

Guide for Manual

The Shihlin electric SS-TYPE inverters have been designed with many complicated parameterized functions to meet most of the application requirements from the market. For customers who deal with the inverter for the first time, such a complicated inverter may cause troubles when using it. So the users are expected to read each part of this manual carefully so as to master the operating method of the inverter. In case there is any question, please feel free to contact us.

In Chapter 2 of this manual, all the series and the corresponding specifications of Shihlin electric SS-TYPE inverters are listed in detail. Section 2-5 instructs the customers on how to install the inverter and emphasizes on **precautions for safety** that should be paid much attention to when utilizing the inverter.

Chapter 3 instructs the customers on how to use the inverter. In Section 3-1, the **operating mode of the inverter** is outlined briefly; in Section 3-2, how to use the **manipulator** is explained; and in Section 3-3, simple operating steps are explained which enables the users to make the motor run easily by the inverter. With knowledge of the above simple operation, users can go into Chapter 4 and learn the functions of each parameter in detail.

The following definitions of terminologies will be embedded in the whole content of the manual, and much attention should be paid to them.

1. The actual output current frequency of the inverter is called 'output frequency'.
The frequency set by user (through a manipulator, multi-speed terminals, voltage signal or current signal) is called 'target frequency'.
When the motor starts running, the output frequency of the inverter will be increased gradually to the target frequency, and finally run steadily at the target frequency. The output frequency at this time is called 'steady output frequency'.
2. There are detailed instructions on parameter settings in Chapter 4. In case users are not familiar with these settings, arbitrary adjustment of the parameter may result in abnormal operations. All parameters can be reset to their default values by the parameter of Pr998. For the setting procedure of this parameter, please refer to Pr998 in Chapter 4.
3. In order to exploit the performance of Shihlin inverters completely, introduction of the basic operations is divided into two parts, namely, the 'operating mode' and the 'working mode'.
In the operating modes, the reference source for the running frequency and the signal source for starting are determined. The Shihlin inverter has totally nine operating modes. Please refer to Section 3-1 for details.
The manipulator mainly concerns monitoring of numeric values, setting of parameters and setting of running frequency. The Shihlin manipulator has totally three working modes. Please refer to Section 3-2 for details.
4. The difference between 'terminal name' and 'function name':
Near the terminals of the control board or the main board, printed letters can be found. These letters are used to distinguish each terminal, and thus called 'terminal name'. For 'input terminals' and 'output terminals', besides the terminal name, the 'function names' are also necessary to be defined. The function names indicate the actual functions of the terminals.
In case functions for a terminal are explained, the name used is its 'function name'.
5. The difference between 'on' and 'turn on'
When the functions for the 'input terminals' are explained, two words 'on' and 'turn on' are often used.
The 'on' is used to indicate that the external switches of input terminal are in close state, and thus belongs to the description of the state.
The 'turn on' is employed to describe the action that the external switches of input terminal are shut on from the open state to the close state, and thus belongs to the description of action.

Contents

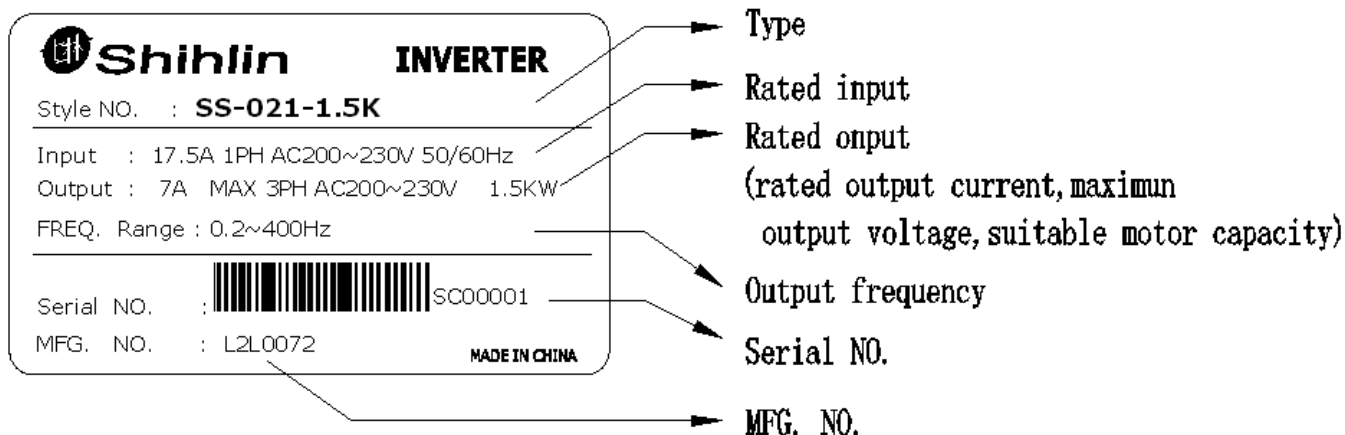
Guide for Manual.....	1
Chapter 1. Product Examination.....	3
Chapter 2.Introduction of Shihlin Inverter.....	4
2-1 Electric specification.....	4
2-2 Common specification (Inverter characteristics)	5
2-3 Mechanical Dimensions.....	7
2-4 Name of each part	9
2-5 Installation and wiring	12
2-6 Selection of peripheral equipments.....	17
Chapter 3. Primary operation.....	19
3-1 Operating modes of the inverter	19
3-2 Working modes of a manipulator.....	20
3-3 In PU mode, the basic operation procedure (Pr79=0 or 1).....	23
3-4 In external mode, the basic operation procedure (Pr79=0 or 2).....	24
3-5 In communication mode, the basic operation procedure (Pr79=3)	24
3-6 In JOG mode, the basic operation procedure (Pr79=0 or 1).....	25
3-7 In Combined mode 1, the basic operation procedure (Pr79=3).....	25
3-8 In Combined mode 2, the basic operation procedure (Pr79=4).....	26
3-9 In Combined mode 3, the basic operation procedure (Pr79=6).....	26
3-10 In Combined mode 4, the basic operation procedure (Pr79=7).....	26
3-11 In Combined mode 5, the basic operation procedure (Pr79=8).....	26
Chapter 4. Parameter description	27
Chapter 5. Inspection and Maintenance.....	62
Appendix 1 Parameter List	65
Appendix 2 Alarm Code List.....	71
Appendix 3 Warning code list	73
Appendix 4 Troubles and Solutions.....	74
Appendix 5 Optional equipment.....	75

Chapter1. Product Examination

Each SS-TYPE inverter has been checked strictly before delivery and packed carefully to prevent from mechanical damage. Please check as follows after opening the package.

- Please check whether it is damaged during transport
- Please check whether the inverter type is identical with which shown on the package

Nameplate instruction:



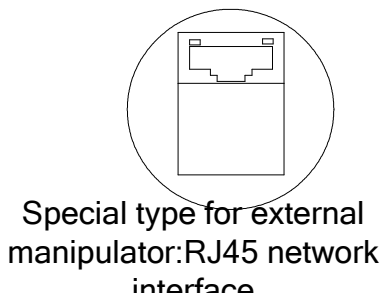
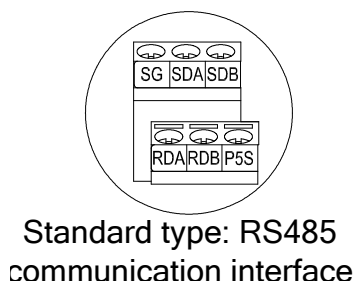
Type instruction: SS - 021 - 1.5K - D

Product series ← input voltage (note 1) ← suitable motor capacity ←

① none: standard type (note 2)
② -D: special type for external manipulator (note 2)

(Note 1) 021: 220V 1-PHASE
023: 220V 3-PHASE
043: 440V 3-PHASE

(Note 2) As indicated in the figure below: the standard type inverters can communicate with personal computer via a RS-485 communication interface. The special type for external manipulator inverters can be used with DU03 operation unit (with knob on it). It has a RJ-45 network interface, and is convenient to be connected.



Chapter2. Introduction of Shihlin Inverter

2-1 Electric specification

●220V Series Single Phase

Model SS021-□□□K		0.4K	0.75K	1.5K	2.2K
Applicable motor capacity	HP	0.5	1	2	3
	kW	0.4	0.75	1.5	2.2
Output	Rated output capacity kVA (Note)	0.95	1.5	2.5	4.2
	Rated output current A (Note)	3.0	5.0	7.0	11.0
	Over-current capability	150% 60 Seconds; 200% 0.5 Seconds (reverse time characteristics)			
	Maximum output voltage	3 Phase 200~240V AC			
Power supply	Rated power voltage	single phase 200~240V 50Hz / 60Hz			
	Power voltage permissible fluctuation	single phase 180~264V 50Hz / 60Hz			
	Power frequency permissible fluctuation	±5%			
	Power source capacity kVA	1.5	2.5	3.5	4.2
Cooling method		Forced air cooling			
Power consumption W (Note)		50	85	100	160
Weight kg		0.9	1.0	1.4	2.2

●220V Series Three-Phase

Model SS023-□□□K		0.4K	0.75K	1.5K	2.2K	3.7K
Applicable motor capacity	HP	0.5	1	2	3	5
	kW	0.4	0.75	1.5	2.2	3.7
Output	Rated output capacity kVA (Note)	1.2	2.0	3.2	4.4	7.0
	Rated output current A (Note)	3.0	5.0	8.0	11.0	17.5
	Over-current capability	150% 60 Seconds; 200% 0.5 Seconds (reverse time characteristics)				
	Maximum output voltage	3 Phase 200~230V AC				
Power supply	Rated power voltage	3 phase 200~240V 50Hz / 60Hz				
	Power voltage permissible fluctuation	3 phase 170~264V 50Hz / 60Hz				
	Power frequency permissible fluctuation	±5%				
	Power source capacity kVA	1.5	2.5	4.5	5.5	9.0
Cooling method		Forced air cooling				
Power consumption W (Note)		35	50	85	100	160
Weight kg		0.95	0.95	1.25	1.35	2.15

●440V Series Three-Phase

Model SS043-□□□K		0.4K	0.75K	1.5K	2.2K	3.7K	5.5K
Applicable motor capacity	HP	0.5	1	2	3	5	7.5
	kW	0.4	0.75	1.5	2.2	3.7	5.5
Output	Rated output capacity kVA (Note)	1.0	2.0	3.0	4.6	6.9	9.1
	Rated output current A (Note)	1.3	2.6	4.0	6.0	9.0	12
	Over-current capability	150% 60 seconds; 200% 0.5 seconds (reverse time characteristics)					
	Maximum output voltage	3 Phase 380~480V 50Hz/60Hz					
Power supply	Rated power voltage	3 Phase AC 380~480V 50Hz / 60Hz					
	Power voltage permissible fluctuation	323~506V 50Hz / 60Hz					
	Power frequency permissible fluctuation	±5%					
	Power source capacity kVA	1.5	2.5	4.5	5.5	9.0	12
Cooling method		Forced air cooling					
Power consumption (Note)	W	35	50	85	100	160	230
Weight	kg	0.95	1.0	1.35	1.4	2.25	2.4

(Note) The test condition of rated output current, rated output capacity and power consumption: the carrier frequency (Pr72) is 5kHz; the inverter output voltage is 220V / 440V; the output frequency is 60Hz; and the ambient temperature is 40℃.

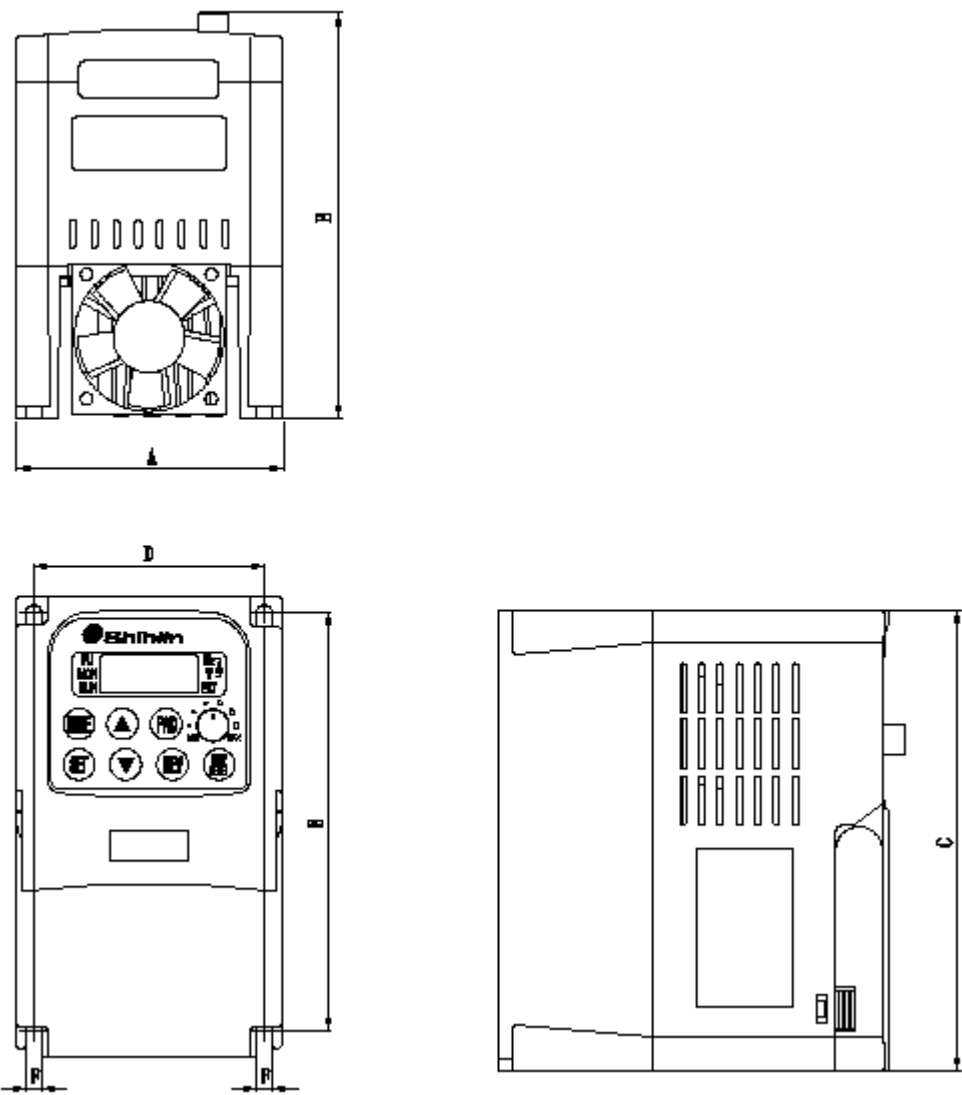
2-2 Common specification (Inverter characteristics)

Control method		SPWM control, V/F control.
Output frequency range		0.2~400Hz (The starting frequency setting range is 0~60Hz).
Resolution for setting frequency	Digital setting	If the frequency set value is below 100Hz, the resolution will be 0.01Hz; If the frequency set value is above 100Hz, the resolution will be 0.1Hz.
	Analog setting	When setting DC 0~5V signals, the resolution will be 1/500; When setting DC 0~10V or 4~20mA signals, the resolution will be 1/1000.
Output frequency accuracy	Digital setting	±0.01% of maximum running frequency
	Analog setting	±0.5% of maximum running frequency
Voltage / frequency output characteristics		Base voltage (pr19), base frequency (pr3) can be arbitrarily set. Constant torque model, variable torque model can be selected (Pr14).
Torque boost		The torque boost setting range is 0~30% (Pr0), auto boost, slip compensation.
Acceleration/deceleration curve characteristics		The acceleration/deceleration time setting range is 0~3600 Seconds (Pr7, Pr8). Different 'acceleration/deceleration curve' model can be selected (Pr29).

