

# Operation manual

**CHV190** series special inverter for crane



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## SAFETY PRECAUTIONS

Please read this operation manual carefully before installation, operation, maintenance or inspection.

In this manual, the safety precautions were sorted to "WARNING" or "CAUTION".



### WARNING

Indicates a potentially hazardous situation which, if not, will result in death or serious injury.



### CAUTION

Indicates a potentially hazardous situation which, if not avoided, will result in minor or moderate injury and physical damage. This sign is also used for alert of any un-safety operation.

In some cases, the contents of "CAUTION" could cause serious accident. Please follow these important precautions in any situation.

★ **NOTE** is the necessary step to ensure the proper operation.

## WARNING

- May cause injury or electric shock.
- Please follow the instructions in the manual before installation or operation.
- Disconnect all power line before opening front cover of unit. Wait at least 5 minute until DC Bus capacitors discharge.
- Use proper grounding techniques.
- Never connect AC power to output UVW terminals

# 1. INTRODUCTION

## 1.1 Technology Features

### • Input & output

- ◆ Input voltage range:  $380 \pm 15\%$
- ◆ Input frequency range: 47~63Hz
- ◆ Output voltage range: 0~rated input voltage
- ◆ Output frequency range: 0~400Hz

### • I/O features

- ◆ Programmable digital input: Provide 5 terminals which can accept ON-OFF input and 1 terminal can accept high speed pulse input (HDI1). 4 inputs can be extended by I/O extension card.
- ◆ Programmable analog input: AI1 can accept input of 0~10V, AI2 can accept input of 0~10V or 0~20mA.
- ◆ Programmable open collector output: Provide 2 output terminals, 1 output (open collector output or high speed pulse output) can be extended by I/O extension card.
- ◆ Relay output: Provide 2 output terminals. 1 output can be extended by I/O extension card.
- ◆ Analog output: Provide 1 output terminal, whose output scope can be 0~20 mA or 0~10 V, as chosen. 1 AO (0~20mA or 0~10V) can be extended by I/O card.
- ◆ Motor temperature detection: I/O extension card can provide 1 terminal for motor temperature detection which supports PT100/PT1000.

### • Main control function

- ◆ Control mode: Sensorless vector control (SVC), vector control with PG (VC), V/F control.
- ◆ Overload capacity: 60s with 150% of rated current, 10s with 180% of rated current, 1s with 200% of rated current.
- ◆ Starting torque: 150% of rated torque at 0.5Hz (SVC); 200% of rated torque at 0 Hz (VC).
- ◆ Speed adjusting range: 1:100 (SVC); 1:1000 (VC)
- ◆ Speed accuracy:  $\pm 0.5\%$  of maximum speed (SVC);  $\pm 0.1\%$  of maximum speed (VC)
- ◆ Carrier frequency: 1.0 kHz~16.0 kHz.

### • Functions

- ◆ Frequency reference source: Digital input, analog input, HDI Input, multi-speed

terminal, UP/DOWN terminal, Modbus communication, Profibus communication, master-slave mode given, classification multi-step speed given

- ◆ Run command source: Keypad, terminal, communication (support Modbus and Profibus communication command)
- ◆ Crane control logic: Brake, contactor control
- ◆ Starting pre-torque compensation
- ◆ DC braking at starting and stopping
- ◆ PG Card: Asynchronous PG Card (12V), synchronous PG Card (5V).
- ◆ Automatic voltage regulation (AVR): Automatically keep the output voltage stable when input voltage fluctuating
- ◆ Up to 30 fault protections: Protect from over current, over voltage, under voltage, over temperature, phase failure, over load etc.
- ◆ "Black box" function: 17 kinds of waveform can be saved at 0.2s before the last fault, which will make trouble shooting more convenient.

## 1.2 Description of Nameplate

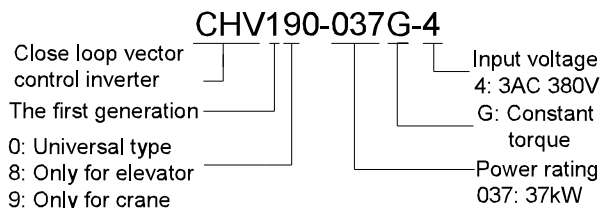
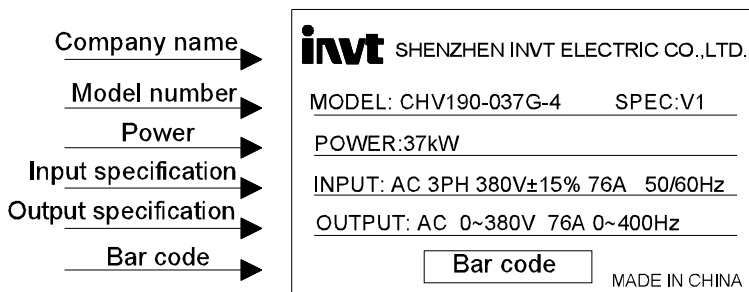


Figure 1.1 Nameplate of inverter

### 1.3 Selection Guide

| Model No.     | Rated power (kW) | Rated input current (A) | Rated output current (A) |
|---------------|------------------|-------------------------|--------------------------|
| 3AC 380V±15%  |                  |                         |                          |
| CHV190-018G-4 | 18.5             | 38                      | 37                       |
| CHV190-022G-4 | 22.0             | 46.0                    | 45.0                     |
| CHV190-030G-4 | 30.0             | 62.0                    | 60.0                     |
| CHV190-037G-4 | 37.0             | 76.0                    | 75.0                     |
| CHV190-045G-4 | 45.0             | 90.0                    | 90.0                     |
| CHV190-055G-4 | 55.0             | 105.0                   | 110.0                    |
| CHV190-075G-4 | 75.0             | 140.0                   | 150.0                    |
| CHV190-090G-4 | 90.0             | 160.0                   | 176.0                    |
| CHV190-110G-4 | 110.0            | 210.0                   | 250.0                    |
| CHV190-132G-4 | 132.0            | 240.0                   | 250.0                    |
| CHV190-160G-4 | 160.0            | 290.0                   | 300.0                    |
| CHV190-185G-4 | 185.0            | 330.0                   | 340.0                    |
| CHV190-200G-4 | 200.0            | 370.0                   | 380.0                    |
| CHV190-220G-4 | 220.0            | 410.0                   | 415.0                    |
| CHV190-250G-4 | 250.0            | 460.0                   | 470.0                    |
| CHV190-280G-4 | 280.0            | 500.0                   | 520.0                    |
| CHV190-315G-4 | 315.0            | 580.0                   | 600.0                    |
| CHV190-350G-4 | 350.0            | 620.0                   | 640.0                    |
| CHV190-400G-4 | 400.0            | 670.0                   | 690.0                    |
| CHV190-500G-4 | 500.0            | 835.0                   | 860.0                    |

### 1.4 Parts Description

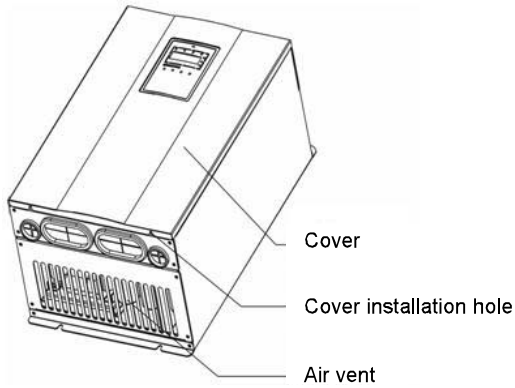
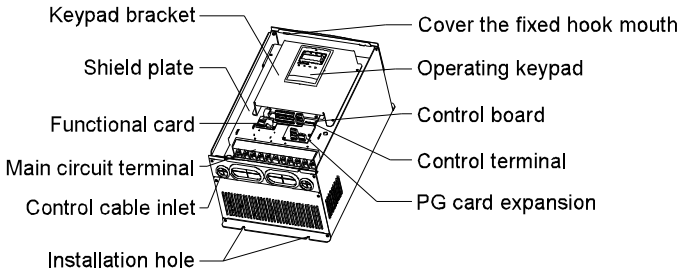


Figure 1.2 Part name of inverter

## 1.5 Description of Extension Card

| Extension card                       | Description  |
|--------------------------------------|--|
| Modbus communication card            | Offer RS232 and RS485 dual physical communication interface<br>1. RS232 adopts standard DB9 master seat.<br>2. 3-hole RS485 interface, two communication modes can be switched by short-connecting module.   |
| Profibus-DP communication card       | Inverter can be connected to a Profibus-DP network; User can monitor and set parameters remotely in this way.  |
| Asynchronous electromotor PG Card    | Receive high-speed pulse from encoder to realize high-accuracy close-loop vector control.<br>1. Both push-and-pull input and open-circuit collector input.<br>2. Offer frequency division output, the frequency-division factor can be selected by dial switch, encode power is 12V.       |
| Synchronization electromotor PG Card | Receive high-speed pulse from encoder to realize high-accuracy close-loop vector control.<br>1. SIN/COS encoder, UVW encoder, incremental encoder are compatible;<br>2. Offer frequency division output, the frequency-division factor can be selected by dial switch, encode power is 5V. |
| I/O extension card                   | Offer more input/output terminals to enhance the external function of inverter. RS485 and CAN terminals are valid.<br><b>Notice: CAN communication interface can only be used by the master-slave control.</b>   |

## 2. UNPACKING INSPECTION



### CAUTION

- **Never install or operate any inverter that is damaged or missing components. Doing so can result in injury.**

Check the following items when unpacking the inverter,

1. Inspect the entire exterior of the Inverter to see if there are any scratches or other damage resulting from shipping.
2. Ensure there is operation manual and warranty card in the packing box.
3. Ensure the nameplate that it is you ordered.
4. Ensure the optional parts are what you need if you ordered any optional parts.

Please contact the local agent if there is any damage of inverter or optional parts.

### 3. DISASSEMBLE AND INSTALLATION



#### WARNING

- Any untrained person working on any parts/systems of inverter or any rule in the “Warning” being violated, that will cause severe injury or property damage. Only licensed person, who has been trained on design, installation, commissioning and operation of inverter, is permitted to operate this equipment.
- Input power cable must be connected tightly, and the equipment must be grounded securely.
- Even if the inverter is not in operating situation, the following terminals still have dangerous voltage:
  - Power Terminals: R, S, T;
  - Motor Connection Terminals: U, V, W.
- Can not install the inverter until discharged completely after the power supply is switched off for 5 minutes.
- The section area of grounding conductor must be no less than that of power supply cable.



#### CAUTION

- Lift the cabinet by its base; do not lift it by holding its panel. Otherwise the main unit will fall off to result in personal injury.
- Install the inverter on top of the fireproofing material (such as, metal) to prevent fire.
- When need install two or more inverters in one cabinet, cooling fan should be applied to make sure that the air temperature is lower than 45°C. Otherwise it could cause fire or damage the device.

### 3.1 Environmental Requirement

#### 3.1.1 Temperature

Environment temperature range: -10°C ~ +40°C. Inverter will be derated if ambient temperature exceeds 40°C.

#### 3.1.2 Humidity

Less than 95% RH, without dewfall.

#### 3.1.3 Altitude

Inverter can output the rated power when installed with altitude of lower than 1000m. It will be derated when the altitude is higher than 1000m. For details, please refer to the following figure:

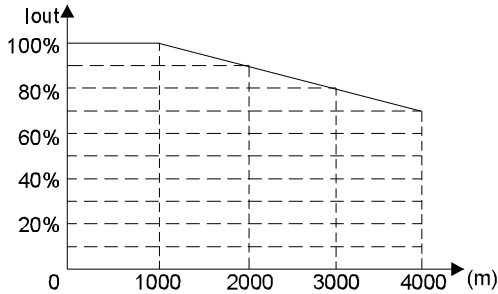


Figure 3.1 Relationship between output current and altitude

### 3.1.4 Impact and oscillation

It is not allowed that the inverter falls down or suffers from fierce impact or the inverter installed at the place that oscillation frequently. The maximum swing should less than  $5.8\text{m/s}^2$  (0.6g).

### 3.1.5 Electromagnetic radiation

Keep away from the electromagnetic radiation source.

### 3.1.6 Water

Do not install the inverter at the wringing or dewfall place.


### 3.1.7 Air pollution

Keep away from air pollution such as dusty, corrosive gas.

### 3.1.8 Storage

Do not store the inverter in the environment with direct sunlight, vapor, oil fog and vibration.

## 4. INSTALLATION AND COMMISSIONING

| Start flowchart   |
|---|
|  <b>WARNING</b>  |
| <ul style="list-style-type: none"> <li>• Startup process must be implemented by qualified electrical technicians.</li> <li>• Startup process must be strictly in accordance with the safety instructions.</li> <li>• Before startup, the situation of machine installation must be re-examined to make sure installation is good.</li> </ul>  |
| <ul style="list-style-type: none"> <li>• Make sure that there will be no danger before starting.</li> <li>• The first start should be of no load because motor steering errors may result in drive equipment damage.</li> </ul>   |
| Start process   |
| <b>1. Power on</b>  |
| <ul style="list-style-type: none"> <li>• Make sure that inverters are cut off less than 5 times within 10 minutes when they are power on, because repeatedly switching will lead to resistor overheating.</li> <li>• Make sure that keypad displays normal, DC-bus voltage displays proper and there is no fault warning.</li> </ul>  |
| <b>2. Parameter setting</b>   |
| <ul style="list-style-type: none"> <li>• Select motor control mode, P0.00 which is speed control mode selection is usually set to be 1 vector control with PG Card.</li> <li>• According to motor nameplate, set motor parameters P2.00~ P2.05, which are motor type, motor rated power, rated frequency, rated speed, rated voltage and rated current respectively.</li> <li>• Set the encoding parameters correctly according to the actual requirements.                     <ul style="list-style-type: none"> <li>P4.00: encoder type</li> <li>P4.01: encoder pulses number</li> <li>P4.02: encoder direction.</li> </ul> </li> <li>• Set autotuning acceleration and deceleration time parameter (P1.20, P1.21) according to load inertia to avoid over-voltage and over-current fault</li> <li>• Parameter autotuning, set the function code P0.07=1, press RUN to start rotation autotuning. The whole process need acceleration, deceleration time and additional time 60s.</li> </ul> |

### 3. Actual operating parameters adjustment

- Set a low frequency, if inverter displays PCE fault, please adjust P4.02 encoder direction.
- Adjust motor running direction according to actual demand, please adjust P0.05 running direction selection.
- Select inverter application mode according to actual requirements, please set P0.11 (Application mode choice).
- Adjust S curve of acceleration and deceleration, please set P1.11~P1.14.

### 4.1 Connections of Peripheral Devices

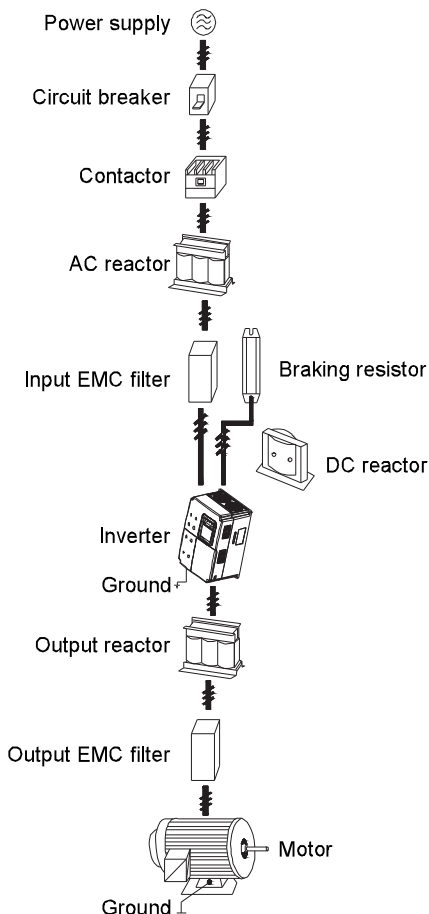


Figure 4.1 Connections of peripheral devices

## 4.2 Terminal configuration

### 4.2.1 Main circuit terminals

|  |            |       |   |   |       |   |   |  |
|--|------------|-------|---|---|-------|---|---|--|
|  | (+) PB (-) | R     | S | T | U     | V | W |  |
|  |            | POWER |   |   | MOTOR |   |   |  |

Figure 4.2 Main circuit terminals (18.5~110kW).

|       |    |     |       |   |   |
|-------|----|-----|-------|---|---|
| R     | S  | T   | U     | V | W |
| POWER |    |     | MOTOR |   |   |
|       | P1 | (+) | (-)   |   |   |

Figure 4.3 Main circuit terminals (132~315kW).

|    |    |     |     |
|----|----|-----|-----|
| R  | S  | T   |     |
| U  | V  | W   |     |
| PE | P1 | (+) | (-) |

Figure 4.4 Main circuit terminals (350~500kW).

Main circuit terminal functions are summarized according to the terminal symbols in the following table. Wire the terminal correctly for the desired purposes.

| Terminal | Description                              |
|----------|--|
| R,S,T    | Terminals of 3 phase AC input            |
| (+),(-)  | Spare terminals of external braking unit |
| P1,(+)   | Spare terminals of external DC reactor   |
| (-)      | Terminal of negative DC bus              |
| U,V,W    | Terminals of 3 phase AC output           |
|          | Terminal of ground                       |

### 4.2.2 Control Circuit Terminals

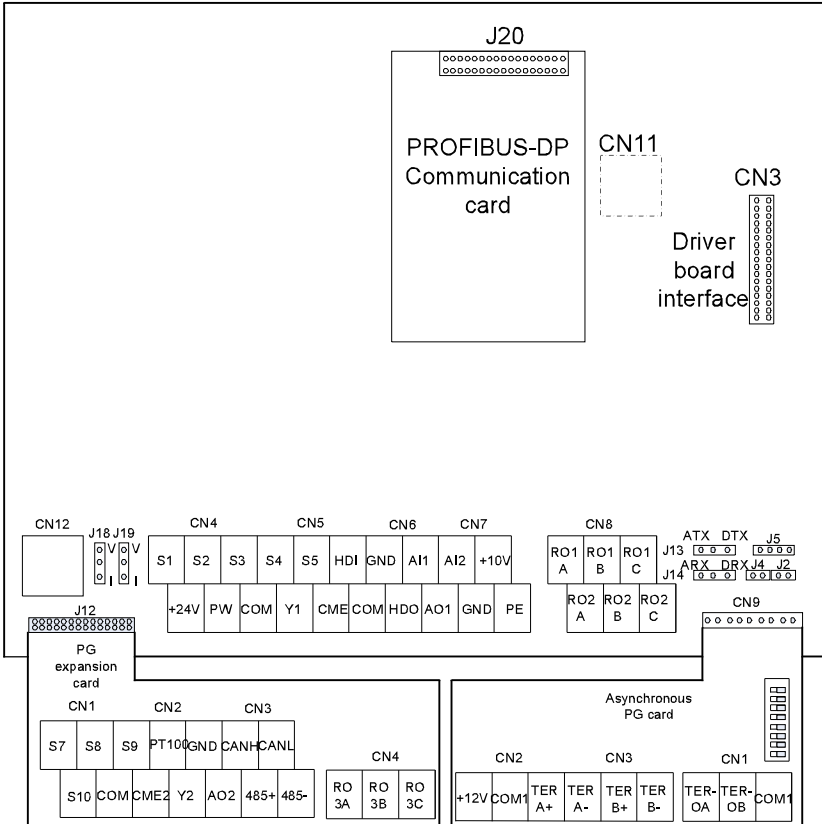


Figure 4.5 Interface distribution in the control board

**Notice: CHV190 series inverter only supports one keypad whose interface is on the back of control board, and CN12 is for the Ethernet interface.**

### 4.3 Typical Wiring Diagram

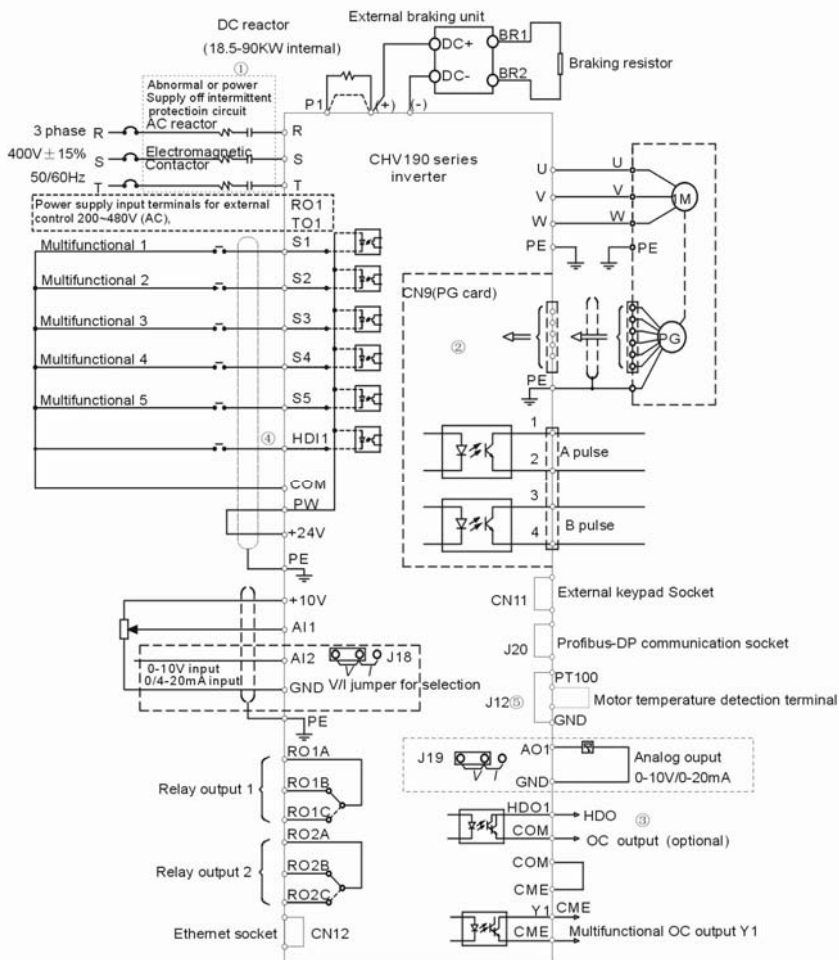


Figure 4. 6 Wiring diagram.

**Notice:**

1. Inverters between 18.5KW and 90KW have built-in DC reactor which is used to improve power factor. For inverters above 110KW, it is recommended to install DC reactor between P1 and (+).
2. For inverters above (including) 18.5KW, if need braking, should install external braking unit between (+) and (-).
3. +24V connect with PW as default setting. If user need external power supply,

**disconnect +24V with PW and connect PW with external power supply.**

## 4.4 Wiring the Main Circuits

### 4.4.1 Wiring at the side of power supply

- Circuit breaker

It is necessary to connect a circuit breaker which is compatible with the capacity of inverter between 3ph AC power supply and power input terminals (R, S, and T). The capacity of breaker is 1.5~2 times to the rated current of inverter. For details, see <Specifications of Breaker, Cable, and Contactor>.

- Contactor

In order to cut off the input power effectively when something is wrong in the system, contactor should be installed at the input side to control the ON-OFF of the main circuit power supply.

- AC reactor

In order to prevent the rectifier damage result from the large current, AC reactor should be installed at the input side. It can also prevent rectifier from sudden variation of power voltage or harmonic generated by phase-control load.

- Input EMC filter

The surrounding device may be disturbed by the cables when the inverter is working. EMC filter can minimize the interference. Just like the following figure.

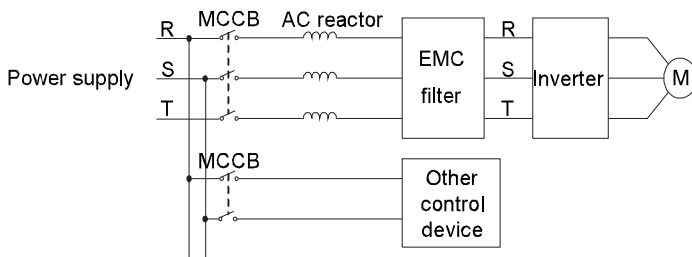


Figure 4.7 Wiring at input side.

### 4.4.2 Wiring for inverter

- DC reactor

DC reactor is built in CHV190 inverter from 18.5kW~90kW (380V classification) DC reactor can improve power factor, can avoid bridge rectifier damaged due to large-capacity transformer Ershi resulting in larger input current, can avoid rectifier circuit damage caused by sinusoidal.

- Braking unit and braking resistor

- Inverter of 18.5KW and above need connect external braking unit which should be installed at (+) and (-) terminals. The cable between inverter and braking unit should be less than 5m. The cable between braking unit and braking resistor should be less than 10m.
- The temperature of braking resistor will increase because the regenerative energy will be transformed to heat. Safety protection and good ventilation is recommended.

**Notice: Be sure that the electric polarity of (+) (-) terminals is right; it is not allowed to connect (+) with (-) terminals directly, Otherwise damage or fire could occur.**

#### 4.4.3 Wiring at motor side of main circuit

##### • Output reactor

When the distance between inverter and motor is more than 50m, inverter may be tripped by over-current protection frequently because of the large leakage current resulted from the parasitic capacitance with ground. And the same time to avoid the damage of motor insulation, the output reactor should be installed.

##### • Output EMC filter

EMC filter should be installed to minimize the leakage current caused by the cable and minimize the radio noise caused by the cables between the inverter and cable. Just see the following figure.

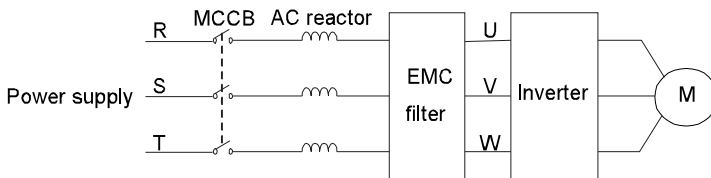


Figure 4.8 Wiring at motor side.

#### 4.4.4 Wiring of regenerative unit

Regenerative unit is used for putting the electricity generated by braking of motor to the grid. Compared with traditional 3 phase inverse parallel bridge type rectifier unit, regenerative unit uses IGBT so that the total harmonic distortion (THD) is less than 4%. Regenerative unit is widely used for centrifugal and hoisting equipment.

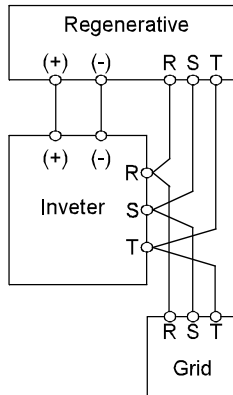


Figure 4.9 Wiring of regenerative unit.

#### 4.4.5 Ground Wiring (PE)

In order to ensure safety and prevent electrical shock and fire, terminal PE must be grounded with ground resistance. The ground wire should be big and short, and it is better to use copper wire ( $>3.5\text{mm}^2$ ). When multiple inverters need to be grounded, do not loop the ground wire.

### 4.5 Wiring Control Circuit Terminals

#### 4.5.1 Precautions

- Use shielded or twisted-pair cables to connect control terminals.
- Connect the ground terminal (PE) with shield wire.
- The cable connected to the control terminal should leave away from the main circuit and heavy current circuits (including power supply cable, motor cable, relay and contactor connecting cable) at least 20cm and parallel wiring should be avoided. It is suggested to apply perpendicular wiring to prevent inverter malfunction caused by external interference.

#### 4.5.2 Control circuit terminals

| Terminal      | Description  |
|---------------|--|
| S1~S5(S7~S10) | ON-OFF signal input, optical coupling with PW and COM.<br>Input voltage range: 9~30V<br>Input impedance: 3.3kΩ   |
| HDI1          | High speed pulse or ON-OFF signal input, optical coupling with PW and COM.<br>Pulse input frequency range: 0~50kHz<br>Input voltage range: 9~30V<br>Input impedance: 1.1kΩ |

| Terminal       | Description  |
|----------------|--|
| PW             | External power supply. +24V terminal is connected to PW terminal as default setting. If user need external power supply, disconnect +24V terminal with PW terminal and connect PW terminal with external power supply. |
| +24V           | Provide output power supply of +24V.<br>Maximum output current: 150mA  |
| AI1            | Analog input, 0~10V<br>Input impedance: 10kΩ   |
| AI2            | Analog input, 0~10V/ 0~20mA, switched by J18.<br>Input impedance: 10kΩ (voltage input) / 250Ω (current input)  |
| GND            | Common ground terminal of analog signal and +10V.<br>GND must isolated from COM.   |
| Y1(Y2)         | Open collector output terminal, the corresponding common ground terminal is CME.<br>External voltage range: 0~24V<br>Output current range: 0~50mA  |
| CME            | Common terminal of open collector output   |
| COM            | Common ground terminal for digital signal and +24V (or external power supply).   |
| +10V           | Supply +10V for inverter.  |
| HDO            | High speed pulse output terminal. The corresponding common ground terminal is COM.<br>Output frequency range: 0~50 kHz   |
| AO1(AO2)       | Provide voltage or current output which can be switched by J19.<br>Output range: 0~10V/ 0~20mA   |
| PE             | Ground terminal.   |
| RO1A,RO1B,RO1C | RO1 relay output: RO1A common; RO1B NC; RO1C NO.<br>Contact capacity: AC 250V/3A, DC 30V/1A.   |
| RO2A,RO2B,RO2C | RO2 relay output: RO2A common; RO2B NC; RO2C NO.<br>Contact capacity: AC 250V/3A, DC 30V/1A.   |
| RO3A,RO3B,RO3C | RO3 relay output: RO3A common; RO3B NC; RO3C NO.<br>Contact capacity: AC 250V/3A, DC 30V/1A.   |

### 4.5.3 Jumper on control board

| Terminal   | Description  |
|------------|--|
| J2, J4, J5 | It is prohibited to be connected together, otherwise it will cause inverter malfunction.   |
| J13, J14   | Do not change factory default connection of J13 (marked with ATX) and J14 (marked with ARX), otherwise it will cause communication malfunction.        |
| J18        | Switch between (0~10V) voltage input and (0~20mA) current input.<br>V connect to GND means voltage input;<br>I connect to GND means current input.     |
| J19        | Switch between (0~10V) voltage output and (0~20mA) current output.<br>V connect to OUT means voltage output;<br>I connect to OUT means current output. |

## 4.6 Installation Guideline to EMC Compliance

### 4.6.1 General knowledge of EMC

EMC is the abbreviation of electromagnetic compatibility, which means the device or system has the ability to work normally in the electromagnetic environment and will not generate any electromagnetic interference to other equipments.

EMC includes two subjects: electromagnetic interference and electromagnetic anti-jamming.

According to the transmission mode, Electromagnetic interference can be divided into two categories: conducted interference and radiated interference.

Conducted interference is the interference transmitted by conductor. Therefore, any conductors (such as wire, transmission line, inductor, capacitor and so on) are the transmission channels of the interference.

Radiated interference is the interference transmitted in electromagnetic wave, and the energy is inverse proportional to the square of distance.

Three necessary conditions or essentials of electromagnetic interference are: interference source, transmission channel and sensitive receiver. For customers, the solution of EMC problem is mainly in transmission channel because of the device attribute of disturbance source and receiver can not be changed.

### 4.6.2 EMC features of inverter

Like other electric or electronic devices, inverter is not only an electromagnetic

interference source but also an electromagnetic receiver. The operating principle of inverter determines that it can produce certain electromagnetic interference noise. And the same time inverter should be designed with certain anti-jamming ability to ensure the smooth working in certain electromagnetic environment. The following is its EMC features:

- Input current is non-sine wave. The input current includes large amount of high-harmonic waves that can cause electromagnetic interference, decrease the grid power factor and increase the line loss.
- Output voltage is high frequency PWM wave, which can increase the temperature rise and shorten the life of motor. And the leakage current will also increase, which can lead to the leakage protection device malfunction and generate strong electromagnetic interference to influence the reliability of other electric devices.
- As the electromagnetic receiver, too strong interference will damage the inverter and influence the normal using of customers.
- In the system, EMS and EMI of inverter coexist. Decrease the EMI of inverter can increase its EMS ability.

#### **4.6.3 EMC Installation Guideline**

In order to ensure all electric devices in the same system to work smoothly, this section, based on EMC features of inverter, introduces EMC installation process in several aspects of application (noise control, site wiring, grounding, leakage current and power supply filter). The good effective of EMC will depend on the good effective of all of these five aspects.

##### **4.6.3.1 Noise control**

All the connections to the control terminals must use shielded wire. And the shield layer of the wire must ground near the wire entrance of inverter. The ground mode is 360 degree annular connection formed by cable clips. It is strictly prohibitive to connect the twisted shielding layer to the ground of inverter, which greatly decreases or loses the shielding effect.

Connect inverter and motor with the shielded wire or the separated cable tray. One side of shield layer of shielded wire or metal cover of separated cable tray should connect to ground, and the other side should connect to the motor cover. Installing an EMC filter can reduce the electromagnetic noise greatly.

##### **4.6.3.2 Site wiring**

Power supply wiring: the power should be separated supplied from electrical transformer. Normally it is 5 core wires, three of which are fire wires, one of which is the neutral wire, and one of which is the ground wire. It is strictly prohibitive to use the same line to be both

the neutral wire and the ground wire

Device categorization: there are different electric devices contained in one control cabinet, such as inverter, filter, PLC and instrument etc, which have different ability of emitting and withstanding electromagnetic noise. Therefore, it needs to categorize these devices into strong noise device and noise sensitive device. The same kinds of device should be placed in the same area, and the distance between devices of different category should be more than 20cm.

Wire Arrangement inside the control cabinet: there are signal wire (light current) and power cable (strong current) in one cabinet. For the inverter, the power cables are categorized into input cable and output cable. Signal wires can be easily disturbed by power cables to make the equipment malfunction. Therefore when wiring, signal cables and power cables should be arranged in different area. It is strictly prohibitive to arrange them in parallel or interlacement at a close distance (less than 20cm) or tie them together. If the signal wires have to cross the power cables, they should be arranged in 90 angles. Power input and output cables should not either be arranged in interlacement or tied together, especially when installed the EMC filter. Otherwise the distributed capacitances of its input and output power cable can be coupling each other to make the EMC filter out of function.

#### 4.6.3.3 Ground

Inverter must be ground safely when in operation. Grounding enjoys priority in all EMC methods because it does not only ensure the safety of equipment and persons, but also is the simplest, most effective and lowest cost solution for EMC problems.

Grounding has three categories: special pole grounding, common pole grounding and series-wound grounding. Different control system should use special pole grounding, and different devices in the same control system should use common pole grounding, and different devices connected by same power cable should use series-wound grounding.

#### 4.6.3.2 Leakage current

Leakage current includes line-to-line leakage current and over-ground leakage current. Its value depends on distributed capacitances and carrier frequency of inverter. The over-ground leakage current, which is the current passing through the common ground wire, can not only flow into inverter system but also other devices. It also can make leakage current circuit breaker, relay or other devices malfunction. The value of line-to-line leakage current, which means the leakage current passing through distributed capacitors of input output wire, depends on the carrier frequency of inverter, the length and section areas of motor cables. The higher carrier frequency of inverter, the longer of the motor

cable and/or the bigger cable section area, the larger leakage current will occur.

Countermeasure:

Decreasing the carrier frequency can effectively decrease the leakage current. In the case of motor cable is relatively long (longer than 50m), it is necessary to install AC reactor or sinusoidal wave filter at the output side, and when it is even longer, it is necessary to install one reactor at every certain distance.

#### 4.6.3.5 EMC Filter

EMC filter has a great effect of electromagnetic decoupling, so it is preferred for customer to install it.

For inverter, noise filter has following categories:

- Noise filter installed at the input side of inverter;
- Install noise isolation for other equipment by means of isolation transformer or power filter.

**4.6.4 If user install inverter and EMI filter according to the installation guideline, we believe inverter system comply with following compliance.**

- EN61000-6-4
- EN61000-6-3
- EN61800-3

#### 4.6.5 Notice

- **This type of PDS is not intended to be used on a low-voltage public network which supplies domestic premise;**
- **Radio frequency interference is expected if used on such a network.**

## 5. OPERATION

### 5.1 Operating Keypad Description





#### 5.1.1 Keypad schematic diagram



Figure 5.1 Keypad schematic diagrams.

#### 5.1.2 Button function description

| Button | Name               | Description  |
|--------|--------------------|--|
|        | Programming Key    | Entry or escape of first-level menu.   |
|        | Enter Key          | Progressively enter menu and confirm parameters.   |
|        | UP Increment Key   | Progressively increase data or function codes.   |
|        | DOWN Decrement Key | Progressive decrease data or function codes.   |
|        | Shift Key          | In parameter setting mode, press this button to select the bit to be modified. In other modes, cyclically displays parameters by right shift |

| Button  | Name            | Description   |
|---|-----------------|---|
|  | Run Key         | Start to run the inverter in keypad control mode.   |
|  | STOP/RST Key    | In running status, restricted by P7.04, can be used to stop the inverter.<br>When fault alarm, can be used to reset the inverter without any restriction.   |
|  | Shortcut Key    | Determined by Function Code P7.03:<br>0: Jog operation<br>1: Switch between forward and reverse<br>2: Clear the UP/DOWN settings.<br>3: Quick debugging mode1 (by menu)<br>4: Quick debugging mode2 (by latest order)<br>5: Quick debugging mode3 (by non-factory setting parameters) |
|  | Combination Key | Pressing the <b>RUN</b> and <b>STOP/RST</b> at the same time can achieve inverter coast to stop.  |

### 5.1.3 Indicator light description

#### 5.1.3.1 Function indicator light description

| Function indicator | Description  |
|--------------------|--|
| <b>RUN/TUNE</b>    | Extinguished: stop status<br>Flickering: parameter autotuning status<br>Light on: operating status |
| <b>FWD/REV</b>     | Extinguished: forward operation<br>Light on: reverse operation.                                    |
| <b>LOCAL/REMOT</b> | Extinguished: keypad control<br>Flickering: terminal control<br>Light on: communication control    |
| <b>TRIP</b>        | Extinguished: normal operation status<br>Flickering: overload pre-warning status                   |

### 5.1.3.2 Unit indicator light description

| Function indicator | Description         |
|--------------------|---------------------|
| Hz                 | Frequency unit      |
| A                  | Current unit        |
| V                  | Voltage unit        |
| RPM                | Rotating speed unit |
| %                  | Percentage          |

### 5.1.3.3 Digital display

Have 5 digit LED , which can display all kinds of monitoring data and alarm codes such as reference frequency, output frequency and so on.

## 5.2 Operation Process

### 5.2.1 Parameter setting

Three levels of menu are:

- Function code group (first-level);
- Function code (second-level);
- Function code value (third-level).

Remarks:

Press both the PRG/ESC and the DATA/ENT can return to the second-class menu from the third-class menu. The difference is: pressing DATA/ENT will save the set parameters into the control panel, and then return to the second-class menu with shifting to the next function code automatically; while pressing PRG/ESC will directly return to the second-class menu without saving the parameters, and keep staying at the current function code.

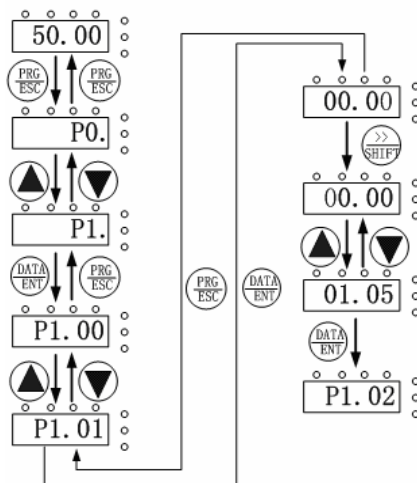


Figure 5.2 Flow chart of parameter setting.

Under the third-class menu, if the parameter has no flickering bit, it means the function code cannot be modified. The possible reasons could be:

- This function code is not modifiable parameter, such as actual detected parameter, operation records and so on;
- This function code is not modifiable in running status, but modifiable in stop status.

### 5.2.2 Fault reset

If the inverter has fault, it will prompt the related fault information. User can use **STOP/RST** or according terminals determined by P5 Group to reset the fault. After fault reset, the inverter is at stand-by state. If user does not reset the inverter when it is at fault state, the inverter will be at operation protection state, and can not run.

### 5.2.3 Parameter copy

For details, please refer to the instructions of LCD keyboard functions

### 5.2.4 Motor parameter autotune

If "Sensorless Vector Control" or "Vector Control with PG" mode is chosen, motor nameplate parameters must be input correctly as the autotuning is based on it. The performance of vector control depends on the parameters of motor strongly, so to achieve excellent performance, firstly must obtain the parameter of motor exactly.

The procedure of motor parameter autotuning is as follows:

Firstly, choose keypad command as the run command source (P0.01).

And then input following parameters according to the actual motor parameters:

P2.00: motor type selection

P2.01: motor rated power

P2.02: motor rated frequency;

P2.03: motor rated speed;

P2.04: motor rated voltage;

P2.05: motor rated current

Encoder parameters determination:

P4.00: encoder type selection;

P4.01: encoder pulses number

Set P0.07 to be 1, and for the detail process of motor parameter autotuning, please refer to the description of Function Code P0.07. And then press **RUN** on the keypad panel, the inverter will automatically calculate following parameter of the motor:

P2.07: motor stator resistance;

P2.08: motor rotor resistance;

P2.09: motor stator and rotor inductance;

P2.10: motor stator and rotor mutual inductance;

P2.11: motor current without load; motor autotuning is finished.

In the self-learning process, the keyboard will show TUN-1, TUN-2. When the keyboard displays END, the motor autotuning is finished. Using **>> / SHIFT** can change parameters and monitor running state of inverter.

**Notice: The motor should be uncoupled with its load; otherwise, the motor parameters obtained by autotuning may be incorrect.**

### 5.2.5 Password Settings:

CHV190 series inverter provides user password protection function. When P7.00 is zero, which is user's password, quitting code editing state can make password protection effective, then pressing **PRG/ESC** can enter code editing state, "-----" will be showed. Operator must enter a correct.

To cancel password protection function, setting P7.00 to be zero is ok. User's password has no protection to the parameter on shortcut menu.

## 5.3 Running State

### 5.3.1 Power-on initialization

Firstly the system initializes during the inverter power-on, and LED displays "8888". After the initialization is completed, the inverter is on stand-by status.

### 5.3.2 Stand-by

At stop or running status, parameters of multi-status can be displayed. Whether or not to display this parameter can be chosen through Function Code P7.06 (Running status display selection) and P7.07 (Stop status display selection) according to binary bits, the detailed description of each bit please refer to the function code description of P7.06 and P7.07.

In stop status, there are sixteen parameters which can be chosen to display or not. They are: reference frequency, fault code, DC bus voltage, input terminal status, output terminal status, motor pole pairs, analog AI1, analog AI2, HDI1 frequency, and some reserved parameters. Whether or not to display can be determined by setting the corresponding binary bit of P7.07. Press the **>>/SHIFT** to scroll through the parameters in right order.

### 5.3.3 Operation

In running status, there are sixteen running parameters which can be chosen to display or not. They are: running frequency, reference frequency, DC bus voltage, output voltage, output current, rotating speed, output power, output torque, input terminal status, output terminal status, analog AI1, analog AI2, HDI1 frequency, magnetic pole position, torque Compensation and some reserved parameters. Whether or not to display can be determined by setting the corresponding binary bit of P7.06. Press the **>>/SHIFT** to scroll through the parameters in right order .

### 5.3.4 Fault

In fault status, inverter will display parameters of STOP status besides parameters of fault status. Press the **>>/SHIFT** to scroll through the parameters in right order.

## 6. DETAILED FUNCTION DESCRIPTION

### 6.1 P0 Group--Basic Function

| Function Code | Name               | Description  | Setting Range | Factory Setting |
|---------------|--------------------|--|---------------|-----------------|
| P0.00         | Speed control mode | 0:Sensorless vector control<br>1:Vector control With PG<br>2:V/F control | 0~2           | 1               |

0: Sensorless vector control: sensorless vector control is only suitable for motor commissioning or some application need not high accuracy.

1: Vector control with PG: The closed-loop vector is used for high accuracy speed control and quick dynamic response working with encoder,

2: V/F control: It is only suitable for motor commissioning or some application need not high accuracy.

**Notice:**

Select vector control mode, you must correctly set the motor nameplate parameters and encoding parameters, and in order to obtain accurate motor parameters self-learning should be finished before running. Only with accurate motor parameters can play a high-performance vector control.

Adjust the parameters of vector control (P3 group) can be optimized vector control performance.

| Function Code | Name               | Description   | Setting Range | Factory Setting |
|---------------|--------------------|---|---------------|-----------------|
| P0.01         | Run command source | 0: Keypad (LED extinguished)<br>1: Terminal (LED flickering)<br>2: Communication (LED lights on)<br>3: Profibus communication (LED lights on) | 0~3           | 1               |

The control commands of inverter include: start, stop, forward run, reverse run, jog, fault reset and so on.

0: Keypad (LED extinguished);

Both **RUN** and **STOP/RST** key are used for running command control. If Multifunction key **QUICK/JOG** is set as FWD/REV switching function (P7.03 is set to be 1), it will be used to change the rotating orientation. In running status, pressing **RUN** and **STOP/RST** in the same time will cause the inverter coast to stop.

#### 1: Terminal (LED flickering)

The operation, including forward run, reverse run, forward jog, reverse jog etc. can be controlled by multifunctional input terminals.

#### 2: Modbus Communication (LED lights on)

Command from the host computer through Modbus communication control. Using this must select Modbus serial communication interface expansion cards which are matched to CHV190.

#### 3: Profibus communication (LED lights on)

Command from the host computer through Profibus communication control. Using this must select Profibus communication interface of the expansion cards.

| Function Code | Name                        | Description   | Setting Range | Factory Setting |
|---------------|-----------------------------|---|---------------|-----------------|
| P0.02         | Speed instruction selection | 0: Keypad:<br>1: AI1<br>2: AI2<br>3: HDI1<br>4: Multi-steps speed<br>5: UP/DOWN terminal<br>6: Modbus Communication<br>7: Profibus communication<br>8: Hierarchical multi-stage speed | 0~8           | 0               |

0: Keypad: Please refer to description of P0.04

1: AI1

2: AI2

The reference speed is set by analog input. AI1 is 0~10V voltage input terminal, while AI3 is -10V~10V voltage input.

#### Notice:

- **For detailed relationship between analog input voltage and frequency, please refer to description of P5.15~P5.19.**
- **100% of AI is corresponding to maximum frequency.**

### 3:HDI1

The reference speed is set by high speed pulse input.

Pulse specification: pulse voltage range 9~30V, and the frequency range 0.0~50.0 kHz.

Pulse input setting 100.0% corresponds to the maximum positive frequency (P0.03); s  
-100.0% corresponds to the maximum frequency of the reverse.

### 4:Multi-steps speed

Select this mode, converter runs with multi-step speed. Running speed is determined by P1 and P5. If P0.02 is not set as multi-step speed, then the multi-step speed settings have priority.

Up to 8 multi-step speed given is set though binary mode, Please refer to P1.

### 5: UP/DOWN terminal

Modified by an external terminal for frequency reference, frequency increment and decrement.

**Notice: The frequency cleared automatically when shutdown.**

### 6: Modbus Communication

Frequency command is given from the host computer via Modbus communication. For details, see Chapter 10 "communication protocol."

### 7: Profibus communication

Speed instruction is given by the Profibus communication. For details, see the Profibus communication protocol.

### 8: Hierarchical multi-step speed

supports up to six steps speed under hierarchical multi-step speed mode, running speed is determined by the P1 and P5 group. Please refer to P1 in order to know combination relationship.

| Function Code | Name              | Description      | Setting Range | Factory Setting |
|---------------|-------------------|------------------|---------------|-----------------|
| P0.03         | Maximum frequency | 10.0Hz ~400.00Hz | 10.0~400.00   | 50.00Hz         |

P0.03 is the maximum frequency which inverter can output, this value is set according to the actual situation. The frequency is the basis for converter to be fast or slow.

| Function Code | Name                       | Description | Setting Range | Factory Setting |
|---------------|----------------------------|-------------|---------------|-----------------|
| P0.04         | Keypad reference frequency | 0.00~P0.03  | 0.00~P0.03    | 50.00Hz         |

When P0.03 is set to be 0, this parameter is the initial value of inverter reference

frequency.

| Function Code | Name                        | Description                                   | Setting Range | Factory Setting |
|---------------|-----------------------------|---|---------------|-----------------|
| P0.05         | Running direction selection | 0: Forward<br>1: Reverse<br>2: Forbid reverse | 0~2           | 0               |

**Notice:**

- The rotation direction of motor is corresponding to the wiring of motor.
- When the factory setting is restored (P0.12 is set to be 1), the rotation direction of motor may be changed. Please be cautious to use.
- If P0.05 is set to 2, user can not change rotation direction of motor by

**QUICK/JOG** or terminal.

| Function Code | Name              | Description | Setting Range | Factory Setting |
|---------------|-------------------|-------------|---------------|-----------------|
| P0.06         | Carrier frequency | 1.0~16.0kHz | 1.0~16.0      | Depend on model |

| Carrier frequency | Electromagnetic noise | Noise leakage current | Radiating        |
|-------------------|-----------------------|-----------------------|------------------|
| 1 kHz             | ↑ Big<br>↓ Small      | ↑ Small<br>↓ Big      | ↑ Small<br>↓ Big |
| 10 kHz            |                       |                       |                  |
| 16 kHz            |                       |                       |                  |

Figure 6.1 Effect of carrier frequency

| Model                | Carrier frequency | Factory Setting( kHz ) |
|----------------------|-------------------|------------------------|
| G Model: 18.5kW~55kW |                   | 4                      |
| G Model: 75kW~185kW  |                   | 2                      |
| G Model: >185kw      |                   | 1                      |

Carrier frequency will affect the noise of motor and the EMI of inverter.

If the carrier frequency is increased, it will cause better current wave, less harmonic current and lower noise of motor.

**Notice:**

- The factory setting is optimal in most cases. Modification of this parameter is not recommended.

- If the carrier frequency exceeds the factory setting, the inverter must be derated because the higher carrier frequency will cause more switching loss, higher temperature rise of inverter and stronger electromagnetic interference.
- If the carrier frequency is lower than the factory setting, it is possible to cause less output torque of motor and more harmonic current.

| Function Code | Name                        | Description  | Setting Range | Factory Setting |
|---------------|-----------------------------|--|---------------|-----------------|
| P0.07         | Motor parameters autotuning | 0: No action<br>1: Rotation autotuning<br>2: Static autotuning | 0~2           | 0               |

0: No action: Forbidding autotuning.

1: Rotation autotuning:

- Do not connect any load to the motor when performing autotuning and ensure the motor is in static status. Otherwise the parameters detected by autotuning will be incorrect; it may influence the performance of inverter. Specific self-learning process, taking into account the following flowchart.
- Set the proper acceleration and deceleration speed (P1.20 and P1.21) according to the motor inertia before performing autotuning. Otherwise it may cause over-current and over-voltage fault during autotuning.

In the process of parameter self-learning, pressing **>>/SHIFT** can switch keyboard display parameters, monitor inverter run state; pressing **STOP/RST** can terminate self-learning process at any time.

### CHV190 series special inverter for crane

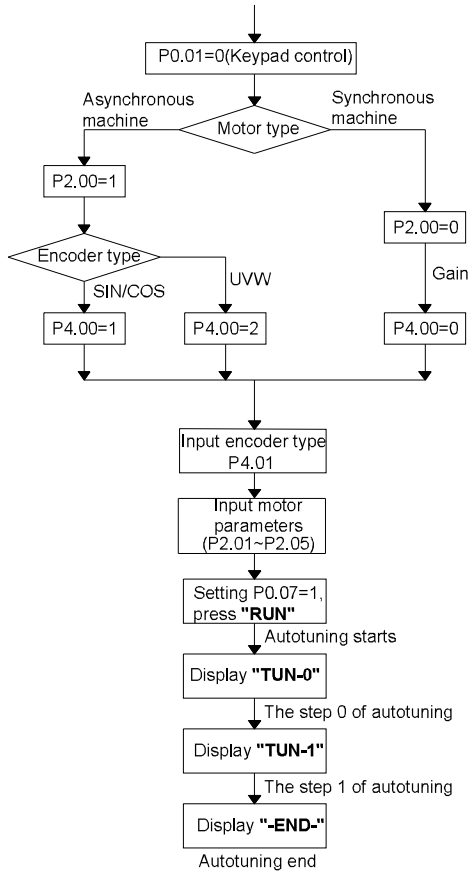


Figure 6.2 Flow chart for motor 1 autotuning

If you choose motor 2 at this time, then the current autotuning of the motor is 2#, for details please refer to the flow chart of motor 1

#### 2: Static autotuning:

- If it is difficult to disconnect the load, static autotuning is recommended.
- The operation process is the same as rotation autotuning except step c.

