



# SVD-E

## User Manual

High Performance /Low-Noise Micro -Type AC Motor Drives



SVD-E Series Compact Inverter

## User Manual

**Version Code: SVD-E-V3.0**

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## Important Safety Information

Read this instruction manual thoroughly before installation, operation, maintenance or inspection of the frequency inverters.

In this manual, safe operation are classified as "WARNING" or "CAUTION".

### WARNING

Indicate a potentially dangerous situation which, if not avoided, could result in death or serious injury to personnel.

### CAUTION

Indicate a potentially dangerous situation which, if not avoided, could result in minor or moderate injury and damage to equipment. It may also be used for warning against unsafe practices.

Even items described as ( CAUTION) may result in a vital accident in some situations. Please follow these important notes:

### NOTE

These are steps to be taken to ensure proper operation.

### Before Installation

### WARNING

Do not install or operate any frequency inverter that is damaged or has missing parts.

Choose the motor of insulation class B or above. Otherwise it may cause an electrical shock.

## Installation

### WARNING

Install the frequency inverter on nonflammable material like metal. Otherwise it may cause a fire.

Make sure that the mounting environment away from metal dust.

Otherwise it may cause damage to the frequency inverter.

### CAUTION

When mount over two inverters in the same cabinet or enclosure, install a fan or other cooling device to keep the temperature inside below 40 °C

Do not let the conductor head or screws fall into the inside of the inverter.

Otherwise it may cause damage to the inverter.

## Wiring

### WARNING

Ensure only qualified personnel to operate. Otherwise it can cause an electrical shock.

Make sure the inverter is isolated from power supply by the circuit breaker.

Otherwise it may cause a fire.

Verify that the power supply is turned OFF before start wiring.

Otherwise it may cause an electrical shock or fire.

Make sure that the round terminal is grounded correctly.

Otherwise it may cause an electrical shock.

 CAUTION

Never connect the AC power supply to output terminals U,V and W. Otherwise the inverter will be damaged and the guarantee is invalid.

Make sure that wiring conform to EMC requirements and local power safe standard. Make sure to use right wire according to this instruction manual. Otherwise it may cause an accident

Braking resistor or braking unit cannot be directly connected to DC bus terminals. Otherwise it may cause a fire.

**Before Turn on the AC Power Supply**

 WARNING

Make sure that the voltage of inverter conforms to the local power supply voltage. Verify that the wiring of input and output is correct and there is no short-circuit in peripheral circuit. Tighten the terminal screws. Otherwise these may cause damage to the inverter.

Turn on the input AC power only after the front cover is put correctly. Otherwise it may cause an electrical shock.

 CAUTION

Never perform a hi-pot or withstand voltage test of the inverter.

Otherwise it may cause damage to the inverter.

Make sure that the optional parts are connected correctly.

Otherwise it may cause damage to the inverter.

## When the Power is On

### WARNING

Do not open or remove the front cover when operation. Otherwise it may cause an electrical shock.

Never touch the inverter and optional parts by wet hands. Never touch the connection terminals. Otherwise it may cause an electrical shock.

When the power is on the inverter will automatically check the power supply circuit. Do not touch U,V,W terminals and motor connection terminals. Otherwise it may cause an electrical shock.

### CAUTION

It is dangerous for the personnel to approach the motor and load during rotation of the motor. Do not change the factory parameters or settings unnecessarily.

Otherwise it may cause a damage or injury.

## Operation

### WARNING

When select the function of restart ,do not approach the mechanical load.

Otherwise it may cause an injury if it restarts suddenly.

Do not touch the heat sink or discharging resistor. Otherwise it may cause harmful burns to the body.

Never change or check signals if not a profession or qualified personnel.

Otherwise it may cause damage and injury.

## CAUTION

Make sure nothing fall into the mechanical load or inverter.

Otherwise it may cause damage.

Start or stop inverter by corresponding buttons only. Otherwise it may cause damage.

## Maintenance

### WARNING

After the main circuit power supply is OFF, make sure the charge LED is OFF when maintain or inspect. Never maintain or inspect the inverter and mechanical load when the power supply is still ON. Otherwise it may cause damage and injury.

Only qualified or authorized professional personnel can maintain, replace and inspect the inverter. Otherwise it may cause damage and injury.

## Notes for Other Important Operations

### CAUTION

#### 1. Check Insulation of the Motor

Check insulation of the motor and wire when the motor is used again after long time idle or for the first time. Disconnect the wire between the motor and the inverter before check insulation. Make sure the insulation resistor is not below  $5M\Omega$ .

#### 2. Thermal Overload Protection of the Motor

When the rated capacity of inverter is larger than that of the motor, install thermal overload relay for the motor or regulate the motor protection parameters of the Inverter

### **3. Consider the Bearing Capability of the Load**

The Inverter can provide output frequency from 0 Hz to 650Hz. If the motor needs to work over 50Hz , user should consider the bearing capability of the load.

### **4. Avoid Mechanical Resonance Frequency**

Regulate the skip frequency parameter of the inverter to avoid mechanical resonance frequency of the load.

### **5. Prohibition of Installation of Phase Advancing Capacitor**

If a phase advancing capacitor or surge suppressor is connected in order to improve the power factor, it may become overheated and damaged by inverter high harmonic components. Also, the inverter may malfunction because of over current.

### **6. Installation of Magnetic Contactor**

If a magnetic contactor is installed at the power supply side, do not use it to control the start of the inverter. If necessary the time span should be one hour or above. Otherwise frequent switching may cause the inverter to malfunction.

If a magnetic contactor is installed between the output terminals and motor (output side of the inverter) make sure there is no output of inverter before switch on and off. Otherwise it may cause damage to the inverter.

### **7.Allowable Voltage Range and Power Supply Phase**

Make sure the inverter works under allowable voltage range. If necessary, use

boosting transformer or step-down transformer to change the voltage of power supply. Never change the 3 phase of Inverter into 2-phase. Otherwise it **will** cause damage to the inverter.

## **8.Thunder Stroke Protection**

Even there is protection device to protect the inverter induction thunder stroke , it's necessary for users in frequent thunder stroke area to install other protective device.

## **9. Altitude and Degradation Use**

At an altitude of 1000m or above, it could be better that use the motor with lower rated capacity. Otherwise the inverter may become overheated because of rare air. For example, in order to control the motor of 4kw rated capacity, it could be better to use 5.5kw inverter.

## **10. Dispose of Scrap Inverter**

The scrap capacitor of main circuit and PCB (printed-circuit board) may explode when it is burned. In order to protect the environment, do not burn waste plastic parts and scrap capacitor.

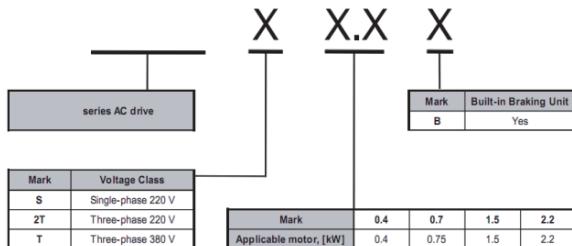
## **11. Choose the Right Matching Inverter for the Motor**

The standard matching motor is 4-pole inductive motor. If not, choose the right matching inverter according to the rated current of the motor.

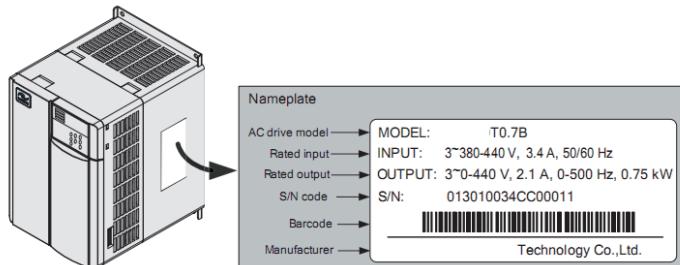
According to the actual working situation of the motor, the factory setting of motor standard parameter can be revised. Otherwise it may cause low efficiency to the unit.

# Chapter 1 Select the Right Model

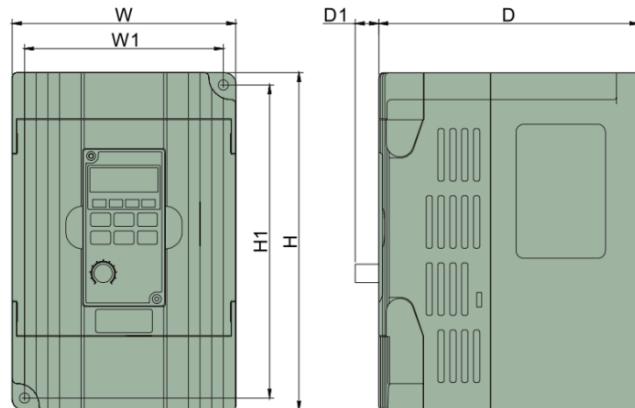
## 1.1 Description of Model



## 1.2 Description of Nameplate



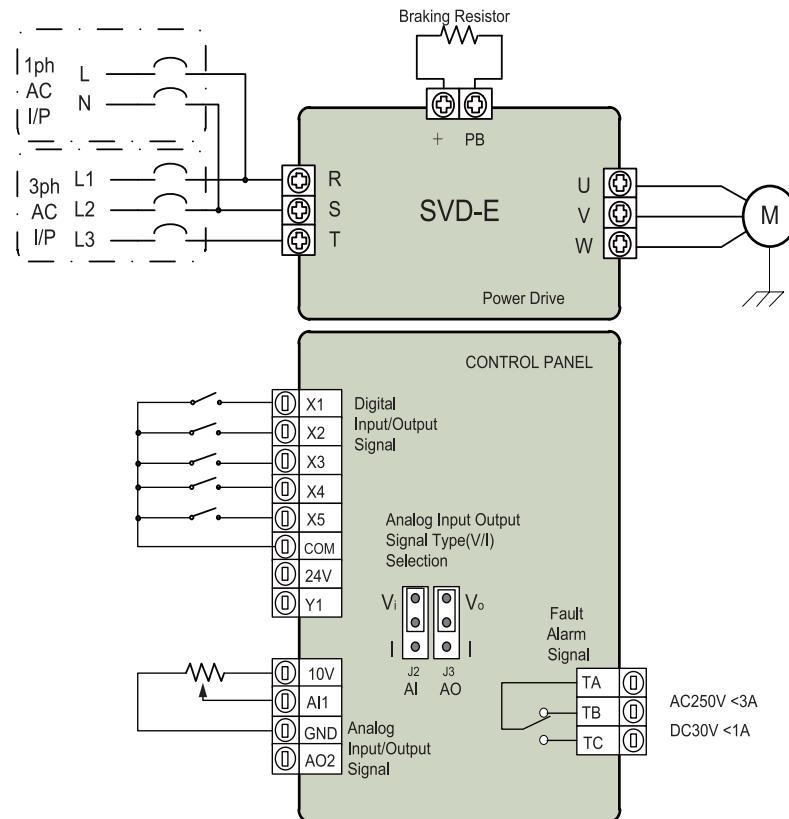
### 1.3 Dimensions of Inverter



Model	Dimensions (mm)						Hole diameter
	W	W1	H	H1	D	D1	
SVD-E	100	89	151	140	117	12	Ø 5

## Chapter 2 Wiring

### 2.1 Standard Wiring Diagram of 3-phase Inverter380V



Note:

1. ◎refers 10 main circuit terminals. ◇ refers to control-circuit terminals.
2. For 220V single phase input inverter, the terminals of main circuit are R and S.