DC braking		The DC braking action frequency is 0~120Hz (Pr10); the DC braking time is 0~10 Seconds (Pr11); the DC braking voltage is 0~30% (Pr12). Beeline brake and racing brake Selection (Pr71).
DC stalling protection		The stalling protection level can be set to 0~200% (Pr22).
PID control		Please refer to Pr160~Pr163 in Chapter 4.
Running frequency setting		Manipulator setting, DC 0~5V signal setting, DC 0~10V signal setting, DC 4~20mA signal setting, multi-speed stage levels setting, communication setting.
Control terminals	Multi-function control terminals	Motor starting(STF, STR), the second function(RT), '15-speed operation'(RL, RM, RH,REX), external thermal relay(OH) (can be set by the users (Pr80~Pr84,Pr86))
	Reset	The inverter can be reset by external contactor (switch) or by manipulator.
Multi-function output terminals	Multi-function output terminals	Motor running checking out (RUN), output frequency reaching checking out (FU), output frequency reaching(SU), overload checking out(OL), zero current checking out(OMD) (Pr40), section detection(PO1),periodical detection(PO2),pause detection(PO3).
	Multi-function output relay	Motor running checking out(RUN), output frequency reaching checking out(FU), output frequency reaching(SU), overload checking out(OL), zero current checking out(OMD), alarm(ALARM)(Pr85), section detection(PO1),periodical detection(PO2),pause detection(PO3).
	Multi function analogy meter	Multi-function DC (0~10V) output (AM); output frequency , output current (Pr54).
Manipulator	Running status monitoring	Output frequency monitoring, output current monitoring, output voltage monitoring, abnormality record (Maximum 4 groups).
Inverter's main machine	LED indication lamp(6)	Run indication lamp, frequency monitoring indication lamp, voltage monitoring indication lamp, current monitoring indication lamp, mode switching indication lamp, PU/external terminals control indication lamp.
Communication function	Communication function	Full duplex RS485 connection
Protection mechanism / Alarming function		Over-current protection, P(-)/N over-voltage protection, voltage too low protection, motor over heat protection (Pr9), IGBT module over heat protection, braking transistor abnormality protection, communication abnormality protection.
Environmental condition	Ambient temperature	-10 ~ +50℃ (non-freezing)
	Ambient humidity	Below 90%Rh (non-condensing)
	Storage temperature	-20 ~ +65℃
	environment around	In room, no corrosive gas, no flammable gas, no flammable dust
Vibration		Below 5.9m/s ² (0.6G), complying with JIS C0911 standard

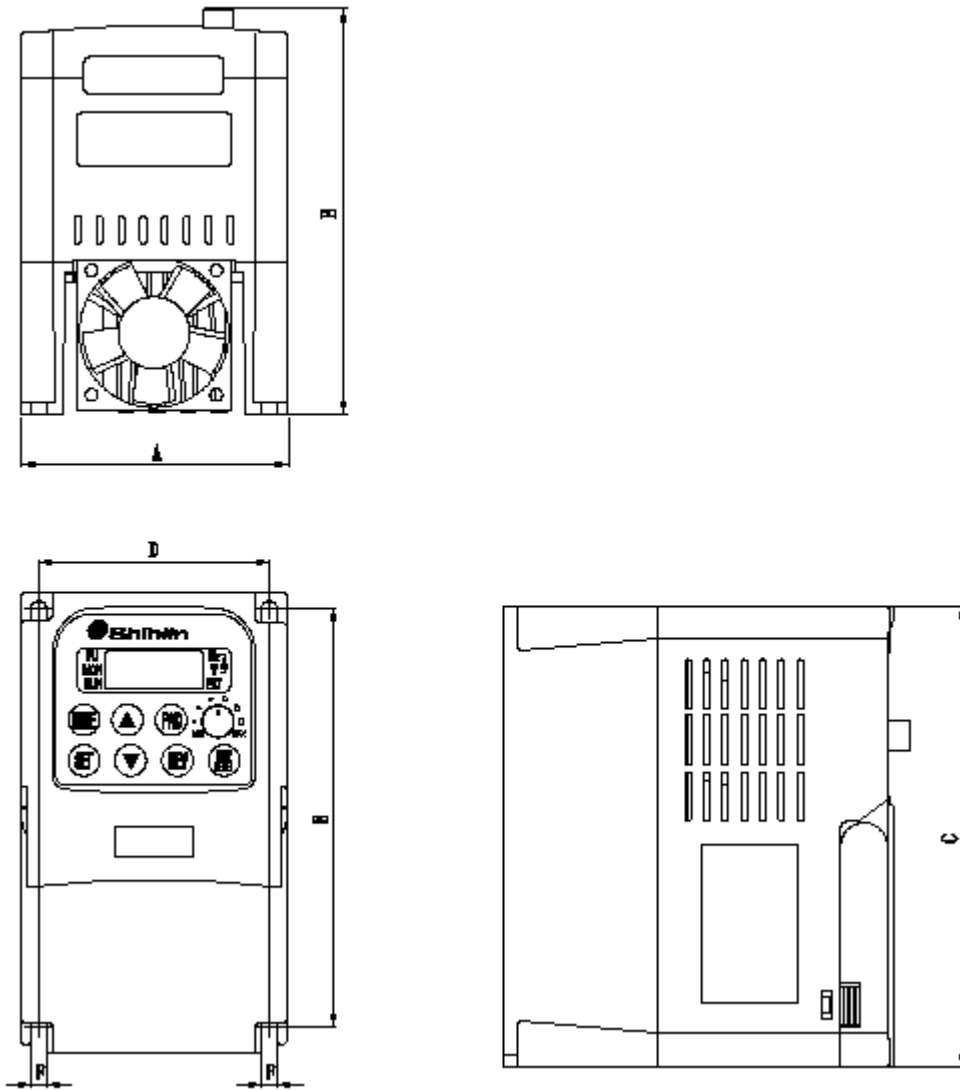
2-3 Mechanical Dimensions

2-3-1 SS021-0.4K~2.2K (0.5HP~3HP) series



Model	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	F (mm)
SS021-0.4K	85	130.5	148	74	134	Φ 5
SS021-0.75K	85	130.5	148	74	134	Φ 5
SS021-1.5K	100	131.5	186	86.5	173.5	Φ 5.5
SS021-2.2K	118	141.5	220	105.5	207	Φ 5.5

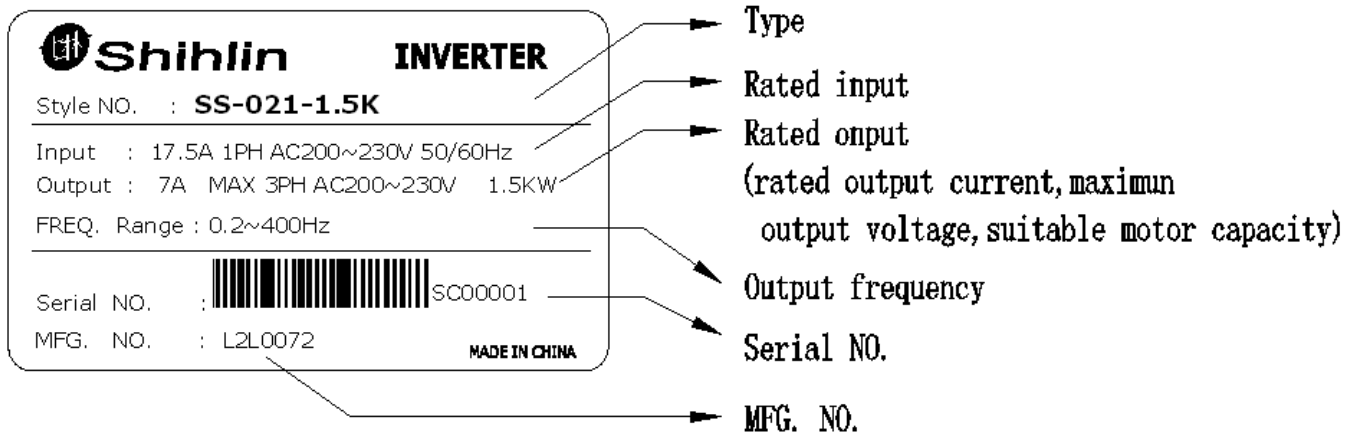
2-3-2 SS0X3-0.4K~5.5K (0.5HP~7.5HP) series



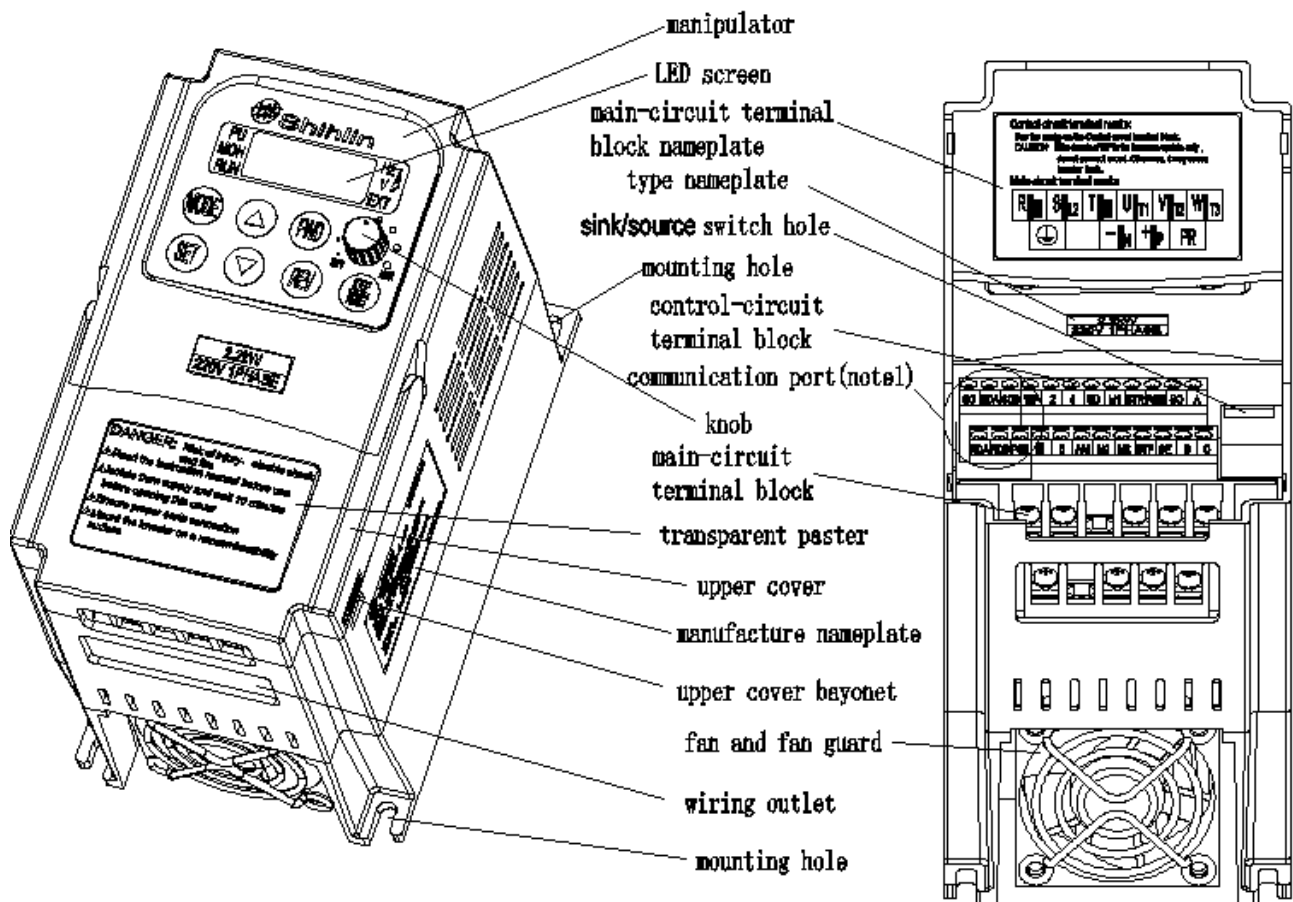
Model	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	F (mm)
SS023-0.4K	85	130.5	148	74	134	Φ 5
SS023-0.75K	85	130.5	148	74	134	Φ 5
SS023-1.5K	100	131.5	186	86.5	173	Φ 5.5
SS023-2.2K	100	131.5	186	86.5	173	Φ 5.5
SS023-3.7K	118	141.5	220	105.5	207	Φ 5.5
SS043-0.4K	85	130.5	148	74	134	Φ 5
SS043-0.75K	85	130.5	148	74	134	Φ 5
SS043-1.5K	100	131.5	186	86.5	173	Φ 5.5
SS043-2.2K	100	131.5	186	86.5	173	Φ 5.5
SS043-3.7K	118	141.5	220	105.5	207	Φ 5.5
SS043-5.5K	120	146.5	150	188	138	Φ 5

2-4 Name of each part

2-4-1 Nameplate and model



2-4-2 SS021-0.4K~2.2K (0.5HP~3HP) Series

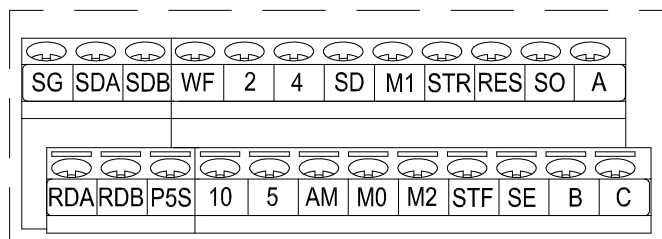


When pressing down the upper cover latches and pulling the cover forward in the inverter front face direction, the upper cover then can be dismounted. After dismounting the upper cover, the 'control-circuit terminal block' and the 'main-circuit terminal block' can be seen.