**Notice: The Mutual inductance and current without load will not be detected by static autotuning, if needed user should input suitable value according to experience.**

| Function Code | Name     | Description | Setting Range | Factory Setting |
|---------------|----------|-------------|---------------|-----------------|
| P0.08~P0.10   | Reserved | 0~65535     | 0~65535       | 0               |

| Function Code | Name                       | Description  | Setting Range | Factory Setting |
|---------------|----------------------------|--|---------------|-----------------|
| P0.11         | Application mode selection | 0: Common application mode<br>1: Operating lever mode<br>2: Remote Mode<br>3: Hierarchical operating lever mode<br>4: Hierarchical remote mode<br>5: Electric potentiometer mode<br>6: Master-slave power equilibrium host mode<br>7: Master-slave power equilibrium subordinate mode<br>8: Master-slave speed synchronization host mode<br>9: Master-slave speed synchronization subordinate mode | 0~9           | 0               |

The users make selection based on the actual application, please refer to appendix part to know corresponding model, when only need setting this one parameter to achieve the basic application requirements.

| Function Code | Name               | Description  | Setting Range | Factory Setting |
|---------------|--------------------|--|---------------|-----------------|
| P0.12         | Restore parameters | 0: No action<br>1: Restore factory setting<br>2: Clear fault records | 0~2           | 0               |

**Notice: This function code will restore to 0 automatically when complete the function operation.**

## 6.2 P1 Group--Speed Curve

| Function Code | Name               | Description   | Setting Range | Factory Setting |
|---------------|--------------------|---------------|---------------|-----------------|
| P1.00         | Multi-step speed 0 | -100.0~100.0% | -100.0~100.0  | 0.0%            |
| P1.01         | Multi-step speed 1 | -100.0~100.0% | -100.0~100.0  | 0.0%            |
| P1.02         | Multi-step speed 2 | -100.0~100.0% | -100.0~100.0  | 0.0%            |
| P1.03         | Multi-step speed 3 | -100.0~100.0% | -100.0~100.0  | 0.0%            |
| P1.04         | Multi-step speed 4 | -100.0~100.0% | -100.0~100.0  | 0.0%            |
| P1.05         | Multi-step speed 5 | -100.0~100.0% | -100.0~100.0  | 0.0%            |
| P1.06         | Multi-step speed 6 | -100.0~100.0% | -100.0~100.0  | 0.0%            |
| P1.07         | Multi-step speed 7 | -100.0~100.0% | -100.0~100.0  | 0.0%            |

P1.00~P1.07 defines a multi-stage classification for a given speed; there are two combinations for the speed:

1. Binary multi-step speed terminal (P0.02 = 4): eight steps speed choices (P1.00 ~ P1.07) can be achieved through the combination of three-speed terminals (MS1, MS2, MS3).
2. Hierarchical multi-step speed (P0.02 = 8): up to six level speed options (P1.00 ~ P1.05) can be achieved through the combination of five multi-step speed.

In normal mode, multi-speed function is valid, and its corresponding binary combinations are as follows:

| Multi-step speed terminal MS1 | Multi-step speed terminal MS2 | Multi-step speed terminal MS3 | Speed setting      | Function code |
|-------------------------------|-------------------------------|-------------------------------|--------------------|---------------|
| OFF                           | OFF                           | OFF                           | Multi-step speed 0 | P1.00         |
| ON                            | OFF                           | OFF                           | Multi-step speed 1 | P1.01         |
| OFF                           | ON                            | OFF                           | Multi-step speed 2 | P1.02         |
| ON                            | ON                            | OFF                           | Multi-step speed 3 | P1.03         |
| OFF                           | OFF                           | ON                            | Multi-step speed 4 | P1.04         |
| ON                            | OFF                           | ON                            | Multi-step speed 5 | P1.05         |

| Multi-step speed terminal MS1 | Multi-step speed terminal MS2 | Multi-step speed terminal MS3 | Speed setting      | Function code |
|-------------------------------|-------------------------------|-------------------------------|--------------------|---------------|
| OFF                           | ON                            | ON                            | Multi-step speed 6 | P1.06         |
| ON                            | ON                            | ON                            | Multi-step speed 7 | P1.07         |

In the other mode (crane mode), grading given is valid and its compositions are as follows:

| Hierarchical given terminal 1 | Hierarchical given terminal 2 | Hierarchical given terminal 3 | Hierarchical given terminal 4 | Hierarchical given terminal 5 | Speed setting        | Function Code |
|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|----------------------|---------------|
| OFF                           | OFF                           | OFF                           | OFF                           | OFF                           | Hierarchical given 0 | P1.00         |
| ON                            | OFF                           | OFF                           | OFF                           | OFF                           | Hierarchical given 1 | P1.01         |
| ON                            | ON                            | OFF                           | OFF                           | OFF                           | Hierarchical given 2 | P1.02         |
| ON                            | ON                            | ON                            | OFF                           | OFF                           | Hierarchical given 3 | P1.03         |
| ON                            | ON                            | ON                            | ON                            | OFF                           | Hierarchical given 4 | P1.04         |
| ON                            | ON                            | ON                            | ON                            | ON                            | Hierarchical given 5 | P1.05         |

**Notice: Only the low-level Hierarchical given is ON, the up-level Hierarchical given will be ready for switching to ON.**

| Function Code | Name                            | Description           | Setting Range | Factory Setting |
|---------------|---------------------------------|-----------------------|---------------|-----------------|
| P1.08         | Acceleration /Deceleration mode | 0:Linear<br>1:S curve | 0~1           | 1               |
| P1.09         | Linear acceleration time        | 0.0~3600.0s           | 0.0~3600.0    | 20.0s           |
| P1.10         | Linear deceleration time        | 0.0~3600.0s           | 0.0~3600.0    | 20.0s           |

| Function Code | Name                                  | Description  | Setting Range | Factory Setting |
|---------------|---------------------------------------|--------------|---------------|-----------------|
| P1.11         | Start section of acceleration S curve | 0.1~50.0%    | 0.1~50.0      | 10.0%           |
| P1.12         | End section of acceleration S curve   | 0.1~50.0%    | 0.1~50.0      | 10.0%           |
| P1.13         | Start section of deceleration S curve | 0.1~50.0%    | 0.1~50.0      | 10.0%           |
| P1.14         | End section of deceleration S curve   | 0.1~50.0%    | 0.1~50.0      | 10.0%           |
| P1.15         | Start frequency                       | 0.00~10.00Hz | 0.00~10.00    | 0.00Hz          |
| P1.16         | Starting frequency keeping time       | 0.00~5.00s   | 0.00~5.00     | 0.00s           |

P1.11 and P1.12 are only active when P1.08=1. During  $t_1$  period, the change rate of output frequency increases from 0; During  $t_2$  period, the change rate of output frequency decrease to 0; During the period between  $t_1$  and  $t_2$ , the change rate of output frequency remain constant.

The curvature of S curve is codetermined by ACC/DEC time, start section time and end section time.

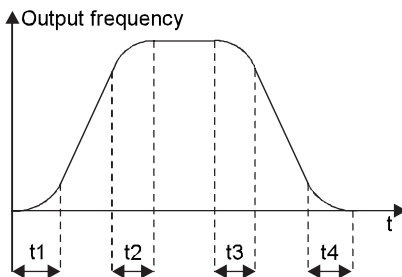


Figure 6.3 S curve diagram.

P1.15 (start frequency) is the initial velocity when inverter starts. If the setting speed is less than starting speed, the inverter output frequency is 0; only when setting speed is greater than or equal to the starting speed, the inverter can run according to s curve. Set

appropriate starting speed to overcome the static friction when the crane starts to reduce impact.

P1.16 (starting speed keeping time) is the time that inverter starts with the start running speed.

| Function Code | Name                  | Description | Setting Range | Factory Setting |
|---------------|-----------------------|-------------|---------------|-----------------|
| P1.17         | Jog reference         | 0.00~P0.03  | 0.00~P0.03    | 5.00Hz          |
| P1.18         | Jog acceleration time | 0.0~3600.0s | 0.0~3600.0    | 20.0s           |
| P1.19         | Jog deceleration time | 0.0~3600.0s | 0.0~3600.0    | 20.0s           |

Set jog speed, jog acceleration/deceleration speed follow the jog curve as follows.

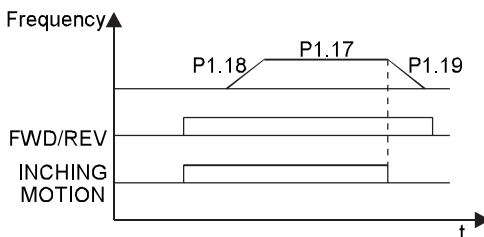


Figure 6.4 Jog running curve

**Notice: The speed selection priority is as follows. Jog running > multi-step speed, keyboard settings or analog settings or communications settings.**

| Function Code | Name                      | Description | Setting Range | Factory Setting |
|---------------|---------------------------|-------------|---------------|-----------------|
| P1.20         | Motor autotuning ACC time | 0.1~3600.0s | 0.1~3600.0    | 40.0s           |
| P1.21         | Motor autotuning DEC time | 0.1~3600.0s | 0.1~3600.0    | 40.0s           |
| P1.22         | Slow running frequency    | 0.00~P0.03  | 0.00~P0.03    | 5.00Hz          |
| P1.23         | Slow running ACC/DEC time | 0.0~3600.0s | 0.0~3600.0    | 20.0s           |

Set slow running frequency and ACC/DEC time. When inverter receives "slow running" signal from the input terminals, it runs under the slow running speed.

| Function Code | Name                     | Description | Setting Range | Factory Setting |
|---------------|--------------------------|-------------|---------------|-----------------|
| P1.24         | Forced deceleration time | 0.1~3600.0s | 0.1~3600.0    | 2.0s            |

Set forced deceleration time. When inverter receives "forced deceleration" signal from the input terminals, the speed reduces to 0 within this deceleration time.

| Function Code | Name      | Description                                 | Setting Range | Factory Setting |
|---------------|-----------|---|---------------|-----------------|
| P1.25         | Stop mode | 0: Deceleration to stop<br>1: Coast to stop | 0~1           | 1               |

0: Deceleration to stop

When the stop command takes effect, the inverter decreases the output frequency according to P1.05 and the selected acceleration/deceleration time till stop.

1: Coast to stop

When the stop command takes effect, the inverter blocks the output immediately. The motor coasts to stop by its mechanical inertia.

| Function Code | Name                               | Description | Setting Range | Factory Setting |
|---------------|------------------------------------|-------------|---------------|-----------------|
| P1.26         | Subsidiary motor acceleration time | 0.0~3600.0s | 0.0~3600.0    | 1.0s            |
| P1.27         | Subsidiary motor deceleration time | 0.0~3600.0s | 0.0~3600.0    | 1.0s            |

Set subsidiary motor ACC/DEC time when master-slave control, the time should be shorter than or equal to ACC/DEC time of the host motor.

| Function Code | Name     | Description | Setting Range | Factory Setting |
|---------------|----------|-------------|---------------|-----------------|
| P1.28         | Reserved | 0~65535     | 0~65535       | 0               |
| P1.29         | Reserved | 0~65535     | 0~65535       | 0               |

### 6.3 P2 Group--Motor Parameters

| Function Code | Name           | Description                                      | Setting Range | Factory Setting |
|---------------|----------------|--|---------------|-----------------|
| P2.00         | Inverter model | 0:Asynchronous machine<br>1: Synchronous machine | 0~1           | 0               |

**Notice: Setting right type of motor before self-learning.**

| Function Code | Name                  | Description | Setting Range | Factory Setting |
|---------------|-----------------------|-------------|---------------|-----------------|
| P2.01         | Motor rated power     | 0.4~900.0kW | 0.4~900.0     | Depend on model |
| P2.02         | Motor rated frequency | 0.01~P0.03  | 0.01~P0.03    | 50.00Hz         |
| P2.03         | Motor rated speed     | 1~36000rpm  | 1~36000       | 1460rpm         |
| P2.04         | Motor rated voltage   | 0~500V      | 0~500         | 380V            |
| P2.05         | Motor rated current   | 0.1~2000.0  | 0.1~2000.0    | Depend on model |

**Notice:**

- In order to achieve superior performance, please set these parameters according to motor nameplate, and then perform autotuning.
- The power rating of inverter should match the motor. If the bias is too big, the control performances of inverter will be deteriorated distinctly.
- Reset P2.01 can initializes P2.07~P2.11 automatically.

| Function Code | Name               | Description | Setting Range | Factory Setting |
|---------------|--------------------|-------------|---------------|-----------------|
| P2.06         | Motor power factor | 0.05~1.00   | 0.05~1.00     | 0.86            |

When the motor is autotuning, setting the parameter can optimize the motor control performance.

| Function Code | Name                     | Description   | Setting Range | Factory Setting |
|---------------|--------------------------|---------------|---------------|-----------------|
| P2.07         | Motor stator resistance  | 0.001~65.535Ω | 0.001~65.535  | Depend on model |
| P2.08         | Motor rotor resistance   | 0.001~65.535Ω | 0.001~65.535  | Depend on model |
| P2.09         | Motor leakage inductance | 0.1~6553.5mH  | 0.1~6553.5    | Depend on model |
| P2.10         | Motor mutual inductance  | 0.1~6553.5mH  | 0.1~6553.5    | Depend on model |
| P2.11         | Current without load     | 0.1~6553.5A   | 0.1~6553.5    | Depend on model |

After autotuning, the value of P2.07~P2.11 will be automatically updated.

**Notice: Do not change these parameters; otherwise it may deteriorate the control performance of inverter.**

| Function Code | Name                                  | Description | Setting Range | Factory Setting |
|---------------|---------------------------------------|-------------|---------------|-----------------|
| P2.12         | Magnetic pole initial position        | 0.00~360.00 | 0.00~360.00   | 0.00            |
| P2.13         | Magnetic pole position amplitude gain | 0.50~1.50   | 0.50~1.50     | 1               |
| P2.14         | C-phase magnetic pole position bias   | 0~9999      | 0~9999        | 433             |
| P2.15         | D-phase magnetic pole position bias   | 0~9999      | 0~9999        | 433             |

P2.12~P2.15 is valid only for synchronous motor.

| Function Code | Name                              | Description | Setting Range | Factory Setting |
|---------------|-----------------------------------|-------------|---------------|-----------------|
| P2.16         | Motor weak magnetic coefficient   | 0.1~2.0     | 0.1~2.0       | 1.0             |
| P2.17         | Motor minimum weak magnetic limit | 10.0~80.0   | 10.0~80.0     | 20.0            |

Motor is used under weak magnetic control.

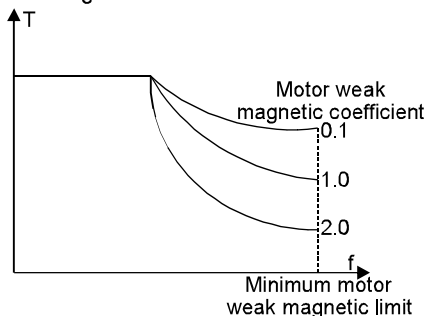


Figure 6.5 Motor weak magnetic

Function code P2.16 and P2.17 are valid for close loop vector control. When motor speed

is higher than rated speed, the motor is running into the weak magnetism. By modifying the weak magnetism control coefficient can change the curvature of weak magnetic curve, the greater of P2.16 the steeper of weak magnetic curve becomes, the smaller of P2.16 the flatter weak magnetic curve becomes.

| Function Code | Name                     | Description | Setting Range | Factory Setting |
|---------------|--------------------------|-------------|---------------|-----------------|
| P2.18         | Weak magnetic proportion | 0~65535     | 0~65535       | 0               |

Appropriate adjustments of this parameter can improve the motor performance when motor is working under weak magnetic control. The adjusting range is 2000~5000.

| Function Code | Name   | Description | Setting Range | Factory Setting |
|---------------|--|-------------|---------------|-----------------|
| P2.19         | Low-frequency oscillation suppression tolerance  | 0~10        | 0~10          | 2               |
| P2.20         | High-frequency oscillation suppression tolerance | 0~10        | 0~10          | 0               |

When oscillation occurs under autotuning or V/F mode, the parameter should be adjusted.

| Function Code | Name                         | Description | Setting Range | Factory Setting |
|---------------|------------------------------|-------------|---------------|-----------------|
| P2.21         | Motor output maximum voltage | P2.04~550V  | P2.04~550     | 380V            |

Set the output maximum voltage of motor during the weak magnetic state.

| Function Code | Name                                 | Description  | Setting Range | Factory Setting |
|---------------|--------------------------------------|--|---------------|-----------------|
| P2.22         | Motor switching type                 | 1. Keypad<br>2. Profibus-DP<br>3. External terminal  | 0~2           | 0               |
| P2.23         | Keypad selection of motor parameters | 0. Motor 0 parameters<br>1. Motor 1 parameters<br>2. Motor 2 parameters<br>3. Motor 3 parameters | 0~3           | 0               |

## 6.4 P3 Group--Vector Control

| Function Code | Name                                   | Description  | Setting Range | Factory Setting |
|---------------|--|--------------|---------------|-----------------|
| P3.00         | ASR low-speed proportional gain        | 0~100        | 0~100         | 20              |
| P3.01         | ASR low-speed integral time            | 0.01~10.00s  | 0.01~10.00    | 0.50s           |
| P3.02         | Speed detection low-speed filter time  | 0.000~3.000s | 0.000~3.000   | 0.000s          |
| P3.03         | Low switching frequency                | 0.00Hz~P3.05 | 0.00~P3.05    | 5.00Hz          |
| P3.04         | ASR high-speed proportional gain       | 0~100        | 0~100         | 25              |
| P3.05         | ASR low-speed integral time            | 0.01~10.00s  | 0.01~10.00    | 1.00s           |
| P3.06         | Speed detection high-speed filter time | 0.000~3.000s | 0.000~3.000   | 0.000s          |
| P3.07         | High switching frequency               | P3.03~P0.04  | P3.03~P0.04   | 10.00HZ         |

P3.00~P3.07 are only valid for vector control and torque control and invalid for V/F control. Through P3.00~P3.07, user can set the proportional gain  $K_p$  and integral time  $K_i$  of speed regulator (ASR), so as to change the speed response characteristic. ASR's structure is shown in following figure.

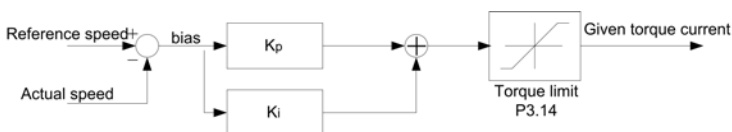


Figure 6.6 ASR diagram.

P3.00 and P3.01 only take effect when output frequency is less than P3.03. P3.04 and P3.05 only take effect when output frequency is greater than P3.07. When output frequency is between P3.03 and P3.07,  $K_p$  and  $K_i$  are proportional to the bias between P3.03 and P3.07. For details, please refer to following figure.

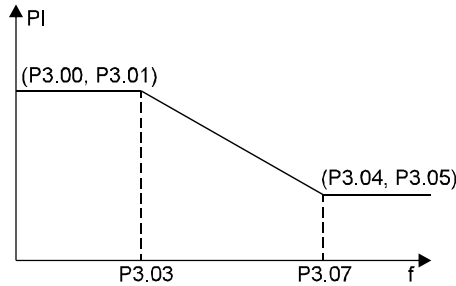


Figure 6.7 PI parameter diagram.

The system's dynamic response can be faster if the proportion gain  $K_p$  is increased; However, if  $K_p$  is too large, the system tends to oscillate.

The system dynamic response can be faster if the integral time  $K_i$  is decreased; However, if  $K_i$  is too small, the system becomes overshoot and tends to oscillate.

P3.00 and P3.01 are corresponding to  $K_p$  and  $K_i$  at low frequency, while P3.04 and P3.05 are corresponding to  $K_p$  and  $K_i$  at high frequency. Please adjust these parameters according to actual situation. The adjustment procedure is as follow:

1. Increase the proportional gain ( $K_p$ ) as far as possible without creating oscillation.
2. Reduce the integral time ( $K_i$ ) as far as possible without creating oscillation.

For more details about fine adjustment, please refer to description of P9 group.

P3.02 and P3.06 is the time for motor speed detection filter time. Under normal circumstances don't need to adjust, but in larger interference occasion need to set the time appropriately.

| Function Code | Name                    | Description | Setting Range | Factory Setting |
|---------------|-------------------------|-------------|---------------|-----------------|
| P3.08         | ACR proportional gain P | 0~65535     | 0~65535       | 500             |
| P3.09         | ACR integral gain I     | 0~65535     | 0~65535       | 500             |

The bigger the proportional gain P, the faster the response, but oscillation may easily occur. If only proportional gain P is applied in regulation, the bias cannot be eliminated. In order to eliminate the bias, apply the integral gain I to achieve PI regulator.

| Function Code | Name                                       | Description | Setting Range | Factory Setting |
|---------------|--|-------------|---------------|-----------------|
| P3.10         | Driver side slip compensation coefficients | 50~200%     | 50~200        | 100%            |

| Function Code | Name  | Description | Setting Range | Factory Setting |
|---------------|---|-------------|---------------|-----------------|
| P3.11         | Braking side slip compensation coefficients | 50~200%     | 50~200        | 100%            |

Slip compensation coefficients is used to adjust slip frequency of vector control and improve control accuracy of system speed. Adjust the parameters appropriately, speed static error can be restrained effectively. These settings are valid for both electric state and regenerative braking states.

| Function Code | Name                  | Description   | Setting Range | Factory Setting |
|---------------|-----------------------|---|---------------|-----------------|
| P3.12         | Torque setting source | 0: Disabled<br>1: Keypad<br>2: AI1<br>3: AI2<br>4: 485 communication<br>5: Profibus communication<br>6: HDI<br>7: Subsidiary machine inside setting | 0~7           | 0               |
| P3.13         | Keypad torque setting | -100.0~100.0%   | -100.0~100.0  | 50.0%           |
| P3.14         | Torque limit          | 0.0~200.0%  | 0.0~200.0     | 150.0%          |

0: Torque control is disabled. Inverter will run at speed control mode. Output torque of inverter which should not greater than torque limit (P3.14) matches the torque of load automatically. When the torque of load is greater than torque limit, output torque will remain as torque limit and output frequency will decrease automatically.

1~7: Torque control is enabled.

When torque control takes effect,

If  $T_{set} > T_{load}$ , output frequency will increase continuously until it reaches upper frequency limit.

If  $T_{set} < T_{load}$ , output frequency will decrease continuously until it reaches lower frequency limit.

Inverter can run at any frequency between upper and lower frequency limit only when  $T_{set} = T_{load}$ .

| Function Code | Name  | Description  | Setting Range | Factory Setting |
|---------------|---|--|---------------|-----------------|
| P3.15         | Torque limit method selection               | 0: Keypad(maximum torque is set up by P3.14)<br>1: Profibus  | 0~1           | 0               |
| P3.16         | Torque control prohibition access selection | 0: Torque control prohibition is invalid<br>1: Terminal torque control prohibition is valid<br>2: Profibus torque control prohibition is valid<br>3: Both controls are valid | 0~3           | 0               |

This function of P3.16 is mainly used in inverter torque control mode to achieve the switch between speed control mode and torque control mode.

0: Torque control prohibition is invalid

As long as P3.12  $\neq$  0, torque control is valid.

1: Terminal torque control prohibition is valid

When P3.12  $\neq$  0, terminal function can be used to prohibit torque control.

2: Profibus torque control prohibition is valid

The terminal torque control prohibition is invalid when P3.16 = 2.

3: Both controls are valid

| Function Code | Name                                 | Description | Setting Range | Factory Setting |
|---------------|--------------------------------------|-------------|---------------|-----------------|
| P3.17         | Forward torque upper frequency limit | 0.00~P0.03  | 0.00~P0.03    | 50.00HZ         |

This function is used to set the maximum frequency when torque control.

| Function Code | Name                                 | Description   | Setting Range | Factory Setting |
|---------------|--------------------------------------|---|---------------|-----------------|
| P3.18         | Forward torque upper frequency limit | 0: Keyboard<br>1: AI1<br>2: AI2<br>3: HDI<br>4: 485 Communications<br>5: Profibus communication | 0~5           | 0               |

When Forward torque upper frequency limit is 0, maximum frequency is set by the function code P3.17.

| Function Code | Name  | Description   | Setting Range | Factory Setting |
|---------------|---|---|---------------|-----------------|
| P3.19         | Reverse torque upper frequency limit                    | 0.00~P0.03  | 0.00~P0.03    | 50.00HZ         |
| P3.20         | Reverse torque upper frequency limit                    | 0: Keypad<br>1: AI1<br>2: AI2<br>3: HDI<br>4: 485 communication<br>5: Profibus-DP | 0~5           | 0               |
| P3.21         | Proportional coefficient of high frequency current loop | 0~65535   | 0~65535       | 1000            |
| P3.22         | Integral coefficient of high frequency current loop     | 0~65535   | 0~65535       | 500             |
| P3.23         | Torque boost  | 0.0~10.0  | 0.0~10.0      | 0.0%            |
| P3.24         | Torque boost upper limited frequency                    | 0.0~50.0%   | 0.0~50.0%     | 20.0%           |

Torque boost is valid under P3.24. Please refer to V/F curve of figure 6.8 as below to improve low frequency V/F torque characteristic.

According to load to select torque boost value.

Increase torque for big load, but the torque boost can not be set too big. Because the torque boost increasing too much will make the motor over excitation, the inverter output current will be big which will cause the motor increasing heating dissipation, reduce the efficiency. If P3.23=0.0%, the inverter torque output boosts automatically.

The inverter torque boost is valid when the frequency is less than P3.24. Otherwise, the torque boost will be invalid.

## 6.5 P4 Group--Encoder

| Function Code | Name         | Description  | Setting Range | Factory Setting |
|---------------|--------------|--|---------------|-----------------|
| P4.00         | Encoder type | 0: Incremental encoder<br>1: SIN/COS encoder<br>2: UVW encoder | 0~2           | 0               |

Encoder wiring diagram please refer to figure 7.2 and 7.3.

Notice: P2.00 = 0 (asynchronous motor), incremental encoder is the only choice; P2.00=1 (synchronous motor), SIN/COS and UVW-type encoders are valid.

| Function Code | Name              | Description | Setting Range | Factory Setting |
|---------------|-------------------|-------------|---------------|-----------------|
| P4.01         | Encoder pulse     | 1~65535     | 1000          | Depend on model |
| P4.02         | Encoder direction | 0~1         | 0~1           | 0               |

**Notice: Encode parameters (P4.01) must be set properly under vector control with PG Card, otherwise the motor can't run properly. After encoder parameters setting, inverter still can't work, please change the encoder direction (P4.02).**

| Function Code | Name   | Description | Setting Range | Factory Setting |
|---------------|--|-------------|---------------|-----------------|
| P4.03         | Low-speed, encoder disconnection detection time  | 0.0~100.0s  | 0.0~100.0     | 1.0s            |
| P4.04         | High-speed, encoder disconnection detection time | 0.0~100.0s  | 0.0~100.0     | 1.0s            |
| P4.05         | Encoder reverse detection time                   | 0.0~100.0s  | 0.0~100.0     | 1.0s            |

P4.03 and P4.04 defines encoder disconnection fault detection time, when the encoder disconnection time is longer than set time, inverter shows PCE, P4.03 corresponds to low-speed segment and P4.04 corresponds to high-speed segment.

P4.05 defines encoder reverse fault detection time, when the encoder reverse time is longer than corresponding reverses detection time, system shows PCDE.

**Notice: The adjustment of these parameters will affect the sensitivity of the encoder fault protection, sometimes even appears abnormal movements, please carefully adjust.**

| Function Code | Name                                  | Description | Setting Range | Factory Setting |
|---------------|---------------------------------------|-------------|---------------|-----------------|
| P4.06         | Position calculator conversion factor | 10.0~6553.5 | 10.0~6553.5   | 10.0            |

This function is used to set location counter conversion factor (unit pulse),

Unit: pulses/mm.

Location counter conversion factor is calculated as follows:

The speed of crane is 60 m/min (60000 mm/min), corresponding motor speed is 1460 rpm.

The pulse number of encoder is 1000 ppr (parameter P4.01), the result of location counter conversion factor is  $(1460 * 1000) / 60000 = 24.3$  pulses/mm.

| Function Code | Name     | Description | Setting Range | Factory Setting |
|---------------|----------|-------------|---------------|-----------------|
| P4.07         | Reserved | 0~65535     | 0~65535       | 0               |
| P4.08         | Reserved | 0~65535     | 0~65535       | 0               |

## 6.6 P5 Group--Input Terminals

CHV190 series inverter comes with 6-channel multi-function digital input terminals, 2-channel analog input terminals. Please match I/O expansion cards to get more input/output terminals.

| Function Code | Name          | Description  | Setting Range | Factory Setting |
|---------------|---------------|--|---------------|-----------------|
| P5.00         | HDI selection | 0: HDI high speed pulse input.<br>1: ON/OFF input. | 0~1           | 0               |

The function code P5.00 is used to define the input type HDI or ON/OFF signals.

| Function Code | Name                        | Description  | Setting Range | Factory Setting |
|---------------|-----------------------------|--|---------------|-----------------|
| P5.01         | S4, S5 input type selection | 0: ON/OFF<br>1: Master-slave synchronization counter | 0~1           | 0               |

When S4 and S5 used as master-slave synchronization count input, S4 terminal should

connect to host PG card's division frequency output terminal, S5 terminal should connect to subsidiary PG card division frequency output terminal, and the common terminal of master and subsidiary motor divider cards should be shorten.

**Notice: Choose master-slave synchronization count input, P5.05 and P5.06 should be modified to 0.**

| Function Code | Name                   | Description                         | Setting Range | Factory Setting |
|---------------|------------------------|-------------------------------------|---------------|-----------------|
| P5.02         | S1 terminal function   | Programmable multifunction terminal | 0~40          | 1               |
| P5.03         | S2 terminal function   | Programmable multifunction terminal | 0~40          | 2               |
| P5.04         | S3 terminal function   | Programmable multifunction terminal | 0~40          | 6               |
| P5.05         | S4 terminal function   | Programmable multifunction terminal | 0~40          | 0               |
| P5.06         | S5 Terminal function   | Programmable multifunction terminal | 0~40          | 0               |
| P5.07         | HDI1 terminal function | Programmable multifunction terminal | 0~40          | 0               |
| P5.08         | S7 terminal function   | Programmable multifunction terminal | 0~40          | 0               |
| P5.09         | S8 terminal function   | Programmable multifunction terminal | 0~40          | 0               |
| P5.10         | S9 terminal function   | Programmable multifunction terminal | 0~40          | 0               |
| P5.11         | S10 terminal function  | Programmable multifunction terminal | 0~40          | 0               |

The meaning of each setting is shown in following table.

| Setting Value | Function    | Description  |
|---------------|-------------|--|
| 0             | Invalid     | Please set unused terminals to be invalid to avoid malfunction.                        |
| 1             | Forward     | When running command channel is terminal control, the crane is controlled by terminal. |
| 2             | Reverse     |  |
| 3             | Jog running | Inverter will work under Jog running state together with                               |

| Setting Value | Function                       | Description   |
|---------------|--------------------------------|---|
|               |                                | UP/DOWN signal when the terminal is selected to be Jog running  |
| 4             | Low-speed running signal       | When inverter receives low-speed running signal, if the current operating frequency is greater than low-speed running signal, the frequency will be slow to low-speed running frequency. If the inverter runs reversely, the speed will be accelerating to maximum in opposite direction. |
| 5             | Coast to stop                  | The inverter blocks the output immediately. The motor coasts to stop by its mechanical inertia.   |
| 6             | Reset fault                    | Resets faults that have occurred. It has the same function as <b>STOP/RST</b> .   |
| 7             | External fault input           | Stop the inverter and output EF when peripheral device fault occurs   |
| 8~10          | Multi-step speed terminals 1~3 | By combination of the first-class speed contacts and three terminal state, eight-step speed can be realized.  |
| 11            | Contact feedback signal (TB)   | P8.04 selects contactor control valid, input terminal function is set to be 11 (contactor feedback signal). If the feedback signal is error, the inverter will show fault TbE.  |
| 12            | Brake feedback signal (FB)     | P8.04 selects brake control is valid, input terminal function is set into 12 (brake feedback signal). If the brake feedback signal is error, the inverter will show fault FAE.  |
| 13            | Inverter enable (ENA)          | When multi-function input terminal is set to be inverter enable, inverter can run only under ENA state.   |
| 14            | Motor switching (MEX)          | When inverter receives motor switching command, inverter runs under the parameters of second group motor in PC group.   |
| 15            | Forced deceleration (FS)       | When the inverter receives forced deceleration signal, the converter will slow down to zero according to forced slow time (P1.24).  |
| 16            | Torque control prohibition     | When P3.16 = 1, inverter can prohibit torque control through this function.   |
| 17            | Motor excitation running       | When the signal is valid, inverter will start motor excitation function.  |

| Setting Value | Function                                 | Description   |
|---------------|--|---|
| 18            | Fast stop(FS)                            | When the signal is valid, inverter will stop according to the fast-stop mode (P8.32).   |
| 19            | Master-slave synchronization enabled     | When the inverter selects master-slave synchronization subsidiary mode (P0.11=9), the signal is valid, enable master-slave synchronization.   |
| 20            | Master-slave synchronization count reset | When the inverter selects master-slave synchronization subsidiary mode (P0.11=9), the signal is valid, reset master-slave synchronization.  |
| 21            | Light-load acceleration enable           | When the inverter selects light-load acceleration function, the signal is valid, the inverter run under light-load acceleration optimized frequency.  |
| 22            | UP command                               | The reference frequency of inverter can be adjusted by UP command and DOWN command.   |
| 23            | DOWN command                             |   |
| 24            | Zero position signal                     | Must check whether the operating rod back to zero position to prevent the inverter restart after the inverter stops (midpoint location). When the operating rod back to zero position, after the delay time (P8.49), the inverter can restart.<br><b>Notice: Zero position signal is effective in the operating lever mode and hierarchical operating lever mode.</b> |
| 25~29         | Classification given terminal 1~5        | By combination of the first-class speed contact and five terminal states, sixteen-stage speed can be realized.<br><b>Notice: Only when the lower-level multi-step speed classification contacts is all closed, higher-level classification contacts can be switch ON.</b>   |
| 30~40         | Reserved                                 | 0~65535   |

| Function Code | Name                 | Description | Setting Range | Factory Setting |
|---------------|----------------------|-------------|---------------|-----------------|
| P5.12         | Input mode selection | 0~0xFF      | 0~0xFF        | 0               |

The selections of ON/OFF input terminals are normal open and normal closed. When

corresponding bit is 1 means normal closed input, this parameter is set to hex, ON/OFF signal input corresponds to the table as follows:

|      |      |      |      |      |
|------|------|------|------|------|
| BIT9 | BIT8 | BIT7 | BIT6 | BIT5 |
| S10  | S9   | S8   | S7   | HDI  |
| BIT4 | BIT3 | BIT2 | BIT1 | BIT0 |
| S5   | S4   | S3   | S2   | S1   |

| Function Code | Name                | Description                 | Setting Range | Factory Setting |
|---------------|---------------------|-----------------------------|---------------|-----------------|
| P5.13         | Input selection     | 0: Concrete.<br>1: Virtual. | 0~1           | 0               |
| P5.14         | ON-OFF filter times | 1~10                        | 1~10          | 5               |

This parameter is used to set filter strength of terminals (S1~S10). When interference is heavy, user should increase this value to prevent malfunction.

| Function Code | Name                                  | Description    | Setting Range | Factory Setting |
|---------------|---------------------------------------|----------------|---------------|-----------------|
| P5.15         | A11 lower limit                       | 0.00V~10.00V   | 0.00~10.00    | 0.00V           |
| P5.16         | A11 lower limit corresponding setting | -100.0%~100.0% | -100.0~100.0  | 0.0%            |
| P5.17         | A11 upper limit                       | 0.00V~10.00V   | 0.00~10.00    | 10.00V          |
| P5.18         | A11 upper limit corresponding setting | -100.0%~100.0% | -100.0~100.0  | 100.0%          |
| P5.19         | A11 filter time constant              | 0.00s~10.00s   | 0.00~10.00    | 0.10s           |

These parameters determine the relationship between analog input voltage and the corresponding setting value. When the analog input voltage exceeds the range between lower limit and upper limit, it will be regarded as the upper limit or lower limit.

The analog input A11 can only provide voltage input, and the range is 0V~10V.

For different applications, the corresponding value of 100.0% analog setting is different.

For details, please refer to description of each application.

**Notice: A11 lower limit must be less or equal to A11 upper limit.**

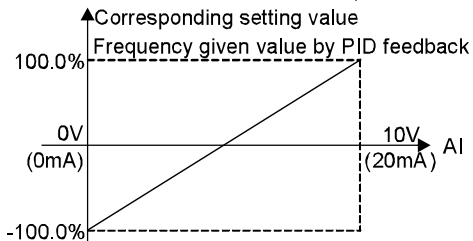


Figure 6.8 Relationship between AI and corresponding setting.

| Function Code | Name                                  | Description    | Setting Range | Factory Setting |
|---------------|---------------------------------------|----------------|---------------|-----------------|
| P5.20         | AI2 lower limit                       | 0.00V~10.00V   | 0.00~10.00    | 0.00V           |
| P5.21         | AI2 lower limit corresponding setting | -100.0%~100.0% | -100.0~100.0  | 0.0%            |
| P5.22         | AI2 upper limit                       | 0.00V~10.00V   | 0.00~10.00    | 5.00V           |
| P5.23         | AI2 upper limit corresponding setting | -100.0%~100.0% | -100.0~100.0  | 100.0%          |
| P5.24         | AI2 filter time constant              | 0.00s~10.00s   | 0.00~10.00    | 0.10s           |

Please refer to description of AI1.

**Notice: When AI2 is set as 0~20mA current input, the corresponding voltage range is 0~5V.**

| Function Code | Name                                   | Description      | Setting Range | Factory Setting |
|---------------|--|------------------|---------------|-----------------|
| P5.25         | HDI1 lower limit                       | 0.0 kHz ~50.0kHz | 0.0~50.0      | 0.0kHz          |
| P5.26         | HDI1 lower limit corresponding setting | -100.0%~100.0%   | -100.0~100.0  | 0.0%            |
| P5.27         | HDI1 upper limit                       | 0.0 kHz ~50.0kHz | 0.0~50.0      | 50.0kHz         |
| P5.28         | HDI1 upper limit corresponding setting | -100.0%~100.0%   | -100.0~100.0  | 100.0%          |
| P5.29         | HDI1 filter time constant              | 0.00s~10.00s     | 0.00~10.00    | 0.10s           |

The description of P5.25~P5.29 is similar to AI1.

| Function Code | Name     | Description | Setting Range | Factory Setting |
|---------------|----------|-------------|---------------|-----------------|
| P5.30~P5.35   | Reserved | 0~65535     | 0~65535       | 0               |

## 6.7 P6 Group--Output Terminals

| Function Code | Name          | Description                                    | Setting Range | Factory Setting |
|---------------|---------------|--|---------------|-----------------|
| P6.00         | HDO selection | 0: High-speed pulse output<br>1: ON-OFF output | 0~1           | 0               |

0: High-speed pulse output: The maximum pulse frequency is 50.0 kHz. Please refer to description of P6.09.

1: ON-OFF output: Please refer to description of P6.03.

**Notice: The output of HDO terminal is multi-function ON-OFF output.**

| Function Code | Name                        | Description           | Setting Range | Factory Setting |
|---------------|-----------------------------|-----------------------|---------------|-----------------|
| P6.01         | Y1 output selection         | Open-collector output | 0~20          | 1               |
| P6.02         | Y2 output selection         | Open-collector output | 0~20          | 0               |
| P6.03         | HDO ON-OFF output selection | Open-collector output | 0~20          | 0               |
| P6.04         | Relay 1 output selection    | Relay output          | 0~20          | 4               |
| P6.05         | Relay 2 output selection    | Relay output          | 0~20          | 5               |
| P6.06         | Relay 3 output selection    | Relay output          | 0~20          | 0               |

OC/Relay output functions are indicated in the following table:

| Setting Value | Function          | Description                      |
|---------------|-------------------|----------------------------------|
| 0             | No output         | Output terminal has no function. |
| 1             | Motor running(LR) | ON: Inverter has output signal   |
| 2             | UP running (UR)   | ON: Crane up running             |
| 3             | Down running (DR) | ON: Crane down running           |

| Setting Value | Function                            | Description   |
|---------------|-------------------------------------|---|
| 4             | Fault output                        | ON: Inverter is in fault status.  |
| 5             | Zero speed running                  | ON: The running frequency of inverter is zero.  |
| 6             | Ready                               | ON: Inverter is ready (no fault, power is ON).  |
| 7             | Brake control                       | ON: Brake open;<br>OFF: Brake closed  |
| 8             | Contactor control                   | ON: Contactor open;<br>OFF: Contactor closed  |
| 9             | Frequency reached                   | Please refer to description of P6.24.   |
| 10            | FDT reached                         | Please refer to description of P6.22~P6.23.   |
| 11            | Motor running1 (LR1)                | ON: Between brake open delay time end and close delay time end.   |
| 12            | Brake closed output (FO)            | ON: Brake closed delay time end until stop  |
| 13            | Motor switching output              | Feedback signal to the host after receive motor switch command  |
| 14            | Motor excitation                    | When running commands and excitation signals are effective at the same time, the signal enabled until the exciting end              |
| 15            | Motor excitation completion output  | The signal is valid when the excitation process end   |
| 16            | Sling loose alarm output            | The signal is valid when the sling loose  |
| 17            | High-speed signal output            | When the inverter choose light-load function, operating frequency higher than the motor rated frequencies, the signal is effective. |
| 18            | Motor over temperature alarm output | When the temperature of motor exceeds the motor overtemperature threshold, output alarm   |
| 19~20         | Reserved                            | Reserved  |

**Notice: Multi-function output terminal 11, 12 is mainly used for: When the brake is in external control mode, inform control system brake.**

| Function Code | Name                   | Description                             | Setting Range | Factory Setting |
|---------------|------------------------|---|---------------|-----------------|
| P6.07         | AO1 function selection | Multifunctional analog output           | 0~14          | 0               |
| P6.08         | AO2 function selection | Multifunctional analog output           | 0~14          | 0               |
| P6.09         | HDO function selection | Multifunctional high-speed pulse output | 0~14          | 0               |

AO/HDO output functions are indicated in the following table:

| Setting Value | Function              | Range                             |
|---------------|-----------------------|-----------------------------------|
| 0             | Running frequency     | 0~maximum frequency (P0.07)       |
| 1             | Reference frequency   | 0~ maximum frequency (P0.07)      |
| 2             | Slope given frequency | 0~ maximum frequency (P0.07)      |
| 3             | Reserved              | Reserved                          |
| 4             | Output current        | 0~2* inverter rated current       |
| 5             | Output voltage        | 0~2* inverter rated voltage       |
| 6             | Output power          | 0~2* rated power                  |
| 7             | Running torque        | 0~2* motor base synchronous speed |
| 8             | Output torque         | 0~2*rated torque                  |
| 9             | AI1                   | 0~10V                             |
| 10            | AI2                   | 0~10V/0~20mA                      |
| 11            | HDI1                  | 0~10V                             |
| 12~14         | Reserved              | Reserved                          |

| Function Code | Name                                 | Description | Setting Range | Factory Setting |
|---------------|--------------------------------------|-------------|---------------|-----------------|
| P6.10         | AO1 lower limit                      | 0.0~100.0%  | 0.0~100.0     | 0.0%            |
| P6.11         | AO1 lower limit corresponding output | 0.00~10.00V | 0.00~10.00    | 0.00V           |
| P6.12         | AO1 upper limit                      | 0.0~100.0%  | 0.0~100.0     | 100.0%          |
| P6.13         | AO1 upper limit corresponding output | 0.00~10.00V | 0.00~10.00    | 10.00V          |

These parameters determine the relationship between analog output voltage/current and the corresponding output value. When the analog output value exceeds the range between lower limit and upper limit, it will output the upper limit or lower limit.

When AO is current output, 1mA is corresponding to 0.5V.

For different applications, the corresponding value of 100.0% analog outputs is different.

For details, please refer to description of each application.

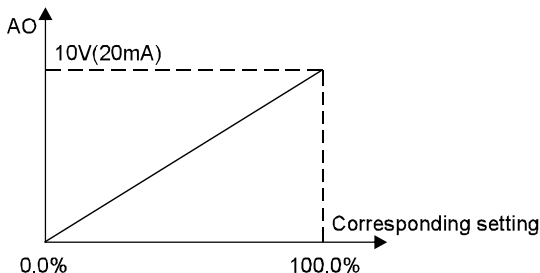


Figure 6.9 Relationship between AO and corresponding setting.

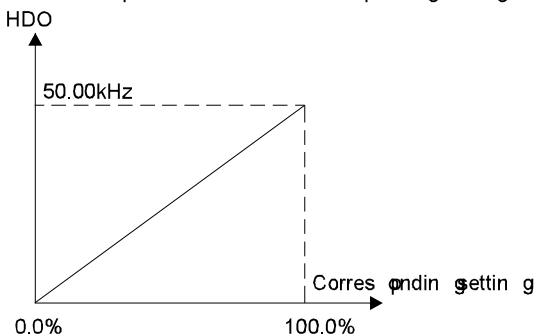


Figure 6.10 Relationship between HDO and corresponding setting.

| Function Code | Name                                 | Description | Setting Range | Factory Setting |
|---------------|--------------------------------------|-------------|---------------|-----------------|
| P6.14         | AO2 lower limit                      | 0.0~100.0%  | 0.0~100.0     | 0.0%            |
| P6.15         | AO2 lower limit corresponding output | 0.00~10.00V | 0.00~10.00    | 0.00V           |
| P6.16         | AO2 upper limit                      | 0.0~100.0%  | 0.0~100.0     | 100.0%          |
| P6.17         | AO2 upper limit corresponding output | 0.00~10.00V | 0.00~10.00    | 10.00V          |
| P6.18         | HDO lower limit                      | 0.0~100.0%  | 0.0~100.0     | 0.0%            |

| Function Code | Name                                 | Description | Setting Range | Factory Setting |
|---------------|--------------------------------------|-------------|---------------|-----------------|
| P6.19         | HDO lower limit corresponding output | 0.0~50.0kHz | 0.0~50.0      | 0.0kHz          |
| P6.20         | HDO upper limit                      | 0.0~100.0%  | 0.0~100.0     | 100.0%          |
| P6.21         | HDO upper limit corresponding output | 0.0~50.0kHz | 0.0~50.0      | 50.0kHz         |

The description of P6.18~P6.21 is similar to AO1.

| Function Code | Name      | Description | Setting Range | Factory Setting |
|---------------|-----------|-------------|---------------|-----------------|
| P6.22         | FDT level | 0.00~P0.03  | 0.00~P0.03    | 50.00HZ         |
| P6.23         | FDT lag   | 0.0~100.0%  | 0.0~100.0     | 5.0%            |

Set output frequency detection value and output action lag value. See figure 6.11.

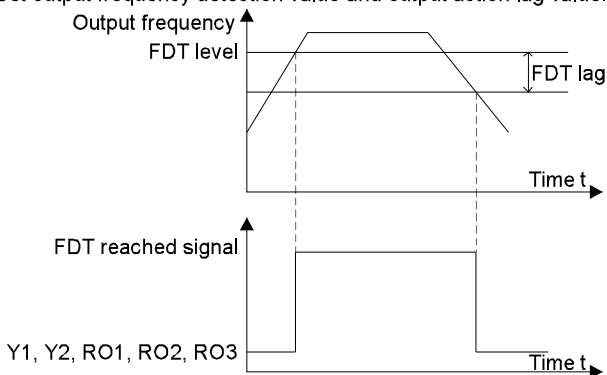


Figure 6.11 FDT level diagram

| Function Code | Name                             | Description | Setting Range | Factory Setting |
|---------------|----------------------------------|-------------|---------------|-----------------|
| P6.24         | Frequency arrive detecting range | 0.0~100.0%  | 0.0~100.0     | 0.0%            |

The inverter output frequency reaches setting frequency; this function can adjust detecting range. See figure 6.12:

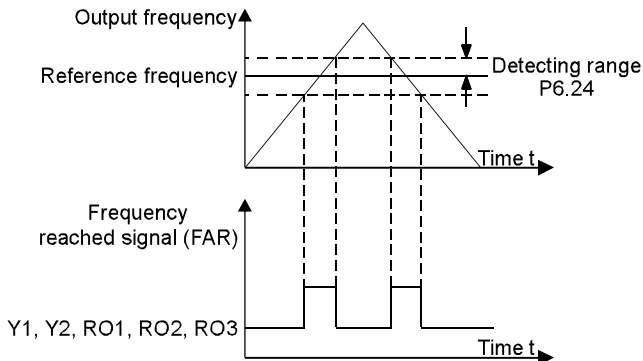


Figure 6.12 Frequency reached detection range diagram

| Function Code | Name     | Description | Setting Range | Factory Setting |
|---------------|----------|-------------|---------------|-----------------|
| P6.25         | Reserved | 0~65535     | 0~65535       | 0               |
| P6.26         | Reserved | 0~65535     | 0~65535       | 0               |

## 6.8 P7 Group--Display Interface

| Function Code | Name          | Description | Setting Range | Factory Setting |
|---------------|---------------|-------------|---------------|-----------------|
| P7.00         | User password | 0~65535     | 0~65535       | 0               |

The password protection function will be valid when set to be any nonzero data. When P7.00 is set to be 00000, user's password set before will be cleared and the password protection function will be disabled.

After the password has been set and becomes valid, the user can not access menu if the user's password is not correct. Only when a correct user's password is input, the user can see and modify the parameters. Please keep user's password in mind.

| Function Code | Name                                   | Description                    | Setting Range | Factory Setting |
|---------------|--|--------------------------------|---------------|-----------------|
| P7.01         | Reserved                               | 0~1                            | 0~1           | 0               |
| P7.02         | Reserved                               | 0~1                            | 0~1           | 0               |
| P7.03         | <b>QUICK/JOG</b><br>function selection | 0: Jog<br>1: FDW/REV switching | 0~1           | 0               |

Parameter setting defines **QUICK/JOG** function, this function is only valid when the keyboard controls.

| Function Code | Name                                  | Description  | Setting Range | Factory Setting |
|---------------|---------------------------------------|--|---------------|-----------------|
| P7.04         | <b>STOP/RST</b><br>function selection | 0: Valid when keypad control (P0.01=0)<br>1: Valid when keypad or terminal control (P0.01=0 or 1)<br>2: Valid when keypad or communication control (P0.01=0 or 2)<br>3: Always valid | 0~3           | 0               |

**Notice:**

- The value of P7.04 only determines the STOP function of **STOP/RST**.
- The RESET function of **STOP/RST** is always valid.

| Function Code | Name              | Description | Setting Range | Factory Setting |
|---------------|-------------------|-------------|---------------|-----------------|
| P7.05         | Motor temperature |             |               |                 |

The function code display motor temperature.

| Function Code | Name                             | Description | Setting Range | Factory Setting |
|---------------|----------------------------------|-------------|---------------|-----------------|
| P7.06         | Running status display selection | 0~0xFFFF    | 0~0xFFFF      | 0x0003          |

P7.06 defines the parameters that can be displayed by LED in running status. If Bit is 0, the parameter will not be displayed; If Bit is 1, the parameter will be displayed.

Press **>>/SHIFT** to scroll through these parameters in right order .

Press **DATA/ENT** + **QUICK/JOG** to scroll through these parameters in left order.

