SENLAN INVERTER

INSTRUCTION MANUAL

SB60/61 Series

Sensorless Vector Control

Chengdu Hope SenLan Inverter Co., Ltd.

CONTENTS

1 General

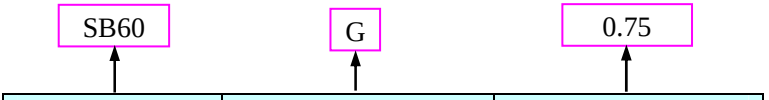
1.1 Inspection points upon delivery

Please inspect the following items after unpacking the SB60/SB61 series inverter:

- Inspect visually if the product has got any damage during shipping.
- Check the nameplate to ensure that the specifications correspond to those you ordered.
- Check to see if the accessories shipped together with the inverter are complete.

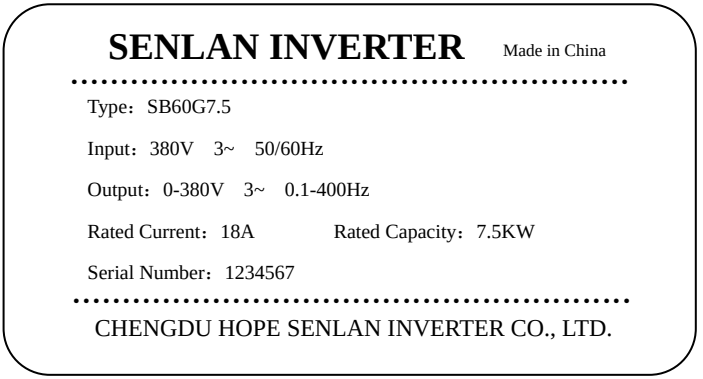
If you find anything missing, contact our local agents or distributors please.

1.2 Type description



Type	Purpose	Inverter capacity
SB60(SB61)	G: General-purpose P: Pumps & Fans	SB60: 0.4 ~ 15KW SB61: 15 ~ 400KW

1.3 Nameplate description



1.4 Product warranty

This product is guaranteed against defects in workmanship for one year from the purchase date or 18 months from the manufacturing date indicated on the nameplate. However, for the following failures or damages, the repair cost should be borne by the customer even within the warranty period.

- Failure or damage caused by incorrect operation or by unauthorized repairs or modifications.
- Failure or damage due to using the inverter beyond the range specified on the nameplate.
- Failure or damage caused by the inverter falling or an accident during transportation after the purchase.

1.5 Safety precautions

Read the following items before installing, wiring, running and maintaining the product, and always bear them in your mind.

Precautions in this manual fall into two types:

 **Danger** : indicates that errors in operation may lead to death or heavy injury.

 **Caution** : indicates that errors in operation may lead to medium or light injury to people or damage to equipment.

(1) Installation

 **Danger**
• **Install the inverter on a nonflammable object(such as metals). Otherwise, there may be a risk of fire.** • **Do not install it in an environment with explosive gas. That may cause explosion.** • **Do not install or run the inverter if it is damaged or any component is missing. Otherwise, accident may occur.**

 **Caution**
• **Install the inverter firmly on an object capable of bearing its weight. Otherwise, the falling of the inverter may cause injury or damage.** • **Do not drop any metal materials in the inverter. Otherwise, accident may occur.**

(2) Wiring

Danger

- **Connect a proper circuit-breaker on the input power side of the inverter. Otherwise, accident may occur, injuring people or damaging objects.**
- **The PE terminal of the inverter must be grounded securely. Otherwise, electric shock or fire may occur.**
- **The wiring must be done by a qualified electrician after the power is cut off and the high-voltage indicator extinguishes.**
- **Never connect the output terminals(U, V, W) to the input power. That will destroy the inverter.**

Caution

- **The input power must conform to the specifications on the nameplate. Otherwise, it may damage the inverter.**

(3) Operation

Danger

- **The power can be switched on only after the wiring is completed and the cover board is attached. Otherwise, there may be a risk of electric shock.**
- **Do not touch inverter terminals when electrical power is going to the inverter even if the motor is stopped. Otherwise, there may be a risk of electric shock.**
- **Do not approach the load if the 'Restart after momentary power failure' function is selected. The sudden restart of the inverter may cause electric shock or injury.**

Caution

- **The running inverter can only be stopped by the panel STOP key or external terminals. Directly cutting off the main power of the running inverter is prohibited. That may damage the inverter.**
- **Do not touch the braking resistor when the inverter is running. Otherwise, there may be a risk of electric shock or burn.**

(4) Maintenance

Danger

- **10 minutes after power-off, use a multimeter measuring the DC filter capacitor voltage. Only when this voltage is less than 36V, can the inverter be inspected and repaired. Otherwise, there may be a risk of electric shock or injury.**
- **Only professional person can maintain the inverter. Otherwise, electric shock or injury may occur.**
- **Do not leave any electricity conductor such as metals etc. in the inverter after repairing it. Otherwise, the inverter may be damaged.**

Caution

- **While charging the inverter that has long not been used, it must be conducted by slowly increasing the input voltage to the rated value through a voltage regulator. Otherwise, accident may occur.**

(5) Disposal

Caution

- **When the product is no longer useful, dispose it as an industrial waste. Otherwise, accident may occur.**

2 Installation and Wiring

2.1 Installation

2.1.1 Ambient condition

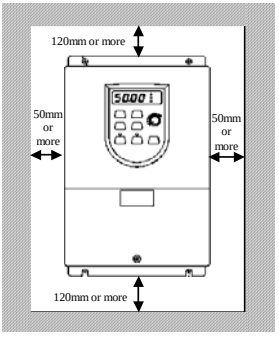
–10~40℃, with humidity less than 90%. If temperature is over 40℃, derate the inverter by 5% for every 1℃ increase.

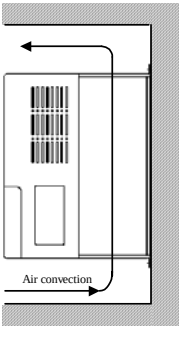
2.1.2 Installation site

- No corrosive, flammable or explosive gases or liquids.
- No dust, floating fibers or metallic particles.
- The support is firm and without vibration.
- No direct sunlight.
- No electromagnetic interference.

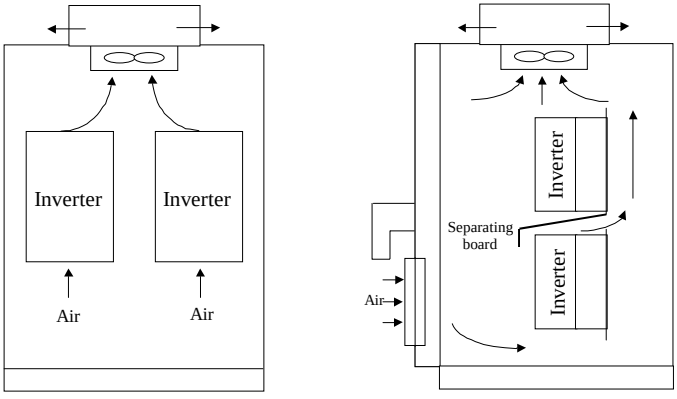
2.1.3 Installation space and heat dissipation

To ensure good cooling effect, the inverter must be installed vertically and adequate space maintained around it, as shown below:





When two or more inverters are installed in one cabinet, horizontal arrangement is recommended to minimize the mutual thermal influence. If the inverters must be installed in a vertical row, a separating board should be provided to prevent the heat from the lower inverter from affecting the upper one.



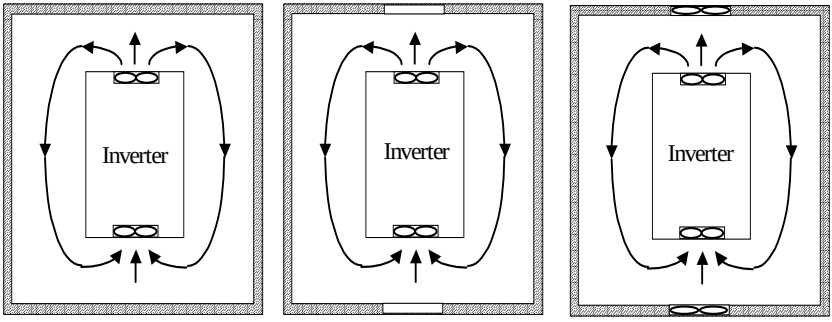
(a) Horizontal arrangement (b) Vertical arrangement

Methods of installing multiple inverters

If the cabinet has exhaust fans on its top, the air flow of the fans must be greater than the total out flow of all individual inverters. For cabinets without exhaust fans, the top should be left open if possible, if not possible, the area of the air vents(inlets & outlets) on the top and bottom of the cabinet must be greater than the total area of the up & down surfaces of individual inverters, and the wind resistance at air vents should be as small as possible.

If the inverter is installed on the wall of a control room, the room should not be enclosed and have good ventilation.

Several typical incorrect installation methods are shown as follows:



A
Enclosed cabinet

B
Air vents too small

C
Exhaust fan capacity too small

Since the cooling fan is vulnerable to damage, a temperature switch is used to control it. If set F415=0, when the temperature inside the inverter is higher than the set value, the cooling fan will run, otherwise the cooling fan will stop.

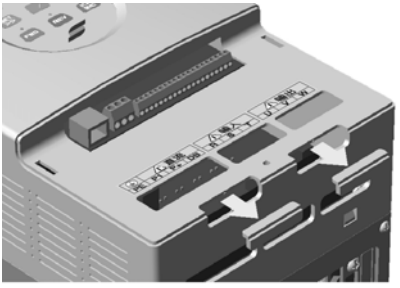
Refer to the following table for the out flow and outlet size of various inverters.

Type		Out flow (m^3/min)	Outlet size (m^2)
SB60	0.75-4KW	1.5	0.023
	5.5-7.5KW	3	0.033
	11-15KW	4	0.051
SB61	15KW	5	0.073
	18.5 ~ 22KW	5	0.073
	30KW	10	0.076
	37 ~ 45KW	10	0.117
	55 ~ 75KW	12	0.145
	90 ~ 110KW	16	0.166
	132KW	16	0.21
	160 ~ 200KW	24	0.238
	250KW	24	0.3
	315 ~ 400KW	30	0.365

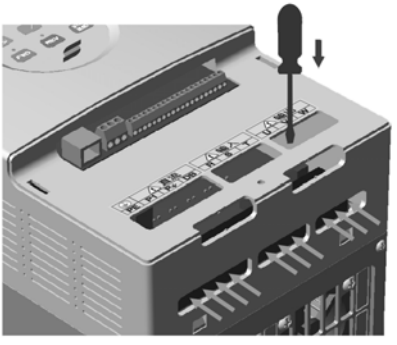
2.2 Removal of front cover (SB60)

Loosen the screw of the front cover

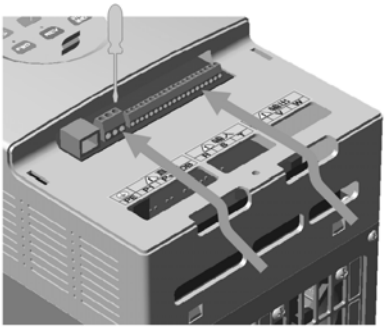
Draw out the front cover



Remove the two blocks



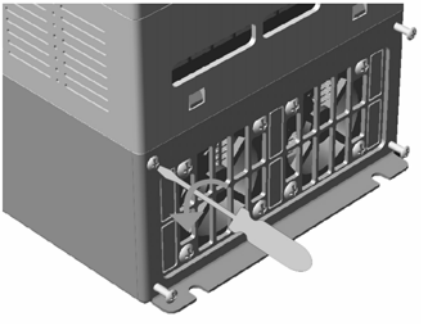
Main circuit wiring



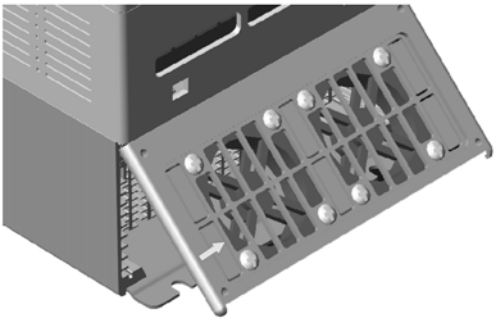
Control circuit wiring

2.3 Removal of cooling fan

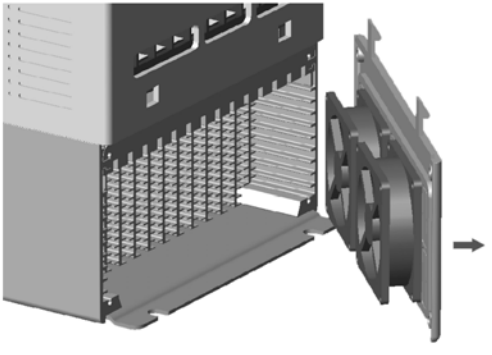
5.5KW or more



Loosen the screws of the fan cover

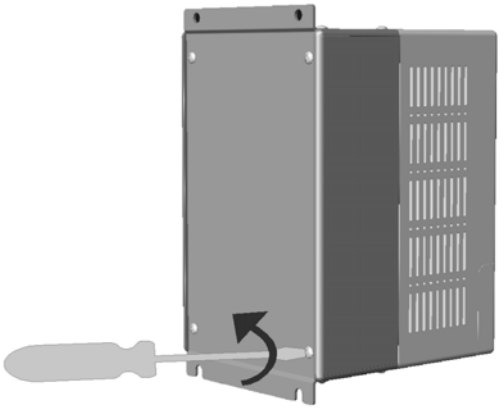


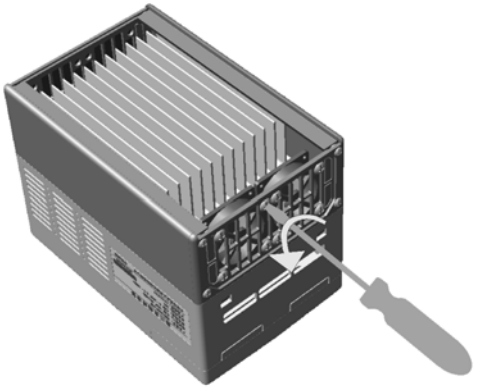
Turn the fan cover



Remove the fan cover and replace the fan

4KW or less

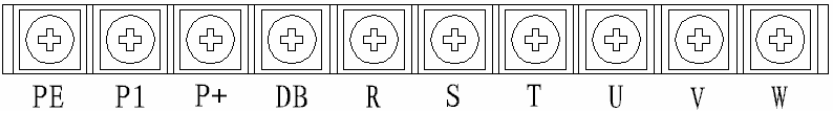




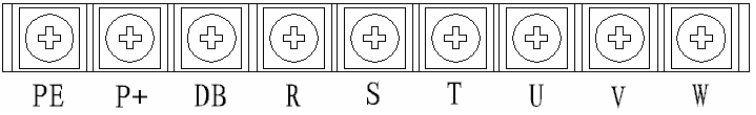
2.4 Wiring of inverter

2.4.1 Main circuit terminals

- SB60 Series

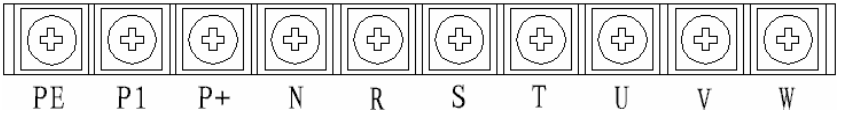


5.5-15KW

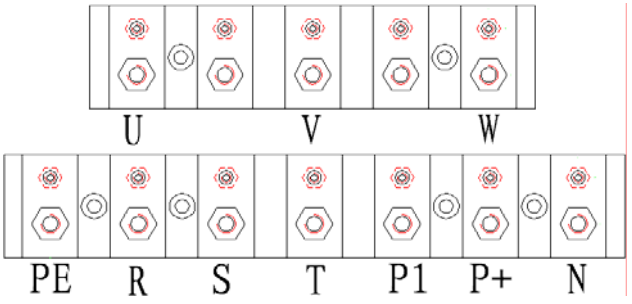


0.75- 4KW

- SB61 Series



15-30KW



37KW or more

Table 2-1 Functions of main circuit terminals

Terminal	Function
R, S, T	Connect 3-phase power supply
U, V, W	Connect a 3-phase motor
PE	Grounding terminal
P+, P_1	Connect a DC reactor
P+, DB	Connect an external braking resister

（1）Main power supply terminals [R, S, T]

- The power supply is connected to the R, S & T terminals via a circuit breaker or a leakage breaker(MCCB), the rated current of which is 1.5~2 times that of the inverter. There is no need to match the phase when connecting.
- It is recommended that the main power supply is fed to the inverter through a magnetic contactor to prevent further problems or damage to the inverter in the event of a failure.

（2）Inverter output terminals [U, V, W]

- Connect a 3-phase motor to the inverter output terminals U, V & W in correct phase order. If the run command does not match the rotary direction of the motor, interchange any two of the U, V, W connections.
- Do not connect a power factor correction capacitor or a surge absorber to the output side of the inverter.
- If the wiring between the inverter and motor is long, the large distribution capacitance between wires may lead to abnormal operation of the inverter or even trip. To avoid this problem, connect a filter or a magnetic ring on the output side and lower the

carrier frequency appropriately.

Refer to the following table for the relationship between wiring length and carrier frequency.

Wiring length	<50m	<100m	⩾100m
Carrier frequency	⩽15KHz	⩽10 KHz	⩽6KHz
F407	⩽7	⩽5	⩽2

- To suppress the interference generated by the inverter with other devices, it is recommended to connect a special noise filter on the output side or place the output cables (U, V, W) in a grounded metal conduit, and separate them from the control signal lines.

（3）DC reactor terminals [P1, P+]

- These terminals are used to connect a DC reactor which is selected according to the inverter capacity.
- The two terminals are connected by a shorting-bar when shipped from the factory, so remove it before connecting the DC reactor.
- If DC reactor is not used, P1 and P+ must be shorted.

（4）External braking resistor terminals [P+, DB]

- These terminals are used to connect an external braking resistor(option).
- The connecting wire should be of twisted pair type and less than 5 meters in length.
- Never short P+ and DB. That will destroy the inverter.

