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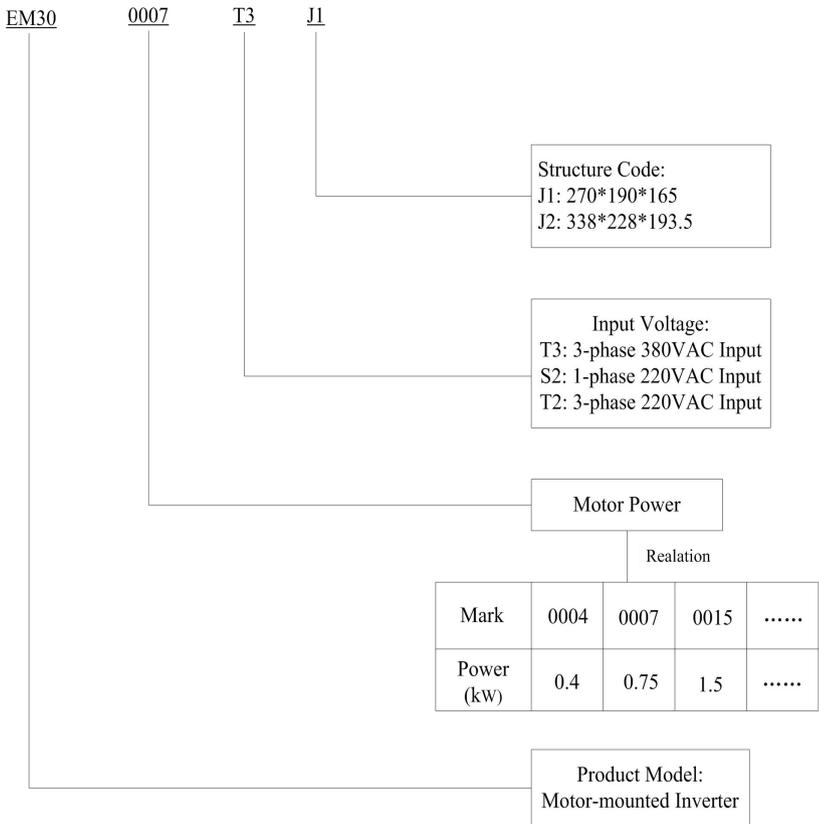
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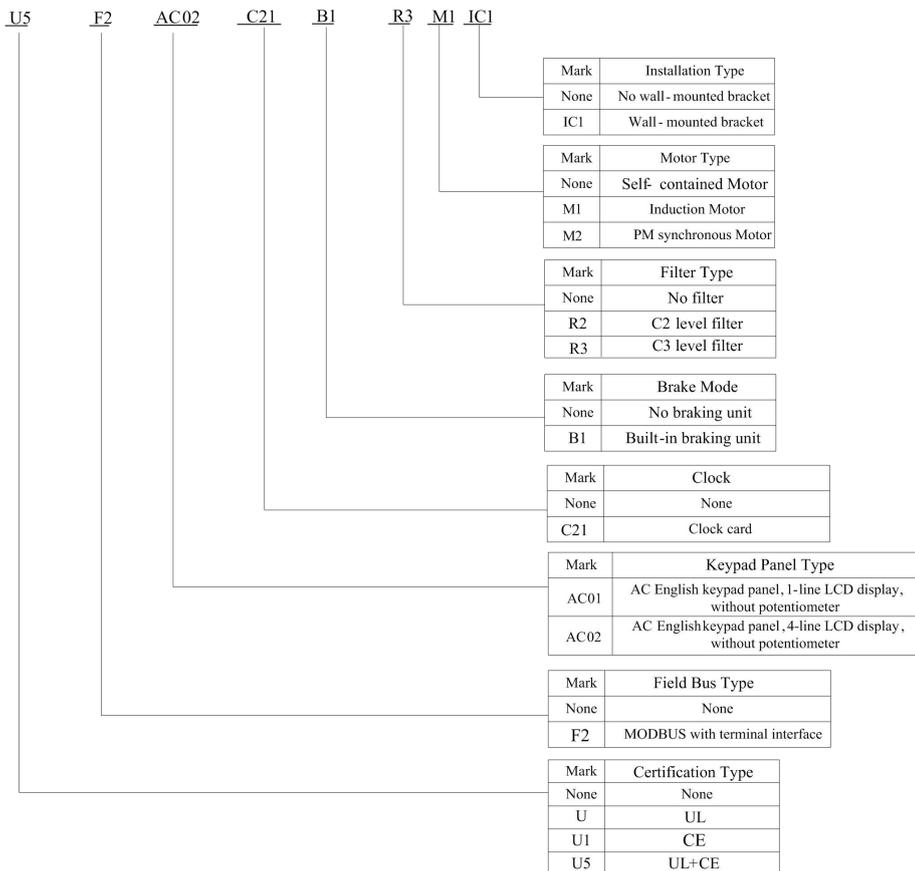
# I. Product

This manual offers a brief introduction of the installation connection, parameters setting and operations for EM30 series inverters, and should therefore be properly kept. Please contact manufacturer or dealer in case of any malfunction during application.

## 1.1 Product model naming rule



## 1.2 Optional function naming rule



### 1.3 Nameplate

Taking for instance the EM30 series 7.5kW inverter with 3-phase 400V input, its nameplate is illustrated as Fig 1-1.

3Ph AC: 3-phase input;

380~480V, 50/60Hz: Input voltage range and rated frequency.

3Ph: 3-phase output; 17A, 7.5kW: Rated output current and power;

|  <b>EURA DRIVES ELECTRIC CO.,LTD</b> |                      |  |                              |
|---|----------------------|--|------------------------------|
| <b>MODEL</b>  | <b>EM30-0075T3J2</b> | <b>OPTION</b>  | <b>UIF2AC02B1R3MIIC1</b>     |
| <b>INPUT</b>  | <b>3 PH AC</b>       | <b>380-480 V</b>   | <b>50/60 Hz</b>              |
| <b>OUTPUT</b>   | <b>3 PH</b>          | <b>17 A</b>  | <b>0-Input V</b>             |
|   | <b>7.5 kW</b>        |  |                              |
|                                      |                      | <div style="border: 1px solid red; display: inline-block; padding: 2px;"> <b>BAR CODE</b> </div> |                              |
|   |                      | <small>SW NO. 1.00</small>   | <small>Made In China</small> |

Fig 1-1 Nameplate

Note: Integrated inverter model include product model and optional function model. Make sure to fill with complete integrated inverter model when making an order.

### 1.4 Appearance

The external structure of EM30 series inverter: die-casting aluminum housing, anti-fingerprints fabrication processing, unique shape, high strength, good tenacity and convenience for maintenance. Taking EM30-0022T3J1 for instance, the external appearance and structure are shown as below in Fig1-2.

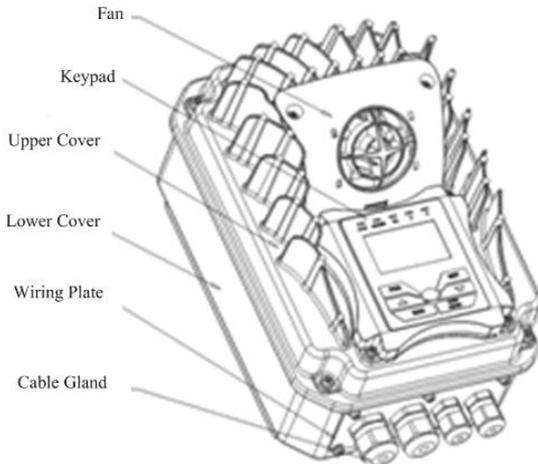


Fig 1-2 Appearance and Structure

Exquisite structure design of aluminum casting housing, detachable cover structure and convenient connection can realize perfect combination with motor. Take EM30-0075T3J2 for instance, the external appearance and structure are shown as below in Fig1-3.

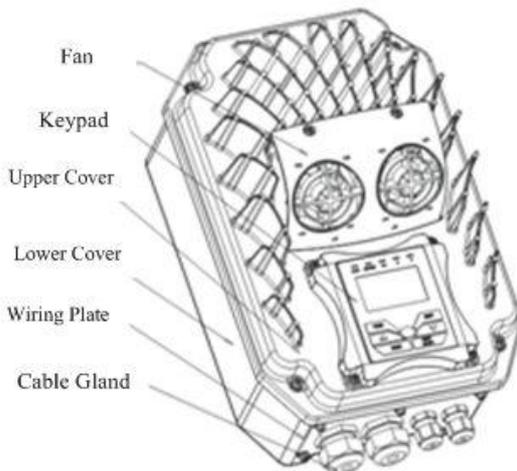


Fig 1-3 Appearance and Structure

## 1.5 Technical parameters

| Power supply | Model       | Motor power (kW) | Rated output current (A) | Input protection current (A) |
|--------------|-------------|------------------|--------------------------|------------------------------|
| 1Ph<br>230V  | EM30-0004S2 | 0.4              | 2.5                      | 10.0                         |
|              | EM30-0007S2 | 0.75             | 4.5                      | 18.1                         |
|              | EM30-0015S2 | 1.5              | 7                        | 25.2                         |
|              | EM30-0022S2 | 2.2              | 10                       | 32.0                         |
| 3Ph<br>230V  | EM30-0004T2 | 0.4              | 2.5                      | 10.0                         |
|              | EM30-0007T2 | 0.75             | 4.5                      | 17.0                         |
|              | EM30-0015T2 | 1.5              | 7                        | 17.5                         |
|              | EM30-0022T2 | 2.2              | 10                       | 25.0                         |
|              | EM30-0030T2 | 3.0              | 12                       | 30.0                         |
|              | EM30-0040T2 | 4.0              | 17                       | 42.5                         |
|              | EM30-0055T2 | 5.5              | 21                       | 53.0                         |

|             |             |      |     |      |
|-------------|-------------|------|-----|------|
| 3Ph<br>400v | EM30-0007T3 | 0.75 | 2   | 6.5  |
|             | EM30-0015T3 | 1.5  | 4   | 11   |
|             | EM30-0022T3 | 2.2  | 6.5 | 15.0 |
|             | EM30-0030T3 | 3.0  | 7   | 16   |
|             | EM30-0040T3 | 4.0  | 9   | 21.0 |
|             | EM30-0055T3 | 5.5  | 12  | 29.0 |
|             | EM30-0075T3 | 7.5  | 17  | 34.0 |
|             | EM30-0110T3 | 11   | 23  | 46.5 |

## 1.6 Technical Specifications

Table1-1 **Technical Specifications for EM 30 Series Inverters**

|                    | Items                         | Contents  |
|--------------------|-------------------------------|---|
| Input              | Rated Voltage Range           | T3 380V-480V(+10%/-15%); S2/T2 220V-240V (±15%)   |
|                    | Rated Frequency               | 50/60Hz   |
| Output             | Rated Voltage Range           | 3-Phase: 0-INPUT(V)   |
|                    | Frequency Range               | 0.50~590.0HZ (In Vector Control Mode: Max frequency is not allowed to exceed 500.00Hz)  |
| Control Mode       | Control Mode                  | Induction Motor: Sensorless Vector Control (SVC), V/F control; PMSM: open-loop vector control (SVC)   |
|                    | Carrier Frequency             | 0.8~16KHz; Fixed carrier-wave and random carrier-wave (F159)  |
|                    | Modulation Mode               | Space Vector PWM  |
|                    | Speed-control Scope           | Induction Motor-SVC 1:100; PMSM-SVC 1:20;   |
|                    | Steady Speed Precision        | ±0.5% (SVC)   |
|                    | Torque Response               | <20ms (SVC)   |
|                    | Torque Control Precision      | ±5% (SVC)   |
|                    | Start Torque                  | 0.5 Hz/100% (VVVF); 0.5Hz/150%(SVC)   |
| Operation Function | DC Braking                    | DC braking frequency: 0.20-50.00 Hz;<br>Braking time: 0.00~30.00s; Braking current: 0.0~100%  |
|                    | Jogging Control               | Jogging frequency range: min frequency~ max frequency,<br>Jogging acceleration/deceleration time: 0.1~3000.0s                                       |
|                    | Frequency Setting mode        | Potentiometer or external analog signal (0~5V, 0~10V, 0~20mA); Keypad (terminals) up/down key; External control logic and self-circulation setting. |
|                    | Main Frequency Source         | Digital given memory, external analogue AI1, AI2, input pulse frequency given(100KHZ), digital given without memory, PID, MODBUS                    |
|                    | Auxiliary Frequency Source    | Flexible auxiliary frequency trim and the operate mode of main and auxiliary frequency.   |
|                    | Auto voltage regulation (AVR) | When source voltage changes, the modulation rate can be adjusted automatically, so that the output voltage is unchanged.                            |
|                    | Analog input                  | 2-channel(AI1/AI2)  |
| Analog output      | 2-channel (AO1/AO2)           |   |

|                          |   |   |
|--------------------------|---|---|
|                          | Digit input   | 5-channel general-form input;<br>1-channel high-speed pulse input<br>Max frequency: 100Khz, Internal impedance: 3.3K $\Omega$ ;   |
|                          | Digit output  | 1-channel DO1   |
|                          | Relay output  | 2-channel programmable relay output   |
|                          | Others  | Built-in PID adjusting, oscillation inhabitation, common DC bus, auto carrier modulation, auto fast current-limiting, I/O terminals self-checking function and OE automatic adjustment. |
| Keypad                   | 4-line LCD  | Support   |
|                          | Parameter copy  | Clone module supported.   |
| Protection Function      | Power supply under-voltage, phase loss, DC over-voltage, over-current, inverter overload, motor overload, output phase loss, overheat, external disturbance, parameter measure failure, analog line disconnected protection, DC-GND short circuit, water shortage protection, pressure protection, dormant state. |   |
| Environmental Conditions | Environment Temperature   | -10 $^{\circ}$ C $\sim$ +40 $^{\circ}$ C  |
|                          | Environment Humidity  | Below 90% (no water-bead coagulation)   |
|                          | Vibration Strength  | 4G  |
|                          | Height above sea level  | 1000m or below(Derating use when above 1000m)   |
| Protection level         | IP66  |   |
| Applicable Motor         | 0.4 $\sim$ 11kW   |   |
| Efficiency               | $\geq$ 93%  |   |
| Others                   | Cooling Mode  | Force-air cooling   |
|                          | Braking Unit  | Built-in braking unit needs external braking resistor.  |
|                          | Fan   | Draught fan is pluggable.   |
|                          | Installation Mode   | Support installing with motor   |

## 1.7 Optional Accessory

If in need, optional accessories should be mentioned when ordering.

Table 1-2 EM30 remote keypad accessories

| Power range        | Product code | Remark                  |
|--------------------|--------------|-------------------------|
| 0.4kW $\sim$ 7.5kW | AD-A01       | Outer lead length noted |

Table 1-3 EM30 motor adapter plate accessories of case 1

| Power range                                  | Structure | Accessories code |
|--|-----------|------------------|
| S2/T2/T3: 0.4 $\sim$ 7.5kW                   | J1        | EJ1ZJ01          |
| S2/T2/T3: 1.5 $\sim$ 3.0kW                   | J1        | EJ1ZJ02          |
| T3: 4.0 kW                                   | J1        | EJ1ZJ03          |
| T3:5.5 $\sim$ 11 kW<br>T2: 4.0 $\sim$ 5.5 kW | J2        | EJ2ZJ01          |

Table 1-3 EM30 motor adapter plate accessories of case 2

| Power range                                      | Structure | Accessories code |
|--|-----------|------------------|
| S2: 0.4~2.2kW<br>T2: 0.4~3.0kW<br>T3: 0.75~4.0kW | J1        | EJ1ZJ11          |
| T3: 5.5~11kW<br>T2: 4.0~5.5kW                    | J2        | EJ2ZJ11          |

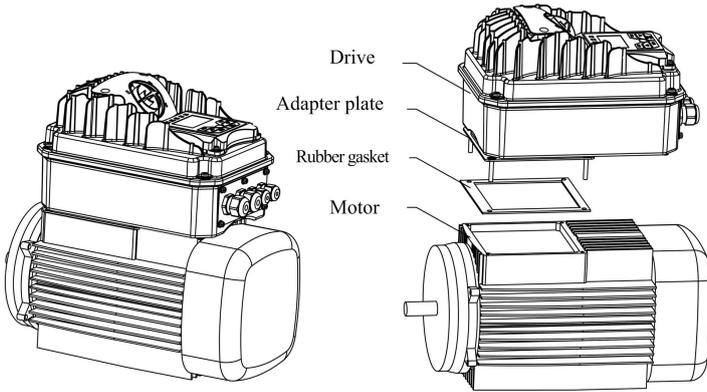
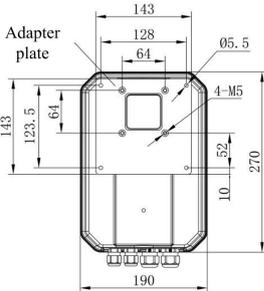


Fig1-6 Motor adapter plate installation of case 2

EM30-J1 metal adapter plate



EM30-J2 metal adapter plate

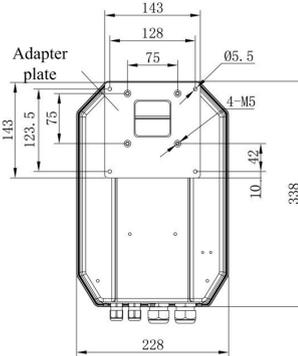
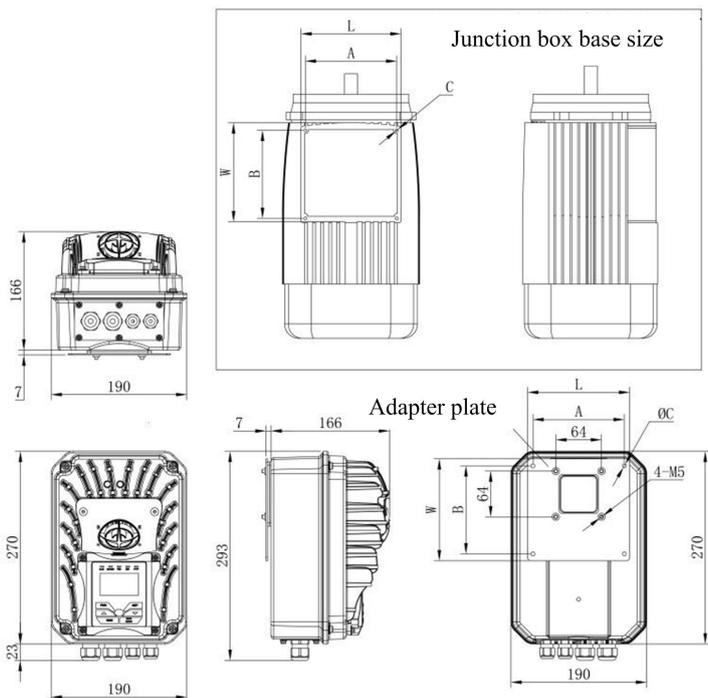
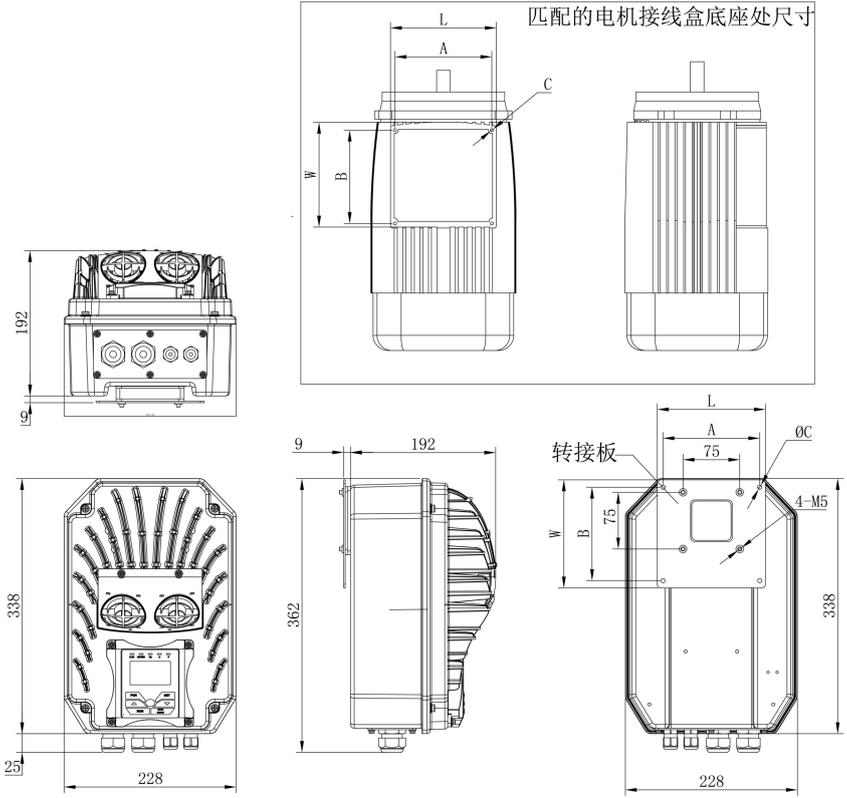


Fig1-7 Metal adapter plate dimension



**Fig1-8 J1 drive and motor adapter plate size**

Note:  $L$ ,  $W$  are the external size of motor junction box base,  $A$ ,  $B$  are installation size of motor junction box base,  $C$  is the screw hole size of between adapter plate and motor junction box base.



**Fig1-9 J2 drive and motor adapter plate size**

Note: L, W are the external size of motor junction box base, A, B are installation size of motor junction box base, C is the screw hole size of between adapter plate and motor junction box base.

**Table 1-5 EM30 keypad outer accessory**

| Structure | M type cable fixed head | Cable outer diameter( mm) | Color | Recommended model         | QTY |
|-----------|-------------------------|---------------------------|-------|---------------------------|-----|
| J1        | M20×1.5                 | 10~14                     | Black | Cable fixed sleeve M2014B | 2   |
|           | M16×1.5                 | 5~10                      | Black | Cable fixed sleeve M1610B | 2   |
| J2        | M25×1.5                 | 13~18                     | Black | Cable fixed sleeve M2518B | 2   |
|           | M16×1.5                 | 5~10                      | Black | Cable fixed sleeve M1610B | 2   |

## 1.8 Designed Standards for Implementation

IEC/EN 61800-5-1: 2007 Adjustable speed electrical power drive systems safety requirements.

IEC/EN 61800-3: 2004/+A1: 2012 Adjustable speed electrical power drive systems-Part 3: EMC product standard including specific test methods.

## 1.9 Safe Instructions and Precautions

- Please check the model in the nameplate of the inverter and the rated value of the inverter. Please do not use the damaged inverter in transit.
- Installation and application environment should be free of rain, drips, steam, dust and oily dirt; without corrosive or flammable gases or liquids, metal particles or metal powder. Environment temperature within the scope of  $-10^{\circ}\text{C}\sim+40^{\circ}\text{C}$ .
- Please install inverter away from combustibles.
- Do not drop anything into the inverter.
- The reliability of inverters relies heavily on the temperature. The around temperature increases by  $10^{\circ}\text{C}$ , inverter life will be halved. Because of the wrong installation or fixing, the temperature of inverter will increase and inverter will be damaged.
- Inverter is installed in a control cabinet, and smooth ventilation should be ensured and inverter should be installed vertically. If there are several inverters in one cabinet, in order to ensure ventilation, please install inverters side by side. If it is necessary to install several inverters up and down, please add heat-insulation plate.
- Never touch the internal elements within 15 minutes after power off. Wait till it is completely discharged.
- Input terminals L1/R, L2/S and L3/T are connected to power supply of 400V/230V (L1, L2 are connected to 230V) while output terminals U, V and W are connected to motor.
- Proper grounding should be ensured with grounding resistance not exceeding  $4\Omega$ ; separate grounding is required for motor and inverter. Grounding with series connection is forbidden.
- There should be separate wiring between control loop and power loop to avoid any possible interference.
- Signal line should not be too long (less than 3m) to avoid any increase with common mode interference.
- If circuit breaker or contactor needs to be connected between the drive and the motor, be sure to operate these circuit breakers or contactor when the drive has no output, to avoid damaging of drive.
- Meet the environmental requirements of EM30 series technical specifications in table 1-1.
- Before using the drive, the insulation of the motors must be checked, especially, if it is used for the first time or if it has been stored for a long time. This is to reduce the risk of the drive from being damaged by the poor insulation of the motor.
- Do not connect any varistor or capacitor to the output terminals of the drive, because the drive's output voltage waveform is pulse wave, otherwise tripping or damaging of components may occur; in addition, do not install circuit breaker or contactor at the output side of the drive as shown in Fig 1-4.

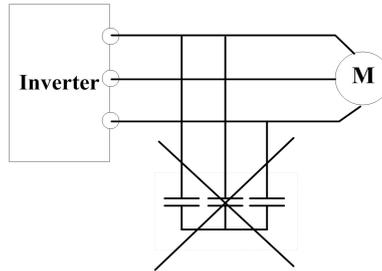


Fig 1-4 Capacitors are prohibited to be used.

- Derating must be considered when the drive is installed at high altitude, greater than 1000m. This is because the cooling effect of drive is deteriorated due to the thin air, as shown in Fig. 1-5 that indicates the relationship between the elevation and rated current of the drive.

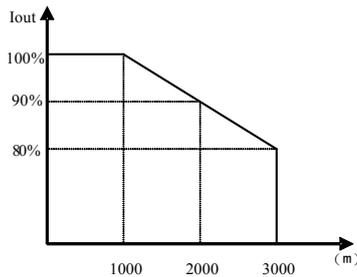


Fig 1-5 Derating drive's output current with altitude

- Never touch high-voltage terminals inside the inverter to avoid any electric shock.
- Before inverter is powered on, please be sure that input voltage is correct.
- Please do not connect input power supply onto U,V,W or  $\text{⏏}$  terminals.
- Please do not install inverter directly under sunshine, do not block up the cooling hole.
- All safety covers should be well fixed before inverter is power connected, to avoid any electric shock.
- Only professional personnel are allowed for any maintenance, checking or replacement of parts.
- No live-line work is allowed.

---

## 1.10 Examination and Maintenance

### 1.10.1 Periodic checking

- Cooling fan and wind channel should be cleaned regularly to check whether it is normal; remove the dust accumulated in the inverter on a regular basis.
- Check inverter's input and output wiring and wiring terminals regularly and check if wirings are ageing.
- Check whether screws on each terminals are fastened.
- Check whether inverter is corrosive.

### 1.10.2 Storage

- Please put the inverter in the packing case of manufacture.
- If inverter is stored for long time, please charge the inverter every half a year to prevent the electrolytic capacitors damaged. The charging time should be longer than 5 hours.

### 1.10.3 Daily Maintenance

Environment temperature, humidity, dust and vibration would decrease the life of inverter. Daily maintenance is necessary to inverters.

Daily inspecting:

- Inspecting for noise of motor when it is working.
- Inspecting for abnormal vibration of motor when it is working.
- Inspecting for the installing environment of inverter.
- Inspecting for the fan and inverter temperature.

Daily cleaning:

- Keep the inverter clean. Clean surface dust of inverter to prevent dust, metal powder, oily dirt and water from dropping into the inverter.

## II. Keypad panel

The keypad function and indicator function for EM30 series will be showed in panel operating illustration.

### 2.1 Panel Illustration

The panel covers three sections: data display section, status indicating section and keypad operating section, as shown in Fig. 2-1.

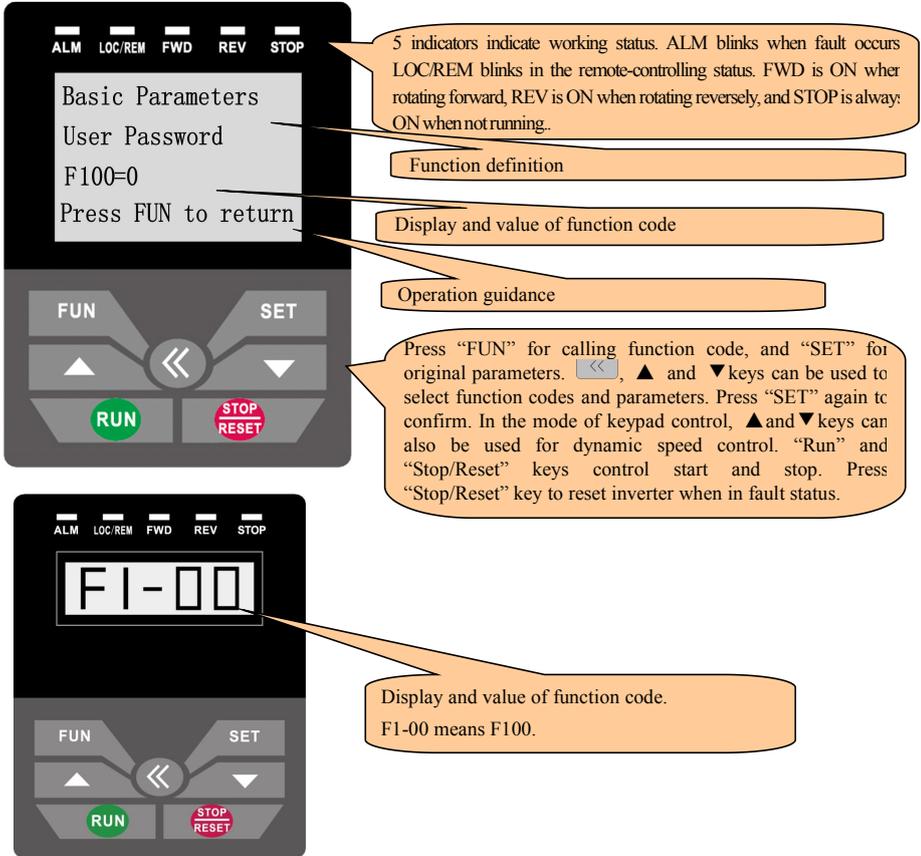


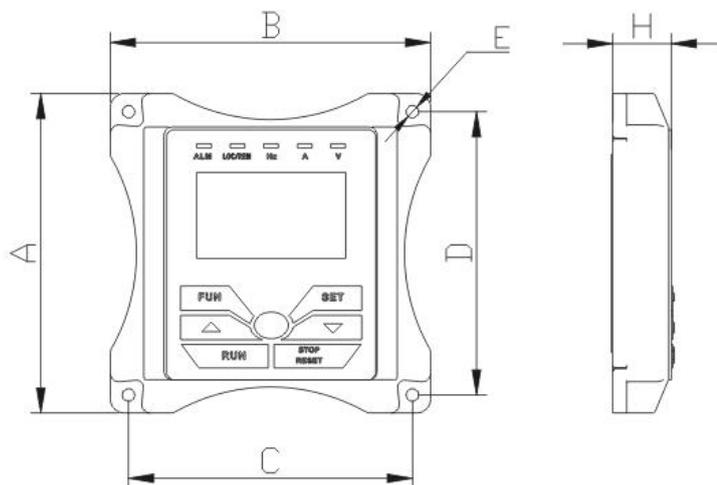
Fig.2-1 Operation Panels

Instructions for operation panel:

1. Local keypad panel can be introduced remotely. Select remote fittings if remote panel is needed.

## 2.2 Keypad panel and installation bracket structure

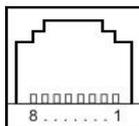
### 2.2.1 Structure Diagram



### 2.2.2 Structure Size for remote keypad panel (Unit: mm)

| Code    |            | A   | B   | C   | D   | H  | E    |
|---------|------------|-----|-----|-----|-----|----|------|
| AC-A-02 | 4-line LCD | 115 | 115 | 102 | 102 | 21 | Φ4.5 |

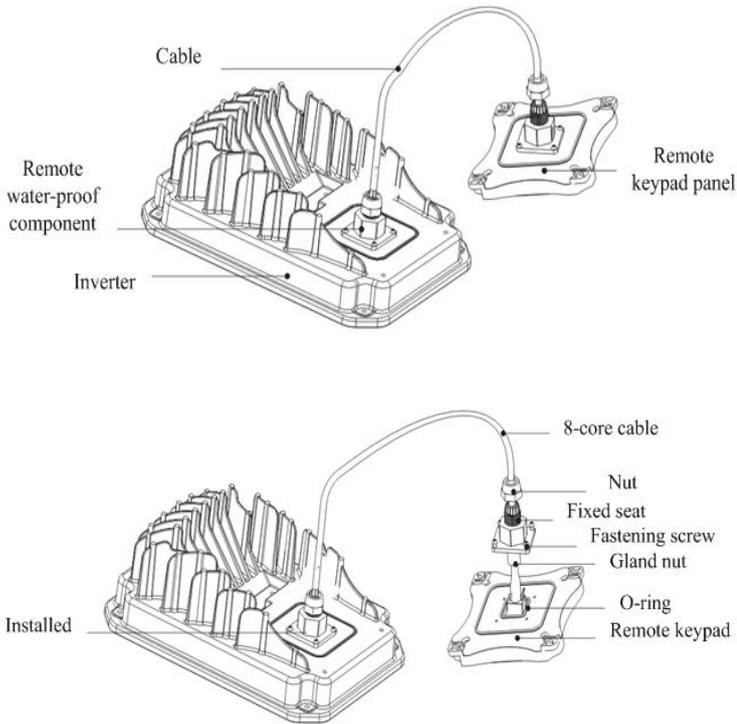
### 2.2.3 Port of Control Panel



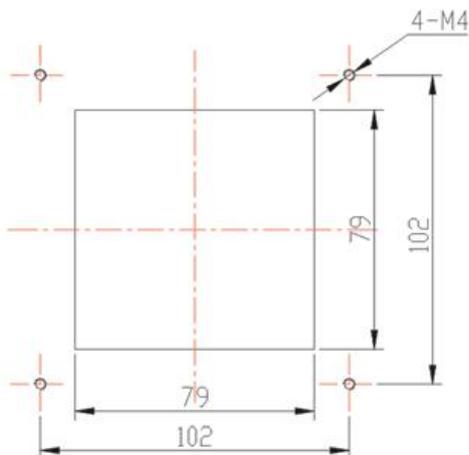
| Pins   | 1        | 2  | 3      | 4      | 5        | 6        | 7        | 8        |
|--------|----------|----|--------|--------|----------|----------|----------|----------|
| 8 core | Reserved | 5V | 5V GND | 5V GND | Signal 1 | Signal 2 | Signal 3 | Signal 4 |

Note: The interface of control board should be completely consistent with the interface of the keypad panel, so the line sequence should also be the same.

2.2.4 The remote-control components should reach the protection grade. The default remote-control wire length is 1m. The length of remote-control wire can be custom-made by users. If on the occasion of strong interference of occasion, or the length is longer than 3m, please put a magnetic ring on the wire to avoid interference. The figures of remote-control components are showed as below:



### 2.2.5 Remote keypad hole dimension figure



## 2.3 Panel Operating

All keys on the panel are available for user. Refer to Table 2-1 for their functions.

Table 2-1 **Uses of Keys**

| Keys  | Names         | Remarks  |
|---|---------------|--|
|    | Fun           | To call function code and switch over display mode.    |
|    | Set           | To call and save data.                                 |
|    | Up            | To increase data (speed control or setting parameters) |
|  | Down          | To decrease data (speed control or setting parameters) |
|  | Run           | To start inverter;                                     |
|  | Stop or reset | To stop inverter; to reset in fault status;            |
|  | Shift key     | Shift and displaying items switchover.                 |

## 2.4 Parameters Setting

This inverter has numerous function parameters, user can modify to effect different modes of operation

control. User needs to realize that if user sets password valid (F107=1), user's password must be entered firstly if parameters need to set after power off or protection is effected, i.e., to call F100 as per the mode in Table 2-2 and enter the correct code. User's password is invalid when leaving factory and user could set corresponding parameters without entering password.

**Table 2-2 Steps for Parameters Setting**

| Steps | Keys   | Operation  | Display   |
|-------|--|--|---|
| 1     |   | Press "Fun" key to display function code                         |  |
| 2     |  or  | Press "Up" or "Down" to select required function code            |  |
| 3     |   | To read data set in the function code                            |  |
| 4     |  or  | To modify data   |  |
| 5     |   | To display corresponding function code after saving the set data |  |
|       |   | To display the current function code                             |  |

The above-mentioned step should be operated when inverter is in stop status.

## 2.5 Function Codes Switchover in/between Code-Groups

It has more than 300 parameters (function codes) available to user, divided into 11 sections as indicated in Table 2-3.

**Table 2-3 Function Code Partition**

| Group Name                               | Group No. | Group Name                             | Group No. |
|--|-----------|--|-----------|
| Basic Parameters                         | F1        | Timing control and protection function | F7        |
| Run Control Mode                         | F2        | Parameters of the motor                | F8        |
| Multi-functional input/output terminal   | F3        | Communication parameters               | F9        |
| Analog signals and pulse of input/output | F4        | PID parameter setting                  | FA        |
| Multi-stage speed parameters             | F5        | Torque control parameters              | FC        |
| Subsidiary function                      | F6        | Parameter display                      | H0        |

As parameters setting costs time due to numerous function codes, such function is specially designed as "Function Code Switchover in a Code Group or between Two Code-Groups" so that parameters setting become convenient and simple.

**The operation of segment LCD:**

Press “Fun” key so that the keypad controller will display function code. If press “▲” or “▼” key then, function code will circularly keep increasing or decreasing by degrees within the group; if press  key, function code will change circularly between two code groups when operating the “▲” or “▼” key.

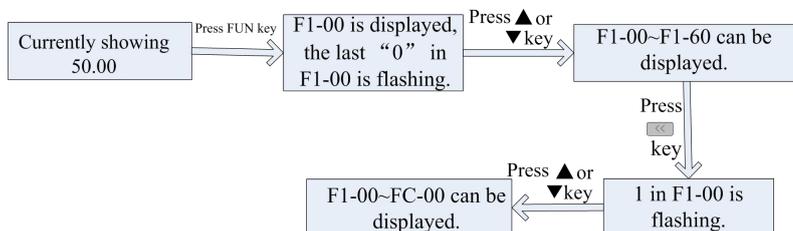


Fig 2-2 Switch over in a Code Group or between Different Code-Groups

### The operation of four-line LCD:

When function code shows F100 and the last “0” in F100 is flashing, after pressing  key, the middle “0” is flashing, then press  again, “1” in F100 is flashing, the flashing value can be changed by pressing “▲”/“▼” key.

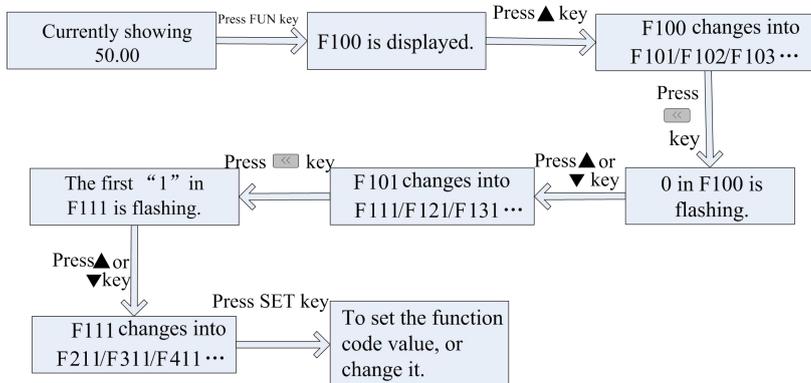


Fig 2-3 Switch over in a Code Group or between Different Code-Groups

## 2.6 Operating instructions of 4-line LCD interface switch

### 2.6.1 Operating instructions of SET/FUN keys

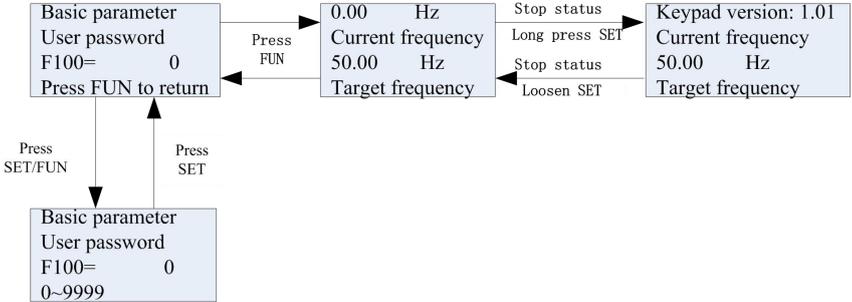


Fig 2-4 Operating flow chart of interface switch

### 2.6.2 Operating instructions of inverter status display

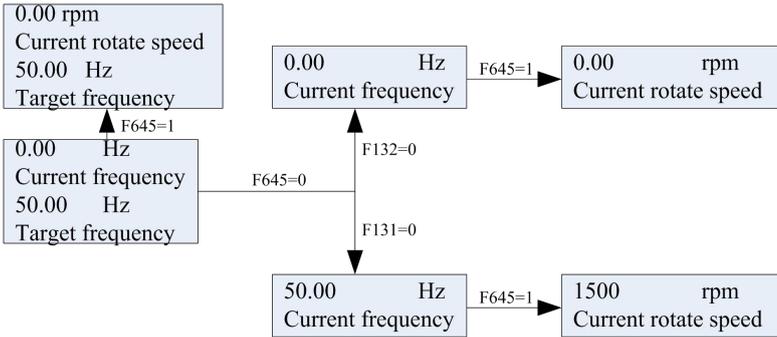


Fig 2-5 Operating flow chart of status parameter display

### 2.6.3 Regulating target frequency/target rotate speed by UP/DOWN keys in running status

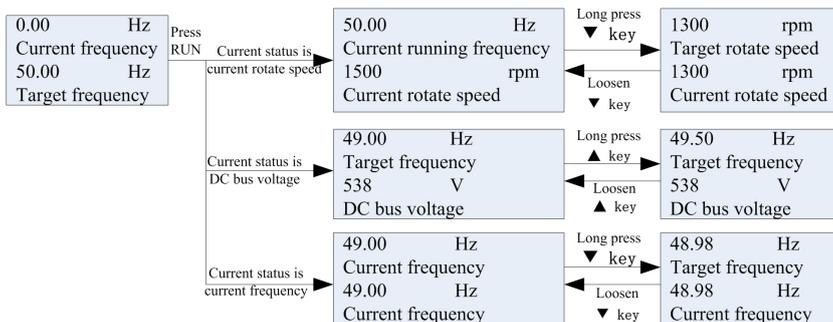


Fig 2-6 Operating flow chart of target frequency/rotate speed adjustments

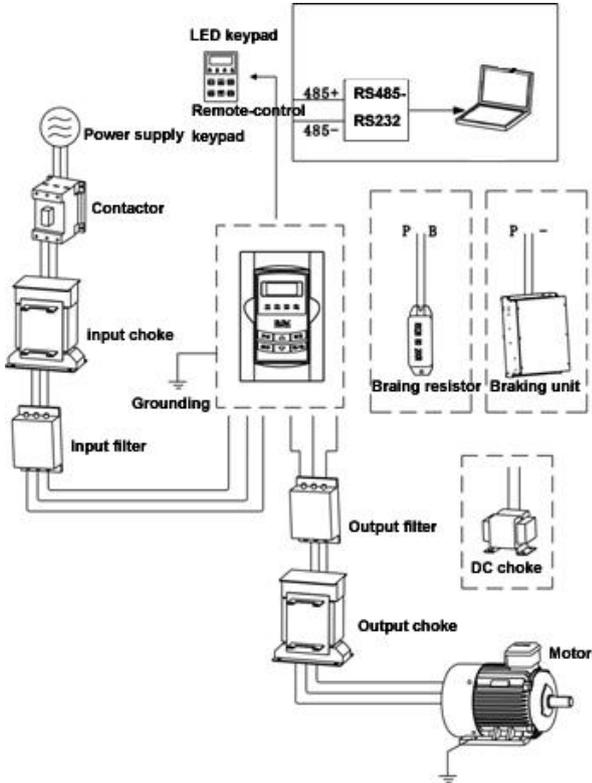
## 2.7 Panel Display

Table 2-5 Items and Remarks Displayed on the Panel

| Items                                       | Remarks   |
|---|---|
| -HF-(segment LCD)                           | It stands for resetting process and will display target frequency after reset.  |
| Power on....                                | It stands for power on process.   |
| OC, OC1, OE, OL1, OL2, OH, LU, PF0, PF1,PCE | Fault code, indicating “over-current OC”, “over-current OC1”, “over-voltage”, “inverter over-load”, “motor over-load” “over-heat”, “under-voltage for input”, “phase loss for output”, “phase loss for input”, and “detuning fault” respectively. |
| AErr, EP, nP, Err5                          | Analog line disconnected, inverter under-load, pressure control, PID parameters are set wrong.  |
| ESP   | During two-line/three line running mode, “stop/reset” key is pressed or external emergency stop terminal is closed, ESP will be displayed.  |
| F152  | Function code (parameter code).   |
| 10.00                                       | Indicating inverter’s current running frequency (or rotate speed) and parameter setting values, etc.  |
| 50.00                                       | Blinking in stopping status to display target frequency.  |
| 0.  | Holding time when changing the running direction. When “Stop” or “Free Stop” command is executed, the holding time can be canceled  |

## III. Installation & Connection

### 3.1 Periphery Wiring

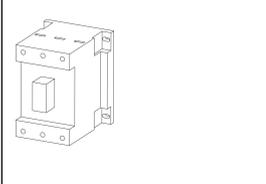
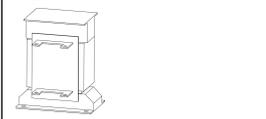
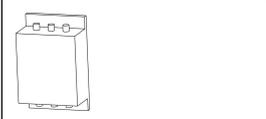
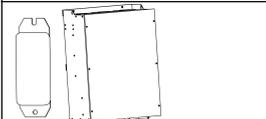


**Note:** Braking unit is built in the T3 model of EM30 series, braking resistor is need only if the load inertia is not too large.

### 3.1.1 Accessories Graphic Illustration

Brake unit adopts EURA standard, the rest shows as below table 3-1:

**Table 3-1 Accessories Graphic Illustration**

| Picture   | Name                     | Description   |
|---|--------------------------|---|
|    | Cables                   | Device to transfer the electronic signals   |
|    | Breaker                  | Prevent from electric shock or protect the power supply and the cables system from over-current when short circuits occur. (Please select the breaker with the function of reducing high order harmonic and the rated sensitive current to 1 one inverter should be above 30mA) |
|    | Input choke              | The device is used to improve the power factor of the input side of the inverter and control higher harmonic current.   |
|    | DC choke                 |   |
|    | Input filter             | Control the electromagnetic interference generated from the inverter, please install close to the input terminal side of the inverter.  |
|   | Braking unit or resistor | Shorten the deceleration time.  |
|  | Output choke             | Control the interference from the output side of the inverter, please install close to the output terminal side of the inverter.  |
|  | Output choke             | Prolong the effective transmit distance of the inverter to control the sudden high voltage when switching on/off the IGBT of the inverter.  |

### 3.2 Installation

Inverter should be installed vertically, as shown in Fig 3-1. Sufficient ventilation space should be ensured in its surrounding. Clearance dimensions (recommended) are available from Table 3-1 for installing the inverter.

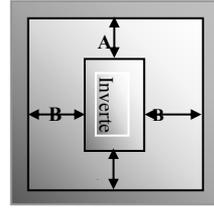


Fig 3-1 Installation Sketch

**Table 3-2 Clearance Dimensions**

| Model              | Clearance Dimensions  |                       |
|--------------------|-----------------------|-----------------------|
| Metal wall-mounted | $A \geq 200\text{mm}$ | $B \geq 100\text{mm}$ |

The Figure below shows that the inverter is installed with motor:

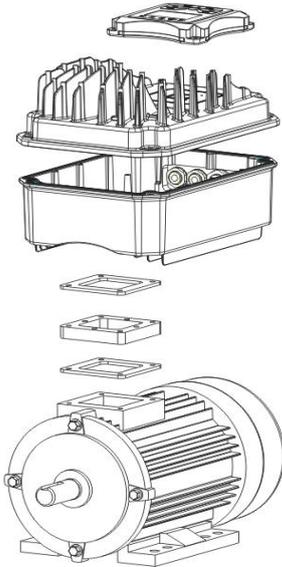


Fig 3-1-1 Sketch map of inverter installed with motor

## Inverter is installed on the wall-mounted plate.

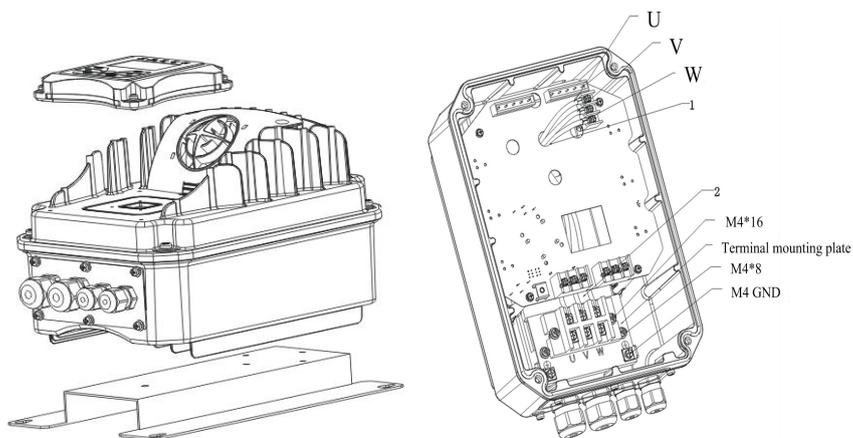


Fig 3-1-2 Sketch map of inverter installed on wall-mounted plate

Note: Make sure effective ventilation space around drives.

### 3.3 Connection

- Connect R/L1, S/L2 and T/L3 terminals (L1 and L2/N terminals for single-phase) with power source from network,  $\overline{PE/E}$  to earth, U, V and W terminals to motor.
- Motor must be ground connected. Or else electrified motor causes interference.

1) Power terminals sketch of inverter with 1-phase 230V 0.4-2.2KW showed as below in Fig 3-2.

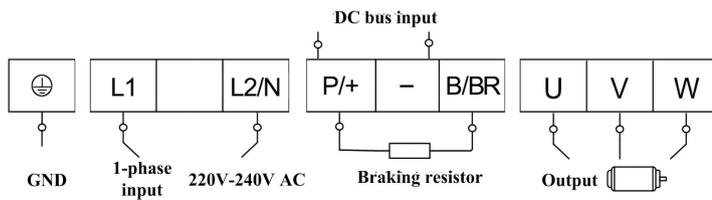


Fig 3-2 Power terminals sketch

- 2) Power terminals sketch of inverter with 3-phase 230V 0.4-5.5KW showed as below in Fig 3-3.

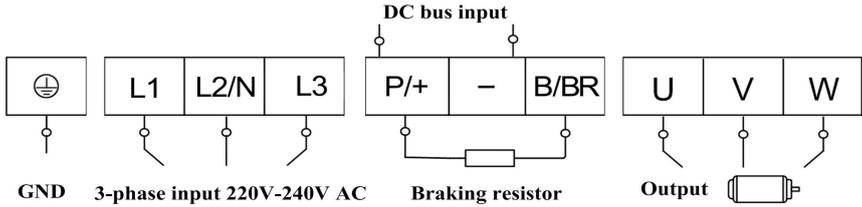


Fig 3-3 Power terminals sketch

- 3) Power terminals sketch of inverter with 3-phase 400V 0.75-15KW showed as below in Fig 3-4.

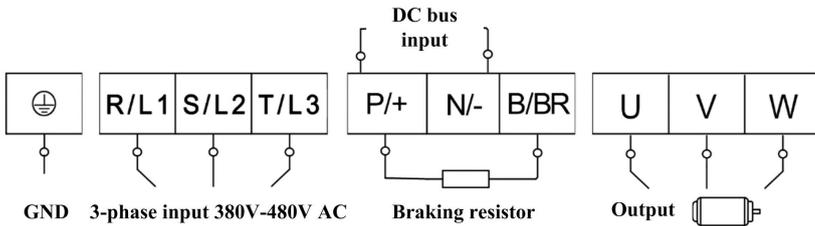


Fig 3-4 Power terminals sketch

### Introduction of terminals of power loop

| Terminals            | Terminal Marking | Terminal Function Description   |
|----------------------|------------------|---|
| Power Input Terminal | R/L1, S/L2, T/L3 | Input terminals of three-phase 400V AC voltage, 1-phase 230V connects to L1, L2/N, 3-phase 230V connects to L1, L2/N and L3.  |
| Output Terminal      | U, V, W          | Inverter power output terminal, connected to motor.   |
| Grounding Terminal   |                  | Inverter grounding terminal.  |
| Rest Terminal        | P/+, B/BR        | External braking resistor terminals (Note: no Terminals P or B for inverter without built-in braking unit).   |
|                      | P/+, N/-         | Common DC bus terminals<br>Externally connected to braking unit<br>P/+ connected to input terminal "P/+" or "DC+" of braking unit,<br>N/- connected to input terminal of braking unit "N/-" or "DC-". |

**Wiring for control loop as follows:**

|         |     |     |     |     |          |          |     |     |    |    |     |     |     |     |     |     |     |     |     |         |     |     |  |
|---------|-----|-----|-----|-----|----------|----------|-----|-----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---------|-----|-----|--|
| TA1     | TB1 | TC1 | TA2 | TB2 | TC2      |          | DO1 | 24V | CM | CM | DI1 | DI2 | DI3 | DI4 | DI5 | DI6 | 10V | AI1 | AI2 | GN<br>D | AO1 | AO2 |  |
| GN<br>D | +5V | A+  | B-  |     | CA<br>NH | CA<br>NL |     |     |    |    |     |     |     |     |     |     |     |     |     |         |     |     |  |

### 3.4 Functions of control terminals

The key to operate the inverter is to operate the control terminals correctly and flexibly. The control terminals are not operated separately, and they should match corresponding settings of parameters. This chapter describes basic functions of the control terminals. The users may operate the control terminals by combining relevant contents hereafter about “Defined Functions of the Terminals”.

Table 3-3 Functions of Control Terminals

| Terminal | Type                                    | Description                                  | Function   |  |  |
|----------|---|--|--|--|--|
| DO1      | Digit<br>Output                         | Multifunctional<br>output terminal 1         | When the token function is valid, the value between this terminal and CM is 0V; when the inverter stops, the value is 24V.   | The functions of output terminals shall be defined per manufacturer's value. Their initial state can be changed through changing function codes. |  |
| TA1      |   | Relay contact                                | TC is a common point, TB-TC is normally closed contacts, and TA-TC is normally open contacts. The contact capacity is 10A/125VAC、5A/250VAC、5A/30VDC.   |  |  |
| TB1      |   |  |  |  |  |
| TC1      |   |  |  |  |  |
| TA2      |   |  |  |  |  |
| TB2      |   |  |  |  |  |
| TC2      |   |  |  |  |  |
| AO1      | Analog<br>output                        | Running<br>frequency                         | It is connected with frequency meter, speedometer or ammeter externally, and its minus pole is connected with GND. See F423~F426 for details..   |  |  |
| AO2      |   | Current output                               |  |  |  |
| 10V      | Analog<br>power<br>supply               | Self contained<br>power supply               | Internal 10V self-contained power supply of the inverter provides power to the inverter. When used externally, it can only be used as the power supply for voltage control signal, with current restricted below 20mA. |  |  |
| AI1      | Analog<br>Input                         | Voltage /<br>Current<br>Analog input<br>port | AI1:0~5V、0~10V、0~20Ma ;  |  |  |
| AI2      |   |  | AI2:0~5V、0~10V、0~20Ma  |  |  |
| GND      | Analog<br>grounding                     | Self-contained<br>Power supply<br>Ground     | Ground terminal of external control signal (voltage control signal or current source control signal) is also the ground of 10V power supply of this inverter.  |  |  |
| 24V      | Power<br>supply                         | Control power<br>supply                      | Power: 24±1.5V, grounding is CM; Current is restricted below 200mA for external use.   |  |  |
| DI1      | Digital<br>input<br>control<br>terminal | Forward jogging                              |  | The functions of input terminals shall be defined per manufacturer's value. Other functions can also be defined by changing                      |  |
| DI2      |   | External scram                               |  |  |  |

|                                  |                             |  |   |                 |
|----------------------------------|-----------------------------|--|---|-----------------|
| DI3                              |                             | “FWD” Terminal                           | When this terminal is valid, inverter will run forward.   | function codes. |
| DI4                              |                             | “REV” Terminal                           | When this terminal is valid, inverter will run reversely.   |                 |
| DI5                              |                             | Reset                                    |   |                 |
| DI6                              |                             | Free stop                                | Make this terminal valid during running can realize free stop.  |                 |
| CM                               | Common port                 | Grounding of control power supply        | The grounding of 24V power supply and other control signals.  |                 |
| +5V                              | Power supply                | RS485 differential signal positive       | RS-485 differential signal positive power supply  |                 |
| A+                               | 485 communication terminals | Positive polarity of differential signal | Standard: TIA/EIA-485(RS-485)<br>Communication protocol: MODBUS<br>Communication rate: 1200/2400/4800/9600/19200/38400/57600bps |                 |
| B-                               |                             | Negative polarity of differential signal |   |                 |
| CAN <sub>H</sub> <sup>Note</sup> | Communication terminal      | CAN communication terminal high level    | CAN <sub>H</sub> bus line(dominant high)  |                 |
| CAN <sub>L</sub> <sup>Note</sup> |                             | CAN communication terminal low level     | CAN <sub>L</sub> bus line(dominant low)   |                 |
| GND <sup>Note</sup>              |                             | Signal grounding                         | Ground/0V/V-  |                 |

**Note:**

GND terminal is on the left side of drive, shielded twisted-pair cable is recommended for communication cable. Please turn J8 coding switch of the first inverter and the last inverter on CAN communication to ON position, turn J8 coding switch of the other inverters on CAN communication to OFF position. Shielding layer is connected to ground by one spot.



**Fig 4-5 Coding switch J8**

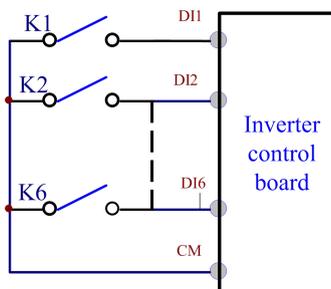
### Wiring for digital input terminals:

Generally, shield cable is adopted and wiring distance should be as short as possible. When active signal is adopted, it is necessary to take filter measures to prevent power supply interference. Mode of contact control is recommended.

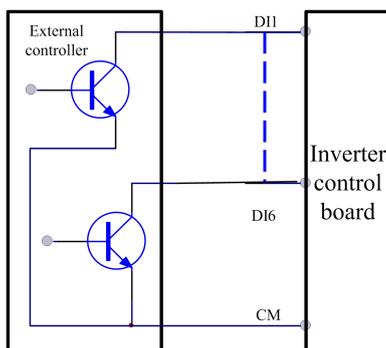
Digital input terminals are only connected by common source electrode (NPN mode) or by common drain electrode (PNP mode). If NPN mode is adopted, please turn the toggle switch to the end of “NPN”.