The display content corresponding to each bit of P7.06 is described in the following table:

| <b>BIT15</b>           | <b>BIT14</b>        | <b>BIT13</b>  | <b>BIT12</b>   | <b>BIT11</b> | <b>BIT10</b>           |
|------------------------|---------------------|---------------|----------------|--------------|------------------------|
| Reserved               | Reserved            | Reserved      | Reserved       | Reserved     | Reserved               |
| <b>BIT9</b>            | <b>BIT8</b>         | <b>BIT7</b>   | <b>BIT6</b>    | <b>BIT5</b>  | <b>BIT4</b>            |
| Magnetic pole position | Torque Compensation | HDI frequency | AI2            | AI1          | Output terminal status |
| <b>BIT3</b>            | <b>BIT2</b>         | <b>BIT1</b>   | <b>BIT0</b>    |              |                        |
| Input terminal status  | Output torque       | Output power  | Rotation speed |              |                        |

Input/output terminal status display inverter input/output terminal signal status at current time, close corresponds to 1, disconnection corresponds to 0. The entire data is displayed as Decimal. Please refer to P7.19, P7.20 for specific description.

| Function Code | Name                          | Description   | Setting Range | Factory Setting |
|---------------|-------------------------------|---------------|---------------|-----------------|
| P7.07         | Stop status display selection | 0x0001~0xFFFF | 0x0001~0xFFFF | 0x00FF          |

P7.07 determines the display parameters in stop status. The setting method is similar with P7.06.

The display content corresponding to each bit of P7.07 is described in the following table:

| BIT15                 | BIT14          | BIT13      | BIT12               | BIT11            | BIT10                  |
|-----------------------|----------------|------------|---------------------|------------------|------------------------|
| Reserved              | Reserved       | Reserved   | Reserved            | Reserved         | Reserved               |
| BIT9                  | BIT8           | BIT7       | BIT6                | BIT5             | BIT4                   |
| Reserved              | HDI frequency  | AI2        | AI1                 | motor pole pairs | Output terminal status |
| BIT3                  | BIT2           | BIT1       | BIT0                |                  |                        |
| Input terminal status | DC bus voltage | Fault code | Reference frequency |                  |                        |

| Function Code | Name                         | Description | Setting Range | Factory Setting |
|---------------|------------------------------|-------------|---------------|-----------------|
| P7.08         | Rectifier module temperature | 0~150.0℃    |               |                 |
| P7.09         | IGBT module temperature      | 0~150.0℃    |               |                 |
| P7.10         | MCU software version         |             |               |                 |
| P7.11         | DSP software version         |             |               |                 |
| P7.12         | Accumulated running time     | 0~65535h    |               |                 |

Rectifier module temperature: Indicates the temperature of rectifier module. Overheat protection point of different inverter may be different.

IGBT module temperature: Indicates the temperature of IGBT module. Overheat protection point of different inverter may be different.

MCU software version: Indicates current software version of MCU.

DSP software version: Indicates current software version of DSP

Accumulated running time: Displays accumulated running time of inverter.

**Notice: Above parameters are read only.**

| Function Code | Name                     | Description | Setting Range | Factory Setting |
|---------------|--------------------------|-------------|---------------|-----------------|
| P7.13         | Third latest fault type  | 0~50        | 0~50          | 0               |
| P7.14         | Second latest fault type | 0~50        | 0~50          | 0               |
| P7.15         | Latest fault type        | 0~50        | 0~50          | 0               |

These parameters record three recent fault types. For details, please refer to description of chapter 7.

| Function Code | Name                                   | Description   | Setting Range | Factory Setting |    |    |    |    |    |   |   |   |     |    |    |    |      |    |    |    |    |    |  |  |
|---------------|--|---|---------------|-----------------|----|----|----|----|----|---|---|---|-----|----|----|----|------|----|----|----|----|----|--|--|
| P7.16         | Output frequency at current fault      | Output frequency at current fault.  |               | 0               |    |    |    |    |    |   |   |   |     |    |    |    |      |    |    |    |    |    |  |  |
| P7.17         | Output current at current fault        | Output current at current fault.  |               |                 |    |    |    |    |    |   |   |   |     |    |    |    |      |    |    |    |    |    |  |  |
| P7.18         | DC bus voltage at current fault        | DC bus voltage at current fault.  |               |                 |    |    |    |    |    |   |   |   |     |    |    |    |      |    |    |    |    |    |  |  |
| P7.19         | Input terminal status at current fault | This value records ON-OFF input terminal status at current fault. The meaning of each bit is as below: <table border="1" style="margin: 10px auto;"> <tr> <td>9</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td> </tr> <tr> <td>S10</td><td>S9</td><td>S8</td><td>S7</td><td>HDI1</td><td>S5</td><td>S4</td><td>S3</td><td>S2</td><td>S1</td> </tr> </table> 1 indicates corresponding input terminal is ON, while 0 indicates OFF. | 9             | 8               | 7  | 6  | 5  | 4  | 3  | 2 | 1 | 0 | S10 | S9 | S8 | S7 | HDI1 | S5 | S4 | S3 | S2 | S1 |  |  |
| 9             | 8                                      | 7   | 6             | 5               | 4  | 3  | 2  | 1  | 0  |   |   |   |     |    |    |    |      |    |    |    |    |    |  |  |
| S10           | S9                                     | S8  | S7            | HDI1            | S5 | S4 | S3 | S2 | S1 |   |   |   |     |    |    |    |      |    |    |    |    |    |  |  |

**Notice: This value is displayed as decimal.**

| Function Code | Name                                    | Description  | Setting Range | Factory Setting |      |      |      |      |     |     |     |     |    |    |  |  |
|---------------|---|--|---------------|-----------------|------|------|------|------|-----|-----|-----|-----|----|----|--|--|
| P7.20         | Output terminal status at current fault | This value records output terminal status at current fault. The meaning of each bit is as below:<br><table border="1" style="margin: 10px auto;"> <tr> <td>BIT5</td> <td>BIT4</td> <td>BIT3</td> <td>BIT2</td> <td>BIT1</td> <td>BIT0</td> </tr> <tr> <td>RO3</td> <td>RO2</td> <td>RO1</td> <td>HDO</td> <td>Y2</td> <td>Y1</td> </tr> </table> 1 indicates corresponding output terminal is ON, while 0 indicates OFF.<br><b>Notice: This value is displayed as decimal.</b> | BIT5          | BIT4            | BIT3 | BIT2 | BIT1 | BIT0 | RO3 | RO2 | RO1 | HDO | Y2 | Y1 |  |  |
| BIT5          | BIT4                                    | BIT3   | BIT2          | BIT1            | BIT0 |      |      |      |     |     |     |     |    |    |  |  |
| RO3           | RO2                                     | RO1  | HDO           | Y2              | Y1   |      |      |      |     |     |     |     |    |    |  |  |
| P7.21         | Inverter rated power                    |  |               |                 |      |      |      |      |     |     |     |     |    |    |  |  |
| P7.22         | Inverter rated current                  |  |               |                 |      |      |      |      |     |     |     |     |    |    |  |  |

### 6.9 P8 Group--Enhanced Function

| Function Code | Name                              | Description  | Setting Range | Factory Setting |
|---------------|-----------------------------------|--|---------------|-----------------|
| P8.00         | Pre-torque signal input selection | 0: No function<br>1: AI1<br>2: AI2<br>3: Profibus communication given<br>4: The internal dynamic given | 0~4           | 0               |

Pre-torque compensation can provide torque corresponding to the weight of the load to avoid pulling carts or sliding down vehicle at the starting.

**Notice: P8.00 and P0.02 can't use the same one analog input.**

| Function Code | Name              | Description   | Setting Range | Factory Setting |
|---------------|-------------------|---------------|---------------|-----------------|
| P8.01         | Pre-torque offset | -100.0~100.0% | -100.0~100.0  | 0.0%            |
| P8.02         | Drive gain        | 0.000~7.000   | 0.000~7.000   | 1.000           |
| P8.03         | Brake gain        | 0.000~7.000   | 0.000~7.000   | 1.000           |

When crane starts, the pre-torque compensate the lifting weights appropriately which can improve the starting performance. Only when P8.00 is not set to 0, the pre-torque compensation is valid.

| Function Code | Name                               | Description | Setting Range | Factory Setting |
|---------------|------------------------------------|-------------|---------------|-----------------|
| P8.04         | Brake, contactor control selection | 0~3         | 0~3           | 0~3             |

0: Brake and contactor are controlled by external controller, not by inverter.

1: Brake is controlled by inverter, and contactor is controlled by external controller.

2: Brake is controlled by external controller, and contactor is controlled by inverter.

3: Both brake and contactor is controlled by inverter.

| Function Code | Name                       | Description | Setting Range | Factory Setting |
|---------------|----------------------------|-------------|---------------|-----------------|
| P8.05         | Delay time of brake closed | 0.00~5.00s  | 0.00~5.00     | 0s              |
| P8.06         | Delay time of brake open   | 0.00~5.00s  | 0.00~5.00     | 0s              |

Delay time of brake closed contains the time between the command output of brake closed and the inverter output frequency reaching P8.09.

Delay time of brake open is from the zero speed running to the command output of brake open. This parameter let inverter prevent starting concussion, before brake open.

**Notice: P8.05 and P8.06 are effective at all times.**

| Function Code | Name                              | Description | Setting Range | Factory Setting |
|---------------|-----------------------------------|-------------|---------------|-----------------|
| P8.07         | Brake feedback detecting interval | 0.1~5.0s    | 0.1~5.0       | 2.0s            |

After selecting brake control, the fault time of crane brake action is more than P8.07, inverter will report brake feedback fault (FAE).

| Function Code | Name                                  | Description | Setting Range | Factory Setting |
|---------------|---------------------------------------|-------------|---------------|-----------------|
| P8.08         | Contactor feedback detecting interval | 0.1~5.0s    | 0.1~5.0       | 2.0s            |

After selecting contactor control, the fault time of crane contactor action is more than P8.08, inverter will report contactor feedback fault (TbE).

| Function Code | Name                         | Description | Setting Range | Factory Setting |
|---------------|------------------------------|-------------|---------------|-----------------|
| P8.09         | Brake frequency when parking | 0.00~5.00Hz | 0.00~5.00     | 0.00Hz          |

This code is used to select the frequency point to close brake.

If P8.05≠0, when the inverter output frequency reaches P8.09, the inverter output close brake signal after the delay time (P8.05), the multi-output signal (FO), the brake control (FC) also stops to output.

If P8.05=0, when the inverter output frequency reaches P8.09, the inverter brakes immediately.

| Function Code | Name                            | Description | Setting Range | Factory Setting |
|---------------|---------------------------------|-------------|---------------|-----------------|
| P8.10         | DC Braking current before start | 0.0~120.0%  | 0.0~120.0     | 0.0%            |
| P8.11         | DC Braking time before start    | 0.0~50.0s   | 0.0~50.0      | 0.0s            |

When inverter starts, it performs DC braking according to P8.10 firstly, then start to accelerate after P8.11.

**Notice:**

- **DC braking is invalid when P8.10 is set to be 0.**
- **The value of P8.11 is the percentage of rated current of inverter. The bigger the DC braking current, the greater the braking torques.**

| Function Code | Name                             | Description | Setting Range | Factory Setting |
|---------------|----------------------------------|-------------|---------------|-----------------|
| P8.12         | Starting frequency of DC braking | 0.00~P0.03  | 0.00~P0.03    | 0.00Hz          |
| P8.13         | Waiting time before DC braking   | 0.0~50.0s   | 0.0~50.0      | 0.0s            |
| P8.14         | DC braking current               | 0.0~120.0%  | 0.0~120.0     | 0.0%            |
| P8.15         | DC braking time                  | 0.0~50.0s   | 0.0~50.0      | 0.0s            |

Starting frequency of DC braking: Starting the DC braking when the running frequency reaches starting frequency determined by P8.12 (P1.25 = 0), the inverter is considered as zero speed running; the close brake delay time begins counting.

**Notice: DC braking is effective only for decelerating to stop; the inverter is considered as zero speed running when DC braking, Delay time of close brake and open brake are valid all the time.**

| Function Code | Name                     | Description | Setting Range | Factory Setting |
|---------------|--------------------------|-------------|---------------|-----------------|
| P8.16         | Inverter stop delay time | 0.00~5.00s  | 0.00~5.00     | 0.00s           |

Inverter stop delay time is used to prevent the inverter slip phenomenon due to the unstable brake holding.

If P1.25=1, when the inverter runs in normal state and coast to stop, the inverter immediately brakes and blocks the output without delay time(P8.16); when the inverter is running to zero speed, brake and coast to stop, the inverter will block the output after the delay time (P8.16).

If P1.25=0, whenever deceleration stop, the inverter will brake and delay stop time(P8.16) and then block the output.

| Function Code | Name               | Description               | Setting Range | Factory Setting |
|---------------|--------------------|---------------------------|---------------|-----------------|
| P8.17         | Auto reset times   | 0~10                      | 0~10          | 0               |
| P8.18         | Fault relay action | 0: Disabled<br>1: Enabled | 0~1           | 0               |
| P8.19         | Reset interval     | 0.1~100.0s                | 0.1~100.0     | 1.0s            |

Auto reset function can reset the fault in preset times and interval. When P8.17 is set to be 0, it means “auto reset” is disabled and the protective device will be activated in case of fault.

P8.18 defines if fault relay active or not during auto reset. If continuous production without interruption is needed, please set P8.18=0.

**Notice:**

**The fault such as OUT 1, OUT 2, OUT 3, OH1 and OH2 cannot be reset automatically. If fault has not occurred for ten minutes after the fault is reset, inverter will automatically clear the previous times of auto reset.**

| Function Code | Name                    | Description  | Setting Range | Factory Setting |
|---------------|-------------------------|--------------|---------------|-----------------|
| P8.20         | Brake threshold voltage | 560.0~750.0V | 560.0~750.0   | 700.0V          |

When the DC bus voltage is greater than the value of P8.20, the inverter will start dynamic

When the DC bus voltage is greater than the value of P8.20, the inverter will start dynamic braking.

| Function Code | Name                               | Description  | Setting Range | Factory Setting |
|---------------|------------------------------------|--|---------------|-----------------|
| P8.21         | Two-phase / three-phase modulation | 0: Two-phase modulation<br>1: Three-phase modulation | 0~1           | 0               |

0: Two-phase modulation: the motor noise is smaller, but its temperature is higher. If you select this function, the inverter should be derated.

1: Three-phase modulation: the motor noise is bigger, but it has better restraint for the motor oscillation.

| Function Code | Name                    | Description  | Setting Range | Factory Setting |
|---------------|-------------------------|--------------|---------------|-----------------|
| P8.22         | Motor excitation enable | 0~1          | 0~1           | 0               |
| P8.23         | Motor excitation time   | 0.004~5.000s | 0.004~5.000   | 0.010s          |

If P8.22 is valid, the inverter must have motor excited at first and then it can work normally.

Excitation command can be used by profibus communication or the multi-function (17), only when the excitation command and the running command are effective at the same time then the excitation will be valid. When the exciting start, the inverter multi-function output terminal will output electrical excitation signal until the excitation process is completed.

P8.23 is the motor excitation process duration, when the time arrives; the inverter multi-function output terminal will send a signal for exciting end.

| Function Code | Name                                  | Description | Setting Range | Factory Setting |
|---------------|---------------------------------------|-------------|---------------|-----------------|
| P8.24         | Torque monitoring selection           | 0~1         | 0~1           | 0               |
| P8.25         | Speed deviation limit of torque fault | 1.0~100.0%  | 1.0~100.0     | 3.0%            |
| P8.26         | Delay time of torque fault            | 0.2~10.0s   | 0.2~10.0      | 1.0s            |

| Function Code | Name   | Description  | Setting Range | Factory Setting |
|---------------|--|--------------|---------------|-----------------|
| P8.27         | Blocking factor of acceleration deviation when ACC/DEC | 110.0~500.0% | 110.0~500.0   | 150.0%          |

This section will be used to monitor the motor torque and output the trip signal while motor torque fault.

P8.24 = 1, torque monitoring enabled. If the absolute value of speed deviation is higher than the value of P8.25 and the time is greater than the delay time of torque fault (P8.26), and then the inverter will be tripped due to the torque fault that display on the keyboard. If the actual motor speed change rate (differential) is higher than the value of P8.27 in acceleration/deceleration duration, torque fault protection will be blocked, and the inverter will not be tripped.

| Function Code | Name   | Description   | Setting Range | Factory Setting |
|---------------|--|---|---------------|-----------------|
| P8.28         | Output torque of electric brake              | 0.0%~200.0%   | 0.0~200.0     | 180.0%          |
| P8.29         | Acceleration time of braking torque          | 0.000~9.000s  | 0.000~9.000   | 1.000s          |
| P8.30         | Braking torque ending frequency              | 0.00~30.00hz  | 0.00~30.00    | 0.1Hz           |
| P8.31         | Applying time of electric brake to fast stop | 0.00~20.00s   | 0.00~20.00    | 2.00s           |
| P8.32         | Fast stop mode                               | 0:The electric braking only<br>1: The electric brake and the mechanical brake<br>2: The mechanical brake only | 0~2           | 0               |

This part is used to adjust fast stop for inverter.

When the P8.32= 0, the electric braking is valid only, the output torque of electric brake is set by P8.28, the brake torque acceleration time is set by P8.29. the electric braking torque is relative to the motor rated torque, the value the greater the brake faster. When the motor decelerates to be P8.30, the inverter output the brake close signal.

When the P8.32=1, the electric brake and mechanical brake are valid, the electric braking process is the same as the one P8.32 = 0, but when the motor decelerate to the value of (P8.30 ) or applying time of electric brake to fast stop reached (P8.31), the inverter output the brake close signal.

When the P8.32=2, that is, only with the mechanical brake, the inverter output brake close signal and stop.

| Function Code | Name                                  | Description | Setting Range | Factory Setting |
|---------------|---------------------------------------|-------------|---------------|-----------------|
| P8.33         | Torque verification enable            | 0~1         | 0~1           | 0               |
| P8.34         | Keypad setting of torque verification | 0.0~100.0%  | 0.0~100.0     | 10.0%           |
| P8.35         | Torque verification fault delay time  | 0.0~10.0 s  | 0.0~10.0      | 0.5s            |

This section is used to verify the inverter torque module.

Torque verification confirm that the inverter's output torque reaches the value of P8.34 before the inverter open brake and starts running to reduce slip cart phenomenon. This function module is only valid for closed-loop vector control mode.

P8.33=1, torque verification enable. If the mechanical brake is valid, when the inverter output torque reaches a positive torque given by P8.34 (relative to motor rated torque), the validation is successful, the mechanical brake will be open, and the inverter implement the next step of the startup sequence; if the torque verification is unsuccessful, after torque verification fault delay time (P8.35), the inverter will output fault.

| Function Code | Name                              | Description                                      | Setting Range | Factory Setting |
|---------------|-----------------------------------|--|---------------|-----------------|
| P8.36         | Light-load speeding up enable     | 0~1  | 0~1           | 0               |
| P8.37         | Speeding up command selection     | 0: Automatic<br>1: Terminals<br>2: Communication | 0~2           | 1               |
| P8.38         | Frequency fluctuation coefficient | 0~100  | 0~100         | 0~100           |

| Function Code | Name  | Description | Setting Range | Factory Setting |
|---------------|---|-------------|---------------|-----------------|
| P8.39         | Speed turning point of constant power       | 0.0~200.0   | 0.0~200.0     | 100.0%          |
| P8.40         | Filtering time factor of load torque signal | 0.0~10.0s   | 0.0~10.0      | 0.2s            |
| P8.41         | Torque autotuning selection without load    | 0~1         | 0~1           | 0               |
| P8.42         | Consumed torque by empty hook rising        | 0.0~150.0%  | 0.0~150.0     | N/A             |
| P8.43         | Consumed torque by empty hook descent       | 0.0~150.0%  | 0.0~150.0     | N/A             |
| P8.44         | Output torque limit of rising up            | 0~150.0%    | 0~150.0       | 100.0%          |
| P8.45         | Output torque limit of descent              | 0~150.0%    | 0~150.0       | 75.0%           |

This part is used to for the inverter speeding up with the light-load.

The function modules can only be used to drag potential load, which is usually used only for crane.

When the motor drags light loads, the inverter can run with the weak magnetic adjusting speed which is the addition that is consist of the motor rated speed (base speed) and additional motor speed, the maximum effective torque of motor will be reduced. In order to ensure providing enough torque to control the load in the speed scope of the weak magnetic, the maximum permitted speed should be calculated.

P8.36 = 1, Light-load speeding up is valid, P8.44 and P8.45 are output torque limit in forward/reverse direction, when the speed rise to point P8.39 (speed turning point of constant power), the module will calculate the maximum permitted speed, and then, if there is speeding up command and the frequency fluctuation coefficient is less than P8.38. The inverter will runs in accordance with calculated frequency.

Frequency fluctuation coefficient (P8.38) is got in the application test for calculating the

maximum permitted speed more accurate.

If the load jitter severe and can not speed up, P8.38 should be adjusted to be bigger.

If the load is relatively stable, P8.38 should be reduced.

| Function Code | Name   | Description   | Setting Range | Factory Setting |
|---------------|--|---|---------------|-----------------|
| P8.46         | Sling loosening torque threshold               | 1.0~100.0%  | 1.0~100.0     | 3.0%            |
| P8.47         | Sling loosening alarm output enable in falling | 0: Prohibition<br>1: Output alarm signal<br>2: Output alarm, shutdown and brake | 0~2           | 0               |

That part is used to detect loosening of the sling by the inverter.

If the inverter output torque is less than sling loosening torque threshold (P8.46) in rising stage, the light-load speed up if the inverter is prohibited to prevent shock.

When the inverter detects the load torque falling down below value of P8.46 the sling loosening torque threshold value, the sling loosening detection will be output according to the setting of P8.47.

**Notice: Please make sure the inverter should autotune without load before using the function of sling loosening output, the value of P8.46 should greater than P8.43.**

| Function Code | Name   | Description | Setting Range | Factory Setting |
|---------------|--|-------------|---------------|-----------------|
| P8.48         | Operating lever zero position detection enable | 0~1         | 0~1           | 0               |
| P8.49         | Operating lever zero position delay time       | 0.0~60.0s   | 0.0~60.0      | 0.3s            |

This part is used to detect operating lever zero position

When P8.48 = 1, Operating lever zero position detection is effective.

To prevent the inverter restart after inverter stopped, it is necessary to check the operating lever back to zero position (midpoint location). After the operating lever is back to zero location and the delay time P8.49 is passed, inverter can be restarted.

**Notice: the zero position signals only can be use in operating lever mode, hierarchical mode of operating lever.**

| Function Code | Name                                      | Description    | Setting Range | Factory Setting |
|---------------|---|----------------|---------------|-----------------|
| P8.50         | Over-current stall protection             | 0~1            | 0~1           | 1               |
| P8.51         | Coefficient of over-current stall         | 100~200%       | 100~200       | 150%            |
| P8.52         | Frequency decreasing rate of over-current | 0.00~50.00Hz/s | 0.00~50.00    | 0.00 Hz/s       |

During acceleration of inverter, the actual motor speed rise rate may lower than the output frequency rise rate because of too big load. If no measures to take, inverter will trip caused by over-current.

The principle of over-current protection is to detect the output current of inverter during inverter operation and compare it with over-current stall threshold determined by P8.51. If it exceeds the value of P8.51 during acceleration, inverter will remain output frequency; if it exceeds the value of P8.51 during constant speed running, inverter will decrease output frequency. When output current of inverter is lower than the value of P8.51, inverter will continue to accelerate until output frequency reach frequency reference. Please refer to following diagram.

| Function Code | Name                                  | Description | Setting Range | Factory Setting |
|---------------|---------------------------------------|-------------|---------------|-----------------|
| P8.53         | DC bus overvoltage adjuster enable    | 0~1         | 0~1           | 0               |
| P8.54         | DC bus overvoltage acceleration point | 70.0~97.0   | 70.0~97.0     | 75.0            |
| P8.55         | PID limit for output of adjuster      | 0.0~10.0    | 0.0~10.0      | 5.0%            |
| P8.56         | Acceleration proportional coefficient | 0.00~5.00   | 0.00~5.00     | 0.005           |
| P8.57         | Acceleration integral coefficient     | 0.01~20.00  | 0.01~20.00    | 1.00s           |

| Function Code | Name                                  | Description | Setting Range | Factory Setting |
|---------------|---------------------------------------|-------------|---------------|-----------------|
| P8.58         | Acceleration integral result limit    | 0.0~10.0    | 0.0~10.0      | 2.0%            |
| P8.59         | Acceleration differential coefficient | 0.01~20.00  | 0.01~20.00    | 0.00s           |

If P8.53=1, the DC bus overvoltage adjuster is enable.

The DC bus voltage exceeds the point P8.54, the adjuster begin to work. Adjust the DC bus voltage by adjusting the speed of motor, when the DC bus voltage exceeds P8.45, the motor speed will increase.

| Function Code | Name                                     | Description   | Setting Range | Factory Setting |
|---------------|--|---|---------------|-----------------|
| P8.60         | PID voltage threshold of adjuster        | 65.0~P8.54  | 65.0~P8.54    | 70%             |
| P8.61         | Adjuster operational ways                | 0 .Dissipated by PID.<br>1. Converted to by current<br>PID adjuster output value<br>(Valid when slave mode is valid only ). | 0~1           | 0               |
| P8.62         | Integral coefficient of adjuster PID     | 0.01~20.00  | 0.01~20.00    | 3.00s           |
| P8.63         | Differential coefficient of adjuster PID | 0.00~20.00  | 0.00~20.00    | 0.00s           |

If P8.53=1, when DC bus voltage is less than P8.60, the adjuster begin to work, adjust motor speed to regulate DC bus voltage. When the DC bus voltage is less than P8.60, slow down motor speed.

## 6.10 P9 Group--Protection Parameters

| Function Code | Name                           | Description               | Setting Range | Factory Setting |
|---------------|--------------------------------|---------------------------|---------------|-----------------|
| P9.00         | Input phase-failure protection | 0: Disabled<br>1: Enabled | 0~1           | 1               |

| Function Code | Name                            | Description               | Setting Range | Factory Setting |
|---------------|---------------------------------|---------------------------|---------------|-----------------|
| P9.01         | Output phase-failure protection | 0: Disabled<br>1: Enabled | 0~1           | 1               |

**Notice: Please be cautious to set these parameters as disabled. Otherwise it may cause inverter and motor overheat even damaged.**

| Function Code | Name                      | Description   | Setting Range | Factory Setting |
|---------------|---------------------------|---|---------------|-----------------|
| P9.02         | Motor overload protection | 0: Disabled<br>1: Normal motor<br>2: Variable frequency motor | 0~2           | 2               |

1: For normal motor, the lower the speed, the poorer the cooling effect. Based on this reason, if output frequency is lower than 30Hz, inverter will reduce the motor overload protection threshold to prevent normal motor from overheat.

2: As the cooling effect of variable frequency motor has nothing to do with running speed, it is not required to adjust the motor overload protection threshold.

| Function Code | Name                              | Description  | Setting Range | Factory Setting |
|---------------|-----------------------------------|--------------|---------------|-----------------|
| P9.03         | Motor overload protection current | 20.0%~120.0% | 20.0~120.0    | 100.0%          |

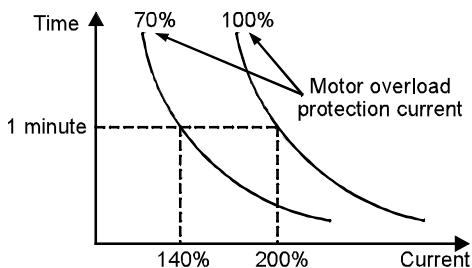


Figure 6.13 Motor overload protection curve.

he value can be determined by the following formula:

$$\text{Motor overload protection current} = (\text{motor rated current} / \text{inverter rated current}) * 100\%$$

**Notice:**

- This parameter is normally used when rated power of inverter is greater than rated power of motor.
- Motor overload protection time: 60s with 200% of rated current. For details,

please refer to above figure.

| Function Code | Name                            | Description  | Setting Range | Factory Setting |
|---------------|---------------------------------|--|---------------|-----------------|
| P9.04         | Overload pre-warning threshold  | 20.0%~150.0%   | 20.0~150.0    | 130.0%          |
| P9.05         | Overload pre-warning selection  | 0: Always detect relative to motor rated current<br>1: Detect while constant speed relative to motor rated current<br>2: Always detect relative to inverter rated current<br>3: Detect while constant speed relative to inverter rated current | 0~3           | 0               |
| P9.06         | Overload pre-warning delay time | 0.0~30.0s  | 0.0~30.0      | 5.0s            |

The value of P9.05 determines the pre-warning category, such as motor overload (OL1) or inverter overload (OL2).

P9.04 determines the current threshold of pre-warning action, it is a percentage of the rated current. When output current of inverter exceeds the value of P9.04 and last the duration determined by P9.06, inverter will output a pre-warning signal. Please refer to following diagram:

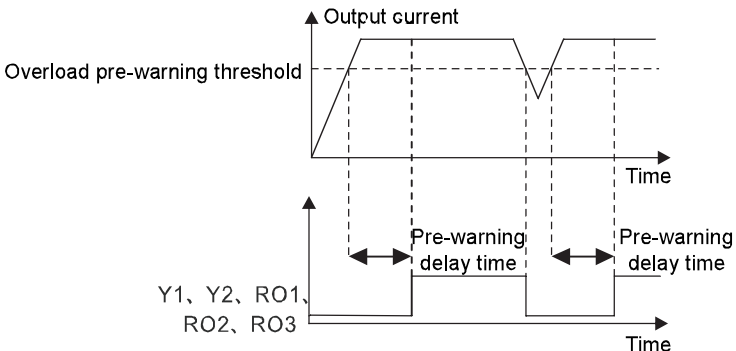


Figure 6.14 Overload pre-warning schematic diagram.

| Function Code | Name                                  | Description  | Setting Range | Factory Setting |
|---------------|---------------------------------------|--------------|---------------|-----------------|
| P9.07         | Motor overspeed protection            | 0~1          | 0~1           | 0               |
| P9.08         | Overspeed protection point of motor 1 | 100.0~200.0% | 100.0~200.0   | 110.0%          |
| P9.09         | Overspeed protection point of motor 2 | 100.0~200.0% | 100.0~200.0   | 110.0%          |

This section is used to monitor the motor speed, the inverter will trip signal when the motor exceeds the given speed

Set P9.07=1 to enable motor overspeed protection. If the motor speed exceeds the setting of P9.08, the inverter will shutdown immediately and reported the fault OFE (enable the brakes at the same time), and the keyboard display the fault.

| Function Code | Name   | Description               | Setting Range | Factory Setting |
|---------------|--|---------------------------|---------------|-----------------|
| P9.10         | Motor over-temperature protection                          | 0: Disabled<br>1: Enabled | 0~1           | 0               |
| P9.11         | Type of motor temperature sensor and signal source setting | 0: PT100<br>1: PT1000     | 0~1           | 0               |
| P9.12         | Temperature adjusting bias                                 | -80.0~80.0                | -80.0~80.0    | 0.0℃            |

This section of P9.12 is used to set the temperature detecting bias. The setting is as follows:

If P9.11 is selected PT100, DIP switch is OFF, a value of 100Ω resistor is connected between the PT100 terminal and GND, and check the value of motor temperature display (P7.05), and temperature adjusting bias (P9.12) is the reverse of P7.05.

If P9.11 is selected PT1000, DIP switch is OFF, a value of 1kΩ resistor is connected between the PT100 terminal and GND

**Notice: Using the motor over-temperature protection feature, you must select I/O expansion cards.**

| Function Code | Name   | Description | Setting Range | Factory Setting |
|---------------|--|-------------|---------------|-----------------|
| P9.13         | Temperature correct factor                   | 50.0~150.0  | 50.0~150.0    | 100.0%          |
| P9.14         | The motor1 over-temperature protection point | 0~150.0     | 0~150.0       | 100.0℃          |

This feature code P9.14 is used to set the motor point of an over-temperature protection. If the motor temperature exceeds an the motor point of an over-temperature protection (P9.14), the inverter will immediately shutdown and report over-temperature fault OH3 (enable the brakes at the same time), and the keypad display the fault.

| Function Code | Name                                       | Description | Setting Range | Factory Setting |
|---------------|--|-------------|---------------|-----------------|
| P9.15         | The motor 1 over-temperature warning point | 20.0~100.0% | 20.0~100.0    | 90.0%           |

This feature code is used to set the motor point of an over-temperature warning. If the motor temperature exceeds the points of motor over-temperature warning (P9.15), the inverter will output the over-temperature warning signal.

| Function Code | Name  | Description | Setting Range | Factory Setting |
|---------------|---|-------------|---------------|-----------------|
| P9.16         | The motor 2 over-temperature protection point | 0~150.0     | 0~150.0       | 100.0℃          |
| P8.51         | Coefficient of over-current stall             | 100~200%    | 100~200       | 150%            |

This feature code is used to set the motor 2 point of over-temperature protection.

Function is same to P9.14.

| Function Code | Name                                       | Description | Setting Range | Factory Setting |
|---------------|--|-------------|---------------|-----------------|
| P9.17         | The motor 2 over-temperature warning point | 20.0~100.0% | 20.0~100.0    | 90.0%           |

This feature code is used to set the motor 2 over-temperature warning points.

Functional description is same to P9.15.

| Function Code | Name                                  | Description               | Setting Range | Factory Setting |
|---------------|---------------------------------------|---------------------------|---------------|-----------------|
| P9.18         | Motor temperature compensation enable | 0: Disabled<br>1: Enabled | 0~1           | 0               |

This section is used to compensate the impact of motor parameters altering at different temperature point; user should equip the electrical temperature sensor and the I/O expansion cards while using this function.

| Function Code | Name     | Description | Setting Range | Factory Setting |
|---------------|----------|-------------|---------------|-----------------|
| P9.19~P9.20   | Reserved | 0~65535     | 0~65535       | 0               |

### 6.11 PA Group--Serial Communication

| Function Code | Name                        | Description | Setting Range | Factory Setting |
|---------------|-----------------------------|-------------|---------------|-----------------|
| PA.00         | Local communication address | 0~247       | 0~247         | 1               |

When the master is writing the frame, if the communication address of the slave is set to be 0 (that is the broadcast communication address), all slaves on the MODBUS bus will receive the frame, but the slaves will not make any response. Note that the slave address should not be set to be 0.

The local communication address is a unique address in the communication network. This is the basis for point-to-point communications between the upper computer and the inverter.

| Function Code | Name                              | Description  | Setting Range | Factory Setting |
|---------------|-----------------------------------|--|---------------|-----------------|
| PA.01         | Communication baud rate selection | 0: 1200BPS<br>1: 2400BPS<br>2: 4800BPS<br>3: 9600BPS<br>4: 19200BPS<br>5: 38400BPS | 0~5           | 4               |

This parameter is used to set the data transmission rate between the upper computer and the inverter.

**Notice: The baud rate setting of the upper computer should be the same as that of the inverter. Otherwise, communications cannot be implemented. The higher the baud rate, the faster the communication speed is.**

| Function Code | Name        | Description   | Setting Range | Factory Setting |
|---------------|-------------|---|---------------|-----------------|
| PA.02         | Data format | 0: No parity (8,N,2) for RTU<br>1: Even parity (8,E,1) for RTU<br>2: Odd parity (8,O,1) for RTU<br>3: No parity (8,N,2) for ASCII<br>4: Even parity (8,E,1) for ASCII<br>5: Odd parity (8,O,1) for ASCII<br>6: No parity (7,N,2) for ASCII<br>7: Even parity (7,E,1) for ASCII<br>8: Odd parity (7,O,1) for ASCII | 0~8           | 1               |

The data format setting of the upper computer should be the same as that of the inverter. Otherwise, communications cannot be implemented.

| Function Code | Name                      | Description | Setting Range | Factory Setting |
|---------------|---------------------------|-------------|---------------|-----------------|
| PA.03         | Communication reply delay | 0~20ms      | 0~20          | 0ms             |

Reply delay: refers to the interval time between the end of data receiving of the inverter and the reply data sending of the upper computer. If the reply delay time is less than the system processing time, take the system processing time as reply delay reference. If the reply delay is longer than the system processing time, after data processing, the system has to wait until the reply delay time is reached before sending data to the upper computer.

| Function Code | Name                             | Description | Setting Range | Factory Setting |
|---------------|----------------------------------|-------------|---------------|-----------------|
| PA.04         | Communication timeout fault time | 0.0~100.0s  | 0.0~100.0     | 0.0s            |

If the functional code is set to 0.0s, the communication delay time parameter is disabled. When the functional code is set to be a valid value, if the interval between the current communication and the next communication exceeds the communication delay time, the system will send a communication fault error (Err18).

Normally, it is set to be “disabled”. If this parameter is set in a consecutive communication system, communication status can be monitored.

| Function Code | Name                        | Description   | Setting Range | Factory Setting |
|---------------|-----------------------------|---|---------------|-----------------|
| PA.05         | Communication reply enable  | 0: Communication reply enabled<br>1: Communication reply disabled   | 0~1           | 0               |
| PA.06         | Transmission error handling | 0: Report fault and coast to stop<br>1: Do not report fault and continue running<br>2: Do not report fault and stop according to setting (communication valid only)<br>3: Do not report fault and stop according to setting (all of the control mode) | 0~3           | 0               |

Select inverter operating status to shield CE fault and shut down or continuing running, in which way inverter can continue running when communication fault.

| Function Code | Name                         | Description  | Setting Range | Factory Setting |
|---------------|------------------------------|--|---------------|-----------------|
| PA.07         | RS485 communication protocol | 0: Modbus protocol<br>1: Master-slave control protocol | 0~1           | 0               |

Selecting 485 communication protocols, the standard modbus protocol should be set to 0, master-slave control protocol should be set to 1, or communication can not work.

| Function Code | Name                                 | Description   | Setting Range | Factory Setting |
|---------------|--------------------------------------|---|---------------|-----------------|
| PA.08         | Ethernet communication speed setting | 0: 10 M full-duplex<br>1: 10 M half-duplex<br>2: 100 M full-duplex<br>3: 100 M half-duplex<br>4: Adaptive | 0~4           | 1               |

The feature code is used for the Ethernet communication speed settings.

| Function Code | Name          | Description | Setting Range | Factory Setting |
|---------------|---------------|-------------|---------------|-----------------|
| PA.09         | IP Address 1  | 0~255       | 0~255         | 192             |
| PA.10         | IP Address 2  | 0~255       | 0~255         | 168             |
| PA.11         | IP Address 3  | 0~255       | 0~255         | 0               |
| PA.12         | IP Address 4  | 0~255       | 0~255         | 1               |
| PA.13         | Subnet Mask 1 | 0~255       | 0~255         | 255             |
| PA.14         | Subnet Mask 2 | 0~255       | 0~255         | 255             |
| PA.15         | Subnet Mask 3 | 0~255       | 0~255         | 254             |
| PA.16         | Subnet Mask 4 | 0~255       | 0~255         | 0               |

This section is used to set the Ethernet IP address and subnet mask of communications.

IP Address format: PA.09, PA.10, PA.11, PA.12

For example: IP address is 192.168.0.1

IP Subnet Mask Format: PA.13, PA.14, PA.15, PA.16

For example: subnet mask is 255.255.255.0.

| Function Code | Name     | Description | Setting Range | Factory Setting |
|---------------|----------|-------------|---------------|-----------------|
| PA.17~PA.21   | Reserved | 0~65535     | 0~65535       | 0               |

This function is reserved.

| Function Code | Name        | Description | Setting Range | Factory Setting |
|---------------|-------------|-------------|---------------|-----------------|
| PA.22         | CAN Address | 0~127       | 0~127         | 1               |

Set CAN Bus mailing address. Local address in the CAN bus communication network, is unique.

| Function Code | Name                   | Description   | Setting Range | Factory Setting |
|---------------|------------------------|---|---------------|-----------------|
| PA.23         | CAN baud rate settings | 0: 20K BPS<br>1: 50K BPS<br>2: 100K BPS<br>3: 250K BPS<br>4: 500K BPS<br>5: 1M BPS<br>5: 1M BPS | 0~5           | 4               |

This parameter is used to set up the data transfer rate of CAN-bus between the two inverters.

| Function Code | Name                            | Description | Setting Range | Factory Setting |
|---------------|---------------------------------|-------------|---------------|-----------------|
| PA.24         | CAN communication timeout delay | 0.0~100.0s  | 0.0~100.0     | 0s              |

When the function code is set to be 0.0s, PA.24 is invalid.

When the function code is set to be non-zero value, if the time between this communication and the next exceeds the communication timeout interval, the system will report communication fault (CANE). Usually this parameter is set to invalid. You can monitor the communication status by this parameter in continuous communication systems.

## 6.12 Pb Group--Master-Slave Control Group

| Function Code | Name                                | Description  | Setting Range | Factory Setting |
|---------------|-------------------------------------|--|---------------|-----------------|
| Pb.00         | Master-slave control mode selection | 0: Stand-alone mode<br>1: Power balance mode<br>2: Speed synchronized mode | 0~2           | 0               |

Power balance mode is a load distribution application for the system that is the shaft coupling applications of two motors through the gear box and rail. The Master sends signals and given value (speed and torque) to the slave through the communication bus. Speed synchronized mode is that two separated cranes lift the same load in one pace. The pulse encoder feedback and communication are necessary for the two inverters during

speed synchronized mode.

If Pb.00  $\neq$  0, the default communication of master-slave is CAN bus. If you want to use 485, please set PA.07=1.

| Function Code | Name                      | Description   | Setting Range | Factory Setting |
|---------------|---------------------------|---|---------------|-----------------|
| Pb.01         | Master-slave mode setting | 0: Master-slave mode is invalid<br>1: This is the master<br>2: This is the slave<br>3: Master or slave is set by Profibus | 0~3           | 0               |

If Pb.01=3, the Profibus-DP card is needed. One of the PZD receiver set to be 6 (master-slave mode selection). The master is 0x55aa, the slave is 0x66bb.

**Notice: If Pb.01=3, When communication mode decides the master-slave mode, the master is sending, the slave is receiving without response.**

| Function Code | Name                                  | Description   | Setting Range | Factory Setting |
|---------------|---------------------------------------|---|---------------|-----------------|
| Pb.02         | Reference signal from master to slave | 0: Master output torque<br>1: Master output current<br>2: Pulse counter of master encoder | 0~2           | 0               |

0: Master output torque.

The reference signal of master to slave is the master output torque.

1: Master output current.

The reference signal of master to slave is the master output current.

2: Pulse counter of master encoder

This function is used master-slave speed synchronous mode commonly.

| Function Code | Name   | Description | Setting Range | Factory Setting |
|---------------|--|-------------|---------------|-----------------|
| Pb.03         | The interval of master sending data to slave | 0~10000ms   | 0~10000       | 10ms            |

This function defines the interval of master sending data to slave every two times when master-slave function enables.

| Function Code | Name   | Description  | Setting Range | Factory Setting |
|---------------|--|--|---------------|-----------------|
| Pb.04         | Master-slave communication channel selection | 0: Prohibited communications<br>1: CAN communication<br>2: 485 | 0~2           | 0               |

This function is used to control the master to send or stop sending data to the slave at any time; or select receiving channel of slave.

| Function Code | Name                                 | Description  | Setting Range | Factory Setting |
|---------------|--------------------------------------|--|---------------|-----------------|
| Pb.05         | The slave control source             | 0: Master communications control<br>1: According to P0.01 setting. | 0~1           | 0               |
| Pb.06         | the slave reference frequency source | 0: From the master communications<br>1: Selection though P0.02     | 0~1           | 0               |

When the master-slave control, the slave chooses the reference speed of the source through the feature code and the channel is the master speed.

| Function Code | Name   | Description | Setting Range | Factory Setting |
|---------------|--|-------------|---------------|-----------------|
| Pb.07         | The gain of the slave reference frequency source | 0.01~100.00 | 0.01~100.00   | 1.00            |

The PID given of the slave synchronous speed is come from the multiplication of Pb.06 and Pb.07 during the master-slave control; it is more convenient for user to adjust the synchronous speed relationship of the master and slave.

| Function Code | Name                              | Description   | Setting Range | Factory Setting |
|---------------|-----------------------------------|---|---------------|-----------------|
| Pb.08         | the slave reference signal source | 0: Master communications<br>1: AI1<br>2: AI2<br>3: HDI1 | 0~3           | 0               |

| Function Code | Name  | Description | Setting Range | Factory Setting |
|---------------|---|-------------|---------------|-----------------|
| Pb.09         | The gain of the slave reference signal source | 0.01~100.00 | 0.01~100.00   | 1.00            |
| Pb.10         | Filtering time of the slave reference signal  | 0.0~3.0s    | 0.0~3.0s      | 0.0s            |

The PID given of the slave reference signal is come from the multiplication of Pb.08 and Pb.09 during the master-slave control; it is more convenient for user to adjust the synchronous speed relationship of the master and slave.

| Function Code | Name                           | Description  | Setting Range | Factory Setting |
|---------------|--------------------------------|--------------|---------------|-----------------|
| Pb.11         | PID proportional coefficient 1 | 0.000~10.000 | 0.000~10.000  | 0.005           |
| Pb.12         | PID integral time 1            | 0.01~80.00s  | 0.01~80.00    | 8.00s           |
| Pb.13         | PID switching low point        | 0.00~Pb.16   | 0.00~Pb.16    | 5.00Hz          |
| Pb.14         | PID proportional coefficient 2 | 0.000~10.000 | 0.000~10.000  | 0.010           |
| Pb.15         | PID integral time 2            | 0.01~80.00s  | 0.01~80.00    | 10.00s          |
| Pb.16         | PID switching high point       | Pb.13~P0.03  | Pb.13~P0.03   | 10.00Hz         |
| Pb.17         | PID Differential time          | 0.00~10.00s  | 0.00~10.00    | 0.00s           |

- Reducing overshooting

If overshooting occurs, shorten the differential time and lengthen the integral time.

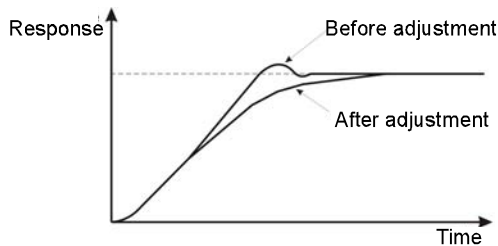


Figure 6.15 Reducing overshooting diagram.

- Rapidly stabilizing control status

To rapidly stabilize the control conditions even when overshooting occurs, shorten the integral time and lengthen the differential time.

- Reducing long-cycle oscillation

If oscillation occurs with a longer cycle than the integral time setting, it means that integral operation is strong. The oscillation will be reduced as the integral time is lengthened.

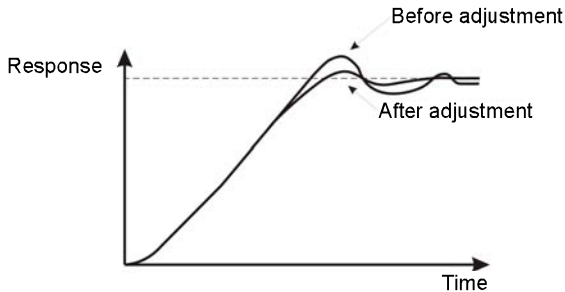


Figure 6.17 Reducing long-cycle oscillation diagram.

- Reducing short-cycle oscillation

If the oscillation cycle is short and oscillation occurs with a cycle approximately the same as the differential time setting, it means that the differential operation is strong. The oscillation will be reduced as the differential time is shortened.

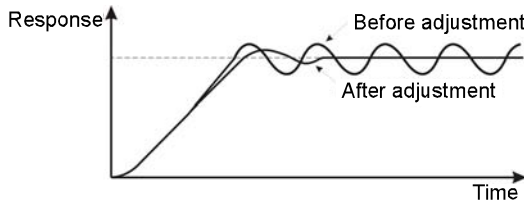


Figure 6.18 Reducing short-cycle oscillation diagram.

If oscillation cannot be reduced even by setting the differential time to 0, then either lowers the proportional gain or raise the PID primary delay time constant.

| Function Code | Name                   | Description | Setting Range | Factory Setting |
|---------------|------------------------|-------------|---------------|-----------------|
| Pb.18         | PID output filter time | 0.00~10.00s | 0.00~10.00    | 0.00s           |

The bigger the filter time, the better the immunity capability, but the response becomes slow, vice versa.

| Function Code | Name                        | Description | Setting Range | Factory Setting |
|---------------|-----------------------------|-------------|---------------|-----------------|
| Pb.19         | Integral result of limiting | 0.0~100.0%  | 0.0~100.0     | 100.0%          |

The result of integral within the inverter will automatically be limited.

| Function Code | Name                       | Description   | Setting Range | Factory Setting |
|---------------|----------------------------|---------------|---------------|-----------------|
| Pb.20         | The results of integration | -100.0~100.0% | -100.0~100.0  | Depend on model |

The integration limiting result is showed for debugging and checking convenient.

| Function Code | Name       | Description | Setting Range | Factory Setting |
|---------------|------------|-------------|---------------|-----------------|
| Pb.21         | Bias limit | 0.0~80.0%   | 0.0~80.0      | 0.0%            |

Bias limit defines the maximum bias between the feedback and the preset. PID stops operation when the bias is within this range, setting this parameter correctly is helpful to improve the system output accuracy and stability.

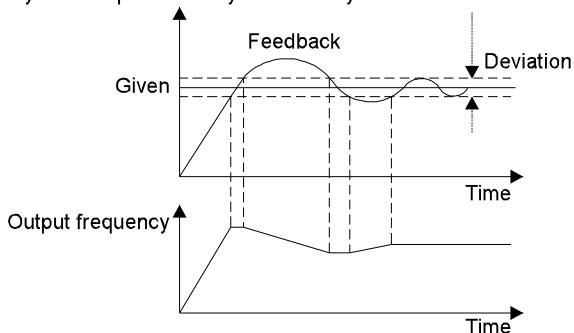


Figure 6.19 Relationship between bias limit and output frequency

| Function Code | Name                           | Description                | Setting Range | Factory Setting |
|---------------|--------------------------------|----------------------------|---------------|-----------------|
| Pb.22         | PID regulation characteristics | 0: Positive<br>1: Negative | 0~1           | 0               |

Pb.22=0, the feedback value is greater than the preset value, output frequency will be decreased.

Pb.22=1, the feedback value is smaller than the preset value, output frequency will be increased.

| Function Code | Name               | Description | Setting Range | Factory Setting |
|---------------|--------------------|-------------|---------------|-----------------|
| Pb.23         | PID mode selection | 0~3         | 0~3           | 2               |

0: Take proportional-plus-integral result as a synchronization coefficient

PID output= PID preset\*(the results of the proportion P+ the results of the integration I)

1: Take proportional coefficient of P as error correction, I as integral synchronous coefficient

PID output = PID preset \*the results of the integration I+ the results of the proportion P

2: Take proportional coefficient P and Integral coefficient I as the error correction

PID output = PID preset+the results of the integration I + the results of the proportion P

3 only use the proportion

| Function Code | Name  | Description | Setting Range | Factory Setting |
|---------------|---|-------------|---------------|-----------------|
| Pb.24         | PID integration of lower synchronized speed limit | 0.0~100.0%  | 0.0~100.0     | 0.0%            |

This function defines the slave PID calculation starting time. When the master synchronized speed reaches Pb.24. the slave begin the PID calculation. This function is used for slave synchronization when master starts firstly.

| Function Code | Name   | Description                | Setting Range | Factory Setting |
|---------------|--|----------------------------|---------------|-----------------|
| Pb.25         | PID enabled                                    | 0: Disabled<br>1: Enabled. | 0~1           | 0               |
| Pb.26         | Numerator of synchronized variable speed ratio | 1~32000                    | 1~32000       | 1000            |
| Pb.27         | Nominator of synchronized variable speed ratio | 1~32000                    | 1~32000       | 1000            |

When the master and the slave use gearboxes with different transmission ratio, you can set the mechanical speed ratio between the master and the slave through Pb.26 and

Pb.27.