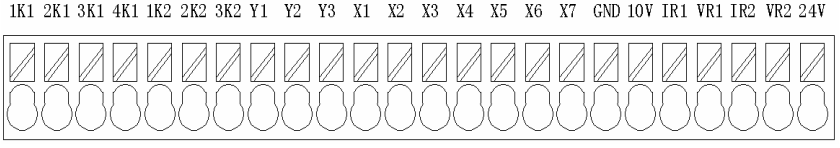
（5）Grounding terminal [PE]

- For safety purpose and to reduce noise, prevent electric shock and fire, this terminal must be securely grounded with the grounding resistance less than 10Ω.

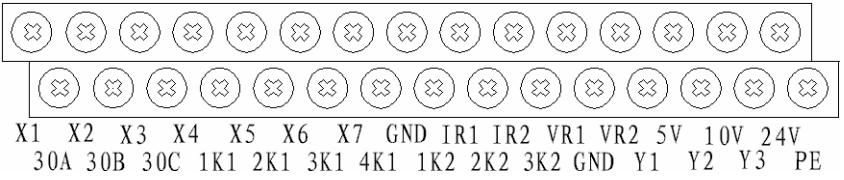
■ When connecting two or more inverters to the ground, be careful not to make the grounding wires form a closed loop.

2.4.2 Control circuit terminals

- SB60 Series



- SB61 Series



（1）Fault output terminals [30A, 30B, 30C]

When failures occur in the inverter, normally-open contacts 30A & 30B close, while normally-closed contacts 30B & 30C open. These terminals can withstand AC 220V/1A. Refer to F507 for related functions.

（2）Multi-function output terminals [Y1, Y2, Y3]

These are open collector output terminals, can withstand DC 24V/50mA. Refer to F508, F509 & F510.

（3）Multi-function input terminals [X1~X7]

Refer to F500 ~ F506.

（4）External analog signal terminals [VR1, IR1, VR2, IR2]
Refer to functions F001~ F003 and function groups F3 & F8.

（5）External power supply terminals [24V, 10V, GND]
Sensor power supply: 24V, 100mA .
Control power supply: 10V, 24mA .
Ground of the control power supply: GND.

（6）Relay control terminals [1K1、2K1、3K1、4K1、1K2、2K2、3K2]
These are control signal terminals for controlling two or more motors simultaneously, can withstand DC 24V/50mA. Refer to F824.

Short NK1 and 24V, #N(N=1~4) motor is driven by the inverter.

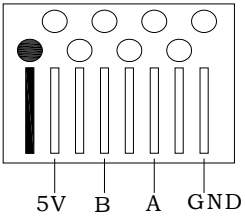
Short NK2 and 24V, #N(N=1~3) motor is driven by the commercial power.

Since the capacity of internal DC 24V power of the inverter is too small to drive multiple motors, if you want to do so, please use an external 24V power or our company’s expansion board SK-1.

（7）Attention points on connection of control circuit terminals
As the analog input signals are weak electric signals and susceptive to the external interference, shielded cables must be used for the wiring and securely connected to the ground.

Separate the control cable from the power supply cable (or other power cables). Do not run them in parallel. They must cross each other, preferably at right angles. If they are arranged in parallel, severe interference will result to affect the normal operation of the inverter.

2.4.3 Communication terminals



- The inverter is connected to the computer(or external panel) via a RS485 port. If to external panel, directly connect the RS485 port to it with a cable; if to computer, must use a RS485-RS232 converter.

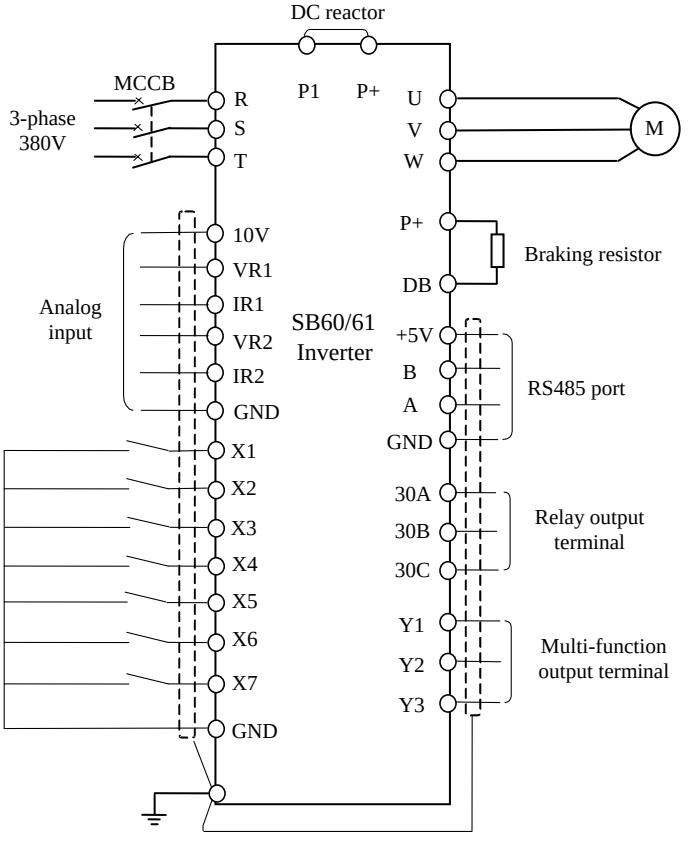
  If you need to control multiple inverters with one computer, please assign a unique address(F901) to each inverter in order that the computer can identify them.

2.4.4 Terminal wiring specifications

Type	Main circuit wiring (mm^2)	Control circuit wiring (mm^2)
SB60G0.75	2.5	⩾0.5
SB60G1.5/SB60P1.5	2.5	⩾0.5
SB60G2.2/SB60P2.2	4	⩾0.5
SB60G4/SB60P4	4	⩾0.5
SB60G5.5/SB60P5.5	6	⩾0.5
SB60G7.5/SB60P7.5	6	⩾0.5
SB60G11/SB60P11	8	⩾0.5
SB60P15	8	⩾0.5
SB61G15	8	0.5
SB61G18.5/SB61P18.5	16	0.5
SB61G22/SB61P22	16	0.5
SB61G30/SB61P30	25	0.5
SB61G37/SB61P37	25	0.5
SB61G45/SB61P45	35	0.5
SB61G55/SB61P55	35	0.5
SB61G75/SB61P75	60	0.5
SB61G90/SB61P90	60	0.5
SB61110G/SB61P110	90	0.5
SB61G132/SB61P132	90	0.5
SB61G160/SB61P160	120	0.5
SB61G200/SB61P200	180	0.5
SB61G250/SB61P250	240	0.5
SB61G315/SB61P315	270	0.5
SB61P375	350	0.5
SB61P400	380	0.5

2.5 Wiring diagram

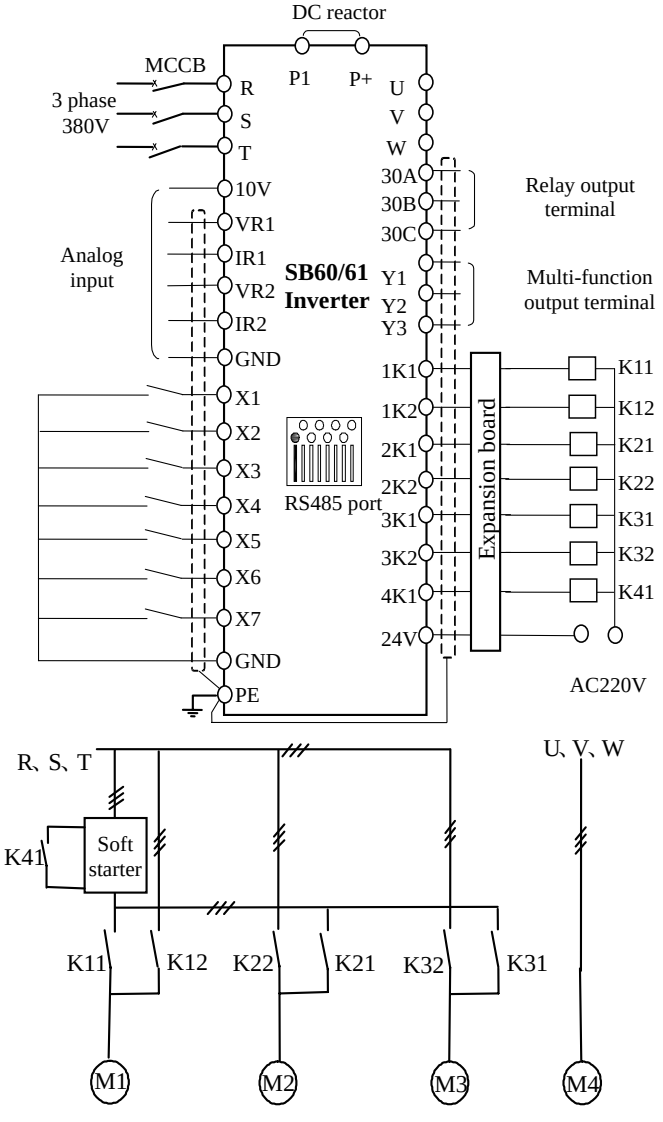
2.5.1 Basic wiring diagram



Note:

1. **The P1-P+ terminals are shorted by a bar when shipped from the factory. Before installing the DC reactor, remove the bar.**
2. **R, S, T, U, V, W, P1, P+, DB & PE are main circuit terminals, while the rest are control circuit terminals.**

2.5.2 Multi-motor wiring diagram (soft starter + four motors)



The figure above illustrates the wiring method for “4 motors + soft starter” mode(F824=5) under process PID control(F800=1).

The starting procedures are as follows:

(1) The inverter starts M4 motor;

(2) If feedback is greater than the target value when motor M4 reaches 50Hz, the soft starter will start motor M1, and M4 remains running;

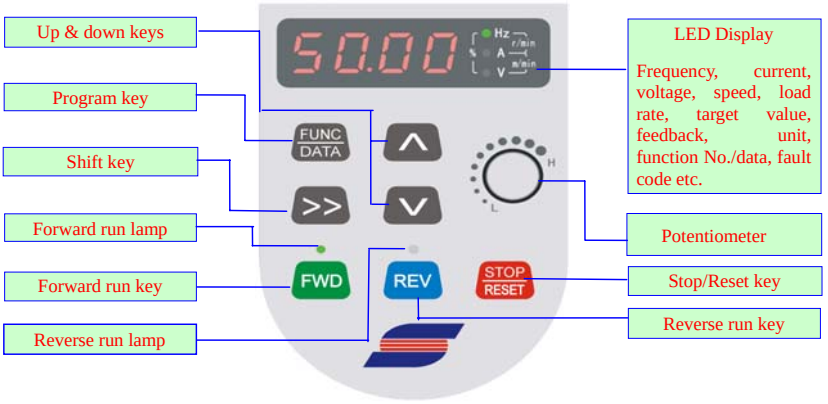
(3) If feedback is still greater than the target value, the softer will start motor M2, and M1 and M4 remain running;

(4) And so on, until feedback equals the target value.

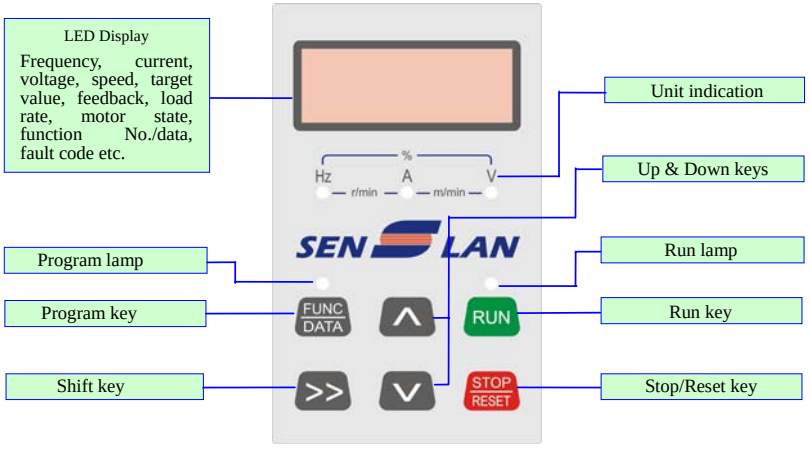
3 Operation Description

3.1 Appearance of operation panel

SB60 series:



SB61 series:



3.2 Key definitions

Key	Function
	Reading out function No. & data; Writing in data
	Switching display status; Switching between function group and function No.; Selecting the data digit to be changed
	Increasing function number or data
	Decreasing function number or data
	Forward run command
	Reverse run command
	Run command
	Stop command Fault reset command Err5 reset command

3.3 Display of alarm information

Error code	Description	Error code	Description
corr	No fault record	**Err1**	Communication error 1
dbr	Braking resistor overheating	**Err2**	Communication error 2
dd	DC braking	**Err3**	Communication error 3
dP	Phase failure	**Err4**	Illegal operation

FErr	Panel setting error	**Err5**	Save failed
FL	Short circuit, grounding fault	**oH**	Overheating
Lu	Undervoltage	**oL**	Overload
oc	Overcurrent	**oLP**	Overload pre-alarm
ou	Overvoltage	**oLE**	External alarm

3.4 Control mode

SB60/61 inverter has four control modes: V/F open-loop control, V/F closed-loop control, speed sensor-less vector control and PG speed sensor vector control. Refer to F013.

3.5 Frequency setting mode

- F002=0: Set F000 with FUNC/DATA key.
- F002=0: Adjust frequency with ∧ or ∨ key.
- F002=0: Set frequency with computer(external panel).
- F002=1: Adjust frequency with the panel potentiometer.
- F002=2 or 3: Set any two of external terminals as UP and DOWN terminals respectively. Short UP and GND, frequency increases; short DOWN and GND, frequency decreases.

3.6 LED display status

3.6.1 Stop status

When the inverter stops, the LED monitor displays related parameters and the run lamp is off.

3.6.2 Run status

Upon receiving correct run command, the inverter runs, the LED monitor displays related parameters and the forward(or reverse) run lamp is on.

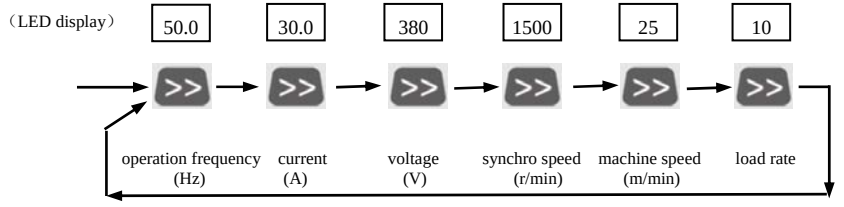
3.6.3 Fault status

With the inverter in stop state, if there is any fault, the LED monitor will display the corresponding fault code(see 3.3). After eliminating the fault, reset the inverter with STOP/RESET key.

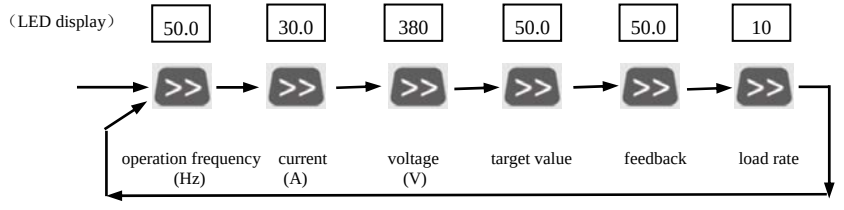
With the inverter in run state, if there is any fault, the inverter immediately stops, the run lamp is off and the LED monitor will display the corresponding fault code(see 3.3). After eliminating the fault, reset the inverter with STOP/RESET key.

3.7 Operation of operation panel

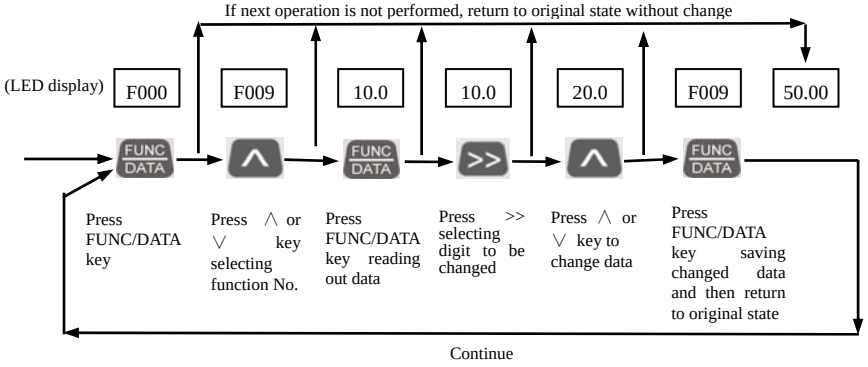
3.7.1 Switching display information in running（F800=0）



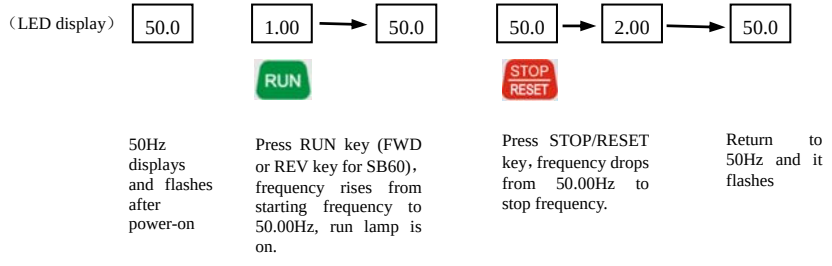
3.7.2 Switching display information in running（F800=1）



3.7.3 Parameter setting（Set F009 = 20S）



3.7.4 Run operation



3.8 Operation of external terminals

3.8.1 Run operation

Set any three of external terminals as forward(FWD), reverse(REV) and 3-wire operation EF inputs respectively, and set F004=1:

① If F006=0，short FWD and GND, inverter will run forward; short REV and GND, inverter will run reverse; short or open FWD, REV and GND simultaneously, inverter will stop.

② If F006=1，short FWD and GND, inverter will run forward;

short FWD, REV and GND simultaneously, inverter will run reverse; short REV and GND or open FWD, REV and GND simultaneously, inverter will stop.

③ If F006=2，short EF and GND, short FWD and GND and then open them. Then short REV and GND, inverter will run forward; open REV and GND, inverter will run reverse; open EF and GND, inverter will stop.

3.8.2 JOG run operation

Set an external terminal as JOG input, set F004=1, and set the functions F604, F605 and F606. Short JOG and GND, inverter will run in JOG mode; open JOG and GND, inverter will stop.

