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SHSY

SY8000 Series
High-performance Vector Inverter
Operation Instruction

Sanyu, Controlling and Protecting Your Motors.

Shanghai sanyu electronics equipment co.,ltd

Foreword

SY8000 series inverter is a new generation of high–performance vector inverter that is developed by Sanyu, representing the future development trend.

SY8000 series inverter is a vector–control general inverter that is independently researched, developed and produced by Shanyu, with the features of high quality, multi functions, large low–frequency torque, ultra silencing, etc.. It realizes the fast response of torque, strong load adaptability, stable operation, high accuracy, perfect reliability, and improves the power factor and efficiency to the largest extent.

SY8000 series inverter provides the automatic parameter tuning, zero–servo non–speed sensor, shift between vector control and V/F control, perfect user's password protection, shortcut menu design, rotation speed tracing, built–in PID controller, given and feedback signal disconnection monitoring and switchover, load–loss protection, fault signal tracing, automatic restart against fault, built–in braking unit, 25 fault protections, fault monitoring, abundant I/O terminals, various speed setting ways, automatic voltage adjustment, wobble frequency control and multi–speed control, it can meet the various loads' requirements of driving control. If the keyboard is operated, LED displays the running data and fault code, and LCD displays the Chinese state information and operation instructions, and copies the parameters and delivers them; the background adjustment and monitoring software can monitor the operation through the built–in standard RS485 interface; MODBUS bus protocol and expansion card can be compatible with PROFIBUS, DeviceNet and CANopen for field bus control. With the compact structure and unique style, the inverter is designed and tested according to the international standard, guaranteeing the reliability; in addition, its ample options are offered for your various configuration selections.

This manual provides the instructions about the type selection, installation, parameter setting, field adjustment, fault diagnose, daily maintenance, etc.. Before using SY8000 series general vector inverter, please read this manual carefully, to guarantee the correct use. The incorrect use may result in abnormal operation of inverter, fault, reduction of service life, even human injury accident, therefore, please read this manual repeatedly and fully understand it before using, and operate strictly according to the instruction.

This manual is the attached document delivered with the inverter, please preserve it well for future reference. Equipment–supporting customer shall deliver this manual with the equipment to the end user.

Contents

This manual includes the operation instructions and attention.
In addition, please submit this manual to the end user.

Safety points
Before installing, operating, maintaining or examining the inverter, please read this manual and attached documents carefully for correct use. Only you fully understand the knowledge, safety information and all precautions about this inverter, you can use it, in this manual, the safety points are classified into "Danger" and "Caution". Danger: The danger caused by the operation not according to the requirements may result in severe injury, even the death. Caution: The danger caused by the operation not according to the requirements may result in medium or light injury and equipment damage.

1.1 Safety points:

1.1.1 Before installing:

Danger	• Don't install or operate the damaged inverter or the inverter lack of the parts, otherwise, the accident will cause any personal injury.

1.1.2 In installing:

Danger	• Mount the inverter at the flame–retardant material (such as the metal), and keep it away from the combustible material, otherwise, the fire will be caused.

Caution	• If more than two inverters are installed in a cabinet, please keep the good heat emission for the installation position (refer to Chapter 3 Mechanical and electrical installation)
	• Don't let the conductor head or screw drop into the inverter, otherwise, the inverter may be damaged.

1.1.3 In wiring:

Danger	• The inverter shall be operated by the professional electrician, otherwise, any electric shock will happen!
	• There must be a circuit breaker for isolating between inverter from power supply, otherwise, the fire will happen!
	• Before connecting, please make sure that the power is switched off, otherwise, you will suffer from the electric shock!
	• Please accord with the standard to perform the earthing operation, otherwise, you will suffer from the electric shock!

Caution	• Don't connect the input power line to the output terminals U, V and W, otherwise the inverter will be damaged!
	• Make sure the provided circuit reaches EMC requirements and local safety standard. Please refer to the suggestions in this manual for the diameter of used conductor, otherwise, any accident will happen!
	• The braking resistor can't be directly connected between (+) terminal and (–) terminal of DC bus, otherwise, the fire may happen!

1.1.4 Before energizing:

Danger	• Please make sure that the supply voltage is consistent with the rated voltage of inverter, the connection positions of input and output are correct, the peripheral circuits have no short circuit, and all circuits are connected firmly, otherwise, the inverter may be damaged!
	• Only the cover plate is closed, the inverter can be energized, otherwise, you will suffer from the electric shock!

Caution	• The inverter has been given the withstand voltage test before leaving the market, so, it needn't to be tested again, otherwise, some accidents may happen!
	• All periphery parts should be connected correctly according to this manual, otherwise, any accident may happen!

1.1.5 After energizing:

Danger	• After the inverter is energized, don't open the cover plate, otherwise, you will suffer from the electric shock!
	• Never touch the inverter and peripheral circuits with the wet hands, otherwise, the accident of electric shock will happen.
	• Don't touch the terminal of inverter, otherwise you will suffer from the electric shock!
	• At the beginning of being electrified, the inverter can conduct the safety check for the external strong current circuit automatically, at this moment, don't touch the terminals U, V and W of inverter or motor terminals, otherwise, the accident of electric shock will happen!

Caution	• If needing the parameter identification, please notice the danger that may be resulted from the motor rotation, otherwise, some injury accidents will happen!
	• Don't change the inverter parameters set by manufacturer randomly, otherwise, the equipment may be damaged.

1.1.6 In running:

Danger	• If selecting the restart function, please keep away from the mechanical equipment, otherwise, the human injury accident may happen!
	• Never touch the cooling fan and discharge resistor to sound the temperature, otherwise, you may be burned!
	• No layman is allowed to detect the signal when the equipment is running, otherwise, the human injury or equipment damage may happen!

Caution	• When the inverter is running, anything is not allowed to drop into, otherwise, it may be damaged!
	• Never adopt the making and breaking methods for contactor to control the start and stop of inverter, otherwise, it may be damaged!

1.1.7 In maintaining:

Danger	• Never maintain the equipment when the power is switched on, otherwise, you may suffer from the electric shock!
	• Only the "Charge" lamp of inverter goes out, the inverter can be maintained, otherwise, you may be injured by the residual capacitance of capacitor!
	• No layman is allowed to maintain the inverter, otherwise, the human injury or equipment damage may happen!

1.2 Precautions

1.2.1 Examination for motor insulation

The motor should be given the insulation examination when it is used at first time and reused after long–time no service and when it is checked regularly, to prevent the inverter being damaged for poor insulation of motor windings. When conducting the check for insulation, must separate the motor wires from the inverter. It is suggested that 500V megohmmeter should be used to measure, the measured insulation resistance should not be less than 5M.

1.2.2 Thermal protection for motor

When the rated capacity of motor doesn't match with that of inverter, especially, the rated power of inverter is larger than that of motor, please adjust the related motor–protection parameters inside the inverter or mount a thermal relay in front of motor additionally to protect the motor.

1.2.3 Running at above power frequency

The inverter can provide the output frequency of 0～600Hz. If user wants it to run at 50Hz above, please take the bearing capacity of mechanical device into the consideration.

1.2.4 Vibration of mechanical device

The inverter may meet the mechanical resonant points of load device at some power frequencies, which can be avoided through setting the hopping frequency parameters inside the inverter.

1.2.5 Motor heat and noise

Because the inverter output voltage is PWM wave, including the certain harmonic, the temperature rise, noise and vibration of motor will be increased slightly compared with that when the inverter runs at power frequency.

1.2.6 Varistor or capacitor for improving the power factor on the output side

Because the inverter outputs PWM wave, if the capacitor for improving the power factor or lightning–protection varistor is mounted on the output side, the instantaneous over current is easily produced to damage the inverter, please don't install them.

1.2.7 Contactors mounted at input and output terminals

If the contactor is mounted between the power supply and inverter input terminal additionally, it is not allowed to control the start and stop of inverter. If necessary, the interval of control should not be less than 1hour, because the frequent charge and discharge will easily reduce the service life of capacitor that is in the inverter. If the contactor is mounted between the output terminal and motor, please make sure that the inverter performs the making and breaking operation when it has no output, otherwise the inverter module will be damaged easily.

1.2.8 Use beyond the rated value

SY8000 series inverter should not be used beyond the permissible working voltage specified in this manual, otherwise, the inverter parts will be damaged. If necessary, please use the step–up or stepdown device for transformation treatment.

1.2.9 Changing three-phase input into two-phase input

SY8000 series three–phase inverter is not allowed to be used as two–phase one, otherwise, the fault or damage of inverter will happen.

1.2.10 Lighting impact protection

The inverter has the lightning over current protection device, so, it has a certain self–protection ability to resist the induction lightning. For the lighting frequent occurrence area, a protection device should be mounted in front of inverter.

1.2.11 Altitude and derating use

In the area where the altitude exceeds 1,000m, the heat emission efficiency of inverter gets bad for the tenuous air, therefore, it is necessary to reduce the capacity. Please contact us for technology enquiry for this case.

1.2.12 Some special methods

If user needs the connection methods that are not specified in this manual, such as the common DC bus, please contact us.

1.2.13 Attentions against the rejection of inverter

The electrolytic capacitor at main circuit and the one at the printed board may be exploded when they are burned. The plastic part may produce the poisonous gas when it is burned, therefore, they shall be treated as the industrial rubbish.

1.2.14 Applicable motor

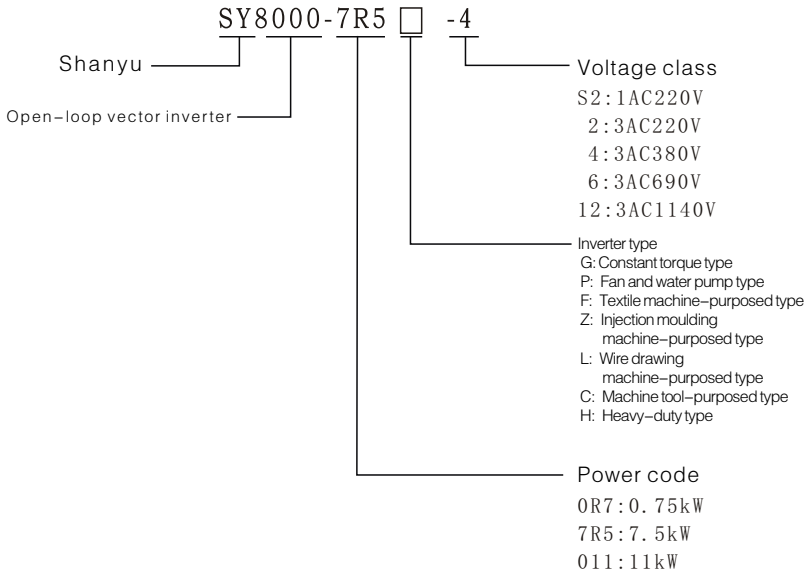
1.2.14.1 The standard applicable motor is the four–pole squirrel cage asynchronous induction motor. If your motor is not the abovementioned one, please select the inverter according to the rated current of motor. If needing the drive of permanent magnet synchronous motor, please contact us.

1.2.14.2 The cooling fan of non–frequency conversion motor is connected coaxially with the rotator, the cooling efficiency of fan is lowered with the rotation speed, therefore, a strong exhaust fan or frequency–conversion fan is mounted against too much heat.

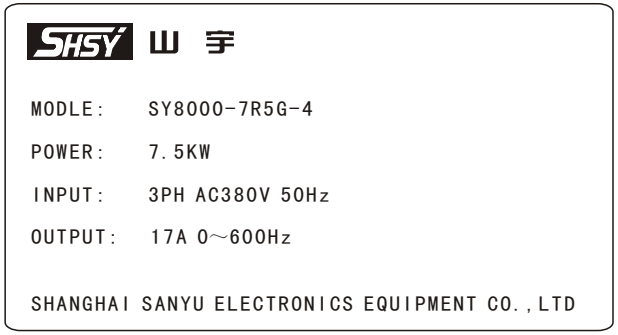
1.2.14.3 The inverter has provided the standard parameters of built–in motor, according to the actual situations, please perform the motor parameter identification or amend the default to accord with the actual value, otherwise, the running efficiency and protection performance will be influenced.

1.2.14.4. If the cable or motor inner has the short circuit, the inverter will make the alarm or it will be exploded, please perform the insulation short–circuit test for the initially–installed motor and cable, and this test is also often conducted in daily maintenance. Please pay attention to that when conducting this test, please switch off the inverter and all tested parts.

2.1 Denomination rules



2.2 Nameplate



2.3 Type of SY8000 series inverter

220V series

Inverter model	Input voltage	Rated out put power (KW)	Rated input current (A)	Rated output current (A)	Applicable motor (KW)
SY8000-0R7G-2	Three-phase 220V voltage range: -15%~+15%	0.75	5.0	4.5	0.75
SY8000-1R5G-2		1.5	7.7	7	1.5
SY8000-2R2G-2		2.2	11	10	2.2
SY8000-004G-2		4.0	17	7	4
SY8000-5R5G-2		5.5	21	20	5.5
SY8000-7R5G-2		7.5	31	30	7.5
SY8000-011G-2		11.0	43	42	11
SY8000-015G-2		15. 0	56	55	15
SY8000-018G-2		18.5	71	70	18.5
SY8000-022G-2		22. 0	81	80	22
SY8000-030G-2		30. 0	112	110	30
SY8000-037G-2		37. 0	132	130	37
SY8000-045G-2		45	163	160	45

380V系列

Inverter model	Input voltage	Rated out put power (KW)	Rated input current (A)	Rated output current (A)	Applicable motor (KW)
SY8000-0R7G-4	Three-phase 380V voltage range: -15%~+15%	0.75	3.4	2.5	0.75
SY8000-1R5G-4		1.5	5.0	3.7	1.5
SY8000-2R2G-4		2.2	5.8	5.0	2.2
SY8000-004G/5R5P-4		4.0/5.5	10.0/15.0	9.0/13.0	4.0/5.5
SY8000-5R5G/7R5P-4		5.5/7.5	15.0/20.0	13.0/17.0	5.5/7.5
SY8000-7R5G/011P-4		7.5/11.0	20.0/26.0	17.0/25.0	7.5/11.0
SY8000-011G/015P-4		11.0/15.0	26.0/35.0	25.0/32.0	11.0/15.0
SY8000-015G/018P-4		15.0/18.5	35.0/38.0	32.0/37.0	15.0/18.5
SY8000-018G/022P-4		18.5/22.0	38.0/46.0	37.0/45.0	18.5/22.0
SY8000-022G/030P-4		22.0/30.0	46.0/62.0	45.0/60.0	22.0/30.0
SY8000-030G/037P-4		30.0/37.0	62.0/76.0	60.0/75.0	30.0/37.0
SY8000-037G/045P-4		37.0/45.0	76.0/90.0	75.0/90.0	37.0/45.0
SY8000-045G/055P-4		45.0/55.0	90.0/105.0	90.0/110.0	45.0/55.0
SY8000-055G/075P-4		55.0/75.0	105.0/140.0	110.0/150.0	55.0/75.0
SY8000-075G/090P-4		75.0/90.0	140.0/160.0	150.0/176.0	75.0/90.0
SY8000-090G/110P-4		90.0/110.0	160.0/210.0	176.0/210.0	90.0/110.0
SY8000-110G/132P-4		110.0/132.0	210.0/240.0	210.0/253.0	110.0/132.0
SY8000-132G/160P-4		132.0/160.0	240.0/290.0	253.0/300.0	132.0160.0
SY8000-160G/185P-4		160.0/185.0	290.0/330.0	300.0/340.0	160.0/185.0
SY8000-185G/200P-4		185.0/200.0	330.0/370.0	340.0/380.0	185.0/200.0
SY8000-200G/220P-4		200.0/220.0	370.0/410.0	380.0/420.0	200.0/220.0
SY8000-220G/250P-4		220.0/250.0	410.0/460.0	420.0/470.0	220.0/250.0
SY8000-250G/280P-4		250.0/280.0	460.0/500.0	470.0/520.0	250.0/280.0
SY8000-280G/315P-4		280.0/315.0	500.0/580.0	520.0/600.0	280.0/315.0
SY8000-315G/350P-4		315.0/350.0	580.0/620.0	600.0/640.0	315.0/350.0
SY8000-350G/400P-4		350.0/400.0	620.0/670.0	640.0/690.0	350.0/400.0

2.4 Technical specifications

Item		Spec.
Basic spec.	Max frequency	600.00Hz
	Carrier frequency	1.0～15.0KHz
	Resolution of input frequency	Digital setting: 0.01Hz Analog setting: Max frequency ×0.1%
	Control mode	Vector control without PG (SVC) V/F control
	Starting torque	Type G: 0.5Hz/150% Type P: 0.5Hz/100%
	Speed regulation range	1:100
	Speed stabilization accuracy	±0.5%
	Overload capacity	Type G: 150% of rated current for 60s; 180% of rated current for1s; Type P: 120% of rated current for 60s; 150% of rated current for1s;
	Torque increase	Automatic torque increase Manual torque increase 0.1%～30.0%
	V/F curve	Two modes: Straight line type 2.0 power
	Acc./dec. curve	Straight-line or S-curve acceleration and decoration mode; two kinds of acceleration and deceleration time; range of acceleration and deceleration time: 0.1～3600.0s
Individual function	DC brake	DC braking frequency:0.0Hz～10.00Hz; braking time: 0.0～50.0s; braking operation current: 0.0～150.0%
	Jogging control	Jogging frequency range: 0.00Hz～P0.13; jogging acceleration and deceleration time: 0.0～3600.0s
	Multi-speed running	8-segment speed control
	Built-in PID	Realizing the process closed loop control system conveniently
	Automatic voltage regulation (AVR)	When the mains voltage makes the change, it can automatically keep the output voltage constant.
	Common DC bus function	Realizing the functions of common DC bus for many inverters
	JOG Key	Programmable key: Jog/forward & reverse rotation switchover/clearing UP/DOWN setting
	Wobble frequency control for spinning	Multi triangular wave frequency control functions
	Timing control	Timing control function: Setting time range 0～65535h

Continued

Input/output characteristics	Running command channel	Three channels: Operation panel setting, control terminal setting, serial communication port setting
	Frequency source	Digital setting, analogy voltage setting, analog current setting, serial port setting, etc.
	Input terminal	Two analog input terminals, hereinto, No. 4 terminal is used for voltage input, and No. 5 terminal is used for voltage or current input.
	Output terminal	One open collector output Two relays output One analog terminal, 0/4 ~ 20mA or 0 ~ 10V available for it, can realize the output of analog quantities such as setting frequency and output frequency.
Display and operation	LED	Displaying parameters
	LCD	Option, displayed in Chinese
	Parameter locking	Preventing other persons setting the parameters
	Protection function	Short–circuit protection, input/output phase–failure protection, over–current protection, under–voltage protection, over–voltage protection, over–load protection, over–heat protection, etc.
	Option	LCD operation panel, multi–function input/output expansion card, braking component, communication wire, etc.
Environment	Service location	Indoors, free from direct sunlight, dust, corrosive gas, combustible gas, oil mist, water vapor, drip or salt, etc.
	Altitude	Lower than 1,000m
	Ambient temp.	–10℃~+40℃(at 40℃~50℃, please use it by derating)
	Humidity	Less than 95%RH , no water condensation.
	Vibration	Less than 5.9m/s²
	Storage temp.	–20℃~+60℃

2.5 Outline & installation dimension

2.5.1 Outline diagram

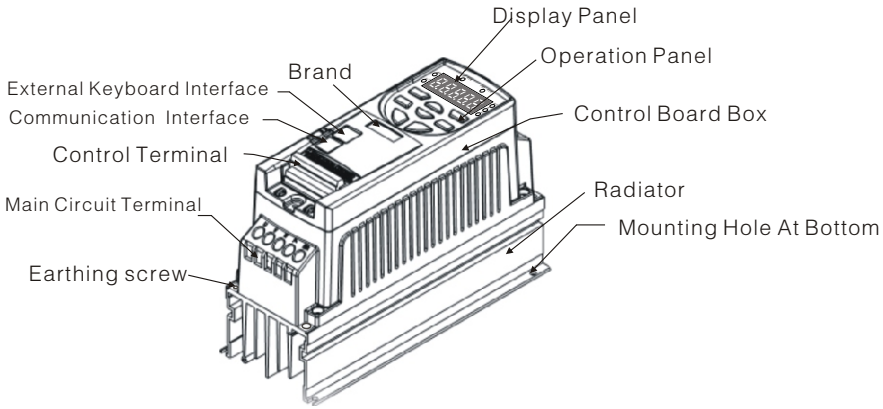


Fig. 2–1 Inverter outline diagram

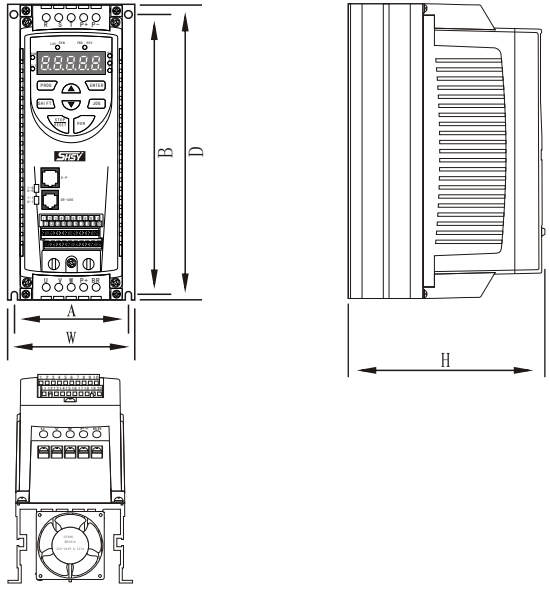


Fig. 2–2 Inverter outline & installation dimension diagram

2.5.2 Dimensions of mounting hole

Model of inverter (G: Constant-torque load P: Fan and water pump load)	Applicable motor (KW)	A (mm)	B (mm)	H (mm)	W (mm)	D (mm)	Mounting hole dia.)mm(	G.W. (kg)
SY8000-0R7G/1R5P-4	0.75G/1.5P	77.5	157	152.5	90	173	5	2
SY8000-1R5G/2R2P-4	1.5G/2.2P							
SY8000-2R2G/004P-4	2.2G/4P	95	210	175	102.5	260	5	3
SY8000-004G/5R5P-4	4G/5.5P							
SY8000-5R5G/7R5P-4	5.5G/7.5P	165	210	170	174	260	7	6
SY8000-7R5G/011P-4	7.5G/11P							
SY8000-011G/015P-4	11G/15P	180	416	190	253	430	9	11
SY8000-015G/018P-4	15G/18.5P							
SY8000-018G/022P-4	18.5G/22P							
SY8000-022G/030P-4	22G/30P							
SY8000-033G-4	30G	250	532	247	324	549	9	17
SY8000-037P-4	37P							
SY8000-037G/045P-4	37G/45P							
SY8000-045G/055P-4	45G/55P							
SY8000-055G-4	55G	300	750	300	468	770	11	62
SY8000-075P-4	75P							
SY8000-075G/090P-4	75G/90P							
SY8000-090G/110P-4	90G/110P							
SY8000-110G/132P-4	110G/132P							
SY8000-132G/160P-4	132G/160P	300	910	330	490	940		75
SY8000-160G/185P-4	160G/185P			343	505	1140		180
SY8000-185G/200P-4	185G/200P							
SY8000-200G/220P-4	200G/220P			410	713	1700		250
SY8000-220G/250P-4	220G/250P							
SY8000-250G/280P-4	250G/280P							
SY8000-280G/315P-4	280G/315P			410	800	1900		380
SY8000-315G/400P-4	315G/400P							

2.6 Options

Name	Instruction
Built-in braking unit	The single-phase 0.75~2.2KW of built-in braking unit, needing a built-out braking resistor additionally. The three-phase 0.75~15KW of built-in braking unit, needing a built-out braking resistor additionally.
Built-out braking unit	Three-phase built-out braking unit of 18.5KW and above
MODBUS communication wire	RS485 communication interface
PROFIBUS-DP bus card	PROFIBUS-DP bus interface
DeviceNET bus card	DeviceNET bus interface
CANopen bus card	CANopen bus interface
Peripheral LCD operation panel	External LCD display and operation keyboard
Extension wire of peripheral LCD operation panel	Provision according to the requirements of site.

2.7 Daily maintenance of inverter

2.7.1 Daily maintenance

The effect of temperature, humidity, dust and vibration leads to the aging of inner parts of inverter,potential fault or reduction of service life of inverter. Therefore, it is necessary to implement the daily and regular maintenance for inverter.

⚠Caution	• After switching off the power, if the filter capacitor still has the high voltage, the inverter can't be maintained immediately, only waiting the charge lamp goes out ,and the bus voltage measured by the multimeter should not exceed 36V, the maintenance can be performed.

Daily inspection items

1) Check whether motor makes the abnormal sound in running.

2) Check whether the motor has the vibration in running.

3) Check whether the installation environment of inverter makes the change.

4) Check whether the cooling fan of inverter works normally.

5) Check whether the inverter is too hot.

Daily cleaning

Keep the inverter clean.

Clear away the dust on the surface of inverter and prevent the dust entering into the inner, especially the metallic dust.

Effectively clear away the oil pollution of cooling fan of inverter.

2.7.2 Regular inspection

Please regularly examine the part that is difficult to be checked in running.

Regular inspection items

1) Check the air duct, and conduct the regular cleaning.