The speed ratio of Master/slave = Pb.26/Pb.27, this speed rate is effective for the slave in the speed synchronous control.

| Function Code | Name                                      | Description | Setting Range | Factory Setting |
|---------------|---|-------------|---------------|-----------------|
| Pb.28         | limit of synchronous speed position error | 0~50000     | 0~50000       | 1000            |

If the speed deviation between the master and slave is higher than Pb.28, the inverter will report to the master-slave speed synchronization fault.

| Function Code | Name  | Description | Setting Range | Factory Setting |
|---------------|---|-------------|---------------|-----------------|
| Pb.29         | Speed synchronous position deviation adjustment dead zone | 0~20000     | 0~20000       | 50              |

When the master-slave speed synchronization control is effective, the synchronous speed deviation between the master and the slave exceeds the Pb.29, and then the slave regulates speed in accordance with setting.

| Function Code | Name  | Description | Setting Range | Factory Setting |
|---------------|---|-------------|---------------|-----------------|
| Pb.30         | The amplitude limiting of speed synchronous regulator | 0.0~100.0%  | 0.0~100.0     | 5.0%            |

When the master-slave speed synchronization control is effective, this code is used to regulate the scope of gain of the slave.

| Function Code | Name   | Description | Setting Range | Factory Setting |
|---------------|--|-------------|---------------|-----------------|
| Pb.31         | the minimum speed of synchronous output enable | 0.0~100.0%  | 0.0~100.0     | 2.0%            |

When you select the master-slave speed synchronization control, the speed is greater than Pb.31; the regulation of speed synchronization is effective.

| Function Code | Name                                      | Description                  | Setting Range | Factory Setting |
|---------------|---|------------------------------|---------------|-----------------|
| Pb.32         | Reset source of speed synchronous counter | 0: Automatic<br>1: Terminals | 0~1           | 0               |

If Pb.32=0, the speed of synchronous counter is reset to 0 when the slave shutdown;

If Pb.32=1, the slave counter return to 0 when terminal reset.

| Function Code | Name   | Description  | Setting Range | Factory Setting |
|---------------|--|--|---------------|-----------------|
| Pb.33         | Reset terminal polarity of synchronous speed counter | 0: Rising edge<br>1: Falling edge                                | 0~1           | 0               |
| Pb.34         | Pulse counter source of synchronous speed            | 0: External terminal S4,S5<br>1: Internal encoder pulse counting | 0~1           | 1               |
| Pb.35         | Reserved   | 0~65535  | 0~65535       | 0               |

### 6.13 PC Group--Motor Parameters 1

| Function Code | Name                          | Description   | Setting Range | Factory Setting |
|---------------|-------------------------------|---|---------------|-----------------|
| PC.00         | Speed control mode 1          | 0: Sensorless vector control<br>1: Vector control With PG<br>2: V/F control | 0~2           | 1               |
| PC.01         | Maximum frequency 1           | 10.00~400.00Hz  | 10.00~400.00  | 50.00Hz         |
| PC.02         | Motor rated speed power 1     | 0.4~900.0kW   | 0.4~900.0     | Depend on model |
| PC.03         | Motor rated speed frequency 1 | 0.01~400.00Hz   | 0.01~400.00   | 50.00Hz         |

| Function Code | Name                                    | Description   | Setting Range | Factory Setting |
|---------------|---|---------------|---------------|-----------------|
| PC.04         | Motor rated speed 1                     | 1~36000rpm    | 1~36000       | 1460rpm         |
| PC.05         | Motor rated speed voltage 1             | 1~480V        | 1~480         | 380V            |
| PC.06         | Motor basic speed current 1             | 0.1~2000.0A   | 0.1~2000.0    | Depend on model |
| PC.07         | Motor rated speed power factor 1        | 0.05~1.00     | 0.05~1.00     | Depend on model |
| PC.08         | Motor stator resistance 1               | 0.001~65.535Ω | 0.001~65.535  | Depend on model |
| PC.09         | Motor rotor resistance 1                | 0.001~65.535Ω | 0.001~65.535  | Depend on model |
| PC.10         | Motor leakage inductance 1              | 0.1~6553.5mH  | 0.1~6553.5    | Depend on model |
| PC.11         | Motor mutual inductance 1               | 0.1~6553.5mH  | 0.1~6553.5    | Depend on model |
| PC.12         | Current without load 1                  | 0.01~655.35A  | 0.01~655.35   | Depend on model |
| PC.13         | Acceleration time 1                     | 0.0~3600.0s   | 0.0~3600.0    | 20.0s           |
| PC.14         | Deceleration time 1                     | 0.0~3600.0s   | 0.0~3600.0    | 20.0s           |
| PC.15         | Start section of acceleration S curve 1 | 0.1~50.0%     | 0.1~50.0      | 10.0%           |
| PC.16         | End section of acceleration S curve 1   | 0.1~50.0%     | 0.1~50.0      | 10.0%           |
| PC.17         | Start section of deceleration S curve 1 | 0.1~50.0%     | 0.1~50.0      | 10.0%           |
| PC.18         | End section of deceleration S curve 1   | 0.1~50.0%     | 0.1~50.0      | 10.0%           |

| Function Code | Name                               | Description  | Setting Range | Factory Setting |
|---------------|------------------------------------|--|---------------|-----------------|
| PC.19         | Encoder type selection             | 0: Increment encoder<br>1: SIN/COS encoder<br>2: UVW encoder | 0~2           | 0               |
| PC.20         | Encoder pulse counting 1           | 1~65535  | 1~65535       | 1000            |
| PC.21         | Encoder direction 1                | 0:forward<br>1:reverse                                       | 0~1           | 0               |
| PC.22         | Carrier frequency 1                | 1.0~16.0kHz  | 1.0~16.0      | Depend on model |
| PC.23         | ASR proportional gain $K_p1$       | 0~100  | 0~100         | 20              |
| PC.24         | ASR integral time $K_i1$           | 0.01~10.00s  | 0.01~10.00    | 0.50s           |
| PC.25         | Low speed detecting filter time 1  | 0.000~1.000s   | 0.000~1.000   | 0.000s          |
| PC.26         | ASR switching point 1              | 0.00Hz~PC.30   | 0.00~PC.30    | 5.00Hz          |
| PC.27         | ASR proportional gain $K_p1$       | 0~100  | 0~100         | 25              |
| PC.28         | ASR integral time $K_i1$           | 0.01~10.00s  | 0.01~10.00    | 1.0s            |
| PC.29         | High speed detecting filter time 1 | 0.000~1.000s   | 0.000~1.000   | 0.000s          |
| PC.30         | ASR switching point 1              | PC.26~P0.03  | PC.26~P0.0    | 10.00Hz         |
| PC.31         | ACR proportional gain P1           | 0~65535  | 0~65535       | 500             |
| PC.32         | ACR integral gain I1               | 0~65535  | 0~65535       | 500             |
| PC.33         | Motor weak magnetic 1              | 1.0~2.0  | 1.0~2.0       | 1.0             |

| Function Code | Name  | Description | Setting Range | Factory Setting |
|---------------|---|-------------|---------------|-----------------|
| PC.34         | Motor Minimum weak magnetic 1                         | 10.0~80.0%  | 10.0~80.0     | 50.0            |
| PC.35         | The proportion of weak magnetic 1                     | 0-65535     | 0-65535       | 0               |
| PC.36         | Low-frequency threshold of restraining oscillation 1  | 0~10        | 0~10          | 2               |
| PC.37         | High-frequency threshold of restraining oscillation 1 | 0~10        | 0~10          | 0               |
| PC.38         | Maximum motor output voltage 1                        | PC.05~550V  | PC.05~550     | 380V            |
| PC.39         | HF-ACR proportional gain P1                           | 0~65535     | 0~65535       | 1000            |
| PC.40         | HF-ACR integral gain I1                               | 0~65535     | 0~65535       | 1000            |
| PC.41         | Slip compensation coefficient 1 of drive side         | 50~200      | 50~200        | 100%            |
| PC.42         | Slip compensation coefficient 1 of braking side       | 50~200      | 50~200        | 100%            |
| PC.43         | Torque upper limit current value 1                    | 0.0~200     | 0.0~200       | 110%            |
| PC.44         | Motor overspeed point 1                               | 0~200       | 0~200         | 110%            |
| PC.45         | Motor overtemperature 1                               | 0~1         | 0~1           | 0               |
| PC.46         | Motor overtemperature                                 | 0.0~60.0    | 0.0~60.0      | 40.0℃           |

| Function Code | Name   | Description | Setting Range | Factory Setting |
|---------------|--|-------------|---------------|-----------------|
|               | threshold 1  |             |               |                 |
| PC.47         | Motor overtemperature prewarning threshold 1       | 20.0~100.0  | 20.0~100.0    | 90%             |
| PC.48         | Motor temperature compensation enable 1            | 0~1         | 0~1           | 0               |
| PC.49         | Motor temperature compensation initial threshold 1 | 0.0~60.0    | 0.0~60.0      | 40.0℃           |
| PC.50         | Motor temperature compensation coefficient 1       | 0.0~200.0   | 0.0~200.0     | 100             |
| PC.51         | Reserved   | 0~65535     | 0~65535       | 0               |
| PC.52         | Reserved   | 0~65535     | 0~65535       | 0               |
| PC.53         | Motor type 1                                       | 0~1         | 0~1           | 0               |
| PC.54         | Magnetic pole initial position 1                   | 0.00~360.00 | 0.00~360.00   | 0               |
| PC.55         | Magnetic pole position amplitude gain 1            | 0.50~1.50   | 0.50~1.50     | 1               |
| PC.56         | C phase magnetic pole position bias 1              | 0~9999      | 0~9999        | 433             |
| PC.57         | D phase magnetic pole position bias 1              | 0~9999      | 0~9999        | 433             |

## 6.14 Pd Group--Profibus Communication

For more information, please refer to Profibus communication enable manual.

| Function Code | Name        | Description | Setting Range | Factory Setting |
|---------------|-------------|-------------|---------------|-----------------|
| Pd.00         | Module type | 1:Profibus  | 1             | Profibus        |

| Function Code | Name            | Description                          | Setting Range | Factory Setting |
|---------------|-----------------|--------------------------------------|---------------|-----------------|
| Pd.01         | Module address  | 0~99                                 | 0~99          | 2               |
| Pd.02         | PZD2 receiving  | 0: Invalid                           | 0~20          | 1               |
| Pd.03         | PZD3 receiving  | 1: Speed reference                   | 0~20          | 2               |
| Pd.04         | PZD4 receiving  | 2: Traction reference                | 0~20          | 3               |
| Pd.05         | PZD5 receiving  | 3: The maximum current               | 0~20          | 0               |
| Pd.06         | PZD6 receiving  | reference                            | 0~20          | 0               |
| Pd.07         | PZD7 receiving  | 4: The starting pre-torque           | 0~20          | 0               |
| Pd.08         | PZD8 receiving  | compensation value                   | 0~20          | 0               |
| Pd.09         | PZD9 receiving  | 5: Torque upper limit                | 0~20          | 0               |
| Pd.10         | PZD10 receiving | frequency                            | 0~20          | 0               |
| Pd.11         | PZD11 receiving | 6: Master-slave mode                 | 0~20          | 0               |
| Pd.12         | PZD12 receiving | selection                            | 0~20          | 0               |
|               |                 | 7~20: Reserved                       |               |                 |
| Pd.13         | PZD2 sending    | 0: Invalid                           | 0~30          | 9               |
| Pd.14         | PZD3 sending    | 1: Running frequency                 | 0~30          | 10              |
| Pd.15         | PZD4 sending    | 2: Reference speed rpm               | 0~30          | 11              |
| Pd.16         | PZD5 sending    | 3: DC bus voltage                    | 0~30          | 6               |
| Pd.17         | PZD6 sending    | 4: Output voltage                    | 0~30          | 7               |
| Pd.18         | PZD7 sending    | 5: Output current                    | 0~30          | 5               |
| Pd.19         | PZD8 sending    | 6: Output torque percentage          | 0~30          | 0               |
| Pd.20         | PZD9 sending    | 7: Output power percentage           | 0~30          | 0               |
| Pd.21         | PZD10 sending   | 8: Frequency reference               | 0~30          | 0               |
| Pd.22         | PZD11 sending   | 9: Function code                     | 0~30          | 0               |
|               |                 | 10: Reserved                         |               |                 |
| Pd.23         | PZD12 sending   | 11: PG card position                 | 0~30          | 0               |
|               |                 | 12: Input terminal status            |               |                 |
|               |                 | 13: Output terminal status           |               |                 |
|               |                 | 14: Torque compensation              |               |                 |
|               |                 | 15: Motor rated torque               |               |                 |
|               |                 | 16: Reference frequency of the slope |               |                 |
|               |                 | 17: Pd.24                            |               |                 |
|               |                 | 18~30: Reserved                      |               |                 |

| Function Code | Name                              | Description | Setting Range | Factory Setting |
|---------------|-----------------------------------|-------------|---------------|-----------------|
| Pd.24         | Temporary variable of PZD sending | 0~65535     | 0~65535       | 0               |

PZD Data sending instruction:

| No. | name                            | Description   |      |      |      |      |      |  |     |    |    |    |  |      |      |      |      |  |    |    |    |    |
|-----|---------------------------------|---|------|------|------|------|------|--|-----|----|----|----|--|------|------|------|------|--|----|----|----|----|
| 1   | Running frequency               | Unit:Hz, Range: (-32767~32767),Example:5000=50.00Hz   |      |      |      |      |      |  |     |    |    |    |  |      |      |      |      |  |    |    |    |    |
| 2   | Running speed                   | Unit:rpm, Range: (-32767 ~ 32767),Example:1000=1000 rpm   |      |      |      |      |      |  |     |    |    |    |  |      |      |      |      |  |    |    |    |    |
| 3   | DC bus voltage                  | Unit:V,Range:(0~ 65535) Example:6000=600.0V   |      |      |      |      |      |  |     |    |    |    |  |      |      |      |      |  |    |    |    |    |
| 4   | Ouput voltage                   | Drive voltage feedback,Unit:V,Range:(0~ 65535) Example:380=380V   |      |      |      |      |      |  |     |    |    |    |  |      |      |      |      |  |    |    |    |    |
| 5   | Output current                  | Drive current feedback,Unit:A,Range: (0~ 65535) Example:1500=150.0A   |      |      |      |      |      |  |     |    |    |    |  |      |      |      |      |  |    |    |    |    |
| 6   | Output torque                   | Unit:%, Range: (-2500~ 2500) Example500=50.0%, 100.0% is corresponding to speed at rated torque   |      |      |      |      |      |  |     |    |    |    |  |      |      |      |      |  |    |    |    |    |
| 7   | Output power                    | Unit:%, Range: (-32767~ 32767) Example500=50.0%, 100.0% corresponding to motor rated power  |      |      |      |      |      |  |     |    |    |    |  |      |      |      |      |  |    |    |    |    |
| 8   | Freqeucy setting absolute value | Unit:Hz,Range:(0~ 32767), Example:5000=50.00Hz  |      |      |      |      |      |  |     |    |    |    |  |      |      |      |      |  |    |    |    |    |
| 9   | Fault code                      | Range: (0~ 65535),Corresponding to the function code of (P7.21~P7.23)   |      |      |      |      |      |  |     |    |    |    |  |      |      |      |      |  |    |    |    |    |
| 10  | Reserved                        | Range: (0~ 65535)   |      |      |      |      |      |  |     |    |    |    |  |      |      |      |      |  |    |    |    |    |
| 11  | PG Card position                | Range:(0~ 65535)  |      |      |      |      |      |  |     |    |    |    |  |      |      |      |      |  |    |    |    |    |
| 12  | Input terminal state            | Range:(0 ~ 65535) is the decimal of input terminal state(binary). Example: 43(decimal)= 00101011(binary), which means S1, S2, S4, S6 is on <table border="1" style="margin-left: 20px; margin-top: 10px;"> <tbody> <tr> <td></td> <td>BIT8</td> <td>BIT7</td> <td>BIT6</td> <td>BIT5</td> </tr> <tr> <td></td> <td>HDI</td> <td>S8</td> <td>S7</td> <td>S6</td> </tr> <tr> <td></td> <td>BIT4</td> <td>BIT3</td> <td>BIT2</td> <td>BIT1</td> </tr> <tr> <td></td> <td>S5</td> <td>S4</td> <td>S3</td> <td>S2</td> </tr> </tbody> </table> |      | BIT8 | BIT7 | BIT6 | BIT5 |  | HDI | S8 | S7 | S6 |  | BIT4 | BIT3 | BIT2 | BIT1 |  | S5 | S4 | S3 | S2 |
|     | BIT8                            | BIT7  | BIT6 | BIT5 |      |      |      |  |     |    |    |    |  |      |      |      |      |  |    |    |    |    |
|     | HDI                             | S8  | S7   | S6   |      |      |      |  |     |    |    |    |  |      |      |      |      |  |    |    |    |    |
|     | BIT4                            | BIT3  | BIT2 | BIT1 |      |      |      |  |     |    |    |    |  |      |      |      |      |  |    |    |    |    |
|     | S5                              | S4  | S3   | S2   |      |      |      |  |     |    |    |    |  |      |      |      |      |  |    |    |    |    |

| No.  | name                      | Description   |      |      |      |      |      |      |      |     |     |     |     |     |     |     |
|------|---------------------------|---|------|------|------|------|------|------|------|-----|-----|-----|-----|-----|-----|-----|
| 13   | Output terminal state     | Range: (0 ~ 65535) is the decimal of output terminal state(binary). Example: 11(decimal)= 1011(binary), which means RO3,RO3 and HDO is on.<br><table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>BIT6</td><td>BIT5</td><td>BIT4</td><td>BIT3</td><td>BIT2</td><td>BIT1</td><td>BIT0</td> </tr> <tr> <td>RO6</td><td>RO5</td><td>RO4</td><td>RO3</td><td>RO2</td><td>RO1</td><td>HDO</td> </tr> </table> | BIT6 | BIT5 | BIT4 | BIT3 | BIT2 | BIT1 | BIT0 | RO6 | RO5 | RO4 | RO3 | RO2 | RO1 | HDO |
| BIT6 | BIT5                      | BIT4  | BIT3 | BIT2 | BIT1 | BIT0 |      |      |      |     |     |     |     |     |     |     |
| RO6  | RO5                       | RO4   | RO3  | RO2  | RO1  | HDO  |      |      |      |     |     |     |     |     |     |     |
| 14   | Torque compensation       | Unit: %, Range:(-2000~ 2000), Example:500=50.0%; 100.0% is corresponding to rated torque at rated speed   |      |      |      |      |      |      |      |     |     |     |     |     |     |     |
| 15   | Torque at rated speed     | Unit: N.m, Range: (0~ 65535), Example: 2000=2000N.m   |      |      |      |      |      |      |      |     |     |     |     |     |     |     |
| 16   | Slope frequency reference | Unit: Hz, Range: (-32767~ 32767), Example: 5000=50.00Hz   |      |      |      |      |      |      |      |     |     |     |     |     |     |     |

## PZD Data receiving instruction:

| No. | name                                   | Description   |
|-----|--|---|
| 1   | Frequency reference                    | Unit: %, Range:(-10000~ 10000), Example: 5000=50.00%, 100.00% is corresponding to maximum frequency P0.03.                                |
| 2   | Torque reference                       | Unit: %, Range: (-10000~ 10000) Example: 5000=50.00%, 100.00% is corresponding to the torque with upper current limit.                    |
| 3   | Upper limit Current reference          | Unit: %, Range:(0~ 2000), Example: 500=50.0%, 100.00% is corresponding to rated current.  |
| 4   | Starting pretorque compensation value  | Unit: %, Range:(-2000~ 2000), Example: 500=50.0%, 100.00% is corresponding to torque at rated speed'                                      |
| 5   | Torque upper limit frequency reference | Unit: %, Range: (-10000~ 10000),Example: 5000=50.00%, 100.00% is corresponding to maximum frequency                                       |
| 6   | Master slave selection                 | Range: (0~ 65535), input data 0x55aa is corresponding to host, input data 0x66bb is slave's.<br>Others is represent non master slave mode |
| 7   | Motor temperature reference            | Range: (-2000~ 2000), Example: 500=50.0°C.  |

## 6.15 PE Group--Factory Setting

This group is the factory-set parameter group. It is prohibited for user to access.

## 6.16 PF Group--Motor Parameters 2

| Function Code | Name                             | Description  | Setting Range | Factory Setting |
|---------------|----------------------------------|--|---------------|-----------------|
| PF.00         | Speed control mode 2             | 0:Sensorless vector control<br>1:Vector control With PG<br>2:V/F control | 0~2           | 1               |
| PF.01         | Maximum frequency 2              | 10.00~400.00Hz   | 10.00~400.00  | 50.00Hz         |
| PF.02         | Motor rated speed power 2        | 0.4~900.0kW  | 0.4~900.0     | Depend on model |
| PF.03         | Motor rated speed frequency 2    | 0.01~400.00Hz  | 0.01~400.00   | 50.00Hz         |
| PF.04         | Motor rated speed 2              | 1~36000rpm   | 1~36000       | 1460rpm         |
| PF.05         | Motor rated speed voltage 2      | 1~480V   | 1~480         | 380V            |
| PF.06         | Motor basic speed current 2      | 0.1~2000.0A  | 0.1~2000.0    | Depend on model |
| PF.07         | Motor rated speed power factor 2 | 0.05~1.00  | 0.05~1.00     | Depend on model |
| PF.08         | Motor stator resistance 2        | 0.001~65.535Ω  | 0.001~65.535  | Depend on model |
| PF.09         | Motor rotor resistance 2         | 0.001~65.535Ω  | 0.001~65.535  | Depend on model |
| PF.10         | Motor leakage inductance 2       | 0.1~6553.5mH   | 0.1~6553.5    | Depend on model |
| PF.11         | Motor mutual inductance 2        | 0.1~6553.5mH   | 0.1~6553.5    | Depend on model |
| PF.12         | Current without load 2           | 0.01~655.35A   | 0.01~655.35   | Depend on model |
| PF.13         | Acceleration time 2              | 0.0~3600.0s  | 0.0~3600.0    | 20.0s           |

| Function Code | Name                                    | Description  | Setting Range | Factory Setting |
|---------------|---|--|---------------|-----------------|
| PF.14         | Deceleration time 2                     | 0.0~3600.0s  | 0.0~3600.0    | 20.0s           |
| PF.15         | Start section of acceleration S curve 2 | 0.1~50.0%  | 0.1~50.0      | 10.0%           |
| PF.16         | End section of acceleration S curve 2   | 0.1~50.0%  | 0.1~50.0      | 10.0%           |
| PF.17         | Start section of deceleration S curve 2 | 0.1~50.0%  | 0.1~50.0      | 10.0%           |
| PF.18         | End section of deceleration S curve 2   | 0.1~50.0%  | 0.1~50.0      | 10.0%           |
| PF.19         | Encoder type selection                  | 0: Increment encoder<br>1: SIN/COS encoder<br>2: UVW encoder | 0~2           | 0               |
| PF.20         | Encoder pulse counting 2                | 1~65535  | 1~65535       | 1000            |
| PF.21         | Encoder direction 2                     | 0:forward<br>1:reverse                                       | 0~1           | 0               |
| PF.22         | Carrier frequency 2                     | 1.0~16.0kHz  | 1.0~16.0      | Depend on model |
| PF.23         | ASR proportional gain $K_p$ 2           | 0~100  | 0~100         | 20              |
| PF.24         | ASR integral time $K_i$ 2               | 0.01~10.00s  | 0.01~10.00    | 0.50s           |
| PF.25         | Low speed detecting filter time 2       | 0.000~1.000s   | 0.000~1.000   | 0.000s          |
| PF.26         | ASR switching point 2                   | 0.00Hz~PF.30   | 0.00~PF.30    | 5.00Hz          |

| Function Code | Name  | Description  | Setting Range | Factory Setting |
|---------------|---|--------------|---------------|-----------------|
| PF.27         | ASR proportional gain $K_p2$                          | 0~100        | 0~100         | 25              |
| PF.28         | ASR integral time $K_i2$                              | 0.01~10.00s  | 0.01~10.00    | 1.0s            |
| PF.29         | High speed detecting filter time 2                    | 0.000~1.000s | 0.000~1.000   | 0.000s          |
| PF.30         | ASR switching point 2                                 | PF.26~P0.03  | PF.26~P0.0    | 10.00Hz         |
| PF.31         | ACR proportional gain P 2                             | 0~65535      | 0~65535       | 500             |
| PF.32         | ACR integral gain I2                                  | 0~65535      | 0~65535       | 500             |
| PF.33         | Motor weak magnetic 2                                 | 1.0~2.0      | 1.0~2.0       | 1.0             |
| PF.34         | Motor Minimum weak magnetic 2                         | 10.0~80.0%   | 10.0~80.0     | 50.0            |
| PF.35         | The proportion of weak magnetic 2                     | 0~65535      | 0~65535       | 0               |
| PF.36         | Low-frequency threshold of restraining oscillation 2  | 0~10         | 0~10          | 2               |
| PF.37         | High-frequency threshold of restraining oscillation 2 | 0~10         | 0~10          | 0               |
| PF.38         | Maximum motor output voltage 2                        | PF.05~550V   | PF.05~550     | 380V            |
| PF.39         | HF-ACR proportional gain P 2                          | 0~65535      | 0~65535       | 1000            |

| Function Code | Name   | Description | Setting Range | Factory Setting |
|---------------|--|-------------|---------------|-----------------|
| PF.40         | HF-ACR integral gain I2                            | 0~65535     | 0~65535       | 1000            |
| PF.41         | Slip compensation coefficient 2 of drive side      | 50~200      | 50~200        | 100%            |
| PF.42         | Slip compensation coefficient 2 of braking side    | 50~200      | 50~200        | 100%            |
| PF.43         | Torque upper limit current value 2                 | 0.0~200     | 0.0~200       | 110%            |
| PF.44         | Motor overspeed point 2                            | 0~200       | 0~200         | 110%            |
| PF.45         | Motor overtemperature 2                            | 0~1         | 0~1           | 0               |
| PF.46         | Motor overtemperature threshold 2                  | 0.0~60.0    | 0.0~60.0      | 40.0℃           |
| PF.47         | Motor overtemperature prewarning threshold 2       | 20.0~100.0  | 20.0~100.0    | 90%             |
| PF.48         | Motor temperature compensation enable 2            | 0~1         | 0~1           | 0               |
| PF.49         | Motor temperature compensation initial threshold 2 | 0.0~60.0    | 0.0~60.0      | 40.0℃           |
| PF.50         | Motor temperature compensation coefficient 2       | 0.0~200.0   | 0.0~200.0     | 100             |
| PF.51         | Reserved   | 0~65535     | 0~65535       | 0               |
| PF.52         | Reserved   | 0~65535     | 0~65535       | 0               |
| PF.53         | Motor type 2                                       | 0~1         | 0~1           | 0               |

| Function Code | Name                                    | Description | Setting Range | Factory Setting |
|---------------|---|-------------|---------------|-----------------|
| PF.54         | Magnetic pole initial position 2        | 0.00~360.00 | 0.00~360.00   | 0               |
| PF.55         | Magnetic pole position amplitude gain 2 | 0.50~1.50   | 0.50~1.50     | 1               |
| PF.56         | C phase magnetic pole position bias 2   | 0~9999      | 0~9999        | 433             |
| PF.57         | D phase magnetic pole position bias 2   | 0~9999      | 0~9999        | 433             |

### 6.17 PP Group--Motor Parameters 3

| Function Code | Name                             | Description  | Setting Range | Factory Setting |
|---------------|----------------------------------|--|---------------|-----------------|
| PP.00         | Speed control mode 3             | 0:Sensorless vector control<br>1:Vector control With PG<br>2:V/F control | 0~2           | 1               |
| PP.01         | Maximum frequency 3              | 10.00~400.00Hz   | 10.00~400.00  | 50.00Hz         |
| PP.02         | Motor rated speed power 3        | 0.4~900.0kW  | 0.4~900.0     | Depend on model |
| PP.03         | Motor rated speed frequency 3    | 0.01~400.00Hz  | 0.01~400.00   | 50.00Hz         |
| PP.04         | Motor rated speed 3              | 1~36000rpm   | 1~36000       | 1460rpm         |
| PP.05         | Motor rated speed voltage 3      | 1~480V   | 1~480         | 380V            |
| PP.06         | Motor basic speed current 3      | 0.1~2000.0A  | 0.1~2000.0    | Depend on model |
| PP.07         | Motor rated speed power factor 3 | 0.05~1.00  | 0.05~1.00     | Depend on model |

| Function Code | Name                                    | Description  | Setting Range | Factory Setting |
|---------------|---|--|---------------|-----------------|
| PP.08         | Motor stator resistance 3               | 0.001~65.535Ω  | 0.001~65.535  | Depend on model |
| PP.09         | Motor rotor resistance 3                | 0.001~65.535Ω  | 0.001~65.535  | Depend on model |
| PP.10         | Motor leakage inductance 3              | 0.1~6553.5mH   | 0.1~6553.5    | Depend on model |
| PP.11         | Motor mutual inductance 3               | 0.1~6553.5mH   | 0.1~6553.5    | Depend on model |
| PP.12         | Current without load 3                  | 0.01~655.35A   | 0.01~655.35   | Depend on model |
| PP.13         | Acceleration time 3                     | 0.0~3600.0s  | 0.0~3600.0    | 20.0s           |
| PP.14         | Deceleration time 3                     | 0.0~3600.0s  | 0.0~3600.0    | 20.0s           |
| PP.15         | Start section of acceleration S curve 3 | 0.1~50.0%  | 0.1~50.0      | 10.0%           |
| PP.16         | End section of acceleration S curve 3   | 0.1~50.0%  | 0.1~50.0      | 10.0%           |
| PP.17         | Start section of deceleration S curve 3 | 0.1~50.0%  | 0.1~50.0      | 10.0%           |
| PP.18         | End section of deceleration S curve 3   | 0.1~50.0%  | 0.1~50.0      | 10.0%           |
| PP.19         | Encoder type selection                  | 0: Increment encoder<br>1: SIN/COS encoder<br>2: UVW encoder | 0~2           | 0               |
| PP.20         | Encoder pulse counting 3                | 1~65535  | 1~65535       | 1000            |
| PP.21         | Encoder direction 3                     | 0:forward<br>1:reverse                                       | 0~1           | 0               |

| Function Code | Name                                   | Description  | Setting Range | Factory Setting |
|---------------|--|--------------|---------------|-----------------|
| PP.22         | Carrier frequency 3                    | 1.0~16.0kHz  | 1.0~16.0      | Depend on model |
| PP.23         | ASR proportional gain $K_p$ 3          | 0~100        | 0~100         | 20              |
| PP.24         | ASR integral time $K_i$ 3              | 0.01~10.00s  | 0.01~10.00    | 0.50s           |
| PP.25         | Low speed detecting filter time 3      | 0.000~1.000s | 0.000~1.000   | 0.000s          |
| PP.26         | ASR switching point 3                  | 0.00Hz~PP.30 | 0.00~PF.30    | 5.00Hz          |
| PP.27         | ASR proportional gain $K_p$ 3          | 0~100        | 0~100         | 25              |
| PP.28         | ASR integral time $K_i$ 3              | 0.01~10.00s  | 0.01~10.00    | 1.0s            |
| PP.29         | High speed detecting filter time 3     | 0.000~1.000s | 0.000~1.000   | 0.000s          |
| PP.30         | ASR switching point 3                  | PP.26~P0.03  | PP.26~P0.0    | 10.00Hz         |
| PP.31         | ACR proportional gain P 3              | 0~65535      | 0~65535       | 500             |
| PP.32         | ACR integral gain I3                   | 0~65535      | 0~65535       | 500             |
| PP.33         | Motor weak magnetic 3                  | 1.0~2.0      | 1.0~2.0       | 1.0             |
| PP.34         | Motor Minimum weak magnetic 3          | 10.0~80.0%   | 10.0~80.0     | 50.0            |
| PP.35         | The proportion of weak magnetic 3      | 0~65535      | 0~65535       | 0               |
| PP.36         | Low-frequency threshold of restraining | 0~10         | 0~10          | 2               |

| Function Code | Name  | Description | Setting Range | Factory Setting |
|---------------|---|-------------|---------------|-----------------|
|               | oscillation 3   |             |               |                 |
| PP.37         | High-frequency threshold of restraining oscillation 3 | 0~10        | 0~10          | 0               |
| PP.38         | Maximum motor output voltage 1                        | PP.05~550V  | PP.05~550     | 380V            |
| PP.39         | HF-ACR proportional gain P3                           | 0~65535     | 0~65535       | 1000            |
| PP.40         | HF-ACR integral gain I3                               | 0~65535     | 0~65535       | 1000            |
| PP.41         | Slip compensation coefficient 3 of drive side         | 50~200      | 50~200        | 100%            |
| PP.42         | Slip compensation coefficient 3 of braking side       | 50~200      | 50~200        | 100%            |
| PP.43         | Torque upper limit current value 3                    | 0.0~200     | 0.0~200       | 110%            |
| PP.44         | Motor overspeed point 3                               | 0~200       | 0~200         | 110%            |
| PP.45         | Motor overtemperature 3                               | 0~1         | 0~1           | 0               |
| PP.46         | Motor overtemperature threshold 3                     | 0.0~60.0    | 0.0~60.0      | 40.0℃           |
| PP.47         | Motor overtemperature prewarning threshold 3          | 20.0~100.0  | 20.0~100.0    | 90%             |

| Function Code | Name   | Description | Setting Range | Factory Setting |
|---------------|--|-------------|---------------|-----------------|
| PP.48         | Motor temperature compensation enable 3            | 0~1         | 0~1           | 0               |
| PP.49         | Motor temperature compensation initial threshold 3 | 0.0~60.0    | 0.0~60.0      | 40.0℃           |
| PP.50         | Motor temperature compensation coefficient 3       | 0.0~200.0   | 0.0~200.0     | 100             |
| PP.51         | Reserved   | 0~65535     | 0~65535       | 0               |
| PP.52         | Reserved   | 0~65535     | 0~65535       | 0               |
| PP.53         | Motor type 3                                       | 0~1         | 0~1           | 0               |
| PP.54         | Magnetic pole initial position 3                   | 0.00~360.00 | 0.00~360.00   | 0               |
| PP.55         | Magnetic pole position amplitude gain 3            | 0.50~1.50   | 0.50~1.50     | 1               |
| PP.56         | C phase magnetic pole position bias 3              | 0~9999      | 0~9999        | 433             |
| PP.57         | D phase magnetic pole position bias 3              | 0~9999      | 0~9999        | 433             |

## 7. DESCRIPTION OF CHV190'S EXTENSION CARD

### 7.1 Description of I/O Extension Card

#### 7.1.1 Description of I/O extension card terminal and jumper

##### (1) Terminals

| Terminal       | Description   |
|----------------|---|
| S7~S10         | ON-OFF signal input, optical coupling with PW and COM<br>Input voltage range:9~30V<br>Input impedance:3.3KΩ   |
| COM            | Common ground terminal for +24V or exterior power   |
| GND            | Common ground terminal of +10V  |
| Y2             | Open collector output terminal, the corresponding common ground output terminal is CME<br>Exterior voltage range:0~24V<br>Output current range:0~50mA |
| CME2           | Open collector output common terminal   |
| AO2            | Analog quantity output terminal<br>Output range:0~10V/0~20mA(select voltage or current output can be switched by J2)                                  |
| RO3A,RO3B,RO3C | Relay output:RO3A common,RO3B NC,RO3C NO<br>Contact capacity:AC250V/3A,DC30V/1A   |
| RS485+,RS485-  | RS485 Communication   |
| CANH,CANL      | CAN communication ports(reserved)   |
| PT100,GND      | Motor temperature detection input, support PT100 and PT1000   |

**Notice: GND must isolate from COM.**

##### (2) Jumper

| Jumper | Description   |
|--------|---|
| J1     | 1 connect to 2 means paralleling a 120Ω matching resistance for CAN control output terminal, 2 and 3 are be hanged in the air.                        |
| J2     | Switch between 0~10V coltage input or 0~20mA current input<br>1(V)connect to 2(GND)means voltage input:<br>2(GND) connect to 3(I)means current inout. |

| Jumper | Description  |
|--------|--|
| S1     | Selection of RS485 communication terminal organ setting.<br>ON: enable terminal organ; OFF: forbidden terminal organ.<br>When the RS485 port is at the end of RS485 communication network cable, which need enable terminal organ. |

### 7.1.2 Description of dimension and terminal compositor

(1) Dimension of I/O extension card and sketch map for CHV190

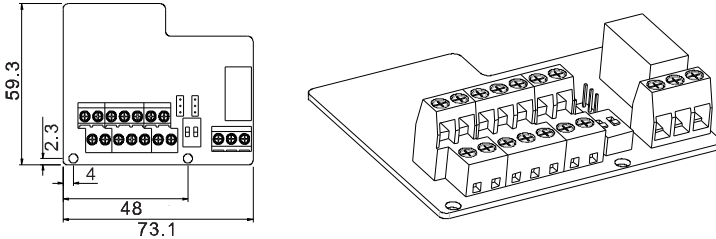
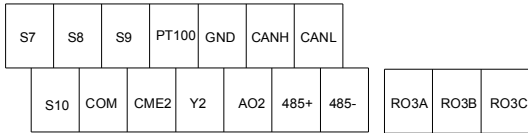


Figure 7.1 Dimension of I/O extension card

(2) Sketch map of terminal compositor



### 7.1.3 Installation of I/O extension card for CHV190

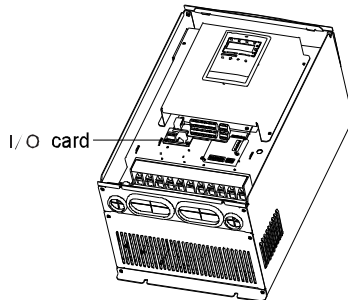


Figure 7.2 Installation of I/O extension card and PG card

## 7.2 Description of Asynchronous PG Card

### 7.2.1 Model and specifications

#### 7.2.1.1 Model description and technical specifications

The technical features of the model of PG card for CHV190 inverters are as follow:

| Terminal                    | Technical features  |
|-----------------------------|---|
| 12V,COM1                    | Encoder power supply, maximum output current is 300mA                                 |
| TERA+,TERA-,<br>TERB+,TERB- | Encoder signal input access<br>Voltage range: 12~15V<br>Response speed: 0~80kHz       |
| TER-OA<br>TER-OB            | Frequency output: 0~80kHz<br>Output impedance: 30Ω<br>Frequency division range: 1~256 |

### 7.2.1.2 Dimensions and installation

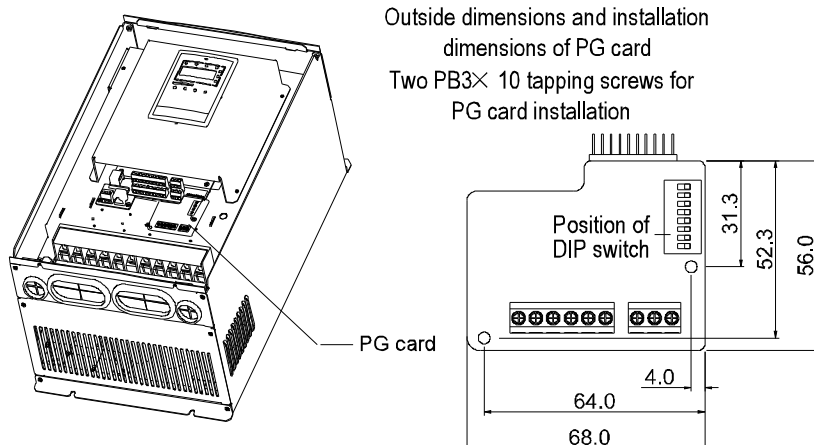


Figure 7.3 Installation and Dimensions of PG Card

**NOTICE:** The contact pin of PG card is inserted into the below connector with control board CN9.

## 7.2.2 Operating Instructions of asynchronous motor PG card

### 7.2.2.1 Functions

If the user requires PG vector control, need to select PG card. The function of the PG card includes processing circuits for two channels of orthogonal coder signals, capable of receiving signals from differential output, open-circuit collector output and push-pull output encoders, Coder power supply (+12V output, adjustable through the potentiometer on the PG card). In addition, it can output in frequency-division the inputted encoder signals (output are two channels of orthogonal signals). The user can make selection according to actual situations.

### 7.2.2.2 Description of terminals and DIP Switch

The PG card has nine wiring terminals, as shown in Figure 7.4.

|      |      |       |       |       |       |        |        |      |
|------|------|-------|-------|-------|-------|--------|--------|------|
| +12V | COM1 | TERA+ | TERA- | TERB+ | TERB- | TER-OA | TER-OB | COM1 |
|------|------|-------|-------|-------|-------|--------|--------|------|

Figure 7.4 User wiring terminals of PG Card.

Where, +12V and COM1 are working voltage output for the coder; TERA+, TERA-, TERB+, and TERB- are signal input terminals for the coder; TER-OA, TER-OB, and COM1 are output terminals for frequency-division signals; PE is the wiring terminal for shielding cable (PE inside the PG card is not connected to the ground, and the user can connect it to the ground during use).

The frequency division factor is determined by the DIP switch on the card. The DIP switch consists of 8 bits. When the binary digits are displayed by DIP switch pluses 1, the relative value is frequency division factor. The bit marked as "1" on the DIP switch is the lower binary bit, while "8" is the higher binary bit. When the DIP switch is switched to ON, the bit is valid, indicating "1"; otherwise, it indicates "0".

Frequency division factors are shown in the table below:

| Decimal digit | Binary digit | Frequency division factor |
|---------------|--------------|---------------------------|
| 0             | 00000000     | 1                         |
| 1             | 00000001     | 2                         |
| 2             | 00000010     | 3                         |
| ...           | ...          | ...                       |
| m             | ...          | m+1                       |
| 255           | 11111111     | 256                       |

### 7.2.2.3 Wiring diagram

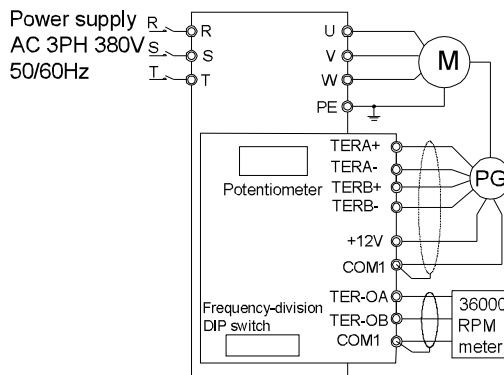


Figure 7.5 PG card wiring diagram

### 7.2.2.4 Notice

1. The signal line of PG card should be separated from the power line. Parallel

wiring is forbidden.

2. To prevent coder signals from disturbance, please select a shielded cable as the signal line of PG card.

3. The shielding layer of shielded cable of PG card should be grounded (such as terminal PE of the inverter), and furthermore, only one end is grounded, to prevent signal from disturbance.

4. If the frequency-division output of PG card is connected to user power supply, the voltage should be less than 24V; otherwise, the PG card may be damaged.

### 7.2.3 Application connection

(1) Wiring diagram of differential output coder

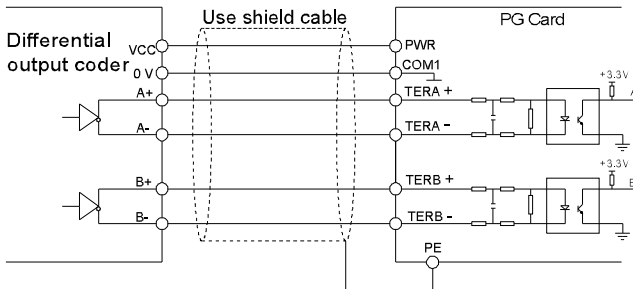


Figure 7.6 Wiring diagram of differential output coder.

(2) Wiring diagram of open collector output coder

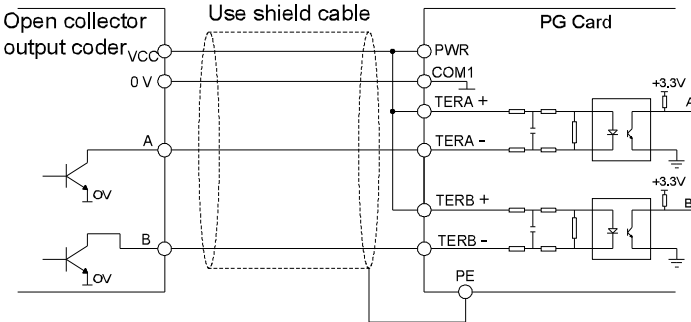


Figure 7.7 Wiring diagram of open collector output coder

(3) Wiring Diagram of Push-pull Output Coder

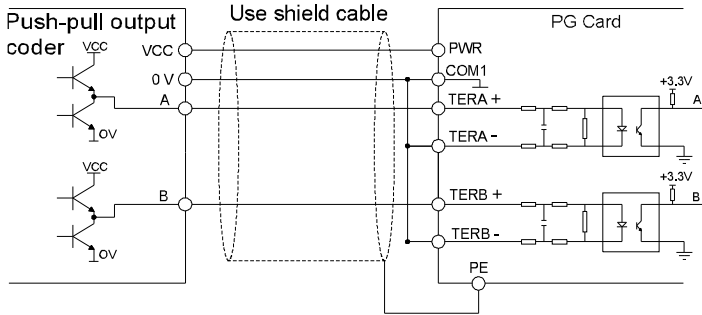


Figure 7-8 Wiring diagram of push-pull output coder.

## (4)Wiring diagram of PG card frequency-division output

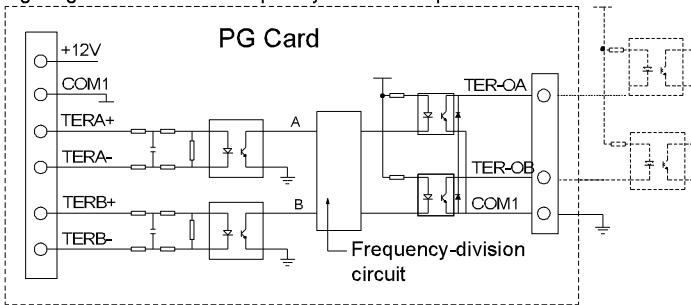


Figure 7.9 Wiring diagram of PG Card frequency-division output

## 7.3 Description of Synchronous PG Card

### 7.3.1 Model and specifications

The model of PG card for CHV190 inverters is ASY-2010-T. The technical features are as follow:

| Terminal          | Technical features   |
|-------------------|--|
| +5V               | Encoder power, the maximum output current is 130mA   |
| The encoder types | Support SIN/COS and UVW encoder,<br>The signal is differential input.  |
| Respond speed     | 0~80kHz  |
| TER-OA,TER-OB     | Output frequency: 0~80kHz<br>Output impedance: 30Ω<br>Frequency division range: 1~256<br>Voltage output range: 5 ~ 30V |

### 7.3.2 Dimensions and installation

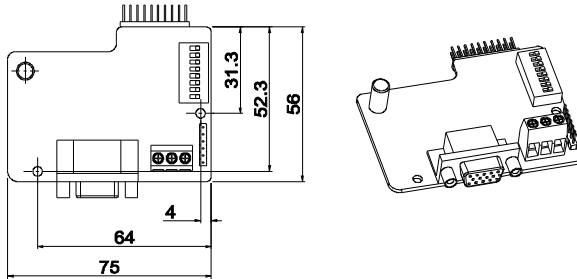


Figure 7.10 Dimension and installation of synchronous PG Card.

**Notice: The position and installation of synchronous PG card is the same as the asynchronous PG card, but there are two lines pins, the asynchronous PG card has only one line pin.**

The PG card of asynchronous motor is the same as all of CHV series inverters, but the PG card of synchronous motor is only used to CHV190 inverter. The PG card is compatible with SIN/COS and UVW encoder, the output voltage is +5V, and the precision is  $\pm 5\%$ . At the same time, its output frequency division to encoder is valid.

### 7.3.3 Description of terminals and DIP switch

The PG card has one signal port and three user ports shown as in Figure 7.11.

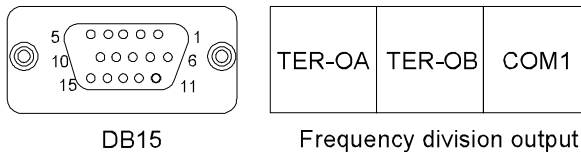


Figure 7.11 The PG Card port and terminals.

TER-OA, TER-OB and COM1 are the signal frequency division output terminals.

**NOTICE: The PE terminal PG Card has not connected to earth; user must connect the card to earth.**

DB15 is the port of the encoder input signal. The order of the ports signal is as follow:

| Port | SIN/COS | UVW |
|------|---------|-----|
| 8    | A       | A   |
| 3    | A-      | A-  |
| 9    | B       | B   |
| 4    | B-      | B-  |
| 15   | R       | Z   |
| 14   | R-      | Z-  |
| 6    | C       | U   |

| Port | SIN/COS | UVW   |
|------|---------|-------|
| 1    | C-      | U-    |
| 7    | D       | V     |
| 2    | D-      | V-    |
| 12   | 5V      | 5V    |
| 13   | 0V      | 0V    |
| 10   | Empty   | W     |
| 5    | Empty   | W-    |
| 11   | Empty   | Empty |

Use DB15 connect synchronous PG card to SIN/COS or UVW encoder.

The frequency division factor is determined by the DIP switch on the card. The DIP switch consists of 8 bits. The binary digits plus 1 is frequency division factor. The bit marked as “1” on the DIP switch is the lower binary bit, while “8” is the higher binary bit. When the DIP switch is switched to ON, the bit is valid, indicating “1”; otherwise, it indicates “0”.

Frequency division factors are shown in the table as below:

| Decimal digit | Binary digit | Frequency division factor |
|---------------|--------------|---------------------------|
| 0             | 00000000     | 1                         |
| 1             | 00000001     | 2                         |
| 2             | 00000010     | 3                         |
| ...           | ...          | ...                       |
| m             | ...          | m+1                       |
| 255           | 11111111     | 256                       |

## 7.4 Description of Modbus Communication Card

### 7.4.1 Model

The model of CHV190's Modbus communication card is PN000TXWX, and it is compatible with CHV's extension card. This card supports RS232 and RS485.

### 7.4.2 Installation

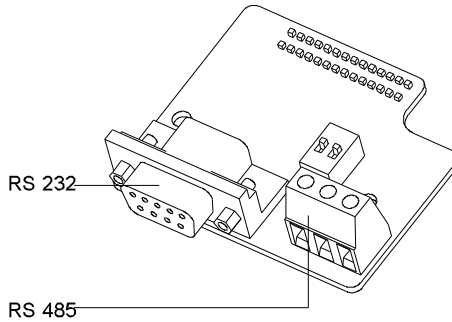


Figure 7.12 Modbus communication card

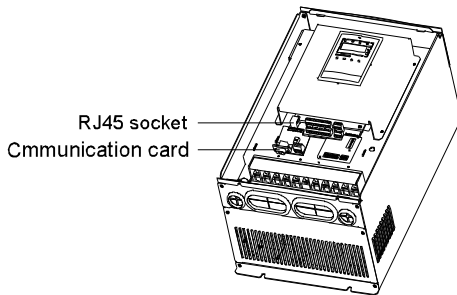


Figure 7.13 Installation of communication card

### 7.4.3 Application of Modbus communication card

The Modbus communication card achieve communication between CHV 190 inverters and host (PLC, industrial PC), it is necessary to choose this communication card. The electric parameters can meet relative international standards and can implement smooth communications between CHV inverter and host.

### 7.4.4 Terminals

The communication card has two groups of terminals, as shown in Figure 7.14.

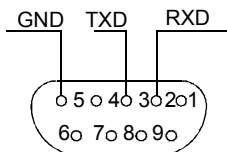


Figure 7.14 D9: Bus-connector terminal

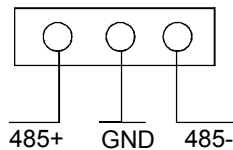


Figure 7.15 RS485 terminal

### 7.4.5 Notice:

1. Please install this card when the inverter is completely powered off.
2. Please make sure the communication card and control board are well connected, and use screws to fix the communication card.
4. To prevent communication signals from external disturbance, please choose twisted

pairs as communication cable, and try to avoid parallel wiring with the drive power.

5. Suggest using the shielded cable for RS232 communication.

## **7.5 Description of Profibus Communication Card**

### **7.5.1 Introduction**

#### 7.5.1.1 Profibus standard

(1) Profibus is an open international fieldbus standard. The standard allows data exchange among various types of automation components. It is widely used in manufacturing automation, process industrial automation and in other areas automation such as buildings, transportation and electric power etc.

(2) Profibus is composed of three compatible components, Profibus-DP (Decentralized Periphery, distributed peripherals), Profibus-PA (Process Automation), Profibus-FMS (Fieldbus Message Specification, Fieldbus Message Specification). It is periodically exchange data with the inverter when using master-slave function. PRNV Profibus-DP adapter module only supports Profibus-DP protocol.

(3) The physical transmission medium is twisted-pair (in line with RS485 standard), two-wire cable or fiber optic cable. Baud rate is from 9.6Kbit/s to 12Mbit/s. The maximum length of cable is between 100 m and 1200 m, specific length depending on the selected transmission rate (see the technical data chapter). Up to 31 nodes can be connected to the same Profibus network when repeaters aren't used. But, if use repeaters, up to 127 nodes can be connected to the same Profibus network segment (including repeaters and master stations).

(4) In the process of Profibus communication, token assign among hosts and master-slave transmission among master-slave stations, which support single-host or multi-host system. Host stations (PLC) select nodes to respond to the host instruction. Cyclic host-from user data transmission and non-cyclic host-host station can also send commands to multiple nodes in the form of broadcast. In this case, the nodes do not need to send feedback signals to the host. In the Profibus network, communication between nodes can not be allowed.