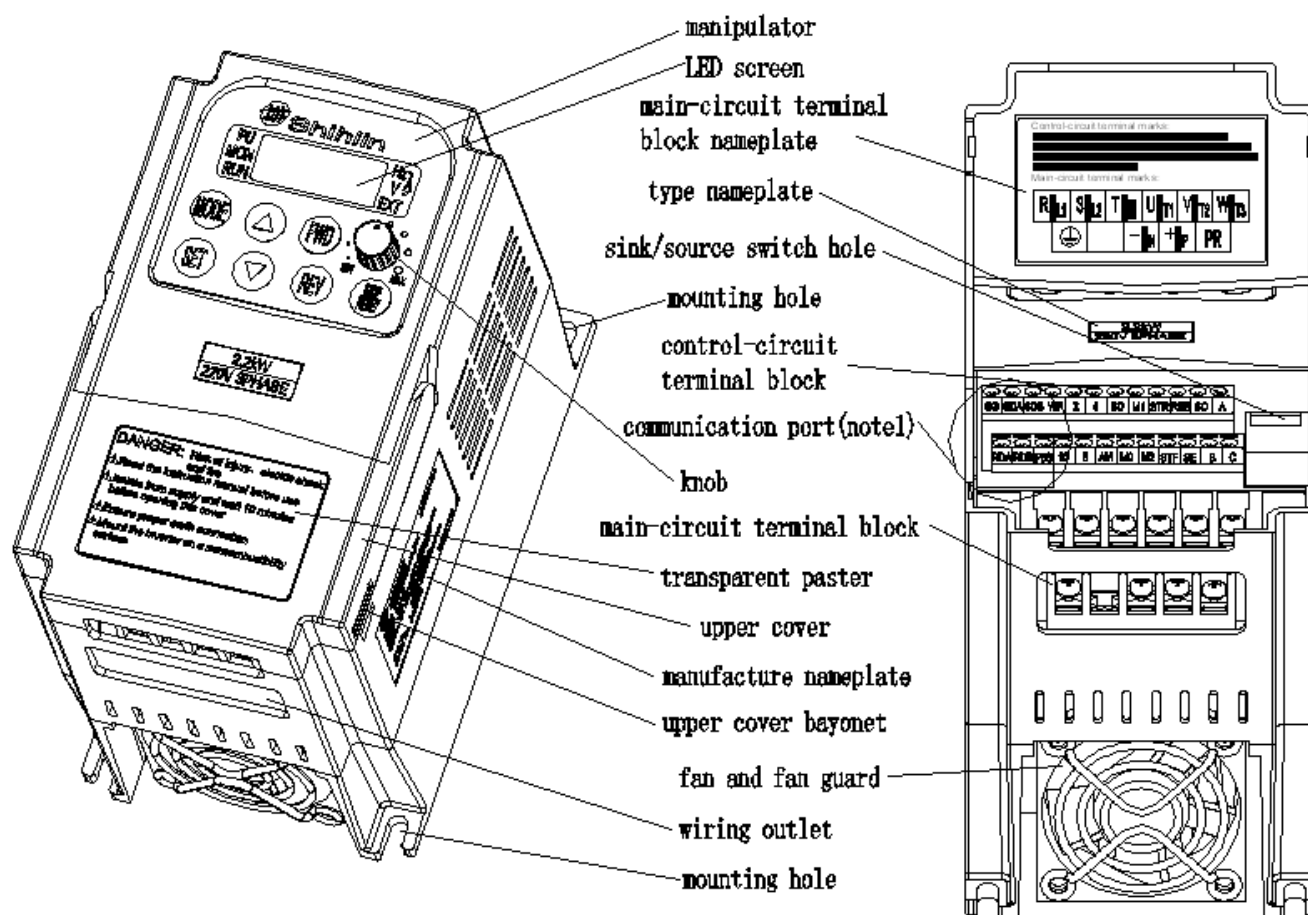
When wiring, the wire must go through the 'wiring outlet' before connecting with the terminal bank.

(note 1) please refer to (note 2) type instruction in Chapter 1.

(note 2) The enlarge figure of the control-circuit terminal block nameplate is as follows:



2-4-3 SS0X3-0.4K ~3.7K (0.5HP ~5HP) Series

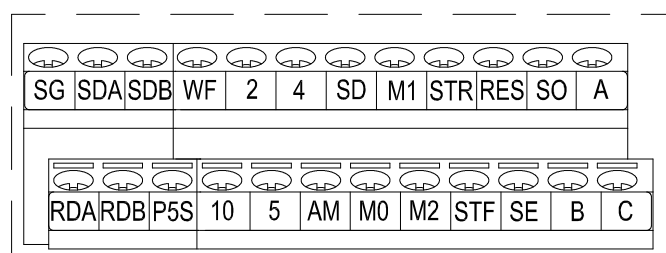


When pressing down the upper cover latches and pulling the cover forward in the inverter front face direction, the upper cover then can be dismounted. After dismounting the upper cover, the 'control terminal block' and the 'main terminal block' can be seen.

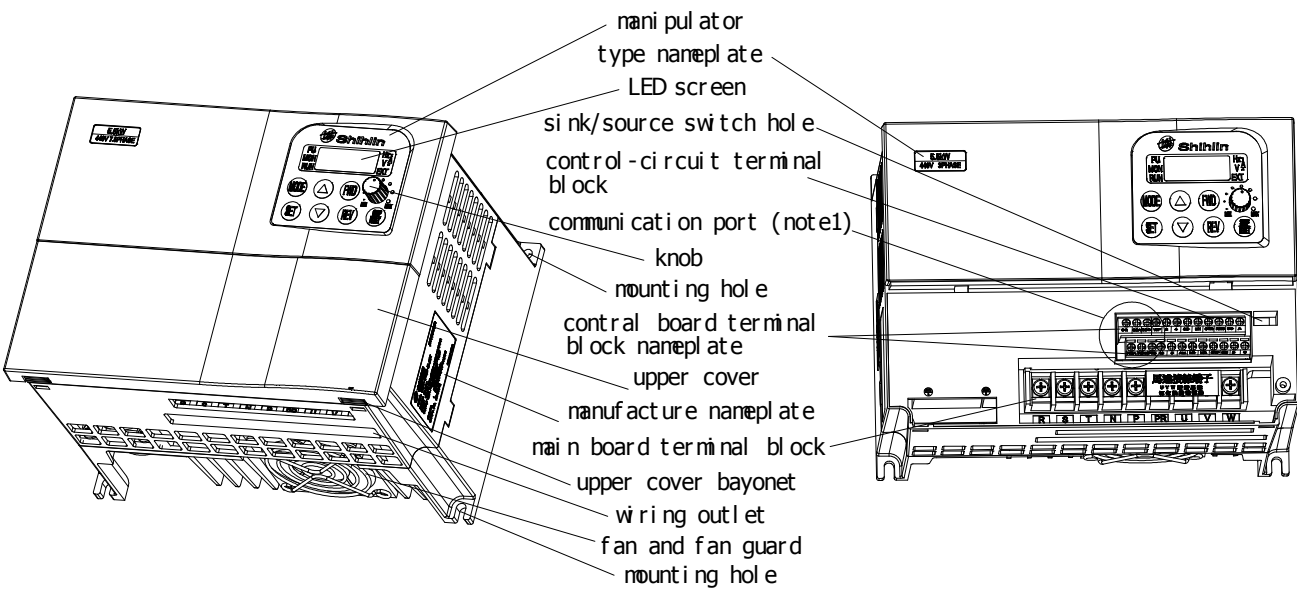
When wiring, the wire must go through the 'wiring outlet' before connected with the terminal bank.

(note 1) please refer to (note 2) type instruction in Chapter 1.

(note 2) The enlarge figure of the control-circuit terminal block nameplate is as follows:



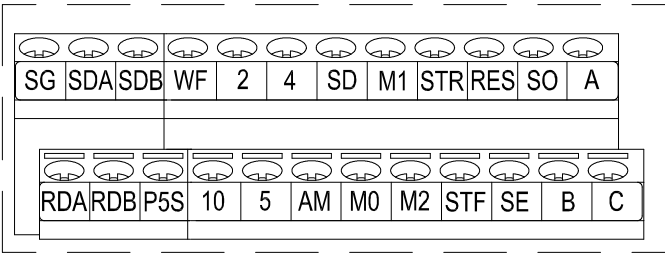
2-4-4 SS043-5.5K(7.5HP)



When pressing down the upper cover latches and pulling the cover forward in the inverter front face direction, the upper cover then can be dismounted. After dismounting the upper cover, the ‘control terminal block’ and the ‘main terminal block’ can be seen.

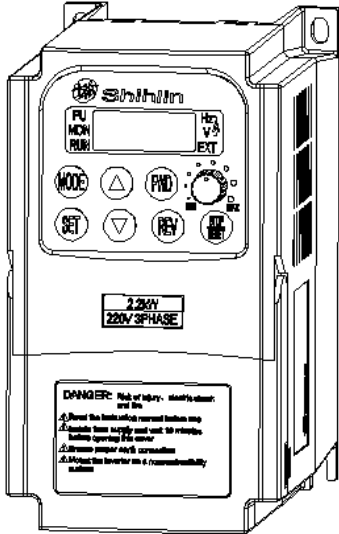
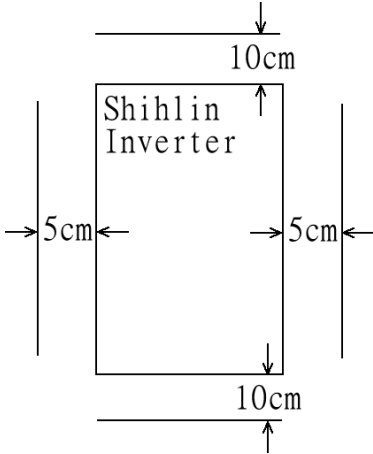
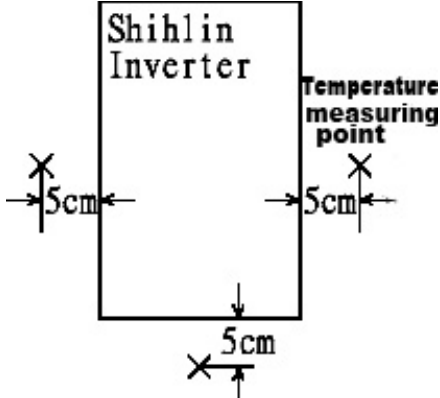
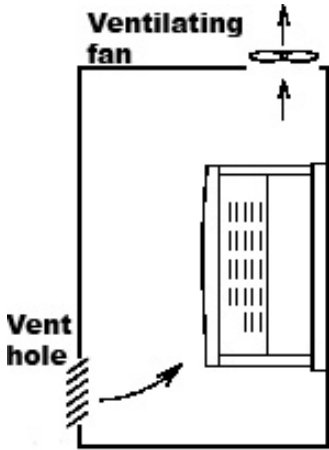
When wiring, the wire must go through the ‘wiring outlet’ before connected with the terminal bank.

- (note 1) please refer to (note 2) type instruction in Chapter 1.
(note 2) The enlarge figure of the control-circuit terminal block nameplate is as follows:



2-5 Installation and wiring

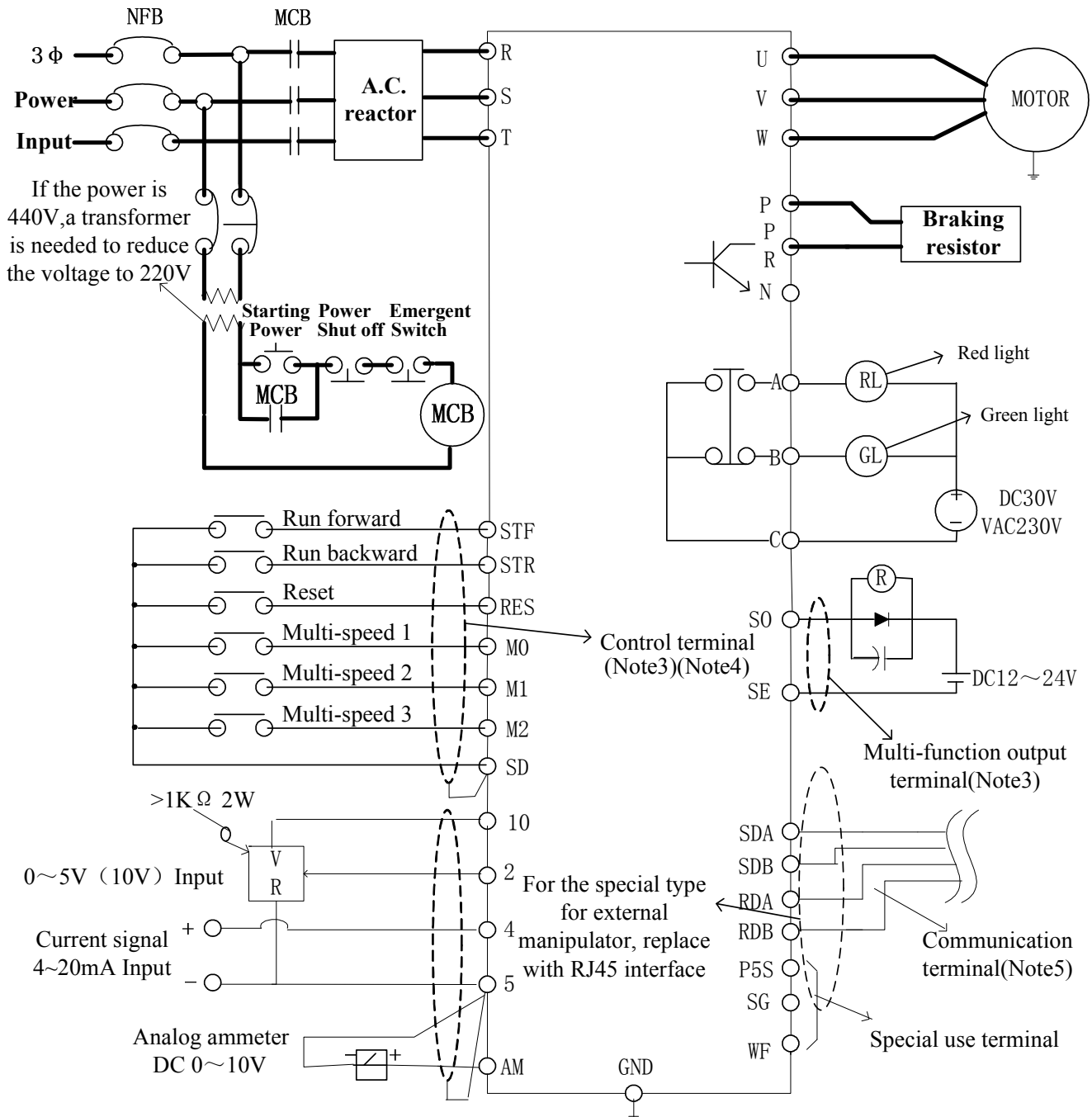
2-5-1 Installation notice

<p>1. Please install in an upright direction</p> 	<p>2. Proper clearance shall be kept from surroundings when installing</p> 
<p>3. The ambient temperature shall not exceed the permissible value.</p> 	<p>4. Correct position for installing in a protection cabin.</p> 
<p>5. Please do not install the inverter where it is subjected to vibration.</p> <p>6. Please do not install the inverter on a surface of inflammable material such as wood etc.</p> <p>7. Please do not install the inverter at places exposed to explosive gas, inflammable dust.</p> <p>8. Please do not install the inverter at places with airborne oil mist and dust.</p> <p>9. Please do not install the inverter at places exposed to corrosive gas, salt laden air.</p> <p>10. Please do not install the inverter in the environment of high temperature and high humidity.</p>	

(Note 1) Only qualified electrical professional personnel can carry out the installation, wire arrangement, dismounting and maintenance.

(Note 2) Please ensure to comply with the installation notice. In case the installation notice has not been fully complied with and damage of the inverter or dangerous accident thus be resulted in, our company will not undertake any legal responsibility. In case there is any question when installing, please feel free to contact us.

2-5-2 Terminal wire arrangement of SS0XX-0.4K~5.5K (0.5HP~7.5HP) series



(Note 1) In the above figure, heavy-gauge wires are main circuit wires; the rest are control circuit wires.

(Note 2) For the usage of external thermal relay, please refer to Pr80~Pr84、Pr86 in Chapter 4.

