STO alarm must be reset after state restoration when STO occurs.<br>1: STO alarm unlock<br>Alarm-unlock means when STO occurs, after state restoration, STO alarm will disappear automatically. | 0 | ○ |
| P08.53 | Bias value of upper limit frequency of torque control | 0.00 Hz–P00.03 (Max. output frequency)<br>**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<br>1: Acceleration/deceleration time 1<br>2: Acceleration/deceleration time 2<br>3: Acceleration/deceleration time 3<br>4: Acceleration/deceleration time 4 | 0 | ○ |
| P08.55 | Enabling auto carrier frequency reduction | 0: Disable<br>1: Enable<br>**Note:** Automatic carrier frequency reduction indicates that the inverter automatically reduces the carrier frequency when detecting the heat sink temperature exceeds the rated temperature. When the temperature decreases to a certain degree, the carrier frequency recovers. This function reduces the chance of inverter overheat alarm. | 0 | ○ |
| P08.56 | Min. carrier frequency | 0.0–15.0kHz | Depends on model | ● |
| P08.57 | Temperature point of auto carrier frequency reduction | 40.0–85.0°C | 70.0 | ○ |

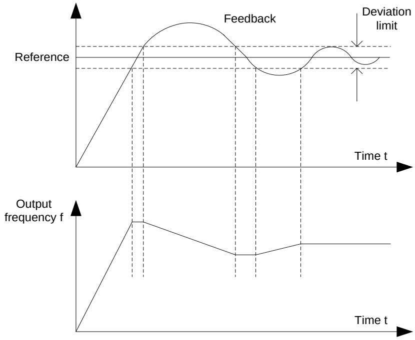
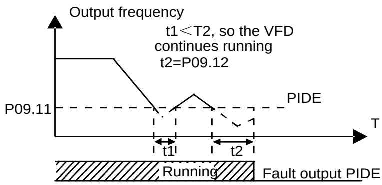
| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| P08.58 | Interval of carrier frequency reduction | 0–30min | 10 | ○ |
| P08.59 | AI1 disconnection detection threshold | 0–100% | 0 | ○ |
| P08.60 | AI2 disconnection detection threshold | 0–100% | 0 | ○ |
| P08.61 | AI3 disconnection detection threshold | 0–100% | 0 | ○ |
| P08.62 | Output current filter time | 0.000–10.000s | 0.000 | ○ |
| P08.63 | Output torque filter times | 0–8 | 8 | ○ |

**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 voltage setting channel (P04.27) is set to 6, the inverter running mode is process PID control.<br>This parameter determines the target reference channel of process PID.<br>0: Set by P09.01<br>1: AI1<br>2: AI2<br>3: AI3<br>4: High-speed pulse HDIA<br>5: Multi-step<br>6: Modbus/Modbus TCP communication<br>7: PROFIBUS/CANopen/DeviceNet communication<br>8: Ethernet communication<br>9: High-speed pulse HDIB<br>10: EtherCAT/PROFINET/EtherNet IP communication<br>11: Programmable card<br>12: Reserved<br>The set target of process PID is a relative value, | 0 | ○ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | | for which 100% equals 100% of the feedback signal of the controlled system.<br>The system always calculates a relative value (0–100.0%). | | |
| P09.01 | PID digital setting | This parameter is mandatory when P09.00 is set to 0. The reference value of this parameter is the feedback of the system.<br>Setting range: -100.0%–100.0% | 0.0% | ○ |
| P09.02 | PID feedback source | This parameter is used to select PID feedback channel.<br>0: AI1<br>1: AI2<br>2: AI3<br>3: High-speed pulse HDIA<br>4: Modbus/Modbus TCP communication<br>5: PROFIBUS/CANopen/DeviceNet communication<br>6: Ethernet communication<br>7: High-speed pulse HDIB<br>8: EtherCAT/PROFINET/EtherNet IP communication<br>9: Programmable expansion card<br>10: Reserved<br>**Note:** The reference channel and feedback channel cannot be duplicate. Otherwise, effective PID control cannot be achieved. | 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 inverter output frequency to decrease for PID to reach balance, eg, tension PID control of winding<br>1: PID output is negative characteristics: namely the feedback signal is less than PID reference, which requires inverter 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.<br>It determines the regulation intensity of the whole | 1.80 | ○ |

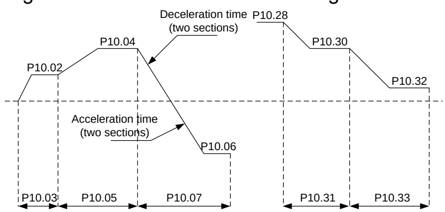
| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | | PID regulator, the larger the value of P, the stronger the regulation intensity. If this parameter is 100, it means when the deviation between PID feedback and reference is 100%, the regulation amplitude of PID regulator (ignoring integral and differential effect) on output frequency command is the max. frequency (ignoring integral and differential actions).<br>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, can reach Max. output frequency (P00.03)<br>The shorter the integral time, the stronger the regulation intensity.<br>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)<br>The longer the derivative time, the stronger the regulation intensity.<br>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.<br>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% | ○ |

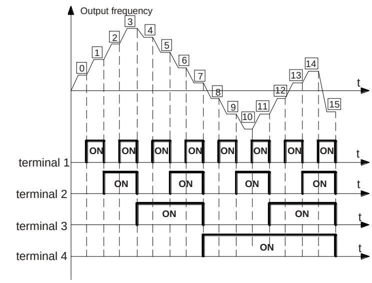
| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | | regulate the precision and stability of PID system.<br>Setting range: 0.0–100.0%<br> | | |
| P09.09 | Upper limit value of PID output | These two function codes are used to set the upper/lower limit value of PID regulator.<br>100.0% corresponds to Max. output frequency (P00.03) or max. voltage (P04.31)<br>Setting range of P09.09: P09.10–100.0%<br>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 inverter will report "PID feedback offline fault", and keypad displays PIDE.<br><br>Setting range of P09.11: 0.0–100.0%<br>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<br>Ones:<br>0: Continue integral control after the frequency reaches upper/lower limit<br>1: Stop integral control after the frequency reaches upper/lower limit<br>Tens: | 0x0001 | ○ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | | 0: The same with the main reference direction<br>1: Contrary to the main reference direction<br>Hundreds:<br>0: Limit based on the max. frequency<br>1: Limit based on A frequency<br>Thousands:<br>0: A+B frequency, acceleration /deceleration of main reference A frequency source buffering is invalid<br>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<br>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**

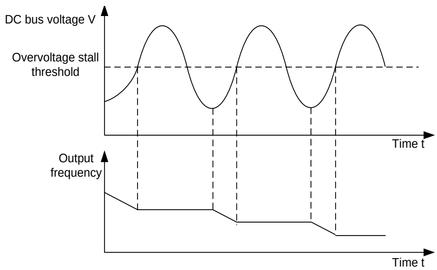
<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th><th>Modify</th></tr>
<tr><td>P10.00</td><td>Simple PLC mode</td><td>0: Stop after running once; the inverter stops automatically after running for one cycle, and it can be started only after receiving running command.<br>1: Keep running in the final value after running once; The inverter keeps the running frequency and direction of the last section after a single cycle.<br>2: Cyclic running; the inverter enters the next cycle after completing one cycle until receiving stop command and stops.</td><td>0</td><td>○</td></tr>
<tr><td>P10.01</td><td>Simple PLC memory selection</td><td>0: No memory after power down<br>1: Memory after power down; PLC memories its running stage and running frequency before power down.</td><td>0</td><td>○</td></tr>
<tr><td>P10.02</td><td>Multi-step speed 0</td><td rowspan="12">Frequency setting range for steps from step 0 to step 15: -300.0–300.0%, 100% corresponds to Max. output frequency (P00.03).<br>Running time setting range for steps from step 0 to step 15: 0.0–6553.5s (min). The time unit is specified by P10.37.<br>When simple PLC operation is selected, you must set P10.02–P10.33 to determine the running frequency and running time of each step.<br>Note: The symbol of multi-step speed determines the running direction of simple PLC, and the negative value means reverse running.<br>
</td><td>0.0%</td><td>○</td></tr>
<tr><td>P10.03</td><td>Running time of step 0</td><td>0.0s(min)</td><td>○</td></tr>
<tr><td>P10.04</td><td>Multi-step speed 1</td><td>0.0%</td><td>○</td></tr>
<tr><td>P10.05</td><td>Running time of step 1</td><td>0.0s(min)</td><td>○</td></tr>
<tr><td>P10.06</td><td>Multi-step speed 2</td><td>0.0%</td><td>○</td></tr>
<tr><td>P10.07</td><td>Running time of step 2</td><td>0.0s(min)</td><td>○</td></tr>
<tr><td>P10.08</td><td>Multi-step speed 3</td><td>0.0%</td><td>○</td></tr>
<tr><td>P10.09</td><td>Running time of step 3</td><td>0.0s(min)</td><td>○</td></tr>
<tr><td>P10.10</td><td>Multi-step speed 4</td><td>0.0%</td><td>○</td></tr>
<tr><td>P10.11</td><td>Running time of step 4</td><td>0.0s(min)</td><td>○</td></tr>
<tr><td>P10.12</td><td>Multi-step speed 5</td><td>0.0%</td><td>○</td></tr>
<tr><td>P10.13</td><td>Running time of step 5</td><td>0.0s(min)</td><td>○</td></tr>
</table>

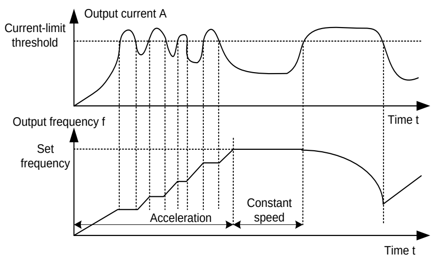
<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th><th>Modify</th></tr>
<tr><td>P10.14</td><td>Multi-step speed 6</td><td rowspan="20">When selecting multi-step speed running, the multi-step speed is within the range of -fmax–fmax, and it can be set continuously. The start/stop of multi-step running is also determined by P00.01. The inverter supports the setting of speeds of 16 steps, which are set by combined codes of multi-step terminals 1–4 (set by S terminals, corresponding to function codes P05.01–P05.06) and correspond to multi-step speeds 0–15.<br><br><br>When terminals 1–4 are OFF, the frequency input mode is set by P00.06 or P00.07. When terminals 1–4 are not all OFF, the frequency set by multi-step speed will prevail, and the priority of multi-step setting is higher than that of the keypad, analog, high-speed pulse, PID, and communication settings.<br>The relationship between terminals 1–4 is shown in the table below.<br>
<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>0.0%</td><td>○</td></tr>
<tr><td>P10.15</td><td>Running time of step 6</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>
<tr><td>P10.34</td><td>Acceleration/</td><td>Detailed illustration is shown in the table below.</td><td>0x0000</td><td>○</td></tr>
</table>

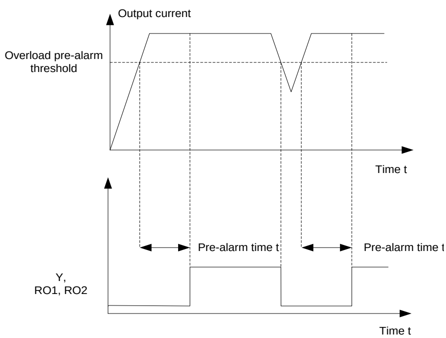
<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th><th>Modify</th></tr>
<tr><td></td><td>deceleration time of steps 0–7 of simple PLC</td><td></td><td></td><td></td></tr>
<tr><td>P10.35</td><td>Acceleration/ deceleration time of steps 8–5 of simple PLC</td><td>
<table>
<tr><th>Function code</th><th colspan="2">Binary</th><th>Step no.</th><th>ACC/ DEC time 1</th><th>ACC/ DEC time 2</th><th>ACC/ DEC time 3</th><th>ACC/ DEC time 4</th></tr>
<tr><td rowspan="8">P10.34</td><td>BIT1</td><td>BIT0</td><td>0</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT3</td><td>BIT2</td><td>1</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT5</td><td>BIT4</td><td>2</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT7</td><td>BIT6</td><td>3</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT9</td><td>BIT8</td><td>4</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT11</td><td>BIT10</td><td>5</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT13</td><td>BIT12</td><td>6</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT15</td><td>BIT14</td><td>7</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td rowspan="8">P10.35</td><td>BIT1</td><td>BIT0</td><td>8</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT3</td><td>BIT2</td><td>9</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT5</td><td>BIT4</td><td>10</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT7</td><td>BIT6</td><td>11</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT9</td><td>BIT8</td><td>12</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT11</td><td>BIT10</td><td>13</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT13</td><td>BIT12</td><td>14</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT15</td><td>BIT14</td><td>15</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
</table>
Select corresponding acceleration/deceleration time, and then convert 16-bit binary number into hexadecimal number, finally, set corresponding function code.<br>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.<br>Setting range: 0x0000–0xFFFF</td><td>0x0000</td><td>○</td></tr>
<tr><td>P10.36</td><td>PLC restart mode</td><td>0: Restart from the first step, namely if the inverter stops during running (caused by stop command, fault, or power down), it will run from the first step after restart.<br>1: Continue running from the step frequency when interruption occurred, namely if the inverter stops during running (caused by stop command or fault), it will record the running time of current step, and enters this step automatically after restart, then</td><td>0</td><td>◎</td></tr>
</table>

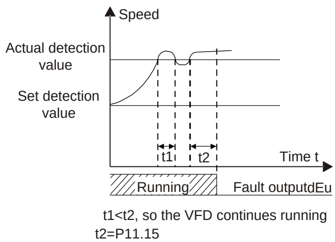
| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | | continue running at the frequency defined by this step in the remaining time. | | |
| P10.37 | Multi-step time unit | 0: second (s). The running time of each step is counted in seconds.<br>1: minute (min). The 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<br>Ones:<br>0: Disable software input phase loss protection<br>1: Enable software input phase loss protection<br>Tens:<br>0: Disable output phase loss protection<br>1: Enable output phase loss protection<br>Hundreds:<br>0: Disable hardware input phase loss protection<br>1: Enable hardware input phase loss protection | 0x110 | ○ |
| P11.01 | Frequency-drop at transient power down | 0: Disable<br>1: Enable | 0 | ○ |
| P11.02 | Energy braking in standby state | 0: Enable<br>1: Disable | 0 | ◎ |
| P11.03 | Overvoltage stall protection | 0: Disable<br>1: Enable<br> | 1 | ○ |
| P11.04 | Overvoltage stall protection voltage | 120–150% (standard bus voltage) (380V) | 136% | ○ |
| | | 120–150% (standard bus voltage) (220V) | 120% | |
| P11.05 | Current-limit | During accelerated running, as the load is too | 01 | ◎ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | selection | large, the actual acceleration rate of motor is lower than that of output frequency, if no measures are taken, the inverter may trip due to overcurrent during acceleration.<br>0x00–0x11<br>Ones: Current-limit action selection<br>0: Invalid<br>1: Always valid<br>Tens: Hardware current-limit overload alarm selection<br>0: Valid<br>1: Invalid | | |
| 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 inverter 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 inverter 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.<br><br><br>Setting range of P11.06: 50.0–200.0% (of the rated inverter output current)<br>Setting range of P11.07: 0.00–50.00Hz/s | G type: 160.0%<br>P type: 120.0% | ◎ |
| P11.07 | Frequency-drop rate during current limit | | 10.00 Hz/s | ◎ |
| P11.08 | Inverter or motor overload/underload pre-alarm | 0x000–0x1132<br>Ones place:<br>0: Motor overload/underload pre-alarm, relative to | 0x000 | ○ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | | rated motor current<br>1: inverter overload/underload pre-alarm, relative to rated inverter output current<br>2: inverter output torque overload/underload pre-alarm, relative to rated motor torque<br>Tens place:<br>0: The inverter continues running after overload/underload alarm.<br>1: The inverter continues running after underload alarm and stops running after overload fault.<br>2: The inverter continues running after overload alarm and stops running after underload fault.<br>3: The inverter stops running after overload/underload fault.<br>Hundreds place:<br>0: Always detect<br>1: Detect during constant-speed running<br>Thousands place: inverter overload current reference selection<br>0: Related to current calibration coefficient<br>1: Irrelated to current calibration coefficient | | |
| P11.09 | Overload pre-alarm detection level | If the inverter 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%<br>P type: 120% | ○ |
| P11.10 | Overload pre-alarm detection time | <br>Setting range of P11.09: P11.11–200% (relative value determined by the ones place of P11.08) | 1.0s | ○ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | | 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 inverter or motor is lower than underload pre-alarm detection level (P11.11), and the duration exceeds underload pre-alarm detection time (P11.12).<br>Setting range of P11.11: 0–P11.09 (relative value determined by the ones place of P11.08)<br>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.<br>0x00–0x11<br>Ones:<br>0: Act during undervoltage fault<br>1: Do not act during undervoltage fault<br>Tens:<br>0: Act during fault reset<br>1: Do not act during fault reset | 0x00 | ○ |
| P11.14 | Speed deviation detection value | 0.0–50.0%<br>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.<br>**Note: Speed deviation protection is invalid when P11.15 is set to 0.0.**<br><br>Setting range: 0.0–10.0s | 2.0s | ○ |
| P11.16 | Automatic frequency-reduction during voltage drop | 0–1<br>0: Invalid<br>1: Valid | 0 | ○ |
| P11.17 | Proportional coefficient of | This parameter is used to set the proportional coefficient of the bus voltage regulator during | 100 | ○ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | voltage regulator during undervoltage stall | undervoltage stall.<br>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.<br>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.<br>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.<br>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.<br>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.<br>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.<br>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.<br>Setting range: 0–2000 | 250 | ○ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| P11.25 | Enable inverter overload integral | 0: Disabled<br>1: Enabled<br>When this parameter is set to 0, the overload timing value is reset to zero after the inverter is stopped. In this case, the determination of inverter overload takes more time, and therefore the effective protection over the inverter is weakened.<br>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 inverter overload takes less time, and therefore the protection over the inverter can be performed more quickly. | 0 | ◎ |
| P11.26 | Reserved | 0–65535 | 0 | ○ |
| P11.27 | VF vibration control method | 0x00–0x11<br>Ones place:<br>0: Method 1<br>1: Method 2<br>Tens place:<br>0–1: Reserved | 0x00 | ◎ |
| P11.28 | SPO switch-on detection delay time | 0.0–60.0(s)<br>**Note:** The SPO detection is started only after the inverter runs for the delay time P11.28 to advoid false alarms caused by the unstable frequency. | 5.0 | ○ |
| P11.29 | SPO unbalance factor | 0–10 | 6 | ○ |
| P11.30 | Reserved | 0 | 0 | ● |
| P11.31 | Fault severity group 1 | 0x0000–0x3333<br>Thousands place/Hundreds place/Tens place/Ones place:<br>0: Report the fault<br>1: Report the fault after deceleration to stop<br>2: Pre-alarm, with the action executed according to P11.51<br>3: Screen out the fault<br>**Note**: Different fault actions are taken for different fault severities. The first 10 faults are not grouped by severity, but each four of the subsequent faults are grouped by severity in ascending order from right to left in hexadecimal format, that is, from the ones place to the thousands place (for example, the ones place of fault severity group 1 corresponds to fault 11).<br>Group 1: Faults 11–14 (OL1, OL2, SPI, SPO) | 0x0000 | ○ |
| P11.32 | Fault severity group 2 | | 0x0000 | ○ |
| P11.33 | Fault severity group 3 | | 0x0000 | ○ |
| P11.34 | Fault severity group 4 | | 0x0000 | ○ |
| P11.35 | Fault severity group 5 | | 0x0000 | ○ |
| P11.36 | Fault severity group 6 | | 0x0000 | ○ |
| P11.37 | Fault severity group 7 | | 0x0000 | ○ |
| P11.38 | Fault severity group 8 | | 0x0000 | ○ |
| P11.39 | Fault severity | | 0x0000 | ○ |

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th><th>Modify</th></tr>
<tr><td></td><td>group 9</td><td rowspan="12">Group 2: Faults 15–18 (OH1, OH2, EF, CE)<br>Group 3: Faults 19–22 (ItE, tE, EEP, PIDE)<br>Group 4: Faults 23–26 (bCE, END, OL3, PCE)<br>Group 5: Faults 27–30 (UPE, DNE, E-DP, E-NET)<br>Group 6: Faults 31–34 (E-CAN, ETH1, ETH2, dEu)<br>Group 7: Faults 35–38 (STo, LL, ENC1O, ENC1D)<br>Group 8: Faults 39–42 (ENC1Z, STO, STL1, STL2)<br>Group 9: Faults 43–46 (STL3, CrCE, P-E1, P-E2)<br>Group 10: Faults 47–50 (P-E3, P-E4, P-E5, P-E6)<br>Group 11: Faults 51–54 (P-E7, P-E8, P-E9, P-E10)<br>Group 12: Faults 55–58 (E-Err, ENCU, E-PN, SECAN)<br>Group 13: Faults 59–62 (OT, F1-Er, F2-Er, F3-Er)<br>Group 14: Faults 63–66 (C1-Er, C2-Er, C3-Er, E-CAT)<br>Group 15: Faults 67–70 (E-BAC, E-DEV, S-Err, OtE1)<br>Group 16: Faults 71–75 (OtE2, E-EIP, E-PAO, E-AI1)<br>Group 17: Faults 75–78 (E-AI2, E-AI3, Reserved, Reserved)<br>Group 18: Faults 79–82 (Reserved, Reserved, Reserved, Reserved)<br>Group 19: Faults 83–86 (Reserved, Reserved, Reserved, Reserved)<br>Group 20: Faults 87–90 (Reserved, Reserved, Reserved, Reserved)</td><td></td><td></td></tr>
<tr><td>P11.40</td><td>Fault severity group 10</td><td>0x0000</td><td>○</td></tr>
<tr><td>P11.41</td><td>Fault severity group 11</td><td>0x0000</td><td>○</td></tr>
<tr><td>P11.42</td><td>Fault severity group 12</td><td>0x0000</td><td>○</td></tr>
<tr><td>P11.43</td><td>Fault severity group 13</td><td>0x0000</td><td>○</td></tr>
<tr><td>P11.44</td><td>Fault severity group 14</td><td>0x0000</td><td>○</td></tr>
<tr><td>P11.45</td><td>Fault severity group 15</td><td>0x0000</td><td>○</td></tr>
<tr><td>P11.46</td><td>Fault severity group 16</td><td>0x0000</td><td>○</td></tr>
<tr><td>P11.47</td><td>Fault severity group 17</td><td>0x0000</td><td>○</td></tr>
<tr><td>P11.48</td><td>Fault severity group 18</td><td>0x0000</td><td>○</td></tr>
<tr><td>P11.49</td><td>Fault severity group 19</td><td>0x0000</td><td>○</td></tr>
<tr><td>P11.50</td><td>Fault severity group 20</td><td>0x0000</td><td>○</td></tr>
<tr><td>P11.51</td><td>Action for fault pre-alarm</td><td>0–4<br>0: Run at the set frequency<br>1: Run at the output frequency at the time of fault<br>2: Run at the frequency upper limit<br>3: Run at the frequency lower limit<br>4: Run at the frequency reserved for exception</td><td>0</td><td>○</td></tr>
<tr><td>P11.52</td><td>Frequency reserved for exception</td><td>0.00–630.00(Hz)</td><td>0.00</td><td>○</td></tr>
<tr><td>P11.53</td><td>Fire mode function</td><td>0–2<br>0: Invalid<br>1: Fire mode 1<br>2: Fire mode 2<br>When P11.53=0, the fire mode is invalid, and the normal running mode is used. In this case, the inverter stops when encountering a fault.<br>When the fire mode function is valid, the inverter runs at the speed specified by P11.54.<br>When fire mode 1 is selected, the inverter always</td><td>0</td><td>◎</td></tr>
</table>

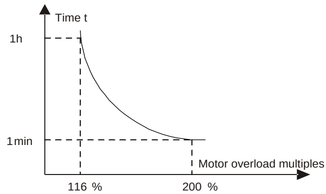
| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | | runs except when the inverter has been damaged. When fire mode 2 is selected, the inverter always runs, but the inverter stops when encountering OUT1, OUT2, OUT3, OC1, OC2, OC3, OV1, OV2, OV3, or SPO.<br>**Note:** Terminal control must be used for a fire mode.<br>When the fire mode has lasted 5 minutes, it is reset, and no warranty of repair is processed. | | |
| P11.54 | Running frequency in fire mode | 0.00Hz–P00.03 (Max. output frequency) | 50.00Hz | ○ |
| P11.55 | Fire mode flag | 0–1<br>**Note:** When the fire mode has lasted 5 minutes, it is reset, and no warranty of repair is processed. | 0 | ● |
| P11.56–P11.69 | rReserved | / | / | / |

**P12—Parameters of motor 2**

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| P12.00 | Type of motor 2 | 0: Asynchronous motor<br>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 | ◎ |
| P12.05 | Rated current of asynchronous motor 2 | 0.8–6000.0A | Depends on model | ◎ |
| P12.06 | Stator resistance | 0.001–65.535Ω | Depends | ○ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | of asynchronous motor 2 | | 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% | ○ |
| P12.14 | Magnetic saturation coefficient 4 of iron core of asynchronous | 0.0–100.0% | 40% | ○ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | motor 2 | | | |
| 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 | ● |
| P12.25 | Reserved | 0%–50% (of the motor rated current) | 10% | ● |
| P12.26 | Overload protection of motor 2 | 0: No protection<br>1: Common motor (with low-speed compensation)<br>2: Frequency-variable motor (without low-speed compensation) | 2 | ◎ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| P12.27 | Overload protection coefficient of motor 2 | Motor overload multiples M = Iout/(In×K)<br>In is rated motor current, Iout is inverter output current, K is motor overload protection coefficient. The smaller the K, the larger the value of M, the easier the protection.<br>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.<br><br><br>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.<br>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. | 80.0% | ○ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | | Setting range: 0.0%–100.0% (of the motor rated current) | | |
| P13.01 | Initial pole detection mode | 0: No detection<br>1: High-frequency current injection<br>2: Pulse superimposition | 0 | ◎ |
| P13.02 | Injection current 1 | Injection current is the pole position orientation current; injection current 1 is valid within the lower limit of injection current switchover frequency threshold. If you need to increase the starting torque, increase the value of this function code properly.<br>Setting range: 0.0%–100.0% (of the motor rated current) | 20.0% | ○ |
| P13.03 | Injection current 2 | Injection current is the pole position orientation current; injection current 2 is valid within the upper limit of injection current switchover frequency threshold, and you do not need to change injection current 2 under common situations.<br>Setting range: 0.0%–100.0% (of the motor rated current) | 10.0% | ○ |
| P13.04 | Injection current switchover frequency | 0.00Hz–200.0% (of the motor rated current) | 20.0% | ○ |
| 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.<br>Setting range: 0.0–300.0% (of the rated voltage of the motor) | 100.0% | ◎ |
| P13.07 | Reserved | 0.0–400.0 | 0.0 | ○ |
| P13.08 | Control parameter 1 | 0–0xFFFF | 0 | ○ |
| P13.09 | Frequency | This parameter is used to set the frequency | 50.00 | ○ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | threshold of phase-lock loop switch-in | 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.<br>Setting range: 0.00–655.35 | | |
| 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.<br>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.<br>Setting range: 0.0–100.0% | 0.0 | ○ |
| P13.13 | High-frequency injection current | 0–300.0% (of the rated inverter 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<br>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.<br>Local communication address is unique in the communication network, which is the basis for point-to-point communication between the upper computer and the inverter.<br>**Note: The slave address cannot be set to 0.** | 1 | ○ |
| P14.01 | Communication baud rate setup | This parameter is used to set the data transmission speed between upper computer and | 4 | ○ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | | the inverter.<br>0: 1200BPS<br>1: 2400BPS<br>2: 4800BPS<br>3: 9600BPS<br>4: 19200BPS<br>5: 38400BPS<br>6: 57600BPS<br>7: 115200BPS<br>**Note: Baud rate of the upper computer must be the same with the inverter; otherwise, communication cannot be performed. The larger the baud rate, the faster the communication speed.** | | |
| P14.02 | Data bit check setup | The data format of upper computer must be the same with the inverter; otherwise, communication cannot be performed.<br>0: No parity check (N, 8, 1) for RTU<br>1: Even parity (E, 8, 1) for RTU<br>2: Odd parity (O, 8, 1) for RTU<br>3: No parity check (N, 8, 2) for RTU<br>4: Even parity (E, 8, 2) for RTU<br>5: Odd parity (O, 8, 2) for RTU | 1 | ○ |
| P14.03 | Communication response delay | 0–200ms<br>It refers to the time interval from when the data is received by the inverter 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 | RS485 communication timeout period | 0.0 (invalid)–60.0s<br>When this parameter is set to 0.0, the communication timeout time is invalid.<br>When it is set a non-zero value, the inverter reports the "Modbus/Modbus TCP communication fault" (CE) if the communication interval exceeds the | 0.0s | ○ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | | value.<br>In general, this parameter is set to 0.0. When continuous communication is required, you can set the function code to monitor communication status. | | |
| P14.05 | Transmission error processing | 0: Alarm and coast to stop<br>1: Do not alarm and continue running<br>2: Do not alarm and stop as per the stop mode (Under communication control mode only)<br>3: Do not alarm and stop as per the stop mode (Under all control modes) | 0 | ○ |
| P14.06 | Modbus communication processing action | 0x00–0x11<br>Ones:<br>0: Write operation has response<br>1: Write operation has no response<br>Tens:<br>0: Communication password protection is invalid<br>1: Communication password protection is valid<br>Hundreds place: Valid only for RS485 communication<br>0: User-defined addresses specified by P14.07 and P14.08 are invalid<br>1: User-defined addresses specified by P14.07 and P14.08 are valid | 0x000 | ○ |
| P14.07 | User-defined running command address | 0x0000–0xFFFF | 0x2000 | ○ |
| P14.08 | User-defined frequency setting address | 0x0000–0xFFFF | 0x2001 | ○ |
| P14.09 | Modbus TCP communication timeout time | 0.0–60.0s | 5.0 | ○ |
| P14.10 | Enabling program upgrade through RS485 | 0–1<br>0: Disable<br>1: Enable | 0 | ◎ |
| P14.11 | Bootloader software version | 0.00–655.35 | 0.00 | ● |
| P14.12 | Displaying no | 0–1 | 0 | ○ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | upgrade bootloader fault | 0: Display<br>1: Do not display | | |
| P14.13–P14.47 | Reserved | 0–65535 | 0 | ● |
| P14.48 | Channel selection for mapping between PZDs and function codes | 0x00–0x12<br>Ones place: Channel for mapping function codes to PZDs<br>0: Reserved<br>1: Group P15<br>2: Group P16<br>Tens place: Save function at power failure<br>0: Disable<br>1: Enable | 0x12 | ○ |
| P14.49 | Mapped function code of received PZD2 | 0x0000–0xFFFF | 0x0000 | ○ |
| P14.50 | Mapped function code of received PZD3 | 0x0000–0xFFFF | 0x0000 | ○ |
| P14.51 | Mapped function code of received PZD4 | 0x0000–0xFFFF | 0x0000 | ○ |
| P14.52 | Mapped function code of received PZD5 | 0x0000–0xFFFF | 0x0000 | ○ |
| P14.53 | Mapped function code of received PZD6 | 0x0000–0xFFFF | 0x0000 | ○ |
| P14.54 | Mapped function code of received PZD7 | 0x0000–0xFFFF | 0x0000 | ○ |
| P14.55 | Mapped function code of received PZD8 | 0x0000–0xFFFF | 0x0000 | ○ |
| P14.56 | Mapped function code of received PZD9 | 0x0000–0xFFFF | 0x0000 | ○ |
| P14.57 | Mapped function | 0x0000–0xFFFF | 0x0000 | ○ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | code of received PZD10 | | | |
| P14.58 | Mapped function code of received PZD11 | 0x0000–0xFFFF | 0x0000 | ○ |
| P14.59 | Mapped function code of received PZD12 | 0x0000–0xFFFF | 0x0000 | ○ |
| P14.60 | Mapped function code of sent PZD2 | 0x0000–0xFFFF | 0x0000 | ○ |
| P14.61 | Mapped function code of sent PZD3 | 0x0000–0xFFFF | 0x0000 | ○ |
| P14.62 | Mapped function code of sent PZD4 | 0x0000–0xFFFF | 0x0000 | ○ |
| P14.63 | Mapped function code of sent PZD5 | 0x0000–0xFFFF | 0x0000 | ○ |
| P14.64 | Mapped function code of sent PZD6 | 0x0000–0xFFFF | 0x0000 | ○ |
| P14.65 | Mapped function code of sent PZD7 | 0x0000–0xFFFF | 0x0000 | ○ |
| P14.66 | Mapped function code of sent PZD8 | 0x0000–0xFFFF | 0x0000 | ○ |
| P14.67 | Mapped function code of sent PZD9 | 0x0000–0xFFFF | 0x0000 | ○ |
| P14.68 | Mapped function code of sent PZD10 | 0x0000–0xFFFF | 0x0000 | ○ |
| P14.69 | Mapped function code of sent PZD11 | 0x0000–0xFFFF | 0x0000 | ○ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| P14.70 | Mapped function code of sent PZD12 | 0x0000–0xFFFF | 0x0000 | ○ |

**P15—Functions of communication expansion card 1**

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| P15.00 | Reserved | 0–4 | 0 | ● |
| P15.01 | Module address | 0–127 | 2 | ◎ |
| P15.02 | Received PZD2 | 0–31<br>0: Invalid<br>1: Set frequency (0–Fmax. Unit: 0.01Hz)<br>2: PID reference (-1000–1000, in which 1000 corresponds to 100.0%)<br>3: PID feedback (-1000–1000, in which 1000 corresponds to 100.0%)<br>4: Torque setting (-3000–+3000, in which 1000 corresponds to 100.0% of the motor rated current)<br>5: Setting of the upper limit of forward running frequency (0–Fmax. Unit: 0.01 Hz)<br>6: Setting of the upper limit of reverse running frequency (0–Fmax. Unit: 0.01 Hz)<br>7: Upper limit of electromotive torque (0–3000, in which 1000 corresponds to 100.0% of the motor rated current)<br>8: Upper limit of braking torque (0–3000, in which 1000 corresponds to 100% of the motor rated current)<br>9: Virtual input terminal command (Range: 0x000–0x3FF, corresponding to S8/S7/S6/S5/HDIB/HDIA/S4/S3/S2/S1)<br>10: Virtual output terminal command (Range: 0x00–0x0F, corresponding to RO2/RO1/HDO/Y1)<br>11: Voltage setting (special for V/F separation) (0–1000, in which 1000 corresponds to 100% of the motor rated voltage)<br>12: AO1 output setting 1 (-1000–+1000, in which 1000 corresponds to 100.0%)<br>13: AO2 output setting 2 (-1000–1000, in which | 0 | ○ |
| P15.03 | Received PZD3 | | 0 | ○ |
| P15.04 | Received PZD4 | | 0 | ○ |
| P15.05 | Received PZD5 | | 0 | ○ |
| P15.06 | Received PZD6 | | 0 | ○ |
| P15.07 | Received PZD7 | | 0 | ○ |
| P15.08 | Received PZD8 | | 0 | ○ |
| P15.09 | Received PZD9 | | 0 | ○ |
| P15.10 | Received PZD10 | | 0 | ○ |
| P15.11 | Received PZD11 | | 0 | ○ |
| P15.12 | Received PZD12 | | 0 | ○ |