2) Check whether the screw is slack.

3) Check whether the inverter is corrosive.

4) Check whether the terminal has the track of arc discharge.

5) Main circuit insulation test

Reminder: When testing the insulation resistance with the megohmmeter (DC 500V megohmmeter), separate the main circuit lines from the inverter. Never use the insulation ohmmeter to test the insulation of control circuit. HV test needn't to be performed, because this test has been finished before the inverter leaves factory.

2.7.3 Change of wearable parts of inverter

The wearable parts of inverter include the cooling fan and electrolytic capacitor for filtering, their service life is closely related to the service environment and maintenance status. In general, their life is shown as follows:

Parts name	Service life
Fan	2~3 years
Electrolytic capacitor	4~5 years

User can determine the age limit according to the running time.

1) Cooling fan

Possible cause for damage: Bearing abrasion and blade aging.

Examination standard: Check whether the fan blade has the crack, whether the fan has the abnormal vibration when it is started.

2) Electrolytic capacitor for filtering

Possible cause for damage: Bad quality of input power, higher environment temperature, frequent jump of load, aging of electrolyte.

Examination standard: Leakage of liquid, projection of safety valve, and test of static capacitance and insulation resistance,

2.7.4 Storage of inverter

After user purchases the inverter, please pay attention to following points for temporary storage and long–time storage.

1) Put the inverter with the original package into our packing case when it is stored.

2) The long–term storage will result in degradation of electrolytic capacitor, so, the inverter must be electrified once every two years, the electrified time should be 5hours at least, the input voltage should rise to the rated value step by step with the voltage regulator.

2.8 Guidance for selecting type

Two control modes are available: Common V/F control and SVC control.

When selecting the inverter, first, you must identify the system technical requirements of frequency–conversion speed regulation, application location of inverter, load characteristics, etc., and take the applicable motor, output voltage, rated output current, etc. into the consideration, then to select the machine type at your request and determine the running way.

Basic principle: The rated load current of motor should not exceed the rated current of inverter, in general, select the inverter according to the applicable motor capacity that is specified as the manual, please compare the rated current of motor with that of inverter. The overload capacity of inverter makes actually sense to the starting and braking operation. Whenever the inverter has the short–time over load, the load speed will be changed. If the speed accuracy is demanding, please take a higher class into account.

Fan and water pump type: The overload capacity is undemanding. Because the load torque is directly proportional to the square of speed, the load (except the rose fan) is very light when it runs at a low speed. And, these loads have no special requirements on the rotation accuracy, so, the square torque V/F is selected.

Constant–torque load: Many loads such as the extruder, agitator, conveyer belt, plant trolley, crane translating mechanism have the constant–torque characteristics, however, their rotation speed and dynamic performance are undemanding. Accordingly, multi–segment V/F operation way is available when choosing the type.

The controlled object has a certain dynamic and static state requirement. The strong mechanical characteristics are required for this type of load when it runs at a low speed, to meet the control system requirements of dynamic and static indicators. SVC control way is available.

Chapter 3 Mechanical and electrical installation

3.1 Mechanical installation

3.1.1 Installation environment

1) Environment temperature: The ambient temperature has a large impact on the service life of inverter, the running environment temperature of inverter should not exceed such temperature range (–10℃ ~ 50℃) .

2) The inverter is installed on the surface of flame–retardant object, it should have the enough space for ventilation, because it produces much heat easily when working. And, it should be vertically installed at the mounting rack with the screw.

3) Please install it in the firm area without easy vibration occurrence. The vibration should not be more than 0.6G. Especially, it should be kept away from the punch.

4) It is installed in the area free from the direct sunlight, dampness and drip.

5) It is installed in the area free from the corrosive, flammable, explosive gas, etc..

6) It is installed in the location free from the oil pollution, much dust and metallic dust.

3.1.2 Prompt for installation environment

Monomer installation diagram

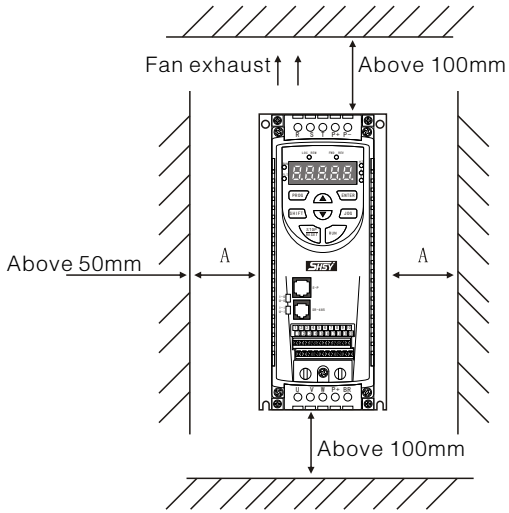


Fig. 3–1 Installation gap

Note: When the inverter power is not larger than 22KW, the dimension A may not be taken into consideration. When larger than 22KW, the dimension A should be larger than 50mm.

Top and bottom installation diagram

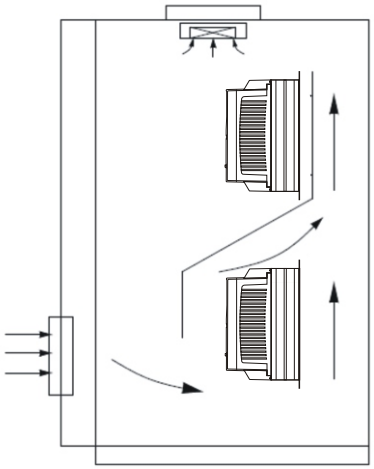


Fig. 3–2 Installation of multi inverters

Note: When the inverter is installed vertically, please mount a heat–insulated baffler shown as fig. 3–2.

Please pay attention to the following points about heat emission when performing the mechanical installation.

1) The inverter should be installed vertically, which enables the heat to emit upwards easily, but it should not be mounted reversely. If many inverters need to be installed in a cabinet, you'd better install them side by side. If the inverters need the top and bottom installation, please mount a heat–insulated baffler shown as fig. 3–2.

2) Make sure the inverter has the enough space for heat emission, the installation space is shown as fig. 3–1. However, when laying it, please consider the heat emission of other parts in the cabinet.

3) The mounting rack must be made of the flame–retardant material.

4) For the area with full metallic dust, it is suggested the installation outside the cabinet of radiator should be adopted, and, the space inside the full–seal cabinet should be as large as possible.

3.1.3 Dismounting and mounting of lower cover plate

SY8000 series inverter of 22KW below adopts the plastic enclosure, exposed main circuit terminal, without disassembling the cover plate.

SY8000 series inverter of 30KW above adopts the sheet metal enclosure, the lower cover plate of sheet metal enclosure needs to be disassembled, just slack the screw of lower cover plate directly.

⚠Danger	• When disassembling the lower cover plate, please avoid its drop, otherwise, the equipment may be damaged.

3.2 Electrical installation

3.2.1、 Circuit breaker, cable and contactor

Model of inverter	Circuit breaker (A)	Input/output wire (Copper wire and cable)	Contactor (A)
SY8000-0R7G-S2	16	2.5	10
SY8000-1R5G-S2	20	4	16
SY8000-2R2G-S2	32	6	20
SY8000-004G-2	40	6	25
SY8000-5R5G-2	63	6	32
SY8000-7R5G-2	100	10	63
SY8000-011G-2	125	25	95
SY8000-015G-2	160	25	120
SY8000-018G-2	160	25	120
SY8000-022G-2	200	35	170
SY8000-030G-2	200	35	170
SY8000-037G-2	200	35	170
SY8000-045G-2	250	70	230
SY8000-0R7G-4	10	2.5	10
SY8000-1R5G-4	16	2.5	10
SY8000-2R2G-4	16	2.5	10
SY8000-004G/5R5P-4	25	4	16
SY8000-5R5G/7R5P-4	25	4	16
SY8000-7R5G/011P-4	40	6	25
SY8000-011G/015P-4	63	6	32
SY8000-015G/018P-4	63	6	50
SY8000-018G/022P-4	100	10	63
SY8000-022G/030P-4	100	16	80
SY8000-030G/037P-4	125	25	95
SY8000-037G/045P-4	160	25	120
SY8000-045G/055P-4	200	35	135
SY8000-055G/075P-4	200	35	170
SY8000-075G/090P-4	250	70	230
SY8000-090G/110P-4	315	70	280
SY8000-110G/132P-4	400	95	315
SY8000-132G/160P-4	400	150	380
SY8000-160G/185P-4	630	185	450

Continued

SY8000-185G/200P-4	630	185	500
SY8000-200G/220P-4	630	240	580
SY8000-220G/250P-4	800	150*2	630
SY8000-250G/280P-4	800	150*2	700
SY8000-280G/315P-4	1000	185*2	780
SY8000-315G/350P-4	1200	240*2	900

3.2.2 AC input reactor

The input AC reactor can suppress the high-order harmonic wave of input current of inverter, and obviously improves the power factor of inverter. It is suggested that the input AC reactor should be used under following conditions:

1) The ratio of power capacity for inverter to the capacity of inverter reaches over 10:1.

2) The thyristor or power factor compensating device with the switching control is connected at the same power supply,.

3) The voltage unbalance degree of three-phase power is quite large (>3%)

4) If the power factor on power side needs to be improved, the power factor can be increased to 0.75~0.85.

AC input reactors of common specifications are shown as following table.

Spec. & model	Power(KW)	Current(A)	Inductance(MH)	Voltage drop (V)
ACL-0005-EISC-E3M8	1.5	5	3.800	2%
ACL-0007-EISC-E2M5	2.2	7	2.500	2%
ACL-0010-EISC-E1M5	3.7	10	1.500	2%
ACL-0015-EISH-E1M0	5.5	15	1.000	2%
ACL-0020-EISH-EM75	7.5	20	0.750	2%
ACL-0030-EISH-EM60	11	30	0.600	2%
ACL-0040-EISH-EM42	15	40	0.420	2%
ACL-0050-EISH-EM35	18.5	50	0.350	2%
ACL-0060-EISH-EM28	22	60	0.280	2%
ACL-0080-EISH-EM19	30	80	0.190	2%
ACL-0090-EISH-EM19	37	90	0.190	2%
ACL-0120-EISH-EM13	45	12	0.130	2%
ACL-0150-EISH-EM11	55	150	0.110	2%
ACL-0200-EISH-EM08	75	200	0.080	2%
ACL-0250-EISH-E65U	90/110	250	0.065	2%
ACL-0330-EISH-EM05	132/160	330	0.050	2%
ACL-0390-EISH-E44U	185	400	0.044	2%
ACL-0490-EISH-E35U	220/200	490	0.035	2%
ACL-0660-EISH-E25U	250/280	530	0.025	2%
ACL-0660-EISH-E25U	315	660	0.025	2%
ACL-0800-EISH-E25U	355	800	0.025	2%

3.2.3 AC output reactor

It can be used for suppressing the emission interference and inductance interference of inverter as well as the voltage fluctuation of motor; it also can prevent the wire on output side leaking the electricity and reduce the electricity leakage when multi motor runs in parallel and wire is laid at a long distance.

AC output reactor of common specifications are shown as following table.

Spec. & model	Power (KW)	Current(A)	Inductance(MH)	Voltage drop (V)
ACL-0005-EISC-EIM5	1.5	5	1.500	0.5%
ACL-0007-EISC-EIM0	2.2	7	1.000	0.5%
ACL-0010-EISC-EM60	3.7	10	0.600	0.5%
ACL-0015-EISH-EM25	5.5	15	0.250	0.5%
ACL-0020-EISH-EM13	7.5	20	0.130	0.5%
ACL-0030-EISH-E87U	11	30	0.087	0.5%
ACL-0040-EISH-E66U	15	40	0.066	0.5%
ACL-0050-EISH-E52U	18.5	50	0.052	0.5%
ACL-0060-EISH-E45U	22	60	0.045	0.5%
ACL-0080-EISH-E32U	30	80	0.032	0.5%
ACL-0090-EISH-E32U	37	90	0.032	0.5%
ACL-0120-EISH-E23U	45	12	0.023	0.5%
ACL-0150-EISH-E19U	55	150	0.019	0.5%
ACL-0200-EISH-E14U	75	200	0.014	0.5%
ACL-0250-EISH-E11U	90/110	250	0.011	0.5%
ACL-0330-EISH-EM01	132/160	330	0.010	0.5%
ACL-0390-EISH-E8U0	185	400	0.008	0.5%
ACL-0490-EISH-E5U0	220/200	490	0.005	0.5%
ACL-0660-EISH-E4U0	250/280	530	0.004	0.5%
ACL-0660-EISH-E4U0	315	660	0.004	0.5%
ACL-0800-EISH-E5U0	355	800	0.005	0.5%

3.2.4 DC reactor

When the capacity of power grid is far larger than that of inverter, or the power capacity is larger than 1,000KVA, the power factor is demanding, the DC reactor should be installed at DC immediate link buses, this reactor may be used together with the AC reactor, with high efficiency in reducing the input high order harmonic. This series of inverter of 30KW above can be equipped with the DC reactor, and the inverter of 160KW above has the built-in DC reactor.、

DC reactors of common specifications are shown as following table.

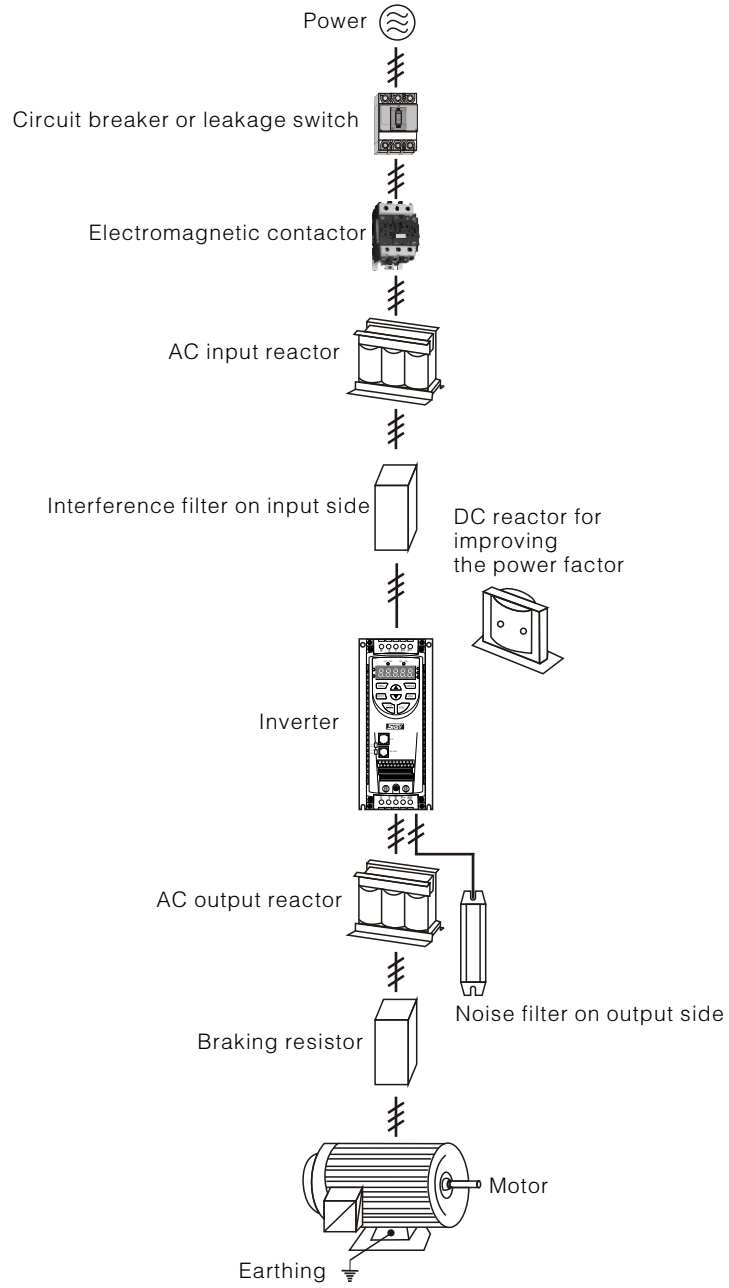
Spec. & model	Power(KW)	Current(A)	Inductance(MH)
DCL-0006-EIDC	1.5/2.2	6	11
DCL-0012-EIDC	3.7	12	6.3
DCL-0023-EIDH	5.5/7.5	23	3.6
DCL-0033-EIDH	11/15	33	2.0
DCL-0040-EIDH	18.5	40	1.3
DCL-0050-EIDH	22	50	1.08
DCL-0065-EIDH	30	65	0.8
DCL-0078-EIDH	37	78	0.7
DCL-0095-EIDH	45	95	0.54
DCL-0115-EIDH	55	115	0.45
DCL-0160-EIDH	75	160	0.36
DCL-0180-EIDH	90	180	0.33
DCL-0250-EIDH	110/132	250	0.26
DCL-0340-EIDH	160	340	0.17
DCL-0460-EIDH	185/200/220	460	0.09
DCL-0650-EIDH	250/280	650	0.072
DCL-0800-EIDH	315/355	800	0.072

3.2.5Braking unit and braking resistor

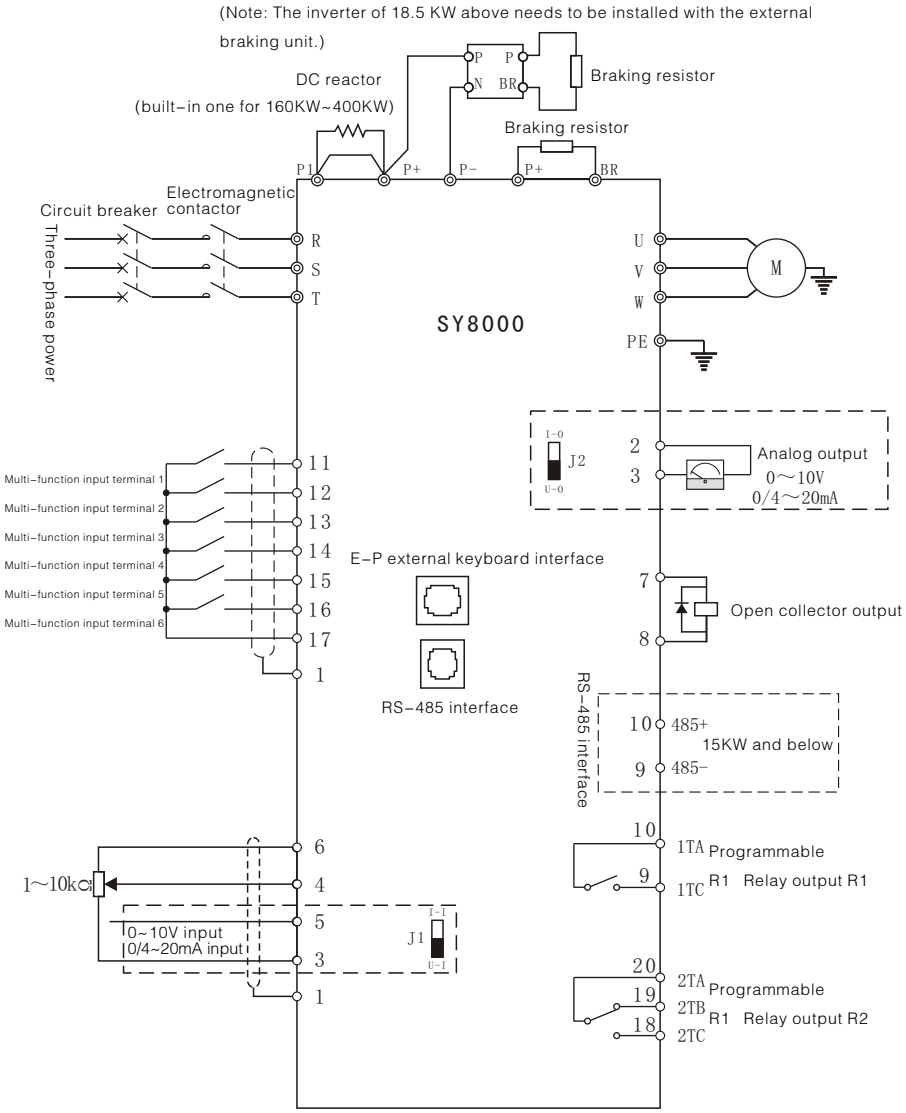
When the braking torque is 100%, the resistance and power of braking resistor of common specifications are shown as following table.

Voltage (V)	Inverter power (KW)	Braking unit(10%ED)		Braking power(10%ED)	
		Spec.	Qty.	Spec.	Purchase
380	0.4			70W/750	1
	0.75			70W/750	1
	1.5			260W/400	1
	2.2			260W/250	1
	3.7			390W/150	1
	5.5			520W/100	1
	7.5			780W/75	1
	11			1040W/50	1
	15			1560W/32	1
	18.5	4030	1	4800W/27.2	1
	22	4030	1	4800W/27.2	1
	30	4030	1	6000W/20	1
	37	4045	1	9600W/16	1
	45	4045	1	9600W/13.6	1
	55	4030	2	6000W/20	2
	75	4045	2	9600W/13.6	2
	110	4220	1	9600W/20	3
	160	4220	1	9600W/13.6	4
	185	4220	1	9600W/13.6	4
	220	4220	1	9600W/16	5
	300	4220	2	9600W/13.6	6

3.2.6 Connection diagram of peripheral equipment



3.3 Connection mode



Note: "J1" and "J2" indicate the sliding switch, and the shadow part denotes the ex-factory position;
"U-I" indicates the voltage analog input, and "I-I" indicates the current analog input
"U-O" indicates the voltage analog output; and "I-O" indicates the current analog output.

3.4 Main circuit terminal and connection

⚠ Danger	● Only the power switch is in the "OFF" state, you can perform the wiring operation otherwise, the accident of electric shock may happen!
	● The wiring operation must be performed by the professional electrician, otherwise, the equipment damage and human injury may happen!
	● Earthing must be reliable, otherwise, the accident of electric shock or fire will happen!

⚠ Caution	● Make sure the input power is identical with the rated value of inverter, otherwise, the inverter may be damaged!
	● Ensure the inverter matches with the motor, otherwise, the motor may be damaged or inverter protection will be caused.
	● The power should not be connected with terminals U, V and W, otherwise, the inverter will be damaged.
	● The braking resistor may not be connected with DC bus P+ and P-, otherwise, the fire will happen!

3.4.1 Instruction for the main circuit terminals of three-phase inverter:

Terminal mark	Name	Description
R,S,T	Three-phase power input terminal	AC three-phase 380V power connection points
U,V,W	Inverter output terminal	Connecting to three-phase motor
P+,P-	Positive and negative terminals of DC bus	Common DC bus input point; connection point of external braking unit of 18.5KW and above
P+,BR	Connection terminal of braking resistor	Connecting point of braking resistor of 15KW and below
P+, BR / P-	Connection terminals of braking resistor/DC bus	Terminal BR/P- of 15KW and below is the connection point of terminal BR. Terminal BR/P- of 18KW and above is the connection point of terminal P-.
PE (⏚)	Earthing terminal	Earthing terminal

3.4.2 Attentions for wiring:

1) Input power R, S and T:

The connection on the input side of inverter has no requirement of phase sequence.

1) DC bus P+ and P- terminals:

Note: After the power supply is just cut off, the DC bus P+ and P- terminals still have the residual voltage, only the lamp in the power panel goes out, and the voltage is less than 36V, you can touch the inverter, otherwise, the electric shock accident will happen.

When selecting the built-out braking unit for the inverter of 18.5KW and above, never connect the polarity of terminals P+ and P- reversely, otherwise, the inverter will be damaged, even the fire will happen. The wiring length of braking unit should not exceed 10m, and the wire must be twisted pair or compact double-wire.

Never connect the braking resistor to the DC bus directly, otherwise, the inverter may be damaged, even the fire may happen.

2) Braking resistor connection terminals P+ and BR:

The inverter of 15KW and below has been provided with the built-in braking unit, so only the braking resistor is connected to terminals P+ and BR.

Please refer to the recommended values for the type selection for braking resistor, and the wiring distance should be less than 5m, otherwise, the inverter will be damaged.

4) Inverter output side terminals U, V and W:

The capacitor or surge absorber should not connected on the output side of inverter, otherwise, the inverter will suffer from frequent protection or damage.

If the motor cable is too long, the electric resonance will be easily produced for the effect of distributed capacitance, so as to cause the damage of motor insulation or produce large leakage current to make the inverter perform the over-current protection. If the motor cable is longer than 50m, the AC output reactor must be mounted additionally.