Wiring for control terminals as follows:

#### 1. Wiring for positive source electrode (NPN mode).

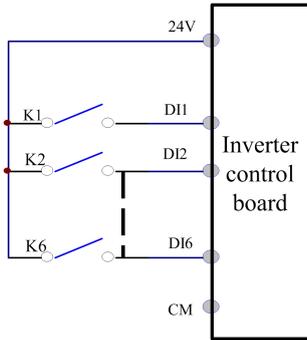


#### 2. Wiring for active source electrode(NPN mode)

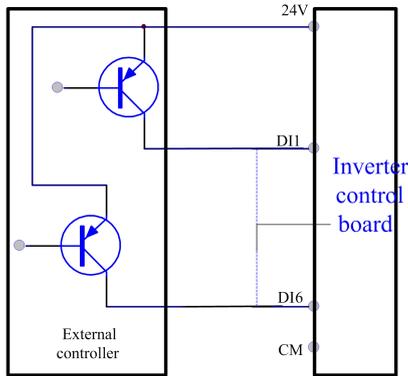


If digital input control terminals are connected by drain electrode, please turn the toggle switch to the end of “PNP”. Wiring for control terminals as follows:

3. Wiring for positive drain electrode (PNP mode)



4. Wiring for active drain electrode (PNP mode)



Wiring by source electrode is a mode in common use at present. As factory defaults of control terminals, wiring for control terminal is connected by source electrode, user should choose wiring mode according to requirement.

Instructions of choosing NPN mode or PNP mode:

1. There is a toggle switch J7 near to control terminals. Please refer to Fig 3-5.
2. When turning J7 to "NPN", DI terminal is connected to CM.  
When turning J7 to "PNP", DI terminal is connected to 24V.



Fig 3-5 Toggle Switch J7

### 3.5 Measurement of main circuit(voltages, currents and powers)

Since the voltages and currents on the inverter power supply and output sides include high-frequency components, measurement data depends on the instruments used and circuits measured. When commercial frequency instruments are used for measurement, measure the following circuits(Fig3-6) with the recommended instruments(Table 3-3).

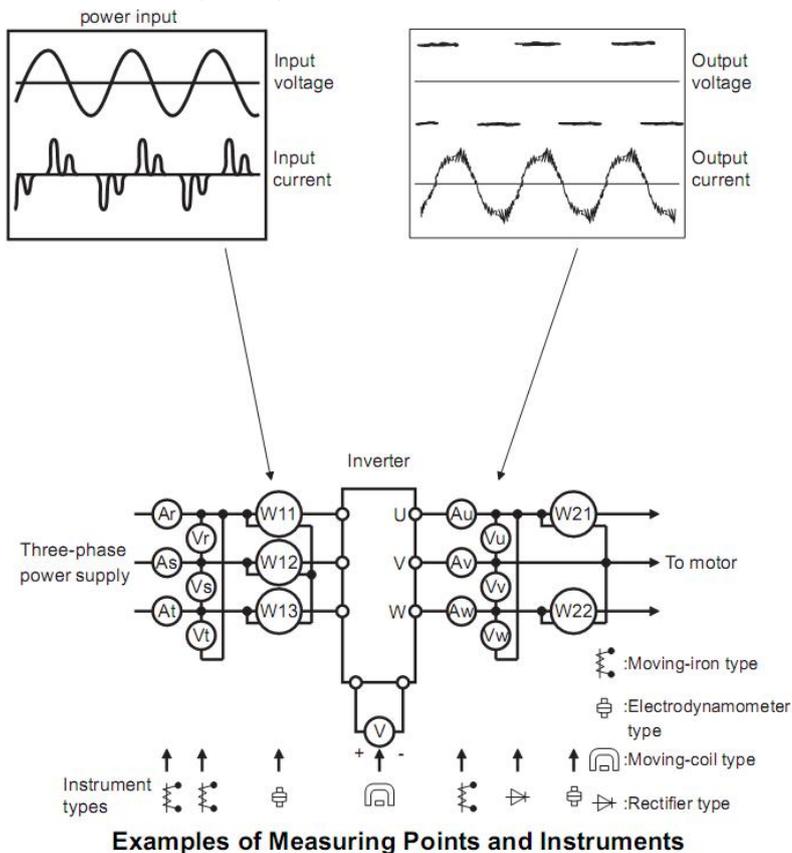


Fig 3-6 Measurement diagram

**Table 3-3 Measuring instruments**

| Item                                      | Measuring Point  | Measuring Instrument  | Remarks (Reference Measurement Value)  |
|---|--|---|--|
| Power supply voltage V1                   | Across R-S,S-T, T-R  | Moving-iron type AC voltmeter                                 | 380±15%,<br>220V±15%   |
| Power supply side current I1              | R, S, and T line currents  | Moving-iron type AC voltmeter                                 |  |
| Power supply side power P1                | At R, S and T, and across R-S, S-T and T-R   | Electrodynamics type single-phase wattmeter                   | P1=W11+W12+W13<br>(3-wattmeter method)   |
| Power supply side power factor Pfl        | Calculate after measuring power supply voltage, power supply side current and power supply side power.[Three phase power supply]<br>$Pfl = \frac{P1}{\sqrt{3}V1 \times I1} \times 100\%$ |   |  |
| Output side voltage V2                    | Across U-V, V-W and W-U  | Rectifier type AC voltmeter (Moving-iron type cannot measure) | Difference between the phases is within ±1% of the maximum output voltage.   |
| Output side current I2                    | U, V and W line currents   | Moving-iron type AC Ammeter                                   | Current should be equal to or less than rated inverter current.<br>Difference between the phases is ±10% or lower of the rated inverter current. |
| Output side power P2                      | U, V, W and U-V, V-W,W-U   | Electrodynamics' type single-phase wattmeter                  | P2 = W21 + W22<br>2-wattmeter method   |
| Output side power factor Pfl2             | Calculate in similar manner to power supply side power factor:<br>$Pfl2 = \frac{P2}{\sqrt{3}V2 \times I2} \times 100\%$  |   |  |
| DC bus voltage (Rectifier bridges output) | Across P+ (P) and -(N)   | Moving-coil type (such as multi-meter)                        | DC voltage, the value is $\sqrt{2} \times V1$  |
| Power supply of control PCB               | Across 10V-GND   | Moving-coil type (such as multi-meter)                        | DC10V±0.2V   |
|   | Across 24V-CM  | Moving-coil type (such as multi-meter)                        | DC24V±1.5V   |
| Analog output AO1                         | Across AO1-GND   | Moving-coil type (such as multi-meter)                        | Approx. DC10V at max frequency.  |
| Alarm signal                              | Across TA/TC<br>Across TB/TC   | Moving-coil type (such as multi-meter)                        | <Normal> <Abnormal><br>Across TA/TC: Discontinuity<br>Continuity<br>Across TB/TC: Continuity<br>Discontinuity                                    |

### 3.6 Wiring Recommended

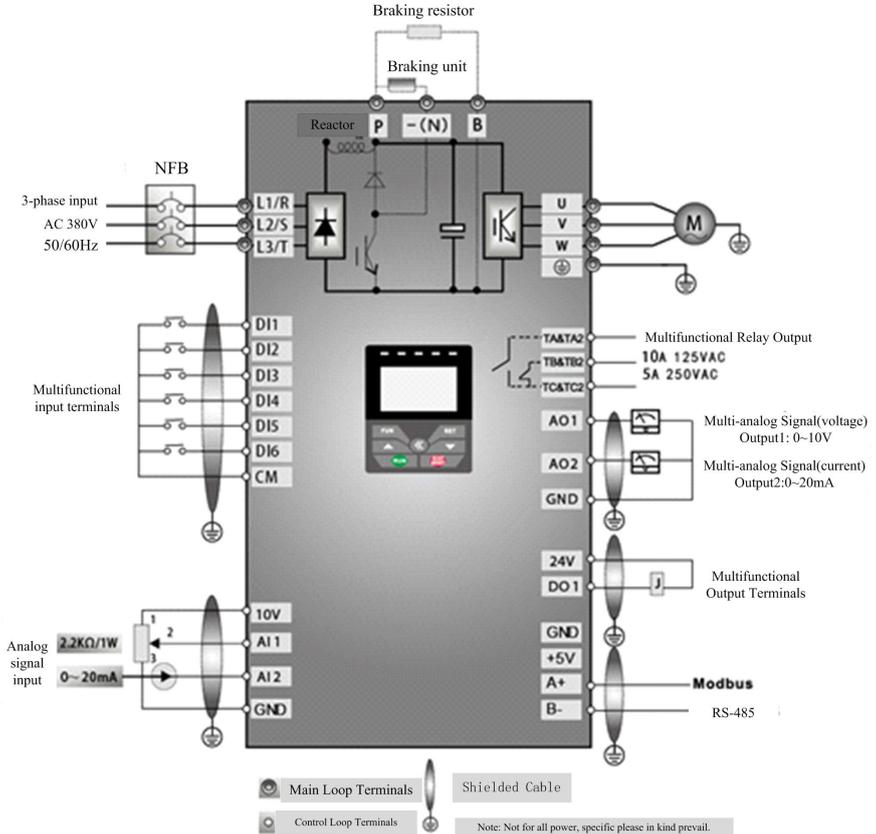
| Inverter Model | LeadSectionArea(mm <sup>2</sup> ) | Inverter Model | LeadSectionArea(mm <sup>2</sup> ) |
|----------------|-----------------------------------|----------------|-----------------------------------|
| EM30-0004S2    | 1.5                               | EM30-0055T2    | 6.0                               |
| EM30-0007S2    | 2.5                               | EM30-0007T3    | 1.5                               |
| EM30-0015S2    | 2.5                               | EM30-0015T3    | 2.5                               |
| EM30-0022S2    | 4.0                               | EM30-0022T3    | 2.5                               |
| EM30-0004T2    | 1.5                               | EM30-0030T3    | 2.5                               |
| EM30-0007T2    | 2.5                               | EM30-0040T3    | 2.5                               |
| EM30-0015T2    | 2.5                               | EM30-0055T3    | 4.0                               |
| EM30-0022T2    | 4.0                               | EM30-0075T3    | 4.0                               |
| EM30-0030T2    | 4.0                               | EM30-0110T3    | 6.0                               |
| EM30-0040T2    | 4.0                               |                |                                   |

### 3.7 Lead section area of protect conductor (grounding wire)

| Lead section area S of U,V,W (mm <sup>2</sup> ) | Minimum lead section area S of E (mm <sup>2</sup> ) |
|---|---|
| $S \leq 16$                                     | S   |
| $16 < S \leq 35$                                | 16  |
| $35 < S$  | S/2   |

### 3.8 Overall Connection

Refer to the figure below for overall connection sketch for EM30 series inverters. Wiring mode is available for various terminals whereas not every terminal needs connection when applied



Note:

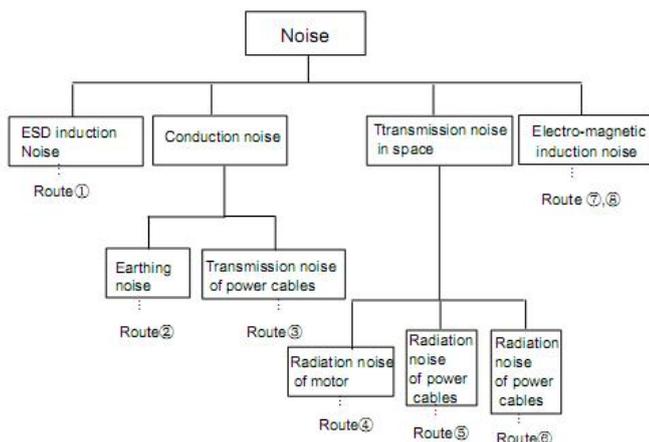
1. The contact capacity of inverter is 10A/125VAC, 5A/250VAC and 5A/30VDC.

### 3.9 Solutions of conduction and radiation interference

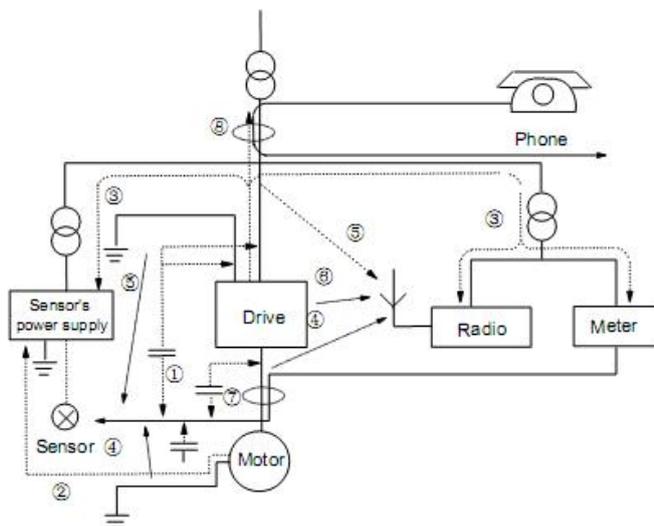
The noise generated by the drive may disturb the equipment nearby. The degree of disturbance depends on the drive system, immunity of the equipment, wiring, installation clearance and earthing methods.

#### 3.9.1 Noise propagation paths and suppressing methods

##### ① Noise categories



##### ② Noise propagation paths

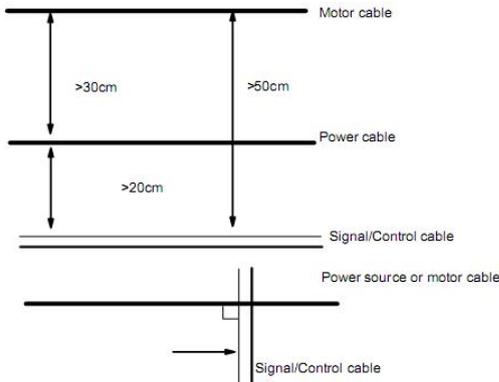


## ③ Basic methods of suppressing the noise

| Noise emission paths | Actions to reduce the noise   |
|----------------------|---|
| ②                    | When the external equipment forms a loop with the drive, the equipment may suffer nuisance tripping due to the drive's earth leakage current. The problem can be solved if the equipment is not grounded.   |
| ③                    | If the external equipment shares the same AC supply with the drive, the drive's noise may transmit along its input power supply cables, which may cause nuisance tripping to other external equipment. Take the following actions to solve this problem: Install noise filter at the input side of the drive, and use an isolation transformer or line filter to prevent the noise from disturbing the external equipment.  |
| ④⑤⑥                  | If the signal cables of measuring meters, radio equipment and sensors are installed in a cabinet together with the drive, these equipment cables will be easily disturbed. Take the actions below to solve the problem:<br>(1) The equipment and the signal cables should be as far away as possible from the drive. The signal cables should be shielded and the shielding layer should be grounded. The signal cables should be placed inside a metal tube and should be located as far away as possible from the input/output cables of the drive. If the signal cables must cross over the power cables, they should be placed at right angle to one another.<br>(2) Install radio noise filter and linear noise filter (ferrite common-mode choke) at the input and output of the drive to suppress the emission noise of power lines.<br>(3) Motor cables should be placed in a tube thicker than 2mm or buried in a cement conduit. Power cables should be placed inside a metal tube and be grounded by shielding layer |
| ①⑦⑧                  | Don't route the signal cables in parallel with the power cables or bundle these cables together because the induced electro-magnetic noise and induced ESD noise may disturb the signal cables. Other equipment should also be located as far away as possible from the drive. The signal cables should be placed inside a metal tube and should be placed as far away as possible from the input/output cables of the drive. The signal cables and power cables should be shielded cables. EMC interference will be further reduced if they could be placed inside metal tubes. The clearance between the metal tubes should be at least 20cm.   |

## 3.9.2 Field Wire Connections

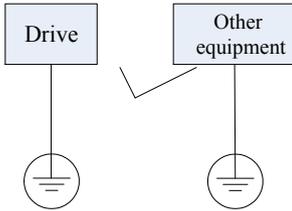
Control cables, input power cables and motor cables should be installed separately, and enough clearance should be left among the cables, especially when the cables are laid in parallel and the cable length is big. If the signal cables must go through the power cables, they should be vertical to each other.



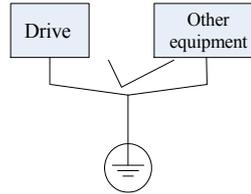
Generally, the control cables should be shielded cables and the shielding metal net must be connected to the metal enclosure of the drive by cable clamps.

### 3.9.3 Earthing

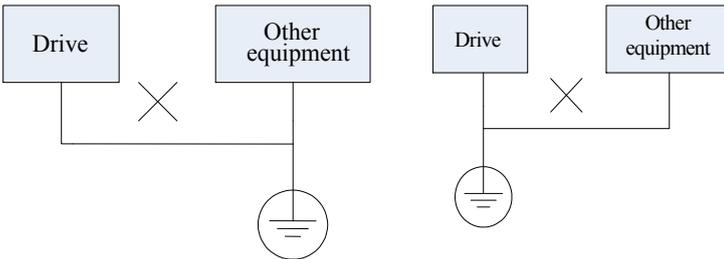
Independent earthing poles (best)



shared earthing pole (good)



Shared earthing cable (not good)



**Note:**

1. In order to reduce the earthing resistance, flat cable should be used because the high frequency impedance of flat cable is smaller than that of round cable with the same CSA.
2. If the earthing poles of different equipment in one system are connected together, then the leakage current will be a noise source that may disturb the whole system. Therefore, the drive's earthing pole should be separated with the earthing pole of other equipment such as audio equipment, sensors and PC, etc.
3. Earthing cables should be as far away from the I/O cables of the equipment that is sensitive to noise, and also should be as short as possible.

### 3.9.4 Leakage current and treatment

Leakage current may flow through the drive's input and output capacitors and the motor's capacitor. The leakage current value is dependent on the distributed capacitance and carrier wave frequency. The leakage current includes ground leakage current and the leakage current between lines.

#### Ground leakage current

The ground leakage current cannot only flow into the drive system, but also other equipment via earthing cables. It may cause the leakage current circuit breaker and relays falsely activated. The higher the drive's carrier wave frequency, the bigger the leakage current, also, the longer the motor cable, the greater the leakage current,

Suppressing methods:

- Reduce the carrier wave frequency, but the motor noise may be louder;
- Motor cables should be as short as possible;
- The drive and other equipment should use leakage current circuit breaker designed for protecting the product against high-order harmonics/surge leakage current;

Leakage current between lines

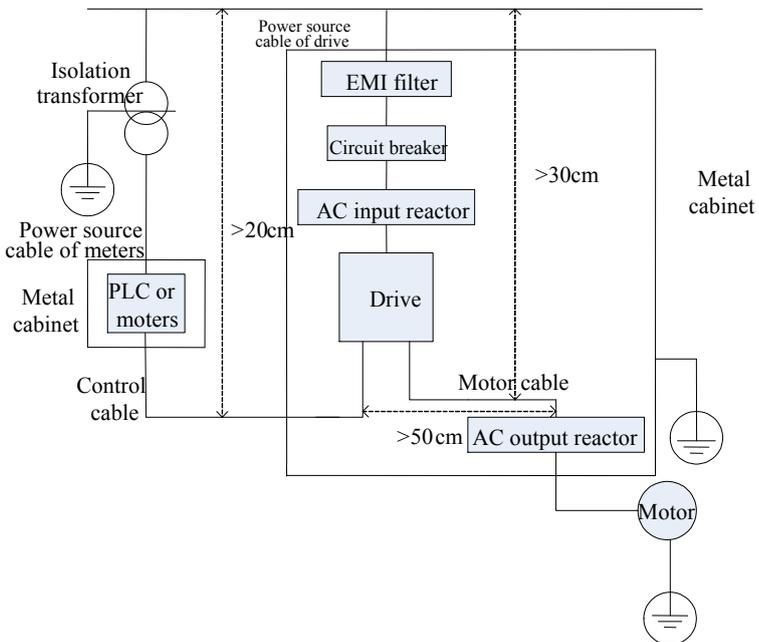
The line leakage current flowing through the distribution capacitors of the drive out side may cause the thermal relay falsely activated, especially for the drive whose power is lower than 7.5kW. When the cable is longer than 50m, the ratio of leakage current to motor rated current may be increased that can cause the wrong action of external thermal relay very easily.

Suppressing methods:

- Reduce the carrier wave frequency, but the motor noise may become louder;
- Install reactor at the output side of the drive.

In order to protect the motor reliably, it is recommended to use a temperature sensor to detect the motor's temperature, and use the drive's over-load protection device (electronic thermal relay) instead of an external thermal relay.

### 3.9.5 Electrical installation of the drive



**Note:**

- Motor cable should be earthed at the drive side, if possible, the motor and drive should be earthed separately;
- Motor cable and control cable should be shielded. The shield must be earthed and avoid entangling at cable end to improve high frequency noise immunity.
- Assure good conductivity among plates, screw and metal case of the drive; use tooth-shape washer and conductive installation plate;

### 3.9.6 Application of Power Line Filter

Power source filter should be used in the equipment that may generate strong EMI or the equipment that is sensitive to the external EMI. The power source filter should be a two-way low pass filter through which only 50Hz current can flow and high frequency current should be rejected.

#### Function of power line filter

The power line filter ensures the equipment can satisfy the conducting emission and conducting sensitivity in EMC standard. It can also suppress the radiation of the equipment.

#### Common mistakes in using power cable filter

##### 1. Too long power cable

The filter inside the cabinet should be located near to the input power source. The length of the power cables should be as short as possible.

##### 2. The input and output cables of the AC supply filter are too close

The distance between input and output cables of the filter should be as far apart as possible, or the high frequency noise may be coupled between the cables and bypass the filter. Thus, the filter will become ineffective.

##### 3. Bad earthing of filter

The filter's enclosure must be earthed properly to the metal case of the drive. In order to be earthed well, make use of a special earthing terminal on the filter's enclosure. If you use one cable to connect the filter to the case, the earthing is useless for high frequency interference. When the frequency is high, so is the impedance of cable, hence there is little bypass effect. The filter should be mounted on the enclosure of equipment. Ensure to clear away the insulation paint between the filter case and the enclosure for good earthing contact.

## IV. Operation and Simple Running

This chapter mainly introduces the basic knowledge of our products, related operation procedure and methods. It will be helpful to your correct operation.

### 4.1 Basic conception

#### 4.1.1 Control mode

EM30 inverter has three control modes: sensorless vector control (F106=0), VVVF control (F106=2), vector control 1 (F106=3) and PMSM sensorless vector control (F106=6).

#### 4.1.2 Torque Compensation Mode

Under VVVF control mode, EM30 inverter has five kinds of torque compensation modes: Linear compensation (F137=0); Square compensation (F137=1); User-defined multipoint compensation (F137=2); Auto torque compensation (F137=3) and V/F separation (F137=4.)

#### 4.1.3 Frequency Setting Mode

Please refer to F203–F207 for the method for setting the running frequency of the EM30 inverter.

#### 4.1.4 Mode of controlling for running command

The channel for inverter to receive control commands (including start, stop and jogging, etc) contains five modes: 0. Keypad (keypad panel) control; 1. External terminal control; 2. MODBUS+Terminal control; 3. MODBUS control; 4. Keypad+Terminal+MODBUS control

The modes of control command can be selected through the function codes F200 and F201.

#### 4.1.5 Operating status of inverter

When the inverter is powered on, there are four kinds of operating status: stopped status, programming status, running status, and fault alarm status. They are described as follows:

##### 1) Stopped status

If re-energize the inverter (if “auto-startup after being powered on” is not set) or decelerate the inverter to stop, the inverter is at the stopping status until receiving control command. At this moment, the running status indicator on the keypad goes off, and the display shows the display status before power down.

##### 2) Programming status

Through keypad panel, the inverter can be switched to the status that can read or change the function code parameters. Such a status is the programming status.

There are numbers of function parameters in the inverter. By changing these parameters, the user can realize different control modes.

##### 3) Running status

The inverter at the stopped status or fault-free status will enter running status after having received operation command.

The running indicator on keypad panel lights up under normal running status.

##### 4) Fault alarm status

The status under which the inverter has a fault and the fault code is displayed.

Fault codes mainly include: OC, OE, OL1, OL2, OH, LU, PF1 and PF0 representing “over current”, “over voltage”, “inverter overload”, “motor overload”, “overheat”, “input under-voltage”, “input phase loss”, and “output phase loss” respectively.

For trouble shooting, please refer to Appendix I to this manual, “Trouble Shooting”.

## 4.2 Keypad panel and operation method

Keypad panel (keypad) is standard configuration of EM30 inverter. Through keypad panel, the user can carry out parameter setting, status monitoring and operation control over the inverter. Both keypad panel and display screen are arranged on the keypad controller, which mainly consists of three sections: data display section, status indicating section, and keypad operating section.

It is necessary to know the functions and how to use the keypad panel. Please read this manual carefully before operation.

### 4.2.1 Operation Method of keypad panel

(1) Operation process of setting the parameters through keypad panel

A three-level menu structure is adopted for setting the parameters through keypad panel of inverter, which enables convenient and quick searching and changing of function code parameters.

Three-level menu: Function code group (first-level menu) → Function code (second-level menu) → Set value of each function code (third-level menu).

(2) Setting the parameters

Setting the parameters correctly is a precondition to give full play of inverter performance. The following is the introduction on how to set the parameters through keypad panel.

Operating procedures of keypad panel:

- a. Press the “Fun” key, to enter programming menu.
- b. Press  the key, and ▲ and ▼ key, the function code will change within the function code group. The first number behind F displayed on the panel is 1, in other words, it displays F1××at this moment. Press ▲ and ▼ key, function code will change between FIXX to FCXX.
- c. Press the key  again, the function code will change within the code group. Press ▲ and ▼ to change the function code to F113; press the “Set” key to display 50.00; while press ▲ and ▼ to change to the need frequency.
- d. Press the “Set” key to complete the change.

### 4.2.2 Switching and displaying of status parameters

Under stopped status or running status, status parameters of the inverter can be displayed. Actual parameters displayed can be selected and set through function codes F131 and F132. Through the  key, it can switch over repeatedly and display the parameters of stopped status or running status. The followings are the description of operation method of displaying the parameters under stopped status and running status.

(1) Switching of the parameters displayed under stopped status

Under stopped status, inverter has five parameters of stopped status, which can be switched over repeatedly and displayed with the keys “Fun”. These parameters are displaying: keypad jogging, target rotary speed, PN voltage, PID feedback value, and temperature. Please refer to the description of function code F132.

(2) Switching of the parameters displayed under running status

Under running status, eight parameters of running status can be switched over repeatedly and displayed with the keys “Fun”. These parameters are displayed: output frequency, output rotary speed, output current, output voltage, PN voltage, PID feedback value, temperature, PID given value and linear speed. Please refer to the description of function code F131.

### 4.2.3 Operation process of measuring motor parameters

The user shall input the parameters accurately as indicated on the nameplate of the motor prior to selecting auto torque compensation of VVVF control mode. Inverter will match standard motor stator resistance parameters according to these parameters indicated on the nameplate. To achieve better control performance, the user may start the inverter to measure the motor stator resistance parameters, so as to obtain accurate parameters of the motor controlled.

The motor parameters can be tuned through function code F800.

For example: If the parameters indicated on the nameplate of the motor controlled are as follows: numbers of motor poles are 4; rated power is 7.5kW; rated voltage is 400V; rated current is 15.4A; rated frequency is 50.00HZ; and rated rotary speed is 1440rpm, operation process of measuring the parameters shall be done as described in the following:

1. In accordance with the above motor parameters, set the values of F801 to F805 correctly: set the value of F801 = 7.5, F802 = 400, F803 = 15.4, F804 = 4 and F805 = 1440 respectively.
2. In order to ensure dynamic control performance of the inverter, set F800=1, i.e. select rotating tuning. Make sure that the motor is disconnected from the load. Press the “Run” key on the keypad, and the inverter will display “TEST”, and it will tune the motor’s parameters of two stages. After that, the motor will accelerate according to the acceleration time set at F114 and maintain for a certain period. The speed of motor will then decelerate to 0 according to the time set at F115. After auto-checking is completed, relevant parameters of the motor will be stored in function codes F806–F809, and F800 will turn to 0 automatically.
3. If it is impossible to disconnect the motor from the load, select F800=2, i.e. stationary tuning. Press the “Run” key, the inverter will display “TEST...”, and it will tune the motor’s parameters of two stages. The motor’s stator resistance, rotor resistance and leakage inductance will be stored in F806-F808 automatically, and F800 will turn to 0 automatically. The user may also calculate and input the motor’s mutual inductance value manually according to actual conditions of the motor.

## 4.2.4 Operation process of simple running

Table 4-1 Brief Introduction to Inverter Operation Process

| Process  | Operation  | Reference                                    |
|--|--|--|
| Installation and operation environment   | Install the inverter at a location meeting the technical specifications and requirements of the product. Mainly take into consideration the environment conditions (temperature, humidity, etc) and heat radiation of the inverter, to check whether they can satisfy the requirements.  | See Chapters I, II, III.                     |
| Wiring of the inverter   | Wiring of input and output terminals of the main circuit; wiring of grounding; wiring of switching value control terminal, analog terminal and communication interface, etc.   | See Chapter III.                             |
| Checking before getting energized  | Make sure that the voltage of input power supply is correct; the input power supply loop is connected with a breaker; the inverter has been grounded correctly and reliably; the power cable is connected to the power supply input terminals of inverter correctly (L1, L2/N terminals for single-phase power grid, and R/L1, S/L2, and T/L3 for three-phase power grid); the output terminals U, V, and W of the inverter are connected to the motor correctly; the wiring of control terminals is correct; all the external switches are preset correctly; and the motor is under no load (the mechanical load is disconnected from the motor). | See Chapters I, II, III                      |
| Checking immediately after energized   | Check if there is any abnormal sound, fuming or foreign flavor with the inverter. Make sure that the display of keypad panel is normal, without any fault alarm message. In case of any abnormality, switch off the power supply immediately.  | See Appendix 1                               |
| Inputting the parameters indicated on the motor's nameplate correctly, and measuring the motor's parameters. | Make sure to input the parameters indicated on the motor nameplate correctly, and study the parameters of the motor. The users shall check carefully, otherwise, serious problems may arise during running. Before initial running with vector control mode, carry out tuning of motor parameters, to obtain accurate electric parameters of the motor controlled. Before carrying out tuning of the parameters, make sure to disconnect the motor from mechanical load, to make the motor under entirely no load status. It is prohibited to measure the parameters when the motor is at a running status.  | See description of parameter group F800-F830 |
| Setting running control parameters   | Set the parameters of the inverter and the motor correctly, which mainly include target frequency, upper and lower frequency limits, acceleration/deceleration time, and direction control command, etc. The user can select corresponding running control mode according to actual applications.  | See description of parameter group.          |
| Checking under trail run with no load  | With the motor under no load, start the inverter with the keypad or control terminal. Check and confirm running status of the drive system.<br>Motor's status: stable running, normal running, correct rotary direction, normal acceleration/deceleration process, free from abnormal vibration, abnormal noise and foreign flavor.<br>Inverter status: normal display of the data on keypad panel, normal running of the fan, normal acting sequence of the relay, free from the abnormalities like vibration or noise.<br>In case of any abnormality, stop and check the inverter immediately.   | See Chapter IV.                              |

|                                    |   |  |
|------------------------------------|---|--|
| Checking under trail run with load | After successful test run under no load, connect the load of drive system properly. Start the inverter with the keypad or control terminal, and increase the load gradually. When the load is increased to 50% and 100%, keep the inverter run for a period respectively, to check if the system is running normally. Carry out overall inspection over the inverter during running, to check if there is any abnormality. In case of any abnormality, stop and check the inverter immediately.                   |  |
| Checking during running            | Check if the motor is running stably, if the rotary direction of the motor is correct, if there is any abnormal vibration or noise when the motor is running, if the acceleration/deceleration process of the motor is stable, if the output status of the inverter and the display of keypad panel is correct, if the blower fan is run normally, and if there is any abnormal vibration or noise. In case of any abnormality, stop the inverter immediately, and check it after switching off the power supply. |  |

### 4.3 Illustration of basic operation

Illustration of inverter basic operation: we hereafter show various basic control operation processes by taking a 7.5kW inverter that drives a 7.5kW three-phase asynchronous AC motor as an example in fig 4-1.

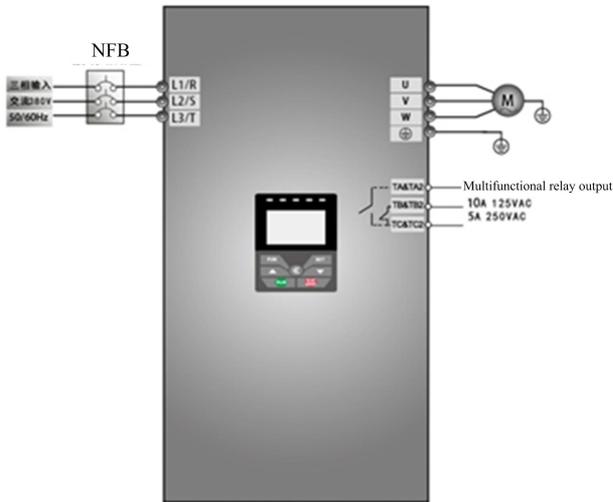


Figure 4-1 Wiring Diagram 1

The parameters indicated on the nameplate of the motor are as follows: 4 poles; rated power, 7.5kW; rated voltage, 400V; rated current, 15.4A; rated frequency 50.00HZ; and rated rotary speed, 1440rpm.

### 4.3.1 Operation process of frequency setting, start, forward running and stop with keypad panel

- (1) Connect the wires in accordance with Figure 4-1. After having checked the wiring successfully, switch on the air switch, and power on the inverter.
- (2) Press the “Fun” key, to enter the programming menu.
- (3) Measure the parameters of the motor.

| Function code | Values |
|---------------|--------|
| F800          | 1(2)   |
| F801          | 7.5    |
| F802          | 400    |
| F803          | 15.4   |
| F805          | 1440   |
| F810          | 50.00  |

Press the “Run” key, to measure the parameters of the motor. After completion of the tuning, the motor will stop running, and relevant parameters will be stored in F806 ~ F809. For the details of tuning of motor parameters, please refer to “Operation process of measuring the motor parameters” in this manual and Chapter XII of this manual. (Note: F800=1 is rotating tuning, F800=2 is stationary tuning. In the mode of rotating tuning, make sure to disconnect the motor from the load).

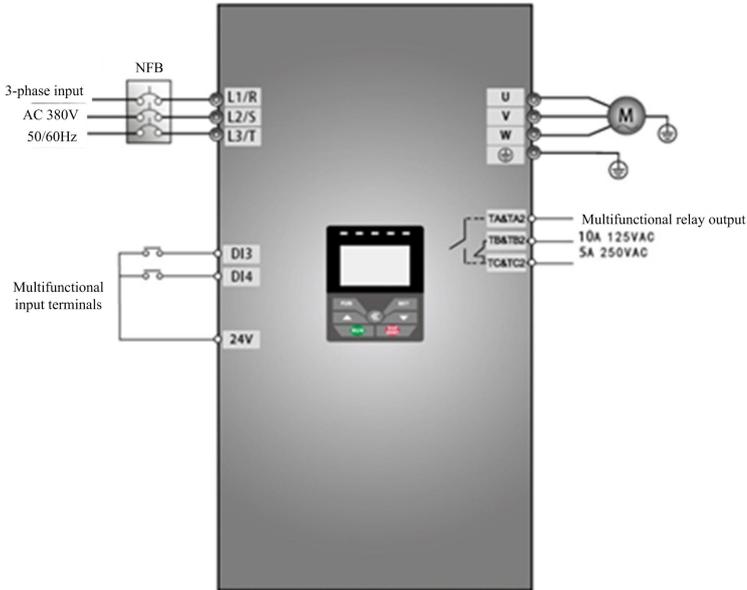
- (4) Set functional parameters of the inverter:

| Function code | Values |
|---------------|--------|
| F111          | 50.00  |
| F200          | 0      |
| F201          | 0      |
| F202          | 0      |
| F203          | 0      |

- (5) Press the “Run” key, to start the inverter;
- (6) During running, current frequency of the inverter can be changed by pressing ▲ or ▼;
- (7) Press the “STOP/RESET” key once, the motor will decelerate until it stops running;
- (8) Switch off the air switch, and power off the inverter.

### 4.3.2 Operation process of setting the frequency with keypad panel, and starting, forward and reverse running, and stopping inverter through control terminals

- (1) Connect the wires in accordance with Figure 4-2. After having checked the wiring successfully, switch on the air switch, and power on the inverter;



**Figure 4-2 Wiring Diagram 2(PNP)**

- (2) Press the “Fun” key, to enter the programming menu.
- (3) Study the parameters of the motor: the operation process is the same as that of example 1.
- (4) Set functional parameters of the inverter:

| Function code | Values |
|---------------|--------|
| F111          | 50.00  |
| F203          | 0      |
| F208          | 1      |

- (5) Close the switch DI3, the inverter starts forward running;
- (6) During running, current frequency of the inverter can be changed by pressing ▲ or ▼;
- (7) During running, switch off the switch DI3, then close the switch DI4, the running direction of the motor will be changed (Note: The user should set the dead time of forward and reverse running F120 on the basis of the load. If it was too short, OC protection of the inverter may occur.)
- (8) Switch off the switches DI3 and DI4, the motor will decelerate until it stops running;
- (9) Switch off the air switch, and power off the inverter.

### 4.3.3 Operation process of setting the frequency with analog terminal and controlling the operation with control terminals

- (1) Connect the wires in accordance with Figure 4-3. After having checked the wiring successfully, switch on the air switch, and power on the inverter.

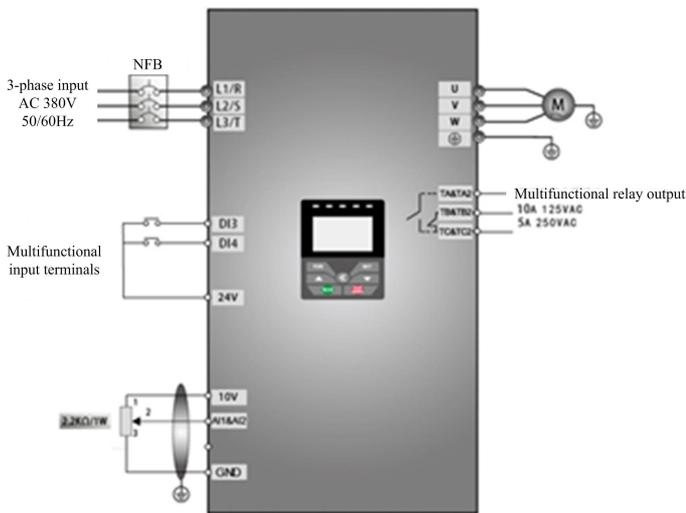


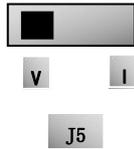
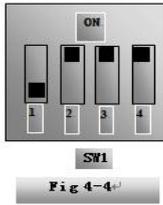
Figure 4-3 Wiring Diagram 3(PNP)

- (2) Press the “Fun” key, to enter the programming menu.  
 (3) Study the parameters of the motor: the operation process is the same as that of example 1.  
 (4) Set functional parameters of the inverter:

| Function code | Values |
|---------------|--------|
| F203          | 1      |
| F208          | 1      |

- (5) There is a red four-digit coding switch SW1 near the control terminal block of EM30 series, as shown in Figure 4-4. The function of coding switch is to select the analog input terminals AI1 and AI2, input range(0~5V/0~10V/0~20mA); In actual application, select the analog input channel through F203. The position of factory coding switch is showed in fig 4-4, AI1: 0~10V input, AI2: 0~20mA input; Another switches states and mode of control speed are as table 4-2.  
 (6) Close the switch DI3, the motor starts forward running;  
 (7) The potentiometer can be adjusted and set during running, and the current setting frequency of the inverter can be changed;  
 (8) During running process, switch off the switch DI3, then, close DI4, the running direction of the motor will be changed;  
 (9) Switch off the switches DI3 and DI4, the motor will decelerate until it stops running;  
 (10) Switch off the air switch, and power off the inverter.

- (11) There are two analog output terminals AO1 and AO2, both terminals can output voltage signal and current signal, the selecting switch of voltage/current is J5, the position of factory toggle switch is showed as below in Fig 4-5, AO1=V, AO2=I, the output relation is shown in table 4-3.



**Table 4-2 The Setting of Coding Switch and Parameters in the Mode of Analog Speed Control**

| Set F203=1, to select channel AI1 |          |                  |                     | Set F203=2, to select channel AI2 |          |                     |
|-----------------------------------|----------|------------------|---------------------|-----------------------------------|----------|---------------------|
| Coding Switch SW1                 |          | Toggle switch S1 | Analog signal range | Coding Switch SW1                 |          |                     |
| Switch 1                          | Switch 3 |                  |                     | Switch 2                          | Switch 4 | Analog signal range |
| OFF                               | OFF      | +                | 0~5V voltage        | OFF                               | OFF      | 0~5V voltage        |
| OFF                               | ON       | +                | 0~10V voltage       | OFF                               | ON       | 0~10V voltage       |
| ON                                | OFF      | +                | 0~20mA current      | ON                                | OFF      | 0~20mA current      |

ON refers to switching the coding switch to the top, OFF refers to switching the coding switch to the bottom

**Table 4-3 The relationship between AO1 and J5 and F423/F427:**

| AO1 output |   | Setting of F423/F427 |        |          |
|------------|---|----------------------|--------|----------|
|            |   | 0                    | 1      | 2        |
| J5         | V | 0~5V                 | 0~10V  | Reserved |
|            | I | Reserved             | 0~20mA | 4~20mA   |

## V. Function Parameters

### 5.1 Basic parameters

|      |                 |                       |                |
|------|-----------------|-----------------------|----------------|
| F100 | User's Password | Setting range: 0~9999 | Mfr's value: 0 |
|------|-----------------|-----------------------|----------------|

·When F107=1 with valid password, the user must enter correct user's password after power on or fault reset if you intend to change parameters. Otherwise, parameter setting will not be possible, and a prompt "Err1" will be displayed.

Relating function code: F107 Password valid or not F108 Setting user's password

|      |                              |  |  |
|------|------------------------------|--|--|
| F102 | Inverter's Rated Current (A) |  | Mfr's value: Subject to inverter model |
| F103 | Inverter Power (kW)          |  | Mfr's value: Subject to inverter model |

· Rated current and rated power can only be checked but cannot be modified.

|      |                      |                           |  |
|------|----------------------|---------------------------|--|
| F105 | Software Edition No. | Setting range: 1:00~10.00 | Mfr's value: Subject to inverter model |
|------|----------------------|---------------------------|--|

Software Edition No. can only be checked but cannot be modified.

|      |              |   |                |
|------|--------------|---|----------------|
| F106 | Control mode | Setting range:<br>0: Sensorless vector control (SVC);<br>2: V/F control;<br>3: Vector control 1;<br>4~5: Reserved;<br>6: PMSM sensorless vector control | Mfr's value: 2 |
|------|--------------|---|----------------|

0: Sensorless vector control is suitable for the application of high-performance requirement. One inverter can only drive one motor.

2: V/F control is suitable for common requirement of control precision or one inverter drives several motors.

3: Vector control 1 is auto torque promotion, which has the same function of F137=3. While studying motor parameters, motor does not need to be disconnected with load. One inverter can only drive one motor.

6: PMSM sensorless vector control is suitable for the application of high-performance requirement. One inverter can only drive one motor.

Note:

1. It is necessary to study the parameters of motor before inverter runs in the sensorless vector control (F106=0 or 3 or 6).
2. Under sensorless vector control (F106=0 or 3 or 6), one inverter can only drive one motor and the power of motor should be similar to the power of inverter. Otherwise, control performance will be decreased or system cannot work properly.
3. The operator may input motor parameters manually according to the motor parameters given by motor manufacturer.
4. Generally, the motor will work normally by inverter's default parameters, but the inverter's best control performance will not be acquired. Therefore, in order to get the best control performance, please study the parameters of motor before inverter runs in the sensorless vector control.

|      |                         |   |                |
|------|-------------------------|---|----------------|
| F107 | Password Valid or Not   | Setting range:<br>0: invalid;<br>1: valid | Mfr's value: 0 |
| F108 | Setting User's Password | Setting range: 0~9999                     | Mfr's value: 8 |

·When F107 is set to 0, the function codes can be changed without inputting the password.

When F107 is set to 1, the function codes can be changed only after inputting the user's password by F100.

·The user can change "User's Password" by F108. The operation process is the same as those of changing other parameters.

· Input the value of F108 into F100, and the user's password can be unlocked.

Note: When password protection is valid (F107=1), if the user's password is not entered, F108 will display 0.

|      |  |                           |                   |
|------|--|---------------------------|-------------------|
| F109 | Starting Frequency (Hz)                | Setting range: 0.00~10.00 | Mfr's value: 0.00 |
| F110 | Holding Time of Starting Frequency (S) | Setting range: 0.0~999.9  | Mfr's value: 0.0  |

·The inverter begins to run from the starting frequency. If the target frequency is lower than starting frequency, F109 is invalid.

·The inverter begins to run from the starting frequency. After it keeps running at the starting frequency for the time as set in F110, it will accelerate to target frequency. The holding time is not included in acceleration/deceleration time.

·Starting frequency is not limited by the Min frequency set by F112. If the starting frequency (F109) is lower than Min frequency set by F112, inverter will start according to the setting parameters set by F109 and F110.

After inverter starts and runs normally, the frequency will be limited by frequency set by F111 and F112.

·Starting frequency should be lower than Max frequency set by F111.

·F109 and F110 are invalid when speed track.

|      |                    |                           |                    |
|------|--------------------|---------------------------|--------------------|
| F111 | Max Frequency (Hz) | Setting range: F113~590.0 | Mfr's value: 50.00 |
| F112 | Min Frequency (Hz) | Setting range: 0.00~F113  | Mfr's value: 0.50  |

· Max frequency is set by F111.

Note: The max frequency is not allowed to higher than 500Hz under the vector mode (F106=0, 1).

· Min frequency is set by F112.

· The setting value of min frequency should be lower than target frequency set by F113.

· The inverter begins to run from the starting frequency. During inverter running, if the given frequency is lower than min frequency, then inverter will run at min frequency until inverter stops or given frequency is higher than min frequency.

Max/Min frequency should be set according to the nameplate parameters and running situations of motor. The motor is forbidden running at low frequency for a long time, or else motor will be damaged because of overheat.

|      |                       |                          |                    |
|------|-----------------------|--------------------------|--------------------|
| F113 | Target Frequency (Hz) | Setting range: F112~F111 | Mfr's value: 50.00 |
|------|-----------------------|--------------------------|--------------------|

·It shows the preset frequency. The value is the Mfr's value of the target frequency when setting the main frequency source as "digital setting". Under keypad speed control or terminal speed control mode, the inverter will run to this frequency automatically after startup.

E.g. Remain the factory defaults unchanged after power on, then press "RUN" key on keypad, so the inverter will run from 0Hz to 50Hz(default value of target frequency).

|      |                              |                            |  |
|------|------------------------------|----------------------------|--|
| F114 | First Acceleration Time (S)  | Setting range:<br>0.1~3000 | Mfr's value: subject to inverter model |
| F115 | First Deceleration Time (S)  |                            |  |
| F116 | Second Acceleration Time (S) |                            |  |
| F117 | Second Deceleration Time (S) |                            |  |

· F119 is used as the reference of setting accel/decel time.

· The second Acceleration/Deceleration time can be chosen by setting multifunction digital input terminals F316~F323 to make value 18 and connecting DI terminal with CM terminal. Please refer to the instructions of multi-functional input terminals.

Note: when speed track is working, acceleration/deceleration time, min frequency and target frequency are invalid.

After speed track is finished, inverter will run to target frequency according to acceleration/deceleration time.

|      |                       |                            |                    |
|------|-----------------------|----------------------------|--------------------|
| F118 | Corner Frequency (Hz) | Setting range: 15.00~590.0 | Mfr's value: 50.00 |
|------|-----------------------|----------------------------|--------------------|

· F118 Corner frequency is the final frequency of V/F curve, and also is the least frequency according to the highest output voltage.

· Corner frequency is as same as motor rated frequency normally.

· When running frequency is lower than this value, inverter has constant-torque output. When running

frequency exceeds this value, inverter has constant-power output.

Note: During the process of speed track, corner frequency is invalid. After speed track is finished, this function code is valid.

|      |   |   |                |
|------|---|---|----------------|
| F119 | The reference of setting accel/decel time | Setting range: 0: 0~50.00Hz<br>1: 0~max frequency | Mfr's value: 0 |
|------|---|---|----------------|

When F119=0, acceleration/ deceleration time means the time for inverter to accelerate/ decelerate from 0Hz (50Hz) to 50Hz (0Hz).

When F119=1, acceleration/ deceleration time means the time for inverter to accelerate/ decelerate from 0Hz (max frequency) to max frequency (0Hz).

|      |  |                         |                   |
|------|--|-------------------------|-------------------|
| F120 | Forward / Reverse Switchover dead-Time (S) | Setting range: 0.0~3000 | Mfr's value: 0.00 |
|------|--|-------------------------|-------------------|

· Within “forward/ reverse switchover dead-time”, this latency time will be cancelled and the inverter will switch to run in the other direction immediately upon receiving “stop” signal. This function is suitable for all the speed control modes except automatic cycle operation.

· This function can ease the current impact in the process of direction switchover.

Note: during the process of speed track, F120 is invalid. After speed track is finished, this function code is valid.

|      |                           |  |                |
|------|---------------------------|--|----------------|
| F122 | Reverse Running Forbidden | Setting range:<br>0: invalid; 1: valid | Mfr's value: 0 |
|------|---------------------------|--|----------------|

When F122=1, inverter will only run forward no matter the state of terminals and the parameters set by F202. Inverter will not run reverse and forward / reverse switchover is forbidden. If reverse signal is given, inverter will stop.

If reverse running locking is valid (F202=1), whatever speed track is valid or not, inverter has no output.

When F122=1, F613=1 and inverter gets forward running command and motor is sliding reverse, if inverter can detect the sliding direction and track to motor speed, then inverter will run to 0.0Hz reverse, then run forward according to the setting value of parameters.

|      |   |                         |                |
|------|---|-------------------------|----------------|
| F123 | Negative frequency allowed in the mode of combined speed control. | 0: Invalid;<br>1: valid | Mfr's value: 0 |
|------|---|-------------------------|----------------|

· In the mode of combined speed control, if running frequency is negative and F123=0, inverter will run at 0Hz; if F123=1, inverter will run reverse at this frequency. (This function is controlled by F122.)

|      |                               |                          |  |
|------|-------------------------------|--------------------------|--|
| F124 | Jogging Frequency (Hz)        | Setting range: F112~F111 | Mfr's value: 5.00                      |
| F125 | Jogging Acceleration Time (S) | Setting range: 0.1~3000  | Mfr's value: subject to inverter model |
| F126 | Jogging Deceleration Time (S) |                          |  |

· In the case of terminal jogging, make “jogging” terminal (such as DI1) connected to CM, and inverter will run to jogging frequency. The rated function codes are from F316 to F323.

Note: when jogging function is valid, speed track function is invalid.

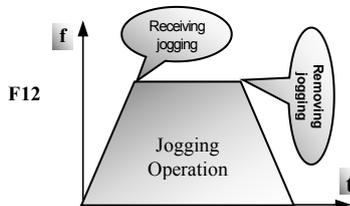


Figure 5-1 Jogging Operation

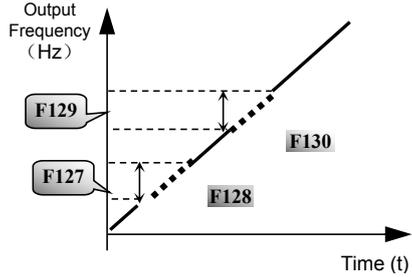
|           |                         |                           |                  |
|-----------|-------------------------|---------------------------|------------------|
| F127/F129 | Skip Frequency A,B (Hz) | Setting range: 0.00~590.0 | Mfr's value:0.00 |
| F128/F130 | Skip Width A,B (Hz)     | Setting range:0~2.50      | Mfr's value: 0.0 |

· Systematic vibration may occur when the motor is running at a certain frequency. This parameter is set to skip this frequency.

·The inverter will skip the point automatically when output frequency is equal to the set value of this parameter.

·“Skip Width” is the span from the upper to the lower limits around Skip Frequency. For example, Skip Frequency=20Hz, Skip Width=±0.5Hz, inverter will skip automatically when output is between 19.5~20.5Hz.

·Inverter will not skip this frequency span during acceleration/deceleration.



**Figure 5-2 Skip Frequency**

Note: During the process of speed track, skip frequency function is invalid. After speed track is finished, this function is valid.

|                                   |   |   |
|-----------------------------------|---|---|
| <p>F131 Running Display Items</p> | <p>0—Current output frequency/function-code<br/>                 1—Output rotary speed<br/>                 2—Output current<br/>                 4—Output voltage<br/>                 8—PN voltage<br/>                 16—PID feedback value<br/>                 32—Temperature<br/>                 64—Count values<br/>                 128—Linear speed<br/>                 256—PID set value<br/>                 2048—Output power<br/>                 4096— Output torque</p> | <p>Mfr’s value:<br/>                 0+1+2+4+8=15</p> |
|-----------------------------------|---|---|

·Selection of one value from 1, 2, 4, 8, 16, 32, 64 and 128 shows that only one specific display item is selected. Should multiple display items be intended, add the values of the corresponding display items and take the total values as the set value of F131, e.g., just set F131 to be 19 (1+2+16) if you want to call “current output rotary speed”, “output current” and “PID feedback value”. The other display items will be covered.

·As F131=8191, all display items are visible, of which, “frequency/function-code” will be visible whether it is selected or not.

·If user intend to check any the display content, press << key to check them.

·Whatever the value of F131 is set to, corresponding target frequency will flash under stopped status.

Note: when count value is displayed and it exceeds 9999, only 4 digits are displayed and add a decimal point to it, i.e. 12345 is displayed as the form of 1234. .

|                                   |   |  |
|-----------------------------------|---|--|
| <p>F132 Display items of stop</p> | <p>Setting range:<br/>                 0: Frequency/function-code<br/>                 2: Target rotary speed<br/>                 4: PN voltage<br/>                 8: PID feedback value<br/>                 16: Temperature<br/>                 32: Count value<br/>                 64: PID given value<br/>                 512: Setting torque</p> | <p>Mfr’s value:<br/>                 0+2+4=6</p> |
|-----------------------------------|---|--|

Note: The setting and displaying of F132 is the same as F131.

|      |                              |                           |                    |
|------|------------------------------|---------------------------|--------------------|
| F133 | Drive ratio of driven system | Setting range: 0.10~200.0 | Mfr's value: 1.00  |
| F134 | Transmission-wheel radius    | 0.001~1.000 (m)           | Mfr's value: 0.001 |

·Calculation of rotary speed and linear speed:

For example, If inverter's max frequency F111=50.00Hz, pole numbers of motor F804=4, drive ratio F133=1.00, transmission-shaft radius R=0.05m, then

Transmission shaft perimeter:  $2\pi r = 2 \times 3.14 \times 0.05 = 0.314$  (meter)

Transmission shaft rotary speed:  $60 \times \text{operation frequency} / (\text{numbers of poles pairs} \times \text{drive ratio}) = 60 \times 50 / (2 \times 1.00) = 1500 \text{rpm}$

Endmost linear speed: rotary speed  $\times$  perimeter =  $1500 \times 0.314 = 471$  (meters/second)

|      |            |  |                |
|------|------------|--|----------------|
| F135 | User macro | Setting range:<br>0: Invalid 1: user macro 1 2: user macro 2 | Mfr's value: 0 |
|------|------------|--|----------------|

When F135=0, user macro parameters are not saved.

When F135=1, all setting parameters are saved in user macro 1.

When F135=2, all setting parameters are saved in user macro 2.

After macro is saved, user can check macro by setting F160=21 or F160=22

|      |                   |                     |                |
|------|-------------------|---------------------|----------------|
| F136 | Slip compensation | Setting range: 0~10 | Mfr's value: 0 |
|------|-------------------|---------------------|----------------|

·Under V/F control mode, rotary speed of motor rotor will decrease as load increases. Be assured that rotor rotate speed is near to synchronization rotary speed while motor with rated load, slip compensation should be adopted according to the setting value of frequency compensation.

Note: during the process of speed track, slip compensation function is invalid. After speed track is finished, this function is valid.

|      |                              |   |  |
|------|------------------------------|---|--|
| F137 | Modes of torque compensation | Setting range:<br>0: Linear compensation;<br>1: Square compensation;<br>2: User-defined multipoint compensation<br>3: Auto torque compensation<br>4: V/F separation | Mfr's value: 0                         |
| F138 | Linear compensation          | Setting range: 1~20   | Mfr's value: subject to inverter model |
| F139 | Power compensation           | Setting range: 1: the power of 1.5<br>2: the power of 1.8<br>3: the power of 1.9<br>4: the 2nd power<br>5、 6: Reserved  | Mfr's value: 1                         |

When F106=2, the function of F137 is valid.

To compensate low-frequency torque controlled by VVVF, output voltage of inverter while low-frequency should be compensated.

When F137=0, linear compensation is chosen and it is applied on universal constant-torque load;

When F137=1, square compensation is chose and it is applied on the loads of fan or water pump;

When F137=2, user-defined multipoint compensation is chosen and it is applied on the special loads of spin-drier or centrifuge;

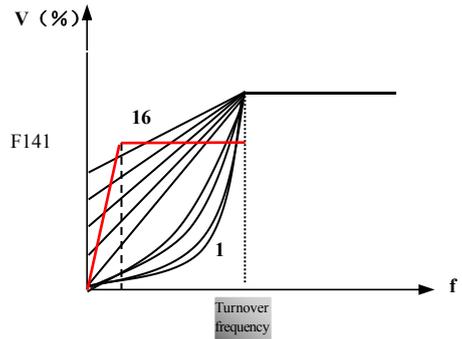
This parameter should be increased when the load is heavier, and this parameter should be decreased when

the load is lighter.

If the torque is elevated too much, motor is easy to overheat, and the current of inverter will be too high. Please check the motor while elevating the torque.

When F137=3, auto torque compensation is chose and it can compensate low-frequency torque automatically, to diminish motor slip, to make rotor rotary speed close to synchro rotary speed and to restrain motor vibration. Customers should set correctly motor power, rotary speed, numbers of motor poles, motor rated current and stator resistance. Please refer to the chapter “Operation process of measuring motor parameters”.

When F137=4, output voltage is not related to output frequency, output frequency is controlled by frequency source, and output voltage is controlled by F671.



**Fig 5-3 Torque Promotion**

|  |                          |                               |
|--|--------------------------|-------------------------------|
| F140 Voltage compensation point frequency (Hz) | Setting range: 0.00~F142 | Mfr's value: 1.00             |
| F141 Voltage compensation point 1 (%)          | Setting range: 0~30      | Mfr's value: subject to model |
| F142 User-defined frequency point F2 (Hz)      | Setting range: F140~F144 | Mfr's value: 5.00             |
| F143 User-defined voltage point V2 (%)         | Setting range: 0~100     | Mfr's value: 13               |
| F144 User-defined frequency point F3 (Hz)      | Setting range: F142~F146 | Mfr's value: 10.00            |
| F145 User-defined voltage point V3 (%)         | Setting range: 0~100     | Mfr's value: 24               |
| F146 User-defined frequency point F4 (Hz)      | Setting range: F144~F148 | Mfr's value: 20.00            |
| F147 User-defined voltage point V4 (%)         | Setting range: 0~100     | Mfr's value: 45               |
| F148 User-defined frequency point F5 (Hz)      | Setting range: F146~F150 | Mfr's value: 30.00            |
| F149 User-defined voltage point V5 (%)         | Setting range: 0~100     | Mfr's value: 63               |
| F150 User-defined frequency point F6 (Hz)      | Setting range: F148~F118 | Mfr's value: 40.00            |
| F151 User-defined voltage point V6 (%)         | Setting range: 0~100     | Mfr's value: 81               |

As shown in Fig5-3, when F317=0, VF curve compensation =Max (F138, F141)

When F137=1, VF curve compensation =Max (F139, F141)

When F137=2, VF curve compensation =Max (Custom compensation, F141)

When F317=3, auto compensation.