<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>1000 corresponds to 100.0%)<br>14: High-order bit of position reference (signed)<br>15: Low-order bit of position reference (unsigned)<br>16: High-order bit of position feedback (signed)<br>17: Low-order bit of position feedback (unsigned)<br>18: Position feedback setting flag (position feedback can be set only after this flag is set to 1 and then to 0)<br>19: Function parameter mapping (PZD2–PZD12 correspond to P14.49–P14.59)<br>20–31: Reserved</td><td></td><td></td></tr>
<tr><td>P15.13</td><td>Sent PZD2</td><td rowspan="11">0–31<br>0: Invalid<br>1: Running frequency (x100, Hz)<br>2: Set frequency (x100, Hz)<br>3: Bus voltage (x10, V)<br>4: Output voltage (x1, V)<br>5: Output current (x10, A)<br>6: Actual output torque (x10, %)<br>7: Actual output power (x10, %)<br>8: Rotation speed of running (x1, RPM)<br>9: Linear speed of running (x1, m/s)<br>10: Ramp reference frequency<br>11: Fault code<br>12: AI1 input (x100, V)<br>13: AI2 input (x100, V)<br>14: AI3 input (x100, V)<br>15: HDIA frequency value (x100, kHz)<br>16: Terminal input status<br>17: Terminal output status<br>18: PID reference (x100, %)<br>19: PID feedback (x100, %)<br>20: Motor rated torque<br>21: High-order bit of position reference (signed)<br>22: Low-order bit of position reference (unsigned)<br>23: High-order bit of position feedback (signed)<br>24: Low-order bit of position feedback (unsigned)<br>25: Status word<br>26: HDIB frequency value (x100, kHz)</td><td>0</td><td>○</td></tr>
<tr><td>P15.14</td><td>Sent PZD3</td><td>0</td><td>○</td></tr>
<tr><td>P15.15</td><td>Sent PZD4</td><td>0</td><td>○</td></tr>
<tr><td>P15.16</td><td>Sent PZD5</td><td>0</td><td>○</td></tr>
<tr><td>P15.17</td><td>Sent PZD6</td><td>0</td><td>○</td></tr>
<tr><td>P15.18</td><td>Sent PZD7</td><td>0</td><td>○</td></tr>
<tr><td>P15.19</td><td>Sent PZD8</td><td>0</td><td>○</td></tr>
<tr><td>P15.20</td><td>Sent PZD9</td><td>0</td><td>○</td></tr>
<tr><td>P15.21</td><td>Sent PZD10</td><td>0</td><td>○</td></tr>
<tr><td>P15.22</td><td>Sent PZD11</td><td>0</td><td>○</td></tr>
<tr><td>P15.23</td><td>Sent PZD12</td><td>0</td><td>○</td></tr>
</table>

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | | 27: High-order bit of PG card pulse feedback<br>28: Low-order bit of PG card pulse feedback<br>29: High-order bit of PG card pulse reference<br>30: Low-order bit of PG card pulse reference<br>31: Function parameter mapping (PZD2–PZD12 correspond to P14.60–P14.70) | | |
| P15.24 | Reserved | 0–0 | 0 | ● |
| P15.25 | DP communication timeout time | 0.0 (invalid)–60.0s | 5.0 | ○ |
| P15.26 | CANopen communication timeout time | 0.0 (invalid)–60.0s | 5.0 | ○ |
| P15.27 | CANopen communication baud rate | 0–7<br>0: 1000kbps<br>1: 800kbps<br>2: 500kbps<br>3: 250kbps<br>4: 125kbps<br>5: 100kbps<br>6: 50kbps<br>7: 20kbps | 3 | ◎ |
| P15.28 | Master/slave CAN communication address | 0–127 | 1 | ◎ |
| P15.29 | Master/slave CAN communication baud rate selection | 0: 50Kbps<br>1: 100 Kbps<br>2: 125Kbps<br>3: 250Kbps<br>4: 500Kbps<br>5: 1M bps | 2 | ◎ |
| P15.30 | Master/slave CAN communication timeout time | 0.0 (invalid)–300.0s | 0.0s | ○ |
| P15.31 | DeviceNET communication | 0.0–60.0s | 5.0 | ○ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | timeout time (Reserved) | | | |
| P15.32 | Display node baud rate | 0–65535 | 0 | ● |
| P15.33 | Enabling polling | 0–1 | 1 | ○ |
| P15.34 | Instance number of polling output | 19–27<br>19: IMO inverter output<br>20: ODVA basic speed control output<br>21: ODVA extended speed control output<br>22: ODVA speed and torque control output<br>23: ODVA extended speed and torque control output<br>24: IMO basic speed control output<br>25: IMO extended speed control output<br>26: IMO extended speed and torque control output<br>27: IMO extended speed and torque control output | 19 | ○ |
| P15.35 | Instance number of polling input | 69–77<br>69: IMO inverter input<br>70: ODVA basic speed control input<br>71: ODVA extended speed control input<br>72: ODVA speed and torque control input<br>73: ODVA extended speed and torque control input<br>74: IMO basic speed control input<br>75: IMO extended speed control input<br>76: IMO extended speed and torque control input<br>77: IMO extended speed and torque control input | 69 | ○ |
| P15.36 | Enabling status change/cycle | 0–1 | 0 | ○ |
| P15.37 | Status change/cycle output instance | 19–27<br>19: IMO inverter output<br>20: ODVA basic speed control output<br>21: ODVA extended speed control output<br>22: ODVA speed and torque control output<br>23: ODVA extended speed and torque control output<br>24: IMO basic speed control output<br>25: IMO extended speed control output | 19 | ○ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | | 26: IMO extended speed and torque control output<br>27: IMO extended speed and torque control output | | |
| P15.38 | Status change/cycle input instance | 69–77<br>69: IMO inverter input<br>70: ODVA basic speed control input<br>71: ODVA extended speed control input<br>72: ODVA speed and torque control input<br>73: ODVA extended speed and torque control input<br>74: IMO basic speed control input<br>75: IMO extended speed control input<br>76: IMO extended speed and torque control input<br>77: IMO extended speed and torque control input | 69 | ○ |
| P15.39 | Component 19 output length | 8–32 | 32 | ○ |
| P15.40 | Component 19 input length | 8–32 | 32 | ○ |
| P15.41 | BACnet communication method (Reserved) | 0–1<br>0: P16.22 is valid.<br>1: P15.42 is valid. | 0 | ◎ |
| P15.42 | BACnet_MSTP baud rate (Reserved) | 0–5 | 0 | ◎ |
| P15.43 | Communication control word expression format | 0–1<br>0: Decimal format<br>1: Binary format | 0 | ◎ |

**P16—Functions of communication expansion card 2**

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| P16.00 | Reserved | 0–0 | 0 | ● |
| P16.01 | Reserved | 0–0 | 0 | ◎ |
| P16.02 | Ethernet monitoring card IP address 1 | 0–255 | 192 | ◎ |
| P16.03 | Ethernet monitoring card | 0–255 | 168 | ◎ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | IP address 2 | | | |
| P16.04 | Ethernet monitoring card IP address 3 | 0–255 | 0 | ◎ |
| P16.05 | Ethernet monitoring card IP address 4 | 0–255 | 1 | ◎ |
| P16.06 | Ethernet monitoring card subnet mask 1 | 0–255 | 255 | ◎ |
| P16.07 | Ethernet monitoring card subnet mask 2 | 0–255 | 255 | ◎ |
| P16.08 | Ethernet monitoring card subnet mask 3 | 0–255 | 255 | ◎ |
| P16.09 | Ethernet monitoring card subnet mask 4 | 0–255 | 0 | ◎ |
| P16.10 | Ethernet monitoring card gateway 1 | 0–255 | 192 | ◎ |
| P16.11 | Ethernet monitoring card gateway 2 | 0–255 | 168 | ◎ |
| P16.12 | Ethernet monitoring card gateway 3 | 0–255 | 0 | ◎ |
| P16.13 | Ethernet monitoring card gateway 4 | 0–255 | 1 | ◎ |
| P16.14 | Ethernet monitoring variable address 1 | 0x0000–0xFFFF | 0x0000 | ○ |
| P16.15 | Ethernet monitoring variable address | 0x0000–0xFFFF | 0x0000 | ○ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | 2 | | | |
| P16.16 | Ethernet monitoring variable address 3 | 0x0000–0xFFFF | 0x0000 | ○ |
| P16.17 | Ethernet monitoring variable address 4 | 0x0000–0xFFFF | 0x0000 | ○ |
| P16.18 | Ethernet monitoring card communication timeout time (Reserved) | 0.0–60.0s | 0.0 | ○ |
| P16.19 | EtherCAT synchronization period (Reserved) | 0–4<br>0: 250μs<br>1: 500μs<br>2: 1ms<br>3: 2ms<br>4: Reserved | 2 | ○ |
| P16.20 | High-order bits of BACnet device number (Reserved) | 0–4194<br>P16.20 and P16.21 comprise an independent BACnet device code (0–4194303). | 0 | ◎ |
| P16.21 | Low-order bits of BACnet device number (Reserved) | 0–999<br>P16.20 and P16.21 comprise an independent BACnet device code (0–4194303). | 1 | ◎ |
| P16.22 | BACnet "I-Am" service mode (Reserved) | 0–1<br>0: Sending at power-on<br>1: Uninterruptible sending | 0 | ○ |
| P16.23 | BACnet communication timeout time (Reserved) | 0.0–60.0s | 5.0 | ○ |
| P16.24 | Identification time for the | 0.0–600.0s<br>If it is set to 0.0, identification fault will not be | 0.0s | ○ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | expansion card in card slot 1 | detected. | | |
| P16.25 | Identification time for the expansion card in card slot 2 | 0.0–600.0s<br>If it is set to 0.0, offline fault will not be detected. | 0.0s | ○ |
| P16.26 | Identification time for the expansion card in card slot 3 | 0.0–600.0s<br>If it is set to 0.0, offline fault will not be detected. | 0.0s | ○ |
| P16.27 | Communication timeout period of expansion card in card slot 1 | 0.0–600.0s<br>If it is set to 0.0, offline fault will not be detected. | 0.0s | ○ |
| P16.28 | Communication timeout period of expansion card in card slot 2 | 0.0–600.0s<br>If it is set to 0.0, offline fault will not be detected. | 0.0s | ○ |
| P16.29 | Communication timeout period of expansion card in card slot 3 | 0.0–600.0s<br>If it is set to 0.0, offline fault will not be detected. | 0.0s | ○ |
| P16.30 | EtherCAT communication timeout time (Reserved) | 0.0–60.0s | 5.0 | ○ |
| P16.31 | PROFINET communication timeout time | 0.0–60.0s | 5.0 | ○ |
| P16.32 | Received PZD2 | 0–31<br>0: Invalid<br>1: Set frequency (0–Fmax. Unit: 0.01Hz)<br>2: PID reference (-1000–1000, in which 1000 corresponds to 100.0%)<br>3: PID feedback (-1000–1000, in which 1000 corresponds to 100.0%)<br>4: Torque setting (-3000–+3000, in which 1000 corresponds to 100.0% of the motor rated current)<br>5: Setting of the upper limit of forward running | 0 | ○ |
| P16.33 | Received PZD3 | | 0 | ○ |
| P16.34 | Received PZD4 | | 0 | ○ |
| P16.35 | Received PZD5 | | 0 | ○ |
| P16.36 | Received PZD6 | | 0 | ○ |
| P16.37 | Received PZD7 | | 0 | ○ |
| P16.38 | Received PZD8 | | 0 | ○ |
| P16.39 | Received PZD9 | | 0 | ○ |
| P16.40 | Received PZD10 | | 0 | ○ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| P16.41 | Received PZD11 | frequency (0–Fmax. Unit: 0.01 Hz) | 0 | ○ |
| P16.42 | Received PZD12 | 6: Setting of the upper limit of reverse running frequency (0–Fmax. Unit: 0.01 Hz)<br>7: Upper limit of electromotive torque (0–3000, in which 1000 corresponds to 100.0% of the motor rated current)<br>8: Upper limit of braking torque (0–3000, in which 1000 corresponds to 100% of the motor rated current)<br>9: Virtual input terminal command (Range: 0x000–0x3FF, corresponding to S8/S7/S6/S5/HDIB/HDIA/S4/S3/S2/S1)<br>10: Virtual output terminal command (Range: 0x00–0x0F, corresponding to RO2/RO1/HDO/Y1)<br>11: Voltage setting (special for V/F separation) (0–1000, in which 1000 corresponds to 100% of the motor rated voltage)<br>12: AO1 output setting 1 (-1000–+1000, in which 1000 corresponds to 100.0%)<br>13: AO2 output setting 2 (-1000–1000, in which 1000 corresponds to 100.0%)<br>14: High-order bit of position reference (signed)<br>15: Low-order bit of position reference (unsigned)<br>16: High-order bit of position feedback (signed)<br>17: Low-order bit of position feedback (unsigned)<br>18: Position feedback setting flag (position feedback can be set only after this flag is set to 1 and then to 0)<br>19: Function parameter mapping (PZD2–PZD12 correspond to P14.49–P14.59)<br>20–31: Reserved | 0 | ○ |
| P16.43 | Sent PZD2 | 0–31<br>0: Invalid<br>1: Running frequency (x100, Hz)<br>2: Set frequency (x100, Hz)<br>3: Bus voltage (x10, V)<br>4: Output voltage (x1, V)<br>5: Output current (x10, A) | 0 | ○ |
| P16.44 | Sent PZD3 | | 0 | ○ |
| P16.45 | Sent PZD4 | | 0 | ○ |
| P16.46 | Sent PZD5 | | 0 | ○ |
| P16.47 | Sent PZD6 | | 0 | ○ |
| P16.48 | Sent PZD7 | | 0 | ○ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| P16.49 | Sent PZD8 | 6: Actual output torque (x10, %)<br>7: Actual output power (x10, %)<br>8: Rotation speed of running (x1, RPM)<br>9: Linear speed of running (x1, m/s)<br>10: Ramp reference frequency<br>11: Fault code<br>12: AI1 input (x100, V)<br>13: AI2 input (x100, V)<br>14: AI3 input (x100, V)<br>15: HDIA frequency value (x100, kHz)<br>16: Terminal input status<br>17: Terminal output status<br>18: PID reference (x100, %)<br>19: PID feedback (x100, %)<br>20: Motor rated torque<br>21: High-order bit of position reference (signed)<br>22: Low-order bit of position reference (unsigned)<br>23: High-order bit of position feedback (signed)<br>24: Low-order bit of position feedback (unsigned)<br>25: Status word<br>26: HDIB frequency value (x100, kHz)<br>27: High-order bit of PG card pulse feedback<br>28: Low-order bit of PG card pulse feedback<br>29: High-order bit of PG card pulse reference<br>30: Low-order bit of PG card pulse reference<br>31: Function parameter mapping (PZD2–PZD12 correspond to P14.60–P14.70) | 0 | ○ |
| P16.50 | Sent PZD9 | | 0 | ○ |
| P16.51 | Sent PZD10 | | 0 | ○ |
| P16.52 | Sent PZD11 | | 0 | ○ |
| P16.53 | Sent PZD12 | | 0 | ○ |
| P16.54 | Ethernet IPcommunication timeout time | 0.0–60.0s | 5.0 | ○ |
| P16.55 | Ethernet IP communication rate | 0–4<br>0: Self-adaptive<br>1: 100M full-duplex<br>2: 100M half-duplex<br>3: 10M full-duplex<br>4: 10M half-duplex | 0 | ◎ |
| P16.56 | Bluetooth pairing code | 0–65535 | 0 | ● |
| P16.57 | Bluetooth host type | 0–65535<br>0: No host connection | 0 | ● |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | | 1: Mobile APP<br>2: Bluetooth box<br>3–65535: Reserved | | |
| P16.58 | Industrial Ethernet communication card IP address 1 | 0–255 | 192 | ◎ |
| P16.59 | Industrial Ethernet communication card IP address 2 | 0–255 | 168 | ◎ |
| P16.60 | Industrial Ethernet communication card IP address 3 | 0–255 | 0 | ◎ |
| P16.61 | Industrial Ethernet communication card IP address 4 | 0–255 | 20 | ◎ |
| P16.62 | Industrial Ethernet communication card subnet mask 1 | 0–255 | 255 | ◎ |
| P16.63 | Industrial Ethernet communication card subnet mask 2 | 0–255 | 255 | ◎ |
| P16.64 | Industrial Ethernet communication card subnet mask 3 | 0–255 | 255 | ◎ |
| P16.65 | Industrial Ethernet communication card subnet mask 4 | 0–255 | 0 | ◎ |
| P16.66 | Industrial Ethernet communication card gateway 1 | 0–255 | 192 | ◎ |
| P16.67 | Industrial Ethernet communication card gateway 2 | 0–255 | 168 | ◎ |
| P16.68 | Industrial Ethernet | 0–255 | 0 | ◎ |

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

**P17—Status viewing**

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| P17.00 | Set frequency | Display current set frequency of the inverter.<br>Range: 0.00Hz–P00.03 | 50.00Hz | ● |
| P17.01 | Output frequency | Display current output frequency of the inverter.<br>Range: 0.00Hz–P00.03 | 0.00Hz | ● |
| P17.02 | Ramp reference frequency | Display current Ramp reference frequency of the inverter.<br>Range: 0.00Hz–P00.03 | 0.00Hz | ● |
| P17.03 | Output voltage | Display current output voltage of the inverter.<br>Range: 0–1200V | 0V | ● |
| P17.04 | Output current | Display the valid value of current output current of the inverter.<br>Range: 0.0–5000.0A | 0.0A | ● |
| P17.05 | Motor speed | Display current motor speed.<br>Range: 0–65535RPM | 0 RPM | ● |
| P17.06 | Torque current | Display current torque current of the inverter.<br>Range: -3000.0–3000.0A | 0.0A | ● |
| P17.07 | Exciting current | Display current exciting current of the inverter.<br>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.<br>Range: -300.0–300.0% (relative to rated motor power) | 0.0% | ● |
| P17.09 | Motor output torque | Display current output torque of the inverter; 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.<br>Range: -250.0–250.0% | 0.0% | ● |
| P17.10 | Estimated motor | The estimated motor rotor frequency under | 0.00Hz | ● |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | frequency | open-loop vector condition.<br>Range: 0.00– P00.03 | | |
| P17.11 | DC bus voltage | Display current DC bus voltage of the inverter.<br>Range: 0.0–2000.0V | 0V | ● |
| P17.12 | Digital input terminal state | Display current digital input terminal state of the inverter.<br>0000–03F<br>Corresponds to HDIB, HDIA, S4, S3, S2 and S1 respectively | 0 | ● |
| P17.13 | Digital output terminal state | Display current digital output terminal state of the inverter.<br>0000–000F<br>Corresponds to RO2, RO1, HDO and Y1 respectively | 0 | ● |
| P17.14 | Digital adjustment variable | Display the regulating variable by UP/DOWN terminals of the inverter.<br>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.<br>Range: -300.0%–300.0% (of the motor rated current) | 0.0% | ● |
| P17.16 | Linear speed | 0–65535 | 0 | ● |
| P17.17 | Reserved | 0–65535 | 0 | ● |
| P17.18 | Count value | 0–65535 | 0 | ● |
| P17.19 | AI1 input voltage | Display input signal of AI 1<br>Range: 0.00–10.00V | 0.00V | ● |
| P17.20 | AI2 input voltage | Display input signal of AI2<br>Range: -10.00V–10.00V | 0.00V | ● |
| P17.21 | HDIA input frequency | Display input frequency of HDIA<br>Range: 0.000–50.000kHz | 0.000 kHz | ● |
| P17.22 | HDIB input frequency | Display input frequency of HDIB<br>Range: 0.000–50.000kHz | 0.000 kHz | ● |
| P17.23 | PID reference value | Display PID reference value<br>Range: -100.0–100.0% | 0.0% | ● |
| P17.24 | PID feedback value | Display PID feedback value<br>Range: -100.0–100.0% | 0.0% | ● |
| P17.25 | Motor power factor | Display the power factor of current motor.<br>Range: -1.00–1.00 | 1.00 | ● |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| P17.26 | Current running time | Display current running time of the inverter.<br>Range: 0–65535min | 0m | ● |
| P17.27 | Acutal stage of simple PLC | Displays the present stage of the simple PLC function.<br>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 percentage of rated torque of the motor.<br>Range: -300.0%–300.0% (of the motor rated current) | 0.0% | ● |
| P17.29 | Pole angle of open-loop synchronous motor | Display initial identification angle of synchronous motor<br>Range: 0.0–360.0 | 0.0 | ● |
| P17.30 | Phase compensation of synchronous motor | Display phase compensation of synchronous motor<br>Range: -180.0–180.0 | 0.0 | ● |
| P17.31 | High-frequency superposition current of synchronous motor | 0.0%–200.0% (of the motor rated current) | 0.0 | ● |
| P17.32 | Motor flux linkage | 0.0%–200.0% | 0.0% | ● |
| P17.33 | Exciting current reference | Display the exciting current reference value under vector control mode<br>Range: -3000.0–3000.0A | 0.0A | ● |
| P17.34 | Torque current reference | Display torque current reference value under vector control mode<br>Range: -3000.0–3000.0A | 0.0A | ● |
| P17.35 | AC incoming current | Display the valid value of incoming current on AC side<br>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. | 0.0Nm | ● |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | | Range: -3000.0Nm–3000.0Nm | | |
| 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 | ● |
| P17.40 | Motor control mode | Ones: Control mode<br>0: Vector 0<br>1: Vector 1<br>2: VF control<br>3: Closed-loop vector control<br>Tens: Control state<br>0: Speed control<br>1: Torque control<br>2: Position control<br>Hundreds: Motor number<br>0: Motor 1<br>1: Motor 2 | 0x2 | ● |
| P17.41 | Upper limit of the torque when motoring | 0.0%–300.0% (of the motor rated current) | 180.0% | ● |
| P17.42 | Upper limit of braking torque | 0.0%–300.0% (of the motor rated 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 | -100.0%–100.0% | 0.0% | ● |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | torque | | | |
| P17.47 | Motor pole pairs | 0–65535 | 0 | ● |
| P17.48 | inverter overload count value | 0–65535 | 0 | ● |
| P17.49 | Frequency set by A source | 0.00–P00.03 | 0.00Hz | ● |
| P17.50 | Frequency set by B source | 0.00–P00.03 | 0.00Hz | ● |
| P17.51 | PID proportional output | -100.0%–100.0% | 0.00% | ● |
| 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 | Peak value at 100Hz frequency component (square-wave orthogonal function detected) | 0.0–300.0V<br>Peak value of bus voltage fluctuation at 100Hz frequency component, which is detected by using a square-wave orthogonal function | 0.0V | ● |
| P17.58 | Peak value at 100Hz frequency component (sine-wave orthogonal function detected) | 0.0–300.0V<br>Peak value of bus voltage fluctuation at 100Hz frequency component, which is detected by using a sine-wave orthogonal function | 0.0V | ● |
| P17.59–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.<br>Range: -999.9–3276.7Hz | 0.0Hz | ● |
| P18.01 | Encoder position count value | Encoder count value, quadruple frequency,<br>Range: 0–65535 | 0 | ● |
| P18.02 | Encoder Z pulse count value | Corresponding count value of encoder Z pulse.<br>Range: 0–65535 | 0 | ● |
| P18.03 | High bit of position reference value | High bit of position reference value, zero out after stop.<br>Range: 0–30000 | 0 | ● |
| P18.04 | Low bit of position reference value | Low bit of position reference value, zero out after stop.<br>Range: 0–65535 | 0 | ● |
| P18.05 | High bit of position feedback value | High bit of position feedback value, zero out after stop.<br>Range: 0–30000 | 0 | ● |
| P18.06 | Low bit of position feedback value | Low bit of position feedback value, zero out after stop.<br>Range: 0–65535 | 0 | ● |
| P18.07 | Position deviation | Deviation between current reference position and actual running position.<br>Range: -32768–32767 | 0 | ● |
| P18.08 | Position of position reference point | Position of reference point of Z pulse when the spindle stops accurately.<br>Range: 0–65535 | 0 | ● |
| P18.09 | Current position setup of spindle | Current position setup when the spindle stops accurately.<br>Range: 0–359.99 | 0.00 | ● |
| P18.10 | Current position when spindle stops accurately | Current position when spindle stops accurately.<br>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 | 0 | ● |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | | of encoder.<br>0: Forward<br>1: Reverse | | |
| P18.12 | Encoder Z pulse angle | Reserved.<br>Range: 0.00–359.99 | 0.00 | ● |
| P18.13 | Encoder Z pulse error times | Reserved.<br>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.<br>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 position mode and pulse speed mode.<br>Range: 0–655.35Hz | 0.00Hz | ● |
| P18.19 | Position regulator output | -327.68–327.67Hz | 0.00Hz | ● |
| P18.20 | Count value of resolver | Count value of resolver.<br>Range: 0–65535 | 0 | ● |
| P18.21 | Resolver angle | The pole position angle read according to the resolver-type encoder.<br>Range: 0.00–359.99 | 0.00 | ● |
| P18.22 | Pole angle of closed-loop synchronous motor | Current pole position.<br>Range: 0.00–359.99 | 0.00 | ● |
| P18.23 | State control word 3 | 0–65535 | 0 | ● |
| P18.24 | High bit of count | 0–65535 | 0 | ● |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | value of pulse reference | | | |
| 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 | ● |
| 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 | 8k test duration | 0–65535 | 0 | ● |

**P19—Expansion card state check**

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| P19.00 | Type of card at slot 1 | 0–65535<br>0: No card | 0 | ● |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| P19.01 | Type of card at slot 2 | 1: Programmable card<br>2: I/O card | 0 | ● |
| P19.02 | Type of card at slot 3 | 3: Incremental PG card<br>4: Incremental PG card with UVW<br>5: Ethernet communication card<br>6: DP communication card<br>7: Bluetooth card<br>8: Resolver PG card<br>9: CANopen communication card<br>10: WIFI card<br>11: PROFINET communication card<br>12: Sine/Cosine PG card without CD signal<br>13: Sine/Cosine PG card with CD signal<br>14: Absolute encoder PG card<br>15: CAN master/slave communication card<br>16: Modbus/Modbus TCP communication card<br>17: EtherCAT communication card<br>18: BacNet communication card<br>19: DeviceNet communication card<br>20: PT100/PT1000 temperature detection card<br>21: EtherNet IP communication card<br>22: MECHATROLINK communication card<br>23–65535: Reserved | 0 | ● |
| P19.03 | Software version of expansion card at slot 1 | 0.00–655.35 | 0.00 | ● |
| P19.04 | Software version of expansion card at slot 2 | 0.00–655.35 | 0.00 | ● |
| P19.05 | Software version of expansion card at slot 3 | 0.00–655.35 | 0.00 | ● |
| P19.06 | Input state of expansion I/O card terminals | 0–0xFFFF | 0 | ● |
| P19.07 | Output state of expansion I/O card terminals | 0–0xFFFF | 0 | ● |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| P19.08 | Reserved | 0.000–65535 | 0 | ● |
| P19.09 | AI3 input voltage of expansion I/O card | 0.00–10.00V | 0.00V | ● |
| P19.10 | EC PT100 detected temperature | -50.0–150.0°C | 0.0 | ● |
| P19.11 | EC PT100 detected digital | 0–4096 | 0 | ● |
| P19.12 | EC PT1000 detected temperature | -50.0–150.0°C | 0.0 | ● |
| P19.13 | EC PT1000 detected digital | 0–4096 | 0 | ● |
| P19.14 | Alarm display | 0–4<br>0: No alarm<br>1: PT100 detected OH alarm (A-Ot1)<br>2: PT1000 detected OH alarm (A-Ot2)<br>3: PT100 disconnection alarm (A-Pt1)<br>4: PT1000 disconnection alarm (A-Pt2) | 0 | ● |
| P19.15 | Inverter control word | 0–65535 | 0 | ● |
| P19.16 | Inverter status word | 0–65535 | 0 | ● |
| P19.17 | Ethernet monitoring variable 1 | 0–65535 | 0 | ● |
| P19.18 | Ethernet monitoring variable 2 | 0–65535 | 0 | ● |
| P19.19 | Ethernet monitoring variable 3 | 0–65535 | 0 | ● |
| P19.20 | Ethernet monitoring variable 4 | 0–65535 | 0 | ● |
| P19.21 | AI/AO detected temperature | -20.0–200.0°C | 0.0 | ● |
| P19.22–P19.39 | Reserved | 0–65535 | 0 | ● |

**P20—Encoder of motor 1**

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| P20.00 | Encoder type | 0: Incremental encoder | 0 | ● |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | display | 1: Resolver-type encoder<br>2: Sin/Cos encoder<br>3: Endat absolute encoder | | |
| P20.01 | Encoder pulse number | Number of pulses generated when the encoder revolves for one circle.<br>Setting range: 0–60000 | 1024 | ◎ |
| P20.02 | Encoder direction | Ones: AB direction<br>0: Forward<br>1: Reverse<br>Tens: Z pulse direction (reserved)<br>0: Forward<br>1: Reverse<br>Hundreds: CD/UVW pole signal direction<br>0: Forward<br>1: Reverse | 0x000 | ◎ |
| 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<br>Ones: Low-speed filter time, corresponds to 2^ (0–9) ×125μs.<br>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.<br>Setting range: 0.001–65.535 | 1.000 | ○ |
| P20.07 | Control parameters of synchronous motor | Bit0: Enable Z pulse calibration<br>Bit1: Enable encoder angle calibration<br>Bit2: Enable SVC speed measurement<br>Bit3: Select resolver speed measurement mode<br>Bit4: Z pulse capture mode<br>Bit5: Do not detect encoder initial angle in v/f control<br>Bit6: Enable CD signal calibration<br>Bit7: Disable sin/cos sub-division speed | 0x3 | ○ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | | measurement<br>Bit8: Do not detect encoder fault during autotuning<br>Bit9: Enable Z pulse detection optimization<br>Bit10: Enable initial Z pulse calibration optimization<br>Bit11: Reserved<br>Bit12: Clear Z pulse arrival signal after stop<br>Bit13: Reserved<br>Bit14: Detect Z pulse after one rotation<br>Bit15: Reserved | | |
| P20.08 | Enable Z pulse offline detection | 0x00–0x11<br>Ones: Z pulse<br>0: Do not detect<br>1: Enable<br>Tens: UVW pulse (for synchronous motor)<br>0: Do not detect<br>1: Enable | 0x10 | ○ |
| P20.09 | Initial angle of Z pulse | Relative electric angle of encoder Z pulse and motor pole position.<br>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.<br>Setting range: 0.00–359.99 | 0.00 | ○ |
| P20.11 | Autotuning of initial angle of pole | 0–3<br>1: Rotary autotuning (DC brake)<br>2: Static autotuning (suitable for resolver-type encoder, sin/cos with CD signal feedback)<br>3: Rotary autotuning (initial angle identification) | 0 | ◎ |
| P20.12 | Speed measurement optimization selection | 0: No optimization<br>1: Optimization mode 1<br>2: Optimization mode 2 | 1 | ◎ |
| P20.13 | CD signal zero offset gain | 0–65535 | 0 | ○ |
| P20.14 | Encoder type selection | Ones: Incremental encoder<br>0: without UVW<br>1: with UVW<br>Tens: Sin/Cos encoder<br>0: without CD signal<br>1: with CD signal | 0x00 | ◎ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| P20.15 | Speed measurement mode | 0: PG card<br>1: local; realized by HDIA and HDIB; supports incremental 24V encoder only | 0 | ◎ |
| P20.16 | Frequency-division coefficient | 0–255<br>When this parameter is set to 0 or 1, frequency division of 1:1 is implemented. | 0 | ○ |
| P20.17 | Pulse filer processing | 0x0000–0xffff<br>Bit0: Enable/disable encoder input filter<br>0: No filter<br>1: Filter<br>Bit1: Encoder signal filter mode (set Bit0 or Bit2 to 1)<br>0: Self-adaptive filter<br>1: Use P20.18 filter parameters<br>Bit2: Enable/disable encoder frequency-division output filter<br>0: No filter<br>1: Filter<br>Bit3: Enable/disable filter for frequency-division output of pulse reference<br>0: No filter<br>1: Filter<br>Bit4: Enable/disable pulse reference filter<br>0: No filter<br>1: Filter<br>Bit5: Pulse reference filter mode (valid when Bit4 is set to 1)<br>0: Self-adaptive filter<br>1: Use P20.19 filter parameters<br>Bit6: Frequency-divided output source setting<br>0: Encoder signals<br>1: Pulse reference signals<br>Bits7–15: Reserved | 0x0033 | ○ |
| P20.18 | Encoder pulse filter width | 0–63<br>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<br>The filtering time is P20.19×0.25 μs. The value 0 or 1 indicates 0.25 μs. | 2 | ○ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| 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<br>**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 | 0x0000–0x7121<br>Ones: Control mode selection<br>0: Speed control<br>1: Position control<br>Tens: Position command source<br>0: Pulse string<br>1: Digital position<br>2: Positioning of photoelectric switch during stop<br>Hundreds: Position feedback source (reserved, fixed to channel P)<br>0: PG1<br>1: PG2<br>Thousands: Servo mode<br>0: Servo disabled, without position deviation<br>1: Servo disabled, with position deviation<br>2: Servo enabled, without position deviation<br>3: Servo enabled, with position deviation<br>4–7: Reserved | 0x0000 | ○ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| P21.01 | Pulse command mode | 0x0000–0x3133<br>Ones: Pulse mode<br>0: A/B quadrature pulse; A precedes B<br>1: A: PULSE; B: SIGN<br>If channel B is of low electric level, the edge counts; if channel B is of high electric level, the edge counts down.<br>2: A: Positive pulse<br>Channel A is positive pulse; channel B needs no wiring<br>3: A/B dual-channel pulse; channel A pulse edge counts; channel B pulse edge counts down<br>Tens: Pulse direction<br>Bit0: Set pulse direction<br>0: Forward<br>1: Reverse<br>Bit1: Set pulse direction by running direction<br>0: Disable, and BIT0 is valid.<br>1: Enable<br>Hundreds: Pulse/direction frequency-doubling selection (reserved)<br>0: No frequency-doubling<br>1: Frequency-doubling<br>Thousands: Pulse control selection<br>Bit0: Pulse filter selection<br>0: Inertia filter<br>1: Average moving filter<br>Bit1: Overspeed control<br>0: No control<br>1: Control | 0x0000 | ◎ |
| 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.<br>Setting range: 0.0–400.0 | 20.0 | ○ |
| P21.03 | APR gain 2 | | 30.0 | ○ |
| P21.04 | Switching mode | This parameter is used to set the APR gain | 0 | ○ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | of position loop 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.<br>0: No switching<br>1: Torque command<br>2: Speed command<br>3–5: Reserved | | |
| P21.05 | Torque command level during position gain switchover | 0.0–100.0% (rated motor torque) | 10.0% | ○ |
| P21.06 | Speed command level during position gain switchover | 0.0–100.0% (rated motor speed) | 10.0% | ○ |
| P21.07 | Smooth filter coefficient during gain switchover | The smooth filter coefficient during position gain switchover.<br>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.<br>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.<br>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.<br>Setting range: 1–65535 | 1000 | ○ |
| P21.12 | Denominator of position command ratio | Setting range: 1–65535 | 1000 | ○ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| P21.13 | Position feedforward gain | 0.00–120.00%<br>For pulse string reference only (position control) | 100.00 | ○ |
| P21.14 | Position feedforward filter time constant | 0.0–3200.0ms<br>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.<br>0.0–3200.0ms | 0.0ms | ◎ |
| P21.16 | Digital positioning mode | 0x0000–0xFFFF<br>Bit0: Positioning mode selection<br>0: Relative position<br>1: Absolute position (home) (reserved)<br>Bit1: Positioning cycle selection<br>0: Cyclic positioning by terminals<br>1: Automatic cyclic positioning<br>Bit2: Cycle mode<br>0: Continuous<br>1: Repetitive (supported by automatic cyclic positioning only)<br>Bit3: P21.17 digital setting mode<br>0: Incremental<br>1: Position type (do not support continuous mode)<br>Bit4: Home searching mode<br>0: Search for the home just once<br>1: Search for the home during each run<br>Bit5: Home calibration mode<br>0: Calibrate in real time<br>1: Single calibration<br>Bit6: Positioning completion signal selection<br>0: Valid during the time set by P21.25 (Hold time of positioning completion signal)<br>1: Always valid<br>Bit7: Initial positioning selection (for cyclic positioning by terminals)<br>0: Invalid (do not rotate)<br>1: Valid<br>Bit8: Positioning enable signal selection (for cyclic positioning by terminals only; positioning function is always enabled for automatic cyclic positioning) | 0x0000 | ○ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | | 0: Pulse signal<br>1: Level signal<br>Bit9: Position source<br>0: P21.17 setting<br>1: PROFIBUS/CANopen setting<br>Bit10: Whether to save the encoder pulse counting value at power failure<br>0: Do not save<br>1: Save<br>Bit 11: Reserved<br>Bit12: Positioning curve selection (reserved)<br>0: Straight line<br>1: S curve | | |
| P21.17 | Position digital reference | Set digital positioning position.<br>Actual position=P21.17×P21.11/P21.12<br>0–65535 | 0 | ○ |
| P21.18 | Positioning speed setup selection | 0: Set by P21.19<br>1: Set by AI1<br>2: Set by AI2<br>3: Set by AI3<br>4: Set by high-speed pulse HDIA<br>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. | 3.00s | ○ |
| P21.21 | Deceleration time of positioning | Acceleration time of positioning means the time needed for the inverter to accelerate from 0Hz to Max. output frequency (P00.03).<br>Deceleration time of positioning means the time needed for the inverter to decelerate from Max. output frequency (P00.03) to 0hz.<br>Setting range of P21.20: 0.01–300.00s<br>Setting range of P21.21: 0.01–300.00s | 3.00s | ○ |
| P21.22 | Hold time of positioning arrival | Set the hold time of waiting when target positioning position is reached.<br>Setting range: 0.000–60.000s | 0.100s | ○ |
| P21.23 | Home search speed | 0.00–50.00Hz | 2.00Hz | ○ |