## 2.2 Descriptions of Terminals.

### 2.2.1 Main Circuit Terminals

Terminals	Descriptions
R,S and T	AC power input terminals. 3-phase: R,S and T Single phase: R and S
U,V and W	AC power input terminals (used to connect motor)
(+)	DC bus terminal of positive pole.
PB	Spare terminals for connecting brake resistor outside
G	Grounding terminal

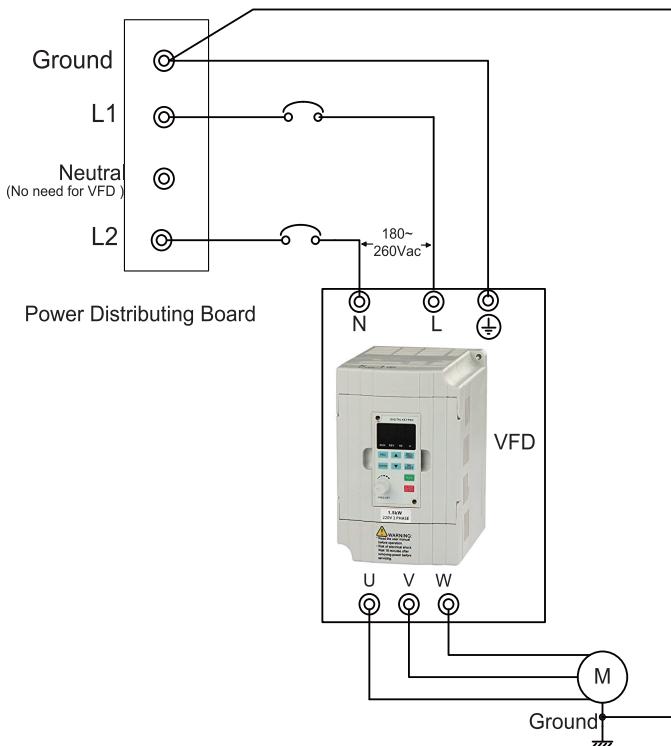
### 2.2.2 Control Circuit Terminals

Terminals	Functions	Descriptions
TA/TB/TC	Programmable relay output	TA-TB: normal open. TB-TC: normal close Contact capacity: AC 250v/3A/normal open AC 250v/3A/normal close
X1-X5	Digital input Terminals	Power is on when connected to GND terminal. Action current is 10mA.
GND	Analog grounding terminal	Zero potential of +10v and +24v
AI1	Analog input terminal	Input voltage: DC 0-10v (impedance: 20kΩ)
10V	Analog reference voltage	10v ± 5%, maxi. Current: 20mA
Y1	Analog output terminal	Default: 0-10v. (4-20mA is possible by choose the right jumper)
AO1	Programmable open collector terminal	Maxi. Current: 50mA. Maxi. Voltage: 48v.
+24V	+24v power supply terminal	Maxi. Output current: 200mA. Generally used as power supply of digital terminals and outside sensor

### 2.2.3 RS485 Interface

Terminal Marking	Function	Remark
RS485+	Positive pole of RS485 differential BUS	Standard RS485 Interface
RS485-	Negative pole of RS485 differential BUS	Standard RS485 Interface

## 2.2.4 Input and output Wiring



Wiring in US Residential Power System

The VFD product take 220Vac input, with wide range of 180~260Vac, converses to 3phases 220V output for driving 3phase 200/220V Motor. In US residential mains supply system , you can have 240V with L1, L2 , means that you just need connect input of the VFD, marked with L, N and Ground on the top of the VFD, with L1, L2 and Earth Ground of power distributing board respectively, Neutral is not needed. The motor grounding is recommended to connect directly to grounding terminal on Power distributing board.

## Chapter 3 Operation

### 3.1 Keypad Description

#### 3.1.1 Keypad Schematic Diagram



#### 3.1.2 Key Function Description

Symbol	Key Name	Function Description
PRGM	Program/ Exit key	Enter or exit of menu parameter modification
ENT	Data enter key	Progressively enter menu and confirm parameter.
▲	UP increase key	Progressively increase data or function codes
▼	DOWN decrease key	Progressively decrease data or function codes
►►	Shift key	Use it to select displayed parameters cyclically during running or stop status. In parameter setting mode, press this key to select the bit to be modified
RUN	Run	Start the AC drive in the keypad operation mode

STOP/ RESET	Stop/reset	Stop the AC drive when it is in running state and perform the reset operation when it is in the faulty state. The function of this key are restricted by P1.22.
REV/ JOG	Multifunction	Perform function Switchover (such as Switchover of command source or direction) according to the setting of p1.21.

### 3.1.3 Indicator Light Description

Indicator Light Name	Description
RUN	Light on: inverter running status
REV	It indicates forward or reverse rotation. OFF indicates forward rotation and ON indicates reverse rotation.
Hz	Light of frequency
A	Light of current

## 3.2 Operation Process

### 3.2.1 Function Code Setting Guide

The function code a group of programmable parameter controlling the behavior of the VFD, for well adapting to diversified application requirement. Setting of function code can be implement by

- A. operation of keypad on the control panel
- B. MODBUS communication . Here is a guidance to use control panel to set the function code.

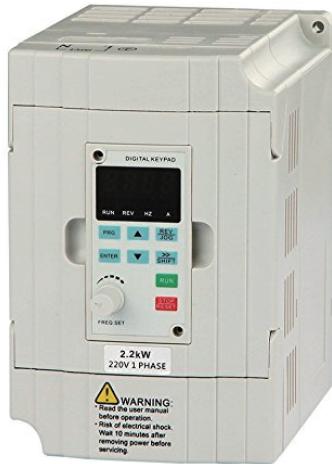


Fig.1 Control Panel Keypad

Some function code can be set under running and stop status, some are invisible under running status, but recommend to set the function code after power up and stop status.

The function code is organize in 3 level hierarchical menu, press PRG button on the control panel can enter the function code setting mode. The first level is index and entrance of function code group, there are P0, P1.. PC , 13 groups of function code, the second level is the function code index, the third level is the value of the function code. Fig. 2& 32 flowchart diagram show transition of function code menu level in response to button operation.

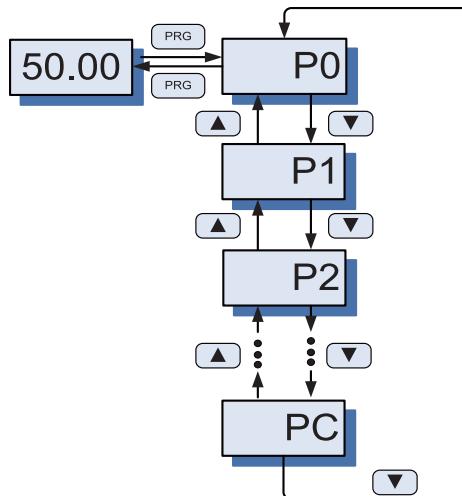
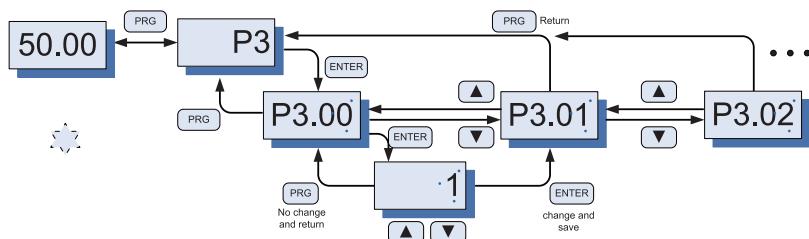


Fig. 2 Browsing function codes menu of the same level



Button on Control Panel, single press

[PRG] Use to enter or exit Program function code mode or return from low level to higher level function code menu

[ENTER] Use to confirm select function code or save set value for function code

[▼] Use to browse function code of same level or change the function code value

[▲] Change digit of value

Fig.2 Flowchart of Setting a function code

Example , set max output frequency to 400Hz

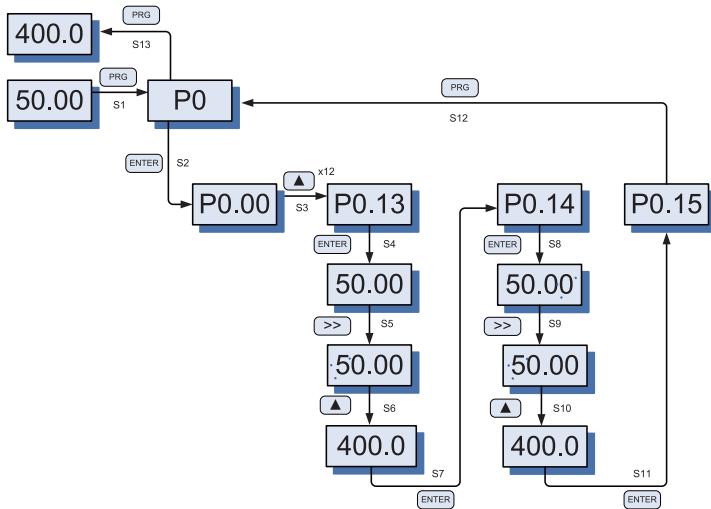


Fig.3 Flow chart to set output frequency to 400Hz

To set max output frequency to 400Hz from default 50Hz, need change the function code both P0.13, and P0.14 to 400Hz . The procedure, refer to Fig.3

The setting must be done under VFD stop state, the LED display 50.00Hz flicking .

Step1 : Marked with S1, Press PRG button to enter function code setting mode, browse with **▲** Or **▼** button , find index of function code group P0 .