F141 cannot be set too high; otherwise, inverter will easily trip into OH and OC.

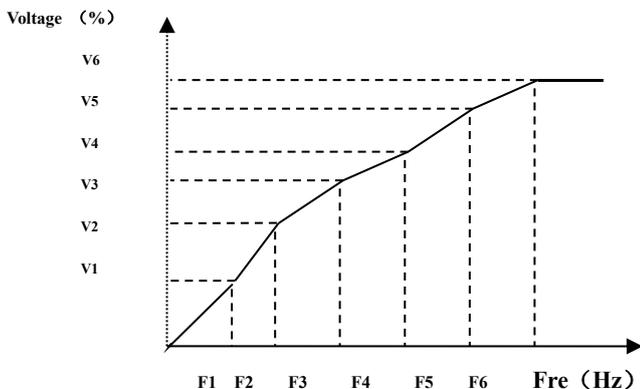
Multi-stage V/F curves are defined by 12 parameters from F140 to F151.

The setting value of VVVF curve is set by motor load characteristic.

Note:  $V_1 < V_2 < V_3 < V_4 < V_5 < V_6$ ,  $F_1 < F_2 < F_3 < F_4 < F_5 < F_6$ . As low-frequency, if the setting voltage is too high,

motor will overheat even damaged. Inverter will be OC stalling or occur over-current protection.

Note: during the process of speed track, polygonal-line V/F curve function is invalid. After speed track is finished, this function is valid.



**Fig 5-4 Polygonal-Line Type VF**

|   |                       |                  |
|---|-----------------------|------------------|
| F152 Output voltage corresponding to corner frequency | Setting range: 10~100 | Mfr's value: 100 |
|---|-----------------------|------------------|

This function can meet the needs of some special loads, for example, when the frequency outputs 300Hz and corresponding voltage outputs 200V (supposed voltage of inverter power supply is 380V), corner frequency F118 should be set to 300Hz and F152 is set to  $(200 \div 380) \times 100 = 52.6$ . And F152 should be equal to 53.

Please pay attention to nameplate parameters of motor. If the working voltage is higher than rated voltage or the frequency is higher than rated frequency, motor would be damaged.

|                                |   |   |
|--------------------------------|---|---|
| F153 Carrier frequency setting | Setting range:<br>subject to inverter model | Mfr's value:<br>subject to inverter model |
|--------------------------------|---|---|

Carrier-wave frequency of inverter is adjusted by setting this code function. Adjusting carrier-wave could reduce motor noise; avoid point of resonance of mechanical system, decrease leakage current of wire to earth and the interference of inverter.

When carrier-wave frequency is low, although carrier-wave noise from motor will increase, the current leaked to the earth will decrease. The wastage of motor and the temperature of motor will increase, but the temperature of inverter will decrease.

When carrier-wave frequency is high, the situations are opposite, and the interference will raise.

When output frequency of inverter is adjusted to high frequency, the setting value of carrier-wave should be increased. Performance is influenced by adjusting carrier-wave frequency as below table:

|                        |            |
|------------------------|------------|
| Carrier-wave frequency | Low → High |
| Motor noise            | Loud → Low |
| Waveform of output     | Bad → Good |
| Motor temperature      | High → Low |
| Inverter temperature   | Low → High |
| Leakage current        | Low → High |
| Interference           | Low → High |

Derating use is need if carrier frequency is adjusted to more than 10k. Refer to derating list below:

| Power | Carrier Frequency |     |     |     |     |     |     |
|-------|-------------------|-----|-----|-----|-----|-----|-----|
|       | 10K               | 11K | 12K | 13K | 14K | 15K | 16K |
| 0.4   | 100%              | 85% | 80% | 75% | 70% | 65% | 60% |
| 0.75  | 100%              | 80% | 75% | 70% | 60% | 55% | 50% |
| 1.5   | 100%              | 85% | 80% | 75% | 70% | 65% | 60% |
| 2.2   | 100%              | 81% | 76% | 71% | 61% | 56% | 51% |
| 3     | 100%              | 80% | 75% | 70% | 60% | 55% | 50% |
| 4     | 100%              | 85% | 80% | 75% | 70% | 65% | 60% |
| 5.5   | 100%              | 81% | 76% | 71% | 61% | 56% | 51% |
| 7.5   | 100%              | 80% | 75% | 70% | 60% | 55% | 50% |

|                                      |   |                |
|--------------------------------------|---|----------------|
| F154 Automatic voltage rectification | Setting range:<br>0: Disabled<br>1: Enabled<br>2: Disabled only in deceleration process | Mfr's value: 0 |
|--------------------------------------|---|----------------|

This function is enable to keep output voltage constant automatically in the case of fluctuation of input voltage, but the deceleration time will be affected by internal PI adjustor. If deceleration time is forbidden being changed, please select F154=2.

|   |                       |                |
|---|-----------------------|----------------|
| F155 Digital accessorial frequency setting(Hz)      | Setting range: 0~F111 | Mfr's value: 0 |
| F156 Digital accessorial frequency polarity setting | Setting range: 0 ~1   | Mfr's value: 0 |
| F157 Reading accessorial frequency                  |                       |                |
| F158 Reading accessorial frequency polarity         |                       |                |

Under combined speed control mode, when accessorial frequency source is digital setting memory (F204=0), F155 and F156 are considered as initial set values of accessorial frequency and polarity (direction).

In the mode of combined speed control, F157 and F158 are used for reading the value and direction of accessorial frequency.

For example, when F203=1, F204=0. F207=1, the given analog frequency is 15Hz; inverter is required to run to 20Hz. In case of this requirement, user can push "UP" button to raise the frequency from 15Hz to 20Hz. User can also set F155=5Hz and F160=0 (0 means forward, 1 means reverse). In this way, inverter can run to 20Hz directly.

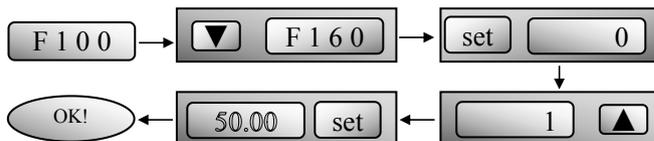
|                                    |  |                   |
|------------------------------------|--|-------------------|
| F159 Random carrier-wave selection | Setting range:<br>0: Control speed normally(prohibited)<br>1: Random carrier-wave frequency(allowed) | Mfr's value:<br>1 |
|------------------------------------|--|-------------------|

When F159=0, inverter will modulate as per the carrier-wave set by F153. When F159=1, inverter will operate in mode of random carrier-wave modulating.

Note: when random carrier-wave is selected, output torque will increase but noise will be loud. When the carrier-wave set by F153 is selected, noise will be reduced, but output torque will decrease. Please set the value according to the situation.

|                                       |   |                |
|---------------------------------------|---|----------------|
| F160 Reverting to manufacturer values | Setting range:<br>0: Not reverting to manufacture value<br>1: Reverting to manufacturer value | Mfr's value: 0 |
|---------------------------------------|---|----------------|

- When there is disorder with inverter's parameters and manufacturer values need to be restored, set F160=1. After "Reverting to manufacturer values" is done, F160 values will be automatically changed to 0.
- "Reverting to manufacturer values" will not work for the function-codes marked "o" in the "change" column of the parameters table. These function codes have been adjusted properly before delivery. And it is recommended not to change them.



**Figure 5-5 Reverting to manufacturer values**

## 5.2 Operation Control

|                              |  |                |
|------------------------------|--|----------------|
| F200 Source of start command | Setting range:<br>0: Keypad command;<br>1: Terminal command;<br>2: Keypad+Terminal;<br>3: MODBUS;<br>4: Keypad+Terminal+MODBUS | Mfr's value: 4 |
| F201 Source of stop command  | Setting range:<br>0: Keypad command;<br>1: Terminal command;<br>2: Keypad+Terminal;<br>3: MODBUS;<br>4: Keypad+Terminal+MODBUS | Mfr's value: 4 |

- F200 and F201 are the resource of selecting inverter control commands.
- Inverter control commands include: starting, stopping, forward running, reverse running, jogging, etc.
- "Keypad command" refers to the start/stop commands given by the "Run" or "stop/reset" key on the keypad.
- "Terminal command" refers to the start/stop command given by the "Run" terminal defined by F316-F323.
- When F200=3 and F201=3, the running command is given by MODBUS communication.
- When F200=2 and F201=2, "keypad command" and "terminal command" are valid at the mean time, F200=4 and F201=4 are the like.

|                                |   |                |
|--------------------------------|---|----------------|
| F202 Mode of direction setting | Setting range:<br>0: Forward running locking;<br>1: Reverse running locking;<br>2: Terminal setting | Mfr's value: 0 |
|--------------------------------|---|----------------|

- The running direction is controlled by this function code together with other speed control mode which can set the running direction of inverter. When auto-circulation speed is selected by F500=2 or F208≠0, this function code is not valid.
- When speed control mode without controlling direction is selected, the running direction of inverter is controlled by this function code, for example, keypad controls speed.

| Direction given by F202 | Direction given by other control mode | Running direction | remarks                              |
|-------------------------|---------------------------------------|-------------------|--------------------------------------|
| 0                       | 0                                     | 0                 | 0 means forward.<br>1 means reverse. |
| 0                       | 1                                     | 1                 |                                      |
| 1                       | 0                                     | 1                 |                                      |
| 1                       | 1                                     | 0                 |                                      |

|                              |  |                |
|------------------------------|--|----------------|
| F203 Main frequency source X | Setting range:<br>0: Memory of digital given;<br>1: External analog AI1;<br>2: External analog AI2;<br>3: Pulse input given;<br>4: Stage speed control;<br>5: No memory of digital given;<br>7, 8:Reserved;<br>9: PID adjusting;<br>10: MODBUS | Mfr's value: 0 |
|------------------------------|--|----------------|

· Main frequency source is set by this function code.

·0: Memory of digital given

Its initial value is the value of F113. The frequency can be adjusted through the key “up” or “down”, or through the “up”, “down” terminals.

“Memory of digital given” means after inverter stops, the target frequency is the running frequency before stop. If the user would like to save target frequency in memory when the power is disconnected, please set F220=1, i.e. frequency memory after power down is valid.

1: External analog AI1; 2: External analog AI2

The frequency is set by analog input terminal AI1 and AI2. The analog signal may be current signal (0-20mA or 4-20mA) or voltage signal (0-5V or 0-10V), which can be chosen by switch code. Please adjust the switch code according to practical situations, refer to fig 4-4 and table 4-2.

When inverters leave the factory, the analog signal of AI1 channel is DC voltage signal, the range of voltage is 0-10V, and the analog signal of AI2 channel is DC current signal, the range of current is 0-20 mA. If 4-20mA current signal is needed, please set lower limit of analog input F406=2, which input resistor is 500OHM. If some errors exist, please make some adjustments.

3: Pulse input given

When frequency is given by pulse input, the pulse is only inputted by DI1 terminal. The max pulse frequency is 10K. The related parameters are from F440 to F446.

4: Stage speed control

Multi-stage speed control is selected by setting stage speed terminals F316-F322 and function codes of multi-stage speed section. The frequency is set by multi-stage terminal or automatic cycling frequency.

5: No memory of digital given

Its initial value is the value of F113. The frequency can be adjusted through the key “up” or “down”, or through the “up”, “down” terminals.

“No memory of digital given” means that the target frequency will restore to the value of F113 after stop no matter the state of F220.

9: PID adjusting

When PID adjusting is selected, the running frequency of inverter is the value of frequency adjusted by PID. Please refer to instructions of PID parameters for PID given resource, PID given numbers, feedback source, and so on.

10: MODBUS

The main frequency is given by MODBUS communication.

|                                     |  |                |
|-------------------------------------|--|----------------|
| F204 Accessorial frequency source Y | Setting range:<br>0: Memory of digital given;<br>1: External analog AI1;<br>2: External analog AI2;<br>3: Pulse input given;<br>4: Stage speed control;<br>5: PID adjusting; | Mfr's value: 0 |
|-------------------------------------|--|----------------|

- When accessorial frequency Y is given to channel as independent frequency, it has the same function with main frequency source X.
- When F204=0, the initial value of accessorial frequency is set by F155. When accessorial frequency controls speed independently, polarity setting F156 is not valid.
- When F207=1 or 3, and F204=0, the initial value of accessorial frequency is set by F155, the polarity of accessorial frequency is set by F156, the initial value of accessorial frequency and the polarity of accessorial frequency can be checked by F157 and F158.
- When the accessorial frequency is given by analog input (AI1, AI2), the setting range for the accessorial frequency is set by F205 and F206.
- Note: accessorial frequency source Y and main frequency source X can not use the same frequency given channel.

**Table 5-1 Combination of Speed Control**

| F204                           | 0. Memory of digital given | 1 External analog AI1 | 2 External analog AI2 | 3 Pulse input given | 4 Terminal stage speed control | 5 PID adjusting | 6 Analog AI3 |
|--------------------------------|----------------------------|-----------------------|-----------------------|---------------------|--------------------------------|-----------------|--------------|
| 0 Memory of Digital setting    | ○                          | ●                     | ●                     | ●                   | ●                              | ●               | ●            |
| 1 External analog AI1          | ●                          | ○                     | ●                     | ●                   | ●                              | ●               | ●            |
| 2 External analog AI2          | ●                          | ●                     | ○                     | ●                   | ●                              | ●               | ●            |
| 3 Pulse input given            | ●                          | ●                     | ●                     | ○                   | ●                              | ●               | ●            |
| 4 Terminal Stage speed control | ●                          | ●                     | ●                     | ●                   | ○                              | ●               | ●            |
| 5 Digital given                | ○                          | ●                     | ●                     | ●                   | ●                              | ●               | ●            |
| 9 PID adjusting                | ●                          | ●                     | ●                     | ●                   | ●                              | ○               | ●            |
| 10 MODBUS                      | ●                          | ●                     | ●                     | ●                   | ●                              | ●               | ●            |

●: Inter-combination is allowable.

○: Combination is not allowable.

The mode of automatic cycle speed control is unable to combine with other modes. If the combination includes the mode of automatic cycle speed control, only main speed control mode will be valid.

|   |  |                  |
|---|--|------------------|
| F205 reference for selecting accessorial frequency source Y range | Setting range:<br>0: Relative to max frequency;<br>1: Relative to main frequency X | Mfr's value: 0   |
| F206 Accessorial frequency Y range (%)                            | Setting range: 0~100   | Mfr's value: 100 |

· When combined speed control is adopted for frequency source, F206 and F205 are used to confirm the relative object of the setting range for the accessorial frequency.

· F205 is to confirm the reference of the accessorial frequency range. If it is relative to main frequency, the range will change according to the change of main frequency X.

|                                 |   |                |
|---------------------------------|---|----------------|
| F207 Frequency source selecting | Setting range:<br>0: X;<br>1: X+Y;<br>2: X or Y (terminal switchover; X is prior to Y when no switchover);<br>3: X or X+Y (terminal switchover);<br>4: Combination of stage speed and analog<br>5: X-Y<br>6: X+Y-Y <sub>MAX</sub> *50%<br>7: Combination of stage speed and digit 1 | Mfr's value: 0 |
|---------------------------------|---|----------------|

· Select the channel of setting the frequency. The frequency is given by combination of main frequency X and accessorial frequency Y.

· When F207=0, the frequency is set by main frequency source.

· When F207=1, X+Y, the frequency is set by adding main frequency source to accessorial frequency source. X or Y cannot be given by PID.

· When F207=2, main frequency source and accessorial frequency source can be switched over by frequency source switching terminal.

· When F207=3, main frequency given and adding frequency given(X+Y) can be switched over by frequency source switching terminal. X or Y cannot be given by PID.

· When F207=4, stage speed setting of main frequency source has priority over analog setting of accessorial frequency source (only suitable for F203=4 F204=1).

· When F207=5, X-Y, the frequency is set by subtracting accessorial frequency source from main frequency source. If the frequency is set by main frequency or accessorial frequency, PID speed control cannot be selected.

· When F207=6, X+Y-Y<sub>MAX</sub>\*50%, the frequency is given by both main frequency source and accessorial frequency source. X or Y can be given by PID. When F205=0, Y<sub>MAX</sub>=F111\*F206. When F205=1, Y<sub>MAX</sub>=X\*F206.

· When F207=7, the stage speed of main frequency source is in preference to the given digital value of accessorial frequency resource. (Only applied to F203=4, F204=0)

**Note:**

1. When F203=4 and F204=1, the difference between F207=1 and F207=4 is that when F207=1, frequency source selecting is the addition of stage speed and analog, when F207=4, frequency source selecting is stage speed with stage speed and analog given at the same time. If stage speed given is canceled and analog given still exists, inverter will run by analog given.

2. Frequency given mode can be switched over by selecting F207. For example: switching PID adjusting and normal speed control, switching stage speed and analog given, switching PID adjusting and analog given, and so on.
3. The acceleration/deceleration time of stage speed is set by function code of corresponding stage speed time. When combined speed control is adopted for frequency source, the acceleration/deceleration time is set by F114 and F115. When the combination of speed control(excluding auto-cycle), accelerate/decelerate by the first acceleration/deceleration time before giving stage-speed signal; accelerate/decelerate by corresponding stage speed time after giving stage-speed signal.
4. The mode of automatic cycle speed control is unable to combine with other modes.
5. When F207=2 (X or Y terminals switchover), if main frequency is not set to be under stage-speed control, accessory frequency can be set to under automatic cycle speed control (F204=4, F500=2). Through the defined switchover terminal, the control mode (defined by X) and automatic cycle speed control (defined by Y) can be freely switched.
6. If the settings of main frequency and accessory frequency are the same, only main frequency will be valid.
7. If F207=6, F205=0, and F206=100,  $X+Y-Y_{MAX} * 50\% = X+Y-F111 * 50\%$ ; If F207=6, F205=1, and F206=100,  $X+Y-Y_{MAX} * 50\% = X+Y-X * 50\%$ .

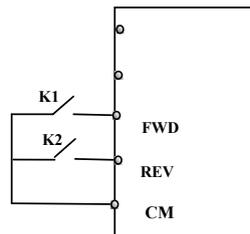
|  |  |                       |
|--|--|-----------------------|
| <p>F208<br/>Terminal<br/>two-line/three-line<br/>operation control</p> | <p>Setting range:<br/>0: No function<br/>1: Two-line operation mode 1;<br/>2: Two-line operation mode 2;<br/>3: three-line operation mode 1;<br/>4: three-line operation mode 2;<br/>5: start/stop controlled by direction pulse</p> | <p>Mfr's value: 0</p> |
|--|--|-----------------------|

- When selecting two-line type or three-line type), F200, F201 and F202 are invalid.
- Five modes are available for terminal operation control.
- “FWD”, “REV” and “X” are three terminals designated in programming DI1~DI8.

**1. Two-line operation mode 1: this mode is the most popularly used two-line mode. The running direction of mode is controlled by FWD, REV terminals.**

E.g.: “FWD” terminal-----“open”: stop, “closed”: forward running;  
 “REV” terminal-----“open”: stop, “closed”: reverse running;  
 “CM” terminal-----common port

| K1 | K2 | Running command |
|----|----|-----------------|
| 0  | 0  | Stop            |
| 1  | 0  | Forward running |
| 0  | 1  | Reverse running |
| 1  | 1  | Stop            |



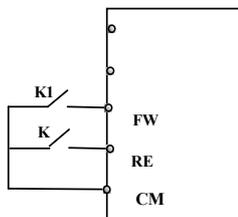
**2. Two-line operation mode 2: when this mode is used, FWD is enable terminal, the direction is controlled by REV terminal.**

For example: “FWD” terminal----“open”: stop, “closed”: running;

“REV” terminal----“open”: forward running, “closed”: reverse running;

“CM” terminal----common port

| K1 | K2 | Running command |
|----|----|-----------------|
| 0  | 0  | Stop            |
| 0  | 1  | Stop            |
| 1  | 0  | Forward running |
| 1  | 1  | Reverse running |



**3. Three-line operation mode 1:**

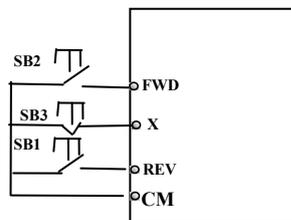
In this mode, X terminal is enable terminal, the direction is controlled by FWD terminal and REV terminal. Pulse signal is valid.

Stopping commands is enabled by opening X terminal.

SB3: Stop button

SB2: Forward button.

SB1: Reverse button.



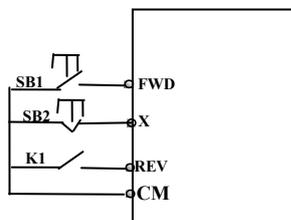
**4. Three-line operation mode 2:**

In this mode, X terminal is enable terminal, running command is controlled by FWD terminal. The running direction is controlled by REV terminal, and stopping command enable by opening X terminal.

SB1: Running button

SB2: Stop button

K1: direction switch. Open stands for forward running; close stands for reverse running.



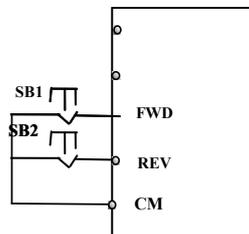
**5. Start/stop controlled by direction pulse:**

“FWD” terminal—(impulse signal: forward/stop)

“REV” terminal—(impulse signal: reverse/stop)

“CM” terminal—common port

Note: when pulse of SB1 triggers, inverter will run forward. When the



pulse triggers again, inverter will stop running.

|   |   |                |
|---|---|----------------|
| F209 Selecting the mode of stopping the motor | Setting range:<br>0: stop by deceleration time;<br>1: free stop<br>2: DC braking stop | Mfr's value: 0 |
|---|---|----------------|

When the stop signal is input, stopping mode is set by this function code:

F209=0: stop by deceleration time

Inverter will decrease output frequency according to setting acceleration/deceleration curve and decelerating time, after frequency decreases to 0, inverter will stop. This is often common stopping type. During the process of speed track, this function is invalid. And inverter will be forced to stop during this process.

F209=1: free stop

After stop command is valid, inverter will stop output. Motor will free stop by mechanical inertia.

F209=2 : Set DC braking waiting time (F656), DC braking frequency (F603) and braking duration time (F605) of shut-down status reasonably when using this function,

|                                     |                          |                   |
|-------------------------------------|--------------------------|-------------------|
| F210 Frequency display accuracy(Hz) | Setting range: 0.01~2.00 | Mfr's value: 0.01 |
|-------------------------------------|--------------------------|-------------------|

Under keypad speed control or terminal UP/DOWN speed control, frequency display accuracy is set by this function code and the range is from 0.01 to 2.00. For example, when F210=0.5, UP/DOWN terminal is pressed at one time, frequency will increase or decrease by 0.5Hz.

This function is valid when inverter is in the running state. When inverter is in the standby state, no matter what value of this function code is, frequency will increase or decrease by 0.01Hz.

|                                      |                           |                   |
|--------------------------------------|---------------------------|-------------------|
| F211 Speed of digital control (Hz/S) | Setting range: 0.01~100.0 | Mfr's value: 5.00 |
|--------------------------------------|---------------------------|-------------------|

When UP/DOWN terminal is pressed, frequency will change at the setting rate. The Mfr's value is 5.00Hz/s.

In practical application, set the value of F211 refer to the calculation of  $F114=50.00(\text{Hz})/F114$  if request to keep consistent with reset frequency and actual running frequency by setting UP/DOWN terminals. For example,  $F114=5.0\text{s}$ ,  $F211=50.00(\text{Hz})/5.0(\text{s})=10(\text{Hz}/\text{S})$

|                       |                                    |                |
|-----------------------|------------------------------------|----------------|
| F212 Direction memory | Setting range: 0: Invalid 1: Valid | Mfr's value: 0 |
|-----------------------|------------------------------------|----------------|

· This function is valid when three-line operation mode 1(F208=3) is valid.

· When F212=0, after inverter is stopped, reset and repower on, the running direction is not memorized.

· When F212=1, after inverter is stopped, reset and repower on, if inverter starts running but no direction signal, inverter will run according to the memory direction.

|                                       |   |                |
|---------------------------------------|---|----------------|
| F213 Auto-starting after repowered on | Setting range:<br>0: invalid; 1: valid<br>2: according to last running mode | Mfr's value: 0 |
| F214 Auto-starting after reset        | Setting range:<br>0: invalid; 1: valid                                      | Mfr's value: 0 |

· Whether or not to start automatically after repowered on is set by F213

F213=0, after repower-on, inverter will not run automatically unless running command is given to inverter.

F213=1, auto-starting after repowered on is valid. When inverter is power off and then powered on again, it will run automatically after the time set by F215. If F220=0 frequency memory after power-down is not valid, inverter will run by the setting value of F113.

F213=2, auto-starting after repowered on is valid. When inverter is power off and then powered on again, it will run automatically according to the running mode before power-down. If F220=0 frequency memory after power-down is not valid, inverter will run by the setting value of F113.

· Whether or not to start automatically after fault resetting is set by F214

When F214=1, if fault occurs, inverter will reset automatically after delay time for fault reset (F217). After resetting, inverter will run automatically after the auto-starting delay time (F215).

If frequency memory after power-down (F220) is valid, inverter will run at the speed before power-down. Otherwise, inverter will run at the speed set by F113.

In case of fault under running status, inverter will reset automatically and auto-start. In case of fault under stopped status, the inverter will only reset automatically.

When F214=0, after fault occurs, inverter will display fault code, it must be reset by manually.

|      |                          |                           |                   |
|------|--------------------------|---------------------------|-------------------|
| F215 | Auto-starting delay time | Setting range: 0.1~3000.0 | Mfr's value: 60.0 |
|------|--------------------------|---------------------------|-------------------|

F215 is the auto-starting delay time for F213 and F214. The range is from 0.1s to 3000.0s.

|      |   |                    |                |
|------|---|--------------------|----------------|
| F216 | Times of auto-starting in case of repeated faults | Setting range: 0~5 | Mfr's value: 0 |
|------|---|--------------------|----------------|

|      |                            |                           |                  |
|------|----------------------------|---------------------------|------------------|
| F217 | Delay time for fault reset | Setting range: 0.0~3000.0 | Mfr's value: 3.0 |
|------|----------------------------|---------------------------|------------------|

|      |                        |  |                |
|------|------------------------|--|----------------|
| F219 | EEPROM write operation | Setting range:<br>0:enabled to write<br>1:prohibit writing | Mfr's value: 1 |
|------|------------------------|--|----------------|

F216 sets the most times of auto-starting in case of repeated faults. If starting times are more than the setting value of this function code, inverter will not reset or start automatically after fault. Inverter will run after running command is given to inverter manually.

F217 sets delay time for fault reset. The range is from 0.0 to 10.0S which is time interval from fault to resetting.

When F219=1 (address 2001H is not operated by PC/PLC), the function code is modified by communication, and it is not saved in the EEPROM. It means there is no memory when power down. When F219=0 ((address 2001H is not operated by PC/PLC), the function code is modified by communication, and it is saved in the EEPROM. It means there is memory when power down.

When F160=1, the value of F219 cannot be reverted to Mfr's value.

|      |                                   |  |                |
|------|-----------------------------------|--|----------------|
| F220 | Frequency memory after power-down | Setting range:<br>0: invalid; 1: valid | Mfr's value: 0 |
|------|-----------------------------------|--|----------------|

F220 sets whether frequency memory is valid or not after power-down.

This function is valid for F213 and F214. Whether or not to memory running state after power-down or malfunction is set by this function.

The function of frequency memory after power-down is valid for main frequency and accessory frequency that is given by digital. Because the digital given accessory frequency has positive polarity and negative polarity, it is saved in the function codes F155 and F156.

|      |                        |                                    |                |
|------|------------------------|------------------------------------|----------------|
| F222 | count memory selection | Setting range: 0: Invalid 1: Valid | Mfr's value: 0 |
|------|------------------------|------------------------------------|----------------|

F220 sets whether or not count memory is valid. Whether or not to memory counting values after power-down or malfunction is set by this function.

|      |   |  |                |
|------|---|--|----------------|
| F224 | when target frequency is lower than Min frequency | Setting range:<br>0: stop<br>1: run at min frequency | Mfr's value: 0 |
|------|---|--|----------------|

F224=0, when target frequency is lower than MIN (F112, 0.1), inverter will stop.

F224=1, when target frequency is lower than Min frequency, inverter will run at Min frequency.

|      |                             |                         |                           |
|------|-----------------------------|-------------------------|---------------------------|
| F277 | Third acceleration time(S)  | Setting range: 0.1~3000 | Subject to inverter model |
| F278 | Third deceleration time(S)  |                         |                           |
| F279 | Fourth acceleration time(S) |                         |                           |

|      |                             |  |  |
|------|-----------------------------|--|--|
| F280 | Fourth deceleration time(S) |  |  |
|------|-----------------------------|--|--|

## 5.3 Multifunctional Input and Output Terminals

### 5.3.1 Digital multifunctional output terminals

|      |                    |   |                 |
|------|--------------------|---|-----------------|
| F300 | Relay token output | Setting range: 0–45                           | Mfr's value: 1  |
| F301 | DO1 token output   |   | Mfr's value: 14 |
| F302 | DO2 token output   | Refer to table 5-2 for detailed instructions. | Mfr's value: 5  |

F300–F302 are still valid when rotate speed tracking.

In water supply system, if the fixed mode or timing interchanging mode is selected, relay token output and DO1 token output is invalid.

Table 5-2 Instructions for digital multifunctional output terminal

| Value | Function                                  | Instructions  |
|-------|---|---|
| 0     | no function                               | Output terminal has no functions.   |
| 1     | inverter fault protection                 | When inverter works wrong, ON signal is output.   |
| 2     | over latent frequency 1                   | Please refer to instructions from F307 to F309.   |
| 3     | over latent frequency 2                   | Please refer to instructions from F307 to F309.   |
| 4     | free stop                                 | Under free stop status, after stop command is given, ON signal is output until inverter completely stops.   |
| 5     | In running status 1                       | Indicating that inverter is running and ON signal is output.  |
| 6     | Reserved                                  |   |
| 7     | acceleration/deceleration time switchover | Indicating that inverter is in the status of acceleration/deceleration time switchover  |
| 8     | Reaching the Set Count Value              | This terminal will be “action” when inverter carries the external count instruction and count value reaches the set value of F314.  |
| 9     | Reaching the Designated Count Value       | This terminal will be “action” when inverter carries the external count instruction and count value reaches the set value of F315.  |
| 10    | Inverter overload pre-alarm               | After inverter overloads, ON signal is output after the half time of protection timed, ON signal stops outputting after overload stops or overload protection occurs.                       |
| 11    | motor overload pre-alarm                  | After motor overloads, ON signal is output after the half time of protection timed, ON signal stops outputting after overload stops or overload protection occurs.                          |
| 12    | stalling                                  | During accel/decel process, inverter stops accelerating/decelerating because inverter is stalling, and ON signal is output.   |
| 13    | Inverter is ready to run                  | When inverter is powered on. Protection function is not in action and inverter is ready to run, then ON signal is output.   |
| 14    | In running status 2                       | Indicating that inverter is running and ON signal is output. When inverter is running at 0HZ, it seems as the running status, and ON signal is output.                                      |
| 15    | frequency arrival output                  | Indicating inverter runs to the setting target frequency, and ON signal is output. See F312.  |
| 16    | overheat pre-alarm                        | When testing temperature reaches 80% of setting value, ON signal is output. When overheat protection occurs or testing value is lower than 80%of setting value, ON signal stops outputting. |

|       |                                      |  |
|-------|--------------------------------------|--|
| 17    | Over latent current output           | When output current of inverter reaches the setting overlatent current, ON signal is output. See F310 and F311.  |
| 18    | Analog line disconnection protection | Indicating inverter detects analog input lines disconnection, and ON signal is output. Please refer to F741.   |
| 19    | Under-load 1 pre-alarm               | Please refer to FA26 and FA27.   |
| 20    | Zero current detecting output        | When inverter output current has fallen to zero current detecting value and after the setting time of F755, ON signal is output. Please refer to F754 and F755.  |
| 21    | Write DO1 by PC/PLC                  | 1 means token output is valid.<br>0 means token output is invalid.   |
| 22    | Write TA2/TC2 by PC/PLC              |  |
| 23    | Write TA1/TC1 by PC/PLC              |  |
| 24    | Watchdog output token                | The token output is valid when inverter trips into Err6.   |
| 25-29 | Reserved                             |  |
| 30    | General pump is running              | Indicating some general pumps are running.   |
| 31    | Converter pump is running            | Indicating some converter pumps are running.   |
| 32    | Over-limit pressure token            | Indicating the max limit value when PID adjusting is valid and negative feedback is selected, and feedback pressure is higher than max pressure set by F503  |
| 41    | Frequency source switchover          | Indicating the function of frequency source switchover.  |
| 43    | Communication timeout 1              | When F907>0, and receiving the previous data, if after the time set by F907, the next data is not received, inverter will output communication timeout signal. The timeout signal will be cleared by this terminal, and after receiving correct data, inverter will accumulate time again. |
| 45    | Lower than setting token temperature | Output token is valid when temperature is not higher than 0℃ ; Output token is invalid when temperature is higher than 0℃+2℃ ;   |
| 56    | Irradiation pre-alarm                | This token signal is valid when before irradiation is lower than FB56. This token signal is invalid when before illumination is higher than FB56.  |
| 57    | Battery panel bypass                 | When before illumination is lower than FB57, bus voltage is near to rated value, the token signal is valid after 15s. When before illumination is higher than FB56, the token signal is invalid.   |

|                               |   |                |
|-------------------------------|---|----------------|
| F303 DO output mode selection | Setting range:<br>0: Switch level output<br>1: pulse output | Mfr's value: 0 |
|-------------------------------|---|----------------|

- When switch level output is selected, all terminal functions in table 5-2 can be defined by F301.
- When pulse output is selected, DO1 can be defined as high-speed pulse output terminal. The max pulse frequency is 100 KHz. The related function codes are F449、F450、F451、F452、F453.

|   |   |      |
|---|---|------|
| F304 S curve beginning stage proportion (%) | Setting range: 2.0~50.0                       | 30.0 |
| F305 S curve ending stage proportion (%)    | Setting range: 2.0~50.0                       | 30.0 |
| F306 Acceleration/deceleration mode         | Setting range:<br>0: Straight-line 1: S curve | 0    |

The setting value of F304, F305 is the percentage of this time count for the time from current frequency to target frequency.

Please refer to Fig 5-9 about S curve acceleration/deceleration:

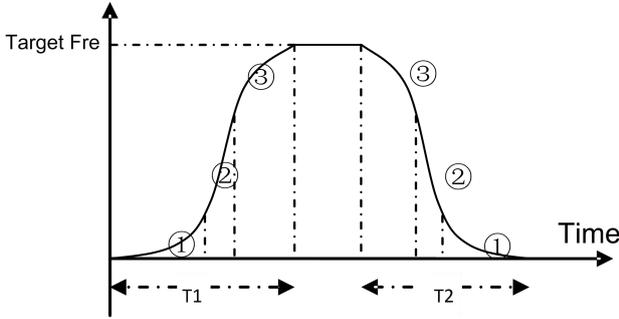


Fig 5-9 S Curve Acceleration /Deceleration

T1 is the acceleration time from present frequency to target frequency.

T2 is the deceleration time from present frequency to target frequency.

During the acceleration process, in the ① stage, the acceleration slope is bigger gradually, in the ② stage, the acceleration slope is constant, in the ③ stage, the acceleration slope is weaker gradually.

|   |                          |                 |
|---|--------------------------|-----------------|
| F307 Characteristic frequency 1(Hz)     | Setting range: F112~F111 | Mfr's value: 10 |
| F308 Characteristic frequency 2(Hz)     |                          | Mfr's value: 50 |
| F309 Characteristic frequency width (%) | Setting range: 0~100     | Mfr's value: 50 |

When F300=2, 3, F301=2, 3 and F302=2, 3 and token characteristic frequency is selected, this group function codes set characteristic frequency and its width. For example: setting F301=2, F307=10, F309=10, when frequency is higher than F307, DO1 outputs ON signal. When frequency is lower than  $(10-10*10\%) = 9\text{Hz}$ , DO1 outputs OFF signal.

|                                      |                         |                            |
|--------------------------------------|-------------------------|----------------------------|
| F310 Characteristic current (A)      | Setting range: 0~5000.0 | Mfr's value: Rated current |
| F311 Characteristic current width(%) | Setting range: 0~100    | Mfr's value: 10            |

When F300=17 and F301=17 and token characteristic current is selected, this group function codes set characteristic current and its width.

For example: setting F301=17, F310=100, F311=10, when inverter current is higher than F310, DO1 outputs ON signal. When inverter current is lower than  $(100-100*10\%) = 90\text{A}$ , DO1 outputs OFF signal.

|                                  |                          |                   |
|----------------------------------|--------------------------|-------------------|
| F312 Frequency arrival threshold | Setting range: 0.00~5.00 | Mfr's value: 0.00 |
|----------------------------------|--------------------------|-------------------|

When F300=15 and F301=15, threshold range is set by F312.

For example: when F301=15, target frequency is 20Hz and F312=2, the running frequency reaches 18Hz (20-2), ON signal is output by DO1 until the running frequency reaches target frequency.

|                                |                           |                   |
|--------------------------------|---------------------------|-------------------|
| F313 Count frequency divisions | Setting range: 1~65000    | Mfr's value: 1    |
| F314 Set count value           | Setting range: F315~65000 | Mfr's value: 1000 |
| F315 Designated count value    | Setting range: 1~F314     | Mfr's value: 500  |

- Count frequency divisions refer to the ratio of actual pulse input and inverter's count times, i.e.,

$$\text{Inverter's Count Times} = \frac{\text{Actual Pulse Input}}{\text{Count Frequency Division}}$$

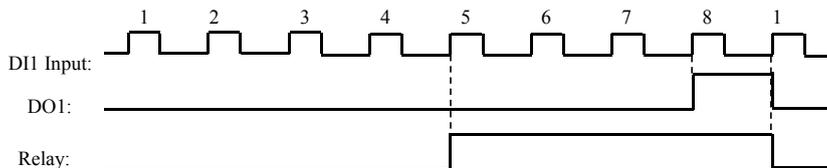
E.g.: When F313=3, inverter will count once for every 3 inputs of external pulse.

- Set count values refer to a count width pulse output by the output terminal (DO1 terminal or relay) programmed with “reaching the set count values” function when a certain number of pulses are input from DI1. Count will restart after the count value reaches “set times”.

As shown in Fig 5-6: if F313=1, F314=8, F301=8, DO1 will output an instruction signal when DI1 inputs the 8<sup>th</sup> pulse.

- Designated count values refer to an pulse output by the output terminal (DO1 or RELAY terminal) programmed with “reaching the set count values” function when a certain number of pulses are input from DI1, until count value reaches the “set times”.

As shown in Fig 5-10: if F313=1, F314=8, F315=5, F300=9, relay will output an instruction signal when DI1 inputs the 5<sup>th</sup> pulse, relay will output an instruction signal until reaching “set count times 8”.



**Fig 5-10 Set Count times & Designated Count Times**

### 5.3.2 Digital multifunctional input terminals

|                                    |   |                 |
|------------------------------------|---|-----------------|
| F316 DI1 terminal function setting | Setting range:<br>0: No function;<br>1: Running ;<br>2: Halt;<br>3: Multi-stage speed 1;<br>4: Multi-stage speed 2;<br>5: Multi-stage speed 3;<br>6: Multi-stage speed 4; | Mfr's value: 11 |
| F317 DI2 terminal function setting | 7: Reset;<br>8: Free stop;<br>9: External emergency stop;<br>10: Acceleration/deceleration forbidden terminal;<br>11: Forward run jogging;                                | Mfr's value: 9  |
| F318 DI3 terminal function setting | 12: Reverse run jogging;<br>13: UP frequency increasing;<br>14: DOWN frequency decreasing;<br>15: "FWD";<br>16: "REV";<br>17: Three-line type input "X" ;                 | Mfr's value: 15 |

|      |                               |   |                 |
|------|-------------------------------|---|-----------------|
| F319 | DI4 terminal function setting | 18: Acceleration/deceleration time switchover 1;<br>19: Reserved;<br>20: switchover between speed and torque;<br>21: frequency source switchover<br>22: Count input;<br>23: Count reset   | Mfr's value: 16 |
| F320 | DI5 terminal function setting | 30: Water shortage signal<br>31: Water signal<br>46: Manual pressure selection<br>47: Auto pressure selection<br>49: PID pause<br>51: Motor switchover<br>53: Watchdog  | Mfr's value: 7  |
| F321 | DI6 terminal function setting | 54: Frequency reset<br>60: Communication timeout 2 signal elimination<br>61: Start/stop terminals<br>71: Water injection<br>72: Water pump<br>73: High water level<br>74: Low water level<br>75: Pump cleaning<br>76: Quit fire mode after manual stop<br>77: Anti-rust and anti-freeze enabled<br>78: Pressure rising<br>79: Pressure dropping<br>80: Pump filling | Mfr's value: 8  |

- This parameter is used for setting corresponding function for multifunctional digital input terminal.
- Both free stop and external emergency stop of the terminal have the highest priority.
- When pulse given is selected, DI1 terminal is set as pulse signal input terminal automatically.
- DI1 terminal function is set as input port of pulse signal when selecting pulse frequency speed adjustment.

Table 5-3 Instructions for digital multifunctional input terminal

| Value | Function                    | Instructions   |
|-------|-----------------------------|--|
| 0     | No function                 | Even if signal is input, inverter will not work. This function can be set by undefined terminal to prevent mistake action.   |
| 1     | Running terminal            | When running command is given by terminal or terminals combination and this terminal is valid, inverter will run. This terminal has the same function with "RUN" key in keypad.      |
| 2     | Stop terminal               | When stop command is given by terminal or terminals combination and this terminal is valid, inverter will stop. This terminal has the same function with "stop/reset" key in keypad. |
| 3     | Multistage speed terminal 1 | 15-stage speed is realized by combination of this group of terminals. See table 5-5.   |
| 4     | Multistage speed terminal 2 |  |
| 5     | Multistage speed terminal 3 |  |
| 6     | Multistage speed terminal 4 |  |
| 7     | Reset terminal              | This terminal has the same function with "stop/reset" key in keypad. Long-distance malfunction reset can be realized by this function.   |
| 8     | Free stop terminal          | Inverter closes off output and motor stop process is not controlled by inverter. This mode is often used when load has big inertia or  |

|    |  |  |
|----|--|--|
|    |  | there are no requirements for stop time. This mode has the same function with free stop of F209.   |
| 9  | External emergency stop terminal             | When external malfunction signal is given to inverter, malfunction will occur and inverter will stop.  |
| 10 | Acceleration/deceleration forbidden terminal | Inverter will not be controlled by external signal (except for stop command), and it will run at the current output frequency.   |
| 11 | forward run jogging                          | Forward jogging running and reverse jogging running. Refer to F124, F125 and F126 for jogging running frequency, jogging acceleration/deceleration time.   |
| 12 | reverse run jogging                          |  |
| 13 | UP frequency increasing terminal             | When frequency source is set by digital given, the setting frequency can be adjusted which rate is set by F211.  |
| 14 | DOWN frequency decreasing terminal           |  |
| 15 | “FWD” terminal                               | When start/stop command is given by terminal or terminals combination, running direction of inverter is controlled by external terminals.  |
| 16 | “REV” terminal                               |  |
| 17 | Three-line input “X” terminal                | “FWD”、 “REV”、 “CM” terminals realize three-line control. See F208 for details.   |
| 18 | acceleration/deceleration time switchover    | Switch to the second acceleration/deceleration time if this function is valid. See details in F116, F117.  |
| 19 | Reserved                                     | Reserved   |
| 20 | Rotate speed/torque switchover               | Switchover between rotate speed and torque.  |
| 21 | frequency source switchover terminal         | When F207=2, main frequency source and accessorial frequency source can be switched over by frequency source switching terminal. When F207=3, X and (X + Y) can be switched over by frequency source switching terminal. |
| 22 | Count input terminal                         | Built-in count pulse input terminal.   |
| 30 | Water shortage signal                        | When PID control, FA26=1, corresponding terminal has signal, inverter will enter protection state.   |
| 31 | Water signal                                 | When PID control, FA26=1, corresponding terminal has signal, the inverter will relieve water shortage protection state   |
| 32 | Fire pressure switchover                     | When PID control is valid and this terminal is valid, the setting value of PID switches into fire pressure given (FA58).   |
| 33 | Emergency fire control                       | When emergency fire mode (FA59) is valid, inverter will be in emergency fire mode.   |
| 34 | Acceleration / deceleration switchover 2     | Please refer to Table 5-4.   |
| 37 | Common-open PTC heat protection              | When this function is valid, common-open heat relay is externally connected. When common-open contact is closed and inverter is in the running status, inverter will trip into OH1.                                      |
| 38 | Common-close PTC heat protection             | When this function is valid, common-close heat relay is externally connected. When common-close contact is open and inverter is in the running status, inverter will trip into OH1.                                      |
| 49 | PID paused                                   | PID adjustment is invalid temporarily.   |

|    |                                      |  |
|----|--------------------------------------|--|
| 51 | Motor switchover                     | If FE00 selects to terminals switch motor, the second motor will be switched when the terminal is valid.   |
| 53 | Watchdog                             | During the time set by F326 elapses without an impulse being registered, inverter will trip into Err6, and inverter will stop according to stop mode set by F327.  |
| 54 | Frequency reset                      | Current target frequency changes to setting value of F113 if frequency terminal is valid in application 4.   |
| 55 | Switch automatically/<br>manually    | Switch the status of manual and automatic running in application 2.  |
| 56 | Run manually                         | Starting signal is provided if manual status terminal is valid in application 2; starting signal is provided in application 3.   |
| 57 | Run automatically                    | Starting signal is provided if automatic status terminal is valid in application 2.  |
| 58 | Direction                            | In the application 1 and 2, the function is used to give direction. When the function is valid, inverter will run reverse. Or else, inverter will run forward.   |
| 60 | Communication timeout<br>2           | When F907>0, and receiving the previous data, if after the time set by F907, the next data is not received, inverter will output communication timeout signal. The timeout signal will be cleared by this terminal, and after receiving correct data, inverter will accumulate time again.   |
| 61 | Start-stop terminal                  | When the function is invalid, it is stop terminal. When the function is valid, it is start terminal.   |
| 71 | Water injection                      | When FA96=1,<br>when water injection signal is valid, if high water level signal is valid, inverter will stop.<br>When water pump signal is valid, if low water level signal is valid, inverter will stop.   |
| 72 | Water pump                           |  |
| 73 | High water level                     |  |
| 74 | Low water level                      |  |
| 75 | Pump cleaning                        | When pump cleaning signal is valid, pump cleaning function will be carried on.   |
| 76 | Quit fire mode after<br>manual stop  | Fire mode will quit when manual stop signal is valid.  |
| 77 | Anti-rust and anti-freeze<br>enabled | When this function is valid, dormant master will be waked up after FB41. After master runs by FB42, if master will enter dormancy status again. After slave stops for FB41, it will run immediately. After slave runs for FB42, it will stop. Running frequency is dormancy frequency.<br>Note: general pump does not have anti-freeze function. |
| 78 | Pressure rising                      | When pressure rising signal is valid, each pulse will make target pressure rise by one unit.   |

|    |                   |  |
|----|-------------------|--|
| 79 | Pressure dropping | When pressure dropping signal is valid, each pulse will make target pressure drop by one unit. |
| 80 | Pump filling      | Pump filling function will be valid.   |

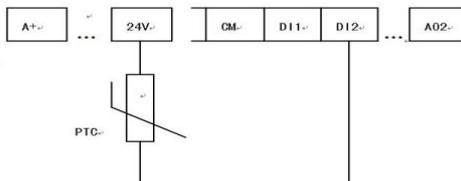


Fig 5-11 PTC protection sketch map

User can follow the followings operations if using PTC as thermal protection. When the coding switch is in the “NPN” side and terminal is set as 38, PTC resistor should be connected between CM and D1x terminal. When the coding switch is in “PNP” side, PTC resistor should be connected between D1x and 24V. The recommended resistor value is 16.5K.

Because the precision of external PTC has some differences with optocoupler consistency, protection value precision will be bad; thermal protection relay is suggested to be used.

Table 5-4 PID outlet target pressure selection

| 32: fire pressure switchover | 46: manual pressure selection | 45: pressure selection 2 | 44: pressure selection 1 | Target pressure |
|------------------------------|-------------------------------|--------------------------|--------------------------|-----------------|
| √                            | *                             | *                        | *                        | FA58            |
| ×                            | √                             | *                        | *                        | FB11            |
| ×                            | ×                             | ×                        | ×                        | FA04            |
| ×                            | ×                             | ×                        | √                        | FA86            |
| ×                            | ×                             | √                        | ×                        | FA87            |
| ×                            | ×                             | √                        | √                        | FA88            |

Note: √ means terminal valid. × means terminal invalid. \* means terminal free status.

Table 5-5 Acceleration/deceleration selection

| Accel/decel switchover 2 (34) | Accel/decel switchover 1 (18) | Present accel/decel time    | Related parameters |
|-------------------------------|-------------------------------|-----------------------------|--------------------|
| 0                             | 0                             | The first accel/decel time  | F114, F115         |
| 0                             | 1                             | The second accel/decel time | F116, F117         |
| 1                             | 0                             | The third accel/decel time  | F277, F278         |
| 1                             | 1                             | The fourth accel/decel time | F279, F280         |

Table 5-6 Instructions for multistage speed

| K4 | K3 | K2 | K1 | Frequency setting    | Parameters                    |
|----|----|----|----|----------------------|-------------------------------|
| 0  | 0  | 0  | 0  | None                 | None                          |
| 0  | 0  | 0  | 1  | Multi-stage speed 1  | F504/F519/F534/F549/F557/F565 |
| 0  | 0  | 1  | 0  | Multi-stage speed 2  | F505/F520/F535/F550/F558/F566 |
| 0  | 0  | 1  | 1  | Multi-stage speed 3  | F506/F521/F536/F551/F559/F567 |
| 0  | 1  | 0  | 0  | Multi-stage speed 4  | F507/F522/F537/F552/F560/F568 |
| 0  | 1  | 0  | 1  | Multi-stage speed 5  | F508/F523/F538/F553/F561/F569 |
| 0  | 1  | 1  | 0  | Multi-stage speed 6  | F509/F524/F539/F554/F562/F570 |
| 0  | 1  | 1  | 1  | Multi-stage speed 7  | F510/F525/F540/F555/F563/F571 |
| 1  | 0  | 0  | 0  | Multi-stage speed 8  | F511/F526/F541/F556/F564/F572 |
| 1  | 0  | 0  | 1  | Multi-stage speed 9  | F512/F527/F542/F573           |
| 1  | 0  | 1  | 0  | Multi-stage speed 10 | F513/F528/F543/F574           |
| 1  | 0  | 1  | 1  | Multi-stage speed 11 | F514/F529/F544/F575           |
| 1  | 1  | 0  | 0  | Multi-stage speed 12 | F515/F530/F545/F576           |
| 1  | 1  | 0  | 1  | Multi-stage speed 13 | F516/F531/F546/F577           |
| 1  | 1  | 1  | 0  | Multi-stage speed 14 | F517/F532/F547/F578           |
| 1  | 1  | 1  | 1  | Multi-stage speed 15 | F518/F533/F548/F579           |

**Note:**

- K4 is multi-stage speed terminal 4, K3 is multi-stage speed terminal 3, K2 is multi-stage speed terminal 2, K1 is multi-stage speed terminal 1. And 0 stands for OFF, 1 stands for ON.**
- 0=OFF, 1=ON**
- The setting of this table is valid when F580=0.**

|   |  |                |
|---|--|----------------|
| F324 Free stop terminal logic               | Setting range:<br>0: positive logic;<br>1: negative logic; | Mfr's value: 0 |
| F325 External emergency stop terminal logic |  | Mfr's value: 0 |

When multi-stage speed terminal is set to free stop terminal (8) and external emergency stop terminal (9), terminal logic level is set by this group of function codes.

When F324=0 and F325=0, positive logic; NPN mode: terminal input is valid when the input is low level; PNP mode: terminal input is valid when input is high level. Same as active level of other terminals.

When F324=1 and F325=1, negative logic; NPN mode: terminal input is valid when the input is high level; PNP mode: terminal input is valid when input is low level. Opposite with active level of other terminals.

|                               |  |                   |
|-------------------------------|--|-------------------|
| F326 Watchdog time            | Setting range:<br>0.0: Invalid;<br>0.1~3000.0              | Mfr's value: 10.0 |
| F327 Stop mode                | Setting range:<br>0: Free to stop; 1: Deceleration to stop | Mfr's value : 0   |
| F328 Terminal filtering times | Setting range: 1~100                                       | Mfr's value: 20   |

When F326=0.0, watchdog function is invalid.

When F327=0, and during the time set by F326 elapses without an impulse being registered, inverter will free to stop and it will trip into Err6, and digital output token is valid.

When F327=1, and during the time set by F326 elapses without an impulse being registered, inverter will

deceleration to stop, then inverter will trip into Err6, and digital output token is valid.

|                                    |                                    |                |
|------------------------------------|------------------------------------|----------------|
| F329 Run command of start terminal | Setting range: 0: Valid 1: Invalid | Mfr's value: 0 |
|------------------------------------|------------------------------------|----------------|

When F329=0, after power on, if start terminals (running terminal, forward jogging, reverse jogging, FWD, REV, 3-line X input enable) is valid, inverter will start running directly.

When F329=1, after power on, if start terminals (running terminal, forward jogging, reverse jogging, FWD, REV, 3-line X input enable) is valid, inverter will start running after disconnect start terminal first and enable it again.

|  |           |
|--|-----------|
| F330 Status display of digital input terminals | Read only |
|--|-----------|

F330 is used to display the status of digital input terminals(DIX).

Please refer to Fig 5-12 about the indicators of DIX digital input terminals, the solid-line box and dotted-line box indicate the invalid and valid respectively.

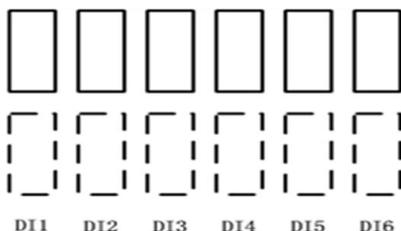
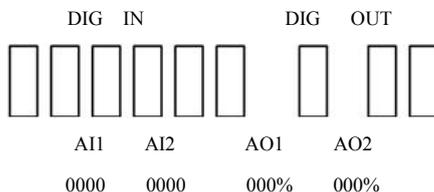


Fig 5-12 Status of digital input terminal

Set F645=22, press “SET”, switch interface by “FUN” key to display 6 boxes. Shorting to D11~D16, terminals are valid if number turns from 0 to 1, and six dotted-line boxes are displayed; Terminals are invalid if number does not turn to 1, and six solid-line boxes are displayed.

If user wants to see the detailed status for each terminal, set the function code as F330, press “SET” to enter diagnosis interface, which is showed below.



The first line indicates digital input, digital output; First six boxes in the second line indicate the state of DI terminals, terminals from left to right are D11~D16, solid-line box is the state showed as above when terminal is invalid; Black box is displayed when terminal is valid. E.g. If all 6 terminals are valid, **■■■■■■** will be displayed.

The last three boxes represent the terminal output status of DO1, relay 1 and relay 2, which display mode is the same as DI terminals. E.g. If 3 terminals are valid at same time, **■■■** will be displayed.

The third line indicates the name of AI1, AI2 and AO1, AO2. The value displayed in fourth line correspond

to the content of third line.

E.g. AI1 AI2 AO1 AO2  
2010 0000 000% 000%

It means the value of AI1 is 2010, so are the rest three values.

After checking diagnosis interface, if user needs to exit interface, press “FUN” key to enter first-level menu.

|                     |  |           |
|---------------------|--|-----------|
| F331Monitoring AI1  |  | Read only |
| F332 Monitoring AI2 |  | Read only |

#### Relay/Digital output simulation

|      |                           |  |                |
|------|---------------------------|--|----------------|
| F335 | Relay output simulation   | Setting range:<br>0: Output inactive.<br>1: Output active. | Mfr's value: 0 |
| F336 | DO1 output simulation     |  | Mfr's value: 0 |
| F337 | Relay 2 output simulation |  | Mfr's value: 0 |

Take an example of DO1 output simulation, when inverter is in the stop status and enter F336, press the UP key, the DO1 terminal is valid. Loosen the UP key, DO1 remains valid status. After quitting F336, DO1 will revert to initial output status.

#### Analog output simulation

|      |                       |                       |                |
|------|-----------------------|-----------------------|----------------|
| F338 | AO1 output simulation | Setting range: 0~4095 | Mfr's value: 0 |
| F339 | AO2 output simulation | Setting range: 0~4095 | Mfr's value: 0 |

When inverter is in the stop status, and enter F338 or F339, press the UP key, the output analog will increase, and when press the DOWN key, the output analog will decrease. If loosen the key, analog output remains stable. After quitting the parameters, AO1 and AO2 will revert to initial output status.

|   |  |                |
|---|--|----------------|
| F340 Selection of terminal negative logic | Setting range:<br>0: Invalid<br>1: DI1 negative logic<br>2: DI2 negative logic<br>4: DI3 negative logic<br>8: DI4 negative logic<br>16: DI5 negative logic<br>32: DI6 negative logic | Mfr's value: 0 |
|---|--|----------------|

F340 is used for setting the logic of DI terminals.

E.g. If setting DI1 as negative logic, F340=1;

If setting DI2 as negative logic, F340=2;

If user wants to set both DI1 and DI4 to negative logic, please set F340=1+8=9 and the like.

|                            |                                    |                |
|----------------------------|------------------------------------|----------------|
| F359 Stop command priority | Setting range: 0: Invalid 1: Valid | Mfr's value: 0 |
|----------------------------|------------------------------------|----------------|

·When F359=1, if inverter get stop command when run command is valid, inverter will stop first.

Inverter will start again only after disconnecting the start terminal first and connect it again.

---

|      |                       |                            |                   |
|------|-----------------------|----------------------------|-------------------|
| F343 | Delay time of DI1 ON  | Setting range: 0.00~650.00 | Mfr's value: 0.00 |
| F344 | Delay time of DI2 ON  | Setting range: 0.00~650.00 | Mfr's value: 0.00 |
| F345 | Delay time of DI3 ON  | Setting range: 0.00~650.00 | Mfr's value: 0.00 |
| F346 | Delay time of DI4 ON  | Setting range: 0.00~650.00 | Mfr's value: 0.00 |
| F347 | Delay time of DI5 ON  | Setting range: 0.00~650.00 | Mfr's value: 0.00 |
| F348 | Delay time of DI6 ON  | Setting range: 0.00~650.00 | Mfr's value: 0.00 |
| F351 | Delay time of DI1 OFF | Setting range: 0.00~650.00 | Mfr's value: 0.00 |
| F352 | Delay time of DI2 OFF | Setting range: 0.00~650.00 | Mfr's value: 0.00 |
| F353 | Delay time of DI3 OFF | Setting range: 0.00~650.00 | Mfr's value: 0.00 |
| F354 | Delay time of DI4 OFF | Setting range: 0.00~650.00 | Mfr's value: 0.00 |
| F355 | Delay time of DI5 OFF | Setting range: 0.00~650.00 | Mfr's value: 0.00 |
| F356 | Delay time of DI6 OFF | Setting range: 0.00~650.00 | Mfr's value: 0.00 |

## 5.4 Analog Input and Output

EM30 series inverters have 2 analog input channels and 2 analog output channels.

|      |  |                           |                    |
|------|--|---------------------------|--------------------|
| F400 | Lower limit of AI1 channel input (V)               | Setting range: 0.00~F402  | Mfr's value: 0.04  |
| F401 | Corresponding setting for lower limit of AI1 input | Setting range: 0~2.0      | Mfr's value: 1.00  |
| F402 | Upper limit of AI1 channel input (V)               | Setting range: F400~10.00 | Mfr's value: 10.00 |
| F403 | Corresponding setting for upper limit of AI1 input | Setting range: 0.00~2.00  | Mfr's value: 2.00  |
| F404 | AI1 channel proportional gain K1                   | Setting range: 0.0~10.0   | Mfr's value: 1.0   |
| F405 | AI1 filtering time constant (S)                    | Setting range: 0.10~10.0  | Mfr's value: 0.10  |

· In the mode of analog speed control, sometimes it requires adjusting coincidence relation among upper limit and lower limit of input analog, analog changes and output frequency, to achieve a satisfactory speed control effect.