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Default value</th><th>Modify</th></tr>
<tr><td>P21.24</td><td>Home position offset</td><td>0–65535</td><td>0</td><td>○</td></tr>
<tr><td>P21.25</td><td>Hold time of positioning completion signal</td><td>The hold time of positioning completion signal, this parameter is also valid for positioning completion signal of spindle orientation.<br>Setting range: 0.000–60.000s</td><td>0.200s</td><td>○</td></tr>
<tr><td>P21.26</td><td>Pulse superposition value</td><td rowspan="3">P21.26: -9999–32767<br>P21.27: 0–3000.0/ms<br>This function is enabled in the pulse speed reference (P00.06=12) or pulse position mode (P21.00=1):<br>1. Input terminal function #68 (enable pulse superposition)<br>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.<br>2. Input terminal function #67 (progressive increase of pulses)<br>When this terminal is enabled, the pulse reference channel is compensated by the pulse superposition rate set in P21.27.<br>Note: Terminal filtering set in P05.09 may slightly affect the actual superposition.<br>Example: P21.27 = 1.0/ms; P05.05 = 67<br>If the input signal of terminal S5 is 0.5s, the actual number of superposed pulses is 500.<br>3. Input terminal function #69 (progressive decrease of pulses)<br>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.<br>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.<br>4. Output terminal function #28 (pulse</td><td>0</td><td>○</td></tr>
<tr><td>P21.27</td><td>Pulse superposition speed</td><td>8.0/ms</td><td>○</td></tr>
<tr><td>P21.28</td><td>Acceleration/ deceleration time after disabling pulse</td><td>5.0s</td><td>○</td></tr>
</table>

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | | superposing)<br>When pulses are superposed, the output terminal operates. After pulses are superposed, the terminal does not operate. | | |
| 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).<br>Setting range: 0–3200.0ms | 10.0ms | ○ |
| P21.30 | Numerator of the 2nd command ratio | 1–65535 | 1000 | ○ |
| P21.31 | Pulse reference speed measuring method | 0–2<br>0: Main control board<br>1: PG card<br>2: Hybrid | 0 | ○ |
| P21.32 | Pulse reference feedforward source | 0x0–0x1 | 0x0 | ◎ |
| P21.33 | Set value of clearing encoder count | 0–65535 | 0 | ◎ |

**P22—Spindle positioning**

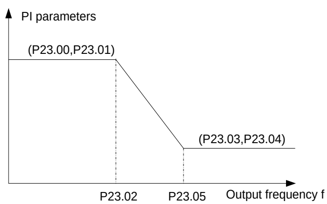
| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| P22.00 | Spindle positioning mode selection | Bit0: Enable spindle positioning<br>0: Disable<br>1: Enable<br>Bit1: Select spindle positioning reference point<br>0: Z pulse input<br>1: S2/S3/S4 terminal input<br>Bit2: Search for reference point<br>0: Search the reference point only once<br>1: Search the reference point every time<br>Bit3: Enable reference point calibration<br>0: Disable<br>1: Enable<br>Bit4: Positioning mode selection 1 | 0 | ○ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | | 0: Set direction positioning<br>1: Near-by direction positioning<br>Bit5: Positioning mode selection 2<br>0: Forward positioning<br>1: Reverse positioning<br>Bit6: Zeroing command selection<br>0: Electric level mode<br>1: Pulse mode<br>Bit7: Reference point calibration mode<br>0: Calibrate at the first time<br>1: Calibrate in real time<br>Bit8: Action selection after zeroing signal cancellation (electric level type)<br>0: Switch to speed mode<br>1: Position lock mode<br>Bit9: Positioning completion signal selection<br>0: Electric level signal<br>1: Pulse signal<br>Bit10: Z pulse signal source<br>0: Motor<br>1: Spindle<br>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.<br>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 inverter to decelerate from Max. output frequency (P00.03) to 0Hz.<br>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).<br>Setting range: 0–65535 | 0 | ○ |
| P22.04 | Spindle zeroing position 1 | Setting range: 0–65535 | 0 | ○ |
| P22.05 | Spindle zeroing position 2 | Setting range: 0–65535 | 0 | ○ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| P22.06 | Spindle zeroing position 3 | Setting range: 0–65535 | 0 | ○ |
| P22.07 | Spindle scale-division angle 1 | You can select seven spindle scale-division values by terminals (functions 48, 49 and 50).<br>Setting range: 0.00–359.99 | 15.00 | ○ |
| P22.08 | Spindle scale-division angle 2 | Setting range: 0.00–359.99 | 30.00 | ○ |
| P22.09 | Spindle scale-division angle 3 | Setting range: 0.00–359.99 | 45.00 | ○ |
| P22.10 | Spindle scale-division angle 4 | Setting range: 0.00–359.99 | 60.00 | ○ |
| P22.11 | Spindle scale-division angle 5 | Setting range: 0.00–359.99 | 90.00 | ○ |
| P22.12 | Spindle scale-division angle 6 | Setting range: 0.00–359.99 | 120.00 | ○ |
| P22.13 | Spindle scale-division angle 7 | Setting range: 0.00–359.99 | 180.00 | ○ |
| P22.14 | Spindle drive ratio | This parameter specifies the reduction ratio of the spindle and the mounting shaft of the encoder.<br>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.<br>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<br>0: Disable<br>1: Enable<br>Tens: Analog port selection<br>0: Invalid | 0x00 | ◎ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | | 1: AI1<br>2: AI2<br>3: AI3 | | |
| 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 | Reserved | 0–0 | 0 | ● |
| P22.23 | Reserved | 0–0 | 0 | ● |
| P22.24 | Reserved | 0–0 | 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.<br><br><br>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</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>
</table>

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | | 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.<br>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.<br>Setting range of P23.00: 0.0–200.0<br>Setting range of P23.01: 0.000–10.000s<br>Setting range of P23.02: 0.00Hz–P23.05<br>Setting range of P23.03: 0.0–200.0<br>Setting range of P23.04: 0.000–10.000s<br>Setting range of P23.05: P23.02–P00.03 (Max. output frequency) | | |
| P23.06 | Speed loop output filter | 0–8 (corresponds to 0–2^8/10ms) | 0 | ○ |
| 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.<br>Setting range: 50–200% | 100% | ○ |
| P23.08 | Slip compensation coefficient of vector control (generating) | | 100% | ○ |
| P23.09 | Current loop proportional coefficient P | **Note:**<br>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.<br>2. Applicable to SVC mode 0 (P00.00=0), SVC mode 1 (P00.00=1), and FVC (P00.00=3)<br>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 | ○ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| P23.12 | Proportional coefficient of high-frequency current loop | In the FVC (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.<br>Setting range of P23.12: 0–65535<br>Setting range of P23.13: 0–65535<br>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<br>1: Resolver-type encoder<br>2: Sin/Cos encoder<br>3: Endat absolute encoder | 0 | ● |
| P24.01 | Encoder pulse number | Number of pulses generated when the encoder revolves for one circle.<br>Setting range: 0–60000 | 1024 | ◎ |
| P24.02 | Encoder direction | Ones: AB direction<br>0: Forward<br>1: Reverse<br>Tens: Z pulse direction (reserved)<br>0: Forward<br>1: Reverse<br>Hundreds: CD/UVW pole signal direction<br>0: Forward<br>1: Reverse | 0x000 | ◎ |
| P24.03 | Detection time of encoder offline fault | 0.0–10.0s | 2.0s | ○ |
| P24.04 | Detection time of encoder reversal | 0.0–100.0s | 0.8s | ○ |

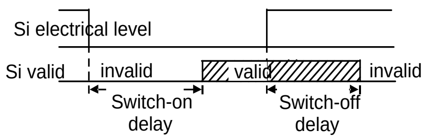
| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | fault | | | |
| P24.05 | Filter times of encoder detection | Setting range: 0x00–0x99<br>Ones: Low-speed filter times, corresponds to 2^ (0–9) ×125μs.<br>Tens: High-speed filter times; corresponds to 2^ (0–9) ×125μs. | 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.<br>Setting range: 0.001–65.535 | 1.000 | ○ |
| P24.07 | Control parameters of synchronous motor | Bit0: Enable Z pulse calibration<br>Bit1: Enable encoder angle calibration<br>Bit2: Enable SVC speed measurement<br>Bit3: Select resolver speed measurement mode<br>Bit4: Z pulse capture mode<br>Bit5: Do not detect encoder initial angle in v/f control<br>Bit6: Enable CD signal calibration<br>Bit7: Disable sin/cos sub-division speed measurement<br>Bit8: Do not detect encoder fault during autotuning<br>Bit9: Enable Z pulse detection optimization<br>Bit10: Enable initial Z pulse calibration optimization<br>Bit11: Reserved<br>Bit12: Clear Z pulse arrival signal after stop<br>Bit13: Reserved<br>Bit14: Detect Z pulse after one rotation<br>Bit15: Reserved | 0x3 | ○ |
| P24.08 | Enable Z pulse offline detection | 0x00–0x11<br>Ones: Z pulse<br>Reserved<br>Tens: UVW pulse<br>0: Do not detect<br>1: Enable | 0x10 | ○ |
| P24.09 | Initial angle of Z pulse | Relative electric angle of encoder Z pulse and motor pole position.<br>Setting range: 0.00–359.99 | 0.00 | ○ |
| P24.10 | Initial angle of the | Relative electric angle of encoder position and | 0.00 | ○ |

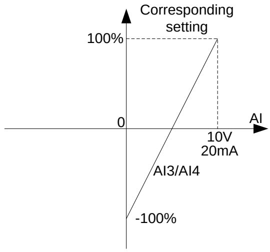
| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | pole | motor pole position.<br>Setting range: 0.00–359.99 | | |
| P24.11 | Autotuning of initial angle of pole | 0–3<br>1: Rotary autotuning (DC brake)<br>2: Static autotuning (suitable for resolver-type encoder, sin/cos with CD signal feedback)<br>3: Rotary autotuning (initial angle identification) | 0 | ◎ |
| P24.12 | Speed measurement optimization selection | 0: No optimization<br>1: Optimization mode 1<br>2: Optimization mode 2 | 1 | ◎ |
| P24.13 | CD signal zero offset gain | 0–65535 | 0 | ○ |
| P24.14 | Encoder type selection | Ones: Incremental encoder<br>0: without UVW<br>1: with UVW<br>Tens: Sin/Cos encoder<br>0: without CD signal<br>1: with CD signal | 0x00 | ◎ |
| P24.15 | Speed measurement mode | 0: PG card<br>1: local; realized by HDIA and HDIB; supports incremental 24V encoder only | 0 | ◎ |
| P24.16 | Frequency-division coefficient | 0–255<br>When this parameter is set to 0 or 1, frequency division of 1:1 is implemented. | 0 | ○ |
| P24.17 | Pulse filer processing | 0x0000–0xFFFF<br>Bit0: Enable/disable encoder input filter<br>0: No filter<br>1: Filter<br>Bit1: Encoder signal filter mode<br>0: Self-adaptive filter<br>1: Use P24.18 filter parameters<br>Bit2: Enable/disable encoder frequency-division output filter<br>0: No filter<br>1: Filter<br>Bit3: Reserved<br>Bit4: Enable/disable pulse reference filter<br>0: No filter | 0x0033 | ○ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | | 1: Filter<br>Bit5: Pulse reference filter mode<br>0: Self-adaptive filter<br>1: Use P24.19 filter parameters<br>Bit6: Frequency-divided output source setting<br>0: Encoder signals<br>1: Pulse reference signals<br>Bits7–15: Reserved | | |
| P24.18 | Encoder pulse filter width | 0–63<br>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<br>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 | 0–16000 | 1024 | ◎ |
| P24.21 | Enable angle compensation of synchronous motor | 0–1 | 0 | ○ |
| P24.22 | Switchover frequency threshold of speed measurement mode | 0–630.00Hz | 1.00Hz | ○ |
| P24.23 | Synchronous motor angle compensation coefficient | -200.0–200.0% | 100.0% | ○ |
| P24.24 | Number of pole pairs in inital magnetic pole angle autotuning | 1–128 | 2 | ◎ |

**P25—Extension I/O card input functions**

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| P25.00 | HDI3 input type selection | 0: HDI3 is high-speed pulse input<br>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 expansion card | 0x00–0x7F | 0x00 | ○ |
| P25.09 | Virtual terminal setup of expansion card | 0x000–0x7F (0: disable, 1: enable)<br>BIT0: S5 virtual terminal<br>BIT1: S6 virtual terminal<br>BIT2: S7 virtual terminal<br>BIT3: S8 virtual terminal<br>BIT4: S9 virtual terminal<br>BIT5: S10 virtual terminal<br>BIT6: HDI3 virtual terminal | 0x00 | ◎ |
| 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.<br><br>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 | | 0.000s | ○ |

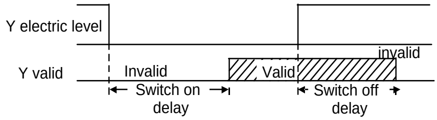
| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | delay | | | |
| P25.16 | S7 terminal switch-on delay | | 0.000s | ○ |
| P25.17 | S7 switch-off delay | | 0.000s | ○ |
| P25.18 | S8 terminal switch-on delay | | 0.000s | ○ |
| P25.19 | S8 switch-off delay | | 0.000s | ○ |
| 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.<br>When analog input is current input, 0–20mA current corresponds to 0–10V voltage.<br>In different application cases, 100% of the analog setting corresponds to different nominal values.<br>The figure below illustrates several settings. | 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 setting of upper limit of AI3 | | 100.0% | ○ |
| P25.28 | Input filter time of AI3 | | 0.030s | ○ |
| P25.29 | Lower limit value of AI4 |  | 0.00V | ○ |
| P25.30 | Corresponding setting of lower limit of AI4 | | 0.0% | ○ |
| P25.31 | Upper limit value of AI4 | | 10.00V | ○ |
| P25.32 | Corresponding setting of upper | Input filter time: Adjust the sensitivity of analog input, increase this value properly can enhance | 100.0% | ○ |

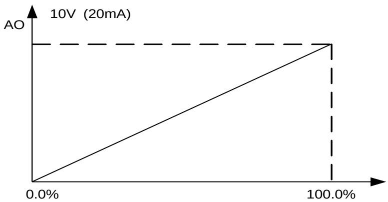
| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | limit of AI4 | the anti-interference capacity of analog variables; however, it will also degrade the sensitivity of analog input.<br>**Note:** AI3 and AI4 can support 0–10V/0–20mA input, when AI3 and AI4 select 0–20mA input, the corresponding voltage of 20mA is 10V.<br>Setting range of P25.24: 0.00V–P25.26<br>Setting range of P25.25: -300.0%–300.0%<br>Setting range of P25.26: P25.24–10.00V<br>Setting range of P25.27: -300.0%–300.0%<br>Setting range of P25.28: 0.000s–10.000s<br>Setting range of P25.29: 0.00V–P25.31<br>Setting range of P25.30: -300.0%–300.0%<br>Setting range of P25.31: P25.29–10.00V<br>Setting range of P25.32: -300.0%–300.0%<br>Setting range of P25.33: 0.000s–10.000s | | |
| P25.33 | Input filter time of AI4 | | 0.030s | ○ |
| P25.34 | HDI3 high-speed pulse input function | 0: Set input via frequency<br>1: Count | 0 | ◎ |
| P25.35 | Lower limit frequency of HDI3 | 0.000 kHz – P25.37 | 0.000 kHz | ○ |
| P25.36 | Corresponding setting of lower limit frequency of HDI3 | -300.0%–300.0% | 0.0% | ○ |
| 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<br>0: Voltage type<br>1: Current type | 0 | ○ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| P25.41 | AI4 input signal type | Range: 0–1<br>0: Voltage type<br>1: Current type | 0 | ○ |
| P25.42–P25.45 | Reserved | 0–65535 | 0 | ○ |

**P26—Output functions of expansion I/O card**

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| P26.00 | HDO2 output type | 0: Open collector high-speed pulse output<br>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 | ○ |
| P26.09 | Relay RO8 output selection | | 0 | ○ |
| P26.10 | Relay RO9 output selection | | 0 | ○ |
| P26.11 | Relay RO10 output selection | | 0 | ○ |
| P26.12 | Output terminal polarity of expansion card | 0x0000–0x7FF<br>RO10, RO9…RO3, HDO2, Y3, Y2 in sequence | 0x000 | ○ |
| P26.13 | HDO2 switch-on delay | Used to define the corresponding delay of the level variation from switch-on to switch-off. | 0.000s | ○ |
| P26.14 | HDO2 switch-off | | 0.000s | ○ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | delay | <br>Setting range: 0.000–50.000s<br>**Note: P26.13 and P26.14 are valid only when P26.00 is set to 1.** | | |
| P26.15 | Y2 switch-on delay | | 0.000s | ○ |
| P26.16 | Y2 switch-off delay | | 0.000s | ○ |
| P26.17 | Y3 switch-on delay | | 0.000s | ○ |
| P26.18 | Y3 switch-off delay | | 0.000s | ○ |
| P26.19 | Relay RO3 switch-on delay | | 0.000s | ○ |
| P26.20 | Relay RO3 switch-off delay | | 0.000s | ○ |
| P26.21 | Relay RO4 switch-on delay | | 0.000s | ○ |
| P26.22 | Relay RO4 switch-off delay | | 0.000s | ○ |
| P26.23 | Relay RO5 switch-on delay | | 0.000s | ○ |
| P26.24 | Relay RO5 switch-off delay | | 0.000s | ○ |
| P26.25 | Relay RO6 switch-on delay | | 0.000s | ○ |
| P26.26 | Relay RO6 switch-off delay | | 0.000s | ○ |
| P26.27 | Relay RO7 switch-on delay | | 0.000s | ○ |
| 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 | | 0.000s | ○ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | switch-on delay | | | |
| 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.<br>When analog output is current output, 1mA corresponds to 0.5V voltage. In different applications, 100% of output value corresponds to different analog outputs.<br><br><br>Setting range of P26.38: -300.0%–P26.40<br>Setting range of P26.39: 0.00V–10.00V<br>Setting range of P26.40: P26.38–100.0%<br>Setting range of P26.41: 0.00V–10.00V<br>Setting range of P26.42: 0.000s–10.000s<br>Setting range of P26.43: -300.0%–P26.45<br>Setting range of P26.44: 0.00V–10.00V<br>Setting range of P26.45: P26.43–300.0%<br>Setting range of P26.46: 0.00V–10.00V<br>Setting range of P26.47: 0.000s–10.000s | 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 AO3 output | | 100.0% | ○ |
| P26.46 | Corresponding AO3 output of upper limit | | 10.00V | ○ |
| P26.47 | AO3 output filter time | | 0.000s | ○ |
| P26.48–P26.52 | Reserved | 0–65535 | 0 | ○ |

**P27—Programmable expansion card functions**

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| P27.00 | Enabling programmable card | 0–1<br>This function is reserved. | 0 | ◎ |
| P27.01 | I_WrP1 | 0–65535<br>Used to write a value to WrP1 of the programmable card. | 0 | ○ |
| P27.02 | I_WrP2 | 0–65535<br>Used to write a value to WrP2 of the programmable card. | 0 | ○ |
| P27.03 | I_WrP3 | 0–65535<br>Used to write a value to WrP3 of the programmable card. | 0 | ○ |
| P27.04 | I_WrP4 | 0–65535<br>Used to write a value to WrP4 of the programmable card. | 0 | ○ |
| P27.05 | I_WrP5 | 0–65535<br>Used to write a value to WrP5 of the programmable card. | 0 | ○ |
| P27.06 | I_WrP6 | 0–65535<br>Used to write a value to WrP6 of the programmable card. | 0 | ○ |
| P27.07 | I_WrP7 | 0–65535<br>Used to write a value to WrP7 of the programmable card. | 0 | ○ |
| P27.08 | I_WrP8 | 0–65535<br>Used to write a value to WrP8 of the programmable card. | 0 | ○ |
| P27.09 | I_WrP9 | 0–65535<br>Used to write a value to WrP9 of the programmable card. | 0 | ○ |
| P27.10 | I_WrP10 | 0–65535<br>Used to write a value to WrP10 of the programmable card. | 0 | ○ |
| P27.11 | Programmable card status | 0–1<br>Used to display the status of the programmable card. | 0 | ● |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | | 0: Stopped<br>1: Running | | |
| P27.12 | C_MoP1 | 0–65535<br>Used to monitor/view the MoP1 value of the programmable card. | 0 | ● |
| P27.13 | C_MoP2 | 0–65535<br>Used to monitor/view the MoP2 value of the programmable card. | 0 | ● |
| P27.14 | C_MoP3 | 0–65535<br>Used to monitor/view the MoP3 value of the programmable card. | 0 | ● |
| P27.15 | C_MoP4 | 0–65535<br>Used to monitor/view the MoP4 value of the programmable card. | 0 | ● |
| P27.16 | C_MoP5 | 0–65535<br>Used to monitor/view the MoP5 value of the programmable card. | 0 | ● |
| P27.17 | C_MoP6 | 0–65535<br>Used to monitor/view the MoP6 value of the programmable card. | 0 | ● |
| P27.18 | C_MoP7 | 0–65535<br>Used to monitor/view the MoP7 value of the programmable card. | 0 | ● |
| P27.19 | C_MoP8 | 0–65535<br>Used to monitor/view the MoP8 value of the programmable card. | 0 | ● |
| P27.20 | C_MoP9 | 0–65535<br>Used to monitor/view the MoP9 value of the programmable card. | 0 | ● |
| P27.21 | C_MoP10 | 0–65535<br>Used to monitor/view the MoP10 value of the programmable card. | 0 | ● |
| P27.22 | Digital input terminal status of programmable card | 0–0x3F<br>Bit5–Bit0 indicate PS6–PS1 respectively. | 0x00 | ● |
| P27.23 | Digital output | 0–0x3 | 0x00 | ● |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| | terminal status of programmable card | Bit0 indicates PRO1, and Bit1 indicates PRO2. | | |
| P27.24 | AI1 of the programmable card | 0–10.00V/0.00–20.00mA<br>AI1 value from the programmable card. | 0 | ● |
| P27.25 | AO1 of programmable card | 0–10.00V/0.00–20.00mA<br>AO1 value from the programmable card. | 0 | ● |
| P27.26 | Length of data sent by programmable card and PZD communication object | 0x01–0x28<br>Ones place: Number of the programmable card sent. The number of sent data is 12*digit on the ones place.<br>3: The inverter sends 24+60 variables, and the programmable card sends 36 variables. This is the default delivery method for generic variables.<br>5: The inverter sends 48+60 variables, and the programmable card sends 60 variables. This is how the programmable card on the inverter communicates with the DP/CANopen/PN card through (24+24) PZDs.<br>8: The inverter sends 96+96 variables, and the programmable card sends 96 variables.<br>You can use other values (not 3/5/8), but only if you know which variables correspond to the selected values. Using other values only changes data volumn sent by the programmable card, but not the number of variables sent by the inverter. The inverter still sends 24+60 by default.<br>Tens place: Card that communicates with the programmable card via PZD (Only valid when the ones of P27.26 is 5)<br>0: DP<br>1: CANopen<br>2: PN<br>**Note:** P27.26 can be changed at any time, but the change will only take effect after the re-power on. | 0x03 | ○ |

| Function code | Name | Description | Default value | Modify |
|---|---|---|---|---|
| P27.27 | Programmable card save function at power failure | 0–1<br>0: Disable<br>1: Enable | 1 | ◎ |

**P28—Master/slave control functions**

| Function code | Name | Description | Default | Modify |
|---|---|---|---|---|
| P28.00 | Master/slave mode | 0: Master/slave control is invalid<br>1: The local machine is a master<br>2: The local machine is a slave | 0 | ◎ |
| P28.01 | Master/slave communication data selection | 0: CAN<br>1: Reserved | 0 | ◎ |
| P28.02 | Master/slave control mode | Ones place: Master/slave running mode selection<br>0: Master/slave mode 0<br>(The master and slave adopt speed control and maintain the power balance by droop control)<br>1: Master/slave mode 1<br>(The master and slave must be in the same type of vector control mode. The master is speed control, and the slave will be forced to be in the torque control mode.<br>2: Master/slave mode 2<br>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)<br>Tens place: Slave start command source selection<br>0: Follow the master to start<br>1: Determined by P00.01<br>Hundreds place: Slave transmitting/master receiving data enable<br>0: Enable<br>1: Disable | 0x001 | ◎ |
| 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 | 0.00–10.00Hz | 5.00Hz | ○ |

| Function code | Name | Description | Default | Modify |
|---|---|---|---|---|
| | mode switching frequency point in master/slave mode 2 | | | |
| P28.06 | Slave count | 0–15 | 1 | ◎ |
| P28.07–P28.08 | Reserved | 0–65535 | 0 | ○ |
| P28.09 | CAN slave torque offset | -100.0–100.0% | 0.0 | ○ |
| P28.10 | Enabling EC PT100/PT1000 to detect temperature | 0x00–0x11<br>Ones place: PT100 temperature detection<br>0: Disable<br>1: Enable<br>Tens place: PT1000 temperature detection<br>0: Disable<br>1: Enable | 0x00 | ◎ |
| P28.11 | EC PT100 detected OH protection threshold | Protection threshold of overheating (OH) detected by the expansion card (EC) with PT100.<br>0.0–150.0°C | 120.0 | ○ |
| P28.12 | EC PT100 detected OH pre-alarm threshold | Pre-alarm threshold of OH detected by the EC with PT100.<br>0.0–150.0°C | 100.0 | ○ |
| P28.13 | EC PT100 detected temperature calibration upper limit | Calibration upper limit of temperature detected by the EC with PT100.<br>50.0–150.0°C | 120.0 | ○ |
| P28.14 | EC PT100 detected temperature calibration lower limit | Calibration lower limit of temperature detected by the EC with PT100.<br>-20.0–50.0°C | 10.0 | ○ |
| P28.15 | EC PT100 calibration upper limit digital | 0–4096 | 2950 | ○ |
| P28.16 | EC PT100 | 0–4096 | 1270 | ○ |

| Function code | Name | Description | Default | Modify |
|---|---|---|---|---|
| | calibration lower limit digital | | | |
| P28.17 | EC PT1000 detected OH protection threshold | 0.0–150.0°C | 120.0 | ○ |
| P28.18 | EC PT1000 detected OH pre-alarm threshold | 0.0–150.0°C | 100.0 | ○ |
| P28.19 | PT1000 detected temperature calibration upper limit | 50.0–150.0°C | 120.0 | ○ |
| P28.20 | EC PT1000 detected temperature calibration lower limit | -20.0–50.0°C | 10.0 | ○ |
| P28.21 | EC PT1000 calibration upper limit digital | 0–4096 | 3100 | ○ |
| P28.22 | EC PT1000 calibration lower limit digital | 0–4096 | 1100 | ○ |
| P28.23 | Detecting for PT100/PT1000 disconnection from EC | 0x00–0x11<br>Ones place: PT100 disconnection detection<br>0: Disable<br>1: Enable<br>Tens place: PT1000 disconnection detection<br>0: Disable<br>1: Enable | 0x00 | ◎ |
| P28.24 | Enabling digital calibration in EC PT100/PT1000 temperature detection | 0–4<br>0: Disable<br>1: Enable PT100 lower limit digital calibration.<br>2: Enable PT100 upper limit digital calibration.<br>3: Enable PT1000 lower limit digital calibration.<br>4: Enable PT1000 upper limit digital calibration. | 0 | ○ |
| P28.25 | Type of sensor | 0–3 | 0 | ◎ |

| Function code | Name | Description | Default | Modify |
|---|---|---|---|---|
| | for AI/AO card to detect motor temperature | 0: No temperature sensor<br>1: PT100<br>2: PT1000<br>3: KTY84<br>**Note:** Temperature is displayed through P19.11. To measure temperature, switch the output of AO1 to current, and connect one end of the temperature resistor to AI1 and AO1, and the other end to GND. | | |
| P28.26 | AI/AO detected motor OH protection threshold | 0.0–200.0°C<br>**Note:** When the motor temperature exceeds the threshold, the inverter releases the OT alarm. | 110.0 | ○ |
| P28.27 | AI/AO detected motor OH pre-alarm threshold | 0.0–200.0°C<br>**Note:** When the motor temperature exceeds the value, the DO terminal with function 48 (AI detected motor OH pre-alarm) outputs a valid signal. | 90.0 | ○ |

**P90—Tension control in speed mode**

| Function code | Name | Description | Default | Modify |
|---|---|---|---|---|
| P90.00 | Tension control mode | 0: Invalid<br>1: Speed mode<br>2: Open-loop torque mode<br>3: Closed-loop torque mode<br>**Note:** The value 0 indicates tension control is invalid. Select a non-0 value to enable the tension control function. | 0 | ◎ |
| P90.01 | Winding/unwinding mode | 0: Winding<br>1: Unwinding<br>**Note:** The motor forward rotation direction is the winding direction. When using the tension control mode, check whether the motor rotation direction is correct in the winding mode; if not, change the rotation direction by swapping two phase wires of the motor. After the rotation direction is corrected, the winding mode can be switched to the | 0 | ○ |

| Function code | Name | Description | Default | Modify |
|---|---|---|---|---|
| | | unwinding mode by setting P90.01 to 1 or changing the winding/unwiding switchover terminals. | | |
| P90.02 | Reel mechanical transmission rate | 0.01–600.00<br>=Motor rotation speed/Reel rotation speed=Reel diameter/Motor shaft diameter | 1.00 | ○ |
| P90.03 | Max. linear speed | 0.0–6000.0 (m/min) | 1000.0 | ○ |
| P90.04 | Input source of linear speed | 0: Keypad<br>1: AI1<br>2: AI2<br>3: AI3<br>4: High-speed pulse HDI<br>5: Main traction encoder frequency-division input | 0 | ◎ |
| P90.05 | Linear speed set through keypad | 0.0–100.0% | 20.0 | ○ |
| P90.06 | Diameter of main traction | 0.0–6000.0mm | 99.0 | ○ |
| P90.07 | Main traction drive ratio | 0.000–60.000 | 1.000 | ○ |
| P90.08 | Linear speed ACC time | 0.00–600.00s | 0.00 | ○ |
| P90.09 | Linear speed DEC time | 0.00–600.00s | 0.00 | ○ |
| P90.10 | Tension setting | 0x00–0x14<br>Ones place: Tension setting source<br>0: Keypad<br>1: AI1<br>2: AI2<br>3: AI3<br>4: High-speed pulse HDI<br>Tens place: Multiplier of max. tension (P90.12)<br>0: 1<br>1: 10 | 0x00 | ◎ |
| P90.11 | Tension set through keypad | 0.0–100.0% | 10.0 | ○ |
| P90.12 | Max. tension | When the tens place of P90.10 is 0, the setting range is 0–60000N. | 1000 | ○ |

| Function code | Name | Description | Default | Modify |
|---|---|---|---|---|
| | | When the tens place of P90.10 is 1, the setting range is (0–60000) *10N. | | |
| P90.13 | Roll diameter calculation mode | 0: Not calculated<br>1: AI1<br>2: AI2<br>3: AI3<br>4: High-speed pulse HDI<br>5: Linear speed<br>6: Thickness (of wire)<br>7: Thickness (of strip) | 0 | ◎ |
| P90.14 | Roll diameter calculation delay time | 0.0–100.0s | 1.0 | ○ |
| P90.15 | Min. roll diameter | 0.0mm–P90.16 | 50.0 | ○ |
| P90.16 | Max. roll diameter | P90.15–5000.0mm | 1000.0 | ○ |
| P90.17 | Initial roll diameter 1 | P90.15–P90.16 (mm) | 100.0 | ○ |
| P90.18 | Initial roll diameter 2 | P90.15–P90.16 (mm) | 100.0 | ○ |
| P90.19 | Initial roll diameter 3 | P90.15–P90.16 (mm) | 100.0 | ○ |
| P90.20 | Linear speed roll diameter calculation filter time | 0.000–60.000s | 2.000 | ○ |
| P90.21 | Linear speed roll diameter calculation restriction | 0x00–0x11<br>Ones place:<br>0:No<br>1: Restrict changes in reverse direction<br>Tens place:<br>0: No<br>1: Automatic restriction according to running frequency and material thickness | 0x00 | ○ |
| P90.22 | Material thickness | 0.001–65.535mm | 0.010 | ○ |
| P90.23 | Number of coils per layer | 1–10000 | 1 | ◎ |

| Function code | Name | Description | Default | Modify |
|---|---|---|---|---|
| P90.24 | Revolution counting function selection | 0–2<br>0: Digital terminal input<br>1: PG card input<br>(Applicable to thickness calculation method)<br>2: Running frequency<br>(No input automatic revolution counting) | 0 | ◎ |
| P90.25 | Number of pulses per revolution | 1–60 | 1 | ◎ |
| P90.26 | Roll diameter set value | 0.0–100.0% | 80.0 | ○ |
| P90.27 | Roll diameter reset setting | 0x0000–0x1111<br>Ones place: At stop<br>0: Remain current roll diameter<br>1: Restore to initial roll diameter<br>Tens place: Power off at running<br>0: Remain current roll diameter<br>1: Restore to initial roll diameter<br>Hundreds place: Reach the roll diameter set value<br>0: Remain current roll diameter<br>1: Restore to initial roll diameter<br>Thousands place: Terminal reset limitation<br>0: Reset allowed at running<br>1: Reset only allowed at stop | 0x1000 | ○ |
| P90.28 | Tension PID output reference | 0–1<br>0: Max. value<br>1: Given value | 0 | ○ |
| P90.29 | Tension PID parameter source | 0–5<br>0: First group of P90<br>1: Roll diameter (max. roll diameter)<br>2: Main reference frequency (max. Frequency)<br>3: Running linear speed (max. linear speed)<br>4: Deviation (Reference 100%)<br>5: Terminal | 0 | ○ |
| P90.30 | Group 1 proportional gain | 0.000–30.000 | 0.030 | ○ |
| P90.31 | Group 1 integral time | 0.00–30.00s | 5.00 | ○ |
| P90.32 | Group 1 differential time | 0.00–10.00s | 0.00 | ○ |

| Function code | Name | Description | Default | Modify |
|---|---|---|---|---|
| P90.33 | Group 2 proportional gain | 0.000–30.000 | 0.030 | ○ |
| P90.34 | Group 2 integral time | 0.00–30.00s | 5.00 | ○ |
| P90.35 | Group 2 differential time | 0.00–10.00s | 0.00 | ○ |
| P90.36 | PID parameter adjustment reference point 1 | 0.0–P90.37% | 10.0 | ○ |
| P90.37 | PID parameter adjustment reference point 2 | P90.36–100.0% | 50.0 | ○ |
| P90.38 | Min. frequency for roll diameter calculation | 0.00–50.00Hz | 0.30 | ○ |
| P90.39 | Min. linear speed for roll diameter calculation | 0.0–100.0% | 3.0 | ○ |