Step2 : Press ENTER button to select function code group P0 setting, will see function code index P0.xx

Step3: Browse by pressing **▲** Or **▼** button , find function code group P0.13

Step4: Press ENTER button to set the value of function code P0.13, will see default value 50.00

Step5: Press **>>** (Shift) button to change the digit to revise, will see flicking digit change

Step6: Press **▲** button , the value will increase , stop the expected value, 400

Step7: Press ENTER button , the new value of 400 has been save to function code P0.13, and the function code index will automatically move to P0.14,

Similar to Step4~step 7 change value of function code P0.14 from 50 to 400 In step step8~step11:

Step8: Press ENTER button to set the value of function code P0.13, will see default value 50.00

Step9: Press **>>** (Shift) button to change the digit to revise, will see flicking digit change

Step10: Press **▲** button , the value will increase , stop the expected value, 400

Step11: Press ENTER button , the new value of 400 has been save to function code P0.14, and the function code index will automatically move to P0.15.

Step12: Because no change to P0.15, press PRG button to upper level menu, will function code group index, P0,

Step13: Press PRG button once more, exit function code setting mode, will see, the target frequency show one the LED has been changed from 50.00Hz to 400.0HZ

### 3.2.2 Typical application guide

#### 3.2.2.1 Simple switch control

You may control the VFD to drive the motor forward/reverse/stop running via remote switch(s) by following steps:

Step 1. Find the control terminal by opening button cover



Fig.1 Find control input terminal X1,X2...X5 & COM under the bottom cover.

## Step2. Wiring

Recommend to connect the 2 normal open(N.O.)button switch to the control terminals as follow

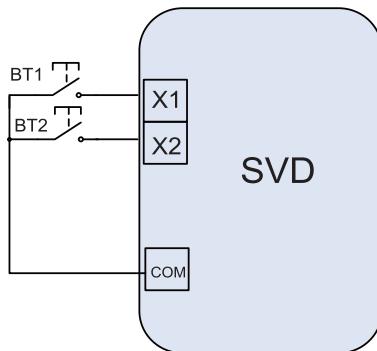


Fig.2 Wiring Diagram

If Reverse run not needed, Button 2 could be omitted.

## Step 3. Set the function code as follow:

### 3.1. Select control source

P0.02=1 to select control terminals as running instruction source .

### 3.2. Define control terminal logic

P3.01 = 1 X1 used as Forward run control terminal

P3.02 = 2 X2 used as Reverse run control terminal

these value have been set as default, just check and revise if necessary

3.3. Select operating mode  
P3.07 = 0 2-line control mode #1

this value have been set as default, just check and revise if necessary

Below logic you can achieve by above wiring and setting

	X1 Button 1 (N.O.)	X2 Button 2 (N.O.)	Status
	Open	Open	STOP
	Close	Open	Forward Run
	Open	Close	Reverse Run
	Close	Close	STOP

Tab.1 Control logic

More complete control logic can be implemented by three line control , see 3 line control setting guide for detail.

### 3.2.2.2 Line control Mode 1 guide

#### **3-line-Control Mode 1 Setting Guide**

A typical application scenario is to use of 3 switches to control the motor rotating

A #1 momentary button switch (N.C.)is used to start run

A #2 switch is used to control rotation direction

A #3 momentary button switch(N.C.) is used to stop running

Step 1. Find the control terminal by opening button cover

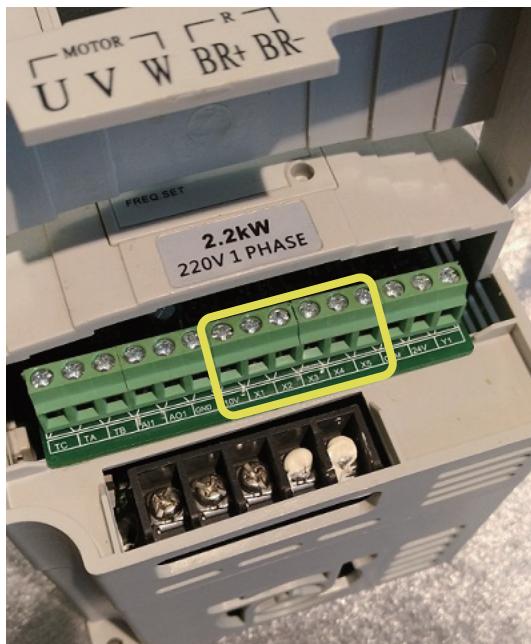


Fig.1 Find control input terminal X1,X2...X5 & COM under the bottom cover

Step 2. Wiring

Recommend connect the 3 momentary buttons/switch to the control terminals as follow:

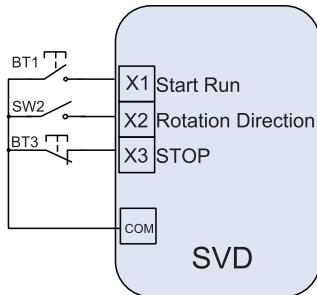


Fig.2 Wiring Diagram

Step 3. Set the function codes as follow:

### 3.1 Select control source

P0.02=1 to select control terminals as running instruction source .

### 3.2 Define control terminal function

P3.01 = 1 X1 used as Start terminal of 3 -line control mode #1

P3.02 = 2 X2 used as Direction terminal of 3 -line control mode #1

P3.03 = 3 X3 used as Stop terminal of 3-line-control

### 3. 3 Select operating mode

P3.07 = 2 (Three-line control mode #1)

then you can have below logic table:

X2 SW2 status	X1 Button #1 (N.O.) status	X3 Button #3 (N.C.) status	Motor Status
Open	Push Trigger 	Close	STARTForward Run
	Any Status	Open	STOP Forward Run
Close	Push Trigger 	Close	START Reverse Run
	Any Status	Open	STOP Reverse Run

The motor running direction can be change during running, when the rotation direction switch is toggle during running, the VFD output frequency/motor speed will ramp down to 0 Hz/RPM , stop for 3s and then ramp up output frequency / motor RPM to setting destination .

Simple switch control logic can be implemented by 2 line control mode, see simple switch control setting guide for detail

### 3.2.2.3 Line control Mode 2 guide

#### **3-line-Control Mode 2 Setting Guide**

A typical application scenario is to use of 3 switches to control the motor rotating.

A #1 momentary button switch is used to control start forward run

A #2 momentary button switch is used to control start reverse run

A #3 button switch is used to stop running

Step 1. Find the control terminal by opening button cover



Fig.1 Find control input terminal X1,X2...X5 & COM under the bottom cover

## Step 2. Wiring

Recommend connect the 3 momentary button switch to the control terminals as follow:

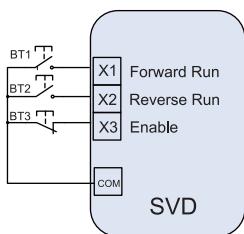


Fig.2 Wiring Diagram

Step 3. Set the function codes as follow:

### 3.1 Select control source

P0.02=1 to select control terminals as running instruction source .

### 3.2 Define control terminal function

P3.01 = 1 X1 used as Forward run start terminal

P3.02 = 2 X2 used as Reverse run start terminal

P3.03 = 3 X3 used as Stop terminal of 3-line-control operating mode

### 3. Select operating mode

P3.07 = 3 (Three-line control mode #2)

then you can have below logic table:

X1 Button 1 (N.O.) status	X2 Button 2 (N.O.) status	X3 Button 3 (N.C.) status	Motor Status
X	X	OPEN	STOP
Push Trigger	Open 	Close	Start Forward Run
Open	Push Trigger	Close 	Start Reverse Run

If Reverse run not needed, Button 2 could be omitted.

Simple switch control logic can be implemented by 2 line control mode , see simple switch control setting guide for detail

### 3.2.2.4 Spindle motor control setting guide

The VFD set default to drive low frequency (50/60Hz) 3phase asynchronous motor, a typical spindle motor run at high speed of more than 20,000 rpms, has also wide different electrical characteristics and parameter, the VFD parameter should be re-programmed accordingly to drive the spindle motor well, please following below procedure to set the VFD parameter for driving the spindle motor.

#### **Step 1: Confirm spindle motor parameter.**

You can find spindle motor parameter on the motor body or datasheet from supplier. A typical spindle motor parameter shown as fig.1



Fig. 1 Parameter of the Motor

From which you can have:

- a. Rated Power :
- b. Rated Current :
- c. Rated Speed
- d. Rated Operating frequency

### **Step 2:Select a Spindle motor Drive**

Rate Voltage: the VFD rated output voltage should be same as motor's

Recommend to select VFD of same or higher rated power , higher power capacity VFD has more operating margin and better stability.

Smaller VFD drive can be use only you know very well loading (rotating resistant) of the motor is much smaller than the rated of the Motor and VFD.

### **Step3:Reset factory default (optional)**

If you have made some in-successful trial of setting , please reset the VFD to factory default setting by Set P1.29 to 1 one time, not need for a brand new product you just receive.

### **Step4: Input the Motor Parameter into PB group function code**

- a) PB.02 => Rated Power of the Spindle Motor eg. 0.8
- b) PB.03 => Rated Frequency of the spindle Motor eg. 400Hz
- c) PB.04 => Rated Speed of the spindle Motor eg. 24000 RPM

Please note: The LED display has 4 digit: using >>/SHIFT button to move the cursor to the second digit , and long press the upward button, the number will keep increasing to 9900 and show a decimal point at the end of the display, don't release until showing 2400. Means you have successfully into the rated speed 24000RPM input the VFD.



Fig.2 Step to set the Rate. Speed in PB.04

- d) PB.05 => Rated voltage of the spindle Motor
- e) PB.06 => Rated current of the spindle Motor

**Step 5: Carry out a parameter auto tuning**

Under no loading situation , carry out a

- a) PB.00 => 2
- b) Press run , when finish, the display show END

**Step 6: Set output frequency of the VFD**

- a) P0.13 => Output frequency setting eg. 400 Hz
- b) P0.14 => Output frequency upper limit eg. 400 Hz

After finish setting , Press PRG to exit function code setting mode , return to standby mode, the Display will present 400, and keep flashing.



Fig.3 The VFD is standby and showing preset frequency 400Hz

**Step 7:** Then you can press "RUN" to start running ,



Fig.4 Working Status

Now it works!

