HYRIA INVERTER

SL Series Inverter Manual

HYRIA INVERTER

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Content

Safety precautions

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

The precautions related to safe operation are classified into "WARNING" and "CAUTION".

WARNING

Points out potential danger which, if not avoided, maycause physical injury or death.

CAUTION

Points out potential danger which, if not avoided, may result in mild or mode rate physical injury and damage to the equipment. It's also available to warns about unsafe operations.

In some cases, even the content described in "Note" may also cause serious accidents. So please follow these important precautions in any situations.

- **NOTE is the necessary step to ensure the proper operation.**
- **WARNING signs are presented on the front cover of inverters.**
- **USING please follow these instructions when using the inverter.**

Warning mark

WARNING
● Please follow the instructions in the manual before installation or operation.
● Disconnect all power line before opening front cover of unit.
● Wait at least 10 minutes until DC Bus capacitors discharge.

1 General

1.1 General technical specifications

•Input & Output

- ◆ Input Voltage Range: 380/220V ± 15%
- ◆ Input Frequency Range: 47 ~ 63Hz
- ◆ Output Voltage Range: 0 ~rated input voltage
- ◆ Output Frequency Range: 0 ~ 600Hz

•I/O features

- ◆Programmable Digital Input: Provide 6 terminals which can accept ON-OFFinputs.
- ◆Programmable Analog Input: AI1 can accept input of 0 ~10V; AI2 can accept input of 0~10V or 0~20mA.
- ◆Open Collector Output: Provide 2 output terminal.
- ◆Relay Output: Provide 1output terminal.
- ◆Analog Output:Provide 1analog output terminal, 0/4~20 mA or 0~10 V is Available.

•Technical features

- ◆Control Mode:Sensorless Vector Control (SVC), V/F Control.
- ◆Overload Capacity: 60s with 150% of rated current and 10s with 180% of rated current.
- ◆Starting Torque: 150% of rated torque at 0.5Hz (SVC).
- ◆Speed Adjusting Range: 1:100 (SVC).
- ◆Speed Accuracy: + 0.5% of maximum speed (SVC).
- ◆Carrier Frequency: 1.0KHz ~15.0KHz.

• Function features

- ◆Reference Frequency Source: keypad, analog input, serial communication,multi-step speed, PID and so on.
- ◆PID Control Function.
- ◆Multi-Step Speed Control Function: 8 steps speed can be set.
- ◆Traverse Control Function.
- ◆Non-Stop when power is instantaneously cut off.
- ◆Speed tracking restart function: make the revolving motor spindle realize non-impact smooth start
- ◆QUICK/JOG Key: User-defined shortcut key.
- ◆Automatic Voltage Regulation (AVR) Function: Automatically keep the output voltage stable when input voltage fluctuating.
- ◆Up to 25 fault protections: protect from overcurrent, overvoltage, undervoltage, overtemperature, phase loss and overload etc.

1.2Description of name plate

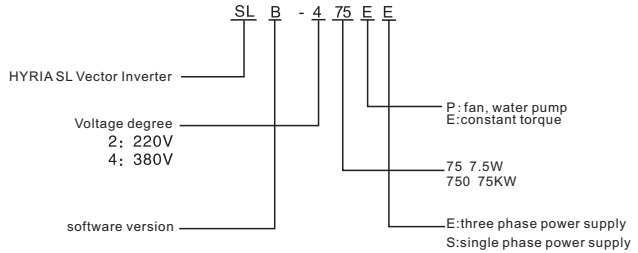


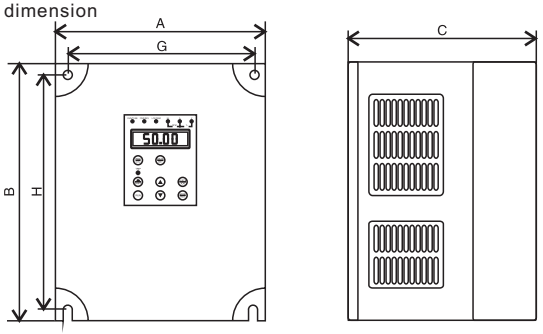
Figure1-1 Nameplate description

1.3Selection guide

Model No.	Input voltage	Rated output power(KW)	Rated input current(A)	Rated output current(A)	Motor power
SL–207EE	Single & Three Phase 220V -15% +15%	0.75	5.0	4.5	0.75
SL–215EE		1.5	7.7	7	1.5
SL–222EE		2.2	11.0	10	2.2
SL–240EE		3.7	17.0	16	3.7
SL–255EE		5.5	21.0	20	5..5
SL–275EE		7.5	31.0	30	7.5
SL–2110EE		11.0	43.0	42	11.0
SL–2150EE		15.0	56.0	55	15.0
SL–2180EE		18.5	71.0	70	18.5
SL–2220EE		22.0	81.0	80	22.0
SL–2300EE		30.0	112.0	110	30.0
SL–2370EE		37.0	132.0	130	37.0
SL–2450EE		45.0	163.0	160	45.0
SL–407EE	Three phase 380V -15%+15%	0.75	3.4	2.5	0.75
SL–415EE		1.5	5.0	3.7	1.5
SL– 422EE		2.2	5.8	5	2.2
SL–440EE/455PE		4.0/5.5	10/15	9/13	4.0/5.5
SL–455EE/475PE		5.5/7.5	15/20	13/17	5.5/7.5
SL–475EE/4110PE		7.5/11.0	20/26	17/25	7.5/11.0
SL–4110EE/4150PE		11.0/15.0	26/35	25/32	11.0/15.0
SL –4150EE/4180PE		15.0/18.5	35/38	32/37	15.0/18.5
SL–4180EE/4220PE		18.5/22.0	38/46	37/45	18.5/22.0
SL –4220EE/4300PE		22.0/30.0	46/62	45/60	22.0/30.0
SL –4300EE/4370PE		30.0/37.0	62/76	60/75	30.0/37.0
SL –4370EE/4450PE		37.0/45.0	76/90	75/90	37.0/45.0
SL–4450EE/4550PE		45.0/55.0	90/105	90/110	45.0/55.0
SL –4550EE/4750PE		55.0/75.0	105/140	110/150	55.0/75.0
SL–4750EE/4900PE		75.0/90.0	140/160	150/176	75.0/90.0
SL –4900EE/41100PE		90.0/110.0	160/210	176/210	90.0//110.0

Model No.	Input voltage	Rated output power(KW)	Rated input current(A)	Rated output current(A)	Motor power
SL –41100EE/41320PE	Three phase 380V -15%+15%	110.0/132.0	210/240	210/253	110.0/132.0
SL –41320EE/41600PE		132.0/160.0	240/290	253/300	132.0/160.0
SL–41600EE/41850PE		160.0/185.0	290/330	300/340	160.0/185.0
SL–41850EE/42000PE		185.0/200.0	330/370	340/380	185.0/200.0
SL–42000EE/42200PE		200.0/220.0	370/410	380/420	200.0/220.0
SL–42200EE/42500PE		220.0/250.0	410/460	420/470	220.0/250.0
SL–42500EE/42800PE		250.0/280.0	460/500	470/520	250.0/280.0
SL–42800EE/43150PE		280.0/315.0	500/580	520/600	280.0/315.0
SL–31500EE/35000PE		315.0/350.0	580/620	600/640	315.0/350.0
SL–35000EE/40000PE		350.0/400.0	620/670	640/690	350.0/400.0
SL–40000EE/50000PE		400.0/500.0	670/835	690/860	400.0/500.0
SL–50000EE/56000PE		500.0/560.0	835/920	860/950	500.0/560.0
SL–56000EE/63000PE		560.0/630.0	920/1050	950/1100	560.0/630.0
SL–63000EE/70000PE		630.0/700.0	1050/1250	1100/1300	630.0/700.0

1.4Outside dimension



Model No.	A（mm）	B（mm）	C（mm）	G（mm）	H（mm）	Φd
207	125	170	162	112	157	4
215						
222	150	220	175	137	205	5
240	217	300	210	202	288	6
255						
275	270	380	248	254	365	6
2110						

Model No.	A（mm）	B（mm）	C（mm）	G（mm）	H（mm）	Φd
407	125	170	162	112	157	4
415						
422	150	220	175	137	205	5
440						
455	217	300	210	202	288	6
475						
4110	229	294	227	204	284	6
4150						
4185	297	450	253	270	432	6
4220						
4300						
4370	341	696.5	335.5	240	650.5	10.5
4450						
4550	368	756	327	286	710	10.5
4750						
4900	570	796	325	420	747	12
41100						
41320						
41600	695	980	325	580	932	12
41850						
42000	890	1160	360	750	1112	/
42200						
42500						
42800						
43150						
43550	cabinet 660(A)*2000(B)*600(C)					
44000						

2 Unpacking inspection

⚠ CAUTION

● Don't install or use any inverter that is damaged or has defective parts, otherwise physical injury may occur

Check following items after unpacking the inverter:

1.Inspect to ensure there are no scratches or other damage caused by the transportation.

2.Ensure there is operation manual in the packing box.

3.Inspect the nameplate and ensure it is the right ordered product.

4.Ensure the optional parts are the right ordered products.

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

3 Disassembly and installation

⚠ WARNING

- Only qualified electricians are allowed to operate on the drive device/system. Ignoring the instructions in "warning" may cause serious physical injury or death or property loss.
- Connect the input power lines tightly and permanently. And ground the device with proper techniques.
- Even when the inverter is stopped, dangerous voltage is present at the terminals:
  - Power Terminals: R, S, T
  - Motor Connection Terminals: U, V, W.
- Stop the drive and disconnect it from the power line. Wait for 5 minutes to let the drive discharge and then begin the installation.
- Minimum cross-sectional areas of the grounding conductor should be equal or larger than the cross-sectional area of the power cord conductors

⚠ CAUTION

- Lift the inverter by its base other than by the keypad or the cover. The dropping of the main part may cause physical injury.
- The inverter is fixed on a non-flammable wall such as metal and away from heat and flammable materials to avoid the fire.
- If more than two drives are installed in a cabinet, the temperature should be lower than 45℃ by means of a cooling fan. Overheat may cause fire or damage to the drive.

3.1 Environmental requirement

3.1.1 Temperature

The ambient temperature is among -10℃ to +40℃ and the inverter has to derate by 4% for every additional l℃ if the ambient temperature exceeds 40℃.

3.1.2 Humidity

Relative humidity of the air: ≤ 95%. No condensation is allowed.

3.1.3 Altitude

The inverter can run at the rated power if the installation site is less than 1000m (including 1000m) above the sea level. But it has to derate if the altitude exceeds 1000m.

See the following figure for details:

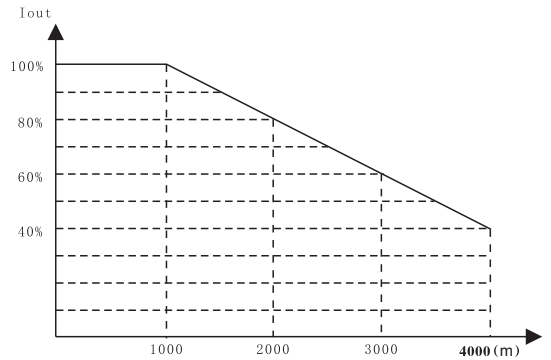


Figure 3.1 Relationship between output current and altitude

3.1.4 Impact Or Shock

The inverter can not bear fierce impact or shock.

The inverter should keep away from place where vibration frequently occur.

3.1.5 Electromagnetic radiation

The inverter should keep away from the electromagnetic radiation source.

3.1.6 Water

The inverter should keep away from water and condensation.

3.1.7 Air contamination

The inverter should keep away from contaminative air, such as corrosive gas, oil mist and conductive dust.

3.1.8 Storage enviroment

The inverter should keep away from direct sunlight, oil mist, and steam environment.

3.2Installation interval and distance

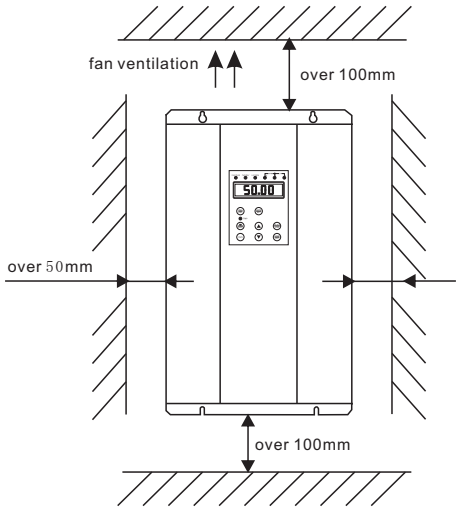
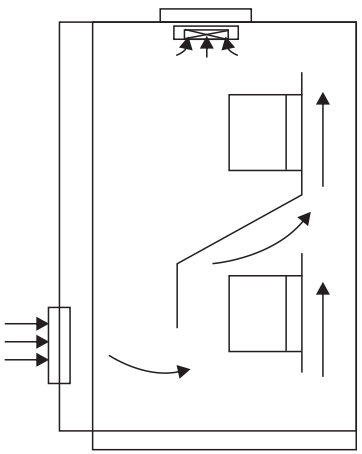


figure 3-2 Installation interval

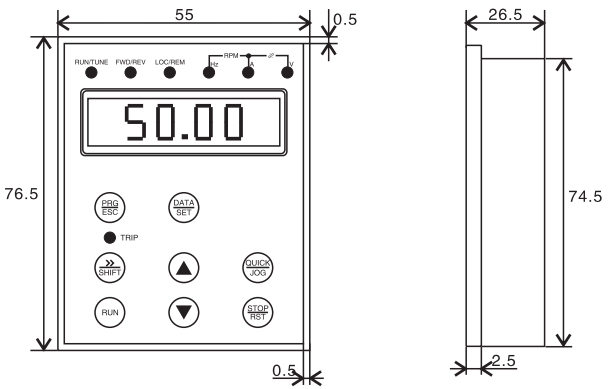


Installation of multiple inverters

Baffler should be mounted when two inverters be installed up and down

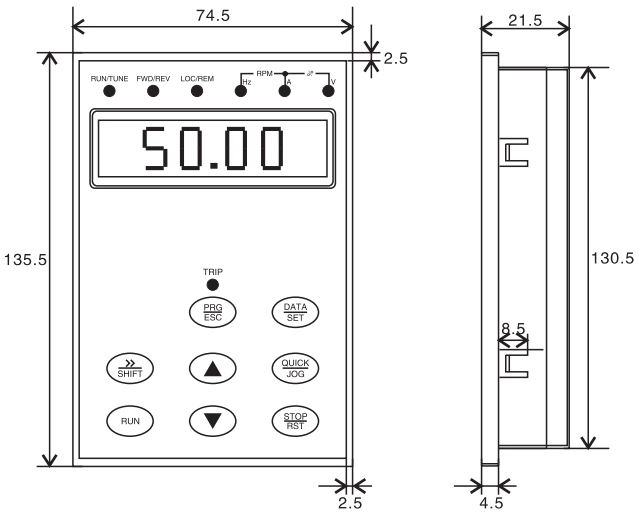
3.3Operation keypad installation size (small)

Unit: mm



3.4Operation keypad installation size (big)

Unit: mm



4 Wiring

WARNING

- Only qualified electricians are allowed to operate on the drive for the insurance of a safe running of the inverter.
- Never carry out any insulation or voltage withstand tests on the cables connecting with the inverter.
- Even if the servo drive is stopped, dangerous voltage is present at the input power lines, DC circuit terminals and motor terminals. Wait for 5 minutes even when the inverter is switched off until is discharge before operation.
- Ground the grounding terminals of the inverter with proper techniques.

  The grounding resistor will be less than 100Ω for 220V series inverter.

  The grounding resistor will be less than 10Ω for 380V series inverter.
- Please ensure right connection between the power wires and the motor wires. The power wire is connected with the terminals of R, S and T. And the motor wire is connected with the terminals of U, V and W.
- Never do wiring or other operations on the inverter with wet hands. Otherwise there is danger of electric shock

CAUTION

- Verify that the rated voltage of the servo drive equals to the voltage of the AC power supply.
- The power wires and motor wires must be permanently fastened and connected.

4.1Connection of peripheral devices

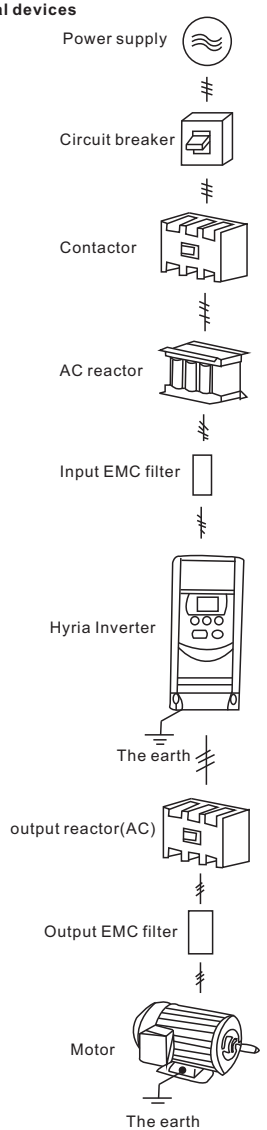
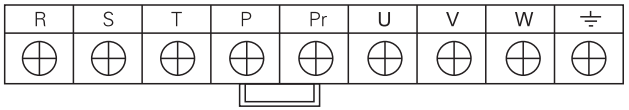


Figure 4.1 Connection of peripheral devices.