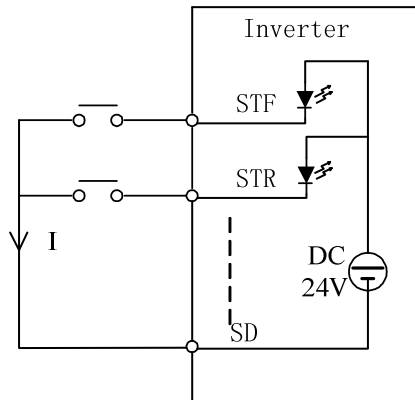
(Note 3) The differences between ‘terminal name’ and ‘function name’:

Near the terminals of the control board or the main circuit board, printed labels can be found. These label are used to distinguish each terminal, and thus called ‘terminal name’.

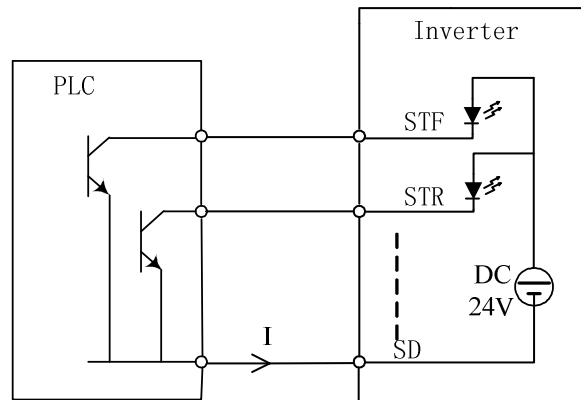
For ‘control terminal’ and ‘multi-function output terminal’, besides the terminal names, the ‘function names’ are also necessary to be defined. The function name indicates the actual function of the terminal.

For the multi-function control terminals and multi-function output terminals, just as their names, they can be set to several function names, so their terminal name and function name may be different.
 (Note 4) For SS0XX-0.4K~5.5K (0.5HP~7.5HP) series, the control terminals have both the 'Sink Input' mode and the 'Source Input' mode. There is a switch that can be used to alternate between those two modes. If the switch is on the left side, 'Sink Input' mode is chosen, and 'Source Input' mode is chosen while on the right side. The wire arrangement is shown in the following figures.

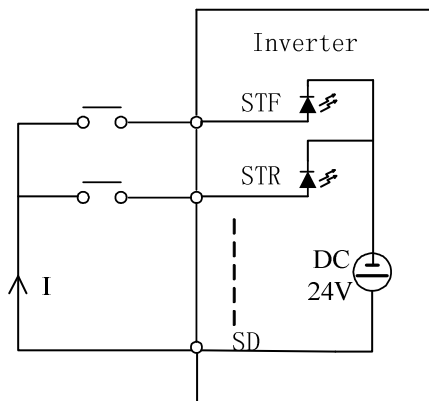
No matter what kind of control terminal it is, all of its outside wire arrangement can be considered as a simple switch. If the switch is 'on', the control signal will be put into the control terminal, if the switch is 'off', the control signal is shut off.



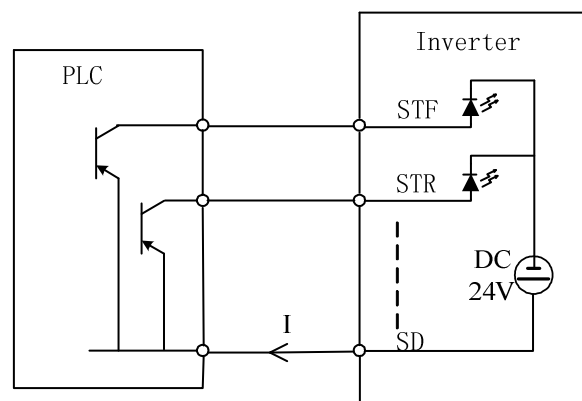
Example of Sink Input



Sink Input used with NPN output,
driven by internal power



Example of Source Input



Source Input used with PNP output,
driven by internal power

Short SD-24VG or SD-24V by a build-in switch. In 'Sink Input' mode, short SD-24VGND. In 'Source Input' mode, short SD-24V.

(Note 5) Please refer to communication part in Chapter 4

Main-circuit terminals	
	Remarks
R- S- T	Connect to the commercial power supply.
U- V- W	Connect to three-phase squirrel-cage motor.
P- PR	Connect to brake resistors. (Note 1)
P- (-)/N	Connect to brake unit (Note 4)
	The grounding terminal for the case of the inverter. For 220V series, the third type of grounding shall be adopted. For 440V series, special type of grounding shall be adopted.

(Note 1)

1. For SS0XX-0.4K~5.5K (0.5HP~7.5HP) series of inverters, the brake resistor isn't appended when sales.
2. For the related knowledge on regenerative voltage, please refer to Pr30 in Chapter 4.

(Note 2) In order to strengthen the braking capability during deceleration, it is suggested to purchase the option of 'brake unit' which is mounted between the terminals P and (-)/N. The 'brake unit' can effectively dissipate the fed-back energy from the motor to the inverter when decelerating. In case there is any problem on purchasing of the 'brake unit', please feel free to contact us.

Control terminals			
Terminal type	Terminal name	Function name	Remarks and function description
Sink Input	STF	Optional	For detailed descriptions, please refer to Pr80~Pr84、Pr86 in Chapter 4.
	STR	Optional	
	M0	Optional	
	M1	Optional	
	M2	Optional	
	RES	Optional	
	SD	SD	Common reference Ground for STF、STR、M0、M1、M2 and RES
Analog signal input	10	---	The internal power is DC 5V at this terminal.
	2	---	The input point of voltage signal 0~5V or 0~10V, is used to set the running frequency. Pr38
	4	---	The input points of current signal 4mA~20mA, is used to set the running frequency. Pr39
	5	---	The common reference ground of 2、4、10 and AM.
Relay output	A	---	Normally, points AC are always open-circuit; B-C always 'short-circuit'.
	B	---	These terminals are multi-function relay output. For detailed descriptions, please refer to Pr85 . (Note) Contactor capacity: VDC30V / VAC230V-- 0.3A
	C	---	
Open collector output	SO	Optional	These terminals can also be called 'multi-function output terminal'. The function name of a multi-function output terminal, can be set by Parameter Pr40. For detailed description, please refer to Pr40 in Chapter 4.
	SE	SE	Open collector output reference ground.
Analog signal output	AM	---	Connected with an external analog meter to indicate the output frequency or current. Please refer to Pr54、Pr55、Pr56 and Pr190、Pr191 in Chapter 4.
485 communication terminal (Note 1)	SDA	SDA	RS485/422 serial communication terminal
	SDB	SDB	
	RDA	RDA	
	RDB	RDB	
	P5S	P5S	5V Source
	SG	SG	5V Ground
	WF (Note 2)	WF	NMI

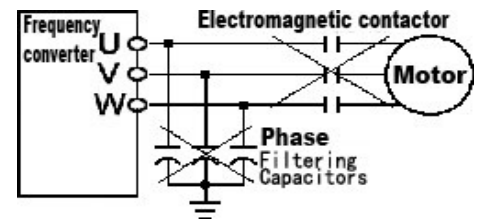
Note 1: The content about RS-485 communication is not suited for the special type for external manipulator.

Note 2: WF terminal is only for program updating. Please don't perform connection during running, otherwise damage or malfunction can be resulted.

2-5-3 Wiring precautions

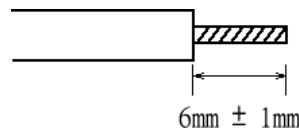
Main circuit wiring:

1. Do not connect the power supply wires to the 'inverter's output terminals U-V-W' which are designed for connecting motors, otherwise, the inverter may be damaged.
2. Please do not mount filtering capacitors, surge absorbers and electromagnetic contactors at the output end of the inverter.
3. Please do not use 'electromagnetic contactors' or 'no-fuse switches' with an online power to start or stop the motor.
4. Please ensure that the case of inverter and the motor are grounded, to avoid personnel electric shock.
5. To appropriately select the diameter of the main wires and the corresponding wire terminals, the no-fuse switches and the electromagnetic contactors, please refer to Section 2-6. And if the distance between the inverter and the motor is far, please employ a wire with larger diameter to ensure the voltage drop along the wire within 2V. (The total length of the wire shall not exceed 500 meters)
6. 'Pressing connection terminals with insulated sleeve' shall be utilized for the wiring at the power source side and the load side.
7. In a short period after the power supply is shut off, high voltage still exists between the terminals P- (-)/N, thus please do not touch them to avoid personnel electric shock.



Control circuit wire arrangement:

1. For wiring of signal input, 'insolated wires' must be used, and the 'metal mesh' of which must be connect with the 'Terminal 5'.
2. For the control board wiring, wires with a diameter of 0.75mm^2 is suggested to be used. And for the stripping of the insulating layer, please comply with the instruction of the following figure.



3. The control board wire (including signal input wire) shall be far away from the main circuit board wire. Binding the control board wires together with the main circuit wires is strictly forbidden.
4. In the inverter, the 'terminal SD', 'terminal SE' and the 'terminal 5' are the referencing grounds for the inner power sources which are isolated from each other.

(Note 1) The terminal block screws must be screwed up tightly. Especially the wire cut pieces shall not be left in the inverter.

(Note 2) When wiring, the 'wire protection rubber' shall be firstly cut in a cross way, then the cable can penetrate through the wire protection rubber before connecting with the terminal bank to protect the cable insulation shield against scratch and damage. When wiring with a PVC pipe / metal pipe, please remove the 'wire protection rubber' and arrange the pipe directly.

(Note 3) Only qualified electrical professional personnel can carry out the installation, wire arrangement, dismounting and maintenance.

(Note 4) Please comply with the wire arrangement notice. In case the installation has not been fully complied with , and damage of the inverter or dangerous accident thus be resulted in, our company will not undertake any legal responsibility. In case there is any question on the wire arrangement, please feel free to contact us.

2- 6 Selection of peripheral equipments

2-6-1 No-fuse switch

Inverter type	Motor capacity	Power source capacity	Applicable NFB type (Shihlin)	Applicable MCB type (Shihlin)
SS021-0.4K	220V 0.5HP	1.5KVA	NF30 5A	S-C11L
SS021-0.75K	220V 1HP	2.5kVA	NF30 10A	S-C11L
SS021-1.5K	220V 2HP	3.5kVA	NF30 15A	S-C11L
SS021-2.2K	220V 3HP	4.2kVA	NF30 20A	S-C11L / S-C12L
SS023-0.4K	220V 0.5HP	1.5KVA	NF30 5A	S-C11L
SS023-0.75K	220V 1HP	2.5kVA	NF30 10A	S-C11L
SS023-1.5K	220V 2HP	4.5kVA	NF30 15A	S-C11L
SS023-2.2K	220V 3HP	5.5kVA	NF30 20A	S-C11L / S-C12L
SS023-3.7K	220V 5HP	9kVA	NF30 30A	S-C20L
SS043-0.4K	440V 0.5HP	1.5KVA	NF30 3A	S-C11L
SS043-0.75K	440V 1HP	2.5kVA	NF30 5A	S-C11L
SS043-1.5K	440V 2HP	4.5kVA	NF30 10A	S-C11L
SS043-2.2K	440V 3HP	5.5kVA	NF30 15A	S-C20L
SS043-3.7K	440V 3HP	9kVA	NF30 20A	S-C20L
SS043-5.5K	440V 7.5HP	12kVA	NF30 30A	S-C20L

2-6-2 Power cable specification/pressing connection terminals specification

Inverter type	Power cable specification		Pressing connection terminal specification (used by power cables)	
	Cables for the power supply R.S.T (mm ²)	Cables for the output U.V.W (mm ²)	Cables for the power supply R.S.T (mm ²)	Cables for the output U.V.W (mm ²)
SS021-0.4K	2	2	2 - 4	2 - 4
SS021-0.75K	2	2	2 - 4	2 - 4
SS021-1.5K	2	2	2 - 4	2 - 4
SS021-2.2K	2	2	2 - 4	2 - 4
SS023-0.4K	2	2	2 - 4	2 - 4
SS023-0.75K	2	2	2 - 4	2 - 4
SS023-1.5K	2	2	2 - 4	2 - 4
SS023-2.2K	2	2	2 - 4	2 - 4
SS023-3.7K	3.5	3.5	5.5 -7.5	5.5-7.5
SS043-0.4K	2	2	2 - 4	2 - 4
SS043-0.75K	2	2	2 - 4	2 - 4
SS043-1.5K	2	2	2 - 4	2 - 4

SS043-2.2K	2	2	2 - 4	2 - 4
SS043-3.7K	2	2	2 - 4	2 - 4
SS043-5.5K	3.5	2	5.5 - 7.5	2 - 4

2-6-3 Brake resistors

Inverter type	Brake resistor specification	Inverter type	Brake resistor specification
SS021-0.4K	100W 220 Ω above	SS023-3.7K	400W 40 Ω above
SS021-0.75K	150W 120 Ω above	SS043-0.4K	80W 1000 Ω above
SS021-1.5K	300W 60 Ω above	SS043-0.75K	100W 800 Ω above
SS021-2.2K	300W 60 Ω above	SS043-1.5K	200W 320 Ω above
SS023-0.4K	100W 220 Ω above	SS043-2.2K	400W 160 Ω above
SS023-0.75K	150W 120 Ω above	SS043-3.7K	600W 120 Ω above
SS023-1.5K	300W 60 Ω above	SS043-5.5K	1000W 75 Ω above
SS023-2.2K	300W 60 Ω above		

(Note 1) The brake resistor capacity listed in the above table is based on the condition that the regenerative brake duty is 10% (that is ,in case braking lasts for 5 seconds, another 45 seconds must be provided for heat dissipation). The brake resistor wattage can be reduced according to the user's application (quantity of heat) and the regenerative brake duty. But the resistance must be larger than the value list in the above table (otherwise damage of the inverter thus be resulted in).

(Note 2) In case frequent start and stop operations are required, a larger regenerative brake duty should be set; and meanwhile, a larger brake resistor should be employed correspondingly. If there is any problem about selection of brake resistors, please feel free to contact us.

Chapter 3. Primary operation

3-1 Operating modes of the inverter

The operation modes are related to the reference source of the running frequency and the signal source of the motor starting. The Shihlin inverter totally has 9 kinds of operation modes, namely, 'PU mode', 'JOG mode', 'external mode', 'communication mode', 'combined mode 1', 'combined mode 2', 'combined mode 3', 'combined mode 4' and 'combined mode 5'.