**P91—Tension control in torque mode**

| Function code | Name | Description | Default | Modify |
|---|---|---|---|---|
| P91.00 | Tension control zero speed reference | 0–1<br>0: Max. linear speed<br>1: Max. frequency | 0 | ◎ |
| P91.01 | Tension control zero speed threshold | 0.0–50.0% | 3.0 | ○ |
| P91.02 | Zero speed offset | 0.0–50.0% | 2.0 | ○ |
| P91.03 | Upper-limit frequency source of torque control | 0–3<br>0: P03.14, P03.15<br>1: Forward rotation limit set by line speed<br>2: Reverse rotation limit set by line speed<br>3: Forward and reverse rotations limit set by line speed | 3 | ◎ |
| P91.04 | Running frequency upper limit offset of | 0.0–100.0% | 5.0 | ○ |

| Function code | Name | Description | Default | Modify |
|---|---|---|---|---|
| | tension control | | | |
| P91.05 | Differential separation threshold | 0.0–100.0% | 5.0 | ○ |
| P91.06 | PID restricts reverse limit at zero speed | 0–1<br>0: Enable<br>1: Disable | 0 | ◎ |
| P91.07 | Torque compensation selection | 0x000–0x111<br>Ones place: Frictional torque compensation<br>0: No<br>1: Yes<br>Tens place: Inertia compensation<br>0: No<br>1: Yes<br>Hundreds place: Compensation direction<br>0: In line with torque direction<br>1: Different from torque direction | 0x000 | ◎ |
| P91.08 | System mechanical parameters identification | 0–2<br>0: No operation<br>1: Enable system mechanical inertia identification<br>2: Enable mechanical friction torque identification | 0 | ◎ |
| P91.09 | Static friction torque compensation coefficient | 0.0–100.0% | 0.0 | ○ |
| P91.10 | Sliding friction torque compensation coefficient 1 | 0.0–100.0% | 0.0 | ○ |
| P91.11 | Sliding friction torque compensation coefficient 2 | 0.0–100.0% | 0.0 | ○ |
| P91.12 | Sliding friction torque compensation coefficient 3 | 0.0–100.0% | 0.0 | ○ |
| P91.13 | High speed torque | 0.0–100.0% | 0.0 | ○ |

| Function code | Name | Description | Default | Modify |
|---|---|---|---|---|
| | compensation coefficient | | | |
| P91.14 | Compensation frequency point of static friction torque | 0.0–P91.15 (%) | 1.0 | ○ |
| P91.15 | Compensation frequency point of sliding friction torque 1 | P91.14–P91.16 (%) | 20.0 | ○ |
| P91.16 | Compensation frequency point of sliding friction torque 2 | P91.15–P91.17 (%) | 50.0 | ○ |
| P91.17 | Compensation frequency point of sliding friction torque 3 | P91.16–P91.18 (%) | 80.0 | ○ |
| P91.18 | High-speed friction torque compensation frequency point | P91.17–100.0% | 100.0 | ○ |
| P91.19 | ACC/DEC frequency source | 0–1<br>0: Linear speed<br>1: Running frequency | 0 | ◎ |
| P91.20 | Material density | 0–30000kg/m$^3$ | 0 | ○ |
| P91.21 | Reel width | 0.000–60.000m | 0.000 | ○ |
| P91.22 | ACC inertia compensation coefficient | 0.0–100.0% | 10.0 | ○ |
| P91.23 | DEC inertia compensation coefficient | 0.0–100.0% | 10.0 | ○ |
| P91.24 | Tension taper coefficient source | 0–4<br>0: Keypad<br>1: AI1<br>2: AI2<br>3: AI3 | 0 | ◎ |

| Function code | Name | Description | Default | Modify |
|---|---|---|---|---|
| | | 4: High-speed pulse HDI | | |
| P91.25 | Tension taper set through keypad | 0.0–100.0% | 30.0 | ○ |
| P91.26 | Tension taper compensation correction | 0.0–5000.0mm | 0.0 | ○ |
| P91.27 | Tension taper curve selection | 0–1<br>0: Inverse proportional curve<br>1: Multi-point curve | 0 | ◎ |
| P91.28 | Roll diameter value 1 | 0.0–5000.0mm | 200.0 | ○ |
| P91.29 | Tension taper coefficient for roll diameter value 1 | 0.0–50.0% | 3.0 | ○ |
| P91.30 | Roll diameter value 2 | 0.0–5000.0mm | 500.0 | ○ |
| P91.31 | Tension taper coefficient for roll diameter value 2 | 0.0–50.0% | 7.0 | ○ |
| P91.32 | Reserved | 0-65535 | 0 | ● |
| P91.33 | Reserved | 0-65535 | 0 | ● |
| P91.34 | Reserved | 0-65535 | 0 | ● |
| P91.35 | Reserved | 0-65535 | 0 | ● |
| P91.36 | Reserved | 0-65535 | 0 | ● |
| P91.37 | Reserved | 0-65535 | 0 | ● |
| P91.38 | Reserved | 0-65535 | 0 | ● |
| P91.39 | Reserved | 0-65535 | 0 | ● |

**P92—Customized tension control functions**

| Function code | Name | Description | Default | Modify |
|---|---|---|---|---|
| P92.00 | Pre-drive speed gain | 0.0–100.0% | 100.0 | ○ |
| P92.01 | Pre-drive torque limit | 0–2<br>0: Set based on P03.20, P03.21<br>1: Set based on P93.02<br>2: Set based on the set tension | 2 | ○ |
| P92.02 | Pre-drive torque | 0.0–200.0% | 100.0 | ○ |

| Function code | Name | Description | Default | Modify |
|---|---|---|---|---|
| | limit setting | | | |
| P92.03 | Zero-bit conversion enabling | 0–1<br>0: Disable<br>1: Enable | 0 | ◎ |
| P92.04 | Initial zero bit | 0.0–100.0% | 10.0 | ○ |
| P92.05 | Final zero bit | 0.0–100.0% | 50.0 | ○ |
| P92.06 | Conversion time from initial zero bit to final zero bit | 0.00–60.00s | 5.00 | ○ |
| P92.07 | Conversion time from final zero bit to initial zero bit | 0.00–60.00s | 5.00 | ○ |
| P92.08 | Feeding interrupt detection mode | 0–3<br>0: Not detect<br>1: Detect based on digital value<br>2: Detect based on roll diameter calculation value<br>3: Detect based on feedback position | 0 | ○ |
| P92.09 | Feeding interrupt detection start delay time | 0.0–200.0s | 20.0 | ○ |
| P92.10 | Frequency lower limit of feeding interrupt detection | 0.00–300.00Hz | 10.00 | ○ |
| P92.11 | Error range of feeding interrupt detection | 0.1–50.0% | 10.0 | ○ |
| P92.12 | Determination delay time of feeding interrupt detection | 0.1–60.0s | 1.0 | ○ |
| P92.13 | Handling mode of feeding interrupt | 0x000–0x111<br>Ones place: Stop mode<br>0: Decelerate to stop in emergency manner<br>1: Coast to stop<br>Tens place: Alarm mode<br>0: Stop in enabled stop mode without reporting an alarm | 0x000 | ◎ |

| Function code | Name | Description | Default | Modify |
|---|---|---|---|---|
| | | 1: Report an alarm and coast to stop<br>Hundreds place: Roll diameter memory function of feeding interrupt<br>0: Disable<br>1: Enable | | |
| P92.14 | Stop braking frequency | 0.00–300.00Hz | 1.50 | ○ |
| P92.15 | Stop braking time | 0.0–600.0s | 0.0 | ○ |

**P93—Tension control status viewing**

| Function code | Name | Description | Default | Modify |
|---|---|---|---|---|
| P93.00 | Actual control mode | 0–3<br>0: Invalid tension control<br>1: Close-loop tension speed control<br>2: Open loop tension torque control<br>3: Close-loop tension torque control | 0 | ● |
| P93.01 | Actual winding/ unwinding mode | 0–1<br>0: Winding<br>1: Unwinding | 0 | ● |
| P93.02 | Initial roll diameter | 0.0–5000.0mm | 0.0 | ● |
| P93.03 | Reset roll diameter | 0.0–5000.0mm | 0.0 | ● |
| P93.04 | Roll diameter change rate | 0.00–655.35 mm/s | 0.00 | ● |
| P93.05 | Present roll diameter | 0.0–5000.0mm | 0.0 | ● |
| P93.06 | Roll diameter for linear speed calculation | 0.0–5000.0mm | 0.0 | ● |
| P93.07 | Set linear speed | 0.0–6000.0 m/min | 0.0 | ● |
| P93.08 | Present linear speed | 0.0–6000.0 m/min | 0.0 | ● |
| P93.09 | Main reference frequency | 0.00–600.00Hz | 0.00 | ● |
| P93.10 | Actual proportional gain | 0.00–30.00 | 0.00 | ● |

| Function code | Name | Description | Default | Modify |
|---|---|---|---|---|
| P93.11 | Actual integral time | 0.00–30.00s | 0.00 | ● |
| P93.12 | Proportional output value | 0–65535 | 0 | ● |
| P93.13 | Integral output value | 0–65535 | 0 | ● |
| P93.14 | PID upper limit | -100.0–100.0% | 0.0 | ● |
| P93.15 | PID lower limit | -100.0–100.0% | 0.0 | ● |
| P93.16 | PID output frequency | -99.99–99.99Hz | 0.00 | ● |
| P93.17 | Main traction running frequency | -300.0–300.0Hz | 0.0 | ● |
| P93.18 | Set tension | 0–30000N | 0 | ● |
| P93.19 | Tension taper coefficient | 0.0–100.0% | 0.0 | ● |
| P93.20 | Actual tension | 0–30000N | 0 | ● |
| P93.21 | Basic torque reference value | -300.0–300.0% | 0.0 | ● |
| P93.22 | Friction compensation torque value | -300.0–300.0% | 0.0 | ● |
| P93.23 | System rotational inertia | 0.00–655.35 $kg.m^2$ | 0.00 | ● |
| P93.24 | Frequency change rate | -99.99–327.67 Hz/s | 0.00 | ● |
| P93.25 | Torque compensation value of system rotational inertia | -300.0–300.0% | 0.0 | ● |
| P93.26 | Reference value after torque compensation | -300.0–300.0% | 0.0 | ● |
| P93.27 | PID output torque | -300.0–300.0% | 0.0 | ● |
| P93.28 | Final output torque | -300.0–300.0% | 0.0 | ● |
| P93.29 | Measured tension | 0–30000N | 0 | ● |

| Function code | Name | Description | Default | Modify |
|---|---|---|---|---|
| P93.30 | Number of materials turns on the reel | -100–32767 | 0 | ● |
| P93.31 | Length of material on the reel | 0–65535m | 0 | ● |
| P93.32 | Length increment | 0.0–6553.5m | 0.0 | ● |

# 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 inverter through the keypad). When the TRIP indicator is on, the alarm or fault code displayed in the keypad indicates the inverter 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 IMO office.

## 7.3 Fault reset

You can reset the inverter through the STOP/RST key on the keypad, digital inputs, or by cutting off the inverter 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 inverter when the latest three faults occurred.

## 7.5 Inverter faults and solutions

When fault occurred, process the fault as shown below.

1. When inverter fault occurred, confirm whether keypad display is improper? If yes, contact IMO.
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

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

| Fault code | Fault type | Possible cause | Corrective measures |
|---|---|---|---|
| OUt1 | [1] Inverter unit phase-U protection | Acceleration is too fast.<br>IGBT module is damaged.<br>Misacts caused by interference; drive wires are poorly connected. | Increase acceleration time.<br>Replace the power unit.<br>Check drive wires.<br>Check whether there is strong interference surrounds the |
| OUt2 | [2] Inverter unit phase-V protection | | |
| OUt3 | [3] Inverter unit | | |

| Fault code | Fault type | Possible cause | Corrective measures |
|---|---|---|---|
| | phase-W protection | Shorted to ground. | peripheral equipment |
| OV1 | [7] Over-voltage during acceleration | Deceleration time is too short.<br>Exception occurred to input voltage.<br>Large energy feedback.<br>Lack of braking units.<br>Dynamic brake is not enabled | Check input power.<br>Check whether load deceleration time is too short; or the motor starts during rotating.<br>Install dynamic braking units.<br>Check the setup of related function codes |
| OV2 | [8] Over-voltage during deceleration | | |
| OV3 | [9] Over-voltage during constant speed running | | |
| OC1 | [4] Over-current during acceleration | Acceleration is too fast.<br>Grid voltage is too low.<br>inverter power is too small.<br>Load transient or exception occurred.<br>To-ground short circuit or output phase loss occur.<br>Strong external interference sources.<br>Overcurrent stall protection is not enabled | Increase acceleration /deceleration time;<br>Check input power;<br>Select the inverter with larger power.<br>Check if the load is short circuited (to-ground short circuit or line-to-line short circuit) or the rotation is not smooth.<br>Check the output wiring.<br>Check if there is strong interference.<br>Check the setup of related function codes. |
| OC2 | [5] Over-current during deceleration | | |
| OC3 | [6] Over-current during constant speed running | | |
| UV | [10] Bus undervoltage fault | Grid voltage is too low.<br>Overvoltage stall protection is not enabled | Check grid input power.<br>Check the setup of related function codes |
| OL1 | [11] Motor overload | Grid voltage is too low.<br>Rated motor current is set improperly.<br>Motor stall or load jumps violently | Check grid voltage.<br>Reset rated motor current.<br>Check the load and adjust torque boost |
| OL2 | [12] inverter overload | Acceleration is too fast.<br>The motor in rotating is restarted.<br>Grid voltage is too low.<br>Load is too large.<br>Power is too small; | Increase acceleration time.<br>Avoid restart after stop.<br>Check grid voltage.<br>Select the inverter with larger power.<br>Select proper motor |
| SPI | [13] Phase loss on | Phase loss or violent | Check the input power. |

| Fault code | Fault type | Possible cause | Corrective measures |
|---|---|---|---|
| | input side | fluctuation occurred to R, S and T input | Check installation wiring |
| SPO | [14] Phase loss on output side | Phase loss occurred to U, V, W output (or the three phases of motor is asymmetrical) | Check the output wiring.<br>Check the motor and cable |
| OH1 | [15] Overheat of rectifier module | Air duct is blocked, or fan is damaged.<br>Ambient temperature is too high.<br>Long-time overload running | Ventilate the air duct or replace the fan.<br>Lower the ambient temperature |
| OH2 | [16] Overheat of inverter module | | |
| EF | [17] External fault | SI external fault input terminal acts | Check external device input |
| CE | [18] Modbus/Modbus TCP communication fault | Baud rate is set improperly.<br>Communication line fault.<br>Communication address error.<br>Communication suffers from strong interference | Set proper baud rate.<br>Check the wiring of communication interfaces.<br>Set proper communication address.<br>Replace or change the wiring to enhance anti-interference capacity |
| ItE | [19] Current detection fault | Poor contact of the connector of control board.<br>Hall component is damaged.<br>Exception occurred to amplification circuit | Check the connector and re-plug.<br>Replace the hall component.<br>Replace the main control board |
| tE | [20] Motor autotuning fault | Motor capacity does not match with the inverter capacity, this fault may occur easily if the difference between them is exceeds five power classes.<br>Motor parameter is set improperly.<br>The parameters gained from autotuning deviate sharply from the standard parameters.<br>Autotuning timeout | Change the inverter model or adopt V/F mode for control.<br>Set proper motor type and nameplate parameters.<br>Empty the motor load and carry out autotuning again.<br>Check motor wiring and parameter setup.<br>Check whether upper limit frequency is larger than 2/3 of the rated frequency |

| Fault code | Fault type | Possible cause | Corrective measures |
|---|---|---|---|
| EEP | [21] EEPROM fault | R/W error occurred to the control parameters.<br>EEPROM is damaged | Press STOP/RST to reset.<br>Replace the main control board |
| PIDE | [22] PID feedback offline fault | PID feedback offline.<br>PID feedback source disappears; | Check PID feedback signal wires.<br>Check PID feedback source |
| bCE | [23] Braking unit fault | Braking circuit fault or braking tube is damaged.<br>The resistance of external braking resistor is too small | Check the braking unit, replace with new brake tubes.<br>Increase brake resistance |
| END | [24] Running time is up | The actual running time of the inverter is larger than the set running time | Ask help from the supplier, adjust the set running time |
| OL3 | [25] Electronic overload fault | The inverter releases overload pre-alarm based on the set value | Check the load and overload pre-alarm threshold |
| PCE | [26] Keypad communication fault | The keypad wire is poorly contacted or disconnected.<br>The keypad wire is too long and suffers strong interference.<br>Circuit fault occurred to the keypad or communication part of the main board | Check the keypad wires to confirm whether fault exists.<br>Check the surroundings to rule out interference source.<br>Replace the hardware and ask for maintenance service |
| UPE | [27] Parameter upload error | The keypad wire is poorly contacted or disconnected.<br>The keypad wire is too long and suffers strong interference.<br>Circuit fault occurred to the keypad or communication part of the main board | Check the surroundings to rule out interference source.<br>Replace the hardware and ask for maintenance service.<br>Replace the hardware and ask for maintenance service |
| DNE | [28] Parameter download error | The keypad wire is poorly contacted or disconnected.<br>The keypad wire is too long and suffers strong interference.<br>Data storage error occurred to the keypad | Check the surroundings to rule out interference source.<br>Replace the hardware and ask for maintenance service.<br>Re-backup keypad data |

| Fault code | Fault type | Possible cause | Corrective measures |
|---|---|---|---|
| ETH1 | [32] To-ground short circuit fault 1 | inverter output is short connected to the ground.<br>Current detection circuit is faulty.<br>Actual motor power setup deviates sharply from the inverter power | Check whether motor wiring is proper.<br>Replace the hall component.<br>Replace the main control board.<br>Reset the motor parameters properly |
| ETH2 | [33] To-ground short circuit fault 1 | inverter output is short connected to ground.<br>Current detection circuit is faulty.<br>Actual motor power setup deviates sharply from the inverter power | Check whether motor wiring is proper.<br>Replace the hall component.<br>Replace the main control board.<br>Reset the motor parameters properly |
| dEu | [34] Speed deviation fault | Load is too heavy, or stall occurred | Check the load to ensure it is proper, increase the detection time.<br>Check whether control parameters are set properly |
| STo | [35] Maladjustment fault | Control parameters of synchronous motor is set improperly.<br>The parameter gained from autotuning is inaccurate.<br>The inverter is not connected to motor | Check the load to ensure it is proper,<br>Check whether load is proper.<br>Check whether control parameters are set correctly.<br>Increase maladjustment detection time |
| LL | [36] Electronic underload fault | The inverter performs underload pre-alarm based on the set value | Check the load and overload pre-alarm threshold |
| ENC1O | [37] Encoder offline fault | Encoder line sequence is wrong, or signal wires are poorly connected | Check the encoder wiring |
| ENC1D | [38] Encoder reversal fault | The encoder speed signal is contrary to the motor running direction | Reset encoder direction |
| ENC1Z | [39] Encoder Z pulse offline fault | Z signal wires are disconnected | Check the wiring of Z signal |
| OT | [59] Motor over-temperature | Motor over-temperature input terminal is valid. | Check the wiring of motor over-temperature input terminal |

| Fault code | Fault type | Possible cause | Corrective measures |
|---|---|---|---|
| | fault | Exception occurred to t temperature detection<br>Exception occurred to resistor.<br>Long-time overload running or exception occurred | (terminal function 57);<br>Check whether temperature sensor is proper.<br>Check the motor and perform maintenance on the motor |
| STO | [40] Safe torque off | Safe torque off function is enabled by external forces | / |
| STL1 | [41] Exception occurred to safe circuit of channel H1 | The wiring of STO is improper.<br>Fault occurred to external switch of STO.<br>Hardware fault occurred to safety circuit of channel H1 | Check whether terminal wiring of STO is proper and firm enough.<br>Check whether external switch of STO can work properly.<br>Replace the control board |
| STL2 | [42] Exception occurred to channel H2 safe circuit | The wiring of STO is improper.<br>Fault occurred to external switch of STO.<br>Hardware fault occurred to safety circuit of channel H2 | Check whether terminal wiring of STO is proper and firm enough.<br>Check whether external switch of STO can work properly.<br>Replace the control board |
| STL3 | [43] Exception occurred to channel H1 and channel H2 | Hardware fault occurred to STO circuit | Replace the control board |
| CrCE | [44] Safety code FLASH CRC check fault | Control board is faulty | Replace the control board |
| E-Err | [55] Repetitive expansion card type | The two inserted expansion cards are of the same type | You should not insert two cards with the same type; check the type of expansion card, and remove one card after power down |
| ENCUV | [56] Encoder UVW loss fault | No electric level variation occurred to UVW signal | Check the wiring of UVW.<br>Encoder is damaged |
| F1-Er | [60] Failed to identify the expansion card in card slot 1 | There is data transmission in interfaces of card slot 1, however, it cannot read the card type | Confirm whether the expansion card inserted can be supported.<br>Stabilize the expansion card interfaces after power down and confirm whether fault still |

| Fault code | Fault type | Possible cause | Corrective measures |
|---|---|---|---|
| | | | occurs at next power-on. Check whether the insertion port is damaged, if yes, replace the insertion port after power down |
| F2-Er | [61] Failed to identify the expansion 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 expansion card inserted can be supported. Stabilize the expansion 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 | [62] Failed to identify the expansion 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 expansion card inserted can be supported. Stabilize the expansion 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 | [63] Communication timeout occurred to the expansion card in card slot 1 | There is no data transmission in interfaces of card slot 1 | Confirm whether the expansion card inserted can be supported. Stabilize the expansion card interfaces after power 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 | [64] Communication timeout occurred to the expansion card in card slot 2 | There is no data transmission in interfaces of card slot 2 | Confirm whether the expansion card inserted can be supported. Stabilize the expansion card interfaces after power down |

| Fault code | Fault type | Possible cause | Corrective measures |
|---|---|---|---|
| | | | and confirm whether fault still occurs at next power-on.<br>Check whether the insertion port is damaged, if yes, replace the insertion port after power down |
| C3-Er | [65] Communication timeout occurred to the expansion card in card slot 3 | There is no data transmission in interfaces of card slot 3 | Confirm whether the expansion card inserted can be supported.<br>Stabilize the expansion card interfaces after power down and confirm whether fault still occurs at next power-on.<br>Check whether the insertion port is damaged, if yes, replace the insertion port after power down |
| E-DP | [29] PROFIBUS card communication timeout fault | There is no data transmission between the communication card and the host controller (or PLC). | Check whether the communication card wiring is loose or dropped. |
| E-NET | [30] Ethernet card communication timeout fault | There is no data transmission between the communication card and the host controller. | Check whether the communication card wiring is loose or dropped. |
| E-CAN | [31] CANopen card communication timeout fault | There is no data transmission between the communication card and the host controller (or PLC) | Check whether the communication card wiring is loose or dropped. |
| E-PN | [57] PROFINET card communication timeout fault | There is no data transmission between the communication card and the host controller (or PLC) | Check whether the communication card wiring is loose or dropped. |
| E-CAT | [66] EtherCAT card communication timeout fault | There is no data transmission between the communication card and the host controller (or PLC) | Check whether the communication card wiring is loose or dropped |
| E-BAC | [67] BACNet card communication timeout fault | There is no data transmission between the communication card and the | Check whether the communication card wiring is loose or dropped |

| Fault code | Fault type | Possible cause | Corrective measures |
|---|---|---|---|
| | | host controller (or PLC). | |
| E-DEV | [68] DeviceNet card communication timeout fault | There is no data transmission between the communication card and the host controller (or PLC). | Check whether the communication card wiring is loose or dropped |
| ESCAN | [58] 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 | [69] CAN slave fault in master/slave synchronization | Fault occurred to one of the CAN slaves inverters | Detect the CAN slave inverter and analyze the corresponding fault cause of the inverter |
| P-E1–P-E10 | [45]– [54] Programmable card customized faults 1–10 | User program logic error in the programmable card.<br>A fault occurred on the customized position. | Check the user program logic.<br>Perform troubleshooting based on actual customized faults. |
| OtE1 | [70] EC PT100 detected OH | The PT100 temperature sensor is inaccurate or not calibrated.<br>Device or ambient temperature is too high. | Calibrate the sensor through parameter settings.<br>Lower the device or ambient temperature. |
| OtE2 | [71] EC PT1000 detected OH | The PT1000 temperature sensor is inaccurate or not calibrated.<br>Device or ambient temperature is too high. | Calibrate the sensor through parameter settings.<br>Lower the device or ambient temperature. |
| E-EIP | [72] EtherNet IP communication timeout | There is no data transmission between the communication card and the host controller (or PLC). | Check whether the communication card wiring is loose or dropped. |
| E-PAO | [73] No upgrade bootloader | The upgrade bootloader is missing. | Contact us. |
| E-AI1 | [74] AI1 disconnection | Input voltage of AI1 is too low.<br>AI1 wiring is disconnected. | Connect a 5V or 10mA power source to check whether the input is normal.<br>Check the wiring or replace the cables. |

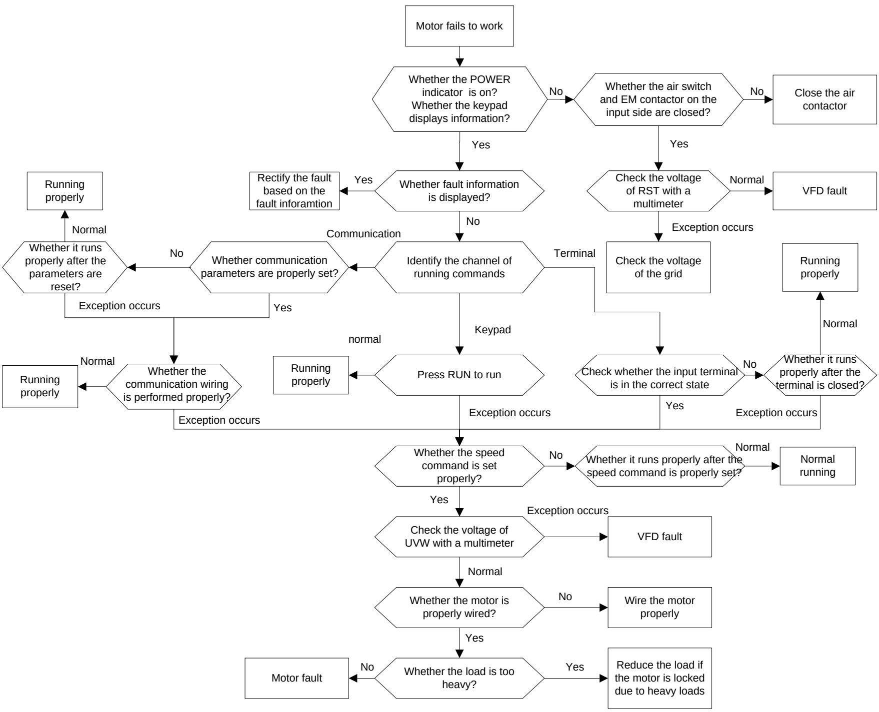
| Fault code | Fault type | Possible cause | Corrective measures |
|---|---|---|---|
| E-AI2 | [75] AI2 disconnection | Input voltage of AI2 is too low.<br>AI2 wiring is disconnected. | Connect a 5V or 10mA power source to check whether the input is normal.<br>Check the wiring or replace the cables. |
| E-AI3 | [76] AI3 disconnection | Input voltage of AI3 is too low.<br>AI4 wiring is disconnected. | Connect a 5V or 10mA power source to check whether the input is normal.<br>Check the wiring or replace the cables. |

### 7.5.2 Other state

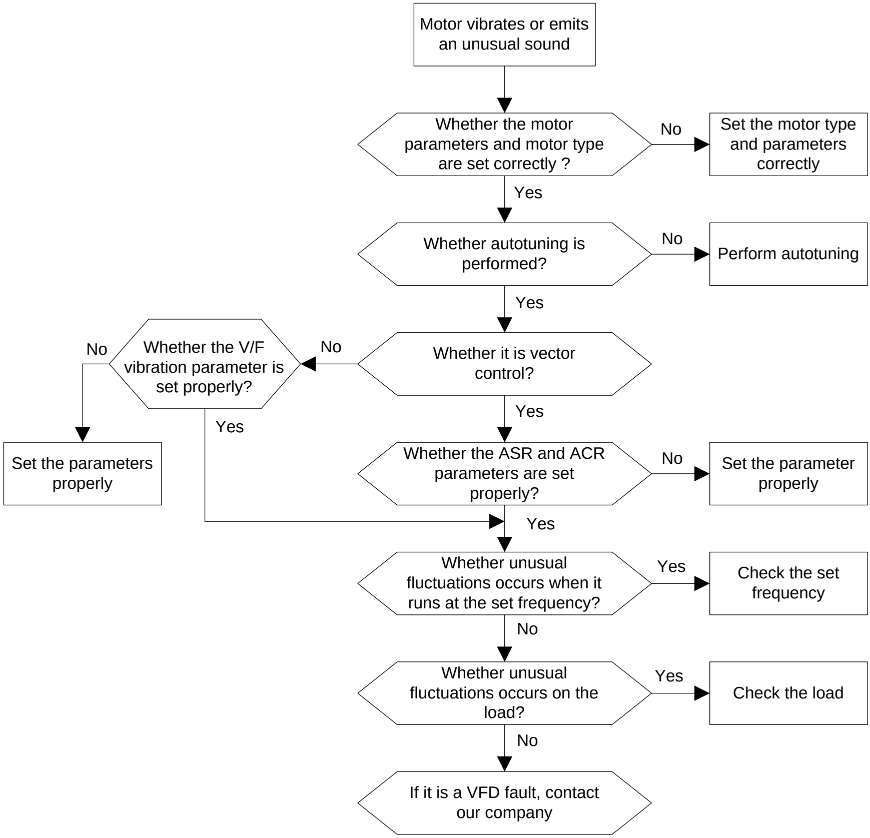
| Displayed code | State type | Possible cause | Solution |
|---|---|---|---|
| PoFF | System power failure | The system is powered off or the bus voltage is too low. | Check the grid conditions. |