### 3.2.2.5 Vector control setting guide

Vector Control mode (P0.00=0) is very sensitive to motor parameter sensitive, please follow below step to review your setting:

**Step 1.** Reset factory setting P1.29= 1 once.

**Step 2.** Set control mode to vector control P0.00 =0

**Step 3.** Input Motor parameter, with refer to parameter on name plate of your motor.

PB.02 = ? Motor rated power (1 hp = 000.7 KW)

PB.03 =??? Hz (Motor rated frequency)

PB.04 = ??? RPMs (Motor rated speed)

PB.05 = 220V (Motor rated voltage)

PB.06 = ? A (Motor rated current)

**Step 4.** carry out a parameter self-tuning.

If the motor can un-couple with the mechanical motion system to drive ,

please select parameter comprehensive self-tuning, PB.00=1

If the motor has be mounted with the mechanical motion system ,

select statics self-tuning . PB.00 =2

After finish self-tuning , you can use the VFD and motor.

## Chapter 4 Function Code Table

If P1-31 is set to a non-zero number, parameter protection is enabled. You must enter the correct user password to enter the menu.

To cancel the password protection function, enter with password and set P1-31 to 0.

The symbols in the function code table are described as follows:

“○”: The parameter can be modified when the AC drive is in either stop or running state.

“◎”: The parameter cannot be modified when the AC drive is in the running state.

“●”: The parameter is the actually measure selected value and cannot be modified.

Function Code	Function	Descriptions	Default	Property	No
<b>Group F0: Standard Function Parameters</b>					
P0.00	Motor control mode	0:Sensorless vector control (SFVC) 1:(V/F) control	1	◎	0

P0.01	Main frequency source selection 1	0:Keyboard Digital setting 1:Analog AI1 setting 2:Analog AI2 setting 3:AI1+AI2 setting 4:compare AI1 with AI2 and output the bigger one 5:Multi-speed operation setting 6:PID control setting 7:Remote communication setting 8:Panel potentiometer setting	8	○	1
P0.02	Command source	0:Operation panel control(LED off) 1:Terminal control (LED blinking ) 2:Communication instruction control channel (LED on)	0	◎	2
P0.03	Keyboard set frequency	0.00Hz to P0.13 (maximum output frequency)	50	○	3
P0.04	Acceleration time 1	0-3600s 0-3600s	Model dependent	○	4
P0.05	Deceleration time 1	0-3600s	Model dependent	○	5
P0.06	Carrier frequency	1.5-15kHz	Model dependent	○	6
P0.07	V/F curve setting	0:Linear V/F 1:Square V/F 2:1.3-power V/F 3:1.7-power V/F 4:Multi- V/F setting	0	◎	7
P0.08	Torque boost	0.0% (auto) 0.1%-30.0%	2.0%	○	8
P0.09	Torque boost Cut-off frequency	0.0%-50.0% (relative to rated frequency of motor)	50.0%	◎	9

P0.10	V/F slip compensation gain	0.0%-200.0%	0.0%	○	10
P0.11	Rotation direction	0: Same direction 1: Reverse direction 2: Reverse prohibited	0	◎	11
P0.12	Forward/Reverse rotation dead-zone time	0.0-3600.0s	1.0	○	
P0.13	Maximum frequency	10.00-650.00Hz	50	◎	13
P0.14	Preset frequency upper limit	Frequency lower limit (P0.15) to maximum frequency (P0.13)	50	○	14
P0.15	Preset frequency lower limit	0.00 Hz to frequency upper limit (P0.14)	0	○	15
P0.16	Main frequency source selection 2	0:Keyboard setting 1:Analog AI1 setting 2:NA 3:NA 4:NA 5:Multi-speed operation setting 6:PID control setting 7:Remote Communication setting 8:Panel potentiometer setting	0	○	16
P0.17	Command source channel 2	0:Keyboard command channel (LED off) 1:Terminal command channel (LED blinking ) 2:Communication command channel (LED on)	0	◎	17
P0.18	V/F frequency point 1	0.00Hz-P0.20	0	◎	18
P0.19	V/F voltage point 1	0-100%	0%	◎	19
P0.20	V/F frequency point 2	P0.18-P0.22	0	◎	20
P0.21	V/F voltage point 2	0-100%	0%	◎	21

P0.22	V/F frequency point 3	P0.20- to rated motor frequency	0	◎	22
P0.23	V/F voltage point 3	0-100%	0%	◎	23
Group P1: Auxiliary Functions					
P1.00	AVR function selection	0:Disable 1:Fully Enable 2:Enable only during deceleration	1	○	25
P1.01	Reserved				26
P1.02	Heatsink temperature	0-100 °C	Model dependent	●	27
P1.03	Temperature of Inverter module	0-100 °C	Model dependent	●	28
P1.04	JOG running frequency	0.00 Hz to P0.13(maximum frequency)	5	○	29
P1.05	JOG acceleration time	0.1-3600.0s	Model dependent	○	30
P1.06	JOG deceleration time	0.1-3600.0s	Model dependent	○	31
P1.07	Acceleration time 2	0-3600s	Model dependent	○	32
P1.08	Deceleration time 2	0-3600s	Model dependent	○	33
P1.09	Acceleration time 3	0-3600s	Model dependent	○	34
P1.10	Deceleration time 3	0-3600s	Model dependent	○	35
P1.11	Acceleration time 4	0-3600s	Model dependent	○	36
P1.12	Deceleration	0-3600s	Model dependent	○	37

P1.13	Acceleration time 5	0-3600s	Model dependent	○	38
P1.14	Deceleration time 5	0-3600s	Model dependent	○	39
P1.15	Acceleration time 6	0-3600s	Model dependent	○	40
P1.16	Deceleration time 6	0-3600s	Model dependent	○	41
P1.17	Acceleration time 7	0-3600s	Model dependent	○	42
P1.18	Deceleration time 7	0-3600s	Model dependent	○	43
P1.19	Acceleration time 8	0-3600s	Model dependent	○	44
P1.20	Deceleration time 8	0-3600s	Model dependent	○	45
P1.21	REV/JOG Key function selection	0:JOG 1:Reverse 2:Clear UP/DOWN settings	1	◎	45
P1.22	STOP/RESET key function	0:Only active to panel control 1:Valid for both panel control and terminal control 2:Valid for both panel control and communication control 3:Valid for all control modes	0	◎	47
P1.23	Keyboard and terminal UP/DOWN setting	0: Valid, and the Inverter power failure with data storage 1: Valid, and the Inverter power failure without data storage 2:UP/DOWN setting is invalid	0	○	48

P1.24	Selection double words of parameter displayed on LED panel in run mode	0000—FFFF ( In hexadecimal) Bit00: Running frequency (Hz) Bit01: Set frequency (Hz) Bit02: Bus voltage (V) Bit03: Output voltage (V) Bit04: Output current (A) Bit05: Running speed Bit06: Output power (kW) Bit07: Output torque (%) Bit08:PID setting value Bit09:PID feedback value Bit010:Input terminal status Bit011:Output terminal status Bit012:Analog AI1 value Bit013:NA Bit014:Current stage of Multi-speed Bit015:Torque set value	00FF	○	49
P1.25	LED display running parameters 2	0~FFFF BIT0: Reserved BIT1: Reserved BIT2~ BIT15:Reserved	0000	○	50
P1.26	Selection double words of parameter displayed on LED panel in stop mode	1~1FFF( In hexadecimal) BIT0: Set frequency (Hz) BIT1: Bus voltage (V) BIT2: DI input status BIT3: DO output status BIT4: PID setting value BIT5: PID feedback value BIT6: Analog AI1 value BIT7: NA BIT8: Current stage of Multi-speed BIT9: Torque set value BIT10: Reserved BIT11: Reserved BIT12~ BIT15:Reserved	00FF	○	51
P1.27	DSP version	Manufacturer parameters	Model dependent	●	52
P1.28	Accumulative running time	0-9999	0	●	53
P1.29	Restore Factory Setting	0: No operation 1: Restore factory settings 2: Clear warning/ fault records	0	◎	54
P1.30	MCU Fire ware version	Manufacturer preset parameters	Model dependent	●	55

P1.31	User password	0-9999	Model dependent	<input type="radio"/>	56
<b>Group P2: Analog terminal parameter</b>					
P2.00	AI1 upper limit	P2.02 ~ 10.00V	10.00V	<input type="radio"/>	60
P2.01	AI1 upper limit setting	-100.0% ~ 100.0%	100.0%	<input type="radio"/>	61
P2.02	AI1 lower limit	0.00V ~ P2.00	0.00V	<input type="radio"/>	62
P2.03	AI1 lower limit setting	-100.0% ~ 100.0%	0.0%	<input type="radio"/>	63
P2.04	AI1 filter time	0.00s ~ 10.00s	0.10s	<input type="radio"/>	64
P2.05	Reserved			<input type="radio"/>	65
P2.06				<input type="radio"/>	66
P2.07				<input type="radio"/>	67
P2.08				<input type="radio"/>	68
P2.09				<input type="radio"/>	69
P2.10	AO1 function selection	0:Running frequency 1:Set frequency 2:Running speed 3:Output current 4:Output voltage 5:Output power 6:Output torque (absolute value) 7:AI1 8:AI2 9~10:Reserved	0	<input type="radio"/>	71
P2.11	AO1output upper limit	P2.13~100.0%	100.0%	<input type="radio"/>	71
P2.12	Upper limit corresponds to AO1 output	0.00V ~10.00V	10.00V	<input type="radio"/>	72
P2.13	AO1output lower limit	0.0%~P2.11	0.0%	<input type="radio"/>	73
P2.14	Lower limit corresponds to AO1 output	0.00V ~10.00V	0.00V	<input type="radio"/>	74

Group P3: Digital terminal parameter					
P3.00	control terminal response upon power-up	1: Response to run command from control terminal upon power-up 0:Not response to run command from control terminal upon power-up	1	○	79
P3.01	X1 function selection	0:No function 1:Forward RUN 2:Reverse RUN 3:Three-line control	1	◎	80
P3.02	X2 function selection	4:Forward JOG (FJOG) 5:Reverse JOG (RJOG)	2	◎	81
P3.03	X3 function selection	6:Coast to stop 7:Fault reset (RESET)	0	◎	82
P3.04	X4 function selection	8:Normally open (NO) input of external fault 9:Terminal UP 10:Terminal DOWN 11:UP and DOWN setting clear (terminal, operation panel) 12:Multi-reference terminal 1 13:Multi-reference terminal 2 14:Multi-reference terminal 3 15:Terminal 1 for acceleration/deceleration time selection 16:Terminal 2 for acceleration/deceleration time selection 17:Terminal 3 for acceleration/deceleration time selection 18:PID pause 19:Wobbulate pause (stops at the current frequency) 20:Wobbulate reset (return to the center frequency) 21:Acceleration/Deceleration prohibited 22:Torque control prohibited 23:Frequency change settings temporarily clear 24: Command source Switchover terminal 25: Frequency source Switchover 26: Reserved	0	◎	83
P3.05	X5 function selection		0	◎	84
P3.06	Switching signal filtering times	1~10	5	○	86
P3.07	Terminal command mode	0: Two-line mode 1 1: Two-line mode 2 2: Three-line mode 1 3: Three-line mode 2	0	◎	87