· Upper and lower limit of analog input are set by F400 and F402.

For example: when F400=1, F402=8, if analog input voltage is lower than 1V, system judges it as 0. If input voltage is higher than 8V, system judges it as 10V (Suppose analog channel selects 0-10V). If Max frequency F111 is set to 50Hz, the output frequency corresponding to 1-8V is 0-50Hz.

· The filtering time constant is set by F405.

The greater the filtering time constant is, the more stable for the analog testing. However, the precision may decrease to a certain extent. It may require appropriate adjustment according to actual application.

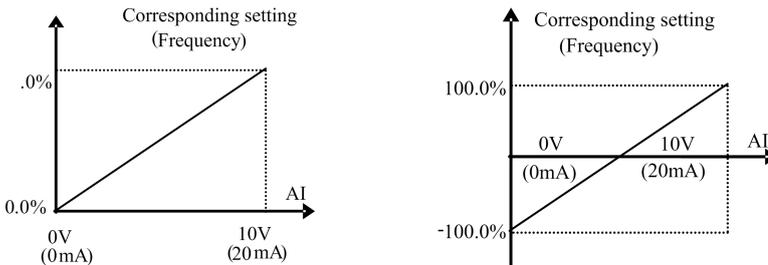
· Channel proportional gain is set by F404.

If 1V corresponds to 10Hz and F404=2, then 1V will correspond to 20Hz.

· Corresponding setting for upper / lower limit of analog input are set by F401 and F403.

If Max frequency F111 is 50Hz, analog input voltage 0-10V can correspond to output frequency from -50Hz to 50Hz by setting this group function codes. Please set F401=0 and F403=2, then 0V corresponds to -50Hz, 5V corresponds to 0Hz and 10V corresponds to 50Hz. The unit of corresponding setting for upper / lower limit of input is in percentage (%). If the value is greater than 1.00, it is positive; if the value is less than 1.00, it is negative. (e.g. F401=0.5 represents -50%).

If the running direction is set to forward running by F202, then 0-5V corresponding to the minus frequency will cause reverse running, or vice versa.

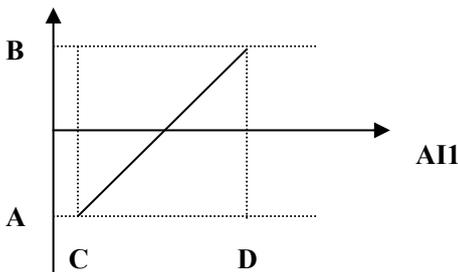


**Fig 5-13 correspondence of analog input to setting**

The unit of corresponding setting for upper / lower limit of input is in percentage (%). If the value is greater

than 1.00, it is positive; if the value is less than 1.00 it is negative. (e.g. F401=0.5 represents -50%). The corresponding setting benchmark: in the mode of combined speed control, analog is the accessorial frequency and the setting benchmark for range of accessorial frequency which relates to main frequency is "main frequency X"; corresponding setting benchmark for other cases is the "max frequency", as illustrated in the right figure:

$$A = (F401-1) * \text{setting value} \quad B = (F403-1) * \text{setting value} \quad C = F400 \quad D = F402$$



|      |  |                            |                    |
|------|--|----------------------------|--------------------|
| F406 | Lower limit of AI2 channel input (V)               | Setting range: 0.00~F408   | Mfr's value: 0.04  |
| F407 | Corresponding setting for lower limit of AI2 input | Setting range: 0.00~2.00   | Mfr's value: 1.00  |
| F408 | Upper limit of AI2 channel input (V)               | Setting range: F406~10.00V | Mfr's value: 10.00 |
| F409 | Corresponding setting for upper limit of AI2 input | Setting range: 0.00~2.00   | Mfr's value: 2.00  |
| F410 | AI2 channel proportional gain K2                   | Setting range: 0.0~10.0    | Mfr's value: 1.0   |
| F411 | AI2 filtering time constant (S)                    | Setting range: 0.10~10.00  | Mfr's value: 0.1   |

The function of AI2 is the same with AI1.

|      |                                   |                       |                   |
|------|-----------------------------------|-----------------------|-------------------|
| F418 | AI1 channel 0Hz voltage dead zone | Setting range: 0~1.00 | Mfr's value: 0.00 |
| F419 | AI2 channel 0Hz voltage dead zone | Setting range: 0~1.00 | Mfr's value: 0.00 |

Analog input voltage 0-5V can correspond to output frequency -50Hz-50Hz (2.5V corresponds to 0Hz) by setting the function of corresponding setting for upper / lower limit of analog input. The group function codes of F418 and F419 set the voltage range corresponding to 0Hz. For example, when F418=0.5 and F419=0.5, the voltage range from (2.5-0.5=2) to (2.5+0.5=3) corresponds to 0Hz. So if F418=N, F419=N, then 2.5±N should correspond to 0Hz. If the voltage is in this range, inverter will output 0Hz.

0Hz voltage dead zone will be valid when corresponding setting for lower limit of input is less than 1.00.

AO1, AO2 are provided as two analog output channels for EM30 series.

|      |  |   |                    |
|------|--|---|--------------------|
| F423 | AO1 output range                         | 0: 0~5V;<br>1: 0~10V or 0~20mA<br>2: 4~20mA | Mfr's value: 1     |
| F424 | AO1 lowest corresponding frequency (Hz)  | Setting range: 0.0~F425                     | Mfr's value: 0.05  |
| F425 | AO1 highest corresponding frequency (Hz) | Setting range: F424~F111                    | Mfr's value: 50.00 |
| F426 | AO1 output compensation (%)              | Setting range: 0~120                        | Mfr's value: 100   |

AO1 output range is selected by F423. When F423=0, AO1 output range selects 0-5V, and when F423=1, AO1 output range selects 0-10V or 0-20mA. When F423=2, AO1 output range selects 4-20mA (When AO1 output range selects current signal, please turn the switch J5 to "P" position)

Correspondence of output voltage range (0-5V or 0-10V) to output frequency is set by F424 and F425. For example, when F423=0, F424=10 and F425=120, analog channel AO1 outputs 0-5V and the output frequency is 10-120Hz.

· AO1 output compensation is set by F426. Analog excursion can be compensated by setting F426.

|      |   |   |                   |
|------|---|---|-------------------|
| F427 | AO2 output range                        | Setting range:<br>0: 0~20mA;<br>1: 4~20mA | Mfr's value: 0    |
| F428 | AO2 lowest corresponding frequency (Hz) | Setting range: 0.0~F429                   | Mfr's value: 0.05 |

|      |  |                          |                    |
|------|--|--------------------------|--------------------|
| F429 | AO2 highest corresponding frequency (Hz) | Setting range: F428~F111 | Mfr's value: 50.00 |
| F430 | AO2 output compensation (%)              | Setting range: 0~120     | Mfr's value: 100   |

The function of AO2 is similar as AO1, but the output of AO2 is only current signal, 0-20mA or 4-20mA could be selected.

|      |                                    |   |                |
|------|------------------------------------|---|----------------|
| F431 | AO1 analog output signal selecting | Setting range:<br>0: Running frequency;<br>1: Output current;<br>2: Output voltage;<br>3: AI1; 4: AI2<br>5: Input pulse<br>6: Output torque<br>7: Given by PC/PLC<br>8: Target frequency<br>9: Actual speed<br>10: Output torque 2<br>12: Output power<br>13: relay 2 output<br>14: Inlet pressure<br>15: Outlet pressure | Mfr's value: 0 |
| F432 | AO2 analog output signal selecting |   | Mfr's value: 1 |

- Token contents output by analog channel are selected by F431 and F432. Token contents include running frequency, output current and output voltage.
- When output current is selected, analog output signal is from 0 to twofold rated current.
- When output voltage is selected, analog output signal is from 0V to rated output voltage (230V or 400V).
- When actual speed is selected, the speed is actual speed in vector control mode, the speed is synchronous speed for the other mode.
- When relay 2 output is selected, AO1/AO2 will output the contents set by F302. For example: F302=1, F431=13, F423=1, analog output coding switch turns to voltage end, when fault occurs, AO1 output 10V, after fault reset, AO1 output 0V. When coding switch turns to current end, AO1 will output 0mA or 20mA.
- 14: it stands for the proportion between inlet pressure and inlet pressure full range.
- 15: it stands for the proportion between outlet pressure and outlet pressure full range.

|      |  |                             |                   |
|------|--|-----------------------------|-------------------|
| F433 | Corresponding current for full range of external voltmeter | Setting range:<br>0.01~5.00 | Mfr's value: 2.00 |
| F434 | Corresponding current for full range of external ammeter   |                             | Mfr's value: 2.00 |

- In case of F431=1 and AO1 channel for token current, F433 is the ratio of measurement range of external voltage type ammeter to rated current of the inverter.
  - In case of F432=1 and AO2 channel for token current, F434 is the ratio of measurement range of external current type ammeter to rated current of the inverter.
- For example: measurement range of external ammeter is 20A, and rated current of the inverter is 8A, then, F433=20/8=2.50.

|      |   |                             |                   |
|------|---|-----------------------------|-------------------|
| F435 | Corresponding multiple of rated power for output max analog value | Setting range:<br>0.01~3.00 | Mfr's value: 2.00 |
|------|---|-----------------------------|-------------------|

- Analog output range is taken as 0.01~3.00 times of torque power.

|      |  |                             |                   |
|------|--|-----------------------------|-------------------|
| F436 | corresponding current multiple of rated torque for output max analog value | Setting range:<br>0.01~3.00 | Mfr's value: 3.00 |
|------|--|-----------------------------|-------------------|

In vector control, when token torque current, the analog output token range is 0.01~3.00 multiple of torque current.

## 5.5 Pulse Input and Output Control

|  |  |                    |
|--|--|--------------------|
| F440 Min frequency of input pulse FI (KHz)     | Setting range: 0.00~F442                     | Mfr's value: 0.00  |
| F441 Corresponding setting of FI min frequency | Setting range:0.00~2.00                      | Mfr's value: 1.00  |
| F442 Max frequency of input pulse FI (KHz)     | Setting range: F440~100.00                   | Mfr's value: 10.00 |
| F443 Corresponding setting of FI max frequency | Setting range:<br>Max (1.00, F441) ~2.00     | Mfr's value: 2.00  |
| F445 Filtering constant of FI input pulse      | Setting range: 0~1000                        | Mfr's value: 0     |
| F446 FI channel 0Hz frequency dead zone (KHz)  | Setting range: 0~F442<br>(Positive-Negative) | Mfr's value: 0.00  |

· When inverter is controlled by pulse frequency, DI1 is defined as pulse signal input port automatically.

· Min frequency of input pulse is set by F440 and max frequency of input pulse is set by F442.

For example: when F440=0K and F442=10K, and the max frequency is set to 50Hz, then input pulse frequency 0-10K corresponds to output frequency 0~50Hz.

· Filtering time constant of input pulse is set by F445.

The greater the filtering time constant is, the more steady pulse measurement, but precision will be lower, so please adjust it according to the application situation.

· Corresponding setting of min frequency is set by F441 and corresponding setting of max frequency is set by F443.

When the max frequency is set to 50Hz, pulse input 0-10K can corresponds to output frequency -50Hz~50Hz by setting this group function codes. Please set F441 to 0 and F443 to 2, then 0K corresponds to -50Hz, 5K corresponds to 0Hz, and 10K corresponds to 50Hz. The unit of corresponding setting for max/min pulse frequency is in percentage (%). If the value is greater than 1.00, it is positive; if the value is less than 1.00, it is negative.

If the running direction is set to forward running by F202, 0-5K corresponding to the minus frequency will cause reverse running, or vice versa.

· 0 Hz frequency dead zone is set by F446.

Input pulse 0-10K can correspond to output frequency -50Hz~50Hz (5K corresponds to 0Hz) by setting the function of corresponding setting for max/min input pulse frequency. The function code F446 sets the input pulse range corresponding to 0Hz. For example, when F446=0.5, the pulse range from (5K-0.5K=4.5K) to (5K+0.5K=5.5K) corresponds to 0Hz. So if F446=N, then 5±N should correspond to 0Hz. If the pulse is in this range, inverter will output 0Hz.

0Hz voltage dead zone will be valid when corresponding setting for min pulse frequency is less than 1.00.

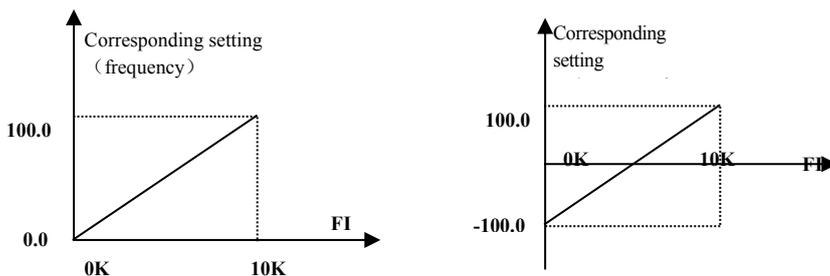


Fig 5-14 correspondence of pulse input and setting

The unit of corresponding setting for max/min input pulse frequency is in percentage (%). If the value is greater than 1.00, it is positive; if the value is less than 1.00, it is negative. (e.g. F441=0.5 represents -50%). The corresponding setting benchmark: in the mode of combined speed control, pulse input is the accessorial frequency and the setting benchmark for range of accessorial frequency which relates to main frequency (F205=1) is “main frequency X”; corresponding setting benchmark for other cases is the “max frequency”, as illustrated in the right figure:

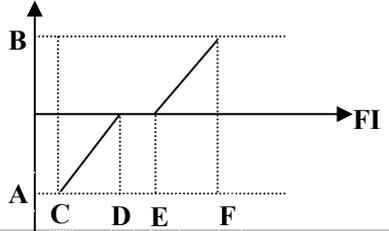


Fig 5-15 relationship between pulse input and setting value

A= (F441-1)\*setting benchmark  
 B= (F443-1)\*setting benchmark  
 C= F440  
 F= F442  
 (E-D)/2=F446

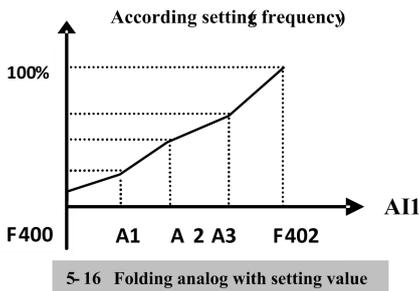
|  |  |                    |
|--|--|--------------------|
| F449 Max frequency of output pulse FO (KHz)              | Setting range: 0.00~100.00   | Mfr's value: 10.00 |
| F450 Zero bias coefficient of output pulse frequency (%) | Setting range: 0.0~100.0   | Mfr's value: 0.0   |
| F451 Frequency gain of output pulse                      | Setting range: 0.00~10.00  | Mfr's value: 1.00  |
| F453 Output pulse signal                                 | Setting range:<br>0: Running frequency<br>1: Output current<br>2: Output voltage<br>3: AI1 4: AI2<br>5: Input pulse<br>6: Output torque<br>7: Given by PC/PLC<br>8: Target frequency | Mfr's value: 0     |

- When DO1 is defined as high-speed pulse output terminal, the max frequency of output pulse is set by F449.
- If “b” stands for zero bias coefficient, “k” stands for gain, “Y” stands for actual output of pulse frequency and “X” stands for standard output, then Y=Kx+b.
- Standard output X is the token value corresponding to output pulse min/max frequency, which range is from zero to max value.
- 100 percent of zero bias coefficient of output pulse frequency corresponds to the max output pulse frequency (the set value of F449.)
- Frequency gain of output pulse is set by F451. User can set it to compensate the deviation of output pulse.
- Output pulse token object is set by F453. For example: running frequency, output current and output voltage, etc. When output current is displayed, the range of token output is 0-2 times of rated current.
- When output voltage is displayed, the range of token output is 0-1.2 times of rated output voltage.

|                             |   |                |
|-----------------------------|---|----------------|
| F460 All channel input mode | Setting range:<br>0: straight line mode<br>1: folding line mode | Mfr's value: 0 |
|-----------------------------|---|----------------|

|      |  |   |                   |
|------|--|---|-------------------|
| F461 | AI2 channel input mode                   | Setting range:<br>0: straight line mode<br>1: folding line mode | Mfr's value: 0    |
| F462 | AI1 insertion point A1 voltage value (V) | Setting range: F400~F464  | Mfr's value: 2.00 |
| F463 | AI1 insertion point A1 setting value     | Setting range: F401~F465  | Mfr's value: 1.20 |
| F464 | AI1 insertion point A2 voltage value (V) | Setting range: F462~F466  | Mfr's value: 5.00 |
| F465 | AI1 insertion point A2 setting value     | Setting range: F463~F467  | Mfr's value: 1.50 |
| F466 | AI1 insertion point A3 voltage value (V) | Setting range: F464~F402  | Mfr's value: 8.00 |
| F467 | AI1 insertion point A3 setting value     | Setting range: F465~F403  | Mfr's value: 1.80 |
| F468 | AI2 insertion point B1 voltage value (V) | Setting range: F406~F470  | Mfr's value: 2.00 |
| F469 | AI2 insertion point B1 setting value     | Setting range: F407~F471  | Mfr's value: 1.20 |
| F470 | AI2 insertion point B2 voltage value (V) | Setting range: F468~F472  | Mfr's value: 5.00 |
| F471 | AI2 insertion point B2 setting value     | Setting range: F469~F473  | Mfr's value: 1.50 |
| F472 | AI2 insertion point B3 voltage value (V) | Setting range: F470~F408  | Mfr's value: 8.00 |
| F473 | AI2 insertion point B3 setting value     | Setting range: F471~F409  | Mfr's value: 1.80 |

When straight-line is selected as the analog channel input mode, please set it according to the parameters from F400 to F429. When folding line mode is selected, three points A1 (B1), A2 (B2) and A3 (B3) are inserted into the straight line, each of which can set the according frequency to input voltage. Please refer to the following figure 5-16:



F400 and F402 are lower/upper limit of analog AI1 input. When F460=1, F462=2.00V, F463=1.4, F111=50, F203=1, F207=0, then A1 point corresponding frequency is  $(F463-1) * F111=20\text{Hz}$ , which means 2.00V corresponding to 20Hz. The other points can be set by the same way. AI2 channel has the same setting way as AI1.

## 5.6 Multi-stage Speed Control

The function of multi-stage speed control is equivalent to a built-in PLC in the inverter. This function can set running time, running direction and running frequency.

EM30 series inverter can realize 15-stage speed control and 8-stage speed auto circulating.

During the process of speed track, multi-stage speed control is invalid. After speed track is finished, inverter will run to target frequency according to the setting value of parameters.

|      |                  |  |                |
|------|------------------|--|----------------|
| F500 | Stage speed type | Setting range:<br>0: 3-stage speed;<br>1: 15-stage speed;<br>2: Max 8-stage speed auto circulating | Mfr's value: 1 |
|------|------------------|--|----------------|

In case of multi-stage speed control (F203=4), the user must select a mode by F500. When F500=0, 3-stage speed is selected. When F500=1, 15-stage speed is selected. When F500=2, max 8-stage speed auto circulating is selected.

When F500=2, "auto circulating" is classified into "2-stage speed auto circulating", "3-stage speed auto circulating" ... "8-stage speed auto circulating", which is to be set by F501.

**Table 5-6 Selection of Stage Speed Running Mode**

| F203 | F500 | Mode of Running                    | Description  |
|------|------|------------------------------------|--|
| 4    | 0    | 3-stage speed control              | The priority in turn is stage-1 speed, stage-2 speed and stage-3 speed. It can be combined with analog speed control. If F207=4, "3-stage speed control" is prior to analog speed control.                         |
| 4    | 1    | 15-stage speed control             | It can be combined with analog speed control. If F207=4, "15-stage speed control" is prior to analog speed control.  |
| 4    | 2    | Max 8-stage speed auto circulating | Adjusting the running frequency manually is not allowable. "2-stage speed auto circulating", "3-stage speed auto circulating" ... "8-stage speed auto circulating" may be selected through setting the parameters. |

|      |   |   |                |
|------|---|---|----------------|
| F501 | Selection of Stage Speed Under Auto-circulation Speed Control | Setting range: 2~8  | Mfr's value: 7 |
| F502 | Selection of Times of Auto-circulation Speed Control          | Setting range: 0~9999<br>(when the value is set to 0, the inverter will carry out infinite circulating) | Mfr's value: 0 |
| F503 | Status After Auto-circulation Running Finished.               | Setting range:<br>0: Stop<br>1: Keep running at last-stage speed  | Mfr's value: 0 |

- If running mode is auto-circulation speed control (F203=4 and F500=2), please set the related parameters by F501~F503.
- That the inverter runs at the preset stage speed one by one under the auto-circulation speed control is called as "one time".
- If F502=0, inverter will run at infinite auto circulation, which will be stopped by "stop" signal.
- If F502>0, inverter will run at auto circulation conditionally. When auto circulation of the preset times is finished continuously (set by F502), inverter will finish auto-circulation running conditionally. When inverter keeps running and the preset times is not finished, if inverter receives "stop command", inverter will stop. If inverter receives "run command" again, inverter will automatically circulate by the setting time of F502.

· If F503=0, then inverter will stop after auto circulation is finished. If F503=1, then inverter will run at the speed of the last-stage after auto-circulation is finished as follows:

e.g., F501=3, then inverter will run at auto circulation of 3-stage speed;

F502=100, then inverter will run 100 times of auto circulation;

F503=1, inverter will run at the speed of the last stage after the auto-circulation running is finished.

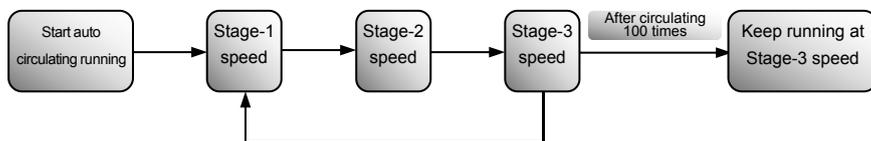


Figure 5-17 Auto-circulating Running

Then the inverter can be stopped by pressing “stop” or sending “stop” signal through terminal during auto-circulation running.

|           |   |   |                           |
|-----------|---|---|---------------------------|
| F504      | Frequency setting for stage 1 speed (Hz)                              | Setting range:<br>F112~F111                                 | Mfr's value: 5.00         |
| F505      | Frequency setting for stage 2 speed (Hz)                              |   | Mfr's value: 10.00        |
| F506      | Frequency setting for stage 3 speed (Hz)                              |   | Mfr's value: 15.00        |
| F507      | Frequency setting for stage 4 speed (Hz)                              |   | Mfr's value: 20.00        |
| F508      | Frequency setting for stage 5 speed (Hz)                              |   | Mfr's value: 25.00        |
| F509      | Frequency setting for stage 6 speed (Hz)                              |   | Mfr's value: 30.00        |
| F510      | Frequency setting for stage 7 speed (Hz)                              |   | Mfr's value: 35.00        |
| F511      | Frequency setting for stage 8 speed (Hz)                              |   | Mfr's value: 40.00        |
| F512      | Frequency setting for stage 9 speed (Hz)                              |   | Mfr's value: 5.00         |
| F513      | Frequency setting for stage 10 speed (Hz)                             |   | Mfr's value: 10.00        |
| F514      | Frequency setting for stage 11 speed (Hz)                             |   | Mfr's value: 15.00        |
| F515      | Frequency setting for stage 12 speed (Hz)                             |   | Mfr's value: 20.00        |
| F516      | Frequency setting for stage 13 speed (Hz)                             |   | Mfr's value: 25.00        |
| F517      | Frequency setting for stage 14 speed (Hz)                             |   | Mfr's value: 30.00        |
| F518      | Frequency setting for stage 15 speed (Hz)                             |   | Mfr's value: 35.00        |
| F519~F533 | Acceleration time setting for the speeds from Stage 1 to Stage 15 (S) | Setting range:<br>0.1~3000                                  | Subject to inverter model |
| F534~F548 | Deceleration time setting for the speeds from Stage 1 to Stage 15 (S) | Setting range:<br>0.1~3000                                  |                           |
| F549~F556 | Running directions of stage speeds from Stage 1 to Stage 8 (S)        | Setting range:<br>0: forward running;<br>1: reverse running | Mfr's value: 0            |
| F573~F579 | Running directions of stage speeds from stage 9 to stage 15 (S)       | Setting range:<br>0: forward running;<br>1: reverse running | Mfr's value: 0            |

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|  |                            |                  |
|--|----------------------------|------------------|
| F557 ~ 564 Running time of stage speeds from Stage 1 to Stage 8 (S)      | Setting range:<br>0.1~3000 | Mfr's value: 1.0 |
| F565 ~ F572 Stop time after finishing stages from Stage 1 to Stage 8 (S) | Setting range:<br>0.0~3000 | Mfr's value: 0.0 |

|                                 |  |                |
|---------------------------------|--|----------------|
| F580 Stage speed mode selection | Setting range:<br>0: Stage speed mode 1<br>1: Stage speed mode 2 | Mfr's value: 0 |
|---------------------------------|--|----------------|

When F580=0, in 15-stage speed, terminal code status 0000 is invalid status, 1111 is 15<sup>th</sup> stage speed.

When F580=1, in 15-stage speed, terminal code status 0000 is 1<sup>st</sup> stage speed, and 1111 is invalid status.

## 5.7 Auxiliary Functions

|   |  |                   |
|---|--|-------------------|
| F600 DC Braking Function Selection              | Setting range:<br>0: Invalid;<br>1: braking before starting;<br>2: braking during stopping;<br>3: braking during starting and stopping | Mfr's value: 0    |
| F601 Initial Frequency for DC Braking (Hz)      | Setting range: 0.20~50.00  | Mfr's value: 1.00 |
| F602 DC Braking efficiency before Starting      | Setting range: 0~100   | Mfr's value: 50   |
| F603 DC Braking efficiency During Stop          |  | Mfr's value: 10   |
| F604 Braking Lasting Time Before Starting (S)   | Setting range: 0.00~30.00  | Mfr's value: 0.50 |
| F605 Braking Lasting Time During Stopping (S)   |  | Mfr's value: 0    |
| F656 DC braking waiting time during stopping(s) | Setting range: 0.00~30.00  | Mfr's value: 0    |

When F600=0, DC braking function is invalid.

When F600=1, braking before starting is valid. After the right starting signal is input, inverter starts DC braking. After braking is finished, inverter will run from the initial frequency.

In some application occasion, such as fan, motor is running at a low speed or in a reverse status, if inverter starts immediately, OC malfunction will occur. Adopting “braking before starting” will ensure that the fan stays in a static state before starting to avoid this malfunction.

During braking before starting, if “stop” signal is given, inverter will stop by deceleration time.

When F600=2, DC braking during stopping is selected. After output frequency is lower than the initial frequency for DC braking (F601), DC braking will stop the motor immediately

During the process of braking during stopping, if “start” signal is given, DC braking will be finished and inverter will start.

If “stop” signal is given during the process of braking during stopping, inverter will have no response and DC braking during stopping still goes on.

When jogging function is valid, the function of braking before starting set by F600 is valid, and the function of speed track is invalid.

When jogging function is invalid and F613-1, the function of braking before starting is invalid.

Parameters related to “DC Braking”: F601, F602, F603, F604, F605, interpreted as follows:

- F601: Initial frequency of DC-braking. DC braking will start to work as inverter's output frequency is lower than this value.
- F602/F603: DC braking efficiency. The bigger value will result in a quick braking. However, motor will overheat with too big value.
- F604: Braking duration before starting. The time lasted for DC braking before inverter starts.
- F605: Braking duration when stopping. The time lasted for DC braking while inverter stops.

Note: during DC braking, because motor does not have self-cool effect cause by rotating, it is in the state of easy over-heat. Please do not set DC braking voltage too high and do not set DC braking time to long.

DC braking, as shown in Figure 5-18

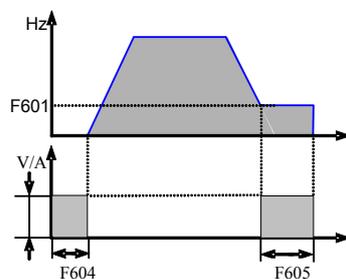


Figure 5-18 DC braking

|      |  |  |  |
|------|--|--|--|
| F607 | Selection of Stalling Adjusting Function | Setting range:<br>0~2:Reserved<br>3: Voltage/current control<br>4: Voltage control<br>5: Current control | Mfr's value: 3   |
| F608 | Stalling Current Adjusting (%)           | Setting range: 60~FC49   | Mfr's value: 160                                       |
| F609 | Stalling Voltage Adjusting (%)           | Setting range: 110~200   | Mfr's value:<br>1-phase 220V: 130<br>3-phase 380V: 140 |
| F610 | Stalling protection judgment time(S)     | Setting range:<br>0.0: disabled<br>0.1~3000  | Mfr's value:<br>0.0                                    |

F607 is used to set selection of stalling adjusting function.

Voltage control: when motor stops quickly or load changes suddenly, DC bus voltage will be high. Voltage control function can adjust deceleration time and output frequency to avoid OE.

When braking resistor or braking unit is used, please do not use voltage control function. otherwise, the deceleration time will be changed.

Current control: when motor accelerates quickly or load changed suddenly, inverter may trip into OC. Current control function can adjust accel/decel time or decrease output frequency to control proper current value. It is only valid in VF control mode.

Note: (1) Voltage/current control is not suitable for lifting application.

(2) This function will change accel/decel time. Please use this function properly.

(3) Please do not use this function when one inverter drives two motors.

Initial value of stalling current adjusting is set by F608, when the present current is higher than rated current \*F608, stalling current adjusting function is valid.

During the process of deceleration, stalling current function is invalid.

During the process of acceleration, if output current is higher than initial value of stalling current adjusting and F607=1, then stalling adjusting function is valid. Inverter will not accelerate until the output current is lower than initial value of stalling current adjusting.

In case of stalling during stable speed running, the frequency will drop. If the current returns to normal during dropping, the frequency will return to rise. Otherwise, the frequency will keep dropping to the minimum frequency and the protection OL1 will occur after it lasts for the time as set in F610.

Initial value of stalling voltage adjusting is set by F609, when the present voltage is higher than rated voltage \*F609, stalling voltage adjusting function is valid.

Stalling voltage adjusting is valid during the process of deceleration, including the deceleration process caused by stalling current.

|      |                                |                         |                           |
|------|--------------------------------|-------------------------|---------------------------|
| F611 | Dynamic Braking threshold (V)  | Setting range: 200~2000 | Subject to inverter model |
| F612 | Dynamic braking duty ratio (%) | Setting range: 0~100    | Mfr's value: 100          |

Initial voltage of dynamic braking threshold is set by F611, which of unit is V. When DC bus voltage is higher than the setting value of this function, dynamic braking starts, braking unit starts working. After DC bus voltage is lower than the setting value, braking unit stops working.

Dynamic braking duty ratio is set by F612, the range is 0~100%. The value is higher, the braking effect is better, but the braking resistor will get hot.

|                  |  |                |
|------------------|--|----------------|
| F613 Speed track | Setting range:<br>0: invalid<br>1: valid<br>2: valid at the first time | Mfr's value: 0 |
|------------------|--|----------------|

When F613=0, the function of speed track is invalid.

When F613=1, the function of speed track is valid.

After inverter tracks motor speed and rotating direction, inverter will begin running according to the tracked frequency, to start the rotating motor smoothly. This function is suitable for the situation of auto-starting after repowered on, auto-starting after reset, auto-starting when running command valid but direction signal lost and auto-starting when running command invalid.

When F613=2, the function is valid at the first time after inverter is repower on.

Note: When F106=0 or 6, speed track function is invalid.

|                       |   |                |
|-----------------------|---|----------------|
| F614 Speed track mode | Setting range:<br>0: Speed track from frequency memory<br>1: Speed track from max frequency<br>2: Speed track from zero | Mfr's value: 0 |
|-----------------------|---|----------------|

When F614 is set to 0, inverter will track speed down from frequency memory.

When F614 is set to 1, inverter will track speed up from max frequency.

When F614 is set to 2, inverter will track speed down from 0Hz.

|                       |                      |                 |
|-----------------------|----------------------|-----------------|
| F615 Speed track rate | Setting range: 1~100 | Mfr's value: 20 |
|-----------------------|----------------------|-----------------|

It is used to select the rotation velocity speed track when the rotation tracking restart mode is adopted. The larger the parameter is, the faster the speed track is. But if this parameter is too large, it likely results in unreliable tracking.

|                                |  |                  |
|--------------------------------|--|------------------|
| F620 Brake delay turn-off time | Setting range:<br>0.0 (Bleed not closed when stop)<br>0.1~3000 | Mfr's value: 5.0 |
|--------------------------------|--|------------------|

F620=0, dynamic brake is not closed in stop status, it starts when PN voltage is higher than brake point;

F620≠0, dynamic brake can proceed normally when inverter is running, the time set by F620 is the delay time after stop, then the dynamic brake closes automatically.

|                              |   |                             |
|------------------------------|---|-----------------------------|
| F638 Parameters copy enabled | Setting range:<br>0: Copy forbidden<br>1: Parameters download 1<br>(voltage level and power are same)<br>2: Parameters download 2<br>(not consider voltage level and power) | Mfr's value: 1              |
| F639 Parameters copy code    |   | Subject to software version |
| F640 Parameter copy type     | Setting range:<br>0: Copy all parameters<br>1: Copy parameters except motor parameters from F801 to F810/F844.  | Mfr's value: 1              |

Please refer to the user manual of parameters copy.

The related fault in the process of parameters copy is in the table below:

| Code                               | Causes   |
|------------------------------------|--|
| Er71 Copy timeout                  | During copying process, there is no valid data after 3s.                 |
| Er72 Copy when running             | Parameters copy when inverter is in the running status.                  |
| Er73 Copy without input password   | Password is valid and user does not input password.                      |
| Er74 Copy between different models | If copy code, or voltage level or power is different, copy is forbidden. |
| Er75 Copy forbidden                | Parameters copy when F638=0  |

|   |                     |                           |
|---|---------------------|---------------------------|
| F641 Inhibition gain of low frequency oscillation | 0~100<br>0: Invalid | Subject to inverter model |
|---|---------------------|---------------------------|

F641 is used for setting the inhibition ability of low frequency oscillation.

When F641=0, inhibition function is invalid.

In the V/F control mode, if inhibition of low frequency oscillation is valid, the following parameters are needed to be set.

- (1) F106=2 (V/F control mode) and F137≤2;
- (2) F613=0, the speed track function is invalid.

Note:

1. When F641=1, one inverter can only drive one motor one time.
2. When F641=1, please set motor parameters (F801~F805, F844) correctly.
3. When inhibition oscillation function is invalid, and inverter runs without motor, output voltage may be unbalanced. This is normal situation. After inverter runs with motor, output voltage will be balanced.

|                          |  |                |
|--------------------------|--|----------------|
| F644 Keypad Copy enabled | Setting range:<br>0: Invalid<br>1: current macro parameter upload<br>2: current macro parameter download<br>3: user macro 1 upload<br>4: user macro 1 download<br>5: user macro 2 upload<br>6: user macro 2 download | Mfr's value: 0 |
|--------------------------|--|----------------|

· Keypad copy is only valid in LCD keypad.

· In stop status, after saving user macro 1/2 parameters and setting F644=1, press "Run" key, inverter will enter parameter upload interface, all parameters of macro will be upload to keypad. When F644=3, user macro 1 parameters will be upload. When F644=5, user macro 2 parameters will be upload. After upload, when F644=2, parameters will be download to current user macro and cover the current parameters. When F644=4, parameters will be download to user macro1 and cover the parameters of macro 1. After setting F644=6, parameters will be download to user macro 2 and cover the parameters of macro 2.

|  |   |                    |
|--|---|--------------------|
|  | 0 | Running frequency  |
|  | 1 | Rotation speed     |
|  | 2 | Target speed       |
|  | 3 | Output current     |
|  | 4 | Output voltage     |
|  | 5 | DC bus voltage     |
|  | 6 | PID setting value  |
|  | 7 | PID feedback value |

|  |    |                                   |
|--|----|-----------------------------------|
|  | 8  | Radiator temperature              |
|  | 9  | Count value                       |
|  | 10 | Linear speed                      |
|  | 11 | Channel for main frequency        |
|  | 12 | Main frequency                    |
|  | 13 | Channel for accessorial frequency |
|  | 14 | Accessorial frequency             |
|  | 17 | Output torque                     |
|  | 18 | Setting torque                    |
|  | 19 | Motor power                       |
|  | 20 | Output power                      |
|  | 21 | Running status                    |
|  | 22 | DI terminal status                |
|  | 23 | Output terminal status            |
|  | 24 | Stage speed of multi-stage speed  |
|  | 25 | AI1 input value                   |
|  | 26 | AI2 input value                   |
|  | 28 | Reserved                          |
|  | 29 | Pulse input frequency             |
|  | 30 | Pulse output frequency            |
|  | 31 | AO1 output percent                |
|  | 32 | AO2 output percent                |
|  | 33 | Power on Hours                    |

User can change the display of first two lines in the operation/halt interface by setting F645.

|                                |                      |                  |
|--------------------------------|----------------------|------------------|
| F646 Backlight time of LCD (S) | Setting range: 0~100 | Mfr's value: 100 |
|--------------------------------|----------------------|------------------|

Change the duration of backlight by setting F646. F646=0, LCD light is always off; F646=100, LCD light is always on. Press 1~99 is the duration time of LCD backlight.

|                         |   |                |
|-------------------------|---|----------------|
| F647 Language selection | Setting range:<br>0: Chinese 1: English<br>2: Deutsch 3: Espanol<br>4: Francais | Mfr's value: 0 |
|-------------------------|---|----------------|

Change display language by setting F647, the default value is Chinese.

|  |   |                  |
|--|---|------------------|
| F657 Instantaneous power failure selection | Setting range:<br>0: Invalid<br>1: Reduce frequency to remain running<br>2: Reduce frequency quickly to stop the inverter | Mfr's value: 0   |
| F658 Voltage rally acceleration time       | Setting range: 0.0~3000s<br>0.0: F114   | Mfr's value: 0.0 |
| F659 Voltage rally deceleration time       | Setting range: 0.0~3000s<br>0.0: F115   | Mfr's value: 0.0 |

|  |                           |                           |
|--|---------------------------|---------------------------|
| F660 Action judging voltage at instantaneous power failure (V) | Setting range: 200~F661   | Subject to inverter model |
| F661 Action stop voltage at instantaneous power failure (V)    | Setting range: F660~1400  | Subject to inverter model |
| F662 Instantaneous voltage recovery judging time(s)            | Setting range: 0.00~10.00 | Mfr's value: 0.30         |

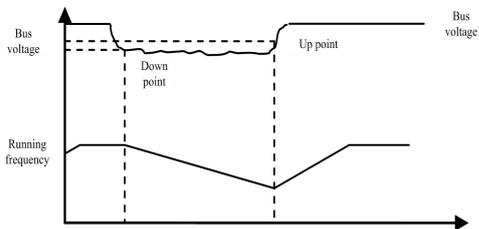
- F657=0, the function of instantaneous power failure is invalid.
- F657=1, when short-time power off or electric dazzling happens, inverter starts to reduce frequency after checking that it satisfies the requirements of instantaneous power failure, and turns kinetic energy to electric energy for maintaining the normal work. Inverter will recover to the former operation status after power resets.
- Upon instantaneous power failure or sudden voltage dip, the DC bus voltage of the inverter reduces. The function enables the inverter to compensate the DC bus voltage reduction with the load feedback energy by reducing the output frequency so as to keep the inverter running continuously.
- F657=2, when satisfying the requirements of instantaneous power failure, inverter starts to reduce frequency, and remain PN voltage as discharge voltage level to make inverter stop quickly. No matter the power resets or not, inverter will stop automatically after slowing down to the min frequency.

Note: The function is suitable for big inertia load, such as, fan and centrifugal pump.

The function is not suitable for the application which frequency is forbidden being decreased.

- When the bus voltage resumes to normal, F658/F659 are used to set the accel/decel time when inverter runs to target frequency.
- When instantaneous function is valid, if PN voltage is lower than F660, instantaneous function works.
- When inverter is at instantaneous status, if PN voltage is higher than F661, the bus voltage remains to normal, inverter will work normally and run to target frequency.
- F662: Inverter stops decelerating after power resets, and it starts to recover to the status before instantaneous stop after judging time.

The function diagram of Instantaneous power failure:



|   |                           |                   |
|---|---------------------------|-------------------|
| F670 Voltage-limit current-limit adjustment coefficient | Setting range: 0.01~10.00 | Mfr's value: 2.00 |
|---|---------------------------|-------------------|

Lower this factor properly if frequent over-voltage protection occurs in the process of deceleration; Increase the factor when deceleration is too slow.

|  |   |                |
|--|---|----------------|
| F671 voltage source for V/F separation | Setting range:<br>0: F672<br>1: AI1<br>2: AI2<br>4: Communication setting<br>5: Pulse setting | Mfr's value: 0 |
|--|---|----------------|

|   |                                |                    |
|---|--------------------------------|--------------------|
|   | 6: PID given<br>7~10: reserved |                    |
| F672 Voltage digital setting for V/F separation | Setting range: 0.00~100.00     | Mfr's value: 100.0 |

F671 is 100% of the setting corresponds to the rated motor voltage.

F671=0: Digital setting, the output voltage is set by F672.

F671=1: AI1; F671=2:AI2; the output voltage is set by analog.

F671=4: Communication setting

The output voltage is set by PC/PLC, the communication address is 2009H, the given range is 0~10000, which means 0~100% of rated voltage.

F671=5 pulse setting

The output voltage is set by external high-speed pulse. The input frequency of pulse corresponds to motor rated voltage.

F671=6: PID given

The output voltage is set by PID. PID adjustment corresponds to 100% of motor rated voltage. For details, please refer to PID parameters group.

F671=7~10: Reserved.

|   |                            |                     |
|---|----------------------------|---------------------|
| F673 Lower limit of voltage at V/F separation (%) | Setting range: 0.00~F674   | Mfr's value: 0.00   |
| F674 Upper limit of voltage at V/F separation (%) | Setting range: F673~100.00 | Mfr's value: 100.00 |

When the voltage is lower than F673, the voltage should equal to F673. When the voltage is higher than F674, the voltage should equal to F674.

|   |                           |                  |
|---|---------------------------|------------------|
| F675 Voltage rise time of V/F separation (S)    | Setting range: 0.0~3000.0 | Mfr's value: 5.0 |
| F676 Voltage decline time of V/F separation (S) | Setting range: 0.0~3000.0 | Mfr's value: 5.0 |

F675 is the time required for the output voltage to rise from 0V to the rated motor voltage.

F676 is the time required for the output voltage to decline from the rated motor voltage to 0V.

|                                  |   |                |
|----------------------------------|---|----------------|
| F677 Stop mode at V/F separation | Setting range:<br>0: voltage and frequency declines to 0 according to respective time.<br>1: Voltage declines to 0 firstly<br>2: Frequency declines to 0 firstly. | Mfr's value: 0 |
|----------------------------------|---|----------------|

When F677 = 0, voltage and frequency declines to 0 according to respective time, inverter will stop when frequency declines to 0.

When F677 = 1, voltage will decline to 0 at first. After voltage is 0, frequency will decline to 0.

When F677 = 2, frequency will decline to 0 at first. After frequency is 0, voltage will decline to 0.

## 5.8 Malfunction and Protection

|  |  |                  |
|--|--|------------------|
| F700 Selection of terminal free stop mode                      | Setting range:<br>0: free stop immediately;<br>1: delayed free stop  | Mfr's value: 0   |
| F701 Delay time for free stop and programmable terminal action | Setting range: 0.0~60.0  | Mfr's value: 0.0 |
| F702 Fan control mode  | 0: controlled by temperature<br>1: Running when inverter is powered on.<br>2: controlled by running status | Mfr's value: 2   |

When F702=0, fan will run if radiator's temperature is up to preset temperature.

When F702=2, fan will run when inverter begins running. When inverter stops, fan will stop according to radiator's temperature.

|   |                        |                  |
|---|------------------------|------------------|
| F704 Inverter Overloading pre-alarm Coefficient (%) | Setting range: 50~100  | Mfr's value: 80  |
| F705 Motor Overloading pre-alarm Coefficient (%)    | Setting range: 50~100  | Mfr's value: 80  |
| F706 Inverter Overloading Coefficient (%)           | Setting range: 120~190 | Mfr's value: 150 |
| F707 Motor Overloading Coefficient (%)              | Setting range: 20~100  | Mfr's value: 100 |

· Inverter overloading coefficient: the ratio of overload-protection current and rated current, which value shall be subject to actual load.

· Motor overloading coefficient (F707): when inverter drives lower power motor, please set the value of F707 by below formula in order to protect motor.

Motor Overloading Coefficient= (Actual motor rated current)/(Inverter rated current)\*100%

Please set F707 according to actual situation. The lower the setting value of F707 is, the faster the overload protection speed. Please refer to Fig 5-19.

E.g. 7.5kW inverter(rated current 17A) drives 5.5kW motor(rated current 12A),  $F707=12/17*100\% \approx 70\%$   
When the actual current of motor reaches 140% of inverter rated current, inverter overload protection will display after 1 minute.

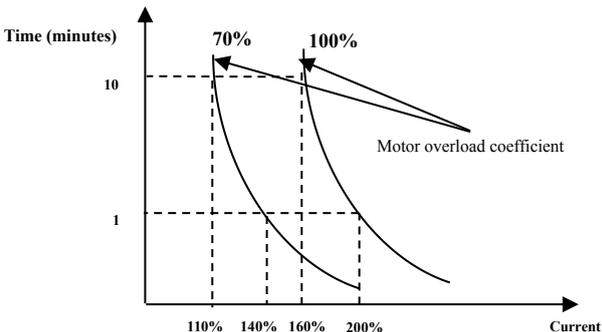


Fig 5-19 Motor overload coefficient

When the output frequency is lower than 10Hz, the heat dissipation effect of common motor will be worse.

So when running frequency is lower than 10Hz, the threshold of motor overload value will be reduced. Please refer to Fig 5-20 (F707=100%):

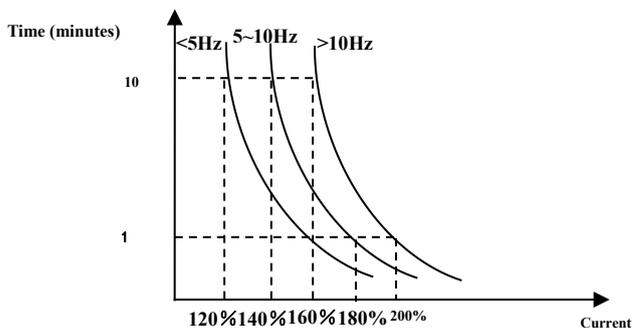


Fig 5-20 Motor overload protection value

|      |  |   |                           |
|------|--|---|---------------------------|
| F708 | Record of The Latest Malfunction Type            | Setting range:<br>Please refer to Appendix 1.                 |                           |
| F709 | Record of Malfunction Type for Last but One      |   |                           |
| F710 | Record of Malfunction Type for Last but Two      |   |                           |
| F711 | Fault Frequency of The Latest Malfunction (Hz)   |   |                           |
| F712 | Fault Current of The Latest Malfunction (A)      |   |                           |
| F713 | Fault PN Voltage of The Latest Malfunction (V)   |   |                           |
| F714 | Fault Frequency of Last Malfunction but One(Hz)  |   |                           |
| F715 | Fault Current of Last Malfunction but One(A)     |   |                           |
| F716 | Fault PN Voltage of Last Malfunction but One (V) |   |                           |
| F717 | Fault Frequency of Last Malfunction but Two(Hz)  |   |                           |
| F718 | Fault Current of Last Malfunction but Two (A)    |   |                           |
| F719 | Fault PN Voltage of Last Malfunction but Two (V) |   |                           |
| F720 | Record of over current protection fault times    |   |                           |
| F721 | Record of overvoltage protection fault times     |   |                           |
| F722 | Record of overheat protection fault times        |   |                           |
| F723 | Record of overload protection fault times        |   |                           |
| F724 | Input phase loss                                 | Setting range:<br>0: invalid;<br>1: valid                     | Subject to inverter model |
| F725 | Under-voltage protection                         | Setting range:<br>1: reset manually<br>2: reset automatically | Mfr's value: 2            |
| F726 | Overheat   | Setting range:<br>0: invalid; 1: valid                        | Mfr's value: 1            |

|      |  |  |                           |
|------|--|--|---------------------------|
| F727 | Output phase loss                          | Setting range:<br>0: invalid; 1: valid | Mfr's value: 1            |
| F728 | Input phase loss filtering constant (S)    | Setting range: 1~60                    | Mfr's value: 5            |
| F729 | Under-voltage filtering constant (2mS)     | Setting range: 1~3000                  | Mfr's value: 5            |
| F730 | Overheat protection filtering constant (S) | Setting range: 0.1~60.0                | Mfr's value: 5.0          |
| F732 | Under-voltage protection voltage threshold | Subject to inverter model              | Subject to inverter model |

“Under-voltage” refers to too low voltage at AC input side.

“Input phase loss” refers to phase loss of three-phase power supply.

“Output phase loss” refers to phase loss of inverter three-phase wirings or motor wirings.

|      |                                       |                                   |                  |
|------|---------------------------------------|-----------------------------------|------------------|
| F737 | Over-current 1 protection             | Setting range: 0:Invalid 1: Valid | Mfr's value: 1   |
| F738 | Over-current 1 protection coefficient | Setting range: 0.50~3.00          | Mfr's value: 2.5 |
| F739 | Over-current 1 protection record      |                                   |                  |

· F738= OC 1 value/inverter rated current

· In running status, F738 is not allowed to modify. When over-current occurs, OC1 is displayed.

|      |   |  |                 |
|------|---|--|-----------------|
| F741 | Analog disconnected protection                  | Setting range:<br>0: Invalid<br>1: Stop and AErr is displayed.<br>2: Stop and AErr is not displayed.<br>3: Inverter runs at the min frequency.<br>4: Reserved. | Mfr's value: 0  |
| F742 | Threshold of analog disconnected protection (%) | Setting range: 1~100   | Mfr's value: 50 |

When the values of F400 and F406 are lower than 0.01V, analog disconnected protection is invalid.

When F741 is set to 1, 2 or 3, the values of F400 and F406 should be set to 1V-2V, to avoid the error protection by interference.

Analog disconnected protection voltage=analog channel input lower limit \* F742. Take the A11 channel for the example, if F400=1.00, F742=50, then disconnection protection will occur when the A11 channel voltage is lower than 0.5V.

|      |  |                                    |                 |
|------|--|------------------------------------|-----------------|
| F745 | Threshold of pre-alarm overheat (%)        | Setting range: 0~100               | Mfr's value: 80 |
| F746 | Carrier frequency auto-adjusting threshold | Setting range: 60~72               | Mfr's value: 65 |
| F747 | Carrier frequency auto-adjusting enable    | Setting range: 0: Invalid 1: Valid | Mfr's value: 1  |

When the temperature of radiator reaches 90℃ \*F745 and multi-function output terminal is set to 16 (Please refer to F300~F302), it indicates inverter is in the status of overheat.

F746: Inverter will reduce carrier frequency when the temperature of inverter is higher than the setting temperature.

When F747=1, the temperature of radiator reaches certain temperature, inverter carrier frequency will adjust automatically, to decrease the temperature of inverter. This function can avoid overheat malfunction.

|      |                               |                         |                  |
|------|-------------------------------|-------------------------|------------------|
| F752 | Overload quitting coefficient | Setting range: 0.1~20.0 | Mfr's value: 1.0 |
|------|-------------------------------|-------------------------|------------------|

|                                       |  |                |
|---------------------------------------|--|----------------|
| F753 Selection of overload protection | Setting range:<br>0: Normal motor<br>1: Variable frequency motor | Mfr's value: 1 |
|---------------------------------------|--|----------------|

·The bigger the setting value of F752 is, the faster the shortened overload cumulative time is.

·When F753=0, because heat dissipation effect of normal motor is bad in low speed, the electronic thermal protection value will be adjusted properly. It means overload protection threshold of motor will be decreased when running frequency is lower than 30Hz.

·When F753=1, because heat dissipation effect of variable frequency motor is not influenced by speed, there is no need to adjust the protection value.

|  |                         |                  |
|--|-------------------------|------------------|
| F754 Zero-current threshold (%)        | Setting range: 0~200    | Mfr's value: 5   |
| F755 Duration time of zero-current (S) | Setting range: 0.0~60.0 | Mfr's value: 0.5 |

When the output current is fallen to zero-current threshold, and after the duration time of zero-current, ON signal is output.

|                           |                                    |                |
|---------------------------|------------------------------------|----------------|
| F760 Grounding protection | Setting range: 0: Invalid 1: Valid | Mfr's value: 1 |
|---------------------------|------------------------------------|----------------|

When output terminals (U, V, W) are connected to the earth or the earth impedance is too low, then the leak current is high, inverter will trip into GP. When grounding protection is valid, U, V, W will output voltage for a while after power on.

Note: single-phase inverters do not have GP protection.

|                                 |   |                |
|---------------------------------|---|----------------|
| F761 Switchover mode of FWD/REV | Setting range:<br>0: At zero<br>1: at start frequency | Mfr's value: 0 |
|---------------------------------|---|----------------|

·When F761=0, FWD/REV switches at zero frequency, F120 is valid.

·When F761=1, FWD/REV switches at start frequency, F120 is invalid, if start frequency is too high, current shock will occur during switchover process.

|                            |  |  |
|----------------------------|--|--|
| F770 Auxiliary version No. |  |  |
|----------------------------|--|--|

·It only can be checked.

## 5.9 Parameters of the Motor

|      |                              |  |                    |
|------|------------------------------|--|--------------------|
| F800 | Motor's parameters tuning    | Setting range:<br>0: Invalid;<br>1: Rotating tuning;<br>2: stationary tuning | Mfr's value: 0     |
| F801 | Rated power (kW)             | Setting range: 0.1~1000.0  | Subject to model   |
| F802 | Rated voltage (V)            | Setting range: 1~1300  |                    |
| F803 | Rated current (A)            | Setting range: 0.2~6553.5  |                    |
| F804 | Number of motor poles        | Setting range: 2~100   | Mfr's value: 4     |
| F805 | Rated rotary speed (rpm/min) | Setting range: 1~30000   |                    |
| F810 | Motor rated frequency (Hz)   | Setting range: 1.0~590.0   | Mfr's value: 50.00 |

·Please set the parameters in accordance with those indicated on the nameplate of the motor.

·Excellent control performance of vector control requires accurate parameters of the motor. Accurate parameter tuning requires correct setting of rated parameters of the motor.

·In order to get the excellent control performance, please configure the motor in accordance with adaptable motor of the inverter. In case of too large difference between the actual power of the motor and that of adaptable motor for inverter, the inverter's control performance will decrease remarkably.

·F800=0, parameter tuning is invalid. But it is still necessary to set the parameters F801~F803, F805 and F810 correctly according to those indicated on the nameplate of the motor.

After powered on, it will use default parameters of the motor (F806-F809) according to the motor power set at F114 and maintain it for a certain period. This value is only a reference value in view of Y series 4-pole asynchronous motor.

·F800=1, rotating tuning.

In order to ensure dynamic control performance of the inverter, select "rotating tuning" after ensuring that the motor is disconnected from the load. Please set F801-805 and F810 correctly prior to running testing.

Operation process of rotating tuning: Press the "Run" key on the keypad to display "TEST", and it will tune the motor's parameter of two stages. After that, the motor will accelerate according to acceleration time set at F114 and maintain it for a certain period. The motor will then decelerate to 0 according to the time set at F115. After auto-checking is completed, relevant parameters of the motor will be stored in function codes F806~F809, and F800 will turn to 0 automatically.

·F800=2, stationary tuning.

It is suitable for the cases where it is impossible to disconnect the motor from the load.

Press the "Run" key, and the inverter will display "TEST", and it will tune the motor's parameter of two stages. The motor's stator resistance, rotor resistance and leakage inductance will be stored in F806-F809 automatically (the motor's mutual inductance uses default value generated according to the power), and F800 will turn to 0 automatically. The user may also calculate and input the motor's mutual inductance value manually according to actual conditions of the motor. With regard to calculation formula and method, please call us for consultation.

When tuning the motor's parameter, motor is not running but it is powered on. Please do not touch motor during this process.

\*Note:

1. No matter which tuning method of motor parameter is adopted, please set the information of the motor (F801-F805) correctly according to the nameplate of the motor. If the operator is quite familiar with the motor, the operator may input all the parameters (F806-F809) of the motor manually.

2. Parameter F804 can only be checked, not be modified.

3. Incorrect parameters of the motor may result in unstable running of the motor or even failure of normal running. Correct tuning of the parameters is a fundamental guarantee of vector control performance. Each time when F801 rated power of the motor is changed, the parameters of the motor (F806-F809) will be refreshed to default settings automatically. Therefore, please be careful while amending this parameter. The motor's parameters may change when the motor heats up after running for a long time. If the load can be disconnected, we recommend auto-checking before each running.

|      |                                |  |                           |
|------|--------------------------------|--|---------------------------|
| F806 | Stator resistance ( $\Omega$ ) | Setting range:<br>0.001~65.53 $\Omega$ (for 15kw and below 15kw)<br>0.1~6553m $\Omega$ (For above 15kw)  | Subject to inverter model |
| F807 | Rotor resistance ( $\Omega$ )  | Setting range:<br>0.001~65.53 $\Omega$ (for 152kw and below 15kw)<br>0.1~6553m $\Omega$ (For above 15kw) |                           |
| F808 | Leakage inductance (mH)        | Setting range:<br>0.01~655.3mH (for 15kw and below 15kw)<br>0.001~65.53mH (for above 15kw)               |                           |
| F809 | Mutual inductance (mH)         | Setting range:<br>0.1~6553mH (for 15kw and below 15kw)<br>0.01~655.3mH (for above 15 kw)                 |                           |
| F844 | Motor no-load current (A)      | Setting range: 0.1~F803  |                           |

·The set values of F806~F809 will be updated automatically after normal completion of parameter tuning of the motor.