3.9 User password function

To prevent illegal change of the parameters, SB60/61 inverter allows the user to set a password.

3.9.1 Setting user password

Enter Fb00, input your password and save it.

If a password has been set, you can change the parameters only after you input the right password in Fb00.

It is recommended to set the user password following adjustment of the inverter.

Do not lose your password. If you do, contact the supplier.

3.9.2 Canceling user password

Enter Fb00, input the right password; reenter Fb00, set Fb00=0, and save.

3.10 Factory special function

Functions FB02~FB06 are used by the factory only. After inputting the right factory password, you will have access to specific information about the product, such as inverter type, operation time, software version and rated current etc.

4 Specifications

4.1 Standard specifications

SB60G Series

SB60G		0.75	1.5	2.2	4	5.5	7.5	11
Motor capacity (KW)		0.75	1.5	2.2	4	5.5	7.5	11
Output	Rated capacity (KVA)	1.6	2.4	3.6	6.4	8.5	12	16
	Rated current (A)	2.5	3.7	5.5	9.7	13	18	24
	Voltage (V)	0 ~ 380V 0 ~ 400 Hz						
	Overload capacity	150% 1 minute						
Power supply		3-phase 380V 50/60Hz						

SB60P Series

SB60P		1.5	2.2	4	5.5	7.5	11	15
Motor capacity (KW)		1.5	2.2	4	5.5	7.5	11	15
Output	2.4	2.4	3.6	6.4	8.5	12	16	20
	3.7	3.7	5.5	9.7	13	18	24	30
	Voltage (V)	0 ~ 380V 0 ~ 400 Hz						
	Overload capacity	120% 1 minute						
Power supply		3-phase 380V 50/60Hz						

SB61G Series

SB61G		15	18.5	22	30	37	45	55	75
		90	110	132	160	200	250	315	
Motor capacity (KW)		15	18.5	22	30	37	45	55	75
		90	110	132	160	200	250	315	
Output	Rated capacity	20	25	30	40	49	60	74	99
	(KVA)	116	138	167	200	248	310	389	
	Rated current	30	38	45	60	75	91	112	150
	(A)	176	210	253	304	377	475	590	
	Voltage (V)	0 ~ 380V 0 ~ 400 Hz							
	Overload capacity	150% 1 minute							
Power supply		3-phase 380V 50/60Hz							

SB61P Series

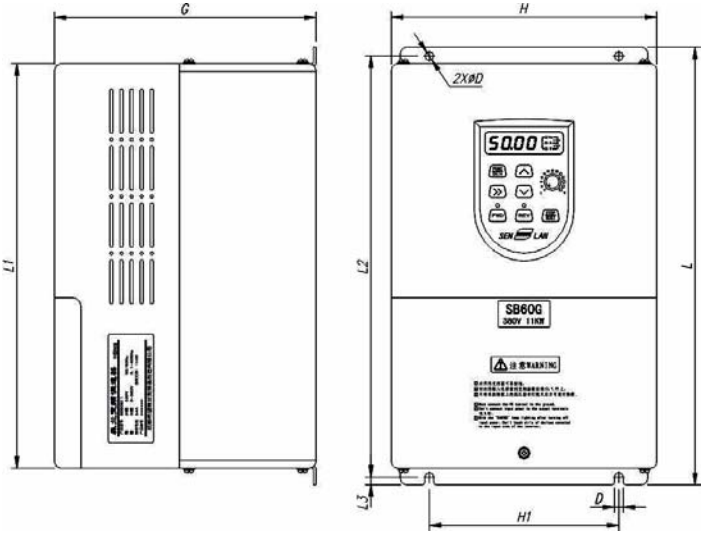
SB61P		18.5	22	30	37	45	55	75	90
		110	132	160	200	250	315	375	400
Motor capacity (KW)		18.5	22	30	37	45	55	75	90
		110	132	160	200	250	315	375	400
Output	Rated capacity	25	30	40	49	60	74	99	116
	(KVA)	138	167	200	248	310	389	460	500
	Rated current	38	45	60	75	91	112	150	176
	(A)	210	253	304	377	475	590	705	760
	Voltage (V)	0 ~ 380V 0 ~ 400 Hz							
	Overload capacity	120% 1 minute							
Power supply		3-phase 380V 50/60Hz							

4.2 Common specifications

Control	Modulation mode	Field-oriented vector control PWM
	Control mode	V/F control mode: open-loop and closed-loop Vector control mode: speed sensor-less and PG speed sensor
	V/F curve	Linear or random V/F curve, up to six step V/F curves can be set by users
	Frequency setting mode	Four main and four auxiliary setting modes. Auxiliary settings are superimposed on the main ones; Analog input (VR1, VR2, IR1 & IR2); Computer setting(via RS485).
	Acceleration/ deceleration control	Eight acceleration/deceleration times，0 ~ 3600S，linear or S-curve mode
	Pattern operation mode	Five modes, fifteen step frequencies
	Additional functions	Upper-limit frequency, lower-limit frequency, jump frequency, current limit, stall control, auto reset, auto energy-saving operation, auto voltage regulation, auto-restart after momentary power failure
Run	Command setting	Panel setting; External terminal setting(X1~X7); Computer setting(via RS485)
	Input signal	Multi-function external terminal inputs X1 ~ X7
	Output signal	Multi-function output (Y1 ~ Y3，DC 24V/50mA); Relay output(30A, 30B & 30C, AC 240V/1A)
Braking function		SB60: External braking resistor SB61: External braking unit and braking resistor
Protection function		Overcurrent, short circuit, grounding fault, overvoltage, undervoltage, overload, overheating, phase failure, external alarm
Ambient	Service site	Indoor and below 1000m altitude
	Temperature/ humidity	-10 ~ +40℃/20 ~ 90% RH, no condensation
	Vibration	Less than 5.9m/s² (0.6G)
	Storage temperature	-20 ~ +60℃
Cooling method		Forced air cooling
Protection degree		IP20

4.3 Outline dimensions

- SB60 Series



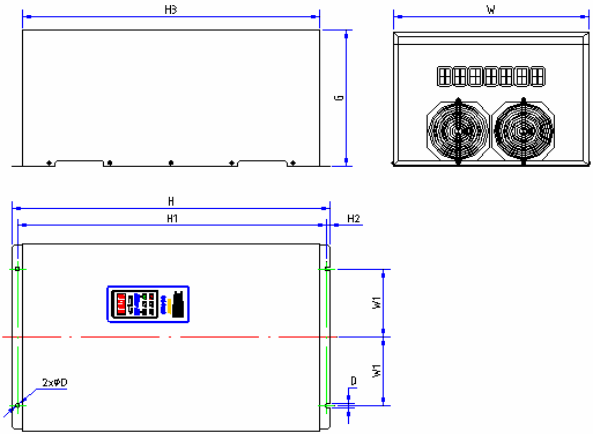
SB60G

	L	L1	L2	L3	H	H1	G	D
0.75 ~ 4KW	231	210	220	5.5	138	100	158	5.6
5.5 ~ 7.5KW	291	270	280	5.5	182	130	181	5.6
11KW	346	320	333	6	210	150	207	7

SB60P

	L	L1	L2	L3	H	H1	G	D
1.5 ~ 4KW	231	210	220	5.5	138	100	157	5.6
5.5 ~ 7.5KW	291	270	280	5.5	182	130	181	5.6
11KW	346	320	333	6	210	150	205	7
15KW	346	320	333	6	210	150	230	7

- SB61 Series



	D	G	H	H1	H2	H3	W	W1
15KW	7	215	426	414	6	401	270	90
18.5~22KW	7	250	462	450	6	431	290	100
30KW	9	255	516	500	8	482	316	100
37 ~ 45KW	9	288	580	560	8	530	370	125
55KW	10	300	610	590	8	560	380	125
75KW	10	315	745	725	8	695	460	150
90~110KW	10	345	780	760	8	730	480	175
132KW	12	360	810	788	10	760	520	175
160~200KW	14	370	980	955	10	920	590	175
250KW	17	395	1100	1068	15	1030	720	225
315~400KW	17	395	1150	1118	15	1080	800	250

Note: SB61G (15~315KW)
SB61P (18.5~400KW)

5 Table of Functions

5.1 Description

5.1.1 In the "**Change**" column of the table:

"○" indicates the function is changeable in running.

"×" indicates the function is unchangeable in running.

"△" indicates the function is unchangeable in running and stop.

5.1.2 In the "**Default**" column of the table

"*" indicates the function is not controlled by Data Protection(F400).

5.1.3 How to change functions

There are more than 240 functions designed for SB60/61 series inverter, which are organized in twelve function groups.

After entering in the function number display screen, you can change the data of a function as follows:

(1) Press >> key switching between function group or function number;

(2) Press ∧ or ∨ key selecting the desired function group or function number;

(3) Press **FUNC/DATA** key to read out the data;

(4) Press ∧ or ∨ key to change the data;

(5) Press **FUNC/DATA** key to save the changed data.

5.2 Table of functions

Function group	No.	Function name	Setting range	Change	Default
F0	F000	Frequency setting	0.10-400.0Hz	○	50.00*
	F001	Frequency setting mode	0. Main and auxiliary setting 1. Main, auxiliary and X4/X5 terminals setting. Δ F is saved. 2. Main, auxiliary and X4/X5 terminals setting. Δ F is not saved 3. Main, auxiliary and X4/X5 terminals setting. Δ F = 0 when power is off. 4. After power-on, frequency is set by F000. Frequency changed by ∧ / ∨ keys is not saved. Only the frequency set by F000 can be changed. 5. Computer setting	×	0
	F002	Main setting signal	0. F000 1. Panel potentiometer 2. VR1 3. IR1	×	0
	F003	Auxiliary setting signal	0. VR1 1. IR1 2. VR2 3. IR2	×	0

Function group	No.	Function name	Setting range	Change	Default
	F004	Command setting mode	0.Panel setting 1.External terminal setting 2.Computer setting	×	0
	F005	STOP key selection	0. Stop invalid, fault reset 1 1. Stop invalid, fault reset 2 2. Stop valid, fault reset 1 3. Stop valid, fault reset 2 4. Emergency stop valid, fault reset 1 5. Emergency stop valid, fault reset 2	×	0
	F006	Self-lock control	0. 2-wire control 1 1. 2-wire control 2 2. Self-lock control	×	0
	F007	Motor stop mode	0. Slowdown stop 1. Coast stop 2. Slowdown top+braking	○	0
	F008	Maximum frequency	50.00-400 Hz	×	50.00
	F009	Accel time 1	0.1-3600S	○	20.0
	F010	Decel time 1	0.1-3600S	○	20.0
	F011	Electronic thermal protection	0.All inactive 1.Electronic thermal protection inactive, overload pre-alarm active 2.All active	○	0
	F012	Electronic thermal protection level	25-105%	○	100

Function group	No.	Function name	Setting range	Change	Default
	F013	Motor control mode	0.V/F open-loop control 1.V/F closed-loop control 2.Speed sensor-less vector control 3.PG speed sensor vector control	×	0
F1	F100	V/F curve	0. Linear V/F 1. Random V/F	×	0
	F101	Base frequency	10.00-400 Hz	×	50.00
	F102	Maximum output voltage	220-380V	×	380
	F103	Torque boost	0-50	×	10
	F104	VF_1 frequency	0.00，5.00-400.0 Hz	×	8.00
	F105	VF_1 voltage	0-380V	×	9
	F106	VF_2 frequency	0.00，5.00-400.0 Hz	×	16.00
	F107	VF_2 voltage	0-380V	×	37
	F108	VF_3 frequency	0.00，5.00-400.0 Hz	×	24.00
	F109	VF_3 voltage	0-380V	×	84
	F110	VF_4 frequency	0.00，5.00-400.0 Hz	×	32.00
	F111	VF_4 voltage	0-380V	×	151
	F112	VF_5 frequency	0.00，5.00-400.0 Hz	×	40.00
	F113	VF_5 voltage	0-380V	×	246
	F114	Slip compensation	0.00-10.00 Hz	○	0.00
	F115	Auto energy-saving mode	0. Disabled 1. Enabled	×	0

Function group	No.	Function name	Setting range	Change	Default
	F116	Auto-restart after momentary power failure	0.Inactive 1.Restart from 0Hz 2.Restart from tracking speed	×	0
	F117	Power recovery tracking time	0.3-5.0S	×	0.5
	F118	Overvoltage stall prevention	0.Stall prevention and discharge are invalid 1.Stall prevention valid, discharge invalid 2.Stall prevention and discharge are valid 3.Stall prevention invalid, discharge valid	×	1
	F119	Overcurrent stall prevention	0. Invalid 1. Valid	×	1
	F120	Overcurrent stall level	G: 20-150 P: 20-120	×	110
	F121	Speed-PID proportional gain	0.0-1000	×	1.0
	F122	Speed-PID integral time	0.1-100.0S	×	0.1
	F123	Speed-PID differential time	0.0-10.0S	×	0.1
	F124	Speed-PID differential gain	0.0-50.0	×	5.0
	F125	Speed-PID low-pass filter	0.00-10.00S	×	0.01
F2	F200	Motor parameter test	0. Manual test 1. Auto test	×	0
	F201	Motor rated frequency	20.00-400Hz	×	50.00
	F202	Motor rated speed	50.0-2400.0（ × 10）	×	144.0

Function group	No.	Function name	Setting range	Change	Default
	F203	Motor rated voltage	220-380V	×	380
	F204	Motor rated current		×	Ie
	F205	Motor no-load current		×	In
	F206	Motor constant R	1-5000	×	2000
	F207	Motor constant X	1-5000	×	1000
	F208	Driving torque	G: 20-200 P: 20-150	○	100
	F209	Braking torque	G: 0-150 P: 0-120	○	100
	F210	ASR proportional coefficient	0.00-2.00	×	1.00
	F211	ASR integral coefficient	0.00-2.00	×	1.00
F3	F300	Analog when main setting is zero	0.00-10.00	×	0.00
	F301	Analog when main setting is 100%	0.00-10.00	×	10.00
	F302	Frequency when main setting is zero	0.00-400.0 Hz	×	0.00
	F303	Analog when auxiliary setting is negative max.	0.00-10.00	×	0.00

Function group	No.	Function name	Setting range	Change	Default
	F304	Analog when auxiliary setting is positive max.	0.00-10.00	×	10.00
	F305	Analog when auxiliary setting is zero	0.00-10.00	×	5.00
	F306	Auxiliary setting gain	0.00-100.0	×	0.00
	F307	Auxiliary setting frequency polarity	0. Positive polarity 1. Negative polarity	×	0
	F308	VR1 filtering time constant	0.0-10.0S	○	1.0
	F309	IR1 filtering time constant	0.0-10.0S	○	1.0
	F310	VR2 filtering time constant	0.0-10.0S	○	1.0
	F311	IR2 filtering time constant	0.0-10.0S	○	1.0
F4	F400	Data protection	0. Disabled 1. Enabled	○	0*
	F401	Data initialization	0. Disabled 1. Enabled	○	0*
	F402	Direction of rotation	0. Forward or Reverse 1. Forward only 2. Reverse only	×	0
	F403	DC braking starting frequency	0.00-60.00 Hz	○	5.00

Function group	No.	Function name	Setting range	Change	Default
	F404	DC braking amount	0-100	○	25
	F405	DC braking time	0.1-20.0S	○	5.0
	F406	Braking resistor overheating	0. Invalid 1. Overheating pre-alarm	○	0
	F407	Carrier frequency	G: 0-7 P: 0-5	×	0
	F408	Auto-reset times	0-7	○	0
	F409	Auto-reset interval	1.0-20.0S	○	5.0
	F410	Undervoltage protection value	350-450V	○	400
	F411	Phase failure protection	0. Disabled 1. Enabled	×	1
	F412	AVR function	0. Disabled 1. Enabled	×	1
	F413	Accel/decel selection	0. Linear 1. S-curve	×	0
	F414	S-curve selection	0-4	×	0
	F415	Cooling fan control	0. Auto run 1. Permanent run	○	0
	F416	Encoder Input phase number	0. Single-phase 1. 2-phase	×	1
	F417	Encoder pulse number	1-4096	×	1024
F5	F500	X1 terminal	0. Multistep frequency 1 (PID setting 1) 1. Multistep frequency 2 (PID setting 2)	×	13
	F501	X2 terminal		×	14
	F502	X3 terminal		×	0

Function group	No.	Function name	Setting range	Change	Default
	F503	X4 terminal	2. Multistep frequency 3 3. Multistep frequency 4 4. Accel/decel time 1 5. Accel/decel time 2 6. Accel/decel time 3 7. Fault normally-open input 8. Fault normally-closed input 9. Reset input 10. Jog input 11. Priority run input 12. Pattern operation pause input 13. Forward input 14. Reverse input 15. Self-lock control input EF 16. X1:Panel/external terminal switching X2:IR1/VR1 switching X3:X4/X5 clear X4:Frequency up X5:Frequency down X6:Encoder input SM1 X7:Encoder input SM2	×	1
	F504	X5 terminal		×	2
	F505	X6 terminal		×	5
	F506	X7 terminal		×	7
	F507	Relay output terminal	0. Running 1. Stopping 2. Frequency reach 3. Random frequency reach 4. Overload pre-alarm	×	14
	F508	Y1 terminal		×	0
	F509	Y2 terminal		×	1

Function group	No.	Function name	Setting range	Change	Default
	F510	Y3 terminal	5. External alarm 6. Panel operation 7. Undervoltage stopping 8. Pattern operation running 9. Pattern operation finished 10. Pattern operation pauses 11. One stage of pattern operation finished 12. Feedback overhigh 13. Feedback overlow 14. Fault alarm 15.Relay: External braking injection signal Y1: Frequency analog output Y2: Frequency analog output Y3: Pulse output(PO) 16. Y1: Current analog output Y2: Current analog output Y3: Frequency down output 17. Y1: Target value analog output Y2: Target value analog output 18. Y2: Frequency up output	×	2
	F511	External braking selection	0. External braking disabled 1. External braking enabled	×	0