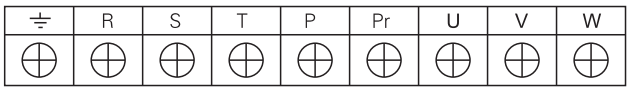
4.2 Terminal configuration

4.2.1 Main circuit terminals

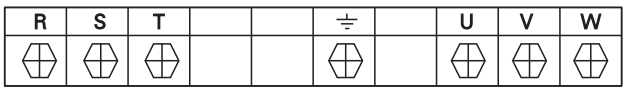
HY0D4043B~HY02D243B HY0D4023B~HY03D4023B



HY04D043B~HY05D043B HY04D023B



HY11D043B~HY30D043B



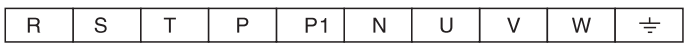


Figure 4-7 Main circuit terminals (55-75kw)

Figure4-8 Main circuit terminals (90-220kw)

Figure4-9 Main circuit terminals (280-400kw)

Functions instruction:

Terminals	Function Description
R、S、T	Terminals of 3 phase AC input
P+、P–	Spare terminals of external braking unit
P+、PB	Spare terminals of external braking resistor
P+、P1	Spare terminals of external DC reactor
P–	Terminal of negative DC bus
U、V、W	Terminals of 3 phase AC output
PE	Grounding terminals

(Note: The terminal configuration above is consult only, if there is fluctuation, according to the real object please.)

4.2.2 Control circuit terminals

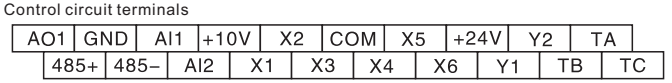


Figure 4-10 Control circuit terminals

4.3 Wiring control circuits

4.3.1 Precautions

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

4.3.2 **Control circuit terminals**

Terminal No.	Function
X1 ~ X6	ON-OFF signal input, optical coupling and COM. Input voltage range: 9 ~ 30V Input impedance: 3.3KΩ
+24V	Local power supply of +24V.Maximum output current: 200mA
COM	Common ground terminal for digital signal and +24V (or external power supply).
AI1	Analog input: O~10V Input impedance: 10 KΩ
AI2	Analog input: O~10V/ 0~20mA, switched by J3. Input impedance: 10 KΩ(/ (voltage input) / 250Ω(current input). when current input is 0-20mA the correspondent voltage is 5V
+10V	Supply +10V to inverter
GND	+10V reference zero electric potential
Y1~Y2	COM is the correspondent common port of open circuit collector
AO1	Analog output terminal,providing voltage or current output which can be switched by J4. (0-20mA) --- Output range: 0~10V/ 0~20mA.
TA、TB、TC	TABC electric relay output, TA common port, TB normally closed,TC normally open contact capacity: AC250V/3A, DC30V/1A

4.3.3 **Jumpers and control board**

Jumper	Function
J3	Switch between (0~1 0V) voltage input and (0~20mA) current input. Jumper 1、2 is voltage input; 2、3is current input
J4	Switch between (0~10V) voltage input and (0~20mA) current input. Jumper 1、2is voltage input; 2、3 is current input

4.4 Standard wiring description

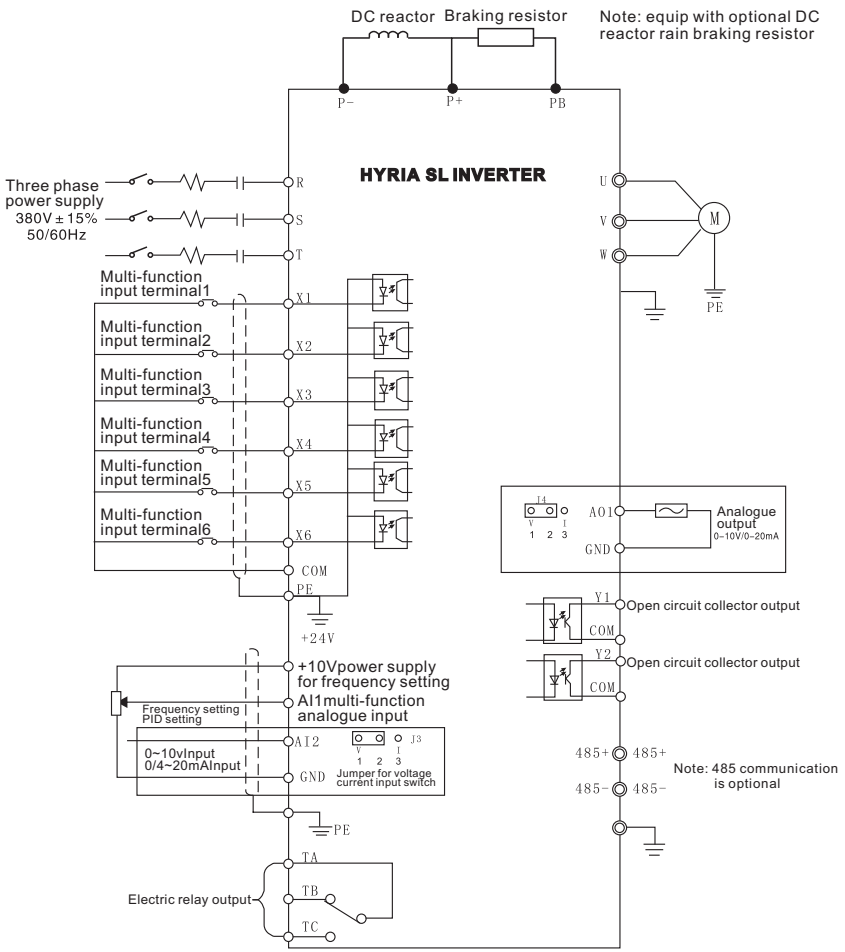


Figure 4-11 Standard wiring description

4.5 Chapter of Specification of Breaker, Cable,Contactor and Reactor

4.5.1 Specification of Breaker, Cable and Contactor

Model	Circuit breaker(A)	Input/output cable (copper core)	Rated current of contactor A (voltage 380 or 220V)
SL–204EE	16	2.5	10
SL –207EE	16	2.5	10
SL –215EE	20	4	16
SL –222EE	32	6	20
SL –204ES	16	2.5	10
SL –207ES	16	2.5	10
SL –215ES	20	4	16
SL –222ES	32	6	20
SL –255ES	63	6	32
SL –275ES	100	10	63
SL –2110ES	125	25	95
SL –2150ES	160	25	120
SL –2180ES	160	25	120
SL –2220ES	200	35	170
SL –2300ES	200	35	170
SL –2370ES	200	35	170
SL –2450ES	250	70	230
SL –407GEE	10	2.5	10
SL –415GEE	16	2.5	10
SL –422GEE	16	2.5	10
SL –440EE/455PE	25	4	16
SL –455EE/475PE	25	4	16
SL –475EE/4110PE	40	6	25
SL –4110EE/4150PE	63	6	32
SL –4150EE/4180PE	63	6	50
SL –4180EE/4220PE	100	10	63
SL –4220EE/4300PE	100	16	80
SL –4300EE/4370PE	125	25	95
SL –4370EE/4450PE	160	25	120
SL –4450EE/4550PE	200	35	135
SL –4550EE/4750PE	200	35	170
SL –4750EE/4900PE	250	70	230
SL –4900EE/41100PE	135	70	280
SL –41100EE/41320PE	400	95	315
SL –41320EE/41600PE	400	150	380
SL –41600EE/41850PE	630	185	450
SL –41850EE/42000PE	630	185	500
SL –42000EE/42200PE	630	240	580
SL –42200EE/42500PE	800	150 × 2	630
SL –42500EE/42800PE	800	150 × 2	700
SL –42800EE/43150PE	1000	185 × 2	780
SL –43150EE/43500PE	1200	240 × 2	900

4.5.2 Specification of Input AC reactor, output AC reactor, DC reactor

Inverter capacity KW	Input AC reactor		Output AC reactor		DC reactor	
	Current (A)	Inductance (mH)	Current (A)	Inductance (mH)	Current (A)	Inductance (mH)
SL–4300EE/4370PE	60	0.24	63	80	80	0.86
SL–4370EE/4450PE	75	0.235	80	100	100	0.70
SL –4450EE/4550PE	91	0.17	100	120	120	0.58
SL –4550EE/4750PE	112	0.16	125	146	146	0.47
SL –4750EE/4900PE	150	0.12	160	200	200	0.35
SL –4900EE/41100PE	180	0.10	200	238	238	0.29
SL –41100EE/41320PE	220	0.09	224	291	291	0.24
SL –41320EE/41600PE	265	0.08	280	326	326	0.215
SL–41600EE/41850PE	300	0.07	315	395	395	0.177
SL–42000EE/42200PE	360	0.06	400	494	494	0.142
SL–42200EE/42500PE	400	0.05	560	557	557	0.126
SL –4280EE/43150PE	560	0.03	600	700	700	0.10
SL–43150EE/43500PE	640	0.0215	630	800	800	0.08
SL–44000EE/45000PE	754	0.15	720	1000	1000	0.04
SL–46300EE/47000PE	1180	0.01	1250	1540	1540	0.015

4.6 Wiring main circuit

4.6.1 Wiring at input side of main circuit

4.6.1.1Circuit breaker

It is necessary to connect a circuit breaker which is compatible with the capacity ofinverter between 3ph AC power supply and power input terminals (R, S and T). The capacity of breaker is I.5~2 times to the rated current of inverter. Please refer to the chapter of Specifications of Breaker, Cable, and Contactor for details.

4.6.1.2 Contactor

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

4.6.1.3 AC reactor

High current in the input power circuit may cause damage to the rectifying components.It is appropriate to use AC reactor in the input side for the avoidance of high-voltage input of the power supply and improvement of the power factors.

6.1.4 Input EMC filter

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

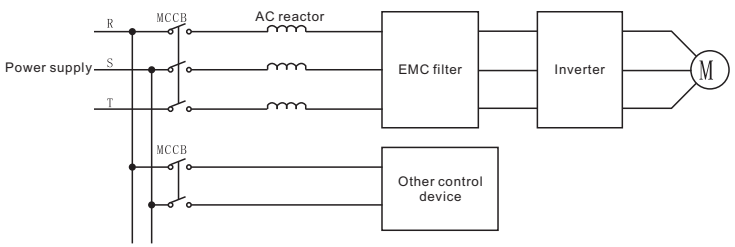


Figure 4-12 Wiring at input side of main circuit

4.6.2 Wiring at inverter side of main circuit

4.6.2.1 DC reactor

Inverters are equipped with internal DC reactors for the improvement of power factors and the avoidance of damage from high input current to the rectifying components because of the high-capacity transformer. The device can also cease the damage to the rectifying components which are caused by supply net voltage transients and harmonic waves

4.6.2.2 Braking unit and braking resistor

In order to dissipate the regenerative energy generated by dynamic braking, the braking resistor should be installed at (P+) and PB terminals. The wire length of the braking resistor should be less than 5m.

The temperature of braking resistor will increase because the regenerative energy will be transformed to heat. Safety protection and good ventilation is recommended.

Inverter above 11KW need connect external braking unit which should be installed at (P+) and (P-) terminals. The cable between inverter and braking unit should be less than 5m. The cable between braking unit and braking resistor should be less than 10m.

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

4.6.3 Wiring at motor side of main circuit

4.6.3.1 Output Reactor

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

4.6.3.2 Output EMC filter

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

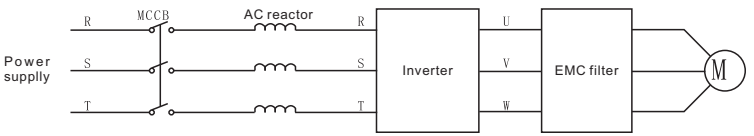


Figure 4-13 Wiring at motor side of main circuit

4.6.4 Wiring of regenerative unit

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

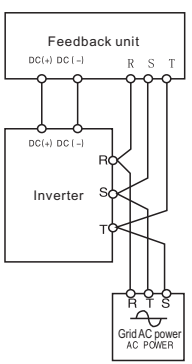


Figure 4-14 Wiring of regenerative unit.

4.6.5 Wiring of Common DC bus

Common DC bus method is widely used in the paper industry and chemical fiber industry which need multi-motor to coordinate. In these applications, some motors are in driving state while some others are in regenerative braking (generating electricity) state. The regenerated energy is automatically balanced through the common DC bus, which means it can supply to motors in driving state. Therefore the power consumption of whole system will be less compared with the traditional method (one inverter drives one motor).

When two motors are running at the same time (i.e. winding application), one is in driving state and the other is in regenerative state. In this case the DC buses of these two inverters can be connected in parallel so that the regenerated energy can be supplied to motors in driving state whenever it needs. Detailed wiring is shown in the following figure:

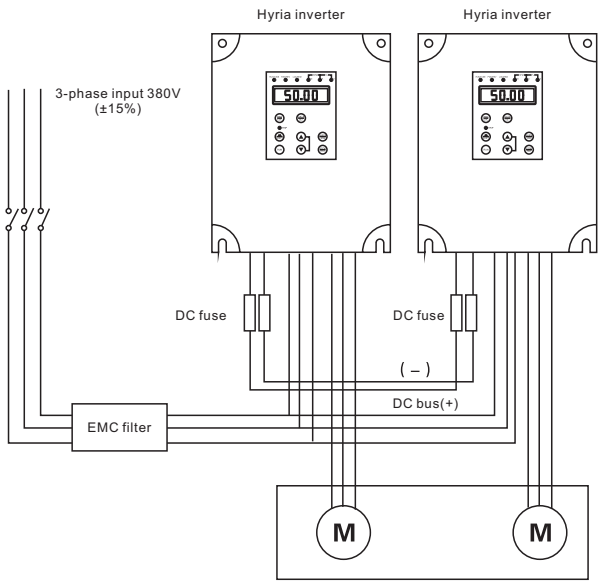


Figure 4-15 Wiring of common DC bus.

Note: When two inverters be wired to bus directly, same model types are suggested, and be powered on at the same time.

4.6.6 Ground wiring (PE)

Ground the PE terminal of the inverter with grounding resistors for the insurance of safety and avoidance of electrical shock and fire. It is appropriate to use thick and short multiple copper core wires whose sectional area is larger than 3.5mm^2. It is not recommended to use the public earth wire; otherwise, the grounding wires may complete the circuit.

4.7 Installation guidline to EMC compliance

4.7.1 General description of EMC

EMC is the abbreviation of electromagnetic compatibility, which means the device or system has the ability to work normally in the electromagnetic environment and will not generate any electromagnetic interference to other equipments. EMC includes two subjects: electromagnetic interference and electromagnetic anti-jamming. According to the transmission mode, Electromagnetic interference can be divided into two categories: conducted interference and radiated interference.

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

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

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

EMC ability varies with different electrical and electronic device which are different in EMC standards or grades.

4.7.2 EMC features of inverter

Like other electric or electronic devices, inverter is not only an electromagnetic interference source but also an electromagnetic receiver. The operating principle of inverter determines that it can produce certain electromagnetic interference noise. And the same time inverter should be designed with certain anti-jamming ability to ensure the smooth working in certain electromagnetic environment. The following is its EMC features:

4.7.2.1 Input current is non-sine wave. The input current includes large amount of high-harmonic waves that can cause electromagnetic interference, decrease the grid power factor and increase the line loss.

4.7.2.2 Output voltage is high frequency PMW wave, which can increase the temperature rise and shorten the life of motor. And the leakage current will also increase, which can lead to the leakage protection device malfunction and generate strong electromagnetic interference to influence the reliability of other electric devices.

4.7.2.3 As the electromagnetic receiver, too strong interference will damage the inverter and influence the normal using of customers.

4.7.2.4 In the system, EMS and EMI of inverter coexist. Decrease the EMI of inverter can increase its EMS ability.

4.7.3 EMC Installation Guideline

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

4.7.3.1 Noise control

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

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

4.7.3.2 Site configuration

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

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

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

4.7.3.3 Grounding

Inverter must be ground safely when in operation. Grounding enjoys priority in all EMC methods because it does not only ensure the safety of equipment and persons, but also is the simplest, most effective and lowest cost solution for EMC problems. Grounding has three categories: special pole grounding, common pole grounding and series-wound grounding. Different control system should use special pole grounding,and different devices in the same control system should use common pole grounding,and different devices connected by same power cable should use series-wound grounding.

4.7.3.4 Leakage Current

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

Countermeasure:

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

4.7.3.5 EMC Filter

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

1. For inverter, noise filter has following categories.
2. Install noise isolation for other equipment by means of isolation transformer or power filter.

5. Operation

5.1 Keypad description

5.1.1 Keypad schematic diagram

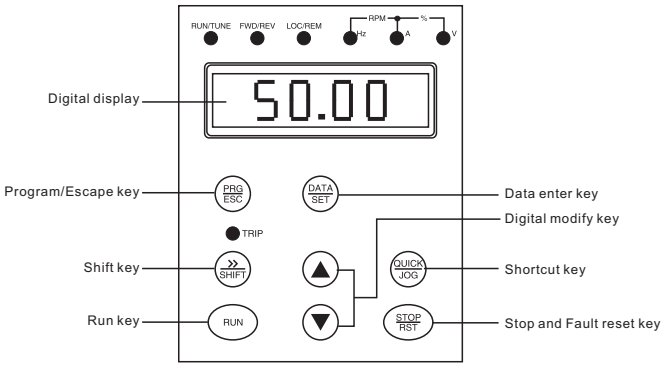


Figure 5-1 Keypad schematic diagram.

5.1.2 Key function description

Button Symbol	Name	Function Description
PRG ESC	Program/Escape	Enter or escape from the first-level menu.
DATA SET	Data enter key	Progressively enter menu and confirm parameters.
▲	Digital modify	Progressively increase data or function codes.
▼	Digital modify	Progressive decrease data or function codes.
DATA SET + QUICK JOG	Combination key	In parameter setting mode, press this button to cyclically display parameters by left shift. Press DATA/ENT at first, and then QUICK/JOG.
SHIFT	Shift key	In parameter setting mode, press this button to select the bit to be modified. In other modes,cyclically displays parameters by right shift.
RUN	Run key	Start to run the inverter in keypad control mode.
STOP RST	Stop key/Fault reset key	In running state, restricted by P1.10, can be used to stop the inverter. When fault alarm, can be used to reset the inverter without any restriction.
QUICK JOG	Shortcut key	Determined by Function Code P1.09 0.Shortcut menu QUICK function. Enter or escape from the first-level menu. 1.FDW/REV switching. 2.Clear UP/DOWN setting.
RUN + STOP RST	Combination key	Pressing the RUN and STOP/RST at the same time can achieve inverter coast to stop.