## 7.6 Analysis on common faults

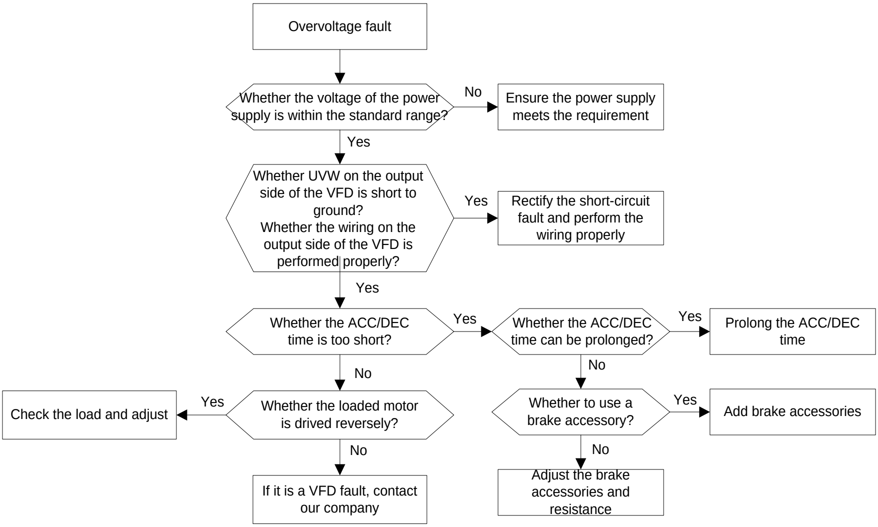
### 7.6.1 Motor fails to work



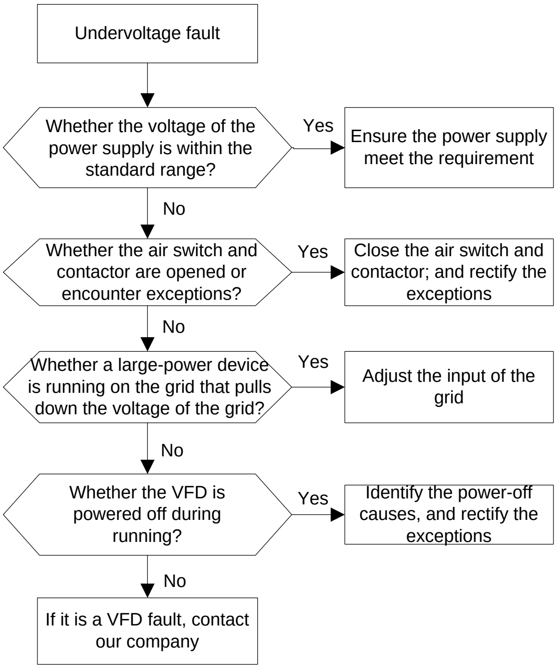
### 7.6.2 Motor vibrates



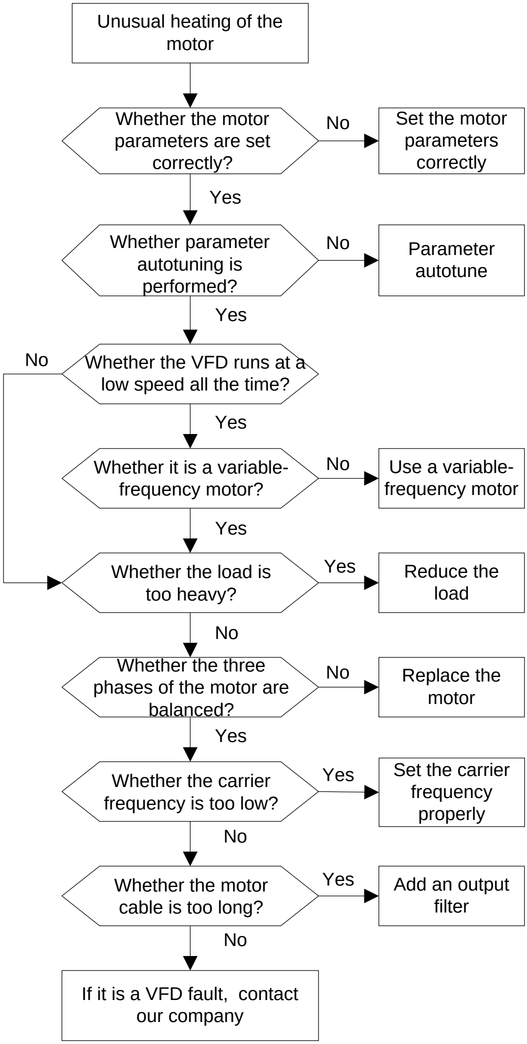
### 7.6.3 Overvoltage



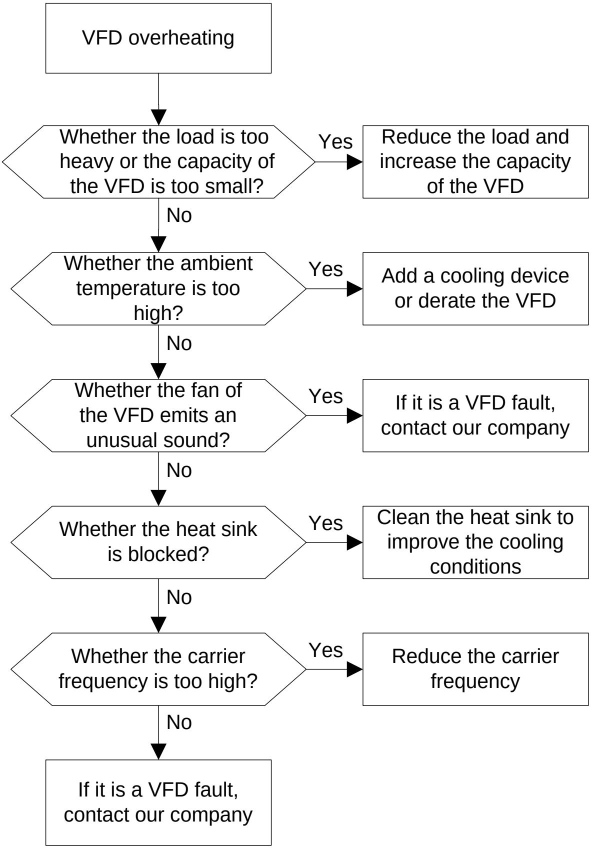

### 7.6.4 Undervoltage



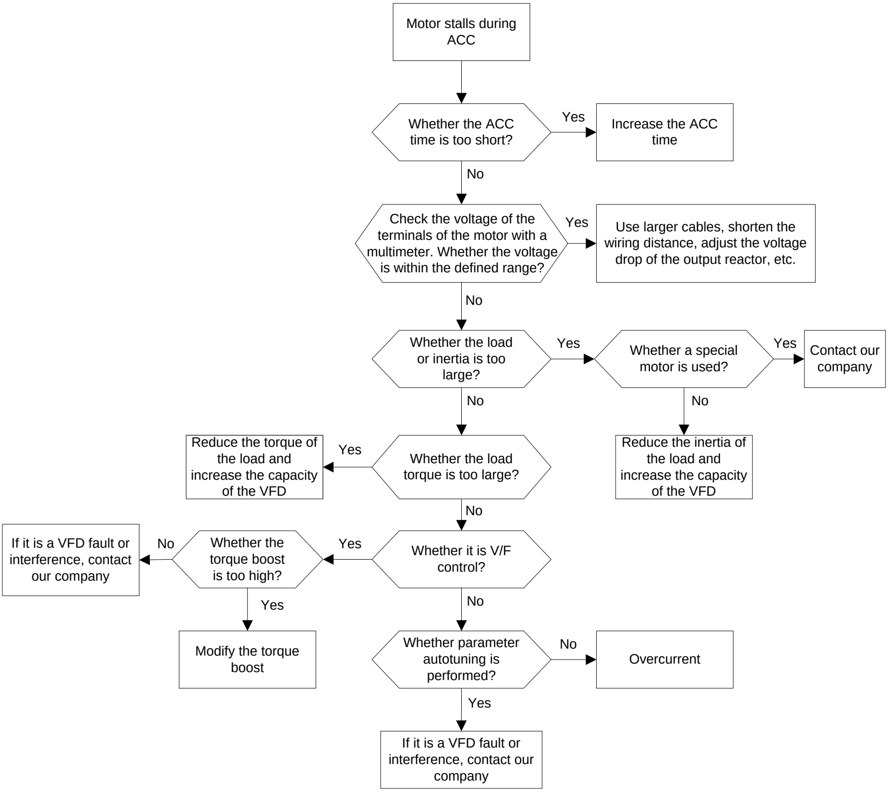
### 7.6.5 Unusual heating of motor



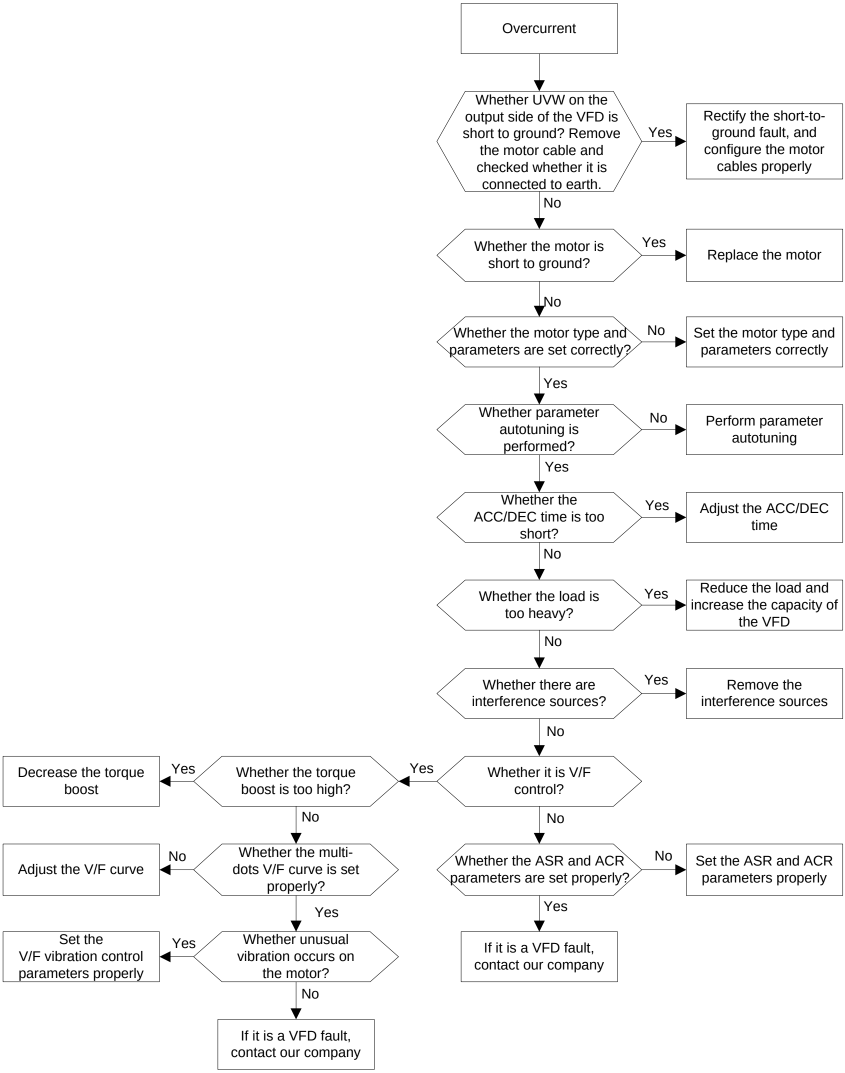
**7.6.6 Inverter overheating**



### 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 the inverter 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, an inverter 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 an inverter 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 inverter is severely affected, displaying the values incorrectly.
6. Proximity switches are used in the system. After an inverter 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 inverter (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 an inverter, 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 many meters or sensors are disturbed, it is recommended to configure an external C2 filter on the input power end of the inverter. 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 an inverter is started.

If the communication cannot be implemented properly, regardless of whether the inverter 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 inverter 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-inverter application scenarios, adopt the chrysanthemum connection mode to connect the communication cables between inverters, which can improve the anti-interference capability.
4. In multi-inverter application scenarios, check and ensure that the driving capacity of the master is sufficient.
5. In the connection of multiple inverters, 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 inverter (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 inverter and motor to the same ground terminal as the upper computer. It is recommended that you connect the inverter 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 inverter with that of the upper computer controller to ensure that ground potential of the communication chip on the control board of the inverter is consistent with that of the communication chip of the upper computer.

4. Try to short GND of the inverter 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 an inverter system where an S terminal is used to control the start and stop, the motor cable and control cable are arranged in the same cable tray. After the system is started properly, the S terminal cannot be used to stop the inverter.

2. Indicator shimmering

After an inverter 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 inverters at the same time through digital input terminals (S), this scheme is not available.

### 7.7.4 Leakage current and interference on RCD

inverters output high-frequency PWM voltage to drive motors. In this process, the distributed capacitance between the internal IGBT of an inverter and the heat sink and that between the stator and rotor of a motor may inevitably cause the inverter 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 an inverter may cause misoperation of an RCD.

1. Rules for selecting RCDs

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

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

(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 inverter power cables and motor cables.

### 7.7.5 Live device chassis

**Phenomenon**

After an inverter 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 inverter 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 inverter and ensure that the jumper at "EMC/J10" on the middle casing of the inverter 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 inverter.

## 8.2 Periodical inspection

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

| 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.<br>**Note:**<br>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 IMO office, or visit our website http://www.IMOPC.com, and choose **Support** > **Services**.

## 8.3 Cooling fan

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

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

The increase of the bearing noise indicates a fan fault. If the inverter 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 IMO.

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 inverter.
2. Open the cable clamp to lose the fan cable (for the 380V 1.5–30 kW inverter 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 inverter in the reverse steps. Assemble the inverter. Ensure that the air direction of the fan is consistent with that of the inverter, as shown in the following figure.

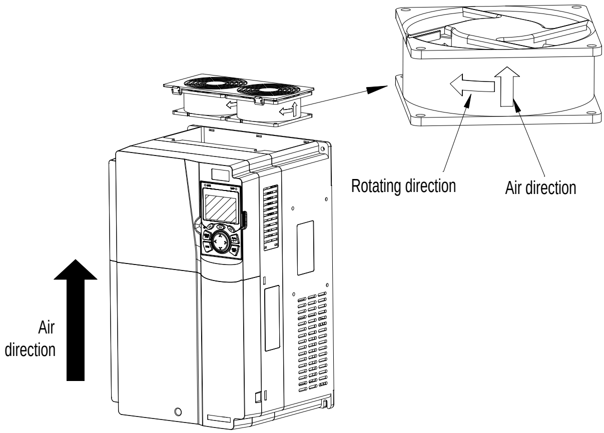



Figure 8-1 Fan maintenance for 7.5 kW and higher inverter models

6. Power on the inverter.

## 8.4 Capacitor

### 8.4.1 Capacitor reforming

If the inverter 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 inverter is delivered.

| Storage time | Operation principle |
|---|---|
| Less than 1 year | No charging operation is required. |
| 1 to 2 years | The inverter 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 inverter: |

| Storage time | Operation principle |
|---|---|
| | Charge the inverter 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 inverter: Charge the inverter 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 inverter is described as follows:

The selection of a voltage-controlled power supply depends on the power supply of the inverter. For inverters 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 inverters 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 inverters 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.

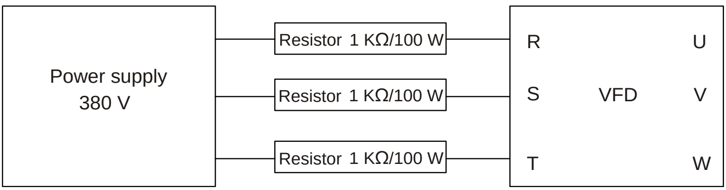



Figure 8-2 380V driving-device charging circuit exmaple

### 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 an inverter must be replaced if it has been used for more than 35,000 hours. For details about the replacement, contact the local IMO 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 inverter, disconnect the power supply, and wait for a time no shorter than the waiting time designated on the inverter.
2. Check the connection of the power cables. Ensure that they are firmly connected.
3. Power on the inverter.

# 9 Communication

## 9.1 What this chapter contains

This chapter describes the communication of the inverter.

The inverter 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 inverter, modifying the running frequency and related function code parameters, and monitoring the working state and fault information of the inverter) 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 inverter 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 inverter 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 inverter**

Figure 9-1 is the Modbus wiring diagram of one inverter 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 inverter 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.

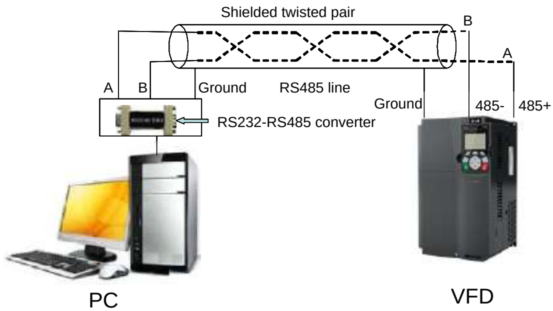



Figure 9-1 Wiring of RS485 applied to one inverter

**9.3.1.2 Application to multiple inverters**

In practical application to multiple inverters, 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.

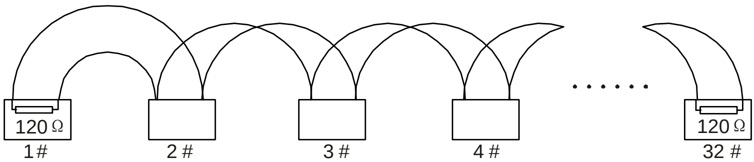



Figure 9-2 On-site chrysanthemum connection diagram

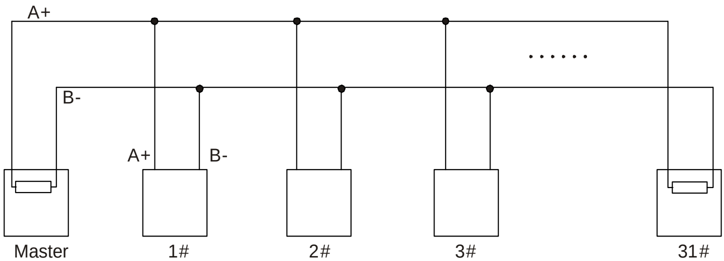



Figure 9-3 Simplified chrysanthemum connection diagram

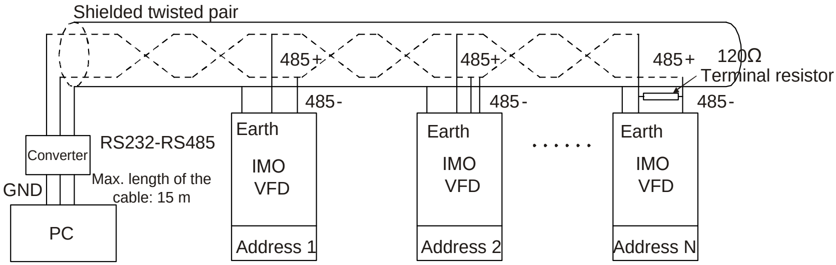



Figure 9-4 Practical application diagram of chrysanthemum connection

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 Figure 9-5, the two devices are devices 1# and 15#).

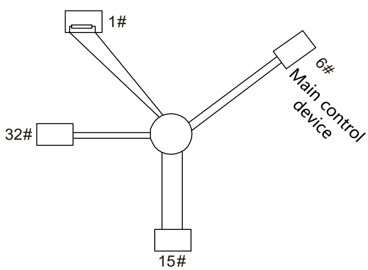



Figure 9-5 Star connection

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 |

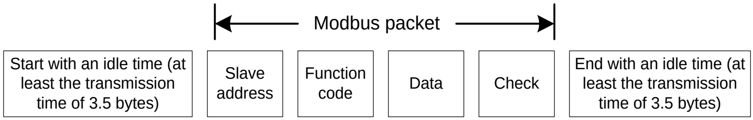
10-bit character frame (Bits 1 to 7 are data bits)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 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<br>06H: write slave parameters |
| DATA (N-1)<br>...<br>DATA (0)<br>(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 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, 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 inverter. 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 inverter.

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 inverter)

| | |
|---|---|
| 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 inverter 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 inverter. 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 inverter 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 inverter 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 inverter 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 inverter. One command can be used to write only one piece of data. It is used to modify the parameters and operation mode of the inverter.

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

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

| | |
|---|---|
| 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 inverter 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 inverter 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 inverter. 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 inverter 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 inverter):

| | |
|---|---|
| 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 inverter 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 inverter.

#### 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<br>1: Keep running in the final value after running once<br>2: Cyclic running | 0–2 | 0 | ○ |
| P10.01 | Simple PLC memory selection | 0: No memory after power down<br>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 inverter is running; some cannot be modified regardless of the state of the inverter. 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 inverter, the master can also control the inverter, such as start and stop it, and monitor the operation state of the inverter. 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 inverter) | |
| | 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:<br>Bit0–1: =00: Motor 1 =01: Motor 2<br>=10: Motor 3 =11: Motor 4<br>Bit2: =1 Torque control disabled =0: Torque control cannot be disabled<br>Bit3: =1 Power consumption reset to 0<br>=0: Power consumption not reset<br>Bit4: =1 Pre-excitation =0: Pre-excitation disabled<br>Bit5: =1 DC brake =0: DC brake disabled | R/W |
| | 200AH | Virtual input terminal command, range: 0x000–0x3FF<br>Corresponding to S8/S7/S6/S5/HDIB/HDIA/S4/ S3/ S2/S1 | R/W |
| | 200BH | Virtual output terminal command, range: 0x00–0x0F<br>Corresponding to local RO2/RO1/HDO/Y1 | R/W |
| | 200CH | Voltage setting (used when V/F separation is implemented)<br>(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 |
| inverter state word 1 | 2100H | 0001H: Forward running | R |
| | | 0002H: Reverse running | |
| | | 0003H: Stopped | |
| | | 0004H: Faulty | |
| | | 0005H: POFF | |
| | | 0006H: Pre-excited | |
| inverter state word 2 | 2101H | Bit0: =0: Not ready to run =1: Ready to run<br>Bi1–2: =00: Motor 1 =01: Motor 2<br>=10: Motor 3 =11: Motor 4<br>Bit3: =0: Asynchronous machine =1: | R |

| Function | Address | Data description | | R/W |
|---|---|---|---|---|
| | | Synchronous machine<br>Bit4: =0: No overload alarm =1: Overload alarm<br>Bit5–Bit6: =00: Keypad-based control =01: Terminal-based control<br>=10: Communication-based control<br>Bit7: Reserved<br>Bit8: =0: Speed control =1: Torque control<br>Bit9: =0: non-position control =1: Position control<br>Bit10–bit11: =0: Vector 0 =1: Vector 1<br>=2: Closed-loop vector<br>=3: Space voltage vector | | |
| inverter fault code | 2102H | See the description of fault types. | | R |
| inverter identification code | 2103H | HD2-----0x01A0 | | R |
| Running frequency | 3000H | 0–Fmax (unit: 0.01Hz) | | 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<br>Corresponding to the local HDIB/ HDIA/S4/S3/S2/S1 | Compatible with CHF100A and CHV100 communication addresses | R |
| Output state | 300BH | 000–0F<br>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 |
| Read current step of | 3012H | 0–15 | | R |

| Function | Address | Data description | | R/W |
|---|---|---|---|---|
| multi-step speed | | | | |
| 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 inverter. 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 "Channel of running commands" (P00.01) to "Communication” and set "Communication mode of running commands" (P00.02) to the Modbus/Modbus TCP communication channel. For another example, when modifying "PID setting", you need to set "PID reference source" (P09.00) to Modbus/Modbus TCP communication.

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

| 8 MSBs | Meaning | 8 LSBs | Meaning |
|---|---|---|---|
| | | 0xa0 | HD2 vector inverter |
| | | 0xa1 | HD2-UL vector inverter |

### 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 outage | 0: Restart is disabled<br>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 inverter is 5.0 (5.0=50/10).

To set the "Wake-up-from-sleep delay" to 5.0s through Modbus/Modbus TCP 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 inverter 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 inverter:

| **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 inverter returns an error message response.

Error message responses are transmitted by the inverter 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:<br>• The function code is applicable only on new devices and is not implemented on this device.<br>• The slave is in the faulty state when processing this request. |
| 02H | Invalid data address | For the inverter, 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 value indicates the error of the remaining structure in the combined request.<br>**Note:** It does not mean that the data item submitted for storage in |

| Code | Name | Definition |
|---|---|---|
| | | 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 inverter. |
| 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 "Channel of running commands" (P00.01, the parameter address is 0001H) of the inverter 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 "Channel of running commands" is 0 to 2. The value 3 exceeds the setting range. In this case, the inverter 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 inverter 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 inverter is 2100H.

The read command transmitted to the inverter 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 inverter is 0003H, which indicates that the inverter is in the stopped state.

Example 2: View information about the inverter 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 inverter is as follows:

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

Assume that the following response is returned:

| 03 | 03 | 0C | 00 23 | 00 23 | 00 23 | 00 23 | 00 23 | 00 23 | 5F D2 |
|---|---|---|---|---|---|---|---|---|---|
| VFD address | Read command | Number of bytes | Most recent fault type | Last fault type | 2nd-last fault type | 3rd-last fault type | 4th-last fault type | 5th-last fault type | CRC |

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 inverter 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 | R/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 inverter 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 inverter. It is the basis of frequency setup and the acceleration/deceleration.<br>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 inverter 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 inverter 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.<br>HD2 series inverter 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 inverter is the first group by default.<br>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 inverter 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 inverter to 03.
2. Set "Channel of running commands" (P00.01) to "Communication” and set "Communication channel of running commands" (P00.02) to the Modbus/Modbus TCP communication channel.
3. Click **Send**. If the line configuration and settings are correct, a response transmitted by the inverter 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 inverter 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 inverter.
- 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 inverter is set incorrectly.

# Appendix A Expansion Cards

## A.1 Model definition

The following table describes extension cards that supported by HD2. The extension cards are optional.

| Name | Model | Specification |
|---|---|---|
| IO extension card | HD2-E-IO | ✧ 4 digital inputs<br>✧ 1 digital output<br>✧ 1 analog input<br>✧ 1 analog output<br>2 relay outputs: 1 double-contact output, and 1 single-contact output |
| IO expansion card 2 | HD2-E-IO2 | ✧ 4 digital inputs<br>✧ 1 PT100<br>✧ 1 PT1000<br>✧ 2 relay outputs: single-contact output |
| Programmable extension card | HD2-E-PLC | ✧ Adopting the global mainstream development environment PLC, supporting multiple types of programming languages, such as the instruction language, structural text, function block diagram, ladderdiagram, continuous function chart, and sequential function chart<br>✧ Supporting breakpoint commissioning<br>✧ Providing user program storage space of 128 kB, and data storagespace of 64 kB<br>✧ 6 digital inputs<br>✧ 2 digital outputs<br>2 relay outputs: 1 double-contact output, and 1 single-contact output |
| Bluetooth communication card | HD2-E-BTP<br>HD2-E-BTM | ✧ Supporting Bluetooth 4.0<br>✧ With IMO's mobile phone APP, you can set the parameters and monitor the states of the inverter through Bluetooth<br>✧ The maximum communication distance in open environments is 30 m.<br>✧ HD2-E-BTP is equipped with a built-in antenna and applicable tomolded case machines.<br>✧ HD2-E-BTM is configured with an external sucker antenna and |

| | | |
|---|---|---|
| | | ✧ applicable to sheet metal machines. |
| WIFI communication card | HD2-E-WFP<br>HD2-E-WFM | ✧ Meeting IEEE802.11b/g/n<br>✧ With IMO's mobile phone APP, you can monitor the inverter locally or remotely through WIFI communication<br>✧ The maximum communication distance in open environments is 30 m.<br>✧ HD2-E-WFP is equipped with a built-in antenna and applicable tomolded case machines.<br>✧ HD2-E-WFM is configured with an external sucker antenna and<br>✧ applicable to sheet metal machines. |
| Ethernet communication card | HD2-E-ENET | ✧ Supporting Ethernet communication with IMO's internal protocol<br>✧ Can be used in combination with IMO's upper computer monitoringsoftware Drive Studio |
| CANopen communication card | HD2-E-COP | ✧ Based on the CAN2.0A physical layer<br>✧ Supporting the CANopen protocol |
| CAN master/slave control communication card | HD2-E-CAN | ✧ Based on the CAN2.0B physical layer<br>✧ Adopting IMO's master-slave control proprietary protocol |
| Profibus-DP communication card | HD2-E-PDP | ✧ Supporting the Profibus-DP protocol |
| PROFINET communication card | HD2-E-PRF | ✧ Supporting the PROFINET protocol |
| Multi-function incrementalPG card | HD2-E-PGIM | ✧ Applicable to OC encoders of 5 V or 12 V<br>✧ Applicable to push-pull encoders of 5 V or 12 V<br>✧ Applicable to differential encoders of 5 V<br>✧ Supporting the orthogonal input of A, B, and Z<br>✧ Supporting the frequency-divided output of A, B, and Z<br>✧ Supporting pulse string setting |
| 24V incremental PG card | HD2-E-PGIM24 | ✧ Applicable to 24V OC encoders<br>✧ Applicable to 24 V push-pull encoders<br>✧ Applicable to 5 V differential encoders<br>✧ Supporting A, B, Z orthogonal input<br>✧ Supporting A, B, Z frequency-divided |

| | | |
|---|---|---|
| | | output<br>✧ Supporting pulse string reference input |
| UVW incremental PG card | HD2-E-PGI | ✧ Applicable to differential encoders of 5 V<br>✧ Supporting the orthogonal input of A, B, and Z<br>✧ Supporting pulse input of phase U, V, and W<br>✧ Supporting the frequency-divided output of A, B, and Z<br>✧ Supporting the input of pulse string reference |
| Resolver PG card | HD2-E-PGR | ✧ Applicable to resolver encoders<br>✧ Supporting frequency-divided output of resolver-simulated A, B, Z |
| Sin/Cos PG card | HD2-E-PGISC | ✧ Applicable to Sin/Cos encoders with or without CD signals<br>✧ Supporting A, B, Z frequency-divided output<br>✧ Supporting pulse string reference input |

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

IO expansion card
HD2-E-IO

IO expansion card 2
HD2-E-IO2

PROFIBUS-DP
communication card
HD2-E-PDP

Ethernet
communication card
HD2-E-ENET


Ethernet/IP
communication card
HD2-E-EIP/
HD2-E-MTCP

Sin/Cos PG card
HD2-E-PGISC

Multifunction incremental PG card HD2-E-PGIM

24V incremental PG card HD2-E-PGIM24

## A.2 Dimensions and installation

All expansion 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 expansion card:

1. Ensure that no power is applied before installing an expansion card.
2. An expansion card can be installed into a respective card slots among SLOT1, SLOT2, and SLOT3.
3. inverters of 5.5 kW or lower can be configured with two expansion cards at the same time, and those of 7.5 kW or higher can be configured with three expansion cards.
4. If interference occurs on the external wires after expansion 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.

**Note:** For 2.2–5.5kW models, the 24V power suply card can be inserted into SLOT1; for 7.5kW and higher models, the 24V power supply card can be inserted into SLOT1 or SLOT3; for 11kW and higher models, the 24V power supply card can be inserted into any of the three slots.

Figure A-1 shows the installation diagram and a inverter with expansion cards installed.

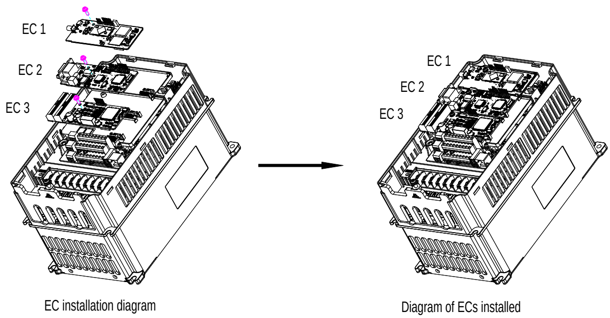



Figure A-1 inverter of 7.5 kW or higher with expansion cards installed

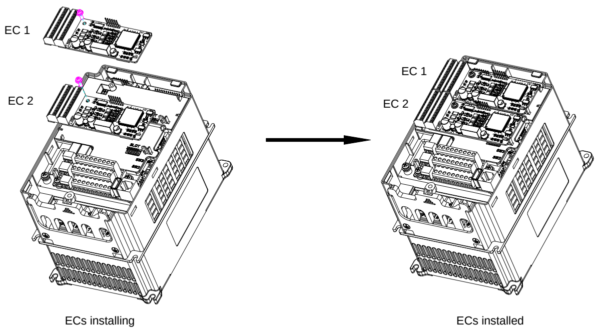



Figure A-2 inverter of 5.5 kW or lower with expansion cards installed

Expansion card installation process:

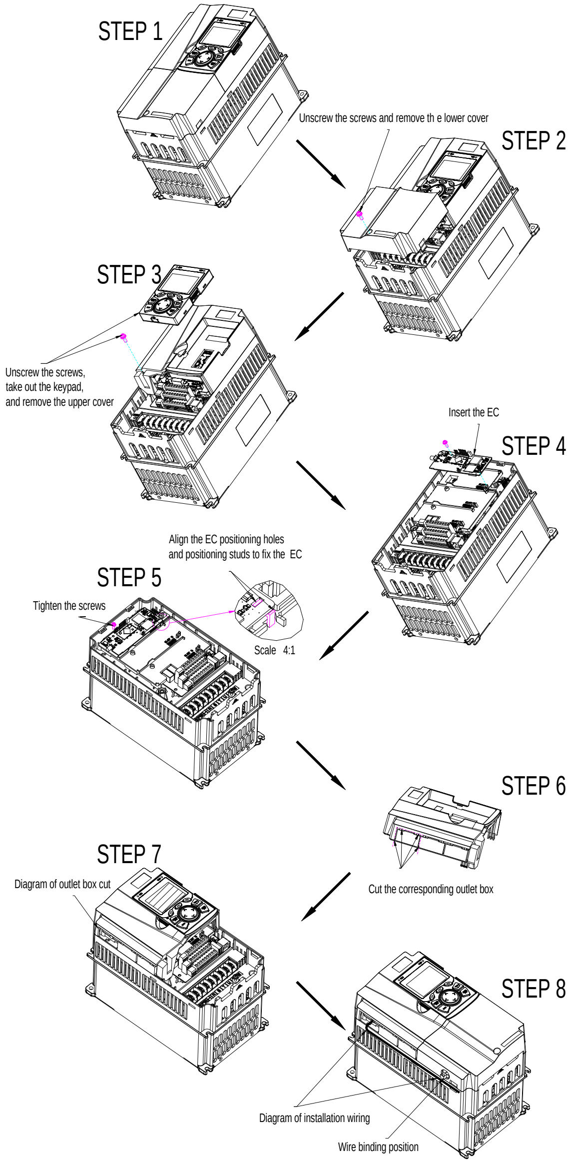



Figure A-3 Expansion card installation process diagram

## A.3 Wiring

1. Ground a shielded cable as follows:

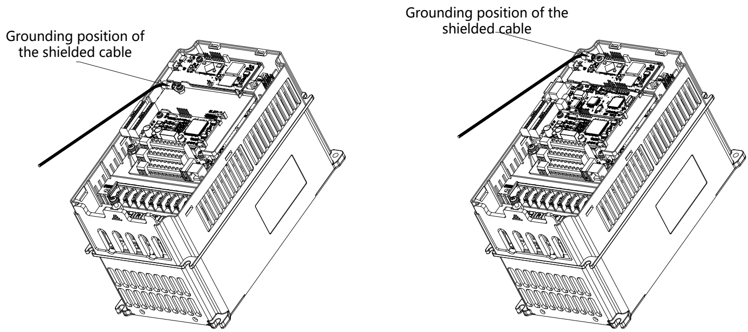


Figure A-4 Expansion card grounding diagram

2. Wire an expansion card as follows:

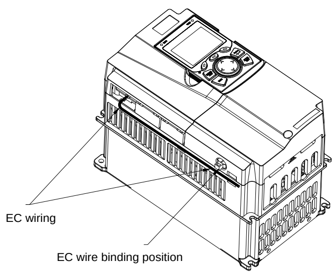
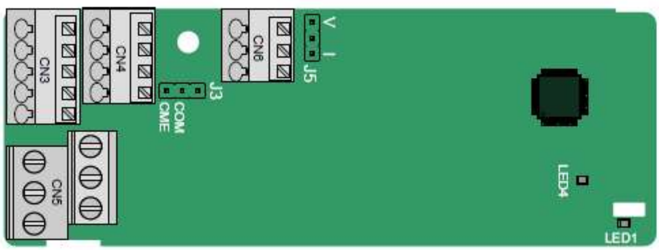


Figure A-5 Expansion card wiring

## A.4 IO expansion card (HD2-E-IO)




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

The terminals are arranged as follows:

| | | |
|---|---|---|
| AI3 | AO2 | GND |

| | | | | |
|---|---|---|---|---|
| COM | CME | Y2 | S5 | |
| PW | +24V | S6 | S7 | S8 |

| | | |
|---|---|---|
| RO3A | RO3B | RO3C |
| RO4A | | RO4C |

**Indicator definition**

| Indicator | Name | Description |
|---|---|---|
| LED1 | State indicator | On: The expansion card is establishing a connection with the control board.<br>Blinking periodically: The expansion card is properly connected to the control board (the period is 1s, on for 0.5s, and off for the other 0.5s).<br>Off: The expansion card is disconnected from the control board. |
| LED4 | Power indicator | On: The control board feeds power to the expansion card. |

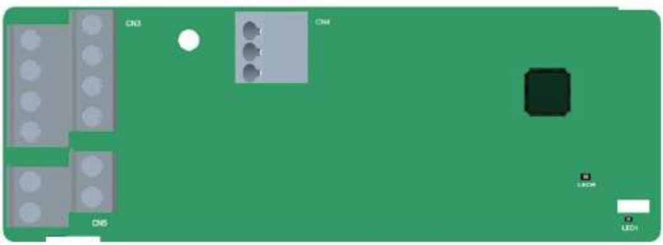
The HD2-E-IO expansion card can be used in scenarios where the I/O interfaces of a HD2-UL inverter cannot meet the application requirements. It can provide 4 digital inputs, 1 digital output, 1 analog input, 1 analog output, and two relay outputs. It is user-friendly, providing relay outputs through European-type screw terminals and other inputs and outputs through spring terminals.

**HD2-E-IO terminal function description**

| Category | Symbol | Name | Description |
|---|---|---|---|
| Power | PW | External power supply | The working power of digital input is provided by an external power supply.<br>Voltage range: 12–30 V<br>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<br>2. Input impedance: 20 kΩ for voltage input; 250 Ω for current input<br>3. Set it to be voltage or current input through the corresponding function code.<br>4. Resolution: When 10 V corresponds to 50 Hz, the minimum resolution is 5 mV.<br>5. Deviation: ±0.5%; input 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<br>2. Whether it is voltage or current output is determined by J5. |

| Category | Symbol | Name | Description |
|---|---|---|---|
| | | | 3. Deviation ±0.5%; output of 5 V or 10 mA or higher at the temperature of 25°C |
| Digital input/output | S5—COM | Digital input 1 | 1. Internal impedance: 3.3 kΩ<br>2. Power input range: 12–30 V<br>3. Bidirectional input terminal<br>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<br>2. Output frequency range: 0–1 kHz<br>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, 1A/DC 30 V<br>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 IO expansion card 2 (HD2-E-IO2)



The terminals are arranged as follows.

| | | |
|---|---|---|
| PT1+ | PT- | PT2+ |

| | | | |
|---|---|---|---|
| S5 | S6 | S7 | S8 |
| +24V | PW | COM | COM |

| | | |
|---|---|---|
| RO4A | RO4C | |
| | RO3A | RO3C |

**Indicator definition**

| Indicator | Definition | Function |
|---|---|---|
| LED1 | State indicator | This indicator is on when the expansion card is establishing a connection with the control board; it |

| Indicator | Definition | Function |
|---|---|---|
| | | 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. |
| LED4 | Power indicator | This indicator is on after the IO expansion card is powered on by the control board. |

The HD2-E-IO2 expansion card can be used in scenarios where the I/O interfaces of the inverter cannot meet the application requirements. It can provide 4 digital inputs, 1 PT100 temperature measurement input (PT1+), 1 PT1000 temperature measurement input (PT2+), and 2 relay outputs. It is user-friendly, providing relay outputs and digital inputs through European-type screw terminals and temperature measurement inputs through spring terminals.