Function group	No.	Function name	Setting range	Change	Default
	F512	External braking injection delay	0.0-20.0S	×	1.0
	F513	Input pulse frequency unit	0.01-10.00Hz	×	0.01
	F514	I/O pulse ratio	0.01-10.00	×	1.00
	F515	Y1 gain	50-200	○	100
	F516	Y2 gain	50-200	○	100
	F517	PO(pulse output) gain	1-100	○	10
	F518	Y1 bias	0-100	○	0
	F519	Y2 bias	0-100	○	0
F6	F600	Starting frequency	0.10-50.00 Hz	○	1.00
	F601	Starting frequency duration	0.0-20.0S	○	0.5
	F602	Stop frequency	0.10-50.00 Hz	○	2.00
	F603	Dead-zone time	0.0-3000S	○	0.0
	F604	Jog frequency	0.10-400 Hz	○	5.00
	F605	Jog accel time	0.1-600.0S	○	0.5
	F606	Jog decel time	0.1-600.0S	○	0.5
	F607	Upper-limit frequency	0.50-400 .0Hz	○	50.00
	F608	Lower-limit frequency	0.10-400.0Hz	○	0.50
	F609	Jump frequency 1	0.00-400.0Hz	○	0.00
	F610	Jump frequency 2	0.00-400.0Hz	○	0.00

Function group	No.	Function name	Setting range	Change	Default
	F611	Jump frequency 3	0.00-400.0Hz	○	0.00
	F612	Jumping width	0.00-10.00Hz	○	0.50
	F613	Frequency reach detection band	0.00-10.00 Hz	○	1.00
	F614	Random detection frequency	0.10-400 .0Hz	○	40.00
	F615	Random detection frequency width	0 .00-10.00 Hz	○	1.00
	F616	Multistep frequency 1	0.00-400.0 Hz	○	2.00
	F617	Multistep frequency 2	0.00-400.0Hz	○	5.00
	F618	Multistep frequency 3	0.00-400.0 Hz	○	8.00
	F619	Multistep frequency 4	0.00-400.0 Hz	○	10.00
	F620	Multistep frequency 5	0.00-400.0 Hz	○	14.00
	F621	Multistep frequency 6	0.00-400.0 Hz	○	18.00
	F622	Multistep frequency 7	0.00-400.0 Hz	○	20.00
	F623	Multistep frequency 8	0.00-400.0 Hz	○	25.00
	F624	Multistep frequency 9	0.00-400.0 Hz	○	30.00

Function group	No.	Function name	Setting range	Change	Default
	F625	Multistep frequency 10	0.00-400.0 Hz	○	35.00
	F626	Multistep frequency 11	0.00-400.0 Hz	○	40.00
	F627	Multistep frequency 12	0.00-400.0 Hz	○	45.00
	F628	Multistep frequency 13	0.00-400.0 Hz	○	50.00
	F629	Multistep frequency 14	0.00-400.0 Hz	○	55.00
	F630	Multistep frequency 15	0.00-400.0 Hz	○	60.00
	F631	Accel time 2	0.1-3600S	○	20.0
	F632	Decel time 2	0.1-3600S	○	20.0
	F633	Accel time 3	0.1-3600S	○	20.0
	F634	Decel time 3	0.1-3600S	○	20.0
	F635	Accel time 4	0.1-3600S	○	20.0
	F636	Decel time 4	0.1-3600S	○	20.0
	F637	Accel time 5	0.1-3600S	○	20.0
	F638	Decel time 5	0.1-3600S	○	20.0
	F639	Accel time 6	0.1-3600S	○	20.0
	F640	Decel time 6	0.1-3600S	○	20.0

Function group	No.	Function name	Setting range	Change	Default
	F641	Accel time 7	0.1-3600S	○	20.0
	F642	Decel time 7	0.1-3600S	○	20.0
	F643	Accel time 8	0.1-3600S	○	20.0
	F644	Decel time 8	0.1-3600S	○	20.0
F7	F700	Pattern operation mode selection	0.Disabled 1.N cycles 2.N cycles with continuous final speed 3.Continous cycle 4.Priority run command valid 5.Wobble operation	×	0
	F701	Pattern operation time unit	0. Second 1. Minute	×	0
	F702	Pattern operation cycle number	1-1000	○	1
	F703	Pattern operation time 1	0.0-3600S	○	1.0
	F704	Run direction & accel/decel 1	01-18	○	01
	F705	Pattern operation time 2	0.0-3600S	○	1.0
	F706	Run direction & accel/decel 2	01-18	○	11
	F707	Pattern operation time 3	0.0-3600S	○	2.0

Function group	No.	Function name	Setting range	Change	Default
	F708	Run direction & accel/decel 3	01-18	○	02
	F709	Pattern operation time 4	0.0-3600S	○	2.0
	F710	Run direction & accel/decel 4	01-18	○	12
	F711	Pattern operation time 5	0.0-3600S	○	3.0
	F712	Run direction & accel/decel 5	01-18	○	03
	F713	Pattern operation time 6	0.0-3600S	○	3.0
	F714	Run direction & accel/decel 6	01-18	○	13
	F715	Pattern operation time 7	0.0-3600S	○	4.0
	F716	Run direction & accel/decel 7	01-18	○	04
	F717	Pattern operation time 8	0.0-3600S	○	4.0
	F718	Run direction & accel/decel 8	01-18	○	14
	F719	Pattern operation time 9	0.0-3600S	○	5.0
	F720	Run direction & accel/decel 9	01-18	○	05

Function group	No.	Function name	Setting range	Change	Default
	F721	Pattern operation time 10	0.0-3600S	○	5.0
	F722	Run direction & accel/decel 10	01-18	○	15
	F723	Pattern operation time 11	0.0-3600S	○	6.0
	F724	Run direction & accel/decel 11	01-18	○	06
	F725	Pattern operation time 12	0.0-3600S	○	6.0
	F726	Run direction & accel/decel 12	01-18	○	16
	F727	Pattern operation time 13	0.0-3600S	○	7.0
	F728	Run direction & accel/decel 13	01-18	○	07
	F729	Pattern operation time 14	0.0-3600S	○	7.0
	F730	Run direction & accel/decel 14	01-18	○	17
	F731	Pattern operation time 15	0.0-3600S	○	8.0
	F732	Run direction & accel/decel 15	01-18	○	08
F8	F800	Process PID control	0. Disabled 1. Enabled	×	0
	F801	Target value 1	0.0-100	○	50.0*

Function group	No.	Function name	Setting range	Change	Default
	F802	Target value 2	0.0-100	○	50.0*
	F803	Target value 3	0.0-100	○	50.0*
	F804	Target value 4	0.0-100	○	50.0*
	F805	Feedback signal selection	0. Feedback channel 1 + Feedback channel 2 1. Feedback channel 1 - Feedback channel 2	×	0
	F806	Feedback channel 1 selection	0. VR2 1. IR2	×	0
	F807	Feedback channel 2 selection	0. VR1 1. IR1 2. VR2 3. IR2	×	0
	F808	Feedback channel 1 zero	0.00-10.00	×	0.00
	F809	Feedback channel 1 polarity	0. Positive polarity 1. Negative polarity	×	0
	F810	Feedback channel 1 gain	0.00-10.00	×	1.00
	F811	Feedback channel 2 zero	0.00-10.00	×	0.00
	F812	Feedback channel 2 polarity	0. Positive polarity 1. Negative polarity	×	0
	F813	Feedback channel 2 gain	0.00-10.00	×	0.00
	F814	Proportional constant (P)	0.0-1000.0	○	1.0
	F815	Integral time (I)	0.1-100.0S	○	1.0

Function group	No.	Function name	Setting range	Change	Default
	F816	Differential time (D)	0.0-10.0S	○	0.5
	F817	Differential gain	5.0-50.0	○	10.0
	F818	Sampling cycle	0.01-10.00S	○	0.05
	F819	PID low-pass filter	0.00-2.00	○	0.10
	F820	Deviation range	0.1-20.0	○	0.5
	F821	PID stop frequency	0.Normal run 1.Inverter stops when output frequency ≤ lower-limit frequency	○	1
	F822	Feedback overhigh alarm	100-150	○	120
	F823	Feedback overlow alarm	10-120	○	80
	F824	Motor number	0. One motor 1. Two motors 2. Three motors 3. Two motors + soft starter 4. Three motors + soft starter 5. Four motors + soft starter	×	0
	F825	Motor-alternation delay time	0.0-600.0S	○	30.0
	F826	Switching time	0.1-20.0S	×	0.5

Function group	No.	Function name	Setting range	Change	Default
	F827	Motor-alternation timing	0-1000h	○	120
	F828	Sleep motor selection	0. Sleep motor disabled 1. Sleep motor enabled	×	0
	F829	Sleep frequency	20.00-50.00Hz	○	40.00
	F830	Sleep waiting time	60.0-5400S	○	1800
	F831	Sleep set value	0.0-100.0	○	40.0
	F832	Sleep tolerance	10-50	○	50
F9	F900	Computer selection	0. Monitors inverter 1. Controls inverter	○	0
	F901	Inverter address	0, 1, 2-32	×	2
	F902	Baud rate selection	0. 1200 1. 2400 2. 4800 3. 9600 4. 19200	×	3
	F903	Data format	0. 1, 8, 1, N 1. 1, 8, 1, O 2. 1, 8, 1, E	×	0
FA	FA00	LED display	0-5	○	0*
	FA01	Speed coefficient	0.01-10.00	○	1.00
	FA02	Inverter output capacity		△	P_e
	FA03	Module temperature	0-100℃	△	50

Function group	No.	Function name	Setting range	Change	Default
	FA04	Cumulated kWh	0-6553.5KWh	△	0.0*
	FA05	Cumulated operation time	0.0-6553.5h	△	0.0*
	FA06	Cumulated kWh clear	0. Disabled 1. Enabled	○	0
	FA07	Cumulated operation time clear	0. Disabled 1. Enabled	○	0
	FA08	Fault record 1		△	corr
	FA09	Fault record 2		△	corr
	FA10	Fault record 3		△	corr
	FA11	DC voltage at the last fault		△	0
	FA12	Output current at the last fault		△	0.0
	FA13	Output frequency at the last fault		△	0.00
	FA14	Heat-sink temperature at the latest fault		△	0
	FA15	Fault record clear	0. Disabled 1. Enabled	○	0
Fb	Fb00	User password	0-9999	○	0*
	Fb01	Factory password		○	0.0*
Fc	Fc00	Set frequency		△	50.00
	Fc01	Output frequency		△	0.00

Function group	No.	Function name	Setting range	Change	Default
	Fc02	Output current		△	0.0
	Fc03	Output voltage		△	0
	Fc04	Set synchronous speed		△	1500
	Fc05	Output synchronous speed		△	0
	Fc06	Set line speed		△	50
	Fc07	Output line speed		△	0
	Fc08	Load rate		△	0
	Fc09	Target value		△	50.0
	Fc10	Feedback value		△	0.0
	Fc11	DC voltage		△	537

6 Function Details

6.1 Function Group F0 : Basic Function

F000 Frequency setting 50.00Hz

This function sets the output frequency, which is restricted by the maximum, upper- and lower-limit frequencies. It can be changed by ∧/∨ keys.

F001 Frequency setting mode 0

This function sets the frequency setting method.

F001=0	Fc00 frequency is set by main & auxiliary setting signals
F001=1	Fc00 frequency is set by main, auxiliary setting signals and X4/X5 terminals. Δ F (frequency change by X4/X5) is saved
F001=2	Fc00 frequency is set by main, auxiliary setting signals and X4/X5 terminals. Δ F is not saved
F001=3	Fc00 frequency is set by main, auxiliary setting signals and X4/X5 terminals. Δ F = 0 when in stop or power-off state
F001=4	After power-on, frequency is set by F000. Frequency changed by ∧ / ∨ keys is not saved. Only the frequency set by F000 can be changed.
F001=5	Computer setting

F002	**Main setting signal**	**0**
F003	**Auxiliary setting signal**	**0**

These functions set the main /auxiliary setting signals.

F002=0	F000(or target value 1~4)
F002=1	Panel potentiometer
F002=2	VR1
F002=3	IR1
F003=0	VR1
F003=1	IR1
F003=2	VR2
F003=3	IR2

The setting signals fall into two types: main and auxiliary. The auxiliary setting signals are superimposed on the main ones. Refer to function group F1 for related functions.

If the main setting signal is set as VR1 or IR1，the auxiliary setting signal will be F003≠0 or F003≠1 respectively.

If F800=1(process PID closed-loop control) and F002=0，the main setting signal will be the target value 1~4(see Table 6-2).

Fig.6-1 and 6-2 show the main setting and auxiliary setting respectively. In Fig. 6-2, A is for positive polarity and B for negative polarity, the points C and D are auxiliary setting zero points(F305).

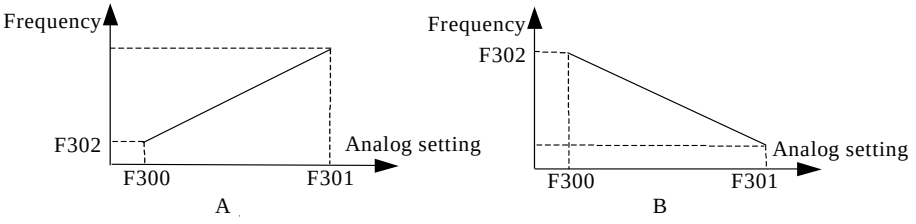


Fig. 6-1

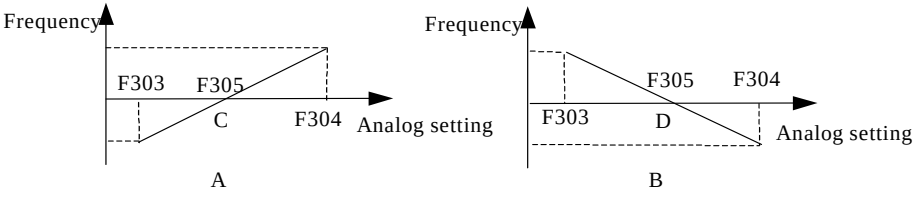


Fig. 6-2

F004 **Command setting mode** **0**

This function sets the operation command setting mode.

F004=0: the operation of the inverter is controlled by FWD, REV and STOP keys on the panel.

F004=1: two terminals among X1~X7(F500~F506) are set as Fwd and Rev inputs. Short Fwd and GND, inverter runs forward; short Rev and GND, inverter runs reverse; short Fwd, Rev and GND simultaneously, inverter stops. In this case, the FWD, REV and STOP keys on the panel are invalid.

F004=2: the operation of the inverter is controlled by the computer via the RS485 communication port.

F004=0	Panel setting
F004=1	External terminal setting
F004=2	Computer setting

F005 **STOP key selection** **0**

This function sets the function of the panel STOP key when the inverter is controlled by external terminals.

F005=0 or 1: STOP key cannot be used to stop the inverter.

F005=4 or 5: STOP key is used for the emergency stop of the inverter. In this case, F007 is invalid, the inverter will coast to a stop.

F005=0	Stop invalid, fault reset 1
F005=1	Stop invalid, fault reset 2
F005=2	Stop valid, fault reset 1
F005=3	Stop valid, fault reset 2
F005=4	Emergency stop valid, fault reset 1
F005=5	Emergency stop valid, fault reset 2

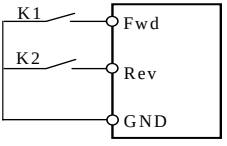
‘Fault reset 1’ means that following the fault reset, the run command must be canceled before the inverter is run again.

‘Fault reset 2’ means that following the fault reset, the inverter restores running if the run command is valid.

F006 **Self-lock control** **0**

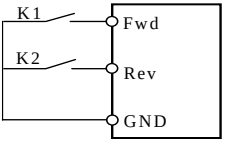
This function sets the external terminal control mode.

F006=0	2-wire control 1(Fig. 6-3A)
F006=1	2-wire control 2(Fig. 6-3B)
F006=2	Self-lock cotrol(Fig. 6-3C)



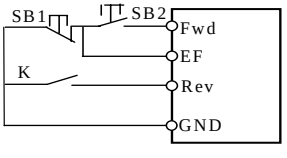
K1	K2	Command
off	off	Stop
off	on	Reverse
on	off	Forward
on	on	Stop

Fig. 6-3A



K1	K2	Command
off	off	Stop
off	on	Stop
on	off	Forward
on	on	Reverse

Fig. 6-3B



K	Command
0	Forward
1	Reverse

EF: self-lock signal input
SB1: stop button
SB2: run button

Fig. 6-3C

F007 **Motor stop mode** **0**

F007=0: the motor slows down to the stop frequency(F602) according to the deceleration time, and then stops.

F007=1: the motor coasts to a stop.

F007=2: the motor first decelerates to the DC braking starting frequency(F403) according to the deceleration time, then stops in the DC braking mode.

F007=0	Slowdown stop(Fig. 6-4A)
F007=1	Coast stop(Fig. 6-4B)
F007=2	Slowdown stop + DC braking(Fig. 6-4C)

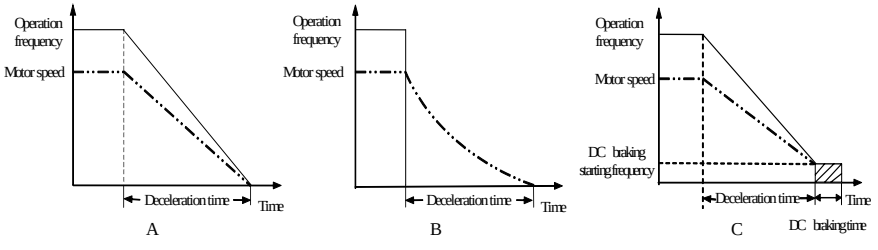


Fig. 6-4

F008 **Maximum frequency** **50.00Hz**

The function sets the allowable maximum output frequency of the inverter.

F009	**Accel time 1**	**20.0S**
F010	**Decel time 1**	**20.0S**

SB60/61 inverter defines eight acceleration/deceleration times. For accel/decel time 2 ~ 8, refer to F631 ~ F644. Accel/decele time is the time period over which frequency rises/drops by 50Hz. Refer to Fig.6-5, where t1 is the accel time, t2 the decel time.

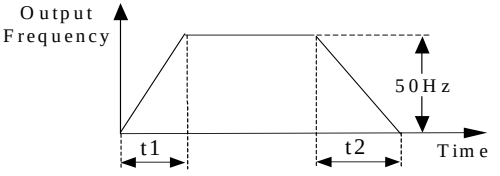


Fig. 6-5

F011	**Electronic thermal protection**	**0**
F012	**Electronic thermal protection level**	**100**

Function F011 can provide overload protection for the motor when the rated current of the motor does not match that of the inverter (see Fig. 6-6).