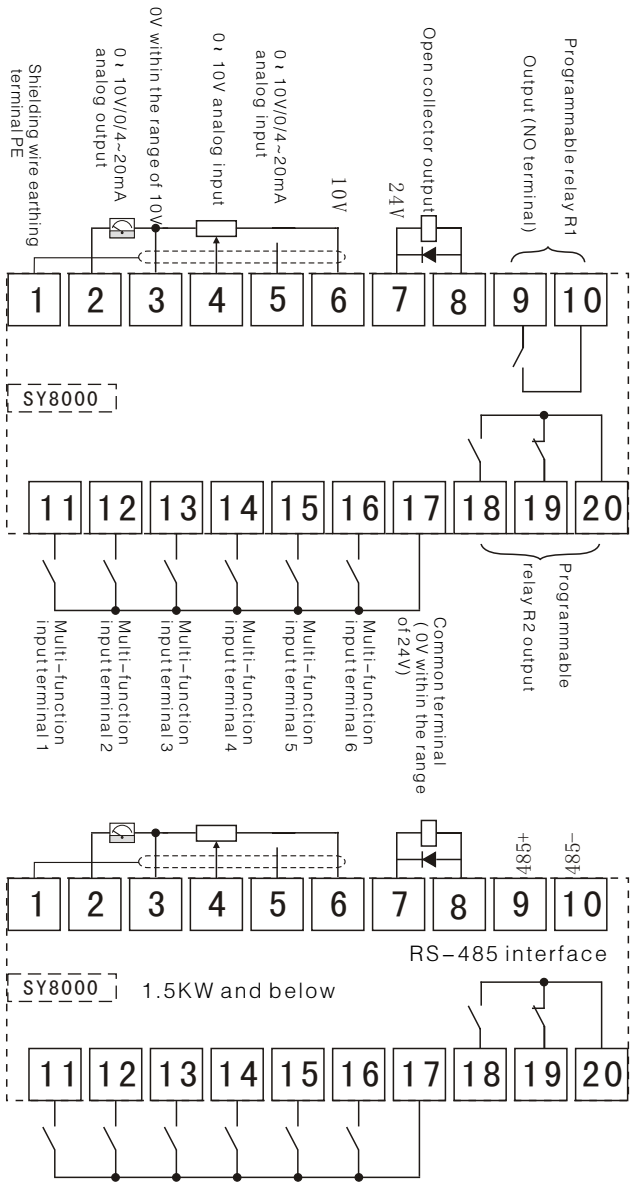
5) Earthing terminal

The terminal must be reliably earthed, the resistance of earthing wire should be less than 5Ω, otherwise, the equipment will work abnormally, even it will be damaged.

Never commonly use the earthing terminal and power neutral line N terminal.

3.5 Control terminal and connection:

3.5.1 Layout of control circuit terminal as follows:



3.5.2Instruction for function of control terminals

Type	Symbol instruction	Terminal instruction	Function instruction
Power supply	6′ 3	+10V power	Providing +10V power supply outside, No. 6 indicates 10V, No. 3 indicates 0V within the range of 10V, the max output current is 10mA for the working power of external potentiometer, the range of potentiometer resistance is 1~10KΩ.
	7′ 17	+24V power	Providing +24 power supply outside, No. 7 indicates 24V, No. 17 indicates 0V within the range of 24V; max output current sensor for the power supply of external is 200mA;
Analog input	4′ 3	Analog input terminal 1	1. Input voltage range: DC 0~10V 2. Input reactance: 100KΩ
Analog input	5′ 3	Analog input terminal 2	1. No. 5 indicates the 0~10 or 0/4~20mA analog input, No. 3 indicates 0V within the range of 10V, the voltage and current signal is selected with the J1 jump wire in the control panel. 2. Input reactance: 100KΩ at voltage input, and 500KΩ at current input.
Digital input	11′ 17	Digital input 1	No. 11, 12, 13, 14, 15 and 16 are the digital input terminals. No. 17 is the common terminal Optical coupler isolation Input reactance: 3.3K Voltage range at level input: 9~30V
	12′ 17	Digital input 2	
	13′ 17	Digital input 3	
	14′ 17	Digital input 4	
	15′ 17	Digital input 5	
	16′ 17	Digital input 6	
Analog output	2′ 3	Analog output	No.2 indicates the 0~10 or 0/4~20mA analog input, No.3 indicates 0V within the range of 10V, the voltage and current signal is selected with J2 jump wire in the control panel.
Digital output	7′ 8	Digital output	No.7 indicates 24V, No.8 indicates the digital output Optical coupler isolation, dual-polarity open collector output Output voltage range: 0~24V Output current range: 0~50mA
Relay output	9′ 10	Relay R1 output	No. 9 and 10 NO terminals (The one of 1.5KW and below is the communication terminal).
	18′ 19′ 20	Relay R2 output	No. 18 and 20 NO terminals No. 19 and 20 NC terminals
Auxiliary interface	E-P	External keyboard interface	External LCD keyboard
	RS-485	Communication interface	RS-485 communication  4:485+ 3:485-

3.5.3 Instruction for the connection of control terminal

1)Analog input terminal:

The faint analog voltage signal is easily interfered by the external, so, the shielded cable is required, and the wire for connection should be as short as possible, not exceed 20m, as shown in fig. 3–3. Where some analog signal is seriously interfered, the filter capacitor or ferrite magnetic core should be mounted on the side of analog signal source, as shown in fig. 3–4.

2)Digital input terminal:

The shielded cable is required, and the wire for connection should be as short as possible, not exceed 20m

3)Digital output terminal:

When the digital output terminal needs the drive of relay, the absorber diode should be mounted on both sides of coils of relay, otherwise, DC 24V power will be damaged.

Note: Must correctly install the polarity of absorber diode, otherwise, DC 24V power will be damaged immediately once the digital output terminal has the output.

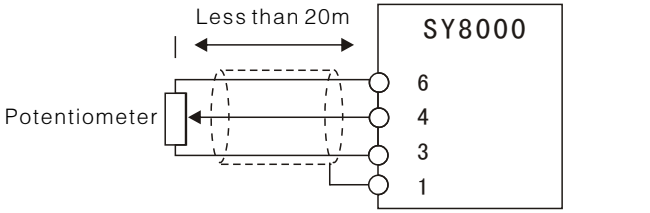


Fig. 3–3 Connection diagram of analog input terminal

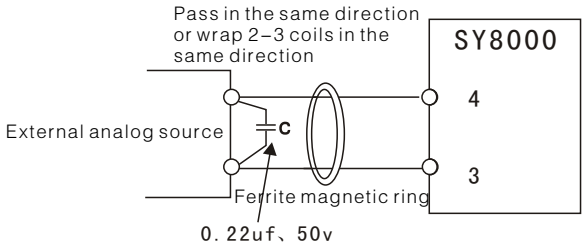


Fig. 3–4 Connection diagram of analog input terminal

3.6 Solutions for EMC problems

3.6.1 Influence of harmonic

1) The high order harmonic of power supply will bring about the damage of inverter, therefore, it is suggested that AC input reactor should be mounted in the area where the power grid is quite bad.

2) Because there is high order harmonic appearing on the output side of the inverter output side, therefore, the capacitor for improving the power factor and surge suppressor may suffer from the electrical vibration on the output side, thus, the equipment will be damaged. Accordingly, the capacitor or surge suppressor should not be mounted on the output side.

3.6.2 Electromagnetic interference and solution

1) Two kinds of electromagnetic interference

One is the interference from the peripheral electromagnetic noise which leads to the error operation of inverter itself. This interference has the low impact, because the inverter has the internal treatment against it when being designed, with the strong ability to resist the interference. The other is the inverter impact on peripheral equipment.

Common solutions

①The earthing wires of inverter and other electrical products should be earthed well, and the earthing resistance should not be larger than 5Ω.

②The dynamopower line of inverter should not be laid with the control circuit in parallel, they can be vertically laid if available.

③Where the interference resistance is demanding, the power line from the inverter to motor uses the shielded cable, the shielded layer should be earthed reliably.

④The lead of interfered equipment should be shielded twisted pair, and the shielded layer should be earthed well.

2) Solutions against the interference from the peripheral electromagnetic equipment

The electromagnetic impact comes from many relays, contactors or electromagnetic brakes that are installed around the inverter. If the inverter performs the error operations for the interference from abovementioned equipment, the following solutions may be taken.

①A surge suppressor is mounted at the equipment that can produce the interference.

②The filter is mounted at the input terminal of inverter.

③The control signal wire of inverter and lead of detection circuit adopt the shielded cable, and the shielded layer should be earthed reliably.

3) Solutions against the inverter noise interference to peripheral equipment:

The noise comes from two operations: one is the emission of inverter itself, the other is the emission of lead from the inverter to motor. These two kinds of emission enable the surface of lead of peripheral electric equipment to suffer from the electromagnetic and static inductance, so that the equipment actuates the error operation. For abovementioned different interferences, the following methods can be taken for handling.

① The signal of metering meter, receiver and sensor are quite weak, if they are mounted near the inverter or installed with the inverter in the same control cabinet, they will be interfered easily and performs the error operation. The following methods may be taken to handle against the interference: keep them away the interference source as far as possible, don't lay the signal wire and power line in parallel, especially, don't bind them in parallel; adopt the shielded cable as the signal wire and power wire; mount the linear filter or wireless noise filter on the input and output side of inverter.

② When the interfered equipment and inverter use the same power supply, if the above methods are useless for eliminating the interference, the linear filter or wireless noise filter should be mounted between the inverter and power supply.

③The peripheral equipment should be earthed independently, thus, in commonly eatrhing, the interference from the leakage current that is produced by the earthing wire of inverter may be avoided.

4) Leakage current and solutions

The leakage current includes line–to–line leakage current and to–earth leakage current.

①Causes for impacting the to–earth leakage current and solutions

The distribution capacitance appears between the inverter and ground, the larger the distribution capacitance is, the larger the leakage current will be; this distribution capacitance may be reduced through efficiently reducing the distance from inverter to motor. And, the larger the carrier frequency, the larger the leakage current will be. This leakage current may be lowered by reducing the carrier frequency. However, please pay attention to that the reduction of carrier frequency will lead to the increase of motor noise. The installation of reactor is also an effective method for eliminating the leakage current. As the leakage current increases with the loop current, the larger power of motor will bring the larger leakage current.

②Causes for producing line–to–line leakage current and solutions

The distribution capacitance appears among the output wires of inverter, if the current passing through the circuit includes the high order harmonic, the resonance will be caused that will produce the leakage current. In this case, if the thermal relay is used, the inverter will actuate some error operations.

The solution is to reduce the carrier frequency or mount an output reactor. It is suggested the thermal relay should not be mounted in front of motor when using the inverter and the electronic overheat protection function should be used.

4.1 Instruction for operation and display interface

Such operations like amendment of function parameter, working state monitoring and running control (start and stop) may be performed by using the operation panel, the panel outline and function area are shown as fig. 4–1.

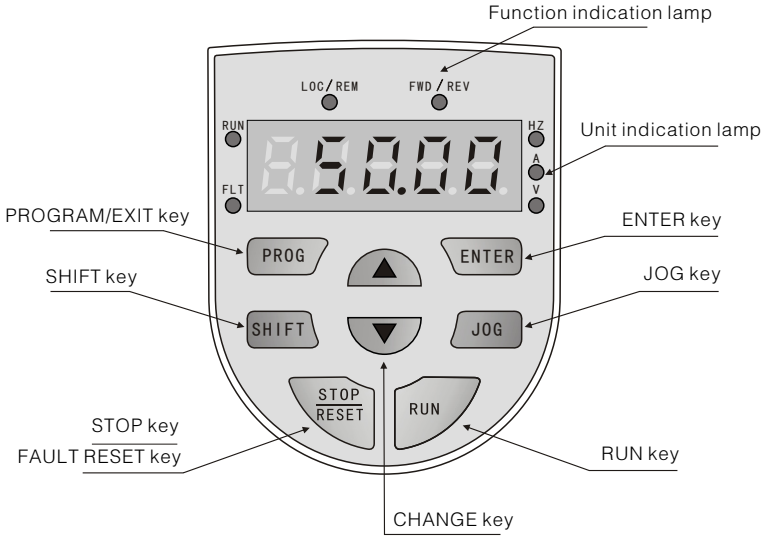


Fig. 4–1 Operation panel diagram

4.1.1 Instruction for button function

Button symbol	Name	Function
PROG	PROGRAM key	Let primary menu enter or exit, delete the shortcut parameters.
ENTER	ENTER key	Enter into the menu picture step by step, confirm the setting parameters.
▲	UP key	Increase the data or function codes
▼	DOWN key	Decrease the data or function codes
SHIFT JOG	COMBINATION	In the "shutdown display" interface and "run display" interface, move to left and circularly select the displayed parameters, please notice that in operation, press "ENTER" key first, then press the "JOG" key.
SHIFT	SHIFT key	In the "shutdown" interface and "run" interface, move to right and circularly select the displayed parameters; in amending the parameters, please select the amended places of parameters.
RUN	RUN key	In the mode of keyboard operation, it is used for "RUN" control.

STOP RESET	STOP/RESET key	In "RUN" state, press this key to stop the running; this function code P1.12 is used to restrict. In "FAULT & ALARM" state, all control modes may be reset by this key.
JOG	SHORTCUT MULTI–FUNCTION key	The function of this key is determined by P1.11. 0: Used for jogging operation, it is the JOG key 1: Used for forward/reverse operation shift, it is the forward/reverse operation shift key. 2: Used for clearing the setting parameters by UP/DOWN keys, namely the frequency values.
STOP RESET RUN	Combination	Press the "RUN" key and "STOP/RST" key at the same time, the inverter will shut down freely.

4.1.2 Instruction for indicator lamp

1)Instruction for function indicator lamp

Indicator lamp Name	Indicator lamp Description
RUN	If the lamp goes out, the inverter is in the shutdown state; if the lamp goes on, the inverter is in the running state; if the lamp flashes, the inverter is in the parameter self–learning state;
LOC/REM	It is the indicator lamp of keyboard operation, terminal operation and remote communication control. if the lamp flashes, the inverter is in the terminal operational control state; if the lamp goes out, the inverter is in the remote operational control state. If this lamp goes out, the inverter is in the keyboard operational control state;
FWD/REV	Forward/reverse rotation indicator lamp If this lamp goes out, the inverter is in the forward rotation state; if this lamp goes on, this inverter is in the reverse rotation state.
FLT	Fault indicator lamp In the fault state, this lamp goes on; in the normal state, this lamp goes out.
HZ	Frequency unit
V	Voltage unit
A	Current unit

2) Digitron display area

LED, with 5 bits, displays the monitoring data such as setting frequency and output frequency, etc. as well as alarm codes.

4.2 Operation flow

4.2.1 Parameter setting

Three classes menu:

1)Function group (primary menu);

2) Function code (secondary menu);

3) Function code setting value (tertiary menu);

Note: When performing the territory menu, press "PROG" key or "ENTER" key to return to the secondary menu. The difference between two keys: press "ENTER" key, the setting parameters is stored in the control panel, then it returns to the secondary menu, and transfers to the next function code automatically; press "PROG" key to directly come back to the secondary menu, without storing the parameters, but staying at the current function code.

Taking the function code P2.09 that is changed into 01.05 to 00.00Hz for example

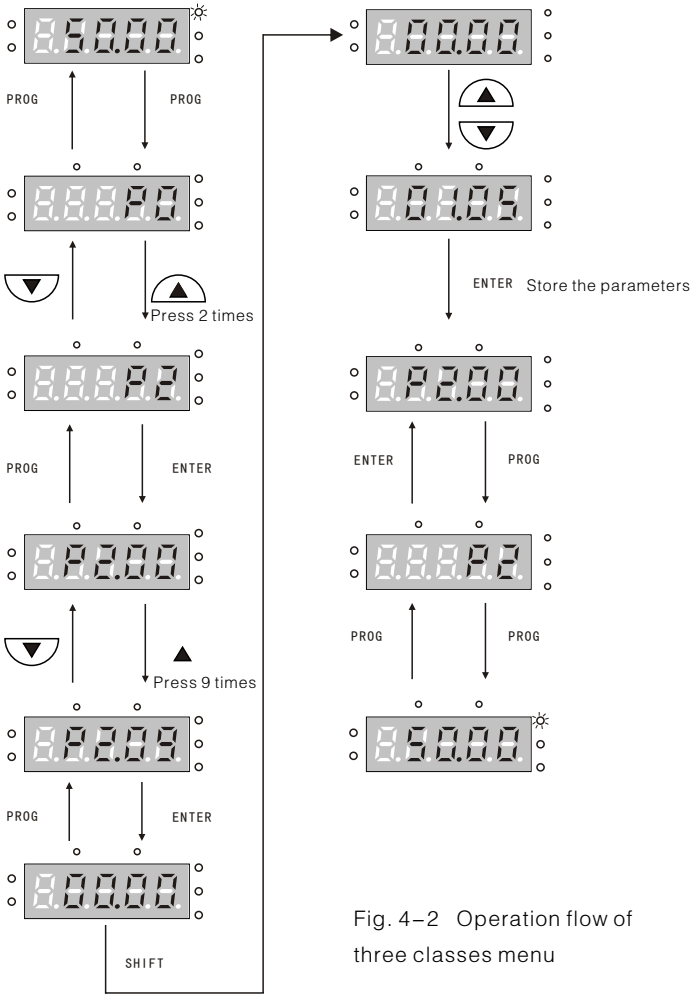


Fig. 4–2 Operation flow of three classes menu

In the state of tertiary menu, if the parameters have no flashing place, the function should not be amended, the possible causes as follows:

1) The function code is the unchangeable parameter, such as the actual detection parameters and running record parameters.

2) The function code is unchangeable in the running state, till the inverter is shut down, it can be amended;

4.2.2 Fault reset

When the inverter has the fault, it will prompt the relevant fault information. User can reset against the fault by pressing the "STOP/RST" key on the keyboard or using the terminal function, after the inverter is reset against the fault, it is in the standby state. If it is in the fault state, user hasn't reset it, the inverter is in the running protection state, and it fails to run.

4.2.3 Motor parameter self learning

If selecting the vector feedback control without PG, the nameplate of motor must be input correctly before the inverter runs. In the vector control mode, the motor parameters must be correct, so as to get the optimal control performance.

Self–learning steps of motor parameters as follows:

1) First, select the running command channel (P0.02) by choosing the "keyboard command channel".

2) Then, input the motor actual parameters:

PB.02 Rated power of motor

PB.03 Rated frequency of motor

PB.04 Rated speed of motor

PB.05 Rated voltage of motor

PB.06 Rated current of motor

Note: The motor should be separated from the load, otherwise, the motor parameters got by self learning function may be incorrect.

3) Set PB.00 to 1, please refer to the introduction for the detailed functions of PB.00 in Page 77 for the self–learning course.

4) Press the "RUN" key in the keyboard panel, the inverter will calculate the following motor parameters:

PB.07 Stator resistance of motor

PB.08 Rotor resistance of motor

PB.09 Stator and rotor inductance of motor

PB.10 Stator and rotor mutual inductance of motor

PB.11 No–load current of motor

When the parameter self–learning operation is ended, it displays the ?–END–?, this means the motor parameter self–learning operation is completed.

4.2.4 Password setting

Sy8000 series inverter provides the user's password protection function, when P1.22 is set to non zero state, the displayed digits are the password, the inverter exits from the function code edition state, the password protection will come into operation, press the "PROG" key again, the inverter enters into the function code edition state, and displays "0.0.0.0.0", the operator must input the user's password correctly, otherwise, the inverter can't enter into the operation. If canceling the password protection function, set P1.22 to 0. The user's password has not protection for the parameters in the shortcut menu.

4.3 Methods for searching the state parameters

4.3.1 Electrification initiation

When the inverter is electrified, the system begins to perform the initiation, LED displays "–S–Y–", after the initiation operation is finished, the inverter will be in the standby state.

4.3.2 Standby

In the shutdown or operation state, the inverter can display various states of parameters. The function codes P1.16 (running parameter) and P1.17 (shutdown parameter) determine whether the parameters are displayed according to the bit of binary system, the definition of each bit is shown as the description of P1.16 and P1.17.

In the shutdown state, the inverter can select whether nine shutdown–state parameters are displayed, the nine shutdown–state parameters are listed as follows: setting frequency, bus voltage, input terminal state, output terminal state, PID setting value, PID feedback value, analog input terminal 4 voltage, analog input terminal 5 voltage, multi–speed segment number, the function code P1.17 determines whether such parameters are displayed according to the bit (binary system). Press the "SHIFT" key to shift and display the selected parameters.

In the running state, the inverter can select whether fourteen running–state parameters are displayed, the fourteen running–state parameters are listed as follows: running frequency, setting frequency, bus voltage, output voltage, output current, output rotation speed, output power, output torque, PID setting value, PID feedback value, input terminal state, output terminal state, analog input terminal 4 voltage, analog input terminal 5 voltage, multi–speed segment number, the function code P1.16 determines whether such parameters are displayed according to the bit (binary system). Press SHIFT key to shift and display the selected parameters.

4.3.2 Fault

Sy8000 series inverter has provided various fault information, please refer to SY8000 series inverter fault and countermeasures for details.

4.4 Fast adjustment

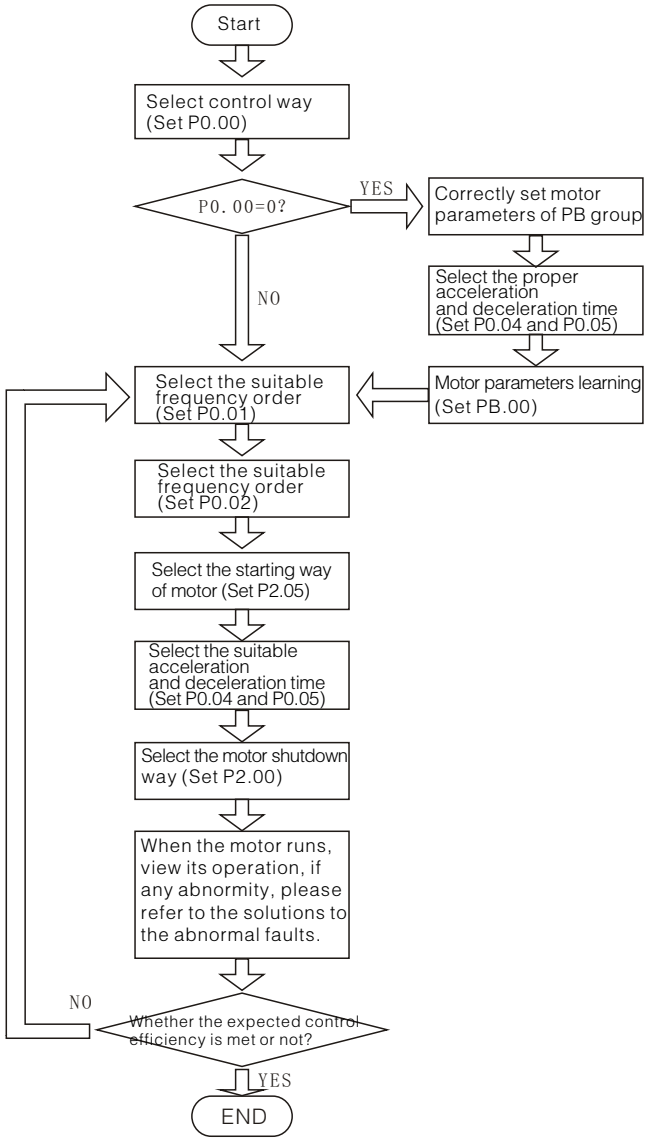


Fig. 4–3 Fast adjustment flow chart

5.1 Function parameters table

The function code adopts tertiary menu, for instance, “P8.08” means No. 8 function code of P8 group function. PE group indicates the manufacturer's function parameters, user has not right to access the parameters of this group.

To take convenience for the setting of function code, when operating with the operation panel, the function group number, function code and function code parameters are respectively corresponding to the primary menu, secondary menu and tertiary menu.

1) The information in the column of function table is described as follows:

Column1: “Function group” that refers to PO ~ PE, total 16 groups;

Column2: “Function code” that refers to the function parameter group and parameter no.

Column 3: “Name” refers to the integral name of function parameters;

“Parameter description” refers to the expatiation of function parameters;

Column 5: “Default” refers to the ex-factory original setting value of function parameters;

Column 6: “Amendment” refers to the amended attribute (that is, amendment conditions or whether the amendment is permissible), introduced as follows:

“○” represents the parameter may be amendable when the inverter is in the shutdown and running state;

"◎"represents the parameter is unallowable to be amended when the inverter is in the running state;

“●” represents the parameter is unallowable to be amended when it is the actual measured and recorded value.

(The inverter has performed the self examination and limitation for the amendment attribute of function parameters, so it can prevent user's incorrect amendment.)

Column 7: “Serial no.” refers to the sequence no. of the whole function code, also indicates the register address of communication.

2) “Parameter system” is the decimal system (DEC), if the parameter adopts the hexadecimal system, when editing the parameters, the data of every bit should be independent each other, the numeric area of some bits may be the hexadecimal system (0~F).

3) “Default” indicates that the value that the function code parameters have been refurbished when operation of ex-factory parameter is restored; but, the actual measured parameter or recorded value can't be refurbished.

4) To get better protection for parameters, the inverter provides the password protection for the function code. After the user's password has been set (namely, the parameter of user's password P1.22 is non zero), user presses the "PROG" key, the inverter enters into the function code edition state, the system will get into the user's password verification state first, it displays “0.0.0.0.0”, the operator must correctly input the user's password, otherwise, the system fails to enter into operation. For the manufacturer's setting parameter area, the operator also should input the manufacturer's password correctly, thus, the system can perform the normal operation. (Notice: User should not attempt to amend the manufacturer's setting parameters, if the parameters haven't been set correctly, the inverter will work abnormally or it will be damaged easily).

In the unlocking state of password protection, the user's password may be amended at any time, it is subject to the last input. The user's password may be canceled by setting P1.22 to 0; when re-electrified, the password goes into effect; if the P1.22 has not been set to 0, the parameter is protected by the password.

5) When amending the function code parameters by serial communication, the function of user's password also follows the abovementioned rules.