(5) Profibus protocol is described in detail in EN 50170 standard. To obtain more information about Profibus, please refer to the EN 50170 standard.

#### 7.5.1.2 Product naming convention

Fieldbus adapter naming rules, the product model:

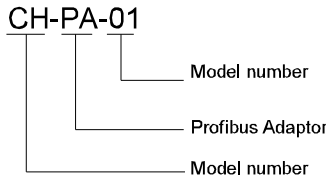


Figure 7.16 Profibus-DP naming convention

### 7.5.1.3 The adapter module of CH-PA01 Profibus-DP

CH-PA01 Profibus-DP Adapter module is an optional device to inverter which can connect inverter to Profibus network. In Profibus network, inverter is a subsidiary device. Using CH-PA01 Profibus-DP adapter module can achieve function as below.

- Send control commands to inverter (start, stop, fault reset, etc.).
- Send speed or torque reference to inverter.
- Read out status and actual values of inverter.
- Modify the inverter parameter.

Please refer to Pd group parameter to know function supported by inverter. INVT Inverter connected to the Profibus bus structure is shown in Figure 7.17:

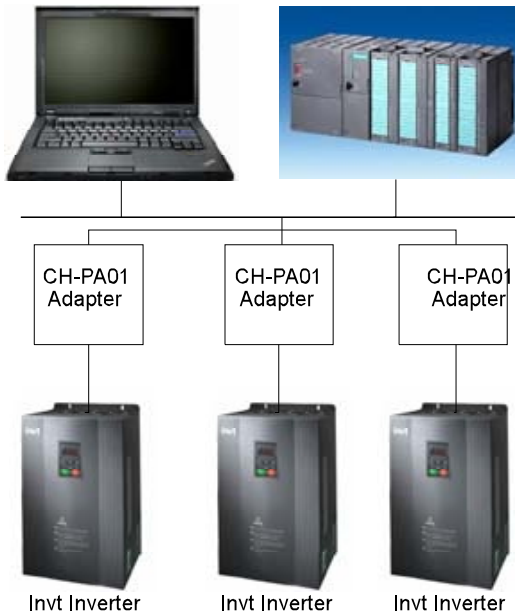


Figure 7.17 Profibus communication structure diagram

### 7.5.1.4 CH-PA01 Profibus-DP Adapter outline structure

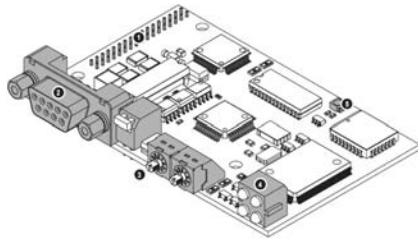


Figure 7.18 CH-PA01 Adapter Module Outline diagram

- |  |   |
|--|---|
| <p>1. Interface to control panel</p> <p>2. Bus connector</p> | <p>3. Rotative switch of node address selection</p> <p>4. Status display LEDs</p> |
|--|---|

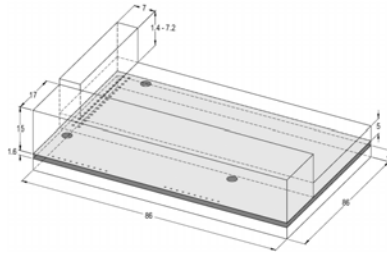


Figure 7.19 CH-PA01 adapter External Dimensions (Unit: mm)

#### 7.5.1.5 CH-PA01 related product information

CH-PA01 adapter is compatible with the following products:

- CH-PA01 is compatible with CHV190 series inverter and other devices supporting Profibus card.
- All host stations support Profibus-DP protocol.

The list of deliverables

The package of CH-PA01 Profibus-DP adapter module includes:

- Profibus-DP adapter module, model number is CH-PA01
- Three fixed connection column
- One manual
- One CD-ROM (GSD file)

If you find some missing, please contact with SHENZHEN INVT ELECTRIC CO., LTD or suppliers.

**Notice: We will not remind for the reasonable product upgrades.**

### 7.5.2 Adapter installation

#### 7.5.2.1 Adapter machinery installation

Installation environment

- Ambient temperature: 0 °C ~ +40 °C
- Relative humidity: 5% ~ 95%
- Other climate conditions: non-condensing, freezing, rain, snow, hail, etc., solar radiation below 700W/m<sup>2</sup>, air pressure 70~106kPa
- Salt spray and corrosive gases: Pollution Level 2
- Dust and solid particles content: Pollution Level 2
- Vibration and shock: 5.9m/s<sup>2</sup> (0.6g) when sinusoidal vibration is 9~ 200Hz.

Installation steps:

- Fix three copper columns to H5, H6 and H7 on the panel.
- Insert module into socket J20 on the control board carefully, then fixed to the connecting column.
- Set bus termination switch of module to the desired location.

**Notice:**

**Be sure that power is cut off and wait at least 3 minutes to ensure the completion of capacitor discharge. Cut off dangerous voltages which is external control circuit to unit input and output terminals.**

**Electronic components on the CH-PA01 adapter module circuit board are sensitive to electrostatic discharge. Do not touch circuit boards with hands. Please wear a grounded wrist strap when you need dealing with circuit boards.**

7.5.2.2 Adapter electrical Installation

7.5.2.2.1 Node selection

Node address is the only address that devices have on the Profibus bus, and it is decided by rotative switch of node address selection. The range of node address number is from 00~99. The left switch represents first number and the right switch represents second number.

Node Address = 10\*first number + 1\*second number

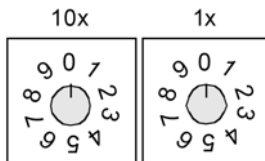


Figure 7.20 Node selection

7.5.2.2.2 Bus terminators

Each head and tail has a bus terminator to ensure that error doesn't occur in the operation. DIP switches on CH-PA01 are connected to the bus terminator which can prevent signal reflection. If the module is the first or the last one in the network, the bus terminator must

be set as ON. If D-sub connector is built in the Profibus, CH-PA01 terminators must be disconnected.

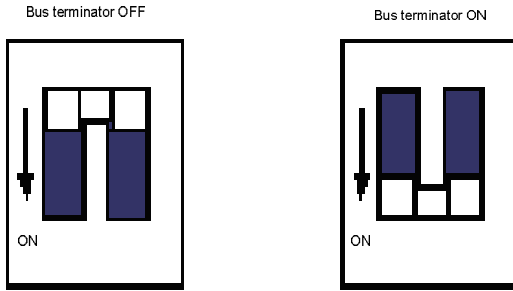


Figure 7.21 Bus terminators

### 7.5.2.3 CH-PA01 adapter bus network connection

#### Bus communication interface

Shielded twisted-pair copper wire (in line with RS485 standard) transmission is the most common way in Profibus transmission.

Transmission basic characteristics:

- Network topology: linear bus, terminal resistors at both ends.
- Transmission rate: 9.6K bit / s ~ 12M bit / s
- Medium: shielded twisted-pair cable or canceling shield, depending on environmental conditions (EMC).
- Sites number: 32 stations per section (without repeater), up to 127 stations (with repeater).
- Terminal: 9 pin D-type port, diagram of connector pin as shown in table 7-1:

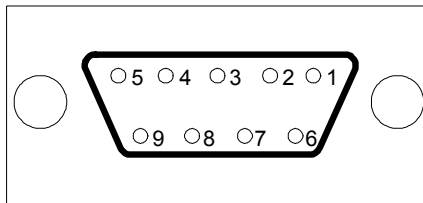


Figure 7.22 Connector pin sequencing

Table 7.1 Connector pin allocation

| Connector pin |        | Description                    |
|---------------|--------|--------------------------------|
| 1             | -      | unused                         |
| 2             | -      | unused                         |
| 3             | B-Line | Data positive (twisted pair 1) |

| Connector pin |         | Description                    |
|---------------|---------|--------------------------------|
| 4             | RTS     | Sending request                |
| 5             | GND_BUS | Isolated ground                |
| 6             | +5V BUS | Isolated 5V DC power supply    |
| 7             | -       | unused                         |
| 8             | A-Line  | Data negative (twisted pair 1) |
| 9             | -       | Unused                         |
| Housing       | SHLD    | Profibus shielded cable        |

+5 V and GND\_BUS are used for bus terminators. Some devices, such as optical transceivers (RS485), may need to obtain an external power supply from these pins.

In some devices, use the RTS to determine sending direction. In normal applications, only use A-Line, B-Line and shielded layer.

Recommend using standard DB9 port produced by SIEMENS Company; please refer to wiring standard if communication baud rate is greater than 187.5kbps.



Figure 7.23 Standard Profibus port

### Repeater

Up to 32 stations can be connected to each segment (master station or subsidiary stations), the repeater have to be used when stations is more than 32. Repeaters in series are generally no more than 3. (Notice: there is no repeater station address)

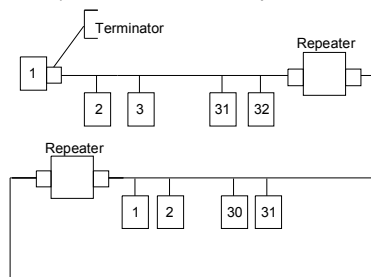


Figure 7.24 Up to 32 stations on each section

### 7.5.2.4 Transmission rate and maximum distance

Maximum length of cable depends on the transmission rate.

Table 7.2 shows the relationship between transmission rate and distance.

Table 7.2 Bus transmission distance

| Transfer rate (kbps) | A-wire (m) | B-wire (m) |
|----------------------|------------|------------|
| 9.6                  | 1200       | 1200       |
| 19.2                 | 1200       | 1200       |
| 93.75                | 1200       | 1200       |
| 187.5                | 1000       | 600        |
| 500                  | 400        | 200        |
| 1500                 | 200        | -----      |
| 12000                | 100        | -----      |

Table 7.3 Transmission line parameters

| Transfer rate (kbps)                      | A-wire (m) | B-wire (m) |
|---|------------|------------|
| Impedance ( $\Omega$ )                    | 135~165    | 100~130    |
| Capacitance per unit length(pF/m)         | < 30       | < 60       |
| Loop Resistance ( $\Omega$ /km)           | 110        | -----      |
| Core wire diameter (mm)                   | 0.64       | > 0.53     |
| Line-core cross-section ( $\text{mm}^2$ ) | > 0.34     | > 0.22     |

Besides shielding twisted-pair copper wires, Profibus can also use optical fiber for transmission in an electromagnetic interference environment to increase the high-speed transmission distance there are two kinds of fiber optical conductors, one is low-cost plastic fiber conductor, used distance is less than 50 meters, the other is glass fiber conductor, and used distance is less than 1 km.

### 7.5.2.5 Profibus connection diagram

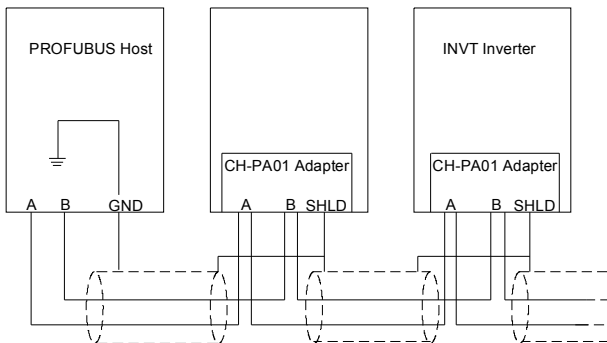


Figure7.24 Standard profibus cable wiring diagram

Above is "terminal" wiring diagram. Cable is a standard Profibus cable consisting of a twisted pair and shielding layer. The shielded layer of Profibus cable on all nodes is directly grounded. Users can choose the best way grounding according to the situation.

### Wiring precautions

Make sure that signal lines do not twist when connecting all stations. Shielded cable should be used when system runs under high electromagnetic interface environment, which can improve electromagnetic compatibility (EMC).

If using shielded braided wire and shielding foil, both ends should be connected to ground. Using shielding area should be large enough to maintain a good conductivity. And data lines must be separated from high-voltage.

Stub line segment should not be used when transmission rate more than 500K bit/s, The plug is available on the market which connects directly to data input and output cable. Bus plug connection can be on or off at any time without interruption of data communications of other station.

## 7.5.3 System configuration

### 7.5.3.1 System Configuration

Host station and inverter should be configured so that the host station can communicate with the module after correctly installing CH-PA01 Profibus-DP Adapter module.

Each Profibus subsidiary station on the Profibus bus need to have "device description document" named GSD file which used to describe the characteristics of Profibus-DP devices. The software we provided for the user includes inverter related GSD files (device data files) information, users can obtain type definition file (GSD) of host machines from local INVT agent.

Table 7.4 CH-PA01 configuration parameters

| Parameter Number | Parameter Name | optional setting | Factory setting |
|------------------|----------------|------------------|-----------------|
| 0                | Module type    | Reading only     | Profibus-DP     |
| 1                | Node address   | 0~99             | 2               |
| 2                | PZD3           | 0~65535          | 0               |
| 3                | PZD4           | Ibid             | 0               |
| ...              | .....          | Ibid             | 0               |
| 9                | PZD12          | Ibid             | 0               |

### 7.5.3.2 Module type

This parameter shows communication module type detected by inverter; users can not adjust this parameter. If this parameter is not defined, communication between the modules and inverter can not be established.

### 7.5.3.3 Node address

In Profibus network, each device corresponds to a unique node address, using node address selection switch to define node address (switch isn't at 0) and the parameter is only used to display the node address. If node address selection switch is 0, this parameter can define node address.

### 7.5.3.4 GSD file

In Profibus network, each Profibus subsidiary station needs GSD file "device description document" which used to describe the characteristics of Profibus-DP devices. GSD file contains all defined parameters, including baud rate, information length, amount of input/output data, meaning of diagnostic data.

A CD-ROM will be offered in which contains GSD file (extension name is .gsd) for fieldbus adapter. Users can copy GSD file to relevant subdirectory of configuration tools, please refer to relevant system configuration software instructions to know specific operations and Profibus system configuration.

## 7.5.4 Profibus-DP communication

### 7.5.4.1 Profibus-DP

Profibus-DP is a distributed I/O system, which enables host machine to use a large number of peripheral modules and field devices. Data transmission shows cycle: host machine read input information from subsidiary machine then give feedback signal. CH-PA01 adapter module supports Profibus-DP protocol.

#### **Service access point**

Profibus-DP has access to Profibus data link layer (Layer 2) services through service access point SAP. Every independent SAP has clearly defined function. Please refer to relevant Profibus user manual to know more about service access point information. PROFIDRIVE-Variable speed drive adopts Profibus model or EN50170 standards (Profibus protocol).

### 7.5.4.2 Profibus-DP information frame data structures

Profibus-DP bus mode allows rapid data exchange between host station and inverter. Adopting master-slave mode dealing with inverter access, inverter is always subsidiary station, and each has definite address. Profibus periodic transmission messages use 16 words (16 bit) transmission, the structure shown in figure 7.26.

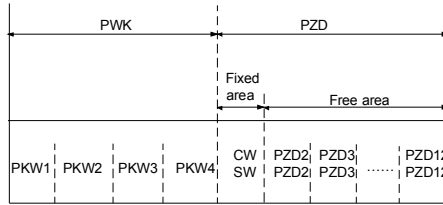


Figure 7.25 Profibus-DP message structure

**Parameters area:**

PKW1-Parameter identification

PKW2-array index number

PKW3-parameter value 1

PKW4-parameter value 2

**Process data:**

CW-Control word (from master to slave, see Table 7.5)

SW-status word (from slave to host, see Table 7.7)

PZD-process data (decided by users) (From master to slave output **【given value】** , from slave to master input **【actual value】** )

**PZD area (process data area)**

PZD area of communication message is designed for control and monitor inverter. PZD from host and slave station is addressed in high priority, the priority of dealing with PZD is superior to that of PKW, and always send current valid date from interface.

Control word (CW) and status word (SW)

Control word (CW) is a basic method of fieldbus system controlling inverter. It is sent by the fieldbus master station to inverter and the adapter module act as gateway. Inverter responds according to the control word and give feedbacks to host machine through status word (SW).

Contents of control word and status word is shown in table 7.5 and table 7.7 respectively. Please refer to inverter manual to know bit code.

Given value

Inverter can receive control information by several ways, these channels include: analog and digital input terminals, inverter control board and module communication (such as RS485, CH-PA01 adapter modules). In order to use Profibus control inverter, the communication module must be set to be inverter controller.

Contents of setting value are shown in Table 7.6.

Actual value

Actual value is a 16-bit word, which contains converter operation information. Monitoring capabilities are defined by inverter parameter. The integer scaling of actual value is sent to host machine depending on selected function, please refer to inverter manual.

Contents of actual values are shown in Table 7.8.

Notice: inverter always check the control word (CW) and bytes of given value.

Mission message (From host station to inverter)

Control word (CW)

The first word of PZD is control word (CW) of inverter, due to different control word (CW) of PWM rectifier regenerative part and inverter part Illustration is depart in next two tables.

Table 7.5 Control word (CW) of CHV190

| Bit      | Name                     | Value | Status/Description                                |
|----------|--------------------------|-------|---|
| 00       | HEARTBEAT REF            | 1     | Heartbeat enable                                  |
|          |                          | 0     | Heartbeat banned                                  |
| 01       | EXTERNAL RESET           | 1     | Fault reset, if the fault still exists            |
|          |                          | 0     | Continue running normally                         |
| 02       | FORWARD COMMAND          | 1     | Forward command                                   |
|          |                          | 0     | Deceleration stop                                 |
| 03       | REVERSE COMMAND          | 1     | Reverse command                                   |
|          |                          | 0     | Deceleration stop                                 |
| 04       | EXCITING COMMAND         | 1     | Excitation enable                                 |
|          |                          | 0     | Excitation unable                                 |
| 05       | TORQUE CONTROL SELECTION | 1     | Torque control enable                             |
|          |                          | 0     | Torque control banned                             |
| 06       | EXTERNAL SAFE SWITCH     | 1     | External safe switching enable                    |
|          |                          | 0     | Coast to stop                                     |
| 07       | QUICK STOP COMMAND       | 1     | Continue running normally                         |
|          |                          | 0     | Emergency disconnect, fast stop deceleration mode |
| 08       | GROUP B SELECTION        | 1     | Motor B switching                                 |
|          |                          | 0     | Continue running normally                         |
| 09       | WRITE ENABLE             | 1     | Write enable<br>(mainly PKW1-PKW4)                |
|          |                          | 0     | Write unable                                      |
| 10 To 15 | Reserved                 | 1     | Reserved  |
|          |                          | 0     | Reserved  |

Setting value (REF):

From 2<sup>nd</sup> word to 12<sup>th</sup> of PZD task message is the main setting value REF, main frequency setting value is offered by main setting signal source. As PWM rectifier feedback part doesn't have main frequency setting part, corresponding settings belong to reserved part, the following table shows inverter part settings for CHV 190.

Table 7.6 CHV190 settings

| Bit            | Name                | From host to slave |
|----------------|---------------------|--------------------|
| PZD2           | SPEED REF           | Decided by host    |
| PZD3           | TENSION REF         | Decided by host    |
| PZD4           | CURRENT LIMIT CLAMP | Decided by host    |
| PZD5~<br>PZD12 | Reserved            | Reserved           |

### Response message (From inverter to main station)

Status word (SW):

The first word of PZD response message is status word (SW) of inverter, the definition of status word is as follows:

Table 7.7 Status Word (SW) of CHV190

| Bit | Name                         | Value | Status/Description                     |
|-----|------------------------------|-------|--|
| 00  | HEARTBEAT FEEDBACK           | 1     | Heartbeat feedback                     |
|     |                              | 0     | No heartbeat feedback                  |
| 01  | FAULT                        | 1     | Fault                                  |
|     |                              | 0     | No fault                               |
| 02  | DC VOLTAGE ESTABLISH         | 1     | DC voltage establish                   |
|     |                              | 0     | DC voltage unestablish                 |
| 03  | GROUP B FEEDBACK             | 1     | Motor B feedback                       |
|     |                              | 0     | Motor B no feedback                    |
| 04  | QUICK STOP FEEDBACK          | 1     | Stop invalid                           |
|     |                              | 0     | Emergency stop in fastest speed enable |
| 05  | DRIVE CURRENT LIMIT FEEDBACK | 1     | Drive current limit feedback enable    |
|     |                              | 0     | Drive current limit feedback unable    |
| 06  | DRIVE FLUX ENABLED           | 1     | Drive flux enabled                     |
|     |                              | 0     | Drive flux disabled                    |
| 07  | RUNNING FORWARD              | 1     | Running forward                        |

| Bit      | Name              | Value | Status/Description         |
|----------|-------------------|-------|----------------------------|
|          |                   | 0     | No running forward         |
| 08       | RUNNING REVERSE   | 1     | Running reverse            |
|          |                   | 0     | No running reverse         |
| 09       | MOTOR TEMPERATURE | 1     | Motor temperature alarm    |
|          |                   | 0     | No motor temperature alarm |
| 10       | FLUX IN EXCITING  | 1     | Flux in exciting           |
|          |                   | 0     | Flux establish             |
| 10 To 15 | Reserved          |       | Reserved                   |

Actual value (ACT):

From 2<sup>nd</sup> word to 12<sup>th</sup> of PZD task message is main setting value ACT, main frequency setting value is offered by main setting signal source.

Table 7.8 Actual value of CHV190

| Bit            | Name                   | From slave to host                  |
|----------------|------------------------|-------------------------------------|
| PZD2           | FAULT CODE             | Fault code:0~N                      |
| PZD3           | SPEED FEEDBACK         | Speed feedback actual value         |
| PZD4           | PG POS COUNTER         | PG Card position                    |
| PZD5           | DRIVE TORQUE FEEDBACK  | Torque actual value                 |
| PZD6           | Motor Running Freq.    | Actual value of motor running freq. |
| PZD7           | DRIVE CURRENT FEEDBACK | Drive current feedback actual value |
| PZD8           | DRIVE VOLTAGE FEEDBACK | Drive voltage feedback actual value |
| PZD9-<br>PZD12 | Reserved               | Reserved                            |

PKW area (parameter identification marks PKW 1-value area)

PKW area describes treatment of parameter identification interface, PKW interface is a mechanism which determine parameters transmission between two communication partners, such as reading and writing parameter values.

Structure of PKW area:

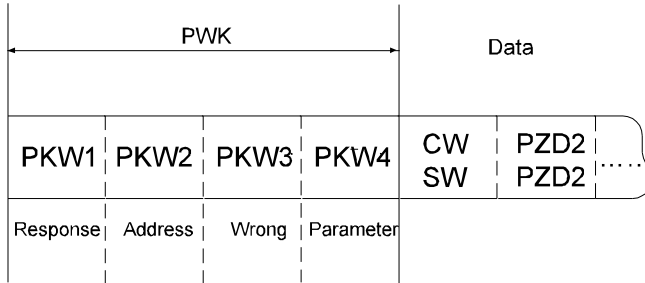


Figure 7.26 Parameter identification zone

In the process of periodic Profibus-DP communication, PKW area is composed of four words (16 bit), each word is defined as follows:

The first word

|                              |                                       |     |
|------------------------------|---------------------------------------|-----|
| The first word PKW1 (16 bit) |                                       |     |
| Bit 15~00                    | Task or response identification marks | 0~7 |

The second word

|                               |                          |       |
|-------------------------------|--------------------------|-------|
| The second word PKW2 (16 bit) |                          |       |
| Bit 15~00                     | Basic parameters address | 0~247 |

The third word

|                              |  |    |
|------------------------------|--|----|
| The third word PKW3 (16 bit) |  |    |
| Bit 15~00                    | Parameter value (high word) or return error code value | 00 |

The fourth word

|                               |                            |         |
|-------------------------------|----------------------------|---------|
| The fourth word PKW4 (16 bit) |                            |         |
| Bit 15~00                     | Parameter value (low word) | 0~65535 |

**Notice: If main station requests one parameter value, the value of PKW3 and PKW4 is no longer valid.**

Task requests and responses

When passing data to slave machine, host machine use request label while slave machine use response label to positive or negative confirmation. Table 5.5 and Table 5.6 list the request/response functional.

The definition of task logo PKW1 is as follows:

Table 7.9 Definition of task logo PKW1

| Request label (From host to slave) |          | Response label        |                       |
|------------------------------------|----------|-----------------------|-----------------------|
| Request                            | Function | Positive confirmation | Negative confirmation |
| 0                                  | No task  | 0                     | —                     |

| Request label (From host to slave) |   | Response label |        |
|------------------------------------|---|----------------|--------|
| 1                                  | Request parameter value   | 1,2            | 3      |
| 2                                  | Modification parameter value (one word)<br>[only change RAM]                | 1              | 3 or 4 |
| 3                                  | Modification parameter value (double word)<br>[only change RAM]             | 2              | 3 or 4 |
| 4                                  | Modification parameter value (one word)<br>[RAM and EEPROM are modified]    | 1              | 3 or 4 |
| 5                                  | Modification parameter value (double word)<br>[RAM and EEPROM are modified] | 2              | 3 or 4 |

Request label

"2"-modification parameter value (one word) [only change RAM],

"3"-modification parameter value (double word) [only change RAM]

"5"-modification parameter value (double word) [RAM and EPROM are modified] not support.

Responses logo PKW1 defines as below:

Table 7.10 Definition of response logo PKW1

| Response label (From slave to host) |  |
|-------------------------------------|--|
| Confirmation                        | Function   |
| 0                                   | No response  |
| 1                                   | Transmission parameter value ( one word)   |
| 2                                   | Transmission parameter value ( two word)   |
| 3                                   | Task can not be executed and returns the following error number:<br>0: Illegal parameter number<br>1: Parameter values can not be changed (read-only parameter)<br>2: Out of setting value range<br>3: The sub-index number is not correct<br>4: Setting is not allowed (only reset)<br>5: Data type is invalid<br>6: The task could not be implemented due to operational status<br>7: Request isn't supported.<br>8: Request can't be completed due to communication error<br>9: Fault occurs when write operation to stationary store<br>10: Request fails due to timeout<br>11: Parameter can not be assigned to PZD |

| Response label (From slave to host) |   |
|-------------------------------------|---|
| Confirmation                        | Function  |
|                                     | 12: Control word bit can't be allocated<br>13: Other errors |
| 4                                   | No parameter change rights                                  |

Example for PKW:

Example 1: Read parameter value

Read keypad setting frequency value (the address of keypad setting frequency is 4) which can be achieved by setting PKW1 as 1, PKW2 as 4, return value is in PKW4.

Request (From master to inverter):

|         | PKW1  | PKW2  | PKW3  | PKW4  | CW    | PZD2  | PZD3  | ... | PZD12 |
|---------|-------|-------|-------|-------|-------|-------|-------|-----|-------|
| Request | 00 01 | 00 04 | 00 00 | 00 00 | xx xx | xx xx | xx xx | ... | xx xx |

Response (From inverter to host)

|          | PKW1  | PKW2  | PKW3  | PKW4  | CW    | PZD2  | PZD3  | ... | PZD12 |
|----------|-------|-------|-------|-------|-------|-------|-------|-----|-------|
| Response | 00 01 | 00 04 | 00 00 | 50 00 | xx xx | xx xx | xx xx | ... | xx xx |

Example 2: Modify the parameter values (RAM and EEPROM are modified)

Modify keypad settings frequency value (the address of keypad setting frequency is 4) which can be achieved by setting PKW1 as 2; PKW2 as 4, modification value (50.00) is in PKW4.

Request (From master to inverter):

|         | PKW1  | PKW2  | PKW3  | PKW4  | CW    | PZD2  | PZD3  | ... | PZD12 |
|---------|-------|-------|-------|-------|-------|-------|-------|-----|-------|
| Request | 00 02 | 00 04 | 00 00 | 50 00 | xx xx | xx xx | xx xx | ... | xx xx |

Response (From inverter to host)

|          |       |       |       |       |       |       |       |     |       |
|----------|-------|-------|-------|-------|-------|-------|-------|-----|-------|
|          | PKW1  | PKW2  | PKW3  | PKW4  | CW    | PZD2  | PZD3  | ... | PZD12 |
| Response | 00 01 | 00 04 | 00 00 | 50 00 | xx xx | xx xx | xx xx | ... | xx xx |

0001: Response (Parameter values refreshed)

Example for PZD:

Transmission of PZD area is achieved through inverter function code; please refer to relevant INVT inverter user manual to know relevant function code.

**Example 1:** Read process data of inverter

Inverter parameter selects "8: Run frequency" as PZD3 to transmit which can be achieved by setting Pd.14 as 8. This operation is mandatory until the parameter is instead of others.

Request (From master to inverter):

|          |       |       |       |       |       |       |       |     |       |
|----------|-------|-------|-------|-------|-------|-------|-------|-----|-------|
|          | PKW1  | PKW2  | PKW3  | PKW4  | CW    | PZD2  | PZD3  | ... | PZD12 |
| Response | xx xx | xx xx | xx xx | xx xx | xx xx | xx xx | 00 0A | ... | xx xx |

**Example 2:** Write process data into inverter

Inverter parameter selects "2: Traction given" from PZD3 which can be achieved by setting Pd.03 as 2. In each request frame, parameters will use PZD3 to update until re-select a parameter.

Request (From master to converter):

|          |       |       |       |       |       |       |       |     |       |
|----------|-------|-------|-------|-------|-------|-------|-------|-----|-------|
|          | PKW1  | PKW2  | PKW3  | PKW4  | CW    | PZD2  | PZD3  | ... | PZD12 |
| Response | xx xx | xx xx | xx xx | xx xx | xx xx | xx xx | 00 00 | ... | xx xx |

In each request frame contents of PZD3 are given by traction until re-select a parameter.

### 7.5.5 Fault information

CH-PA01 module is equipped with three fault display LEDs as shown in figure 7.27. The roles of these LEDs are as follows:

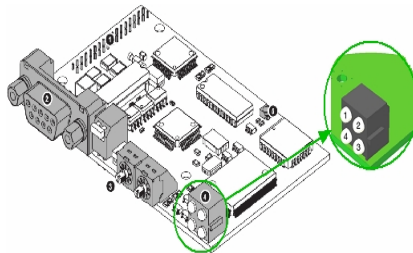


Figure 7.27 Fault display LEDs

| LED No. | Name         | Color | Function   |
|---------|--------------|-------|--|
| 1       | Main display | Green | ON--Connection works   |
|         |              | Red   | ON-Connection lost for ever<br>Flashes- Connection lost for temporary  |
| 2       | Online       | Green | ON-module online and data can be exchanged.<br>OFF-module is not in "online" state.  |
| 3       | Offline      | Red   | ON-module offline and data can't be exchanged.<br>OFF-module is not in "offline" state.  |
| 4       | Fault        | Red   | Flicker frequency 1Hz-configuration error: The length of user parameter data sets is different from that of network configuration process during module initialization process.<br>Flicker frequency 2Hz-user parameter data error: The length or content of user parameter data sets is different from that of network configuration process during module initialization process.<br>Flicker frequency 4Hz-Profibus communication ASIC initialization error.<br>OFF-Diagnostic closed. |

## 7.6 Ethernet Communication Description

Ethernet function is integrated within CHV190, interface is CN12, please use standard Ethernet RJ45 cable with host software provided by INVT. All parameters within inverter can be easily set up, upload, download through host. It's easy to monitor up to more than 100 messages waveform real time within inverter.

CHV190 has "black box" function; inverter can keep 0.2s information waveform before the last fault. The information can be extracted through host computer software and it's easy to analyze fault cause.

## 8. TROUBLE SHOOTING

### 8.1 Fault and Trouble Shooting

CHV190 series is the inverter with perfect protection that can give full play to equipment performance, while be implemented effective protection. However, in the process of using it also encounter some trouble instructions, and please you analysis according to the following table to determine the reasons for the timely exclusion occurs. When confronted with equipment damage so that you can not be solved, please contact with your local distributor factoring, repairing centers or manufacturers to find a way of solution.

| Fault code | Fault type                               | Reason  | Solution  |
|------------|--|---|---|
| OUT1       | IGBT Ph-U fault                          | 1. Acc/Dec time is too short.   | 1. Increase Acc/Dec time.   |
| OUT2       | IGBT Ph-V fault                          | 2. IGBT module fault.   | 2. Ask for support.   |
| OUT3       | IGBT Ph-W fault                          | 3. Malfunction caused by interference.<br>4. Grounding is not properly.       | 3. Inspect external equipment and eliminate interference.           |
| OC1        | Over-current when acceleration           | 1. Short-circuit or ground fault occurred at inverter output.                 | 1. Inspect whether motor damaged, insulation worn or cable damaged. |
| OC2        | Over-current when deceleration           | 2. Load is too heavy or Acc/Dec time is too short.                            | 2. Increase Acc/Dec time or select bigger capacity inverter.        |
| OC3        | Over-current when constant speed running | 3. V/F curve is not suitable.<br>4. Sudden change of load.                    | 3. Check and adjust V/F curve.<br>4. Check the load.                |
| OV1        | Over-voltage when acceleration           | 1. Dec time is too short and regenerative energy from the motor is too large. | 1. Increase Dec time or connect braking resistor.                   |
| OV2        | Over-voltage when deceleration           | 2. Input voltage is too high.   | 2. Decrease input voltage within specification.                     |
| OV3        | Over-voltage when constant speed running |   |   |

| Fault code | Fault type           | Reason   | Solution  |
|------------|----------------------|--|---|
| UV         | DC bus Under-voltage | 1. Open phase occurred with power supply.<br>2. Momentary power loss occurred<br>3. Wiring terminals for input power supply are loose.<br>4. Voltage fluctuations in power supply are too large. | Inspect the input power supply or wiring.   |
| OL1        | Motor overload       | 1. Motor drive heavy load at low speed for a long time.<br>2. Improper V/F curve<br>3. Improper motor's overload protection threshold (Pb.03)<br>4. Sudden change of load.                       | 1. Select variable frequency motor.<br>2. Check and adjust V/F curve.<br>3. Check and adjust Pb.03.<br>4. Check the load.             |
| OL2        | Inverter overload    | 1. Load is too heavy or Acc/Dec time is too short.<br>2. Improper V/F curve<br>3. Capacity of inverter is too small.   | 1. Increase Acc/Dec time or select bigger capacity inverter.<br>2. Check and adjust V/F curve.<br>3. Select bigger capacity inverter. |
| SPI        | Input phase failure  | 1. Open-phase occurred in power supply.<br>2. Momentary power loss occurred.<br>3. Wiring terminals  | Check the wiring, installation and power supply.  |

| Fault code | Fault type           | Reason   | Solution  |
|------------|----------------------|--|---|
|            |                      | for input power supply are loose.<br>4. Voltage fluctuations in power supply are too large.<br>5. Voltage balance between phases is bad. |   |
| SPO        | Output phase failure | 1. There is a broken wire in the output cable<br>2. There is a broken wire in the motor winding.<br>3. Output terminals are loose.       | Check the wiring and installation.  |
| OH1        | Rectify overheat     | 1. Ambient temperature is too high.<br>2. Near heat source.  | 1. Install cooling unit.<br>2. Remove heat source.  |
| OH2        | IGBT overheat        | 3. Cooling fans of inverter stop or damaged.<br>4. Obstruction of ventilation channel<br>5. Carrier frequency too high.                  | 3. Replace cooling fan<br>4. Clear the ventilation channel.<br>5. Decrease carrier frequency. |
| EF         | External fault       | Sx: External fault input terminal take effect.   | Inspect external equipment.   |
| CE         | Communication fault  | 1. Improper baud rate setting.<br>2. Receive wrong data.<br>3. Communication is  | 1. Set proper baud rate.<br>2. Check communication  |

| Fault code | Fault type                     | Reason   | Solution   |
|------------|--------------------------------|--|--|
|            |                                | interrupted for Long time.   | devices and signals.   |
| ITE        | Current detection fault        | 1. Wires or connectors of control board are loose.<br>2. Hall sensor is damaged.<br>3. Amplifying circuit is abnormal. | 1. Check the wiring.<br>2. Ask for support.  |
| TE         | Autotuning fault               | 1. Improper setting of motor rated parameters.<br>2. Overtime of autotuning.   | 1. Set rated parameters according to motor nameplate.<br>2. Check motor's wiring.                |
| PCE        | Encoder fault                  | 1. Signal wire of encoder was broken.<br>2. Encoder was damaged.   | 1. Inspect encoder connection.<br>2. Inspect whether the encoder output signal or not.           |
| PCDE       | Encoder reverse fault          | Encoder signal wire was connected wrong.   | Adjust encoder wiring.   |
| EEP        | EEPROM fault                   | Read/Write fault of control parameters.  | Press <b>STOP/RESET</b> to reset.<br>Ask for support.  |
| PPPE       | Magnetic pole position failure | The position of autotuning magnetic pole was detected wrong.   | 1. Check parameters of motor<br>2. Set rated parameters according to motor and autotuning again. |
| BCE        | Brake unit fault               | 1. Braking circuit failure or brake tube damaged.  | 1. Inspect braking unit, replace braking tube.<br>2. Increase braking                            |

| Fault code | Fault type                               | Reason  | Solution  |
|------------|--|---|---|
|            |  | 2. Too low resistance of externally connected braking resistor.             | resistance.   |
| -END-      | Trial time reached                       | Trial time which determined by factory reached.                             | Contact supplier and ask for support.   |
| LCD-E      | LCD disconnected                         | 1. LCD disconnected.<br>2. Material broken during tension control.          | 1. Press <b>STOP/RST</b> to reset, connect LCD then download or upload parameter.<br>2. Check material. |
| FAE        | Brake feedback fault                     | The feedback of brake is error,   | Inspect the controlling system of crane.  |
| TbE        | Contactor feedback fault                 | The feedback of contactor is error,   | Inspect the controlling system of crane.  |
| TPF        | Torque verification fault                | Torque verification is unsuccessful.  | Check torque verify.  |
| OFE        | Motor speed fault                        | The actual motor speed exceeds the set speed.                               | Check control system and load.  |
| TFT        | Torque Monitoring fault                  | The monitoring of torque is error.  | Check control system and load.  |
| PCF        | Profibus communication fault             | The communication of Profibus is unsuccessful.                              | Check Profibus communication module and communication links.  |
| ELS        | Master-slave speed synchronization fault | The position error between master and slave exceeds the position bias limit | Adjust the master and slave position and recount the master-slave.                                      |
| STEP       | Multi-step speed rating fault            | The lower classification contact is   | Please connect the lower classification at  |

| Fault code | Fault type                   | Reason  | Solution  |
|------------|------------------------------|---|---|
|            |                              | disconnected, the higher classification contact is connected. | first, and then connect the more advanced classification. |
| STC        | Operating lever fault        | Operating lever has not returned to zero position.            | Put the operating lever back zero.                        |
| ETH        | Earth connection fault       | Grounding is error.   | Given speed is set by analog, GND disconnect.             |
| CANE       | CAN bus communication fault  | Improper baud rate setting.                                   | Set proper baud rate.                                     |
|            |                              | Receive data error.   | Press <b>STOP/RST</b> to reset. Ask for support.          |
|            |                              | Communication is interrupted for Long time.                   | Check communication devices and signals.                  |
| OH3        | Motor over-temperature fault | Motor temperature is too high.                                | Check motor.  |
|            |                              | Temperature sensor is damaged.                                | Check temperature sensor.                                 |
|            |                              | Temperature sensor wirings loose.                             | Check temperature sensor wiring.                          |

## 8.2 Common Faults and Solutions

◆ Inverter may have following faults or malfunctions during operation, please refer to the following solutions.

### No display after power on:

Inspect whether the voltage of power supply is the same as the inverter rated voltage or not with multi-meter. If the power supply has problem, inspect and solve it.

◆ After the power supply is switched off for a few minutes, inspect whether the three-phase rectify bridge is in good condition or not. If the rectification bridge is burst out, ask for support.

◆ Check the CHARGE light. If the light is off, the fault is mainly in the rectify bridge or the

buffer resistor. If the light is on, the fault may be lies in the switching power supply. Please ask for support.

**Power supply air switch trips off when power on:**

- ◆ Inspect whether the input power supply is grounded or short circuit. Please solve the problem.
- ◆ Inspect whether the rectify bridge has been burnt or not. If it is damaged, ask for support.

**Motor doesn't move after inverter running:**

- ◆ Inspect if there is balanced three-phase output among U, V, W. If yes, then motor could be damaged, or mechanically locked. Please solve it.
- ◆ If the output is unbalanced or lost, the inverter drive board or the output module may be damaged, ask for support.

**Inverter displays normally when power on, but switch at the input side trips when running:**

- ◆ Inspect whether the output side of inverter is short circuit. If yes, ask for support.
- ◆ Inspect whether ground fault exists. If yes, solve it.
- ◆ If trip happens occasionally and the distance between motor and inverter is too far, it is recommended to install output AC reactor.

## 9. MAINTENANCE



### WARNING

- Maintenance must be performed according to designated maintenance methods.
- Maintenance, inspection and replacement of parts must be performed only by authorized personnel.
- After turning off the main circuit power supply, waiting for 10 minutes before performance maintenance or inspection.
- DO NOT directly touch components or devices of PCB board. Otherwise inverter can be damaged by electrostatic.
- After maintenance, all screws must be tightened.

### 9.1 Daily Maintenance

In order to prevent the fault of inverter to make it operate smoothly in high-performance for a long time, user must inspect the inverter periodically (within half year). The following table indicates the inspection content.

| Items to be checked   | Main inspections   |   | Criteria   |
|-----------------------|--|---|--|
|                       | Inspection content   | Frequency   | Means/Methods  |
| Operation environment | (1) Temperature, humidity<br>(2) Dust, vapor, leakage<br>(3) Gases | (1) Point thermometer, hygrometer<br>(2) Observation<br>(3) Visual examination and smelling | (1) Ambient temperature shall be lower than 50℃; otherwise, the rated values should be decreased. Humidity shall meet the requirement<br>(2) No dust accumulation, no traces of water leakage and no condensate.<br>(3) No abnormal color and smell. |

| Items to be checked         | Main inspections  |   | Criteria   |
|-----------------------------|---|---|--|
|                             | Inspection content  | Frequency   | Means/Methods  |
| Inverter                    | (1) Vibration<br>(2) Cooling and heating<br>(3) Noise   | (1) Point thermometer comprehensive observation<br>(2) Listening                  | (1) Smooth operation without vibration.<br>(2) Fan is working in good condition. Speed and air flow are normal.<br>(3) No abnormal heat.<br>(4) No abnormal noise. |
| Motor                       | (3) Vibration<br>(2) Heat<br>(3) Noise  | (1) Comprehensive observation Listening<br>(2) Point thermometer<br>(3) Listening | (1) No abnormal vibration and no abnormal noise.<br>(2) No abnormal heat.<br>(3) No abnormal noise.  |
| Operation status parameters | (1) Power input voltage<br>(2) Inverter output voltage<br>(3) Inverter output current<br>(4) Internal temperature | (1) Voltmeter<br>(2) Rectifying voltmeter<br>(3) Ammeter<br>(4) Point thermometer | (1) Satisfying the specification.<br>(2) Satisfying the specification.<br>(3) Satisfying the specification.<br>(4) Temperature rise is lower than 40°C.            |

## 9.2 Periodic Maintenance

Customer should check the drive every 3 months or 6 months according to the actual environment

1. Check whether the screws of control terminals are loose. If so, tighten them with a screwdriver;
2. Check whether the main circuit terminals are properly connected; whether the mains cables are over heated;
3. Check whether the power cables and control cables are damaged, check especially for any wear on the cable tube;
4. Check whether the insulating tapes around the cable lugs are stripped;
5. Clean the dust on PCBs and air ducts with a vacuum cleaner;
6. For drives that have been stored for a long time, it must be powered on every 2 years. When supplying AC power to the drive, use a voltage regulator to raise the input voltage to

rated input voltage gradually. The drive should be powered for 5 hours without load.

7. Before performing insulation tests, all main circuit input/output terminals should be short-circuited with conductors. Then precede insulation test to the ground. Insulation test of single main circuit terminal to ground is forbidden; otherwise the drive might be damaged. Please use a 500V Mega-Ohm-Meter.

8. Before the insulation test of the motor, disconnect the motor from the drive to avoid damaging it.

### **9.3 Replacement of Wearing Parts**

Fans and electrolytic capacitors are wearing part; please make periodic replacement to ensure long term, safety and failure-free operation. The replacement periods are as follows:

- ◆ Fan: Must be replaced when using up to 20,000 hours;
- ◆ Electrolytic Capacitor: Must be replaced when using up to 30,000~40, 000 hours.

## 10. COMMUNICATION PROTOCOL

### 10.1 Interfaces

RS485: asynchronous, half-duplex.

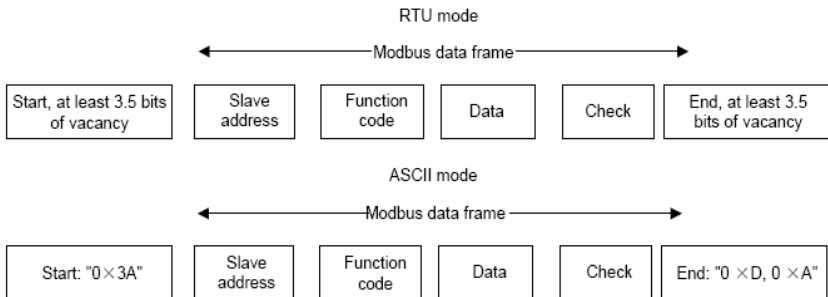
Default: 8-E-1, 19200bps. Please refer to Group PC: parameter settings.

### 10.2 Communication Modes

- (1) The protocol is Modbus protocol. Besides the common register Read/Write operation, it is supplemented with commands of parameters management.
- (2) The drive is a slave in the network. It communicates in 'point to point' master-slave mode. It will not respond to the command sent by the master via broadcast address.
- (3) In the case of multi-drive communication or long-distance transmission, connecting a 100~120Ω resistor in parallel with the master signal line will help to enhance the immunity to interference.

### 10.3 Protocol Format

Modbus protocol supports both RTU and ASCII mode. The frame format is illustrated as follows:



Modbus adopts "Big Endian" representation for data frame. This means that when a numerical quantity larger than a byte is transmitted, the most significant byte is sent first.

#### RTU mode

In RTU mode, the Modbus minimum idle time between frames should be no less than 3.5 bytes. The checksum adopts CRC-16 method. All data except checksum itself sent will be counted into the calculation. Please refer to section: CRC Check for more information.

Note that at least 3.5 bytes of Modbus idle time should be kept and the start and end idle time need not be summed up to it.

The table below shows the data frame of reading parameter 002 from slave node address

1.

| Node adds. | Command | Data adds. |      | Read No. |      | CRC  |      |
|------------|---------|------------|------|----------|------|------|------|
| 0x01       | 0x03    | 0x00       | 0x02 | 0x00     | 0x01 | 0x25 | 0xCA |

The table below shows the reply frame from slave node address 1.

| Node adds. | Command | Bytes No. | Data |      | CRC  |      |
|------------|---------|-----------|------|------|------|------|
| 0x01       | 0x03    | 0x02      | 0x00 | 0x00 | 0xB8 | 0x44 |

### ASCII mode

In ASCII mode, the frame head is "0x3A", and default frame tail is "0x0D" or "0x0A". The frame tail can also be configured by users. Except frame head and tail, other bytes will be sent as two ASCII characters, first sending higher nibble and then lower nibble. The data have 7/8 bits. "A"~"F" corresponds to the ASCII code of respective capital letter. LRC check is used. LRC is calculated by adding all the successive bytes of the message except the head and tail, discarding any carriers, and then two's complementing the result.

Example of Modbus data frame in ASCII mode:

The command frame of writing 0x0003 into address "0x1000" of slave node address 1 is shown in the table below:

LRC checksum = the complement of  $(01+06+10+00+0x00+0x03) = 0xE5$ .

|       | Frame head | Node adds. |    | Command |    | Data adds. |    |    |    |
|-------|------------|------------|----|---------|----|------------|----|----|----|
| Code  |            | 0          | 1  | 0       | 6  | 1          | 0  | 0  | 0  |
| ASCII | 3A         | 30         | 31 | 30      | 36 | 31         | 30 | 30 | 30 |

| Data to write |    |    |    | LRC |    | Frame tail |    |
|---------------|----|----|----|-----|----|------------|----|
| 0             | 0  | 0  | 3  | E   | 5  | CR         | LF |
| 30            | 30 | 30 | 33 | 45  | 35 | 0D         | 0A |

## 10.4 Protocol Function

Different respond delay can be set through drive's parameters to adapt to different needs. For RTU mode, the respond delay should be no less than 3.5 bytes interval, and for ASCII mode, no less than 1ms.

The main function of Modbus is to read and write parameters. The Modbus protocol supports the following commands:

|      |  |
|------|--|
| 0x03 | Read inverter's function parameter and status parameters         |
| 0x06 | Write single function parameter or command parameter to inverter |

All drive's function parameters, control and status parameters are mapped to Modbus R/W data address.

The data addresses of each function parameters. Please refer to the sixth column of APPENDIX E.

The data address of control and status parameters please refer to the following table.

| Parameter description                   | Address | Meaning of value  | R/W feature |
|---|---------|---|-------------|
| Control command                         | 1000H   | 0001H: Up   | W/R         |
|   |         | 0002H: Down   |             |
|   |         | 0003H: JOG forward  |             |
|   |         | 0004H: JOG reverse  |             |
|   |         | 0005H: Stop   |             |
|   |         | 0006H: Coast to stop  |             |
|   |         | 0007H: Reset fault  |             |
|   |         | 0008H: JOG stop   |             |
| Inverter status                         | 1001H   | 0001H: Forward running  | R           |
|   |         | 0002H: Reverse running  |             |
|   |         | 0003H: Standby  |             |
|   |         | 0004H: Fault  |             |
| Frequency source communication setting  | 2000H   | Communication Setting Range (-10000~10000)<br>Note: the communication setting is the percentage of the relative value (-100.00%~100.00%). If it is set as frequency source, the value is the percentage of the maximum frequency (P0.04). If it is set as PID (preset value or feedback value), the value is the percentage of the PID. | W/R         |
| Virtual terminal input function setting | 2001H   | Setting range: 000H~03FFH. Each bit corresponds to S1~S10, HDI1, HDI2 and S6~S8 respectively.<br>Notice: The functional code P5.01 should be set to the communication virtual terminal input function, and should also be unrelated to HDI1 and HDI2 input types.   | W/R         |

| Parameter description      | Address  | Meaning of value  | R/W feature |
|----------------------------|----------|---|-------------|
| Reserved                   | 2002H    |   | W           |
| Reserved                   | 2003H    |   | W           |
| Torque reference setting   | 2004H    | Communication setting range (-10000~10000).<br>Note:the value(-100.00%~100.00%) cooresponding to torque upper limit.                            | W           |
| Torque upper limit setting | 2005H    | Communication setting range (-10000~10000).<br>Note:the value(-100.00%~100.00%) corresponding to torque upper limit.<br>Write command is valid. | W           |
| Reserved                   | 2006H    |   | W           |
| Motor temperature setting  | 2007H    | Communication setting range (-2000~2000) is corresponding to (-200.0~200.0).  | W           |
| Status parameters          | 3000H    | Output speed  | R           |
|                            | 3001H    | Reference speed   | R           |
|                            | 3002H    | DC Bus voltage  | R           |
|                            | 3003H    | Output voltage  | R           |
|                            | 3004H    | Output current  | R           |
|                            | 3005H    | Running frequency   | R           |
|                            | 3006H    | Output power  | R           |
|                            | 3007H    | Output torque   | R           |
|                            | 3008H    | Input terminal status   | R           |
|                            | 3009H    | Output terminal status  | R           |
|                            | 300AH    | Input of AI1  | R           |
|                            | 300BH    | Input of AI2  | R           |
|                            | 300CH    | Input of HDI  | R           |
|                            | 300DH    | Torque compensation   | R           |
|                            | 300EH    | Pole position   | R           |
| 300FH ~ 3014H              | Reserved | R   |             |

| Parameter description                   | Address | Meaning of value  | R/W feature |
|---|---------|---|-------------|
|   | 3015H   | Torque direction<br>(0: forward, 1: reverse)  | R           |
|   | 3016H   | Device code   | R           |
|   | 4000H   | ****  | R           |
| Parameter lock password check address   | 4001H   | 55AAH   | R           |
| Parameter lock password command address | 5000H   | This address stores the fault type of inverter. The meaning of each value is same as P7.15. | R           |
| Fault info address                      |         |   |             |

The above shows the format of the frame. Now we will introduce the Modbus command and data structure in details, which is called protocol data unit for simplicity. Also MSB stands for the most significant byte and LSB stands for the least significant byte for the same reason. The description below is data format in RTU mode. The length of data unit in ASCII mode should be doubled.