Function F012 sets the overload protection level.

SB60G overload capacity: 150% × I_N for 1 minute
SB60P overload capacity: 120% × I_N for 1 minute

F011=0	All inactive
F011=1	Electronic thermal protection inactive, overload pre-alarm active
F011=2	All active

$$F012 = \frac{\text{allowable max. load current}}{\text{inverter rated output current}} \times 100\%$$

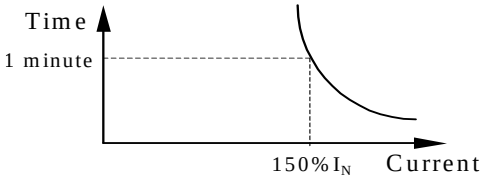


Fig. 6-6

F013 **Motor control mode** **0**

This function selects how the inverter control the motor.

F013=0 or 1: V/F control. Function group F1 and F8 need to be correctly set. Function group F2 is invalid.

F013=2 or 3: vector control. In this mode, please set F200=1 before you operate the inverter for the first time. Function group F2 needs to be correctly set. Function group F1 is invalid.

F013=0	V/F open-loop control
F013=1	V/F closed-loop control
F013=2	Speed sensor-less vector control
F013=3	PG speed sensor vector control

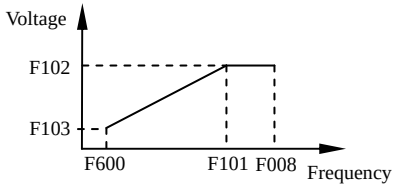
6.2 Function Group F1: V/F Control

Functions F100 ~ F125 are valid when F013=0 or 1.

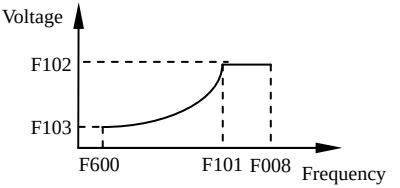
F100 V/F curve 0

This function sets the pattern of the V/F curve.

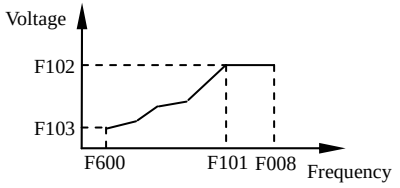
F100=0	Linear V/F(A, Fig.6-7)
F100=1	Random V/F(B & C, Fig.6-7)



A Linear V/F curve



B Squared-torque V/F curve



C Random V/F curve

Fig. 6-7

F101 Base frequency 50.00Hz

Base frequency is set as the rated operation frequency indicated on the motor nameplate.

F102 Maximum Output Voltage 380V

Maximum output voltage is set as the rated operation voltage indicated on the motor nameplate.

F103	**Torque boost**	**10**

This function increases the output voltage at the low frequency range so as to boost the torque.

If F103 is set to 0, torque boost is performed automatically.

If the torque to too low to start the motor, increase F103 gradually until the motor is started(see Fig. 6-8).

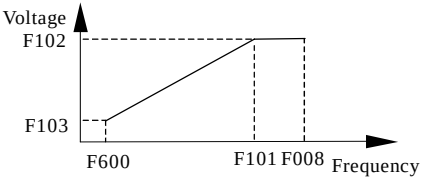


Fig. 6-8

F104	**VF_1 Frequency**	**8.00Hz**
F105	**VF_1 Voltage**	**9**
F106	**VF_2 Frequency**	**16.00Hz**
F107	**VF_2 Voltage**	**37**
F108	**VF_3 Frequency**	**24.00Hz**
F109	**VF_3 Voltage**	**84**
F110	**VF_4 Frequency**	**32.00Hz**
F111	**VF_4 Voltage**	**151**
F112	**VF_5 Frequency**	**40.00Hz**
F113	**VF_5 Voltage**	**246**

These functions are used to set special V/F curves(see Fig. 6-9). If $F_{n+1} < F_n$, F_{n+1} is invalid.

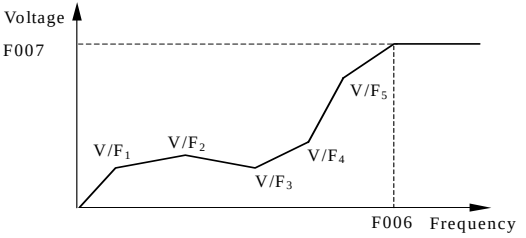


Fig. 6-9

F114 Slip compensation 0.00Hz

When the load of the asynchronous motor increases, the slip will increase. This function is used to compensate the slip, ensuring the motor speed is approximately equal to the synchronous speed under the rated load.

$$\text{F114=Base frequency} \times \frac{\text{Synchronous speed} - \text{Rated speed}}{\text{Synchronous speed}}$$

F115 Auto energy-saving mode 0

When F115=1, with the decrease of the load(i.e. light-load run), the inverter will adjust the output voltage according to the measured load current, thus achieving the energy-saving operation.

This function is especially applicable to fans, pumps and squared-torque loads, but not to loads that change frequently or to motors that run at near full-load.

Refer to Fig.6-10, where ① V/F constant，② energy-saving operation.

F115=0	Disabled
F115=1	Enabled

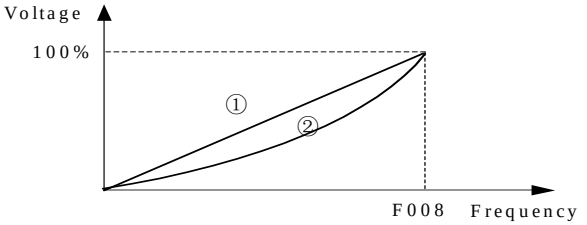


Fig. 6-10

F116 **Auto-restart after momentary power failure**	**0**
F117 **Power recovery tracking time**	**0.5S**

Function F116 sets the restart mode of the inverter after momentary power failure and recovery.

Function F117 sets the waiting time from the power recovery to the restart of the inverter.

F116=0	Inactive(Fig. 6-11A)
F116=1	Restart from 0Hz(Fig. 6-11B)
F116=2	Restart from tracking speed(Fig. 6-11C)

F116=0: After power recovery, the LED displays the fault code Lu, inverter does not operate.

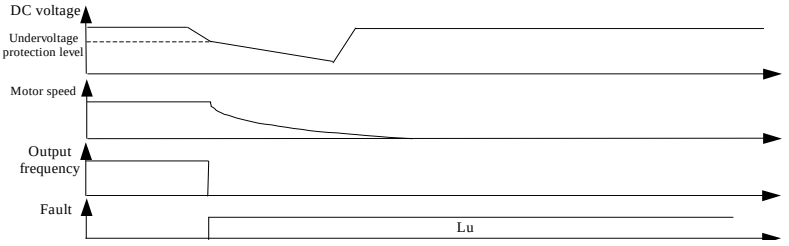


Fig. 6-11A

F116=1: after power recovery, when the inverter detects that the DC voltage is greater than the undervoltage protection level(F410), it restarts from 0Hz.

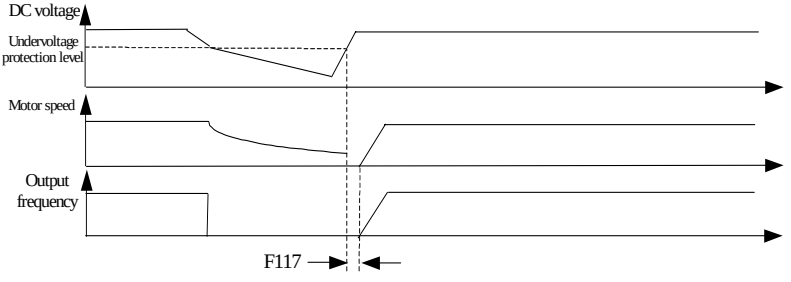


Fig. 6-11B

F116=2: after power recovery, the inverter first detects the output frequency at the power failure and tracks down the motor speed until the DC voltage is greater than F410, then restarts from the frequency corresponding to the tracking speed.

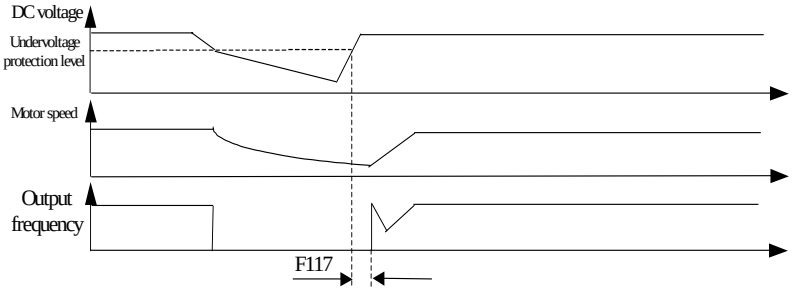


Fig. 6-11C

F118 **Overvoltage stall prevention** **1**

This function is use to prevent the overvoltage stall.

F118=0	Stall prevention and discharge are invalid
F118=1	Stall prevention valid, discharge invalid
F118=2	Stall prevention and discharge are valid
F118=3	Stall prevention invalid, discharge valid

During the inverter deceleration, the regenerative energy produced by the motor will lead to the increase of the DC voltage. If this voltage reaches the overvoltage stall level, the inverter stops decelerating(i.e. output frequency remains constant). When this voltage drops to a certain value below the stall level, the inverter continues decelerating. Refer to Fig.6-12.

If the DC voltage exceeds the action voltage of the braking resistor, and F118=2 and a braking resistor is connected between P+ and DB, the inverter brakes.

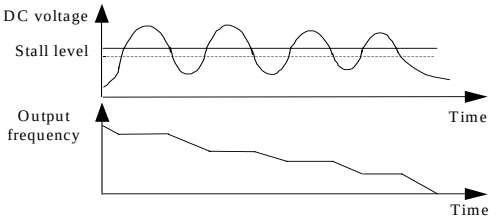


Fig. 6-12

F119 **Overcurrent stall prevention**	**1**
F120 **Overcurrent stall level**	**125**

These functions set the overcurrent stall prevention function and the overcurrent stall level.

F119=0	Invalid
F119=1	Valid

During inverter steady-state operation, if the output current exceeds the overcurrent stall level, the inverter will lower its output frequency. And when the output current drops to a certain value below the stall level, the inverter reaccelerates to the set frequency. See Fig. 6-13.

During inverter acceleration, too fast acceleration or too large load will lead to sharp rise of the output current which may exceeds the stall level. In this case, the inverter will prolong the acceleration time or stop accelerating. And when the current drops to a certain value below the stall level, the inverter continues accelerating. See Fig. 6-14.

SB60/61G: setting range of F120 is 20 ~ 150%

SB60/61P: setting range of F120 is 20 ~ 120%

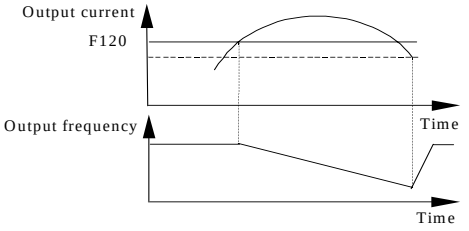


Fig. 6-13 Overcurrent stall control during steady-state operation

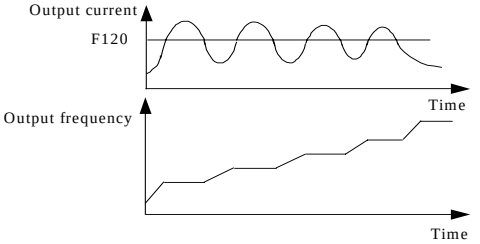


Fig. 6-14 Overcurrent stall control during acceleration

F121 **Speed-PID proportional gain（P） 1.0**

This function sets the gain of the error when in V/F closed-loop control mode.

If I(PID integral time)=0 and D(PID deferential time)=0, the V/F closed-loop is of proportional control type.

Functions F121 ~ F125 are valid when F013=1.

F122 Speed-PID integral time（I） 0.1

This function sets the PID response speed in V/F closed-loop control mode to temper the overshoot caused by excessive setting of the speed-PID proportional gain. If I is large, the response is slow; if I small, the response fast. However, too short integral time will lead to oscillation.

F123 Speed-PID differential time（D） 0.1

This function sets the PID attenuation to temper the disadvantage of setting the integral time too large.

D large, attenuation is strong; D small, attenuation is weak.

F124 Speed-PID differential gain 5.0

This function sets a limit for the differential gain, ensuring to obtain a pure differential gain at low frequencies and obtain a constant differential gain at high frequencies.

F125 Speed-PID low-pass filter 0.01

Speed-PID low-pass filter can suppress the oscillation of the feedback signal and reduce its influence on the modulation, thus keeping the PID system stable.

6.3 Function Group F2: Vector Control

Functions F200 ~ F211 are valid when F013=2 or 3.

F200	**Motor parameter test**	**0**

This function sets the motor parameter test mode.

F200=1: the inverter automatically tests the motor parameters and saves them in corresponding functions(F201~207).

F200=0: the operator manually tests the motor parameters and saves them in corresponding functions(F201~207).

In following cases, auto test is needed:

- The actual motor parameters are different from F201 ~ F207.
- The output side impedance of the inverter cannot be ignored, for example, there is a very long cable or a reactor between the inverter and motor.
- A nonstandard motor or a special motor is used.

F200=0	Manual test
F200=1	Auto test

F201	**Motor rated frequency**	**50.00Hz**
F202	**Motor rated speed**	**150.0**
F203	**Motor rated voltage**	**380V**
F204	**Motor rated current**	**I_e**
F205	**Motor no-load current**	**I_n**
F206	**Motor constant R**	**2000**

F207	**Motor constant X**	**1000**

Functions F201, F202 and F203 are respectively set to the rated frequency, rated speed and rated voltage indicated on the nameplate. The default settings of F204 and F205 depend on the motor rated current(I_e) and no-load current(I_n) respectively.

F208	**Driving Torque**	**100**

Setting range: 20 ~ 200(SB60/61G)
20 ~ 150(SB60/61P)

F209	**Braking torque**	**100**

Setting range: 0 ~ 150(SB60/61G)
0 ~ 120(SB60/61P)

F210	**ASR proportional cofficient**	**1.00**
F211	**ASR integral cofficient**	**1.00**

These functions set the proportional cofficient(P) and integral cofficient(I) of the speed PID regulator(ASR) to regulate the dynamic response of the vector control.

Either increasing P or decreasing I can increase the system response speed，however, excessive large P or excessive small I easily causes oscillation.

When you need regulate these two parameters, you should regulate P first, and then I.

6.4 Function Group F3: Analog Setting

F300	**Analog when main setting is zero**	**0.00**
F301	**Analog when main setting is 100%**	**10.00**

🕮 These functions set the analog signal levels when the main setting is analog signals.

F302	**Frequency when main setting is zero**	**0.00Hz**

🕮 This function sets the setting frequency corresponding to zero main setting signal.

F303	**Analog when auxiliary setting is negative max.**	**0.0**
F304	**Analog when auxiliary setting is positive max.**	**10.0**

🕮 These functions set the levels of auxiliary setting signals.

F305	**Analog when auxiliary setting is zero**	**0.00**
F306	**Auxiliary setting gain**	**0.00**

🕮 Function F305 sets the analog signal level when auxiliary setting is 0.

Function F306 sets the magnification of the auxiliary setting signal.

$$\text{Auxiliary setting frequency} = \frac{(\text{setting signal}-F305) \times F008 \times F306}{10}$$

F307	**Auxiliary setting frequency polarity**	**0**

This function sets the polarity of the auxiliary setting signal (see Fig. 6-2).

F307=0	Positive polarity
F307=1	Negative polarity

F308	**VR1 filtering time constant**	**1.0S**
F309	**IR1 filtering time constant**	**1.0S**
F310	**VR2 filtering time constant**	**1.0S**
F311	**IR2 filtering time constant**	**1.0S**

These functions can reduce the interference of voltage and current analog input signals with the inverter.

6.5 Function Group F4: Auxiliary Function

F400 Data protection 0

Setting F400=1 can lock the data preventing illegal change. Note that functions F000, F801 ~ 804, F900, FA00, Fb00 and Fb01 are not controlled by this function.

F400=0	Disabled
F400=1	Enabled

F401 Data initialization 0

This function is used for restoring all parameters to factory settings. It is controlled by F400. Note that function group F9 is out of this function control.

F401=0	Disabled
F401=1	Enabled

F402 Direction of rotation 0

This function sets the run direction of the motor.

F402=0	Forward or reverse
F402=1	Forward
F402=2	Reverse

F403	**DC braking starting frequency**	**5.00Hz**
F404	**DC braking amount**	**25**
F405	**DC braking time**	**5.0S**

These functions are used to stop the motor quickly and prevent the creep of the motor.

F403 sets the DC braking starting frequency.

F404 sets the DC braking torque. It is recommended to increase it gradually until braking is achieved.

F405 sets the DC braking time.

F406	**Braking resistor overheating**	**0**

The braking resistor may be destroyed by overheating if it is not selected properly. Setting F406=1 can pre-alarm the overheating condition.

F406=0	Invalid
F406=1	Overheating pre-alarm

F407	**Carrier frequency**	**0**

This function is used to reduce the electromagnetic noise.

The SB60/61 series inverter uses IGBT as the main device. The carrier frequency can be set to 3.5~ 15KHz.

When a higher carrier frequency is adopted, the current waveform is good, the low-frequency torque is large and the noise is low. But increasing the carrier frequency will increase

the power consumption of IGBT and lower the inverter efficiency and the motor torque. However, adopting excessive low carrier frequency may lead to unstable operation of the inverter at low frequencies.

If the inverter is to run at frequencies over the default carrier frequency, the inverter should be derated by 5% for every 1 increment of F407.

SB60/61G: 0 ~ 7
SB60/61P: 0 ~ 5

F408	**Auto-reset times**	**0**
F409	**Auto-reset interval**	**5.0S**

📖 These functions set the maximum number of retries and the reset interval when a trip occurs. Auto-reset is only valid when F003=1 or in pattern operation. The oH(overheating) fault has no auto-reset function.

In following cases, auto-reset function is invalid.

- STOP/RESET key is pressed or external terminals are reset.
- Inverter power is turned off.

F410	**Undervoltage protection value**	**410V**

📖 This function sets the action DC voltage when undervoltage fault occurs.