5.1.3 Indicator light description

(1) Function Indicator Liqht Description

Indicator Light Name	State Indicator
RUN/TUNE	Extinguished: stop state Flickering;parameter auto running state Light on; running state
FWD/REV	Extinguished: forward operation Light on: reverse operation.
LOCAL/REMOT	Extinguished: keypad control Flickering: terminal control Light on: communication control
TRIP	Extinguished: normal operation state Flickering: overload pre-warning state

(2) Unit Indicator Light Description

Symbol	Description
Hz	Frequency unit
A	Current unit
V	Voltage unit
RPM	Rotation speed unit
%	Percentage

(3) Digital display

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

5.2 Operation process

5.2.1 Parameter setting

Three levels of menu are:

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

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

E.G. The following picture shows to change the function code P4.09 from 00.00Hz to 01.05Hz

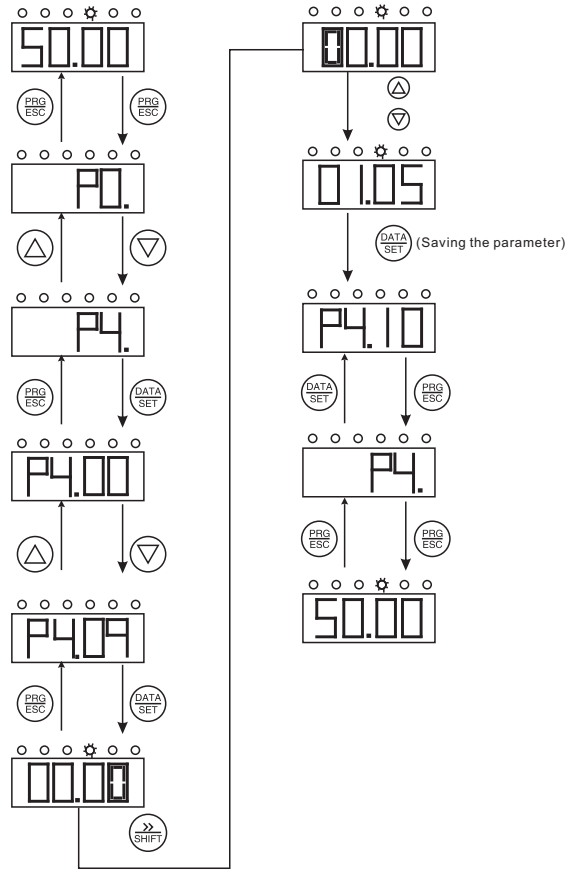


Figure 5-2 Flow chart of parameter setting.

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

(1)This function code is not modifiable parameter, such as actual detected parameter, operation records and so on;

(2) This function code is not modifiable in running state, but modifiable in stop state

5.2.2 Fault reset

If the inverter has fault, it will prompt the related fault information. The user can use STOP/RST or according terminals determined by P3 Group to reset the fault. After fault reset, the inverter is at stand-by state. If the user does not reset the inverter when it is at fault state, the inverter will be at operation protection state, and can not run.

5.2.3 Parameter copy (save)

See the function description of LCD kepad

5.2.4 Motor parameter autotuning

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

The procedure of motor parameter autotuning is specified as follows:

Firstly, choose the keypad command channel as the operation command channel

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

PB.02: motor rated power.

PB.03: motor rated frequency;

PB.04: motor rated speed;

PB.05: motor rated voltage;

PB.06: motor rated current

Note: the motor should be uncoupled with its load, otherwise, the motor parameters obtained by autotuning may be not correct. Set PB.00 to be 1, and for the detail process of motor parameter autotuning, please refer to the description of Function Code PB.00.

And then press RUN on the keypad panel the inverter will automatically calculate following parameter of the motor:

PB.07: motor stator resistance;

PB.08: motor rotor resistance;

PB.09: motor stator and rotor inductance;

PB.10: motor stator and rotor mutual inductance;

PB.11: motor current without load;Then motor autotuning is finished.

5.2.5 Password setting

HYRIA SL series inverter offers the user's password protection function. When P1.20 is set to be nonzero, it will be the user's password, and after exiting function code edit mode, it will become effective after 1 minute.

If pressing the FRG/ESC again to try to access the function code edit mode, "0.0.0.0.0"will be displayed, and the operator must input correct user's password, otherwise will be unable to access it. If it is necessary to cancel the password protection function, just set P1.20 to be zero.User's password don't provide protection function to the parameters of shortcut menu.

5.3 Running state

5.3.1 Power-on initialization

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

5.3.2 Stand-by

At stop or running state, parameters of multi-state can be displayed. Whether or not to display this parameter can be chosen through Function Code P1.14 (Running state display selection) and P1.15 (Stop state display selection) according to binary bits, the detailed description of each bit please refer the function code description of P1.14 and P1.15.

In stop state, there are nine parameters which can be chosen to display or not. They are: reference frequency, DC bus voltage, ON-OFF input state, open collector output state, PID setting, PID feedback, analog input AI1voltage, analog input AI2 voltage, step number of multi-step speed. Whether or not to display can be decided by setting the corresponding binary bit of P1.15. Press the /SHIFT to scroll through the parameters in right order . Press DATA/ENT+ QUICK/JOG to scroll through the parameters in left order.

5.3.3 Motor parameter autotuning

For details, please refer to the description of PB.00.

5.3.4 Operation

In running state, there are fourteen running parameters: output frequency, reference frequency, DC bus voltage, output voltage, output current, output torque, PID setting, PID feedback, ON-OFF input state, open collector output state, voltage of AII , voltage of AI2 and step number of multi-step speed. Whether or not to display can be decided by the bit option of Function Code P1.14 (converted into binary system). Press the >>/SHIFT to scroll through the parameters in right order . Press DATA/ENT+ QUICK JOG to scroll through the parameters in left order.

5.3.5 Fault

HYRIA SL series inverter offers a variety of fault information. Please refer to the inverter faults and their troubleshooting for detailed information.

5.4 Quick testing

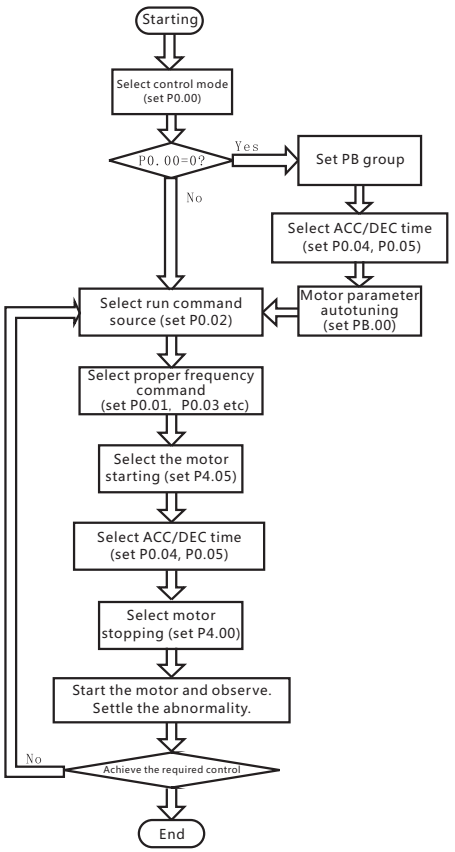


Figure 5-3 Quick testing diagram

6.Abbreviation of Function Parameters

The function parameters of HYRIA SL series inverters have been divided into 12 groups (P0~PB) according to the function. Each function group contains certain function codes applying 3-class menus. For example, "P8.08" means the eighth function code in the P8 group function, and all reservation variable are factory reserved, and users are forbidden to access these parameters.

For the convenience of function codes setting, the function group number corresponds to the first class menu, the function code corresponds to the second class menu and the function code corresponds to the third class menu.

1. Below is the instruction of the function lists:

The first line "Function code": codes of function parameter group and parameters;

The second line "Name": full name of function parameters;

The third line "Detailed illustration of parameters": Detailed illustration of the function parameters;

The fourth line "Range Setting": Effective Range Setting of function parameter that shows in keypad LCD display;

The fifth line "Factory Setting": the original factory set value of the function parameter;

The sixth line "Modify": the modifying character of function codes (the parameters can be modified or not and the modifying conditions), below is the instruction:

"O": means the set value of the parameter can be modified on stop and running state ;

"◎": means the set value of the parameter can not be modified on the running state;

"●": means the value of the parameter is the real detection value which can not be modified.

(The inverter has limited the automatic inspection of the modifying character of the parameters to help users avoid mismodifying)

The seventh line "No.": The serial number of function code, at the same time, it also means the register address during communication.

2."Parameter radix" is decimal (DEC), if the parameter is expressed by hex, then the parameter is separated from each other when editing. The setting range of certain bits are 0~F (hex).

3.Factory setting" means the function parameter will restore to the default value during default parameters restoring. But the detected parameter or recorded value won't be restored.

4.For a better parameter protection, the inverter provides password protection to the parameters. After setting the password (set P1.20 to any non-zero number), the system will come into the state of password verification firstly after the user press PRG/ESC to come into the function code editing state. And then "0.0.0.0.0." will be displayed. Unless the user input right password, they cannot enter into the system. For the factory setting parameter zone, it needs correct factory password (remind that the users can not modify the factory parameters by themselves, otherwise, if the parameter setting is incorrect, damage to the inverter may occur).

If the password protection is unlocked, the user can modify the password freely and the inverter will work as the last setting one. When P1.20 is set to 0, the password can be canceled. If P1.20 is not 0 during powering on, then the parameter is protected by the password.

5.When modify the parameters by serial communication, the function of the password follows the above rules, too.

7. List of function parameters

P0 Basic function

Function code	Name	Detailed illustration of parameters	Factory setting	Modify	Serial No
P0.00	Speed control mode	0: Sensorless vector control 1: V/F control	0	◎	0.
P0.01	Frequency command source	0 : Keypad 1: AI1 2:AI2 3: AI1 + AI2 4: Multi-step speed 5: PID 6: Communication	0	○	1.
P0.02	Run command source	0: Keypad (LED extingguishes) 1:Terminal (LED flickers) 2:Communication (LED lights up)	0	◎	2.
P0.03	Keypad frequency setting	0.00 Hz ~ P0.04 (Max frequency)	50.00Hz	○	3.
P0.04	Acceleration 1	0.1 ~ 3600.00s	Model selection	○	4.
P0.05	Deceleration1	0.1 ~ 3600.00s	Model selection	○	5.
P0.06	Carrier frequency	0.5 – 15.0KHz		○	6.
P0.07	curve selection	0: Linear curve 1: Torque-stepdown curve(2.0 order)	Model selection	◎	7.
P0.08	Torque boost	0.0%: (auto) 0.1% ~ 30.0%	0.0%	○	8.
P0.09	Torque boost cut-off	0.0% ~ 50.0% (motor rated frequency)	20.0%	◎	9.
P0.10	V/F Slip compensation limit	0.0~200.0%	100.0%	○	10.
P0.11	Running direction selection	0: Forward 1: Reverse 2: Forbid reverse	0	◎	11.
P0.12	Dead time of FWD/REV	0.0 ~ 3600s	0.0s	○	12.
P0.13	Maximum output frequency	10.00 ~ 600.00Hz	50.00Hz	◎	13.
P0.14	Upper frequency limit	P 0.15 ~ P0.13 (Maximum frequency)	50.00Hz	○	14.
P0.15	Lower frequency limit	0.00Hz ~ P0.14 (Upper frequency limit)	0.00Hz	○	15.

P1 Complementary parameter

Function code	Name	Detailed illustration of parameters	Factory setting	Modify	Serial No
P1.00	AVR function	0: Disabled 1: Enabled all the time 2: Disabled during deceleration	2	○	16.
P1.01	Braking threshold voltage	115.0 ~ 140.0% (Standard bus voltage)(220V series)	120.0%	○	17.
		115.0 ~ 140.0% (Standard bus voltage)(380V series)	130.0%		
P1.02	Radiator temperature	0~100.0℃		●	18.
P1.03	Inverter temperature	0~100.0℃		●	19.
P1.04	Inching run frequency	0.00~P0.04 (Maximum frequency)	5.00HZ	○	20.
P1.05	Inching run acceleration	0.1~3600.0S	Model selection	○	21
P1.06	Inching run deceleration	0.1~3600.0S	Model selection	○	22.
P1.07	Acceleration2	0.1~3600.0S	Model selection	○	23.
P1.08	Deceleration2	0.1~3600.0S	Model selection	○	24.

Function code	Name	Detailed illustration of parameters	Factory setting	Modify	Serial No
P1.09	QUICK/JOG function selection	0: Jog 1: FDW/REV swiching 2: Clear UP/DOWN setting	0	◎	25.
P1.10	STOP/RST function option	0: Valid when keypad control 1: Valid when keypad or terminal control 2: Valid when keypad or communication control 3: Always valid	0	◎	26.
P1.11	UP/DOWN setting	0: Valid, save UP/DOWN value when power off 1: Valid, do not save 2: UP/DOWN invalid	0	○	27.
P1.12	Keypad display selection	0: Preferential to external 1: Both display, only external key valid 2: Both display, only local key valid 3: Both display and key valid	0	○	28.
P1.13	Coefficient of rotation speed	0.1~999.9% machine rotation speed =120 * Running frequency*P1.13/Motor pole logarithm	100.0%	○	29.
P1.14	Running state display selection	0 ~ 0X7FFF BIT0: Output frequency BIT1: Reference frequency BIT2: DC bus voltage BIT3: Output voltage BIT4: Output current BIT5: Rotation speed BIT6: Output power BIT7: Output torque BIT8: PID preset BIT9: PID feedback BIT10: Input terminal state BIT11: Output terminal state BIT12: AI1 BIT13: AI2 BIT14: Step No. of mult-step BIT15: Reserved	0XFF	○	30.
P1.15	Stop state display selection	1 ~ 0X1FF BIT0: Reference frequency BIT1: DC bus voltage BIT2: Input terminal state BIT3: Output termial state BIT4: PID preset BIT5: PID feedback BIT6: AI1 BIT7: AI2 BIT8: Step No. of multi-step BIT9: Reserved	0XFF	○	31.

Function code	Name	Detailed illustration of parameters	Factory setting	Modify	Serial No
P1.16	Reserve variable				32.
P1.17	Running time	0~65535H	0	●	33.
P1.18	Parameter recovery	0: Invalid 1: Recover factory setting 2: Clear fault record	0	◎	34.
P1.19	Software version				35.
P1.20	The user password	0 ~ 65535	*****	●	36.

P2 Analogue terminals

Function code	Name	Detailed illustration of parameters	Factory setting	Modify	Serial No
P2.00	AI1 upper limint	0.00V ~ 10.00V	10.00V	○	37.
P2.01	AI1 upper limit corresponding setting	–100.0% ~ 100.0%	100.0%	○	38.
P2.02	AI1 lower limit	0.00V ~ 10.00V	0.00V	○	39.
P2.03	AI1 lower limit corresponding setting	–100.0% ~ 100.0%	0.0%	○	40.
P2.04	AI1 filter time constant	0.00s ~ 10.00s	0.10s	○	41.
P2.05	AI2 upper limint	0.00V ~ 10.00V	10.00V	○	42.
P2.06	AI2 upper limit corresponding setting	–100.0% ~ 100.0%	100.0%	○	43.
P2.07	AI2 lower limit	0.00V ~ 10.00V	0.00V	○	44.
P2.08	AI2 lower limit corresponding setting	–100.0% ~ 100.0%	0.0%	○	45.
P2.09	AI2 filter time constant	0.00s ~ 10.00s	0.10s	○	46.
P2.10	AO selection	0 : Running frequency 1 : Reference frequency 2 : Motor speed 3 : Output current 4 : Output voltage 5 : Output power 6 : Output torque 7 : AI1 voltage 8 : AI2 voltage/current 9~10 : Reserved	0	○	47.
P2.11	AO upper limit	0.0% ~ 100.0%	100.0%	○	48.
P2.12	AO upper limit corresponding output	0.00V ~ 10.00V	10.00V	○	49.
P2.13	AO lower limit	0.0% ~ 100.0%	0.0%	○	50.
P2.14	AO lower limit corresponding output	0.00V ~ 10.00V	0.00V	○	51.

P3 Digital termial parameter

Function code	Name	Detailed illustration of parameters	Factory setting	Modify	Serial No
P3.00	FWD/REV enable when power on	0: terminal running command is invalid when powering on 1: terminal running command is valid when powering on	0	○	52.
P3.01	X1 terminal function selection	0: Invalid 1: Forward 2: Reverse 3: 3-wire control 4: JOG forward 5: JOG reverse 6: Coast to stop 7: Reset fault 8: External fault input 9: UP command	1	◎	53.
P3.02	X2 terminal function selection		4	◎	54.