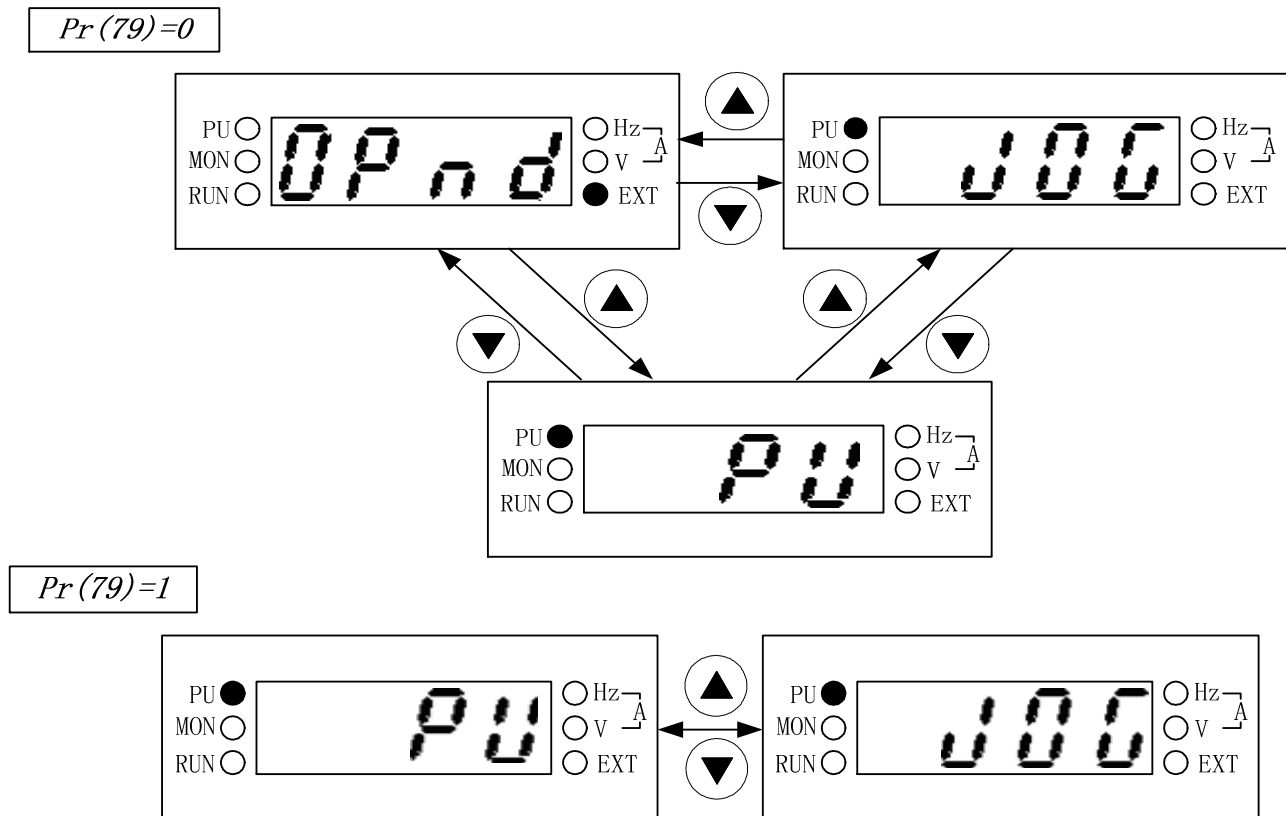
Related parameters	values	Operation mode	The reference source of running frequency	The signal source of motor starting	Remarks
Operation mode selection Pr79	0	PU mode (<i>P U</i>)	Set by manipulator	Press the key <i>FWD</i> or <i>REV</i> on the manipulator	(Note 1) The ‘PU mode’, ‘External mode’ and ‘JOG mode’ are valid and interchangeable
		JOG mode (<i>J O G</i>)	The set value of Pr15	Press the key <i>FWD</i> or <i>REV</i> on the manipulator	
		External mode (<i>E P n d</i>)	‘Voltage /current signal value’ or ‘combination of multi-speed stage levels’	External terminals	
	1	PU mode(<i>P U</i>)	Equal to the ‘PU mode’ when Pr79=0		‘PU mode’ and ‘JOG mode’ are valid and interchangeable
		JOG mode (<i>J O G</i>)	Equal to the ‘JOG mode’ when Pr79=0		
	2	External mode (<i>E P n d</i>)	Equal to the ‘External mode’ when Pr79=0		
	3	Communication mode (<i>C U</i>)	Communication	Communication	(Note 2)
	4	Combined mode 1(<i>H 1</i>)	Set by manipulator	External terminals	(Note 1)
	5	Combined mode 2(<i>H 2</i>)	‘Voltage /current signal value’ or ‘combination of multi-speed stage levels’	Press the key <i>FWD</i> or <i>REV</i> on the manipulator	(Note 1)
	6	Combined mode 3(<i>H 3</i>)	Communication 、 ‘combination of multi-speed stage levels’ 、 external JOG(Pr15)	External terminals	(Note 2)
	7	Combined mode 4(<i>H 4</i>)	‘Voltage /current signal value’ or ‘combination of multi-speed stage levels’	Communication	
8	Combined mode 5(<i>H 5</i>)	Set by keyboard, ‘combination of multi-speed stage levels’ or external JOG(Pr15)	External terminals	(Note 1)	

When it is started, Pr79=0, and the inverter is in *E x t* mode, but the set value of Pr79 can be changed to shift the operating mode.

(Note 1) For the special type for external manipulator, all the processes that can be operated by PU manipulator also can be operated by DU03 operation panel.

(Note 2) The special type for external manipulator can't be used in communication mode, combined mode 3 and combined mode 4.

3-1-1 The flow charts for transferring operation modes with a SS-TYPE series of manipulator.



(Note 1)

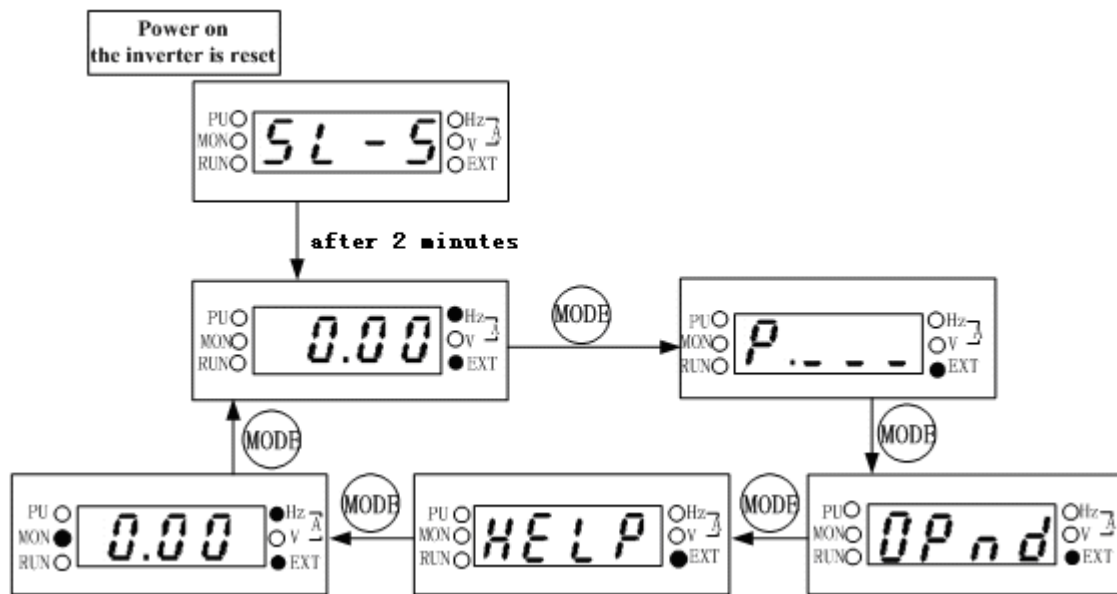
1. In 'PU mode', the indicating lamp **PU** in the manipulator will be lit.
2. In 'external mode' the indicating lamp **EXT** will be lit.
3. In 'combined mode 1,2,3,4 or 5', the indicating lamp **PU** will be lit.
4. In 'JOG mode', the indicating lamp **PU** will be lit, and at the same time the display screen will display **JOG** while the motor is not running.

(Note 2) If the Pr79=2、3、4、5、6、7 or 8, the operation mode will be constant, so there are no flow charts for it.

3-2 Working modes of a manipulator

A manipulator can be used to monitor the output frequency, output current, and output voltage, browse the alarming information, set parameters and running frequencies, and etc. Therefore, there are totally five working modes for a manipulator, namely, 'monitoring mode', 'parameter setting mode', 'frequency setting mode', 'operating mode' and 'alarm mode'.

3-2-1 The flow charts for transferring working modes with a SS-TYPE Series of manipulator



(Note 1) For detailed operating flow in monitoring mode, please refer to Section 3-2-2.

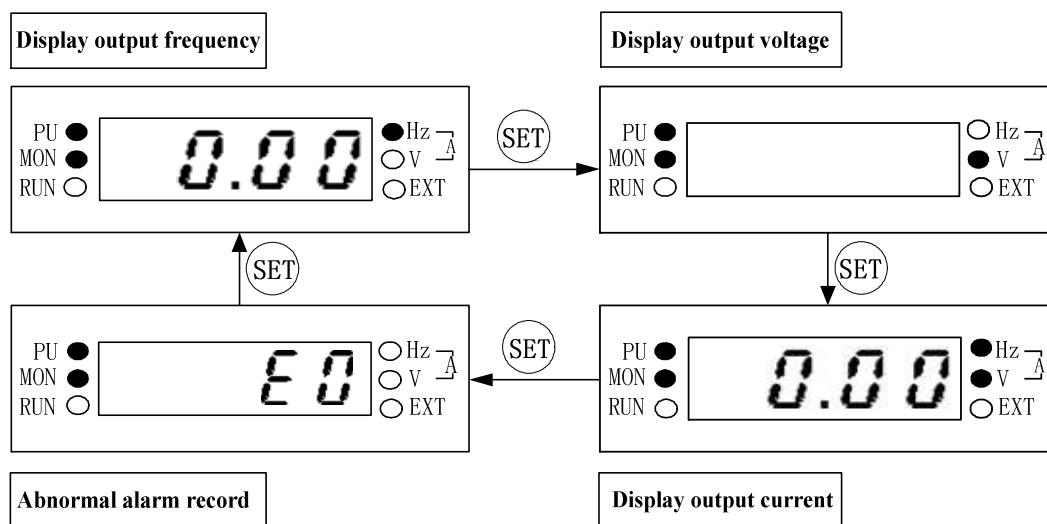
(Note 2) For detailed operating flow in frequency setting mode, please refer to Section 3-2-3.

(Note 3) For detailed operating flow in parameter setting mode, please refer to Section 3-2-4.

(Note 4) For detailed operating flow in operating mode, please refer to Section 3-1-1.

(Note 5) For detailed operating flow in **HELP** mode, please refer to Section 3-2-5.

3-2-2 The operating flow charts for monitoring mode with a SS-TYPE Series of manipulator

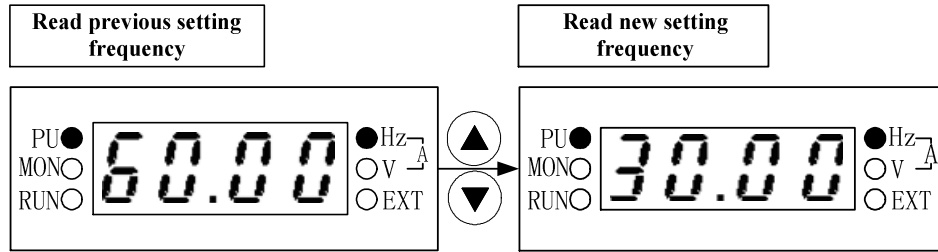


(Note 1)

1. When in 'monitoring output frequency' mode, the indicating lamp of **MON** and **Hz** will be lit, and at the same time the screen will display the current output frequency.
2. When in 'monitoring output voltage' mode, the indicating lamp of **MON** and **V** will be lit, and the screen will display the current output voltage value.
3. When in 'monitoring output current' mode, the indicating lamp of **MON** and **A** will be lit, and the screen will display the current output current value.
4. When in 'browsing alarm recording' mode, the indicating lamp of **MON** will be lit, and the screen will display the current alarm code.

(Note 2) For the alarm codes, please refer to Appendix 2.

3-2-3 The operating flow charts for frequency setting mode with a SS-TYPE Series of manipulator

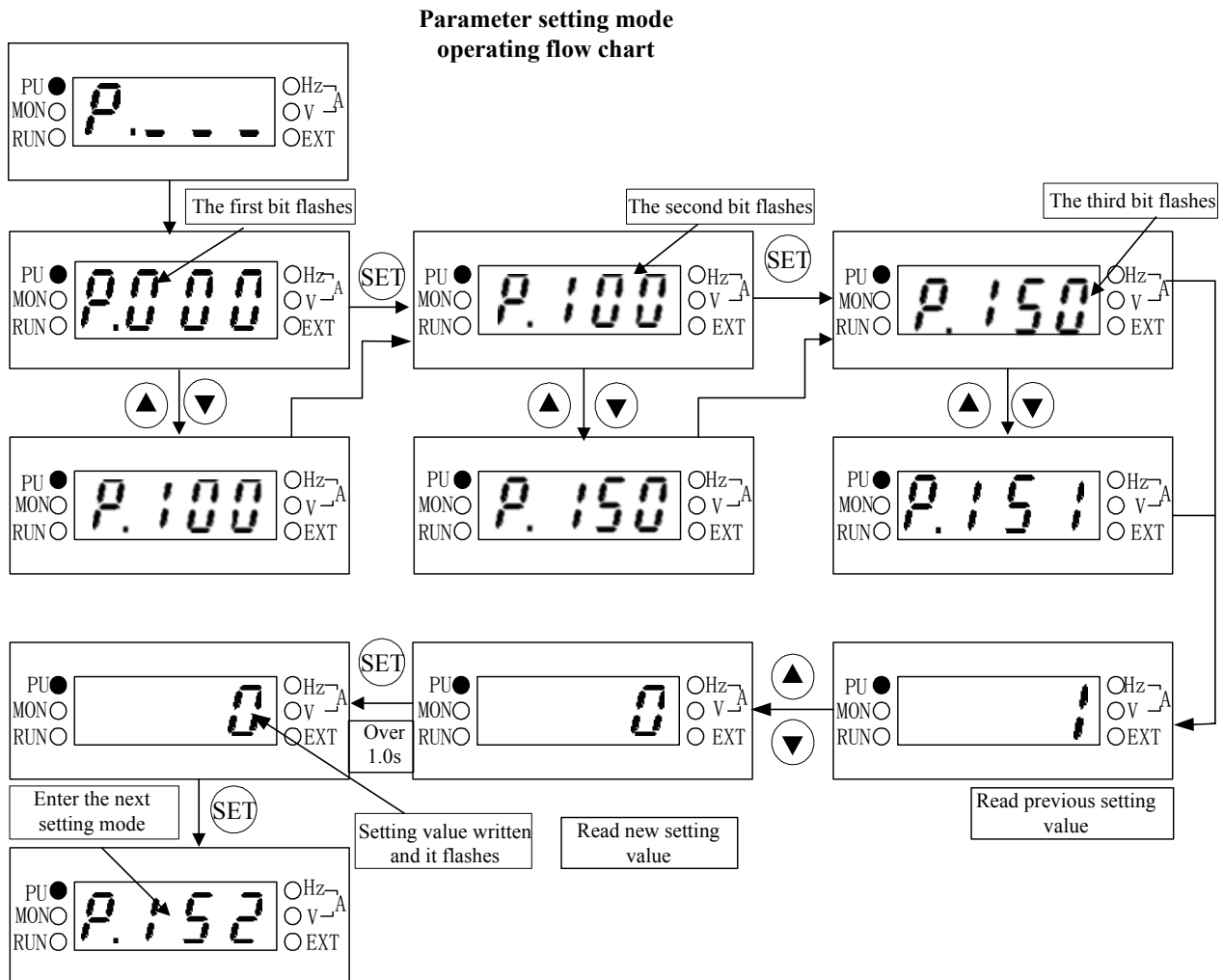


(Note) When the inverter runs, the frequency can be changed by and .