P3.08	Frequency increment slope upon control terminal UP/DOWN action	0.01~50.00Hz/s	0.50Hz/s	○	88
P3.09	Output terminal Y1 function selection (open-collector output terminal)	0: No output 1: Motor forward running 2: Motor reverse running 3: Fault output (stop) 4: Frequency-level detection FDT output 5: Frequency reached 6: Zero-speed running (no output at stop) 7: Frequency upper limit reached 8: Frequency lower limit reached (no output at stop) 9~10: Reserved	1	○	89
P3.10	Relay function		3	○	90
P3.11	(Reserved)		2	○	91
P3.12	FDT frequency detection value	0.00 Hz to maximum frequency	50.00Hz	○	92
P3.13	FDT frequency detection hysteresis	0.0%~100.0% (FDT level)	5.0%	○	93
P3.14	Detection range of frequency reached	0.00~100% (maximum frequency)	0.0%	○	94
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P4.02	Stop DC braking time	0.0~50.0s	0.0s	○	98
P4.03	Stop DC braking current	0.0~150.0%	0.0%	○	99

P4.04	Initial frequency of stop DC braking	0.00 Hz to maximum frequency	1.00Hz	○	100
P4.05	Start mode	0:Direct start 1:Braking and then start 2:Speed tracking restart	0	◎	101
P4.06	Startup frequency holding time	0.0~50.0s	0.0s	○	102
P4.07	Startup DC braking time/ Pre-excited time	0.0~50.0s	0.0s	○	103
P4.08	Startup DC braking current/ Pre-excited current	0.0~150.0%	0.0%	○	104
P4.09	Startup frequency	0.00~10.00Hz	0.00Hz	○	105
P4.10	Jump frequency	0.00 to P0.13 (maximum output frequency)	0.00Hz	○	106
P4.11	Jump frequency range	0.00 to P0.13 (maximum output frequency)	0.00Hz	○	107
P4.12	Acceleration/Deceleration mode	0:Linear acceleration/deceleration	0	○	108

**Group P5: Swing Frequency control**

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P5.02	Swing frequency amplitude	0.0~100.0% (relative setting frequency )	0.0%	○	111
P5.03	Swing frequency rise time	0.1~3600.0s	10.0s	○	112
P5.04	Swing frequency fall time	0.1~3600.0s	10.0s	○	113

**Group P6: Fault and Protection**

P6.00	Overvoltage stall protective	0:Disabled 1:Enabled	0	○	133
P6.01	Overvoltage stall protective voltage	110~150% (220V)	115%	○	134
P6.02	Motor overload protection selection	0:OFF 1:Normal motor (with low speed compensation) 2:Inverter motor (without low speed compensation)	1	◎	135

P6.03	Motor overload protection current	20.0%~120.0% (motor rated current)	100.0%	○	136
P6.04	Automatic current limiting level	100~200%	160%	○	137
P6.05	Frequency fall rate at current limiting	0.00~50.00Hz/s	10.0Hz/s	○	138
P6.06	Descending Frequency point of momentary power failure	70.0~110.0% (standard bus voltage)	80.0%	○	139
P6.07	Frequency fall rate at momentary power supply interruption	0.00Hz~P0.13 (maximum output frequency)	0.00Hz	○	140
P6.08	Output phase loss protection selection	0: Disabled 1: Enabled	0	○	141
P6.09	1st fault code log	0~25 0:No fault 1:Inverter unit U phase protection (OUT1)	-	●	142
P6.10	2nd fault code log	2:Inverter unit V phase protection (OUT2) 3:Inverter unit W phase protection (OUT3) 4:Overcurrent during acceleration (OC1) 5:Overcurrent during deceleration (OC2) 6:Overcurrent at constant speed (OC3) 7:Overvoltage during acceleration (OV1) 8:Overvoltage during deceleration (OV2) 9:Overvoltage at constant speed (OV3) 10:Bus undervoltage (UV) 11:Motor overload (OL1) 12:AC drive overload (OL2) 13:Power input phase loss (SPI) 14:Power output phase loss (SPO) 15:Rectifier module overheat (OH1) 16:Inverter module overheat (OH2) 17:External equipment fault (ET) 18:Communication fault (CE) 19:Current detection fault (lE) 20:Motor auto-tuning fault (tE) 21:EEPROM read-write fault (EEP) 22:PID feedback lost during running (PIDE) 23:Brake unit failure (bCE) 24:Hardware overcurrent protection (OCH) 25:Reserved	-	●	143
P6.11	3rd (latest)fault code log		-	●	144

P6.12	Frequency upon 3rd fault	-	0.00Hz	●	145
P6.13	Current upon 3rd fault	-	0.0A	●	146
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P6.16	Output terminal status upon 3rd fault	-	0	●	149
P6.17	Time interval of fault auto reset	0.1~100.0s	1.0s	○	150
P6.18	Fault auto reset times	0~10	0	○	151

**Group P7: Process Control PID Function**

P7.00	PID feedback source	0:AI1 1:AI2 2:AI1+AI2 3:Communication setting	0	○	152
P7.01	PID setting source	0:P7.02 setting 1:AI1 2:AI2 3:Communication setting 4:Multi-reference 5:Keyboard ▼ or ▲ key	0	○	153
P7.02	Keyboard preset PID setting	0.0%~400.0%	0.0%	○	154
P7.03	PID output selection	0:PID output is positive 1:PID output is negative	0	○	155
P7.04	Proportional gain Kp	0.00~100.00	1.00	○	156
P7.05	Integral time Ti	0.01~10.00s	0.10s	○	157
P7.06	Differential time Td	0.00~10.00s	0.00s	○	158
P7.07	Sampling period (T)	0.01~100.00s	0.10s	○	159
P7.08	PID control deviation limit	0.0~100.0%	0.0%	○	160
P7.09	Feedback disconnection detection value	0.0~100.0%	0.0%	○	161

P7.10	Feedback disconnection detection time	0.0~3600.0s	1.0s	○	162
P7.11	Reserved	0~2	0	○	163
P7.12	Wake-up threshold	0~100.0%	20.0%	○	164
P7.13	Dormant function	0: Disabled 1: Enabled	0	○	165
P7.14	Dormant threshold	0~200.0%	80.0%	○	166
P7.15	Dormant delay time	0.0~6000.0s	0.0	○	167
P7.16	Wake-up delay time	0.0~6000.0s	0.0	○	168
P7.17	range	0~100	0	○	169
P7.18	range error	-30~30	0	○	170
P7.19	PID ▼ or ▲ Key setting range	0~P7.17	0	○	171

**Group P8: Multi-speed control**

P8.00	Multi-speed operating mode	0: Multi-speed given frequency and direction 1: Multi-speed only given frequency, the direction of the operation of the terminal by the decision	0	○	183
P8.01	Multi-speed0	-100.0~100.0%	0.0%	○	184
P8.02	Multi-speed 1	-100.0~100.0%	0.0%	○	185
P8.03	Multi-speed 2	-100.0~100.0%	0.0%	○	186
P8.04	Multi-speed 3	-100.0~100.0%	0.0%	○	187
P8.05	Multi-speed 4	-100.0~100.0%	0.0%	○	188
P8.06	Multi-speed 5	-100.0~100.0%	0.0%	○	189
P8.07	Multi-speed 6	-100.0~100.0%	0.0%	○	190
P8.08	Multi-speed 7	-100.0~100.0%	0.0%	○	191

Group P9:485 Communication Parameters					
P9.00	Local Communication address	0: Broadcast address 1~247	1	○	192
P9.01	Baud rate	0:1200bps 1:2400bps 2:4800bps 3:9600bps 4:19200bps 5:38400bps	3	○	193
P9.02	Date bits parity settings	0: no parity (N, 8, 1) for RTU 1: even parity (E, 8, 1) for RTU 2: odd parity (O, 8, 1) for RTU 3: no parity (N, 8, 2) for RTU 4: even parity (E, 8, 2) for RTU 5: odd parity (O, 8, 2) for RTU 6: no parity (N, 7, 1) for ASCII 7: even parity (E, 7, 1) for ASCII 8: odd parity (O, 7, 1) for ASCII 9: no parity (N, 7, 2) for ASCII 10: even parity (E, 7, 2) for ASCII 11: odd parity (O, 7, 2) for ASCII 12: no parity (N, 8, 1) for ASCII 13: even parity (E, 8, 1) for ASCII 14: odd parity (O, 8, 1) for ASCII 15: no parity (N, 8, 2) for ASCII 16: even parity (E, 8, 2) for ASCII 17: odd parity (O, 8, 2) for ASCII	0	○	194
P9.03	Communication response delay	0~200ms	5ms	○	195
P9.04	Communication timeout fault time	0.0: (invalid) 0.1~100.0s	0.0s	○	196
P9.05	Transmission error handling	0: Alarm and free stop 1: No alarm and continue to run 2: No alarm and stop at the selected mode (under communication control mode only)	1	○	197

Group PA:Simple PLC Function					
PA.00	Simple PLC running mode	0:PLC disable 1:Continuous cycle mode 2:Stop after the AC drive runs one cycle 3:Keep final values after the AC drive runs one cycle	0	○	200
PA.01	Simple PLC retentive selection	0:Disabled 1:Enabled	0	○	201
PA.02	Simple PLC running time unit	0:second 1:minute	0	○	202
PA.03	Running time of reference 1	0~6000.0	2.0	○	203
PA.04	Running time of reference 2	0~6000.0	2.0	○	204
PA.05	Running time of reference 3	0~6000.0	2.0	○	205
PA.06	Running time of reference 4	0~6000.0	2.0	○	206
PA.07	Running time of reference 5	0~6000.0	2.0	○	207
PA.08	Running time of reference 6	0~6000.0	2.0	○	208
PA.09	Running time of reference 7	0~6000.0	2.0	○	209
PA.10	Running time of reference 8	0~6000.0	2.0	○	210
Group PB:Motor parameter					
PB.00	Motor parameter auto tunning	0:No operation 1:Motor parameters static auto tuning 2:Motor parameters comprehensive auto tuning	0	◎	
PB.01	Motor type selection	0: G-type 1: P-type	Model dependent	◎	
PB.02	Rated motor	0.4~900.0kW	Model	◎	
PB.03	Rated motor frequency	0.01Hz~P0.13 (maximum frequency)	50.00Hz	◎	
PB.04	Rated motor rotational speed	0~36000rpm	Model dependent	◎	