Function code	Name	Detailed illustration of parameters	Factory setting	Modify	Serial No
P3.03	X3 terminal function	10：Down command 11：Clear UP/DOWN 12：Multi-step speed reference1 13：Multi-step speed reference2 14：Multi-step speed reference3 15：ACC/DEC time selection 16：Pause PID 17：Pause traverse operation 18：Reset traverse operation 19：ACC/DEC ramp hold 20：Disable torque control 21：UP/DOWN invalid temporarily 22~25：reserved	7	◎	55.
P3.04	X4 terminal function		0	◎	56.
P3.05	X5 terminal function		7	◎	57.
P3.06	X6 terminal function		0	◎	58.
P3.07	ON/OFF filter times	1 ~ 10	5	○	59.
P3.08	FWD/REV control mode	0：2-wire control mode 1 1：2wire control mode 2 2：3-wire control mode 1 3：3wire control mode 2	0	◎	60.
P3.09	UP/DOWN setting change rate	0.01 ~ 50.00Hz/s	0.50Hz/s	○	61.
P3.10	Y1 output selection	0：No output 1：Run forward 2：Run reverse 3：Fault output 4：FDT reached 5：Frequency reached 6：Zero speed running 7：Upper frequency limit reached 8：Lower frequency limit reached 9~10：Reserved	1	○	62.
P3.11	Y2 output selection		1	○	63.
P3.12	Relay output selection		3	○	64.
P3.13	FDT level	0.00 ~ P0.04 (maximum frequency)	50.00Hz	○	65.
P3.14	FDT lag	0.0 ~ 100.0% (FDTD level)	5.0%	○	66.
P3.15	Frequency arrival detecting range	0.0 ~ 100.0% (Maximum frequency)	0.0%	○	67.

P4 Start/Stop parameter

Function code	Name	Detailed illustration of parameters	Factory setting	Modify	Serial No
P4.00	Stop mode	0：Deceleration to stop 1：Coast to stop	0	○	68.
P4.01	Waiting time before DC braking	00~50.0S	0.0S	○	69.
P4.02	DC braking time	00~50.0S	0.0S	○	70.
P4.03	Stop braking time	0.0 ~ 150.0%	0.0%	○	71.
P4.04	Starting frequency of DC braking	0.00 ~ P0.04 (Maximum frequency)	0.00HZ	○	72.
P4.05	Start mode	0：Start directly 1：DC braking and start 2：Rotation speed tracking restart above 5KW	0	◎	73.
P4.06	Hold time of starting frequency	0.0 ~ 50.0S	0.0S	○	74.
P4.07	DC Braking time before start	0.0 ~ 50.0S	0.0S	○	75.
P4.08	DC Braking current before start	0.0 ~ 150.0%	0.0%	○	76.
P4.09	Starting frequency	0.00 ~ 10.00HZ	0.00HZ	○	77.

Function code	Name	Detailed illustration of parameters	Factory setting	Modify	Serial No
P4.10	Skip frequency	0.00 ~ P0.04(Maximum frequency)	0.00HZ	○	78.
P4.11	Skip frequency bandwidth	0.00 ~ P0.04(Maximum frequency)	0.00HZ	○	79.

P5 Traverse parameters

Function code	Name	Detailed illustration of parameters	Factory setting	Modify	Serial No
P5.00	Jitter frequency	0.0 ~ 50.0% (Relative frequency amplitude)	0.0%	○	80.
P5.01	Traverse amplitude	0.0 ~ 100.0% (Relative reference frequency)	0.0%	○	81.
P5.02	Rise time of traverse	0.1 ~ 3600.0S	5.0S	○	82.
P5.03	Fall time of traverse	0.1 ~ 3600.0S	5.0S	○	83.

P6 Protection function parameter

Function code	Name	Detailed illustration of parameters	Factory setting	Modify	Serial No
P6.00	Over-voltage stall protection	0：Disabled 1：Enabled	0	○	84.
P6.01	Over-voltage stall protection point	110 ~ 150% (380V series) 110 ~ 150% (220V series)	120% 115%	○	85.
P6.02	Motor overload protection	0：Disabled 1：Normal motor 2：Variable frequency motor	1	◎	86.
P6.03	Motor overload protection current	20.0% ~ 120.0% (motor rated current)	100.0%	○	87.
P6.04	Auto current limiting threshold	100 ~ 200%	P model:120% G model160%	○	88.
P6.05	Frequency decrease rate when current limiting	0.00 ~ 100.00Hz/s	10.00Hz/s	○	89.
P6.06	Threshold of trip-free	70.0 ~ 110.0% (standard bus voltage)	80.0%	○	90.
P6.07	Decrease rate of trip-free	0.00Hz ~ P0.04 (Maximum frequency)	0.00Hz	○	91.
P6.08	Previous two fault types	0：No fualt 1：IGBT PH-U fault (OUT 1) 2：IGBT PH-V fault (OUT 2) 3：IGBT PH-W fault (OUT 3) 4：Over-current when acceleration (OC1) 5：Over-current when deceleration (OC2) 6：Over-current when constant speed running (OV3) 7：Over-voltage when acceleration(OV1) 8：Over-voltage when deceleration(OV2)		●	92.
P6.09	Previous fault types	9：Over-voltage when constant speed running (OV3) 10：DC bus Under-voltage (UV) 11：Motor overload (OL1) 12：Inverter overload (OL2) 13：Input phase failure (SPI) 14：Output phase failure(SPO) 15：Retify overheat (OH1) 16：IGBT overheat (OH2) 17：External fault (EF) 18：Communication fault (CE) 19：Current detection fault (ITE) 20：Autotuning fault (TE)		●	93.

Function code	Name	Detailed illustration of parameters	Factory setting	Modify	Serial No
P6.10	Current fault type	21：EEPROM fault (EEP) 22：PID feedback fault (PIDE) 23：Braking unit fault (bCE) 24：Reserved		●	94.
P6.11	Output frequency at current fault		0.00HZ	●	95.
P6.12	Output current at current fault		0.0A	●	96.
P6.13	DC bus voltage at current fault		0.0V	●	97.
P6.14	Input terminal state at current fault		0	●	98.
P6.15	Output terminal state at current fault		0	●	99.
P6.16	Fault auto reset inverval time setting	0.1 ~ 100.0S	1.0S	○	100.
P6.17	Fault auto reset times	0 ~ 3	0	○	101.

P7 PID control

Function code	Name	Detailed illustration of parameters	Factory setting	Modify	Serial No
P7.00	PID feedback source selection	0 : AI1 1 : AI2 2 : AI1+AI2 3 : Communication	0	○	102.
P7.01	PID preset source selection	0 : Keypad (P7.02) 1 : AI1 2 : AI2 3 : Communication 4 : Multi-step	0	○	103.
P7.02	Keypad PID preset	0.0% ~ 100.0%	0.0%	○	104.
P7.03	PID output characteristic	0：Positive 1：Negative	0	○	105.
P7.04	Proportional gain (Kp)	0.00 ~ 100.00	1.00	○	106.
P7.05	Integral time (Ti)	0.01 ~ 10.00S	0.10S	○	107.
P7.06	Differential time(Td)	0.00 ~ 10.00S	0.00S	○	108.
P7.07	Sampling cycle	0.01 ~ 100.00S	0.10S	○	109.
P7.08	Bias limit	0.0 ~ 100.0%	0.0%	○	110.
P7.09	Feedback lost detecting value	0.0 ~ 100.0%	0.0%	○	111.
P7.10	Feedback lost detecting time	0.0 ~ 3600.0S	1.0S	○	112.

P8 Multi-step Speed Control

Function code	Name	Detailed illustration of parameters	Factory setting	Modify	Serial No
P8.00	Multi-step speed 0	–100.0 ~ 100.0%	0.0%	○	113.
P8.01	Multi-step speed 1	–100.0 ~ 100.0%	0.0%	○	114.
P8.02	Multi-step speed 2	–100.0 ~ 100.0%	0.0%	○	115.
P8.03	Multi-step speed 3	–100.0 ~ 100.0%	0.0%	○	116.
P8.04	Multi-step speed 4	–100.0 ~ 100.0%	0.0%	○	117.
P8.05	Multi-step speed 5	–100.0 ~ 100.0%	0.0%	○	118.
P8.06	Multi-step speed 6	–100.0 ~ 100.0%	0.0%	○	119.
P8.07	Multi-step speed 7	–100.0 ~ 100.0%	0.0%	○	120.

P9 485Communication parameter

Function code	Name	Detailed illustration of parameters	Factory setting	Modify	Serial No
P9. 00	Local address	1~247, 0Broadcast address	1	○	121.
P9. 01	Baud rate selection	0：1200BPS 1：2400BPS 2：4800BPS 3：9600BPS 4：19200BPS 5：38400BPS	3		122.
P9. 02	Data format	0: RTU, 1 start bit, 8 data bits, no parity check, 1 stop bit 1: RTU, 1 start bit, 8 data bits, even parity check, 1 stop bit 2: RTU, 1 start bit, 8 data bits, odd parity check, 1 stop bit 3: RTU, 1 start bit, 8 data bits, no parity check, 2 stop bits 4: RTU, 1 start bit, 8 data bits, even parity check, 2 stop bits 5: RTU, 1 start bit, 8 data bits, odd parity check, 2 stop bits 6: ASCII, 1 start bit, 7 data bits, no parity check, 1 stop bit 7: ASCII, 1 start bit, 7 data bits, even parity check, 1 stop bit 8: ASCII, 1 start bit, 7 data bits, odd parity check, 1 stop bit 9: ASCII, 1 start bit, 7 data bits, no parity check, 2 stop bits 10: ASCII, 1 start bit, 7 data bits, even parity check, 2 stop bits 11: ASCII, 1 start bit, 7 data bits, odd parity check, 2 stop bits 12: ASCII, 1 start bit, 8 data bits, no parity check, 1 stop bit 13: ASCII, 1 start bit, 8 data bits, even parity check, 1 stop bit 14: ASCII, 1 start bit, 8 data bits, odd parity check, 1 stop bit 15: ASCII, 1 start bit, 8 data bits, no parity check, 2 stop bits 16: ASCII, 1 start bit, 8 data bits, even arity check, 2 stop bits 17: ASCII, 1 start bit, 8 data bits, odd parity check, 2 stop bits	0	○	123.
P9.03	Communication delay time	0 ~ 200ms	5ms	○	124.
P9.04	Communication timeout delay	0.0 (Disabled) , 0.1 ~ 100.0	0.0s	○	125.
P9. 05	Communication error action	0 : Alarm and coast to stop 1 : No alarm and continue to run 2 : No alarm but stop according to P4.00 3 : No alarm but stop according to P4.00	1	○	126.
P9. 06	Response action	0：Response to writing 1：No response to writing	0	○	127.

PA vector control

Function code	Name	Detailed illustration of parameters	Factory setting	Modify	Serial No
PA.00	ASR proportional gain Kp1	0 ~ 100	20	○	128.
PA.01	ASR integral time Ki1	0.01 ~ 10.00s	0.50s	○	129.
PA.02	ASR switching point1	0.00Hz ~ PA.05	5.00Hz	○	130.
PA.03	ASR proportional gain Kp2	0 ~ 100	15	○	131.
PA.04	ASR integral time Kp2	0.01 ~ 10.00s	1.00	○	132.
PA.05	ASR integral time Ki2	PA.02 ~ P0.04 (Maximum frequency)	10.00Hz	○	133.
PA.06	Slip compensation rate of VC	50% ~ 200%	100%	○	134.
PA.07	Torque limit	0.0 ~ 200.0% (Inverter rated current)	150.0%	○	135.

PB Motor parameter

Function code	Name	Detailed illustration of parameters	Factory setting	Modify	Serial No
PB. 00	Motor parameters autotuning	0：No action 1：Rotation autotuning 2：Static autotuning	0	◎	136.

Function code	Name	Detailed illustration of parameters	Factory setting	Modify	Serial No
PB. 01	E/P option	0 : E model 0 : P model	Model selection	◎	137.
PB.02	Motor rated power	0.4 ~ 900.0kW	Model selection	◎	138.
PB.03	Motor rated frequency	0.01Hz ~ P0.13 (Maximum frequency)	50.00Hz	◎	139.
PB.04	Motor rated speed	0 ~ 36000rpm	Model selection	◎	140.
PB.05	Motor rated voltage	0 ~ 460V	Model selection	◎	141.
PB.06	Motor rated current	0.1 ~ 2000.0A	Model selection	◎	142.
PB.07	Motor stator resistance	0.001 ~ 65.535Ω	Model selection	○	143.
PB.08	Motor rator resistance	0.001 ~ 65.535Ω	Model selection	○	144.
PB.09	Motor leakage inductance	0.1 ~ 6553.5m	Model selection	○	145.
PB.10	Motor mutual inductance	0.1 ~ 6553.5mH	Model selection	○	146.
PB.11	Current without load	0.01 ~ 655.35A	Model selection	○	147.

8 Detailed function description

P0 group

Function code	Name	Description	Setting range	Factory setting
P0.00	Speed control mode	0：Sensorless vector control 1：V/F control	0~1	0

Inverter running mode selection

0: Sensorless vector control:

It is widely used for the application which requires high torque at low speed, higher speed accuracy, and quicker dynamic response, such as machine tool, injection molding machine, centrifugal machine and wire-drawing machine,etc.

1: V/F control:

It is suitable for general purpose application such as pumps, fans etc.

Function code	Name	Description	Setting range	Factory setting
P0.01	Frequency command source	0 : Keypad setting 1 : AI1 2 : AI2 3 : AI1+AI2 4 : Multi-Step speed 5 : PID 6 : Communication	0~6	0

Enter the Frequency command source, 7 main frequency source in total

0: Keypad

Modify the value of P0.03 to set the frequency by the keypad

0: AI1

0: AI2

0: AI1+AI2

The reference frequency is set by analog input. SL series inverter provides 2 analog input terminals. AI1 is 0~10V voltage input terminal, while AI2 is 0~10V voltage input or 0~20mA current input. Voltage input or current input of AI2 can be selected by Jumper J3.

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

Analouge input setting 100% is corresponding to maximum frequency(P0.14), and -100% to opposing maximum frequency(P0.14)

4: Multi-step speed

The reference frequency is determined by P3 and P8 group. The selection of steps is determined by combination of multi-step speed terminals.

5:PID Control setting

The reference frequency is the result of PID adjustment. For details, please refer to

description of P7 group

6: Communication

The reference frequency commands are controlled by the upper PC through communication. For details, please refer to the communication protocol

Function code	Name	Description	Setting range	Factory setting
P0.02	Run command source	0: Kepad(LED extinguished) 1: Terminal (LED flickering) 2: Communication (LED lights)	0~2	0

Run command source of inverter.

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

0: Keypad (LOC/REM extinguished);Both RUN and STOP/RST key are used for running command control. If multifunction key QUICK/JOG is set to FWD/REV switching function (P1.09 is set to be 1), it will be used to change the rotating orientation. In running state, pressing RUN and STOP/RST simultaneously will cause the inverter coast to stop.

Terminal (LOC/REM flickering) The operation, including forward running, reverse running, forward jogging, reverse jogging etc. can be controlled by multifunctional input terminals.

Communication (LOC/REM lights on) The running commands are controlled by the upper PC through communication.

Function code	Name	Description	Setting range	Factory setting
P0.03	Keypad reference frequency	0.00 Hz ~ P0.13 maximum frequency	0.00~P0.13	50.00Hz

When P0.01 is set to be 0, this parameter is the initial value of inverter reference frequency.

Function code	Name	Description	Setting range	Factory setting
P0.04	Acceleration time1	0.1~3600s	0.1~3600	Depend on model
P0.05	Deceleration time1	0.1~3600s	0.1~3600	Depend on model

Acceleration time is the time of accelerating from 0Hz to maximum frequency (P0.13).

Deceleration time is the time of decelerating from maximum frequency (P0.13) to 0Hz.

Please refer to the following figure:

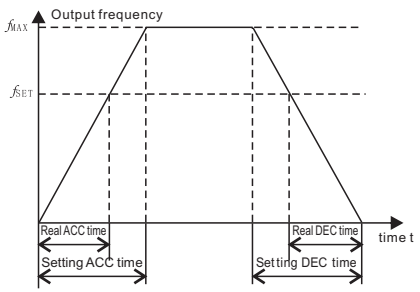


Figure 8-1 Acceleration and deceleration time

When the reference frequency is equal to the maximum frequency, the actual acceleration and deceleration time will be equal to the P0.04 and P0.05 respectively.

When the reference frequency is less than the maximum frequency, the actualacceleration and deceleration time will be less than the P0.04 and P0.05 respectively.

The actual acceleration (deceleration) time = P0.00 (P0.05) * reference frequency/P0.13.

SL series inverter has 2 groups of acceleration and deceleration time.

1st group

2nd group

The acceleration and deceleration time can be selected by combination of multifunctional ON-OFF input terminals determined by P3 Group.

5.5KW and below model's ADD/DEC factory setting is 10.0S, 7.5KW~55KW model is 20.0S, 75KW and above model is 40.0S

Function code	Name	Description	Setting range	Factory setting
P0.06	Carrier frequency	1.0~15.0KHz	1.0~15.0	Depend on model

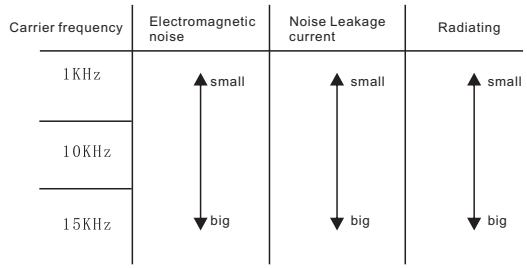


Figure 6.2 Effect of carrier frequency

The following table is the relationship between power ratting and carrier frequency

Carrier frequency			
E model:0.4~11KW P model:0.75~15KW	15	0.5	8
E model:15~55KW P model:18.5~75KW	8	0.5	4
E model:75~300KW P model:90~315KW	6	0.5	2

The advantage of high carrier frequency: ideal current waveform, little current harmonic wave and motor noise. The disadvantage of high carrier frequency: increasing the switch loss, increasing inverter temperature and the impact to the output capacity. The inverter needs to derate on high carrier frequency. At the same time, the leakage and electrical magnetic interference will increase.

Applying low carrier frequency is contrary to the above, too low carrier frequency will cause unstable running, torque decreasing and surge.

The manufacturer has set a reasonable carrier frequency when the inverter is in factory. In general, users do not need to change the parameter.