F411 **Phase failure protection** **0**

This function selects whether to enable the phase failure protection function.

F411=0	Disabled
F411=1	Enabled

F412 **AVR function** **0**

This function selects whether to enable the AVR function.

If F412=1，when the input voltage deviates from the rating, the inverter automatically regulates the PWM width, making the output voltage approach the set value.

F412=0	Disabled
F412=1	Enabled

F413 **Accel /decel selection** **0**

F414 **S-curve selection** **0**

Function F413 sets the acceleration/deceleration mode.

F413=0: the output frequency rises/drops linearly.

F413=1: the output frequency rises/drops according to the S-curve.

Refer to Fig.6-16, where t1 is the acceleration time, t2 the deceleration time.

Function F414 selects the shape of the S-curve.

F414=0: linear acceleration/declaration., the bent degree of the S-curve increases with the increase of F414(from 1 to 4).

F413=0	Linear
F413=1	S-curve

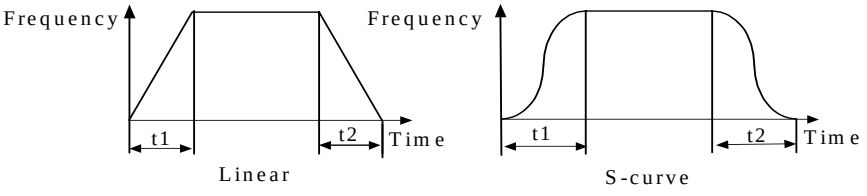


Fig. 6-16

F415 **Cooling fan control** **0**

This function sets the operation mode of the cooling fan.

When the power goes on, the cooling fan first conducts self-test, then runs according to the set mode.

F415=0: if the temperature inside the inverter is higher than the set temperature(default), the cooling fan begins to run; and when the temperature is below the set temperature, the cooling fan will stop.

F415=1: the cooling fan runs permanently.

F415=0	Auto run
F415=1	Permanent run

F416 **Input pulse phase number** **0**

This function sets the input pulse phase number in PG closed-loop control mode. It should be selected in accordance with the encoder operation mode.

If the speed and direction of the motor are required to detect simultaneously, set F416=1, otherwise set F416=0.

When F416=0, the encoder signal is input from the X6 terminal.

F416=0	Single-phase
F416=1	2-phase

F417 **Encoder pulse number** **1024**

This function sets the encoder pulse number per revolution in PG closed-loop control mode.

It must be correctly set when F013=1 or 3.

The maximum encoder output frequency is 50KHz.

6.6 Function Group F5: Terminal Function

F500	**X1 terminal**	**13**
F501	**X2 terminal**	**14**
F502	**X3 terminal**	**0**
F503	**X4 terminal**	**1**
F504	**X5 terminal**	**4**
F505	**X6 terminal**	**5**
F506	**X7 terminal**	**7**

These functions set the input signals of the terminals X1 ~ X7.

Table 6-1 Input terminal functions 1 ~ 15

0	Multistep frequency 1(PID setting 1)
1	Multistep frequency 2(PID setting 2)
2	Multistep frequency 3
3	Multistep frequency 4
4	Accel/decel time 1
5	Accel/decel time 2
6	Accel/decel time 3
7	Fault normally-open input
8	Fault normally-closed input
9	Reset input
10	Jog input
11	Priority run input
12	Pattern operation pause input
13	Forward input
14	Reverse input
15	Self-lock control input EF

Table 6-2 Function selection of terminals X1 & X2

X2	X1	Target value selection
OFF	OFF	Target value 1(F801)
OFF	ON	Target value 2(F802)
ON	OFF	Target value 3(F803)
ON	ON	Target value 4(F804)

Table 6-3 Input terminal function 16

X1=16	Panel/external terminal switching
X2=16	IR1/VR1 switching
X3=16	UP/DOWN terminal clear
X4=16	Frequency up
X5=16	Frequency down
X6=16	Encoder input SM1
X7=16	Encoder input SM2

The detailed function description of input terminals:

0 ~ 3: Multistep frequency selection

ON/OFF combinations of these four terminals can define up to 15 step frequencies(Table 6-4) . Refer to F616~F630.

4 ~ 6: Accel/decel time selection

ON/OFF combinations of these three terminals can set 8 different accel /decel times(Table 6-5).

7 ~ 8: Fault input

External fault signals can be input into the inverter through the two terminals. There are two input modes: normally-open & normally-closed.

9: Reset input

When a fault occurs and is eliminated, shorting this terminal and

GND can reset the inverter. This terminal has the same function as the STOP/RESET key on the keypad panel.

10: Jog input

Shorting this terminal and GND makes the inverter run in jog mode. Refer to F604 ~ F606.

Table 6-4 Multistep frequency selection

X4	X3	X2	X1	Multistep frequency setting
OFF	OFF	OFF	OFF	F000
OFF	OFF	OFF	ON	F616
OFF	OFF	ON	OFF	F617
OFF	OFF	ON	ON	F618
OFF	ON	OFF	OFF	F619
OFF	ON	OFF	ON	F620
OFF	ON	ON	OFF	F621
OFF	ON	ON	ON	F622
ON	OFF	OFF	OFF	F623
ON	OFF	OFF	ON	F624
ON	OFF	ON	OFF	F625
ON	OFF	ON	ON	F626
ON	ON	OFF	OFF	F627
ON	ON	OFF	ON	F628
ON	ON	ON	OFF	F629
ON	ON	ON	ON	F630

Table 6-5 Accel/decel time selection

Terminal 3	Terminal 2	Terminal 1	Selection
OFF	OFF	OFF	Accel/decel time 1
OFF	OFF	ON	Accel/decel time 2
OFF	ON	OFF	Accel/decel time 3
OFF	ON	ON	Accel/decel time 4
ON	OFF	OFF	Accel/decel time 5
ON	OFF	ON	Accel/decel time 6
ON	ON	OFF	Accel/decel time 7
ON	ON	ON	Accel/decel time 8

11: Priority run input

During pattern operation, short this terminal and GND, the inverter will run at the frequency set by F001.

12: Pattern operation pause input

Short this terminal and GND, the pattern operation pauses; open this terminal and GND, the pattern operation restores.

13 ~ 14: Forward/Reverse input

Short the Forward terminal and GND, inverter runs forward; short the Reverse terminal and GND, inverter runs reverse. This input signal is controlled by F402.

15: Self-lock control input EF

Refer to F006.

16: Panel/external terminal switching

This terminal, together with F004, sets the command setting mode.

	Short terminal and GND	Open terminal and GND
F004=0	External terminal control	Panel control
F004=1	Panel control	External terminal control

16: IR1/VR1 switching

This terminal, together with F002 and F003, sets the main/auxiliary setting mode.

	Short terminal and GND	Open terminal and GND
F002=2	IR1	VR1
F002=3	VR1	IR1

	Short terminal and GND	Open terminal and GND
F003=0	IR1	VR1
F003=1	VR1	IR1

16: X4/X5 terminal clear

Shorting this terminal and GND will clear ΔF(frequency change).

16: Frequency up/down input

Shorting this terminal and GND will enable the frequency up/down function(increasing/decreasing frequency or function data). In this case, the accel/decel time is the first accel/decel time.

16: Encoder input SM1/SM2

SM1 and SM2 are two phase orthogonal pulse inputs in PG closed-loop control mode. When F416=0(single phase), the encoder signal is input from the terminal X6.

F507	**Relay output terminal**	**14**
F508	**Y1 terminal**	**0**
F509	**Y2 terminal**	**1**
F510	**Y3 terminal**	**2**

📖 These functions set the output signals of the relay output terminals (30A, 30B & 30C) and open collector output terminals(Y1, Y2 & Y3).

Table 6-6 Output terminal function 1 ~ 14

0	Running
1	Stopping
2	Frequency reach
3	Random frequency reach
4	Overload pre-alarm
5	External alarm
6	Panel operation
7	Undervoltage stopping
8	Pattern operation running
9	Pattern operation finished
10	Pattern operation pauses
11	One stage of pattern operation finished
12	Feedback overhigh
13	Feedback overlow
14	Fault alarm

Table 6-7 Output terminal function 15

F507=15	External braking injection signal
F508=15	Frequency analog output
F509=15	Frequency analog output
F510=15	Pulse output(PO)

Table 6-8 Output terminal function 16

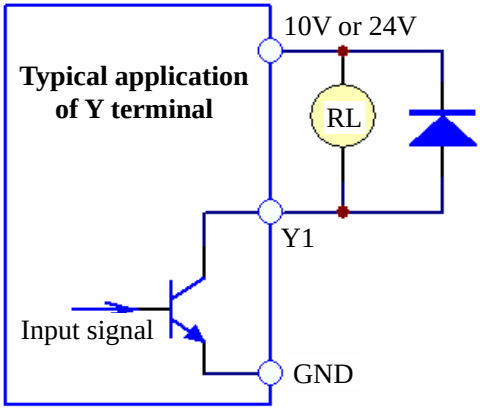
F508=16	Current analog output
F509=16	Current analog output
F510=16	Frequency down output

Table 6-9 Output terminal function 17

F508=17	Target value analog output
F509=17	Target value analog output

Table 6-10 Output terminal function18

F509=18	Frequency up output



The detailed function description of output terminals:

0: Running

A signal is output when the inverter is running.

1: Stopping

A signal is output when the inverter is stopping.

2: Frequency reach

A signal is output when the output frequency reaches the set frequency.

3: Random frequency reach

A signal is output when the output frequency reaches the random detection frequency.

4: Overload pre-alarm

A signal is output when the output current exceeds F012 and F011=1 or 2.

5: External alarm

When this terminal is disconnected from GND, a signal is output.

6: Panel operation

When F004=0， a signal is output.

7: Undervoltage stopping

When undervoltage causes the inverter to stop， a signal is output.

8: Pattern operation running

When F700≠0 and the inverter is in pattern operation, a signal is output.

9: Pattern operation finished

When F700≠0 and after a cycle of the pattern operation is finished, a 0.5S signal is output.

10: Pattern operation pauses

When F700≠0, a signal is output.

11: One stage of pattern operation finished

When F700≠0 and after any stage of pattern operation is finished, a 0.5S signal is output.

12: Feedback overhigh

When output frequency > (F822 × set value), a signal is output.

13: Feedback overlow

When output frequency < (F823 × set value), a signal is output.

14: Fault alarm

When the inverter has faults, this terminal is used to indicate faults or control peripheral devices.

When F507=14, contacts 30A & 30B close，while contacts 30B & 30C open.

When F508=14, F509=14 and F510=14, a signal is output from this terminal(Y1, Y2 or Y3).

15: External braking injection signal

Refer to F511 & F512.

15: Frequency analog output

Refer to F515 ~ F516.

15: Pulse output

Refer to F517.

16: Current analog output

Refer to F515 ~ F516.

16: Frequency down output

Each time the frequency down command is input, this terminal will output a 2ms pulse. Refer to F513 & F514.

17: Target value analog output

Refer to F515 ~ F516.

18: Frequency up output

Each time the frequency up command is input, this terminal will output a 2ms pulse. Refer to F513 & F514.

F511	**External braking selection**	**0**
F512	**External braking injection delay**	**1.0**

Function F511 sets the external braking mode. When F511=1 and F507=15, the internal contact of the relay output terminal closes to introduce the external braking.

Function F512 sets the time period over which the inverter remains running at the minimum frequency after the inverter slows down and the external braking is injected.

F511=0	External braking disabled
F511=1	External braking enabled

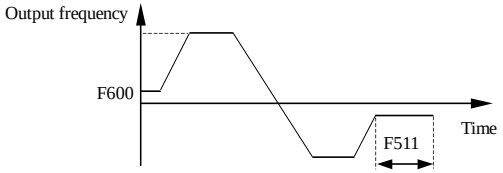


Fig. 6-17

F513	**Input pulse frequency unit**	**0.01**
F514	**I/O pulse ratio**	**1.00**

Function F513 sets the unit of the input signals from X4 & X5 terminals.

Function F514 sets the ratio of the output pulse(from Y1 & Y2 terminals) to the input pulse(from X4 & X5 terminals).

When you need apply synchronous speed control to loads of multiple inverters, you may connect Y1 & Y2 of No.1 inverter to X4 & X5 terminals of No.2 inverter respectively and set F513 & F514 properly. Then by adjusting No.1 inverter's X4 & X5 terminals, No.1 and No.2 inverters can be made run at synchronous speed.

F515	**Y1 gain**	**100**
F516	**Y2 gain**	**100**
F518	**Y1 bias**	**0**
F519	**Y2 bias**	**0**

📖 F515 & F516 set the maximum values of the analog outputs from Y1 & Y2.

F518 & F519 set the minimum values of the analog outputs from Y1 & Y2.

These four functions are valid only when Y1 & Y2 are used as analog outputs.

F517	**PO (pulse output) gain**	**10**

📖 This function sets the gain of the pulse output.

6.7 Function Group F6: Auxiliary Frequency Function

F600	**Starting frequency**	**1.00Hz**
F601	**Starting frequency duration**	**0.5S**
F602	**Stop frequency**	**2.00Hz**
F603	**Dead-zone time**	**0.0S**

📖 F600 and F601 set the starting frequency and its duration.

Dead-zone time is the waiting time from the end of the operation in one direction to the beginning of the operation in another direction. See Fig.6-18.

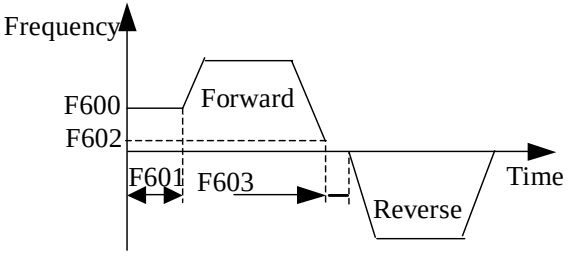


Fig. 6-18

F604	**Jog frequency**	**5.00Hz**
F605	**Jog accel time**	**0.5S**
F606	**Jog decel time**	**0.5S**

📖 These functions set the jog frequency, jog acceleration and deceleration time respectively.

If any three terminals among F500~F506 are set as FWD, REV and JOG inputs respectively, close FWD/REV and GND(deciding the direction), then short JOG and GND, the inverter will accelerate from the starting frequency to the jog frequency. Then if open JOG and GND, the inverter will stop. F604~F606 are valid when F004=1.

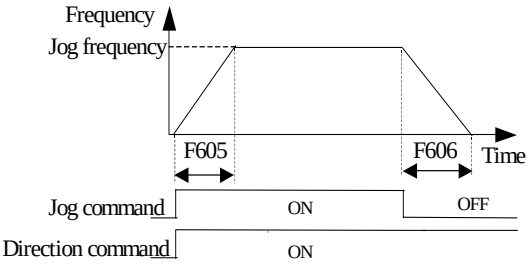


Fig. 6-19

F607	**Upper-limit Frequency**	**50.00Hz**
F608	**Lower-limit Frequency**	**0.50Hz**

Upper-limit(lower-limit) frequency is the maximum(minimum) frequency which is set according to the load.

In the multi-motor closed-loop control mode, if the output frequency rises to the upper-limit frequency and the continuous run time at this frequency exceeds F825, another motor will be added(started); if the output frequency drops to the lower-limit frequency and the continuous run time at this frequency exceeds F825, one running motor will be reduced(stopped). F608 is always less than F607.

F609	**Jump frequency 1**	**0.00Hz**
F610	**Jump frequency 2**	**0.00Hz**
F611	**Jump frequency 3**	**0.00Hz**
F612	**Jumping width**	**0.50Hz**

These functions make the inverter output frequency avoid the mechanical resonant points(see Fig.6-20)

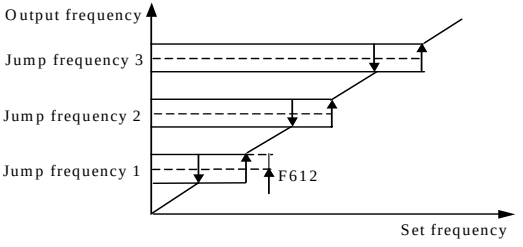


Fig. 6-20

F613	**Frequency reach detection band**	**1.00Hz**

If F508=2 or F509=2, when the output frequency falls in the range of set frequency ± F613, a signal will be output from Y1 or Y2. See Fig. 6-21.

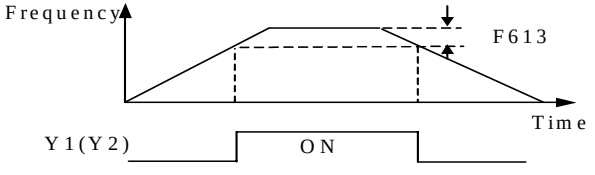


Fig 6-21

F614	**Random detection frequency**	**40.00Hz**
F615	**Random detection frequency width**	**1.00Hz**

When the output frequency reaches the random detection frequency, the internal contact of the output terminal closes; when the output frequency drops to F614 - F615, the internal contact opens.

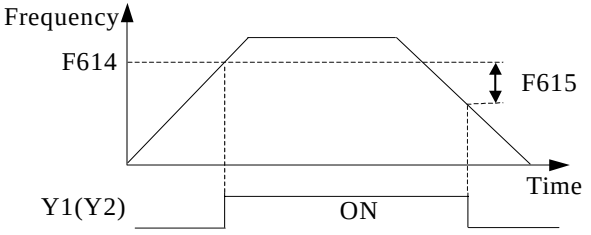


Fig. 6-22

F616	**Multistep frequency 1**	**2.00Hz**
F617	**Multistep frequency 2**	**5.00Hz**
F618	**Multistep frequency 3**	**8.00Hz**
F619	**Multistep frequency 4**	**10.00Hz**
F620	**Multistep frequency 5**	**14.00Hz**
F621	**Multistep frequency 6**	**18.00Hz**
F622	**Multistep frequency 7**	**20.00Hz**
F623	**Multistep frequency 8**	**25.00Hz**
F624	**Multistep frequency 9**	**30.00Hz**
F625	**Multistep frequency 10**	**35.00Hz**

F626	**Multistep frequency 11**	**40.00Hz**
F627	**Multistep frequency 12**	**45.00Hz**
F628	**Multistep frequency 13**	**50.00Hz**
F629	**Multistep frequency 14**	**55.00Hz**
F630	**Multistep frequency 15**	**60.00Hz**

These functions set the multistep frequencies for pattern operation mode or external terminal operation mode. They are restricted by the upper-, lower-limit frequencies and the maximum frequency. If set F500=0, F501=1, F502=2 and F503=3, then the terminals X1~X4 are selected as the input signals, thus multistep frequency operation can be achieved by ON/OFF combinations of X1~X4.