Function parameters table: 1

Function group	Function code	Name	Parameter description	Default	Amendment	Serial no.
P0 group Basic function group	P0.00	Speed control mode	0: Vector control without PG 1: V/F control	0	◎	ABS000
	P0.01	Frequency command selection	0:Keyboard setting 1:Analog terminal 4 setting 2:Analog terminal 5 setting 3:Terminal 4+ terminal 5 4:Setting of multi-speed running 5:PID control setting 6:Remote communication setting	0	○	ABS001
	P0.02	Running command channel	0:Keyboard command channel (LOC/REM lamp goes out) 1:Terminal command channel (LOC/REM lamp flashes) 2:Communication command channel (LOC/REM lamp goes on)	0	○	ABS002
	P0.03	Keyboard setting frequency	0.00Hz ~ P0.13(max frequency)	50.00Hz	○	ABS003
	P0.04	Acceleration time 1	0.1~3600.0s	Depend on the machine type	○	ABS004
	P0.05	Deceleration time 1	0.1~3600.0s	Depend on the machine type	○	ABS005
	P0.06	Carrier frequency setting	1.0~15.0KHZ	Depend on the machine type	○	ABS006
	P0.07	V/F curve setting	0:Straight-line type VF curve 1: 2nd power	0	◎	ABS007
	P0.08	Torque increase	0.0%:(automatic) 0.1% ~ 30.0%	0.0%	◎	ABS008
	P0.09	Cut-off point of torque increase	0.0%~50.0% (related to rated frequency of motor)	0.0%	○	ABS009
	P0.10	Limit point of VF slip compensation	0.0~200.0%	0.0%	○	ABS010
	P0.11	Running direction selection	0:Default direction running 1:Opposite direction running 2:Forbidden reverse running	0	◎	ABS011
	P0.12	Dead time of forward /reverse rotation	0.1~3600.0s	Depend on the machine type	○	ABS012
	P0.13	Max output frequency	10.00Hz~600.00Hz	50.00Hz	◎	ABS013
	P0.14	Upper-limit frequency	P0.15~P0.13	50.00Hz	○	ABS014
	P0.15	Lower-limit frequency	0.00Hz ~ P0.14 (upper-limit frequency)	0.00Hz	◎	ABS015

Note:

"○"represents the parameter setting values may be amendable when the inverter is in the shutdown and running state;

"◎"represents the parameter setting values are unallowable to be amended when the inverter is in the running state;

"●"represents the parameter is unallowable to be amended when it is the actual measured and recorded value.

Function parameters table: 2

P1 group Human-machine interface group	P1.00	Selection of AVR functions	0: Invalid 1: Valid in the whole course 2: Invalid only at deceleration	2	○	ABS016
	P1.01	Braking threshold voltage	115.0 ~ 140.0%(standard bus voltage) (380V series)	130.0%	○	ABS017
			115.0 ~ 140.0%(standard bus voltage) (220V series)	120.0%		
	P1.02	Jump frequency	0.00~P0.13 (max frequency)	0.00Hz	○	ABS018
	P1.03	Amplitude of jump frequency	0.00~P0.13 (max frequency)	0.00Hz	○	ABS019
	P1.04	Reserve				ABS020
	P1.05	Inverter temp.	0~100.0℃		●	ABS021
	P1.06	Jogging operation frequency	0.00~P0.13 (max frequency)	5.00Hz	○	ABS022
	P1.07	Acceleration time of jogging operation	0.1~3600.0s	Depend on the machine type	○	ABS023
	P1.08	Deceleration time of jogging operation	0.1~3600.0s	Depend on the machine type	○	ABS024
	P1.09	Acceleration time 2	0.1~3600.0s	Depend on the machine type	○	ABS025
	P1.10	Deceleration time 2	0.1~3600.0s	Depend on the machine type	○	ABS026
	P1.11	JOG key function selection	0: Jogging operation 1: Shift between forward rotation and reverse rotation 2: Clear the values set by pressing UP/DOWN key	0	◎	ABS027
	P1.12	STOP/RST key Shutdown function selection	0: Valid only for panel control 1: Valid for panel and terminal control 2: Valid for panel and communication control 3: Valid for all control modes	0	○	ABS028
	P1.13	Keyboard and terminal UP/DOWN setting	0: Valid, inverter storage against the power failure 1: Valid, inverter no storage against the power failure 2: Invalid 3: The setting is valid in operation, clearing in stopping.	0	○	ABS029
	P1.14	Keyboard display selection	0: External keyboard is prior. 1: Local host and external keyboard displays simultaneously, but only validness for the external button. 2. Local host and external keyboard displays simultaneously, but only validness for local host button. 3. Local host and external keyboard displays simultaneously, validness for the buttons of both them.	0	○	ABS030
	P1.15	Rotation speed display factor	0.1~999.9% Mechanical rotation speed= 120* operation frequency *P1.15/motor pole pair	100.0%	○	ABS031

3 Function parameters table: 3

P1 group Human-machine interface group	P1.16	Parameter selection in running state display	0 ~ 0X7FFF BIT0: Running frequency BIT1: Setting frequency BIT2: Bus voltage BIT3: Output voltage BIT4: Output current BIT5: Running speed BIT6: Output power BIT7: Output torque BIT8: PID setting value BIT9: PID feedback value BIT10: Input terminal state BIT11: Output terminal state BIT12: Analog terminal 4 value BIT13: Analog terminal 5 value BIT14: Current segment no. of multi-speed operation BIT15: Reserved	0xFF	○	ABS032
	P1.17	Parameter selection in shutdown state display	1~0X1FF BIT0: Setting frequency BIT1: Bus voltage BIT2: Input terminal state BIT3: Output terminal state BIT4: PID setting value BIT5: PID feedback value BIT6: Analog terminal 4 value BIT7: Analog terminal 5 value BIT8: Current segment no. of multi-speed operation BIT9-BIT15: Reserved	0xFF	○	ABS033
	P1.18	Reserved variable				ABS034
	P1.19	Running time	0~65535h	0	●	ABS035
	P1.20	Restoration of function parameters	0: No operation 1: Restore the default 2: Clear the fault record	0		ABS036
	P1.21	Software edition	0: Stop by deceleration 1: Free stop		●	ABS037
	P1.22	User password	0~65535	0	○	ABS038
P2 group Start and stop control group	P2.00	Shutdown way selection		0	○	ABS039
	P2.01	Time for waiting the brake at shutdown	0.0~50.0S	0.0s	○	ABS040
	P2.02	DC braking time at shutdown	0.0~50.0S	0.0s	○	ABS041

Function parameters table: 4

P2 group Start and stop control group	P2.03	DC braking current at shutdown	0.0～150.0%	0.0%	○	ABS042
	P2.04	Frequency at the beginning of braking for shutdown	0.00～5.00Hz	0.00Hz	○	ABS043
	P2.05	Startup operation way	0: Direct startup 1: DC braking first, then starting 2. Restarting by tracking the speed	0	◎	ABS044
	P2.06	Holding time of starting frequency	0.0～50.0s	0.0s	○	ABS045
	P2.07	Braking time before starting	0.0～50.0s	0.0s	○	ABS046
	P2.08	Braking current before starting	0.0～150.0%	0.0%	○	ABS047
	P2.09	Frequency at the beginning of direct startup	0.00～10.00Hz	0.00Hz	○	ABS048
P3 and P4 Input and output terminal group	P3.00	Upper limit of terminal 4	0.00～10.00v	10.00v	○	ABS049
	P3.01	Corresponding setting of upper limit of terminal 4	-100.0%～100.0%	100.0%	○	ABS050
	P3.02	Lower limit of terminal 4	0.00～10.00v	0.00v	○	ABS051
	P3.03	Corresponding setting of upper limit of terminal 4	-100.0%～100.0%	0.0%	○	ABS052
	P3.04	Input filtering time of terminal 4	0.00s～10.00s	0.10s	○	ABS053
	P3.05	Upper limit of terminal 5	0.00～10.00v	10.00v		ABS054
	P3.06	Corresponding setting of upper limit of terminal 5	-100.0%～100.0%	100.0%	○	ABS055
	P3.07	Lower limit of terminal 5	0.00～10.00v	0.00v	○	ABS056
	P3.08	Corresponding setting of upper limit of terminal 5	-100.0%～100.0%	0.0%	○	ABS057
	P3.09	Input filtering time of terminal 5	0.00s～10.00s	0.10s	○	ABS058
	P3.10	Output selection of terminal 2	0: Running frequency 1: Setting frequency 2: Running speed 3: Output current 4: Output voltage 5: Output power 6: Output torque	0	○	ABS059

Function parameters table: 5

P3 and P4 group Input and output terminal group			7:Input value of analog terminal 4 8:Input value of analog terminal 5 9～10:Reserved			
	P3.11	Upper limit of No. 2 terminal output	0.0%～100.0%	100.0%	○	ABS060
	P3.12	No. 2 terminal corresponding output of upper limit	0.00V～10.00V	10.00V	○	ABS061
	P3.13	Lower limit of No. 2 terminal output	0.0%～100.0%	0.0%	○	ABS062
	P3.14	No. 2 terminal corresponding output of lower limit	0.00V～10.00V	0.00V	○	ABS063
	P4.00	Terminal function detection selection when electrified	0: The terminal running command is invalid when electrified 1: The terminal running command is valid when electrified	0	○	ABS064
	P4.01	Selection of No. 11 terminal function	0: No function 1.Forward running 2.Reverse running 3.Three-line running control 4.Forward jogging operation 5.Reverse jogging operation 6.Free stop 7.Fault reset 8.External fault input 9.Increment (UP) of frequency setting value 10: Decrement (DOWN) of frequency setting value 11: Clearing the setting of frequency decrement 12: Multi-speed terminal 1 13: Multi-speed terminal 2 14: Multi-speed terminal 3 15: Selection for acceleration and decoration time 16: PID control pause 17: Wobble frequency pause (stop at current frequency) 18: Wobble frequency reset (return to the central frequency) 19: Forbidding the acceleration and deceleration. 20: Forbidding the torque control 21: Temporary clearing of the setting values of frequency increment and decrement 22~25: Reserved	1	◎	ABS065
	P4.02	Selection of No. 12 terminal function		4	◎	ABS066
	P4.03	Selection of No. 13 terminal function		7	◎	ABS067
	P4.04	Selection of No. 14 terminal function		0	◎	ABS068
	P4.05	Selection of No. 15 terminal function		0	◎	ABS069
	P4.06	Selection of No. 16 terminal function		0	◎	ABS070
	P4.07	Switch quantity filtering times	1～10	5	○	ABS071
	P4.08	Running mode of terminal control	0: Two-line control 1 1: Two-line control 2 2: Three-line control 1 3: Three-line control 2	0	◎	ABS072

Function parameters table: 6

P3 and P4 group Input and output terminal group	P4.09	Terminal UP/DOWN frequency increment variable rate	0.01～50.00Hz/s	0.50Hz/s	○	ABS073
	P4.10	Selection of No.8 terminal output	0: Without output 1: Motor in forward running 2: Motor in reverse running 3. Fault output 4. Frequency level detection FDT output 5. Frequency arrival 6. Under running at zero speed 7: Upper-limit frequency arrival 8: Lower-limit frequency arrival 9: Auxiliary pump 1 10: Auxiliary pump 2 11~12: Reserved	1	○	ABS074
	P4.11	Relay R1 output Selection of No. 9 and 10 terminals		0	○	ABS075
	P4.12	Relay R2 output Selection of No. 18, 19 and 20 terminals		3	○	ABS076
	P4.13	FDT level detection value	0.00～P0.13(max frequency)	50.00Hz	○	ABS077
	P4.14	FDT lag detection value	0.0～100.0%(FDT level)	5.0Hz	○	ABS078
	P4.15	Frequency arrival and detection amplitude	0.0～100.0%(max frequency)	0.0Hz	○	ABS079
P5 group Protection function group	P5.00	Over-voltage stalling protection	0: Forbidden 1: Allowable	0	○	ABS080
	P5.01	Over-voltage stalling protection voltage	110～150%(380V series)	120%	○	ABS081
			110～150%(220V series)	115%		
	P5.02	Selection of motor overload protection	0: No protection 1: Common motor (with low-speed compensation) 2: Variable frequency motor (without low-speed compensation)	1	◎	ABS082
	P5.03	Motor overload protection current	20.0%～120.0% (motor rated current)	100.0%	○	ABS083
	P5.04	Automatic current limiting level	100～200%	Type G:160% Type P:120%	○	ABS084
	P5.05	Decrease rate of frequency during current limiting	0.00～100.00Hz/s	0.00Hz/s	○	ABS085
	P5.06	Frequency reducing point of instantaneous power failure	70.0～110.0%(standard bus voltage)	80.0%	○	ABS086
	P5.07	Decrease rate of instantaneous power failure frequency	0.00Hz～P0.13(max frequency)	0.00Hz	○	ABS087
	P5.08	Type of previous two faults	0～24 0: No fault 1: Inversion unit phase U protection (ERR01) 2: Inversion unit phase V protection (ERR02)		●	ABS088
	P5.09	Type of previous one fault			●	ABS089

Function parameters table: 7

P5 group Protection function group	P5.10	Current fault type	24.Reserved 23.Braking unit fault (ERR23) 22.PID feedback disconnection fault (ERR22) 21.EEPROM operation fault (ERR21) 20.Motor self-learning fault(ERR20) 19.Current detection fault (ERR19) 18.Communication fault (ERR18) 17.External fault(ERR17) 16.Over heat on the inversion mould(ERR16) 15.Over heat on rectifying module(ERR15) 14.Phase failure on output side (ERR14) 13.Phase failure on input side (ERR13) 12.Inverter over load (ERR12) 11.Motor over load (ERR11) 10.Bus under-voltage fault(ERR10) 9: Over voltage at constant speed (ERR09) 8: Over voltage at deceleration (ERR08) 7: Over voltage at acceleration (ERR07) 6: Over current at constant speed(ERR06) 5: Over current at deceleration (ERR05) 4: Over current at acceleration (ERR04) 3：Inversion unit phase W protection (ERR03)		●	ABS090
	P5.11	Running frequency of current fault			●	ABS091
	P5.12	Output current of current fault			●	ABS092
	P5.13	Bus voltage of current fault			●	ABS093
	P5.14	Input terminal state of current fault			●	ABS094
	P5.15	Output terminal state of current fault			●	ABS095
	P5.16	Setting of interval time of fault automatic reset	0.1～100.0s	1.0s	○	ABS096
	P5.17	Times of fault automatic reset	0～3	0	○	ABS097
P6 group Wobble frequency function group	P6.00	Jump frequency amplitude	0.0～50.0%(Relative to frequency amplitude)	0.0%	○	ABS098
	P6.01	Wobble frequency amplitude	0.0～100.0%(Relative to setting frequency)	0.0%	○	ABS099
	P6.02	Wobble frequency rise time	0.1～3600.0s(relative to setting frequency)	5.0s	○	ABS100
	P6.03	Wobble frequency fall time	0.1～3600.0s(relative to setting frequency)	5.0s	○	ABS101

Function parameters table: 8

P7 group PID function group	P7.00	Selection of PID feedback source	0: Feedback of analog channel terminal 4 1: Feedback of analog channel terminal 5 2: Terminal 4+ terminal 5 feedback 3: Remote communication feedback	0	○	ABS102
	P7.01	Selection of PID specified source	0: Keyboard setting (P7.02) 1: Setting of analog channel terminal AI1 2: Setting of analog channel terminal AI2 3: Remote communication setting 4: Multi-segment setting	0	○	ABS103
	P7.02	Setting of keyboard preset PID	0.0%～100.0%	0.0%	○	ABS104
	P7.03	Selection of PID output characteristics	0: PID output is the positive characteristics 1: PID output is the negative characteristics	0	○	ABS105
	P7.04	(Kp) Proportional gain	0.00～100.00	1.00	○	ABS106
	P7.05	(Ti) Integral time	0.01～10.00s	0.10s	○	ABS107
	P7.06	(Td) Derivative time	0.01～10.00s	0.00s	○	ABS108
	P7.07	(T) Sampling period	0.01～100.00s	0.10s	○	ABS109
	P7.08	PID-control deviation limit	0.0%～100.0%	0.0%	○	ABS110
	P7.09	Feedback disconnection detection value	0.0%～100.0%	0.0%	○	ABS111
	P7.10	Feedback disconnection detection time	0.0～3600.0S	1.0S	○	ABS112
P8 group Multi-speed function group	P8.00	Multi-segment frequency 0	-100.0～100.0%	0.0%	○	ABS113
	P8.01	Multi-segment frequency 1	-100.0～100.0%	0.0%	○	ABS114
	P8.02	Multi-segment frequency 2	-100.0～100.0%	0.0%	○	ABS115
	P8.03	Multi-segment frequency 3	-100.0～100.0%	0.0%	○	ABS116
	P8.04	Multi-segment frequency 4	-100.0～100.0%	0.0%	○	ABS117
	P8.05	Multi-segment frequency 5	-100.0～100.0%	0.0%	○	ABS118
	P8.06	Multi-segment frequency 6	-100.0～100.0%	0.0%	○	ABS119
	P8.07	Multi-segment frequency 7	-100.0～100.0%	0.0%	○	ABS120
P9 group Serial communication group	P9.00	Communication address of local host	1～247, 0: Broadcast address	1	○	ABS121
	P9.01	Setting of communication baud rate	0:1200BPS 1:2400BPS 2:4800BPS 3:9600BPS 4:19200BPS 5:38400BPS	3	○	ABS122

Function parameters table: 9

P9 group Serial communication group	P9.02	Setting of data bit check	0: No check (N, 8, 1) for RTU 1: Even check (E, 8, 1) for RTU 2: Odd check (0, 8, 1) for RTU 3: No check (N, 8, 2) for RTU 4: Even check (E, 8, 2) for RTU 5: Odd check (0, 8, 2) for RTU 6: No check (N, 7, 1) for ASCII 7: Even check (E, 7, 1) for ASCII 8: Odd check (0, 7, 1) for ASCII 9: No check (N, 7, 2) for ASCII 10: Even check (E, 7, 2) for ASCII 11: Odd check (0, 7, 2) for ASCII 12: No check (N, 8, 1) for ASCII 13: Even check (E, 8, 1) for ASCII 14: Odd check (0, 8, 1) for ASCII 15: No check (N, 8, 2) for ASCII 16: Even check (E, 8, 2) for ASCII 17: Odd check (0, 8, 2) for ASCII	0		ABS123
	P9.03	Communication response time delay	0～200ms	5ms		ABS124
	P9.04	Communication time-out fault time	0.0(invalid), 0.1～100.0s	0.0s		ABS125
	P9.05	Handling operation against communication fault	0: Alarm and free stop 1: No alarm, but go on running 2: No alarm, and conduct the shutdown by means of stopping (only under the communication control way) 3: No alarm, and conduct the shutdown by means of stopping (under all communication control ways)	1		ABS126
	P9.06	Communication response operation	0: Response for the writing operation. 1: No response for the writing operation	0		ABS127
PA group Vector control group	PA.00	Speed loop proportional gain 1	1～100	20	○	ABS128
	PA.01	Speed loop integral gain 1	0.01～10.00s	0.50s	○	ABS129
	PA.02	Switching low-point frequency	0.00Hz～PA.05	5.00Hz	○	ABS130
	PA.03	Speed loop proportional gain 2	1～100	15	○	ABS131
	PA.04	Speed loop integra gain 2	0.01～10.00s	1.0	○	ABS132
	PA.05	Switching high-point frequency	0.00Hz～P0.04(max frequency)	10.00Hz	○	ABS133
	PA.06	VC slip compensation factor	50%～200%	100%	○	ABS134
	PA.07	Setting of torque upper limit	0.0～200.0%(rated current of inverter)	150.0%	○	ABS135

Function parameters table: 10

PB group Motor parameter setting group	PB.00	Motor parameter self-learning operation	0: No operation 1: Parameters overall self-learning operation 2: Parameters static self-learning operation		◎	ABS136
	PB.01	Type of inverter	0: Type G 1: Type P	Depend on the machine type	◎	ABS137
	PB. 02	Motor rated power	0.4～900.0kW	Depend on the machine type	◎	ABS138
	PB. 03	Motor rated frequency	0.01Hz～P0.13(max frequency)	50.00Hz	◎	ABS139
	PB. 04	Motor rated speed	0～3600rpm	Depend on the machine type	◎	ABS140
	PB. 05	Motor rated voltage	0～460V	Depend on the machine type	◎	ABS141
	PB. 06	Motor rated current	0.1～2000.0A	Depend on the machine type	◎	ABS142
	PB. 07	Motor stator resistance	0.001～65.535Ω	Depend on the machine type	◎	ABS143
	PB. 08	Motor rotor resistance	0.001～65.535Ω	Depend on the machine type	◎	ABS144
	PB. 09	Inductance of motor stator and rotor	0.1～6553.5mH	Depend on the machine type	◎	ABS145
	PB. 10	Mutual inductance of motor stator and rotor	0.1～6553.5mH	Depend on the machine type	◎	ABS146
	PB. 11	Motor no-load current	0.01～655.35A	Depend on the machine type	◎	ABS147
PC group Multi-pump control	PC. 00	Qty. of auxiliary pump	0～2	0	○	ABS148
	PC. 01	PID upper-limit frequency	0～600.00Hz	50.00Hz	○	ABS149
	PC. 02	PID lower-limit frequency	0～600.00Hz	0.00Hz	○	ABS150
	PC. 03	Waking pressure	0.0%～100.0%	50.0%	○	ABS151
	PC. 04	Sleep function	0: Invalid 1: Valid	0	○	ABS152
PE group Manufacturer's function group	PE. 00	Manufacturer's password		*****	◎	ABS159
	PE. 01	Selection of machine type			◎	ABS160
	PE. 02	Inverter model			◎	ABS161
	PE. 03	Inverter rated power			◎	ABS162
	PE. 04	Inverter rated voltage			◎	ABS163
	PE. 05	Inverter rated current			◎	ABS164
	PE. 06	Dead time			◎	ABS165
	PE. 07	Over-voltage point of software			◎	ABS166
	PE. 08	Under -voltage point of software			◎	ABS167
	PE. 09	Over-current point of software			◎	ABS168
	PE. 10	Voltage correction factor			◎	ABS169
	PE. 11	Current correction factor			◎	ABS170
	PE. 12	Manufacturer's time setting			◎	ABS171

P0 Basic function group

Function code	Name	Parameter description	Setting range	Default
P0.00	Speed control mode	0: Vector control without PG 1: V/F control	0～1	0

0: Vector control without PG

This function code refers to open-loop vector. It is suitable for high-performance general location, one inverter only drives one motor of following loads such as the machine tool, centrifuge, wire drawing bench, injection moulding machine, etc..

1: V/F control

This function is suitable for the loads whose control accuracy is undemanding such as the fan, pump, etc., it enables the inverter to drive multi motors.

Note: When selecting the vector control, the motor parameter self-learning operation must be performed. Only the motor parameters are correct, the best vector control can be got. Through adjusting the parameters (PA group) of speed regulator, the better performance can be achieved.

Function code	Name	Parameter description	Setting range	Default
P0.01	Selection of frequency command	0: Keyboard setting 1: Setting of analog terminal 4 2: Setting of analog terminal 5 3: Setting of terminal 4 and terminal 5 4: Multi-speed operation setting 5: Setting of PID control 6: Setting of remote communication	0～1	0

0: Keyboard setting

Get the keyboard-setting frequency through amending the value of function code P0.03 "keyboard-setting frequency"

1: Setting of analog terminal 4

2: Setting of analog terminal 5

3: Setting of terminal 4 and terminal 5

The function code refers to that the frequency is set by the analog input terminal. The standard configuration of SY8000 series inverter presents 2-channel analog input terminals, hereinto, terminal 4 has 0~10V input, terminal 5 has 0~10V input or 0 ~20mA input, the current and voltage input may be switched through the jump wire J1. 0~10V input is corresponding to U-I in the control board, and 0（4）~20mA input is corresponding to I-I in the control board.

Note: When terminal 5 selects 0~20mA input, the voltage corresponding to 20mA is 10V. 100% by analog input setting is corresponding to the max frequency (function code P0.13), -100% is corresponding to opposite max frequency (function code P0.13).

4: Multi-speed operation setting

Selection of multi-speed running way: the parameters of "multi-speed control group" P3, P4 and P8 need to be set to determine the corresponding relationship between the setting percentage and specified frequency.

5: PID control setting

Selection of process PID control: at this moment, P7 group "PID function group" needs setting. The running frequency of inverter is the value after action of PID. Hereinto, the definitions of PID specified source, specified amount and feedback source are shown as the "PID function" of P7 group.

6: Remote communication setting

The frequency command is set by means of communication of the upper machine.Refer to P9 group and communication protocol for details

Function code	Name	Parameter description	Setting range	Default
P0.02	Running command channel	0: Keyboard command channel (LOC/REM lamp goes out) 1: Terminal command channel (LOC/REM lamp flashes) 2: Communication command channel (LOC/REM lamp goes on)	0～3	0

Select the control command channel of inverter

The control command of inverter includes the startup, shutdown, forward rotation, reverse rotation, jogging, fault reset, etc..

0: Keyboard command channel (LOC/REM lamp goes out)

Conduct the operation command control by pressing the buttons of RUN and STOP/RST in the keyboard panel, if the multi–function key JOG is set to FWD/REV switching function (P1.11 is set to 1), the rotation direction may be changed by this key; in the running state, if pressing RUN and STOP/RST key at the same time, the inverter will stop freely.