Function code	Name	Description	Setting range	Factory setting
P0.07	V/F torque selection	0 : linear curve 1 : Tourque-stepdown curve (2.0 order)	0~1	0

Square V/F control is for load of blower and pump

0 : Linear curve. It is applicable for normal constant torque load.

1 : Torque-stepdown curve. It is applicable for variable torque load, such as blower, pump and so on

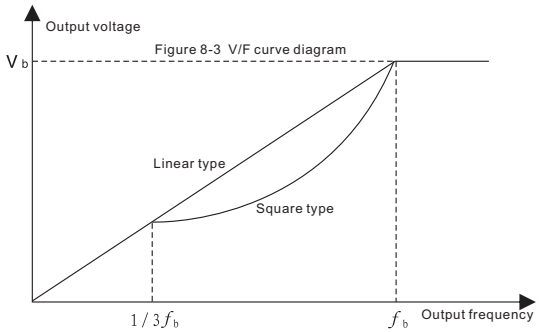


Figure 8-3 V/F curve diagram

Function code	Name	Description	Setting range	Factory setting
P0.08	Tourque boost	0.0%：（auto）0.1% ~ 30.0%	0.0~30.0	0.0%
P0.09	Tourque boost cut-off	0.0% ~ 50.0% (motor rated frequency)	0.0~50.0	20.0%

Torque boost will take effect when output frequency is less than cut-off frequency of torque boost (P0.09). Torque boost can improve the torque performance of V/F control at low speed.

The value of torque boost should be determined by the load. The heavier the load, the larger the value. Tourque boost setting should not be too large, otherwise the motor would be over-heat or the inverter would be tripped by over-current or over-load.

If torque boost is set to 0.0%, the inverter will boost the output torque according to the load automatically. Please refer to following diagram.

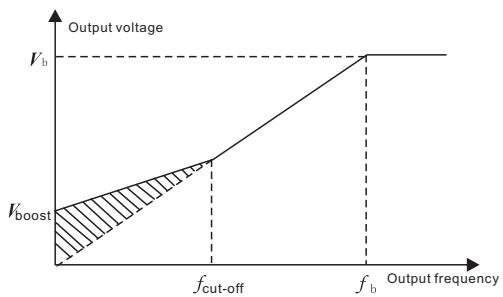


Figure8-4 Manual torque boost diagram

Function code	Name	Description	Setting range	Factory setting
P0.10	V/F compensation limit	0.0~200.0%	0.0~200.0	100.0%

The motor's slip changes with the load torque, which results in the variance of motor speed. The inverter's output frequency can be adjusted automatically through slip compensation according to the load torque. Therefore the change of speed due to the load change can be reduced. The value of compensated slip is dependent on the motor's rated slip.

Function code	Name	Description	Setting range	Factory setting
P0.11	FWD/REV enable option whenc power on	0：Forward 1：Reverse 2：Forbid reverse	0~2	0

0：Default direction running. Inverter will run according to real direction when powering on.

1：REV running. By setting the function code can change the running direction of motor without changing other parameter. It equals to change the running direction of motor by adjusting arbitrary two motor lines (U,V,W).

Note: After initialization, the running direction of motor will go back to original state, so it should be cautious in the occasion that forbiding change running direction of motor after adjusting the system.

2. Forbid reverse. It can be applied in occasion that reverse is forbidden.

Function code	Name	Description	Setting range	Factory setting
P1.12	Dead time of FWD/REV	0.0~3600.0s	0.0~3600.0	0.0s

Set the hold time at zero frequency in the transition between forward and reverse running. It is shown as following figure 6-6

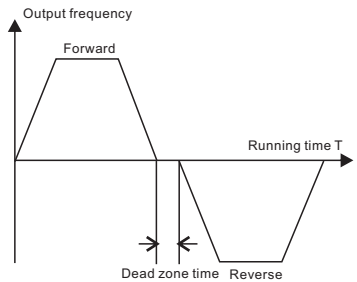


Figure8-5 FWD/REV dead time diagram

Function code	Name	Description	Setting range	Factory setting
P0.13	Maximum output frequency	10.00~600.00Hz	10.00~600.00	50.00Hz

To set the maximum output frequency of inverter. Frequency setting and acceleration and deceleration are based on it, please be noted.

Function code	Name	Description	Setting range	Factory setting
P0.14	Upper frequency lilmit	P0.15~P0.13 (Maximum frequency)	P0.15~P0.13	50.00Hz

Upper limit of frequency output.

The value should be less than or equal to the maximum frequency output.

Function code	Name	Description	Setting range	Factory setting
P0.15	Lower frequency limit	0.00Hz~P0.14 (Running frequency upper limit)	0.00~P0.14	0.00Hz

Lowe frequency limit of inverter

If frequency reference is lower than the lower frequency limit, the inverter will run with lower frequency limit.

Maximum output frequency ≥Upper frequency limit ≥Lower frequency limit

P1group Complementary parameter

Function code	Name	Description	Setting range	Factory setting
P1.00	AVR function	0：Disabled 1：Enabled all the time 2：Disabled during deceleration	0~2	2

AVR (Auto Voltage Regulation) function ensures the output voltage of inverter stable no matter how the DC bus voltage changes. During deceleration, if AVR function is disabled, the deceleration time will be short but the current will be big. If AVR function is enabled all the time, the deceleration time will be long but the current will be small.

Note: when the motor is decelerating to stop, closing the AVR function will speed up the deceleration and avoid overvoltage.

Function code	Name	Description	Setting range	Factory setting
P1.01	Brake threshold voltage	115.0~140.0%(Standard bus voltage) (380V series)	115.0~140.0	130.0%
		115.0~140.0%(Standard bus voltage) (220V series)	115.0~140.0	120.0%

The function code is used to set the original bus voltage of the energy braking. Adjust the value properly can brake the load effectively.

Function code	Name	Description	Setting range	Factory setting
P1.02	Radiator temperature	0~100.0℃		
P1.03	IGBT module temperature	0~100.0℃		

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

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

Function code	Name	Description	Setting range	Factory setting
P1.04	Jog frequency	0.00~Maximum frequency(P0.13)	0.00~P0.13	5.00Hz
P1.05	Jog acceleration time	0.1~3600.0s	0.1~3600.0	Model selection
P1.06	Jog deceleration time	0.1~3600.0s	0.1~3600.0	Model selection

Defining inverter's given frequency and ACC/DCC time. Jog will start as start directly mode and stop as deceleration to stop mode.

Jog acceleration time indicates the time inverter need to accelerate from 0Hz to maximum output frequency (P0.13)

Jog deceleration time indicates the time inverter need to decelerate from maximum output frequency to 0Hz (P0.13)

5.5KW and above model's ACC and DCC factory setting is 40.0S.

Function code	Name	Description	Setting range	Factory setting
P1.07	Acceleration2	1.0~3600.0s	1.0~3600.0	Model selection
P1.08	Deceleration2	1.0~3600.0s	1.0~3600.0	Model selection

ACC/DCC time can choose P0.04, P0.05 and above stated modes. For detailed, please refer to P0.04 and P0.05

5.5KW and below model's ACC and DCC factory setting is 40.0S.

ACC/DCC time 0-1 can be choosen through different combination of multipul digital input terminal.

Function code	Name	Description	Setting range	Factory setting
P1.09	QUICK/JOG function selection	0：Jog 1：FDW/REV switching 2：Clear UP/DOWN setting	0~2	0

QUICK/JOG is a multifunctional key, whose function can be defined by parameter setting.

0：Jog: Press QUICK/JOG the inverter will jog.

1:FWD/REV switching: Press FDW/REV, the running direction of inverter will reverse. It is only valid in keypad command source

2:Clear UP/DOWN setting: QUICK/JOG clear the setting value of UP/DOWN

Function code	Name	Description	Setting range	Factory setting
P1.10	STOP/RST function option	0:Valid when keypad control 1:Valid when keypad control or terminal control 2:Valid when keypad control or communication control 3:Always valid	0~3	0

The value of P1.10 only determines the STOP function of STOP/RST. The RESET function of STOP/RST is always valid.

Function code	Name	Description	Setting range	Factory setting
P1.11	UP/DOWN setting	0:Valid, save UP/DOWN value when power off 1:Valid, do not save UP/DOWN value when power off 2:Invalid	0~2	0

The frequency can be set by"▲" "▼"and terminal UP/DOWN. This setting method have the highest and it can be combined with setting channel. It is used to adjust the output frequency during the commissioning of controlling system.

0: valid, and the value can be saved when the inverter is powered off. The frequency command can be set and the value can be saved after the inverter is powered off and it will combinate with the current frequency when it is repowered on.

1: valid, and the value can not be saved when the inverter is powered off. The frequency command can be set but the value can not be saved after the inverter is powered off

2:invalid, the function of "▲""▼"and terminal UP/DOWN is invalid, and the setting will be cleared automatically.

Note: When the factory setting is restored, the value of keypad and UP/DOWN will be cleared.

Function code	Name	Description	Setting range	Factory setting
P1.12	Keypad display selection	0：Preferential to external keypad 1：Both display, only external keypad valid 2：Both display, only local keypad valid 3：Both display and key valid	0~3	0

This function set the logic relationship between local keypad and external keypad's display press function

Function code	Name	Description	Setting range	Factory setting
P1.13	Coefficient of rotation speed	Actual mechanical speed = 120* output frequency * P1.13/ Number of poles of motor	0.0~999.9%	100.0%

Actual mechanical speed = 120* output frequency * P1.13/ Number of poles of motor. This parameter is used to calibrate the bias between actual mechanical speed and rotation speed.

Function code	Name	Description	Setting range	Factory setting
P1.14	Running state display selection	0~0X7FFF	0~0x7FFF	0X7FFF

P1.14 defines the parameters that can be displayed by LED in running state. If Bit is l , the parameter will be displayed. Press >>/SHIFT to scroll through these parameters . If Bit is 0, the parameter will not be displayed;

The display content corresponding to each bit of P1.14 is described in the following table:

BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
Output	Output	Running	Output	Output	DC bus	Reference	Running
Torque	Power	Rotation speed	Current	Voltage	Voltage	Frequency	Frequency

The display content corresponding to each bit of P1.14 is described in the following table:

BIT15	BIT14	BIT13	BIT12	BIT11	BIT10	BIT9	BIT8
Reserved	Step No. of multi-step	AI2	AI1	Output terminal state	Input terminal state	PID feedback	PID preset

The input/output terminal state is displayed by decimal. X1(Y) corresponds to the lowest bit. For example: if the input terminal is displayed to 3, terminals XI and X2 are switched on and other terminals are switched off. Please refer to PD1.14 and P1.15 for detailed information.

Function code	Name	Description	Setting range	Factory setting
P1.15	Stop state display selection	0~0x1FF	0~0x1FF	0xFF

The setting of this function code is the same as that of P1.14. When SL series inverters are in the stopping state, the displaying of the parameter is determined by the function code.

The display content corresponding to each bit of P1.15 is described in the following table:

BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
AI2	AI1	PID feedback	PID prese	Output terminal state	Input terminal state	DC bus	Frequency reference

The display content corresponding to each bit of P1.15 is described in the following table:

BIT15	BIT14	BIT13	BIT12	BIT11	BIT10	BIT9	BIT8
Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Step No. of multi-step

Function code	Name	Description	Setting range	Factory setting
P1.16	Reserved variable	Factory parameter		

Function code	Name	Description	Setting range	Factory setting
P1.17	Running time	0~65535h		

Running time: display the accumulative running time of inverter by present.

Function code	Name	Description	Setting range	Factory setting
P1.18	Restore function parameter restore	0:No action 1:Restore Factory setting 2:Clear fault record	0~2	0

1: Restore all parameters fo factory setting

2: Clear recent fault records

The function code restore to 0 after finish the operation of selected fuction

Function code	Name	Description	Setting range	Factory setting
P1.19	Software version			

Software version: software version No

Function code	Name	Description	Setting range	Factory setting
P1.20	The user password	0~65535	0~65535	0

The password protection function will be valid when set to be any nonzero data.

00000: WhenP1.20 is set to be 00000, the user's password set before will be cleared and the password protection function will be disabled.

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

The password will be valid in l minute after retreat the function code edition state. Press PRG/ESC to enter into the function code edition state after the password takes effect, "0.0.0.0.0." will be displayed. The operator should input correct password.

P2 group Analouge terminal parameter

Function code	Name	Description	Setting range	Factory setting
P2.00	AI1 upper limit	0.00V ~ 10.00V	0.00 ~ 10.00	10.00V
P2.01	AI1 upper limit corresponding setting	−100.0% ~ 100.0%	−100.0 ~ 100.0	100%
P2.02	AI1 lower limit	0.00V ~ 10.00V	0.00 ~ 10.00	0.00V
P2.03	AI1 lower limit corresponding setting	−100.0% ~ 100.0%	−100.0 ~ 100.0	0.0%
P2.04	AI1 filter time constant	0.00s ~ 10.00s	0.00 ~ 10.00	0.10s

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

The analog input AIl can only provide voltage input, and 0mA~20mA 's corresponding voltage range is 0V~5V. For different applications, the corresponding value of 100.0% analog setting is different. For details, please refer to description of each application.

The following figures show several setting cases. Note: AIl lower limit must be less or equal to AIl upper limit.

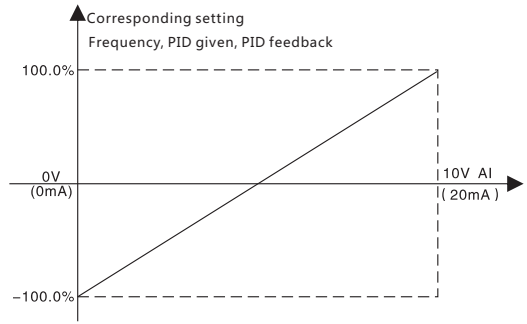


Figure8-13 Relationship between AI and corresponding setting

AIl filter time constant is effective when there are sudden changes or noise in the analog input signal. Responsiveness decreases as the setting increases.

Function code	Name	Description	Setting range	Factory setting
P2.05	AI2 upper limit	0.00V ~ 10.00V	0.00 ~ 10.00	10.00V
P2.06	AI2 upper limit corresponding setting	−100.0% ~ 100.0%	−100.0 ~ 100.0	100.0%
P2.07	AI2 lower limit	0.00V ~ 10.00V	0.00 ~ 10.00	0.00V
P2.08	AI2 lower limit corresponding setting	−100.0% ~ 100.0%	−100.0 ~ 100.0	0.0%
P2.09	AI2 filter time constant	0.00s ~ 10.00s	0.00 ~ 10.00	0.10s

AI2 is similar with AIl. AI2 can be set as 0~10V/0~20mA. When AI2 is set to 0~20mA current input, the corresponding voltage range is 5V.

Function code	Name	Description	Setting range	Factory setting
P2.10	A01 output selection	Multifunctional analogue output	0~10	0

The standard output of analogue is 0~20 mA or 0~10V. Current or voltage output can be chosen through Jumper J4:

Setting value	Function	Range
0	Running frequency	0~ maximum frequency
1	Reference frequency	0~ maximum frequency
2	Motor speed	0~2* rated synchoronous speed of motor
3	Output current	0~2* inverter rated current
4	Output voltage	0~1.5* inverter rated voltage
5	Output power	0~2* rated power
6	Output torque	0~2* rated current
7	Analogue AI1 input	0~10V
8	Analogue AI2 input	0~10V/0~20mA
9~10	Reserved	Reserved

Function code	Name	Description	Setting range	Factory setting
P2.11	AO1 upper limit	0.0% ~ 100.0%	0.0 ~ 100.0	100.0%
P2.12	AO1 upper limit corresponding output	0.00V ~ 10.00V	0.00 ~ 10.00	10.00V
P2.13	AO1 lower limit	0.0% ~ 100.0%	0.0 ~ 100.0	0.0%
P2.14	AO1 lower limit corresponding output	0.00V ~ 10.00V	0.00 ~ 10.00	0.00V

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

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

For different applications, the corresponding value of 100.0% analog output is different. For details, please refer to the description of each application.

The following figures show several setting cases:

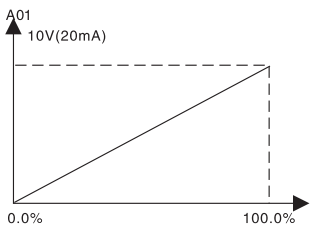


Figure 8-14 Relationship between AO and corresponding setting.

P3 Group Digital terminal parameter

Function code	Name	Description	Setting range	Factory setting
P3.00	FWD/REV enable option when power on	0:Disabled 1:Enabled	0~1	0

This function only takes effect if run command source is terminal control.

0: If P3.00 is set to be 0, when power on, inverter will not start even if FWD/REV terminal is active, until FWD/REV terminal disabled and enabled again.

1: If P3.00 is set to be 1, when power on and FWD/REV terminal is active, inverter will start automatically.

Note: This function may cause the inverter restart automatically, please be cautious.

Function code	Name	Description	Setting range	Factory setting
P3.01	X1 terminal function selection	Programmable multifunctional terminal	0~25	1
P3.02	X2 terminal function selection	Programmable multifunctional terminal	0~25	4
P3.03	X3 terminal function selection	Programmable multifunctional terminal	0~25	7
P3.04	X4 terminal function selection	Programmable multifunctional terminal	0~25	0
P3.05	X5 terminal function selection	Programmable multifunctional terminal	0~25	
P3.06	X6 terminal function selection	Programmable multifunctional terminal	0~25	

The parameter used to set the corresponding problem of digital multifunctional input terminal

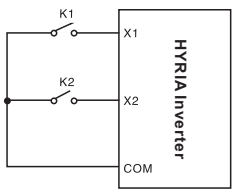
Function code	Name	Description	Setting range	Factory setting
P3.07	ON/OFF filter times	1~10	1~10	5

This parameter is used to set filter strength of terminals (X1~X6). When interference is heavy, the user should increase this value to prevent malfunction.