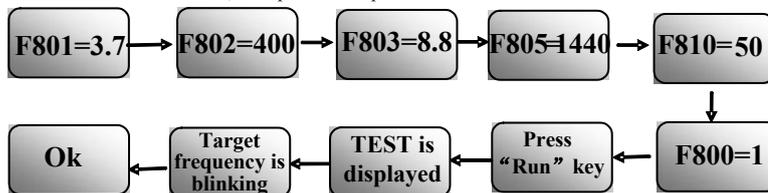
·If it is impossible to measure the motor at the site, input the parameters manually by referring to the known parameters of a similar motor.

F844 can be got automatically by rotating tuning.

If the no-load current is higher when motor is running, please decrease the value of F844.

If running current or start current is higher when motor is running with load, please increase the value of F844.

Take a 3.7kW inverter for the example: all data are 3.7kW, 400V, 8.8A, 1440rpm/min, 50Hz, and the load is disconnected. When F800=1, the operation steps are as below:



|      |                           |                           |                           |
|------|---------------------------|---------------------------|---------------------------|
| F812 | Pre-excitation time (S)   | Setting range: 0.00~30.00 | 0.30                      |
| F813 | Rotary speed loop KP1     | Setting range: 1~100      | 30                        |
| F814 | Rotary speed loop KI1     | Setting range: 0.01~10.00 | 0.50                      |
| F815 | Rotary speed loop KP2     | Setting range: 1~100      | Subject to inverter model |
| F816 | Rotary speed loop KI2     | Setting range: 0.01~10.00 | 1.00                      |
| F817 | PID switching frequency 1 | Setting range: 0~F818     | 5.00                      |
| F818 | PID switching frequency 2 | Setting range: F817~F111  | 10.00                     |

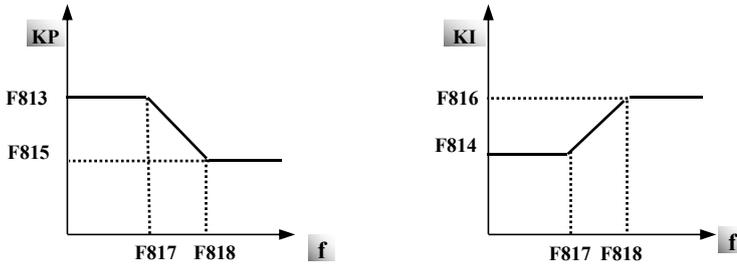


Fig 5-21 PI parameter sketch map

Dynamic response of vector control speed can be adjusted through adjusting proportional and storage gains of speed loop. Increasing KP and KI can speed up dynamic response of speed loop. However, if proportional gain or storage gain is too large, it may give rise to oscillation.

Recommended adjusting procedures:

Make fine adjustment of the value on the basis of manufacturer value if the manufacturer setting value can not meet the needs of practical application. Be cautious that amplitude of adjustment each time should not be too large.

In the event of weak loading capacity or slow rising of rotary speed, please increase the value of KP first under the precondition of ensuring no oscillation. If it is stable, please increase the value of KI properly to speed up response.

In the event of oscillation of current or rotary speed, decrease KP and KI properly.

Note: Improper setting of KP and KI may result in violent oscillation of the system, or even failure of normal operation. Please set them carefully.

|  |                       |                  |
|--|-----------------------|------------------|
| F819 Slip coefficient                    | Setting range: 50~200 | Mfr's value: 100 |
| F820 Filtering coefficient of speed loop | Setting range: 0~100  | Mfr's value: 0   |

F819 is used to adjust steady speed precision of motor in vector control.

In vector control mode, if speed fluctuation is higher or inverter stops instability, please increase the value of F820 properly; it will influence response speed of speed loop.

|  |                         |                  |
|--|-------------------------|------------------|
| F822 Upper limit of speed control torque | Setting range:0.0~250.0 | Mfr's value: 200 |
|--|-------------------------|------------------|

The parameter of F822 limits the output current in the vector control mode.

|                           |   |                |
|---------------------------|---|----------------|
| F840 Halt speed detection | Setting range:<br>0: based on feedback speed<br>1: based on given speed | Mfr's value: 0 |
|---------------------------|---|----------------|

F840=0: Inverter tests feedback speed when deceleration and stop output when meeting requirement.

F840=1: Inverter tests given speed when deceleration and stop output when meeting requirement.

|                   |   |                |
|-------------------|---|----------------|
| F861 Control Mode | Setting range:<br>0: Control mode 1-General PMSM<br>1: Control mode 2-High-frequency PMSM | Mfr's value: 0 |
|-------------------|---|----------------|

F861=0: Control mode 1, which is suitable for general PMSM

F861=1: Control mode 2, which is suitable for high-frequency PMSM.

|   |  |                    |
|---|--|--------------------|
| F862 Frequency switch point                 | Setting range: 0.1~50.0                                  | Mfr's value: 5.0   |
| F870 PMSM back electromotive force (mV/rpm) | Setting range: 0.1~6553.0<br>(valid value between lines) | Mfr's value: 100.0 |
| F871 PMSM D-axis inductance (mH)            | Setting range: 0.01~655.30                               | Mfr's value:5.00   |
| F872 PMSM Q-axis inductance (mH)            | Setting range: 0.01~655.30                               | Mfr's value:7.00   |
| F873 PMSM stator resistance (Ω)             | Setting range: 0.001 ~ 65.535<br>(phase resistor)        | Mfr's value:0.500  |

·F870(back electromotive force of PMSM, unit = 0.1mV/1rpm, it is back electromotive force value between lines), it is forbidden to revert to Mfr's value by F160.

·F871(PMSM D-axis inductance, unit = 0.01 mH), it is forbidden to revert to Mfr's value by F160.

·F872(PMSM Q-axis inductance, unit = 0.01 mH), it is forbidden to revert to Mfr's value by F160.

·F873(PMSM Stator resistance, unit = m-ohm, 0.001 ohm), it is forbidden to revert to Mfr's value by F160.

·F870-F873 are motor parameters of PMSM, they are not shown in the motor nameplate. User can get them by auto tuning or asking manufacture.

|  |                          |                   |
|--|--------------------------|-------------------|
| F876 PMSM injection current without load (%)                               | Setting range: 0.0~100.0 | Mfr's value: 20.0 |
| F877 PMSM injection current compensation without load (%)                  | Setting range: 0.0~50.0  | Mfr's value: 0.0  |
| F878 PMSM cut-off point of injection current compensation without load (%) | Setting range: 0.0~50.0  | Mfr's value: 10.0 |
| F879 PMSM injection current with heavy load (%)                            | Setting range: 0.0~100.0 | Mfr's value: 0.0  |

F876, F877 and F879 are the percent of rated current. F878 is the percent of rated frequency.

For example:

When F876=20, if F877=10 and F878=0, the injection current without load is 20% of rated current.

When F876=20, if F877=10 and F878=10, and rated frequency is 50Hz, injection current without load will decrease by a linear trend from 30 (F876+F877). When inverter runs to 5Hz (5Hz=rated frequency X F878%), injection current will decrease to 20, and 5Hz is cut-off point of injection current compensation without load.

|                                  |                         |                  |
|----------------------------------|-------------------------|------------------|
| F880 PMSM PCE detection time (S) | Setting range: 0.1~10.0 | Mfr's value: 0.2 |
|----------------------------------|-------------------------|------------------|

|   |                                       |                   |
|---|---------------------------------------|-------------------|
| F898 Power consumption correction coefficient | Setting range:<br>50.0~100.0          | Mfr's value: 80.0 |
| F899 Power consumption clear                  | Setting range:<br>0: invalid 1: Valid | Mfr's value: 0    |

When F899=1, accumulative power consumption will be clear. The value of function code will turn to 0 automatically.

## 5.10 Communication Parameter

|  |  |                  |
|--|--|------------------|
| F900 Communication Address               | Setting range:<br>1~255: single inverter address<br>0: broadcast address                           | Mfr's value: 1   |
| F901 Communication Mode                  | Setting range:<br>1: ASCII<br>2: RTU<br>3: Remote Keypad   | Mfr's value: 2   |
| F902 Stop bits                           | Setting range: 1~2   | Mfr's value: 2   |
| F903 Parity Check                        | Setting range:<br>0: Invalid<br>1: Odd<br>2: Even  | Mfr's value: 0   |
| F904 Baud Rate                           | Setting range:<br>0: 1200;<br>1: 2400;<br>2: 4800;<br>3: 9600;<br>4: 19200<br>5: 38400<br>6: 57600 | Mfr's value: 3   |
| F905 Communication timeout period (S)    | Setting range: 0.0~3000.0  | Mfr's value: 0.0 |
| F907 Time 2 of communication timeout (S) | Setting range: 0.0~3000.0  | Mfr's value: 0.0 |

F904=9600 is recommended for baud rate, which makes run steady. Communication parameters refer to Appendix 4.

When F905 is set to 0.0, the function is invalid. When  $F905 \neq 0.0$ , if the inverter has not received effective command from PC/PLC during the time set by F905, inverter will trip into CE.

When  $F907 > 0$ , and receiving the previous data, if after the time set by F907, the next data is not received, inverter will output communication timeout signal. The timeout signal will be cleared by this terminal, and after receiving correct data, inverter will accumulate time again.

|                           |  |                |
|---------------------------|--|----------------|
| F926 CAN baud rate (kbps) | Setting range:<br>1:50 2:100 3:125 4:250 5:500<br>6:1000 | Mfr's value: 6 |
|---------------------------|--|----------------|

|                     |                      |                |
|---------------------|----------------------|----------------|
| F928 BACnet address | Setting range: 0~127 | Mfr's value: 1 |
|---------------------|----------------------|----------------|

|                             |   |                |
|-----------------------------|---|----------------|
| F929 BACnet baud rate (bps) | Setting range:<br>0: 9600 1: 19200<br>2: 38400 3: 76800 | Mfr's value: 1 |
|-----------------------------|---|----------------|

|                                     |                           |                  |
|-------------------------------------|---------------------------|------------------|
| F930 Keypad disconnected protection | 0: Invalid<br>1~10: 1~10S | Mfr's value: 0.0 |
|-------------------------------------|---------------------------|------------------|

F930 means that the delay time(s) that running inverter freely stops and jump to malfunction when taking out the keypad.

Communication parameters refer to Appendix 7.

## 5.11 PID Parameters

### 5.11.1 Internal PID adjusting and constant pressure water supply

Internal PID adjusting control is used for single pump or double pump automatic constant-pressure water supply, or used for simple close-loop system with convenient operation.

The usage of pressure meter:

As FAO2=1: channel A11

“10V” connect with the power supply of pressure meter, if the power supply of pressure meter is 5V, please supply a 5V power.

“A11” connect with the pressure signal port of pressure meter

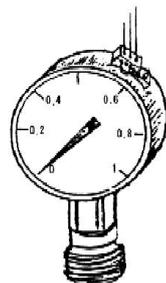
“GND” connect with the grounding of pressure meter

As FAO2=2: channel A12

“10V” connect with the power supply of pressure meter, if the power supply of pressure meter is 5V, please supply a 5V power.

“A12” connect with the pressure signal port of pressure meter

“GND” connect with the grounding of pressure meter



### 5.11.2 Parameters

|                        |   |                |
|------------------------|---|----------------|
| FA00 Water supply mode | Setting range:<br>0: Single pump (PID control mode)<br>1: Fixed mode<br>2: Timing interchanging<br>5: Dormancy interchanging<br>6: fixed pumps interchanging by time<br>7: fixed pumps interchanging at sleep<br>10: master/slave fixed mode<br>11: master/slave interchanging by time<br>12: master/slave interchanging at sleep | Mfr's value: 0 |
|------------------------|---|----------------|

When FA00=0 and single pump mode is selected, the inverter only controls one pump. The control mode can be used in the closed-loop control system, for example, pressure, flow.

When FA00=1, one motor is connected with converter pump all the time, 1~3 pcs motors are connected to general pumps.

When FA00=2, three pumps are interchanging to connect with inverter for a fixed period of time. The duration time is set by FA25.

When FA00=5, inverter pumps enters into dormancy status, inverter pumps will convert to fixed pump, fixed pump will convert to inverter pump.

When FA00=6, one pump is always the inverter pump all the time, 1~3 pcs fixed pump will interchange the sequence according to the time of FA25.

When FA00=7, one pump is always the inverter pump all the time. When inverter pump is in sleeping mode, the 1-3pcs fixed pump will interchange the sequence.

When FA00=10, the inverter of the smallest address will be the master.

When FA00=11, when the master runs for the time of FA25, the next inverter will be the new master.

When FA00=12, when the master is in sleeping mode, the next inverter will be the new master.

|  |  |                |
|--|--|----------------|
| FA01 PID adjusting target given source | Setting range:<br>0: FA04<br>1: A11<br>2: A12<br>4: FI (pulse frequency input) | Mfr's value: 0 |
|--|--|----------------|

When FA01=0, PID adjusting target is given by FA04 or MODBUS.

When FA01=1, PID adjusting target is given by external analog A11.

When FA01=2, PID adjusting target is given by external analog A12.

When FA01=4, PID adjusting target is given by FI pulse frequency (DI1 terminal).

When FA00=10, 11, 12, only FA01=0 is workable

|  |   |                |
|--|---|----------------|
| FA02 PID adjusting feedback given source | Setting range:<br>1: AI1<br>2: AI2<br>3: FI (pulse frequency input)<br>4: reserved<br>5: Running current<br>6: Output power<br>7: Output torque | Mfr's value: 1 |
|--|---|----------------|

When FA02=1, PID feedback signal is given by external analog AI1.

When FA02=2, PID feedback signal is given by external analog AI2.

When FA03=3, PID feedback signal is given by FI pulse frequency input (DI1 terminal).

When FA03=5, PID feedback signal is given by inverter running current.

When FA02=6, PID feedback signal is given by inverter output power.

When FA02=7, PID feedback signal is given by inverter output torque.

|   |           |                    |
|---|-----------|--------------------|
| FA03 Max limit of PID adjusting (%)     | FA04~FA50 | Mfr's value: 100.0 |
| FA04 Internal PID pressure setpoint (%) | FA05~FA03 | Mfr's value: 50.0  |
| FA05 Min limit of PID adjusting (%)     | 0.0~FA04  | Mfr's value: 0.0   |

FA03: When negative feedback adjusting is valid, if the feedback is higher than max limit of PID adjusting(FA03), pressure protection will occur. Then it will free stop, and “nP” is displayed. When positive feedback adjusting is valid, if feedback is higher than internal PID setpoint+PID dead zone(FA04+FA29), it indicates that feedback pressure is too low, inverter should accelerate or one more pump should be added.

FA04: When FA01=0, the value set by FA04 is digital PID setpoint. When the 4-line LCD display is display PID setpoint, customer can push UP/DOWN key to change it, and store it into FA04.

FA05: When negative feedback adjusting, if the feedback is lower than PID setpoint-PID dead zone(FA04-FA29), it indicates that feedback pressure is too low, inverter should accelerate or one more pump will be added. When positive feedback adjusting is valid, if the feedback is lower than min limit of PID adjusting, pressure protection will occur. Then it will free stop, and “nP” is displayed.

For example: if the range of pressure meter is 0-1.6MPa, the FA04 setpoint is  $1.6 \times 70\% = 1.12\text{MPa}$ , and the FA03 max limit pressure is  $1.6 \times 90\% = 1.44\text{MPa}$ , and the FA05 min limit pressure is  $1.6 \times 5\% = 0.08\text{MPa}$ .

|                   |  |                |
|-------------------|--|----------------|
| FA06 PID polarity | 0: Positive feedback<br>1: Negative feedback | Mfr's value: 1 |
|-------------------|--|----------------|

When FA06=0, the higher feedback value is, the higher the motor speed is. This is positive feedback.

When FA06=1, the lower the feedback value is, the higher the motor speed is. This is negative feedback.

|                 |                                    |                |
|-----------------|------------------------------------|----------------|
| FA07 Sleep mode | Setting range: 0: Valid 1: Invalid | Mfr's value: 1 |
|-----------------|------------------------------------|----------------|

When FA07=0, if inverter runs at the min frequency FA09 for a period time set by FA10, inverter will stop.

When FA07=1, the dormancy function is invalid.

|                             |  |                   |
|-----------------------------|--|-------------------|
| FA09 PID Min frequency (Hz) | Setting range:<br>MAX (F112, 0.1)~F111 | Mfr's value: 5.00 |
|-----------------------------|--|-------------------|

The min frequency is set by FA09 when PID adjusting is valid.

|                           |                        |                   |
|---------------------------|------------------------|-------------------|
| FA10 Sleep delay time (S) | Setting range: 0~500.0 | Mfr's value: 15.0 |
|---------------------------|------------------------|-------------------|

When FA07=0, inverter runs at min frequency FA09 for a period time set by FA10, inverter will free stop and enter into the sleep status, “SLP” is displayed.

In single pump mode, if it is PID control of emptying port, it will display “SLP”. If it is PID control of filling port, it will display “SLP1”.

|                          |                         |                  |
|--------------------------|-------------------------|------------------|
| FA11 Wake delay time (S) | Setting range: 0.0~3000 | Mfr's value: 3.0 |
|--------------------------|-------------------------|------------------|

When pressure protection(nP, nP1) or sleep mode(SLP, SLP1) is enable, after the wake delay time, if the pressure is lower than PID min limit (Negative feedback) or the pressure is higher than the PID max limit,

inverter will begin running immediately. Otherwise, inverter will keep in sleep mode.

|                            |                          |                    |
|----------------------------|--------------------------|--------------------|
| FA12 PID max frequency(Hz) | Setting range: FA09~F111 | Mfr's value: 50.00 |
|----------------------------|--------------------------|--------------------|

When PID is valid, FA12 is the max frequency setpoint

|  |  |                |
|--|--|----------------|
| FA13 pressure setpoint source of filling inlet | Setting range:<br>0: invalid<br>1: AI1<br>2: AI2 | Mfr's value: 0 |
|--|--|----------------|

·FA13=0, PID control at filling inlet is invalid

·FA13=1, pressure setpoint source of filling inlet is AI1.

·FA13=2, pressure setpoint source of filling inlet is Ai2.

|  |                        |                |
|--|------------------------|----------------|
| FA18 Whether PID adjusting setpoint is changable | 0: Invalid<br>1: Valid | Mfr's value: 1 |
|--|------------------------|----------------|

When FA18=0 and FA01≠0, PID setpoint is the setting of the first time after power on. It can not be changed anymore.

|                                |                           |                  |
|--------------------------------|---------------------------|------------------|
| FA19 Proportion Gain P         | Setting range: 0.00~10.00 | Mfr's value: 0.3 |
| FA20 Integration time I (S)    | Setting range: 0.1~100.0  | Mfr's value: 0.3 |
| FA21 Differential time D (S)   | Setting range: 0.1~10     | Mfr's value: 0.1 |
| FA22 PID sampling period (2mS) | Setting range: 1~500      | Mfr's value: 5   |

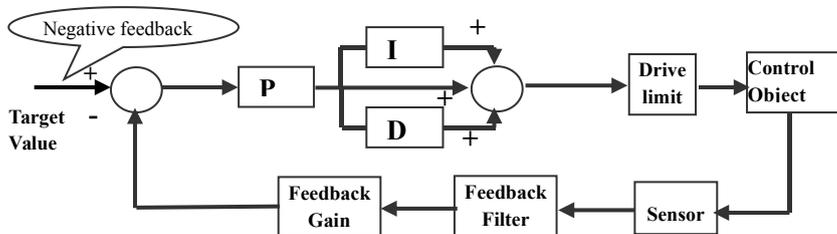
Increasing proportion gain, decreasing integration time and increasing differential time can increase the dynamic response of PID closed-loop system. However, if P is too high, I is too low or D is too high, system will not be steady.

Recommend adjusting method:

If mfr's value cannot satisfy requirement, fine adjustments can be proceed based on the mfr's value: increase the proportion gain firstly to ensure system not shaking; then reducing integration time to make system have fast response characteristics; if still not meet the requirement, increase differential time to make system overshoot. To avoid system oscillation, setting high value is not recommended.

FA22 works as PID adjustor sampling period, which means that the sampling time to feedback value for PID adjustor. The shorter the sampling time is, the faster adjustment speed is. Its basic unit is 2ms. E.g. 1 means sampling period is 2ms; 5 means 10ms.

The following is PID adjusting arithmetic



|  |   |                |
|--|---|----------------|
| FA23 PID negative frequency output selection | Setting range:<br>0: Invalid<br>1: Valid<br>2: Only negative output | Mfr's value: 0 |
|--|---|----------------|

When FA23=0, PID output frequency is FA09~FA12.

When FA23=1, PID output frequency is -FA12~FA12.

When FA23=2, PID output frequency is -FA12~0.

FA23=1/2 is only valid when FA00=0.

|                                      |                                  |                  |
|--------------------------------------|----------------------------------|------------------|
| FA24 Timing unit for pump switchover | Setting range: 0: hour 1: minute | Mfr's value: 0   |
| FA25 Switchover Timing Setting       | Setting range: 1~9999            | Mfr's value: 100 |

Switching time is set by FA25. The unit is set by FA24.

|   |  |                 |
|---|--|-----------------|
| FA26 Under-load protection mode                     | Setting Range<br>0: No protection<br>1: Protection by terminal input<br>2: Protection by PID<br>3: Protection by current | Mfr's value: 0  |
| FA27 Current threshold of under-load protection (%) | Setting range: 10~150  | Mfr's value: 80 |
| FA66 Duration time of under-load protection (S)     | Setting range: 0~60  | Mfr's value: 20 |

Note: the percent of under-load protection current corresponds to motor rated current.

Under-load protection is used to save energy. For some pumps device, when the output power is too low, the efficiency will get worse, so we suggest that the pumps should be closed.

During the running process, if the load decreases to zero suddenly, it means the mechanical part is broken. For example, belt is broken or water pump is dried up. Under-load protection must occur.

When FA26=1, water signal and lack water signal is controlled by two input terminals. When the lack water terminal is valid, inverter will enter into the protection status, and EP is displayed. When the water terminal is valid for a certain period(FA28), inverter will deactivate EP fault automatically.

When FA26=2, PID adjusting frequency runs to max frequency, if inverter current is lower than the product of FA27 value and rated current, inverter will enter PID under-load protection status immediately, and EP2 is displayed.

When FA26=3, if inverter current is lower than the product of FA27 and rated current, after duration time of FA66, inverter will enter under-load protection, and EP3 is displayed.

|  |        |                 |
|--|--------|-----------------|
| FA28 Waking time after under-load protection (min) | 1~3000 | Mfr's value: 60 |
|--|--------|-----------------|

After the duration time of FA28, inverter will judge that whether the under-load protection signal disappears.

If malfunction is reset, inverter will run again. Or else inverter will wait until malfunction resets. User can reset the inverter by pressing "stop/reset", inverter will stop.

|   |           |                   |
|---|-----------|-------------------|
| FA29 PID dead zone (%)                                | 0.0~10.0  | Mfr's value: 2.0  |
| FA30 Running Interval of restarting inverter pump (S) | 2.0~999.9 | Mfr's value: 20.0 |
| FA31 Delay time of switch on pumps (S)                | 0.1~999.9 | Mfr's value: 30.0 |
| FA32 Delay time of switch off pumps (S)               | 0.1~999.9 | Mfr's value: 30.0 |

FA29, PID dead zone has two functions. First, setting dead time can restrain PID adjustor oscillation. The greater this value is, the lighter PID oscillation is. But if the value of FA29 is too high, PID adjusting precision will decrease. For example: when FA29=2.0% and FA04=70, PID adjusting will be active during the feedback value from 68 to 72.

Second, FA29 is set to PID dead time when starting and stopping fixed pumps. When negative feedback adjusting is valid, if feedback value is lower than value FA04-FA29 (which equal to set value MINUS dead-time value), inverter will delay the set time of FA31, and then start the fixed pump. If feedback value is higher than value FA04+FA29 (which equal to set value PLUS dead-time value), inverter will delay the set time of FA32, then stop the fixed pump.

When the fixed pump will be switched on, the inverter pump will free stop. After the fixed pump is fully started, inverter will delay the time of FA30, and restart inverter pump. Or, when rotation time(FA25) is finished, the fixed pump will free stop. After the delay time of FA30, inverter will restart the inverter pump.

When inverter drives 1 inverter pump and 1 fixed with negative feedback adjusting, if the frequency of inverter pump already reaches the max value and after the delay time (FA31), the pressure is still lower than the setpoint to switchover the fixed pump, then the inverter will stop output immediately and motor will freely stop. At the

same time, the fixed pump will be started. After the fixed pump is fully run, if the present pressure is higher than the setpoint, inverter will low down the output to the min frequency. After delaying the set time (FA32), inverter will stop the fixed pump and the inverter pump will work with PID control.

When inverter drives 1 inverter pump and 1 fixed with positive feedback adjusting, if the frequency of inverter pump already reaches the max value and after the delay time (FA31), the pressure value still higher than the setpoint to switchover the fixed pump, then the inverter will stop output immediately and motor will freely stop. At the same time the general pump will be started. After the general pump runs, if the present pressure is lower than the setpoint, inverter will low down the output to the min frequency. After delaying the set time (FA32), inverter will stop the fixed pump and the inverter pump will work with PID control.

|  |   |                |
|--|---|----------------|
| FA33 stop mode when constant pressure water supply | 0: free stop<br>1: deceleration to stop | Mfr's value: 0 |
|--|---|----------------|

FA33 is used to set the stop mode after inverter stops converter pump or trips with nP and EP.

|                                |   |                |
|--------------------------------|---|----------------|
| FA34 pressure measurement unit | 0: %<br>1: Mpa<br>2: bar<br>3: psi<br>4: CM<br>5: M<br>6: CM/Seg<br>7: M/Seg<br>8: °C | Mfr's value: 0 |
|--------------------------------|---|----------------|

|                              |                                  |                |
|------------------------------|----------------------------------|----------------|
| FA36 No.1 relay is available | 0: not available<br>1: available | Mfr's value: 0 |
| FA37 No.2 relay is available | 0: not available<br>1: available | Mfr's value: 0 |

No. 1 relay corresponds to the terminal DO1, No. 2 relay corresponds to the terminal TA1/TC1.

|                                   |  |                   |
|-----------------------------------|--|-------------------|
| FA38 Proportion gain Kp2          | Setting range: 0.00~10.00  | Mfr's value: 0.30 |
| FA39 Integration time Ki2(S)      | Setting range: 0.1~100.0   | Mfr's value: 0.3  |
| FA40 Differential time Kd2(S)     | Setting range: 0.0~10.0  | Mfr's value: 0.0  |
| FA41 PI parameter switchover type | Setting range: 0: no switchover<br>1: reserved 2: Auto switchover<br>3: reserved | Mfr's value: 0    |
| FA42 Switchover error 1           | Setting range: FA05~FA43   | Mfr's value: 0.0  |
| FA43 Switchover error 2           | Setting range: FA42~FA03   | Mfr's value: 0.0  |

·FA38~FA40 is the second group of PID parameters. They can be used with the first group parameters separately.

·When FA41=0, the first group PID parameters are used. The parameters are FA19~FA21.

·When FA41=2, if the current error(difference between PID given value and PID feedback) is higher than FA43, the second group of PID parameters will be used. When the current error is lower than FA42, the first group of PID parameters will be used. When current error is between error 1 and error 2, PID will

use transition parameters.

|                                |   |                |
|--------------------------------|---|----------------|
| FA44 Master/slave control mode | 0:same frequency<br>1: high efficiency mode | Mfr's value: 0 |
|--------------------------------|---|----------------|

- When FA44=0, under master/slave control, all inverters run at the same speed.
- When FA44=1, under master/slave control,each pump switched on will run to max frequency one by one, but the last one will run with PID control.

|   |                         |                |
|---|-------------------------|----------------|
| FA45 pressure setpoint compensation (%) | Setting range: 0.0~10.0 | Mfr's value: 0 |
|---|-------------------------|----------------|

- PID given value(FA01) plus FA45 will be the final PID given value.

|   |                     |                 |
|---|---------------------|-----------------|
| FA47 The sequence of starting No. 1 relay | Setting range: 1~20 | Mfr's value: 20 |
| FA48 The sequence of starting No. 2 relay | Setting range: 1~20 | Mfr's value: 20 |

The sequence of starting relays is set by FA47~FA48. The default value is 20, and 20 means invalid. The setting value of FA47 and FA48 must be different with each other, and one of them must be set to 1. Otherwise "Err5" is displayed in the keypad.

|                                      |                          |                    |
|--------------------------------------|--------------------------|--------------------|
| FA49 filling inlet pressure range(%) | Setting range: 0.0~100.0 | Mfr's value: 100.0 |
|--------------------------------------|--------------------------|--------------------|

- FA49 is used to set the pressure range of filling input.

|                                     |                          |                    |
|-------------------------------------|--------------------------|--------------------|
| FA50 Empty outlet pressure range(%) | Setting Range: 0.0~100.0 | Mfr's value: 100.0 |
|-------------------------------------|--------------------------|--------------------|

- FA50 is used to set the pressure range of empty outlet.

|   |  |                  |
|---|--|------------------|
| FA51 pressure threshold of refilling at inlet (%) | Setting range: FA52~FA49                 | Mfr's value: 0.0 |
| FA52 Pressure threshold of water-lack at inlet(%) | Setting range: 0.0~FA51;<br>0.0: invalid | Mfr's value: 0.0 |
| FA53 delay time for refilling at inlet(S)         | Setting range: 0.0~60.0                  | Mfr's value: 0.0 |
| FA54 delay time for warning water-lack(S)         | Setting range: 0.0~60.0                  | Mfr's value: 0.0 |

- FA52: It is the pressure to indicate that it is the lack of water at inlet. When FA52=0.00, the function of detecting negative pressure is invalid.

·The function of detecting negative pressure: The pressure at inlet is detected in real time. If the pressure at inlet is lower than FA52, after the delay time of FA54, all inverter will free stop and alarm with "EP5". When the pressure at inlet is higher than FA51, after the delay time of FA53, "EP5" will be reset and all pump will rework.

Note:

1. This function will only work if there is negative-pressure detecting device at inlet. If not, FA52 should be set to 0.0.
2. FA13 is the given source of inlet pressure. It can not be the same source of PID feedback(FA02). FA02 is the feedback source of outlet.

|                               |                     |                |
|-------------------------------|---------------------|----------------|
| FA55 master/slave pump number | Setting range: 0~14 | Mfr's value: 0 |
|-------------------------------|---------------------|----------------|

- When it is master/slave control, if there is any mistake of setting, the inverter will display the following alarm.

·E001: If two inverter has the same address, the inverter will alarm with"E001"

·E002: If FA55≠0, but the actual inverter number is less than FA55, the master inverter will alarm with

“E002”.

·E003: If CAN communication is interfered, the inverter will alarm with “E003”.

·E004: If FA55≠0, but the actual inverter number is more than FA55, the master inverter will alarm with “E004”

|   |                        |                |
|---|------------------------|----------------|
| FA56 outlet sensor disconnection protection | 0: invalid<br>1: valid | Mfr's value: 0 |
| FA57 inlet sensor disconnection protection  | 0: invalid<br>1: valid | Mfr's value: 0 |

·When it is master/slave control, the setting of F400 and F406 is higher than 0.10.

If all outlet emptying sensors are disconnected and FA56=1, the inverter will alarm with AEr0(fault number 58)

If all inlet filling sensors are disconnected and FA57=1, the inverter will alarm with AEr1(fault number 73)

|                                    |                          |                   |
|------------------------------------|--------------------------|-------------------|
| FA58 Fire pressure given value (%) | Setting range: 0.0~100.0 | Mfr's value: 80.0 |
|------------------------------------|--------------------------|-------------------|

FA58 is also called second pressure, when the fire control terminal is valid or switchover terminal of fire mode at PID control is valid, pressure target value will switch into second pressure value.

|                          |   |                |
|--------------------------|---|----------------|
| FA59 Emergency fire mode | Setting range: 0: Invalid<br>1: Emergency fire mode 1<br>2: Emergency fire mode 2 | Mfr's value: 0 |
|--------------------------|---|----------------|

When emergency fire mode is valid and emergency fire terminal is valid, inverter will be forbidden operating and protecting (When OC and OE protection occur, inverter will reset automatically and start running). And inverter will run at the frequency of FA60 or target frequency until inverter is broken.

Emergency fire mode 1: when the terminal is valid, inverter will run at target frequency.

Emergency fire mode 2: when the terminal is valid, inverter will run at the frequency of FA60.

|  |                          |                   |
|--|--------------------------|-------------------|
| FA60 Running frequency of emergency fire | Setting range: F112~F111 | Mfr's value: 50.0 |
|--|--------------------------|-------------------|

When emergency fire mode 2 is set, the fire terminal is valid, inverter will run at the frequency set by FA60.

|                     |  |                |
|---------------------|--|----------------|
| FA62 Fire mode stop | Setting range:<br>0: no stop<br>1: manual stop valid | Mfr's value: 0 |
|---------------------|--|----------------|

·When FA62=0, inverter keeps working at fire emergency mode

·When FA62=1, inverter quits from fire emergency mode.

|  |   |                   |
|--|---|-------------------|
| FA67 Wakeup mode                             | Setting range: 0: wakeup mode 1<br>1: wakeup mode 2 | Mfr's value: 0    |
| FA68 Wakup pressure of postive feedback(%)   | Setting range: 0.0~100.0                            | Mfr's value: 30.0 |
| FA69 Wakup pressure of negative feedback (%) | Setting range: 0.0~100.0                            | Mfr's value: 30.0 |

·When FA67=0, inverter will be awoken according to FA03 and FA05.

If FA67=1 and FA06=1, when the present pressure is higher than target pressure, and PID adjusts to min frequency, inverter will enter into sleeping status after the delay time of FA10. If inverter is in the sleeping status and the present pressure is lower than target pressure-FA69, inverter will be awoken after wake delay time (FA11) .

If FA06=0, when the present pressure is lower than target pressure, and PID adjusts to min frequency, inverter will free stop and enter into sleeping status after the setting time of FA10. If inverter is in the sleeping status, when the present pressure is higher than target pressure + FA68, inverter will be awoken after wake delay time(FA11).

If target pressure+FA68> 100%,it is equal to 100%. If target pressure-FA69 <0%, it is equal to 0%.

|                                       |                                       |                 |
|---------------------------------------|---------------------------------------|-----------------|
| FA78 Flow detection enable            | Setting range: 0: invalid<br>1: valid | Mfr's value: 0  |
| FA79 interval time for flow detection | Setting range: 1~60000                | Mfr's value: 60 |

|  |                           |                  |
|--|---------------------------|------------------|
| (min)  |                           |                  |
| FA80 pressure compensation for flow detection(%) | Setting range: 0.1~10.0   | Mfr's value: 2.0 |
| FA81 no flow restart delay (S)                   | Setting range: 0.0~3000.0 | Mfr's value:10.0 |

When FA78=1, no-flow detection is enable in order to prevent motor to be damaged in case of no flow. When the pressure in pipe is stable, after the interval time of FA79, the target pressure will be change to "present pressure + pressure compensation(FA80)". When the pressure in pipe becomes stable again, after FA81 delay time, the target pressure will be recovered to previous setpoint.

|   |                                  |                |
|---|----------------------------------|----------------|
| FA82 No.3 relay is available              | 0: not available<br>1: available | Mfr's value: 0 |
| FA83 The sequence of starting No. 3 relay | Setting range: 1~20              | Mafr's value20 |

·No. 3 relay is TA2/TC2

|                 |  |                |
|-----------------|--|----------------|
| FA84 Sleep mode | 0: sleeping mode 1<br>1: sleeping mode 2 | Mfr's value: 0 |
|-----------------|--|----------------|

·When FA84=0, if the present pressure is higher than the target pressure, slave will decrease to PID min frequency(FA09) . After sleep delay time(FA10), the slave will be in sleep status

When FA84=1, if the present pressure is higher than target pressure, the slave will decrease to PID min frequency(FA09). After a half of sleep delay time(FA10), the slave will decrease again to inverter's min frequency(F112). After the second half of FA10, the slave will be in sleep status.

|                     |                                      |                |
|---------------------|--------------------------------------|----------------|
| FA85 Dead Zone mode | 0: $\pm$ dead zone<br>1: + dead zone | Mfr's value: 0 |
|---------------------|--------------------------------------|----------------|

·When FA85=0, PID control is in the range of target pressure $\pm$ dead zone.

·When FA85=1, PID control is in the range of target pressure + dead zone.

|  |                          |                   |
|--|--------------------------|-------------------|
| FA86 Internal PID pressure setpoint 2(%) | Setting range: FA05~FA03 | Mfr's value: 50.0 |
| FA87 Internal PID pressure setpoint 3(%) | Setting range: FA05~FA03 | Mfr's value: 50.0 |
| FA88 Internal PID pressure setpoint 4(%) | Setting range: FA05~FA03 | Mfr's value: 50.0 |

·FA86~FA88 is more option for target pressure. Customers can use the function combination of DI terminal(F316~F321=44 , 45). Please refer to Table 5-4 outlet target pressure selection.

|                         |  |  |
|-------------------------|--|--|
| FA89 pump start counter |  |  |
|-------------------------|--|--|

·It counts each time of starting pump, including sleep/awake operation.

|   |  |                   |
|---|--|-------------------|
| FA90 Switchover of inlet/outlet PID control     | 0: invalid<br>1: valid                       | Mfr's value: 0    |
| FA91 Inlet max pressure(%)                      | setting range: FA93~FA49                     | Mfr's value: 25.0 |
| FA92 Pressure of switch to inlet PID control(%) | setting range: FA94~FA49                     | Mfr's value: 5.0  |
| FA93 Inlet pressure setpoint(%)                 | setting range: FA94~FA91                     | Mfr's value: 10.0 |
| FA94 Inlet min pressure(%)                      | setting range: 0.0~FA93                      | Mfr's value: 0.0  |
| FA95 Inlet PID control polarity                 | setting range:<br>0: Positive<br>1: Negative | Mfr's value: 0    |

·When it is PID control of outlet, if the pressure at inlet is lower than FA93, inverter will switchover to inlet PID control according to inlet's pressure setpoint, max pressure, min pressure.

·When it is inlet PID control, if inlet pressure is higher than FA92, inverter will switchover to outlet PID control.

Note: When it is inlet PID control, if it is negative feedback, if the inlet pressure is higher than FA91, inverter will free stop and trip with “nP1”. If it is positive feedback, if the inlet pressure is lower than FA94, inverter will free stop and trip with “nP1”.

|                    |  |                |
|--------------------|--|----------------|
| FA96 level control | setting range:<br>0: invalid<br>1: valid | Mfr's value: 0 |
|--------------------|--|----------------|

·When FA96=1, level control is enable.

When DI terminal is enable with 71(filling), if DI terminal is enable with 73(high entry level), inverter will stop. Otherwise, inverter will keep running.

When DI terminal is enable with 72(emptying), if DI terminal is enable with 74(low entry level), inverter will stop. Otherwise, inverter will keep running.

|  |  |                |
|--|--|----------------|
| FA98 Inverter pump stop when a fixed pump is switched on | setting range:<br>0: invalid<br>1: valid | Mfr's value: 1 |
|--|--|----------------|

·At inverter/fixed pump mode(FA00=1/2/5), when fixed pump is switched on, inverter pump could stop or not stop.

·When FA98=0, inverter pump will not stop, usually the fixed pump is softly started at this situation.

·When FA98=1, inverter will stop during switching on fixed pump.

|                              |  |                |
|------------------------------|--|----------------|
| FA99 parameter synchronizing | setting range:<br>0: invalid<br>1: valid | Mfr's value: 0 |
|------------------------------|--|----------------|

·When it is master/slave control, if a new inverter is added in the pump group, it is only need to set F203, F900 and FA00. Then customer can set FA99=1 in any inverter in the pump group, then all the parameter setting will be copied to the new inverter. After that, FA99 will be changed to 0 automatically.

|                                   |                         |                  |
|-----------------------------------|-------------------------|------------------|
| FB00 Pump autotuning              | 0: invalid<br>1: valid  | Mfr's value: 0   |
| FB01 Pump autotuning time step(S) | setting range: 0.1~5.0  | Mfr's value: 1.0 |
| FB02 Pump autotuning current(A)   | setting range: 0.0~F803 | Mfr's value: 0.0 |

·When FB00=1, after inverter run, it make autotuning of pump. After autotuning, PID min frequency(FA09) will be changed automatically. If the autotuning is not successful, inverter will alarm with “ErAT”.

|   |                           |                   |
|---|---------------------------|-------------------|
| FB10 Outlet pressure setpoint of manual control(%)        | setting range: FA05~FA03  | Mfr's value: 50.0 |
| FB11 Outlet sleep frequency of manual control(Hz)         | setting range: F112~F111  | Mfr's value: 5.00 |
| FB12 Outlet Sleep delay time of manual control (S)        | setting range: 0.0~500.0  | Mfr's value: 15.0 |
| FB13 Outlet wakeup pressure setpoint of manual control(%) | setting range: 0.0~FB10   | Mfr's value: 0.0  |
| FB14 Outlet wakeup delay time of                          | setting range: 0.0~3000.0 | Mfr's value: 3.0  |

|   |                          |                    |
|---|--------------------------|--------------------|
| manual control(S)                             |                          |                    |
| FB15 Outlet max pressure of manual control(%) | setting range: FA04~FA50 | Mfr's value: 100.0 |

·When DI terminal is valid of 46(Manual pressure selection ), FB10~FB15 is the parameter for manual control of outlet.

|                                  |  |   |
|----------------------------------|--|---|
| FB16 Dry operation protection    | setting range:<br>0: invalid<br>1: valid | Mfr's value: 0                                |
| FB17 Dry operation pressure (%)  | setting range: 0.0~FB23                  | Mfr's value: 0.0                              |
| FB18 Dry operation delay time(S) | setting range: 0.0~300.0                 | Mfr's value: 60.0                             |
| FB19 Dry operation current(A)    | setting range: 0.1~1000.0                | Mfr's value:<br>according to<br>power ratings |

·FB16=1, when inverter is in outlet PID control, after all pumps have been switched on, if the actual outlet pressure is lower than FB17\* target pressure and the current is lower than FB19 as well, inverter will alarm with EP4 after delay time of FB18.

|                                 |                                       |                   |
|---------------------------------|---------------------------------------|-------------------|
| FB20 Pipe filling installation  | setting range:<br>0: invalid 1: valid | Mfr's value: 0    |
| FB21 Pipe filling frequency(Hz) | setting range: 0.00~FA12              | Mfr's value: 5.00 |
| FB22 Prefilling time (S)        | setting range: 0.0~300.0              | Mfr's value: 60.0 |
| FB28 Filling timeout(min)       | setting range: 0.0~300.0              | Mfr's value: 10.0 |

·When FB20=1, pipe filling installation is enable. It is only active the first time the pressure group is activated. The pressure feedback is never reached the target pressure ago. In general, this happens at the first time the pumping equipment is turned on and the pressure group is activated.

·When the inverter is started, if the pressure feedback is lower than target pressure, inverter will run at the max frequency. If it is master/slave control, all pump will be started. After running for FB22 time, the master inverter will decrease to FA09+FB21, and slave inverter will stop. When the pressure feedback reaches the target pressure, inverter will quit the pipe filling mode and execute normal PID control.

If the filling time exceeds FB28, inverter will stop and alarm with "FILL".

|                                    |  |                  |
|------------------------------------|--|------------------|
| FB23 Leakage pressure detection(%) | setting range: FB17~80.0<br>0.0: invalid | Mfr's value: 0.0 |
| FB24 Leakage detecting time 1(S)   | setting range: 0.0~300.0                 | Mfr's value: 5.0 |
| FB25 Leakage detecting time 2(S)   | setting range: 0.0~300.0                 | Mfr's value: 5.0 |
| FB26 Leakage detecting time 3(S)   | setting range: 0.0~300.0                 | Mfr's value: 5.0 |
| FB27 Leakage detecting cycle       | setting range: 1~10                      | Mfr's value: 3   |

·When FB23=0.0, leakage detection is not enable.

Detection pressure is the percentage between the present outlet pressure and target pressure.

·When the inverter run at the max frequency and all pumps are started, if the present pressure is lower than leakage detection pressure for FB24 time, inverter will stop and execute leakage detection.

·Leakage detection procedure: inverter will start and run up to max frequency after delay time of FB25. If the present pressure is lower than leakage pressure setpoint, inverter will stop after running for FB26. Then, inverter will execute the same action again.

If the present pressure is higher than leakage pressure setpoint, inverter will quit the leakage detection mode. If the detection operation is executed for more than FB27 times, inverter will stop and alarm with "EP6".

|                                   |                                       |                |
|-----------------------------------|---------------------------------------|----------------|
| FB29 Activate Manual/Auto control | setting range: 0: invalid<br>1: valid | Mfr's value: 0 |
|-----------------------------------|---------------------------------------|----------------|

·When FB29=1, manual/auto control is enable. And DI terminal also should be defined as 46 and 47.

|      |                           |                       |                 |
|------|---------------------------|-----------------------|-----------------|
| FB31 | Run time for cleaning(S)  | setting range: 1~3000 | Mfr's value: 30 |
| FB32 | Stop time for cleaning(S) | setting range: 1~3000 | Mfr's value: 30 |

·In manual control, when the DI terminal defined as 75(pump cleaning) is enable, inverter starts to clean pump. It will run forward for FB31, stop for FB32, run backward for FB31, and stop for FB32. The running frequency is FA09.

|      |   |                          |                  |
|------|---|--------------------------|------------------|
| FB33 | Solar filtered time for frequency limit (S) | setting range: 0.0~100.0 | Mfr's value: 3.0 |
|------|---|--------------------------|------------------|

·When FB33 is valid and FB33≠0, if the frequency limit is higher than min frequency, inverter will start after filtered time of FB33.

|      |                   |                                       |                |
|------|-------------------|---------------------------------------|----------------|
| FB34 | Solar mode enable | setting range: 0: invalid<br>1: valid | Mfr's value: 0 |
|------|-------------------|---------------------------------------|----------------|

·When FB34=1, solar pump mode is enable, the undervoltage value will be adjusted automatically according to actual power ratings of inverter.

·Solar pump mode is only valid when F203=0 or F203=9.

·Under solar pump mode, output frequency is adjusted according to the sunlight and DC bus voltage.

|      |                           |  |                |
|------|---------------------------|--|----------------|
| FB35 | Frequency limiting source | setting range:<br>0: invalid<br>1: AI1<br>2: AI2 | Mfr's value: 0 |
|------|---------------------------|--|----------------|

·The actual PID output frequency will be always lower than frequency limit corresponding to analog input.

When the frequency corresponding to analog input is lower than min frequency, inverter will stop.

·FB35=0, frequency limit for solar is not valid.

·FB35=1, output frequency is limited by AI1 input.

·FB35=2, output frequency is limited by AI2 input.

·When it is PID control(only FA00=0), if frequency limit corresponding to AI is lower than FA09, inverter will stop. When it is not PID control, if frequency limit corresponding to AI is lower than F112, inverter will stop.

|      |   |   |                  |
|------|---|---|------------------|
| FB36 | Outlet feedback compensation direction  | setting range: 0: positive<br>1: negative | Mfr's value: 0   |
| FB37 | Outlet feedback compensation display(%) | setting range: 0.0~FA50                   | Mfr's value: 0.0 |
| FB38 | Inlet feedback compensation direction   | setting range: 0: positive<br>1: negative | Mfr's value: 0   |
| FB39 | Inlet feedback compensation display(%)  | setting range: 0.0~FA49                   | Mfr's value: 0.0 |

·When FB36=0, the display of outlet pressure feedback is the actual feedback +FB37.

·When FB36=1, the display of outlet pressure feedback is the actual feedback -FB37.

·When FB38=0, the display of inlet pressure feedback is the actual feedback +FB39.

·When FB38=1, the display of inlet pressure feedback is the actual feedback -FB39.

|      |   |                                       |                      |
|------|---|---------------------------------------|----------------------|
| FB40 | Anti-freeze/Ant-irust function          | setting range: 0: invalid<br>1: valid | Mfr's value: 0       |
| FB41 | Stop time for Anti-freeze/Anti-rust (S) | setting range: 1.0~3000.0             | Mfr's value:<br>60.0 |
| FB42 | Run time for Anti-freeze/Anti-rust (S)  | setting range: 1.0~3000.0             | Mfr's value:<br>60.0 |

·When FB40=1, the sleeping master inverter will be waked up after stopping time of FB41. Then it will run for time of FB42. If it meets the sleeping condition, master inverter will recover to sleeping mode.

The standby slave inverter will run after stopping time of FB41. It will run for time of FB42, and then stop again. The running frequency is sleeping frequency.

Note: fixed pump is not available with this function.

|                     |                                       |                |
|---------------------|---------------------------------------|----------------|
| FB43 Well pump mode | setting range: 0: invalid<br>1: valid | Mfr's value: 0 |
|---------------------|---------------------------------------|----------------|

·FB43 is to define the pump as well pump.

|  |                                       |                |
|--|---------------------------------------|----------------|
| FB44 Anti-return valve installed                                   | setting range: 0: invalid<br>1: valid | Mfr's value: 0 |
| FB45 delay time for restart pump without anti-return valve(minute) | setting range: 0~99                   | Mfr's value: 3 |

·FB44 means whether there is anti-return valve in pump.

·When it is well pump mode or solar mode, if there is no anti-return value in pump system, it is necessary to wait until the end of discharging water column in outlet pipe. If FB44=0, when inverter is restarted from sleep mode or reset from alarm, inverter should delay for FB45 and then run.

|  |                          |                  |
|--|--------------------------|------------------|
| FB46 Accelerating time for valid water supply(S) | setting range: 0.0~100.0 | Mfr's value: 0.0 |
| FB47 Decelerating time for valid water supply(S) | setting range: 0.0~100.0 | Mfr's value: 0.0 |

·When FB46≠0, F203=9, if the running frequency is lower than FA09 during acceleration, then inverter will execute FB46 as accelerating time.

·When FB46≠0, F203=0, if the running frequency is lower than F112 during acceleration, then inverter will execute FB46 as accelerating time.

·When B47≠0, FA84=0, if the running frequency is lower than FA09 during deceleration, then inverter will execute FB47 as decelerating time.

·When B47≠0, FA84=1, if the running frequency is lower than FA112 during deceleration, then inverter will execute FB47 as decelerating time.

|  |                                       |                   |
|--|---------------------------------------|-------------------|
| FB48 Anti-jam function                   | setting range: 0: invalid<br>1: valid | Mfr's value: 0    |
| FB49 Jam current(%)                      | setting range: 100~150                | Mfr's value: 115  |
| FB50 Jam judgement time(S)               | setting range: 0.1~60.0               | Mfr's value: 10.0 |
| FB51 Delay time for anti-jam running(S)  | setting range: 0.0~30.0               | Mfr's value: 3.0  |
| FB52 Anti-jam running time(S)            | setting range: 1.0~30.0               | Mfr's value: 3.0  |
| FB53 Number of times of anti-jam attempt | setting range: 1~10                   | Mfr's value: 3    |

·Anti-jam function is only valid when F203=0. Usually the application is waste water pump, and no pressure sensor is used.

·When FB48=1, if the current is higher than FB49 and last for FB50, inverter will start to judge whether the pump is blocked. The procedure is as follows.

Inverter will stop firstly, delay for FB51, and run backwards up to F113 and last for FB52. Then, inverter will stop again, delay for FB51, and run forwards up to F113 and last for FB52. If the present current is always lower than FB49 even after two times of FB52, inverter will quit the anti-jam judgement.

If the current is higher than FB49, then inverter will execute another circulation of anti-jump judgement. If the circulation exceeds FB53, inverter will stop and alarm with ErJA.

|                               |                                  |                   |
|-------------------------------|----------------------------------|-------------------|
| FB54 Max sunlight(W/m2)       | setting range: FB55~1500         | Mfr's value: 1500 |
| FB55 Working sunlight(W/m2)   | setting range: FB56~FB54         | Mfr's value: 1000 |
| FB56 Min sunlight(W/m2)       | setting range: 50~FB55           | Mfr's value: 600  |
| FB57 Alarm min sunlight(W/m2) | setting range: 0~FB56 0: invalid | Mfr's value: 0    |

·The max sunlight corresponds to analog 10V.

- When F203=0, analog input of working sunlight corresponds to F113, analog input of min sunlight corresponds to FA09.
- When F203=9, analog input of working sunlight corresponds to FA12, analog input of min sunlight corresponds to FA09.
- When solar mode is enable(FB34=1), if the present frequency is FA09 and run for FA10 time, inverter will enter into solar sleep mode, and display SSLP.

|      |   |                         |                                  |
|------|---|-------------------------|----------------------------------|
| FB58 | Open-circuit voltage of solar panel (V) | setting range: FB59~800 | Mfr's value:<br>T3:682 T2/S2:379 |
| FB59 | Max-power voltage of solar panel(V)     | setting range: 100~FB58 | Mfr's value:<br>T3:556 T2/S2:309 |

- Set FB58 and FB59 according to the technical data of solar panel.

|      |                                |                           |                    |
|------|--------------------------------|---------------------------|--------------------|
| FB60 | voltage regulation coefficient | setting range:0.01~10.00  | Mfr's value:1.00   |
| FB61 | voltage regulation cycle       | setting range:0.001~1.000 | Mfr's value: 0.001 |

- FB60 and FB61 is used to regulate the DC bus voltage at solar mode.

|      |                        |                       |                |
|------|------------------------|-----------------------|----------------|
| FB80 | Password for pump manu | setting range: 0~9999 | Mfr's value: 0 |
|------|------------------------|-----------------------|----------------|

## 5.12 Time setting

|      |        |                          |                         |
|------|--------|--------------------------|-------------------------|
| FD00 | Year   | Setting range: 2000~9999 | Mfr's value: local time |
| FD01 | Month  | Setting range: 1~12      | Mfr's value: 5          |
| FD02 | Date   | Setting range: 1~31      | Mfr's value: 15         |
| FD03 | Week   | Setting range: 1~7       | Mfr's value: 1          |
| FD04 | Hour   | Setting range: 0~23      | Mfr's value: 8          |
| FD05 | Minute | Setting range: 0~59      | Mfr's value: 0          |
| FD06 | Second | Setting range: 0~59      | Mfr's value: 0          |

|      |                                       |                                       |                   |
|------|---------------------------------------|---------------------------------------|-------------------|
| FD07 | Supplying water on appointed date     | Setting range: 0: invalid<br>1: valid | Mfr's value: 0    |
| FD08 | Supplying water on weekend            | Setting range: 0: invalid<br>1: valid | Mfr's value: 0    |
| FD09 | Supplying water on everyday           | Setting range: 0: invalid<br>1: valid | Mfr's value: 0    |
| FD10 | Starting time 1 on appointed date     | Setting range: 01.01~12.31            | Mfr's value: 1.01 |
| FD11 | Stopping time 1 on appointed date     | Setting range: 01.01~12.31            | Mfr's value: 1.01 |
| FD12 | Pressure setpoint 1 on appointed date | Setting range: FA05~FA03              | Mfr's value: 0.0  |
| FD13 | Starting time 2 on appointed date     | Setting range: 01.01~12.31            | Mfr's value: 1.01 |
| FD14 | Stopping time 2 on appointed date     | Setting range: 01.01~12.31            | Mfr's value: 1.01 |
| FD15 | Pressure setpoint 2 on appointed date | Setting range: FA05~FA03              | Mfr's value: 0.0  |

|      |                                       |                            |                   |
|------|---------------------------------------|----------------------------|-------------------|
| FD16 | Starting time 3 on appointed date     | Setting range: 01.01~12.31 | Mfr's value: 1.01 |
| FD17 | Stopping time 3 on appointed date     | Setting range: 01.01~12.31 | Mfr's value: 1.01 |
| FD18 | Pressure setpoint 3 on appointed date | Setting range: FA05~FA03   | Mfr's value: 0.0  |
| FD19 | Starting time 4 on appointed date     | Setting range: 01.01~12.31 | Mfr's value: 1.01 |
| FD20 | Stopping time 4 on appointed date     | Setting range: 01.01~12.31 | Mfr's value: 1.01 |
| FD21 | Pressure setpoint 4 on appointed date | Setting range: FA05~FA03   | Mfr's value: 0.0  |
| FD22 | Starting time 5 on appointed date     | Setting range: 01.01~12.31 | Mfr's value: 1.01 |
| FD23 | Stopping time 5 on appointed date     | Setting range: 01.01~12.31 | Mfr's value: 1.01 |
| FD24 | Pressure setpoint 5 on appointed date | Setting range: FA05~FA03   | Mfr's value: 0.0  |
| FD25 | Starting time 6 on appointed date     | Setting range: 01.01~12.31 | Mfr's value: 1.01 |
| FD26 | Stopping time 6 on appointed date     | Setting range: 01.01~12.31 | Mfr's value: 1.01 |
| FD27 | Pressure setpoint 6 on appointed date | Setting range: FA05~FA03   | Mfr's value: 0.0  |
| FD28 | Starting time 7 on appointed date     | Setting range: 01.01~12.31 | Mfr's value: 1.01 |
| FD29 | Stopping time 7 on appointed date     | Setting range: 01.01~12.31 | Mfr's value: 1.01 |
| FD30 | Pressure setpoint 7 on appointed date | Setting range: FA05~FA03   | Mfr's value: 0.0  |
| FD31 | Starting time 8 on appointed date     | Setting range: 01.01~12.31 | Mfr's value: 1.01 |
| FD32 | Stopping time 7 on appointed date     | Setting range: 01.01~12.31 | Mfr's value: 1.01 |
| FD33 | Pressure setpoint 8 on appointed date | Setting range: FA05~FA03   | Mfr's value: 0.0  |
| FD34 | Starting time 1 at weekend            | Setting range: 0.00~23.59  | Mfr's value: 0.00 |
| FD35 | Stopping time 1 at weekend            | Setting range: 0.00~23.59  | Mfr's value: 0.00 |
| FD36 | Pressure setpoint 1 at weekend        | Setting range: FA05~FA03   | Mfr's value: 0.0  |
| FD37 | Starting time 2 at weekend            | Setting range: 0.00~23.59  | Mfr's value: 0.00 |
| FD38 | Stopping time 2 at weekend            | Setting range: 0.00~23.59  | Mfr's value: 0.00 |
| FD39 | Pressure setpoint 2 at weekend        | Setting range: FA05~FA03   | Mfr's value: 0.0  |
| FD40 | Starting time 3 at weekend            | Setting range: 0.00~23.59  | Mfr's value: 0.00 |
| FD41 | Stopping time 3 at weekend            | Setting range: 0.00~23.59  | Mfr's value: 0.00 |
| FD42 | Pressure setpoint 3 at weekend        | Setting range: FA05~FA03   | Mfr's value: 0.0  |
| FD43 | Starting time 4 at weekend            | Setting range: 0.00~23.59  | Mfr's value: 0.00 |

|      |                                 |                           |                   |
|------|---------------------------------|---------------------------|-------------------|
| FD44 | Stopping time 4 at weekend      | Setting range: 0.00~23.59 | Mfr's value: 0.00 |
| FD45 | Pressure setpoint 4 at weekend  | Setting range: FA05~FA03  | Mfr's value: 0.0  |
| FD46 | Starting time 5 at weekend      | Setting range: 0.00~23.59 | Mfr's value: 0.00 |
| FD47 | Stopping time 5 at weekend      | Setting range: 0.00~23.59 | Mfr's value: 0.00 |
| FD48 | Pressure setpoint 5 at weekend  | Setting range: FA05~FA03  | Mfr's value: 0.0  |
| FD49 | Starting time 6 at weekend      | Setting range: 0.00~23.59 | Mfr's value: 0.00 |
| FD50 | Stopping time 6 at weekend      | Setting range: 0.00~23.59 | Mfr's value: 0.00 |
| FD51 | Pressure setpoint 6 at weekend  | Setting range: FA05~FA03  | Mfr's value: 0.0  |
| FD52 | Starting time 7 at weekend      | Setting range: 0.00~23.59 | Mfr's value: 0.00 |
| FD53 | Stopping time 7 at weekend      | Setting range: 0.00~23.59 | Mfr's value: 0.00 |
| FD54 | Pressure setpoint 7 at weekend  | Setting range: FA05~FA03  | Mfr's value: 0.0  |
| FD55 | Starting time 8 at weekend      | Setting range: 0.00~23.59 | Mfr's value: 0.00 |
| FD56 | Stopping time 8 at weekend      | Setting range: 0.00~23.59 | Mfr's value: 0.00 |
| FD57 | Pressure setpoint 8 at weekend  | Setting range: FA05~FA03  | Mfr's value: 0.0  |
| FD58 | Starting time 1 on everyday     | Setting range: 0.00~23.59 | Mfr's value: 0.00 |
| FD59 | Stopping time 1 on everyday     | Setting range: 0.00~23.59 | Mfr's value: 0.00 |
| FD60 | Pressure setpoint 1 on everyday | Setting range: FA05~FA03  | Mfr's value: 0.0  |
| FD61 | Starting time 2 on everyday     | Setting range: 0.00~23.59 | Mfr's value: 0.00 |
| FD62 | Stopping time 2 on everyday     | Setting range: 0.00~23.59 | Mfr's value: 0.00 |
| FD63 | Pressure setpoint 2 on everyday | Setting range: FA05~FA03  | Mfr's value: 0.0  |
| FD64 | Starting time 3 on everyday     | Setting range: 0.00~23.59 | Mfr's value: 0.00 |
| FD65 | Stopping time 3 on everyday     | Setting range: 0.00~23.59 | Mfr's value: 0.00 |
| FD66 | Pressure setpoint 3 on everyday | Setting range: FA05~FA03  | Mfr's value: 0.0  |
| FD67 | Starting time 4 on everyday     | Setting range: 0.00~23.59 | Mfr's value: 0.00 |
| FD68 | Stopping time 4 on everyday     | Setting range: 0.00~23.59 | Mfr's value: 0.00 |
| FD69 | Pressure setpoint 4 on everyday | Setting range: FA05~FA03  | Mfr's value: 0.0  |
| FD70 | Starting time 5 on everyday     | Setting range: 0.00~23.59 | Mfr's value: 0.00 |
| FD71 | Stopping time 5 on everyday     | Setting range: 0.00~23.59 | Mfr's value: 0.00 |

|      |                                 |                           |                   |
|------|---------------------------------|---------------------------|-------------------|
| FD72 | Pressure setpoint 5 on everyday | Setting range: FA05~FA03  | Mfr's value: 0.0  |
| FD73 | Starting time 6 on everyday     | Setting range: 0.00~23.59 | Mfr's value: 0.00 |
| FD74 | Stopping time 6 on everyday     | Setting range: 0.00~23.59 | Mfr's value: 0.00 |
| FD75 | Pressure setpoint 6 on everyday | Setting range: FA05~FA03  | Mfr's value: 0.0  |
| FD76 | Starting time 7 on everyday     | Setting range: 0.00~23.59 | Mfr's value: 0.00 |
| FD77 | Stopping time 7 on everyday     | Setting range: 0.00~23.59 | Mfr's value: 0.00 |
| FD78 | Pressure setpoint 7 on everyday | Setting range: FA05~FA03  | Mfr's value: 0.0  |
| FD79 | Starting time 8 on everyday     | Setting range: 0.00~23.59 | Mfr's value: 0.00 |
| FD80 | Stopping time 8 on everyday     | Setting range: 0.00~23.59 | Mfr's value: 0.00 |
| FD81 | Pressure setpoint 8 on everyday | Setting range: FA05~FA03  | Mfr's value: 0.0  |

### 5.13 Torque control parameters

|                                     |   |                |
|-------------------------------------|---|----------------|
| FC00 Speed/torque control selection | Setting range:<br>0: Speed control<br>1: Torque control<br>2: Terminal switchover | Mfr's value: 0 |
|-------------------------------------|---|----------------|

0: speed control. Inverter will run by frequency setpoint, and output torque will automatically match with the torque of load, and output torque is limited by max torque (set by manufacturer.)