1: Terminal command channel ("LOC/REM lamp flashes)

Perform the running command control by the multi–function input terminal forward rotation, reverse rotation, forward jogging operation and reverse jogging operation.

2: Communication command channel ("LOC/REM lamp goes on)

The running command is controlled by the means of communication of upper machine.

Function code	Name	Parameter description	Setting range	Default
P0.03	Keyboard setting frequency	0.00Hz～P0.13(max frequency)	0.00～P0.13	50.00Hz

If selecting the "keyboard setting" for controlling the frequency command, the function code value is the frequency digital–setting initial value of inverter.

Function code	Name	Parameter description	Setting range	Default
P0.04	Acceleration time 1	0.1～3600.0s	0.1～3600.0	Depend on the machine type
P0.05	Deceleration time 1	0.1～3600.0s	0.1～3600.0	Depend on the machine type

The acceleration time 1 refers to t1 required by inverter that accelerates from 0Hz to max output frequency (P0.13); and the deceleration time refers to t2 required by inverter that decelerates from max output frequency (P0.13) to 0Hz, shown as following diagram:

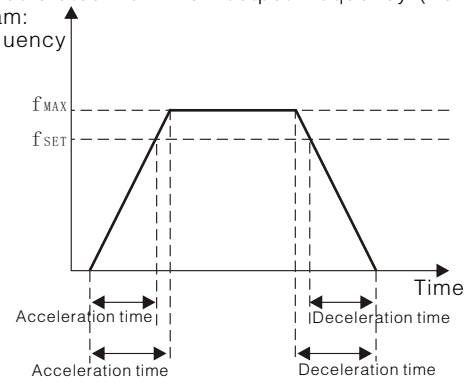


Fig. 6–1 Acceleration and deceleration time diagram

When the setting frequency is equal to the max frequency, the actual acceleration/deceleration time is equal to the setting acceleration/deceleration time. When the setting frequency is less than max frequency, the actual acceleration/decoration time is less than the setting acceleration/deceleration time.

Actual acceleration/deceleration time=Setting acceleration/deceleration time × Setting frequency/max frequency

SY8000 series inverter has two groups of acceleration/deceleration time

Group 1: P0.04 and P0.05 Group 2: P1.09 and P1.10

Select the acceleration/deceleration time by the combination of multi–function digital input terminal parameters (P3 and P4 group).

The default of acceleration/deceleration time of inverter of 5.5kW and below is 10.0s, that of the machine of 7.5kW~55kW is 20.0s, and that of the inverter of 75kW and above is 40.0s.

Function code	Name	Parameter description	Setting range	Default
P0.06	Setting of carrier frequency	1.0～15.0KHz	1.0～15.0	Depend on the machine type

Carrier frequency	Electromagnetic noise	Noise and leakage current	Heat dissipation
0.5KHz	▲High	▲Low	▲Low
10KHz			
1.5KHz	▼Low	▼High	▼High

Fig. 6–2 Chart of carrier impact on the environment

List of relationship between machine type and carrier

Carrier frequency / Machine type	Max carrier frequency(KHZ)	Min carrier frequency(KHZ)	Default(KHZ)
Type G：0.4～11kW Type P：0.75～15kW	15	0.5	8
Type G：15～55kW Type P：18.5～75kW	8	0.5	4
Type G：75～315kW Type P：90～400kW	6	0.5	2

This function is mainly used for alleviating the noise of motor operation and interference of inverter.

If adopting the high carrier frequency, the inverter has the following advantages: ideal current waveform, little current harmonic, low motor noise, and the disadvantages: increasing the switch loss and temperature rise, influencing the output capacity, pushing the leakage current up and enlarging electromagnetic influence. Under high carrier frequency, the inverter should be derated.

If adopting the low carrier frequency, the inverter is contrary to abovementioned situations, the over low carrier frequency leads to the instability of running at low frequency, reduction of torque, vibration, etc.. Before the inverter leaves factory, its carrier frequency has been set properly. Therefore, in general, it is unnecessary to amend the parameters.

Function code	Name	Parameter description	Setting range	Default
P0.07	Setting of V/F curve	0: Straight-line type V/F curve 1: 2nd power	0～1	0

0: Straight-line type V/F curve
Suitable for common constant torque load
1: 2nd- power V/F curve
Suitable for the centrifugal loads such as fan, water pump, etc..

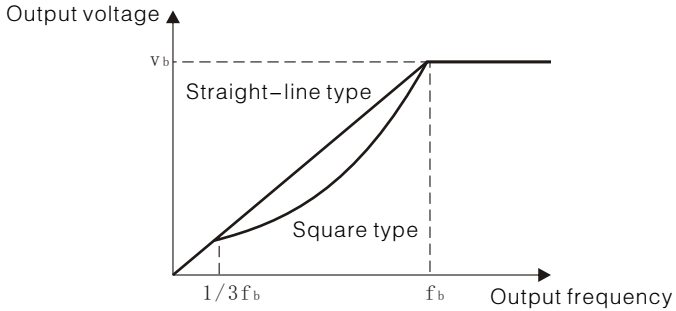


Fig. 6-3 V/F curve chart

Function code	Name	Parameter description	Setting range	Default
P0.08	Torque increase	0.0%:(automatic)0.1%～30.0%	0.0～30.0	0.0%
P0.09	Cut-off point of torque increase	0.0%～50.0%(relative to the rated frequency of motor)	0.0～50.0	20.0%

The torque increase is mainly used for the occasion when the frequency is lower than cut-off frequency (P0.09). V/F curve (after torque is increased) is shown as follows. The torque increase may improve the low-frequency torque characteristics of V/F.

According to the load size, select the proper torque amount, the larger load may make the torque increase more. But the torque increase should not be set too much, because the over much torque increase enables the motor to run at over excitation, and cause the overheat, the larger the output current of inverter is, the lower the efficiency will be.

When the torque rise is set to 0.0%, the inverter has the automatic torque increase.

Cut-off frequency for torque increase: Under this frequency, the torque increase is effective. If exceeding the setting frequency, the torque increase is inefficiency, as shown in fig. 6-4.

Function code	Name	Parameter description	Setting range	Default
P0.10	V/F slip compensation limit point	0.0～200.0%	0.0～200.0	0%

Once the parameter is set, the change of rotation speed of on-load motor may be compensated in V/F control, to improve the hardness of motor mechanical property, this value should be corresponding to the rated slip frequency.

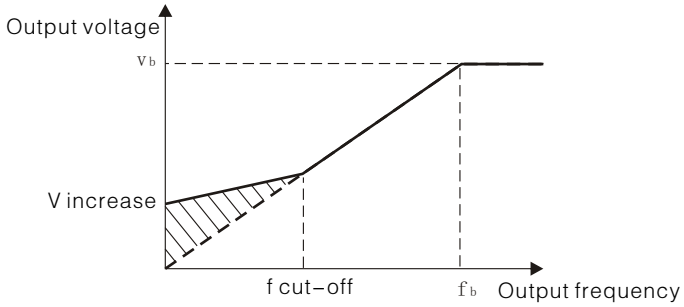


Fig. 6-4 Manual torque increase diagram

Function code	Name	Parameter description	Setting range	Default
P0.11	Selection of running direction	0: Operation in default direction 1: Operation in opposite direction 2: Forbidden reverse operation	0~2	0

0: Operation in default direction.
When the inverter is electrified, it runs according to the actual direction.
1: Operation in opposite direction.
Change the rotation direction of motor through amending the function code without changing other any parameters. Its function is equal to that the transfer of motor rotation direction is realized by adjusting any two of motor wires (U, V and W).

Prompt: After the parameter is initialized, the running direction of motor returns to the original state. If the system has been adjusted, the inverter should be used prudently in the location where the motor rotation direction is forbidden to be changed.

2. Forbidden reverse operation.
This function is used to forbid the inverter to perform reverse operation, suitable for the special occasion when the reverse rotation is forbidden.

Function code	Name	Parameter description	Setting range	Default
P0.12	Dead time of forward /reverse rotation	0.1～3600.0s	0.1～3600.0	0.0s

Set the transition time at the output zero frequency in the transition course of inverter forward and reverse rotation.

Function code	Name	Parameter description	Setting range	Default
P0.13	Max output frequency	10.00Hz～600.00Hz	10.00～600.00	50.00Hz

This function code is used to set the max output frequency of inverter. It is the foundation of frequency setting and of acceleration and deceleration, therefore, user shall pay more attention to it.

Function code	Name	Parameter description	Setting range	Default
P0.14	Upper-limit frequency	P0.15～P0.13	P0.15～P0.13	50.00Hz

The function code indicates the upper-limit value of inverter output frequency. This value should be the max output frequency or less than.

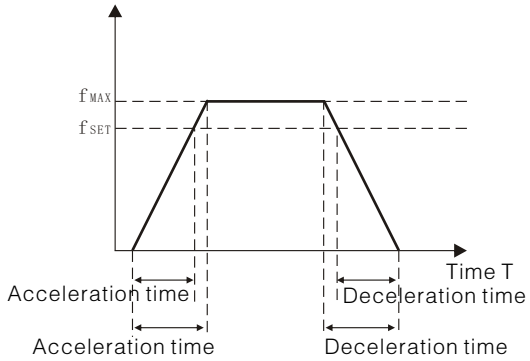


Fig. 6–5 Forward/reverse rotation dead time diagram

Function code	Name	Parameter description	Setting range	Default
P0.15	Lower–limit frequency	0. 00Hz–P–0. 14 (upper–limit frequency	0.00Hz–P0.14	0.00Hz

This function code indicates the lower–limit value of inverter output frequency. When the setting frequency is lower than the lower–limit frequency, it runs under lower–limit frequency.

Wherein, max output frequency≥ upper–limit frequency≥ lower–limit frequency

Group P1 Man-machine interface

Function code	Name	Parameter description	Setting range	Default
P1.02	Jump frequency	0. 00–P–0. 13 (max frequency)	0.00–P0.13	0.00Hz
P1.03	Amplitude of jump frequency	0. 00–P–0. 13 (max frequency)	0.00–P0.13	0.00Hz

When the set frequency remains within the jumping frequency range, the actual running frequency would run at the jump frequency boundary that is near the set frequency.

Let the inverter avoid the mechanical resonance point of load through setting jump frequency. This inverter can be set with a jump frequency point, this function would not take effect if all jump frequencies are set at 0. See fig.6–6:

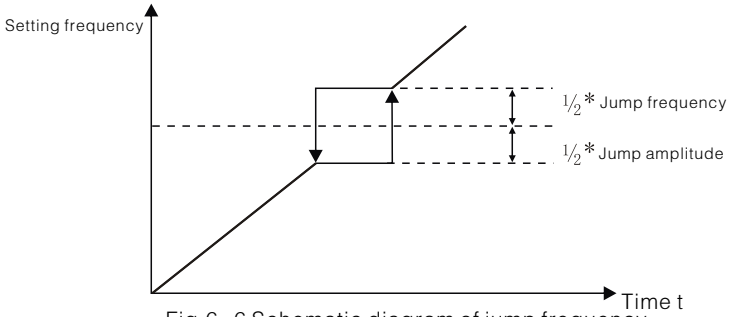


Fig.6–6 Schematic diagram of jump frequency

Function code	Name	Parameter description	Setting range	Default
P1.04	Reserve			
P1.05	Temperature of inverter	0~100.0℃		

This temperature is for read only, and can not be modified.

Function code	Name	Parameter description	Setting range	Default
P1.06	Jog running frequency	0~P0. 13 (max frequency)	0. 00~P0. 13	5.00Hz
P1.07	Acceleration time of jog running	0. 1~3600.0s	0. 1~3600.0s	Model setting
P1.08	Acceleration time of jog running	0. 1~3600.0s	0. 1~3600.0s	Model setting

Define the given frequency, acceleration and deceleration time of inverter during jog running. Start and stop operation of jog running is operated according to direct starting mode and decelerating stop mode.

Jog acceleration time means the required time for inverter to accelerate from 0Hz to max output frequency (P0.13).

Jog deceleration time means the required time for inverter to decelerate from max output frequency (P0.13) to 0Hz.

Ex–factory value of acceleration and deceleration time of models up to and including 5.5kW is 10.0s, of models of 7.5kW~55kW is 20.0s, of models exceeding 75kW is 40.0s.

Function code	Name	Parameter description	Setting range	Default
P1.09	Acceleration time 2	0. 1~3600.0s	0. 1~3600.0s	Model setting
P1.10	Acceleration time 2	0. 1~3600.0s	0. 1~3600.0s	Model setting

We can select P0.04, P0.05 and above three types of acceleration and deceleration time, they have the same meaning, please refer to the relevant description of P0.04 and P0.05.

Ex–factory value of acceleration and deceleration time of models up to and including 5.5kW is 10.0s, of models of 7.5kW~55kW is 20.0s, of models exceeding 75kW is 40.0s.

It is able to select the acceleration and deceleration time 0–1 during running of inverter through different combinations of multifunctional digital input terminals.

Function code	Name	Parameter description	Setting range	Default
P1.11	Function selection of key JOG	0: Inching 1: Switching of forward and reverse rotation 2: Clean up the UP/DOWN setting	0–2	0

The key JOG is a multifunctional key, it is able to set the defined functions through parameter setting.

0: Inching. Key JOG realizes inching motion.

1: Switching of forward and reverse rotation. Key JOG realizes to switch the direction of frequency command, it is only effective at keyboard command channel.

2: Clean up the UP/DOWN setting. Key JOG is able to clean up the setting values of UP/DOWN.

Function code	Name	Parameter description	Setting range	Default
P1.12	Stop function selection of key STOP/RST	0: Only effective for panel control 1: Effective for panel and terminal control synchronously 2: Effective for panel and communication control synchronously 3: Effective for all control modes	0–3	0

This function code defines the effective stop function selection of STOP/RST. For fault reset, key STOP/RST is effective under any state.

Function code	Name	Parameter description	Setting range	Default
P1.13	Setting of keyboard and terminal UP/DOWN	0: Effective, store data at power failure of inverter 1: Effective, without data storing at power failure of inverter 2: Ineffective 3: Effective setting during running, clear at stop	0–3	0

SY8000 is able to set the frequency through ▲ and ▼ on the keyboard as well as terminal UP/DOWN (increase/decrease by degrees for frequency setting), it has the highest power, it is able to combine with any other frequency setting channels. It is mainly used for fine tuning of output frequency of inverter during debugging of control system.

0: Effective, store data at power failure of inverter.

It is able to set the frequency command, store the frequency value at power failure of inverter, and combine with the current frequency automatically when the power is recovered.

1: Effective, without data storing at power failure of inverter.

It is able to set the frequency command, but this frequency value would not be stored when the inverter comes across power failure.

2: Ineffective, frequency value set by the keyboard and terminal UP/DOWN would be cleared automatically, and setting of keyboard and terminal UP/DOWN will be ineffective.

3: During running, settings of ▲ and ▼ as well as terminal UP/DOWN are effective, and they would be cleared up when it stops.

Notice: when user carries out operation of default value recovery to the function parameters of inverter, the frequency values set by keyboard and terminal UP/DOWN would be cleared automatically.

Function code	Name	Parameter description	Setting range	Default
P1.14	Selection of keyboard display	0: External keyboard have priority 1: Local and external keyboards display synchronously, only keys of external keyboard are in effect 2: Local and external keyboards display synchronously, only keys of local keyboard are in effect 3: Local and external keyboards display synchronously, both keys of local and external keyboards are in effect	0–3	0

This function is used to set the logical relationship on display of local and external keyboards.

Notice: function 3 should be used carefully, misoperation may lead to serious consequences.

Function code	Name	Parameter description	Setting range	Default
P1.15	Rotary speed display factor	0.1~999.9%	0.1~999.9%	100%

Mechanical rotary speed=120*running frequency* P1.22/number of pole pairs of motor, this function code is used for correcting the graduation display error of rotary speed, it makes no impression on actual rotary speed.

Function code	Name	Parameter description	Setting range	Default value
P1.16	Selection of parameters displayed in running state	0~0X7FFF BIT0: Running frequency BIT1: Setting frequency BIT2: Bus voltage BIT3: Output voltage BIT4: Output current BIT5: Running rotary speed BIT6: Output power BIT7: Output torque BIT8: Set value of PID BIT9: Feedback value of PID BIT10: State of input terminal BIT11: State of output terminal BIT12: Value of analog quantity AI1 BIT13: Value of analog quantity AI2 BIT14: Current speed stage of the multi–speed BIT15: Reserved	0–15	0XFF

Under running condition, parameter display of SY8000 series inverter will be affected by the function code, i.e. a binary number of 16–bit, if one bit is 1, then the corresponding parameter of this bit can be checked by key SHIFT during running. If this bit is 0, the corresponding parameter of this bit would not be displayed. When setting the function code P1.16, it is necessary to convert the binary digit into hexadecimal number, input this function code.

Lower 8–bit represents the content as follows:

BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
Output torque	Output power	Running speed	Output current	Output voltage	Bus voltage	Setting frequency	Running frequency

Higher 8–bit represents the content as follows:

BIT15	BIT14	BIT13	BIT12	BIT11	BIT10	BIT9	BIT8
Reserved	Current speed stage of the multi–speed	Analog quantity terminal 5	Analog quantity terminal 4	State of output terminal	State of input terminal	Feedback value of PID	Set value of PID

State of input and output terminals will be displayed with decimal number, 11 corresponds to the least significant bit, for example: when input state displays 3, it means that the terminals 11 and 12 are closed, and other terminals are opened. Please refer to P5.14 and P5.15 for details.

Function code	Name	Parameter description	Setting range	Default value
P1.17	Selection of parameters displayed in stop state	1~0X1FFF BIT0: Setting frequency BIT1: Bus voltage BIT2: State of input terminal BIT3: State of output terminal BIT4: Set value of PID BIT5: Feedback value of PID BIT6: Value of analog quantity AI1 BIT7: Value of analog quantity AI2 BIT8: Current speed stage of the multi–speed BIT9~BIT15: reserved	0–15	0XFF

Setting of this function is the same as that of P1.16. But when the SY8000 series inverter is under stop condition, display of parameters will be affected by this function code.

Lower 8–bit represents the content as follows:

BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
Analog quantity terminal 5	Analog quantity terminal 4	Feedback value of PID	Set value of PID	State of output terminal	State of input terminal	Bus voltage	Running frequency

BIT15	BIT14	BIT13	BIT12	BIT11	BIT10	BIT9	BIT8
Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Current speed stage of the multi–speed

Higher 8–bit represents the content as follows:

Function code	Name	Parameter description	Setting range	Default value
P1.19	Running time	0~65535h	0~65535	0

It displays the cumulative running time of inverter up to now.

Function code	Name	Description	Setting range	Default value
P1.21	Software version			
P1.22	User password	0~65535h	0~65535	0

When it is set into any digit except for zero, password protection function comes into effect.

00000: clear up the former password, and let the password protection function be of no effect, it also is able to clear up the former password by recovering the default value.

When the password is set and comes into effect, user will be unable to enter into parameter menu by inputting wrong password, only when the input password is correct that the user is able to look over and modify the parameters. Please keep the user password firmly in mind.

Exit the edit mode of function code, the password protection would come into effect 1min later. After that, it would display "0.0.0.0.0" when pushing down the key PRG/ESC to enter into function code editing mode, the operator must input correct user password, otherwise, it would be unable to enter.

Group P2 Start and stop control group

Function code	Name	Parameter description	Setting range	Default value
P2.00	Selection of stop mode	0: Deceleration stop 1: Free stop	0.1–999.9	100%

0: Deceleration stop

When the stop command is effective, inverter will reduce the output frequency according to the deceleration mode and defined acceleration and deceleration time, and stops when frequency is reduced to zero.

1: Free stop

When the stop command is effective, inverter will stop immediately. The loads will stop freely under the mechanical inertia.

Function code	Name	Parameter description	Setting range	Default value
P2.01	Stop braking waiting time	0.0–50.0s	0.0–50.0	0.0s
P2.02	DC braking time for stopping	0.0–50.0s	0.0–50.0	0.0s
P2.03	DC braking current for stopping	0.0–150.0%	0.0–150.0	0.0%
P2.04	Initial frequency for stop braking	0.00–50.00Hz	0.00–50.00	0.00Hz

Stop braking waiting time: before the DC brake of stopping, inverter stops outputting, after time delay, it begins to DC brake. It is used to prevent over–current fault caused by DC brake at high speed.

DC braking time for stopping: duration of DC braking. DC braking is ineffective when the time is 0, inverter will stop according to the preset deceleration time.

DC braking current for stopping: it means the applied DC braking quantity. The heavier the current is, the stronger the DC braking efficiency will be.

Initial frequency of DC brake for stopping: during the deceleration stopping, when it reaches this frequency, it begins to DC brake for stopping

(See fig.6–7)

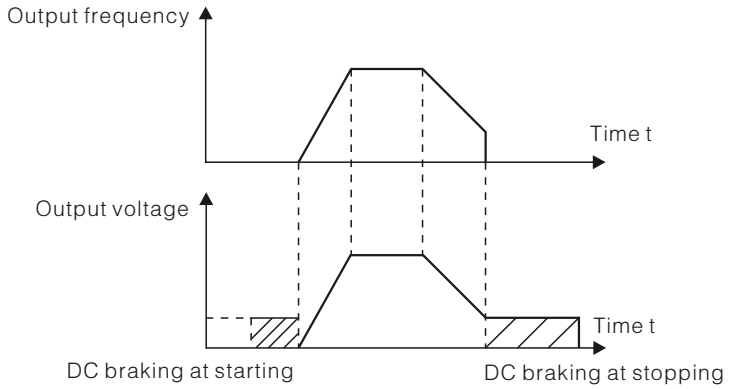


Fig.6–7 Schematic diagram of DC braking

Function code	Name	Parameter description	Setting range	Default value
P2.05	Selection of stop mode	0: Direct starting 1: DC braking first, then to start 2: Starting after rotary speed tracking	0–2	0

0：Direct starting:

Start with the starting frequency.

1：Starting after DC braking:

DC brake first (pay attention to setting parameters P2.07 and P2.08), then start the motor with starting frequency. This is suitable for loads of low inertia that may have reverse rotation during starting.

2：Starting after rotary speed tracking:

The inverter will calculate the running speed and direction of motor first, then runs with the current speed until to the set frequency, and realizes smooth and non–impact starting of rotating motor, this method is applicable to loads of high inertia, for restarting after momentary power interruption.

Function code	Name	Parameter description	Setting range	Default value
P2.06	Holding time of starting frequency	0.0–50.0s	0.0–50.0	0.0s
P2.07	Braking time before starting	0.0–50.0s	0.0–50.0	0.0s
P2.08	Braking current before starting	0.0–150.0%	0.0–150.0	0.0%
P2.09	Initial frequency of direct starting	0.00–10.00Hz	0.00–10.00	0.00Hz

It is able to increase the starting torque by setting suitable starting frequency. Within the holding time of starting frequency, output frequency of inverter is the starting frequency, then it runs from the starting frequency to the target frequency, if the target frequency (frequency command) is smaller than the starting frequency, inverter will not run and stay under stand–by state. Starting frequency value will not be limited by the lower frequency.

During switching of forward and reverse rotation, starting frequency will not come into play.

When the inverter starts, it carries out DC braking first with the preset before–starting DC braking current, after the preset before–starting DC braking time, it begins to make accelerate run. If the preset DC braking time is 0, then the DC braking is ineffective.

The heavier the braking current is, the stronger the braking force will be. Before–starting DC braking current means the percentage ratio corresponding to rated current of inverter.

Group 3 and 4 Input and output terminal blocks

Function code	Name	Parameter description	Setting range	Default value
P3.00	Upper limit of terminal 4	0.00V–10.00V	0.00–10.00	10.00V
P3.01	Upper limit corresponding setting of terminal 4	–100.0%–100%	–100.0–100.0	100.0%
P3.02	Upper limit of terminal 4	0.00V–10.00V	0.00–10.00	0.00V
P3.03	Upper limit corresponding setting of terminal 4	–100.0%–100%	–100.0–100.0	0.0%
P3.04	Input filtering time of terminal 4	0.00s–10.00s	0.00–10.00	0.10s

The above function codes define the relationship between the analog input voltage and corresponding setting value of analog input, when analog input voltage is beyond the set range of max input or min input, the part goes beyond should be calculated on the basis of max input or min input. When the analog input is current input, current of 0mA~20mA corresponds to voltage of 0V~5V.

In different application situations, the corresponding nominal values of 100.0% of analog setting will be different, please refer to the description of every application situation for details.

The following legends illustrate some types of setting situations:

(Notice: lower value of terminal 4 must be smaller than or equal to the upper value of terminal 4.)

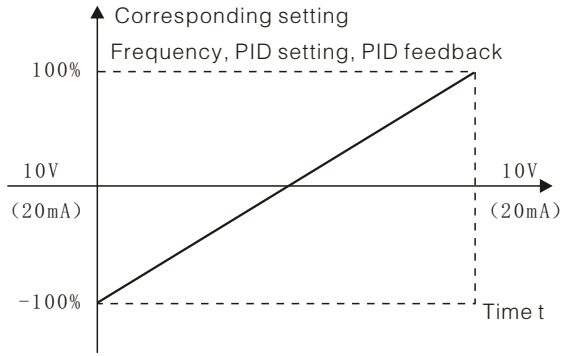


Fig.6–8 Corresponding relationship between analog setting and setting value

Input filtering time of terminal 4: determine the sensitivity of analog input. If want to prevent analog quantity from being interfered and leading to misoperation, just increase this parameter to strengthen the antijamming capability, however, this would reduce the sensitivity of analog input.