(注) In the frequency setting mode, the indicating lamp Hz will be lit, but MON will not be lit.

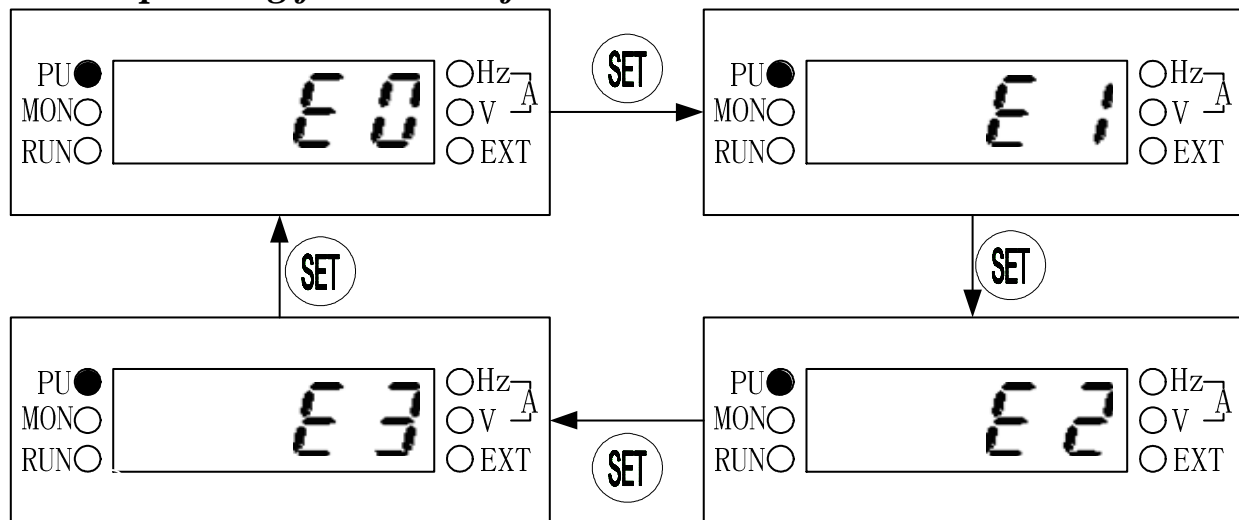
(注) When setting frequency in PU mode, the set value can not exceed the upper frequency. When high frequency is needed, the upper frequency should be changed first.

3-2-4 The operating flow charts for parameter setting mode with a SS-TYPE Series of manipulator



(Note) In the parameter setting mode, both the indicating lamp of Hz and indicating lamp of MON will turn off.

3-2-5 The operating flow charts for HELP mode









(Note 1) When browsing the alarm record, the screen will display the latest 4 alarm records.

(Note 2) For the alarm code, please refer to appendix 2.


3-3 The basic operation procedure for PU mode (Pr79=0 or 1)



Steps	Description
1	<p>Changing the operation mode to PU mode. and the indicating lamp of PU ● will be lit.</p> <p>(Note)</p> <ol style="list-style-type: none"> When Pr79=0, after the power is switched on or the inverter is reset, the inverter will enter external mode first. For selection and shifting of operation modes, please refer to Section 3-1.
2	<p>Entering frequency setting mode, and writing the running frequency into the memory.</p> <p>(Note) For the detailed setting procedure, please refer to Section 3-2.</p>
3	<p>Press FWD or REV, then the motor will start running. At this time, the indicating lamp of RUN ● will flicker which indicates that the motor is running. The manipulator then enters the monitoring mode automatically.</p> <p>(Note)</p> <ol style="list-style-type: none"> For the operating flow of monitoring mode, please refer to Section 3-2. While the motor is running, the frequency setting mode is also valid, and thus the running frequency can be changed to regulate the motor speed.
4	<p>Press STOP RESET, then the motor will decelerate, till it stops. The indicating lamp of RUN ● will not turn off until the inverter stops outputting voltages.</p>

3-4 The basic operation procedure for external mode(Pr79=0 or 2)

Steps	Description
1	<p>Change the operation mode to the external mode, and then the indicating lamp of EXT  will be lit. (Note)</p> <p>1. When Pr79=0, after the power is turned on or the inverter is reset, press  to shift to 'operating mode'. The inverter will enter the OPn d mode first, then press  or  to shift to PU mode.</p> <p>2. When Pr79=2, the inverter will always in OPn d mode.</p> <p>3. For selection and shifting of operation modes, please refer to Section 3-1.</p>
2	<p>If the running frequency is set by a current signal, please refer to Pr39 in Chapter 4.</p> <p>If the running frequency is set by multi-speed stage levels, please refer to Pr4 in Chapter 4.</p> <p>If the running frequency is set by a voltage signal, please refer to Pr38 in Chapter 4.</p> <p>If programmable operating mode is chosen, please refer to multi-function terminals Pr80~Pr84、 Pr86 in chapter 4.</p>
3	<p>Turn on STF or STR, the motor will start running. At this time, the indicating lamp of RUN  will blink which indicates that the motor is running.</p> <p>(Note)</p> <p>1. For advanced setting of the starting terminals STF and STR, please refer to Pr78 and multi-function terminal Pr80~Pr84、 Pr86 in Chapter 4.</p> <p>2. For the operating procedure of the monitoring mode, please refer to Section 3-2.</p> <p>3. If programmed operation mode is chosen, STF becomes starting signal and STR becomes pause signal, they are not Run Forward or Run Reverse terminals anymore. Turn on STF, the motor will start running. Turn off STF, and the motor will decelerate, until it stops. While the motor is running turn on STR, the motor will decelerate, till it stops. Turn off STR, then the motor will start running again.</p>
4	<p>Turn off STF or STR, then the motor will decelerate, till it stops.</p> <p>The indicating lamp of RUN  will not turn off until the inverter has stopped putting out voltages.</p> <p>(Note)Please refer to note3 above.</p>

3-5 The basic operation procedure for JOG mode (Pr79=0 or 1)




Steps	Description
1	<p>Change the operation mode to the JOG mode; and the indicating lamp of PU  will be lit, and the screen will display JOG before the motor runs.</p> <p>(Note) For selection and shift of the operation modes, please refer to Section 3-1.</p>

2	<p>1. Press down FWD or REV, then the motor will start running. At this time, the indicating lamp of RUN  will blink which indicates that the motor is running.</p> <p>2. When releasing FWD or REV, the motor will decelerate, till it stops. The indicating lamp RUN  will not turn off until the motor has stopped putting out voltages.</p> <p>(Note 1) For the operating procedure of the monitoring mode, please refer to Section 3-2.</p> <p>(Note 2) In the JOG mode, the running frequency is the value of Pr15, and the acceleration / deceleration time is the value of Pr16. Please refer to Pr15 in Chapter 4.</p>
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3-6 The basic operation procedure for communication mode(Pr79=3)

In communication mode, the user can set parameters, run/stop, and reset the inverter by communication. Please refer to **Pr31~Pr53** and **communication protocol** for details.

3-7 The basic operation procedure for Combined mode 1 (Pr79=4)

Steps	Description
1	<p>In Combined mode 1, the indicating lamp of PU  will blink.</p> <p>(Note) For selection and shifting of operation modes, please refer to Section 3-1.</p>
2	<p>Enter the frequency setting mode, and write the running frequency into the memory.</p> <p>(Note) For the operating procedure of the frequency setting mode, please refer to Section 3-2.</p>
3	<p>Set the running frequency by the manipulator and start the inverter by the external terminals.</p> <p>At this time, the indicating lamp of RUN  will blink which indicated that the motor is running.</p> <p>(Note)</p> <p>1. For the operating procedure of the monitoring mode, please refer to Section 3-2.</p>
4	<p>Turn off STF or STR, and then the motor will decelerate, till it stops. The indicating lamp of RUN  will not turn off until the inverter has stopped putting out voltages.</p>

3-8 The basic operation procedure for Combined mode 2 (Pr79=5)

Steps	Description
1	In Combined mode 2, the indicating lamp of PU  will be lit. (Note) For selection and shifting of the operation mode, please refer to Section 2-1.
2	If the running frequency is set by a current signal, please refer to Pr39 in Chapter 4. If the running frequency is set by multi-speed stage levels, please refer to Pr4 in Chapter 4. If the running frequency is set by a voltage signal, please refer to Pr38 in Chapter 4.
3	Press down FWD or REV , and then the motor starts running. At this time, the indicating lamp of RUN  will blink, which indicates that the motor is running. And the manipulator will enter the 'monitoring mode' automatically. (Note) 1. For the operating procedure of the monitoring mode, please refer to Section 3-2. 2. In case the motor is running the frequency setting mode is also valid ,and thus the running frequency can be changed to regulate the motor speed.
4	After pressing down STOP RESET , the motor will decelerate, till it stops. The indicating lamp of RUN  will not turn off until the inverter has stopped putting out voltages.

3-9 The basic operation procedure for Combined mode 3 (Pr79=6)

The running frequency is determined by communication. when M0、M1、M2、REX are 'ON', the running frequency is determined by external terminals (Please refer to Pr4~Pr6, Pr80~Pr84、Pr86) When EXJ is 'ON', the running frequency is determined by the set value of Pr15. Acceleration/deceleration time is set by the value of Pr16. The inverter startup is determined by external terminals. The functions of Pr996, Pr998 and Pr999 can be accomplished.

3-10 The basic operation procedure for Combined mode 4 (Pr79=7)

The running frequency of the inverter is determined by the 'voltage signal value', 'current signal value' or 'combination of multi-speed stage levels' terminals. The inverter startup is determined by communication (including 'reset').

3-11 The basic operation procedure for Combined mode 5 (Pr79=8)

The running frequency is determined by the manipulator. when M0、M1、M2、REX are 'ON', the running frequency is determined by external terminals (Please refer to Pr4~Pr6, Pr80~Pr84、Pr86). When EXJ is 'ON', the running frequency is determined by the set value of Pr15. Acceleration/deceleration time is set by the value of Pr16.

Chapter 4. Parameter description

Pr0 Torque Boost

Pr3 Base Frequency

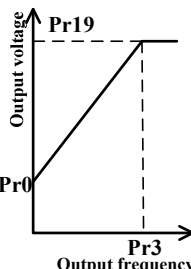
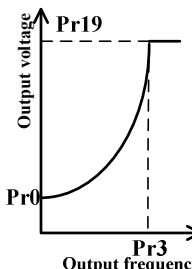
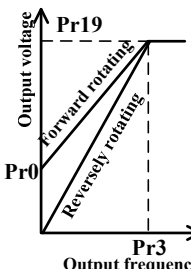
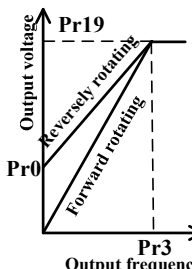
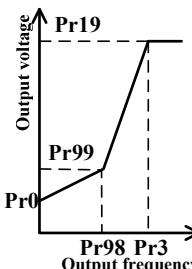
Pr14 Load pattern selection

Pr19 Base Voltage

Pr98 Middle frequency

Pr99 Voltage output at middle frequency

1. The maximum output voltage of the inverter is called 'base voltage'.
2. If the output frequency is lower than the base frequency, the output voltage of the inverter will increase with the output frequency; if the output frequency has reached the base frequency, the output voltage will just be equal to the base voltage. If the output frequency exceeds the base frequency, and increase continuously, the output voltage will be fixed to the base voltage. Please refer to the following figures for the V/F curves (output voltage vs output frequency).
3. For an inverter controlled by V/F mode, when the motor starts up, since the output voltage of the inverter is inadequate, the startup torque is usually inadequate. In this case, the output voltage can be improved by properly setting the torque boost (Pr0), and thus a better starting torque can be acquired.
4. If Pr0=6% and Pr19=220V, and when output frequency of the inverter is 0Hz, the output voltage is $Pr19 * Pr0 = 220 * 6\% = 13.2V$.
5. If Pr14=4, suppose that Pr19=220V, Pr98=5HZ, Pr99=10%, when the inverter is running at 5HZ, the output voltage equals $Pr99 * Pr19 = 10\% * 220V = 22V$.

Parameter	Pr14				
value	0	1	2	3	4
V/F Curve					
Description	1.Constant torque loads 2.Applicable to trolley and conveyer belt etc.	1.Variable torque loads 2. Applicable to fans and pumps etc.	Ascending/ descending loads	Ascending/ descending loads	Whether it is high startup torque or descending torque is due to the set values of Pr98 and Pr99

(Note1) If the set value of Pr0 is too high, it will result in the action of the current protection of the inverter or will disable the inverter to start smoothly.

(Note2) If Pr19=9999, the maximum output voltage of the inverter will depend on the value of the power supply voltage.

Pr1 Maximum frequency

Pr2 Minimum frequency

Pr18 High-speed maximum frequency

As shown in the following figures,

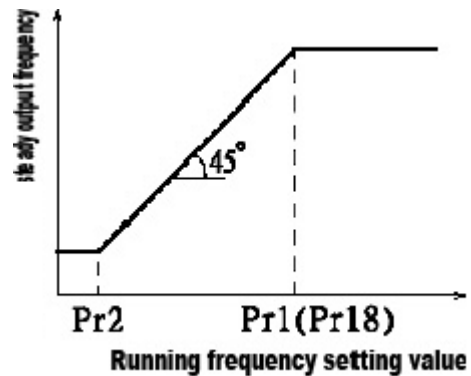
If the running frequency \leq Pr2, the steady output frequency equals Pr2.

If $\text{Pr2} < \text{output frequency} \leq \text{Pr1}(\text{Pr18})$, the steady output frequency equals output frequency.

If $\text{Pr1}(\text{Pr18}) < \text{output frequency}$, the steady output frequency equals Pr1.

(Note1) The ‘maximum frequency’ and the ‘high-speed maximum frequency’ are related with each other. It means that if the user writes value to Pr1, at the same time, the same value will be written to Pr18. On the contrary, if the user writes value to Pr18, at the same time, the same value will be written to Pr1. Hence, Pr1 always equals Pr18.

If the running upper limit frequency is in the range of 0~120Hz, Pr1 must be used; if the running upper limit frequency is in the range of 120~400Hz, then Pr18 must be employed.



(Note2) If $\text{Pr1} < \text{Pr2}$, the steady output frequency will be clamped to Pr1.

(Note3) the set frequency value can not exceed the value of Pr1.