Protocol data unit format of reading parameters:

Request format:

| Protocol data unit | Data length (bytes) | Range         |
|--------------------|---------------------|---------------|
| Command            | 1                   | 0x03          |
| Data address       | 2                   | 0~0xFFFF      |
| Read number        | 2                   | 0x0001~0x0010 |

Reply format (success):

| Protocol data unit   | Data length (bytes) | Range          |
|----------------------|---------------------|----------------|
| Command              | 1                   | 0x03           |
| Returned byte number | 2                   | 2* Read number |
| Content              | 2* Read number      |                |

If the command is reading the type of inverter (data address 0x3016), the content value in reply message is the device code:

The high 8 bit of device code is the type of the inverter, and the low 8 bit of device code is

the sub type of inverter.

For details, please refer to the following table:

| High byte | Meaning | Low byte | Meaning                    |
|-----------|---------|----------|----------------------------|
| 00        | CHV     | 01       | Universal type             |
|           |         | 02       | For water supply           |
|           |         | 03       | Middle frequency<br>1500HZ |
|           |         | 04       | Middle frequency<br>3000HZ |
| 01        | CHE     | 01       | Universal type             |
|           |         | 02       | Middle frequency<br>1500HZ |
| 02        | CHF     | 01       | Universal type             |

If the operation fails, the inverter will reply a message formed by failure command and error code. The failure command is (Command+0x80). The error code indicates the reason of the error; see the table below:

| Value | Name                  | Mean  |
|-------|-----------------------|---|
| 01H   | Illegal command       | The command from master can not be executed.<br>The reason maybe:<br>1. This command is only for new version and this version can not realize.<br>2. Slave is in fault status and can not execute it.         |
| 02H   | Illegal data address. | Some of the operation addresses are invalid or not allowed to access.   |
| 03H   | Illegal value         | When there are invalid data in the message framed received by slave.<br>Note: This error code does not indicate the data value to write exceed the range, but indicate the message frame is an illegal frame. |
| 06H   | Slave busy            | Inverter is busy (EEPROM is storing).   |
| 10H   | Password error        | The password written to the password check address is not same as the password set by P7.00.  |
| 11H   | Check error           | The CRC (RTU mode) or LRC (ASCII mode) check not passed.  |

| Value | Name                 | Mean   |
|-------|----------------------|--|
| 12H   | Written not allowed. | It only happen in write command, the reason maybe:<br>1. The written data exceeds the parameter range.<br>2. The parameter should not be modified now.<br>3. The terminal has already been used. |
| 13H   | System locked        | When password protection take effect and user does not unlock it, write/read the function parameter will return this error.  |

Protocol data unit format of writing single parameter:

Request format:

| Protocol data unit | Data length (bytes) | Range    |
|--------------------|---------------------|----------|
| Command            | 1                   | 0x06     |
| Data address       | 2                   | 0~0xFFFF |
| Write content      | 2                   | 0~0xFFFF |

Reply format (success):

| Protocol data unit | Data length (bytes) | Range    |
|--------------------|---------------------|----------|
| Command            | 1                   | 0x06     |
| Data address       | 2                   | 0~0xFFFF |
| Write content      | 2                   | 0~0xFFFF |

If the operation fails, the inverter will reply a message formed by failure command and error code. The failure command is (Command + 0x80). The error code indicates the reason of the error; see table 1.

## 10.5 Notice

10.5.1 Between frames, the span should not less than 3.5 bytes interval; otherwise, the message will be discarded.

10.5.2 Be cautious to modify the parameters of PC group through communication, otherwise may cause the communication interrupted.

10.5.3 In the same frame, if the spans between two .near bytes more than 1.5 bytes interval, the behind bytes will be assumed as the start of next message so that communication will failure.

## 10.6 CRC Check

For higher speed, CRC-16 uses tables. The following are C language source code for

CRC-16.

```

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);
}
    
```

## 10.7 Example

### 10.7.1 RTU mode, read 2 data from 0004H

The request command is:

|                            |  |
|----------------------------|--|
| START                      | T1-T2-T3-T4 (transmission time of 3.5 bytes) |
| Node address               | 01H  |
| Command                    | 03H  |
| High byte of start address | 00H  |
| Low byte of start address  | 04H  |
| High byte of data number   | 00H  |
| Low byte of data number    | 02H  |
| Low byte of CRC            | 85H  |
| High byte of CRC           | CAH  |
| END                        | T1-T2-T3-T4 (transmission time of 3.5 bytes) |

The reply is :

|                      |  |
|----------------------|--|
| START                | T1-T2-T3-T4 (transmission time of 3.5 bytes) |
| Node address         | 01H  |
| Command              | 03H  |
| Returned byte number | 04H  |

|                      |  |
|----------------------|--|
| Higher byte of 0004H | 13H  |
| Low byte of 0004H    | 88H  |
| High byte of 0005H   | 00H  |
| Low byte of 0005H    | 00H  |
| Low byte of CRC      | 7EH  |
| High byte of CRC     | 9DH  |
| END                  | T1-T2-T3-T4 (transmission time of 3.5 bytes) |

### 10.7.2 ASCII mode, read 2 data from 0004H:

The request command is:

|                            |     |
|----------------------------|-----|
| START                      | ‘.’ |
| Node address               | ‘0’ |
|                            | ‘1’ |
| Command                    | ‘0’ |
|                            | ‘3’ |
| High byte of start address | ‘0’ |
|                            | ‘0’ |
| Low byte of start address  | ‘0’ |
|                            | ‘4’ |
| High byte of data number   | ‘0’ |
|                            | ‘0’ |
| Low byte of data number    | ‘0’ |
|                            | ‘2’ |
| LRC CHK Hi                 | ‘F’ |
| LRC CHK Lo                 | ‘6’ |
| END Lo                     | CR  |
| END Hi                     | LF  |

The reply is

|                      |     |
|----------------------|-----|
| START                | ‘.’ |
| Node address         | ‘0’ |
|                      | ‘1’ |
| Command              | ‘0’ |
|                      | ‘3’ |
| Returned byte number | ‘0’ |
|                      | ‘4’ |

|                      |     |
|----------------------|-----|
| Higher byte of 0004H | '1' |
|                      | '3' |
| Low byte of 0004H    | '8' |
|                      | '8' |
| High byte of 0005H   | '0' |
|                      | '0' |
| Low byte of 0005H    | '0' |
|                      | '0' |
| LRC CHK Lo           | 5'  |
| LRC CHK Hi           | 'D' |
| END Lo               | CR  |
| END Hi               | LF  |

### 10.7.3 RTU mode, write 5000 (1388H) into address 0004H, slave node address 02.

The request command is:

|                            |  |
|----------------------------|--|
| START                      | T1-T2-T3-T4 (transmission time of 3.5 bytes) |
| Node address               | 02H  |
| Command                    | 06H  |
| High byte of data address  | 00H  |
| Low byte of data address   | 04H  |
| High byte of write content | 13H  |
| Low byte of write content  | 88H  |
| Low byte of CRC            | C5H  |
| High byte of CRC           | 6EH  |
| END                        | T1-T2-T3-T4 (transmission time of 3.5 bytes) |

The reply command is:

|                            |  |
|----------------------------|--|
| START                      | T1-T2-T3-T4 (transmission time of 3.5 bytes) |
| Node address               | 02H  |
| Command                    | 06H  |
| High byte of data address  | 00H  |
| Low byte of data address   | 04H  |
| High byte of write content | 13H  |
| Low byte of write content  | 88H  |
| Low byte of CRC            | C5H  |
| High byte of CRC           | 6EH  |

|     |  |
|-----|--|
| END | T1-T2-T3-T4 (transmission time of 3.5 bytes) |
|-----|--|

**10.7.4 ASCII mode, write 5000 (1388H) into address 0008H, slave node address 02.**

The request command is:

|                            |     |
|----------------------------|-----|
| START                      | ‘:’ |
| Node address               | ‘0’ |
|                            | ‘2’ |
| Command                    | ‘0’ |
|                            | ‘6’ |
| High byte of data address  | ‘0’ |
|                            | ‘0’ |
| Low byte of data address   | ‘0’ |
|                            | ‘4’ |
| High byte of write content | ‘1’ |
|                            | ‘3’ |
| Low byte of write content  | ‘8’ |
|                            | ‘8’ |
| LRC CHK Hi                 | ‘5’ |
| LRC CHK Lo                 | ‘9’ |
| END Lo                     | CR  |
| END Hi                     | LF  |

The reply command is:

|                            |     |
|----------------------------|-----|
| START                      | ‘:’ |
| Node address               | ‘0’ |
|                            | ‘2’ |
| Command                    | ‘0’ |
|                            | ‘6’ |
| High byte of data address  | ‘0’ |
|                            | ‘0’ |
| Low byte of data address   | ‘0’ |
|                            | ‘4’ |
| High byte of write content | ‘1’ |
|                            | ‘3’ |
| Low byte of write content  | ‘8’ |
|                            | ‘8’ |

|            |     |
|------------|-----|
| LRC CHK Hi | '5' |
| LRC CHK Lo | '9' |
| END Lo     | CR  |
| END Hi     | LF  |

**10.7.5 RTU mode, diagnose that the asked data bytes of address 01H should be the same as responds.**

The request command is:

|                            |  |
|----------------------------|--|
| START                      | T1-T2-T3-T4                                  |
| Node address               | 01H  |
| Command                    | 08H  |
| High byte of data address  | 00H  |
| Low byte of data address   | 00H  |
| High byte of write content | 12H  |
| Low byte of write content  | ABH  |
| Low byte of CRC            | ADH  |
| High byte of CRC           | 14EH   |
| END                        | T1-T2-T3-T4 (transmission time of 3.5 bytes) |

The reply command is:

|                            |  |
|----------------------------|--|
| START                      | T1-T2-T3-T4 (transmission time of 3.5 bytes) |
| Node address               | 01H  |
| Command                    | 08H  |
| High byte of data address  | 00H  |
| Low byte of data address   | 00H  |
| High byte of write content | 12H  |
| Low byte of write content  | ABH  |
| Low byte of CRC            | ADH  |
| High byte of CRC           | 14H  |
| END                        | T1-T2-T3-T4 (transmission time of 3.5 bytes) |

**10.7.6 ASCII mode, diagnose that the asked data bytes of address 01H should be the same as responds.**

The request command is:

|              |     |
|--------------|-----|
| START        | ':' |
| Node address | '0' |
|              | '1' |

|                            |     |
|----------------------------|-----|
| Command                    | '0' |
|                            | '8' |
| High byte of data address  | '0' |
|                            | '0' |
| Low byte of data address   | '0' |
|                            | '0' |
| High byte of write content | '1' |
|                            | '2' |
| Low byte of write content  | 'A' |
|                            | 'B' |
| LRC CHK Hi                 | '3' |
| LRC CHK Lo                 | 'A' |
| END Lo                     | CR  |
| END Hi                     | LF  |

The reply command is:

|                            |     |
|----------------------------|-----|
| START                      | ∴   |
| Node address               | '0' |
|                            | '1' |
| Command                    | '0' |
|                            | '8' |
| High byte of data address  | '0' |
|                            | '0' |
| Low byte of data address   | '0' |
|                            | '0' |
| High byte of write content | '1' |
|                            | '2' |
| Low byte of write content  | 'A' |
|                            | 'B' |
| LRC CHK Hi                 | '3' |
| LRC CHK Lo                 | 'A' |
| END Lo                     | CR  |
| END Hi                     | LF  |

## APPENDIX A APPLICATION MODE DESCRIPTION

### A.0 Open loop sequence

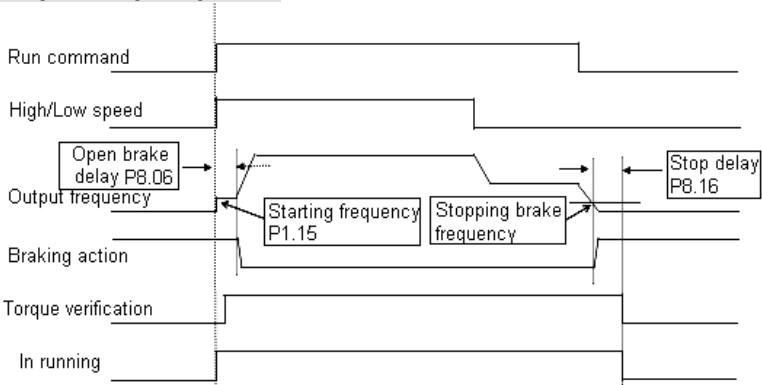


Figure A.1 Open loop sequential

Detailed information of P1.15, P8.06, P8.09 and P8.16 refer to the Chapter 6.

Open loop running sequential brief:

1. Inverter receives the UP/DOWN running and speed command from controller, and then inverter startup from 0 to starting speed P1.15. After delay time of P8.06, inverter output open brake control signal.
2. Controller block UP/DOWN and speed command, the inverter will coast to stop, when the speed reaches the brake frequency P8.09, the inverter will output brake instruction, after the delay time P8.16, the inverter stops and output motor stop signal.

## A.1 Close loop sequence

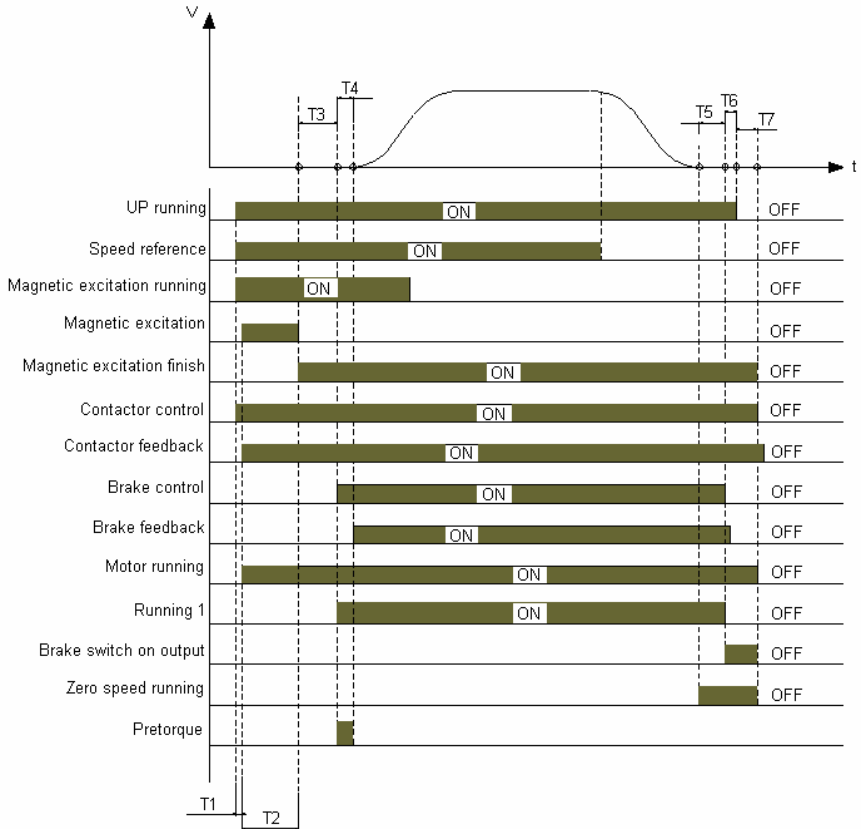


Figure A.2 Close loop vector control sequence diagram

| Symbol | Details  |
|--------|--|
| T1     | P8.08  |
| T2     | P8.23  |
| T3     | P8.06  |
| T4     | P8.07  |
| T5     | P8.05  |
| T6     | The waiting time is calculated from output brake command to receiving external signal of controller. It depends on external command. |
| T7     | P8.16  |

Detailed information of P8.05, P8.06, P8.07, P8.08, P8.16 and P8.23 refer to the Chapter

6.

Close loop running sequential brief:

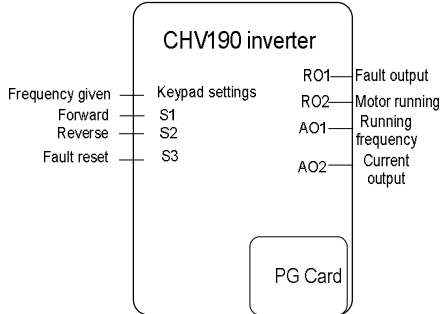
1. Inverter receives the UP/DOWN running and magnetic excitation from controller, Inverter outputs contactor switch on control instruction and then receive its feedback instruction after delay time T1, T1 depends on contactor hardware delay time. P8.08 definite maximum delay time. If  $T1 > P8.08$ , the inverter will show fault and stop.
2. After the motor running and inverter magnetic excitation running T2, inverter output excitation finish signal and start to zero speed running for T3, then the inverter output brake switch on signal and provides a pretorque for motor.
3. After the time T4, inverter receive brake feedback signals to confirm the brake is switch on, meanwhile, inverter start to accelerate according to S curve. T4 depends on the brake switching time. P8.07 definite maximum delay time. If  $T4 > P8.07$ , the inverter will show fault and stop.
4. After the controller cutting off speed instruction, inverter begins to decelerate according to S curve, when the speed reaches the threshold of stopping brake frequency. Inverter will output brake instruction after delay time T5, which demand controller cut off UP/DOWN command and output zero speed running signal.
5. The controller receives stopping command after T6, then inverter will stop after inverter T7. meanwhile, inverter should output contactor loose and motor stop signal until the complete process finish.

**Notice: the logical is suitable for contactor and brake signal of inverter, If it is not used for controlling brake, Running 1 and brake switch on signal can be used for brake control of inverter.**

## APPENDIX B APPLICATION MODE DESCRIPTION

### B.0 General Application Mode

General application mode wiring diagram is as follows:



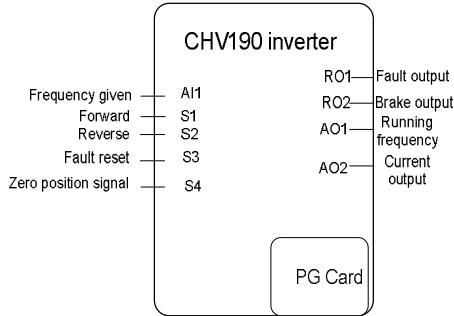
If set P0.11=0, general mode is valid, I/O signal settings and functions are set as default.

General application mode parameter settings are as follows:

| Function code | Name                      | Selection | Description                             |
|---------------|---------------------------|-----------|---|
| P0.01         | Run command source        | 1         | Terminal command channel (LED flashing) |
| P0.02         | Speed command selection   | 0         | Keypad settings                         |
| P5.01         | S4, S5 input type         | 0         | ON/OFF input                            |
| P5.02         | S1 terminal function      | 1         | Forward (FWD)                           |
| P5.03         | S2 terminal function      | 2         | Reverse (REV)                           |
| P5.04         | S3 terminal function      | 6         | Fault reset (RET)                       |
| P6.04         | Relay 1 output selections | 4         | Fault output                            |
| P6.05         | Relay 2 output selections | 1         | Motor running                           |
| P6.07         | AO1 output selection      | 0         | Running frequency                       |
| P6.08         | AO2 output selection      | 1         | Setting frequency                       |

### B.1 Operating Lever Mode

Operating lever mode wiring diagram is as follows:



If set P0.11=1, operating lever mode is valid which connect to analog I/O terminal directly. Speed is given by analog AI1, digital terminal S1 and S2 control crane running up and down. If inverter receives two directions simultaneously, it will coast to stop; keypad will not display the fault information.

Operating lever zero position detection is valid, if you set P8.48=1, when inverter stopped, it can be restart after operating lever back to zero position and P8.49 (delay time of operating lever zero position).

When operating lever goes back to the zero position. Speed reference of AI1 is bigger than 1V, it may be ground fault, and keypad displays ground fault information.

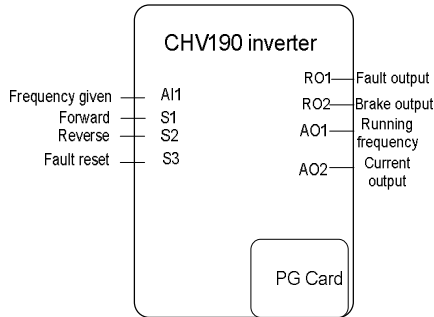
Operating lever mode parameter settings are as follows:

| Function code | Name                            | Selection | Description                             |
|---------------|---------------------------------|-----------|---|
| P0.01         | Run command source              | 1         | Terminal command channel (LED flashing) |
| P0.02         | Speed command selection         | 1         | Analog AI1 given                        |
| P1.09         | Straight-line acceleration time | 4.0s      | Acceleration time                       |
| P1.10         | Straight-line deceleration time | 4.0s      | Deceleration time                       |
| P5.01         | S4, S5 input type selection     | 0         | ON/OFF input                            |
| P5.02         | S1 terminal function            | 1         | Forward (FWD)                           |
| P5.03         | S2 terminal function            | 2         | Reverse (REV)                           |
| P5.04         | S3 terminal function            | 6         | Fault reset (RET)                       |
| P5.05         | S4 terminal function            | 24        | Zero position signal                    |
| P6.04         | Relay 1 output                  | 4         | Fault output                            |

| Function code | Name                     | Selection | Description                     |
|---------------|--------------------------|-----------|---------------------------------|
| P6.05         | Relay 2 output           | 7         | Brake output                    |
| P6.07         | AO1 output               | 0         | Running frequency               |
| P6.08         | AO2 output               | 4         | Current output                  |
| P8.04         | Brake, contactor control | 1         | Brake is controlled by inverter |
| P8.16         | Inverter stop delay time | 0.25s     | Delay time of stop              |

## B.2 Remote Control Mode

Remote control model wiring diagram is as follows:



If set P0.11=2, remote control mode is valid when operating lever is connected to wireless controller or PLC.

Speed is given by analog AI1, digital terminal S1 and S2 control crane running up and down. If inverter receives two directions simultaneously, it will coast to stop; keypad will not display the fault information.

Zero-position detection is invalid in this mode.

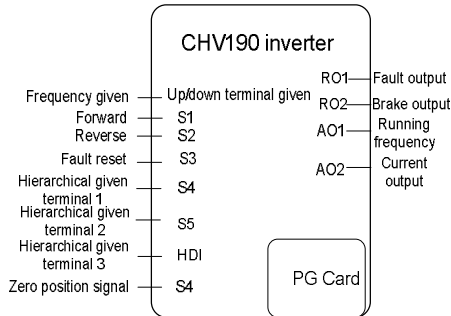
Remote control mode parameter settings are as follows:

| Function code | Name                     | Selection | Description                             |
|---------------|--------------------------|-----------|---|
| P0.01         | Run command source       | 1         | Terminal command channel (LED flashing) |
| P0.02         | Speed command selection  | 1         | Analog AI1 given                        |
| P1.09         | Linear acceleration time | 4.0s      | Acceleration time                       |
| P1.10         | Linear deceleration time | 4.0s      | Deceleration time                       |
| P5.01         | S4, S5 input type        | 0         | ON/OFF input                            |
| P5.02         | S1 terminal function     | 1         | Forward (FWD)                           |

| Function code | Name                     | Selection | Description                     |
|---------------|--------------------------|-----------|---------------------------------|
| P5.03         | S2 terminal function     | 2         | Reverse (REV)                   |
| P5.04         | S3 terminal function     | 6         | Fault reset (RET)               |
| P6.04         | Relay 1 output           | 4         | Fault output                    |
| P6.05         | Relay 2 output           | 7         | Brake output                    |
| P6.07         | AO1 output               | 0         | Running frequency               |
| P6.08         | AO2 output               | 4         | Current output                  |
| P8.04         | Brake, contactor control | 1         | Brake is controlled by inverter |
| P8.16         | Inverter stop delay time | 0.25s     | Delay time of stop              |

### B.3 Hierarchical Operating Lever Mode

Hierarchical operating lever mode wiring diagram is as follows:



If set P0.11=3, hierarchical operating lever mode is valid when hierarchical operating lever is connected to the digital input I/O of inverter.

Digital terminal S1 and S2 control crane running up and down. If inverter receives two directions simultaneously, it will coast to stop; keypad will not display the fault information. Speed is given by multi-step function which supports up to 6 different speeds. Direction command gives the first level contacts and the other five level contacts. Hierarchical contacts can be connected to any digital input S terminal, corresponding speed given is set by P1.00 to P1.05, and the system default setting is 4 levels.

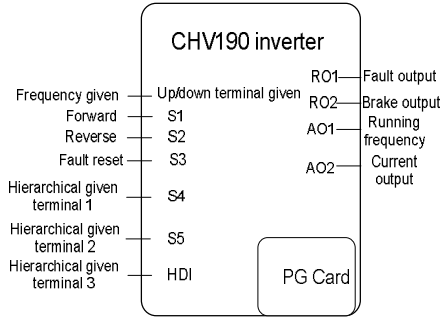
Speed reference of hierarchical contacts should be switched on from low bit to high. The higher contacts can be switch on only when lower ones are on. If the opposite situation appears, inverter will display hierarchical operating lever fault and stops.

Operating lever zero position detection is valid, if you set P8.48=1, when inverter stopped, it can be restart after operating lever back to zero position and P8.49 (delay time of operating lever zero position).

| Function code | Name                     | Selection | Description   |
|---------------|--------------------------|-----------|---|
| P0.01         | Run command source       | 1         | Terminal command channel (LED flashing)             |
| P0.02         | Speed command source     | 8         | Hierarchical multi-step speed given                 |
| P1.09         | Linear acceleration time | 4.0s      | Acceleration time                                   |
| P1.10         | Linear deceleration time | 4.0s      | Deceleration time                                   |
| P5.00         | HDI input type           | 1         | HDI as switch input                                 |
| P5.01         | S4, S5 input type        | 0         | ON/OFF input  |
| P5.02         | S1 terminal function     | 1         | Forward (FWD)                                       |
| P5.03         | S2 terminal function n   | 2         | Reverse (REV)                                       |
| P5.04         | S3 terminal function     | 6         | Fault reset (RET)                                   |
| P5.05         | S4 terminal function     | 25        | Hierarchical given terminal 1                       |
| P5.06         | S5 terminal function     | 26        | Hierarchical given terminal 2                       |
| P5.07         | HDI1 terminal function   | 27        | Hierarchical given terminal 3                       |
| P5.08         | S7 terminal function     | 24        | Zero position signal (Selection I/O extension card) |
| P6.04         | Relay 1 output           | 4         | Fault output  |
| P6.05         | Relay 2 output           | 7         | Brake output  |
| P6.07         | AO1 output               | 0         | Running frequency                                   |
| P6.08         | AO2 output               | 4         | Current output                                      |
| P8.04         | Brake, contactor control | 1         | Brake is controlled by inverter                     |
| P8.16         | Inverter stop delay time | 0.25s     | Delay time of stop                                  |

## B.4 Hierarchical Remote Control Mode

Hierarchical remote control mode wiring diagram is as follows:



If set P0.11=4, hierarchical remote control mode is valid when digital input for hierarchical remote control is connected to hierarchical remote controller or PLC.

Digital terminal S1 and S2 control crane running up and down. If inverter receives two directions simultaneously, it will coast to stop; keypad will not display the fault information. Speed is given by multi-step function which supports up to 6 different speeds. Hierarchical contacts can be connected to any digital input S terminal; corresponding speed given is set by P1.00 to P1.05.

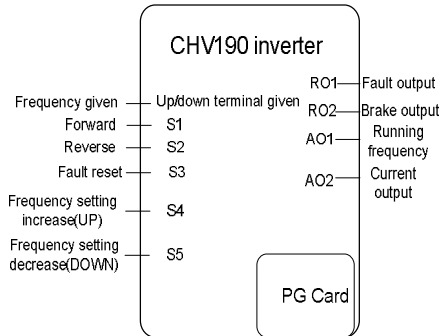
Zero position detection and hierarchical operating lever fault aren't necessary in the mode. Hierarchical remote mode parameter settings are as follows:

| Function code | Name                     | Selection | Description                             |
|---------------|--------------------------|-----------|---|
| P0.02         | Speed command source     | 8         | Terminal command channel (LED flashing) |
| P1.09         | Linear acceleration time | 4.0s      | Hierarchical multi-step speed given     |
| P1.10         | Linear deceleration time | 4.0s      | Acceleration time                       |
| P5.00         | HDI input type           | 1         | Deceleration time                       |
| P5.01         | S4, S5 input type        | 0         | HDI as switch input                     |
| P5.02         | S1 terminal function     | 1         | Switch input                            |
| P5.03         | S2 terminal function     | 2         | Forward (FWD)                           |
| P5.04         | S3 terminal function     | 6         | Reverse (REV)                           |
| P5.05         | S4 terminal function     | 25        | Fault reset (RET)                       |
| P5.06         | S5 terminal function     | 26        | Hierarchical given terminal 1           |
| P5.07         | HDI1 terminal function   | 27        | Hierarchical given terminal 2           |
| P6.04         | Relay 1 output           | 4         | Fault output                            |

| Function code | Name                     | Selection | Description                     |
|---------------|--------------------------|-----------|---------------------------------|
| P6.05         | Relay 2 output           | 7         | Brake output                    |
| P6.07         | AO1 output               | 0         | Running frequency               |
| P6.08         | AO2 output               | 4         | Current output                  |
| P8.04         | Brake, contactor control | 1         | Brake is controlled by inverter |
| P8.16         | Inverter stop delay time | 0.25s     | Delay time of stop              |

## B.5 Electric Potential Mode

Electric potential mode wiring diagram is as follows:



If set P0.11= 5, Electric potential mode is valid which use a button provide reference of acceleration and deceleration commands.

Digital terminal S1 and S2 control crane running up and down. If inverter receives two directions simultaneously, it will coast to stop; keypad will not display the fault information.

Acceleration and deceleration commands are connected to S4 and S5. If acceleration contact closes after inverter starts accelerating toward 100% speed with certain slope. If acceleration signal is removed before reaching 100%, inverter stops accelerating and runs at current speed. If acceleration signal apply again, inverter accelerates according to 100% speed with certain slope again. Deceleration command is the same as acceleration command.

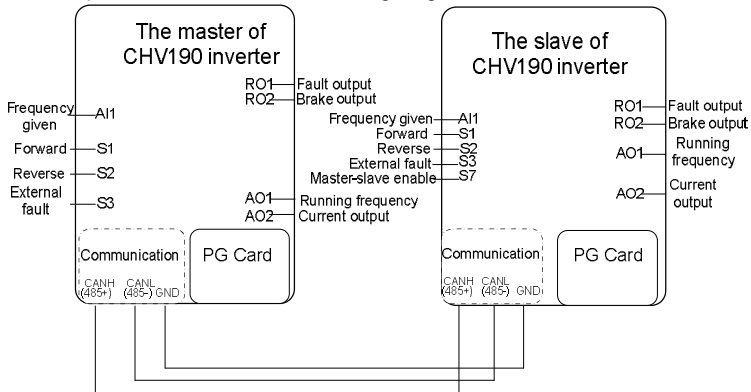
If direction command is removed, inverter decelerates toward zero speed with certain slope. If direction command is given again before inverter stops, it stops deceleration and runs at current speed.

Electric potential mode parameter settings are as follows:

| Function code | Name                     | Selection | Description                             |
|---------------|--------------------------|-----------|---|
| P0.01         | Run command source       | 1         | Terminal command channel (LED flashing) |
| P0.02         | Speed command source     | 5         | Up/down terminal given                  |
| P1.09         | Linear acceleration time | 4.0s      | Acceleration time                       |
| P1.10         | Linear deceleration time | 4.0s      | Deceleration time                       |
| P5.01         | S4, S5 input type        | 0         | ON/OFF input                            |
| P5.02         | S1 terminal function     | 1         | Forward (FWD)                           |
| P5.03         | S2 terminal function     | 2         | Reverse (REV)                           |
| P5.04         | S3 terminal function     | 6         | Fault reset (RET)                       |
| P5.05         | S4 terminal function     | 22        | Frequency setting increase (UP)         |
| P5.06         | S5 terminal function     | 23        | Frequency setting decrease (DOWN)       |
| P6.04         | Relay 1 output           | 4         | Fault output                            |
| P6.05         | Relay 2 output           | 7         | Brake output                            |
| P6.07         | AO1 output               | 0         | Running frequency                       |
| P6.08         | AO2 output               | 4         | Current output                          |
| P8.04         | Brake, contactor control | 1         | Brake is controlled by inverter         |
| P8.16         | Inverter stop delay time | 0.25s     | Delay time of stop                      |

## B.6 Master-slave Power Equilibrium Host Mode

Master-slave power balance host mode wiring diagram is as follows:



**Notice: 485 communications (communications card and I/O expansion cards) and CAN communication (I/O expansion card) are valid in master-slave power balance host mode.**

Master-slave control is used to distribute load among two or more motor to reach balance. When transmission device is driven by two or more motor and these motors are coupled by gears, chains or belts, then master-slave control function is needed.

An external control signal can be connected to host only which control slave by a serial communication link (CAN bus or 485 bus). The external signal can also be connected to both host and slave, while the communication only passes the host torque signal.

Host uses speed control and slave follows host's torque or speed given. There are three kinds of application in general.

1) When motor shaft of master and slave use flexible connection.

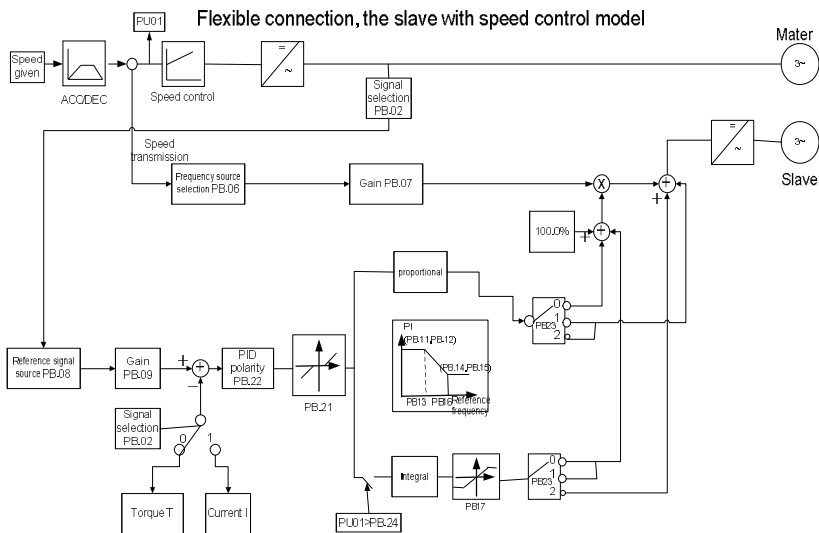
The host works as speed control and the slave should use speed control mode too because slight difference of speed between host and slave are permitted, please refer to example one for master-slave control.

2) When motor shaft of host and slave machine use rigid connection by gears, chains.

The slave should use torque control mode to make sure no speed differences among drive units. Please refer to example two for master-slave control.

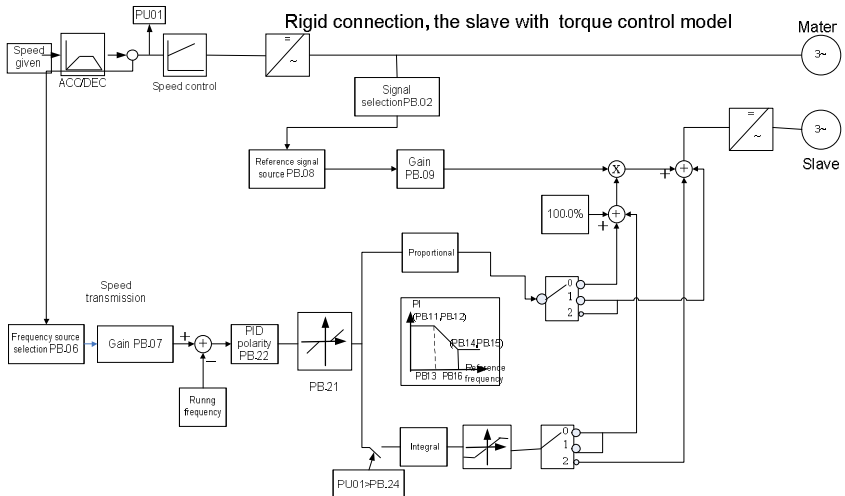
3) The slave needs using both speed control and torque control in some applications. One digital input terminal is needed for switching between speed control and torque control.

**Example one for master-slave control:**



**Notice:**

- 1) Example one above is application control diagram for flexible load drive. The master and slave are connected by belts or other extendable materials (flexible load). Due to ductility of materials, some speed error between master and slave is permitted.
- 2) The master and slave both use speed control under this situation. The host sends the running frequency to the slave as frequency reference. At the same time, the slave receives current output torque (output current) of the host, and then compares with its own torque to do PID error calculation whose result will be used as the adjustment for the slave's current frequency reference. The master and slave can realize synchronization control and power balance at last.
- 3) In the master-slave control mode, the running command of the host is connected to fault signals of the slave, once the slave is fault; the host is not allowed to run.
- 4) There are three types mode for PID calculations of the slave depending on specific applications.
- 5) The meaning of  $F\_m > Pb.24$  is to make sure that the slave starts PID calculation after the host starts to prevent PID initial calculation accumulation of slave before host starting.

**Example two for master-slave control:**

**Notice:**

- 1) Example two above is application control diagram for rigid load drive. The connection between the master and the slave is fixed. It should be no speed error

between the master and the slave.

2) The master use speed control and the slave use torque control under this situation. The master sends output torque (output current) to the slave as the torque reference. At the same time, the slave receives running frequency of the host, and then compares with its own frequency to do PID error calculation, whose result will be used as the slave's adjustment current torque reference. The master and slave can realize synchronization control and power balance at last.

3) In the master-slave control mode, the running command of the host is connected to fault signals of the slave, once the slave is fault; the host is not allowed to run.

4) There are three types mode for PID calculations of the slave depending on specific applications.

5) The meaning of F\_m> Pb.24 is to make sure that the slave starts PID calculation after the host starts to prevent PID initial calculation accumulation of slave before host starting.

If set P0.11=6, the master-slave power equilibrium host mode is valid when the inverter master-slave power equilibrium control mode is host under master-slave speed control host mode.

Digital terminal S1 and S2 control crane running up and down. If inverter receives two directions simultaneously, it will coast to stop; keypad will not display the fault information. Fault output of the slave should be connected to the external fault terminal of the host. Master-slave power equilibrium host mode parameter settings are as follows:

| Function code | Name                     | Selection | Description                             |
|---------------|--------------------------|-----------|---|
| P0.01         | Run command source       | 1         | Terminal command channel (LED flashing) |
| P0.02         | Speed command source     | 1         | AI1 setting                             |
| P1.09         | Linear acceleration time | 4.0s      | Acceleration time                       |
| P1.10         | Linear deceleration time | 4.0s      | Deceleration time                       |
| P5.01         | S4, S5 input type        | 0         | ON/OFF input                            |
| P5.02         | S1 terminal function     | 1         | Forward (FWD)                           |
| P5.03         | S2 terminal function     | 2         | Reverse (REV)                           |
| P5.04         | S3 terminal function     | 7         | External fault (EF)                     |
| P6.04         | Relay 1 output           | 4         | Fault output                            |
| P6.05         | Relay 2 output           | 7         | Brake output                            |
| P6.07         | AO1 output               | 0         | Running frequency                       |
| P6.08         | AO2 output               | 4         | Current output                          |

| Function code | Name                                      | Selection | Description                     |
|---------------|---|-----------|---------------------------------|
| P8.04         | Brake, contactor control                  | 1         | Brake is controlled by inverter |
| P8.16         | Inverter stop delay time                  | 0.25s     | Delay time of stop              |
| Pb.00         | Master-slave type                         | 1         | Power balance model             |
| Pb.01         | Master-slave mode                         | 1         | The slave                       |
| Pb.04         | Data sending of host communication enable | 1         | CAN communication sending       |

## B.7 Master-slave Power Equilibrium Slave Mode

If set P0.11=7, the master-slave power equilibrium slave mode is valid when the inverter of the master-slave power equilibrium control mode is slave under master-slave power equilibrium slave mode.

Direction and speed commands of crane are given by the host.

Fault output of the slave should be connected to the external fault terminal of the host.

Master-slave power equilibrium slave mode parameter settings are as follows:

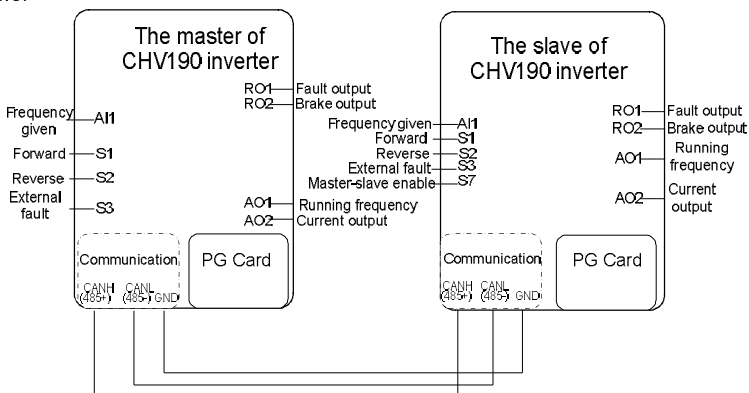
| Function code | Name                     | Selection | Description                                   |
|---------------|--------------------------|-----------|---|
| P0.01         | Run command source       | 1         | Terminal command channel (LED flashing)       |
| P0.02         | Speed command source     | 1         | A11 setting                                   |
| P1.09         | Linear acceleration time | 4.0s      | Acceleration time                             |
| P1.10         | Linear deceleration time | 4.0s      | Deceleration time                             |
| P5.01         | S4, S5 input type        | 0         | ON/OFF input                                  |
| P5.04         | S3 terminal function     | 7         | External fault (EF)                           |
| P5.08         | S7 terminal function     | 19        | Master-slave enable (need I/O extension card) |
| P6.04         | Relay 1 output           | 4         | Fault output                                  |
| P6.05         | Relay 2 output           | 7         | Brake output                                  |
| P6.07         | AO1 output               | 0         | Running frequency                             |
| P6.08         | AO2 output               | 4         | Current output                                |
| P8.04         | Brake, contactor control | 1         | Brake is controlled by inverter               |
| P8.16         | Inverter stop delay time | 0.25s     | Delay time of stop                            |
| Pb.00         | Master-slave type        | 1         | Power balance model                           |

| Function code | Name                                      | Selection | Description               |
|---------------|---|-----------|---------------------------|
| Pb.01         | Master-slave mode                         | 2         | The slave                 |
| Pb.04         | Data sending of host communication enable | 1         | CAN communication sending |

## B.8 Master-slave Speed Synchronization Host Mode

There are two different types wiring diagram for master-slave speed synchronization according to speed synchronous pulse counter source.

1. If set Pb.34=1 (internal encoder pulse counting), direction, speed command and position pulse counter of the slave are given by host communication, wiring diagram is as follows:



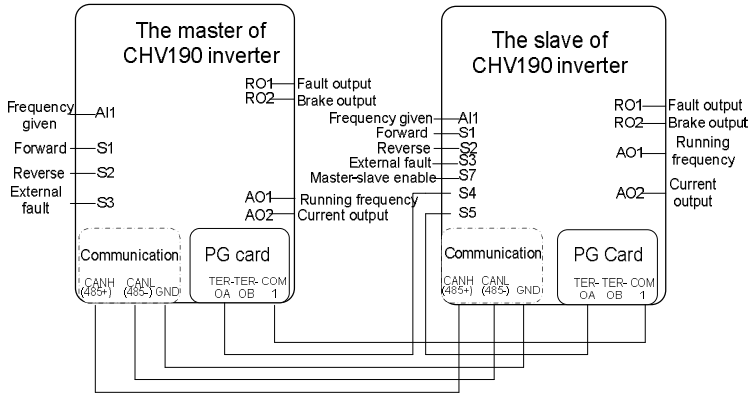
**Notice: The communication of the figure above can be 485 communications (communication card and I/O expansion card) and CAN communication (I/O expansion card).**

2. If set Pb.34=0 (external terminals S4, S5), direction and speed command of the slave are given by host communication; position pulse counter is given by external terminals S4, S5. Digital input terminal S4 is connected to PG card frequency division output of the host, while digital input terminal S5 is connected to the slave's. PG Card frequency division coefficients of the host and slave must be consistent.

Frequency division coefficient calculation formula is as follows:

$$K = \frac{\text{Motor maximum rotation speed (r/min)} \times \text{encoder pulses}}{5 \times 1024 \times 60}$$

Frequency division coefficients of the master and the slave must be greater or equal to that calculated one, wiring diagram is as follows:



**Notice: The communication of the figure above can be 485 communications (communication card and I/O expansion card) and CAN communication (I/O expansion card).**

Master-slave speed synchronization is used for two motor running synchronously. The function requires two inverters both with pulse encoder feedback.

Master-slave speed synchronization function is comparing position counting values of the master and the slave. The deviation for the slave can be reduced to zero by adding a velocity correction given which is calculated by PID proportion coefficients one (Pb.11) and integral time one (Pb.12).

When position deviation exceeds Pb.29 (speed synchronous position error dead zone), the collection of slave is valid. If the correction value exceeds Pb.30 (speed synchronous regulator output limit), it will be limited to Pb.30. If position deviation of the master and slave exceeds Pb.28 (speed synchronous position deviation fault limit), the slave brakes and displays "ELS" on the keypad.

The speed of the slave is lower than Pb.31 (the minimum speed of speed synchronous output enable); the collection of slave is invalid. (Position deviations are still detected and will be used when new start command is given.)

Master-slave speed synchronization can enable and cut off by an external signal 19: the external signal is connected to the slave.

When the master-slave speed synchronous enables, only the host have start command and speed given is valid. The host sends start commands and speed given to the slave

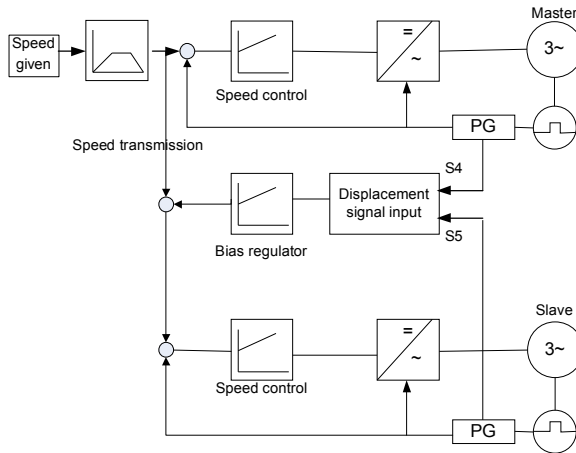
through communication (CAN or 485 bus). Acceleration and deceleration time of the slave should be set equal to or less than that of the master. If there is no communication card, the master and slave should use the same run command and speed given, acceleration and deceleration time of the slave should be consistent with the master.

When the master-slave speed synchronization is cut off, the two inverters work in their own "normal mode", if master-slave synchronous speed is separated or integrated when the motor is running, the slave should decelerate to stop.

When gearbox reduction ratio of the master and slave is different, please set the value of master/slave speed ratio as Pb.07 (the gain frequency reference of slave). When each pulse corresponding to the distance of master/slave encoder output is different, Please use Pb.26 and Pb.27 to set pulse speed ratio of master and slave.

Master/slave unit pulse speed ratio =  $Pb.26/Pb.27$ . This scale factor multiplies position value of the slave only when the master-slave speed synchronization control is effective.

Control diagram is as follows:



If set P0.11=8, the master-slave speed synchronization host mode is valid when the inverter of the master-slave speed synchronization control mode is host under master-slave speed synchronization host mode.

Digital terminal S1 and S2 control crane running up and down. If inverter receives two directions simultaneously, it will coast to stop; keypad will not display the fault information.

Fault output of the master should be connected to the external fault terminal of the slave.

Master-slave speed synchronous host mode parameter settings are as follows:

| Function code | Name                                      | Selection | Description                             |
|---------------|---|-----------|---|
| P0.01         | Run command source                        | 1         | Terminal command channel (LED flashing) |
| P0.02         | Speed command source                      | 1         | AI1 setting                             |
| P1.09         | Linear acceleration time                  | 4.0s      | Acceleration time                       |
| P1.10         | Linear deceleration time                  | 4.0s      | Deceleration time                       |
| P5.01         | S4, S5 input type                         | 0         | ON/OFF input                            |
| P5.02         | S1 terminal function                      | 1         | Forward (FWD)                           |
| P5.03         | S2 terminal function                      | 2         | Reverse (REV)                           |
| P5.04         | S3 terminal function                      | 7         | Fault reset (RET)                       |
| P6.04         | Relay 1 output                            | 4         | Fault output                            |
| P6.05         | Relay 2 output                            | 7         | Brake output                            |
| P6.07         | AO1 output                                | 0         | Running frequency                       |
| P6.08         | AO2 output                                | 4         | Current output                          |
| P8.04         | Brake, contactor control                  | 1         | Brake is controlled by inverter         |
| P8.16         | Inverter stop delay time                  | 0.25s     | Delay time of stop                      |
| PA.06         | 485 communication protocol selection      | 1         | Internal master-slave control protocol  |
| Pb.00         | Master-slave type selection               | 2         | Speed synchronous mode                  |
| Pb.01         | Master-slave mode selection               | 1         | The master                              |
| Pb.04         | Data sending of host communication enable | 1         | CAN communication sending               |

## B.9 Master-slave Speed Synchronization Slave Mode

If set P0.11=9, the master-slave speed synchronization slave mode is valid when the inverter of the master-slave speed synchronization control mode is slave under master-slave speed synchronization slave mode.

Fault output of the slave should be connected to the external fault terminal of the host

Master-slave speed synchronous slave mode parameter settings are as follows:

| Function code | Name                | Function | Description                             |
|---------------|---------------------|----------|---|
| P0.01         | Run command channel | 1        | Terminal command channel (LED flashing) |

| Function code | Name                                      | Function | Description                                       |
|---------------|---|----------|---|
| P0.02         | Speed command selection                   | 1        | AI1 setting                                       |
| P1.09         | Linear acceleration time                  | 4.0s     | Acceleration time                                 |
| P1.10         | Linear deceleration time                  | 4.0s     | Deceleration time                                 |
| P5.01         | S4, S5 input type                         | 1        | Master-slave synchronization counting input       |
| P5.04         | S3 terminal function                      | 7        | External fault (EF)                               |
| P5.05         | S4 terminal function                      | 0        | Non-function (HDI is admitted)                    |
| P5.06         | S5 terminal function                      | 0        | Non-function (HDI is admitted)                    |
| P5.08         | S7 terminal function                      | 19       | Master-slave enable (I/O expansion cards)         |
| P5.09         | S8 terminal function                      | 20       | Master-slave speed synchronization counting reset |
| P6.04         | Relay 1 output                            | 4        | Fault output                                      |
| P6.05         | Relay 2 output                            | 7        | Brake output                                      |
| P6.07         | AO1 output                                | 0        | Running frequency                                 |
| P6.08         | AO2 output                                | 4        | Current output                                    |
| P8.04         | Brake, contactor control                  | 1        | Brake is controlled by inverter                   |
| P8.16         | Inverter stop delay time                  | 0.25s    | Delay time of stop                                |
| Pb.00         | Master-slave type                         | 2        | Speed synchronous mode                            |
| Pb.01         | Master-slave mode                         | 2        | The master  |
| Pb.04         | Data sending of host communication enable | 1        | CAN communication sending                         |

## APPENDIX C THE SELECTION GUIDE OF CHV190

### C.1 Inverter Capacity Calculation

Inverter current is heavy for crane running up and down, the maximum starting torque and ACC/DEC torque of motor should be calculated. Please refer to details for inverter selection of crane running up and down, horizontal movement.

(1) The lifting mechanism

Motor shaft output power for lifting mechanism of gantry crane is as follows:

$$P_M = W * V / 6120\eta$$

W - Rated lifting load weight of lifting mechanism, kg

V - Rated speed of lifting mechanism, m/min

$\eta$  - Mechanical efficiency of lifting mechanism

Inverter capacity must be bigger than output required by load.

$$P_0 \text{ [KVA]} \geq k P_M / \eta \cos\phi$$

k - Overload coefficient 1.33

$P_M$  - Motor shaft output power required by load, kW

$\eta$  - Motor efficiency

$\cos\phi$  - Motor power factor

Starting torque required by lifting mechanism is 1.3-1.6 times of rated torque, considering the 125% overload requirements, maximum torque is required to be 1.6-2 times of rated torque, in order to make its safe use. CHV190 crane special inverter can afford up to 150% rated torque for 60s, the overload factor  $k = 2/1.5 = 1.33$ .