Function code	Name	Parameter description	Setting range	Default value
P3.05	Upper limit of terminal 5	0.00V–10.00V	0.00–10.00	10.00V
P3.06	Upper limit corresponding setting of terminal 5	–100.0%–100%	–100.0–100.0	100.0%
P3.07	Upper limit of terminal 5	0.00V–10.00V	0.00–10.00	0.00V
P3.08	Upper limit corresponding setting of terminal 5	–100.0%–100%	–100.0–100.0	0.0%
P3.09	Input filtering time of terminal 5	0.00s–10.00s	0.00–10.00	0.10s

Setting method for function of terminal 5 is similar to that of terminal 4.

The analog quantity of terminal 5 supports input of 0~10V or 0~20mA, when terminal 5 selects 0~20mA for input, corresponding voltage of 20mA is 5V.

Function code	Name	Parameter description	Setting range	Default value
P3.10	Output selection of terminal 2	Multifunctional analog output	0–10	0

Standard output of analog output is 0~20mA (or 0~10V), it is able to select current or voltage output through jumper wire J2.

The corresponding range as follows:

Set value	Function	Parameter description
0	Running frequency	0~max output frequency
1	Setting frequency	0~max output frequency
2	Rotary speed of motor	0~2 times of rated speed of motor
3	Output current	0~2 times of rated current of inverter
4	Output voltage	0~1.5 times of rated voltage of inverter
5	Output power	0~2 times of rated power
6	Output torque	0~2 times of rated current of motor
7	Input of analog quantity of terminal 4	0~10V
8	Input of analog quantity of terminal 5	0~10V/0~20mAr
9~10	Reserved	Reserved

Function code	Name	Parameter description	Setting range	Default value
P3.11	Upper output limit of terminal 2	–100.0%–100%	–100.0–100.0	100.0%
P3.12	Upper limit output corresponding to terminal 2	0.00V–10.00V	0.00–10.00	10.00V
P3.13	Lower output limit of terminal 2	–100.0%–100%	–100.0–100.0	0.0%
P3.14	Lower limit output corresponding to terminal 2	0.00s–10.00s	0.00–10.00	0.00V

The above function codes define the relationship between the output value and corresponding output value of analog output, when the output value is beyond the set range of max output or min output, the part goes beyond should be calculated on the basis of max input or min input.

When the analog output is current output, current of 1mA corresponds to voltage of 0.5V.

In different application situations, the corresponding analog output of 100% of output value will be different, please refer to the description of every application situation for details. The following legends illustrate some types of setting situation:

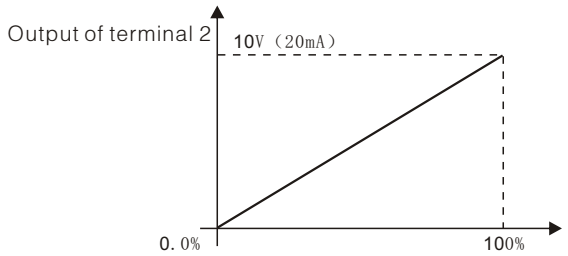


Fig.6–9 Corresponding relationship between given quantity and analog output

Function code	Name	Parameter description	Setting range	Default value
P4.00	Test selection of terminal function at power on	0: Terminal running command is ineffective at power on 1: Terminal running command is effective at power on	0–1	0

When the running command channel is of terminal control, the system will test the status of running terminal automatically during the process of being electrified.

0: The terminal running command is ineffective at power on.

During the process of power on, even if it detects that the running command is effective, the inverter would not run, and the system will be under running protection status until canceling the running command terminal, and inverter will run by operating this terminal again.

1: The terminal running command is effective at power on.

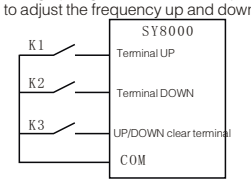
During the process of power on, when it detects that the running command is effective, the system would start up the inverter automatically after the initialization.

Notice, users should select this function cautiously, as it may lead to serious consequences.

Function code	Name	Parameter description	Setting range	Default value
P4.01	Function selection of terminal 11	Programmable multifunctional terminal	0–25	1
P4.02	Function selection of terminal 12	Programmable multifunctional terminal	0–25	4
P4.03	Function selection of terminal 13	Programmable multifunctional terminal	0–25	7
P4.04	Function selection of terminal 14	Programmable multifunctional terminal	0–25	0
P4.05	Function selection of terminal 15	Programmable multifunctional terminal	0–25	7
P4.06	Function selection of terminal 16	Programmable multifunctional terminal	0–25	0

This parameter is used for setting the corresponding functions of multifunctional input terminals.

Setting value	Function	Parameter description
0	No function	The inverter would not operate even if there is signal input. The terminals that have not been used can be set with no function, preventing misoperation.
1	Forward running	Control inverter's forward rotation and reverse rotation through external terminal.
2	Reverse running	
3 3	Three–wire running mode	Confirm that the running mode of inverter is three–wire running mode through this terminal. Refer to the function code description of P4.08 three–wire control mode for details.
4	Forward inching	Refer to P1.06, P1.07 and P1.08 for details of frequency during inching running as well as acceleration and deceleration time of inching motion.
5	Reverse inching	
6	Free stop	Inverter locks the output, stop process of motor is out of control of inverter. It is applicable to loads of high inertia that have no requirements to the stop time. This method has the same meaning with that of free stop described in P2.00.
7	Fault reset	Function of external fault reset. It has the same function with that of key STOP/RESET on keyboard.
8	External fault input	When inverter receives the external fault signal, it reports fault and stops.

9	Frequency setting of increasing by degrees (UP)	When the frequency is set by external terminal, modify the frequency command of increasing and decreasing by degrees. When the frequency source is of digital setting, it is able to adjust the frequency up and down.  This terminal is able to clear the setting frequency set by UP/DOWN, let the set frequency recover to the frequency given by the frequency command channel.
10	Frequency setting of decreasing by degrees (DOWN)	
11	Clear up the frequency setting of decreasing by degrees	
12	Multi-speed terminal 1	Through digital status combination of these three terminals, it is able to realize eight-speed setting. Notice: multi-speed 1 is low bit, multi-speed 3 is high bit.
13	Multi-speed terminal 2	
14	Multi-speed terminal 3	
15	Multi-speed terminal 3	It is able to select two types of acceleration and deceleration time through digital status combination of these two terminals.
16	PID control pause	PID is out of service temporarily, inverter maintains the current frequency output.
17	Wobble frequency pause (stop at current frequency)	Inverter pauses at the current output frequency, and begins with the current frequency when the function is cancelled.
18	Wobble frequency reset (return to the central frequency)	Inverter returns to the center frequency output.
19	Acceleration and deceleration forbidding	It guarantees that the inverter would not be affected by foreign signals (except for stop command), maintains current output.
20	Torque control forbidding	It forbids inverter to make torque control mode, and inverter would change over to speed control mode
21	Clearing the setting of frequency decreasing by degrees temporarily	It is able to clear up the frequency value set by UP/DOWN when terminal closes, let the given frequency recover to the value set by command channel, and return to the value after the increase and decrease setting again when terminal opens.
22~25	Reserved	Reserved

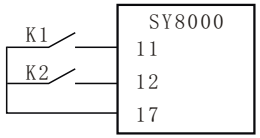
Terminal	Selection of acceleration or deceleration time	Corresponding parameter
OFF	Acceleration time 1	P0.04, P0.05
ON	Acceleration time 2	P1.09, P1.10

Function code	Name	Description	Setting range	Default value
P4.07	Switch quantity filtering times	1~10	1~10	5

Set the filtering time of that of terminals 11~16. When under condition of large interference, please increase this parameter for preventing misoperation.

Function code	Name	Description	Setting range	Default value
P4.08	Running mode of terminal control	0: Two-wire control 1 2: Three-wire control 1 1: Two-wire control 2 3: Three-wire control 2	1~10	5

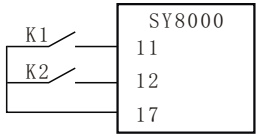
This parameter defines four different control modes of inverter running through external terminal control. Hereinafter, terminal 11 is set as forward rotation of motor; terminal 12 is set as reverse rotation of motor; terminal 13 is set with function of three-wire running control. 0: Two-wire control 1. This is the most usual two-wire mode, forward rotation and reverse rotation of motor will be determined by command of terminals 11 and 12.



K1	K2	Running command
OFF	OFF	Stop
ON	OFF	Forward rotation
OFF	ON	Reverse rotation
ON	ON	Forward rotation

Schematic diagram of two-wire running mode 1

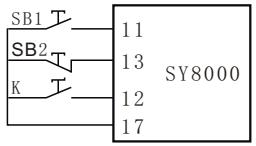
1: Two-wire control 2. Under this mode, 11 is the enable terminal. Direction will be determined by status of 12.



K1	K2	Running command
OFF	OFF	Stop
OFF	ON	Stop
ON	OFF	Forward rotation
ON	ON	Reverse rotation

Schematic diagram of two-wire running mode 2

2: Three-wire control 1. Under this mode, 13 is the enable terminal. Running command will be produced by 11, direction command will be produced by 12, 13 is the NC input.

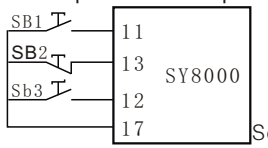


K1	Running command
OFF	Stop
ON	Forward rotation

Schematic diagram of three-wire running mode 1

Thereinto: K: forward and reverse rotation switch SB1: running button SB2: stop button 13 define the function of corresponding terminal as function 3 "three-wire running".

3: Three-wire control 2. Under this mode, 13 is the enable terminal. Running command will be produced by SB1 or SB2, it controls the running direction at the same time, the stop command is produced by SB2 of NC input.



Schematic diagram of three-wire running mode 2

Thereinto: SB1: forward rotation running button SB2: stop button SB3: reverse rotation running button 13 define the function of corresponding terminal as function 3 "three-wire running control".

Note: for two-wire running mode, when the terminal 11/12 is effective, the inverter is stopped when receiving stop command due to other reasons, even if the control terminal 11/12 is still effective, the inverter would not run when the stop command is disappeared. If it is necessary to run the inverter, just initiate the terminal 11/12 again.

Function code	Name	Parameter description	Setting range	Default value
P4.09	Frequency increment change rate of terminal UP/DOWN	0.01~50.00Hz/s	0.01~50.00	0.50Hz/s

Terminal UP/DOWN is used to regulate the change rate for frequency setting.

Function code	Name	Parameter description	Setting range	Default value
P4.10	Output selection of terminal 8	Function of open-collector output	0~10	1
P4.11	Output selection of relay R1	Function of relay output	0~10	1
P4.12	Output selection of relay R2	Function of relay output	0~10	3

Setting range	Function	Parameter description
0	Zero output	Output terminal does not have any function
1	Forward rotation running of inverter	It represents forward rotation running of inverter, there is output frequency. It outputs signal ON at this moment.
2	Reverse rotation running of inverter	It represents reverse rotation running of inverter, there is output frequency. It outputs signal ON at this moment.
3	Fault output	It outputs signal ON when the inverter comes across fault.
4	Reach the frequency level detection FDT	Please refer to the detailed description of function codes P4.13 and P4.14.
5	Reach the frequency	Please refer to the detailed description of function code P4.15.
6	During zero frequency running	It outputs signal ON when the output frequency of inverter is lower than the starting frequency.
7	Reach the upper frequency	It outputs signal ON when the running frequency reaches the upper limit.
8	Reach the lower frequency	It outputs signal ON when the running frequency reaches the lower limit.
9	Auxiliary pump 1	PID one-drive-two
10	Auxiliary pump 2	PID one-drive-three

Function code	Name	Parameter description	Setting range	Default value
P4.13	FDT level detection value	0.00~P0.13 (max frequency)	0.00~P0.13	50.00Hz
P4.14	FDT lag detection value	0.0~100.0% (FDT level)	0.0~100.0	50.00Hz

Setting of detection value of output frequency and lagged value of output action canceling, as shown in the following drawing:

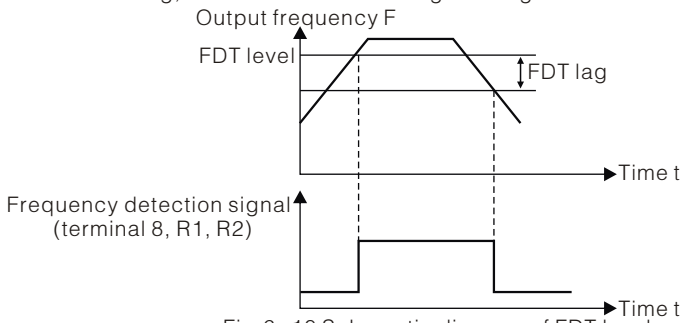


Fig.6-10 Schematic diagram of FDT level

Function code	Name	Parameter description	Setting range	Default value
P4.15	Frequency reaches the checkout range	0.0~100.0 %(max frequency)	0.0~100.00	0.0Hz

When the output frequency of inverter reaches the set value, this function is able to regulate its checkout range. As shown in following diagram:

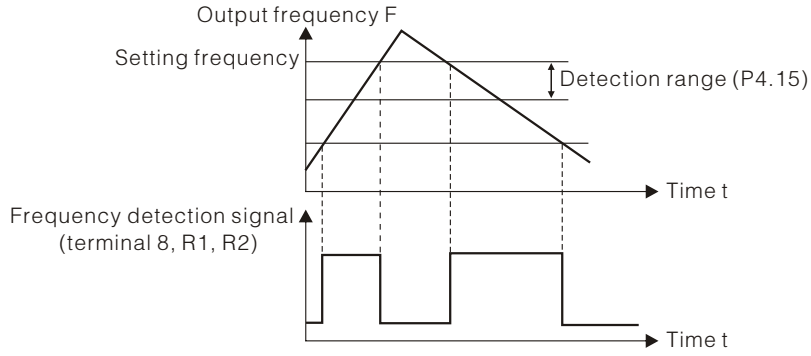


Fig.6-11 Schematic diagram of frequency reaching checkout value

Group P5 Protection functions

Function code	Name	Parameter description	Setting range	Default value
P5.00	Over-voltage stalling protection	0: Forbidden 1: Permissible	0~1	0
P5.01	Over-voltage stalling protection voltage	110~150% (380V series)	110~150	120%
		110~150% (220V series)	110~150	115%

During the deceleration running, the actual decrease rate of motor speed may be lower than decrease rate of output frequency due to the effect of load inertia, at this moment, motor will feed back the electric energy to the inverter, and cause the voltage of inverter bus to rise, this would lead to inverter trip due to over-voltage fault of bus if no measures are taken.

Over-voltage stalling protection function: during running of inverter, it detects the bus voltage and compares with the over-voltage stalling point defined by P5.01 (relative to standard bus voltage), if the detected value is beyond the over-voltage stalling point, output frequency of inverter will stop falling, when the detected value is lower than the stalling point again, it will continue to make deceleration running. As shown in diagram 6-12.

Function code	Name	Description	Setting range	Default value
P5.02	Selection of motor overload protection	0: Without protection 1: Common motor (with low-speed compensation) 2: Frequency conversion motor (without low-speed compensation)	0~2	0

0: Without protection. It does not have motor overload protection property (operation with caution), at this time, inverter does not have overload protection to the load motor.

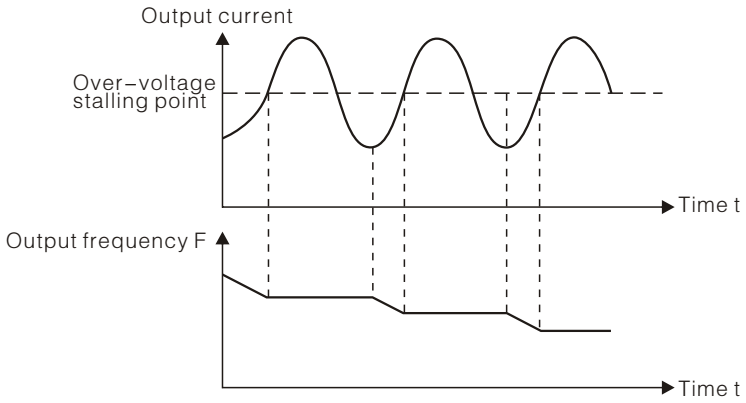


Fig.6–12 Schematic diagram of over–voltage stalling function

1: Common motor (with low–speed compensation). As the heat emission of common motor is rather bad in low–speed condition, the corresponding thermal protection value should be regulated reasonably, the low–speed compensation here means to regulate the threshold value of motor overload protection whose running frequency is lower than 30Hz to a lower value.

2: Frequency conversion motor (without low–speed compensation). As the heat emission of special frequency conversion motor will be unaffected by the rotary speed, it need not to regulate protection value for low–speed running.

Function code	Name	Parameter description	Setting range	Default value
P5.03	Motor overload protection current	20.0%~120.0% (Rated current of motor)	20.0~120.0	100%

This value can be determined through the following formula:

Current of motor overload protection=(permissible max load current/rated current of inverter) *100%. Permissible max load current is usually defined as rated current of load motor. When the rated current of load motor does not match with the rated current of inverter, it is able to realize overload protection to the motor through setting P5.02~P5.03.

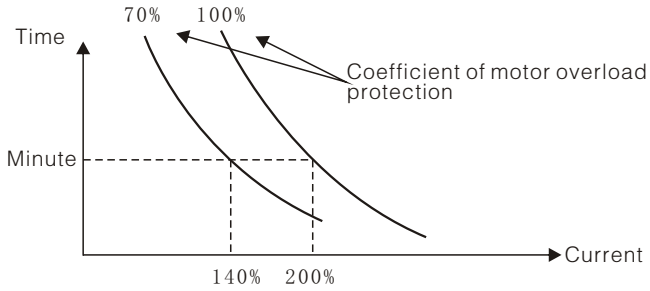


Fig.6–13 Coefficient setting of motor overload protection

Function code	Name	Parameter description	Setting range	Default value
P5.04	Automatic current limiting level	100~200%	100~200	G: 160% P: 120%
P5.05	Decrease rate of frequency during current limiting	0.00~100.00Hz/s	0.00~100.00	0.00Hz/s

During running of inverter, the actual rise rate of motor speed is lower than the rise rate of output frequency due to excessive loads, this would lead to inverter trip due to over–current fault of acceleration if no measures are taken.

Over–current stalling protection function: during running of inverter, it detects the output current and compares with the current limiting point defined by P5.04, if the detected value is beyond the current limiting point, output frequency of inverter will fall according to the decrease rate (P5.05) of over–current frequency, when the detected output current is lower than the current limiting point again, it recovers normal running.

As shown in diagram:

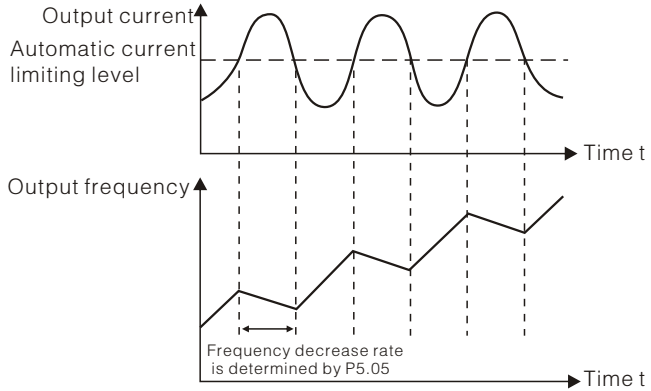


Fig.6–14 Schematic diagram of current limiting protection

Function code	Name	Parameter description	Setting range	Default value
P5.06	Frequency reducing point of instantaneous power failure	70.0~110.0% (standard bus voltage)	70.0~110.0	80.0%
P5.07	Decrease rate of instantaneous power failure frequency	0.00~100.00Hz/s	0.00~P0.04	0.00Hz

When the decrease rate of instantaneous power failure frequency is set at 0, the instantaneous power failure restarting function will be ineffective.

Frequency reducing point of instantaneous power failure: when the power grid comes across power failure, bus voltage is reduced to the frequency reducing point of power failure, the inverter begins to reduce the running frequency according to the decrease rate (P5.07) of instantaneous power failure frequency, let the motor under power generating state, and maintain bus voltage with feedback electric energy, guaranteeing normal running of inverter until power recovery.

Notice, it is able to realize power grid switching by regulating these two parameters properly, but will not cause stop due to protection of inverter.

Function code	Name	Parameter description	Setting range	Default value
P5.08	Type of previous two faults	0~24		
P5.09	Type of previous one fault	0~24		
P5.10	Type of current fault	0~24		

It is able to record the type of latest three faults: 0 means no fault, 1~24 means 24 different types of fault. Refer to the fault analysis for details.

Function code	Name	Parameter description	Setting range	Default value
P5.11	Running frequency of current fault	Output frequency during the current fault		
P5.12	Output current of current fault	Output current during the current fault		
P5.13	Bus voltage of current fault	Bus voltage during the current fault		
P5.14	Status of input terminal of current fault	This value is a decimal digit. It shows the status of all digital input terminals of latest one fault, sequence as follows: BIT3 BIT2 BIT1 BIT0 11 12 13 14 When input terminal is ON, it should be 1 correspondingly. OFF corresponds to 0. It is able to know the digital input signal situation at that time through this value.		
P5.15	Status of output terminal of current fault	This value is a decimal digit. It shows the status of all input terminals of latest one fault, sequence as follows: BIT3 BIT2 BIT1 BIT0 R1 R2 Terminal 8 When input terminal is ON, it should be 1 correspondingly. OFF corresponds to 0. It is able to know the digital output signal situation at that time through this value.		

Function code	Name	Parameter description	Setting range	Default value
P5.16	Interval time setting for automatic reset of fault	0.1~100.0s	0.1~100.0	1.0s
P5.17	Times of automatic reset of fault	0~3	0~3	0

Times of automatic reset of fault: when the inverter selects automatic reset, it can be used for setting the times of automatic reset. When it is beyond this value, inverter will be under fault stand–by status waiting for restoring.

Interval time setting for automatic reset of fault: it is used to set the interval time between fault occurrence and automatic reset action.

Group P6 Wobble frequency function

Function code	Name	Parameter description	Setting range	Default value
P6.00	Range of jump frequency	0.0~50.0% (relative frequency range)	0.0~50.0	0.0%
P6.01	Range of wobble frequency	0.0~100.0% (relative setting frequency)	0.0~100.0	0.0%
P6.02	Wobble frequency rise time	0.1~3600.0S (relative setting frequency)	0.1~3600.0	5.0S
P6.03	Wobble frequency fall time	0.1~3600.0S (relative setting frequency)	0.1~3600.0	5.0S

Wobble frequency is applicable to industries of textile, chemical fiber and other occasions where require traversing and winding functions.

Wobble frequency means that the output frequency of inverter wobbles around setting frequency, track of running frequency on time axis as shown in the following diagram, thereinto, wobble amplitude is set by P6.01, when the P6.01 is set at 0, i.e. wobble amplitude is 0, and the wobble frequency is out of function.

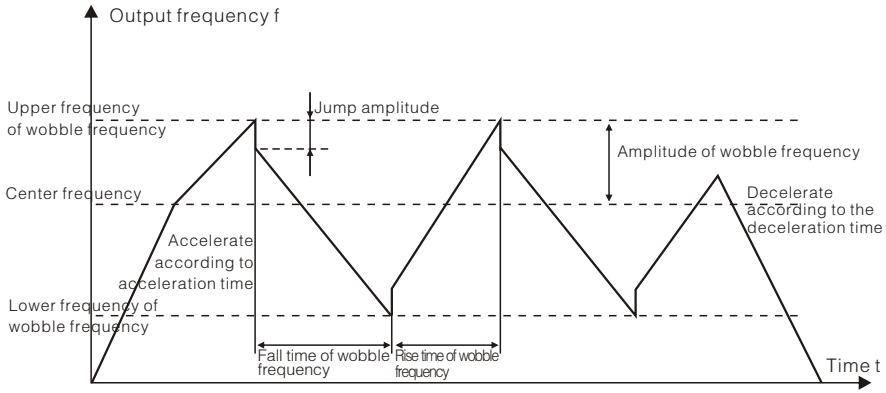


Fig.6–15 Schematic diagram of running of wobble frequency

Group 7 PID function

PID control is a classical method for process control, through proportion, integral and derivative operations to the dispersion of feedback signal and target quantity signal of controlled quantity, forms a negative feedback system, makes the controlled quantity keep at target quantity steadily. It is suitable for flow control, pressure control and temperature control and other process controls. Basic functional block diagram of control as follows:

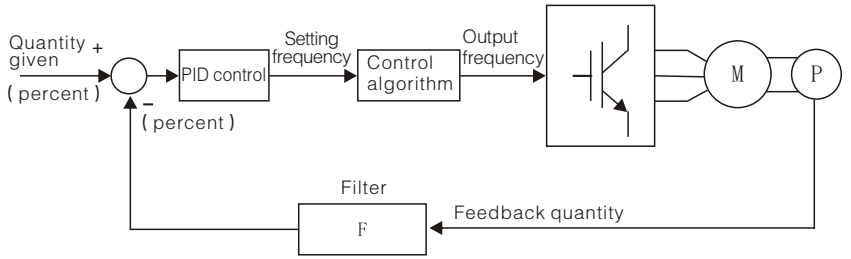


Fig.6–16 Functional block diagram of PID control

Function code	Name	Parameter description	Setting range	Default value
P7.00	Selection of PID feedback source	0: Terminal feedback of analog channel 4 1: Terminal feedback of analog channel 5 2: Feedback of terminal 4+terminal 5 3: Feedback of remote communication	0~3	0

Select the PID feedback channel through this parameter.