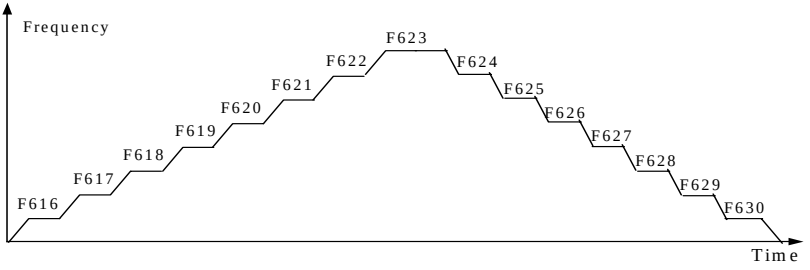


Fig. 6-23

F631	**Accel time 2**	**20.0S**
F632	**Decel time 2**	**20.0S**
F663	**Accel time 3**	**20.0S**
F634	**Decel time 3**	**20.0S**
F635	**Accel time 4**	**20.0S**
F636	**Decel time 4**	**20.0S**
F637	**Accel time 5**	**20.0S**
F638	**Decel time 5**	**20.0S**
F639	**Accel time 6**	**20.0S**
F640	**Decel time 6**	**20.0S**
F641	**Accel time 7**	**20.0S**
F642	**Decel time 7**	**20.0S**
F643	**Accel time 8**	**20.0S**
F644	**Decel time 8**	**20.0S**

📖 SB60/61 series inverter can set eight acceleration/deceleration times. Refer to F009 and F010.

6.8 Function Group F7: Simple PLC Function

F700 Pattern operation mode selection 0

This function selects the pattern operation mode.

Pattern operation means the inverter runs in accordance with the presetting programs, thus achieving the full-automation of the production process.

F700=0	Disabled
F700=1	N cycles
F700=2	N cycles with continuous final speed
F700=3	Continuous cycle
F700=4	Priority run command valid
F700=5	Wobble operation

Note: “N” denotes cycle number, refer to F702.

F700=1 ~ 4: Pattern operation. See Fig. 6-24

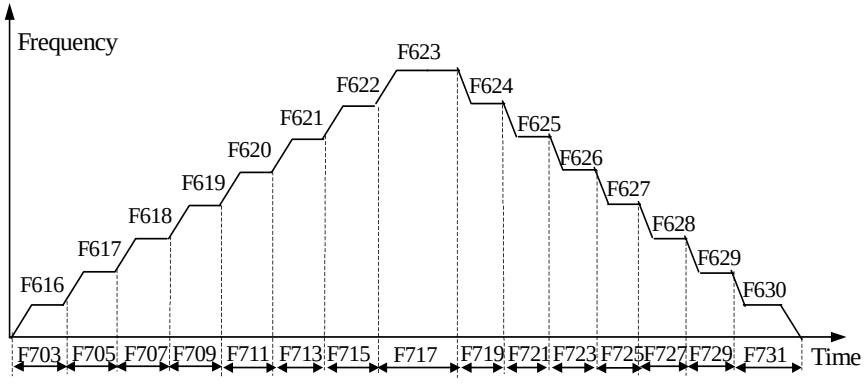


Fig. 6-24 Pattern operation

F700=5: Wobble operation. This means that the set frequency varies cyclically according to certain rules. This function helps wind silk evenly on textile machines.

Refer to Fig. 6-25, where ΔF is multistep frequency 1，① accel time 2，② decel time 3，③ accel time 3，④ decel time 2.

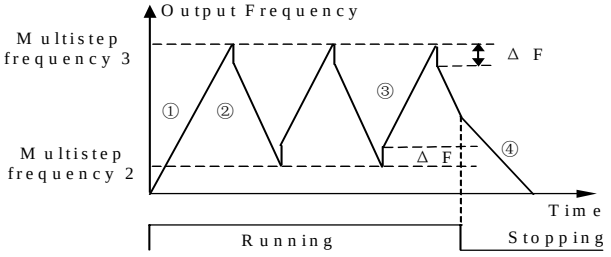


Fig. 6-25 Wobble operation

F701	**Pattern operation time unit**	**0**
F702	**Pattern operation cycle number**	**1**

Function F701 sets the unit of the pattern operation time. If F701=1, the operation time of each stage can be set up to 60 hours.

Function F702 sets the cycle number of the pattern operation.

F701=0	Second
F701=1	Minute

F703	**Pattern operation time 1**	**1.0S**
F705	**Pattern operation time 2**	**1.0S**
F707	**Pattern operation time 3**	**2.0S**
F709	**Pattern operation time 4**	**2.0S**
F711	**Pattern operation time 5**	**3.0S**
F713	**Pattern operation time 6**	**3.0S**
F715	**Pattern operation time 7**	**4.0S**
F717	**Pattern operation time 8**	**4.0S**
F719	**Pattern operation time 9**	**5.0S**
F721	**Pattern operation time 10**	**5.0S**
F723	**Pattern operation time 11**	**6.0S**
F725	**Pattern operation time 12**	**6.0S**
F727	**Pattern operation time 13**	**7.0S**
F729	**Pattern operation time 14**	**7.0S**
F731	**Pattern operation time 15**	**8.0S**

📖 These functions set the run time for 1~15 stages of pattern operation. If any of them is set to 0, this stage will be skipped.

F704	**Run direction & accel/decel 1**	**01**
F706	**Run direction & accel/decel 2**	**11**
F708	**Run direction & accel/decel 3**	**02**
F710	**Run direction & accel/decel 4**	**12**
F712	**Run direction & accel/decel 5**	**03**
F714	**Run direction & accel/decel 6**	**13**
F716	**Run direction & accel/decel 7**	**04**
F718	**Run direction & accel/decel 8**	**14**
F720	**Run direction & accel/decel 9**	**05**
F722	**Run direction & accel/decel 10**	**15**
F724	**Run direction & accel/decel 11**	**06**
F726	**Run direction & accel/decel 12**	**16**
F728	**Run direction & accel/decel 13**	**07**
F730	**Run direction & accel/decel 14**	**17**
F732	**Run direction & accel/decel 15**	**08**

📖 These functions set the run directions and acceleration/deceleration times for 1 ~ 15 stages of the pattern operation. Refer to the following table.

Table 6-11 Run direction and accel/decel time

01	Forward, accel/decel 1
02	Forward, accel/decel 2
03	Forward, accel/decel 3
04	Forward, accel/decel 4
05	Forward, accel/decel 5
06	Forward, accel/decel 6
07	Forward, accel/decel 7
08	Forward, accel/decel 8
11	Reverse, accel/decel 1
12	Reverse, accel/decel 2
13	Reverse, accel/decel 3
14	Reverse, accel/decel 4
15	Reverse, accel/decel 5
16	Reverse, accel/decel 6
17	Reverse, accel/decel 7
18	Reverse, accel/decel 8

6.9 Function Group F8: Process PID Function

F800	**Process PID control**	**0**

This function sets the PID control mode.

F800=0	Disabled
F800=1	Enabled

F801	**Target value 1**	**50.0**
F802	**Target value 2**	**50.0**
F803	**Target value 3**	**50.0**
F804	**Target value 4**	**50.0**

These functions set the size of the setting signal in process PID control system. Terminals X1 & X2 determine which target value is selected. Refer to table 6-4.

F805	**Feedback signal selection**	**0**

This function sets the feedback input mode.

F805=0	Feedback channel 1+feedback channel 2
F805=1	Feedback channel 1- feedback channel 2

F806	**Feedback channel 1 selection**	**0**

This function sets the feedback signal 1. If VR2 or IR2 is set as feedback signal 1, then it can not act as feedback signal 2, and vice versa.

F806=0	VR2
F806=1	IR2

F807 Feedback channel 2 selection 0

This function sets the feedback signal 2. If VR2 or IR2 is set as feedback signal 2, then it can not act as feedback signal 1, and vice versa.

F807=0	VR1
F807=1	IR1
F807=2	VR2
F807=3	IR2

F808 Feedback channel 1 zero 0.00

F811 Feedback channel 2 zero 0.00

These functions set the feedback signal 1 and 2 at the zero point.

F809 Feedback channel 1 polarity 0

F812 Feedback channel 2 polarity 0

These functions set the polarities of the feedback signal 1 and 2. If F809=0 or F812=0, when the feedback signal is decreased, the motor speed is required to increase. If you require the motor speed to decrease with the decrease of the feedback signal, you must set F809=1 or F812=1.

F809=0	Positive polarity
F809=1	Negative polarity
F812=0	Positive polarity
F812=1	Negative polarity

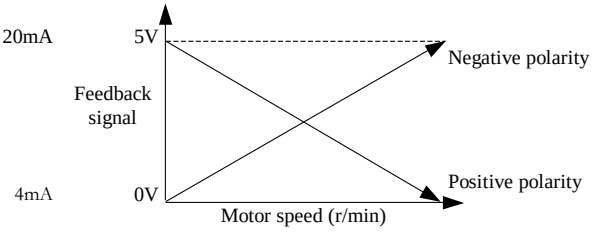


Fig. 6-26

F810	**Feedback channel 1 gain**	**1.00**
F813	**Feedback channel 2 gain**	**0.00**

These functions set the gains of the feedback signal 1 and 2 respectively.

F814	**Proportional constant（P）**	**1.0**

This function sets the gain of the error. If I=0, D=0, that means proportional control.

F815	**Integral time（I）**	**1.0S**

This function sets the response speed of PID. It is used to ease the overshoot caused by setting P too large. If I is large,

response is slow; otherwise, response is fast. However, too small I will cause oscillation.

F816 **Differential time（D） 0.5S**

📖 This function sets the accelerating effect of PID. It is used to temper the disadvantage of slow response caused by setting I too large. If D is large, the accelerating effect is obvious, otherwise, the accelerating effect is unobvious.

F817 **Differential gain 10.0**

📖 This function set a limit for the differential gain, ensuring to get a pure differential gain at low frequencies and get a constant differential gain at high frequencies.

F818 **Sampling cycle 0.05S**

📖 This function sets the sampling cycle for the sensor feedback signal according to the PID time constant.

F819 **PID low-pass filter 0.10**

📖 PID low-pass filter can suppress the oscillation of the feedback signal and reduce its influence on the modulation, thus keep a stable PID system. Note that too large F819 will lead to slow response.

F820 **Deviation range 0.5**

📖 This function sets the max. deviation range of the output value from the set value in the closed-loop system. When the system

goes into the deviation range, the PI regulator will stop regulating and the inverter hold its output.

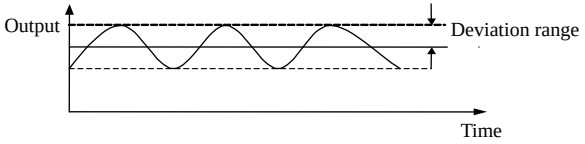


Fig. 6-27

F821	**PID stop frequency**	**1**

When the output frequency of the closed-loop system is not greater than the lower-limit frequency, if you need the inverter continue to work, set F821=0, otherwise, set F821=1.

F821=0	Normal run
F821=1	Inverter stops when output frequency ≤ lower-limit frequency

F822	**Feedback overhigh alarm**	**120**
F823	**Feedback overlow alarm**	**80**

This function sets the upper- and lower-limit of the feedback. If feedback > （F822 × set value）or feedback < （F823 × set value），the alarm signal will be output from terminals Y1 or Y2(when F508=12, F509=13).

F824 **Motor number** **0**

This function selects the number of the motors being used. Refer to the wiring diagram in Chapter 2.

F824=0	One motor
F824=1	Two motors
F824=2	Three motors
F824=3	Two motors + soft starter
F824=4	Three motors + soft starter
F824=5	Four motors + soft starter

F825 **Motor-alternation delay time** **30.0S**

This function sets the waiting time from the stop to the start of the added motor after the output frequency of the inverter rises to the upper-limit frequency, or the waiting time from the run to the stop of the reduced motor after the output frequency drops to the lower-limit frequency.

This parameter should be set according to the pressure change speed, and the shorter the better within the range of no oscillation.

F826 **Switching time** **0.5S**

This function sets the waiting time it takes for the inverter to switch from inverter operation to commercial power operation or vice versa. The larger the motor capacity is, the longer the switching time.

F827	**Motor-alternation timing**	**120h**

This function automatically alternates the motor according to the timing, thus ensuring each motor has an equal duty time. Note that this function does not apply to motors with different capacities.

F828	**Sleep motor selection**	**0**

This function sets the sleep motor.

F828=0	Sleep motor disabled
F828=1	Sleep motor enabled

F829	**Sleep frequency**	**40.00Hz**

This function sets the frequency at which the main motor begins to sleep.

F830	**Sleep waiting time**	**1800S**

When the main motor reaches the sleep frequency, it will wait a period of time before it begins to sleep. This time is the sleep waiting time. Refer to Fig.6-28.

F831	**Sleep set value**	**40.0**
F832	**Sleep tolerance**	**50**

Here we give an example to describe the two functions:

When at deep night the water requirement is reduced, the main motor will run at variable frequencies. When the frequency is less than the sleep frequency, after a period of time(F830), the

main motor stops and the sleep motor begins to run; when the feedback is higher or less than the sleep set value(F831) to some extent(i.e. beyond the sleep tolerance F832), the sleep motor stops and the main motor begins to run at variable frequencies.

When again the operation frequency is less than the sleep frequency, the preceding process will be repeated. During the whole process, the system pressure is kept constant.

By monitoring the feedback, the system regulates the operation frequency of the motor and conducts the sleep control, thus achieving the purpose of water or electricity saving.

Refer to Fig. 6-28.

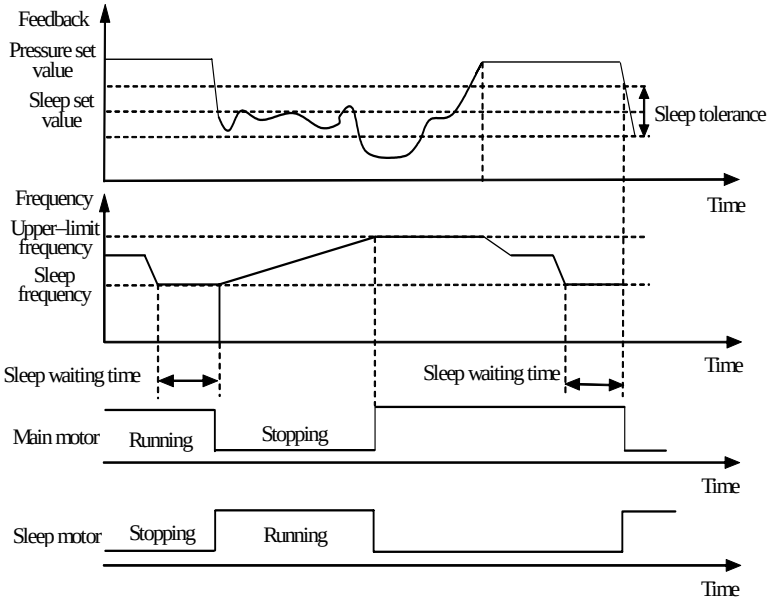


Fig. 6-28

6.10 Function Group F9: Communication Parameters

F900 Computer selection 0

This function sets the computer control mode.

F900=0: the computer can only monitor the operation of the inverter.

F900=1: the computer controls the inverter via the RS485 port.

F900=0	Monitors inverter
F900=1	Controls inverter

F901 Inverter address 2

This function assigns an address No. to each inverter when multiple inverters are controlled by the computer via the RS485 port. Up to 31 inverters can operate simultaneously. This function cannot be changed during running.

F902 Baud rate selection 0

This function selects the communication data transmitting speed. It can be changed only by the computer and it cannot be changed during running.

Setting	Baud rate
F902=0	1200
F902=1	2400
F902=2	4800
F902=3	9600
F902=4	19200

F903 **Data format** **0**

This function sets the format of the communication data. It can be changed only by the computer and it cannot be changed during running.

F903=0	1 start bit, 8 data bits, 1 stop bit, no parity check
F903=1	1 start bit, 8 data bits, 1 stop bit, odd check
F903=2	1 start bit, 8 data bits, 1 stop bit, even check

6.11 Function Group FA: Display Function

FA00 **LED display** **0**

This function selects which information is displayed on the LED monitor when the power of the inverter is turned on. It can be directly changed with the >> key on the remote panel.

Setting	Display in running		Display in stop	
	others	**Process PID**	**others**	**Process PID**
FA00=0	Output frequency		Set frequency	
FA00=1	Output current		Set frequency	
FA00=2	Output voltage		Set frequency	
FA00=3	Synchro speed	Target value	Set synchro speed	Target value
FA00=4	Line speed	Feedback value	Set line speed	Feedback value
FA00=5	Overload rate		Set frequency	

FA01 **Speed coefficient** **1.00**

This function sets the speed coefficient when the line speed or load speed is required to display on the LED monitor.

Displayed line speed or load speed = Frequency × Speed coefficient

FA02	**Inverter output capacity**	P_e

This function is used to display the inverter output capacity. The rated output capacity is the default setting.

FA03	**Module temperature**	**20℃**

This function is used to display the temperature of the heat sink of the IGBT module. It is unchangeable both in running and stop.

FA04	**Cumulated kWh**	**0**
FA05	**Cumulated operation time**	**0**
FA06	**Cumulated kWh clear**	**0**
FA07	**Cumulated operation time clear**	**0**

Function FA04 is used to display the total amount of the inverter consumed electricity. Actual active electricity = FA04 × 10kWh.

Function FA05 is used to display the cumulated operation time of the inverter.

Both functions are unchangeable in running and in stop, they can only be cleared by setting FA06/FA07=1.

FA06=0	Disabled
FA06=1	Enabled
FA07=0	Disabled
FA07=1	Enabled

FA08	**Fault record 1**	**corr**
FA09	**Fault record 2**	**corr**
FA10	**Fault record 3**	**corr**
FA11	**DC voltage at the last fault**	**0V**
FA12	**Output current at the last fault**	**0.0A**
FA13	**Output frequency at the last fault**	**0.00Hz**
FA14	**Heat-sink temperature at the last fault**	**0℃**
FA15	**Fault record clear**	**0**

Functions FA08 ~ FA10 record the last three faults respectively. After faults have been eliminated, setting FA15=1 will clear the fault records of FA08 ~ FA10. corr indicates no errors.