Function code	Name	Description	Setting range	Factory setting
P3.08	FWD/REV control mode	0: 2-wire control mode 1 1: 2-wire control mode 2 2: 3-wire control mode 1 3: 3-wire control mode 2	0~3	0

This parameter defines four different control modes that control the inverter operation through external terminals.

0: 2-wire control mode 1: Integrate START/STOP command with run direction.

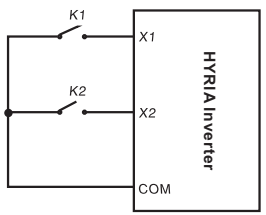


K1	K2	Run command
OFF	OFF	Stop
ON	OFF	FWD
OFF	ON	REV
ON	ON	Stop

Parameter setting:
P0.02=1 external control
P3.01=1 FWD
P3.02=2 REV
P3.08=0 2-wire control 1

Figure8-7 2-wire control mode1

1: 2-wire control mode 2: START/STOP command is determined by FWD terminal. Run direction is determined by REV terminal.

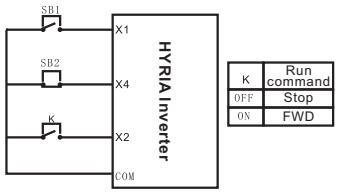


K1	K2	Run command
OFF	OFF	Stop
OFF	ON	FWD
ON	OFF	REV
ON	ON	Stop

Parameter setting:
P0.02=1 external control
P3.01=1 FWD
P3.02=2 REV
P3.08=1 2-wire control 2

Figure8-8 2-wire control mode2

2:3-wire control mode1: X4 is the multifunctional input terminal. Run command is given by X1, direction command by X2. X4 is normally close input.



K	Run command
OFF	Stop
ON	FWD

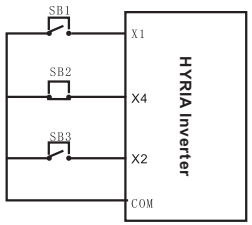
Parameter setting:

P0.02=1 External control
P3.01=1 FWD
P3.02=2 REV
P3.04=3 3-wire function
P3.08=2 3-wire control mode1

Figure 8-9 3-wire control mode 1

K: Run direction button SB1: Start button SB2: Stop button

3:3-wire control mode2. X4 is multifunctional terminal. Run command is given by SB1 or SB2, and can control running direction at the same time. Stop command is given by normally close SB2.



Parameter setting:

P0.02=1 External control
P3.01=1 FWD
P3.02=2 REV
P3.04=3 3-wire function
P3.08=2 3-wire control mode2

Figure 8-10 3-wire control mode2

SB1 : FWD SB2: Stop SB3 : REV

Note: When 2-wire control mode is active, the inverter will not run in following situation even if X1/X2 terminalis enabled: Coast to stop (press RUN and STOP/RST at the same time); stop command from serial communication. To let the inverter run , X1/X2 should be triggered again.

Function code	Name	Description	Setting range	Factory setting
P3.09	UP/DOWN setting change rate	0.01~50.00Hz/s	0.01~50.00	0.50Hz/s

Terminal UP/DOWN regulates the incremental rate of setting frequency.

Function code	Name	Description	Setting range	Factory setting
P3.10	Y1 output selection	Collector open circuit output function	0~10	1
P3.11	Y2 output selection	Collector open circuit output function	0~10	3
P3.12	Relay TA,B,C output selection	Collector open circuit output function	0~10	

Collector open circuit output function:

Reference	Function	Description
0	No output	Output terminal has no function
1	Run forward	ON: During forward run.
2	Run reverse	ON: During reverse run
3	Fault output	ON: Inverter is in fault state
4	FDT reached	Please refer to description of P3.13, P3.14
5	Frequency reached	Please refer to description of P3.15
6	Zero speed running	ON: The running frequency of inverter is zero
7	Upper frequency limit reached	ON : Running frequency reaches the upper frequency limit
8	Lower frequency limit reached	ON : Running frequency reaches the lower frequency limit
9~10	Reserved	Reserved

Function code	Name	Description	Setting range	Factory setting
P3.13	FDT level	0.00 ~ P0.13 (Maximum frequency)	0.00~P0.13	50.00Hz
P3.14	FDT lag	0.0 ~ 100.0% (FDT level)	0.0~100.0	5.0%

When the output frequency reaches a certain preset frequency (FDT level), output terminal will output an ON-OFF signal until output frequency drops below a certain frequency of FDT level (FDT level - FDT lag), as shown in following figure :

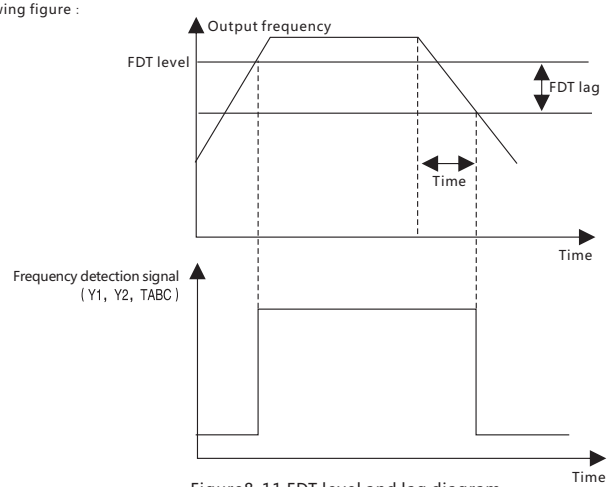


Figure8-11 FDT level and lag diagram

Function code	Name	Description	Setting range	Factory setting
P3.15	Frequency arrival detecting range	0.0 ~ 100.0% Maximum frequency	0.0 ~ 100.0	0.0%

Figure8-12 Frequency arriving signal diagram

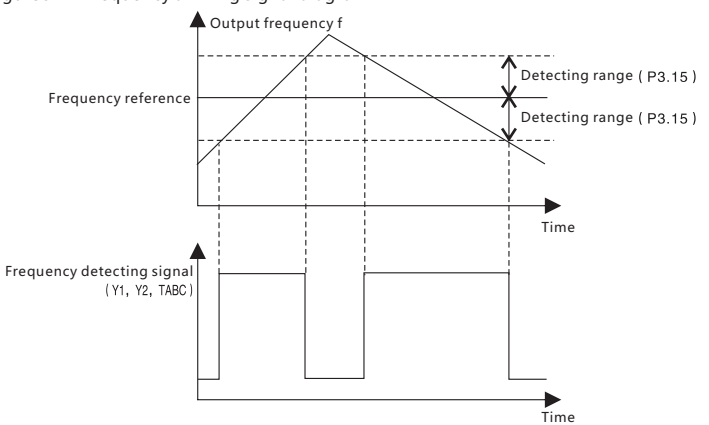


Figure8-12 Frequency arrival detecting range

P4 Group Stop mode

Function code	Name	Description	Setting range	Factory setting
P4.00	Stop mode	0: Decelerate to stop 1: Coast to stop	0~1	0

0:Decelerate to stop
When the stop command takes effect, the inverter decreases the output frequency according to the selected acceleration/deceleration time till stop.

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

Function code	Name	Description	Setting range	Factory setting
P4.01	Waiting time before DC braking	0.0~50.0s	0.0~50.0	0.0s
P4.02	DC braking time	0.0~50.0s	0.0~50.0	0.0s
P4.03	DC braking current	0.0~150.0%	0.0~150.0	0.0%
P4.04	Starting frequency of DC braking	0.00~P0.13 (Maximum frequency)	0.00~10.0	0.00Hz

Waiting time before DC braking: Inverter blocks the output before starting the DC braking. After this waiting time, the DC braking will be started. It is used to prevent over-current fault caused by DC braking at high speed.

DC braking time: The time used to perform DC braking. If the time is 0, the DC braking will be invalid.

DC braking current: The value of P4.03 is the percentage of rated current of inverter. The bigger the DC braking current, the greater the braking torque.

Starting frequency of DC braking: Start the DC braking when output frequency reaches starting frequency determined by P4.04.

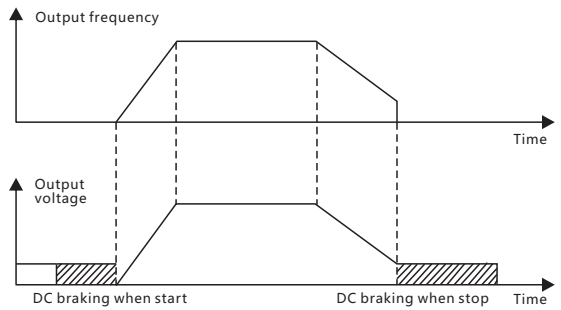


Figure8-6 DC braking diagram

Function code	Name	Description	Setting range	Factory setting
P4.05	Start mode	0:Start directly 1:DC braking and start 2:5.5KW and above's model have rotation detection restart function	0~2	0

0:Start the motor at the starting frequency.
1:DC braking and start: Inverter will output DC current firstly and then start the motor at the starting frequency. Please refer to description of P4.07, P4.08
2: Rotation speed tracking restart. Inverter will count the rotation speed and direction of motor, and then run to reference frequency with current speed in order to realize slide and non-impact start of motor.

Function code	Name	Description	Setting range	Factory setting
P4.06	Hold time of starting frequency	0.0~50.0s	0.0~50.0	0.0s
P4.07	DC Braking time before start	0.0~50.0s	0.0~50.0	0.0s
P4.08	DC Braking current before start	0.0~150.0%	0.0~150.0	0.0%
P4.09	Starting frequency	0.00~10.00Hz	0.00~10.00	0.00Hz

Setting suitable starting frequency will increase the torque when start. Within the time of P4.06, inverter's output frequency is starting frequency, and then run into targeted frequency. If the targeted frequency is less than starting frequency, the inverter will stay in standby state and not run. Starting frequency is not limited by lower frequency limit.

During FWD /REV switch, starting frequency is invalid

When inverter starts, it performs DC braking according to P4.08 firstly, then start to accelerate after P4.07. DC braking is invalid when P4.07 is set to be 0. The value of P4.08 is the percentage of rated current of inverter. The bigger the DC braking current, the greater the braking torque.

Function code	Name	Description	Setting range	Factory setting
P4.10	Skip frequency	0.00 ~ P0.13 (Maximum frequency)	0.00~P0.13	0.00Hz
P4.11	Skip frequency bandwidth	0.00~P0.13 (Maximum frequency)	0.00~P0.13	0.00Hz

When the reference frequency is among the skip frequency range, the running frequency will be the edge of the skip frequency.

By means of setting skip frequency, the inverter can keep away from the mechanical resonance with the load. The inverter can set 1 skip frequency point. If set the skip frequency point to 0, this function is invalid.

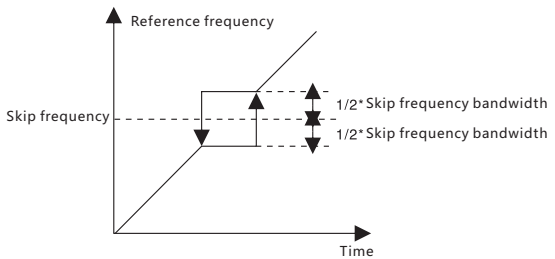


Figure8-18 Jump frequency diagram

P5 Group Traverse amplitude parameters

Function code	Name	Description	Setting range	Factory setting
P5.00	Jitter frequency	0.0~50.0% (Relative traverse amplitude)	0.0~50.0	0.0%
P5.01	Traverse amplitude	0.0~100.0% (Relative frequency reference)	0.0~100.0	0.0%
P5.02	Rise time of traverse	0.1~3600.0s	0.1~3600.0	5.0s
P5.03	Fall time of traverse	0.1~3600.0s	0.1~3600.0	5.0s

Traverse operation is widely used in textile and chemical fiber industry. The typical application is shown in following figure.

Traverse function means the output frequency of the inverter bobs with the reference frequency as the center. The track of the output frequency is shown as below, of which, the traverse bandwidth is set by P5.01. When P5.01 is set to 0, the traverse bandwidth is 0 and has no action.

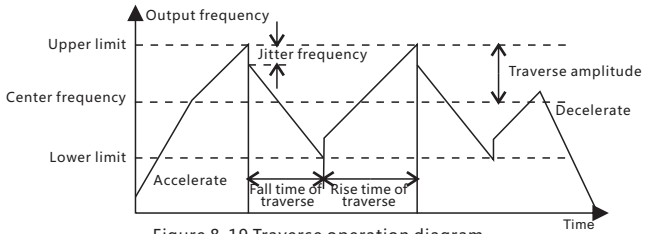


Figure 8-19 Traverse operation diagram.

Traverse running frequency is restricted by upper and lower frequency limit frequency

Center frequency: Traverse amplitude AW= center frequency * traverse amplitude P5.01

Jitter frequency :traverse amplitude (AW) * P5.00

Rise time of traverse: Indicates the time rising from the lowest traverse frequency to the highest traverse frequency.

Fall time of traverse: Indicates the time falling from the highest traverse frequency to the lowest traverse frequency.

P6 Group Protection function

Function code	Name	Description	Setting range	Factory setting
P6.00	Over-voltage stall protection	0:Disabled 1:Enabled	0~1	0
P6.01	Over-voltage stall protection point	110～150% (380V series)	110~150	120%
		110～150% (220V series)	110~150	115%

During deceleration, the motor's decelerating rate may be lower than that of inverter's output frequency due to the load inertia. At this time, the motor will feed the energy back to the inverter, resulting in DC bus voltage rise. If no measures taken, the inverter will trip due to over voltage.

During deceleration, the inverter detects DC bus voltage and compares it with over-voltage stall protection point. If DC bus voltage exceeds P6.01, the inverter will stop reducing its output frequency. When DC bus voltage become lower than P6.01, the deceleration continues, as shown in following figure.

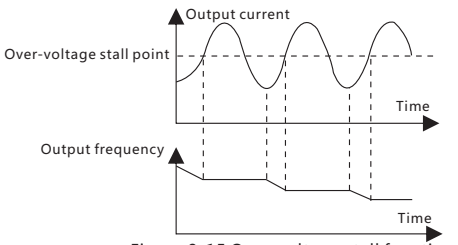


Figure 8-15 Over-voltage stall function

Function code	Name	Description	Setting range	Factory setting
P6.02	Motor overload protection	0:Disabled 1:Normal motor 2:Variable frequency motor	0~2	1

0: No protection. Inverter has no overload protection for load motor, please be cautious.

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

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

Function code	Name	Description	Setting range	Factory setting
P6.03	Motor overload protection current	20.0%~120.0%	20.0~120.0	100.0%

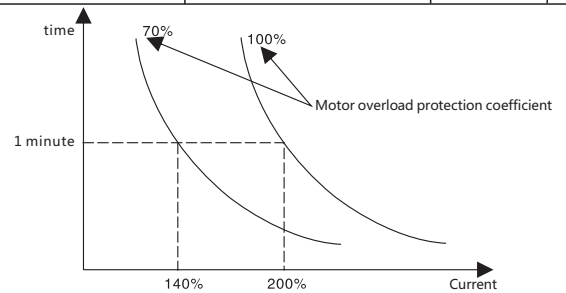


Figure 8-16 Motor overload protection curve

Function code	Name	Description	Setting range	Factory setting
P6.08	Previous two fault types	0~24		
P6.09	Previous fault type	0~24		
P6.10	Current fault type	0~24		

These parameters record three recent fault types: 0 means no fault, 1~24 means 24 types of fault. Please refer to the fault analysis for detailed information.

Function code	Name	Description	Setting range	Factory setting
P6.11	Output frequency at current fault	Output frequency at current fault		
P6.12	Output current at current fault	Output current at current fault		
P6.13	DC bus voltage at current fault	DC bus voltage at current fault		
P6.14	Input terminal state at current fault	The state of current fault input terminal is displayed as decimal figures. Display the state of all digital input terminals at the latest fault. The order is: BIT3 BIT2 BIT1 BIT0 XA X3 X2 X1 Current input terminal is ON and the corresponding bit is 0. The state of the digital input terminal at fault can be known through this value.		
P6.15	Output terminal state at current fault	The state of current fault output terminal is displayed as decimal figures. Display the state of all digital output terminals at the latest fault. The order is: BIT3 BIT2 BIT1 BIT0 TABC Y1 Current output terminal is ON and the corresponding bit is 0. The state of the digital output terminal at fault can be known through this value.		

The value can be determined by the following formula:

Motor overload protection current = (the largest load current allowed / Inverter rated current) 100%. Normally the largest load current is load motor's rated current

When the load motor's rated current is not suitable to inverter's rated current, setting P6.02~P6.03 to realize motor overload protection.

Function code	Name	Description	Setting range	Factory setting
P6.04	Auto current limiting threshold	100 ~ 200%	100~200	Pmodel: 120% Emodel: 160%
P6.05	Frequency decrease rate when current	0.00 ~ 100.00Hz/s	0.00~100.00	10.00Hz/s

During inverter running state, motor rotation's actual rising rate is less than output frequency rising rate. If don't take measures, acceleration over current fault will be caused, thus lead to trip of inverter.

Auto current limiting is used to limit the current of inverter smaller than the value determined by P6.04 in real time. Therefore the inverter will not trip due to surge over-current. This function is especially useful for the applications with big load inertia or step change of load. P6.04 is a percentage of the inverter's rated current. P6.05 defines the decrease rate of output frequency when this function is active. If P6.04 is too small, overload fault may occur. If it is too big, the frequency will change too sharply and therefore, the feedback energy of motor will be too large and may cause over-voltage fault. This function is always enabled during acceleration or deceleration.