Function code	Name	Parameter description	Setting range	Default value
P7.01	Selection of PID given source	0: Keyboard given (P7.02) 1: Terminal given of analog channel 4 2: Terminal given of analog channel 5 3: Remote communication given 4: Multi-segment given	0~4	0

When the frequency source selects PID, i.e. selection of P0.01 is 5, this group of functions will take effect. This parameter determines the target quantity given channel of process PID. The set target quantity of process PID is a relative value, the set 100% corresponds to 100% of feedback signal of controlled system; the system always carries out calculation according to the relative value (0~100.0%).

Notice: multi-segment given enables it to realize to set parameters of group PA.

Function code	Name	Parameter description	Setting range	Default value
P7.02	Keyboard presetting PID given	0.0%~100.0%	0.0~100. 0	0. 0%

When setting P7.01=0, i.e. target source is keyboard given, it is necessary to set this parameter. Reference value of this parameter is the feedback quantity of system.

Function code	Name	Parameter description	Setting range	Default value
P7.03	Feature selection of PID output	0: PID output is of positive feature 1: PID output is of negative feature	0~10	0

PID output is of positive feature: when the feedback signal is larger than the given of PID, only when the output frequency of inverter is reduced that PID is able to reach balance. Such as PID control of winding tension.

Function code	Name	Parameter description	Setting range	Default value
P7.04	Proportional gain (Kp)	0.00~100.00	0.00~100.0	1.00
P7.05	Integral time (Ti)	0.01~10.00s	0.01~10.00	0.10s
P7.06	Derivative time (Td)	0.01~10.00s	0.01~10.00	0.00s

Proportional gain (Kp): it determines the regulating strength of the whole PID controller, the higher the P is, the larger the regulating strength is. When this parameter is 100, deviation between PID feedback quantity and given quantity is 100%, regulating amplitude of PID controller to the output frequency command is the max frequency (ignore the integral action or derivative action).

Integral time (Ti): it determines the integral controlling speed of PID controller to the deviation between PID feedback quantity and given quantity. Integral time: when the deviation between PID feedback quantity and given quantity is 100%, integral controller (ignore the proportional action or derivative action) makes continuous regulation in this period, let the controlling quantity reach the max frequency (P0.04). The shorter the integral time is, the higher the controlling strength is.

Derivative time (Td): it determines the controlling strength of PID controller to the change rate of deviation between PID feedback quantity and given quantity. Derivative time: when the feedback quantity changes for 100% in this period, regulation quantity of derivative controller is the max frequency (P0.13) ((ignore the proportional action or integral action). The longer the derivative time is, the higher the controlling strength is.

PID is the most classical method for process control, each part of it plays different roles, general of operating principle and regulating method as follows:

Proportional control (P): when the feedback and given have deviation, output and deviation are in proportion, if the deviation is constant, then the regulating quantity will be constant too. Proportional control is able to respond to the change of feedback rapidly, however, single proportional control is unable to get isochronous control. The larger the proportional gain is, the quicker the regulating speed of system is, but over-large would lead to oscillation. Regulating method is to set a rather long integral time and set the derivative time at zero, let the system run with proportional control only, change the value of given quantity, observe the steady-state error (static error) of feedback signal and given quantity, if the steady-state error is in the changing direction of given quantity (e.g. add the given quantity, feedback quantity will always be smaller than the given quantity after stabilization of system), continue to increase the proportional gain, on the contrary, reduce the proportional gain, repeat the above process until the steady-state error is in lower side (it is difficult to thoroughly eliminate the steady-state error).

Integral time (I): when the feedback and given have deviation, accumulate the output regulating quantity continuously, if the deviation still exists, then continue to increase the regulating quantity until the deviation is eliminated. Integral controller is able to eliminate steady-state error effectively. However, if the integral controller is too strong, it may have repeated over-adjustment, and the system would be unstable at all times until oscillation occurs. Characteristics of oscillation caused by over-strong of integral action: feedback signal wobbles around the given quantity, amplitude enlarges gradually until oscillation occurs. Regulation of integral time usually is from low to high, regulate step to step to observe the regulating efficiency until reach the speed requirement of system stabilization.

Derivative time (D): when the deviation between feedback and given changes, regulating quantity of proportioning output and deviation change rate, this regulating quantity only is relative to the direction and magnitude of deviation change, and has no connection with the direction or magnitude of deviation itself. Function of derivative control is to regulate the feedback signal and restrain it from changing according to the change trend when the feedback signal changes. Please use the derivative control carefully, as it may enlarge the system interference, especially the interferences have high changing frequency.

Function code	Name	Parameter description	Setting range	Default value
P7.07	Sampling period (T)	0.01~100.00s	0.01~100.0	0.00s
P7.08	Deviation limit of PID control	0.0%~100.0%	0.0~100.00	0.0%

Sampling period (T): it means the sampling period of feedback quantity, the controller carries out operation for one time during every sampling period. The larger the sampling period is, the slower the response is.

Deviation limit of PID control: the permissible max deviation amount of PID system output value relative to the closed loop given value, as shown in the diagram 6-17, within the deviation limit, PID controller stops regulating. It is able to regulate the accuracy and stability of PID system through setting this function code reasonably.

Function code	Name	Parameter description	Setting range	Default value
P7.07	Detection value of feedback disconnection	0.0~100.0%	0.0~100.00	0.0%
P7.08	Detection time of feedback disconnection	0.0~3600.0s	0.0~3600.0	1.0s

Detection value of feedback disconnection: this detection value corresponds to the full range (100%), the system always detects the PID feedback quantity, when the feedback quantity is lower than or equal to the disconnecting detection value of feedback, the system starts the detection timing. When the detected value is beyond the detection time of feedback disconnection, system will report PID feedback disconnection fault (ERR22).

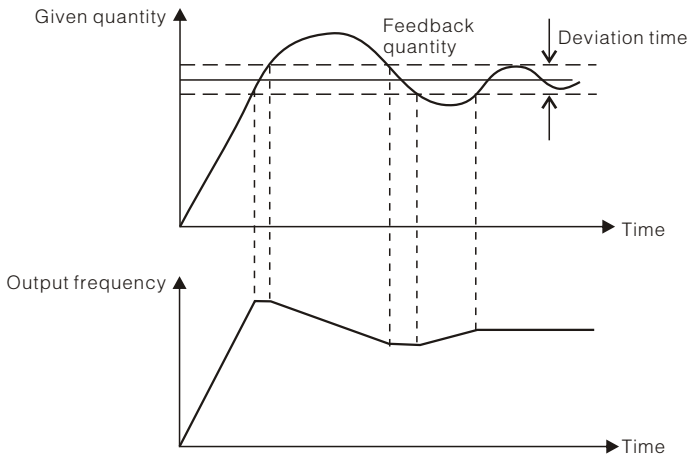


Fig.6–17 Relationship between deviation limit and output frequency

Group 8 Multi-speed function

Function code	Name	Parameter description	Setting range	Default value
P8.00	Multi–speed frequency 0	–100.0~100.0%	–100.0~100.0	0.0%
P8.01	Multi–speed frequency 1	–100.0~100.0%	–100.0~100.0	0.0%
P8.02	Multi–speed frequency 2	–100.0~100.0%	–100.0~100.0	0.0%
P8.03	Multi–speed frequency 3	–100.0~100.0%	–100.0~100.0	0.0%
P8.04	Multi–speed frequency 4	–100.0~100.0%	–100.0~100.0	0.0%
P8.05	Multi–speed frequency 5	–100.0~100.0%	–100.0~100.0	0.0%
P8.06	Multi–speed frequency 6	–100.0~100.0%	–100.0~100.0	0.0%
P8.07	Multi–speed frequency 7	–100.0~100.0%	–100.0~100.0	0.0%

Description: the multi–speed symbol determines the running direction. If it is negative value, it represents negative direction. The frequency setting 100.0% corresponds to the max frequency (P0.13).

When 11=12=13=OFF, frequency input mode can be selected by P0.01. When not all of the terminals 11, 12 and 13 are OFF, during multi–speed running, priority of multi–speed is higher than the keyboard, analog and communication frequency input, through combination code of 11, 12 and 13, it is able to select 8–speed at most.

Start and stop channel selection during multi–speed running also is determined by the function code P0.01, multi–speed control process as shown in diagram 6–18. Relationship between speed stage of multi–speed and terminals 11, 12 and 13 as shown in following table.

11	OFF	ON	OFF	ON	OFF	ON	OFF	ON
12	OFF	OFF	ON	ON	OFF	OFF	ON	ON
13	OFF	OFF	OFF	OFF	ON	ON	ON	ON
Running speed stage	0	1	2	3	4	5	6	7

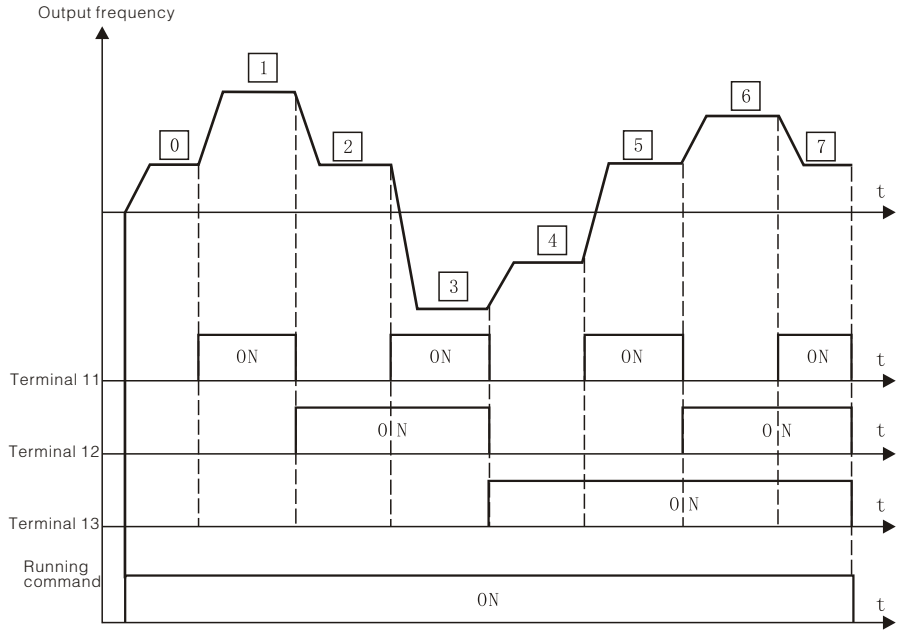


Fig.6–18 Logic diagram of multi–speed running

Group P9 Serial communication

Function code	Name	Parameter description	Setting range	Default value
P9.00	Communication address of local host	1~247, 0 is the broadcast address	0~247	1

When the local host is under compiling frame, communication address of slave machine is set at 0, i.e. the broadcast address, all the slave machines on MODBUS concentric line will accept this frame but will not make response. Notice, address of slave machine can not be set at 0.

Communication address of local host is unique in the communication network, which is the base of realizing point–to–point communication between upper machine and inverter.

Function code	Name	Parameter description	Setting range	Default value
P9.01	Setting of communication baud rate	0: 1200BPS 1: 2400BPS 2: 4800BPS 3: 9600BPS 4: 19200BPS 5: 38400BPS	0~5	3

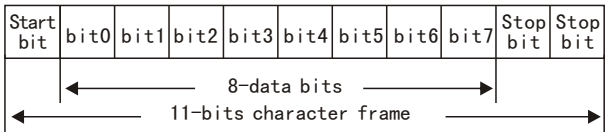
This parameter is used for setting data transmission rate between the upper machine and inverter. Notice, baud rate of upper machine and inverter must be the accordant, otherwise, the communication will be failed. The larger the baud rate is, the quicker the communication speed will be.

Function code	Name	Parameter description	Setting range	Default value
P9.02	Setting of data bit check	0: No check (N, 8, 1) for RTU 1: Even check (E, 8, 1) for RTU 2: Odd check (O, 8, 1) for RTU 3: No check (N, 8, 2) for RTU 4: Even check (E, 8, 2) for RTU 5: Odd check (O, 8, 2) for RTU 6: No check (N, 7, 1) for ASCII 7: Even check (E, 7, 1) for ASCII 8: Odd check (O, 7, 1) for ASCII 9: No check (N, 7, 2) for ASCII 10: Even check (E, 7, 2) for ASCII 11: Odd check (O, 7, 2) for ASCII 12: No check (N, 8, 1) for ASCII 13: Even check (E, 8, 1) for ASCII 14: Odd check (O, 8, 1) for ASCII 15: No check (N, 8, 2) for ASCII 16: Even check (E, 8, 2) for ASCII 17: Odd check (O, 8, 2) for ASCII	0~17	0

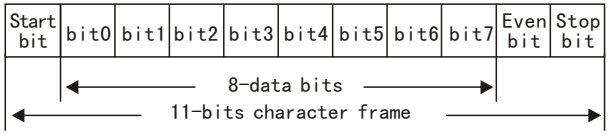
Data format of upper machine and inverter must be accordant, otherwise, the communication will be failed.

11-bits (for RTU)

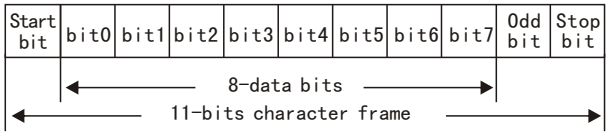
Data format: 8-N-2



Data format: 8-E-2

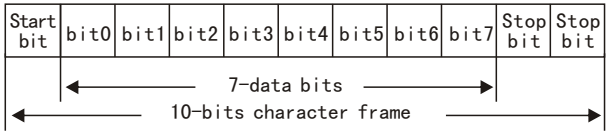


Data format: 8-0-1

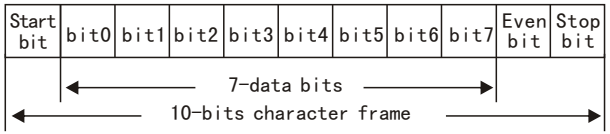


10-bits(for ASCII)

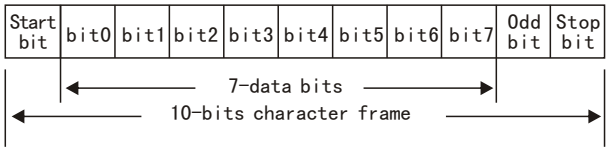
Data format: 7-N-2



Data format: 7-E-1



Data format: 7-0-1



Function code	Name	Parameter description	Setting range	Default value
P9.03	Communication response time delay	0~200ms	0~200	5ms

Response time delay: it means the interval time from accepting stop to sending response data to the upper machine. If the response time delay is shorter than the handling time of system, then the response time delay should be subject to the handling time of system, if the response time delay is longer than the system handling time, then it still has to wait after the system handling until the delay time is up, then send data to the upper machine.

Function code	Name	Parameter description	Setting range	Default value
P9.04	Fault time of communication time override	0.0 (ineffective), 0.1~100.0s	0~100. 0	0. 0ms

When this function code is set at 0.0s, parameter of communication override time is ineffective.

When this function code is set at effective value, if the interval time between a communication and the next one goes beyond the communication override time, the system would report the communication error (ER188).

Under normal conditions, this parameter will be set ineffective. In continuous communication system, it is able to monitor the communication situation by setting this parameter.

Function code	Name	Parameter description	Setting range	Default value
P9.05	Treatment for communication error	0: Give an alarm and free stop 1: Continue to run without alarm 2: Stop according to the halt mode without alarm (only under communication control mode) 3: Stop according to the halt mode without alarm (under all control modes)	0~3	3

Under abnormal communication condition, inverter is able to screen the fault alarm or stop through selecting the protection operation, and keep running.

Function code	Name	Parameter description	Setting range	Default value
P9.06	Response operation of communication	0: Write operation responds 1: Write operation does not respond	0~1	1

When this function code is set at 0, the inverter will respond to the read write command from upper machine.

When this function code is set at 1, the inverter will respond to the read command from upper machine, but will not respond to the write command, it is able to improve the communication efficiency through this mode.

Group PA Vector control

Function code	Name	Parameter description	Setting range	Default value
PA.00	Proportional gain 1 of speed ring	0~100	0~100	20
PA.01	Integral gain 1 of speed ring	0.01~10.00s	0.01~10.00	0.50s
PA.02	Frequency for switching low point	0.00Hz~PA.05	0.00~PA.05	5.00Hz
PA.03	Proportional gain 2 of speed ring	0~100	0~100	15
PA.04	Integral gain 2 of speed ring	0.01~10.00s	0.01~10.00	1.00s
PA.05	Frequency for switching high point	0.00Hz~P0.13 (max frequency)	0.00~P0.04	10.00Hz

The above parameters are only effective for vector control, but ineffective for V/F control. When under switching frequency 1 (PA.02), parameter PI of speed ring is PA.00 and PA.01. When it is above switching frequency 2 (PA.05), parameter PI of speed ring is PA.03 and PA.04. Between the switching points, parameter PI is got from line change of two groups of parameters, as shown in diagram 6–19.

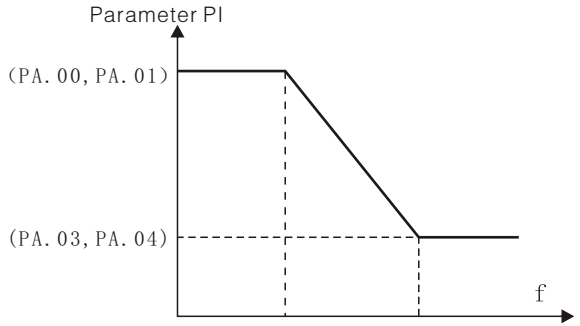


Fig.6–19 Schematic diagram of parameter PI

It is able to regulate the speed dynamic response of vector control through setting proportion factor and integral time. It is able to speed up the dynamic response of speed ring both by adding proportional gain and reducing integral time, but too large of proportional gain or too short of integral time would lead to system oscillation and over–large overshoot. However, too small of proportional gain also may lead to system oscillation and speed steady–state error. Parameter PI of speed ring has close relationship with inertia of motor system, users should regulate according to different load requirements on the basis of default PI parameter, to satisfy demands of various occasions.

Function code	Name	Parameter description	Setting range	Default value
PA.06	VC slip compensating factor	50%~200%	50~200	100%

Slip compensating factor: it is used for regulating the slip frequency of vector control, improving speed control accuracy of system, it is able to prevent speed steady–state error by regulating this parameter suitably.

Function code	Name	Parameter description	Setting range	Default value
PA.07	Upper limit setting of torquer	0.0~200.0% (rated current of inverter)	0. 0~200. 0	150. 0%

Setting of 100.0% corresponds to the rated output current of inverter.

Group PB Motor parameter setting

Function code	Name	Description	Setting range	Default value
PB.00	Self–learning of motor parameterr	0: No operation 1: Overall self–learning of parameter 2: Static self–learning of parameter	0~2	0

0: No operation, i.e. forbidden to self–learn.

1: Overall self–learning of parameter

Before self–learning of motor parameter, please release the motor from loads first, let the motor under no–load state, and make sure that the motor is under static state.

Before self–learning of motor parameter, please input the nameplate parameters (PB.01–PB.06) of motor properly, otherwise, the self–learning result of motor parameter may be incorrect.

Before self–learning of motor parameter, please set the acceleration and deceleration time (P0.04 and P0.05) reasonably according to magnitude of motor, otherwise, there may have over–current fault during self–learning of motor parameter.

Set P0.00 at 0, set PB.00 at 1, then push down the key ENTER, enter into self–learning of motor parameter, at this moment, LED displays "–TUN–" and flickers, then push down the key RUN and begin to self–learn of parameter, then LED displays "TUN–0", after motor runs, it displays "TUN–1", light "RUN" flickers, when the parameter self–learning is finished, it displays "–END–", and return to stop state interface, when "–TUN" flickers, it is able to exit the parameter self–learning state by pushing down the key PROG.

During the parameter self–learning, it is able to stop the parameter self–learning operation by pushing down the key STOP/RESET. Notice, start and stop of parameter self–learning will be controlled by the keyboard only.

2：Static self–learning of parameter

During static self–learning of motor parameter, it is not necessary to release motor from loads. Before parameter self–learning, please input the nameplate parameters (PB.01–PB.06) of motor properly, after the self–learning, it will detect out the stator resistance and rotor resistance as well as leakage inductance of motor. It is unable to detect out the mutual induction of motor or no–load current, users can input corresponding function code as a matter of experience.

Function code	Name	Parameter description	Setting range	Default value
PB.01	Type of inverter	0: Type G 1: Type P	0~1	0

0: It is suitable for constant torque load of specified rated parameter

1: It is suitable for variable torque loads (fan and water pump loads) of specified rated parameter

SY8000 series inverter adopts G/P integrated mode, applicable motor power for constant torque load (type G) is one step lower than that for fan and water pump loads (type P).

When leaving the factory, this parameter is set at type G, if want to set at type P, operate as follows:

1) Set this function code at 1;

2) Reinstall the motor parameters of group PB.

e.g.: The machine model SY8000–022G/030P–4 has been set as 22kW G type, if want to change into 30kW P type, just operate as follows:

1) Set this function code at 1;

2) Reinstall the motor parameters of group PB.

Function code	Name	Parameter description	Setting range	Default value
PB.02	Rated power of motor	0.4~900.0kW	0.4~900.0	Model setting
PB.03	Rated frequency of motor	0.01Hz~P0.13 (max frequency)	0.01~P0.04	50.00Hz
PB.04	Rated speed of motort	0~36000rpm	0~36000	Model setting
PB.05	Rated voltage of motor	0~460V	0~460	Model setting
PB.06	Rated current of motor	0.1~2000.0A	0.1~2000.0	Model setting

Notice: please set according to the nameplate parameters of motor. Excellent control performance of vector control requires accurate motor parameters.

SY8000 series inverter provides parameter self–learning function. The accurate parameter self–learning stems from accurate setting of motor nameplate parameters. In order to guarantee control performance, please arrange suitable motor configuration according to the standard applicable motor of inverter, if the motor power has a too large difference with the standard applicable motor, control performance of inverter would fall obviously.

Notice: it is able to initialize the motor parameters PB.03~PB.11 by reinstalling the rated power (PB.02) of motor

Function code	Name	Parameter description	Setting range	Default value
PB.07	Stator resistance of motor	0.001~65.535Ω	0.001~65.535	0
PB.08	Rotor resistance of motor	0.001~65.535Ω	0.001~65.535	Model setting
PB.09	Stator and rotor inductance of motor	0.1~6553.5mH	0.1~6553.5	Model setting
PB.10	Stator and rotor mutual inductance of motor	0.1~6553.5mH	0.1~6553.5	Model setting
PB.11	No–load current of motor	0.01~655.35A	0.01~655.35	Model setting

When the parameter self–learning of motor is finished normally, the setting value of PB.07–PB.11 will update automatically. These parameters are the reference parameters of high performance vector control, will affect the control performance directly.

Notice: users please do not modify this group of parameters randomly.