1: Torque control. Inverter will run by setting torque, and output speed will automatically match with the speed of load, and output speed is limited by max speed (set by FC23 and FC25). Please set the proper torque and speed limited.

2: Terminal switchover. User can set DIX terminal as torque/speed switchover terminal to realize switchover between torque and speed. When the terminal is valid, torque control is valid. When the terminal is invalid, speed control is valid.

|      |                             |                  |     |
|------|-----------------------------|------------------|-----|
| FC02 | Torque accel/decel time (S) | Range: 0.1~100.0 | 1.0 |
|------|-----------------------------|------------------|-----|

The time is for inverter to run from 0% to 100% of rated torque.

|      |                      |   |   |
|------|----------------------|---|---|
| FC06 | Torque given channel | Setting range:<br>0: Digital given (FC09)<br>1: Analog input AI1<br>2: Analog input AI2<br>4: Pulse input channel FI<br>5: Reserved | 0 |
|------|----------------------|---|---|

When FC06=4, only DI1 terminal can be selected because only DI1 terminal has the pulse input function.

|      |                                |         |       |
|------|--------------------------------|---------|-------|
| FC07 | Torque given coefficient       | 0~3.000 | 3.000 |
| FC09 | Torque given command value (%) | 0~300.0 | 100.0 |

FC07: when input given torque reaches max value, FC07 is the ratio of inverter output torque and motor rated torque. For example, if FC06=1, F402=10.00, FC07=3.00, when AI1 channel output 10V, the output torque of inverter is 3 times of motor rated torque.

FC09 means the percentage relative to motor rated torque.

|      |                                     |   |       |
|------|-------------------------------------|---|-------|
| FC14 | Offset torque given channel         | Setting range:<br>0: Digital given (FC17)<br>1: Analog input AI1<br>2: Analog input AI2<br>4: Pulse input channel FI<br>5: Reserved | 0     |
| FC15 | Offset torque coefficient           | 0~0.500   | 0.500 |
| FC16 | Offset torque cut-off frequency (%) | 0~100.0   | 10.00 |
| FC17 | Offset torque command value (%)     | 0~50.0  | 10.00 |

· Offset torque is used to output larger start torque which equals to setting torque and offset torque when motor drives big inertia load. When actual speed is lower than the setting frequency by FC16, offset torque is given by FC14. When actual speed is higher than the setting frequency by FC16, offset torque is 0.

· When FC14≠0, and offset torque reaches max value, FC15 is the ratio of offset torque and motor rated torque. For example: if FC14=1, F402=10.00 and FC15=0.500, when AI1 channel outputs 10V, offset torque is 50% of motor rated torque.

|      |                               |   |      |
|------|-------------------------------|---|------|
| FC22 | Forward speed limited channel | Setting range:<br>0: Digital given (FC23)<br>1: Analog input AI1<br>2: Analog input AI2<br>4: Pulse input channel FI<br>5: Reserved | 0    |
| FC23 | Forward speed limited (%)     | 0~100.0   | 10.0 |
| FC24 | Reverse speed limited channel | 0: Digital given (FC25)<br>1: Analog input AI1<br>2: Analog input AI2<br>5: Reserved  | 0    |
| FC25 | Reverse speed limited (%)     | 0~100.0   | 10.0 |

· Speed limited FC23/FC25: if given speed reaches max value, they are used to set percent of inverter output frequency and max frequency F111.

|      |                                   |   |        |
|------|-----------------------------------|---|--------|
| FC28 | Electric torque limit channel     | 0: Digital given (FC30)<br>1: Analog input AI1<br>2: Analog input AI2<br>4: Pulse input channel FI<br>5: Reserved | 0      |
| FC29 | Electric torque limit coefficient | 0~3.000   | 3.000  |
| FC30 | Electric torque limit (%)         | 0~300.0   | 200.0  |
| FC33 | Braking torque limit channel      | 0: Digital given (FC35)<br>1: Analog input AI1<br>2: Analog input AI2<br>4: Pulse input channel FI<br>5: Reserved | 0      |
| FC34 | Braking torque limit coefficient  | 0~3.000   | 3.000  |
| FC35 | Braking torque limit (%)          | 0~300.0   | 200.00 |

· When motor is in the electric status, output torque limit channel is set by FC28. When FC28 does not equal to 0, limit torque is set by FC29. When FC28=0, limit torque is set by FC30.

· When motor is in the Braking status, Braking torque limit channel is set by FC31. When FC33 does not equal to 0, limit torque is set by FC34. When FC33=0, limit torque is set by FC35.

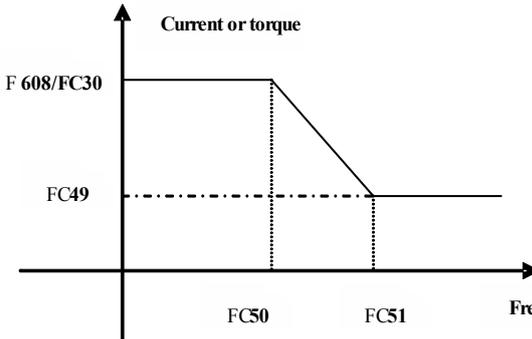
|                                |                                    |   |
|--------------------------------|------------------------------------|---|
| FC48 Torque switchover enabled | Setting range: 0: Invalid 1: Valid | 0 |
|--------------------------------|------------------------------------|---|

|                                       |           |       |
|---------------------------------------|-----------|-------|
| FC49 Current-limiting point 2 (%)     | F608~200  | 190   |
| FC50 Frequency switchover point 1(Hz) | 1.00~FC51 | 10.00 |
| FC51 Frequency switchover point 2(Hz) | FC51~F111 | 20.00 |

·FC48 is used to limit max torque or max current during running process. In VF and auto torque promotion mode, it is used to limit current, in vector control mode. It is used to limit torque.

·FC49 is the percentage of rated current in VF and auto torque promotion mode. FC49 is the percentage of rated torque in vector control mode.

·FC50 and FC51 is frequency switchover point when torque or current change. Please see below Fig.



### 5.14 Parameters Display

|   |  |  |
|---|--|--|
| H000 Running frequency/target frequency(Hz) |  |  |
|---|--|--|

In stopped status, target frequency is displayed. In running status, running frequency is displayed.

|                                      |  |  |
|--------------------------------------|--|--|
| H001 Actual speed/target speed (rpm) |  |  |
|--------------------------------------|--|--|

In stopped status, actual speed is displayed. In running status, target speed is displayed.

|                         |  |  |
|-------------------------|--|--|
| H002 Output current (A) |  |  |
|-------------------------|--|--|

In running status, output current is displayed. In stopped status, H002=0.

|                         |  |  |
|-------------------------|--|--|
| H003 Output voltage (V) |  |  |
|-------------------------|--|--|

In running status, output voltage is displayed. In stopped status, H003=0.

|                      |  |  |
|----------------------|--|--|
| H004 Bus voltage (V) |  |  |
|----------------------|--|--|

Bus voltage is displayed by H004.

|                       |  |  |
|-----------------------|--|--|
| H005 PID feedback (%) |  |  |
|-----------------------|--|--|

PID feedback value is displayed by H005.

|                       |  |  |
|-----------------------|--|--|
| H006 Temperature (°C) |  |  |
|-----------------------|--|--|

·Inverter temperature is displayed by H006.

|                  |  |  |
|------------------|--|--|
| H007 Count value |  |  |
|------------------|--|--|

The count value of DI1 input impulse is displayed by H007.

|   |   |  |  |
|---|---|--|--|
| H008  | linear speed                              |  |  |
| Inverter linear speed is displayed by H008.   |   |  |  |
| H009  | PID setting value (%)                     |  |  |
| PID setting value is displayed by H009.   |   |  |  |
| H012  | Output power (KW)                         |  |  |
| Inverter output power is displayed by H012.   |   |  |  |
| H013  | Output torque (%)                         |  |  |
| H014  | Target torque (%)                         |  |  |
| Inverter output torque is displayed by H013 and target torque is displayed by H014. |   |  |  |
| H017  | Current stage speed for multi-stage speed |  |  |
| In multi-stage speed mode, current stage speed is displayed by H017.                |   |  |  |
| H018  | Frequency of input pulse                  |  |  |
| Input pulse frequency of DI1 terminal is displayed by H018, the unit is 0.01        |   |  |  |
| H019  | Feedback speed (Hz)                       |  |  |
| Feedback speed is displayed as frequency by H019.                                   |   |  |  |
| H021  | A11 voltage(digital )                     |  |  |
| H022  | A12 voltage( digital )                    |  |  |
| Analog input voltage is display by H021 and H022.                                   |   |  |  |
| H025  | Current power-on time (minute)            |  |  |
| H026  | Current running time (minute)             |  |  |
| Current power-on time and running time are displayed by H025 and H026.              |   |  |  |
| H027  | Input pulse frequency(Hz)                 |  |  |
| Input pulse frequency is displayed by H027, the unit is 1Hz.                        |   |  |  |
| H030  | Main frequency source X (Hz)              |  |  |
| H031  | Accessorial frequency source Y(Hz)        |  |  |
| Main frequency and accessorial frequency are displayed by H030 and H031.            |   |  |  |
| H032  | Communication status of master/slave      |  |  |
| ·It displays the communication status of the present inverter and other inverters.  |   |  |  |
| H035  | Slave number                              |  |  |
| ·It display the quantity of salve inverter  |   |  |  |
| H036  | Accumulated power-on time(h)              |  |  |
| H037  | Accumulated running time(h)               |  |  |
| H038  | low-level power consumption(kW.H)         |  |  |
| H039  | High-level power consumption(MW.H)        |  |  |
| Total power consumption=(H039*1000 + H038)kW.H.                                     |   |  |  |
| H040  | Inlet pressure(%)                         |  |  |

## VI. Maintenance

Because the potential malfunctions may be caused by the influence of environmental temperature, humidity, dust and vibration, or aging and wearing components of internal inverter, daily inspection and periodic maintenance are necessary for inverter.

Be aware that check the content below to avoid electric shock hazard before inspection and maintenance:

1. The inverter's power is shut off.
2. The power indicator is off after opening the front cover.
3. Measure if the voltage between P/+ and N/- is below 36V with DC static high voltage meter.

### 6.1. Daily Inspection

Some unexpected situation may happen during operation, user should follow the reminder below to make daily inspection. Maintain a good operation environment; record daily operating data and find out abnormal cause earlier are good ways for prolonging the service life of inverter.

Daily Inspection Reminder

| Checking objects      | Inspection               |         |                            | Standard                                    |
|-----------------------|--------------------------|---------|----------------------------|---|
|                       | Content                  | Period  | Methods                    |   |
| Operation Environment | Temperature and humidity | Anytime | Thermometer and hygrometer | -10℃ ~ +50℃ , +50℃ ~ +60℃<br>Derating       |
|                       | Dust and water leakage   |         | Visual Check               | No water leakage trace                      |
|                       | Gases                    |         | Olfaction                  | No peculiar smell                           |
| Inverter              | Vibration and heating    | Anytime | Touch cover                | Steady vibration and reasonable temperature |
|                       | Noise                    |         | Audition                   | No abnormal voice                           |
| Motor                 | Heating                  | Anytime | Touch                      | No abnormal heating                         |
|                       | Noise                    |         | Auditory                   | Well-balanced voice                         |
| Running Status        | Output current           | Anytime | Ampere meter               | Within rated range                          |
|                       | Output voltage           |         | Voltmeter                  | Within rated range                          |

### 6.2. Periodic Maintenance

According to the operating environment, the inverter can be checked periodically every 3 or 6 months.

Note:

1. Disassemble components, maintenance and exchange can only be performed by specialized staff.
2. Do not leave any metal parts like screws or gaskets in machine, or damage may happen.

#### Inspection Content:

1. Clean cooling fan and air channel regularly and check if it is normal; Clean dust inside regularly.
2. Check input/output connections regularly to see if there is arcing in terminals or the wire is aging.
3. Check that the binding screw of each terminal is fastened.
4. Check that any damage of power cable and control cable, especially the incised wound of the wrapper contact with metal surface.
5. Clean the dust on the surface of PCB and air channel, vacuum cleaner is better.
6. At least one time power-on test must proceed within 2 years for Inverters of long-term storage. Use voltage regulator to raise rated value gradually, which during time is around 5 hours without load.

7. For the insulation test to inverter, grounding test must proceed after shorting all the input/output terminals (L1/R, L2/S, L3/T, U, V, W, PE, P/+, N/- and B/BR) of main loop with wires. Single-terminal grounding test is prohibited. Tramegger of 500V is required.
8. For the insulation test to motor, input terminals U, V, W of motor must be taken apart from inverter at first, then test motor separately to avoid damage of inverter.
9. Hi-Pot test has passed before leaving factory, user does not need to test again.
10. Changing original components of inverter with different model or electrical parameter may cause damage.

### 6.3. Exchange of Vulnerable parts

The main vulnerable parts of inverter are cooling fan and filter electrolytic capacitor, which life is closely related to the operation environment and maintenance situation.

#### 1. Cooling fan

The service life of cooling fan is 2~3 years normally. User can change cooling fan according to operation time.

Cause of damage: bearing wear, leaf aging.

Distinguish standard: any cracks on fan blade, abnormal vibration voice when power-on.

#### 2. Filter electrolytic capacitor

The service life is around 4~5 years. User can change based on the operation time.

Cause of damage: poor quality of input power, high temperature, frequent load jumps, aging electrolyte.

Distinguish standard: liquid leakage, safety valve bulge, measurement of electrostatic capacity and insulation resistance.

#### 3. Relay

The service life is 100 thousand times. User can change according to the operation time.

Cause of damage: corrosion, frequent movement.

Distinguish standard: open-close failure

### 6.4. Storage

Notice when temporary and long-term storage:

1. Try the best to put in the packing case as-is when storage.
2. Ensure good ventilation and keep away from the location of high-temperature, humidity and full of dust or metal dust.
3. Ensure charging every half year and the conduction time is at least 5 hours avoid the degradation of capacitor because of long-term storage.

## VII. Motor

### 7.1. Motor Nameplate

#### 7.1.1. Nameplate of EVPM motor

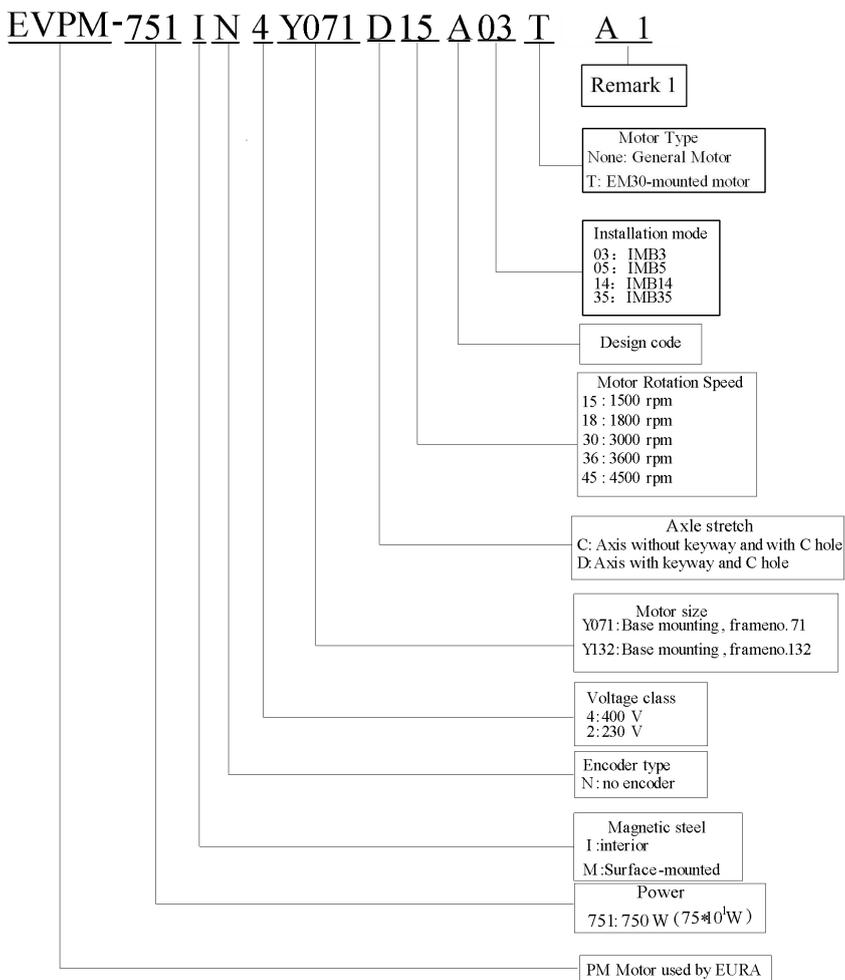
|  <b>Three-Phase PM Motor</b>         |            |              |         |  |
|---|------------|--------------|---------|--|
| Model: EVPM-751IN4Y071D15A03  |            | IEC60034     |         |  |
| 380 V   | 3~Mot      | 4 Pole       | 0.75 kW |  |
| 1500 rpm  | eff. 85.6% | 1.7 A        | 4.8 N•m |  |
| Tmax. 9.6 N•m   |            | 16.5Ω        | 227.3mH |  |
| Ke 120 V/krpm   |            | Y-connecting | S1      |  |
| No.*****  |            | Date:*****   | 5.4kg   |  |
|  <b>EURA DRIVES ELECTRIC CO.,LTD</b> |            |              |         |  |

#### 7.1.2. Nameplate of EVIM motor

|  <b>Three-Phase I M Motor</b> |          |              |         |  |
|--|----------|--------------|---------|--|
| Model: EVIM-751SN4Y071D15A03   |          | IEC60034     |         |  |
| 380V   | 3~Mot    | 4 Pole       | 0.75 kW |  |
| 1500 rpm   | eff. 87% | 3.4 A        | 4.8 N•m |  |
| Tmax. 9.6 N•m  |          | ***Ω         | ***mH   |  |
| Ke 60 V/krpm   |          | Y-connecting | S1      |  |
| No.*****   |          | Date:*****   | 5.4 kg  |  |
| <b>EURA DRIVES ELECTRIC CO.,LTD</b>  |          |              |         |  |

## 7.2. Naming Rule

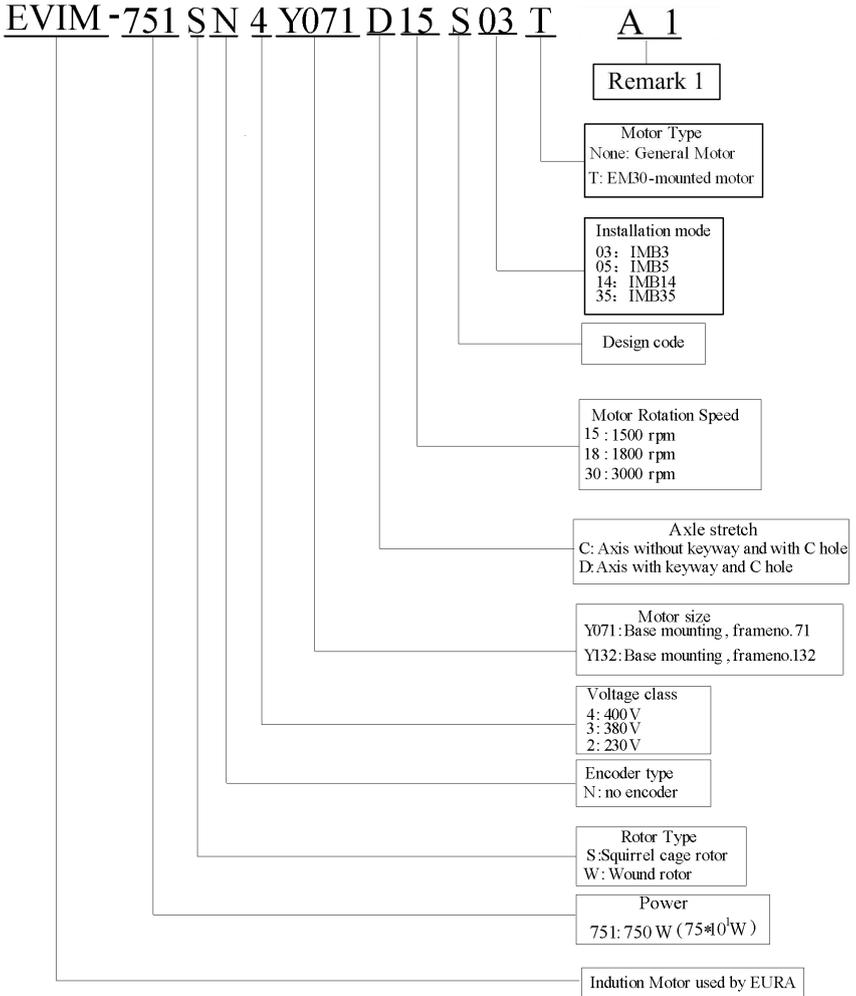
### 7.2.1. EVPM Motor Naming Rule:



#### Remark 1(A 1):

- A-Bearing Type: (1) None: Deep-groove ball bearing(horizontal, flange mounted)  
 (2) Angular contact bearing (vertical-mounted, axis down)  
 (3) Angular contact bearing (vertical-mounted, axis up)
- 1-Junction box location: (1) None: Close to shaft end; (2)1: Close to fan end;

7.2.2. EVIM Motor Naming Rule



**Note: Motor Size includes:**

|      |                             |      |                              |
|------|-----------------------------|------|------------------------------|
| Y063 | Base mounting, frame no. 63 | Y112 | Base mounting, frame no. 112 |
| Y071 | Base mounting, frame no. 71 | Y132 | Base mounting, frame no. 132 |
| Y090 | Base mounting, frame no. 90 | Y160 | Base mounting, frame no. 160 |

**7.3. Motor Technical Specification**

Table 7-1 EVPM motor technical specification

| Motor Model        | PM Motor(Permanent-magnet)  |           |
|--------------------|---|-----------|
| Magnetic material  | Highest intrinsic coercivity rare earth permanent materials                                   |           |
| Motor Power        | 0.75~7.5KW  | 0.4~2.2KW |
| Rated voltage      | 400V  | 230V      |
| Rotor magnet steel | Interior (Significant difference for inductance of DQ axis)                                   |           |
| Magnetic steel     | Demagnetization temperature $\geq 130^{\circ}\text{C}$  |           |
| Cooling fan        | Rotate with motor shaft in same speed, called coaxial fan                                     |           |
| Installation type  | Standard IMB3, meanwhile satisfy with IMB5, 35 and 14   |           |
| Protection grade   | IP55  |           |
| Temperature rise   | Surface temperature rise $\leq 50^{\circ}\text{C}$ when motor runs continuously at rated load |           |
| Certification      | CE Certification(IEC 60034)   |           |
| Motor efficiency   | Meet the standard of IE4  |           |

Table 7-2 EVIM motor technical specification

| Motor Model                | Induction Motor   |
|----------------------------|---|
| Rated motor                | 380V  |
| Motor power                | 0.75~30kW   |
| Rated frequency            | 50Hz  |
| Motor pole number          | 2/4/6   |
| Cooling fan                | Rotate with motor shaft in same speed, called coaxial fan                                     |
| Installation mode          | Standard IMB3, meanwhile satisfy with IMB5, 35 and 14   |
| Protection grade           | IP55  |
| Temperature rise           | Surface temperature rise $\leq 70^{\circ}\text{C}$ when motor runs continuously at rated load |
| Connection mode            | Y/ $\Delta$   |
| Temperature classification | F   |
| Motor efficiency           | Meet the standard of IE2  |

## 7.4. Motor Type

### 7.4.1. EVPM motor type list

| Motor Model            | Pole No. | Rotate Speed (rpm) | Rated Current (A) | Rated Torque (Nm) | Momentary Overload Capacity (Nm) |
|------------------------|----------|--------------------|-------------------|-------------------|----------------------------------|
| EVPM-751N4Y071D15A**   | 4        | 1500               | 1.7               | 4.8               | 9.6                              |
| EVPM-112IN4Y071D15A**  | 4        | 1500               | 2.45              | 7                 | 14                               |
| EVPM-152IN4Y090D15A**  | 4        | 1500               | 3.3               | 9.6               | 19.2                             |
| EVPM-222IN4Y090D15A**  | 4        | 1500               | 4.7               | 14                | 28                               |
| EVPM-302IN4Y090D15A**  | 4        | 1500               | 6.4               | 19.1              | 38.2                             |
| EVPM-402IN4Y112D15A**  | 4        | 1500               | 8.6               | 25.5              | 51.2                             |
| EVPM-552IN4Y112D15A**  | 4        | 1500               | 11.6              | 35                | 70                               |
| EVPM-752IN4Y112D15A**  | 4        | 1500               | 16                | 47.8              | 95.6                             |
| EVPM-113IN4Y132D15A**  | 4        | 1500               | 22                | 70                | 140                              |
| EVPM-153IN4Y132D15A**  | 4        | 1500               | 30.9              | 95.5              | 191                              |
| EVPM-183IN4Y160D15A**  | 4        | 1500               | 37.8              | 117.8             | 235.6                            |
| EVPM-223IN4Y160D15A**  | 4        | 1500               | 45                | 140               | 280                              |
| EVPM-303IN4Y160D15A**  | 4        | 1500               | 61                | 191               | 382                              |
| EVPM-751N4Y071D30A**   | 4        | 3000               | 1.7               | 2.4               | 4.8                              |
| EVPM-112IN4Y071D30A**  | 4        | 3000               | 2.45              | 3.5               | 7                                |
| EVPM-152IN4Y090D30A**  | 4        | 3000               | 3.3               | 4.8               | 9.6                              |
| EVPM-222IN4Y090D30A**  | 4        | 3000               | 4.7               | 7                 | 14                               |
| EVPM-302IN4Y090D30A**  | 4        | 3000               | 6.4               | 9.55              | 19.2                             |
| EVPM-402IN4Y112D30A**  | 4        | 3000               | 8.6               | 12.8              | 25.6                             |
| EVPM-552IN4Y112D30A**  | 4        | 3000               | 11.6              | 17.5              | 35                               |
| EVPM-752IN4Y112D30A**  | 4        | 3000               | 16                | 24                | 48                               |
| EVPM-113IN4Y132D30A**  | 4        | 3000               | 22                | 35                | 70                               |
| EVPM-153IN4Y132D30A**  | 4        | 3000               | 30.9              | 47.75             | 95.5                             |
| EVPM-183IN4Y160D30A**  | 4        | 3000               | 37.8              | 59                | 118                              |
| EVPM-223IN4Y160D30A**  | 4        | 3000               | 45                | 70                | 140                              |
| EVPM-303IN4Y160D30A**  | 4        | 3000               | 61                | 95.5              | 191                              |
| EVPM-201IN4Y063D30A03* | 4        | 3000               | 0.6               | 0.635             | 1.27                             |
| EVPM-401IN4Y063D30A03* | 4        | 3000               | 1.2               | 1.27              | 2.54                             |
| EVPM-201IN4Y063D15A03* | 4        | 1500               | 0.6               | 1.27              | 2.54                             |

|                        |   |      |     |      |      |
|------------------------|---|------|-----|------|------|
| EVPM-401IN4Y063D15A03* | 4 | 1500 | 1.2 | 2.54 | 5.08 |
| EVPM-401IN2Y063D15A03* | 4 | 1500 | 2.4 | 2.54 | 5.08 |
| EVPM-751IN2Y071D15A03* | 4 | 1500 | 3.4 | 4.8  | 9.6  |
| EVPM-112IN2Y071D15A03* | 4 | 1500 | 4.9 | 7    | 14   |
| EVPM-152IN2Y090D15A03* | 4 | 1500 | 6.6 | 9.6  | 19.2 |
| EVPM-222IN2Y090D15A03* | 4 | 1500 | 9.4 | 14   | 28   |
| EVPM-401IN2Y063D30A03* | 4 | 3000 | 2.4 | 1.27 | 2.54 |
| EVPM-751IN2Y071D30A03* | 4 | 3000 | 3.4 | 2.4  | 4.8  |
| EVPM-112IN2Y071D30A03* | 4 | 3000 | 4.9 | 3.5  | 7    |
| EVPM-152IN2Y090D30A03* | 4 | 3000 | 6.6 | 4.8  | 9.6  |
| EVPM-222IN2Y090D30A03* | 4 | 3000 | 9.4 | 7    | 14   |

Note: \* means: None: general motor; T: EM30-mounted motor

#### 7.4.2. EVIM motor type list

| Motor Model            | Pole No. | Rotate Speed (rpm) | Rated Current (A) | Rated Torque (Nm) | Rated Torque Multiple |
|------------------------|----------|--------------------|-------------------|-------------------|-----------------------|
| EVIM-751SN4Y080D30A03* | 2        | 3000               | 1.8               | 2.5               | 3                     |
| EVIM-112SN4Y080D30A03* | 2        | 3000               | 2.5               | 3.7               | 2.9                   |
| EVIM-152SN4Y090D30A03* | 2        | 3000               | 3.2               | 5                 | 2.6                   |
| EVIM-222SN4Y090D30A03* | 2        | 3000               | 4.5               | 7.4               | 2.5                   |
| EVIM-302SN4Y100D30A03* | 2        | 3000               | 6                 | 9.9               | 2.8                   |
| EVIM-402SN4Y112D30A03* | 2        | 3000               | 7.9               | 13.2              | 3                     |
| EVIM-552SN4Y132D30A03* | 2        | 3000               | 10.6              | 18                | 2.9                   |
| EVIM-752SN4Y132D30A03* | 2        | 3000               | 14.2              | 24.6              | 2.9                   |
| EVIM-113SN4Y160D30A03* | 2        | 3000               | 20.5              | 35.7              | 3.1                   |
| EVIM-153SN4Y160D30A03* | 2        | 3000               | 27.7              | 48.7              | 3.0                   |
| EVIM-183SN4Y160D30A03* | 2        | 3000               | 33.6              | 60.2              | 2.7                   |
| EVIM-223SN4Y160D30A03* | 2        | 3000               | 40.7              | 71.3              | 3.6                   |
| EVIM-303SN4Y200D30A03* | 2        | 3000               | 54.4              | 96.8              | 3.4                   |
| EVIM-373SN4Y200D30A03* | 2        | 3000               | 66.8              | 119.4             | 3.4                   |
| EVIM-453SN4Y225D30A03* | 2        | 3000               | 81.8              | 144.7             | 3.3                   |
| EVIM-553SN4Y250D30A03* | 2        | 3000               | 101.9             | 176.6             | 3.3                   |

|                        |   |      |       |       |     |
|------------------------|---|------|-------|-------|-----|
| EVIM-751SN4Y080D15A03* | 4 | 1500 | 1.88  | 5     | 3   |
| EVIM-112SN4Y090D15A03* | 4 | 1500 | 2.53  | 7.4   | 2.6 |
| EVIM-152SN4Y090D15A03* | 4 | 1500 | 3.4   | 10.1  | 2.6 |
| EVIM-222SN4Y100D15A03* | 4 | 1500 | 4.8   | 14.6  | 2.7 |
| EVIM-302SN4Y100D15A03* | 4 | 1500 | 6.3   | 19.8  | 2.9 |
| EVIM-402SN4Y112D15A03* | 4 | 1500 | 8.4   | 26.5  | 2.7 |
| EVIM-552SN4Y132D15A03* | 4 | 1500 | 11.3  | 36.2  | 2.7 |
| EVIM-752SN4Y132D15A03* | 4 | 1500 | 14.9  | 49.2  | 2.7 |
| EVIM-113SN4Y160D15A03* | 4 | 1500 | 21.9  | 71.7  | 2.8 |
| EVIM-153SN4Y160D15A03* | 4 | 1500 | 29.3  | 97.8  | 2.8 |
| EVIM-183SN4Y180D15A03* | 4 | 1500 | 35.4  | 120.2 | 3.4 |
| EVIM-223SN4Y180D15A03* | 4 | 1500 | 41.9  | 142.4 | 3.5 |
| EVIM-303SN4Y200D15A03* | 4 | 1500 | 56.1  | 194.2 | 3.1 |
| EVIM-373SN4Y225D15A03* | 4 | 1500 | 68.9  | 238.8 | 3.1 |
| EVIM-453SN4Y225D15A03* | 4 | 1500 | 84.4  | 289.4 | 3.4 |
| EVIM-553SN4Y250D15A03* | 4 | 1500 | 102.7 | 354.9 | 3.0 |
| EVIM-751SN4Y090D10A03* | 6 | 1000 | 2.1   | 7.7   | 2.8 |
| EVIM-112SN4Y090D10A03* | 6 | 1000 | 3     | 11.2  | 2.8 |
| EVIM-152SN4Y100D10A03* | 6 | 1000 | 3.8   | 15.1  | 2.5 |
| EVIM-222SN4Y112D10A03* | 6 | 1000 | 5.4   | 22.1  | 2.8 |
| EVIM-302SN4Y132D10A03* | 6 | 1000 | 7.2   | 29.8  | 2.6 |
| EVIM-402SN4Y132D10A03* | 6 | 1000 | 9.3   | 39.8  | 2.5 |
| EVIM-552SN4Y132D10A03* | 6 | 1000 | 12.5  | 54.4  | 2.5 |
| EVIM-752SN4Y160D10A03* | 6 | 1000 | 16.8  | 73.8  | 2.7 |
| EVIM-113SN4Y160D10A03* | 6 | 1000 | 23.9  | 108.3 | 2.6 |
| EVIM-153SN4Y180D10A03* | 6 | 1000 | 31.4  | 146.9 | 2.7 |
| EVIM-183SN4Y200D10A03* | 6 | 1000 | 37.5  | 180.3 | 2.9 |
| EVIM-223SN4Y200D10A03* | 6 | 1000 | 44.3  | 214.4 | 2.7 |
| EVIM-303SN4Y225D10A03* | 6 | 1000 | 58.5  | 290.9 | 2.6 |
| EVIM-373SN4Y250D10A03* | 6 | 1000 | 70.9  | 358.7 | 2.7 |
| EVIM-453SN4Y280D10A03* | 6 | 1000 | 85.8  | 436.3 | 2.8 |
| EVIM-553SN4Y280D10A03* | 6 | 1000 | 104.4 | 533.2 | 2.7 |

Note: \* means: None: general motor; T: EM30-mounted motor

## 7.5. Reference Table of inverter and motor

### 7.5.1. Reference Table of inverter and EVPM motor

| EM30 Inverter Model                  | Power(KW) | EVPM Motor Model         |
|--------------------------------------|-----------|--------------------------|
| EM30-0007S2J1U1F2 (AC02/4)(B1)(R3)M2 | 0.75      | EVPM-751IN2Y071D15A03*   |
|                                      |           | EVPM-751IN2Y071D30A03*   |
| EM30-0015S2J1U1F2 (AC02/4)(B1)(R3)M2 | 1.5       | EVPM-152IN2Y090D30A03*   |
|                                      |           | EVPM-152IN2Y090D15A03*   |
| EM30-0022S2J1U1F2 (AC02/4)(B1)(R3)M2 | 2.2       | EVPM-222IN2Y090D30A03*   |
|                                      |           | EVPM-222IN2Y090D15A03*   |
| EM30-0030T2J1U1F2 (AC02/4)(B1)(R3)M2 | 3.0       | Custom-made motor models |
| EM30-0040T2J2U1F2 (AC02/4)(B1)(R3)M2 | 4.0       |                          |
| EM30-0055T2J2U1F2 (AC02/4)(B1)(R3)M2 | 5.5       |                          |
| EM30-0007T3J1U1F2 (AC02/4)(B1)(R3)M2 | 0.75      | EVPM-751IN4/3Y071D30A03* |
|                                      |           | EVPM-751IN4/3Y071D15A03* |
| EM30-0015T3J1U1F2 (AC02/4)(B1)(R3)M2 | 1.5       | EVPM-152IN4/3Y090D30A03* |
|                                      |           | EVPM-152IN4/3Y090D15A03* |
| EM30-0022T3J1U1F2 (AC02/4)(B1)(R3)M2 | 2.2       | EVPM-222IN4/3Y090D30A03* |
|                                      |           | EVPM-222IN4/3Y090D15A03* |
| EM30-0030T3J1U1F2 (AC02/4)(B1)(R3)M2 | 3.0       | EVPM-302IN4/3Y090D30A03* |
|                                      |           | EVPM-302IN4/3Y090D15A03* |
| EM30-0040T3J1U1F2 (AC02/4)(B1)(R3)M2 | 4.0       | EVPM-402IN4/3Y112D30A03* |
|                                      |           | EVPM-402IN4/3Y112D15A03* |
| EM30-0055T3J2U1F2 (AC02/4)(B1)(R3)M2 | 5.5       | EVPM-552IN4/3Y112D30A03* |
|                                      |           | EVPM-552IN4/3Y112D15A03* |
| EM30-0075T3J2U1F2 (AC02/4)(B1)(R3)M2 | 7.5       | EVPM-752IN4/3Y112D30A03* |
|                                      |           | EVPM-752IN4/3Y112D15A03* |

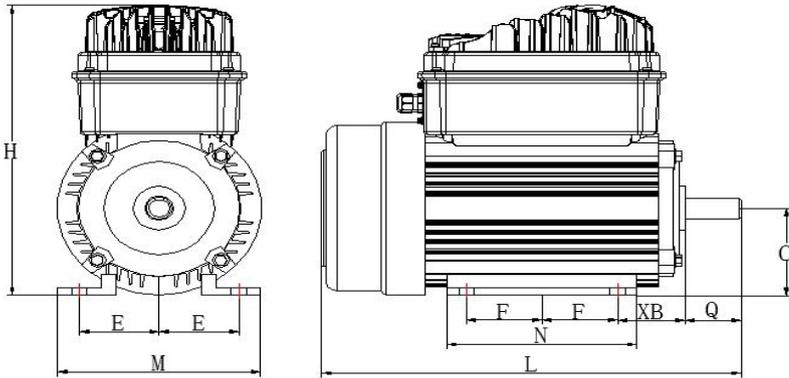
### 7.5.2 Reference Table of inverter and EVIM motor

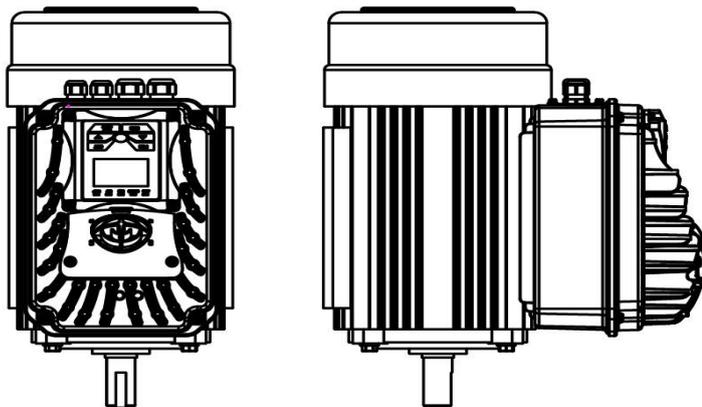
| EM30 Inverter Model  | Power (KW) | EVIM Motor Model         |
|--|------------|--------------------------|
| EM30-0007S2J1U1F2 (AC02/4)(B1)(R3)M1<br>EM30-0007T2J1U1F2 (AC02/4)(B1)(R3)M1 | 0.75       | EVIM-751SN2Y071D30A03*   |
|  |            | EVIM-751SN2Y071D15A03*   |
|  |            | EVIM-751SN2Y071D10A03*   |
| EM30-0015S2J1U1F2 (AC02/4)(B1)(R3)M1<br>EM30-0015T2J1U1F2 (AC02/4)(B1)(R3)M1 | 1.5        | EVIM-152SN2Y090D30A03*   |
|  |            | EVIM-152SN2Y090D15A03*   |
|  |            | EVIM-152SN2Y090D10A03*   |
| EM30-0022S2J1U1F2 (AC02/4)(B1)(R3)M1<br>EM30-0022T2J1U1F2 (AC02/4)(B1)(R3)M1 | 2.2        | EVIM-222SN2Y090D30A03*   |
|  |            | EVIM-222SN2Y090D15A03*   |
|  |            | EVIM-222SN2Y090D10A03*   |
| EM30-0030T2J1U1F2 (AC02/4)(B1)(R3)M1   | 3.0        | Custom-made motor models |

|                                      |      |                          |
|--------------------------------------|------|--------------------------|
| EM30-0040T2J1U1F2 (AC02/4)(B1)(R3)M1 | 4.0  |                          |
| EM30-0055T2J1U1F2 (AC02/4)(B1)(R3)M1 | 5.5  |                          |
| EM30-0007T3J1U1F2 (AC02/4)(B1)(R3)M1 | 0.75 | EVIM-751SN4/3Y080D30A03* |
|                                      |      | EVIM-751SN4/3Y080D15A03* |
|                                      |      | EVIM-751SN4/3Y090D10A03* |
| EM30-0015T3J1U1F2 (AC02/4)(B1)(R3)M1 | 1.5  | EVIM-152SN4/3Y090D30A03* |
|                                      |      | EVIM-152SN4/3Y090D15A03* |
|                                      |      | EVIM-152SN4/3Y100D10A03* |
| EM30-0022T3J1U1F2 (AC02/4)(B1)(R3)M1 | 2.2  | EVIM-222SN4/3Y090D30A03* |
|                                      |      | EVIM-222SN4/3Y100D15A03* |
|                                      |      | EVIM-222SN4/3Y112D10A03* |
| EM30-0030T3J1U1F2 (AC02/4)(B1)(R3)M1 | 3.0  | EVIM-302SN4/3Y100D30A03* |
|                                      |      | EVIM-302SN4/3Y100D15A03* |
|                                      |      | EVIM-302SN4/3Y132D10A03* |
| EM30-0040T3J1U1F2 (AC02/4)(B1)(R3)M1 | 4.0  | EVIM-402SN4/3Y112D30A03* |
|                                      |      | EVIM-402SN4/3Y112D15A03* |
|                                      |      | EVIM-402SN4/3Y132D10A03* |
| EM30-0055T3J2U1F2 (AC02/4)(B1)(R3)M1 | 5.5  | EVIM-552SN4/3Y132D30A03* |
|                                      |      | EVIM-552SN4/3Y132D15A03* |
|                                      |      | EVIM-552SN4/3Y132D10A03* |
| EM30-0075T3J2U1F2 (AC02/4)(B1)(R3)M1 | 7.5  | EVIM-752SN4/3Y132D30A03* |
|                                      |      | EVIM-752SN4/3Y132D15A03* |
|                                      |      | EVIM-752SN4/3Y160D10A03* |

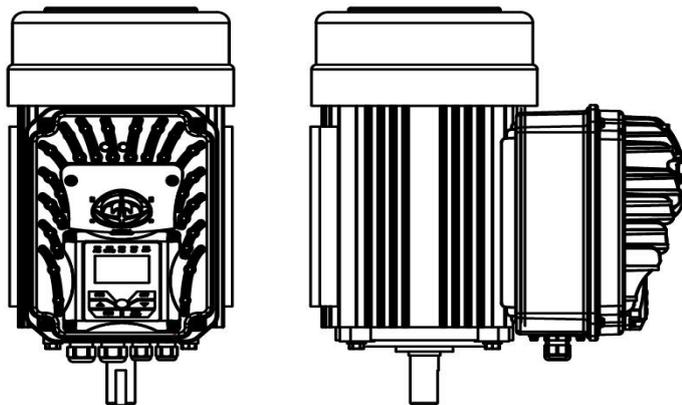
**7.6. Motor Installation Size**

7.6.1. EM30 Installation Size





Angular contact bearing (vertical-mounted, axis up)



Angular contact bearing (vertical-mounted, axis down)

EM30 overall dimensions

| Model                                 | Frame                  | E    | F    | XB | Q  | C   | L   | H   | M   |
|---------------------------------------|------------------------|------|------|----|----|-----|-----|-----|-----|
| EM30-0004S2J1U1F2 (AC02/4)(B1)(R3)M1  | 63                     | 50   | 40   | 40 | 23 | 63  | 230 | 290 | 135 |
| EM30-0007S2J1U1F2 (AC02/4)(B1)(R3)M1  | 71                     | 56   | 45   | 45 | 30 | 71  | 255 | 305 | 150 |
| EM30-0015S2J1U1F2 (AC02/4)(B1)(R3)M1  | 90S                    | 70   | 50   | 56 | 50 | 90  | 320 | 360 | 180 |
|                                       | 90L                    | 70   | 62.5 | 56 | 50 | 90  | 345 | 360 | 180 |
| EM30-0022S2J1U1F2 (AC02/4)(B1)(R3)M1  | 90S                    | 70   | 50   | 56 | 50 | 90  | 320 | 360 | 180 |
|                                       | 90L                    | 70   | 62.5 | 56 | 50 | 90  | 345 | 360 | 180 |
| EM30-0007T2J1U1F2 (AC02/4)(B1)(R3)M1  | 71                     | 56   | 45   | 45 | 30 | 71  | 255 | 305 | 150 |
| EM30-0015T2J1U1F2 (AC02/4)(B1)(R3)M1  | 90S                    | 70   | 50   | 56 | 50 | 90  | 320 | 360 | 180 |
|                                       | 90L                    | 70   | 62.5 | 56 | 50 | 90  | 345 | 360 | 180 |
| EM30-0022T2J1U1F2 (AC02/4) (B1)(R3)M1 | 90S                    | 70   | 50   | 56 | 50 | 90  | 320 | 360 | 180 |
|                                       | 90L                    | 70   | 62.5 | 56 | 50 | 90  | 345 | 360 | 180 |
| EM30-0030T2J1U1F2 (AC02/4)(B1)(R3)M1  | Custom-made dimensions |      |      |    |    |     |     |     |     |
| EM30-0040T2J2U1F2 (AC02/4)(B1)(R3)M1  |                        |      |      |    |    |     |     |     |     |
| EM30-0055T2J2U1F2 (AC02/4)(B1)(R3)M1  |                        |      |      |    |    |     |     |     |     |
| EM30-0007T3J1U1F2 (AC02/4)(B1)(R3)M1  | 71                     | 62.5 | 50   | 50 | 40 | 80  | 295 | 305 | 165 |
| EM30-0015T3J1U1F2 (AC02/4)(B1)(R3)M1  | 90S                    | 70   | 50   | 56 | 50 | 90  | 320 | 360 | 180 |
|                                       | 90L                    | 70   | 62.5 | 56 | 50 | 90  | 345 | 360 | 180 |
| EM30-0022T3J1U1F2 (AC02/4)(B1)(R3)M1  | 90S                    | 70   | 50   | 56 | 50 | 90  | 320 | 360 | 180 |
|                                       | 90L                    | 70   | 62.5 | 56 | 50 | 90  | 345 | 360 | 180 |
| EM30-0030T3J1U1F2 (AC02/4)(B1)(R3)M1  | 100L                   | 80   | 70   | 63 | 60 | 100 | 385 | 380 | 205 |
| EM30-0040T3J1U1F2 (AC02/4)(B1)(R3)M1  | 112                    | 95   | 70   | 70 | 60 | 112 | 404 | 440 | 230 |
| EM30-0055T3J2U1F2 (AC02/4)(B1)(R3)M1  | 132S                   | 108  | 70   | 89 | 80 | 132 | 470 | 485 | 270 |
|                                       | 132M                   | 108  | 89   | 89 | 80 | 132 | 510 | 485 | 270 |
| EM30-0075T3J2U1F2 (AC02/4)(B1)(R3)M1  | 132S                   | 108  | 70   | 89 | 80 | 132 | 470 | 485 | 270 |
|                                       | 132M                   | 108  | 89   | 89 | 80 | 132 | 510 | 485 | 270 |
| EM30-0007S2J1U1F2 (AC02/4)(B1)(R3)M2  | 80M                    | 62.5 | 50   | 50 | 40 | 80  | 295 | 330 | 165 |
| EM30-0015S2J1U1F2 (AC02/4)(B1)(R3)M2  | 90S                    | 70   | 50   | 56 | 50 | 90  | 320 | 360 | 180 |
|                                       | 90L                    | 70   | 62.5 | 56 | 50 | 90  | 345 | 360 | 180 |
| EM30-0022S2J1U1F2 (AC02/4)(B1)(R3)M2  | 90S                    | 70   | 50   | 56 | 50 | 90  | 320 | 360 | 180 |
|                                       | 90L                    | 70   | 62.5 | 56 | 50 | 90  | 345 | 360 | 180 |
| EM30-0007T3J1U1F2 (AC02/4)(B1)(R3)M2  | 80M                    | 62.5 | 50   | 50 | 40 | 80  | 295 | 330 | 165 |
| EM30-0015T3J1U1F2 (AC02/4)(B1)(R3)M2  | 90S                    | 70   | 50   | 56 | 50 | 90  | 320 | 360 | 180 |
|                                       | 90L                    | 70   | 62.5 | 56 | 50 | 90  | 345 | 360 | 180 |
| EM30-0022T3J1U1F2 (AC02/4)(B1)(R3)M2  | 90S                    | 70   | 50   | 56 | 50 | 90  | 320 | 360 | 180 |
|                                       | 90L                    | 70   | 62.5 | 56 | 50 | 90  | 345 | 360 | 180 |
| EM30-0030T3J1U1F2 (AC02/4)(B1)(R3)M2  | 100L                   | 80   | 70   | 63 | 60 | 100 | 385 | 380 | 205 |
| EM30-0040T3J1U1F2 (AC02/4)(B1)(R3)M2  | 112                    | 95   | 70   | 70 | 60 | 112 | 404 | 440 | 230 |

|                                      |      |     |    |    |    |     |     |     |     |
|--------------------------------------|------|-----|----|----|----|-----|-----|-----|-----|
| EM30-0055T3J2U1F2 (AC02/4)(B1)(R3)M2 | 132S | 108 | 70 | 89 | 80 | 132 | 470 | 485 | 270 |
|                                      | 132M | 108 | 89 | 89 | 80 | 132 | 510 | 485 | 270 |
| EM30-0075T3J2U1F2 (AC02/4)(B1)(R3)M2 | 132S | 108 | 70 | 89 | 80 | 132 | 470 | 485 | 270 |
|                                      | 132M | 108 | 89 | 89 | 80 | 132 | 510 | 485 | 270 |

## 7.7. Installation

1. Check the information of nameplate is satisfy with requirement,
2. Check carefully before installation: If motor has bump or deformation and fasteners have loose or dislocation during transport.
3. Motor shaft cannot be dragged when transferring.
4. Use spring cushion to fasten when fixing the motor.
5. Try the best to avoid the vibration of bearing block.
6. Motor cannot bear stronger axial and radial load.
7. Motor shaft must maintain coaxial with equipment's axle.
8. Measure insulation resistance  $R_i$  with megger of 500V to see if it's low. The value of insulation resistance should not lower than the calculation as below:

$$R_i \geq 0.38 \times 2^{(7.5 - 0.1t)} M \Omega$$

T-ambient temperature



Drying treatment should be introduced if the value of insulation resistance is low. Drying treatment can be used in the methods of hot air drying or ohmic heating. Avoid using direct current when ohmic heating. Make the rotor locked and energize by voltage regulator. It is better that the current is not higher than 1/2 of rated current.

## 7.8. Trouble Shooting

### 7.8.1. voice phenomena, discrimination and trouble shooting

| Voice                 | Phenomena   | Discriminating and trouble shooting  |
|-----------------------|---|--|
| Bearing sounds        | <ol style="list-style-type: none"> <li>1. Irregular metallic sounds on bearing outer ring, which is irrelevant to rotate speed.</li> <li>2. Gurgle sounds at low velocity, before shut-down or at the beginning of operation.</li> <li>3. Rustling sounds irrelevant to bearing load.</li> <li>4. Purring sounds which cycle is proportional to rotary speed or intermittent chewing sounds and bearing is too hot.</li> <li>5. Purring sounds occasionally, small and irregular noise irrelevant to rotary speed.</li> </ol> | <ol style="list-style-type: none"> <li>1. Lack of grease. Add more grease or change bearing.</li> <li>2. Generated by impaction of balls (or rollers). Eliminate gradually after running a while, belong to non-fault noise.</li> <li>3. Add more grease or change bearings.</li> <li>4. Scratch on the surface of balls (or rollers). Change bearings.</li> <li>5. Impurity in bearings. Clean or change bearings.</li> </ol> |
| Electromagnetic noise | <ol style="list-style-type: none"> <li>1. High-frequency gear whines.</li> <li>2. Droning sounds and motor cannot start.</li> <li>3. Humming sound and vibration</li> </ol>   | <ol style="list-style-type: none"> <li>1. Improve chopping frequency.</li> <li>2. One-phase interruption or electricity deficiency of stator winding.</li> <li>3. Stator winding interturn</li> </ol>  |

|           |  |   |
|-----------|--|---|
|           | when motor starts.   | short-circuits or grounding at two points.                                      |
| Resonance | Droning sound only within the scope of a specific running speed. | Avoid running within this scope, check installation conditions or change motor. |

### 7.8.2. Motor winding short-circuit

- Short-circuit to ground in winding

Shut down motor immediately and fix if there is obvious noise with aggravated vibration and overheat when operation. It is because the damage of winding insulation, the wire of winding is collide with shell or core, which makes short-circuit to ground in winding.

- Short-circuit in winding

It includes in-phase and three-phase winding interturn short-circuits. Their faults forms are similar with short-circuit to ground in winding, the main causes show as below:

- Winding, that seriously affected with damp and not dried, directly access to the power supply.
- With long-term overload, insulator carbonizes because of overheat.

### 7.8.3. Motor start-up failure cause, phenomena and treatment

| Cause and phenomena  | Treatment   |
|--|---|
| 1. Wiring error of control equipment. Motor cannot start up.   | 1. Check and modify electric circuit.   |
| 2. Two-phase outage of power supply circuit. There is no voice and motor cannot rotate.  | 2. Check wire, connector, fuse, actuator, output and motor winding to exclude.  |
| 3. One-phase outage. Motor cannot start up but along with humming sound.   | 3. Same as Treatment 2.   |
| 4. Low-voltage power supply.   | 4. Check if the setting of actuator is suitable. Reset if not suitable.   |
| 5. Short-circuit (ground or interphase) in stator winding or open-circuit fault makes starting torque too small to start-up, and electricity makes fuse burn-out occasionally. | 5. Check the situation of short circuit and open circuit. Fix by themselves or ask for professionals to fix in accordance with practical situation. |
| 6. Because static load torque is too large or there is foreign matter stuck inside motor, motor cannot start and along with humming sound.                                     | 6. Check if motor can be rotated manually in the condition of no load, check if there is foreign matter in motor or change high-power motor.        |

### 7.8.4. Motor overheat failure cause, phenomena and treatment

| Cause and phenomena | Treatment |
|---------------------|-----------|
|---------------------|-----------|

|   |  |
|---|--|
| 1. Mismatching of power.  | 1. Change high-power motor.  |
| 2. Phase-broken of motor, high current caused by short-circuit in winding or over-current protection of inverter. | 2. Check and eliminate motor failure.  |
| 3. Rub between Stator and rotor, rotate inflexibly or bearings run inner ring or outer ring.                      | 3. Check if there is foreign matter between stator and rotor; Contact with manufacturer if running inner ring or brush coating the matching surface of bearing or end cover. |
| 4. Ambient temperature is too high, poor ventilation or sunlight exposure.  | 4. Improve the environment.  |

#### 7.8.5. Motor excessive current failure cause, phenomena and treatment

| Cause and phenomena   | Treatment   |
|---|---|
| 1. Core dislocation of stator and rotor.  | 1. Adjust axial position of rotor.  |
| 2. Number of turns of winding or pitch is less than the original design after fixing motor. | 2. Wire wrapping and inserting winding again,                                     |
| 3. Burn core when fixing motor.   | 3. Taking out coil, which is soaked with paint remover, after heated when fixing. |

## 7.9. Maintenance & Servicing

The motor should be checked and the shell needs to be cleaned regularly. High pressure air should be used for cleaning.