FA15=0	Disabled
FA15=1	Enabled

6.12 Function Group Fb: Factory Function

Fb00	**User password**	**0**
Fb01	**Factory password**	**0**

Function Fb00 enable the user to set a password (1~9999) preventing illegal data change by unauthorized persons. This function is not controlled by F401(data protection).

Function Fb01 can be used only by the manufacturer.

6.13 Function Group Fc : Computer Display Function

This function group includes the parameters that the computer displays when it communicates with the inverter.

Fc00	**Set frequency**	**50.00Hz**
Fc01	**Output frequency**	**0.00Hz**
Fc02	**Output current**	**0.0A**
Fc03	**Output voltage**	**0V**
Fc04	**Set synchronous speed**	**1500**
Fc05	**Output synchronous speed**	**0**
Fc06	**Set line speed**	**50**
Fc07	**Output line speed**	**0**
Fc08	**Load rate**	**0**
Fc09	**Target value**	**50.0**
Fc10	**Feedback value**	**0.0**
Fc11	**DC voltage**	**537V**

7 Maintenance

DANGER

- **Only professionally trained persons can disassemble and repair the inverter and replace its parts.**
- **Don't leave any electricity conductor like metals in the inverter after repair. That may destroy the inverter.**

CAUTION

Before repairing the inverter, check and verify the following items. Otherwise, electric shock may occur.

- **The power supply of the inverter has been cut off.**
- **The high-voltage lamp on the main control board has extinguished.**
- **The DC voltage has fallen to the safety level(below DC 36V).**

CAUTION

- **The insulation test has been performed at factory. Try not to test the insulation with a megger. That may destroy the product. If you have to use a megger, follow the steps described hereinafter(7.3).**
- **When conducting an insulation test on control terminals, use only a tester(high resistance range). Otherwise, parts on the control circuit will be destroyed.**

7.1 Daily inspection & maintenance

In order that the inverter may work reliably for a long period, you must install and operate it strictly in accordance with this manual. And conduct the daily inspection and maintenance as follows:

- Check that if the operation environment of the inverter meets the requirements.
- Check that if inverter operation parameters are set within the specified ranges.
- Check that if the inverter or motor has signs of unusual noise, vibration or overheating.

7.2 Periodical maintenance

Periodical maintenance should be performed once every 3 or 6 months depending on the service conditions.

Check items:

- Check to see if the three phase output voltages (U, V, W) are balanced when the inverter operates without any load.
- Check to see if the screws of the control circuit terminals are loose. If so, tighten them.
- Check the input(R, S, T) and output(U, V, W) terminals for damage.
- Check that if the connections between terminals(R, S, T, U, V, W) and copperplates are firm.
- Check the terminals and copperplates for overheating, discoloration and deformation.
- Check to see if the insulation of the main circuit & control circuit terminals meets the requirements.

- Check the power cables and control cables for damage, aging and discoloration.
- Remove dirt with cloth immersed with neutral chemicals and dust with a vacuum cleaner, especially from the vents and printed circuit boards.
- When leaving the inverter unused for a long time, check it for functioning at least once every year by supplying it with electricity for at least two hours with the motor disconnected. While supplying the power, the input voltage should be increased gradually with a transformer to the rated value.

7.3. Insulation test

7.3.1 Main circuit test

- Prepare a DC 500V megger.
- Disconnect all inverter terminals.
- Connect the main circuit terminals (R、S、T、P1、P+、DB、U、V、W) with a common wire.
- Perform the insulation test only between the common wire and ground(PE terminal).
- If the megger's indication is greater than 5MΩ, that means normal.

7.3.2 Control circuit test

- Disconnect all control circuit terminals.
- Perform the insulation test between the control circuit terminal and ground. If the megger's indication is greater than 1MΩ, that means normal.

7.4 Replacement of parts

The lives of parts vary with their types, installation environments and service conditions. It is recommended to replace a part before it is damaged. Refer to the following table for replacement cycles of various parts.

Table 7-1. Replacement cycles of parts

Part name	Standard replacement cycle
Cooling fan	3 years
DC filter capacitor	5 years
Electrolytic capacitor on printed circuit board	7 years
Other parts	Determined after inspection

8 Troubleshooting

8.1 Troubleshooting

When faults occur, diagnose the inverter according to the following table and make a detailed record. If your problem can't be resolved by the aid of the table or you need technical support, please contact our distributors.

Table 8-1 Faults and remedies

Code	Fault type	Possible causes	Remedies
ou	Overvoltage	(1) Supply voltage abnormal (2) Decel time too short (3) Braking resistor improper	(1) Check input power (2) Reset decel time (3) Reselect braking resistor
Lu	Undervoltage	(1) Input voltage abnormal (2) Failure inside inverter	(1) Check input power (2) Call us
oL	Overload	(1) Setting of electronic thermal protection parameter improper (2) Load too large	(1) Reset electronic thermal protection parameter (2) Use an inverter with higher capacity
dp	Phase failure	(1) Input phase failure (2) Output phase failure	(1) Eliminate the failure (2) Call us
FL	Module failure	(1) Input voltage too low (2) Load too large (3) Shorting or grounding fault (4) Failure inside inverter	(1) Check input power (2) Use an inverter with higher capacity (3) Eliminate the fault (4) Call us
oLE	External alarm	(1) External circuit failure	(1) Eliminate the failure

Code	Fault type	Possible causes	Remedies
oH	Overheating	(1) Fan damaged (2) Air vent blocked (3) Failure inside inverter	(1) Replace the fan (2) Clear air vent (3) Call us
oc	Overcurrent	(1) Accel/decel time too short (2) V/F curve setting improper (3) Inverter capacity too low	(1) Reset accel/decel time (2) Reset V/F curve (3) Use an inverter with higher capacity
FErr	Computer setting error	Computer setting error	Reset F900
Err1	Communication error 1	Failure inside inverter	Call us
Err2	Communication error 2	Failure inside inverter	Call us
Err3	Communication error 3	Failure inside inverter	Call us
Err5	Save failed	Failure inside inverter	Call us
	No display on the panel	(1) Input voltage abnormal (2) Connector, cable or display abnormal (3) Failure inside inverter	(1) Check input power (2) Replace connector, cable, or display (3) Call us
	Motor malfunction	(1) Motor failure (2) V/F curve improper (3)External terminal connection incorrect (4) Failure inside inverter	(1) Replace the motor (2) Reset V/F curve (3) Reconnect external terminal (4) Call us

8.2 Anti-interference measures

8.2.1 Preventing external noise

- Separate the control cable(shielded wire preferred) and the power cable(input R、S、T and output U、V、W), and connect the shielded wire firmly to the inverter PE terminal or the common terminal.
- If the control cable is long , run it through and wrap 2-3 circles on the magnetic ring before connecting it to the inverter.

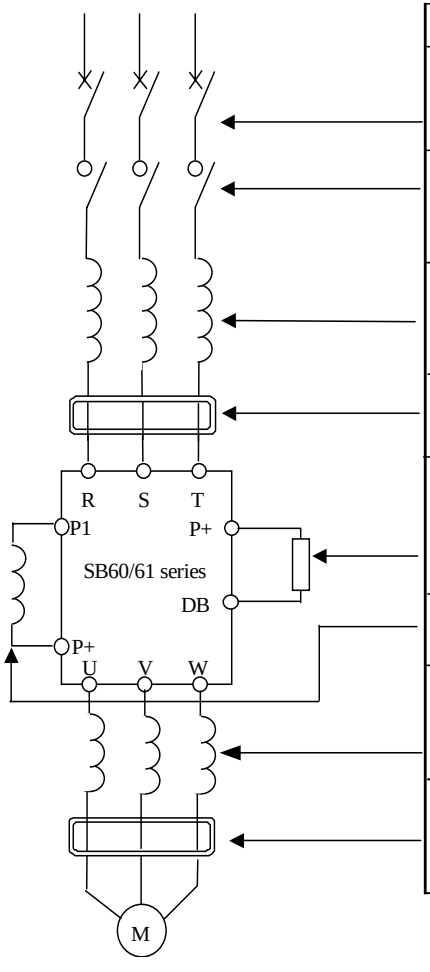
8.2.2 Preventing radio interference

Connect an AC reactor on both input and output side of the inverter, and put the inverter and the power cable in the grounded metal cabinet and conduit respectively.

Also you can connect a filter on both the input side and output side of the inverter. If the filter is not available, an equivalent magnetic ring can be used as the substitute: run the wires(R, S, T, U, V, W) through it and wrap them 3-4 circles in the same direction.

9 Peripheral Devices

9.1 Connecting diagram of peripheral devices



Peripheral devices and options	Function
Air switch (non-fuse breaker)	Shuts off the inverter to prevent the failure of inverter and circuits from leading to power failure
Magnetic contactor	Shuts off the main power when inverter fails and prevents restart after power-off and failure
AC reactor	Improves the power factor, reduces higher harmonics and suppresses surge voltage
Filter	Reduces radio interference generated by inverter
Braking resistor	Used when the braking torque is insufficient. Applicable to large-inertia loads and the cases where frequent braking or quick stop is required
DC reactor	Improves power factor and suppresses current peak
Output AC reactor	Suppresses inverter radiated and inducted interference and the motor vibration
Filter	Reduces radio interference generated by inverter

9.2 Description of options

9.2.1 AC reactor

The input AC reactor can suppress the higher harmonic of the inverter input current and obviously improve the power factor. It is recommended to adopt it in following cases:

- The ratio of the power supply capacity to inverter capacity is greater than 10:1.
- Thyristor loads or power factor compensators are connected to the power supply.
- The voltage unbalance of the 3-phase power is great(⩾ 3%).
- The power factor on the input side is required to improve. It may be increased to 0.75~0.85.
- The inverter capacity is greater than 30KW.

9.2.2 Filter

The filter suppresses not only the inverter generated radio interference, but also the external radio interference, and the transient shock & surge interference with the inverter.

The radio noise filter should be adopted in following cases:

- The requirement of anti-radio interference is highly emphasized.
- Meeting CE, UL and CSA standards is required.
- There are devices with poor anti-interference ability around the inverter.

The filter should be located as close as possible to the inverter, with the wiring as short as possible.

9.2.3 Braking resistor

If quick braking is needed, connect a braking resistor between

terminals P1 and DB.

The table below lists the resistances and capacities of common types of braking resistors (braking torque 100%).

SB60 Series

Voltage(V)	Motor capacity(kW)	Resistance(Ω)	Capacity(kW)
3 phase 380 V	0.75	500	0.25
	1.5	400	0.4
	2.2	250	0.6
	3.7	150	1
	5.5	100	1.5
	7.5	80	2
	11	60	2.5
	15	50	4

SB61 Series

Voltage(V)	Motor capacity(kW)	Resistance(Ω)	Capacity(kW)
380V	15 ~ 22	40	4
	30	20	5
	37 ~ 45	15	9
	55	20/2	12
	75 ~ 90	20/3	18
	110 ~ 132	20/4	30
	160	20/6	36
	200	20/7	45
	250	13.6/7	56
	315	13.6/8	80
	375~400	13.6/10	100

9.2.4 DC reactor

When the power grid capacity is far more than the inverter capacity, or improving the power factor is very important, a DC reactor should be connected between P1 and P+.

The DC reactor can be used together with the AC reactor. It also effectively decreases the higher harmonics and can raise the power factor up to 0.95.

9.2.5 Remote panel

The operation panel for SB60 is integrated with the inverter. If you hope to control the inverter from a remote location, you can choose our remote panel(see Chapter 3) and special cables.

9.2.6 Current-leak protector

Since the static capacitance to the ground exists in the inverter, motor and wire leads, and the carrier frequency used by the inverter is high, therefore, the leakage current of the inverter to the ground is very high, sometimes even leads to error action of the protection circuit.

To avoid above problem, reduce the carrier frequency, shorten the wire leads, and install a current-leak protector.

While using the current-leak protector, pay attention to the following points:

- The current-leak protector should be connected on the input side of the inverter, and behind the air switch.
- The action current of the current-leak protector should be ten times the leakage current of the same circuit(this circuit should be supplied by the commercial power without the inverter connected).

9.2.7 Dust cover

In the environment full of dust or fiber, to prevent the blocking up of air vents, a dust cover is recommended for types of over 5.5KW at the air inlets. The dust cover should be cleaned once or twice a week (keeping ventilation area > 80%). For its removal, refer to passage 2.3.

9.2.8 Capacitor box

This option is specially used for supplying power when the momentary power-off time is long(>20mS) so that the inverter can run continuously.

As using this device will affect some parameters of the inverter, it is not recommended.

9.2.9 Computer software and communication adaptor

The software SBINCS and communication adaptor SBCU RS232 allow you to control the inverter via a computer. The field bus adaptor SBPBU applies to PROFIBUS field bus.

SenLan SB60/61 inverter adopts semiduplex RS485 serial communication mode, the computer being the host and the inverter the slave. The communication protocols for SB60 are as follows:

（1）Computer reads data

Bit	Data	Description
1	D5H	Communication start code
2	D7H	Code for reading data
3	Address	Inverter address No.
4	Group	Inverter function group
5	Name	Inverter function No.
6	0	Data High
7	0	Data Low
8	Efficacy	Check sum

Efficacy = FFH − (D7H + Address + Group + Name + Data High + Data Low)

In this case, the inverter sends back the following data:

Bit	Data	Description
1	Address	Inverter address No.
2	Group	Inverter function group
3	Name	Inverter function No.
4	Data High	Data High
5	Data Low	Data Low
6	Max High	Max. data high bit
7	Max Low	Max. data low bit
8	Min High	Min. data high bit
9	Min Low	Min. data low bit
10	Efficacy	Check sum

Efficacy = FFH − (Address + Group + Name + Data High + Data Low + Max High + Max Low + Min High + Min Low)

Example: The computer reads the data of F103 of 2# inverter

D5H，D7H，2H，1H，3H，0，0，22H

Check sum = 0FF-(D7+2+1+3+0+0) = 22H

Example: The inverter sends data back to the computer(Setting value 10, MAX=50, MIN=0)

2H，1H，3H，0，0AH，0，32H，0，0，0C0H

Check sum = 0FF-(2+1+3+0+0A+0+32+0+0)= C0H

（2）Computer writes data:

Bit	Data	Description
1	D5H	Communication start code
2	D8H	Code for writing data
3	Address	Inverter address No.
4	Group	Inverter function group
5	Name	Inverter function No.
6	Data High	Data High
7	Data Low	Data Low
8	Efficacy	Check sum

Efficacy = FFH − (D8H + Address + Group + Name + Data High + Data Low)

Example: Change 2# inverter’s F103 to 1

D5H, D8H, 2H, 1H, 3H, 0, 1, 22H

Check sum = 0FF-(D8+2+1+3+0+1) = 20H

Example: The computer sets the frequency to 40.00Hz(0FA0H)

D5, D8H, 2H, 0DH, 1H, 0FH, 0A0H, 68H

Check sum = 0FF-(D8+2+0D+1+0F+0A0) = 68H

（3）Computer runs the inverter

Bit	Data	Description
1	D5H	Communication start code
2	D8H	Code for writing data
3	Address	Inverter address No.
4	0DH	Inverter function group
5	0	Inverter run function
6	0	Data High
7	1/2	1: Forward run command 2: Reverse run command
8	Efficacy	Check sum

Efficacy = FFH − (D8H + Address + Group + Name + Data High + Data Low)

（4）Computer stops the inverter

Bit	Data	Description
1	D5H	Communication start code
2	D8H	Code for writing data
3	Address	Inverter address No.
4	0DH	Inverter function group
5	0	Inverter stop function
6	0	Data High
7	3	Stop command
8	Efficacy	Check sum

Efficacy = FFH − (D8H + Address + Group + Name + Data High + Data Low)

（5）Computer resets inverter fault

Bit	Data	Description
1	D5H	Communication start code
2	D8H	Code for writing data
3	Address	Inverter address No.
4	0DH	Inverter function group
5	0	Inverter fault reset function
6	0	Data High
7	4	Fault reset command
8	Efficacy	Check sum

Efficacy = FFH − (D8H + Address + Group + Name + Data High + Data Low)

（6）Computer reads data cyclically

Bit	Data	Description
1	D5H	Communication start code
2	D7H	Code for reading data
3	Address	Inverter address No.
4	0CH	Inverter function group
5	0-0BH	output frequency/current/voltage, Set frequency, set synchro speed, output synchro speed, set line speed, output line speed, load rate, target value, feedback value, DC voltage
6	0	Data High
7	0	Reading command
8	Efficacy	Check sum

Efficacy = FFH − (D7H + Address + Group + Name + Data High + Data Low)

The computer can read out different parameter by setting the 5th bit to different data. In this case, the inverter sends back the following data:

Bit	Data	Description
1	Address	Inverter address No.
2	Group	Inverter function group
3	Name	Inverter function No.
4	Data High	Data High
5	Data Low	Data Low
6	Max High	Inverter fault 1
7	Max Low	Inverter fault 2
8	Min High	Inverter state parameters
9	Min Low	Inverter address No.
10	Efficacy	Check sum

Efficacy= FFH − (Address + Group + Name + Data High + Data Low + Max High + Max Low + Min High + Min Low)

Max Low: 0 bit—FL short-circuit
1 bit—oH overheating
2 bit—ou overvoltage
3 bit—Lu undervoltage
4 bit—oLE external alarm
5 bit—oL overload
6 bit—dp phase failure
7 bit—oc overcurrent

Max High: 0 bit—Err5 short-circuit
1 bit—dd DC braking
2 bit—
3 bit—
4 bit—dLp overload pre-alarm
5 bit—oLp underload pre-alarm
6 bit—dbr braking resistor overheating
7 bit—oc fault mark

Min High: 0 bit—
1 bit—type selection =1 G series
2 bit—user password =1 valid
3 bit—factory password =1 valid
4 bit—PID =1 valid
5 bit—data protection =1 valid
6 bit—computer control =1 valid
7 bit—inverter run =1 inverter is running

Min Low: inverter address

9.2.10 Expansion board

If you want to control multiple motors with one inverter, please use an external 24V power or our special expansion board SK-1, since the load capacity of the internal 24V power is to small to support that.

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