**HD2-E-IO2 terminal function description**

| Category | Symbol | Name | Function |
|---|---|---|---|
| Power | PW | External power supply | The working power of digital input is provided by an external power supply.<br>Voltage range: 24(-20%)–48VDC (+10%), 24(-10%)–48VAC (+10%) |
| | +24V | Internal power | User power provided by the inverter.<br>Max. output current: 200mA |
| | COM | Power reference | Common terminal of +24V |
| Digital input | S5—COM | Digital input 5 | Internal impedance: 6.6kΩ<br>Supported external power: 24(-20%)–48VDC (+10%), 24(-10%)–48VAC (+10%)<br>Supporting internal power 24V<br>Bi-directional input terminals, supporting NPN/PNP modes<br>Max. input frequency: 1kHz<br>All are programmable digital input terminals. You can set the terminal function via function codes. |
| | S6—COM | Digital input 6 | |
| | S7—COM | Digital input 7 | |
| | S8—COM | Digital input 8 | |
| Temperature detection input | PT1+ | PT100 input | Independent PT100 and PT1000 inputs.<br>PT1+ connects to PT100, and PT2+ connects to PT1000.<br>1. Resolution: 1°C<br>2. Range: -20°C–150°C<br>3. Detection accuracy: 3°C<br>4. Supporting offline protection |
| | PT2+ | PT1000 input | |
| | PT- | Reference input of PT100/PT1000 | Zero potential reference of PT100/PT1000 |

| Category | Symbol | Name | Function |
|---|---|---|---|
| Relay output | RO3A | Contact A of NO relay 3 | RO3 relay output. RO3A: NO; RO3C: common terminal<br>Contact capacity: 3A/AC250V, 1A/DC30V |
| | RO3C | Contact C of NO relay 3 | |
| | RO4A | Contact A of NO relay 4 | RO4 relay output. RO4A: NO; RO4C: common terminal<br>Contact capacity: 3A/AC250V, 1A/DC30V |
| | RO4C | Contact C of NO relay 4 | |

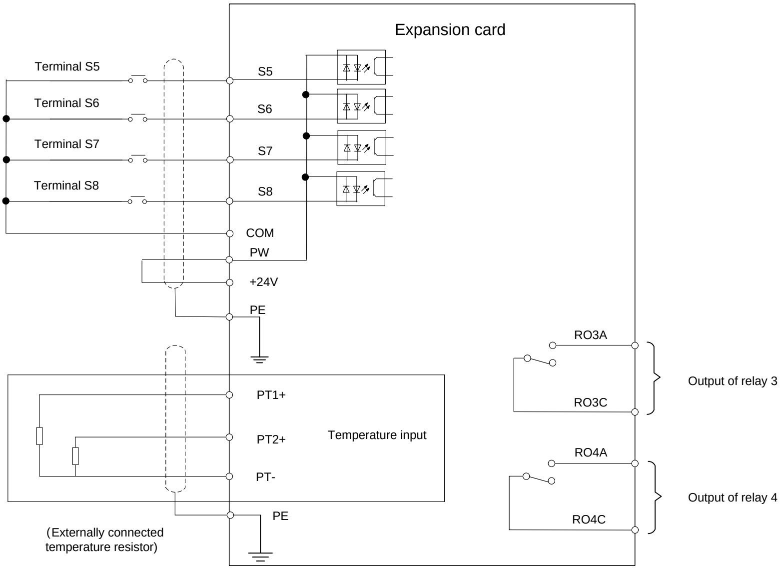
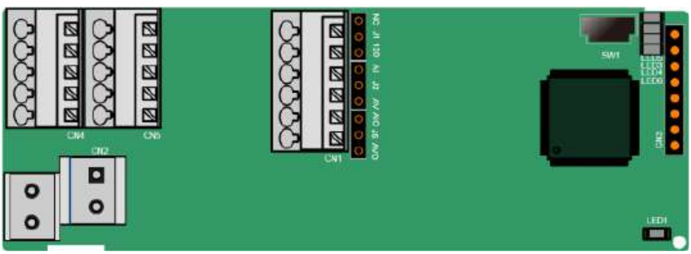



Figure A-6 Control circuit wiring of IO expansion card 2

## A.6 Programmable expansion card (HD2-E-PLC)



SW1 is the start/stop switch of the programmable expansion card. CN1 contains terminals PE, 485-, 485+, GND, AI1, and AO1, and a selection jumper resides on the next. "AI" and "AV" are the current type input selection and voltage type input selection of AI1, and they can be selected through J2. "AIO" and "AVO" are the current type output selection and voltage type output selection of AO1, and they can be selected through J5. "120" indicates 120Ω terminal resistor, and it can connect to J1. By default, J1 connects to NC, J2 to AV, and J5 to AVO.

The terminals are arranged as follows.

| | | | | | |
|---|---|---|---|---|---|
| PE | 485- | 485+ | GND | AI1 | AO1 |

| | | | | |
|---|---|---|---|---|
| COM | COM | PS1 | PS2 | PS3 |
| PW | 24V | PS4 | PS5 | PS6 |

| | |
|---|---|
| PRO2A | PRO2C |
| PRO1A | PRO1C |

**Indicator definition**

| Indicator | Name | Description |
|---|---|---|
| LED1 | PWR power indicator (green) | The indicator is on when the expansion card is powered on. |
| LED3 | COMM communication indicator (green) | This indicator is on when the expansion card is establishing a connection with the control board.<br>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);<br>and it is off when the expansion card is disconnected from the control board. |
| LED4 | ERR fault indicator (red) | Blinks: an error occurs (the period is 1s, on for 0.5s, and off for the other 0.5s), and the error type can be queries through the upper computer Auto Station;<br>Off: no fault. |
| LED5 | PWR power indicator (green) | The indicator is on when the expansion card is powered on. |
| LED6 | RUN status indicator (green) | On: PLC program is running<br>Off: PLC program stops |

The HD2-E-PLC programmable expansion card can replace some micro-PLC applications. It adopts the global mainstream development environment PLC, supporting the instruction language (IL), ladder diagram (LD), and sequential function chart (SFC). It provides a user program storage space of 16K steps and data storage space of 8K words and supports saving data of 1K words at power failure, which facilitate customers' secondary development and meets the customization requirements.

The HD2-E-PLC programmable expansion card provides 6 digital inputs, 2 relay outputs, 1 analog input, 1 analog output, 1 RS485 communication channel (supports master/slave switchover). It is user-friendly, providing relay outputs through European-type screw terminals and other inputs and outputs through spring terminals.

**HD2-E-PLC terminal function description**

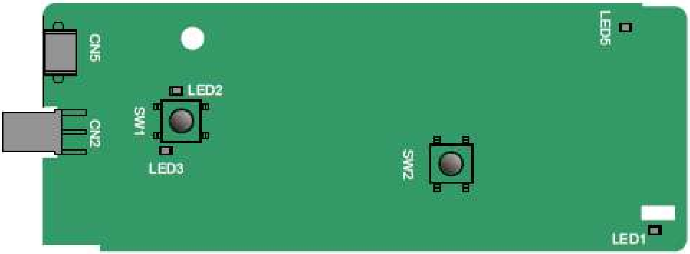
| Category | Symbol | Name | Function |
|---|---|---|---|
| Power supply | PW | External power supply | To provide input digital working power from external to internal.<br>Voltage range: 12–24V<br>PW and +24V are short connected by default. |
| | 24V | Internal power supply | Internal output power supply, 100mA |
| Common terminal/ground | COM | Common terminal of +24V | Common terminal of +24V. If PS1 is connected, COM indicates PS1 is connected. |
| | GND | Analog ground | Reference zero potential of +10V |
| | PE | Protective earthing terminal | Protective earthing terminal |
| Digital input | PS1—COM | Digital input 1 | 1. Internal impedance: 4kΩ<br>2. Accept 12–30V voltage input<br>3. Bi-directional input terminal<br>4. Max. input frequency: 1kHz<br>5. Both source and sink inputs are allowed, but the input types must be the same |
| | 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 | |
| Analog input and output | AI1 | Analog input 1 | 1. Input range: AI1 voltage and current range: 0–10V, 0–20mA<br>2. Input impedance: 20kΩ during voltage input; 250Ω during current input<br>3. Voltage or current input is set through the jumper.<br>4. Resolution ratio: When 10V corresponds to 50Hz, the min. resolution ratio is 5mV<br>5. Deviation: ±1% when the input reaches full the measurement range at 25°C |
| | AO1 | Analog output 1 | 1. Output range: 0–10V voltage or 0–20mA current<br>2. Voltage or current output is set through the jumper.<br>3. Deviation: ±1% when the input reaches full the measurement range at 25°C. |
| Relay output | PRO1A | NO contact of relay 1 | 1. Contact capacity: 2A/AC250V, 1A/DC30V<br>2. Unable to function as high frequency switch output |
| | PRO1C | Common contact of relay 1 | |
| | PRO2A | NO contact of relay 2 | |
| | PRO2C | Common contact of relay 2 | |

| Category | Symbol | Name | Function |
|---|---|---|---|
| Communication | 485+ | RS485 communication terminal | RS485 communication port, which can be set as the master or slave through the Auto Station. It is differential signal output. Whether to connect the 120Ω resistor of RS485 is set through the jumper. |
| | 485- | | |

For details about how to use the programmable card, see the HD2 series AutoStation programmable card manual.

## A.7 Communication cards

### A.7.1 Bluetooth communication card (HD2-E-BTP) and WIFI communication card (HD2-E-WFP)

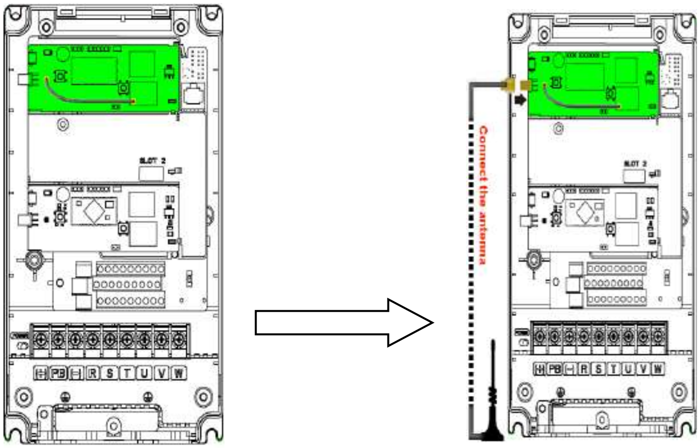



**Definitions of indicators and function buttons**

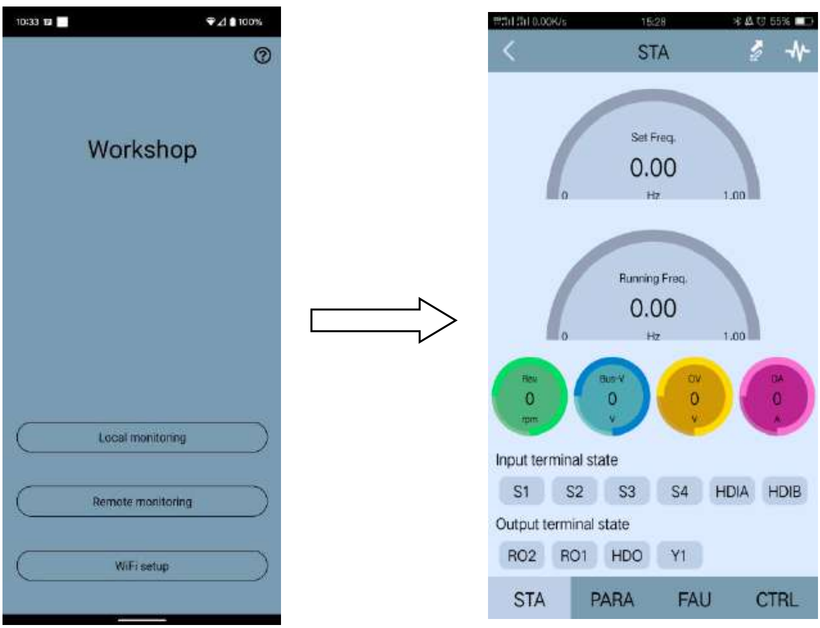
| Indicator | Name | Description |
|---|---|---|
| LED1/LED3 | Bluetooth/WIFI state indicator | On: The expansion card is establishing a connection with the control board.<br>Blinking periodically: The expansion card is properly connected to the control board (the period is 1s, on for 0.5s, and off for the other 0.5s).<br>Off: The expansion card is disconnected from the control board. |
| LED2 | Bluetooth communication state indicator | On: Bluetooth communication is online and data exchange can be performed.<br>Off: Bluetooth communication is not in the online state. |
| LED5 | Power indicator | On: The control board feeds power to the Bluetooth card. |
| SW1 | WIFI factory reset button | It is used to restore the expansion card to default values and return to the local monitoring mode. |
| SW2 | WIFI hardware reset button | It is used to restart the expansion card. |

The wireless communication card is especially useful for scenarios where you cannot directly use the keypad to operate the inverter due to the restriction of the installation space. With a mobile phone APP, you can operate the inverter in a maximum distance of 30 m. You can choose a PCB antenna or an external sucker antenna. If the inverter is 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.

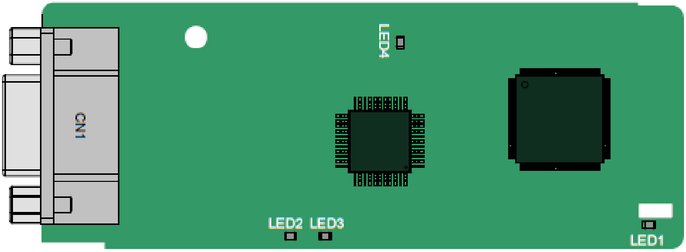
When installing a sucker antenna, install a wireless communication card on the inverter first, and then lead the SMA connector of the sucker antenna into the inverter and screw it to CN2, as shown in the following figure. Place the antenna base on the chassis and expose the upper part. Try to keep it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



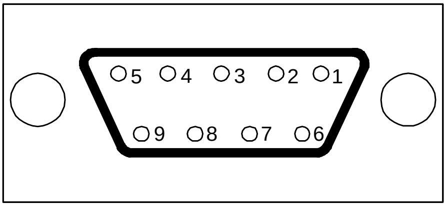

The wireless communication card must be used with the IMO inverter APP. Scan the QR code of the inverter nameplate to download it. For details, refer to the wireless communication card manual provided with the expansion card. The main interface is shown as follows.



### A.7.2 PROFIBUS-DP communication card (HD2-E-PDP)




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 transmission |
| 5 | GND_BUS | Isolation ground |
| 6 | +5V BUS | Isolated power supply of 5 V DC |
| 7 | - | Unused |
| 8 | A-Line | Data- (twisted pair 2) |
| 9 | - | Unused |
| Housing | SHLD | PROFIBUS cable shielding line |

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

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

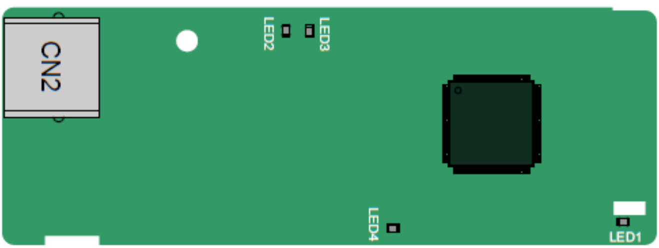
**Indicator definition**

| Indicator | Name | Description |
|---|---|---|
| LED1 | State indicator | On: The expansion card is establishing a connection with the control board.<br>Blinking periodically: The expansion card is properly connected to the control board (the period is 1s, on for 0.5s, and off for the other |

| Indicator | Name | Description |
| --- | --- | --- |
| | | 0.5s).<br>Off: The expansion card is disconnected from the control board. |
| LED2 | Online indicator | On: The communication card is online and data exchange can be performed.<br>Off: The communication card is not in the online state. |
| LED3 | Offline/Fault indicator | On: The communication card is offline and data exchange cannot be performed.<br>Blinks: The communication card is not in the offline state.<br>Blinks at the frequency of 1 Hz: A configuration error occurs: The length of the user parameter data set during the initialization of the communication card is different from that during the network configuration.<br>Blinks at the frequency of 2 Hz: User parameter data is incorrect. The length or content of the user parameter data set during the initialization of the communication card is different from that during the network configuration.<br>Blinks at the frequency of 4 Hz: An error occurs in the ASIC initialization of PROFIBUS communication.<br>Off: The diagnosis function is disabled. |
| LED4 | Power indicator | On: The control board feeds power to the communication card. |

For details about the operation, see the *HD2 Series inverter Communication Expansion Card Operation Manual*.

**A.7.3 Ethernet communication card (HD2-E-ENET)**

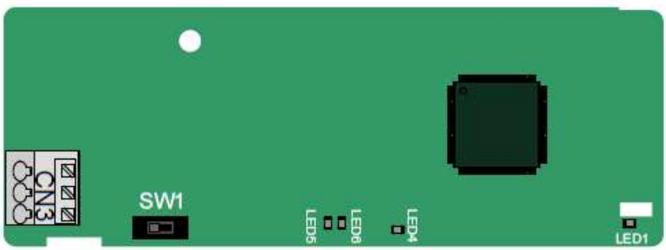



The HD2-E-ENET communication card adopts standard RJ45 terminals.

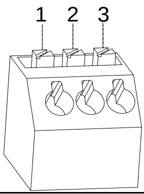
**Indicator definition**

| Indicator No. | Definition | Function |
|---|---|---|
| LED1 | State indicator | On: The expansion card is establishing a connection with the control board.<br>Blinking periodically: The expansion card is properly connected to the control board (the period is 1s, on for 0.5s, and off for the other 0.5s).<br>Off: The expansion card is disconnected from the control board. |
| LED2 | Network connection status indicator | On: The physical connection to the upper computer is normal.<br>Off: The upper computer is disconnected. |
| LED3 | Network communication status indicator | On: There is data exchange with the upper computer.<br>Off: There is no data exchange with the upper computer. |
| LED4 | Power indicator | On: The control board feeds power to the communication card. |

### A.7.4 CANopen communication card (HD2-E-COP) and CAN master/slave control communication card (HD2-E-CAN)




The HD2-E-COP/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**

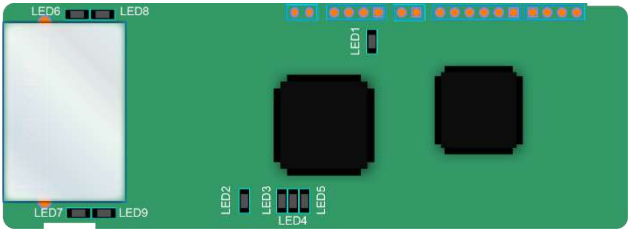
| Terminal resistor switch | Position | Function | Description |
|---|---|---|---|
| | Left | OFF | CAN_H and CAN_L are not connected to a terminal resistor. |
| | Right | ON | CAN_H and CAN_L are connected to a terminal resistor of 120 Ω. |

**Indicator definition**

| Indicator No. | Definition | Function |
|---|---|---|
| LED1 | State indicator | On: The expansion card is establishing a connection with the control board.<br>Blinking periodically: The expansion card is properly connected to the control board (the period is 1s, on for 0.5s, and off for the other 0.5s).<br>Off: The expansion card is disconnected from the control board. |
| LED4 | Power indicator | On: The control board feeds power to the communication card. |
| LED5 | Running indicator | On: The communication card is running.<br>Off: A fault occurs. Check whether the reset pin of the communication card and the power supply are properly connected.<br>Blinks: The communication card is in the pre-operation state.<br>Blinks once: The communication card is in the stopped state. |
| LED6 | Error indicator | On: The CAN controller bus is off, or a fault occurs on the inverter.<br>Off: The communication card is in the working state.<br>Blinks: The address setting is incorrect.<br>Blinks once: A received frame is missed or an error occurs during frame receiving. |

For details about the operation, see the *HD2 Series inverter Communication Expansion Card Operation Manual*.

### A.7.5 PROFINET communication card (HD2-E-PRF)




The terminal CN2 adopts a standard RJ45 interface, where CN2 is the dual RJ45 interface, and these 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 |

Definition of the state indicator

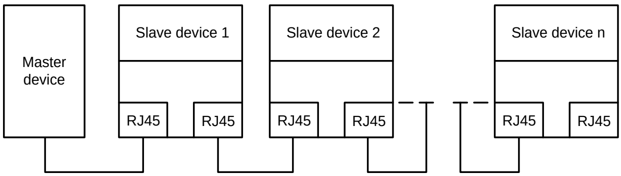
The PROFINET communication card has 9 indicators, of which LED1 is the power indicator, LEDs 2–5 are the communication state indicators of the communication card, and LEDs 6–9 are the state indicators of the network port.

| LED | Color | State | Description |
|---|---|---|---|
| LED1 | Green | | 3.3V power indicator |
| LED2 (Bus state indicator) | Red | On | No network connection |
| | | Blinking | The connection to the PROFINET controller through a network cable 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 is enabled |
| | | Off | PROFINET diagnosis is not enabled |
| LED4 (Slave ready indicator) | Green | On | TPS-1 protocol stack has started |
| | | Blinking | TPS-1 waits for MCU initialization |
| | | Off | TPS-1 protocol stack does not start |
| LED5 | Green | | Manufacturer-specific—depending on |

| LED | Color | State | Description |
|---|---|---|---|
| (Maintenance state indicator) | | | the characteristics of the device |
| LED6/7 (Network port state indicator) | Green | On | PROFINET communication card and PC/PLC have been connected through a network cable. |
| | | Off | PROFINET communication card and PC/PLC have not been connected. |
| 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 communicating. |

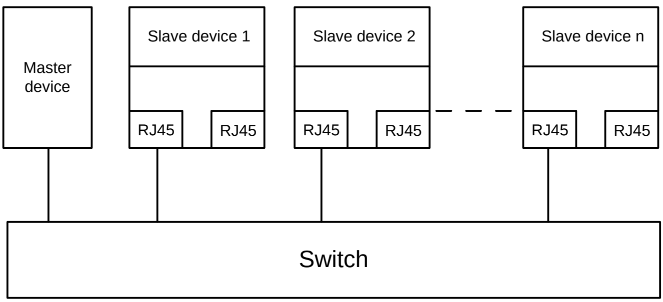
**Electrical connection**

The PROFINET communication card adopts a standard RJ45 interface and can adopt the linear network topology or star network topology. The electrical connection in linear network topology mode is shown in the following.

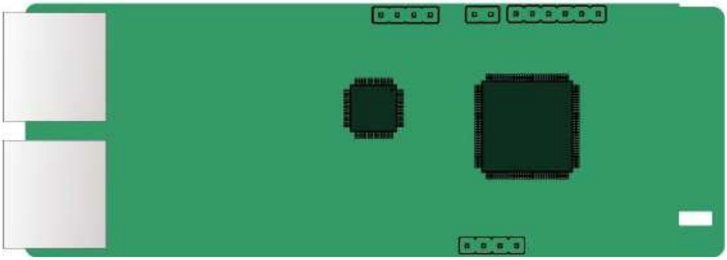



**Note:** For the star network topology, you need to prepare PROFINET switches.

The electrical connection in start network topology mode is shown in the following.



### A.7.6 Ethernet/IP communication card (HD2-E-EIP) and Modbus TCP communication card (HD2-E-MTCP)



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

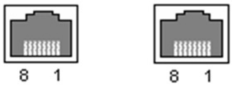



Figure A-7 Standard RJ45 interface

**Standard RJ45 interface functions**

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

**State indicators**

The EtherNet/IP communication card provides four LED indicators and four net port indicators to indicate its states.

| LED | Color | State | Description |
|---|---|---|---|
| LED1 | Green | On | The card is shaking hands with the inverter. |
| | | Blinking (1Hz) | The card and inverter communicate normally. |
| | | Off | The card and inverter communicate improperly. |
| LED2 | Green | On | The communication between the card and PLC is online and data interchange is allowed. |
| | | Blinking (1Hz) | IP address conflict between the card and PLC. |
| | | Off | The communication between the card and PLC is offline. |

| LED | Color | State | Description |
|---|---|---|---|
| LED3 | Red | On | Failed to set up I/O between the card and PLC. |
| | | Blinking (1Hz) | Incorrect PLC configuration. |
| | | Blinking (2Hz) | The card failed to send data to the PLC. |
| | | Blinking (4Hz) | The connection between the card and PLC timed out. |
| | | Off | No fault. |
| LED4 | Red | On | 3.3V power indicator. |
| Net port indicator | Yellow | On | Link indicator, indicating successful Ethernet connection. |
| | | Off | Link indicator, indicating Ethernet connection not established. |
| Net port indicator | Green | On | ACK indicator, indicating data interchange being performed. |
| | | Off | ACK indicator, indicating data interchange is not performed. |

**Electrical wiring**

The EtherNet/IP communication card provides standard RJ45 ports and supports the linear, star, and ring topologies. The following three figures show the electrical wiring diagrams.

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

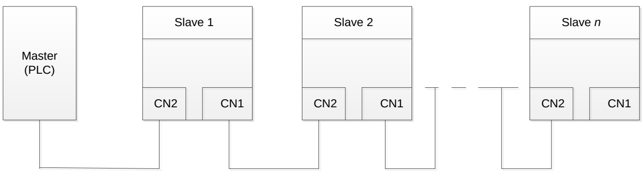



Figure A-8 Electrical wiring diagram for a linear topology

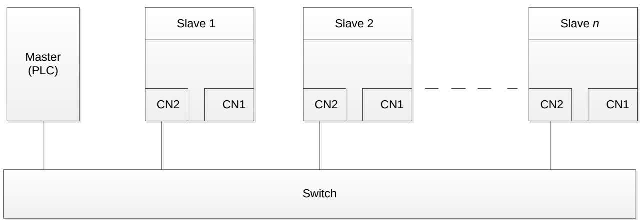



Figure A-9 Electrical wiring diagram for a star topology

**Note:** Ethernet switches must be available when the star topology is used.

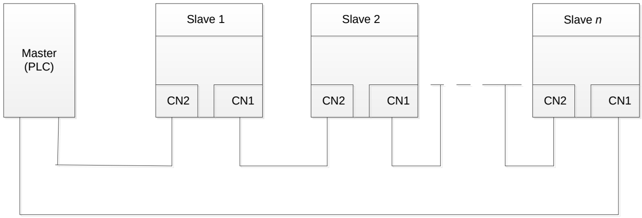
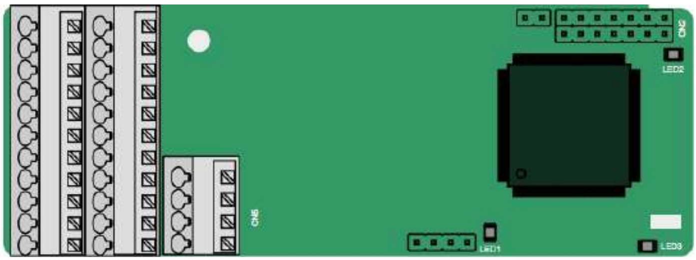



Figure A-10 Electrical wiring diagram for a ring network

## A.8 PG expansion card function description

### A.8.1 Sin/Cos PG card (HD2-E-PGISC)



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 |

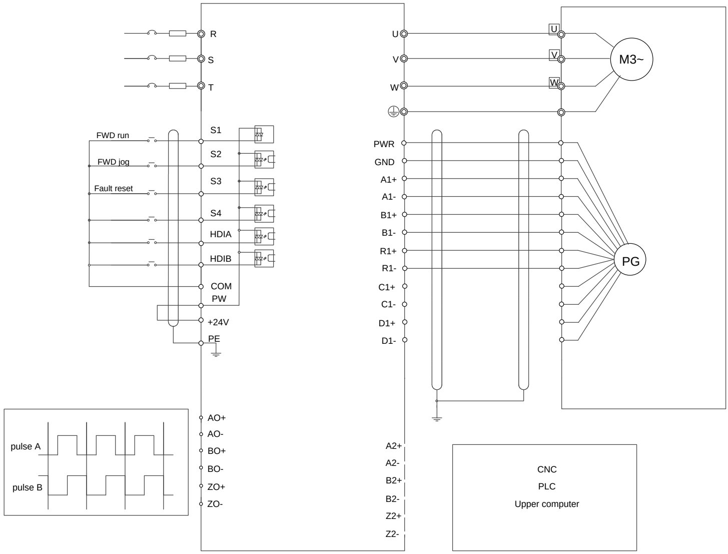
**Indicator definition**

| Indicator | Name | Description |
|---|---|---|
| LED1 | Disconnection indicator | Off: A1 and B1 of the encoder are disconnected.<br>Blinking: C1 and D1 of the encoder are disconnected.<br>On: The encoder signals are normal. |
| LED2 | Power indicator | On: The control board feeds power to the PG card. |
| LED3 | State indicator | On: The expansion card is establishing a connection with the control board.<br>Blinking periodically: The expansion card is properly connected to the control board (the period is 1s, on for 0.5s, and off for the other 0.5s).<br>Off: The expansion card is disconnected from the control board. |

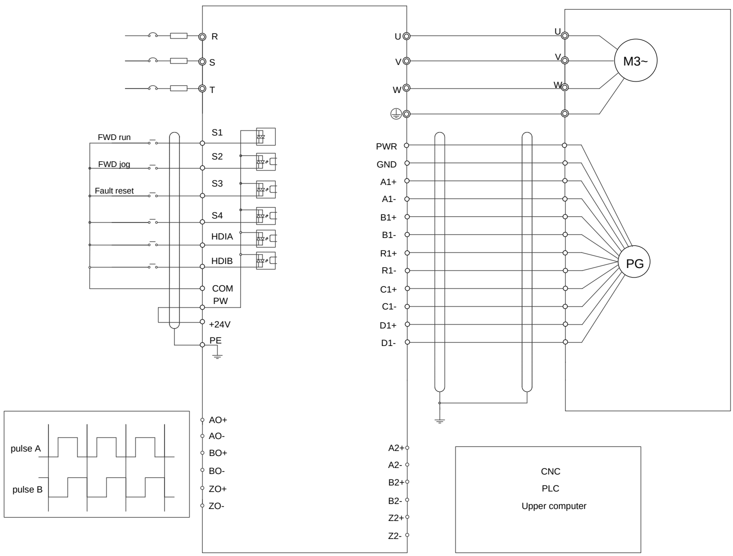
**HD2-E-PGISC terminal function description**

| Signal | Port | Function |
|---|---|---|
| PWR | Encoder power | Voltage: 5 V ± 5%<br>Max. output current: 150 mA |
| GND | | |
| A1+ | Encoder interface | 1. Supporting Sin/Cos encoders<br>2. SINA/SINB/SINC/SIND 0.6–1.2Vpp; SINR 0.2–0.85Vpp<br>3. Max. frequency response of A/B signals: 200 kHz<br>Max. frequency response of C/D signals: 1 kHz |
| A1- | | |
| B1+ | | |
| B1- | | |
| R1+ | | |
| R1- | | |
| C1+ | | |
| C1- | | |
| D1+ | | |
| D1- | | |
| A2+ | Pulse reference | 1. Supporting 5V differential signal<br>2. Frequency response: 200 kHz |
| A2- | | |
| B2+ | | |
| B2- | | |
| Z2+ | | |
| Z2- | | |
| AO+ | Frequency-divided output | 1. Differential output of 5 V<br>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- | | |

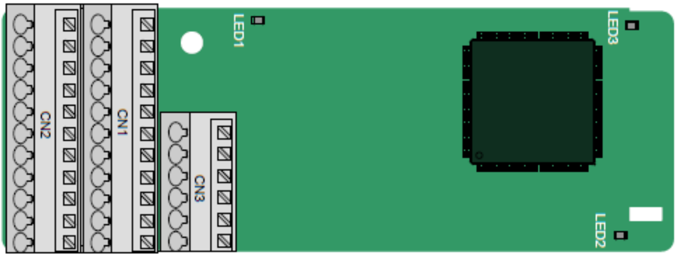
The following figure shows the external wiring of the PG card when it is used in combination with an encoder without CD signals.




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



### A.8.2 UVW incremental PG card (HD2-E-PGI)




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 | Name | Description |
|---|---|---|
| LED1 | Disconnection indicator | This indicator blinks only if A1 or B1 signal is disconnected during encoder rotating; and it is on in other cases. |
| LED2 | State indicator | On: The expansion card is establishing a connection with the control board.<br>Blinking periodically: The expansion card is properly connected to the control board (the period is 1s, on for 0.5s, and off for the other 0.5s).<br>Off: The expansion card is disconnected from the control board. |
| LED3 | Power indicator | On: The control board feeds power to the PG card. |

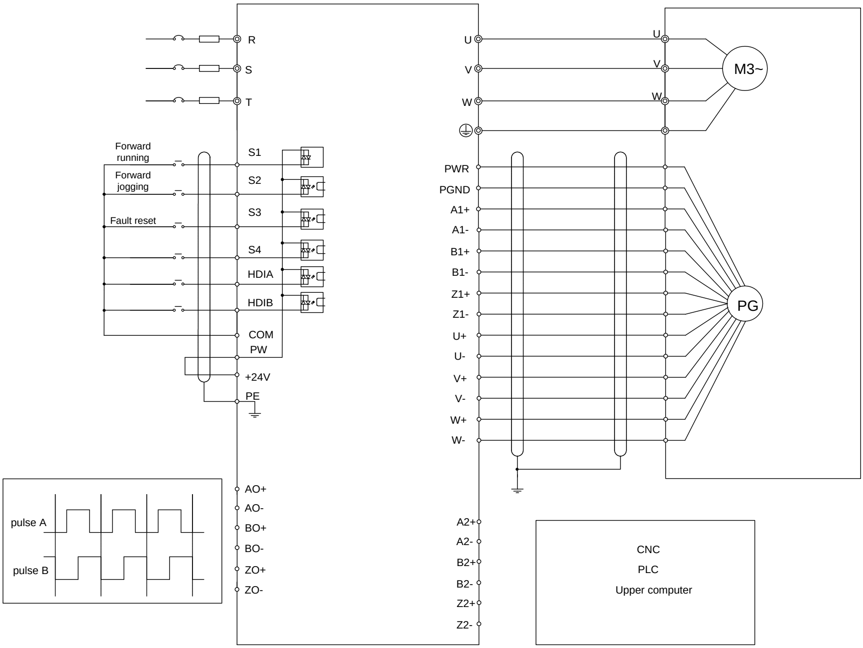
The HD2-E-PGI expansion card supports the input of absolute position signals and integrates the advantages of absolute and incremental encoders. It is user-friendly, adopting spring terminals.

**HD2-E-PGI terminal function description**

| Signal | Port | Description |
|---|---|---|
| PWR | Encoder power | Voltage: 5 V±5%<br>Max. current: 200 mA |
| PGND | | |
| A1+ | Encoder interface | 1. Differential incremental PG interface of 5 V<br>2. Response frequency: 400 kHz |
| A1- | | |
| B1+ | | |

| Signal | Port | Description |
|---|---|---|
| B1- | | |
| Z1+ | | |
| Z1- | | |
| A2+ | Pulse setting | 1. Differential input of 5 V<br>2. Response frequency: 200 kHz |
| A2- | | |
| B2+ | | |
| B2- | | |
| Z2+ | | |
| Z2- | | |
| AO+ | Frequency-divided output | 1. Differential output of 5 V<br>2. Supporting frequency division of 1–255, which can be set through P20.16 or P24.16 |
| AO- | | |
| BO+ | | |
| BO- | | |
| ZO+ | | |
| ZO- | | |
| U+ | UVW encoder interface | 1. Absolute position (UVW information) of the hybrid encoder, differential input of 5 V<br>2. Response frequency: 40 kHz |
| U- | | |
| V+ | | |
| V- | | |
| W+ | | |
| W- | | |

The following figure shows the external wiring of the HD2-E-PGI expansion card.