Each time bearing runs 2500h, inspection should be carried out at least once. Power off the motor and examine if there is abnormal (increase of noise, abnormal noise and increase of temperature etc.). Change bearings with same specifications if rotor cannot rotate smoothly because of the over-worn or ruptured bearings.



Warning: Motor is forbidden to flush by water.

## Appendix 1 Trouble Shooting

When malfunction occurs to inverter, don't run by resetting immediately. Check any causes and get it removed if there is any.

Take counter measures by referring to this manual in case of any malfunctions on inverter. Should it still be unsolved, contact the manufacturer. Never attempt any repairing without due authorization.

**Table 1-1 Inverter's Common Cases of Malfunctions**

| Fault                    | Description                           | Causes  | Countermeasures   |
|--------------------------|---------------------------------------|---|---|
| Revisable when stop      | Prohibition modify function code      | * prohibition modify the function code during running process.  | * Please modify the function code in stopped status.  |
| Not open password        | Wrong password                        | *Enter wrong password when password is valid<br>* Do not enter password when modifying function code.   | * Please enter the correct password.  |
| Read only non-modifiable | Read-only function codes unchangeable | Read-only parameters can be checked, but cannot be modified   |   |
| 2: O.C.                  | Over-current                          | * too short acceleration time<br>* short circuit at output side   | *prolong acceleration time;<br>*whether motor cable is broken;  |
| 16: OC1                  | Over-current 1                        | * locked rotor with motor<br>* Too heavy load.  | *check if motor overloads;<br>*reduce V/F compensation value  |
| 67: OC2                  | Over-current 2                        | * Parameter tuning is not correct.  | * measure parameter correctly.  |
| 3: O.E.                  | DC Over-Voltage                       | *supply voltage too high;<br>*load inertia too big<br>*deceleration time too short;<br>*motor inertia rise again<br>* bad effect of dynamic braking<br>*parameter of rotary speed loop PID is set abnormally. | *check if rated voltage is input;<br>*add braking resistance(optional);<br>*increase deceleration time<br>* Enhancing the dynamic braking effect<br>*set the parameter of rotary speed loop PID correctly.<br>* Change to VF control for centrifugal fan. |
| 4: P.F1.                 | Input Phase loss                      | *phase loss with input power  | *check if power input is normal;<br>*check if parameter setting is correct.   |
| 5: O.L1                  | Inverter Overload                     | * load too heavy  | *reduce load; *check drive ratio;<br>*increase inverter's capacity  |
| 6: L.U.                  | Under-Voltage Protection              | *input voltage on the low side  | *check if supply voltage is normal<br>*check if parameter setting is correct.   |
| 7: O.H.                  | Radiator Overheat                     | *environment temperature too high;<br>*radiator too dirty<br>*install place not good for ventilation;<br>*fan damaged<br>* Carrier wave frequency or compensation curve is too high.                          | *improve ventilation;<br>*clean air inlet and outlet and radiator;<br>*install as required;<br>*change fan<br>* Decrease carrier wave frequency or compensation curve.  |
| 8: O.L2                  | Motor Overload                        | * load too heavy  | *reduce load; *check drive ratio;<br>*increase motor's capacity   |
| 11: ESP                  | External fault                        | *External emergency-stop terminal is valid.   | *Check external fault.  |
| 12: Err3                 | Current malfunction before running    | *Current alarm signal exists before running.  | *check if control board is connected with power board well.<br>*ask for help from manufacture.  |

|            |  |  |   |
|------------|--|--|---|
| 13: Err2   | Parameters tuning wrong                                      | *Do not connect motor when measuring parameters  | *please connect motor correctly.  |
| 15: Err4   | Current zero excursion malfunction                           | *Flat cable is loosened.<br>*Current detector is broken.   | *check the flat cable.<br>*ask for help from manufacture.   |
| 17: PF0    | Output Phase loss  | * Motor is broken<br>* Motor wire is loose.<br>* Inverter is broken  | * check if wire of motor is loose.<br>* check if motor is broken.   |
| 18: AErr   | Line disconnected  | * Analog signal line disconnected<br>* Signal source is broken.  | * Change the signal line.<br>* Change the signal source.  |
| 19: EP3    | Inverter under-load  | * Water pump dries up.<br>* Belt is broken.<br>* Equipment is broken.  | * Supply water for pump<br>* Change the belt.<br>* Repair the equipment.                                    |
| 20: EP/EP2 |  |  |   |
| 22: nP     | Pressure control   | * Pressure is too high when negative feedback.<br>* Pressure is too low when positive feedback.<br>* Inverter enters into the dormancy status. | * Decrease the min frequency of PID.<br>* Reset inverter to normal status.                                  |
| 23: Err5   | PID parameters are set wrong,                                | * PID parameters are set wrong.  | * Set the parameters correctly.   |
| 26: GP     | Earth fault protection (1-phase does not have GP protection) | *Motor cable is damaged, short connected to grounding.<br>*Motor isolation is damaged, short connected to grounding.<br>*inverter fault.       | *change a new cable.<br>*repair the motor.<br>*contact manufacturer.  |
| 32: PCE    | PMSM distuning fault   | *motor parameters measurement is wrong.<br>*load is too heavy.   | * Measure motor parameters correctly.<br>* Decrease the load.   |
| 35: OH1    | PTC overheat protection                                      | *external relay protection.  | *check external heat protection equipment.  |
| 44: Er44   | Master loses slave's response                                | *communication fault between master and slave  | * check wiring.<br>*check baud rate<br>*check communication parameters setting                              |
| 45: CE     | Communication timeout error                                  | Communication fault  | *PC/PLC does not send command at fixed time<br>*Check whether the communication line is connected reliably. |
| 47: EEEP   | EEPROM read/write fault                                      | *interference around<br>*EEPROM is damaged.  | * remove interferences<br>*contact manufacturer.  |
| 49: Err6   | Watchdog fault   | Watchdog timeout   | *please check watchdog signal   |

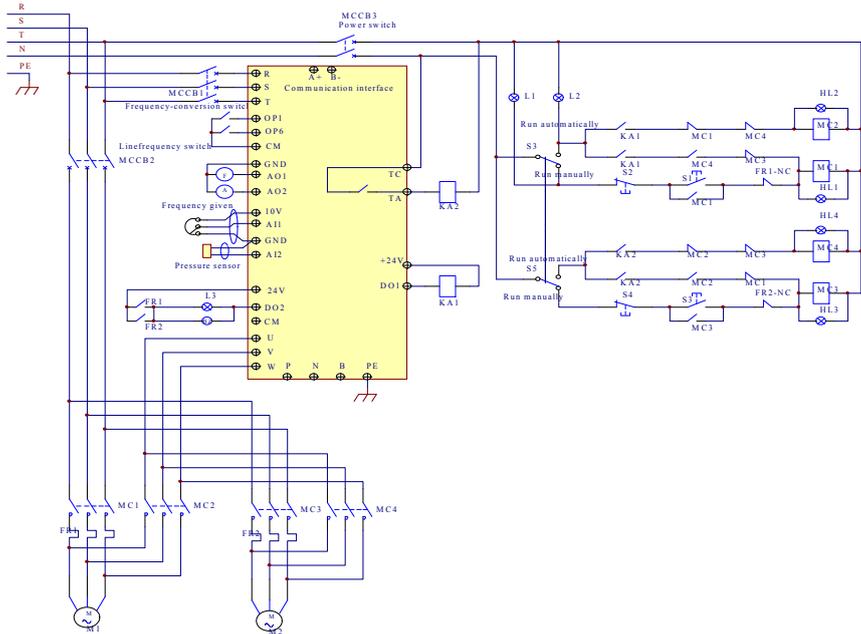
Table 1-2

**Motor Malfunction and Counter Measures**

| Malfunction                                 | Items to Be Checked  | Counter Measures   |
|---|--|--|
| Motor not Running                           | Wiring correct?<br>Setting correct?<br>Too big with load?<br>Motor is damaged?<br>Malfunction protection occurs?                                   | Get connected with power<br>Check wiring;<br>Checking malfunction;<br>Reduce load;<br>Check Table 1-1                            |
| Wrong Direction of Motor Running            | U, V, W wiring correct?<br>Parameters setting correct?   | To correct wiring<br>Setting the parameters correctly.   |
| Motor Turning but Speed Change not Possible | Wiring correct for lines with given frequency?<br>Correct setting of running mode?<br>Too big with load?   | To correct wiring;<br>To correct setting;<br>Reduce load   |
| Motor Speed Too High or Too Low             | Motor's rated value correct?<br>Drive ratio correct?<br>Inverter parameters are set in-corrected?<br>Check if inverter output voltage is abnormal? | Check motor nameplate data;<br>Check the setting of drive ratio;<br>Check parameters setting;<br>Check VVVF Characteristic value |
| Motor Running Unstable                      | Too big load?<br>Too big with load change?<br>Phase loss?<br>Motor malfunction.  | Reduce load;<br>Reduce load change, increase capacity;<br>Correct wiring.  |
| Power Trip                                  | Wiring current is too high?  | Check input wiring;<br>Selecting matching air switch;<br>Reduce load;<br>checking inverter malfunction.                          |



## 2. Rotating mode of 1 inverter driving 2 pumps



- (1) Please connect the wiring according to above wiring, after checking the wiring and close MCCB3.
  - (2) Please set F208=1, F203=9, FA00=2, FA36=1, FA37=1, FA47=1, FA48=2, FA04=pressure percentage, FA03=channel limit pressure, and FA05
  - (3) In manual status, please close power-frequency switch MCCB2. When pressing S1, pump M1 starts working. When pressing S2, M1 stops working. When pressing S3, M2 starts working. When pressing S4, M2 stops working.
  - (4) In automatic status, please close converter-frequency switch MCCB1 and power-frequency switch MCCB2.
- When inverter is powered on, KA1 is “action”, and inverter will run forward by short-connecting DI3 terminal, KA2 makes M1 start working at converter frequency status. If the pressure is not enough, inverter will accelerate to max frequency. If the pressure is still not high enough after duration time FA31, inverter will free stop and pump M2 will start working at power frequency status. After the duration time of FA30, inverter will start working and M1 works at converter frequency status.
  - After the duration time FA25, all pumps will free stop, then KA2 is “action”, M2 is converter pump. If the pressure is not high enough, inverter will accelerate to max frequency. If the pressure is still not high enough after duration time FA31, inverter will free stop and KA1 makes M1 start working at power frequency status. After the duration time of FA30, inverter will start working and M2 works at converter frequency status.
  - When two pumps work at the same time, if pressure is too high, inverter will decelerate to min frequency. If the pressure is still too high after the duration time FA32, general pump stops working.
  - If one pump works at converter frequency status and inverter works at the min frequency, inverter will free stop after the duration time FA10, inverter will enter into dormancy status and nP is displayed.

## Appendix 3 Products & Structures

EM30 series inverter has its power range between 0.4~7.5kW. Refer to Tables 3-1 and 3-2 for main data. There may be two (or more than two) kinds of structures for certain products. Please make a clear indication when placing your order.

Inverter should operate under the rated output current, with overload permitted for a short time. However, it shall not exceed the allowable values at working time.

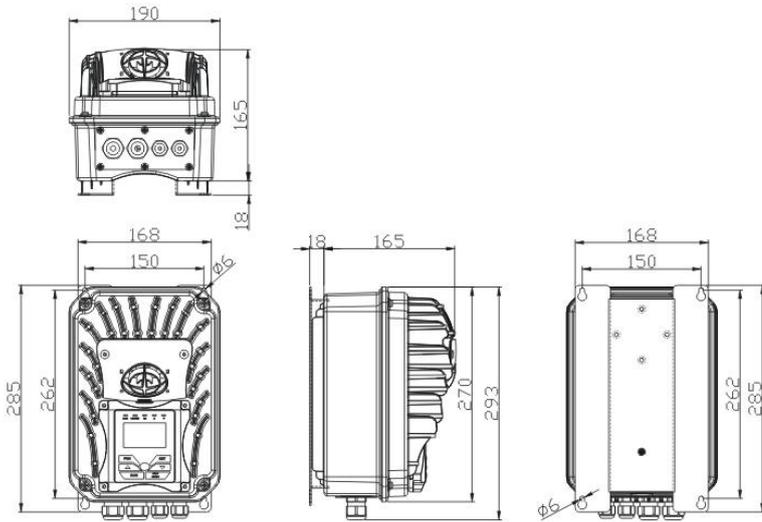
**Table 3-1 Product List of EM30**

| Model       | Applicable Motor (kW) | Rated Current Output | Structure Code | Weight (kg) | Cooling Mode    | Remarks                                    |
|-------------|-----------------------|----------------------|----------------|-------------|-----------------|--|
| EM30-0004S2 | 0.4                   | 2.5                  | J1             | 2.4         | Natural-Cooling | Single-phase<br>230V metal wall<br>hanging |
| EM30-0007S2 | 0.75                  | 4.5                  | J1             | 2.5         | Air- Cooling    |  |
| EM30-0015S2 | 1.5                   | 7                    | J1             | 2.7         | Air- Cooling    |  |
| EM30-0022S2 | 2.2                   | 10                   | J1             | 2.9         | Air- Cooling    |  |
| EM30-0004T2 | 0.4                   | 2.5                  | J1             | 2.4         | Natural-Cooling | 3-phase 230V<br>metal wall<br>hanging      |
| EM30-0007T2 | 0.75                  | 4.5                  | J1             | 2.5         | Air- Cooling    |  |
| EM30-0015T2 | 1.5                   | 7                    | J1             | 2.7         | Air- Cooling    |  |
| EM30-0022T2 | 2.2                   | 10                   | J1             | 2.8         | Air- Cooling    |  |
| EM30-0030T2 | 3.0                   | 12                   | J1             | 2.9         | Air- Cooling    |  |
| EM30-0040T2 | 4.0                   | 17                   | J1             | 6.0         | Air- Cooling    |  |
| EM30-0055T2 | 5.5                   | 21                   | J2             | 6.1         | Air- Cooling    |  |
| EM30-0007T3 | 0.75                  | 2                    | J1             | 2.5         | Natural-Cooling |  |
| EM30-0015T3 | 1.5                   | 4                    | J1             | 2.7         | Natural-Cooling |  |
| EM30-0022T3 | 2.2                   | 6.5                  | J1             | 2.8         | Air- Cooling    |  |
| EM30-0030T3 | 3.0                   | 7                    | J1             | 2.9         | Air- Cooling    |  |
| EM30-0040T3 | 4.0                   | 9                    | J2             | 6.0         | Air- Cooling    |  |
| EM30-0055T3 | 5.5                   | 12                   | J2             | 6.1         | Air- Cooling    |  |
| EM30-0075T3 | 7.5                   | 17                   | J2             | 6.2         | Air- Cooling    |  |
| EM30-0110T3 | 11                    | 23                   | J2             | 6.3         | Air- Cooling    |  |

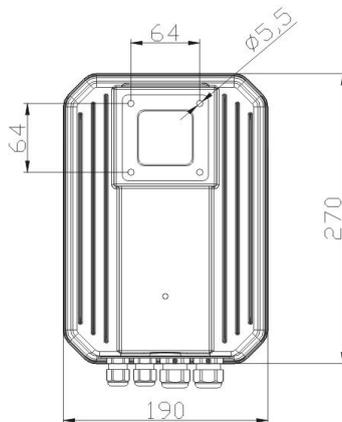
**Table 3-2 Structure List**

| Structure Code | External Dimension [A×B×H] | Mounting Size(W×L) | Mounting Bolt | Remarks          |
|----------------|----------------------------|--------------------|---------------|------------------|
| J1             | 270×190×165                | 150×262            | M5            | Metal<br>Housing |
| J2             | 338×228×193.5              | 191×313            | M5            |                  |

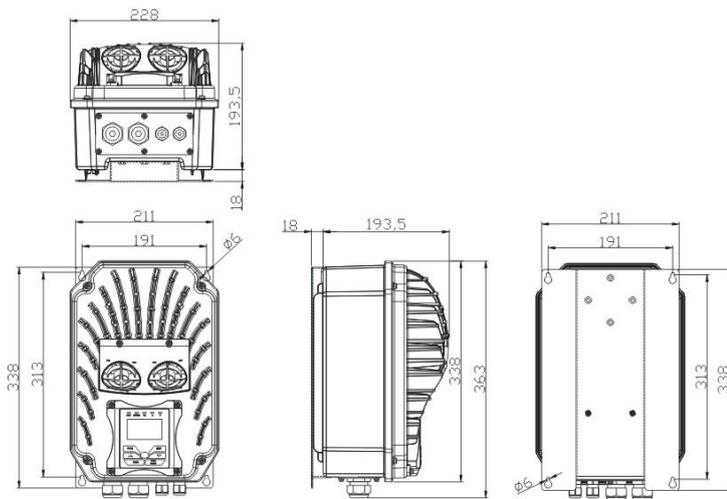
Dimensions unit: mm



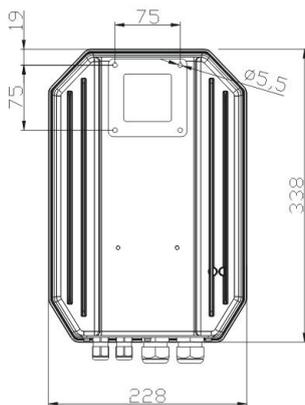
**J1 Wall-hanging Dimension Figure**



**J1 mounted on Motor Dimension Figure**



**J2 Wall-hanging Dimension Figure**



**J2 mounted on Motor Dimension Figure**

## Appendix 4 Selection of Braking Resistance

| Inverter model | Applicable motor power (kW) | Min resistor value ( $\Omega$ ) | Min resistor power (W) |
|----------------|-----------------------------|---------------------------------|------------------------|
| EM30-0004S2    | 0.4                         | 80                              | 200W                   |
| EM30-0007S2    | 0.75                        |                                 |                        |
| EM30-0015S2    | 1.5                         |                                 |                        |
| EM30-0022S2    | 2.2                         |                                 |                        |
| EM30-0004T2    | 0.4                         |                                 |                        |
| EM30-0007T2    | 0.75                        |                                 |                        |
| EM30-0015T2    | 1.5                         |                                 |                        |
| EM30-0022T2    | 2.2                         |                                 |                        |
| EM30-0030T2    | 3.0                         |                                 |                        |
| EM30-0040T2    | 4.0                         | 95                              | 550W                   |
| EM30-0055T2    | 5.5                         | 95                              | 750W                   |
| EM30-0007T3    | 0.75                        | 145                             | 100W                   |
| EM30-0015T3    | 1.5                         | 95                              | 150W                   |
| EM30-0022T3    | 2.2                         | 95                              | 250W                   |
| EM30-0030T3    | 3.0                         | 95                              | 250W                   |
| EM30-0040T3    | 4.0                         | 95                              | 400W                   |
| EM30-0055T3    | 5.5                         | 95                              | 550W                   |
| EM30-0075T3    | 7.5                         | 95                              | 750W                   |
| EM30-0110T3    | 11                          | 50                              | 1.1kW                  |

**Note: in the occasion of large inertia load, if the braking resistor heat is serious, please adopt the larger power of resistor than recommended resistor.**

# Appendix 5 Communication Manual

(Version 1.8)

## I. General

Modbus is a serial and asynchronous communication protocol. Modbus protocol is a general language applied to PLC and other controlling units. This protocol has defined an information structure which can be identified and used by a controlling unit regardless of whatever network they are transmitted.

You can read reference books or ask for the details of MODBUS from manufactures.

Modbus protocol does not require a special interface while a typical physical interface is RS485.

## II. Modbus Protocol

### 2.1 Transmission mode

#### 2.1.1 Format

##### (1) ASCII mode

| Start       | Address             | Function         | Data           |           |     |           | LRC check                 |                             | End              |                     |
|-------------|---------------------|------------------|----------------|-----------|-----|-----------|---------------------------|-----------------------------|------------------|---------------------|
| :<br>(0X3A) | Inverter<br>Address | Function<br>Code | Data<br>Length | Data<br>1 | ... | Data<br>N | High-order<br>byte of LRC | Low-order<br>byte of<br>LRC | Return<br>(0X0D) | Line Feed<br>(0X0A) |

##### (2) RTU mode

| Start           | Address             | Function         | Data   | CRC check                |                              | End         |
|-----------------|---------------------|------------------|--------|--------------------------|------------------------------|-------------|
| T1-T2-T3-T<br>4 | Inverter<br>Address | Function<br>Code | N data | Low-order byte<br>of CRC | High-order<br>byte<br>of CRC | T1-T2-T3-T4 |

#### 2.1.2 ASCII Mode

In ASCII mode, one Byte (hexadecimal format) is expressed by two ASCII characters.

For example, 31H (hexadecimal data) includes two ASCII characters '3(33H)', '1(31H)'.

Common characters, ASCII characters are shown in the following table:

|                   |     |     |     |     |     |     |     |     |
|-------------------|-----|-----|-----|-----|-----|-----|-----|-----|
| <b>Characters</b> | '0' | '1' | '2' | '3' | '4' | '5' | '6' | '7' |
| <b>ASCII Code</b> | 30H | 31H | 32H | 33H | 34H | 35H | 36H | 37H |
| <b>Characters</b> | '8' | '9' | 'A' | 'B' | 'C' | 'D' | 'E' | 'F' |
| <b>ASCII Code</b> | 38H | 39H | 41H | 42H | 43H | 44H | 45H | 46H |

#### 2.1.3 RTU Mode

In RTU mode, one Byte is expressed by hexadecimal format. For example, 31H is delivered to data packet.

### 2.2 Baud rate

Setting range of EM30 series: 1200, 2400, 4800, 9600, 19200, 38400, 57600

## 2.3 Frame structure:

### (1) ASCII mode

| Byte | Function   |
|------|--|
| 1    | Start Bit (Low Level)  |
| 7    | Data Bit   |
| 0/1  | Parity Check Bit (None for this bit in case of no checking. Otherwise 1 bit) |
| 1/2  | Stop Bit (1 bit in case of checking, otherwise 2 bits)                       |

### (2) RTU mode

| Byte | Function   |
|------|--|
| 1    | Start Bit (Low Level)  |
| 8    | Data Bit   |
| 0/1  | Parity Check Bit (None for this bit in case of no checking. Otherwise 1 bit) |
| 1/2  | Stop Bit (1 bit in case of checking, otherwise 2 bits)                       |

## 2.4 Error Check

### 2.4.1 ASCII mode

Longitudinal Redundancy Check (LRC): It is performed on the ASCII message field contents excluding the 'colon' character that begins the message, and excluding the CRLF pair at the end of the message.

The LRC is calculated by adding together successive 8-bit bytes of the message, discarding any carries, and then two's complementing the result.

A procedure for generating an LRC is:

1. Add all bytes in the message, excluding the starting 'colon' and ending CRLF. Add them into an 8-bit field, so that carries will be discarded.
2. Subtract the final field value from FF hex (all 1's), to produce the ones-complement.
3. Add 1 to produce the two-complement.

### 2.4.2 RTU Mode

Cyclical Redundancy Check (CRC): The CRC field is two bytes, containing a 16-bit binary value.

The CRC is started by first preloading a 16-bit register to all 1's. Then a process begins of applying successive 8-bit bytes of the message to the current contents of the register. Only the eight bits of data in each character are used for generating the CRC. Start and stop bits, the parity bit, do not apply to the CRC.

A procedure for generating a CRC-16 is:

- (1) Load a 16-bit register with FFFF hex (all 1's). Call this the CRC register.
- (2) Exclusive OR the first 8-bit byte of the message with the high-order byte of the 16-bit CRC register, putting the result in the CRC register.
- (3) Shift the CRC register one bit to the right (toward the LSB), zero-filling the MSB. Extract and examine the LSB.
- (4) (If the LSB was 0): Repeat Step 3 (another shift).
- (5) (If the LSB was 1): Exclusive OR the CRC register with the polynomial value A001 hex (1010 0000 0000 0001).
- (6) Repeat Steps 3 and 4 until 8 shifts have been performed. When this is done, a complete 8-bit byte will have been processed.
- (7) When the CRC is appended to the message, the low-order byte is appended first, followed by the high-order byte.

## 2.4.3 Protocol Converter

It is easy to turn a RTU command into an ASCII command followed by the lists:

- 1) Use the LRC replacing the CRC.
- 2) Transform each byte in RTU command into a corresponding two byte ASCII. For example: transform 0x03 into 0x30, 0x33 (ASCII code for 0 and ASCII code for 3).
- 3) Add a 'colon' ( : ) character (ASCII 3A hex) at the beginning of the message.
- 4) End with a 'carriage return – line feed' (CRLF) pair (ASCII 0D and 0A hex).

So we will introduce RTU Mode in followed part. If you use ASCII mode, you can use the up lists to convert.

## 2.5 Command Type & Format

### 2.5.1 The listing below shows the function codes.

| code | name                   | description  |
|------|------------------------|--|
| 03   | Read Holding Registers | Read the binary contents of holding registers in the slave.<br>(Less than 10 registers once time ) |
| 06   | Preset Single Register | Preset a value into holding register   |

### 2.5.2 Address and meaning

The part introduces inverter running, inverter status and related parameters setting.

#### 2.5.2.1 Description of rules of function codes parameters address:

- (1) Use the function code as parameter address

General Series:

High-order byte: 01~0A (hexadecimal)

Low-order byte: 00~50 (max range) (hexadecimal) Function code range of each partition is not the same.

The specific range refers to manual.

For example: parameter address of F114 is 010E (hexadecimal).

parameter address of F201 is 0201 (hexadecimal).

For H section, please convert H0 to 43.

For example: the address of H014 is 430E.

Note: in this situation, it allows to read six function codes and write only one function code.

Some function codes can only be checked but cannot be modified; some function codes can neither be checked nor be modified; some function codes cannot be modified in run state; some function codes cannot be modified both in stop and run state.

In case parameters of all function codes are changed, the effective range, unit and related instructions shall refer to user manual of related series of inverters. Otherwise, unexpected results may occur.

- (2) Use different parameters as parameter address

(The above address and parameters descriptions are in hexadecimal format, for example, the decimal digit 4096 is represented by hexadecimal 1000).

### 2.5.2.2 Running status parameters

| Parameters Address | Parameter Description (read only)  |
|--------------------|--|
| 1000               | Output frequency   |
| 1001               | Output voltage   |
| 1002               | Output current   |
| 1003               | Pole numbers/ control mode, high-order byte is pole numbers, low-order byte is control mode.   |
| 1004               | Bus-line voltage   |
| 1005               | Drive ratio/inverter status<br>High-order byte is drive ratio, low-order byte is inverter status<br>Inverter status:<br>0X00: Standby mode                      0X01: Forward running<br>0X02: Reverse running                0X04: Over-current (OC)<br>0X05: DC over-current (OE)        0X06: Input Phase loss (PF1)<br>0X07: Frequency Over-load (OL1)   0X08: Under-voltage (LU)<br>0X09: Overheat (OH)                0X0A: Motor overload (OL2)<br>0X0B: Interference (Err)            0X0D: External Malfunction (ESP)<br>0X0E: Err1   0X0F: Err2   0X10: Err3   0X11: Err4   0X12: OC1<br>0X13:PF0   0X14: Analog disconnected protection (AErr)   0X15: EP3<br>0X16:Under-load protection (EP)   0X17: PP<br>0X18: Pressure control protection (nP)<br>0X19: PID parameters are set incorrectly (Err5)<br>0X2D: Communication timeout (CE)   0X31: Watchdog fault (Err6) |
| 1006               | The percent of output torque   |
| 1007               | Inverter radiator temperature  |
| 1008               | PID given value  |
| 1009               | PID feedback value   |
| 100A               | Read integer power value: PC/PLC read the integer of power value, discarding the decimal parts   |
| 100B               | DI terminal status: DI1~DI8—bit0~bit7  |
| 100C               | Terminal output status :<br>bit0-OUT1   bit1-OUT2(>22kw)   bit2-fault relay  |
| 100D               | AI1: 0~4095   read input analog digital value  |
| 100E               | AI2: 0~4095   read input analog digital value  |
| 100F               | AI3: 0~4095   read input analog digital value  |
| 1010               | Reserved   |
| 1011               | 0~100.00%   the percent of input pulse   |
| 1012               | 0~100.00%   the percent of output pulse  |
| 1013               | Monitoring in which stage speed inverter is.<br>0000 : no function                      0001 : stage speed 1<br>0010 : stage speed 2                    0011 : stage speed 3<br>0100 : stage speed 4                    0101 : stage speed 5<br>0110 : stage speed 6                    0111 : stage speed 7<br>1000 : stage speed 8                    1001 : stage speed 9<br>1010 : stage speed 10                  1011 : stage speed 11<br>1100 : stage speed 12                  1101 : stage speed 13   |

|      |  |
|------|--|
|      | 1110 : stage speed 14                      1111 : stage speed 15   |
| 1014 | Monitoring external counting value   |
| 1015 | Monitoring analog output percent, AO1 (0~100.00)   |
| 1016 | Monitoring analog output percent, AO2 (0~100.00)   |
| 1017 | Monitoring current speed.  |
| 1018 | Read accurate power value, and correct the power to 1 decimal place.   |
| 101A | Output current(when the current is too high, data overflow from 1002)<br>101A: high 16 bits of output current<br>101B: low 16 bits of output current |
| 101B |  |
| 101C | Transmission ratio   |
| 101D | Inverter is ready.   |

Control command address:

Note1: Not every inverter model has all the command type in 2000 for each inverter model.

| Parameters Address | Parameters Description (write only)   |
|--------------------|---|
| 2000               | Command meaning:<br>0001: Forward running (no parameters)<br>0002: Reverse running (no parameters)<br>0003: Deceleration stop    0004: Free stop<br>0005: Forward jogging start<br>0006: Forward jogging stop<br>0007: Reserved    0008: Run (no directions)    0009: Fault reset<br>000A: Forward jogging stop    000B: Reverse jogging stop<br>000C: Wakeup |
| 2001               | Lock parameters<br>0001: Relieve system locked (remote control locked)<br>0002: Lock remote control (any remote control commands are no valid before unlocking)<br>0003: RAM and eeprom are permitted to be written.<br>0004: Only RAM is permitted to be written, eeprom is prohibited being written.  |
| 2002               | AO1 output percent is set by PC/PLC.<br>Setting range: 0~1000<br>Token output analog is 0~100.0%.   |
| 2003               | AO2 output percent is set by PC/PLC.<br>Setting range: 0~1000<br>Token output analog is 0~100.0%.   |
| 2004               | FO output percent is set by PC/PLC.<br>Setting range: 0~1000<br>FO token output pulse is 0~100.0%.  |
| 2005               | To control multi-function output terminal:<br>1 means token output is valid.<br>0 means token output is invalid.  |
| 2006               |   |
| 2007               |   |
| 2009               | Voltage is set by PC/PLC when V/F separation.   |

Note2: Write RAM only allowed when leave factory. Unlock (2001=0003 or F219=0) if changing EEPROM.

### 2.5.2.2.3 Illegal Response When Reading Parameters

| Command Description       | Function                               | Data  |
|---------------------------|--|---|
| Slave parameters response | The highest-order byte changes into 1. | Command meaning:<br>0001: Illegal function code<br>0002: Illegal address<br>0003: Illegal data<br>0004: Slave fault <sup>note 2</sup> |

Note 2: Illegal response 0004 appears below two cases:

1. Do not reset inverter when inverter is in the malfunction state.
2. Do not unlock inverter when inverter is in the locked state.

### 2.5.3 Additional Remarks

#### Expressions during communication process:

Parameter Values of Frequency=actual value X 100 (General Series)

Parameter Values of Frequency=actual value X 10 (Medium Frequency Series)

Parameter Values of Time=actual value X 10

Parameter Values of Voltage=actual value X 1

Parameter Values of Power=actual value X 100

Parameter Values of Drive Ratio=actual value X 100

Parameter Values of Version No. =actual value X 100

Instruction: Parameter value is the value sent in the data package. Actual value is the actual value of inverter. After PC/PLC receives the parameter value, it will divide the corresponding coefficient to get the actual value.

NOTE: Take no account of radix point of the data in the data package when PC/PLC transmits command to inverter. The valid value is range from 0 to 65535.

## III Function Codes Related to Communication

|      |                         |  |   |
|------|-------------------------|--|---|
| F200 | Source of start command | 0: Keypad command;<br>1: Terminal command;<br>2: Keypad+Terminal;<br>3:MODBUS;<br>4: Keypad+Terminal+MODBUS  | 4 |
| F201 | Source of stop command  | 0: Keypad command;<br>1: Terminal command;<br>2: Keypad+Terminal;<br>3:MODBUS;<br>4: Keypad+Terminal+MODBUS  | 4 |
| F203 | Main frequency source X | 0: Digital setting memory;<br>1: External analog AI1;<br>2: External analog AI2;<br>3: Pulse input given;<br>4: Stage speed control;<br>5: Digital given no memory;<br>6~8: Reserved<br>9: PID adjusting<br>10: Modbus | 0 |

|      |                       |  |   |
|------|-----------------------|--|---|
| F900 | Inverter Address      | 1~255: single inverter address<br>0: Broadcast address                       | 1 |
| F901 | Modbus Mode Selection | 1: ASCII mode<br>2: RTU mode<br>3: Remote keypad                             | 2 |
| F903 | Parity Check          | 0: Invalid<br>1: Odd<br>2: Even  | 0 |
| F904 | Baud Rate             | 0: 1200<br>1: 2400<br>2: 4800<br>3: 9600<br>4: 19200<br>5: 38400<br>6: 57600 | 3 |

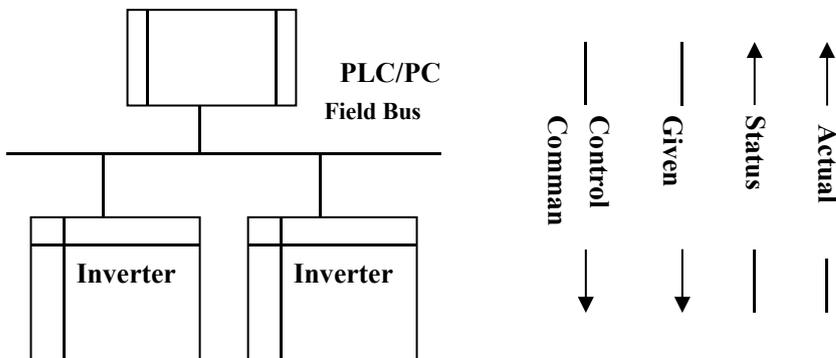
Please set functions code related to communication consonant with the PLC/PC communication parameters, when inverter communicates with PLC/PC.

## IV Physical Interface

### 4.1 Interface instruction

Communication interface of RS485 is located on the most left of control terminals, marked underneath with A+ and B-

### 4.2 Structure of Field Bus



Connecting Diagram of Field Bus

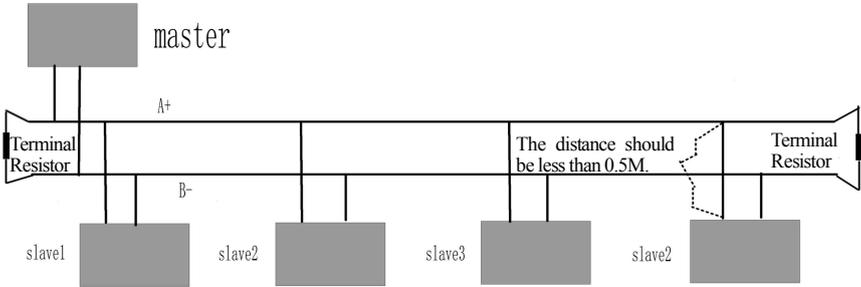
RS485 Half-duplex communication mode is adopted for EM30 series inverter. Daisy chain structure is adopted by 485 Bus-line. Do not use 'spur' lines or a star configuration. Reflect signals which are produced by spur lines or star configuration will interfere in 485 communications.

Please note that for the same time in half-duplex connection, only one inverter can have communication with PC/PLC. Should two or more than two inverters upload data at the same time, then bus competition will occur, which will not only lead to communication failure, but higher current to certain elements as well.

### 4.3 Grounding and Terminal

Terminal resistance of 120 ohm will be adopted for terminal of RS485 network, to diminish the reflection of signals. Terminal resistance shall not be used for intermediate network.

No direct grounding shall be allowed for any point of RS485 network. All the equipment in the network shall be well grounded via their own grounding terminal. Please note that grounding wires will not form closed loop in any case.



**Connecting Diagram of Terminal Resistance**

Please think over the drive capacity of PC/PLC and the distance between PC/PLC and inverter when wiring. Add a repeaters if drive capacity is not enough.



**All wiring connections for installation shall have to be made when the inverter is disconnected from power supply.**

## V. Examples

**Eg1:** In RTU mode, change acc time (F114) to 10.0s in NO.01 inverter.

### Query

| Address | Function | Register Address Hi | Register Address Lo | Preset Data Hi | Preset Data Lo | CRC Lo | CRC Hi |
|---------|----------|---------------------|---------------------|----------------|----------------|--------|--------|
| 01      | 06       | 01                  | 0E                  | 00             | 64             | E8     | 1E     |

**Function code F114**

**Value: 10.0S**

### Normal Response

| Address | Function | Register Address Hi | Register Address Lo | Response Data Hi | Response Data Lo | CRC Lo | CRC Hi |
|---------|----------|---------------------|---------------------|------------------|------------------|--------|--------|
| 01      | 06       | 01                  | 0E                  | 00               | 64               | E8     | 1E     |

**Function code F114**

**Normal Response**

### Abnormal Response

| Address | Function | Abnormal code | CRC Lo | CRC Hi |
|---------|----------|---------------|--------|--------|
| 01      | 86       | 04            | 43     | A3     |

**The max value of function code is 1. Slave fault**

**Eg 2:** Read output frequency, output voltage, output current and current rotate speed from NO.2 inverter.

### Host Query

| Address | Function | First Register Address Hi | First Register Address Lo | Register count Hi | Register count L0 | CRC Lo | CRC Hi |
|---------|----------|---------------------------|---------------------------|-------------------|-------------------|--------|--------|
| 02      | 03       | 10                        | 00                        | 00                | 04                | 40     | FA     |

**Communication Parameters Address 1000H**

### Slave Response:

| Address | Function | Byte Count | Data Hi | Data Lo | Crc Lo | Crc Hi |
|---------|----------|------------|---------|---------|---------|---------|---------|---------|---------|---------|--------|--------|
| 02      | 03       | 08         | 13      | 88      | 01      | 90      | 00      | 3C      | 02      | 00      | 82     | F6     |

**Output Frequency    Output Voltage    Output Current    Numbers of Pole Pairs    Control**

### Mode

NO.2 Inverter's output frequency is 50.00Hz, output voltage is 380V, output current is 6.0A, numbers of pole pairs are 2 and control mode keypad control.

**Eg 3:** NO.1 Inverter runs forwardly.

### Host Query:

| Address | Function | Register Hi | Register Lo | Write status Hi | Write status Lo | CRC Lo | CRC Hi |
|---------|----------|-------------|-------------|-----------------|-----------------|--------|--------|
| 01      | 06       | 20          | 00          | 00              | 01              | 43     | CA     |

**Communication parameters address 2000H                      Forward running**

### Slave Normal Response:

| Address | Function | Register Hi | Register Lo | Write status Hi | Write status Lo | CRC Lo | CRC Hi |
|---------|----------|-------------|-------------|-----------------|-----------------|--------|--------|
| 01      | 06       | 20          | 00          | 00              | 01              | 43     | CA     |

**Normal Response**

### Slave Abnormal Response:

| Address | Function | Abnormal Code | CRC Lo | CRC Hi |
|---------|----------|---------------|--------|--------|
| 01      | 86       | 01            | 83     | A0     |

**The max value of function code is 1.    Illegal function code (assumption)**

**Eg4:** Read the value of F113, F114 from NO.2 inverter

**Host Query:**

| Address | Function | Register Address Hi | Register Address Lo | Register Count Hi | Register Count Lo | CRC Lo | CRC Hi |
|---------|----------|---------------------|---------------------|-------------------|-------------------|--------|--------|
| 02      | 03       | 01                  | 0D                  | 00                | 02                | 54     | 07     |

**Communication Parameter Address F10DH**

**Numbers of Read Registers**

**Slave Normal Response:**

| Address | Function | Byte count | The first parameters status Hi | The first parameters status Lo | The second parameters status Hi | The second parameters status Lo | CRC Lo | CRC Hi |
|---------|----------|------------|--------------------------------|--------------------------------|---------------------------------|---------------------------------|--------|--------|
| 02      | 03       | 04         | 03                             | E8                             | 00                              | 78                              | 49     | 61     |

**The actual value is 10.00.**

**The actual value is 12.00.**

**Slave Abnormal Response:**

| Address | Function Code | Abnormal Code | CRC Lo | CRC Hi |
|---------|---------------|---------------|--------|--------|
| 02      | 83            | 08            | B0     | F6     |

**The max value of function code is 1.**

**Parity check fault**

## Appendix 6 Zoom Table of Function Code

### Basic parameters: F100-F160

| Function Code | Function Definition   | Setting Range  | Mfr's Value               | Change |
|---------------|---|--|---------------------------|--------|
| F100          | User's Password   | 0~9999   | 0                         | √      |
| F102          | Inverter's Rated Current (A)                                    |  | Subject to inverter model | △      |
| F103          | Inverter Power (kW)   |  | Subject to inverter model | △      |
| F105          | Software Edition No.  | 1.00~10.00   | Subject to inverter model | △      |
| F106          | Control mode  | 0: Sensorless vector control (SVC);<br>2: VVVF<br>3: Vector control 1<br>6: PMSM sensorless vector control | 2                         | ×      |
| F107          | Password Valid or Not   | 0: invalid; 1: valid   | 0                         | √      |
| F108          | Setting User's Password   | 0~9999   | 8                         | √      |
| F109          | Starting Frequency (Hz)   | 0.0~10.00  | 0.00                      | √      |
| F110          | Holding Time of Starting Frequency (S)                          | 0.0~999.9  | 0.0                       | √      |
| F111          | Max Frequency (Hz)  | F113~590.0   | 50.00                     | ×      |
| F112          | Min Frequency (Hz)  | 0.00~F113  | 0.50                      | √      |
| F113          | Target Frequency (Hz)   | F112~F111  | 50.00                     | √      |
| F114          | 1 <sup>st</sup> Acceleration Time (S)                           | 0.1~3000   | subject to inverter model | √      |
| F115          | 1 <sup>st</sup> Deceleration Time (S)                           | 0.1~3000   |                           | √      |
| F116          | 2 <sup>nd</sup> Acceleration Time (S)                           | 0.1~3000   |                           | √      |
| F117          | 2 <sup>nd</sup> Deceleration Time (S)                           | 0.1~3000   |                           | √      |
| F118          | Turnover Frequency (Hz)   | 15.00~590.0  | 50.00                     | ×      |
| F119          | Reference of setting accel/decel time                           | 0: 0~50.00Hz<br>1: 0~max frequency   | 0                         | ×      |
| F120          | Forward/Reverse Switchover dead-Time                            | 0.0~3000   | 0.0S                      | √      |
| F122          | Reverse Running Forbidden                                       | 0: invalid; 1: valid   | 0                         | ×      |
| F123          | Minus frequency is valid in the mode of combined speed control. | 0: Invalid; 1: valid   | 0                         | ×      |
| F124          | Jogging Frequency   | F112~F111  | 5.00Hz                    | √      |
| F125          | Jogging Acceleration Time                                       | 0.1~3000   | subject to inverter model | √      |
| F126          | Jogging Deceleration Time                                       | 0.1~3000   |                           | √      |

|      |   |   |                           |   |
|------|---|---|---------------------------|---|
| F127 | Skip Frequency A                          | 0.00~590.0  | 0.00                      | √ |
| F128 | Skip Width A                              | 0.00~2.50   | 0.00                      | √ |
| F129 | Skip Frequency B                          | 0.00~590.0  | 0.00                      | √ |
| F130 | Skip Width B                              | 0.00~2.50   | 0.00                      | √ |
| F131 | Running Display Items                     | 0—Present output frequency / function code<br>1—Current output rotary speed<br>2—Output current<br>4—Output voltage<br>8—PN voltage<br>16—PID feedback value<br>32—Temperature<br>64—Count values<br>128—Linear speed<br>256—PID set value<br>2048—Output power<br>4096—Output torque | 0+1+2+4+8=15              | √ |
| F132 | Display items of stop                     | 0:frequency/function code<br>2: Target rotary speed<br>4: PN voltage<br>8: PID feedback value<br>16: Temperature<br>32: Count values<br>64: PID given value<br>512: Setting torque  | 2+4=6                     | √ |
| F133 | Drive Ratio of Driven System              | 0.10~200.0  | 1.0                       | √ |
| F134 | Transmission-wheel radius                 | 0.001~1.000 (m)   | 0.001                     | √ |
| F135 | User macro                                | 0: Invalid<br>1:user macro 1<br>2: user macro 2   | 0                         | × |
| F136 | Slip compensation                         | 0~10  | 0                         | × |
| F137 | Modes of torque compensation              | 0: Linear compensation;<br>1: Square compensation;<br>2: User-defined multipoint compensation<br>3: Auto torque compensation<br>4: V/F separation   | 0                         | × |
| F138 | Linear compensation                       | 1~20  | subject to inverter model | × |
| F139 | Square compensation                       | 1: 1.5; 2: 1.8;<br>3: 1.9; 4: 2.0   | 1                         | × |
| F140 | Voltage compensation point frequency (Hz) | 0~F142  | 1.00                      | × |
| F141 | Voltage compensation point 1 (%)          | 0~30  | subject to inverter model | × |

|      |  |   |                           |   |
|------|--|---|---------------------------|---|
| F142 | User-defined frequency point 2 (Hz)                | F140~F144   | 5.00                      | × |
| F143 | User-defined voltage point 2(%)                    | 0~100   | 13                        | × |
| F144 | User-defined frequency point 3 (Hz)                | F142~F146   | 10.00                     | × |
| F145 | User-defined voltage point 3(%)                    | 0~100   | 24                        | × |
| F146 | User-defined frequency point 4 (Hz)                | F144~F148   | 20.00                     | × |
| F147 | User-defined voltage point 4(%)                    | 0~100   | 45                        | × |
| F148 | User-defined frequency point 5 (Hz)                | F146~F150   | 30.00                     | × |
| F149 | User-defined voltage point 5(%)                    | 0~100   | 63                        | × |
| F150 | User-defined frequency point 6 (Hz)                | F148~F118   | 40.00                     | × |
| F151 | User-defined voltage point 6(%)                    | 0~100   | 81                        | × |
| F152 | Output voltage corresponding to turnover frequency | 10~100  | 100                       | × |
| F153 | Carrier frequency setting                          | Subject to inverter model   | Subject to inverter model | × |
| F154 | Automatic voltage rectification                    | Setting range:<br>0: Invalid 1: Valid<br>2:Invalid during deceleration process      | 0                         | × |
| F155 | Digital accessory frequency setting                | 0~F111  | 0                         | × |
| F156 | Digital accessory frequency polarity setting       | 0~1   | 0                         | × |
| F157 | Reading accessory frequency                        |   |                           | △ |
| F158 | Reading accessory frequency polarity               |   |                           | △ |
| F159 | Random carrier-wave frequency selection            | 0: Control speed normally(Prohibited);<br>1: Random carrier-wave frequency(Allowed) | 1                         | × |
| F160 | Reverting to manufacturer values                   | 0: Not reverting to manufacturer values;<br>1: Reverting to manufacturer values     | 0                         | × |

**Running control mode: F200-F230**

|      |  |  |     |   |
|------|--|--|-----|---|
| F200 | Source of start command  | 0: Keypad command;<br>1: Terminal command;<br>2: Keypad+Terminal;<br>3:MODBUS;<br>4: Keypad+Terminal+MODBUS  | 4   | × |
| F201 | Source of stop command   | 0: Keypad command;<br>1: Terminal command;<br>2: Keypad+Terminal;<br>3:MODBUS;<br>4: Keypad+Terminal+MODBUS  | 4   | × |
| F202 | Mode of direction setting  | 0: Forward running locking;<br>1: Reverse running locking;<br>2: Terminal setting  | 0   | × |
| F203 | Main frequency source X  | 0: Digital setting memory;<br>1: External analog AI1;<br>2: External analog AI2;<br>3: Pulse input given;<br>4:<br>5: No memory by digital setting;<br>7, 8: Reserved;<br>9: PID adjusting;<br>10: MODBUS                      | 0   | × |
| F204 | Accessorial frequency source Y                                     | 0: Digital setting memory;<br>1: External analog AI1;<br>2: External analog AI2;<br>3: Pulse input given;<br>4: Stage speed control;<br>5: PID adjusting;  | 0   | × |
| F205 | Reference for selecting<br>accessorial frequency source Y<br>range | 0: Relative to max frequency;<br>1: Relative to main frequency X   | 0   | × |
| F206 | Accessorial frequency Y range                                      | 0~100%   | 100 | × |
| F207 | Frequency source selecting   | 0: X; 1: X+Y;<br>2: X or Y (terminal switchover);<br>3: X or X+Y (terminal switchover);<br>4: Combination of stage speed and<br>analog 5: X-Y<br>6: X+Y-Y <sub>MAX</sub> *50%<br>7: Combination of stage speed and<br>analog 1 | 0   | × |
| F208 | Terminal two-line/three-line<br>operation control                  | 0: No function;<br>1: Two-line operation mode 1;<br>2: Two-line operation mode 2;<br>3: three-line operation mode 1;<br>4: three-line operation mode 2;<br>5: start/stop controlled by<br>direction pulse                      | 0   | × |

|      |   |  |                                    |   |
|------|---|--|------------------------------------|---|
| F209 | Selecting the mode of stopping the motor          | 0: stop by deceleration time;<br>1: free stop<br>2: Stop by DC braking | 0                                  | × |
| F210 | Frequency display accuracy                        | 0.01~2.00  | 0.01                               | √ |
| F211 | Speed of digital control                          | 0.01~100.00Hz/S  | 5.00                               | √ |
| F212 | Direction memory                                  | 0: Invalid 1: Valid  | 0                                  | √ |
| F213 | Auto-starting after repowered on                  | 0: invalid; 1: valid   | 0                                  | √ |
| F214 | Auto-starting after reset                         | 0: invalid; 1: valid   | 0                                  | √ |
| F215 | Auto-starting delay time                          | 0.1~3000.0   | 60.0                               | √ |
| F216 | Times of auto-starting in case of repeated faults | 0~5  | 0                                  | √ |
| F217 | Delay time for fault reset                        | 0.0~10.0   | 3.0                                | √ |
| F218 | Reserved  |  |                                    |   |
| F219 | EEPROM write operation                            | 0:enabled to write<br>1:prohibit writing                               | 1                                  | √ |
| F220 | Frequency memory after power-down                 | 0: invalid; 1: valid   | 0                                  | √ |
| F221 | Reserved  |  |                                    |   |
| F222 | count memory selection                            | Setting range:<br>0: Invalid 1: Valid                                  | 0                                  | √ |
| F224 | When target frequency is lower than Min frequency | 0: stop<br>1: run at min frequency                                     | 0                                  | × |
| F229 | Macro setting                                     | 0~9  | 0<br>(disable)                     | × |
| F277 | Third Acceleration Time (S)                       | Setting range: 0.1~3000  | subject<br>to<br>inverter<br>model | √ |
| F278 | Third Deceleration Time (S)                       |  |                                    | √ |
| F279 | Fourth Acceleration Time (S)                      |  |                                    | √ |
| F280 | Fourth Deceleration Time (S)                      |  |                                    | √ |

## Multifunctional Input and Output Terminals: F300-F340

| Function Code | Function Definition                    | Setting Range   | Mfr's Value   | Change |
|---------------|--|---|---------------|--------|
| F300          | Relay token output                     | 0: no function;<br>1: inverter fault protection;<br>2: over latent frequency 1;<br>3: over latent frequency 2;<br>4: free stop;<br>5: in running status 1;<br>6: Reserved   | 1             | √      |
| F301          | DO1 token output                       | 7: Accel/decel time switchover;<br>8: Reaching the Set Count Value;<br>9: Reaching the Designated Count Value;<br>10: inverter overload pre-alarm;<br>11: motor overload pre-alarm;<br>12: stalling;<br>13: Inverter is ready to run<br>14: in running status 2;<br>15: frequency arrival output;<br>16: overheat pre-alarm;<br>17: over latent current output<br>18: Analog line disconnection protection<br>19: Under-load protection output<br>20: Zero current detecting output<br>21: Write DO1 by PC/PLC<br>22: Write TA2/TC2 by PC/PLC<br>23: Write TA2/TC2 by PC/PLC<br>24: Watchdog output token<br>30: General pump is running<br>31: Converter pump is running<br>32: Over-limit pressure token<br>41: Frequency source switchover<br>43: Communication timeout 1<br>45: Lower than setting temperature token<br>56: Irradiation pre-alarm<br>57: Battery panel bypass | 14            | √      |
| F302          | DO2 token output                       |   | 5             |        |
| F303          | DO output types selection              | 0: level output 1 : pulse output  | 0             | √      |
| F304          | S curve beginning stage proportion (%) | 2.0~50.0  | 30.0          | √      |
| F305          | S curve ending stage proportion (%)    | 2.0~50.0  | 30.0          | √      |
| F306          | Accel/decel mode                       | 0: Straight-line 1: S curve   | 0             | ×      |
| F307          | Characteristic frequency 1             | F112~F111   | 10.00         | √      |
| F308          | Characteristic frequency 2             | F112~F111   | 50.00         | √      |
| F309          | Characteristic frequency width (%)     | 0~100   | 50            | √      |
| F310          | Characteristic current (A)             | 0~5000.0  | Rated current | √      |

|      |                                  |   |      |   |
|------|----------------------------------|---|------|---|
| F311 | Characteristic current width (%) | 0~100   | 10   | √ |
| F312 | Frequency arrival threshold (Hz) | 0.00~5.00   | 0.00 | √ |
| F313 | Count frequency divisions        | 1~65000   | 1    | √ |
| F314 | Set count value                  | F315~65000  | 1000 | √ |
| F315 | Designated count value           | 1~F314  | 500  | √ |
| F316 | DI1 terminal function setting    | 0: no function;<br>1: running terminal;<br>2: stop terminal;<br>3: multi-stage speed terminal 1;<br>4: multi-stage speed terminal 2;<br>5: multi-stage speed terminal 3;<br>6: multi-stage speed terminal 4;  | 11   | √ |
| F317 | DI2 terminal function setting    | 7: reset terminal;<br>8: free stop terminal;<br>9: external emergency stop terminal;<br>10: accel/deceleration forbidden terminal;<br>11: forward run jogging;<br>12: reverse run jogging;  | 9    | √ |
| F318 | DI3 terminal function setting    | 13: UP frequency increasing terminal;<br>14: DOWN frequency decreasing terminal;<br>15: "FWD" terminal;<br>16: "REV" terminal;<br>17: three-line type input "X" terminal;<br>18: accel/decel time switchover 1;<br>19: Reserved;  | 15   | √ |
| F319 | DI4 terminal function setting    | 20: Switchover between speed and torque<br>21: frequency source switchover terminal;<br>22: Count input terminal:<br>30: Water lack signal;<br>31: Signal of water  | 16   | √ |
| F320 | DI5 terminal function setting    | 32: Fire pressure switchover;<br>33: Emergency fire control<br>34: Accel / decel switchover 2<br>37: Common-open PTC heat protection<br>38: Common-close PTC heat protection<br>49: PID paused  | 7    | √ |
| F321 | DI6 terminal function setting    | 51: Motor switchover<br>53: Watchdog<br>54: Frequency reset<br>55~59: Reserved<br>60: Communication timeout 2 signal elimination<br>61: Start/stop terminals<br>71: Water injection<br>72: Water pump<br>73: High water level<br>74: Low water level<br>75: Pump cleaning | 8    | √ |

|      |   |  |      |   |
|------|---|--|------|---|
|      |   | 76: Quit fire mode after manual stop<br>77: Anti-rust and anti-freeze enabled<br>78: Pressure rising<br>79: Pressure dropping<br>80: Pump filling                  |      |   |
| F324 | Free stop terminal logic                  | 0: positive logic (valid for low level);<br>1: negative logic (valid for high level)   | 0    | × |
| F325 | External emergency stop terminal logic    |  | 0    | × |
| F326 | Watchdog time                             | 0.0: function invalid<br>0.1~3000.0  | 10.0 | √ |
| F327 | Stop mode                                 | 0: Stop immediately<br>1: Deceleration to stop   | 0    | × |
| F328 | Terminal filter times                     | 1~100  | 20   | √ |
| F329 | Run command of start terminal             | 0: Valid 1: Invalid  | 0    | √ |
| F330 | Status display of digital input terminals |  |      | △ |
| F331 | Monitoring AI1                            |  |      | △ |
| F332 | Monitoring AI2                            |  |      | △ |
| F335 | Relay output simulation                   | 0: Output active.<br>1: Output inactive.   | 0    | × |
| F336 | DO1 output simulation                     |  | 0    | × |
| F337 | Relay 2 output simulation                 |  | 0    | × |
| F338 | AO1 output simulation                     | 0~4095   | 0    | × |
| F339 | AO2 output simulation                     | 0~4095   | 0    | × |
| F340 | Selection of terminal negative logic      | 0: Invalid<br>1: DI1 negative logic<br>2: DI2 negative logic<br>4: DI3 negative logic<br>8: DI4 negative logic<br>16: DI5 negative logic<br>32: DI6 negative logic | 0    | √ |