7.1 Fault information and diagnosis

Fault code	Symptom	Possible cause	Remedy
ERR01	Phase U of inversion unit has fault	1. Accelerate too quickly 2. Inner of IGBT of this phase is damaged 3. Interference causes misoperation 4. Whether the earthing is in good condition	1. Lengthen the acceleration time 2. Ask for help 3. Check the peripheral equipment to see if there is strong interference source.
ERR02	Phase V of inversion unit has fault		
ERR03	Phase W of inversion unit has fault		
ERR04	Over–current during acceleration running	1. Accelerate too quickly 2. Voltage of power grid is on the low side 3. Power of inverter is on the low side	1.Lengthen the acceleration time 2.Check the input power supply 3.Select inverter of higher power
ERR05	Over–current during deceleration running	1.Decelerate too quickly 2.Inertia torque of loads is large 3.Power of inverter is on the low side	1.Lengthen the deceleration time 2.Apply suitable dynamic braking assemblies additionally 3.Select inverter of higher power
ERR06	Over–current during constant speed running	1.Loads have sudden change or abnormity 2.Voltage of power grid is on the low side 3. Power of inverter is on the low side	1.Check the loads or reduce sudden change of loads 2.Check the input power supply 3.Select inverter of higher power
ERR07	Over–current during acceleration running	1.Input voltage is abnormal 2.Restart the rotating motor after instantaneous power failure	1.Check the input power supply 2.Avoid restarting after stopping
ERR08	Over–current during deceleration running	1.Decelerate too quickly 2.Inertia of loads is large 3.Input voltage is abnorma	1.Lengthen the deceleration time 2.Add dynamic braking assemblies 3.Check the input power supply
ERR09	Over–voltage during constant speed running	1.Input voltage has abnormal change 2.Inertia of loads is large	1.Install an input reactor 2.Apply suitable dynamic braking assemblies additionally
ERR10	Under–voltage of bus	1. Voltage of power grid is on the low side	1.Check the input power supply of power grid
ERR11	Overload of motor	1.Voltage of power grid is too low 2.Rated current setting of motor is improper 3.Motor rotation blockage or load change is too large 4.Big horse pull a small carriage	1.Check the voltage of power grid 2.Reset the rated current of motor 3.Check the loads, regulate torque increasing capacity 4.Select suitable motor
ERR12	Overload o f inverter	1.Accelerate too quickly 2.Restart the rotating motor 3.Voltage of power grid is on the low side 4.Load duty is too heavy	1.Lengthen the acceleration time 2.Avoid restarting after stopping 3.Check the voltage of power grid 4.Select inverter of higher power
ERR13	Open–phase on the input side	There is open–phase input on R, S or T	1.Check the input power supply 2.Check the installation and wiring

Fault code	Symptom	Possible cause	Remedy
ERR14	Open–phase on the output side	There is open–phase output on U, V or W (or the three–phase loads are unbalanced seriously)	1.Check the output wiring 2.Check the motor and cables
ERR15	Over–heat of rectification module	1. Inverter has instantaneous over–current 2. Output three–phase has interphase or earthing short–circuit 3.Air channel is blocked or fan is damaged 4.Ambient temperature is over high 5.Wiring or plug–in unit of control panel is loosened 6.Auxiliary power supply is damaged, driving voltage is under–voltage 7.Power module bridge arm direct through 8.Control panel is abnormal	1.Refer to the countermeasures for over–current 2.Rewiring 3.Dredge the wind channel or change the fan 4.Reduce the ambient temperature 5.Check and reconnect 6.Ask for service 7.Ask for service 8.Ask for service
ERR16	Over–heat of inversion module		
ERR17	External fault	1. SI external fault input terminal operates	1. Check the input of external equipment
ERR18	Communication fault	1.Baud rate setting is not suitable 2.Communication error when adopting serial communication Communication is interrupted for long time	1.Set suitable baud rate 2.Push down the key STOP/RST, ask for service Check the wiring at communication interface
ERR19	Current detection circuit comes across fault	1.Bad contact of connector of control panel 2.Auxiliary power supply is damaged 3.Hall device is damaged Amplifying circuit is abnormal	1.Check the connector, reconnect 2.Ask for service 3.Ask for service Ask for service
ERR20	Self–learning of motor comes across fault	1.Motor capacity does not match with the inverter capacity 2.Rated parameter setting of motor is not suitable 3.Self–learned parameters have large difference with standard parameters 4.Time override of self–learning	1.Change the model of inverter 2.Set rated parameters according to the motor nameplate 3.Let the motor under no load, and identify over again 4.Check the wiring and parameter setting of motor
ERR21	EEPROM read–write fault	1.There is something wrong with read–write of control parameters 2.EEPROM is damaged	1.Push down the key STOP/RST to reset, ask for service 2.Ash for service
ERR22	PID feedback disconnection fault	1.PID feedback is disconnected 2.PID feedback source is disappeared	1.Check PID feedback signal line 2.Check the PID feedback source
ERR23	Brake unit is failed	1.Brake line has fault or brake pipe is damaged Resistance value of external brake is too low	1.Check the brake unit, change the brake pipe 2.Increase the brake resistance
ERR24	Reserved by the factory		
P.oFF	Power down	Power supply of inverter is failed	Self reset

7.2Usual faults and solutions

During the operation of inverter, it may come across the following situations, please analyze according to the following methods:

No display after being electrified:

Use avometer to measure the input power supply of inverter, to see if it accords with the rated voltage of inverter. If there is something wrong with the power supply, please check and eliminate. Check the three–phase rectifier bridge to see if it is in good condition. If not, please ask for service.

Check if the lamp CHARGE is on, if not, the fault usually is on rectifier bridge or buffer resistor, if this lamp is on, then the fault usually is on the switching power supply. Please ask for service.

Air switch of power supply trips after power on:

Check if there is earthing or short–circuit situation among input power supplies, eliminate the problems.

Check if the rectifier bridge has been broken down, if it is, ask for service.

The motor is failed to run when the inverter has been put into operation:

Check if there is balanced three–phase output among U, V and W, if there is, then the motor line or motor itself is damaged, or motor is blocked due to mechanical cause, please eliminate the cause.

When there is output with unbalanced three–phase, then the drive board of inverter or output module may be damaged, please ask for service.

If there no output voltage, then the drive board or output module may be damaged, please ask for service.

The inverter displays normally after power on, but air switch of power supply trips after running:

Check if the interphase among the output modules has short–circuit situation, if there is, please ask for service. Check if there is short–circuit or earthing condition among motor lead wires, if there is, please eliminate.

If the trip phenomenon appears sporadically, and the motor is far away from the inverter, please consider adding an output AC reactor.

Warning
■ Maintenance personnel should carry out maintenance according to the specified methods. ■ Please ask for professional and qualified personnel to carry out the maintenance. ■ Before maintaining, please cut off the power supply of inverter first, and carry out maintenance 10min later. ■ Don't touch the elements and components on the PCB plate directly, otherwise, the static electricity may damage the inverter. ■ When the maintenance is finished, make sure that all the screws have been tightened.

8.1Daily maintenance

In order to protect the inverter from faults, guaranteeing normal running of equipment, and prolong service life of inverter, please carry out daily maintenance to the inverter, content of daily maintenance as follows:

Inspection item	Content
Temp./humidity	Make sure that the temperature is within 0℃~50℃, humidity is within 20~90%
Oil mist and dust	Make sure that no oil mist, dust or condensate water remain in the inverter
Inverter	Check if the inverter has abnormal heating or abnormal vibration
Fan	Make sure that the fan runs normally without any block situation
Input power supply	Make sure that the voltage and frequency of input power supply remain within the permissible range
Motor	Check if the motor has abnormal vibration, heating, abnormal noise, open–phase or other problems.

8.2Regular maintenance

In order to protect the inverter from faults, guaranteeing long–term high–performance and stable running, users must detect the inverter periodically (within half a year), detection content as follows:

Inspection item	Content	Elimination methods
Screws of external terminals	Whether the screws are loosened or not	Tighten them
PCB plate	Dust, dirt	Clear away foreign matters thoroughly with dry compressed air
Fan	Abnormal noise or vibration, whether cumulative time reaches 20000h or not	1.Clear away foreign matters 2.Change the fan
Electrolytic capacitor	If it changes color or has peculiar smell	Change the electrolytic capacitor
Radiator	Dust, dirt	Clear away foreign matters thoroughly with dry compressed air
Power components	Dust, dirt	Clear away foreign matters thoroughly with dry compressed air

8.3Change of wearable parts of inverter

Fan and electrolytic capacitor inside the inverter are wear parts, in order to guarantee long–term, safety and fault–free running of inverter, please change the wear parts regularly, changing time as follows:

Fan: it should be changed after 20000h of working

Electrolytic capacitor: it should be changed after 30000~40000h of working

8.4Warranty for inverter

Free maintenance only is for the inverter itself.

1. The company would be responsible for the inverter for any fault or damage on the inverter under normal operation for 12 months (since the date of leaving the factory), but require reasonable maintenance cost for that exceeding 12 months;

2. Within 12 months, a certain maintenance cost would be required for the following situations:

1) The machine is damaged due to operation without according to the operating manual;

2) Damage caused by fire, flood, abnormal voltage or others;

3) Damage caused by using the inverter in abnormal condition;

Relevant service charge would be calculated according to the factory standard, and the agreement would have priority if there were.

Communication protocol

SY series inverter provides RS485 communication interface, adopts international standard ModBus communication protocol for master-slave mode communication. Users are able to realize centralized control (setting of control command and running frequency of inverter, modification of relevant parameters of function code, working state of inverter and monitoring of fault information) through PC/PLC and controlling upper machine, adapting to special application requirements.

9.1 Contents of protocol

This Modbus serial communication protocol defines the frame content and operation format of asynchronous transmission of serial communication. It includes formats of host machine polling, broadcast frame and slave machine response frame; frame content organized by host machine contains address of slave machine (or broadcast address), executive command, data, error checkout and others. Response of slave machine also adopts the same structure, content includes operation confirmation, returning data, error checkout and others. If the slave machine comes across fault during receiving frame, or is unable to finish the operation that the host machine requires, it would organize a fault frame as response and feed back to the host machine.

9.2 Application way

SY series inverter accesses to the control network of "single-host multi-slave" that has RS232/RS485 bus line.

9.3 Bus structure

1) Interface mode:

RS485 hardware interface

2) Transmission mode

Asynchronous serial, half-duplex transmission mode. At the same time, only host machine or slave machine sends data, and the other one receives data. During the serial asynchronous communication, the data is transmitted in message mode and send one by one.

3) Topological structure

System of single host machine and multi slave machines. Setting range of address of slave machine is 1~247, 0 is the address of broadcast communication. Address of each slave machine in the network is unique, this guarantees base for ModBus serial communication.

9.4 Instruction for protocol

Communication protocol of SY series inverter is a kind of asynchronous serial and host-slave ModBus communication protocol, there is only one equipment (host machine) is able to establish protocol (called "search/command"). Other equipment (slave machine) only is able to respond to the "search/command" through providing data, or make corresponding actions according to the "search/command". Host machine here means the personal computer (PC), industrial control equipment or programmable logic controller (PLC), slave machine means the SY series inverter or other control equipment that has similar communication protocol. The host machine not only is able to communicate with a single slave machine, but also is able to send broadcast information to all slave machines. For "search/command" of single accessing, the slave machine will feed back an information (called response), for broadcast information sent out by host machine, slave machines need not to feed back.

9.5 Structure of communication frame

Communication data format of ModBus protocol of SY series inverter can be divided into RTU (remote terminal unit) and ASCII (American Standard Code for Information International Interchange) two types.

Under mode RTU, format of each byte as follows:,

Coding system: eight-bit binary system,

Hexadecimal system 0~9, A~F,

Each eight-bit frame domain includes two hexadecimal characters.

Under mode ASCII, format of each byte as follows:

Coding system: communication system belongs to hexadecimal system, message character meaning of ASCII:

"0" "9", "A" "F", each hexadecimal system represents each ASCII information, for example

Character	'0'	'1'	'2'	'3'	'4'	'5'	'6'	'7'	'8'	'9'
ASCII CODE	0x30	0x31	0x32	0x33	0x34	0x35	0x36	0x37	0x38	0x39
Character	'A'	'B''	'C'	'D'	'E'	'F'				
ASCII CODE	0x41	0x42'	0x43	0x44	0x45	0x46				

Bit of byte: including start bit, 7 or 8 data bits, check bits and stop bits.

Description of byte bit as follows:

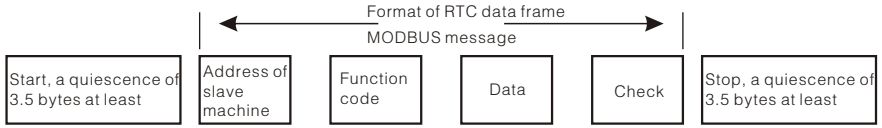
11–bit character frame:

Start bit	Bit1	Bit2	Bit3	Bit4	Bit5	Bit6	Bit7	Bit8	No check bit Even check bit Odd check bit	Stop bit

10–bit character frame:

Start bit	Bit1	Bit2	Bit3	Bit4	Bit5	Bit6	Bit7	No check bit Even check bit Odd check bit	Stop bit

Under mode RTU, the new one always starts with a quiescence that is equal to transmission time of 3.5 bytes at least. In the network where the transmission rate is calculated with baud rate, transmission time of 3.5 bytes can be mastered easily. The data domains followed closely are address of slave machine, operating command code, data and CRC check character, transmission bytes of each domain are 0…9 and A…F of hexadecimal system. The network equipment always monitors the action of communication bus, even if in the interval time of quiescence. When receiving the first domain (address information), each network equipment will make a confirmation to this byte. Along with the finish of transmission of the last byte, there will be another similar transmission time interval of 3.5 bytes, this means that this frame is finished, after that, it will start to transmit a new frame.

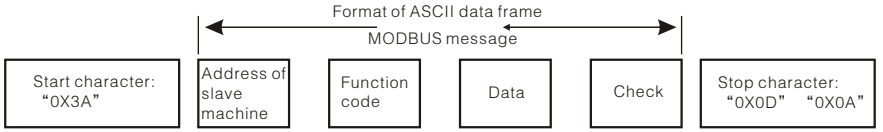


Information of a frame must be transmitted in a continuous data flow, if there is an interval that is more than 1.5 bytes before the whole frame transmission is finished, the receiving equipment would clear up this incomplete information, and judge the followed byte as a part of address domain of new frame by mistake, in the same way, when interval between new frame and previous frame is less than transmission time of 3.5 bytes, the receiving equipment would also judge it as a part of previous frame by mistake, and the CRC check value would be incorrect due to error of frame, this would lead to communication fault finally.

Standard structure of RTU frame

Frame head START	T1–T2–T3–T4 (transmission time of 3.5 bytes)
Address domain of slave machine ADDR	Communication address: 0~247 (decimal system) (0 is the broadcast address)
Function domain CMD	03H: read parameters of slave machine; 06H: write parameters of slave machine
Data domain DATA (N–1) …DATA (0)	Data of 2*N bytes, this part is the main content of communication, also is the core of data exchange in communication.
CRC CHK low bit	Detection value: CRC check value (16BIT)
CRC CHK high bit	
Frame end END	T1–T2–T3–T4 (transmission time of 3.5 bytes)

In mode ASCII, frame head is ":" ("0x3A), frame end is the default "CRLF" ("0x0D" "0x0A"). Under the mode ASCII, all the data bytes except for frame head and frame end are transmitted in ASCII code, it transmits the higher 4 bit bytes first, then transmits the lower 4 bit bytes. Data under ASCII mode is of 7 or 8–bit in length. It adopts the capital letter of ASCII code for A'~F'. At this time, the data adopts LRC check from address of slave machine to information part of data. The check sum equals to complement of character sum (carry rejection bit) of all data that take part in the check.



Standard structure of ASCII frame

START	":" (0x3A)
Address Hi	Communication address: Address of 8–bit is composed of 2 ASCII codes
Address Lo	
Function Hi	Function code: Address of 8–bit is composed of 2 ASCII codes
Function Lo	
DATA (N–1) … DATA (0)	Data content: Data content of nx8–bit is composed of 2n ASCII codes n<=16, max 32 ASCII codes
LRC CHK Lo	LRC check code: Check code of 8–bit is composed of 2 ASCII codes
LRC CHK Hi	
END Hi	Stop character: END Hi=CR (0x0D), END Lo=LF (0x0A)
END Lo	

9.6Command code and communication data

9.6.1Command code: 03H (0000 0011), read N characters (Word) (16 characters at most continuously)

e.g. when an inverter whose address of slave machine is 01H, start address of internal memory is 0004, read consecutive 2 characters, then the structure description of this frame as follows:

RTU host machine command information

START	T1–T2–T3–T4 (transmission time of 3.5 bytes)
ADDR	01H
CMD	03H
High bit of start address	00H
Low bit of start address	04H
High bit of data number	00H
Low bit of data number	02H
CRC CHK low bit	85H
CRC CHK high bit	CAH
END	T1–T2–T3–T4 (transmission time of 3.5 bytes)

RTU slave machine response information

START	T1–T2–T3–T4 (transmission time of 3.5 bytes)
ADDR	01H
CMD	03H
Byte number	04H
High bit of data address 0004H	00H
Low bit of data address 0004H	00H
High bit of data address 0005H	00H
Low bit of data address 0005H	00H
CRC CHK low bit	43H
CRC CHK high bit	07H
END	T1–T2–T3–T4 (transmission time of 3.5 bytes)

ASCII host machine command information

START	':'
ADDR	'0'
	'1'
CMD	'0'
	'3'
High bit of start address	'0'
	'0'
Low bit of start address	'0'
	'4'
High bit of data number	'0'
	'0'
Low bit of data number	'0'
	'2'
CRC CHK Lo	'F'
CRC CHK Hi	'6'
END Lo	'CR'
END Hi	'LF'

ASCII host machine command information

START	':'
ADDR	'0'
	'1'
CMD	'0'
	'3'
Byte number	'0'
	'4'
High bit of data address 0004H	'0'
	'0'
Low bit of data address 0004H	'0'
	'2'
High bit of data address 0005H	'0'
	'0'
Low bit of data address 0005H	'0'
	'0'
CRC CHK Lo	'F'
CRC CHK Hi	'6'
END Lo	'CR'
END Hi	'LF'

9.6.2 **Command code:** 06H (0000 0110), write a character (Word)

e.g. write 5000 (1388H) at the address 0008H of inverter of the slave machine address 02H, then the structure of this frame can be described as follows:

RTU host machine command information

START	T1–T2–T3–T4 (transmission time of 3.5 bytes)
ADDR	02H
CMD	06H
High bit of write data address	00H
Low bit of write data address	08H
High bit of data content	13H
Low bit of data content	88H
CRC CHK low bit	05H
CRC CHK high bit	6DH
END	T1–T2–T3–T4 (transmission time of 3.5 bytes)

RTU slave machine response information

START	T1–T2–T3–T4 (transmission time of 3.5 bytes)
ADDR	02H
CMD	06H
High bit of write data address	00H
Low bit of write data address	08H
High bit of data content	13H
Low bit of data content	88H
CRC CHK low bit	05H
CRC CHK high bit	6DH
END	T1–T2–T3–T4 (transmission time of 3.5 bytes)

ASCII host machine command information

START	':'
ADDR	'0'
	'2'
CMD	'0'
	'6'
High bit of write data address	'0'
	'0'
Low bit of write data address	'0'
	'8'
High bit of data content	'1'
	'3'
Low bit of data content	'8'
	'8'
CRC CHK Hi	'5'
CRC CHK Lo	'5'
END Lo	'CR'
END Hi	'LF'

ASCII host machine command information

START	':'
ADDR	'0'
	'2'
CMD	'0'
	'6'
High bit of write data address	'0'
	'0'
Low bit of write data address	'0'
	'8'
High bit of data content	'1'
	'3'
Low bit of data content	'8'
	'8'
CRC CHK Hi	'5'
CRC CHK Lo	'5'
END Lo	'CR'
END Hi	'LF'

9.6.3Wrong check of communication frame

Wrong check of frame mainly includes two parts, i.e. bit check (odd/even check) of byte and entire data check (CRC check or LRC check) of frame.

9.6.3.1 Byte bit check

Users can select different bit check modes as required, also no-check is available, this would affect the check bit setting of each byte.

Even check: add an even check bit before the data transmission, used to denote that the number "1" in the transmitted data is odd or even, when it is even, check bit is set "0", otherwise, set "1", used to keep the parity unchanged.

Odd check: add an odd check bit before the data transmission, used to denote that the number "1" in the transmitted data is odd or even, when it is odd, check bit is set "0", otherwise, set "1", used to keep the parity unchanged.

e.g. it is required to transmit "11001110", there are five "1" in the data, when using even check, the even check bit is "1", when using odd check, the odd check bit is "0", when transmitting data, the odd-even check bit is placed at position of check bit of frame through calculation, the receiving equipment also will carry out odd-even check, if the parity of received data is different from the preset one, it would be judged that there is error in communication.

9.6.3.2 CRC check mode --- CRC (Cyclical Redundancy Check):

RTU frame format, the frame contains the frame error check domain on the basis of CRC calculation method. CRC domain checks the content of the whole frame. CRC domain has two bytes, including binary value of 16-bit. It is added to the frame after calculation of transmission equipment. The receiving equipment will recalculate the CRC of received frame, and compare it with the value in received CRC domain, if the two CRC values are different, then there must have error during transmission.

CRC will log the 0xFFFF first, then call a procedure to treat the 6 above consecutive bytes and value in the current register. Only the 8Bit data in each character is effective to the CRC, the start bit, stop bit or odd-even check bit is ineffective.

During the production course of CRC, each 8-bit character will respectively differ (or XOR) with the content of register, and moves in the direction of least significant bit, the most significant digit will be filled with 0. Take LSB out for testing, if LSB is 1, register will be respectively differ with the preset value, if LSB is 0, then no operation would be carried out. The whole process should be repeated for 8 times. When the last bit (8th bit) is finished, the next 8-bit byte will respectively differ with the current value of register again. At last, the value in the register just is the CRC value of all the bytes after calculation in frame.

Calculation method of CRC adopts international standard CRC check rules, users can refer to relevant CRC calculation standard when editing the algorithm of CRC, to get a CRC calculation program that is actually in accordance with the requirements.

Hereinafter there is a simple function for CRC calculating for reference (using programming language C):

In ladder logic, CKSM calculates the CRC value according to frame content, adopting table look-up method for calculation, this method is featured with simple program and quick operating rate, but the program occupies large ROM space, please consider this point when applying it to occasions where is strict to the program space.

9.6.3.3 Check (LRC Check) under ASCII mode

Check code (LRC Check) is the sum of results from Address to Data Content, see above paragraphs.

9.6.3.4Check code of communication information:

0x02+0x06+0x00+0x08+0x13+0x88=0xAB, then take the complement code of 2=0x55.

9.6.4 Definition of address of communication data

This part defines the address of communication data, used for controlling running of inverter, and obtaining status information and setting relevant function parameters of inverter.

1)Address expression rule of function code parameters

Take the serial number of function code as corresponding register address of parameter, but it should be converted into hexadecimal system, e.g. serial number of P4.15 is 79, then the address of this function code expressed with hexadecimal system is 004FH.

Range of high and low bytes: high bit byte 00~01; low bit byte 00~FF.

Notice: group PE: parameters are set by the manufacturer, it is unable to read or change; some parameters can not be changed only during running of inverter; some parameters can not be changed under any condition of inverter; please also pay attention to the setting range, unit and relevant description when modifying the parameters of function code.

Besides, as frequent storing of EEPROM would reduce its service life, for users, some function codes under communication mode are unnecessary to store, just modify the value in RAM to satisfy the operating requirements. When wanting to realize this function, just modify the highest bit of corresponding address of function code from 0 into 1. e.g.:

Don't want to store the function code P0.03 in EEPROM, then just modify the value in RAM, set the address as 800CH; this address can only be used for writing RAM in the SCM, and can not be used for reading, it would be an ineffective address when is used for reading.

2) Address description of other functions:

Function description	Address definition	Data description	R/W characteristic
Communication control command	1000H	0001H: Forward rotation	W/R
		0002H: Reverse rotation	
		0003H: Forward jogging	
		0004H: Reverse jogging	
		0005H: Stop	
		0006H: Free stop (emergency stop)	
		0007H: Fault reset	
		0008H: Jogging stop	
State of inverter	1001H	0001H: During forward rotation	R
		0002H: During reverse rotation	
		0003H: In stand-by of inverter	
		0004H: In failure	
Address of communication setting value	2000H	Setting range of communication (-10000~10000) Notice: communication setting value is the percentage of relative value (-100.00%~100.00%), can be used for writing operation of communication. When it is set as frequency source, relative to the percentage of max frequency (P0.04); When it is used as PID given or feedback, relative to the percentage of PID. Thereinto, both PID set value and PID feedback carry out PID calculation in the form of percentage.	W/R

Continued

Address description of running/stop parameters	3000H	Running frequency	R
	3001H	Setting frequency	R
	3002H	Bus voltage	R
	3003H	Output voltage	R
	3004H	Output current	R
	3005H	Running speed	R
	3006H	Output power	R
	3007H	Output torque	R
	3008H	PID set value	R
	3009H	PID feedback value	R
	300AH	State of terminal input symbol	R
	300BH	State of terminal output symbol	R
	300CH	Value of analog quantity AI1	R
	300DH	Value of analog quantity AI2	R
	300EH	Reserved	R
	300FH	Reserved	R
	3010H	Reserved	R
	3011H	Reserved	R
	3012H	Current stage of multi-speed	R
Fault address of inverter	5000H	The fault information codes are the same as the serial number of fault type in menu of function codes, the difference is that this part only feed back hexadecimal number to upper machine, but not fault characters.	R
ModBus communication fault address	5001H	0001H: Invalid password 0002H: Invalid command code 0003H: CRC check error 0004H: Illegal address 0005H: Invalid data 0006H: Ineffective parameter modification 0007H: System is locked 0008H: Inverter busy (EEPROM is storing)	R

9.6.5 Additional response during error communication

When the inverter communication is connected, if there is error, the inverter would respond error code to the master control system in fixed format, in this way, the master control system would judge that there is error occurred. Command byte of fault response of inverter will all be carried out according to "06" no matter the command code is "03" or "06", and the data address is fixed at 0x5001. For example:

RTU slave machine response information

START	T1-T2-T3-T4 (transmission time of 3.5 bytes)
ADDR	01H
CMD	06H
High bit of fault return address	50H
Low bit of fault return address	01H
Error code high bit	00H
Error code low bit	05H
CRC CHK low bit	09H
CRC CHK high bit	09H
END	T1-T2-T3-T4 (transmission time of 3.5 bytes)

ASCII host machine command information

START	':'
ADDR	'0'
	'1'
CMD	'0'
	'6'
High bit of fault return address	'5'
	'0'
Low bit of fault return address	'0'
	'1'
Error code high bit	'0'
	'0'
Error code low bit	'0'
	'5'
CRC CHK Hi	'A'
CRC CHK Lo	'3'
END Lo	'CR'
END Hi	'LF'

Meanings of error code

Error code	Description
1	Invalid password
2	Incorrect command code
3	CRC check error
4	Illegal address
5	Invalid data
6	Parameter modification is ineffective
7	System is locked
8	Inverter busy (EEPOM is storing)