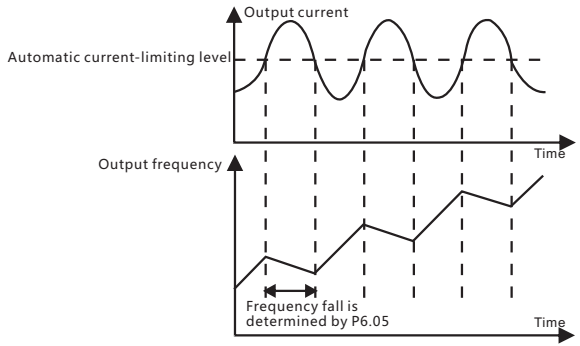


Figure 8-17 Current limiting protection function

Function code	Name	Description	Setting range	Factory setting
P6.06	Threshold of trip-free	70.0 ~ 110.0% (Standard DC bus voltage)	70.0~110.0	80.0%
P6.07	Decrease rate of trip-free	0.00Hz ~ P0.13 (Maximum frequency)	0.00~P0.13	0.00Hz

If P6.07 is set to be 0, the trip-free function is invalid.

Trip-free function enables the inverter to perform low-voltage compensation when DC bus voltage drops below P6.07. The inverter can continue to run without tripping by reducing its output frequency and feedback energy via motor.

Note: If P6.07 is too big, the feedback energy of motor will be too large and may cause over-voltage fault. If P6.07 is too small, the feedback energy of motor will be too small to achieve voltage compensation effect. So please set P6.07 according to load inertia and the actual load.

Function code	Name	Description	Setting range	Factory setting
P6.16	Reset interval	0.1 ~ 100.0s	0.1~100.0	1.0s
P6.17	Auto reset times	0 ~ 3	0~3	0

Auto reset times: When the inverter selects auto reset times, this parameter is used to set the times of auto reset. But if the inverter reset continuously for more than the set time, the inverter will stop for fault and the user has to deal with the problem by hands.

Reset interval: This parameter selects the interval time from fault occurring to auto reset.

P7 Group PID control

PID control is a common used method in process control, such as flow, pressure and temperature control. The principle is firstly detect the bias between preset value and feedback value, then calculate output frequency of inverter according to proportional gain, integral and differential time. Please refer to following figure.

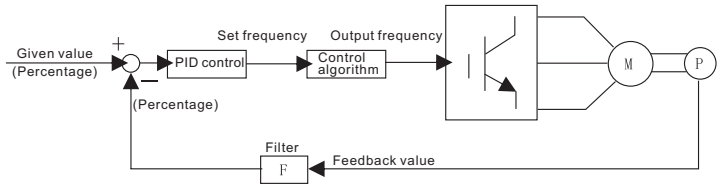


Figure 8-20 PID control diagram

Function code	Name	Description	Setting range	Factory setting
P7.00	PID feedback source selection	0:AI1 1:AI2 2:AI1+AI2 3:Communication	0~3	0

These parameters are used to select PID feedback source.

Function code	Name	Description	Setting range	Factory setting
P7.01	PID preset source selection	0:Keypad PID preset (P7.02) 1:AI1 2:AI2 3:Communication 4:Multi-step	0~4	0

When frequency source select PID, P0.01 set as 5, this function group is active.
This parameter determines procedure PID targeted value given source.

Procedure PID targeted value is relative, 100% of preset value is corresponding t0 100% of feedback value. System always perform operation according to relative value (0~100%).

Note: multi-step given can be realized by setting P8 group parameter.

Function code	Name	Description	Setting range	Factory setting
P7.02	Keypad PID preset	0.0% ~ 100.0%	0.0~100.0	0.0%

When set P7.01=0, the targeted source is keypad preset. This parameter should be set.
The parameter's base value is system's feedback value.

Function code	Name	Description	Setting range	Factory setting
P7.03	PID output characteristics	0:Positive 1:Negative	0~1	0

Positive. When the feedback value is greater than the preset value, output frequency will be decreased, such as tension control in winding application.

Negative. When the feedback value is greater than the preset value, output frequency will be increased, such as tension control in unwinding application.

Determine the integral adjustting speed of PID adjustor acting on PID feedback value and given value's deviation. Integral time means when the deviation of PID feedback and reference is 100%, and the adjusting bandwidth is the maximum frequency (P0.13 ignoring the integration effect and the derivation effect).

The shorter the integral time, the stronger the adjusting strength is.

Differential time (Td): when the error between the feedback and the reference, a proportional adjustment will be output. The adjustment only depends on the direction and value of the error change other than the error itself. The derivation adjustment controls the change of feedback signals according to the changing trend when it fluctuates. Because the derivation may enlarge the interference to the system, especially the frequent-changing interference, please use it carefully.

PID is the most common method in the procedure control. The effect of every part is different from the other. Below is the simple instruction:

Proportional adjustment (P): when there is an error between the feedback and the reference, a Proportional adjustment will be output. If the error is constant, the adjustment will be constant, too. Proportional adjustment can respond to the feedback change quickly, but it can not realize non-fault control. The gain will increase with the adjustment speed, but too much gain may cause vibration. The adjustment method is: set a long integration time and derivation time to 0 first. Secondly make the system run by proportional adjustment and change the reference. And then watch the error of the feedback signal and the reference. If the static error is available (for example, increasing the reference, the feedback will be less than the reference after a stable system), continue to increase the gain, vice versa. Repeat the action until the static error achieves a little value.

Integral time (I): the output adjustment will accumulate if there is an error between the feedback and the reference. The adjustment will keep on increasing until the error disappears. If the error is existent all the time, the integration adjustor can cancel the static error effectively. Vibration may occur as a result of unstable system caused by repeated over-adjustment if the integration adjustor is too strong.

The features of this kind of vibration are: the fluctuating feedback signal (around the reference) and increasing traverse range will cause vibration. Adjust the integration time parameter from a big value to a little one to change the integration time and monitor the result until a stable system speed is available.

Differential time (Td): when the error between the feedback and the reference, a proportional adjustment will be output. The adjustment only depends on the direction and value of the error change other than the error itsef. The derivation adjustment controls the change of feedback signals according to the changing trend when it fluctuates. Because the derivation may enlarge the interference to the system, especially the frequent-changing interference, please use it carefully.

Function code	Name	Description	Setting range	Factory setting
P7.07	Sampling cycle (T)	0.01 ~ 100.00s	0.01~100.00	0.10s
P7.08	Bias limit	0.0 ~ 100.0%	0.0~100.0	0.0%

Sampling cycle T refers to the sampling cycle of feedback value. The PI regulator calculates once in each sampling cycle. The bigger the sampling cycle, the slower the response is.

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

Function code	Name	Description	Setting range	Factory setting
P7.04	Proportional gain (Kp)	0.00 ~ 100.00	0.00~100.00	1.00
P7.05	Integral time (Ti)	0.01 ~ 10.00s	0.01~10.00	0.10s
P7.06	Differential time (Td)	0.00 ~ 10.00s	0.00~10.00	0.00s

Proportional gain (Kp): it determines the adjusting strength of the PID adjustor. The larger the value of P, the stronger the adjusting strength is. If the parameter is 100, it means that.

when the deviation of PID feedback and reference is 100% and the adjusting bandwidth is the maximum frequency (ignoring the integration effect and the derivation effect).

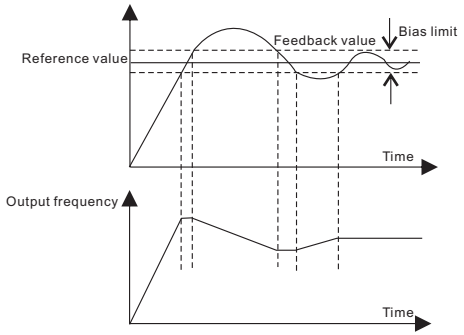


Figure 8-21 Relationship between bias limit and output frequency.

Function code	Name	Description	Setting range	Factory setting
P7.09	Feedback lost detecting value	0.0 ~ 100.0%	0.0~100.0	0.0%
P7.10	Feedback lost detecting time	0.0 ~ 3600.0s	0.0~3600.0	10.0s

Feedback offline detection value: the detection value is relative to l00%. The system will detect the feedback of PID all the time. When the feedback value is below or equal to the feedback offline detection value, the system will begin to count the detecting time.

When the time exceeds the feedback offline detection time, the system will report PIDE.(E201)

P8 Group Multi-step speed control

Function code	Name	Description	Setting range	Factory setting
P8.00	Multi-speed0	–100.0 ~ 100.0%	–100.0 ~ 100.0	0.0%
P8.01	Multi-speed1	–100.0 ~ 100.0%	–100.0 ~ 100.0	0.0%
P8.02	Multi-speed2	–100.0 ~ 100.0%	–100.0 ~ 100.0	0.0%
P8.03	Multi-speed3	–100.0 ~ 100.0%	–100.0 ~ 100.0	0.0%
P8.04	Multi-speed4	–100.0 ~ 100.0%	–100.0 ~ 100.0	0.0%
P8.05	Multi-speed5	–100.0 ~ 100.0%	–100.0 ~ 100.0	0.0%
P8.06	Multi-speed6	–100.0 ~ 100.0%	–100.0 ~ 100.0	0.0%
P8.07	Multi-speed7	–100.0 ~ 100.0%	–100.0 ~ 100.0	0.0%

Note: 100% of multi-step speed x corresponds to the maximum frequency (P0.13). If the value of multi-step speed x is negative, the direction of this step will be reverse, otherwise it will be forward. Multi-step speed function has highest priority. Selection of step is determined by combination of multi-step terminals. Please refer to following figure and table.

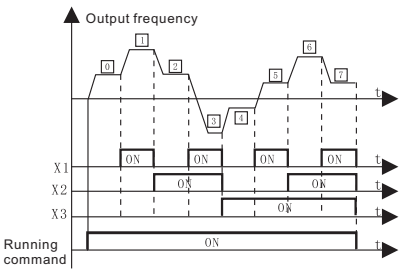


Figure 8-22 Multi-steps speed operating diagram

Multi-steps running start and coast to stop source selection is also determined by P0.02. X1, X2, X3 terminal and multi-steps' relationship is showed in following table.

Relationship of X1, X2, X3 terminal and multi-steps.

X1	OFF	ON	OFF	ON	OFF	ON	OFF	ON
X2	OFF	OFF	ON	ON	OFF	OFF	ON	ON
X3	OFF	OFF	OFF	OFF	ON	ON	ON	ON
Running step	0	1	2	3	4	5	6	7

P9 Group 485 Communication (optional)

Function code	Name	Description	Setting range	Factory setting
P9.00	Local address	1~247,0 is the broadcast address	0~247	1

This parameter determines the slave address used for communication with master. The value "0" is the broadcast address.

Local address is unique in communication network. This is the base of realizing upper PC and inverter's point to point communication.

Function code	Name	Description	Setting range	Factory setting
P9.01	Communication baud rate setting	0：1200BPS 1：2400BPS 2：4800BPS 3：9600BPS 4：19200BPS 5：38400BPS	0~5	3

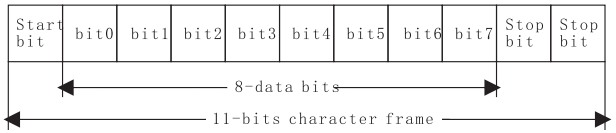
This parameter can set the data transmission rate during serial communication. Note: The baud rate of master and slave must be the same.

Function code	Name	Description	Setting range	Factory setting
P9.02	Data format	0: RTU, 1 start bit, 8 data bits, no parity check, 1 stop bit 1: RTU, 1 start bit, 8 data bits, even parity check, 1 stop bit 2: RTU, 1 start bit, 8 data bits, odd parity check, 1 stop bit 3: RTU, 1 start bit, 8 data bits, no parity check, 2 stop bits 4: RTU, 1 start bit, 8 data bits, even parity check, 2 stop bits 5: RTU, 1 start bit, 8 data bits, odd parity check, 2 stop bits 6: ASCII, 1 start bit, 7 data bits, no parity check, 1 stop bit 7: ASCII, 1 start bit, 7 data bits, even parity check, 1 stop bit 8: ASCII, 1 start bit, 7 data bits, odd parity check, 1 stop bit 9: ASCII, 1 start bit, 7 data bits, no parity check, 2 stop bits 10: ASCII, 1 start bit, 7 data bits, even parity check, 2 stop bits 11: ASCII, 1 start bit, 7 data bits, odd parity check, 2 stop bits 12: ASCII, 1 start bit, 8 data bits, no parity check, 1 stop bit 13: ASCII, 1 start bit, 8 data bits, even parity check, 1 stop bit 14: ASCII, 1 start bit, 8 data bits, odd parity check, 1 stop bit 15: ASCII, 1 start bit, 8 data bits, no parity check, 2 stop bits 16: ASCII, 1 start bit, 8 data bits, even arity check, 2 stop bits 17: ASCII, 1 start bit, 8 data bits, odd parity check, 2 stop bits	0~17	0

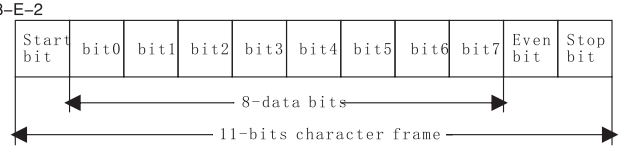
Upper PC and inverter's setting dada form must be the same, otherwise the communication is invalid.

11-bits(for RTU)

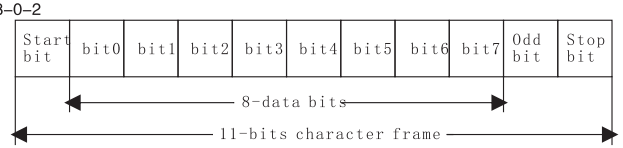
Data form:8-N-2



Data form: 8-E-2

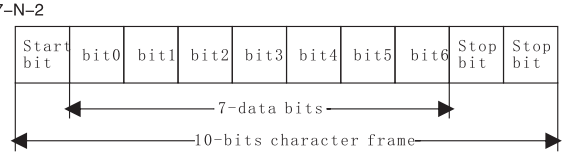


Data form: 8-0-2

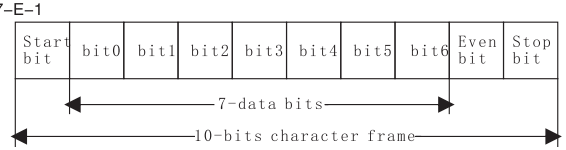


10-bots(for ASII)

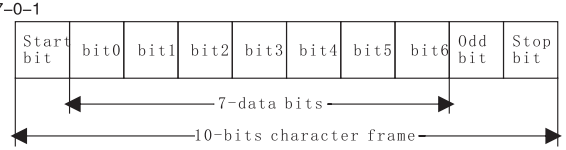
Data form: 7-N-2



Data form: 7-E-1



Data form: 7-0-1



Function code	Name	Description	Setting range	Factory setting
P9.03	Communication delay time	0 ~ 200ms	0~200	5ms

Answer delay: the interval time between the data receiving of the inverter and data sending to the upper monitor. If the answer delay is shorter than the system time, then it is subject to the system time, and if the answer delay is longer than the system, then the waiting time should be prolonged after the data processing to achieve the answer delay and then to send data to the upper monitor.

Function code	Name	Description	Setting range	Factory setting
P9.04	Communication timeout delay	0.0 (Disabled) , 0.1 ~ 100.0	0~100	0.0s

If the function code is set to 0.0s, this parameter is invalid.

If the function code is set to a valid value, when the interval time exceeds the communication overtime, the system will report communication fault (E017).

Generally, the parameter is set to invalid. If the parameter is set in a continuous communication system, the communication state can be monitored.

Function code	Name	Description	Setting range	Factory setting
P9.05	Communication error action	0:Alarm and coast to stop 1:Do not alarm and keep running 2:Do not alarm and stop at the stopping method (only for communication control mode) 3:Do not alarm and stop at stopping method (for all control modes)	0~3	1

In the abnormal situation, the inverter can act through setting communication fault processing. The selected running state of the inverter is: shield the CE fault, stop or keep running.

Function code	Name	Description	Setting range	Factory setting
P9.06	Response action	0:Response to writing 1:No response to writing	0~1	0

When this function code is set to 0, inverter have response to reading and writing command of Upper PC

When this function code is set to 1, inverter only have response reading command and no response to writing command. The communication efficiency can be improved by this way.

PAGroup vector control

Function code	Name	Description	Setting range	Factory setting
PA.00	ASR proportional gain Kp1	0 ~ 100	0 ~ 100	20
PA.01	ASR integral time Ki1	0.01 ~ 10.00s	0.01 ~ 10.00	0.50s
PA.02	ASR switching point1	0.00Hz ~ PA.05	0.00 ~ PA.05	5.00Hz
PA.03	ASR proportional gain Kp2	0 ~ 100	0 ~ 100	15
PA.04	ASR integral time Ki2	0.01 ~ 10.00s	0.01 ~ 10.00	1.00s
PA.05	ASR switching point2	PA.02 ~ P0.13 (maximum frequency)	PA.02 ~ P0.13	10.00Hz

PA.04~PA.05 are only valid for vector control and torque control and invalid for V/F control. Through PA.00~PA.05, the user can set the proportional gain Kp and integral time K of speed regulator (ASR), so as to change the speed response characteristic. ASR's structure is shown in following figure.PA.00 and PA.01 only take effect when output frequency is less than PA.02. PA.03 and PA.04 only take effect when output frequency is greater than PA.05. When output frequency is between PA.02 and PA.05, Kp and Ki are proportional to the bias between PA.02 and PA.05. For details, please refer to following figure.

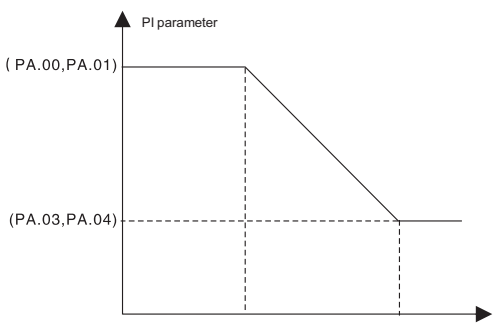


Figure 8-23 PI parameter diagram.