## Analog Input and Output

|      |  |   |       |   |
|------|--|---|-------|---|
| F400 | Lower limit of AI1 channel input (V)               | 0.00~F402   | 0.04  | √ |
| F401 | Corresponding setting for lower limit of AI1 input | 0~2.00  | 1.00  | √ |
| F402 | Upper limit of AI1 channel input (V)               | F400~10.00  | 10.00 | √ |
| F403 | Corresponding setting for upper limit of AI1 input | 0.00~2.00   | 2.00  | √ |
| F404 | AI1 channel proportional gain K1                   | 0.0~10.0  | 1.0   | √ |
| F405 | AI1 filtering time constant (S)                    | 0.01~10.0   | 0.10  | √ |
| F406 | Lower limit of AI2 channel input (V)               | 0.00~F408   | 0.04  | √ |
| F407 | Corresponding setting for lower limit of AI2 input | 0~2.00  | 1.00  | √ |
| F408 | Upper limit of AI2 channel input (V)               | F406~10.00  | 10.00 | √ |
| F409 | Corresponding setting for upper limit of AI2 input | 0.00~2.00   | 2.00  | √ |
| F410 | AI2 channel proportional gain K2                   | 0.0~10.0  | 1.0   | √ |
| F411 | AI2 filtering time constant                        | 0.01~10.00  | 0.10  | √ |
| F418 | AI1 channel 0Hz voltage dead zone                  | 0.00~1.00   | 0.00  | √ |
| F419 | AI2 channel 0Hz voltage dead zone                  | 0.00~1.00   | 0.00  | √ |
| F423 | AO1 output range                                   | 0: 0~5V;<br>1: 0~10V or 0-20mA<br>2: 4-20mA   | 1     | √ |
| F424 | AO1 lowest corresponding frequency                 | 0.0~F425  | 0.05  | √ |
| F425 | AO1 highest corresponding frequency                | F424~F111   | 50.00 | √ |
| F426 | AO1 output compensation                            | 0~120   | 100   | √ |
| F427 | AO2 output range                                   | 0: 0~20mA;<br>1: 4~20mA   | 0     | √ |
| F428 | AO2 lowest corresponding frequency                 | 0.0~F429  | 0.05  | √ |
| F429 | AO2 highest corresponding frequency                | F428~F111   | 50.00 | √ |
| F430 | AO2 output compensation                            | 0~120%  | 100   | √ |
| F431 | AO1 analog output signal selecting                 | 0: Running frequency;<br>1: Output current;<br>2: Output voltage;<br>3: AI1<br>4: AI2<br>5: Input pulse | 0     | √ |
| F432 | AO2 analog output signal selecting                 | 6: Output torque<br>7: Given by PC/PLC<br>8: Target frequency   | 1     | √ |

|      |  |  |       |   |
|------|--|--|-------|---|
|      |  | 9: Actual speed<br>10: Output torque 2<br>12: Output power<br>13: relay 2 output<br>14: Inlet pressure<br>15: Outlet pressure                                      |       |   |
| F433 | Corresponding current for full range of external voltmeter           | 0.01~5.00 times of rated current   | 2.00  | × |
| F434 | Corresponding current for full range of external ammeter             |  | 2.00  | × |
| F436 | Corresponding current multiple of output max analog to rated torque. | 0.01~3.00  | 3.00  | × |
| F440 | Min frequency of input pulse FI                                      | 0.00~F442  | 0.00  | √ |
| F441 | Corresponding setting of FI min frequency                            | 0.00~2.00  | 1.00  | √ |
| F442 | Max frequency of input pulse FI                                      | F440~100.00  | 10.00 | √ |
| F443 | Corresponding setting of FI max frequency                            | Max (1.00, F441) ~2.00   | 2.00  | √ |
| F445 | Filtering constant of FI input pulse                                 | 0~1000   | 0     | √ |
| F446 | FI channel 0Hz frequency dead zone                                   | 0~F442 (Positive-Negative)   | 0.00  | √ |
| F449 | Max frequency of output pulse FO                                     | 0.00~100.00  | 10.00 | √ |
| F450 | Zero bias coefficient of output pulse frequency (%)                  | 0.0~100.0  | 0.0   | √ |
| F451 | Frequency gain of output pulse                                       | 0.00~10.00   | 1.00  | √ |
| F452 | Reserved   |  |       |   |
| F453 | Output pulse signal  | 0: Running frequency<br>1: Output current<br>2: Output voltage<br>3: AI1 4: AI2<br>5: Input pulse<br>6: Output torque<br>7: Given by PC/PLC<br>8: Target frequency | 0     | √ |
| F460 | AI1 channel input mode   | 0: straight line mode<br>1: folding line mode  | 0     | × |
| F461 | AI2 channel input mode   | 0: straight line mode<br>1: folding line mode  | 0     | × |
| F462 | AI1 insertion point A1 voltage value                                 | F400~F464  | 2.00  | × |
| F463 | AI1 insertion point A1 setting value                                 | F401~F465  | 1.20  | × |
| F464 | AI1 insertion point A2 voltage value                                 | F462~F466  | 5.00  | × |
| F465 | AI1 insertion point A2 setting value                                 | F463~F467  | 1.50  | × |
| F466 | AI1 insertion point A3 voltage value                                 | F464~F402  | 8.00  | × |

|      |                                      |           |      |   |
|------|--------------------------------------|-----------|------|---|
| F467 | A11 insertion point A3 setting value | F465~F403 | 1.80 | × |
| F468 | A12 insertion point B1 voltage value | F406~F470 | 2.00 | × |
| F469 | A12 insertion point B1 setting value | F407~F471 | 1.20 | × |
| F470 | A12 insertion point B2 voltage value | F468~F472 | 5.00 | × |
| F471 | A12 insertion point B2 setting value | F469~F473 | 1.50 | × |
| F472 | A12 insertion point B3 voltage value | F470~F408 | 8.00 | × |
| F473 | A12 insertion point B3 setting value | F471~F409 | 1.80 | × |

### Multi-stage Speed Control: F500-F580

|           |   |   |                           |   |
|-----------|---|---|---------------------------|---|
| F500      | Stage speed type  | 0: 3-stage speed;<br>1: 15-stage speed;<br>2: Max 8-stage speed auto circulating      | 1                         | × |
| F501      | Selection of Stage Speed Under Auto-circulation Speed Control     | 2~8   | 7                         | √ |
| F502      | Selection of Times of Auto- Circulation Speed Control             | 0~9999 (when the value is set to 0, the inverter will carry out infinite circulating) | 0                         | √ |
| F503      | Status after auto circulation running Finished                    | 0: Stop<br>1: Keep running at last stage speed  | 0                         | √ |
| F504      | Frequency setting for stage 1 speed                               | F112~F111   | 5.00                      | √ |
| F505      | Frequency setting for stage 2 speed                               | F112~F111   | 10.00                     | √ |
| F506      | Frequency setting for stage 3 speed                               | F112~F111   | 15.00                     | √ |
| F507      | Frequency setting for stage 4 speed                               | F112~F111   | 20.00                     | √ |
| F508      | Frequency setting for stage 5 speed                               | F112~F111   | 25.00                     | √ |
| F509      | Frequency setting for stage 6 speed                               | F112~F111   | 30.00                     | √ |
| F510      | Frequency setting for stage 7 speed                               | F112~F111   | 35.00                     | √ |
| F511      | Frequency setting for stage 8 speed                               | F112~F111   | 40.00                     | √ |
| F512      | Frequency setting for stage 9 speed                               | F112~F111   | 5.00                      | √ |
| F513      | Frequency setting for stage 10 speed                              | F112~F111   | 10.00                     | √ |
| F514      | Frequency setting for stage 11 speed                              | F112~F111   | 15.00                     | √ |
| F515      | Frequency setting for stage 12 speed                              | F112~F111   | 20.00                     | √ |
| F516      | Frequency setting for stage 13 speed                              | F112~F111   | 25.00                     | √ |
| F517      | Frequency setting for stage 14 speed                              | F112~F111   | 30.00                     | √ |
| F518      | Frequency setting for stage 15 speed                              | F112~F111   | 35.00                     | √ |
| F519-F533 | Acceleration time setting for the speeds from Stage 1 to stage 15 | 0.1~3000  | Subject to inverter model | √ |
| F534-F548 | Deceleration time setting for the speeds from Stage 1 to stage 15 | 0.1~3000  |                           | √ |
| F549-F556 | Running directions of stage speeds from Stage 1 to stage 8        | 0: forward running;<br>1: reverse running   | 0                         | √ |

|           |  |  |     |   |
|-----------|--|--|-----|---|
| F557-F564 | Running time of stage speeds from Stage 1 to stage 8         | 0.1~3000                                       | 1.0 | √ |
| F565-F572 | Stop time after finishing stages from Stage 1 to stage 8.    | 0.0~3000                                       | 0.0 | √ |
| F573-F579 | Running directions of stage speeds from Stage 9 to stage 15. | 0: forward running;<br>1: reverse running      | 0   | √ |
| F580      | Stage-speed mode   | 0: Stage speed mode 1<br>1: Stage speed mode 2 | 0   | √ |

### Auxiliary Functions: F600-F650

|      |  |   |                  |   |
|------|--|---|------------------|---|
| F600 | DC Braking Function Selection            | 0: Invalid;<br>1: braking before starting;<br>2: braking during stopping;<br>3: braking during starting and stopping    | 0                | √ |
| F601 | Initial Frequency for DC Braking         | 0.20~50.00  | 1.00             | √ |
| F602 | DC Braking efficiency before Starting    | 0~100   | 50               | √ |
| F603 | DC Braking efficiency During Stop        | 0~100   | 10               | √ |
| F604 | Braking Lasting Time Before Starting     | 0.0~30.00   | 0.50             | √ |
| F605 | Braking Lasting Time During Stopping     | 0.0~30.00   | 0.50             | √ |
| F607 | Selection of Stalling Adjusting Function | Setting range:<br>0~2: Reserved<br>3: Voltage/current control<br>4: Voltage control<br>5: Current control               | 3                | √ |
| F608 | Stalling Current Adjusting (%)           | 60~FC49   | 160              | √ |
| F609 | Stalling Voltage Adjusting (%)           | 110~200   | 140              | √ |
| F610 | Stalling protection judging time (s)     | 0.0~3000  | 0.0              | √ |
| F611 | Dynamic Braking threshold (V)            | 200~2000  | Subject to model | × |
| F612 | Dynamic braking duty ratio (%)           | 0~100   | 100              | × |
| F613 | Speed track enable                       | 0: invalid<br>1: valid<br>2: valid at the first time  | 0                | × |
| F614 | Speed track mode                         | Setting range:<br>0: Speed track from frequency memory<br>1: Speed track from max frequency<br>2: Speed track from zero | 0                | × |
| F615 | Speed track rate                         | 1~100   | 20               | × |
| F620 | Brake delay turn-off time (s)            | 0.0: discharge not closed when stop<br>0.1~3000   | 5.0              |   |
| F638 | Parameter copy enable                    | 0: copy forbidden<br>1: parameter download 1(voltage level and power accordance)<br>2: parameter download 2(not         | 1                | × |

|      |  |   |                     |   |
|------|--|---|---------------------|---|
|      |  | consider voltage level and power)   |                     |   |
| F639 | Parameter copy codes                               |   | Subject to software | △ |
| F640 | Parameter copy type                                | 0: Total parameters copy<br>1: Parameter copy (motor F801~F810/F844 not include)  | 1                   | × |
| F641 | Inhibition of current oscillation at low frequency | 0: Invalid<br>0~100   | Subject to model    | × |
| F644 | Keypad copy enabled                                | 0: Invalid<br>1: current macro parameter upload<br>2: current macro parameter download<br>3: user macro 1 upload<br>4: user macro 1 download<br>5: user macro 2 upload<br>6: user macro 2 download  | 0                   | × |
| F645 | Status display of inverter                         | 0: Current running frequency<br>1: Current rotate speed<br>2: Target rotate speed<br>3: Output current<br>4: Output voltage<br>5: PN voltage<br>6: PID setting value<br>7: PID feedback value<br>8: Radiator temperature<br>9: Count value<br>10: Linear speed<br>11: Main frequency setting channel<br>12: Main frequency<br>13: Auxiliary frequency setting channel<br>14: Auxiliary frequency<br>15: Target frequency<br>16: Reserved<br>17: Output torque<br>18: Setting torque<br>19: Motor power<br>20: Output power<br>21: Frequency status<br>22: DI terminal status<br>23: Output terminal status<br>24: Current stage of multi-stage speed<br>25: AI1 input value<br>26: AI2 input value<br>27, 28: Reserved<br>29: Pulse input frequency<br>30: Pulse output frequency | 0                   | √ |

|      |   |   |                  |    |
|------|---|---|------------------|----|
|      |   | 31: AO1 output percentage<br>32: AO2 output percentage<br>33: Power-on time   |                  |    |
| F646 | LCD backlight time(s)                                 | 0~100   | 100              | √  |
| F647 | Language selection                                    | 0: Chinese 1: English<br>2: Deutsch 3: Espanol<br>4: Francais   | 0                | √  |
| F656 | DC braking waiting time during stopping(s)            | 0.00~30.00  | 0                | √○ |
| F657 | Instantaneous power failure selection                 | 0: Invalid<br>1: Reduce frequency to remain running<br>2: Reduce frequency quickly to stop the inverter                                     | 0                | ×  |
| F658 | Voltage rally acceleration time                       | 0.0~3000<br>0.0: F114   | 0.0              | √  |
| F659 | Voltage rally deceleration time                       | 0.0~3000<br>0.0: F115   | 0.0              | √  |
| F660 | Action judging voltage at instantaneous power failure | 200~F661  | Subject to model | ×○ |
| F661 | Action stop voltage at instantaneous power failure    | F660~1400   | Subject to model | ×○ |
| F662 | Instantaneous voltage recovery judging time(s)        | 0.00~10.00  | 0.30             | √  |
| F670 | Voltage-limit current-limit adjustment coefficient    | 0.01~10.00  | 2.00             | √  |
| F671 | voltage source for V/F separation                     | 0: F672 1: A11 2:A12<br>4: Communication setting<br>5: pulse setting 6: PID<br>7~10: reserved   | 0                | ×  |
| F672 | Voltage digital setting for V/F separation            | 0.00~100.00   | 100.00           | √  |
| F673 | Lower limit of voltage at V/F separation (%)          | 0.00~F674   | 0.00             | ×  |
| F674 | Upper limit of voltage at V/F separation (%)          | F673~100.00   | 100.00           | ×  |
| F675 | Voltage rise time of V/F separation                   | 0.0~3000.0  | 5.0              | √  |
| F676 | Voltage rise time of V/F separation                   | 0.0~3000.0  | 5.0              | √  |
| F677 | Stop mode at V/F separation                           | 0: voltage and frequency declines to 0 according to respective time.<br>1: Voltage declines to 0 first<br>2: frequency declines to 0 first. | 0                | ×  |

## Timing Control and Protection: F700-F760

|      |   |   |     |   |
|------|---|---|-----|---|
| F700 | Selection of terminal free stop mode                      | 0: free stop immediately;<br>1: delayed free stop   | 0   | √ |
| F701 | Delay time for free stop and programmable terminal action | 0.0~60.0  | 0.0 | √ |
| F702 | Fan control mode  | 0: controlled by temperature<br>1: Running when inverter is powered on<br>2: Controlled by running status   | 2   | × |
| F703 | Reserved  |   |     |   |
| F704 | Inverter Overloading pre-alarm coefficient (%)            | 50~100  | 80  | √ |
| F705 | Motor overloading adjusting gains                         | 50~100  | 80  | × |
| F706 | Inverter Overloading coefficient%                         | 120~190   | 150 | × |
| F707 | Motor Overloading coefficient %                           | 20~100  | 100 | × |
| F708 | Record of The Latest Malfunction Type                     | Setting range:<br>2: Over current (OC)<br>3: over voltage (OE)<br>4: input phase loss (PF1)<br>5: inverter overload (OL1)<br>6: under voltage (LU)<br>7: overheat (OH)  |     | △ |
| F709 | Record of Malfunction Type for Last but One               | 8: motor overload (OL2)<br>11: external malfunction (ESP)<br>13: studying parameters without motor (Err2)<br>16: Over current 1 (OC1)<br>17: output phase loss (PF0)<br>18: Aerr analog disconnected<br>20: EP/EP2/EP3 under-load |     | △ |
| F710 | Record of Malfunction Type for Last but Two               | 22: nP pressure control<br>23: Err5 PID parameters are set wrong<br>45: Communication timeout (CE)<br>46: Speed track fault (FL)<br>49: Watchdog fault (Err6)   |     | △ |
| F711 | Fault Frequency of The Latest Malfunction                 |   |     | △ |
| F712 | Fault Current of The Latest Malfunction                   |   |     | △ |
| F713 | Fault PN Voltage of The Latest Malfunction                |   |     | △ |
| F714 | Fault Frequency of Last Malfunction but One               |   |     | △ |

|      |   |  |                           |    |
|------|---|--|---------------------------|----|
| F715 | Fault Current of Last Malfunction but One       |  |                           | △  |
| F716 | Fault PN Voltage of Last Malfunction but        |  |                           | △  |
| F717 | Fault Frequency of Last Malfunction but         |  |                           | △  |
| F718 | Fault Current of Last Malfunction but Two       |  |                           | △  |
| F719 | Fault PN Voltage of Last Malfunction but        |  |                           | △  |
| F720 | Record of over-current protection fault         |  |                           | △  |
| F721 | Record of overvoltage protection fault          |  |                           | △  |
| F722 | Record of overheat protection fault times       |  |                           | △  |
| F723 | Record of overload protection fault times       |  |                           | △  |
| F724 | Input phase loss                                |  | Subject to inverter model | ×  |
| F725 | Under-voltage protection                        | 0: Reset manually<br>1: Reset automatically  | 2                         | ×  |
| F726 | Overheat  | 0: invalid; 1: valid   | 1                         | ○× |
| F727 | Output phase loss                               | 0: invalid; 1: valid   | 1                         | ○  |
| F728 | Input phase loss filtering constant             | 1~60   | 5                         | √  |
| F729 | Under-voltage filtering constant(2ms)           | 1~3000   | 5                         | √  |
| F730 | Overheat protection filtering constant          | 0.1~60.0   | 5.0                       | √  |
| F732 | Voltage threshold of under-voltage protection   | Subject to inverter model  | Subject to inverter model | ×  |
| F737 | Over-current 1 protection                       | 0: Invalid 1: Valid  | 1                         |    |
| F738 | Over-current 1 protection coefficient           | 0.50~3.00  | 2.5                       |    |
| F739 | Over-current 1 protection record                |  |                           | △  |
| F741 | Analog disconnected protection                  | 0: Invalid<br>1: Stop and AErr is displayed.<br>2: Stop and AErr is not displayed.<br>3: Inverter runs at the min frequency.<br>4: Reserved. | 0                         | √  |
| F742 | Threshold of analog disconnected protection (%) | 1~100  | 50                        | √  |
| F745 | Threshold of pre-alarm overheat (%)             | 0~100  | 80                        | √○ |
| F746 | Carrier frequency auto-adjusting threshold(°C)  | 60~72  | 65                        | √  |
| F747 | Carrier frequency auto-adjusting                | 0: Invalid 1: Valid  | 1                         | √  |
| F752 | Overload quitting coefficient                   | 0.1~20.0   | 1.0                       | √  |
| F753 | Selection of overload protection                | 0: Normal motor<br>1: variable frequency motor   | 1                         | ×  |
| F754 | Zero-current threshold (%)                      | 0~200  | 5                         | ×  |
| F755 | Duration time of zero-current                   | 0~60.0   | 0.5                       | √  |
| F760 | Grounding protection                            | 0: Invalid 1: Valid  | 1                         | *  |
| F761 | Switchover mode of FWD/REV                      | 0: at zero 1: at start frequency   | 0                         | ×  |

**Motor parameters: F800-F830**

|      |                                     |  |                           |   |
|------|-------------------------------------|--|---------------------------|---|
| F800 | Motor's parameters selection        | Setting range:<br>0: Invalid;<br>1: Rotating tuning.;<br>2: Stationary tuning              | 0                         | × |
| F801 | Rated power(kW)                     | 0.1~1000   |                           | × |
| F802 | Rated voltage(V)                    | 1~1300   |                           | × |
| F803 | Rated current(A)                    | 0.2~6553.5   |                           | × |
| F804 | Number of motor poles               | 2~100  | 4                         | × |
| F805 | Rated rotary speed(rpm)             | 1~30000  |                           | × |
| F806 | Stator resistance                   | 0.001~65.53Ω (for 15kw and below 15kw)<br>0.1~6553mΩ (For above 15kw)                      | Subject to inverter model | × |
| F807 | Rotor resistance                    | 0.001~65.53Ω (for15kw and below 15kw)<br>0.1~6553mΩ (For above 15kw)                       | Subject to inverter model | × |
| F808 | Leakage inductance                  | Setting range:<br>0.01~655.3mH (for 15kw and below 15kw)<br>0.001~65.53mH (for above 15kw) | Subject to inverter model | × |
| F809 | Mutual inductance                   | Setting range:<br>0.1~6553mH (for 15kw and below 15kw)<br>0.01~655.3mH (for above 15 kw)   | Subject to inverter model | × |
| F810 | Motor rated frequency               | 1.00~590.0   | 50.00                     | × |
| F812 | Pre-exciting time                   | 0.00~30.00   | 0.30                      | √ |
| F813 | Rotary speed loop KP1               | 1~100  | 30                        | √ |
| F814 | Rotary speed loop KI1               | 0.01~10.00   | 0.50                      | √ |
| F815 | Rotary speed loop KP2               | 1~100  | Subject to inverter model | √ |
| F816 | Rotary speed loop KI2               | 0.01~10.00   | 1.00                      | √ |
| F817 | PID switching frequency 1           | 0~F818   | 5.00                      | √ |
| F818 | PID switching frequency 2           | F817~F111  | 10.00                     | √ |
| F819 | Slip coefficient                    | 50~200   | 100                       | √ |
| F820 | Filtering coefficient of speed loop | 0~100  | 0                         | √ |
| F822 | Upper limit of speed control torque | 0.0~250.0  | 200                       | √ |
| F840 | Halt speed detection                | 0: detection according to feedback<br>1: detection according to given speed                | 0                         | √ |
| F861 | Control mode                        | 0: Control mode 1-General PMSM<br>1: Control mode 2-high-freq PMSM                         | 0                         | × |

|      |   |   |                  |                |
|------|---|---|------------------|----------------|
| F862 | Frequency switch point  | 0.1~50.0                                  | 5.0              | ×              |
| F844 | Motor current without load (A)  | 0.1~F803                                  | Subject to model | × <sub>o</sub> |
| F870 | PMSM back electromotive force (mV/rpm)                                | 0.1~6553.0<br>(valid value between lines) | 100.0            | ×              |
| F871 | PMSM D-axis inductance (mH)   | 0.01~655.30                               | 5.00             | ×              |
| F872 | PMSM Q-axis inductance (mH)   | 0.01~655.30                               | 7.00             | ×              |
| F873 | PMSM stator resistance (Ω)  | 0.001~65.530<br>(phase resistor)          | 0.500            | ×              |
| F876 | PMSM injection current without load (%)                               | 0.0~100.0                                 | 20.0             | ×              |
| F877 | PMSM injection current compensation without load (%)                  | 0.0~50.0                                  | 0.0              | ×              |
| F878 | PMSM cut-off point of injection current compensation without load (%) | 0.0~50.0                                  | 10.0             | ×              |
| F879 | PMSM injection current with heavy load (%)                            | 0.0~100.0                                 | 0.0              | ×              |
| F880 | PMSM PCE detection time (S)   | 0.1~10.0                                  | 0.2              | ×              |
| F898 | Power consumption correction coefficient                              | 50.0~100.0                                | 80.0             | √              |
| F899 | Power consumption clear   | 0: invalid 1: Valid                       | 0                | √              |

### Communication parameter: F900-F930

|      |                                     |   |     |   |
|------|-------------------------------------|---|-----|---|
| F900 | Communication Address               | 1~255: single inverter address<br>0: broadcast address          | 1   | √ |
| F901 | Communication Mode                  | 1: ASCII 2: RTU   | 2   | √ |
| F902 | Stop bits                           | 1~2   | 2   | √ |
| F903 | Parity Check                        | 0: Invalid 1: Odd 2: Even                                       | 0   | √ |
| F904 | Baud Rate                           | 0: 1200; 1: 2400; 2: 4800; 3: 9600 ; 4: 19200 5: 38400 6: 57600 | 3   | √ |
| F905 | Communication timeout period (S)    | 0.0~3000.0  | 0.0 | √ |
| F907 | Time 2 of communication timeout (S) | 0.0~3000.0  | 0.0 | √ |
| F926 | CAN baud rate (kbps)                | 0:20 1:50 2:100<br>3:125 4: 250 5:500 6:1000                    | 6   | √ |
| F928 | BACnet address                      | 0~127   | 1   | √ |

|      |                                   |                                       |   |   |
|------|-----------------------------------|---------------------------------------|---|---|
| F929 | BACnet baud rate (bps)            | 0: 9600 1: 19200<br>2: 38400 3: 76800 | 1 | × |
| F930 | Keypad disconnected protection(s) | 0: Invalid<br>1~10                    | 0 | √ |
| F933 | BACnet device No.                 | 0~65535                               | 1 | √ |

### PID parameters: FA00-FA80

|      |  |   |       |   |
|------|--|---|-------|---|
| FA00 | Water supply mode                          | 0: Single pump (PID control mode)<br>1: Fixed mode<br>2: Timing interchanging<br>5: Dormancy interchanging<br>6: fixed pumps interchanging by time<br>7: fixed pumps interchanging at sleep<br>10: master/slave fixed mode<br>11: master/slave interchanging by time<br>12: master/slave interchanging at sleep | 0     | × |
| FA01 | PID adjusting target given source          | 0: FA04 1: AI1 2: AI2<br>4: FI (pulse frequency input)  | 0     | × |
| FA02 | PID adjusting feedback given source        | 1: AI1 2: AI2<br>3: FI (pulse frequency input)<br>4: reserved<br>5: Running current<br>6: Output power<br>7: Output torque  | 1     | × |
| FA03 | Max limit of PID adjusting (%)             | FA04~FA50   | 100.0 | √ |
| FA04 | Digital setting value of PID adjusting (%) | FA05~FA03   | 50.0  | √ |
| FA05 | Min limit of PID adjusting (%)             | 0.0~FA04  | 0.0   | √ |
| FA06 | PID polarity                               | 0: Positive feedback<br>1: Negative feedback  | 1     | × |
| FA07 | Dormancy function selection                | 0: Valid 1: Invalid   | 1     | × |
| FA09 | Min frequency of PID adjusting (Hz)        | Max(FI12, 0.1)~F111   | 5.00  | √ |
| FA10 | Dormancy delay time (S)                    | 0~500.0   | 15.0  | √ |
| FA11 | Wake delay time (S)                        | 0.0~3000  | 3.0   | √ |
| FA12 | PID max frequency(Hz)                      | FA09~F111   | 50.00 | √ |
| FA13 | pressure setpoint source of filling inlet  | 0: invalid<br>1: AI1 2: AI2   | 0     | √ |
| FA18 | Whether PID adjusting target is changed    | 0: Invalid 1: Valid   | 1     | × |
| FA19 | Proportion Gain P                          | 0.00~10.00  | 0.30  | √ |
| FA20 | Integration time I (S)                     | 0.0~100.0   | 0.3   | √ |

|      |   |  |       |   |
|------|---|--|-------|---|
| FA21 | Differential time D (S)                           | 0.1~10.0   | 0.1   | √ |
| FA22 | PID sampling period (mS)                          | 1~500  | 5     | √ |
| FA23 | PID negative frequency output selection           | 0: Invalid 1: Valid<br>2: Only negative output   | 0     | √ |
| FA24 | Switching Timing unit setting                     | 0: hour 1: minute  | 0     | × |
| FA25 | Switching Timing Setting                          | 1~9999   | 100   | × |
| FA26 | Under-load protection mode                        | 0: No protection<br>1: Protection by contactor<br>2: Protection by PID<br>3: Protection by current | 0     | × |
| FA27 | Current threshold of under-load protection (%)    | 10~150   | 80    | √ |
| FA28 | Waking time after protection (min)                | 1~3000   | 60    | √ |
| FA29 | PID dead time (%)                                 | 0.0~10.0   | 2.0   | √ |
| FA30 | Running Interval of restarting converter pump (S) | 2.0~999.9  | 20.0  | √ |
| FA31 | Delay time of starting general pumps (S)          | 0.1~999.9  | 30.0  | √ |
| FA32 | Delay time of stopping general pumps (S)          | 0.1~999.9  | 30.0  | √ |
| FA33 | stop mode when constant pressure water supply     | 0: free stop<br>1: deceleration to stop  | 0     | × |
| FA34 | Pressure measurement unit                         | 0: % 1: Mpa 2: bar 3: psi<br>4: CM 5: M 6: CM/Seg<br>7: M/Seg 8: °C                                | 0     | √ |
| FA36 | Whether No.1 relay is started                     | 0: Stopped 1: Started  | 0     | × |
| FA37 | Whether No.2 relay is started                     | 0: Stopped 1: Started  | 0     | × |
| FA44 | Master/slave control mode                         | 0:same frequency<br>1: high efficiency mode  | 0     | × |
| FA45 | Pressure setpoint compensation (%)                | 0.0~10.0   | 0     | √ |
| FA47 | The sequence of starting No 1 relay               | 1~20   | 20    | × |
| FA48 | The sequence of starting No 2 relay               | 1~20   | 20    | × |
| FA49 | Filling inlet pressure range(%)                   | 0.0~100.0  | 100.0 | √ |
| FA50 | FA50 Empty outlet pressure range(%)               | 0.0~100.0  | 100.0 | √ |
| FA51 | Pressure threshold of refilling at inlet (%)      | FA52~FA49  | 0.01  | √ |
| FA52 | Pressure threshold of water-lack at inlet(%)      | 0.0~FA51<br>0.0: invalid   | 0.00  | √ |
| FA53 | Delay time for refilling at inlet(S)              | 0.0~60.0   | 0.0   | √ |
| FA54 | Delay time for warning water-lack(S)              | 0.0~60.0   | 0.0   | √ |

|      |   |  |                  |   |
|------|---|--|------------------|---|
| FA55 | Master/slave pump number                        | 0~14   | 0                | × |
| FA56 | Outlet sensor disconnection protection          | 0: invalid<br>1: valid   | 0                | √ |
| FA57 | Inlet sensor disconnection protection           | 0: invalid<br>1: valid   | 0                | √ |
| FA58 | Fire pressure given value (%)                   | 0.0~100.0  | 80.0             | √ |
| FA59 | Emergency fire mode                             | 0: Invalid<br>1: Emergency fire mode 1<br>2: Emergency fire mode 2 | 0                | × |
| FA60 | Running frequency of emergency fire             | F112~F111  | 50.00            | √ |
| FA62 | When fire emergency control terminal is invalid | 0: no stop<br>1: manual stop valid                                 | 0                | × |
| FA66 | Duration time of under-load protection (S)      | 0~60   | 20.0             | √ |
| FA67 | Dormancy mode                                   | 0: dormancy mode 1<br>1: dormancy mode 2                           | 0                | × |
| FA68 | Given pressure offset 1 (%)                     | 0.0~100.0  | 30.0             | √ |
| FA69 | Given pressure offset 2 (%)                     | 0.0~100.0  | 30.0             | √ |
| FA78 | Flow detection enable                           | 0: invalid 1: valid  | 0                | √ |
| FA79 | Interval time for flow detection (min)          | 1~60000  | 60               | √ |
| FA80 | Pressure Compensation for flow detection(%)     | 0.1~10.0   | 2.0              | √ |
| FA81 | No flow restart delay (S)                       | 0.0~3000.0   | 10.0             | √ |
| FA82 | No.3 relay is available                         | 0: not available<br>1: available                                   | 0                | × |
| FA83 | The sequence of starting No. 3 relay            | 1~20   | 20               | × |
| FA84 | Sleep mode                                      | 0: sleeping mode 1<br>1: sleeping mode 2                           | 0                | √ |
| FA85 | Dead Zone mode                                  | 0: ±dead zone<br>1: + dead zone                                    | 0                | √ |
| FA86 | Internal PID pressure setpoint 2(%)             | FA05~FA03  | 50.0             | √ |
| FA87 | Internal PID pressure setpoint 3(%)             | FA05~FA03  | 50.0             | √ |
| FA88 | Internal PID pressure setpoint 4 (%)            | FA05~FA03  | 50.0             | √ |
| FA89 | Pump start counter                              |  | Subject to model | Δ |

|      |  |                         |       |   |
|------|--|-------------------------|-------|---|
| FA90 | Switchover of inlet/outlet PID control               | 0: invalid<br>1: valid  | 0     | √ |
| FA91 | Inlet max pressure(%)                                | FA93~FA49               | 25.0  | √ |
| FA92 | Pressure of switich to inlet PID control(%)          | FA94~FA49               | 5.0   | √ |
| FA93 | Inlet pressure setpont(%)                            | FA94~FA91               | 10.0  | √ |
| FA94 | Inlet min pressure(%)                                | 0.0~FA93                | 0.0   | √ |
| FA95 | Inlet PID control polarity                           | 0: Positive 1: Negative | 0     | √ |
| FA96 | Level control  | 0: Invalid 1: valid     | 0     | × |
| FA98 | Inverter pump stop when a fixed pump is switched on  | 0: invalid<br>1: valid  | 1     | √ |
| FA99 | Parameter synchronizing                              | 0: invalid 1: valid     | 0     | × |
| FB00 | Pump autotuning                                      | 0: invalid 1: valid     | 0     | × |
| FB01 | Pump autotuning time step(S)                         | 0.1~5.0                 | 1.0   | √ |
| FB02 | Pump autotuning current(A)                           | 0.0~F803                | 0.0   | √ |
| FB10 | Outlet pressure setpoint of manual control(%)        | FA05~FA03               | 50.0  | √ |
| FB11 | Outlet sleep frequency of manual control(Hz)         | F112~F111               | 5.00  | √ |
| FB12 | Outlet Sleep delay time of manual control (S)        | 0.0~500.0               | 15.0  | √ |
| FB13 | Outlet wakeup pressure setpoint of manual control(%) | 0.0~FB10                | 0.0   | √ |
| FB14 | Outlet wakeup delay time of manual control(S)        | 0.0~3000.0              | 3.0   | √ |
| FB15 | Outlet max pressure of manual control(%)             | FA04~FA50               | 100.0 | √ |
| FB16 | Dry operation protection                             | 0: invalid 1: valid     | 0     | √ |
| FB17 | Dry operation pressure (%)                           | 0.0~FB23                | 0.0   | √ |
| FB18 | Dry opeation delay time(S)                           | 0.0~300.0               | 60.0  | √ |
| FB19 | Dry operation current(A)                             | 0.1~1000.0              |       |   |
| FB20 | Pipe filling installation                            | 0: invalid 1: valid     | 0     | × |
| FB21 | Pipe filling frequency(Hz)                           | 0.00~FA12               | 5.00  | √ |
| FB22 | Prefilling time (S)                                  | 0.0~300.0               | 60.0  | √ |
| FB28 | Filling timeout(min)                                 | 0.0~300.0               | 0.0   | √ |

|      |  |                           |      |   |
|------|--|---------------------------|------|---|
| FB23 | Leakage pressure detection(%)                                  | FB17~80.0<br>0.0: invalid | 5.0  | √ |
| FB24 | Leakage detecting time 1(S)                                    | 0.0~300.0                 | 5.0  | √ |
| FB25 | Leakage detecting time 2(S)                                    | 0.0~300.0                 | 5.0  | √ |
| FB26 | Leakage detecting time 3(S)                                    | 0.0~300.0                 | 3    | √ |
| FB27 | Leakage detecting cycle  | 1~10                      | 10.0 | √ |
| FB29 | Activate Manual/Auto control                                   | 0: invalid 1: valid       | 0    | √ |
| FB31 | Run time for cleaning(S)                                       | 1~3000                    | 30   | √ |
| FB32 | Stop time for cleaning(S)                                      | 1~3000                    | 30   | √ |
| FB33 | Solar filtered time for frequency limit (S)                    | 0.0~100.0                 | 3.0  | √ |
| FB34 | Solar mode enable  | 0: invalid 1: valid       | 0    | × |
| FB35 | Frequency limiting source                                      | 0: invalid 1: AI1 2: AI2  | 0    | √ |
| FB36 | Outlet feedback compensation direction                         | 0:positive 1: negative    | 0    | √ |
| FB37 | Outlet feedback compensation display(%)                        | 0.0~FA50                  | 0.0  | √ |
| FB38 | Inlet feedback compensation direction                          | 0: positive 1: negative   | 0    | √ |
| FB39 | Inlet feedback compensation display(%)                         | 0.0~FA49                  | 0.0  | √ |
| FB40 | Anti-freeze/Ant-irust function                                 | 0: invalid 1: valid       | 0    | √ |
| FB41 | Stop time for anti-freeze /anti-rust (S)                       | 1.0~3000.0                | 60.0 | √ |
| FB42 | Run time for anti-freeze /anti-rust (S)                        | 1.0~3000.0                | 60.0 | √ |
| FB43 | Well pump mode   | 0: invalid 1: valid       | 0    | × |
| FB44 | Anti-return valve installed                                    | 0: invalid 1: valid       | 0    | × |
| FB45 | Delay time for restart pump without anti-return valve (minute) | 0~99                      | 3    | √ |
| FB46 | Accelerating time for valid water supply(S)                    | 0.0~100.0                 | 0.0  | × |
| FB47 | Decelerating time for valid water supply(S)                    | 0.0~100.0                 | 0.0  | √ |
| FB48 | Anti-jam function  | 0: invalid 1: valid       | 0    | × |
| FB49 | Jam current (%)  | 100~150                   | 115  | √ |

|      |   |                      |                     |   |
|------|---|----------------------|---------------------|---|
| FB50 | Jam judgement time (S)                  | 0.1~60.0             | 10.0                | √ |
| FB51 | Delay time for anti-jam running(S)      | 0.0~30.0             | 3.0                 | √ |
| FB52 | Anti-jam running time(S)                | 1.0~30.0             | 3.0                 | √ |
| FB53 | Number of times of anti-jam attempt     | 1~10                 | 3                   | √ |
| FB54 | Max sunlight(W/m2)                      | FB55~1500            | 1500                | × |
| FB55 | Working sunlight(W/m2)                  | FB56~FB54            | 1000                | × |
| FB56 | FB56 Min sunlight(W/m2)                 | 50~FB55              | 600                 | × |
| FB57 | Alarm min sunlight (W/m2)               | 0~FB56<br>0: invalid | 0                   | × |
| FB58 | Open-circuit voltage of solar panel (V) | FB59~800             | T3:682<br>T2/S2:379 |   |
| FB59 | Max-power voltage of solar panel(V)     | 100~FB58             | T3:556<br>T2/S2:309 |   |
| FB80 | Password for pump manu                  | 0~9999               | 0                   |   |

### Torque control parameters: FC00-FC40

|       |                                     |   |       |   |
|-------|-------------------------------------|---|-------|---|
| FC00  | Speed/torque control selection      | 0: Speed control<br>1: Torque control<br>2: Terminal switchover   | 0     | √ |
| FC02  | Torque accel/decel time (S)         | 0.1~100.0   | 1.0   | √ |
| FC06  | Torque given channel                | 0: Digital given (FC09)<br>1: Analog input AI1<br>2: Analog input AI2<br>4: Pulse input channel FI<br>5: Reserved | 0     | × |
| FC07  | Torque given coefficient            | 0~3.000   | 3.000 | × |
| FC08  | Reserved                            |   |       |   |
| FC09  | Torque given command value (%)      | 0~300.0   | 100.0 | √ |
| FC14  | Offset torque given channel         | 0: Digital given (FC17)<br>1: Analog input AI1<br>2: Analog input AI2<br>4: Pulse input channel FI<br>5: Reserved | 0     | × |
| FC15  | Offset torque coefficient           | 0~0.500   | 0.500 | × |
| FC16  | Offset torque cut-off frequency (%) | 0~100.0   | 10.00 | × |
| FC17  | Offset torque command value (%)     | 0~50.0  | 10.00 | √ |
| FC18- | Reserved                            |   |       |   |

|      |                                     |   |        |   |
|------|-------------------------------------|---|--------|---|
| FC21 |                                     |   |        |   |
| FC22 | Forward speed limited channel       | 0: Digital given (FC23)<br>1: Analog input AI1<br>2: Analog input AI2<br>4: Pulse input channel FI<br>5: Reserved | 0      | × |
| FC23 | Forward speed limited (%)           | 0~100.0   | 10.00  | √ |
| FC24 | Reverse speed limited channel       | 0: Digital given (FC25)<br>1: Analog input AI1<br>2: Analog input AI2   | 0      | × |
| FC25 | Reverse speed limited (%)           | 0~100.0   | 10.0   | √ |
| FC28 | Electric torque limited channel     | 0: Digital given (FC30)<br>1: Analog input AI1<br>2: Analog input AI2<br>4: Pulse input channel FI<br>5: Reserved | 0      | × |
| FC29 | Electric torque limited coefficient | 0~3.000   | 3.000  | × |
| FC30 | Electric torque limited (%)         | 0~300.0   | 200.0  | √ |
| FC31 | Reserved                            |   |        |   |
| FC32 | Reserved                            |   |        |   |
| FC33 | Braking torque limited channel      | 0: Digital given (FC35)<br>1: Analog input AI1<br>2: Analog input AI2<br>4: Pulse input channel FI<br>5: Reserved | 0      | × |
| FC34 | Braking torque limited coefficient  | 0~3.000   | 3.000  | × |
| FC35 | Braking torque limited (%)          | 0~300.0   | 200.00 | √ |
| FC48 | Torque switchover enabled           | 0: Invalid 1: Valid   | 0      | × |
| FC49 | Current-limiting point 2 (%)        | F608~200  | 190    | √ |
| FC50 | Frequency switchover point 1(Hz)    | 1.00~FC51   | 10.00  | √ |
| FC51 | Frequency switchover point 2(Hz)    | FC50~F111   | 20.00  | √ |

### Time setting

|      |   |           |            |   |
|------|---|-----------|------------|---|
| FD00 | Running frequency / target frequency (Hz) | 2000~9999 | Local time | √ |
| FD01 | Speed with load / target speed            | 1~12      | 5          | √ |
| FD02 | Output current (A)                        | 1~31      | 15         | √ |
| FD03 | Output voltage (V)                        | 1~7       | 1          | √ |
| FD04 | PN voltage (V)                            | 0~23      | 8          | √ |

|      |                                       |                     |      |   |
|------|---------------------------------------|---------------------|------|---|
| FD05 | PID feedback value (%)                | 0~59                | 0    | √ |
| FD06 | Temperature (°C)                      | 0~59                | 0    | √ |
| FD07 | Count values                          | 0: invalid 1: valid | 0    | × |
| FD08 | Linear speed                          | 0: invalid 1: valid | 0    | × |
| FD09 | PID given value (%)                   | 0: invalid 1: valid | 0    | × |
| FD10 | Starting time 1 on appointed date     | 01.01~12.31         | 1.01 | √ |
| FD11 | Stopping time 1 on appointed date     | 01.01~12.31         | 1.01 | √ |
| FD12 | Pressure setpoint 1 on appointed date | FA05~FA03           | 0.0  | √ |
| FD13 | Starting time 2 on appointed date     | 01.01~12.31         | 1.01 | √ |
| FD14 | Stopping time 2 on appointed date     | 01.01~12.31         | 1.01 | √ |
| FD15 | Pressure setpoint 2 on appointed date | FA05~FA03           | 0.0  | √ |
| FD16 | Starting time 3 on appointed date     | 01.01~12.31         | 1.01 | √ |
| FD17 | Stopping time 3 on appointed date     | 01.01~12.31         | 1.01 | √ |
| FD18 | Pressure setpoint 3 on appointed date | FA05~FA03           | 0.0  | √ |
| FD19 | Starting time 4 on appointed date     | 01.01~12.31         | 1.01 | √ |
| FD20 | Stopping time 4 on appointed date     | 01.01~12.31         | 1.01 | √ |
| FD21 | Pressure setpoint 4 on appointed date | FA05~FA03           | 0.0  | √ |
| FD22 | Starting time 5 on appointed date     | 01.01~12.31         | 1.01 | √ |
| FD23 | Stopping time 5 on appointed date     | 01.01~12.31         | 1.01 | √ |
| FD24 | Pressure setpoint 5 on appointed date | FA05~FA03           | 0.0  | √ |
| FD25 | Starting time 6 on appointed date     | 01.01~12.31         | 1.01 | √ |
| FD26 | Stopping time 6 on appointed date     | 01.01~12.31         | 1.01 | √ |
| FD27 | Pressure setpoint 6 on appointed date | FA05~FA03           | 0.0  | √ |
| FD28 | Starting time 7 on appointed date     | 01.01~12.31         | 1.01 | √ |
| FD29 | Stopping time 7 on appointed date     | 01.01~12.31         | 1.01 | √ |
| FD30 | Pressure setpoint 7 on appointed date | FA05~FA03           | 0.0  | √ |
| FD31 | Starting time 8 on appointed date     | 01.01~12.31         | 1.01 | √ |
| FD32 | Stopping time 7 on appointed date     | 01.01~12.31         | 1.01 | √ |
| FD33 | Pressure setpoint 8 on appointed date | FA05~FA03           | 0.0  | √ |
| FD34 | Starting time 1 at weekend            | 0.00~23.59          | 0.00 | √ |

|      |                                 |            |      |   |
|------|---------------------------------|------------|------|---|
| FD35 | Stopping time 1 at weekend      | 0.00~23.59 | 0.00 | √ |
| FD36 | Pressure setpoint 1 at weekend  | FA05~FA03  | 0.0  | √ |
| FD37 | Starting time 2 at weekend      | 0.00~23.59 | 0.00 | √ |
| FD38 | Stopping time 2 at weekend      | 0.00~23.59 | 0.00 | √ |
| FD39 | Pressure setpoint 2 at weekend  | FA05~FA03  | 0.0  | √ |
| FD40 | Starting time 3 at weekend      | 0.00~23.59 | 0.00 | √ |
| FD41 | Stopping time 3 at weekend      | 0.00~23.59 | 0.00 | √ |
| FD42 | Pressure setpoint 3 at weekend  | FA05~FA03  | 0.0  | √ |
| FD43 | Starting time 4 at weekend      | 0.00~23.59 | 0.00 | √ |
| FD44 | Stopping time 4 at weekend      | 0.00~23.59 | 0.00 | √ |
| FD45 | Pressure setpoint 4 at weekend  | FA05~FA03  | 0.0  | √ |
| FD46 | Starting time 5 at weekend      | 0.00~23.59 | 0.00 | √ |
| FD47 | Stopping time 5 at weekend      | 0.00~23.59 | 0.00 | √ |
| FD48 | Pressure setpoint 5 at weekend  | FA05~FA03  | 0.0  | √ |
| FD49 | Starting time 6 at weekend      | 0.00~23.59 | 0.00 | √ |
| FD50 | Stopping time 6 at weekend      | 0.00~23.59 | 0.00 | √ |
| FD51 | Pressure setpoint 6 at weekend  | FA05~FA03  | 0.0  | √ |
| FD52 | Starting time 7 at weekend      | 0.00~23.59 | 0.00 | √ |
| FD53 | Stopping time 7 at weekend      | 0.00~23.59 | 0.00 | √ |
| FD54 | Pressure setpoint 7 at weekend  | FA05~FA03  | 0.0  | √ |
| FD55 | Starting time 8 at weekend      | 0.00~23.59 | 0.00 | √ |
| FD56 | Stopping time 8 at weekend      | 0.00~23.59 | 0.00 | √ |
| FD57 | Pressure setpoint 8 at weekend  | FA05~FA03  | 0.0  | √ |
| FD58 | Starting time 1 on everyday     | 0.00~23.59 | 0.00 | √ |
| FD59 | Stopping time 1 on everyday     | 0.00~23.59 | 0.00 | √ |
| FD60 | Pressure setpoint 1 on everyday | FA05~FA03  | 0.0  | √ |
| FD61 | Starting time 2 on everyday     | 0.00~23.59 | 0.00 | √ |
| FD62 | Stopping time 2 on everyday     | 0.00~23.59 | 0.00 | √ |
| FD63 | Pressure setpoint 2 on everyday | FA05~FA03  | 0.0  | √ |

|      |                                 |            |      |   |
|------|---------------------------------|------------|------|---|
| FD64 | Starting time 3 on everyday     | 0.00~23.59 | 0.00 | √ |
| FD65 | Stopping time 3 on everyday     | 0.00~23.59 | 0.00 | √ |
| FD66 | Pressure setpoint 3 on everyday | FA05~FA03  | 0.0  | √ |
| FD67 | Starting time 4 on everyday     | 0.00~23.59 | 0.00 | √ |
| FD68 | Stopping time 4 on everyday     | 0.00~23.59 | 0.00 | √ |
| FD69 | Pressure setpoint 4 on everyday | FA05~FA03  | 0.0  | √ |
| FD70 | Starting time 5 on everyday     | 0.00~23.59 | 0.00 | √ |
| FD71 | Stopping time 5 on everyday     | 0.00~23.59 | 0.00 | √ |
| FD72 | Pressure setpoint 5 on everyday | FA05~FA03  | 0.0  | √ |
| FD73 | Starting time 6 on everyday     | 0.00~23.59 | 0.00 | √ |
| FD74 | Stopping time 6 on everyday     | 0.00~23.59 | 0.00 | √ |
| FD75 | Pressure setpoint 6 on everyday | FA05~FA03  | 0.0  | √ |
| FD76 | Starting time 7 on everyday     | 0.00~23.59 | 0.00 | √ |
| FD77 | Stopping time 7 on everyday     | 0.00~23.59 | 0.00 | √ |
| FD78 | Pressure setpoint 7 on everyday | FA05~FA03  | 0.0  | √ |
| FD79 | Starting time 8 on everyday     | 0.00~23.59 | 0.00 | √ |
| FD80 | Stopping time 8 on everyday     | 0.00~23.59 | 0.00 | √ |
| FD81 | Pressure setpoint 8 on everyday | FA05~FA03  | 0.0  | √ |

### Parameters display:

|      |   |  |  |   |
|------|---|--|--|---|
| H000 | Running frequency / target frequency (Hz) |  |  | Δ |
| H001 | Speed with load / target speed            |  |  | Δ |
| H002 | Output current (A)                        |  |  | Δ |
| H003 | Output voltage (V)                        |  |  | Δ |
| H004 | PN voltage (V)                            |  |  | Δ |
| H005 | PID feedback value (%)                    |  |  | Δ |
| H006 | Temperature (℃)                           |  |  | Δ |
| H007 | Count values                              |  |  | Δ |
| H008 | Linear speed                              |  |  | Δ |
| H009 | PID given value (%)                       |  |  | Δ |
| H010 | Yarn length                               |  |  | Δ |
| H011 | Center frequency (Hz)                     |  |  | Δ |
| H012 | Output power                              |  |  | Δ |

|      |   |  |  |   |
|------|---|--|--|---|
| H013 | Output torque (%)                         |  |  | △ |
| H014 | Target torque (%)                         |  |  | △ |
| H015 | Encoder phase sequence adjustment         |  |  | △ |
| H016 | Reserved                                  |  |  | △ |
| H017 | Current stage speed for multi-stage speed |  |  | △ |
| H018 | Input pulse frequency (0.01KHz)           |  |  | △ |
| H019 | Feedback speed (Hz)                       |  |  | △ |
| H020 | Feedback speed (rpm)                      |  |  | △ |
| H021 | Monitoring AI1                            |  |  | △ |
| H022 | Monitoring AI2                            |  |  | △ |
| H024 | Reserved                                  |  |  | △ |
| H025 | Power-On time (h)                         |  |  | △ |
| H026 | Running time (h)                          |  |  | △ |
| H027 | Input pulse frequency (Hz)                |  |  | △ |
| H028 | Reserved                                  |  |  | △ |
| H029 | Reserved                                  |  |  | △ |
| H030 | Main frequency X (Hz)                     |  |  | △ |
| H031 | Accessorial frequency Y(Hz)               |  |  | △ |
| H032 | Communication status of master/slave      |  |  | △ |
| H035 | Slave number                              |  |  | △ |
| H036 | Accumulated power-on time(h)              |  |  | △ |
| H037 | Accumulated running time(h)               |  |  | △ |
| H038 | Low-level power consumption(kW.H)         |  |  | △ |
| H039 | High-level power consumption(MW.H)        |  |  | △ |
| H040 | Inlet pressure(%)                         |  |  | △ |

Note: × indicating that function code can only be modified in stop state.

√ indicating that function code can be modified both in stop and run state.

△ indicating that function code can only be checked in stop or run state but cannot be modified.

○ indicating that function code cannot be initialized as inverter restores manufacturer's value but can only be modified manually.

\* indicating that function code can only be modified by manufacture.

## Appendix 7 Master/slave control

### I. Overview

When several water pumps work together in the same system, two types of working patterns can be provided, one of which is traditional PID control of several water pumps based on their collected feedback pressure, the other one is the cooperative control of master drive and slave drive, which is also called master/slave control. The implement methods and characteristics are:

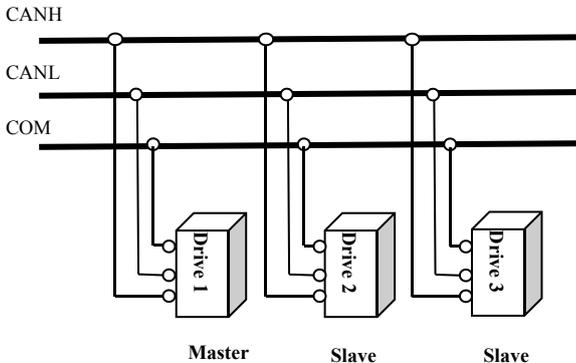
1. Master and slave drives are connected by CAN communication, the highest communication baud rate can reach 1M. Max 14 water pumps work in network.
2. Master collects pipe network pressure and proceeds on PID adjusting; automatically put into slave operation in turn when under pressure; when pressure is higher than limit, cut off the slave automatically to reach the intelligent optimum control and realize stable pipe pressure.
3. When the master water pump in the network is cut off because of failure, the new master will be selected from the rest slaves to take the control without human manual intervention.

## II. signal connection

1. CAN communication is adopted.
2. CAN communication distance

The distance is measured value in the experiment, it has some difference with actual communication distance. CAN baud rate is closely related to communication distance, lower the baud rate properly is the distance is too long. User should adjust the distance according to actual situation, and shielding cable is recommended.

3. Control cables are connected to master, master is connected to slave by communication cable.



## III. System debugging

1. Please make sure all cables are connected correctly. Set motor parameters, test control loop

and motor running when inverter runs at low frequency in V/F control mode.

2. Check motor running direction. Each motor should run separately in V/F control mode, all motor running directions should be same, if the running direction is different, please change any two phases of motor.
3. Motor parameter study: Before setting master/slave control mode, set motor parameter correctly to study each motor parameters separately.
4. Action logic: Master collects pipe network pressure and proceeds on PID adjusting, if master accelerates to max frequency delay time FA31 but lack of the pressure, master continues running and start one slave to run at same time; if still lack of the pressure, run another slave. When master and slave run together, if the pressure is too large, master decelerates to min frequency; if the pressure is still too large after delay time FA32, cut off slave; if cutting off all slaves, only one master runs in min frequency and the pressure still too large after delay time FA10, the master stops freely and enters dormancy status, “nP” is displayed on inverter.
5. Master/slave logic: If master offline or fails over 1s, system will select master from the rest slaves automatically.
6. All inverters in use need to set different local address by F900.

#### IV. Parameters setting

##### Master:

| Function code | Definition                               | Setting range  | Setting value | Remarks     |
|---------------|--|--|---------------|-------------|
| F203          | Main frequency source X                  | 0: Digital setting memory;<br>1: External analog AI1;<br>2: External analog AI2;<br>3: Pulse input given;<br>4: Stage speed control;<br>5: Digital given no memory;<br>6~8: Reserved<br>9: PID adjusting<br>10: Modbus | 9             | Must be     |
| F900          | Communication Address                    | 1~255: single inverter address<br>0: broadcast address   | 1             | Must be     |
| F911          | Master-slave control enabled             | 0:Disabled 1:Enabled   | 1             | Must be     |
| F912          | Master and slave selection               | 0:Master 1:Slave   | 0             | Must be     |
| F913          | Running command of slave                 | 0:Slave not following running commands of master<br>1:Slave following running commands of master<br>2: Slave water supply mode   | 2             | Recommended |
| F915          | Slave action when master stops           | 0: continue running<br>1: Free stop<br>2: Deceleration to stop   | 0             | Recommended |
| F916          | Slave action when master stops           | 1: Free stop<br>2: Deceleration to stop  | 1             | Recommended |
| F917          | Slave following master command selection | 0: given torque(torque)<br>1: given frequency 1(Droop)   | 3             | Must be     |

|      |   |  |      |                           |
|------|---|--|------|---------------------------|
|      |   | 2: given frequency 2 (Droop)<br>3: slave synchronize in water supply mode  |      |                           |
| F924 | Time of communication timeout (S)                 | 0.0~3000.0   | 1.0  | Recommended               |
| F927 | Master action when put into slave                 | 0: Stop<br>1: Remain running   | 1    | Recommended               |
| FA00 | Water supply mode                                 | 0: Single pump (PID control mode)<br>1: Fixed mode<br>2: Timing interchanging  | 0    | Must be                   |
| FA02 | PID adjusting feedback given source               | 1: AI1 2: AI2<br>3: FI (pulse frequency input)<br>4: reserved<br>5: Running current<br>6: Output power<br>7: Output torque | 2    | Based on actual situation |
| FA04 | Digital setting value of PID adjusting (%)        | FA05~FA03  | 50.0 | Based on actual situation |
| FA29 | PID dead time (%)                                 | 0.0~10.0   | 2.0  | Based on actual situation |
| FA30 | Running Interval of restarting converter pump (S) | 2.0~999.9s   | 20.0 | Recommended               |
| FA31 | Delay time of starting general pumps (S)          | 0.1~999.9s   | 30.0 | Recommended               |
| FA32 | Delay time of stopping general pumps (S)          | 0.1~999.9s   | 30.0 | Recommended               |

**Slave:**

| Function code | Definition                   | Setting range  | Setting value | Remarks                   |
|---------------|------------------------------|--|---------------|---------------------------|
| F203          | Main frequency source X      | 0: Digital setting memory;<br>1: External analog AI1;<br>2: External analog AI2;<br>3: Pulse input given;<br>4: Stage speed control;<br>5: Digital given no memory;<br>6~8: Reserved<br>9: PID adjusting<br>10: Modbus | 9             | Must be                   |
| F900          | Communication Address        | 1~255: single inverter address<br>0: broadcast address   | 2             | Based on actual situation |
| F911          | Master-slave control enabled | 0: Disabled 1: Enabled   | 1             | Must be                   |
| F912          | Master and slave selection   | 0: Master 1: Slave   | 1             | Must be                   |
| F913          | Running command of slave     | 0: Slave not following running commands of master<br>1: Slave following running commands of master<br>2: Slave water supply mode   | 2             | Recommended               |

|      |   |   |      |                           |
|------|---|---|------|---------------------------|
| F915 | Slave action when master stops                    | 0: continue running<br>1: Free stop<br>2: Deceleration to stop  | 0    | Recommended               |
| F916 | Slave action when master stops                    | 1: Free stop<br>2: Deceleration to stop   | 1    | Recommended               |
| F917 | Slave following master command selection          | 0: given torque(torque)<br>1: given frequency 1(Droop)<br>2: given frequency 2 (Droop)<br>3: slave synchronize in water supply mode | 3    | Must be                   |
| F924 | Time of communication timeout (S)                 | 0.0~3000.0  | 1.0  | Recommended               |
| F927 | Master action when put into slave                 | 0: Stop<br>1: Remain running  | 1    | Recommended               |
| FA00 | Water supply mode                                 | 0: Single pump (PID control mode)<br>1: Fixed mode<br>2: Timing interchanging   | 0    | Must be                   |
| FA02 | PID adjusting feedback given source               | 1: AI1 2: AI2<br>3: FI (pulse frequency input)<br>4: reserved<br>5: Running current<br>6: Output power<br>7: Output torque          | 1    | Based on actual situation |
| FA04 | Digital setting value of PID adjusting (%)        | FA05~FA03   | 50.0 | Based on actual situation |
| FA30 | Running Interval of restarting converter pump (S) | 2.0~999.9s  | 20.0 | Recommended               |
| FA31 | Delay time of starting general pumps (S)          | 0.1~999.9s  | 30.0 | Recommended               |
| FA32 | Delay time of stopping general pumps (S)          | 0.1~999.9s  | 30.0 | Recommended               |

Note: user must set the parameters based on above table when the remarks are “must be”.

## V. Remarks

1. If baud rate must be decreased because of equipment distance, the time interval of master sending command must be extended.
2. Direction of master and slave must be same.

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