Current verification should be done after inverter capacity is chosen.

$$I_{CN} \geq kI_M$$

k - Current waveform correction factor ( $k=1.05-1.1$  when PWM modulation mode)

$I_{CN}$  - Inverter rated output current, A

$I_M$  - Motor rated current of frequency power, A

There are two separate lifting mechanisms for general large-tonnage cranes; each lifting mechanism has two motors synchronously drive their wire reel, then upgrade hook by pulley multi-level reduction. The scheme of variable frequency timing system for lifting mechanism is one inverter for one motor. In order to improve dynamic characteristics and high torque output capability of low-speed transmission, each inverter uses speed closed-loop control with encoder pulse. Master-slave control scheme with power balance and speed synchronization control function is provided by CHV190 series inverter used between two inverters of each lifting mechanism. The program can achieve accurate

torque balance of two motors distribution and speed synchronization of two lifting mechanism.

## (2) Horizontal movement mechanism

Horizontal movement mechanisms of cranes are classified to cart agency with big motor or small motor. Carts agencies use multi-motors drive scheme. As rotation inertia of crane horizontal movement mechanism is large, motor acceleration need larger starting torque, motor shaft output power  $P_M$  of crane horizontal movement mechanism is composed of load power  $P_j$  and acceleration power  $P_a$ .

$$P_M \geq P_j + P_a$$

As horizontal movement mechanism adopts one CHV190 inverter driving more than one motor, inverter capacity selection should follow formula as below.

$$I_{CN} \geq k I_M$$

$$I_{CN} \geq k I_M$$

$k$  - Current waveform correction factor ( $k=1.05-1.1$  when PWM modulation mode)

$I_{CN}$  - Inverter rated output current, A

$I_M$  - Motor rated current of frequency power, A

$n$  – Motor number of inverter driven

## C.2 Renewable Energy Treatment

The lifting and horizontal movement mechanism drive potential load running down or horizontally as emergency deceleration or downwind. Then motor works in regenerative state. Inverter transfer mechanical energy to electrical energy and feed back to DC circuit. The voltage of capacity of DC bus rose. If no necessary measures, when the voltage rises to protection limit and trip over voltage.

There are two schemes to deal with continuous renewable energy in high-performance engineering inverter.

① Dissipate the energy by resistor connecting to DC circuit

This way is called dynamic brake;

② Use renewable rectifier way to return regenerative energy to mains. This way is called regenerative braking.

Please refer to DBU and RBU manual for specific parameters and instructions.

### C.2.1 Dynamic braking

Dynamic brake is composed of braking unit and braking resistor. Dynamic brake ability depends on permitted power of braking resistor. Renewable power  $P_M$  must meet the condition,  $P_M < P_R$  ( $P_R$  is permitted power of braking resistor). If  $P_M > P_R$ , it is necessary

to reconsider deceleration time and load inertia. The following are ways to calculate PM of brake resistor and RB.

① Calculate renewable energy EM

② Calculate renewable energy to inverter PM

$$PM = E_M/t_0$$

PM- Effective regenerative power during braking, W

EM-Regenerative energy when emergency deceleration and running down, J

t<sub>0</sub>-Braking cycle time, S

③ Select appropriate braking unit and braking resistor

Select appropriate braking unit and braking resistor; the following conditions must be met:

$$P_M < P_R \ \& \ P_M < P_{DB}$$

PM - Effective regenerative power during braking, W

PR - Power permission of resistor, W

P<sub>DB</sub> - Power permission of braking unit, W

If PM > PR, it is necessary to reconsider deceleration time and load inertia.

④ Braking resistors calculation R<sub>B0</sub>

Internal motor consumption can get about 20% braking torque in regeneration, even braking resistor is not set. R<sub>B0</sub> can be calculated by following formula:

$$R_{B0} = V_C^2 / 1.027 (T_B - 0.2T_M) n_1$$

V<sub>C</sub> - Voltage of DC circuit (about 700V), V

T<sub>B</sub> - Braking torque, kg • m

T<sub>M</sub> - Rated torque, kg • m

n<sub>1</sub> - Speed when motor begins to slow down, rpm

Discharge circuit of dynamic braking is composed of braking unit and braking resistor, the maximum current is limited by maximum allowable current of braking transistor, the minimum allowable value of braking resistor is R<sub>MIN</sub> = V<sub>C</sub>/I<sub>C</sub>. Braking resistor should meet the following conditions:

$$R_{MIN} < R_B < R_{B0}$$

The selection above is based on accurate calculation, if accurate data can not be achieved in actual engineering calculation, the selection can also based on the following empirical formula:

① Regenerative power P<sub>M</sub> of lifting mechanism

$$PM = Pb \times \eta_{total}$$

$$Pb = m \times g \times v$$

$$\eta_{total} = \eta_{mec} \times \eta_{mot} \times 0.98$$

Pb- Regenerative power

m- Lifting weight

v- Lifting speed

$\eta_{mec}$ - Mechanical efficiency

$\eta_{mot}$ - Motor efficiency

② Approximate calculation of braking resistors  $R_{B0}$

$$R_{B0} = V_C^2 / PM$$

Horizontal movement mechanism is belong to friction load, braking unit and braking resistor can be set according to standard configuration of inverter (see table as below).

| Inverter capacity<br>kW (HP) | Brake unit     |           | Brake resistor<br>(100% brake torque, 10% usage) |                        |        |
|------------------------------|----------------|-----------|--|------------------------|--------|
|                              | Specifications | Number    | Equivalent brake resistor                        | Equivalent brake power | Number |
| CHV190-018G-4                | DBU-055-4      | 1         | 20Ω  | 6000W                  | 1      |
| CHV190-022G-4                |                | 1         | 20Ω  | 6000W                  | 1      |
| CHV190-030G-4                |                | 1         | 20Ω  | 6000W                  | 1      |
| CHV190-037G-4                |                | 1         | 13.6Ω  | 9600W                  | 1      |
| CHV190-045G-4                |                | 1         | 13.6Ω  | 9600W                  | 1      |
| CHV190-055G-4                |                | 1         | 13.6Ω  | 9600W                  | 1      |
| CHV190-075G-4                |                | 2         | 13.6Ω  | 9600W                  | 2      |
| CHV190-090G-4                |                | 2         | 13.6Ω  | 9600W                  | 2      |
| CHV190-110G-4                |                | 2         | 13.6Ω  | 9600W                  | 2      |
| CHV190-132G-4                |                | DBU-160-4 | 1  | 4Ω                     | 30000W |
| CHV190-160G-4                | 1              |           | 4Ω   | 30000W                 | 1      |
| CHV190-185G-4                | DBU-220-4      | 1         | 3Ω   | 40000W                 | 1      |
| CHV190-200G-4                |                | 1         | 3Ω   | 40000W                 | 1      |
| CHV190-220G-4                |                | 1         | 3Ω   | 40000W                 | 1      |
| CHV190-250G-4                | DBU-315-4      | 1         | 2Ω   | 60000W                 | 1      |
| CHV190-280G-4                |                | 1         | 2Ω   | 60000W                 | 1      |
| CHV190-315G-4                |                | 1         | 2Ω   | 60000W                 | 1      |
| CHV190-350G-4                | DBU-220-4      | 2         | 3Ω   | 40000W                 | 2      |
| CHV190-400G-4                |                | 2         | 3Ω   | 40000W                 | 2      |
| CHV190-500G-4                | DBU-315-4      | 2         | 2Ω   | 60000W                 | 2      |

### **C.2.2 Regenerative braking**

In order to return renewable power generative energy to grid, mains-side converter should be reversible. Mains-side converter of INVT's RBU has the same structure as inverter by adopting voltage detecting board with PWM control mode, which can control amplitude; phase of main-side voltage to make sure that the phase of AC input current is the same as voltage like sine waveform. The power factor is greater than 0.9, regenerative braking has 100% feedback capability to grid without auto-transformer.

### **C.2.3 Choices of renewable energy treatment**

Dynamic braking control has the advantages of simple control, low cost, but energy-saving effect is not as good as regenerative braking.

**Notice: Regenerative braking can be used only under stable grid voltage.**

For sliding contact line powered cranes, we recommend using dynamic braking for reliability.

## APPENDIX D RELATIVE DIMENSION OF INVERTER

### D.1 External Dimension

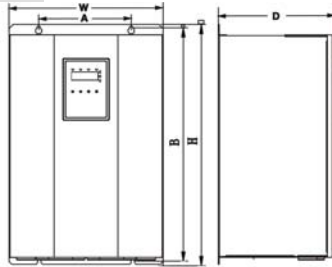


Figure D.1 Dimensions (18.5kW~110kW)

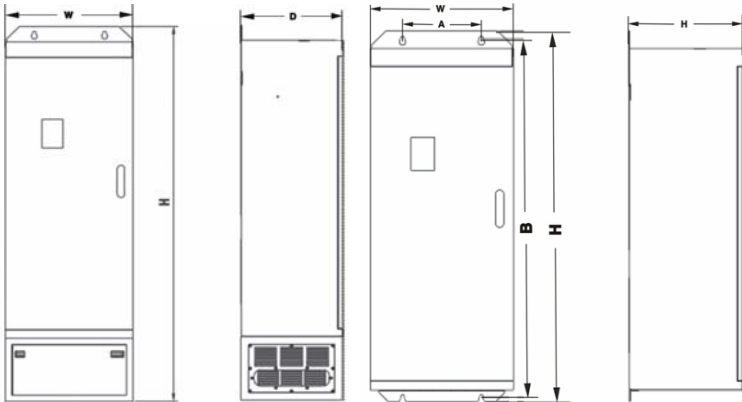


Figure D.2 Dimensions (132 kW~315kW)

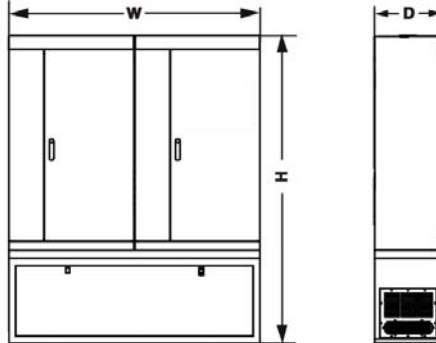


Figure D.3 Dimensions (350kW~500kW)

| Power (kW) | Size             | A (mm)                 | B (mm) | H (mm)             | W (mm) | D (mm) | Installation hole (mm) |
|------------|------------------|------------------------|--------|--------------------|--------|--------|------------------------|
|            |                  | Installation Dimension |        | External Dimension |        |        |                        |
| 18.5~30    | E                | 176                    | 454.5  | 467                | 290    | 215    | 6.5                    |
| 37~55      | F                | 230.0                  | 564.5  | 577.0              | 375.0  | 270.0  | 7.0                    |
| 75~110     | G                | 320.0                  | 738.5  | 755.0              | 460.0  | 330.0  | 9.0                    |
| 132~185    | H (without base) | 270                    | 1233   | 1275               | 490    | 391    | 13                     |
|            | H (with base)    | —                      | —      | 1490               | 490    | 391    | —                      |
| 200~315    | I (without base) | 500                    | 1324   | 1358               | 750    | 402    | 12.5                   |
|            | I (with base)    | —                      | —      | 1670               | 750    | 402    | —                      |
| 350~500    | —                | —                      | —      | 1950               | 1200   | 502    | —                      |

## D.2 Dimensions of External Keypad

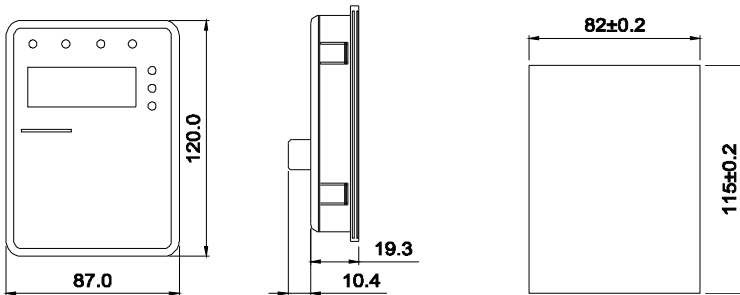


Figure D.4 Dimension of keypad

### D.3 Installation Space

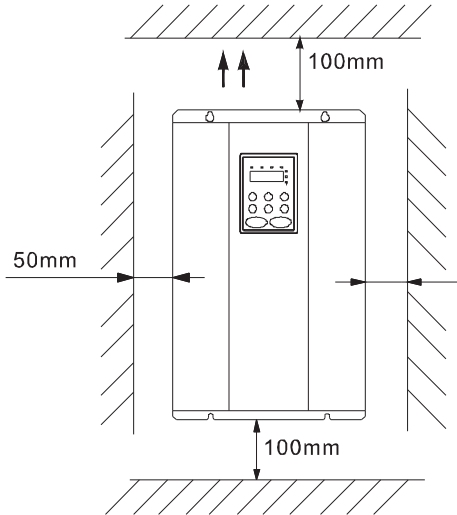


Figure D.5 Safety space

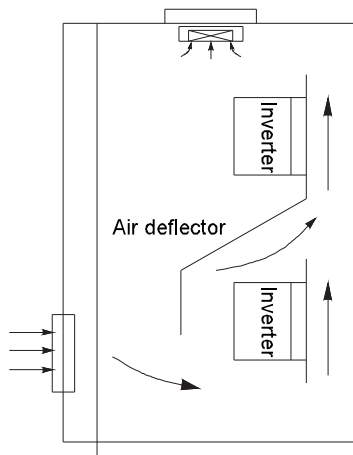


Figure D.6 Installation of multiple inverters

**Notice: Add the air deflector when apply the up-down installation.**

### D.4 Disassembly

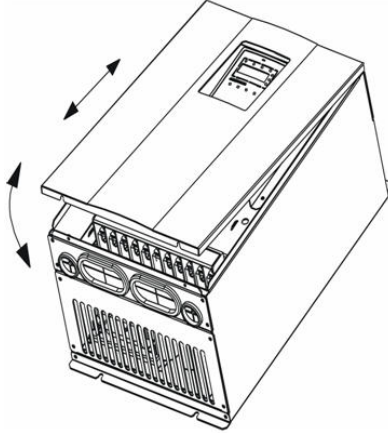


Figure D.7 Disassembly of metal plate cover

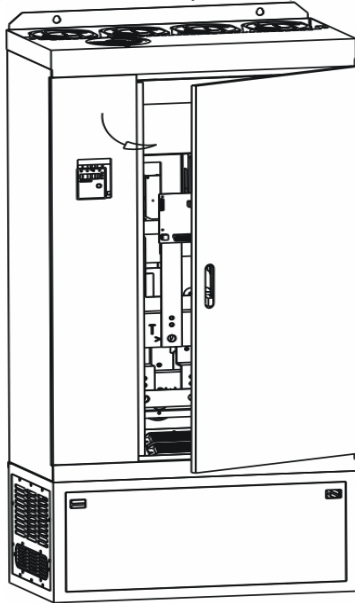


Figure D.8 Open inverter cabinet

## APPENDIX E SPECIFICATIONS OF ACCESSORIES

### E.1 Specifications of Breaker, Cable, Contactor and Reactor

#### E.1.1 Specifications of breaker, cable and contactor

| Model No.     | Circuit breaker (A) | Input/Output cable<br>(mm <sup>2</sup> )<br>(Copper wire) | Rated current of<br>contactor (A)<br>(380V or 220V) |
|---------------|---------------------|---|---|
| CHV190-018G-4 | 100                 | 10  | 63  |
| CHV190-022G-4 | 100                 | 16  | 80  |
| CHV190-030G-4 | 125                 | 25  | 95  |
| CHV190-037G-4 | 160                 | 25  | 120   |
| CHV190-045G-4 | 200                 | 35  | 135   |
| CHV190-055G-4 | 200                 | 35  | 170   |
| CHV190-075G-4 | 250                 | 70  | 230   |
| CHV190-090G-4 | 315                 | 70  | 280   |
| CHV190-110G-4 | 400                 | 95  | 315   |
| CHV190-132G-4 | 400                 | 150   | 380   |
| CHV190-160G-4 | 630                 | 185   | 450   |
| CHV190-185G-4 | 630                 | 185   | 500   |
| CHV190-200G-4 | 630                 | 240   | 580   |
| CHV190-220G-4 | 800                 | 150x2   | 630   |
| CHV190-250G-4 | 800                 | 150x2   | 700   |
| CHV190-280G-4 | 1000                | 185x2   | 780   |
| CHV190-315G-4 | 1200                | 240x2   | 900   |
| CHV190-350G-4 | 1280                | 240x2   | 960   |
| CHV190-400G-4 | 1380                | 185x3   | 1035  |
| CHV190-500G-4 | 1720                | 185x3   | 1290  |

#### E.1.2 Specifications of AC input/output and DC reactor

| Model No.     | AC input reactor |                    | AC output reactor |                | DC reactor         |                |
|---------------|------------------|--------------------|-------------------|----------------|--------------------|----------------|
|               | Current<br>(A)   | Inductance<br>(mH) | Current<br>(A)    | Current<br>(A) | Inductance<br>(mH) | Current<br>(A) |
| CHV190-018G-4 | 50               | 0.35               | 50                | 0.052          | 40                 | 1.3            |

| Model No.     | AC input reactor |                 | AC output reactor |             | DC reactor      |             |
|---------------|------------------|-----------------|-------------------|-------------|-----------------|-------------|
|               | Current (A)      | Inductance (mH) | Current (A)       | Current (A) | Inductance (mH) | Current (A) |
| CHV190-022-4  | 60               | 0.28            | 60                | 0.045       | 50              | 1.08        |
| CHV190-030-4  | 80               | 0.19            | 80                | 0.032       | 65              | 0.8         |
| CHV190-037G-4 | 90               | 0.16            | 90                | 0.030       | 78              | 0.7         |
| CHV190-045G-4 | 120              | 0.13            | 120               | 0.023       | 95              | 0.54        |
| CHV190-055G-4 | 150              | 0.10            | 150               | 0.019       | 115             | 0.45        |
| CHV190-075G-4 | 200              | 0.12            | 200               | 0.014       | 160             | 0.36        |
| CHV190-090G-4 | 250              | 0.06            | 250               | 0.011       | 180             | 0.33        |
| CHV190-110G-4 | 250              | 0.06            | 250               | 0.011       | 250             | 0.26        |
| CHV190-132G-4 | 290              | 0.04            | 290               | 0.008       | 250             | 0.26        |
| CHV190-160G-4 | 330              | 0.04            | 330               | 0.008       | 340             | 0.18        |
| CHV190-185G-4 | 400              | 0.04            | 400               | 0.005       | 460             | 0.12        |
| CHV190-200G-4 | 490              | 0.03            | 490               | 0.004       | 460             | 0.12        |
| CHV190-220G-4 | 490              | 0.03            | 490               | 0.004       | 460             | 0.12        |
| CHV190-250G-4 | 530              | 0.03            | 530               | 0.003       | 650             | 0.11        |
| CHV190-280G-4 | 600              | 0.02            | 600               | 0.003       | 650             | 0.11        |
| CHV190-315G-4 | 660              | 0.02            | 660               | 0.009       | 660             | 0.009       |
| CHV190-350G-4 | 400*2            | 0.03            | 400*2             | 0.022       | 400*2           | 0.12        |
| CHV190-400G-4 | 490*2            | 0.03            | 490*2             | 0.004       | 460*2           | 0.12        |
| CHV190-500G-4 | 530*2            | 0.03            | 530*2             | 0.003       | 650*2           | 0.11        |

**Notice: The CHV190-018G-4 ~ CHV190-090G-4 are using the DC reactor inside.**

### E.1.3 Specification of input filter and output filter

| Model No      | Input filter model | Output filter model |
|---------------|--------------------|---------------------|
| CHV190-018G-4 | NFI-050            | NFO-050             |
| CHV190-022-4  | NFI-050            | NFO-050             |
| CHV190-030-4  | NFI-065            | NFO-065             |
| CHV190-037G-4 | NFI-080            | NFO-080             |
| CHV190-045G-4 | NFI-100            | NFO-100             |
| CHV190-055G-4 | NFI-150            | NFO-150             |
| CHV190-075G-4 | NFI-150            | NFO-150             |
| CHV190-090G-4 | NFI-200            | NFO-200             |

| <b>Model No</b> | <b>Input filter model</b> | <b>Output filter model</b> |
|-----------------|---------------------------|----------------------------|
| CHV190-110G-4   | NFI-250                   | NFO-250                    |
| CHV190-132G-4   | NFI-250                   | NFO-250                    |
| CHV190-160G-4   | NFI-300                   | NFO-300                    |
| CHV190-185G-4   | NFI-400                   | NFO-400                    |
| CHV190-200G-4   | NFI-400                   | NFO-400                    |
| CHV190-220G-4   | NFI-250                   | NFO-600                    |
| CHV190-250G-4   | NFI-600                   | NFO-600                    |
| CHV190-280G-4   | NFI-900                   | NFO-900                    |
| CHV190-315G-4   | NFI-1200                  | NFO-1200                   |
| CHV190-350G-4   | NFI-1200                  | NFO-1200                   |
| CHV190-400G-4   | NFI-1200                  | NFO-1200                   |

## APPENDIX F FUNCTION PARAMETERS

### Notice:

1. PE group is factory reserved, users are forbidden to access these parameters.

2. The column “Modify” determines the parameter can be modified or not.

“○” indicates that this parameter can be modified all the time.

“◎” indicates that this parameter cannot be modified during the inverter is running.

“●” indicates that this parameter is read only.

3. “Factory setting” indicates the value of each parameter while restoring the factory parameters, but those detected parameters or record values cannot be restored.

| Function Code                   | Name                        | Description   | Setting Range | Factory Setting | Modify |
|---------------------------------|-----------------------------|---|---------------|-----------------|--------|
| <b>P0 Group: Basic function</b> |                             |   |               |                 |        |
| P0.00                           | Speed control mode          | 0: Sensorless vector control<br>1: Vector control with PG<br>2: V/F control   | 0~2           | 1               | ◎      |
| P0.01                           | Run command source          | 0: Keypad (LED extinguished)<br>1: Terminal (LED flickering)<br>2: Communication (LED lights on)<br>3. Profibus communication (LED lights on) | 0~3           | 1               | ◎      |
| P0.02                           | Speed instruction selection | 0: Keypad<br>1: AI1<br>2. AI3<br>3: HDI1<br>4: Multi-steps speed<br>5: UP / DOWN terminal   | 0~8           | 0               | ◎      |

| Function Code | Name                        | Description   | Setting Range | Factory Setting | Modify |
|---------------|-----------------------------|---|---------------|-----------------|--------|
|               |                             | 6:Modbus communication<br>7:Profibus communication<br>8:Hierarchical multi-stage speed  |               |                 |        |
| P0.03         | Maximum frequency           | 10.00~400.00Hz  | 10.00~400.00  | 50.00Hz         | ☉      |
| P0.04         | Keypad reference frequency  | 0.00Hz~P0.03  | 0~P0.03       | 50.00Hz         | ○      |
| P0.05         | Running direction selection | 0: Forward<br>1: Reverse<br>2: Forbid reverse   | 0~2           | 0               | ☉      |
| P0.06         | Carrier frequency           | 1.0~16.0kHz   | 1.0~16.0      | Depend on model | ○      |
| P0.07         | Motor parameters autotuning | 0: No action<br>1: Rotation autotuning<br>2: Static autotuning  | 0~2           | 0               | ☉      |
| P0.08         | Reserved                    | 0~65535   | 0~65535       | 0               | ☉      |
| P0.09         | Reserved                    | 0~65535   | 0~65535       | 0               | ☉      |
| P0.10         | Reserved                    | 0~65535   | 0~65535       | 0               | ☉      |
| P0.11         | Application mode selection  | 0: Common application mode<br>1: Operating lever mode<br>2: Remote Mode<br>3: Hierarchical operating lever mode<br>4: Hierarchical remote mode<br>5: Electric potentiometer mode<br>6: Master-slave power equilibrium host mode | 0~9           | 0               | ☉      |

| Function Code                | Name                               | Description   | Setting Range | Factory Setting | Modify |
|------------------------------|------------------------------------|---|---------------|-----------------|--------|
|                              |                                    | 7: Master-slave power equilibrium subordinate mode<br>8: Master-slave speed synchronization host mode<br>9: Master-slave speed synchronization subordinate mode |               |                 |        |
| P0.12                        | Restore parameters                 | 0: No action<br>1: Restore factory setting<br>2: Clear fault records  | 0~2           | 0               | ⊙      |
| <b>P1 Group: Speed curve</b> |                                    |   |               |                 |        |
| P1.00                        | (Multi-segment speed) rating for 0 | -100.0%~100.0%  | -100.0~100.0  | 0.0%            | ⊙      |
| P1.01                        | (Multi-segment speed) rating for 1 | -100.0%~100.0%  | -100.0~100.0  | 0.0%            | ⊙      |
| P1.02                        | (Multi-segment speed) rating for 2 | -100.0%~100.0%  | -100.0~100.0  | 0.0%            | ⊙      |
| P1.03                        | (Multi-segment speed) rating for 3 | -100.0%~100.0%  | -100.0~100.0  | 0.0%            | ⊙      |
| P1.04                        | (Multi-segment speed) rating for 4 | -100.0%~100.0%  | -100.0~100.0  | 0.0%            | ⊙      |
| P1.05                        | (Multi-segment speed) rating for 5 | -100.0%~100.0%  | -100.0~100.0  | 0.0%            | ⊙      |
| P1.06                        | (Multi-segment speed) rating for 6 | -100.0%~100.0%  | -100.0~100.0  | 0.0%            | ⊙      |
| P1.07                        | (Multi-segment speed) rating for 7 | -100.0%~100.0%  | -100.0~100.0  | 0.0%            | ⊙      |
| P1.08                        | Acceleration /Deceleration mode    | 0: Linear<br>1:S curve  | 0~1           | 1               | ⊙      |

| Function Code | Name                                  | Description  | Setting Range | Factory Setting | Modify |
|---------------|---------------------------------------|--------------|---------------|-----------------|--------|
| P1.09         | Linear acceleration time              | 0.0~3600.0s  | 0.0~3600.0    | 20.0s           | ○      |
| P1.10         | Linear deceleration time              | 0.0~3600.0s  | 0.0~3600.0    | 20.0s           | ○      |
| P1.11         | Start section of acceleration S curve | 0.1~50.0%    | 0.1~50.0      | 10.0%           | ◎      |
| P1.12         | End section of acceleration S curve   | 0.1~50.0%    | 0.1~50.0      | 10.0%           | ◎      |
| P1.13         | Start section of deceleration S curve | 0.1~50.0%    | 0.1~50.0      | 10.0%           | ◎      |
| P1.14         | End section of deceleration S curve   | 0.1~50.0%    | 0.1~50.0      | 10.0%           | ◎      |
| P1.15         | Start frequency                       | 0.00~10.00Hz | 0.00~10.00    | 0.00Hz          | ◎      |
| P1.16         | Starting frequency keeping time       | 0.00~5.00s   | 0.00~5.00     | 0.00s           | ◎      |
| P1.17         | Jog run frequency                     | 0.00Hz~P0.03 | 0.00~P0.03    | 5.00Hz          | ◎      |
| P1.18         | Jog acceleration running time         | 0.0~3600.0s  | 0.0~3600.0    | 20.0s           | ◎      |
| P1.19         | Jog deceleration running time         | 0.0~3600.0s  | 0.0~3600.0    | 20.0s           | ◎      |
| P1.20         | Motor autotuning ACC time             | 0.1~3600.0s  | 0.1~3600.0    | 40.0s           | ◎      |
| P1.21         | Motor autotuning DEC time             | 0.1~3600.0s  | 0.1~3600.0    | 40.0s           | ◎      |
| P1.22         | Slowly running frequency              | 0.00Hz~P0.03 | 0.00~P0.03    | 5.00Hz          | ◎      |
| P1.23         | Slow running ACC/DEC time             | 0.0~3600.0s  | 0.0~3600.0    | 20.0s           | ◎      |

| Function Code                     | Name                               | Description                                       | Setting Range | Factory Setting | Modify |
|-----------------------------------|------------------------------------|---|---------------|-----------------|--------|
| P1.24                             | Forced deceleration time           | 0.0~3600.0s                                       | 0.0~3600.0    | 2.0s            | ☉      |
| P1.25                             | Stop mode                          | 0: Deceleration to stop<br>1: Coast to stop       | 0~1           | 0               | ○      |
| P1.26                             | Subsidiary motor acceleration time | 0.0~3600.0s                                       | 0.0~3600.0    | 1.0s            | ○      |
| P1.27                             | Subsidiary motor deceleration time | 0.0~3600.0s                                       | 0.0~3600.0    | 1.0s            | ○      |
| P1.28                             | Reserved                           | 0~65535   | 0~65535       | 0               | ☉      |
| P1.29                             | Reserved                           | 0~65535   | 0~65535       | 0               | ☉      |
| <b>P2 Group: Motor parameters</b> |                                    |   |               |                 |        |
| P2.00                             | Inverter model                     | 0: Asynchronous machine<br>1: Synchronous machine | 0~1           | 0               | ☉      |
| P2.01                             | Motor rated power                  | 0.4~900.0kW                                       | 0.4~900.0     | Depend on model | ☉      |
| P2.02                             | Motor rated frequency              | 0.01Hz~P0.03                                      | 0.01~P0.03    | 50.00Hz         | ☉      |
| P2.03                             | Motor rated speed                  | 1~36000rpm  | 1~36000       | 1460rpm         | ☉      |
| P2.04                             | Motor rated voltage                | 0~500V  | 0~500         | 380V            | ☉      |
| P2.05                             | Motor rated current                | 0.1~2000.0A                                       | 0.1~2000.0    | Depend on model | ☉      |
| P2.06                             | Motor power factor                 | 0.05~1.00   | 0.05~1.00     | 0.86            | ☉      |
| P2.07                             | Motor stator resistance            | 0.001~65.535Ω                                     | 0.001~65.535  | Depend on model | ○      |
| P2.08                             | Motor rotor resistance             | 0.001~65.535Ω                                     | 0.001~65.535  | Depend on model | ○      |
| P2.09                             | Motor leakage inductance           | 0.1~6553.5mH                                      | 0.1~6553.5    | Depend on model | ○      |
| P2.10                             | Motor mutual inductance            | 0.1~6553.5mH                                      | 0.1~6553.5    | Depend on model | ○      |

| Function Code                   | Name   | Description  | Setting Range | Factory Setting | Modify |
|---------------------------------|--|--------------|---------------|-----------------|--------|
| P2.11                           | Current without load                             | 0.01~655.35A | 0.01~655.35   | Depend on model | ○      |
| P2.12                           | Magnetic pole initial position                   | 0.00~360.00  | 0.00~360.00   | 0.00            | ◎      |
| P2.13                           | Magnetic pole position amplitude gain            | 0.50~1.50    | 0.50~1.50     | 1               | ◎      |
| P2.14                           | C-phase magnetic pole position bias              | 0~9999       | 0~9999        | 433             | ◎      |
| P2.15                           | D-phase magnetic pole position bias              | 0~9999       | 0~9999        | 433             | ◎      |
| P2.16                           | Motor weak magnetic coefficient                  | 0.1~2.0      | 0.1~2.0       | 1.0             | ◎      |
| P2.17                           | Motor minimum weak magnetic limitation           | 10.0~80.0%   | 10.0~80.0     | 50.0            | ◎      |
| P2.18                           | Weak magnetic proportion                         | 0~65535      | 0~65535       | 0               | ◎      |
| P2.19                           | Low-frequency oscillation suppression tolerance  | 0~10         | 0~10          | 2               | ◎      |
| P2.20                           | High-frequency oscillation suppression tolerance | 0~10         | 0~10          | 0               | ◎      |
| P2.21                           | Motor output maximum voltage                     | P2.04~550    | P2.04~550     | 380             | ◎      |
| P2.22                           | Reserved   | 0~65535      | 0~65535       | 0               | ◎      |
| <b>P3 Group: Vector control</b> |  |              |               |                 |        |
| P3.00                           | ASR low-speed proportional gain                  | 0~100        | 0~100         | 20              | ○      |

| Function Code | Name  | Description   | Setting Range | Factory Setting | Modify |
|---------------|---|---|---------------|-----------------|--------|
| P3.01         | ASR low-speed integral time                 | 0.01~10.00s   | 0.01~10.00    | 0.50s           | ○      |
| P3.02         | Speed detection low-speed filter time       | 0.000~1.000s  | 0.000~1.000   | 0.000s          | ○      |
| P3.03         | Low switching frequency                     | 0.00Hz~P3.07  | 0.00~P3.07    | 5.00Hz          | ○      |
| P3.04         | ASR high-speed proportional gain            | 0~100   | 0~100         | 25              | ○      |
| P3.05         | ASR low-speed integral time                 | 0.01~10.00s   | 0.01~10.00    | 1.00            | ○      |
| P3.06         | Speed detection high-speed filter time      | 0.000~1.000s  | 0.000~1.000   | 0.000s          | ○      |
| P3.07         | High switching frequency                    | P3.03~P0.03   | P3.03~P0.03   | 10.00Hz         | ○      |
| P3.08         | ACR proportional gain P                     | 0~65535   | 0~65535       | 500             | ○      |
| P3.09         | ACR integral gain I                         | 0~65535   | 0~65535       | 500             | ○      |
| P3.10         | Driver side slip compensation coefficients  | 50%~200%  | 50~200        | 100%            | ○      |
| P3.11         | Braking side slip compensation coefficients | 50%~200%  | 50~200        | 100%            | ○      |
| P3.12         | Torque setting source                       | 0: Disabled<br>1: Keypad<br>2: AI1<br>3: AI2<br>4: 485 communication<br>5: Profibus communication | 0~7           | 0               | ◎      |

| Function Code | Name  | Description   | Setting Range | Factory Setting | Modify |
|---------------|---|---|---------------|-----------------|--------|
|               |   | 6: HDI<br>7: Subsidiary machine inside setting  |               |                 |        |
| P3.13         | Keypad torque setting   | -100.0%~100.0%  | -100.0~100.0  | 50.0%           | ○      |
| P3.14         | Torque limit  | 0.0~200.0% (Rated current of inverter)  | 0.0~200.0     | 150.0%          | ○      |
| P3.15         | Torque limit method selection                                 | 0: Keypad<br>1: Profibus  | 0~1           | 0               | ◎      |
| P3.16         | Torque control prohibition access selection                   | 0: Torque control ban is invalid<br>1: Terminal torque control prohibition is effective<br>2: Profibus torque control prohibition is effective<br>3: Both control are valid | 0~3           | 0               | ◎      |
| P3.17         | Forward torque upper frequency limit                          | 0.00~P0.03  | 0.00~P0.03    | 50.00Hz         | ○      |
| P3.18         | Forward torque maximum frequency limitation setting selection | 0: Keypad<br>1: AI1<br>2: AI2<br>3: HDI<br>4: 485 communications<br>5: Profibus communication   | 0~5           | 0               | ◎      |
| P3.19         | Reverse torque maximum frequency limitation                   | 0.00~P0.03  | 0.00~P0.03    | 50.00Hz         | ○      |
| P3.20         | Reverse torque  | 0: Keypad   | 0~5           | 0               | ◎      |

| Function Code            | Name  | Description  | Setting Range | Factory Setting | Modify |
|--------------------------|---|--|---------------|-----------------|--------|
|                          | maximum frequency limitation setting selection          | 1: AI1<br>2: AI2<br>3: HDI<br>4: 485 communications<br>5: Profibus communication |               |                 |        |
| P3.21                    | Proportional coefficient of high frequency current loop | 0~65535  | 0~65535       | 1000            | ○      |
| P3.22                    | Integral coefficient of high frequency current loop     | 0~65535  | 0~65535       | 500             | ○      |
| P3.23                    | Torque boost  | 0.0~10.0   | 0.0~10.0      | 0.0%            | ◎      |
| P3.24                    | Torque boost upper limited frequency                    | 0.0~50.0%  | 0.0~50.0%     | 20.0%           | ◎      |
| <b>P4 Group: Encoder</b> |   |  |               |                 |        |
| P4.00                    | Encoder type  | 0: Incremental encoder<br>1: SIN / COS Encoder<br>2: UVW encoder                 | 0~2           | 0               | ◎      |
| P4.01                    | Encoder pulse   | 1~65535  | 1~65535       | 1000            | ◎      |
| P4.02                    | Encoder direction                                       | 0: Forward<br>1: Reverse   | 0~1           | 0               | ◎      |
| P4.03                    | Low-speed, encoder disconnection detection time         | 0.1~100.0s   | 0.0~100.0     | 1.0             | ◎      |
| P4.04                    | High-speed, encoder disconnection detection time        | 0.1~100.0s   | 0.0~100.0     | 1.0             | ◎      |
| P4.05                    | Encoder reverse   | 0.1~100.0s   | 0.0~100.0     | 1.0             | ◎      |

| Function Code                    | Name                                  | Description   | Setting Range | Factory Setting | Modify |
|----------------------------------|---------------------------------------|---|---------------|-----------------|--------|
|                                  | detection time                        |   |               |                 |        |
| P4.06                            | Position calculator conversion factor | 10.0~6553.5   | 10.0~6553.5   | 10.0            | ⊙      |
| P4.07                            | Reserved                              | 0~65535   | 0~65535       | 0               | ⊙      |
| P4.08                            | Reserved                              | 0~65535   | 0~65535       | 0               | ⊙      |
| <b>P5 Group: Input terminals</b> |                                       |   |               |                 |        |
| P5.00                            | HDI selection                         | 0: HDI high speed pulse input.<br>1: HDI switch input.          | 0~1           | 0               | ⊙      |
| P5.01                            | S4, S5 Input type selection           | 0: ON/OFF<br>1: Master-slave synchronization counter            | 0~1           | 0               | ⊙      |
| P5.02                            | S1 terminal function                  | 0: Invalid<br>1: Forward  | 0~40          | 1               | ⊙      |
| P5.03                            | S2 terminal function                  | 2: Reverse<br>3: Jog running                                    | 0~40          | 2               | ⊙      |
| P5.04                            | S3 terminal function                  | 4: Low-speed running signal                                     | 0~40          | 6               | ⊙      |
| P5.05                            | S4 terminal function                  | 5: Coast to stop<br>6: Reset fault                              | 0~40          | 0               | ⊙      |
| P5.06                            | S5 terminal function                  | 7: External fault input<br>8: Multi-step speed terminal 1 (MS1) | 0~40          | 0               | ⊙      |
| P5.07                            | HDI1 terminal function                | 9: Multi-step speed terminal 2 (MS2)                            | 0~40          | 0               | ⊙      |
| P5.08                            | S7 terminal function                  | 10: Multi-step speed terminal3 (MS3)                            | 0~40          | 0               | ⊙      |
| P5.09                            | S8 terminal function                  | 11: Contactor feedback signal (TB)                              | 0~40          | 0               | ⊙      |
| P5.10                            | S9 terminal function                  | 12: Brake feedback signal (FB)                                  | 0~40          | 0               | ⊙      |
| P5.11                            | S10 terminal function                 | 13: Inverter enable (ENA)                                       | 0~40          | 0               | ⊙      |

| Function Code | Name                 | Description  | Setting Range | Factory Setting | Modify |
|---------------|----------------------|--|---------------|-----------------|--------|
|               |                      | 14: Motor switch (MEX)<br>15: Forced deceleration (FS)<br>16: Torque control prohibition<br>17: Motor excitation running<br>18: Fast stop (FS)<br>19: Master-slave synchronization enabled<br>20: Master-slave synchronization count reset<br>21: Light-load acceleration enable<br>22: Up command<br>23: DOWN command<br>24: Zero position signal<br>25: Classification given terminal 1<br>26: Classification given terminal 2<br>27: Classification given terminal 3<br>28: Classification given terminal 4<br>29: Classification given terminal 5<br>30~40: Reserved |               |                 |        |
| P5.12         | Input mode selection | 0~0x3FF  | 0~0x3FF       | 0x000           | ☉      |
| P5.13         | Input selection      | 0: Concrete.<br>1: Virtual.  | 0~1           | 0               | ☉      |

| Function Code | Name                                   | Description    | Setting Range | Factory Setting | Modify |
|---------------|--|----------------|---------------|-----------------|--------|
| P5.14         | ON-OFF filter times                    | 1~10           | 1~10          | 5               | ○      |
| P5.15         | AI1 lower limit                        | 0.00V~10.00V   | 0.00~10.00    | 0.00V           | ○      |
| P5.16         | AI1 lower limit corresponding setting  | -100.0%~100.0% | -100.0~100.0  | 0.0%            | ○      |
| P5.17         | AI1 upper limit                        | 0.00V~10.00V   | 0.00V~10.00   | 10.00V          | ○      |
| P5.18         | AI1 upper limit corresponding setting  | -100.0%~100.0% | -100.0~100.0  | 100.0%          | ○      |
| P5.19         | AI1 filter time constant               | 0.00s~10.00s   | 0.00~10.00    | 0.10s           | ○      |
| P5.20         | AI2 lower limit                        | 0.00V~10.00V   | 0.00~10.00    | 0.00V           | ○      |
| P5.21         | AI2 lower limit corresponding setting  | -100.0%~100.0% | -100.0~100.0  | 0.0%            | ○      |
| P5.22         | AI2 upper limit                        | 0.00V~10.00V   | 0.00~10.00    | 5.00V           | ○      |
| P5.23         | AI2 upper limit corresponding setting  | -100.0%~100.0% | -100.0~100.0  | 100.0%          | ○      |
| P5.24         | AI2 filter time constant               | 0.00s~10.00s   | 0.00~10.00    | 0.10s           | ○      |
| P5.25         | HDI1 lower limit                       | 0Hz~50.0kHz    | 0~50.0        | 0.0kHz          | ○      |
| P5.26         | HDI1 lower limit corresponding setting | -100.0%~100.0% | -100.0~100.0  | 0.0%            | ○      |
| P5.27         | HDI1 upper limit                       | 0Hz~50.0kHz    | 0~50.0        | 50.0kHz         | ○      |
| P5.28         | HDI1 upper limit corresponding setting | -100.0%~100.0% | -100.0~100.0  | 100.0%          | ○      |
| P5.29         | HDI1 filter time constant              | 0.00s~10.00s   | 0.00~10.00    | 0.10s           | ○      |
| P5.30         | Reserved                               | 0~65535        | 0~65535       | 0               | ◎      |

| Function Code                     | Name                        | Description  | Setting Range | Factory Setting | Modify |
|-----------------------------------|-----------------------------|--|---------------|-----------------|--------|
| P5.31                             | Reserved                    | 0~65535  | 0~65535       | 0               | ⊙      |
| P5.32                             | Reserved                    | 0~65535  | 0~65535       | 0               | ⊙      |
| P5.33                             | Reserved                    | 0~65535  | 0~65535       | 0               | ⊙      |
| P5.34                             | Reserved                    | 0~65535  | 0~65535       | 0               | ⊙      |
| P5.35                             | Reserved                    | 0~65535  | 0~65535       | 0               | ⊙      |
| <b>P6 Group: Output terminals</b> |                             |  |               |                 |        |
| P6.00                             | HDO selection               | 0: High-speed pulse output<br>1: ON-OFF output   | 0~1           | 0               | ⊙      |
| P6.01                             | Y1 output selection         | 0: No output<br>1: Motor running   | 0~20          | 1               | ○      |
| P6.02                             | Y2 output selection         | 2: Up running (UR)<br>3: Down running (DR)   | 0~20          | 0               | ○      |
| P6.03                             | HDO ON-OFF output selection | 4: Fault output<br>5: Zero speed running   | 0~20          | 0               | ○      |
| P6.04                             | Relay 1 output selection    | 6: Ready<br>7: Brake control   | 0~20          | 4               | ○      |
| P6.05                             | Relay 2 output selection    | 8: Contactor control<br>9: Frequency reached   | 0~20          | 5               | ○      |
| P6.06                             | Relay 3 output selection    | 10: FDT reached<br>11: Motor running1 (LR1)<br>12: Closing output (FO)<br>13: Motor switching output<br>14: Motor excitation<br>15: Motor excitation completion output<br>16: Sling loose alarm output<br>17: High-speed signal output<br>18: Motor over temperature alarm | 0~20          | 0               | ○      |

| Function Code | Name                                 | Description  | Setting Range | Factory Setting | Modify                |
|---------------|--------------------------------------|--|---------------|-----------------|-----------------------|
|               |                                      | output<br>19~20: Reserved  |               |                 |                       |
| P6.07         | AO1 function selection               | 0: Running frequency<br>1: Reference frequency   | 0~14          | 0               | <input type="radio"/> |
| P6.08         | AO2 function selection               | 2: Slope given frequency<br>3: Reserved  | 0~14          | 1               | <input type="radio"/> |
| P6.09         | HDO function selection               | 4: Output current<br>5: Output voltage<br>6: Output power<br>7: Running torque<br>8: Output torque<br>9: AI1<br>10: AI2<br>11: HDI1<br>12~14: Reserved | 0~14          | 0               | <input type="radio"/> |
| P6.10         | AO1 lower limit                      | 0.0%~100.0%  | 0.0~100.0     | 0.0%            | <input type="radio"/> |
| P6.11         | AO1 lower limit corresponding output | 0.00V ~10.00V  | 0.00~10.00    | 0.00V           | <input type="radio"/> |
| P6.12         | AO1 upper limit                      | 0.0%~100.0%  | 0.0~100.0     | 100.0%          | <input type="radio"/> |
| P6.13         | AO1 upper limit corresponding output | 0.00V ~10.00V  | 0.00~10.00    | 10.00V          | <input type="radio"/> |
| P6.14         | AO2 lower limit                      | 0.0%~100.0%  | 0.0~100.0     | 0.0%            | <input type="radio"/> |
| P6.15         | AO2 lower limit corresponding output | 0.00V ~10.00V  | 0.00~10.00    | 0.00V           | <input type="radio"/> |
| P6.16         | AO2 upper limit                      | 0.0%~100.0%  | 0.0~100.0     | 100.0%          | <input type="radio"/> |
| P6.17         | AO2 upper limit corresponding output | 0.00V ~10.00V  | 0.00~10.00    | 10.00V          | <input type="radio"/> |
| P6.18         | HDO lower limit                      | 0.0%~100.0%  | 0.0~100.0     | 0.0%            | <input type="radio"/> |
| P6.19         | HDO lower limit                      | 0.0 ~ 50.0kHz  | 0.0~50.0      | 0.0kHz          | <input type="radio"/> |

| Function Code                      | Name                                   | Description  | Setting Range | Factory Setting | Modify |
|------------------------------------|--|--|---------------|-----------------|--------|
|                                    | corresponding output                   |  |               |                 |        |
| P6.20                              | HDO upper limit                        | 0.0%~100.0%  | 0.0~100.0     | 100.0%          | ○      |
| P6.21                              | HDO upper limit corresponding output   | 0.0 ~ 50.0kHz  | 0.0~50.0      | 50.0kHz         | ○      |
| P6.22                              | FDT level                              | 0.00~ P0.03  | 0.00~ P0.03   | 50.00Hz         | ○      |
| P6.23                              | FDT lag                                | 0.0~100.0%   | 0.0~100.0     | 5.0%            | ○      |
| P6.24                              | Frequency arrive detecting range       | 0.0~100.0%   | 0.0~100.0     | 0.0%            | ○      |
| P6.25                              | Reserved                               | 0~65535  | 0~65535       | 0               | ◎      |
| P6.26                              | Reserved                               | 0~65535  | 0~65535       | 0               | ◎      |
| <b>P7 Group: Display interface</b> |  |  |               |                 |        |
| P7.00                              | User password                          | 0~65535  | 0~65535       | 0               | ○      |
| P7.01                              | Reserved                               | 0~1  | 0~1           | 0               | ○      |
| P7.02                              | Reserved                               | 0~1  | 0~1           | 0               | ◎      |
| P7.03                              | <b>QUICK/JOG</b><br>function selection | 1: Jog<br>2: FDW/REV switching   | 0~1           | 0               | ◎      |
| P7.04                              | <b>STOP/RST</b><br>function selection  | 0: Valid when keypad control (P0.01=0)<br>1: Valid when keypad or terminal control (P0.01=0 or 1)<br>2: Valid when keypad or communication control (P0.01=0 or 2)<br>3: Always valid | 0~3           | 0               | ○      |
| P7.05                              | Motor temperature                      | -200.0~200.0℃  | -200.0~200.0  | 0.0℃            | ●      |
| P7.06                              | Running status display selection       | 1. Output frequency<br>2. Reference frequency<br>3. DC bus voltage<br>4. Output voltage<br>5. Output current   | 0~0xFFFF      | 0x0003          | ○      |

| Function Code | Name                          | Description   | Setting Range     | Factory Setting | Modify |
|---------------|-------------------------------|---|-------------------|-----------------|--------|
|               |                               | Other parameters display is determined by 16 bit binary digit<br>BIT0: Rotation speed<br>BIT1: Output power<br>BIT2: Output torque<br>BIT3: Input terminal status<br>BIT4: Output terminal status<br>BIT5: AI1<br>BIT6: AI2<br>BIT7: HDI frequency<br>BIT8: Torque Compensation<br>BIT9: Magnetic pole position<br>BIT10: Reserved<br>BIT11: Reserved<br>BIT12: Reserved<br>BIT13: Reserved<br>BIT14: Reserved<br>BIT15: Reserved |                   |                 |        |
| P7.07         | Stop status display selection | BIT0: Reference frequency<br>BIT1: Fault code<br>BIT2: DC bus voltage<br>BIT3: Input terminal status<br>BIT4: Output terminal status<br>BIT5: Motor pole pairs  | 0x0001~0xFF<br>FF | 0x00FF          | ○      |

| Function Code | Name                         | Description   | Setting Range | Factory Setting | Modify |
|---------------|------------------------------|---|---------------|-----------------|--------|
|               |                              | BIT6: AI1<br>BIT7: AI2<br>BIT8: HDI frequency<br>BIT9: Reserved<br>BIT10: Reserved<br>BIT11: Reserved<br>BIT12: Reserved<br>BIT13: Reserved<br>BIT14: Reserved<br>BIT15: Reserved |               |                 |        |
| P7.08         | Rectifier module temperature | 0~150.0℃  |               |                 | ●      |
| P7.09         | IGBT module temperature      | 0~150.0℃  |               |                 | ●      |
| P7.10         | MCU software version         | Factory setting   |               |                 | ●      |
| P7.11         | DSP software version         | Factory setting   |               |                 | ●      |
| P7.12         | Accumulated running time     | 0~65535h  |               |                 | ●      |
| P7.13         | Third latest fault type      | 0: Not fault<br>1: IGBT Ph-U fault  |               |                 | ●      |
| P7.14         | Second latest fault type     | (OUT1)<br>2: IGBT Ph-V fault  |               |                 | ●      |
| P7.15         | Latest fault type            | (OUT2)<br>3: IGBT Ph-W fault<br>(OUT3)<br>4: Over-current when Acceleration (OC1)<br>5: Over-current when Deceleration (OC2)<br>6: Over-current when constant speed running       |               |                 | ●      |

| Function Code | Name | Description   | Setting Range | Factory Setting | Modify |
|---------------|------|---|---------------|-----------------|--------|
|               |      | (OC3)<br>7: Over-voltage when Acceleration (OV1)<br>8: Over-voltage when Deceleration (OV2)<br>9: Over-voltage when constant speed running (OV3)<br>10: DC bus Under-voltage (UV)<br>11: Motor overload (OL1)<br>12: Inverter overload (OL2)<br>13: Input phase failure (SPI)<br>14: Output phase failure (SPO)<br>15: Rectify overheat (OH1)<br>16: IGBT overheat (OH2)<br>17: External fault (EF)<br>18: Communication fault (CE)<br>19: Current detection fault (ITE)<br>20: Autotuning fault (TE)<br>21: Encoder fault (PCE)<br>22: Encoder reverse fault (PCDE)<br>23: System fault (OPSE)<br>24: EEPROM fault (EEP) |               |                 |        |

| Function Code | Name | Description  | Setting Range | Factory Setting | Modify |
|---------------|------|--|---------------|-----------------|--------|
|               |      | 25: Magnetic pole position failure (PPCE)<br>26: Brake unit fault (bCE)<br>27: Trial time reached (-END-)<br>28: LCD disconnected (LCD-E)<br>29: Brake feedback fault (FAE)<br>30: Contactor feedback fault (TbE)<br>31: Torque verification fault (TPF)<br>32: Motor speed fault (OFE)<br>33: Torque Monitoring fault (TFT)<br>34: Profibus communication fault (PCF)<br>35: Master-slave speed synchronization fault (ELS)<br>36: Multi-segment speed rating fault (STEP)<br>37: Operating lever fault (STC)<br>38: Earth connection fault (ETH)<br>39: CAN bus communication fault (CA) |               |                 |        |