The system's dynamic response can be faster if the proportion gain Kp is increased; However, if Kp is too large, the system tends to oscillate. The system dynamic response can be faster if the integral time K is decreased; However, if K is too small, the system becomes overshoot and tends to oscillate.

PA.00 and PA.01 are corresponding to Kp and K at low frequency, while PA.03 and PA.04 are corresponding to Kp and K at high frequency. Please adjust these parameters according to actual situation.

Function code	Name	Description	Setting range	Factory setting
PA.06	Slip compensation rate of VC	50% ~ 200%	50~100	100%
PA.07	Torque limit	0.0 ~ 200.0% (Inverter rated current)	0.0~200.0	150.0%

Slip compensation rate of VC: is to adjust vector control's slip frequency and improve system's speed control accuracy. To adjust this parameter appropriately can restrain static error.

Torque limit: Set 100.0% corresponds to the rated output current of the inverter.

PB Group Motor parameters

Function code	Name	Description	Setting range	Factory setting
PB.00	Motor parameter autotuning	0:No action 1:Rotation autotuning 2:Static autotuning	0~2	0

0:No action: Forbidding autotuning.

1: Rotation autotuning:

Do not connect any load to the motor when performing autotuning and ensure the motor is in static state.

Input the nameplate parameters of motor (PB.02 ~PB.06) correctly before performing autotuning. Otherwise the parameters detected by autotuning will be incorrect; it may influence the performance of inverter.

Set the proper acceleration and deceleration time (P0.04 and P0.05) according to the motor inertia before performing autotuning. Otherwise it may cause over-current and over-voltage fault during autotuning. The operation process is as follow:

Set PB.00 to be 1 then press DATA/ENT, LED will display "-FUN-" and flickers. During "-FUN-" is flickering, if you want to exit autotuning, press the PRG/ESC to exit autotuning. Press the RUN to start the autotuning. LED will display "-FUN-". After a few seconds the motor will start to run. LED will display "-FUN-" and "RUN/TUNE" light will flicker. After a few minutes, LED will display "-END-". That means the autotuning is finished and return to the stop state.

During the autotuning, pressing STOP/RST can also stop autotuning. Note: Only the keypad can control the autotuning. PB.00 will restore to 0 automatically when the autotuning is finished or cancelled.

2: Static autotuning:

If it is difficult to disconnect the load, static autotuning is recommended. The operation process is the same as rotation autotuning except step c. Note: The Mutual inductance and current without load will not be detected by static autotuning, if needed the user should input suitable value according to experience.

Function code	Name	Description	Setting range	Factory setting
PB.01	E/P option	0:E model 1:P model	0~1	0

0: Applicable to constant torque load

1: Applicable to variable torque load (i.e. fans, pumps) SL series inverters provide the E/P integration function. The adaptive motor power used for constant torque load (E model) should be one grade less than that used for variable torque load (P model). It only has E model for 220V inverter.

The factory setting of inverter is E model. To change from E model to P model, procedures are as follow:

(1)Set this function code to 1

(2)Reset PB Group motor parameter

Function code	Name	Description	Setting range	Factory setting
PB.02	Motor rated power	0.4 ~ 900.0kW	0.4~900.0	to set according to model type
PB.03	Motor rated frequency	0.01Hz ~ P0.13 (maximum frequency)	0.01~P0.13	50.00Hz
PB.04	Motor rated speed	0 ~ 36000rpm	0~36000	to set according to model type
PB.05	Motor rated voltage	0 ~ 460V	0~460	to set according to model type
PB.06	Motor rated current	0.1 ~ 2000.0A	0.1~2000.0	to set according to model type

Note: In order to achieve superior performance, please set these parameters according to motor nameplate, and then perform autotuning.

SL series inverter provide parameter autotuning function. Correct parameter autotuning stems from correct setting of nameplate parameter of motor.

The power rating of inverter should match the motor. If the bias is too big, the control performances of inverter will be deteriorated distinctly.

Note:Reset PB.02 can initialize PB.03~ PB.11 automatically.

Function code	Name	Description	Setting range	Factory setting
PB. 07	Motor stator resistance	0.001 ~ 65.535Ω	0.001 ~ 65.535	to set according to model type
PB. 08	Motor rator resistance	0.001 ~ 65.535Ω	0.001 ~ 65.535	to set according to model type
PB. 09	Motor leakage inductance	0.1 ~ 6553.5m	0.1 ~ 6553.5	to set according to model type
PB. 10	Motor mutual inductance	0.1 ~ 6553.5Mh	0.1 ~ 6553.5	to set according to model type
PB. 11	Current without load	0.01 ~ 655.35A	0.01 ~ 655.35	to set according to model type

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

Note: Do not change these parameters, otherwise it may deteriorate the control performance of inverter.

9 Trouble shooting

9.1 Fault and trouble shooting

Fault Code	Fault Type	Reason	Solution
OUT1	IGBT Ph-U fault	1.Acc time is too short. 2. IGBT module fault. 3. Malfunction caused by interference. 4. Grounding is not properly.	1.Increase Acc time. 2. Ask for support. 3. Inspect external equipment and eliminate interference.
OUT2	IGBT Ph-V fault		
OUT3	IGBT Ph-W fault		
OC1	Over-current when acceleration	1. Acc time is too short. 2. The voltage of the grid is too low. 3. The power of the inverter is too low.	1. Increase Acc time. 2. Check the input power 3. Select bigger capacity inverter.
OC2	Over-current when deceleration	1. Dec time is too short. 2. The torque of the load inertia is big. 3. The power of the inverter is too low.	1. Increase Dec time. 2.Install a proper energy consumption braking components 3. Select bigger capacity inverter.
OC3	Over-current when constant speed running	1 The load transients or is abnormal. 2. The voltage of the grid is too low. 3. The power of the inverter is too low.	1. Check the load or reduce the transient of the load 2. Check the input power supply 3. Select bigger capacity inverter.
OV1	Over-voltage when acceleration	1. The input voltage is abnormal 2. Restart the running motor after sudden power loss.	1 Check the input power 2.Avoid restart-up after stopping
OV2	Over-voltage when deceleration	1. Dec time is too short. 2. The inertia of the load is big. 3.The input voltage is abnormal	1.Increase the Dec time 2. Increase the energy-consuming components 3. Check the input power
OV3	Over-voltage when constant speed running	1. The input voltage changes abnormally. 2. The inertia of the load is big.	1. Install the input reactor 2.Add proper energy-consuming components
UV	DC bus Under-voltage	1. The voltage of the grid is low	1.Check the input power supply of the grid
OL1	Motor overload	1. The voltage of the power supply is too low. 2. The motor setting rated current is incorrect. 3. The motor stall or load transients is too strong. 4. The power of the motor is too big.	1. Check the power of the supply line 2. Reset the rated current of the motor 3. Check the load and adjust the torque lift 4. Select a proper motor.
OL2	Inverter overload	1. The acceleration is too fast 2. Reset the rotating motor 3. The voltage of the power supply is too low. 4. The load is too heavy.	1. Increase the ACC time 2. Avoid the restarting after stopping. 3. Check the power of the supply line 4. Select an inverter with bigger power
SP1	Input phase loss	Phase loss or fluctuation of input R, S and T	1. Check input power 2. Check installation distribution
SP0	Output phase loss	U, V and W phase loss Input (or serious asymmetrical three phase of the load)	1. Check the output distribution 2. Check the motor and cable
OH1	Rectify overheat	1.Sudden overcurrent of the inverter 2.There is direct or indirect short circuit between output 3 phase 3.Air duct jam or fan damage 4. Ambient temperature is too high. 5.The wiring of the control panel or plug-ins are loose 6.The assistant power supply is damaged and the drive voltage is undervoltage 7.The bridge arm of the power module is switched on 8.The control panel is abnormal	1.Refer to the overcurrent solution 2. Redistribute 3. Dredge the wind channel or change the fan 4. Low the ambient temperature 5. Check and reconnect 6. Ask for service 7. Ask for service 8. Ask for service
OH2	IGBT overheat		
EF	External fault	X1: External fault input terminal take effect.	1. Check the external device input

Fault Code	Fault Type	Reason	Solution
CE	Communication fault	1.The baud rate setting is incorrect. 2.Communication fault 3. The communication is off for a long time.	1.Set proper baud rate 2. Press STOP/RST to reset and ask for help 3. Check the communication connection distribution
ITE	Current detection fault	1. The connection of the control board is not good Assistant power is bad 2. Assistant power is Damaged 3. Hoare components is broken 4. The modifying circuit is abnormal.	1. Check and reconnect 2. Ask for service 3. Ask for service 4. Ask for service
TE	Autotuning fault	1. The motor capacity does not comply with the inverter capability 2. The rated parameter of the motor does not set correctly. 3. The offset between the parameters from autotune and the standard parameter is huge 4. Autotune overtime	1.Change the inverter model 2.Set the rating parameters according to the nameplate of the motor 3.Empty the motor and identify again 4.Check the motor wiring and set the parameters
EEP	EEPROM fault	1. Error of controlling the write and read of the parameters 2. Damage to EEPROM 3. The power of the inverter is too low.	1.Press STOP/RST to reset 2. Ask for service
PIDE	PID feedback fault	1. PID feedback offline 2. PID feedback source disappear	1.Check the PID feedback signal wires 2.Check PID feedback source
BCE	Braking unit fault	1. Braking circuit fault or damage to the braking pipes 2.The external braking resistor is a little low	1.Check the braking unit and change new braking pipes 2.Increase the braking resistor
	Time reach of factory setting		

9.2 Common faults and solutions

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

No display after power on:

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

Inspect whether the three-phase rectify bridge is in good condition or not. If the rectification bridge is burst out, ask for support.

Check the CHARGE light. If the light is off, the fault is mainly in the rectify bridge or the buffer resistor. If the light is on, the fault may be lies in the switching power supply. Please ask for support.

Power supply air switch trips off when power on:

Inspect whether the input power supply is grounded or short circuit. Please solve the problem.

Inspect whether the rectify bridge has been burnt or not. If it is damaged, ask for support.

Motor doesn't move after inverter running:

Inspect if there is balanced three-phase output among U, V, W. If yes, then motor could be damaged, or mechanically locked. Please solve it.

If the output is unbalanced , the inverter drive board or the output module may be damaged, ask for support.

If there is no output, the inverter drive board or the output module may be damaged, ask for support.

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

Inspect whether the output modules are short circuit. If yes, ask for support.

Inspect whether ground fault exists. If yes, solve it.

If trip happens occasionally and the distance between motor and inverter is too far, it is recommended to install output AC reactor.

10 Maintenance

⚠WARNING

- Maintenance must be performed according to designated maintenance methods. Only qualified technicians are allowed to carry out the maintenance.
- Disconnect the power supply before maintenance. Wait for 10 minutes before maintenance.
- Do not touch the components or devices on PCB board directly. Otherwise inverter may be damaged by electrostatic.
- Check to ensure the tightness of the screws after the maintenance.

10.1 Daily maintenance

Daily maintenance should be performed for the avoidance of the fault and insurance of the normal operation and long usage. See the following table for the detailed maintenance:

Items	Instructions
Temperature/Humility	Check to ensure the ambient temperature is among 0℃~50℃ and the humility is among 20~90%.
Oil fog and dust	Check to ensure there is no oil fog, dust and condensation in the inverter.
The inverter	Check to ensure that there is abnormal heating in the inverter.
The fan	Check to ensure the fan works normally and there is no foreign objection in the inverter.
Input power supply	Check to ensure the voltage and frequency of the input power supply is in the allowed range.
The motor	Check to ensure there is no abnormal vibration, heating, noise and phase loss on the motor.

10.2 Periodic maintenance

The user has to check the inverter periodically (within half year) for the avoidance of fault and stable and long-term high-performance running. See the following table for the detailed check:

Items	Instructions	Method
The screws of the external terminal	Check the screws areloose or not	Tight the screw driver/sleeve
PCB board	Dust and dirtiness	Use dry and compressed air to clean the dirtiness completely.
The fan	The accumulative time of abnormal noise and vibration is over 20 thousand hours.	1. Clean the foreign objections 2. Chang the fan
Electrolytic capacitors	Check the color changes or not and there is peculiar smell	Change the electrolytic capacitor
Radiator	Dust and dirtiness	Use dry and compressed air to clean the dirtiness completely.
Power component	Dust and dirtiness	Use dry and compressed air to clean the dirtiness completely.

10.3 Replacement of wearing parts

Fans and electrolytic capacitors are wearing part; please change the wearing parts periodically for a long-term, safe and smooth operation. The replacement periods of the wearing parts are as follows:

- ◆ Fan: Should be changed after 20,000 hours of utilization,
- ◆ Electrolytic Capacitor: Should be changed after 30,000~40, 000 hours of utilization.

10.4 Guarantee

The SL series inverters are guaranteed for 12 months.

11 Braking resistor/unit selection

11.1 Selection reference

When all the control devices driven by the inverter need quick braking, the braking units need to consume the energy which is feedbacked to the DC bus. In Hyria SL series inverters, 0.4~7.5 KW are embedded with braking units and the inverters above 18.5kW (including 18.5KW) should select external braking units. It is necessary to select proper braking resistor according to the inverter capacity.

The utilization and selection for the inverters of 220V

The inverter capacity kw (HP)	Braking unit		Braking unit (10% of the braking torque)		
	Specification on	Number	Equivalent braking resistor	Equivalent braking power	Number
0.4 (0.5)	Embedded	1	200Ω	80W	1
0.75 (1)		1	200Ω	80W	1
1.5 (2)		1	100Ω	260W	1
2.2 (3)		1	70Ω	260W	1
4 (5)		1	40Ω	390W	1
5.5 (7.5)		1	30Ω	520W	1
7.5 (11)		1	20Ω	780W	1
11 (15)	B5-032	1	13.6Ω	2400W	1
15 (20)		1	10Ω	3000W	1
18.5 (25)	B5-042	1	8Ω	4000W	1
22 (30)		1	6.8Ω	4800W	1
30 (40)		1	5Ω	6000W	1
37 (50)		1	4Ω	9600W	1
45 (60)	B5-052	1	3.4Ω	9600W	1

The utilization and selection for the inverters of 380V

The inverter capacity kw (HP)	Braking unit		Braking unit (10% of the braking torque)		
	Specification on	Number	Equivalent braking resistor	Equivalent braking power	Number
0.4 (0.5)	B5-054	1	750Ω	80W	1
0.75 (1)		1	750Ω	80W	1
1.5 (2)		1	400Ω	260W	1
2.2 (3)		1	250Ω	260W	1
4 (5)		1	150Ω	390W	1
5.5 (7.5)		1	100Ω	520W	1
7.5 (11)		1	75Ω	780W	1
11 (15)	B5-054	1	50Ω	1040W	1
15 (20)		1	40Ω	1560W	1
18.5 (25)		1	32Ω	4800W	1
22 (30)		1	27.2Ω	4800W	1
30 (40)		1	20Ω	6000W	1
37 (45)		1	16Ω	9600W	1
45 (55)		1	13.6Ω	9600W	1
55 (75)	B5-064	1	10Ω	12000W	1
75 (100)		1	6.8Ω	12000W	1
90 (120)		1	6.8Ω	12000W	1
110 (150)		1	6Ω	20000W	1
132 (180)		1	6Ω	20000W	1
160 (215)		2	5Ω	25000W	2
185 (250)		3	4Ω	30000W	3
200 (270)		3	4Ω	30000W	3
220 (300)		3	4Ω	30000W	3
250 (340)		4	3Ω	40000W	4
280 (380)		5	3Ω	40000W	5
315 (430)		5	3Ω	40000W	5
350 (470)		5	3Ω	40000W	5
400 (540)		6	2Ω	50000W	6
500 (680)		6	2Ω	50000W	6
560 (760)		7	2Ω	50000W	7
630 (860)		7	2Ω	60000W	7

Note:

- Select the resistor and power of the braking unit according to the data provided by the company.
- The braking resistor may increase the braking torque of the inverter. The resistor power in the above table is designed on 10% braking torque. If the users need more braking torque, the braking resistor can decrease properly and the power needs to be magnified.

11.2 Connection

11.2.1 Connection of braking reistor

Figure 9-1 Hyria inverter 7.5KW and below model's connection of braking resistor, please refer to figure 9-1

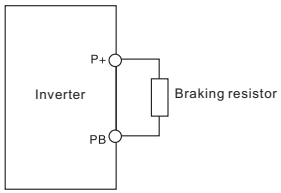


Figure 9-1 Connection of braking reistor

11.2.2 Connection of braking unit

Please refer to figure 9-2

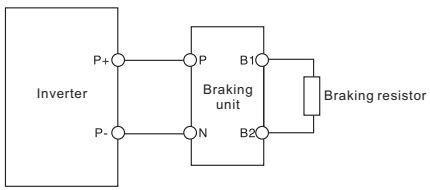


Figure 9-2 Connection of braking unit

11.2.3 Parallel connection of braking unit

Braking unit's largest suitable power is 45 KW for one unit. If the above inverter's specification need to use energy braking, two or more parallel connection of braking units are needed. Please refer to Figure 9-3

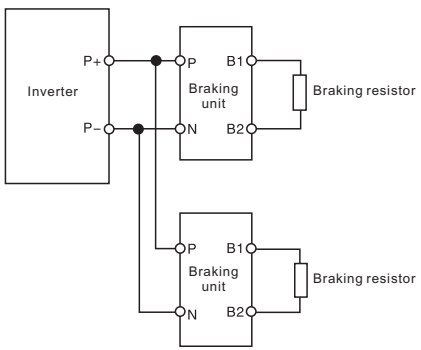


Figure 9-3 Parallel connection of braking unit