PB.05	Rated motor voltage	0~460V	Model dependent	◎	
PB.06	Rated motor current	0.1~2000.0A	Model dependent	◎	
PB.07	Motor stator resistance	0.001~65.535Ω	Tuning parameters	◎	
PB.08	Motor rotor resistance	0.001~65.535Ω	Tuning parameters	◎	
PB.09	Motor leakage inductive reactance	0.1~6553.5mH	Tuning parameters	◎	
PB.10	Motor mutual inductive reactance	0.1~6553.5mH	Tuning parameters	◎	
PB.11	Motor no-load current	0.01~655.35A	Tuning parameters	◎	

**Group PC:Vector Control Parameters**

PC.00	Speed loop proportional gain 1	0~100	15	○	239
PC.01	Speed integral time 1	0.01~10.00s	2.00s	○	240
PC.02	Switchover frequency 1	0.00Hz~PC.05	5.00Hz	○	241
PC.03	Speed loop proportional gain 2	0~100	10	○	242
PC.04	Speed loop integral time 2	0.01~10.00s	3.00	○	243
PC.05	Switchover frequency 2	PC.02 to maximum output frequency	10.0Hz	○	244
PC.06	Slip compensation coefficient	50%~200%	100%	○	245
PC.07	Digital setting of torque upper limited	0.0~200.0% (Inverter rated current)	150.0%	○	246
PC.08	No-load current compensation coefficient	0~9.999	0.5	○	247

PC.09	Oscillation suppression lower freq threshold	0~500	15	○	248
PC.10	Oscillation suppression upper freq threshold	0~500	15	○	249
PC.11	Amplitude of oscillation suppression	0~100	20	○	250
PC.12	Oscillation suppression demarcation frequency	0~400.00	12.50	○	251
PC.13	Torque control reserved1	0-6	0	○	252
PC.14	Torque control reserved 2	-200%-200%	000	○	253
PC.15	Torque control reserved 3	0.000-1.000	0.050	○	254
PC.16	Torque control reserved 4	0.000-1.000	0.000	○	255
PC.17	Oscillation suppression enable	0:Enabled 1:Disabled	0	○	256
PC.18	PWM MODE	0~122	001	◎	257
<b>Group PE-PF: Reserved</b>					

# Chapter 5 Trouble Shooting

## 5.1 Fault and Trouble Shooting

Fault Code	Fault Type	Reason	Solution
OUT1	Inverter unit U-phase fault	1:Acceleration time is too short 2: IGBT module damaged 3: Malfunction caused by interference 4: Grounding is not properly	1:Increase acceleration time 2:Ask for support 3:Inspect external equipment and eliminate interference 4:Check grounding wire
OUT2	Inverter unit V-phase fault		
OUT3	Inverter unit W-phase fault		
OC1	Over-current when acceleration	1: Accelerate too fast 2: Input voltage is too low 3: Inverter capacity is too low	1:Increase acceleration time 2:Inspect the input Power supply or wiring 3:Select larger capacity Inverter
OC2	Over-current when deceleration	1: Decelerate too fast 2: Load is too heavy and has large inertia 3: Inverter capacity is too low	1:Increase deceleration time 2:Add suitable braking units 3:Select larger capacity Inverter
OC3	Over-current at constant running speed	1:Sudden change of load 2:Input voltage is to low 3:Inverter capacity is too low	1:Check the load 2:Inspect the input Power supply or wiring 3:Select larger capacity Inverter
OV1	Over voltage when acceleration	1:Input voltage abnormal 2:Restart the motor when instantaneous trip-off occurs	1:Inspect input power 2:Avoid prompt restart when trip-off
OV2	Over voltage when deceleration	1:Decelerate too fast 2:Load is too heavy and has large inertia 3:Input voltage abnormal	1:Increase deceleration time 2:Add suitable braking units 3:Inspect input power
OV3	Over-voltage at constant running speed	1:Input voltage abnormal 2:Load inertia is too large	1:Install input AC reactor 2:Add suitable braking units

<b>LU</b>	Under voltage of DC bus	Input voltage is too low	Inspect power grid
<b>OL1</b>	Motor overload	1:Input voltage is too low 2:Improper setting of motor rated current 3:Improper motor's overload protection threshold 4:Inverter capacity is too low	1:Inspect voltage of power grid 2:Properly setting of motor rated current 3:Inspect load and boost the torque 4:Select larger capacity Inverter
<b>OL2</b>	Inverter overload	1:Accelerate too fast 2:Restart the motor when instantaneous trip-off occurs 3:Input voltage is too low 4:Load is too heavy	1:Increase acceleration time 2:Avoid prompt restart when trip-off 3:Inspect power grid 4:Select larger capacity Inverter
<b>SPO</b>	Phase-Lack of output side	1:There is a broken wire in the output cable 2:There is a broken wire in the motor winding 3:Output terminals are loose	Check the wiring and installation
<b>OH2</b>	Inverter overheat	1:Instantaneous over current of Inverter 2:Output short circuit 3:Cooling fans of Inverter stop or damaged. Obstruction of ventilation channel 4:Ambient temperature is too high 5:The cables or terminals are loose 6:Power circuit abnormal 7:Control PCB board abnormal	1:Refer to over current solutions 2:Use the good wire 3:Replace cooling fan and clear the ventilation channel 4:Decrease the ambient temperature 5:Inspect and tighten the wire and terminals 6:Ask for support

<b>ET</b>	External fault	External fault input terminals take effect	Inspect external equipment
<b>CE</b>	Communication fault	1:Improper baud rate setting 2:Receive wrong data 3:Communication is interrupted for long time	1:Set proper baud rate 2:Push STOP/RESET to reset and ask for support 3:Check communication devices and cables
<b>ItE</b>	Current detection fault	1:Wires or connectors of control board are loose 2:Amplifying circuit abnormal 3:Hall sensor is damaged 4:Power circuit abnormal	1:Check the wiring and connectors 2:Ask for support
<b>tE</b>	Auto-tunning fault	1:Improper setting of motor rated parameters 2:Overtime of auto-tunning 3:Too much error	1:Set rated parameters according to motor nameplate 2:Check motor's wiring 3:Make motor uncoupled with load and Autotuning again
<b>EEP</b>	EEPROM fault	1:Read/Write fault of control parameters 2:EEPROM damaged	Push STOP/RESET to reset and ask for support
<b>PIDE</b>	PID feedback lost fault	1:Sensor disconnect or loose contact 2:Detecting time of disconnection is too short 3:No feedback signal of system	1:Check sensor installation and connection 2:Extend the detecting time of sensor disconnection
	<b>Reserved</b>		

## 5.2 Common Faults and Solutions

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

### No display after power on:

- Inspect whether the voltage of power supply is the same as the Inverter rated voltage or not with multimeter. If the power supply has problem, inspect and solve it.
- Inspect whether the three-phase rectify bridge is in good condition or not. If the rectification bridge is burst out ask for support.

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

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

### Motor doesn't run after Inverter works:

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

### Inverter displays normally when power on, but switch at the

#### Input side trips when running:

- Inspect whether the output side of Inverter is short circuit. If yes, ask for support.
- Inspect whether ground fault exists. If yes, solve it.
- If trip happens occasionally and the distance between motor and Inverter is too far,it is recommended to ins all output AC reactor.
- Inspect whether the output module is burnt or not. If yes ask for support.

# Chapter 6 RS485 Communication protocol

## ModBus Communication Standards

The ModBus protocol is an industrial communications and distributed control system to integrate PLCs, computers, terminals, and other monitoring, sensing and control devices.

ModBus is a Master-Slave communications protocol. The Master controls all serial activity by selectively polling one or more slave devices. The protocol provides for one master device and up to 247 slave devices on a common line. Each device is assigned an address to distinguish it from all other connected devices.

The ModBus protocol uses the master-slave technique, in which only one device (the master) can initiate a transaction. The other devices (the slaves) respond by supplying the requested data to the master, or by taking the action requested in the query. The master can address individual slaves or initiate a broadcast message to all slaves. Slaves return a message ("response") to queries that are addressed to them individually. Responses are not returned to broadcast queries from the master. A transaction comprises a single query and single response frame or a single broadcast frame. The transaction frames are defined below.

Valid slave device addresses are in the range of 0–247 decimal. The individual slave devices are assigned addresses in the range of 1–247. A master addresses a slave by placing the slave address in the address field of the message. When the slave sends its response, it places its own address in this address field of the response to let the master know which slave is responding. The function code field of a message frame contains two characters (ASCII) or eight bits (RTU). Valid codes are in the range of 1–255 decimal. When a message is sent from a master to a slave device, the function code field tells the slave what kind of action to perform. Examples are to read the ON/OFF states of a group of discrete coils or inputs; to read the data contents of a group of registers; to read the diagnostic status of the slave; to write to designated coils or registers; or to allow loading, recording or verifying the program within the slave. When the slave responds to the master, it uses the function code field to indicate either a normal (error-free) response or that some kind of error occurred (called an exception response). For a normal response, the slave simply echoes

the original function code. For an exception response, the slave returns a code that is equivalent to the original function code with its most significant bit set to a logic state of 1. The data field is constructed using sets of two ex. a decimal digits, in the range of 00 to FF hexadecimal. These can be made from a pair of ASCII characters, or from one RTU character, according to the network's serial transmission mode.

The data field of messages sent from a master to slave devices contains additional information that the slave must use to take the action defined by the function code. This can include items like discrete and register addresses, the quantity of items to be handled, and the count of actual data bytes in the field. If no error occurs, the data field of a response from a slave to a master contains the data requested. If an error occurs, the field contains an exception code that the master application can use to determine the next action to be taken. Two kinds of checksum are used for standard ModBus networks. The error checking field contents depend upon the transmission method that is being used.