### A.8.3 Resolver PG card (HD2-E-PGR)


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

**Indicator definition**

| Indicator | Name | Description |
|---|---|---|
| LED1 | State indicator | On: The expansion card is establishing a connection with the control board.<br>Blinking periodically: The expansion card is properly connected to the control board (the period is 1s, on for 0.5s, and off for the other 0.5s). |

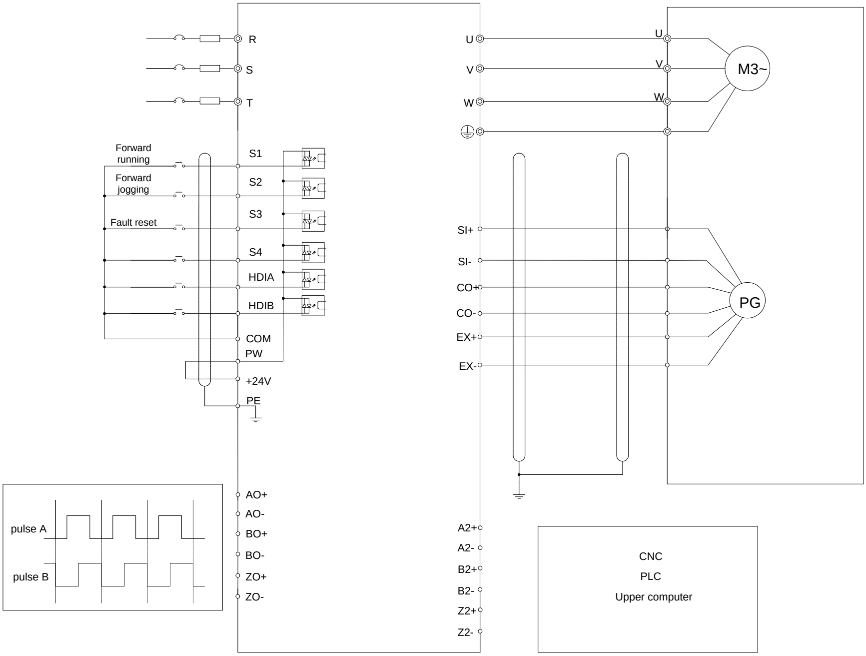
| Indicator | Name | Description |
|---|---|---|
| | | Off: The expansion card is disconnected from the control board. |
| LED2 | Disconnection indicator | Off: The encoder is disconnected.<br>On: The encoder signals are normal.<br>Blinks: The encoder signals are not stable. |
| LED3 | Power indicator | On: The control board feeds power to the PG card. |

The HD2-E-PGR expansion card can be used in combination with a resolver of excitation voltage 7 Vrms. It is user-friendly, adopting spring terminals.

**HD2-E-PGR terminal function description**

| Signal | Port | Description |
|---|---|---|
| SI+ | Encoder signal input | Recommended resolver transformation ratio: 0.5 |
| SI- | | |
| CO+ | | |
| CO- | | |
| EX+ | Encoder excitation signal | 1. Factory setting of excitation: 10 kHz<br>2. Supporting resolvers with an excitation voltage of 7 Vrms |
| EX- | | |
| A2+ | Pulse setting | 1. Differential input of 5 V<br>2. Response frequency: 200 kHz |
| A2- | | |
| B2+ | | |
| B2- | | |
| Z2+ | | |
| Z2- | | |
| AO+ | Frequency-divided output | 1. Differential output of 5 V<br>2. Frequency-divided output of resolver simulated A1, B1, and Z1, which is equal to an incremental PG card of 1024 pps.<br>3. Supporting frequency division of $2^N$, which can be set through P20.16 or P24.16<br>4. Max. output frequency: 200 kHz |
| AO- | | |
| BO+ | | |
| BO- | | |
| ZO+ | | |
| ZO- | | |

The following figure shows the external wiring of the HD2-E-PGR expansion card.




### A.8.4 Multifunction incremental PG card (HD2-E-PGIM)


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 | Name | Description |
|---|---|---|
| LED1 | State indicator | On: The expansion card is establishing a connection with the control board.<br>Blinking periodically: The expansion card is |

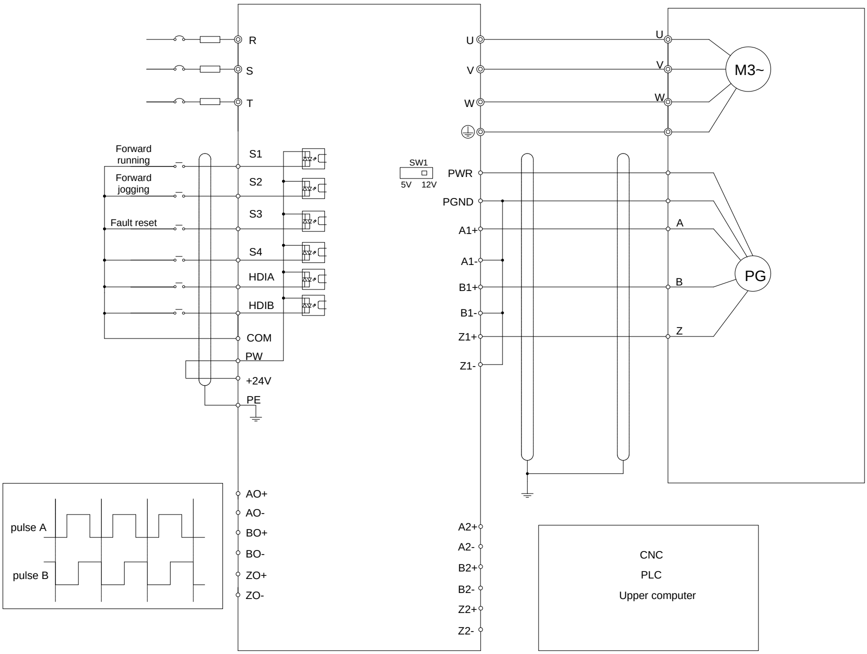
| Indicator | Name | Description |
|---|---|---|
| | | properly connected to the control board (the period is 1s, on for 0.5s, and off for the other 0.5s).<br>Off: The expansion card is disconnected from the control board. |
| LED2 | Disconnection indicator | This indicator blinks only if A1 or B1 signal is disconnected during encoder rotating; and it is on in other cases. |
| LED3 | Power indicator | On: The control board feeds power to the PG card. |

The HD2-E-PGIM expansion card can be used in combination with multiple types of incremental encoders through different modes of wiring. It is user-friendly, adopting spring terminals.

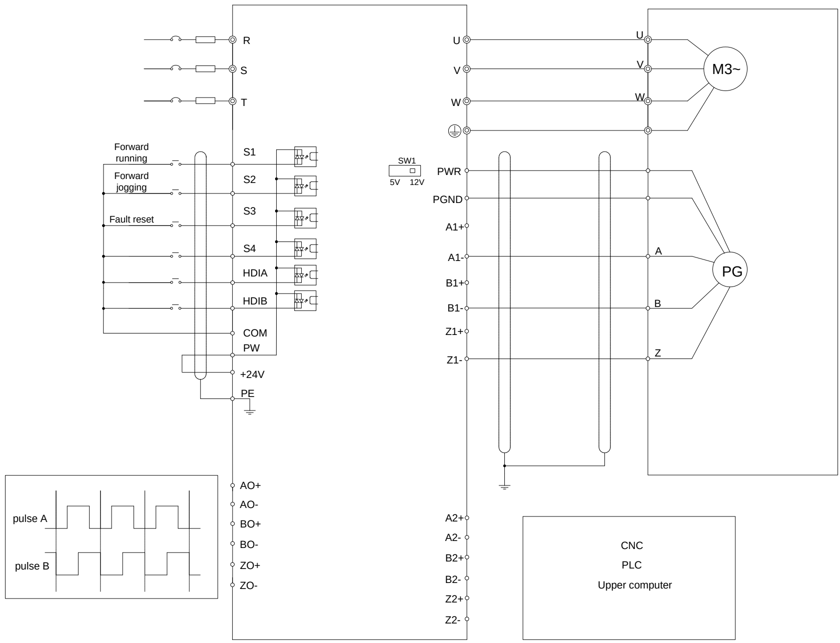
**HD2-E-PGIM terminal function description**

| Signal | Port | Description |
|---|---|---|
| PWR | Encoder power | Voltage: 5 V/12 V ±5%<br>Max. output: 150 mA<br>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<br>2. Supporting open collector interfaces of 5 V/12 V<br>3. Supporting differential interfaces of 5 V<br>4. Response frequency: 200 kHz |
| A1- | | |
| B1+ | | |
| B1- | | |
| Z1+ | | |
| Z1- | | |
| A2+ | Pulse setting | 1. Supporting the same signal types as the encoder signal types<br>2. Response frequency: 200 kHz |
| A2- | | |
| B2+ | | |
| B2- | | |
| Z2+ | | |
| Z2- | | |
| AO+ | Frequency-divided output | 1. Differential output of 5 V<br>2. Supporting frequency division of 1–255, which can be set through P20.16 or P24.16 |
| AO- | | |
| BO+ | | |
| BO- | | |
| ZO+ | | |
| ZO- | | |

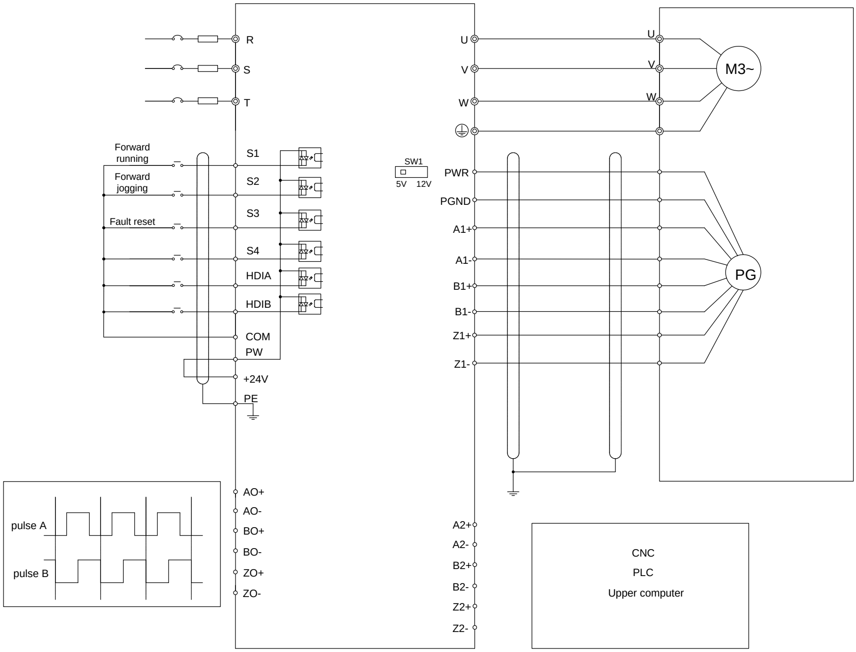
The following figure shows the external wiring of the expansion card used in combination with an open collector encoder. A pull-up resistor is configured inside the PG card.



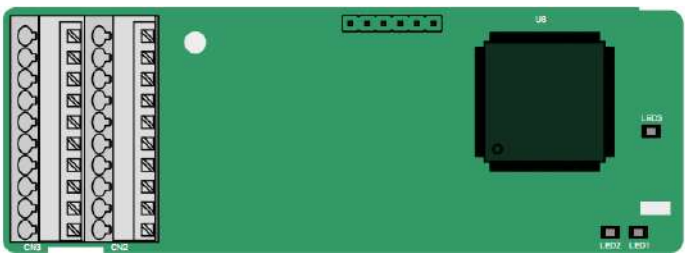
The following figure shows the external wiring of the expansion card used in combination with a push-pull encoder.



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




### A.8.5 24V incremental PG card (HD2-E-PGIM24)



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**

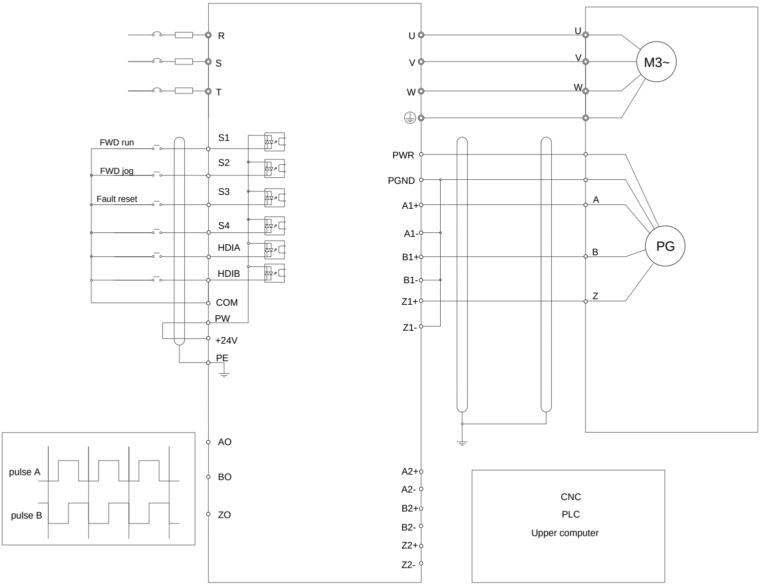
| Indicator | Name | Description |
|---|---|---|
| LED1 | State indicator | On: The expansion card is establishing a connection with the control board.<br>Blinking periodically: The expansion card is properly connected to the control board (the period is 1s, on for 0.5s, and off for the other 0.5s).<br>Off: The expansion card is disconnected from the control board. |
| LED2 | Disconnection indicator | This indicator blinks only if A1 or B1 signal is disconnected during encoder rotating; and it is on in other cases. |
| LED3 | Power indicator | On: The control board feeds power to the PG card. |

HD2-E-PGIM24 can work in combination with multiple types of incremental encoders through various external wiring modes. It is user-friendly, adopting spring terminals.

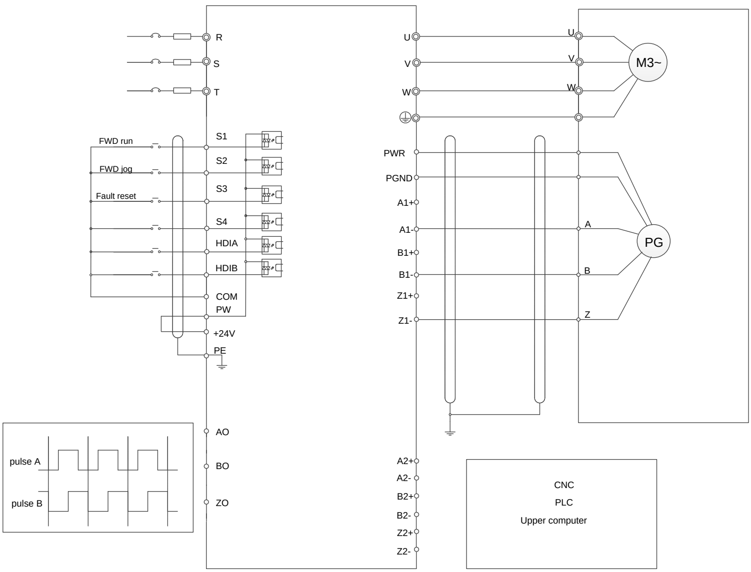
**HD2-E-PGIM24 terminal function description**

| Signal | Port | Description |
|---|---|---|
| PWR | Encoder power supply | Voltage: 24 V ± 5%<br>Max. output current: 150 mA |
| PGND | | |
| A1+ | Encoder interface | 1. Supporting 24 V push-pull interfaces<br>2. Supporting 24 V open collector interfaces<br>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<br>2. Frequency response: 200 kHz |
| A2- | | |
| B2+ | | |
| B2- | | |
| Z2+ | | |
| Z2- | | |
| AO | Frequency-divided output | 1. Open collector output<br>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.



# Appendix B Technical Data

## B.1 What this chapter contains

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

## B.2 Derated application

### B.2.1 Capacity

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

**Note:**

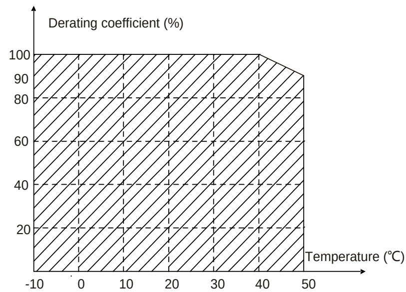
- The maximum allowable shaft power of the motor is limited to 1.5 times the rated power of the motor. If the limit is exceeded, the inverter automatically restricts the torque and current of the motor. This function effectively protects the input shaft against overload.
- The rated capacity is the capacity 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 inverter installation site exceeds 40°C, the inverter installation site altitude exceeds 1000m, a cover with heat dissipation vents is used, or the carrier frequency is higher than the recommended, the inverter 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 inverter 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 inverter is installed is lower than 1000 m, the inverter can run at the rated power. When the altitude exceeds 1000 m, derate 1% for every additional 100 m. When the installation site altitude exceeds 3000 m, consult the local IMO dealer or office.

#### B.2.2.3 Derating due to carrier frequency

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

## B.3 Grid specifications

| | |
|---|---|
| **Grid voltage** | AC 3PH 380V (-15%)–440V (+10%)<br>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 inverter is applicable to scenarios where the transmitted current in the circuit is no larger than 100 kA when the inverter 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 (Motor rated voltage), 3PH symmetrical, Umax (inverter rated voltage) 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 Ratings. |
| **Power limit** | 1.5 times the motor rated power |
| **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) |
|---|---|
| Second environment (C3) | 30 |

You can learn the maximum length of the motor cable through the running parameters of the inverter. To understand the accurate maximum cable length for using an external EMC filter, contact the local IMO 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 inverters comply with.

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

### B.5.1 CE marking

The CE marking on the name plate of a inverter indicates that the inverter 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 inverters.

Application environment categories:

First environment: Any residential area where the inverter is directly connected to a public low-voltage supply without an intermediate transformer.

Second environment: All locations outside residentaial areas.

inverter categories:

C1: Rated voltage lower than 1000 V, applied to the first environment.

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

**Note:** The EMC standard IEC/EN 61800-3 no longer restricts the power distribution of inverters, 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 the second environment. They cannot be applied to the first environment.

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

### B.6.1 inverter category 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 inverter according to the description in the manual.
4. For the maximum length of the motor cable, see section "EMC compatibility and motor cable length".

### B.6.2 inverter category C3

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

The induction disturbance limit meets the following stipulations:

1. Select an optional EMC filter according to Appendix D Optional Peripheral Accessories and install it following the description in the EMC filter manual.
2. Select the motor and control cables according to the description in the manual.
3. Install the inverter according to the description in the manual.
4. For the maximum length of the motor cable, see section "EMC compatibility and motor cable length".

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

# Appendix C Dimension Drawings

## C.1 What this chapter contains

This chapter describes the inverter dimension drawings. The dimension unit used in the drawings is millimeter (mm).

## C.2 Keypad structure

### C.2.1 Structure diagram

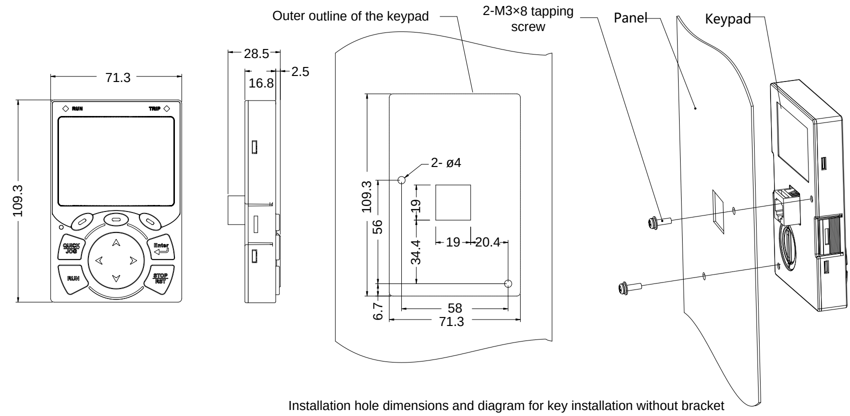
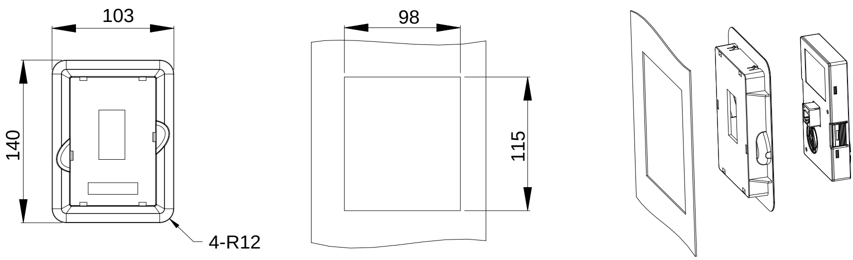



Figure C-1 Keypad structure diagram

### C.2.2 Keypad installation bracket

**Note:** You can directly use M3 threaded screws or a keypad bracket to install the keypad externally. For the 380V 1.5–75kW inverter models, you need to use optional keypad installation brackets. For the 380V 90–500kW and the 660V 22–630kW inverter models, you can either use optional brackets or install the standard keypad brackets externally.




Keypad adapter bracket Installation dimensions

Figure C-2 Keypad installation bracket (optional) for 380V 1.5–500kW and 660V 22–630kW models

## C.3 Inverter structure

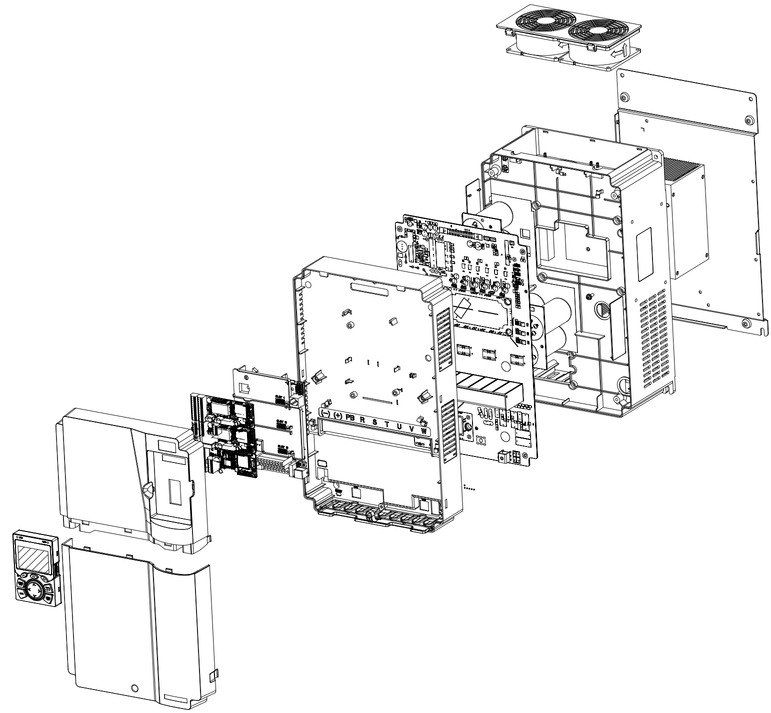



Figure C-3 inverter structure diagram

## C.4 Dimensions of AC 3PH 380V (-15%)–440V (+10%)

### C.4.1 Wall mounting dimensions

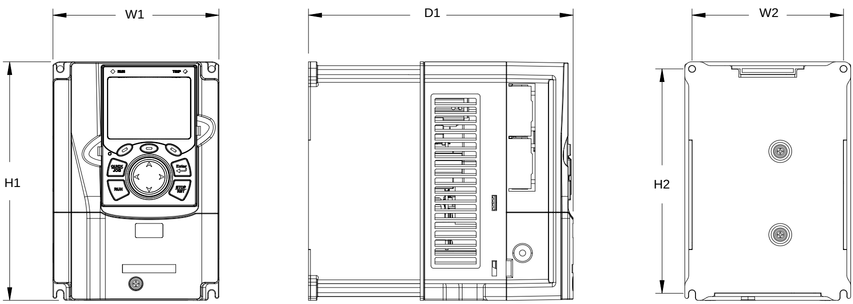



Figure C-4 Wall mounting diagram for 380V 1.5–37kW models

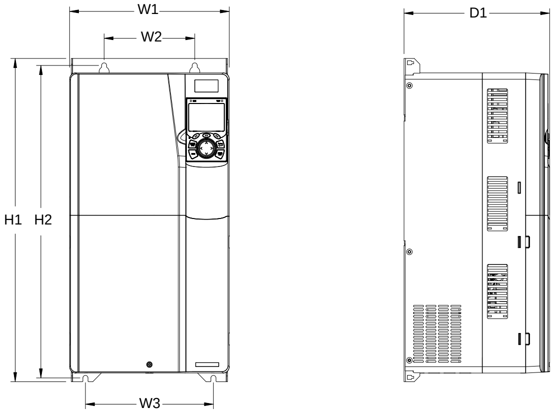



Figure C-5 Wall mounting diagram for 380V 45–75kW models

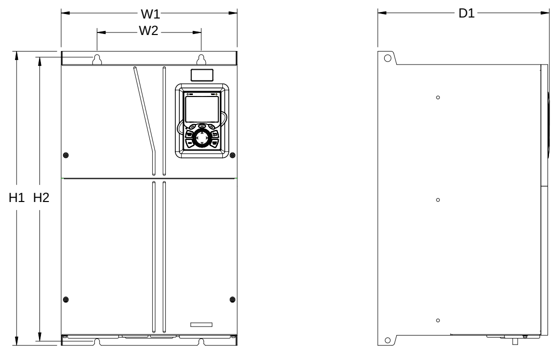



Figure C-6 Wall mounting diagram for 380V 90–110kW models

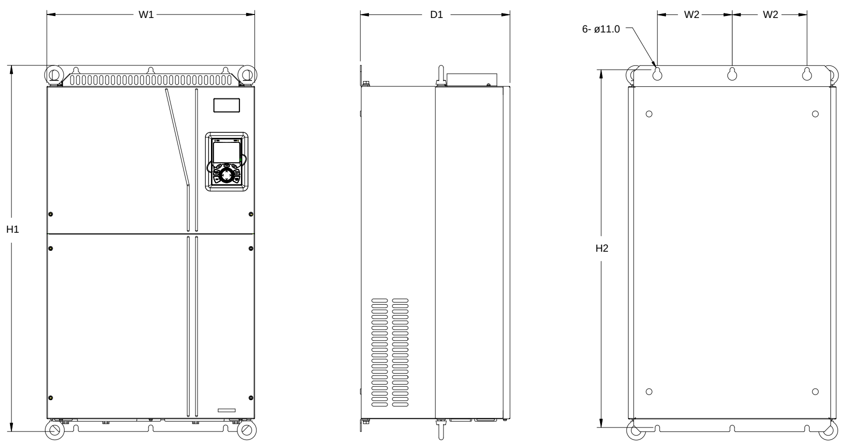



Figure C-7 Wall mounting diagram for 380V 132–200kW models

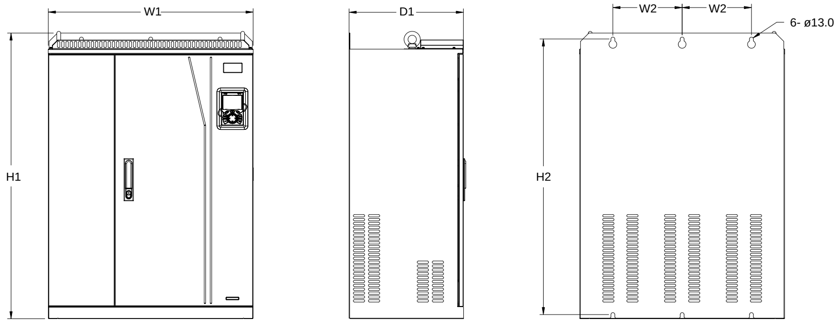



Figure C-8 Wall mounting diagram for 380V 220–315kW models

Table C–1 Wall mounting dimensions of 380V inverter models (unit: mm)

| Inverter model | W1 | W2 | W3 | H1 | H2 | D1 | Mounting 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 mounting dimensions

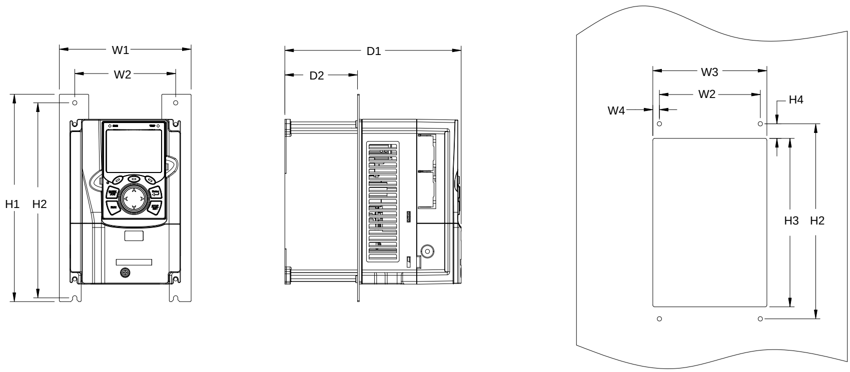



Figure C-9 Flange mounting diagram for 380V 1.5–75kW models

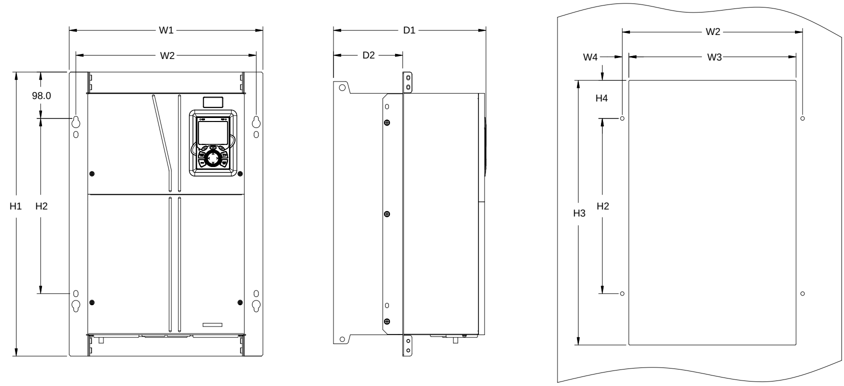



Figure C-10 Flange mounting diagram for 380V 90–110kW models

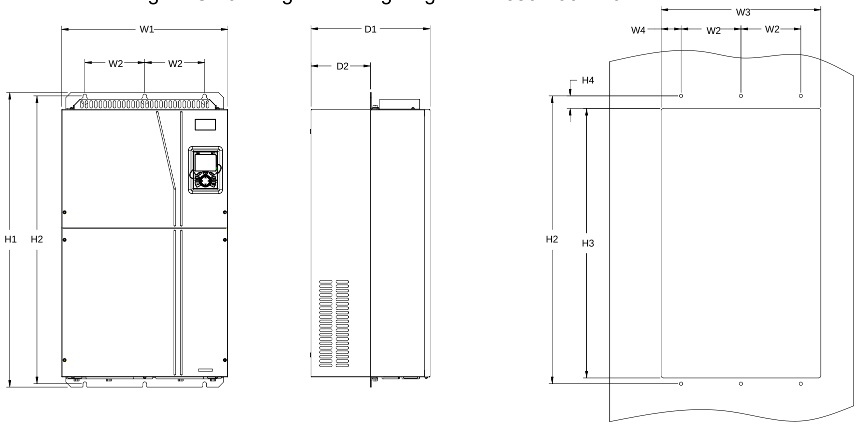



Figure C-11 Flange mounting diagram for 380V 132–200kW models

Table C–2 Flange mounting dimensions of 380V inverters (unit: mm)

| **Inverter model** | **W1** | **W2** | **W3** | **W4** | **H1** | **H2** | **H3** | **H4** | **D1** | **D2** | **Mounting 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 mounting dimensions

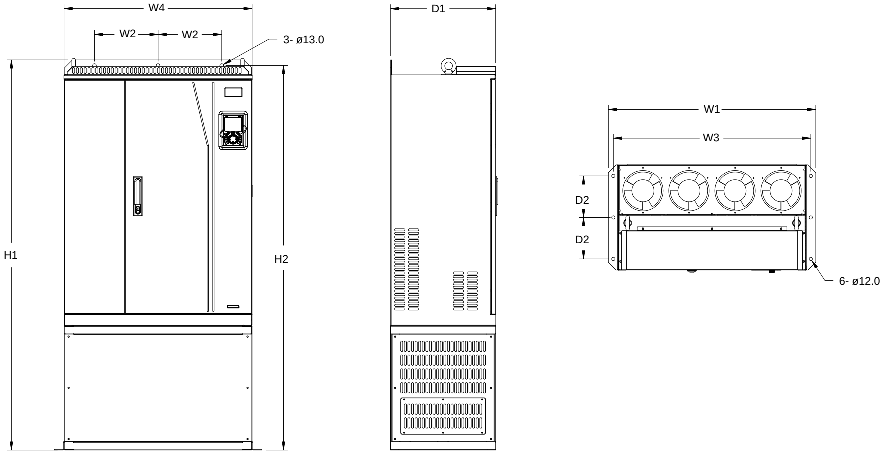



Figure C-12 Floor mounting diagram for 380V 220–315kW models

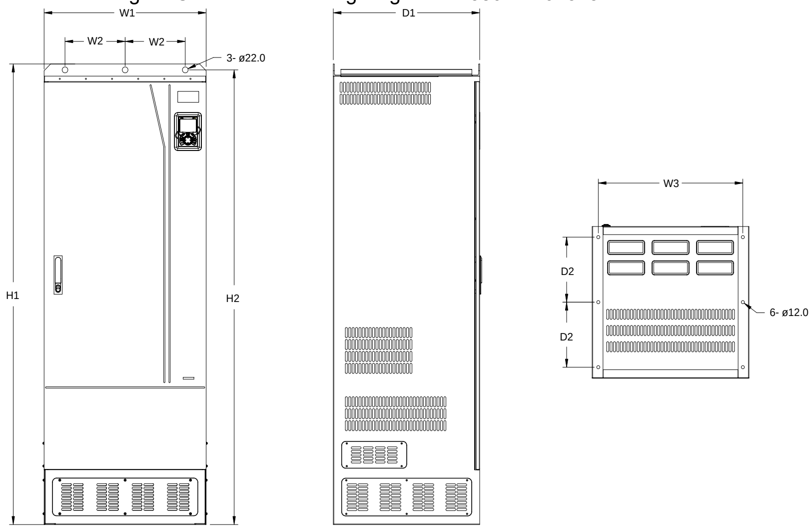



Figure C-13 Floor mounting diagram for 380V 355–500kW models

Table C–3 Floor mounting dimensions of 380V inverter models (unit: mm)

| Inverter model | W1 | W2 | W3 | W4 | H1 | H2 | D1 | D2 | Mounting 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 for parallel inverters

### C.5.1 Dimensions with the recommended mounting method

**Note:** The recommended mounting method for parallel inverters facilitates internal air intake and better heat dissipation, but the installation size is larger.

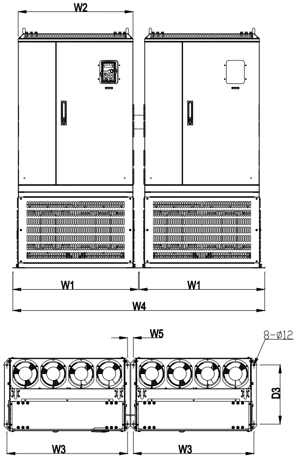



Figure C-14 Parallel mounting diagram for 380V 560–630kW and for 660V 710kW

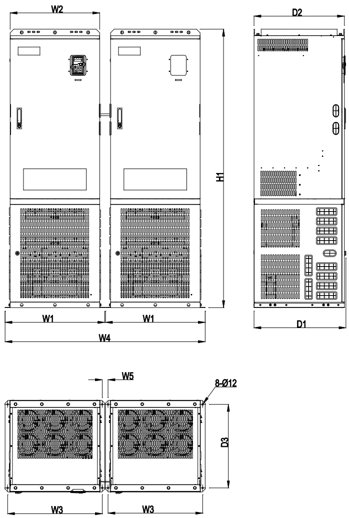



Figure C-15 Parallel mounting diagram for 380V 710–3000kW and for 660V 800-3000kW

Table C–4 Dimensions of mounting parallel 380V inverters with recommended method (Unit: mm)

| Inverter model | W1 | W2 | W3 | W4 | W5 | H1 | H2 | D1 | D2 | D3 | Mounting hole |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 560–630kW | 749 | 685 | 719 | 1503 | 35 | 1419.9 | 1356 | 442.5 | 429.5 | 350 | Ø 12 |
| 710–1000kW | 690 | 620 | 655 | 1385 | 40 | 1900 | - | 636.3 | 625.5 | 570 | Ø 12 |
| 1200–1500kW | 690 | 620 | 655 | 2080 | 40 | 1900 | - | 636.3 | 625.5 | 570 | Ø 12 |
| 2000kW | 690 | 620 | 655 | 2775 | 40 | 1900 | - | 636.3 | 625.5 | 570 | Ø 12 |
| 2500kW | 690 | 620 | 655 | 3470 | 40 | 1900 | - | 636.3 | 625.5 | 570 | Ø 12 |
| 3000kW | 690 | 620 | 655 | 4165 | 40 | 1900 | - | 636.3 | 625.5 | 570 | Ø 12 |

### C.5.2 Dimensions with the close mounting method

**Note:** The close mounting method for parallel inverters has a smaller size, which will affect the internal air intake of the product but meet the product cooling effect.