| Function Code                      | Name                                    | Description  | Setting Range | Factory Setting | Modify |
|------------------------------------|---|--|---------------|-----------------|--------|
|                                    |   | 40: Motor over-temperature fault (OH3)<br>41~50: Reserved  |               |                 |        |
| P7.16                              | Output frequency at current fault       |  |               |                 | ●      |
| P7.17                              | Output current at current fault         |  |               |                 | ●      |
| P7.18                              | DC bus voltage at current fault         |  |               |                 | ●      |
| P7.19                              | Input terminal status at current fault  |  |               |                 | ●      |
| P7.20                              | Output terminal status at current fault |  |               |                 | ●      |
| P7.21                              | Inverter rated power                    |  |               |                 | ●      |
| P7.22                              | Inverter rated current                  |  |               |                 | ●      |
| <b>P8 Group: Enhanced function</b> |   |  |               |                 |        |
| P8.00                              | Pre-torque signal input selection       | 0: No function<br>1: AI1<br>2: AI2<br>3: Profibus communication given<br>4: The internal dynamic given | 0~4           | 0               | ◎      |
| P8.01                              | Pre-torque offset                       | -100.0~100.0%  | -100.0~100.0  | 0.0%            | ○      |
| P8.02                              | Drive gain                              | 0.000~7.000  | 0.000~7.000   | 1.000           | ○      |
| P8.03                              | Brake gain                              | 0.000~7.000  | 0.000~7.000   | 1.000           | ○      |
| P8.04                              | Brake, contactor control selection      | 0: Invalid<br>1: Brake valid, contactor  | 0~3           | 0               | ◎      |

| Function Code | Name   | Description  | Setting Range | Factory Setting | Modify |
|---------------|--|--|---------------|-----------------|--------|
|               |  | invalid<br>2: Brake invalid,<br>contactor valid<br>3: Brake and contactor<br>valid |               |                 |        |
| P8.05         | Delay time of<br>brake closed                | 0.00~5.00s   | 0.00~5.00     | 0.00s           | ☉      |
| P8.06         | Delay time of<br>brake open                  | 0.00~5.00s   | 0.00~5.00     | 0.00s           | ☉      |
| P8.07         | Brake feedback<br>inspecting interval        | 0.1~5.0S   | 0.1~5.0       | 2.0s            | ☉      |
| P8.08         | Contactor<br>feedback<br>inspecting interval | 0.1~5.0s   | 0.1~5.0       | 2.0s            | ☉      |
| P8.09         | Brake frequency<br>when parking              | 0.00~5.00Hz  | 0.00~5.00     | 0.00Hz          | ☉      |
| P8.10         | DC braking<br>current before<br>start        | 0.0~120.0%   | 0.0~120.0     | 0.0%            | ☉      |
| P8.11         | DC braking time<br>before start              | 0.0~50.0s  | 0.0~50.0      | 0.0s            | ☉      |
| P8.12         | Starting frequency<br>of DC braking          | 0.00~P0.03   | 0.00~P0.03    | 0.00Hz          | ○      |
| P8.13         | Waiting time<br>before DC braking            | 0.0~50.0s  | 0.0~50.0      | 0.0s            | ○      |
| P8.14         | DC braking<br>current                        | 0.0~120.0%   | 0.0~120.0     | 0.0%            | ○      |
| P8.15         | DC braking time                              | 0.0~50.0s  | 0.0~50.0      | 0.0s            | ○      |
| P8.16         | Inverter stop delay<br>time                  | 0.00~5.00s   | 0.00~5.00     | 0.00s           | ☉      |
| P8.17         | Auto reset times                             | 0~10   | 0~10          | 0               | ○      |
| P8.18         | Fault relay action                           | 0: Disabled<br>1: Enabled  | 0~1           | 1               | ○      |

| Function Code | Name   | Description   | Setting Range | Factory Setting | Modify |
|---------------|--|---|---------------|-----------------|--------|
| P8.19         | Reset interval   | 0.1~100.0s  | 0.1~100.0     | 1.0s            | ○      |
| P8.20         | Brake threshold voltage                                | 320.0~750.0V  | 320.0~750.0   | 700.0V          | ○      |
| P8.21         | Two-phase/three-phase modulation                       | 0: Two-phase modulation<br>1: Three-phase modulation      | 0~1           | 0               | ◎      |
| P8.22         | Electrical excitation enable                           | 0: Disabled<br>1: Enabled                                 | 0~1           | 0               | ◎      |
| P8.23         | Motor excitation time                                  | 0.004~5.000s  | 0.004~5.000   | 0.010s          | ◎      |
| P8.24         | Torque monitoring selection                            | 0: Invalid<br>1: Valid                                    | 0~1           | 0               | ◎      |
| P8.25         | Speed deviation limit of torque fault                  | 0.0~100.0%  | 0.0~100.0     | 10.0%           | ◎      |
| P8.26         | Delay time of torque fault                             | 0~60000ms   | 0~60000       | 1000ms          | ◎      |
| P8.27         | Blocking factor of acceleration deviation when ACC/DEC | 110.0~500.0%  | 110.0~500.0   | 150.0%          | ◎      |
| P8.28         | Output torque of electric brake                        | 0.0~200.0%  | 0.0~200.0     | 180.0%          | ○      |
| P8.29         | Acceleration time of braking torque                    | 0.001~9.000s  | 0.001~9.000   | 1.000s          | ○      |
| P8.30         | Braking torque ending frequency                        | 0.00~30.00Hz  | 0.00~30.00    | 0.10Hz          | ○      |
| P8.31         | Applying time of electric brake to fast stop           | 0.00~20.00s   | 0.00~20.00    | 2.00s           | ○      |
| P8.32         | Fast stop mode   | 0: The electric braking only<br>1: The electric brake and | 0~2           | 0               | ◎      |

| Function Code | Name  | Description  | Setting Range | Factory Setting | Modify |
|---------------|---|--|---------------|-----------------|--------|
|               |   | the mechanical brake<br>2: The mechanical brake only |               |                 |        |
| P8.33         | Torque verification enable                  | 0: Disabled<br>1: Enabled                            | 0~1           | 0               | ☉      |
| P8.34         | Keypad setting of torque verification       | 0.0~100.0%   | 0.0~100.0     | 10.0%           | ☉      |
| P8.35         | Torque verification fault delay time        | 0.0~10.0 s   | 0.0~10.0      | 0.5s            | ☉      |
| P8.36         | Light-load speeding up enable               | 0: Invalid<br>1: Valid                               | 0~1           | 0               | ☉      |
| P8.37         | Speeding up command selection               | 0: Automatic<br>1: Terminals<br>2: Communication     | 0~2           | 1               | ☉      |
| P8.38         | Frequency fluctuation coefficient           | 0~100  | 0~100         | 10              | ☉      |
| P8.39         | Speed turning point of constant power       | 0.0~200.0%   | 0.0~200.0     | 100.0%          | ☉      |
| P8.40         | Filtering time factor of load torque signal | 0.0~10.0s  | 0.0~10.0      | 0.2s            | ☉      |
| P8.41         | Torque autotuning selection without load    | 0: Self-tuning deactive<br>1: Self-tuning active     | 0~1           | 0               | ☉      |
| P8.42         | Consumed torque by empty hook rising        | 0.0~150.0%   | 0.0~150.0     |                 | ●      |
| P8.43         | Consumed torque by empty hook descent       | 0.0~150.0%   | 0.0~150.0     |                 | ●      |

| Function Code | Name   | Description   | Setting Range | Factory Setting | Modify |
|---------------|--|---|---------------|-----------------|--------|
| P8.44         | Output torque limit of rising up               | 0.0~150.0%  | 0~150.0       | 100.0%          | ☉      |
| P8.45         | Output torque limit of descent                 | 0.0~150.0%  | 0~150.0       | 75.0%           | ☉      |
| P8.46         | Sling loosening torque threshold               | 1.0~100.0%  | 1.0~100.0     | 3.0%            | ☉      |
| P8.47         | Sling loosening alarm output enable in falling | 0: Prohibition<br>1: Output alarm signal<br>2: Output alarm, shutdown and brake | 0~2           | 0               | ☉      |
| P8.48         | Operating lever zero position detection enable | 0: Disabled<br>1: Enabled   | 0~1           | 0               | ☉      |
| P8.49         | Operating lever zero position delay time       | 0.0~60.0s   | 0.0~60.0      | 0.3s            | ☉      |
| P8.50         | Over-current stall protection                  | 0: Disabled<br>1: Enabled   | 0~1           | 1               | ☉      |
| P8.51         | Coefficient of over-current stall              | 100~200%  | 100~200       | 150%            | ☉      |
| P8.52         | Frequency decreasing rate of over-current      | 0.00~50.00Hz/s  | 0.00~50.00    | 10.00Hz/s       | ☉      |
| P8.53         | Reserved                                       | 0~65535   | 0~65535       | 0               | ☉      |
| P8.54         | Reserved                                       | 0~65535   | 0~65535       | 0               | ☉      |
| P8.55         | Reserved                                       | 0~65535   | 0~65535       | 0               | ☉      |
| P8.56         | Acceleration proportional coefficient          | 0.00~5.00   | 0.00~5.00     | 0.005           | ○      |
| P8.57         | Acceleration integral coefficient              | 0.01~20.00  | 0.01~20.00    | 1.00s           | ○      |
| P8.58         | Acceleration integral result limit             | 0.0~10.0  | 0.0~10.0      | 2.0%            | ○      |

| Function Code                        | Name                                     | Description   | Setting Range | Factory Setting | Modify                           |
|--------------------------------------|--|---|---------------|-----------------|----------------------------------|
| P8.59                                | Acceleration differential coefficient    | 0.01~20.00  | 0.01~20.00    | 0.00s           | <input type="radio"/>            |
| P8.60                                | PID voltage threshold of adjuster        | 65.0~P8.54  | 65.0~P8.54    | 70%             | <input type="radio"/>            |
| P8.61                                | Adjuster operational ways                | 0 .Dissipated by PID.<br>1. Converted to by current PID adjuster output value (Valid when slave mode is valid only ). | 0~1           | 0               | <input type="radio"/>            |
| P8.62                                | Integral coefficient of adjuster PID     | 0.01~20.00  | 0.01~20.00    | 3.00s           | <input type="radio"/>            |
| P8.63                                | Differential coefficient of adjuster PID | 0.00~20.00  | 0.00~20.00    | 0.00s           | <input type="radio"/>            |
| <b>P9 Group: Protection function</b> |  |   |               |                 |                                  |
| P9.00                                | Input phase-failure protection           | 0: Disabled<br>1: Enabled   | 0~1           | 1               | <input type="radio"/>            |
| P9.01                                | Output phase-failure protection          | 0: Disabled<br>1: Enabled   | 0~1           | 1               | <input type="radio"/>            |
| P9.02                                | Motor overload protection                | 0: Disabled<br>1: Normal motor<br>2: Variable frequency motor   | 0~2           | 2               | <input checked="" type="radio"/> |
| P9.03                                | Motor overload protection current        | 20.0%~120.0%  | 20.0~120.0    | 100.0%          | <input type="radio"/>            |
| P9.04                                | Overload pre-warning threshold           | 20.0%~150.0%  | 20.0~150.0    | 130.0%          | <input type="radio"/>            |
| P9.05                                | Overload                                 | 0: Always detect  | 0~3           | 0               | <input checked="" type="radio"/> |

| Function Code | Name   | Description   | Setting Range | Factory Setting | Modify |
|---------------|--|---|---------------|-----------------|--------|
|               | pre-warning selection                                      | relative to motor rated current<br>1: Detect while constant speed relative to motor rated current<br>2: Always detect relative to inverter rated current<br>3: Detect while constant speed relative to inverter rated current |               |                 |        |
| P9.06         | Overload pre-warning delay time                            | 0.0~30.0s   | 0.0~30.0      | 5.0s            | ○      |
| P9.07         | Motor overspeed protection                                 | 0: Invalid<br>1: Valid  | 0~1           | 0               | ◎      |
| P9.08         | Overspeed protection point of motor 1                      | 100.0~200.0%  | 100.0~200.0   | 110.0%          | ◎      |
| P9.09         | Overspeed protection point of motor 2                      | 100.0~200.0%  | 100.0~200.0   | 110.0%          | ◎      |
| P9.10         | Motor over-temperature protection                          | 0: Disabled<br>1: Enabled   | 0~1           | 0               | ◎      |
| P9.11         | Type of motor temperature sensor and signal source setting | 0: PT100<br>1: PT1000   | 0~1           | 0               | ◎      |
| P9.12         | Temperature adjusting bias                                 | -80.0~80.0℃   | -80.0~80.0    | 0.0℃            | ◎      |
| P9.13         | Temperature correct factor                                 | 50.0~150.0%   | 50.0~150.0    | 100.0%          | ◎      |

| Function Code                         | Name  | Description  | Setting Range | Factory Setting | Modify |
|---------------------------------------|---|--|---------------|-----------------|--------|
| P9.14                                 | The motor 1 over-temperature protection point | 0~150.0℃   | 0~150.0       | 100.0℃          | ⊙      |
| P9.15                                 | The motor 1 over-temperature warning point    | 20.0%~100.0%   | 20.0~100.0    | 90.0%           | ⊙      |
| P9.16                                 | The motor 2 over-temperature protection point | 0~150.0℃   | 0~150.0       | 100.0℃          | ⊙      |
| P9.17                                 | The motor 2 over-temperature warning point    | 20.0%~100.0%   | 20.0~100.0    | 90.0%           | ⊙      |
| P9.18                                 | Motor temperature compensation enable         | 0: Disabled<br>1: Enabled  | 0~1           | 0               | ⊙      |
| P9.19                                 | Reserved                                      | 0~65535  | 0~65535       | 0               | ⊙      |
| P9.20                                 | Reserved                                      | 0~65535  | 0~65535       | 0               | ⊙      |
| P9.21                                 | Reserved                                      | 0~65535  | 0~65535       | 0               | ⊙      |
| P9.22                                 | Reserved                                      | 0~65535  | 0~65535       | 0               | ⊙      |
| <b>PA Group: Serial communication</b> |   |  |               |                 |        |
| PA.00                                 | Local communication address                   | 1~247<br>0: Broadcast address  | 1~247         | 1               | ○      |
| PA.01                                 | Communication baud rate selection             | 0: 1200BPS<br>1: 2400BPS<br>2: 4800BPS<br>3: 9600BPS<br>4: 19200BPS<br>5: 38400BPS | 0~5           | 4               | ○      |
| PA.02                                 | Data format                                   | 0: No parity (8,N,2) for RTU<br>1: Even parity (8,E,1) for RTU                     | 0~8           | 1               | ○      |

| Function Code | Name                             | Description   | Setting Range | Factory Setting | Modify |
|---------------|----------------------------------|---|---------------|-----------------|--------|
|               |                                  | 2: Odd parity (8,O,1) for RTU<br>3: No parity (8,N,2) for ASCII<br>4: Even parity (8,E,1) for ASCII<br>5: Odd parity (8,O,1) for ASCII<br>6: No parity (7,N,2) for ASCII<br>7: Even parity (7,E,1) for ASCII<br>8: Odd parity (7,O,1) for ASCII |               |                 |        |
| PA.03         | Communication reply delay        | 0~20ms  | 0~20          | 0ms             | ○      |
| PA.04         | Communication timeout fault time | 0.0 (invalid)<br>0.1~100.0s   | 0.0~100.0     | 0.0s            | ○      |
| PA.05         | Communication reply enable       | 0: Communication reply enabled<br>1: Communication reply disabled   | 0~1           | 0               | ○      |
| PA.06         | Transmission error handling      | 0: Report fault and coast to stop<br>1: Do not report fault and continue running<br>2: Do not report fault and stop according to setting<br>3: Do not report fault and stop according to setting  | 0~3           | 1               | ◎      |
| PA.07         | 485 communication protocol       | 0: Modbus protocol<br>1: Master-slave control protocol  | 0~1           | 0               | ◎      |

| Function Code                         | Name                                 | Description   | Setting Range | Factory Setting | Modify |
|---------------------------------------|--------------------------------------|---|---------------|-----------------|--------|
| PA.08                                 | Ethernet communication speed setting | 0: 10 M full-duplex<br>1: 10 M half-duplex<br>2: 100 M full-duplex<br>3: 100 M half-duplex<br>4: Adaptive | 0~4           | 0               | ⊙      |
| PA.09                                 | IP address 1                         | 0~255   | 0~255         | 192             | ⊙      |
| PA.10                                 | IP address 2                         | 0~255   | 0~255         | 168             | ⊙      |
| PA.11                                 | IP address 3                         | 0~255   | 0~255         | 0               | ⊙      |
| PA.12                                 | IP address 4                         | 0~255   | 0~255         | 1               | ⊙      |
| PA.13                                 | Subnet mas 1                         | 0~255   | 0~255         | 255             | ⊙      |
| PA.14                                 | Subnet mas 2                         | 0~255   | 0~255         | 255             | ⊙      |
| PA.15                                 | Subnet mas 3                         | 0~255   | 0~255         | 254             | ⊙      |
| PA.16                                 | Subnet mas 4                         | 0~255   | 0~255         | 0               | ⊙      |
| PA.17                                 | Reserved                             | 0~255   | 0~255         | 0               | ⊙      |
| PA.18                                 | Reserved                             | 0~255   | 0~255         | 0               | ⊙      |
| PA.19                                 | Reserved                             | 0~255   | 0~255         | 0               | ⊙      |
| PA.20                                 | Reserved                             | 0~255   | 0~255         | 0               | ⊙      |
| PA.21                                 | Reserved                             | 0~255   | 0~255         | 0               | ⊙      |
| PA.22                                 | CAN address                          | 0~127   | 0~127         | 1               | ⊙      |
| PA.23                                 | CAN baud rate settings               | 0: 20K BPS<br>1: 50K BPS<br>2: 100K BPS<br>3: 250K BPS<br>4: 500K BPS<br>5: 1M BPS                        | 0~5           | 4               | ⊙      |
| PA.24                                 | CAN communication timeout delay      | 0.0 (invalid)<br>0.1~100.0s   | 0.0~100.0     | 0               | ⊙      |
| <b>Pb Group: Master-slave control</b> |                                      |   |               |                 |        |
| Pb.00                                 | Master-slave control mode selection  | 0: Stand-alone mode<br>1: Power balance mode<br>2: Speed synchronous mode                                 | 0~2           | 0               | ⊙      |

| Function Code | Name   | Description   | Setting Range | Factory Setting | Modify |
|---------------|--|---|---------------|-----------------|--------|
| Pb.01         | Master-slave mode setting                            | 0: Master-slave mode is invalid<br>1: This is the master<br>2: This is the slave<br>3: Master or slave is set by Profibus | 0~3           | 0               |        |
| Pb.02         | Reference signal source from the master to the slave | 0: Master output torque<br>1: Master output current<br>2: Pulse counter of master encoder                                 | 0~2           | 0               | ○      |
| Pb.03         | The interval of master sending data to slave         | 0~10000ms   | 0~10000       | 4ms             | ○      |
| Pb.04         | Master-slave communication channel selection         | 0: Prohibited communications<br>1: CAN communication<br>2: 485  | 0~2           | 0               | ○      |
| Pb.05         | The slave control source                             | 0: Master communications control<br>1: According to P0.01 setting.  | 0~1           | 0               | ○      |
| Pb.06         | The slave reference frequency source                 | 0: From the master communications<br>1: Selection through P0.02   | 0~1           | 0               | ○      |
| Pb.07         | The gain from the slave reference frequency source   | 0.01~100.00   | 0.01~100.00   | 1.00            | ○      |
| Pb.08         | The slave reference signal source                    | 0: Master communications<br>1: AI1<br>2: AI2<br>3: HDI1   | 0~3           | 0               | ○      |

| Function Code | Name  | Description  | Setting Range | Factory Setting | Modify |
|---------------|---|--|---------------|-----------------|--------|
| Pb.09         | The gain of the slave reference signal source | 0.01~100.00  | 0.01~100.00   | 1.00            | ○      |
| Pb.10         | Filtering time of the slave reference signal  | 0.0~3.0s   | 0.0~3.0       | 0.0s            | ◎      |
| Pb.11         | PID proportional coefficient 1                | 0.000~10.000   | 0.00~10.000   | 0.005           | ○      |
| Pb.12         | PID integral time 1                           | 0.01~80.00s  | 0.01~80.00    | 8.00s           | ○      |
| Pb.13         | PID switching low point                       | 0.00Hz~Pb.16   | 0.00~Pb.16    | 5.00Hz          | ○      |
| Pb.14         | PID proportional coefficient 2                | 0.00~10.000  | 0.00~10.000   | 0.010           | ○      |
| Pb.15         | PID integral time 2                           | 0.01~80.00s  | 0.01~80.00    | 10.00s          | ○      |
| Pb.16         | PID switching high point                      | Pb.13~P0.03  | Pb.13~P0.03   | 10.00Hz         | ○      |
| Pb.17         | PID differential time                         | 0.00~10.00s  | 0.00~10.00    | 0.00s           | ○      |
| Pb.18         | PID output filter time                        | 0.00~10.00s  | 0.00~10.00    | 0.00s           | ○      |
| Pb.19         | Integral result of limiting                   | 0.0~100.0%   | 0.0~100.0     | 100.0%          | ○      |
| Pb.20         | The results of integration                    | -100.0~100.0%  | -100.0~100.0  |                 | ●      |
| Pb.21         | Bias limit                                    | 0.0~80.0%  | 0.0~80.0      | 0.0%            | ○      |
| Pb.22         | PID regulation characteristics                | 0: Positive<br>1: Negative   | 0~1           | 0               | ○      |
| Pb.23         | PID mode selection                            | 0: Take proportional-plus-integral result as the synchronization coefficient<br>1: Take proportional | 0~2           | 2               | ○      |

| Function Code | Name  | Description  | Setting Range | Factory Setting | Modify                |
|---------------|---|--|---------------|-----------------|-----------------------|
|               |   | coefficient of P as error correction, I as integral synchronous coefficient<br>2: Take proportional coefficient P and Integral coefficient I as the error correction<br>3: Only use the proportion |               |                 |                       |
| Pb.24         | PID integration of lower synchronized speed limit         | 0.0~100.0%   | 0.0~100.0     | 0.0%            | <input type="radio"/> |
| Pb.25         | PID enabled   | 0: Disabled<br>1: Enabled  | 0~1           | 0               | <input type="radio"/> |
| Pb.26         | Numerator of synchronized variable speed ratio            | 1 ~32000   | 1 ~32000      | 1000            | <input type="radio"/> |
| Pb.27         | Nominator of synchronized variable speed ratio            | 1 ~32000   | 1 ~32000      | 1000            | <input type="radio"/> |
| Pb.28         | limit of synchronous speed position fault                 | 0~50000  | 0~50000       | 1000            | <input type="radio"/> |
| Pb.29         | Speed synchronous position deviation adjustment dead zone | 0~20000  | 0~20000       | 50              | <input type="radio"/> |
| Pb.30         | The amplitude   | 0.0~100.0%   | 0.0~100.0     | 5.0%            | <input type="radio"/> |

| Function Code                       | Name   | Description   | Setting Range | Factory Setting | Modify |
|-------------------------------------|--|---|---------------|-----------------|--------|
|                                     | limiting of speed synchronous regulator              |   |               |                 |        |
| Pb.31                               | the minimum speed of synchronous output enable       | 0.0~100.0%  | 0.0~100.0     | 2.0%            | ⊙      |
| Pb.32                               | Reset source of speed synchronous counter            | 0: Automatic<br>1: Terminals  | 0~1           | 0               | ⊙      |
| Pb.33                               | Reset terminal polarity of synchronous speed counter | 0: Rising edge<br>1: Falling edge   | 0~1           | 0               | ⊙      |
| Pb.34                               | Pulse counter source of synchronous speed            | 0: External terminal S4, S5<br>1: Internal encoder pulse counting           | 0~1           | 1               | ⊙      |
| Pb.35                               | Reserved   | 0~65535   | 0~65535       | 0               | ⊙      |
| <b>PC Group: Motor parameters 1</b> |  |   |               |                 |        |
| PC.00                               | Speed control mode 1                                 | 0: Sensorless vector control<br>1: Vector control with PG<br>2: V/F control | 0~2           | 1               | ⊙      |
| PC.01                               | Maximum frequency 1                                  | 10.00~400.00Hz  | 10.00~400.00  | 50.00Hz         | ⊙      |
| PC.02                               | Motor rated speed power 1                            | 0.4~900.0kW   | 0.4~900.0     | Depend on model | ⊙      |
| PC.03                               | Motor rated speed frequency 1                        | 0.01Hz~400.00Hz   | 0.01~400.00   | 50.00Hz         | ⊙      |
| PC.04                               | Motor rated speed1                                   | 1~36000rpm  | 1~36000       | 1460rpm         | ⊙      |

| Function Code | Name                                    | Description          | Setting Range | Factory Setting | Modify |
|---------------|---|----------------------|---------------|-----------------|--------|
| PC.05         | Motor rated speed voltage 1             | 1~480V               | 1~480         | 380V            | ☉      |
| PC.06         | Motor basic speed current 1             | 0.1~2000.0A          | 0.1~2000.0    | Depend on model | ☉      |
| PC.07         | Motor rated speed power factor 1        | 0.05~1.00            | 0.05~1.00     | 0.86            | ☉      |
| PC.08         | Motor stator resistance 1               | 0.001~65.535Ω        | 0.001~65.535  | Depend on model | ○      |
| PC.09         | Motor rotor resistance 1                | 0.001~65.535Ω        | 0.001~65.535  | Depend on model | ○      |
| PC.10         | Motor leakage inductance 1              | 0.1~6553.5mH         | 0.1~6553.5    | Depend on model | ○      |
| PC.11         | Motor mutual inductance 1               | 0.1~6553.5mH         | 0.1~6553.5    | Depend on model | ○      |
| PC.12         | Current without load 1                  | 0.01~655.35A         | 0.01~655.35   | Depend on model | ○      |
| PC.13         | Acceleration time 1                     | 0.0~3600.0s          | 0.0~3600.0    | 20.0s           | ○      |
| PC.14         | Deceleration time 1                     | 0.0~3600.0s          | 0.0~3600.0    | 20.0s           | ○      |
| PC.15         | Start section of acceleration S curve 1 | 0.1~50.0%            | 0.1~50.0      | 10.0%           | ☉      |
| PC.16         | End section of acceleration S curve 1   | 0.1~50.0%            | 0.1~50.0      | 10.0%           | ☉      |
| PC.17         | Start section of deceleration S curve 1 | 0.1~50.0%            | 0.1~50.0      | 10.0%           | ☉      |
| PC.18         | End section of deceleration S curve 1   | 0.1~50.0%            | 0.0~50.0      | 10.0%           | ☉      |
| PC.19         | Encoder type                            | 0: Increment encoder | 0~2           | 0               | ☉      |

| Function Code | Name                               | Description                          | Setting Range | Factory Setting | Modify |
|---------------|------------------------------------|--------------------------------------|---------------|-----------------|--------|
|               | selection                          | 1: SIN/COS encoder<br>2: UVM encoder |               |                 |        |
| PC.20         | Encoder pulse counting 1           | 1~65535                              | 1~65535       | 1000            | ☉      |
| PC.21         | Encoder direction 1                | 0: Forward<br>1: Reverse             | 0~1           | 0               | ☉      |
| PC.22         | Carrier frequency 1                | 1.0~16.0kHz                          | 1.0~16.0      | Depend on model | ○      |
| PC.23         | ASR proportional gain $K_p1$       | 0~100                                | 0~100         | 20              | ○      |
| PC.24         | ASR integral time $K_i1$           | 0.01~10.00s                          | 0.01~10.00    | 0.50s           | ○      |
| PC.25         | Low speed detecting filter time 1  | 0.000~1.000s                         | 0.000~1.000   | 0.000s          | ○      |
| PC.26         | ASR switching point 1              | 0.00Hz~PC.30                         | 0.00~PC.30    | 5.00Hz          | ○      |
| PC.27         | ASR proportional gain $K_p1$       | 0~100                                | 0~100         | 25              | ○      |
| PC.28         | ASR integral time $K_i2$           | 0.01~10.00s                          | 0.01~10.00    | 1.00            | ○      |
| PC.29         | High speed detecting filter time 1 | 0.000~1.000s                         | 0.000~1.000   | 0.000s          | ○      |
| PC.30         | ASR switching point 2              | PC.26~P0.03                          | PC.26~P0.03   | 10.00Hz         | ○      |
| PC.31         | ACR proportional gain P1           | 0~65535                              | 0~65535       | 500             | ○      |
| PC.32         | ACR integral gain I1               | 0~65535                              | 0~65535       | 500             | ○      |
| PC.33         | Motor weak magnetic 1              | 0.1~2.0                              | 0.1~2.0       | 1.0             | ☉      |
| PC.34         | Motor minimum                      | 10.0~80.0%                           | 10.0~80.0     | 50.0%           | ☉      |

| Function Code | Name  | Description | Setting Range | Factory Setting | Modify |
|---------------|---|-------------|---------------|-----------------|--------|
|               | weak magnetic 1                                       |             |               |                 |        |
| PC.35         | The proportion of weak magnetic 1                     | 0~65535     | 0~65535       | 0               | ⊙      |
| PC.36         | Low-frequency threshold of restraining oscillation 1  | 0~10        | 0~10          | 2               | ⊙      |
| PC.37         | High-frequency threshold of restraining oscillation 1 | 0~10        | 0~10          | 0               | ⊙      |
| PC.38         | Maximum motor output voltage 1                        | PC.05~550V  | PC.05~550     | 380V            | ⊙      |
| PC.39         | HF-ACR proportional gain P1                           | 0~65535     | 0~65535       | 1000            | ⊙      |
| PC.40         | HF-ACR integral gain I1                               | 0~65535     | 0~65535       | 1000            | ○      |
| PC.41         | Slip compensation coefficient 1 of drive side         | 50~200      | 50~200        | 100%            | ○      |
| PC.42         | Slip compensation coefficient 1 of braking side       | 50~200      | 50~200        | 100%            | ○      |
| PC.43         | Torque upper limit current value 1                    | 0.0~200     | 0.0~200       | 110%            | ⊙      |
| PC.44         | Motor overspeed point 1                               | 0~200       | 0~200         | 110%            | ⊙      |
| PC.45         | Motor overtemperature 1                               | 0~1         | 0~1           | 0               | ⊙      |
| PC.46         | Motor overtemperature threshold 1                     | 0.0~60.0    | 0.0~60.0      | 40.0℃           | ⊙      |

| Function Code                           | Name   | Description        | Setting Range | Factory Setting | Modify |
|---|--|--------------------|---------------|-----------------|--------|
| PC.47                                   | Motor overtemperature prewarning threshold 1       | 20.0~100.0         | 20.0~100.0    | 90%             | ☉      |
| PC.48                                   | Motor temperature compensation enable 1            | 0~1                | 0~1           | 0               | ☉      |
| PC.49                                   | Motor temperature compensation initial threshold 1 | 0.0~60.0           | 0.0~60.0      | 40.0℃           | ○      |
| PC.50                                   | Motor temperature compensation coefficient 1       | 0.0~200.0          | 0.0~200.0     | 100             | ○      |
| PC.51                                   | Reserved   | 0~65535            | 0~65535       | 0               | ☉      |
| PC.52                                   | Reserved   | 0~65535            | 0~65535       | 0               | ☉      |
| PC.53                                   | Motor type 1                                       | 0~1                | 0~1           | 0               | ☉      |
| PC.54                                   | Magnetic pole initial position 1                   | 0.00~360.00        | 0.00~360.00   | 0               | ☉      |
| PC.55                                   | Magnetic pole position amplitude gain 1            | 0.50~1.50          | 0.50~1.50     | 1               | ☉      |
| PC.56                                   | C phase magnetic pole position bias 1              | 0~9999             | 0~9999        | 433             | ☉      |
| PC.57                                   | D phase magnetic pole position bias 1              | 0~9999             | 0~9999        | 433             | ☉      |
| <b>Pd Group: Profibus communication</b> |  |                    |               |                 |        |
| Pd.00                                   | Module type  | 1: Profibus        | 1             | 00001           | ●      |
| Pd.01                                   | Module address                                     | 0~99               | 0~99          | 2               | ☉      |
| Pd.02                                   | PZD2 receiving                                     | 0: Invalid         | 0~20          | 1               | ○      |
| Pd.03                                   | PZD3 receiving                                     | 1: Speed reference | 0~20          | 2               | ○      |

| Function Code | Name            | Description                                   | Setting Range  | Factory Setting | Modify |
|---------------|-----------------|---|----------------|-----------------|--------|
| Pd.04         | PZD4 receiving  | 2: Traction reference                         | 0~20           | 3               | ○      |
| Pd.05         | PZD5 receiving  | 3: The maximum current reference              | 0~20           | 0               | ○      |
| Pd.06         | PZD6 receiving  |   | 0~20           | 0               | ○      |
| Pd.07         | PZD7 receiving  | 4: The starting pre-torque compensation value | 0~20           | 0               | ○      |
| Pd.08         | PZD8 receiving  |   | 0~20           | 0               | ○      |
| Pd.09         | PZD9 receiving  | 5: Torque upper limit frequency               | 0~20           | 0               | ○      |
| Pd.10         | PZD10 receiving |   | 0~20           | 0               | ○      |
| Pd.11         | PZD11 receiving | 6: Master-slave mode selection                | 0~20           | 0               | ○      |
| Pd.12         | PZD12 receiving |   | 7~20: Reserved |                 |        |
| Pd.13         | PZD2 sending    | 0: Invalid                                    | 0~30           | 9               | ○      |
| Pd.14         | PZD3 sending    | 1: Running speed                              | 0~30           | 10              | ○      |
| Pd.15         | PZD4 sending    | 2: Reference speed                            | 0~30           | 11              | ○      |
| Pd.16         | PZD5 sending    | 3: DC bus voltage                             | 0~30           | 6               | ○      |
| Pd.17         | PZD6 sending    | 4: Output voltage                             | 0~30           | 7               | ○      |
| Pd.18         | PZD7 sending    | 5: Output current                             | 0~30           | 5               | ○      |
| Pd.19         | PZD8 sending    | 6: Output torque                              | 0~30           | 0               | ○      |
| Pd.20         | PZD9 sending    | 7: Output power                               | 0~30           | 0               | ○      |
| Pd.21         | PZD10 sending   | 8: Running frequency                          | 0~30           | 0               | ○      |
| Pd.22         | PZD11 sending   | 9: Function code                              | 0~30           | 0               | ○      |
| Pd.23         | PZD12 sending   | 10: Reserved                                  | 0~30           | 0               | ○      |
|               |                 | 11: PG Card position                          |                |                 |        |
|               |                 | 12: Input terminal status                     |                |                 |        |
|               |                 | 13: Output terminal status                    |                |                 |        |
|               |                 | 14: Torque compensation                       |                |                 |        |
|               |                 | 15: Motor rated torque                        |                |                 |        |
|               |                 | 16: Given frequency of the slope              |                |                 |        |
| 17: Pd.24     |                 |   |                |                 |        |
|               |                 | 18~30: Reserved                               |                |                 |        |

| Function Code                       | Name                                  | Description   | Setting Range | Factory Setting | Modify                           |
|-------------------------------------|---------------------------------------|---|---------------|-----------------|----------------------------------|
| Pd.24                               | Temporary variable of PZD sending     | 0~65535   | 0~65535       | 0               | <input type="radio"/>            |
| Pd.25                               | The timeout of dp communication fault | 0.0 (invalid),<br>0.1~100.0s  | 0.0~100.0     | 0.0s            | <input type="radio"/>            |
| <b>PE Group: Factory setting</b>    |                                       |   |               |                 |                                  |
| PE.00                               | Factory password                      | 0~65535   | 0~65535       | *****           | <input checked="" type="radio"/> |
| <b>PF Group: Motor parameters 2</b> |                                       |   |               |                 |                                  |
| PF.00                               | Speed control mode 2                  | 0: Sensorless vector control<br>1: Vector control with PG<br>2: V/F control | 0~2           | 1               | <input checked="" type="radio"/> |
| PF.01                               | Maximum frequency 2                   | 10.00~400.00Hz  | 10.00~400.00  | 50.00Hz         | <input checked="" type="radio"/> |
| PF.02                               | Motor rated speed power 2             | 0.4~900.0kW   | 0.4~900.0     | Depend on model | <input checked="" type="radio"/> |
| PF.03                               | Motor rated speed frequency 2         | 0.01Hz~400.00Hz   | 0.01~400.00   | 50.00Hz         | <input checked="" type="radio"/> |
| PF.04                               | Motor rated speed2                    | 1~36000rpm  | 1~36000       | 1460rpm         | <input checked="" type="radio"/> |
| PF.05                               | Motor rated speed voltage 2           | 1~480V  | 1~480         | 380V            | <input checked="" type="radio"/> |
| PF.06                               | Motor basic speed current 2           | 0.1~2000.0A   | 0.1~2000.0    | Depend on model | <input checked="" type="radio"/> |
| PF.07                               | Motor rated speed power factor 2      | 0.05~1.00   | 0.05~1.00     | 0.86            | <input checked="" type="radio"/> |
| PF.08                               | Motor stator resistance 2             | 0.001~65.535Ω   | 0.001~65.535  | Depend on model | <input type="radio"/>            |
| PF.09                               | Motor rotor resistance 2              | 0.001~65.535Ω   | 0.001~65.535  | Depend on model | <input type="radio"/>            |
| PF.10                               | Motor leakage inductance 2            | 0.1~6553.5mH  | 0.1~6553.5    | Depend on model | <input type="radio"/>            |

| Function Code | Name                                    | Description  | Setting Range | Factory Setting | Modify                           |
|---------------|---|--|---------------|-----------------|----------------------------------|
| PF.11         | Motor mutual inductance 2               | 0.1~6553.5mH   | 0.1~6553.5    | Depend on model | <input type="radio"/>            |
| PF.12         | Current without load 2                  | 0.01~655.35A   | 0.01~655.35   | Depend on model | <input type="radio"/>            |
| PF.13         | Acceleration time 2                     | 0.0~3600.0s  | 0.0~3600.0    | 20.0s           | <input type="radio"/>            |
| PF.14         | Deceleration time 2                     | 0.0~3600.0s  | 0.0~3600.0    | 20.0s           | <input type="radio"/>            |
| PF.15         | Start section of acceleration S curve 2 | 0.1~50.0%  | 0.1~50.0      | 10.0%           | <input checked="" type="radio"/> |
| PF.16         | End section of acceleration S curve 2   | 0.1~50.0%  | 0.1~50.0      | 10.0%           | <input checked="" type="radio"/> |
| PF.17         | Start section of deceleration S curve 2 | 0.1~50.0%  | 0.1~50.0      | 10.0%           | <input checked="" type="radio"/> |
| PF.18         | End section of deceleration S curve 2   | 0.1~50.0%  | 0.0~50.0      | 10.0%           | <input checked="" type="radio"/> |
| PF.19         | Encoder type selection                  | 0: Increment encoder<br>1: SIN/COS encoder<br>2: UVM encoder | 0~2           | 0               | <input checked="" type="radio"/> |
| PF.20         | Encoder pulse counting 2                | 1~65535  | 1~65535       | 1000            | <input checked="" type="radio"/> |
| PF.21         | Encoder direction 2                     | 0: Forward<br>1: Reverse                                     | 0~1           | 0               | <input checked="" type="radio"/> |
| PF.22         | Carrier frequency 2                     | 1.0~16.0kHz  | 1.0~16.0      | Depend on model | <input type="radio"/>            |
| PF.23         | ASR proportional gain $K_p2$            | 0~100  | 0~100         | 20              | <input type="radio"/>            |
| PF.24         | ASR integral time $K_i2$                | 0.01~10.00s  | 0.01~10.00    | 0.50s           | <input type="radio"/>            |

| Function Code | Name  | Description  | Setting Range | Factory Setting | Modify |
|---------------|---|--------------|---------------|-----------------|--------|
| PF.25         | Low speed detecting filter time 2                     | 0.000~1.000s | 0.000~1.000   | 0.000s          | ○      |
| PF.26         | ASR switching point 2                                 | 0.00Hz~PF.30 | 0.00~PF.30    | 5.00Hz          | ○      |
| PF.27         | ASR proportional gain $K_p2$                          | 0~100        | 0~100         | 25              | ○      |
| PF.28         | ASR integral time $K_i2$                              | 0.01~10.00s  | 0.01~10.00    | 1.00            | ○      |
| PF.29         | High speed detecting filter time 2                    | 0.000~1.000s | 0.000~1.000   | 0.000s          | ○      |
| PF.30         | ASR switching point 2                                 | PF.26~P0.03  | PF.26~P0.03   | 10.00Hz         | ○      |
| PF.31         | ACR proportional gain P2                              | 0~65535      | 0~65535       | 500             | ○      |
| PF.32         | ACR integral gain I2                                  | 0~65535      | 0~65535       | 500             | ○      |
| PF.33         | Motor weak magnetic 2                                 | 0.1~2.0      | 0.1~2.0       | 1.0             | ◎      |
| PF.34         | Motor minimum weak magnetic 2                         | 10.0~80.0%   | 10.0~80.0     | 50.0%           | ◎      |
| PF.35         | The proportion of weak magnetic 2                     | 0-65535      | 0-65535       | 0               | ◎      |
| PF.36         | Low-frequency threshold of restraining oscillation 2  | 0~10         | 0~10          | 2               | ◎      |
| PF.37         | High-frequency threshold of restraining oscillation 2 | 0~10         | 0~10          | 0               | ◎      |
| PF.38         | Maximum motor   | PF.05~550V   | PF.05~550     | 380V            | ◎      |

| Function Code | Name   | Description | Setting Range | Factory Setting | Modify |
|---------------|--|-------------|---------------|-----------------|--------|
|               | output voltage 2                                   |             |               |                 |        |
| PF.39         | HF-ACR proportional gain P2                        | 0~65535     | 0~65535       | 1000            | ⊙      |
| PF.40         | HF-ACR integral gain I2                            | 0~65535     | 0~65535       | 1000            | ○      |
| PF.41         | Slip compensation coefficient 2 of drive side      | 50~200      | 50~200        | 100%            | ○      |
| PF.42         | Slip compensation coefficient 2 of braking side    | 50~200      | 50~200        | 100%            | ○      |
| PF.43         | Torque upper limit current value 2                 | 0.0~200     | 0.0~200       | 110%            | ⊙      |
| PF.44         | Motor overspeed point 2                            | 0~200       | 0~200         | 110%            | ⊙      |
| PF.45         | Motor overtemperature 2                            | 0~1         | 0~1           | 0               | ⊙      |
| PF.46         | Motor overtemperature threshold 2                  | 0.0~60.0    | 0.0~60.0      | 40.0℃           | ⊙      |
| PF.47         | Motor overtemperature prewarning threshold 2       | 20.0~100.0  | 20.0~100.0    | 90%             | ⊙      |
| PF.48         | Motor temperature compensation enable 2            | 0~1         | 0~1           | 0               | ⊙      |
| PF.49         | Motor temperature compensation initial threshold 2 | 0.0~60.0    | 0.0~60.0      | 40.0℃           | ○      |
| PF.50         | Motor temperature compensation                     | 0.0~200.0   | 0.0~200.0     | 100             | ○      |

| Function Code                      | Name                                    | Description   | Setting Range | Factory Setting | Modify |
|------------------------------------|---|---|---------------|-----------------|--------|
|                                    | coefficient 2                           |   |               |                 |        |
| PF.51                              | Reserved                                | 0~65535   | 0~65535       | 0               | ⊙      |
| PF.52                              | Reserved                                | 0~65535   | 0~65535       | 0               | ⊙      |
| PF.53                              | Motor type 2                            | 0~1   | 0~1           | 0               | ⊙      |
| PF.54                              | Magnetic pole initial position 2        | 0.00~360.00   | 0.00~360.00   | 0               | ⊙      |
| PF.55                              | Magnetic pole position amplitude gain 2 | 0.50~1.50   | 0.50~1.50     | 1               | ⊙      |
| PF.56                              | C phase magnetic pole position bias 2   | 0~9999  | 0~9999        | 433             | ⊙      |
| PF.57                              | D phase magnetic pole position bias 2   | 0~9999  | 0~9999        | 433             | ⊙      |
| <b>PP Group: Motorparameters 3</b> |   |   |               |                 |        |
| PP.00                              | Speed control mode 3                    | 0: Sensorless vector control<br>1: Vector control with PG<br>2: V/F control | 0~2           | 1               | ⊙      |
| PP.01                              | Maximum frequency 3                     | 10.00~400.00Hz  | 10.00~400.00  | 50.00Hz         | ⊙      |
| PP.02                              | Motor rated speed power 3               | 0.4~900.0kW   | 0.4~900.0     | Depend on model | ⊙      |
| PP.03                              | Motor rated speed frequency 3           | 0.01Hz~400.00Hz   | 0.01~400.00   | 50.00Hz         | ⊙      |
| PP.04                              | Motor rated speed3                      | 1~36000rpm  | 1~36000       | 1460rpm         | ⊙      |
| PP.05                              | Motor rated speed voltage 3             | 1~480V  | 1~480         | 380V            | ⊙      |
| PP.06                              | Motor basic speed current 3             | 0.1~2000.0A   | 0.1~2000.0    | Depend on model | ⊙      |
| PP.07                              | Motor rated speed                       | 0.05~1.00   | 0.05~1.00     | 0.86            | ⊙      |

| Function Code | Name                                    | Description  | Setting Range | Factory Setting | Modify |
|---------------|---|--|---------------|-----------------|--------|
|               | power factor 3                          |  |               |                 |        |
| PP.08         | Motor stator resistance 3               | 0.001~65.535Ω  | 0.001~65.535  | Depend on model | ○      |
| PP.09         | Motor rotor resistance 3                | 0.001~65.535Ω  | 0.001~65.535  | Depend on model | ○      |
| PP.10         | Motor leakage inductance 3              | 0.1~6553.5mH   | 0.1~6553.5    | Depend on model | ○      |
| PP.11         | Motor mutual inductance 3               | 0.1~6553.5mH   | 0.1~6553.5    | Depend on model | ○      |
| PP.12         | Current without load 3                  | 0.01~655.35A   | 0.01~655.35   | Depend on model | ○      |
| PP.13         | Acceleration time 3                     | 0.0~3600.0s  | 0.0~3600.0    | 20.0s           | ○      |
| PP.14         | Deceleration time 3                     | 0.0~3600.0s  | 0.0~3600.0    | 20.0s           | ○      |
| PP.15         | Start section of acceleration S curve 3 | 0.1~50.0%  | 0.1~50.0      | 10.0%           | ◎      |
| PP.16         | End section of acceleration S curve 3   | 0.1~50.0%  | 0.1~50.0      | 10.0%           | ◎      |
| PP.17         | Start section of deceleration S curve 3 | 0.1~50.0%  | 0.1~50.0      | 10.0%           | ◎      |
| PP.18         | End section of deceleration S curve 3   | 0.1~50.0%  | 0.0~50.0      | 10.0%           | ◎      |
| PP.19         | Encoder type selection                  | 0: Increment encoder<br>1: SIN/COS encoder<br>2: UVM encoder | 0~2           | 0               | ◎      |
| PP.20         | Encoder pulse counting 3                | 1~65535  | 1~65535       | 1000            | ◎      |
| PP.21         | Encoder direction                       | 0: Forward   | 0~1           | 0               | ◎      |

| Function Code | Name                                     | Description  | Setting Range | Factory Setting    | Modify |
|---------------|--|--------------|---------------|--------------------|--------|
|               | 3  | 1: Reverse   |               |                    |        |
| PP.22         | Carrier frequency<br>3                   | 1.0~16.0kHz  | 1.0~16.0      | Depend<br>on model | ○      |
| PP.23         | ASR proportional<br>gain $K_p3$          | 0~100        | 0~100         | 20                 | ○      |
| PP.24         | ASR integral time<br>$K_i3$              | 0.01~10.00s  | 0.01~10.00    | 0.50s              | ○      |
| PP.25         | Low speed<br>detecting filter<br>time 3  | 0.000~1.000s | 0.000~1.000   | 0.000s             | ○      |
| PP.26         | ASR switching<br>point 3                 | 0.00Hz~PP.30 | 0.00~PP.30    | 5.00Hz             | ○      |
| PP.27         | ASR proportional<br>gain $K_p3$          | 0~100        | 0~100         | 25                 | ○      |
| PP.28         | ASR integral time<br>$K_i2$              | 0.01~10.00s  | 0.01~10.00    | 1.00               | ○      |
| PP.29         | High speed<br>detecting filter<br>time 3 | 0.000~1.000s | 0.000~1.000   | 0.000s             | ○      |
| PP.30         | ASR switching<br>point 2                 | PP.26~P0.03  | PP.26~P0.03   | 10.00Hz            | ○      |
| PP.31         | ACR proportional<br>gain $P3$            | 0~65535      | 0~65535       | 500                | ○      |
| PP.32         | ACR integral gain<br>$I3$                | 0~65535      | 0~65535       | 500                | ○      |
| PP.33         | Motor weak<br>magnetic 3                 | 0.1~2.0      | 0.1~2.0       | 1.0                | ◎      |
| PP.34         | Motor minimum<br>weak magnetic 3         | 10.0~80.0%   | 10.0~80.0     | 50.0%              | ◎      |
| PP.35         | The proportion of<br>weak magnetic 3     | 0~65535      | 0~65535       | 0                  | ◎      |
| PP.36         | Low-frequency<br>threshold of            | 0~10         | 0~10          | 2                  | ◎      |

| Function Code | Name  | Description | Setting Range | Factory Setting | Modify |
|---------------|---|-------------|---------------|-----------------|--------|
|               | restraining oscillation 3                             |             |               |                 |        |
| PP.37         | High-frequency threshold of restraining oscillation 3 | 0~10        | 0~10          | 0               | ☉      |
| PP.38         | Maximum motor output voltage 3                        | PP.05~550V  | PP.05~550     | 380V            | ☉      |
| PP.39         | HF-ACR proportional gain P3                           | 0~65535     | 0~65535       | 1000            | ☉      |
| PP.40         | HF-ACR integral gain I3                               | 0~65535     | 0~65535       | 1000            | ○      |
| PP.41         | Slip compensation coefficient 3 of drive side         | 50~200      | 50~200        | 100%            | ○      |
| PP.42         | Slip compensation coefficient 3 of braking side       | 50~200      | 50~200        | 100%            | ○      |
| PP.43         | Torque upper limit current value 3                    | 0.0~200     | 0.0~200       | 110%            | ☉      |
| PP.44         | Motor overspeed point 3                               | 0~200       | 0~200         | 110%            | ☉      |
| PP.45         | Motor overtemperature 3                               | 0~1         | 0~1           | 0               | ☉      |
| PP.46         | Motor overtemperature threshold 3                     | 0.0~60.0    | 0.0~60.0      | 40.0℃           | ☉      |
| PP.47         | Motor overtemperature prewarning threshold 3          | 20.0~100.0  | 20.0~100.0    | 90%             | ☉      |
| PP.48         | Motor temperature                                     | 0~1         | 0~1           | 0               | ☉      |

| Function Code | Name   | Description | Setting Range | Factory Setting | Modify |
|---------------|--|-------------|---------------|-----------------|--------|
|               | compensation enable 3                              |             |               |                 |        |
| PP.49         | Motor temperature compensation initial threshold 3 | 0.0~60.0    | 0.0~60.0      | 40.0℃           | ○      |
| PP.50         | Motor temperature compensation coefficient 3       | 0.0~200.0   | 0.0~200.0     | 100             | ○      |
| PP.51         | Reserved   | 0~65535     | 0~65535       | 0               | ◎      |
| PP.52         | Reserved   | 0~65535     | 0~65535       | 0               | ◎      |
| PP.53         | Motor type 3                                       | 0~1         | 0~1           | 0               | ◎      |
| PP.54         | Magnetic pole initial position 3                   | 0.00~360.00 | 0.00~360.00   | 0               | ◎      |
| PP.55         | Magnetic pole position amplitude gain 3            | 0.50~1.50   | 0.50~1.50     | 1               | ◎      |
| PP.56         | C phase magnetic pole position bias 3              | 0~9999      | 0~9999        | 433             | ◎      |
| PP.57         | D phase magnetic pole position bias 3              | 0~9999      | 0~9999        | 433             | ◎      |