## 6.2 Function code and data

### 6.2.1 Function code: 03H, read N(1~16) words

Example: To read 2 words from register address of 0x0004 from the slave with address of 01H, the base structure of the frames should be:

RTU Master sending command frame:

START	T1-T2-T3-T4
Slave Address	01H
Function Code	03H
Start address High	00H
Start address Low	04H
Number of Data(Words)High	00H
Number of Data(Words)Low	02H
CRC High	85H
CRC Low	CAH
END	T1-T2-T3-T4

RTU Slave Response Frame

START	T1-T2-T3-T4
Slave Address	01H
Function Code	03H
Number of Data(Words)	02H
Data high at address 0004H	13H
Data low at address 0004H	88H
Data high at address 0005	02H
Data Low at address 0005	85H
CRC High	73H
CRC Low	CBH
END	T1-T2-T3-T4

ASCII format Master Sending Command Frame

START	':'
Slave Address	'0'
	'1'
Function Code	'0'
	'3'
Start address High	'0'
	'0'
Start address Low	'0'
	'4'
Number of Data(Words)High	'0'
	'0'
Number of Data(Words)Low	'0'
	'2'
LRC High	'F'
LRC Low	'6'
END Hi	CR

END Lo	LF
--------	----

ASCII Slave Response Frame

START	‘.’
Slave Address	‘0’
	‘1’
Function Code	‘0’
	‘3’
Data length(Words)	‘0’
	‘4’
Data high at address 0004H	‘1’
	‘3’
Data low at address 0004H	‘8’
	‘8’
Data high at address 0005	‘1’
	‘3’
Data Low at address 0005	‘8’
	‘8’
LRC High	‘C’
LRC Low	‘2’
END Hi	CR
END Lo	LF

6.2.2 Instruction Code: 06H (0000 0110) To write a word

Example o write 5000 (1388H) to register address of 0x002B to the slave with address of 02H,

the base structure of the frames should be:

RTU Master sending command frame:

START	T1-T2-T3-T4
Slave Address	02H
Function Code	06H

Start Address High	00H
Start Address Low	2BH
Data High	13H
Data Low	88H
CRC High	F4H
CRC Low	A7H
END	T1-T2-T3-T4

RTU Slave response command frame

START	T1-T2-T3-T4
Slave Address	02H
Function Code	06H
Start Address High	00H
Start Address Low	2BH
Data High	13H
Data Low	88H
CRC High	F4H
CRC Low	A7H
END	T1-T2-T3-T4

ASCII Master sending command frame

START	':'
Slave Address	'0'
	'2'
Function Code	'0'
	'6'
Start Address High	'0'
	'0'
Start Address Low	'2'
	'B'

Data High	'1' '3'
Data Low	'8' '8'
LRC High	'3'
LRC Low	'2'
END Hi	CR
END Lo	LF

ASCII Slave response command frame

START	':'
Slave Address	'0' '2'
Function Code	'0' '6'
Start Address High	'0' '0'
Start Address Low	'2' 'B'
Data High	'1' '3'
Data Low	'8' '8'
LRC High	'3'
LRC Low	'2'
END Hi	CR
END Lo	LF

### 6.2.3 Instruction Code: 08H (0000 1000), Read Diagnostics

Sub-function code Definition:

Sub-function code	Remark
0000	Read Diagnostics

RTU Master sending frame:	
START	T1-T2-T3-T4
Slave Address	01H
Function Code	08H
Sub-function code High	00H
Sub-function code Low	00H
Data High	12H
Data Low	ABH
CRC High	ADH
CRC Low	14H
END	T1-T2-T3-T4

#### RTU Slave response frame

START	T1-T2-T3-T4
Slave Address	01H
Function Code	08H
Sub-function code High	00H
Sub-function code Low	00H
Data High	12H
Data Low	ABH
CRC High	ADH
CRC Low	14H
END	T1-T2-T3-T4

#### ASCII Master sending command frame

START	:
Slave Address	'0'
	'1'
Function Code	'0'
	'8'
Sub-function code High	'0'

	'0'
Sub-function code Low	'0'
	'0'
	'0'
Data High	'1'
	'2'
Data Low	'A'
	'B'
LRC High	'3'
LRC Low	'A'
END Hi	CR
END Lo	LF

#### ASCII Slave response command frame

START	':'
Slave Address	'0'
	'1'
Function Code	'0'
	'8'
Sub-function code High	'0'
	'0'
Sub-function code Low	'0'
	'0'
Data High	'1'
	'2'
Data Low	'A'
	'B'
LRC High	'3'
LRC Low	'A'
END Hi	CR
END Lo	LF

#### 6.3 Communication frame Checksum

2 kind of ModBus standards checksum are support. i.e. Parity Check and Frame Check Sequence (CRC or LRC)

### 6.3.1 CRC CRC(Cyclical Redundancy Check) Checksum:

To use RTU frame, 2 Bytes of standards CRC checksum are included.

A standards RTU CRC algorithm are use in the protocol, here below a CRC function implementation in C language is provided for reference.

```
=====
```

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

```
=====
```

### 6.3.2 ASCII Mode Checksum(LRC Check)

In a ASCII communication frame, a Standards LRC checksum was used. here below a LRC function implementation in C language is provided for reference.

```
=====
```

```
Static unsigned char LRC(auchMsg,usDataLen)
unsigned char *auchMsg;
```

```

unsigned short usDataLen;
{
    unsigned char uchLRC=0;

    while(usDataLen--)
        uchLRC+=*auchMsg++;
    return((unsigned char)~((char)uchLRC));
}
//=====================================================================

```

#### 6.4 Definition of Register address

Here below is definition register, which is used to control the running of the VFD, acquire s  
nd the set the parameters.

##### (2) Predetermined Instruction definition and register address

Instruction	Register Address	Function description	R/W
Running control instruction	1000H	0001H: Start forward run	W/R
		0002H: Start reverse run	
		0003H: Forward JOG	
		0004H: Reverse JOG	
		0005H: 停机 Stop	
		0006H: Emergency stop	
		0007H: Fault reset	
		0008H: Jog stop	
VFD Status	1001H	0001H: Forward Running	R
		0002H: Reverse Running	
		0003H: VFD standby	

tatus and the set the parameters.

(2) Predetermined Instruction definition and register address

Instruction	Register Address	Function description	R/W
Running control instruction	1000H	0001H: Start forward run	W/R
		0002H: Start reverse run	
		0003H: Forward JOG	
		0004H: Reverse JOG	
		0005H: 停机 Stop	
		0006H: Emergency stop	
		0007H: Fault reset	
		0008H: Jog stop	
VFD Status	1001H	0001H: Forward Running	R
		0002H: Reverse Running	
		0003H: VFD standby	
		0004H: VFD Fault	
Communication setting address	2000H	Communication setting range (-10000~10000)	W/R
Running / standby parameter address	3000H	Running frequency	R
	3001H	Setting frequency	R
	3002H	DC BUS voltage	R
	3003H	Output Voltage	R
	3004H	Output Current	R
	3005H	Running speed	R

Instruction	Register Address	Function description	R/W
	3006H	Output Power	R
	3007H	Output Torque	R
	3008H	PID reference	R
	3009H	PID feedback value	R
	300AH	Terminal Input Status	R
	300BH	Terminal Output Status	R
	300CH	Analogy Input(AI1) Value	R
	300DH	Reserved	R
	300EH	Reserved	R
	300FH	Reserved	R
	3010H	Reserved	R
	3011H	Reserved	R
	3012H	Multi-speed and PLC current Speed	R
	3013H	Length	R
	3014H	External counter input	R
	3015H	Rotating direction(0: forward, 1:reverse)	R
Parameter password validation address	4000H	****	
Parameter password setting address	4001H	55AAH	W

Instruction	Register Address	Function description	R/W
Fault code address	5000H	The fault code shown in 5000H is in accordance with fault code response to function code menu, the only difference is the code response to function code menu is hexadecimal.	R

**Fault code from address 5000H definition**

Fault code	Fault type
0x00	NO FAULT
0x01	U phase fault protection (OUT1)
0x02	V phase fault protection (OUT2)
0x03	W phase fault protection (OUT3)
0x04	Overcurrent during acceleration (OC1)
0x05	Overcurrent during deceleration (OC 2)
0x06	Overcurrent at constant speed (OC3)
0x07	Overvoltage during acceleration (OV1)
0x08	Overvoltage during deceleration (OV2)
0x09	Overvoltage at constant speed (OV3)
0x0A	DC BUS Undervoltage (UV)
0x0B	Motor overload (OL1)
0x0C	VFD OVERLOAD(OL2)
0x0D	Power input phase loss (SPI)
0x0E	Power output phase loss (SPO)
0x0F	Rectifier Module overheat (OH1)
0x10	Inverter IGBT Module overheat (OH2)
0x11	External equipment fault (E F)
0x12	Communication fault(CE)

Fault code	Fault type
0x 13	Current detection fault(ITE)
0x 14	Motor auto-tuning fault(TE)
0x 15	EEPROM read-write fault
0x 16	Feedback lost during running (PIDE)
0x 17	Braking Unit Fault (bCE)

## 6.5 Acknowledgment of Fault Code Query.

To response to an instruction, the VDF use function code and fault code to indicate the acknowledgment is normal or abnormal. The normal acknowledgment includes function code and query result data or sub function code. The abnormal code include functional code and the date , but the MSB of the frame is set to 1.

For example ,the Master read a group of VFD function address, sends following code:

0 0 0 0 0 0 1 1 (0x03H)

An abnormal acknowledge will be :

1 0 0 0 0 0 1 1 (0x83H)

Beside abnormal function code, the VFD will feedback a byte of exception code,explain the reason of exception

When the Master device receive a abnormal acknowledge , typical processing method is resend the query instruction, or change the instruction according to exception code.

### Exception code definition

ModBus Exception Code		
Code	Name	Reason
01H	Illegal function	The function code from master device is an prohibited operation, or it is because the UPS receive the function in fault mode.

ModBus Exception Code		
Code	Name	Reason
02H	Illegal address	The Master device access to a illegal address, attention should be paid to mistaken combination of particular register address and target data length
03H	Illegal data	Data field include a data not allowed
06H	The VFD is busy	The VFD is busy (e.g.writing EPPROM ) can not response the instruction
10H	Password error	The input password is not in accordance with password save in password validation register
11H	Checksum error	The CRC or LRC checksum result is not same as the CRC field in the communication frame from master
12H	The Parameter modification error	The communication frame from master is target to change a register of read-only
13H	System Locked	The Master is try to read/write the locked VFD before unlocked with password.

### (1) Function code access address

Each function code has index, and mapped to a register address, to access the parameter, converter the index of the function code to hexadecimal to get function code address.

E.g. Index of Function code P5.05 is 76, then , hexadecimal address of the function code is 0x04CH.

Note : PE group function code, is factory setting , and non revisable .