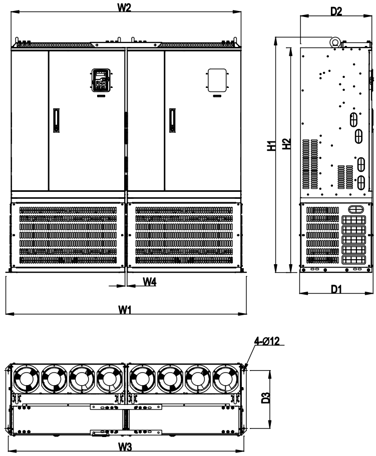



Figure C-16 Parallel mounting diagram for 380V 560–630kW and 660V 710kW

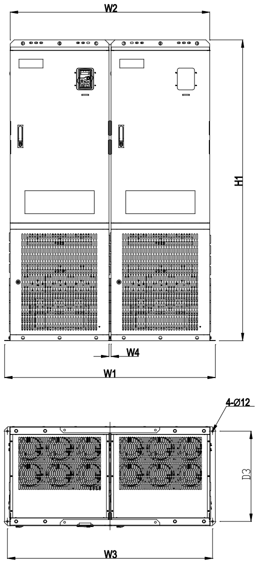



Figure C-17 Parallel mounting diagram for 380V 710–3000kW and 660V 800–3000kW

Table C–5 Dimensions of closely mounting parallel 380V inverters (Unit: mm)

| Inverter model | W1 | W2 | W3 | W4 | H1 | H2 | D1 | D2 | D3 | Mounting hole |
|---|---|---|---|---|---|---|---|---|---|---|
| **560–630kW** | 1447 | 1383 | 1417 | 13 | 1419.9 | 1356 | 442.5 | 429.5 | 350 | Ø12 |
| **710–1000kW** | 1323 | 1253 | 1288 | 13 | 1900 | - | 636.3 | 625.5 | 570 | Ø12 |
| **1200–1500kW** | 1956 | 1886 | 1921 | 13 | 1900 | - | 636.3 | 625.5 | 570 | Ø12 |
| **2000kW** | 2589 | 2519 | 2554 | 13 | 1900 | - | 636.3 | 625.5 | 570 | Ø12 |
| **2500kW** | 3222 | 3152 | 3187 | 13 | 1900 | - | 636.3 | 625.5 | 570 | Ø12 |
| **3000kW** | 3855 | 3785 | 3820 | 13 | 1900 | - | 636.3 | 625.5 | 570 | Ø12 |

Table C–6 Dimensions of closely mounting parallel 660V inverters (Unit: mm)

| Inverter model | W1 | W2 | W3 | W4 | H1 | H2 | D1 | D2 | D3 | Mounting hole |
|---|---|---|---|---|---|---|---|---|---|---|
| **710kW** | 1447 | 1383 | 1417 | 13 | 1419.9 | 1356 | 442.5 | 429.5 | 350 | Ø 12 |
| **800–1200kW** | 1323 | 1253 | 1288 | 13 | 1900 | - | 636.3 | 625.5 | 570 | Ø 12 |
| **1500kW** | 1956 | 1886 | 1921 | 13 | 1900 | - | 636.3 | 625.5 | 570 | Ø 12 |
| **2000–2500kW** | 2589 | 2519 | 2554 | 13 | 1900 | - | 636.3 | 625.5 | 570 | Ø 12 |
| **3000kW** | 3222 | 3152 | 3187 | 13 | 1900 | - | 636.3 | 625.5 | 570 | Ø 12 |

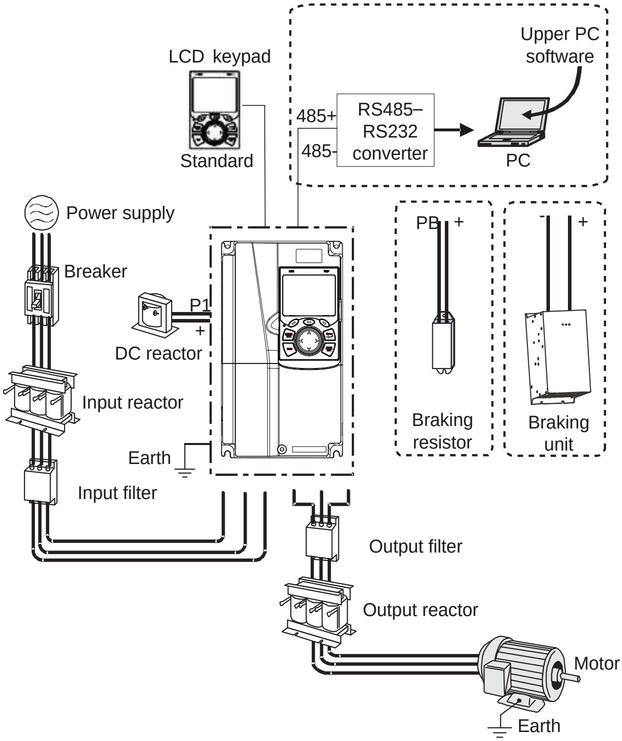
# Appendix D Optional Peripheral Accessories

## D.1 What this chapter contains

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

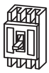
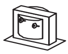
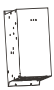
## D.2 Wiring of peripheral accessories

The following figure shows the external wiring of the inverter.




**Note:**

- The 380V 37kW and lower models are equipped with built-in braking units, and the 380V 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 and all 660V models, which enable the inverters to be directly connected to external DC reactors.
- The braking units are IMO 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 inverters and can restrict high-order harmonics, and of which the rated sensitive current for one inverter is larger than 30mA. |
|  | Input reactor | Accessories used to improve the current adjustment coefficient on the input side of the inverter, and thus restrict high-order harmonic currents.<br>The 380V 132kW and higher inverter models and all 660V inverter models can be directly connected to external DC reactors. |
|  | DC reactor | |
|  | Input filter | Accessory that restricts the electromagnetic interference generated by the inverter and transmitted to the public grid through the power cable. Try to install the input filter near the input terminal side of the inverter. |
|  or  | Braking unit or braking resistor | Accessories used to consume the regenerative energy of the motor to reduce the deceleration time.<br>The 380V 37kW and lower inverter models only need external braking resistors. The 380V 132kW and higher and all 660V inverter models also need braking units. The 380V 45kW–110kW inverter models can be configured with built-in braking units. |
|  | Output filter | Accessory used to restrict interference generated in the wiring area on the output side of the inverter. Try to install the output filter near the output terminal side of the inverter. |
|  | Output reactor | Accessory used to lengthen the valid transmission distance of the inverter, which effectively restrict the transient high voltage generated during the switch-on and switch-off of the IGBT module of the inverter. |

## D.3 Power supply

Refer to chapter 4 Installation Guide.

| | |
|---|---|
|  | ✧ Ensure that the voltage class of the inverter is consistent with that of the grid. |

## D.4 Cables

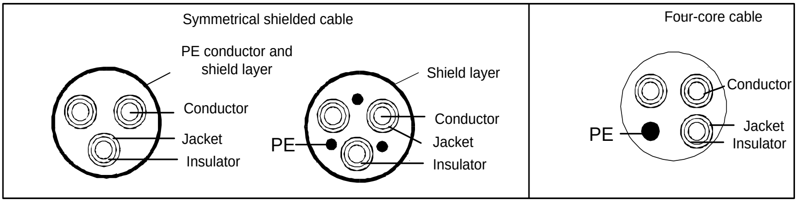
### D.4.1 Power cables

The sizes of the input power cable, 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).

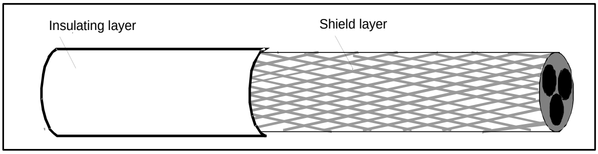
Four-core cables can be used as input cables, but symmetrical shielded cables are recommended. Compared with four-core cables, symmetrical shielded cables can reduce electromagnetic radiation as well as the current and loss of the motor cables.




**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.

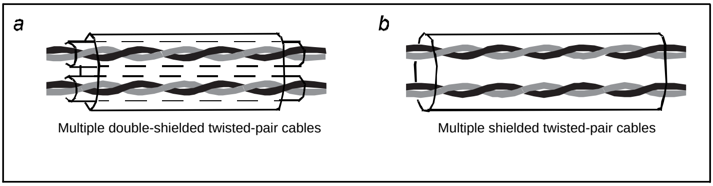
To effectively restrict the emission and conduction of radio frequency (RF) interference, the conductivity of the shielded cable must at least be 1/10 of the conductivity of the phase conductor. This requirement can be well met by a copper or aluminum shield layer. The following figure shows the minimum requirement on motor cables of an inverter. 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 inverter or its components. Insulation and voltage endurance tests have been performed between the main circuit and chassis of each inverter before delivery. In addition, voltage limiting circuits that can automatically cut off the test voltage are configured inside the inverters.

**Note:** Check the insulation conditions of the input power cable of an inverter according to the local regulations before connecting it.

### D.4.3 Recommended cable sizes

Table D–1 AC 3PH 380V (-15%)–440V (+10%)

| Inverter model | Recommended cable size (mm²) | | | | Screw | |
|---|---|---|---|---|---|---|
| | R, S, T U, V, W | PE | P1, (+) | PB, (+), (-) | Terminal screw | Fastening torque (Nm) |
| HD2-3.7A-43 | 1.0 | 1.0 | 1.0 | 1.0 | M4 | 1.2–1.5 |
| HD2-5A-43 | 1.0 | 1.0 | 1.0 | 1.0 | M4 | 1.2–1.5 |

| Inverter model | Recommended cable size (mm²) | | | | Screw | |
|---|---|---|---|---|---|---|
| | R, S, T U, V, W | PE | P1, (+) | PB, (+), (-) | Terminal screw | Fastening torque (Nm) |
| HD2-9.5A-43 | 1.5 | 1.5 | 1.5 | 1.5 | M4 | 1.2–1.5 |
| HD2-14A-43 | 1.5 | 1.5 | 1.5 | 1.5 | M5 | 2–2.5 |
| HD2-18.5A-43 | 2.5 | 2.5 | 2.5 | 2.5 | M5 | 2–2.5 |
| HD2-25A-43 | 4 | 4 | 4 | 4 | M5 | 2–2.5 |
| HD2-32A-43 | 6 | 6 | 6 | 6 | M5 | 2–2.5 |
| HD2-38A-43 | 10 | 10 | 10 | 10 | M6 | 4–6 |
| HD2-45A-43 | 10 | 10 | 10 | 10 | M6 | 4–6 |
| HD2-60A-43 | 16 | 16 | 16 | 16 | M8 | 9–11 |
| HD2-75A-43 | 25 | 16 | 25 | 25 | M8 | 9–11 |
| HD2-92A-43 | 25 | 16 | 25 | 25 | M8 | 9–11 |
| HD2-115A-43 | 35 | 16 | 35 | 35 | M10 | 18–23 |
| HD2-150A-43 | 50 | 25 | 50 | 50 | M10 | 18–23 |
| HD2-180A-43 | 70 | 35 | 70 | 70 | M10 | 18–23 |
| HD2-215A-43 | 95 | 50 | 95 | 95 | 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%)

| Inverter model | Recommended cable size (mm²) | | | | Screw | |
|---|---|---|---|---|---|---|
| | R, S, T U, V, W | PE | P1, (+) | PB, (+), (-) | Terminal screw | Fastening torque (Nm) |
| HD2-45A-43 | 4 | 4 | 4 | 4 | M8 | 9–11 |
| HD2-60A-43 | 6 | 6 | 6 | 6 | M8 | 9–11 |
| HD2-75A-43 | 6 | 6 | 6 | 6 | M8 | 9–11 |
| HD2-92A-43 | 10 | 10 | 10 | 10 | M8 | 9–11 |
| HD2-115A-43 | 16 | 16 | 16 | 16 | M10 | 18–23 |
| HD2-150A-43 | 16 | 16 | 16 | 16 | M10 | 18–23 |
| HD2-180A-43 | 16 | 16 | 16 | 16 | M10 | 18–23 |
| HD2-215A-43 | 25 | 16 | 25 | 25 | M10 | 18–23 |

**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.

### D.4.4 Cable sizes for parallel inverters

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

| Total power (kW) | 380V parallel Inverter requirement | | Recommended copper-core cable size for a single inverter (mm²) | | |
|---|---|---|---|---|---|
| | Power (kW) | Quantity | RST UVW | PE | (+)(-) |
| 560 | 280 | 2 | 95*4P | 95*2P | 120*2P |
| 630 | 315 | 2 | 95*4P | 95*2P | 150*2P |
| 710 | 350 | 2 | 95*4P | 95*2P | 150*2P |
| 800 | 400 | 2 | 150*4P | 150*2P | 120*3P |
| 1000 | 500 | 2 | 150*4P | 150*2P | 150*3P |
| 1200 | 400 | 3 | 150*4P | 150*2P | 120*3P |
| 1500 | 500 | 3 | 150*4P | 150*2P | 150*3P |
| 2000 | 500 | 4 | 150*4P | 150*2P | 150*3P |
| 2500 | 500 | 5 | 150*4P | 150*2P | 150*3P |
| 3000 | 500 | 6 | 150*4P | 150*2P | 150*3P |

**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.

### D.4.5 Cable configuration for parallel inverters

| | Master | Slave 1 | Slave 2 | Slave 3 | Slave 4 | Slave 5 |
|---|---|---|---|---|---|---|
| RST input cable | User provided | User provided | User provided | User provided | User provided | User provided |
| UVW output cable | User provided | User provided | User provided | User provided | User provided | User provided |

| | Master | Master–Slave 1 | Slave 1–Slave 2 | Slave 2–Slave 3 | Slave 3–Slave 4 | Slave 4–Slave 5 |
|---|---|---|---|---|---|---|
| Bus cable of (+) and (-) | - | Standard | Standard | Standard | Standard | Standard |

| | Master | Master–Slave 1 | Master–Slave 2 | Master–Slave 3 | Master–Slave 4 | Master–Slave 5 |
|---|---|---|---|---|---|---|
| Optical fiber cable | Standard | Standard | Standard | Standard | Standard | Standard |
| 15-core serial port cable | Standard | Standard | Standard | Standard | Standard | Standard |

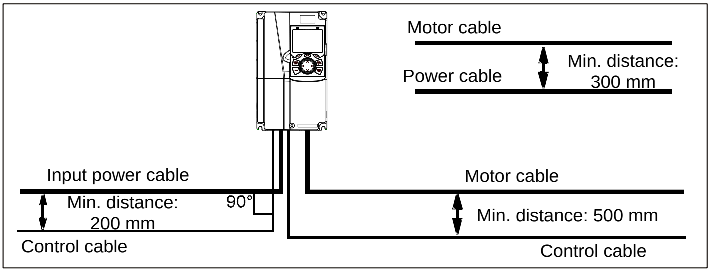
### D.4.6 Cable arrangement

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

If a control cable and power cable must cross each other, ensure that the angle between them is 90 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.4.7 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 inverter.
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 inverter. 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 inverter 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 inverter can be effectively cut off when a system fault occurs.

### D.5.1 For a single inverter

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

| Inverter model | Breaker rated current (A) | Fast-acting fuse rated current (A) | Contactor rated current (A) |
|---|---|---|---|
| HD2-3.7A-43 | 6 | 10 | 9 |
| HD2-5A-43 | 10 | 10 | 9 |
| HD2-9.5A-43 | 20 | 20 | 18 |
| HD2-14A-43 | 25 | 35 | 25 |
| HD2-18.5A-43 | 32 | 40 | 32 |
| HD2-25A-43 | 50 | 50 | 38 |
| HD2-32A-43 | 63 | 60 | 50 |
| HD2-38A-43 | 63 | 70 | 65 |
| HD2-45A-43 | 80 | 90 | 80 |
| HD2-60A-43 | 100 | 125 | 80 |
| HD2-75A-43 | 125 | 125 | 98 |
| HD2-92A-43 | 140 | 150 | 115 |
| HD2-115A-43 | 180 | 200 | 150 |
| HD2-150A-43 | 225 | 250 | 185 |
| HD2-180A-43 | 250 | 300 | 225 |
| HD2-215A-43 | 315 | 350 | 265 |

**Note:** The accessory specifications described in the preceding table are ideal values. You can select accessories based on the actual market conditions but try not to use those with lower values.

### D.5.2 For parallel inverters

The following tables lists the fuse/breaker model selection for the inverters to be paralleled. The current of the fuse/breaker for a parallel inverter system is twice the rated current of the parallel inverter system.

Table D–5 AC 3PH 380V (-15%) ~440V (+10%)

| Inverter model | Breaker rated current (A) | Fast-acting fuse rated current (A) | Contactor rated current (A) |
|---|---|---|---|
| 280 kW | 1500 | 1000 | 780 |
| 315 kW | 1740 | 1200 | 900 |
| 350 kW | 1860 | 1280 | 960 |
| 400 kW | 2010 | 1380 | 1035 |
| 500 kW | 2505 | 1720 | 1290 |

Table D–6 AC 3PH 520V (-15%) ~690V (+10%)

| Inverter model | Breaker rated current (A) | Fast-acting fuse rated current (A) | Contactor rated current (A) |
|---|---|---|---|
| 350 kW | 1110 | 630 | 580 |
| 400 kW | 1230 | 800 | 630 |
| 500 kW | 1500 | 1000 | 780 |
| 630 kW | 2010 | 1380 | 1035 |

## 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 inverter 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 inverter 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 an inverter 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 50 m, an output reactor must be added on the output side of the inverter. If the distance between the inverter and motor is 50 m to 100 m, select the reactor according to the following table. If the distance is longer than 100m, contact IMO's technical support technicians.

DC reactors can be directly connected to the 380V 132kW and higher and all 660V inverter models. DC reactors can improve the power factor, avoid damage to bridge rectifiers caused due to large input current of the inverter when large-capacity transformers are connected, and avoid damage to the rectification circuit caused due to harmonics generated by grid voltage transients or phase-control loads.

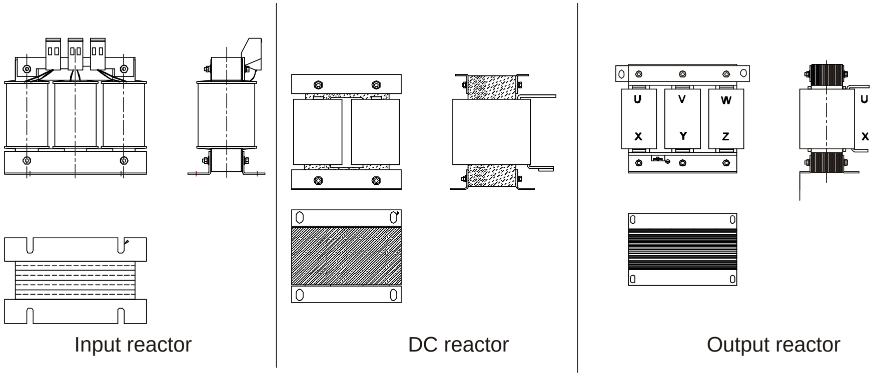



Figure D-1 Vertical reactor diagram for 380V 315kW and lower and 660V 350kW and lower

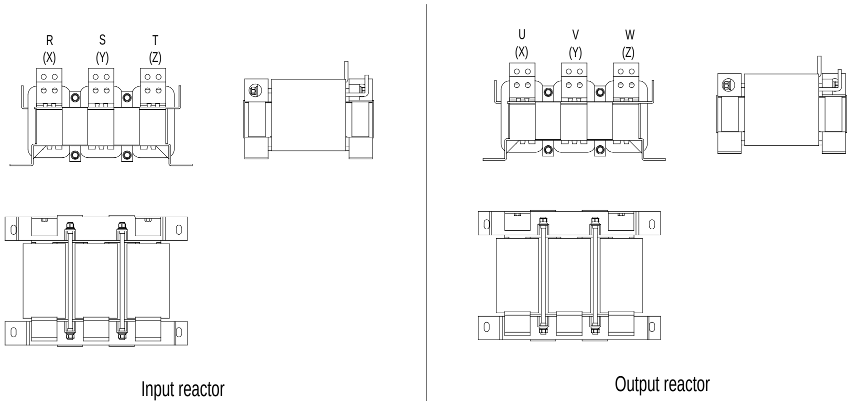



Figure D-2 Horizontal reactor diagram for 380V 350–500kW and 660V 400–630kW

### D.6.1 For a single inverter

Table D–7 Reactors for AC 3PH 380V (-15%)–440V (+10%)

| Inverter model | Input reactor | DC reactor | Output reactor |
|---|---|---|---|
| HD2-3.7A-43 | ACLC-1.5-4 | / | OCLC-1.5-4 |
| HD2-5A-43 | ACLC-2.2-4 | / | OCLC-2.2-4 |
| HD2-9.5A-43 | ACLC-4.0-4 | / | OCLC-4.0-4 |
| HD2-14A-43 | ACLC-5.5-4 | / | OCLC-5.5-4 |
| HD2-18.5A-43 | ACLC-7.5-4 | / | OCLC-7.5-4 |
| HD2-25A-43 | ACLC-11-4 | / | OCLC-11-4 |
| HD2-32A-43 | ACLC-15-4 | / | OCLC-15-4 |

| Inverter model | Input reactor | DC reactor | Output reactor |
|---|---|---|---|
| HD2-38A-43 | ACLC-18-4 | Standard | OCLC-18-4 |
| HD2-45A-43 | ACLC-22-4 | Standard | OCLC-22-4 |
| HD2-60A-43 | ACLC-37-4 | Standard | OCLC-37-4 |
| HD2-75A-43 | ACLC-37-4 | Standard | OCLC-37-4 |
| HD2-92A-43 | ACLC-45-4 | Standard | OCLC-45-4 |
| HD2-115A-43 | ACLC-55-4 | Standard | OCLC-55-4 |
| HD2-150A-43 | ACLC-75-4 | Standard | OCLC-75-4 |
| HD2-180A-43 | ACLC-110-4 | Standard | OCLC-110-4 |
| HD2-215A-43 | ACLC-110-4 | Standard | OCLC-110-4 |

**Note:**

- The rated input voltage drop of input reactors is 2%±15%.
- The current adjustment coefficient on the input side of the inverter 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 whether external or built-in accessories are needed in your purchase order.

### D.6.2 For parallel inverters

The following tables lists the reactor model selection for the inverters to be paralleled.

Table D–8 Reactor model selection for AC 3PH 380V (-15%)–440V (+10%)

| Inverter model | Input reactor model | DC reactor model | Output reactor model |
|---|---|---|---|
| 280kW | ACLC-280-4 (Standard) | DCLC-280-4 (Optional) | OCLC-280-4 (Standard) |
| 315 kW | ACLC-315-4 (Standard) | DCLC-315-4 (Optional) | OCLC-315-4 (Standard) |
| 350 kW | ACLC-350-4 (Standard) | DCLC-400-4 (Optional) | OCLC-350-4 (Standard) |
| 400 kW | ACLC-400-4 (Standard) | DCLC-400-4 (Optional) | OCLC-400-4 (Standard) |
| 500 kW | ACLC-500-4 (Standard) | DCLC-500-4 (Optional) | OCLC-500-4 (Standard) |

**Note:**

- The rated input voltage drop of input reactors is 2%±15%.
- The current adjustment coefficient on the input side of the inverter is higher than 90% after a DC reactor is configured.
- The rated output voltage drop of output reactors is 1%±15%.
- DC reactors are externally connected. You need to specify whether external or built-in reactors are needed in your purchase order.

Table D–9 Reactor model selection for AC 3PH 520V (-15%)–690V (+10%)

| Inverter model | Input reactor model | DC reactor model | Output reactor model |
|---|---|---|---|

| Inverter model | Input reactor model | DC reactor model | Output reactor model |
|---|---|---|---|
| 350 kW | ACLC-350G-6 (Standard) | DCLC-350G-6 (Optional) | OCLC-350G-6 (Standard) |
| 400 kW | ACLC-400G-6 (Standard) | DCLC-400G-6 (Optional) | OCLC-400G-6 (Standard) |
| 500 kW | ACLC-560G-6 (Standard) | DCLC-560G-6 (Optional) | OCLC-560G-6 (Standard) |
| 630 kW | ACLC-630G-6 (Standard) | DCLC-630G-6 (Optional) | OCLC-630G-6 (Standard) |

**Note:**

- The rated input voltage drop of input reactors is 2%±15%.
- The current adjustment coefficient on the input side of the inverter is higher than 90% after a DC reactor is configured.
- The rated output voltage drop of output reactors is 1%±15%.
- DC reactors are externally connected. You need to specify whether external or built-in reactors are needed in your purchase order.

## D.7 Filters

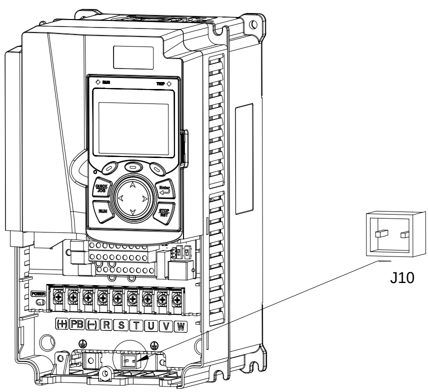
J10 is not connected in factory for the 380V 110kW and lower inverter models. Connect the J10 packaged with the manual if IEC/EN 61800-3 C3 requirements need to be met.

J10 is connected in factory for the 380V 132kW and higher inverter models, all of which meet IEC/EN 61800-3 C3 requirements.

**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 inverter interference on the surrounding devices.

Noise filters on the output side can decrease the radio noise caused by the cables between inverters and motors and the leakage current of conducting wires.

IMO provides some of the filters for you to choose.

### D.7.1 Filter model description

**HD2 – IF 1 004A - 43**

A B C D E

| Field identifier | Field description |
|---|---|
| A | HD2: Name of the inverter series |
| B | Filter type<br>IF: Power input filter<br>OF: Output filter |
| C | Filter application environment<br>1: First environment (IEC61800-3), category C1 (EN 61800-3)<br>2: First environment (IEC61800-3), category C2 (EN 61800-3) |
| D | 3-digit code indicating the rated current. For example, 015 indicates 15 A. |
| E | Voltage class<br>43: AC 3PH 380V–480V |

### D.7.2 Filter model selection

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

| Inverter model | Input filter | Output filter |
|---|---|---|
| HD2-3.7A-43 | HD2-IF2006A-43 | HD2-OF2006A-43 |
| HD2-5A-43 | | |
| HD2-9.5A-43 | HD2-IF2016A-43 | HD2-OF2016A-43 |
| HD2-14A-43 | | |
| HD2-18.5A-43 | HD2-IF2032A-43 | HD2-OF2032A-43 |
| HD2-25A-43 | | |
| HD2-32A-43 | HD2-IF2045A-43 | HD2-OF2045A-43 |
| HD2-38A-43 | | |
| HD2-45A-43 | HD2-IF2065A-43 | HD2-OF2065A-43 |
| HD2-60A-43 | | |
| HD2-75A-43 | HD2-IF2100A-43 | HD2-OF2100A-43 |
| HD2-92A-43 | | |
| HD2-115A-43 | HD2-IF2150A-43 | HD2-OF2150A-43 |
| HD2-150A-43 | | |
| HD2-180A-43 | HD2-IF2240A-43 | HD2-OF2240A-43 |

| Inverter model | Input filter | Output filter |
|---|---|---|
| HD2-215A-43 | | |

**Note:**

- The input EMI meets the C2 requirements after an input filter is configured.
- The preceding table describes external accessories. You need to specify whether external or built-in accessories are needed in your purchase order.

## D.8 Braking system

### D.8.1 Braking component selection

When the inverter 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 inverter, causing the bus voltage of the inverter to rise. If the bus voltage exceeds a specific value, the inverter 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.<br>✧ Follow all the "Warning" instructions during the operation. Otherwise, major physical injuries or property loss may be caused.<br>✧ Only qualified electricians are allowed to perform the wiring. Otherwise, damage to the inverter or braking components may be caused.<br>✧ Read the braking resistor or unit instructions carefully before connecting them to the inverter.<br>✧ 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 inverter and fire may be caused. |
| | ✧ Connect the braking components to the inverter according to the wiring diagram. If the wiring is not properly performed, damage to the inverter or other devices may be caused. |

The 380V 37kW and lower inverter models are equipped with built-in braking units, and the 380V 45kW and higher inverter models need to be configured with external braking units. The 380V 45kW–110kW inverter models can be configured with optional built-in braking unitsFor a parallel 380V large-power inverter system, you need to configure the external braking unit that is an optional part. Select braking resistors according to the specific requirements (such as the braking torque and braking usage requirements) on site.

Table D–11 Braking units for AC 3PH 380V (-15%)–440V (+10%)

| Inverter model | Resistance applicable for 100% braking torque (Ω) | Dissipated power of braking resistor (kW) | | | Min. allowable brake resistance (Ω) |
|---|---|---|---|---|---|
| | | 10% braking usage | 50% braking usage | 80% braking usage | |
| HD2-3.7A-43 | 326 | 0.23 | 1.1 | 1.8 | 170 |
| HD2-5A-43 | 222 | 0.33 | 1.7 | 2.6 | 130 |
| HD2-9.5A-43 | 122 | 0.6 | 3 | 4.8 | 80 |
| HD2-14A-43 | 89 | 0.75 | 4.1 | 6.6 | 60 |
| HD2-18.5A-43 | 65 | 1.1 | 5.6 | 9 | 47 |
| HD2-25A-43 | 44 | 1.7 | 8.3 | 13.2 | 31 |
| HD2-32A-43 | 32 | 2 | 11 | 18 | 23 |
| HD2-38A-43 | 27 | 3 | 14 | 22 | 19 |
| HD2-45A-43 | 22 | 3 | 17 | 26 | 17 |
| HD2-60A-43 | 17 | 5 | 23 | 36 | 17 |
| HD2-75A-43 | 13 | 6 | 28 | 44 | 11.7 |
| HD2-92A-43 | 10 | 7 | 34 | 54 | 6.4 |
| HD2-115A-43 | 8 | 8 | 41 | 66 | |
| HD2-150A-43 | 6.5 | 11 | 56 | 90 | |
| HD2-180A-43 | 5.4 | 14 | 68 | 108 | 4.4 |
| HD2-215A-43 | 4.5 | 17 | 83 | 132 | |

Refer to the preceding table for the model selection for a paralel inverter system.

**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 inverter. 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 inverter may not run properly.

| | |
|---|---|
| ⚠ | ✧ Do not use braking resistors whose resistance is lower than the specified |

| | |
|---|---|
| | minimum resistance. inverters 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 and a parallel 660V large-power inverter system. Select braking resistors according to the specific requirements (such as the braking torque and braking usage requirements) on site.

●

| | |
|---|---|
| ⚠ | ✧ Do not use braking resistors whose resistance is lower than the specified minimum resistance. The inverter 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.

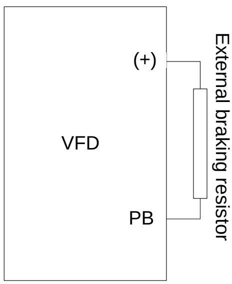
**D.8.3 Braking resistor installation**

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 is 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 inverter models need only external braking resistors.<br>✧ PB and (+) are the terminals for connecting braking resistors. |

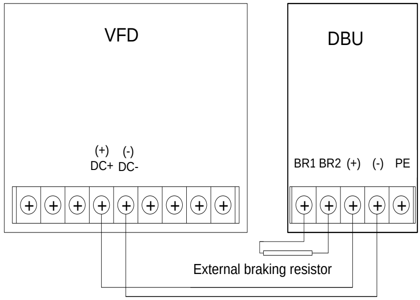



Installation of braking units

| | |
|---|---|
| ⚠ | ✧ (+) and (-) are the terminals for connecting braking units.<br>✧ The connection cables between the (+) and (-) terminals of an inverter 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 10 m. |

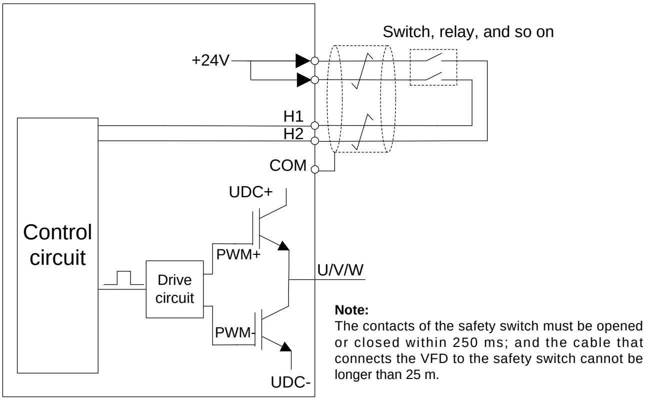
The following figure shows the connection of one inverter to a dynamic braking unit.



# 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.<br>Fault code:<br>40: Safe torque off (STO) |
| H1 and H2 closed simultaneously | The STOP function is not triggered, and the drive runs properly. |
| Either of H1 and H2 opened, and the other closed | The STL1, STL2, or STL3 fault occurs.<br>Fault code:<br>41: Channel H1 exception (STL1)<br>42: Channel H2 exception (STL2)<br>43: Both channels H1 and H2 are abnormal (STL3) |

## E.2 STO channel delay description

The following table describes the trigger and indication delay of the STO channels.

| STO mode | STO trigger delay[1] and STO indication delay[2] |
|---|---|
| STO fault: STL1 | Trigger delay < 10 ms<br>Indication delay < 280 ms |
| STO fault: STL2 | Trigger delay < 10 ms<br>Indication delay < 280 ms |
| STO fault: STL3 | Trigger delay < 10 ms<br>Indication delay < 280 ms |
| STO fault: STO | Trigger delay < 10 ms<br>Indication delay < 100 ms |

1. STO trigger delay: Time interval between triggering the STO function and switching off the drive output
2. STO instruction delay: Time interval between triggering the STO function and indicating STO output status

## 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 the motor stops running:<br>✧ If the drive is running, send a stop command to it and wait until the shaft of the motor stops rotating.<br>✧ Activate the STO circuit and send a start command to the drive. Ensure that the motor does not start.<br>✧ 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:<br>✧ Start the drive. Ensure that the motor is running properly.<br>✧ Activate the STO circuit.<br>✧ The drive reports an STO fault (for details, see section 5.5.19 Fault handling). Ensure that the motor coasts to stop rotating.<br>✧ 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 IMO office. Provide the model and serial number of the product you query about. You can visit www.imopc.com to find a list of IMO offices.

## F.2 Feedback on IMO inverter manuals

Your comments on our manuals are welcome. Visit www.imopc.com, directly contact online service personnel or choose **Contact Us** to obtain contact information.

Email ID: automation@imopc.com

## F.3 Documents on the Internet

You can find manuals and other product documents in the PDF format on the Internet. Visit www.imopc.com and choose **Support** > **Download**.

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