Pr4~Pr6, Pr24~Pr27, Pr142~Pr149 Multi- speed

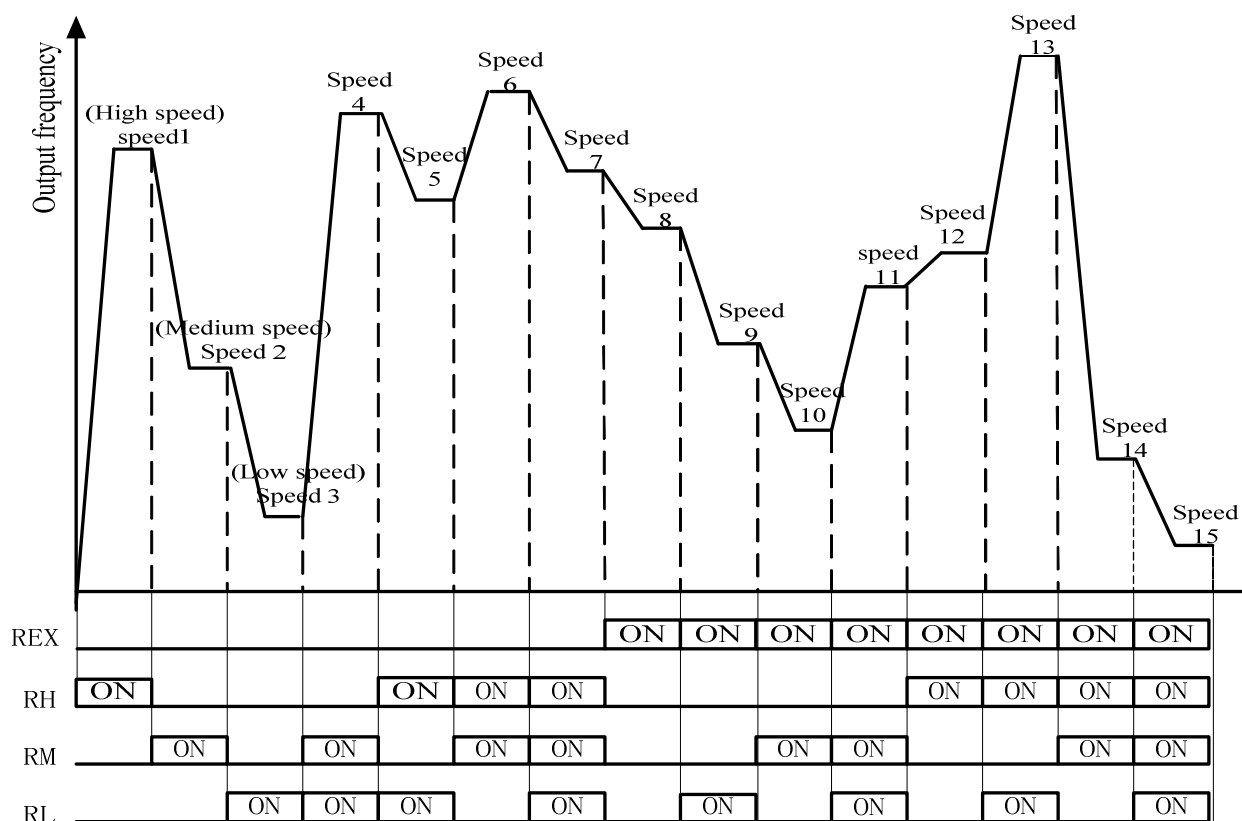
Related parameter	Description
Pr4~Pr6	Pr4→speed 1(high speed), Pr5→speed 2(medium speed), Pr6→speed 3 (low speed)
Pr24~Pr27	Multi-speed setting (speeds 4 to 7). If a parameter value is the default value of 9999, the speed is invalid.
Pr142~Pr149	Multi-speed setting (speeds 8 to 15). If a parameter value is the default value of 9999, the speed is invalid.

(Note1) Only in ‘external mode’, ‘combined mode 2’ or ‘combined mode 4’, the multi-speed is valid.

(Note2) If all the setting values of Pr24~Pr27、Pr142~Pr149 are not 9999, ‘15-speed operation’ is active.

It means that with the combination of RL、RM、RH and REX, there are 15 kinds of speeds in all.

For the setting of the running frequency of the inverter, please refer to the figure below.



(Note3) Provided that the values of Pr24~Pr27 and Pr142~Pr149 are all defaulted, '3-speed operation' is active. In this case, the running frequency can be set as follows (the priority for the terminals is $RL > RM > RH$):

Parameter Running frequency	Pr24= 9999	Pr25= 9999	Pr26= 9999	Pr27= 9999	Pr142 =9999	Pr143 =9999	Pr144 =9999	Pr145 =9999	Pr146 =9999	Pr147 =9999	Pr148 =9999	Pr149 =9999
RL (Pr6)	○	○		○	○	○		○		○		○
RM (Pr5)			○				○				○	
RH (Pr4)									○			

For example: If Pr26=9999, the running frequency is determined by RM (the setting value of Pr5).

(Note4) RL、RM、RH mentioned in this section are 'the function names of multi-function control terminal'. (For example: Pr80=2, M0 terminal is chosen to perform the RL function). Please refer to Pr80-84 、Pr86 for multi-function selection; Please refer to section 3-5 for wiring.

Pr7 Acceleration time

Pr8 Deceleration time

Pr20 Acceleration/ deceleration reference frequency

Pr29 Acceleration/deceleration pattern selection

1. When the output frequency of the inverter is accelerated from 0Hz to Pr20, the required time is defined as 'acceleration time (Pr7)'
2. When the output frequency of the inverter is decelerated from Pr20 to 0Hz, the

required time is defined as ‘deceleration time (Pr8)’.

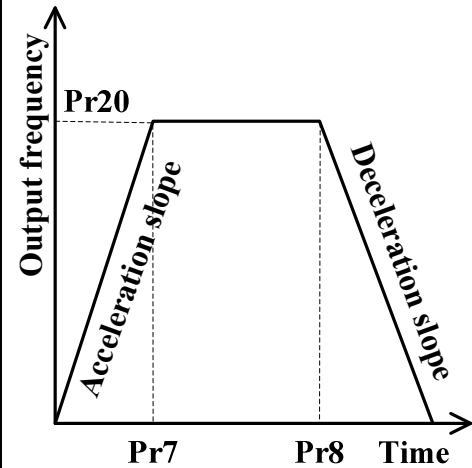
When Pr29=0

‘Linear acceleration/deceleration curve’

An acceleration slope is constructed by combination of Pr7 and Pr20.

A deceleration slope is fabricated by combination of Pr8 and Pr20.

When the running frequency varies, it increases with the ‘acceleration slope’ or decreases with the ‘deceleration slope’ linearly.



When Pr29=1,

‘S pattern acceleration/deceleration curve 1’

The acceleration/deceleration slope is formed by combination of Pr7 and Pr3.

The ‘acceleration /deceleration curve’ possesses S-shape.

The equation for the ascending S pattern curve between 0 and Pr3 is:

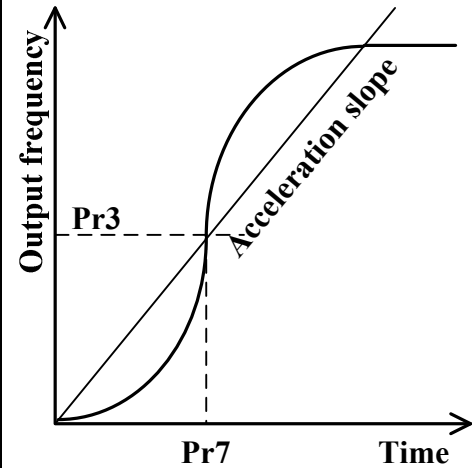
$$f = \left[1 - \cos \left(\frac{90^\circ \times t}{Pr7} \right) \right] \times Pr3$$

The equation for the ascending S pattern curve above Pr3 is:

$$t = \frac{4}{9} \times \frac{Pr7}{Pr3^2} \times f^2 + \frac{5}{9} \times Pr7$$

t: time f: output frequency

(Note) This pattern is applicable to main shafts of the working machines.



When Pr29=2,
‘S pattern acceleration/deceleration curve 2’

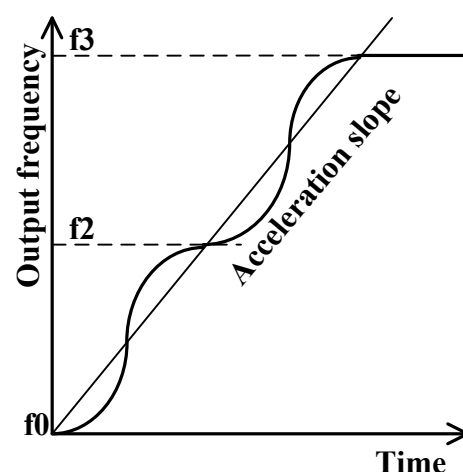
An acceleration slope is formed by combination of Pr7 and Pr20.

A deceleration slope is formed by combination of Pr8 and Pr20.

When the running frequency varies, it increases with the ‘acceleration slope’ or decreases with the ‘deceleration slope’.

As shown in the right figure, when the setting value of the inverter is adjusted from f_0 to f_2 , an acceleration in S pattern is undertook once, and the time is $\text{Pr7} \times (f_2 - f_0) / \text{Pr20}$; then if the frequency is set from f_2 to f_3 , a second acceleration is experienced, and the time is $\text{Pr7} \times (f_3 - f_2) / \text{Pr20}$.

(Note) In this pattern the motor vibration can be reduced substantially during acceleration / deceleration, and thus the life span of belts and gears is expanded



Pr9 Electronic thermal relay capacity

1. The ‘electronic thermal relay’ employed the built-in program to simulate a thermal relay to prevent the motor from overheating.
2. When a squirrel-cage inductive motor that made in Taiwan (standard motor) is applied, the value of Pr9 is usually the rated current value at 60Hz; when a squirrel-cage inductive motor that made in the mainland (standard motor) is applied, the set value of Pr9 is usually the rated current value at 50Hz.
3. If Pr9=0, the electronic thermal relay is disabled.

4. In case the calculated heat by the electronic thermal relay exceeds the upper limit, an alarm will be output (at this time, the alarm lamp will be lit.), the screen will display **Err**, and the output will be stopped.

(Note1) After the inverter is reset, the thermal accumulating record of the electronic thermal relay will be reset to zero. Attention should be paid to it.

(Note2) When two or more motors are connected to the inverter, they cannot be protected by the electronic thermal relay. Install an external thermal relay to each motor.

(Note3) When a special motor is employed, the electronic thermal relay is no longer invalid. Install an external thermal relay to each motor.

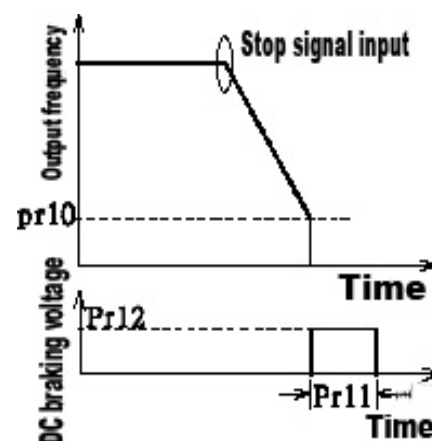
(Note4) About wiring for an external thermal relay, refer to Pr80-84.

Pr10 DC injection brake operation frequency

Pr11 DC injection brake operation time

Pr12 DC injection brake voltage

1. After a stop signal is put in (please refer to Chapter 3 for the primary operation), the output frequency of the inverter



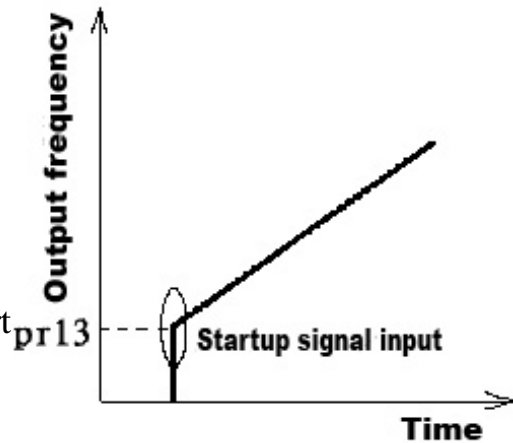
will decrease gradually. In case the output frequency reaches the 'DC injection brake operation frequency (Pr10)', the DC injection brake will be active.

2. During DC injection brake, a DC voltage will be injected into the motor windings by the inverter, which is used to lock the motor rotor. This voltage is called 'DC injection brake voltage (Pr12)'. The larger the Pr12 value is, the higher the DC brake voltage and the stronger the brake capability.
3. The DC brake operation will last a period (the set value of Pr11) to overcome the motor inertia. To achieve an optimum control, Pr11 and Pr12 should be set properly.

(Note) Proper setting of Pr10, Pr11 and Pr12, the positioning accuracy can be improved.

Pr13 Starting frequency

1. When the motor starts up, the instant output frequency of the inverter is called 'starting frequency' (please refer to Chapter 2 for the primary operation of the motor).
2. If the running (target) frequency of the inverter is lower than the setting value of Pr13, the motor will not run.



Pr14 Load pattern selection

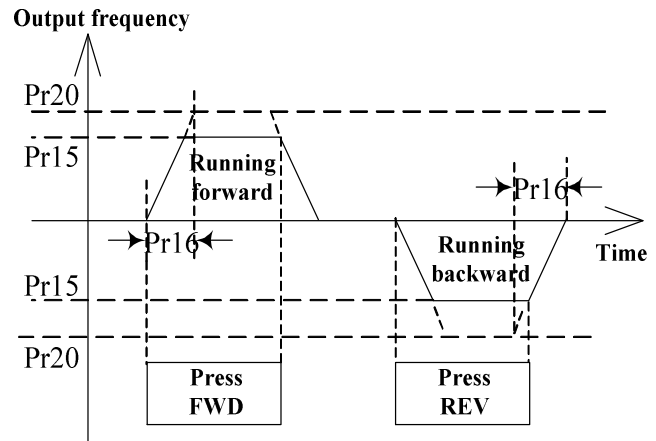
Refer to Pr0.

Pr15 JOG frequency

Pr16 JOG acceleration/deceleration time

In JOG mode, the output frequency is the set value of Pr15, and the acceleration/deceleration time is the set value of Pr16.

(Note) Please refer to Section 3-1 for how to enter the JOG mode.



Pr19 Base frequency voltage

Please refer to Pr0.

Pr20 Acceleration/deceleration reference frequency

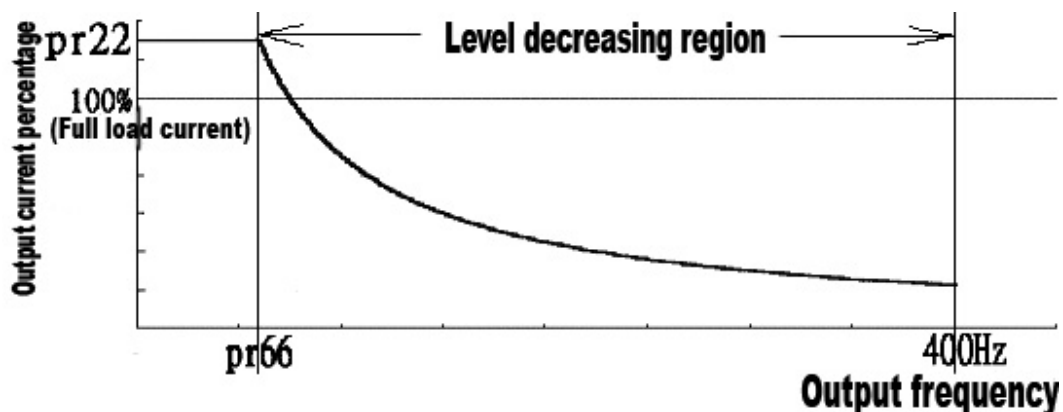
Please refer to Pr7.