Frequently writing EEPROM will affect the lifetime of the EEPROM, parts of function code do not need to be save into EEPROM but just change parameter in corresponding RAM address could implement function code effect. To use the function code in RAM, just need to change the address of function code form 0-->1 . e.g. To change and apply Function code P0.07 in RAM, but do not save to EEPROM, user can use address 0x8007, but the address is not readable . Otherwise, it is regards as illegal address.

### Address of Function Code

P0.00	0	P1.09	33	P2.10	66	P5.00	99	P7.09	132	PA.06	165	PC.16	198
P0.01	1	P1.10	34	P2.11	67	P5.01	100	P7.10	133	PA.07	166	PC.17	199
P0.02	2	P1.11	35	P2.12	68	P5.02	101	P7.11	134	PA.08	167	PC.18	200
P0.03	3	P1.12	36	P2.13	69	P5.03	102	P7.12	135	PA.09	168	PF.00	201
P0.04	4	P1.13	37	P2.14	70	P5.04	103	P7.13	136	PA.10	169	PF.01	202
P0.05	5	P1.14	38	P3.00	71	P6.00	104	P7.14	137	PB.00	170	PF.02	203
P0.06	6	P1.15	39	P3.01	72	P6.01	105	P7.15	138	PB.01	171	PF.03	204
P0.07	7	P1.16	40	P3.02	73	P6.02	106	P7.16	139	PB.02	172	PF.04	205
P0.08	8	P1.17	41	P3.03	74	P6.03	107	P7.17	140	PB.03	173	PF.05	206
P0.09	9	P1.18	42	P3.04	75	P6.04	108	P7.18	141	PB.04	174	PF.06	207
P0.10	10	P1.19	43	P3.05	76	P6.05	109	P7.19	142	PB.05	175	PF.07	208
P0.11	11	P1.20	44	P3.06	77	P6.06	110	P8.00	143	PB.06	176	PF.08	209
P0.12	12	P1.21	45	P3.07	78	P6.07	111	P8.01	144	PB.07	177	PF.09	210
P0.13	13	P1.22	46	P3.08	79	P6.08	112	P8.02	145	PB.08	178	PF.10	211
P0.14	14	P1.23	47	P3.09	80	P6.09	113	P8.03	146	PB.09	179	PF.11	212
P0.15	15	P1.24	48	P3.10	81	P6.10	114	P8.04	147	PB.10	180	PF.12	213
P0.16	16	P1.25	49	P3.11	82	P6.11	115	P8.05	148	PB.11	181	PF.13	214
P0.17	17	P1.26	50	P3.12	83	P6.12	116	P8.06	149	PC.00	182	PF.14	215
P0.18	18	P1.27	51	P3.13	84	P6.13	117	P8.07	150	PC.01	183	PF.15	216
P0.19	19	P1.28	52	P3.14	85	P6.14	118	P8.08	151	PC.02	184	PF.16	217
P0.20	20	P1.29	53	P4.00	86	P6.15	119	P9.00	152	PC.03	185	PF.17	218
P0.21	21	P1.30	54	P4.01	87	P6.16	120	P9.01	153	PC.04	186		
P0.22	22	P1.31	55	P4.02	88	P6.17	121	P9.02	154	PC.05	187		
P0.23	23	P2.00	56	P4.03	89	P6.18	122	P9.03	155	PC.06	188		

P1.00	24	P2.01	57	P4.04	90	P7.00	123	P9.04	156	PC.07	189		
P1.01	25	P2.02	58	P4.05	91	P7.01	124	P9.05	157	PC.08	190		
P1.02	26	P2.03	59	P4.06	92	P7.02	125	P9.06	158	PC.09	191		
P1.03	27	P2.04	60	P4.07	93	P7.03	126	PA.00	159	PC.10	192		
P1.04	28	P2.05	61	P4.08	94	P7.04	127	PA.01	160	PC.11	193		
P1.05	29	P2.06	62	P4.09	95	P7.05	128	PA.02	161	PC.12	194		
P1.06	30	P2.07	63	P4.10	96	P7.06	129	PA.03	162	PC.13	195		
P1.07	31	P2.08	64	P4.11	97	P7.07	130	PA.04	163	PC.14	196		
P1.08	32	P2.09	65	P4.12	98	P7.08	131	PA.05	164	PC.15	197		

## Q&A

Q 1: The factory default maximum output is 50 hz. How is that reset to 60 hz or more higher?

A 1: If you want high output frequency , please use PRG, that reset to 60 hz or panel, to revise function code P0.13 & P0.14 setting to your expected MAXIMUM output frequency.

Q 2: Can the digital inputs be connected to 24V?

A 2: The digital input has connected with an internal isolated 24V voltage source so no external voltage level signal is needed, to activate the digital input , just short-circuit the digital input terminal(x1~x5) with COM terminal, so a (relay/switch type) dry-contact signal or a OC (open collector) transistor circuit is perfect to control the digital input.

Q 3: What Phase are the input and output?

A 3: It is single Phase in and three Phase out, All VFD will be three phase out or it wouldn't be able to control the motor speed.

Q 4: Can It be turned off and on with a light switch for example. Or is it required to use a momentary push button switch?

A 4: Yes, you could control the VFD to work or stop responding to ON/OFF of a signal switch via control terminal .

Q 5: Does the fan run continuously, or does it cycle on and off? How loud/annoying is it?

A 5: Yes, the fan is run continuously, it is 50db! Because it need to be make cooling in order to support the running.

Q 6: What terminals do I use to connect an external potentiometer? what parameter do I change for it to work? what resistance, 100ohm ?

A 6: We recommend you could buy a 2m extension cable together with the product, the front panel of the product can unplug from the product and connect with the VFD mainframe via the extension cable, then you can use the control panel from 2 meter away, including control the speed via the rotary jog.

If you do need an extra potent meter, then you may use the 10V, AI1, GND 3 terminals for connection of potentiometer. The potentio meter 10K is recommend . HOWEVER, we would like remind you , AI1, 10V, GND, 3 Terminals carry harmful voltage, to use the external potentiometer, secure insulation must be implemented to prevent electric shock to the operator.

Q 7: My 3 phase motor says 200 volts, 3.2 amps. my concern is the 200 volts. will this VFD work?

A 7: Normally, the motor can work normally with a few percent voltage deviation , so the output voltage of 220V VFD can work with motor of 200V without big problem, especially when the load level is less than your motor rating.

If you do concern the voltage precision, one easy solution is using V/F

operation , in which the VFD output voltage is proportion to frequency, and set the maximum of VFD output frequency to a value higher than your motor freq. Rating, and let the VFD work at your motor rating, in this way the motor voltage could be decrease to your expected.

Q 8: Where do I put a ground wire from machine to the VFD?

A 8: The soft glue is for safe alarm of the usage of AI1 , can be peel off easily.

There is a grounding terminal on the input terminal for VFD grounding. To have best safety grounding, the Motor earth ground wire should be connected to VFD upstream power distributing panel together with the VFD input grounding wire.

Q 9: I got my VFD hooked up, I found that i am only able to start my machine if i press start during the VFD ramping up before at speed, if i start my machine after the VFD has ramped up, the VFD makes a popping noise and display OCH.WHY?

A 9: It is normal symptom , one of key function of the VFD is to start the motor softly, to avoid huge electric current impact to mains system and mechanical shock occur to machine system , during start up, the VFD well control the speed and torque , the current of motor is well controlled within a safe range. if the motor connect to the VFD after VFD ramp up, the soft start function is skip, the start current of the motor is dangerously huge, will trip Over Current Protection of the VFD, so strongly recommend NOT to Turn on the Motor after VFD start up.

Q 10: I want to use the VFD to control a 3 phase motor with a 3 phase supply input, it did not come with 3 screws for the input, is there anything i need to do to configure the device for a 3 phase input?

A 10: The product take 220V input ,converse to 3phase 220V output for 3phase 220V Motor, in US residential mains supply system , you can have 220V with L1, L2 , means that you just need connect L1, L2 on the input terminal block and connect ground on to grounding terminal marked with ground icon. No Neutral or the third line L3 needed. the output of the product has phase just fit your Motor.

Q 11: Can you tell me why it is runs a very slow rpm, example 10 rpm versus 1000 rpm?

A 11: The most possible reason is the output Torque of the Motor is not enough for driving your motion system at low RPM situation, so you can use Torque Boosting function by revising function code P0.08 from default value of 2% to 20~30%, to boost the torque by the setting percent at low speed. if it is still not enough , you go further to narrow the RPM upper limit (MAX VFD output Frequency) to minimum acceptable value.

Q 12: If I want to raise or lower the speed a small amount I can do so with the rheostat. Is that correct?

A 12: You can vary the speed with the rheostat without problem , however, if you want 10RPMs out of say 1500RPM of full speed for the resolution and low speed

torque control issue, using the rheostat might not be so easy to get that small value. using low speed Torque Boosting may help in controlling the RPMs precisely .

Q 13: I successfully programmed it for Static Tuning by setting P0.00 to 2. It ran for about 5 seconds then stopped with the message OCH. Can you tell me what that means?

A 13: OCH means the Over current Protection is tripped. Normally it is caused by mismatch of VFD setting and the motor or overload/stuck of mechanical system.

First of all, we recommend to disconnect the motor from the VFD, and run the VFD, if the VFD works and the frequency figure shown on the LED ramp up and reach target correctly, means the VFD status should be in OK condition and we should focus on setting of the VFD to match the motor.

Q 14: I wired it and powered it and the display reads 'POFF' /'UU' and no output voltage. Can you help me?

A 14: POFF / UU indicate under voltage on input side, please check on input terminal , if correct mains voltage 220V+/- 20% has been applied to L1 - L2 terminal.

Also please confirm there is no lossen wiring in the power supply path, most easy solution is using a multi-meter to monitor input voltage. there should be no significant Voltage drop when motor start and speed variation.

Q 15: The unit worked, then it was dropped, now the display flashes, will not

respond to run command. I think a fault was tripped. How do you reset?

A 15: Please unplug the panel and plug it back, then try to work again!

Q 16: How do i reset VFD to factory?

A 16: Reset factory setting P1.29 = 1 once time.

Q 17: Does this VFD have a forward and reversing input? X1-x5?

A 17: Yes it does, plus a speed (rpm) control.

Q 18: does this VFD have 150% overload capability

A 18: The 1.5KW model have 150% overload capability.

Q 19: Can this be used to control speed on a single phase motor?

A 19: No--only 3 phase.

Q 20: Does this thing need to be mounted in an electrical cabinet, or can I safely mount it to the side of a piece of equipment?

A 20: Yes, you can mount it in a box or just put it outside!