Pr22 Stall prevention operation level

Pr66 Stall prevention operation level reduction starting frequency

Pr23 Offset coefficient for Stall prevention operation level at double speed

1. With a heavy load, in the case when a motor starts or the running frequency is adjusted (increasing), the motor speed often can not tightly follow the output frequency. If the motor speed is lower than the output frequency, the output current will increase to improve the output torque. However, if the difference between the output frequency and the motor speed is too great, the motor torque will decrease, which is called 'stall'.
2. During the period when a motor starts or the output frequency increases, the output current of the inverter will increase. Once the output current exceeds the upper limit pre-set as the following figure, the adjustment of the output frequency is paused automatically and will continue to proceed until the motor captures the output frequency (at this moment the output current of the inverter will decrease correspondingly).



$$\text{Level percentage} = A + B \times \frac{\text{pr22} - A}{\text{pr22} - B} \times \frac{\text{Pr23} - 100}{100}$$

$$A = \frac{\text{Pr66} \times \text{Pr22}}{\text{Output frequency}} \quad B = \frac{\text{Pr66} \times \text{Pr22}}{400}$$

(Note) If the stall prevention operates, the screen will display **OL1**.

Pr24~Pr27 Multi-speed

Please refer to Pr4.

Pr29 Acceleration/deceleration pattern selection

Please refer to Pr7.

Pr30 Regenerative function selection

Pr70 Special regenerative brake duty

1. At the moment when the output frequency switches from high to low, due to the load inertia, the motor speed will be higher than the output frequency of the inverter, and thus the generator effect is formed. It results in high voltage between the main-circuit terminals P and (-)/N, which will damage the inverter. Therefore, a proper brake resistor shall be mounted between the terminals P and PR to dissipate the fed-back energy.
2. There's a built-in transistor (called as brake transistor) in the inverter. The conducting time ratio of the transistor is called as 'regenerative brake duty'. The Higher the regenerative brake duty is, the more energy the brake resistor consumes, and the stronger the brake capability is.

Related parameters	Set value	Description
Pr30	0	The regenerative brake duty is fixed to 10%, and Pr70 is invalid.
	1	The regenerative brake duty is the setting value of Pr70.
Pr70	0~30%	-----

(Note1) In occasions where frequent start/stop occurs, a high capacity brake resistor is required.

(Note2) Refer to Section 2-6 for brake resistor selection

Pr31 Communication selection

Pr32 Serial communication Baud rate selection

Pr36 Inverter station number

Pr48 Data length

Pr49 STOP bit length

Pr50 Parity check selection

Pr51 CR, LF selection

Pr52 Number of communication retries

Pr53 Communication check time interval

(note1) Pr31-Pr53 above with related communication parameters and protocols are only applied for standard type ,not for the special type of external manipulator(-D).

(note2) When the communication parameters are revised, please reset the inverter.

1. Communication protocol (initials):

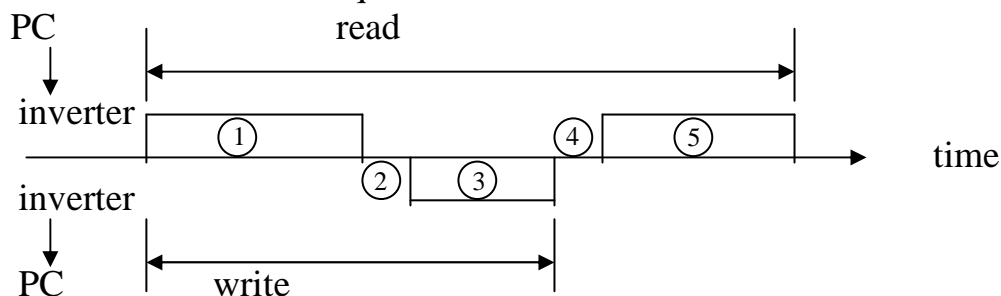
Parameters	Value	Instruction
Pr31	0	Connect with DU01(optional)(default value)
	1	Set when communicating with personal computer
Pr32	0	Baud rate: 4800bps
	1	Baud rate: 9600bps (default value)
	2	Baud rate: 19200bps
Pr36	0~99	Station number: 0 (default value)(note 1)
Pr48	0	Data length: 8 bit (default value)
	1	Data length: 7bit
Pr49	0	STOP bit length: 1 bit (default value)
	1	STOP bit length: 2 bit
Pr50	0	Not Given (default value)
	1	odd
	2	even
Pr51	1	Only CR (default value)
	2	CR and LF
Pr52	0~10	1 (default value)
Pr53	0~999.8 、 9999	0~999.8, unit of sec, 9999 (default value)(note 2)

Note 1: At present, the communication interface enables a host computer to control up to 32 inverters, and even more if the termination impedance matches with the characteristic impedance.

Note 2: When Pr53=9999, there is no time limit.

2. Communication format:

1. Communication sequence:



- ① PC communication request
- ② waiting time (please refer to note 1 in 2.Communication format)
- ③ Inverter sending out data
- ④ PC processing time
- ⑤ PC sending out data

Note: the time for ② should be more than 500 μS .

2.Communication format:

(a) PC-inverter communication request

Format A: (Write data into inverter)

ENQ	Station NO.		command		Waiting time	content				SUM CHECK		CR
1	2	3	4	5	6	7	8	9	10	11	12	13

Format B: (Read data from inverter)

ENQ	Station NO.		command		Waiting time	content		SUM CHECK
1	2	3	4	5	6	7	8	9

(b) The inverter replies data when writing to inverter

Format C: (Content is right)

ACK	Station NO.		CR
1	2	3	4

Format D: (Content is wrong)

NAK	Station NO.		Wrong codes	CR
1	2	3	4	5

(c) The inverter replies data when reading from inverter

Format E: (Content is right)

STX	Station NO.		Reading information				Unit *note 1	ETX		SUM CHECK		CR
1	2	3	4	5	6	7	8	9	10	11		12

Format F: (Content is wrong)

NAK	Station NO.		Wrong code	CR
1	2	3	4	5

(d) Computer replies data when accepting data from inverter

Format G: (Content is right)

ACK	Station NO.		CR
1	2	3	4

Format F:

NAK	Station NO.		CR
1	2	3	4

Note1: waiting time: 0~15, unit: 10ms (0:no waiting time, the inverter need take 2ms to response)

Note 2: When the value of parameters are 9999, the content for Format A must be HFFFF, the content read out in Format E is HFFFF.

Note 3: Material of data communication last CR, LF code is setted by people according to the PC mode when PC to convey the date to invertor. At the same time ,the invertor will be setted with PC accordly. CR, LF code witch is selected by the value of the Pr51.

Note 4: Given by bit7 and bit6, 0: minimum unit is 1; 1: minimum unit is 0.1; 2: minimum unit is 0.01; 3: Minimum unit is 0.001

3.Syntax Instruction (ASCII CODE)

STX----H02 ETX----H03 ENQ----H05 ACK----H06

CR----H0D NAK---H15 LF-----H0A

4.SUM CHECK instruction:

(Example 1)

ENQ	Station NO.	Command	Waiting time	Content	SUM CHECK
	0 1	E 1	1	0 7 A D	F 4
H05	H30 H31	H45 H31	H31	H30 H37 H41 H44	H46 H34

$$\overleftarrow{\hspace{10em}} \downarrow \hspace{1.5em} H30+H31+H45+H31+H31+H30+H37+H41+H44=H1F4$$

(Example 2)

STX	Station NO.	Reading content	unit	ETX	SUM CHECK
	0 1	1 7 7 0			B 0
H02	H30 H31	H31 H37 H37 H30	H80	H03	H42 H30

$$\overleftarrow{\hspace{10em}} \downarrow \hspace{1.5em} H30+H31+H31+H37+H37+H30+H80=H1B0$$

5.Error code

Code	Error content	Code	Error content	Code	Error content
H0	Computer NAK error	H1	Parity error	H2	SUM CHECK error
H3	Protocol error	H4	Framing error	H5	Over run error
H6	Reserved	H7	Reserved	H8	Reserved
H9	Reserved	HA	Mode error	HB	Command error
HC	Data range error	HD	Reserved	HE	Performing FC=H9966、H9696、H55AA、H5A5A when running.





3.Read/Write command codes

No	Item		Com- mand	Content		Byte bits																																																		
1	Running mode	Read	H7B	H0000:CU H0001:External H0002:JOG H0003:Combined mode 1(manipulator Startup, frequency set by EXT) H0004: Combined mode 2 (EXT Startup, frequency set by manipulator) H0005: PU		4Bytes																																																		
		Write	HFB	H0000:PU H0001:External H0002:JOG H0003:Combined mode 1(manipulator Startup, frequency set by EXT) H0004: Combined mode 2 (EXT Startup, frequency set by manipulator)																																																				
2	Moni torin g	Output frequency	H6F	H0000~H9C40		4Bytes																																																		
		Set frequency	H73	H0000~H9C40		4Bytes																																																		
		Output current	H70	H0000~HFFFF		4Bytes																																																		
		Output voltage	H71	H0000~HFFFF		4Bytes																																																		
		Error contents	H74 ~ H75	H0000~HFFFF: error codes for the lasted 2 times Example: error codes for H74 <div><div><div>0</div><div>1</div><div>0</div><div>0</div><div>0</div><div>0</div><div>0</div><div>1</div><div>1</div><div>0</div><div>1</div><div>0</div><div>0</div><div>0</div><div>0</div><div>0</div></div><div>Error code for last time (FAN)Error code for this time (OPT)</div></div> <table><tr><td>Data</td><td>Content</td><td>Data</td><td>Content</td></tr><tr><td>H00</td><td>No Fault</td><td>H50</td><td>UVT</td></tr><tr><td>H10</td><td>OC1</td><td>H51</td><td>OP1</td></tr><tr><td>H11</td><td>OC2</td><td>H60</td><td>OLT</td></tr><tr><td>H12</td><td>OC3</td><td>H70</td><td>BE</td></tr><tr><td>H20</td><td>OV1</td><td>H80</td><td>GF</td></tr><tr><td>H21</td><td>OV2</td><td>H90</td><td>OHT</td></tr><tr><td>H22</td><td>OV3</td><td>HA0</td><td>OPT</td></tr><tr><td>H30</td><td>THT</td><td>HB0</td><td>PE</td></tr><tr><td>H31</td><td>THN</td><td>HB1</td><td>PUE</td></tr><tr><td>H32</td><td>NTC</td><td>HB2</td><td>RET</td></tr><tr><td>H40</td><td>EEP</td><td>HC0</td><td>CPU</td></tr><tr><td>H41</td><td>FAN</td><td></td><td></td></tr></table> Other Error code: SPE		Data	Content	Data	Content	H00	No Fault	H50	UVT	H10	OC1	H51	OP1	H11	OC2	H60	OLT	H12	OC3	H70	BE	H20	OV1	H80	GF	H21	OV2	H90	OHT	H22	OV3	HA0	OPT	H30	THT	HB0	PE	H31	THN	HB1	PUE	H32	NTC	HB2	RET	H40	EEP	HC0	CPU	H41	FAN	
Data	Content	Data	Content																																																					
H00	No Fault	H50	UVT																																																					
H10	OC1	H51	OP1																																																					
H11	OC2	H60	OLT																																																					
H12	OC3	H70	BE																																																					
H20	OV1	H80	GF																																																					
H21	OV2	H90	OHT																																																					
H22	OV3	HA0	OPT																																																					
H30	THT	HB0	PE																																																					
H31	THN	HB1	PUE																																																					
H32	NTC	HB2	RET																																																					
H40	EEP	HC0	CPU																																																					
H41	FAN																																																							
3	Running instruction		HFA	H0000~HFFFF b0:reserved b1: Rotate forward (STF) b2: Rotate backward (STR) b3:Low speed(RL) b4:Medium speed(RM) b5:High speed(RH) b6: the Second acceleration/deceleration selection (RT) b7:Output terminate (MRS) b8~b15: reserved		4Bytes																																																		

4	Inverter state	H7A	H0000~HFFFF b0: running b1: Rotating forward b2: Rotating backward b3: Frequency achieved b4: Overload b5: Pr998 end b6: Frequency checking b7: Error b8: RES ON b9: STF ON b10: STR ON b11: EXT RUN PUSH STOP b12~b15: Reserved	4Bytes																														
5	Running frequency writing	HEE	H0000~H9C40	4Bytes																														
6	Inverter RESET	HFD	H9696---Pr.997	4Bytes																														
7	Parameter and Error clearance	HFC	<table border="1"> <thead> <tr> <th>Pr content</th><th>Communication Pr.</th><th>check</th><th>other Pr.</th><th>Error code</th></tr> </thead> <tbody> <tr> <td>H9696</td><td>x</td><td>x</td><td>o</td><td>x</td></tr> <tr> <td>H9966</td><td>o</td><td>o</td><td>o</td><td>x</td></tr> <tr> <td>H5A5A</td><td>o</td><td>x</td><td>o</td><td>x</td></tr> <tr> <td>H55AA</td><td>x</td><td>o</td><td>o</td><td>x</td></tr> <tr> <td>HA5A5</td><td>x</td><td>x</td><td>x</td><td>o</td></tr> </tbody> </table> <p>When H9696 is written into the inverter, parameters will be set to default values. Communication parameter should be set again for the next use.</p>	Pr content	Communication Pr.	check	other Pr.	Error code	H9696	x	x	o	x	H9966	o	o	o	x	H5A5A	o	x	o	x	H55AA	x	o	o	x	HA5A5	x	x	x	o	4Bytes
Pr content	Communication Pr.	check	other Pr.	Error code																														
H9696	x	x	o	x																														
H9966	o	o	o	x																														
H5A5A	o	x	o	x																														
H55AA	x	o	o	x																														
HA5A5	x	x	x	o																														
8	Parameter reading	H00~H63	Please refer to the Manual for Data range Example: Reading code for Pr.7 is:H07 Writing code is:H87	4Bytes																														
9	Parameter writing	H80~HE3																																
10	Link Parameter extension	read H7F write HFF	H00~H63, H80~HE3 change H0000----Pr.0~Pr.99 accessible H0001----Pr.100~Pr.199 accessible	4Bytes																														

Pr37 Speed display

Related parameters	Set value	Description
Pr37	0	In 'output frequency monitoring mode', the screen will display the output frequency.
	0.1~5000 r/min	<p>In 'output frequency monitoring mode', the screen will display the corresponding mechanical speed.</p> <p>The set value of Pr37 is the mechanical speed of the inverter when its output frequency is 60Hz.</p> <p>For example: if the transmitting belt speed is 950 m/minute when the inverter output frequency is 60Hz, Pr37 shall be set to 950. In 'output frequency monitoring mode', the screen will display the speed of the transmitting belt.</p> <p>(Note1) There's minute discrepancy between the displayed mechanical speed and the actual one.</p> <p>(Note2) Please refer to Section 2-2, for detailed operation of the 'manipulator working mode'.</p> <p>(Note3) When the output mechanical speed is more than 9998, the screen will display 9999.</p>

Note: When the inverter is running in the the rotate speed monitoring state, press   to change the frequency, and the display will return to the rotate speed monitoring state after we release the key. When the inverter is running in voltage/current monitoring state, the display will shift to 'frequency setting mode' if we press  , and it will return to rotate speed monitoring state after we release the key.

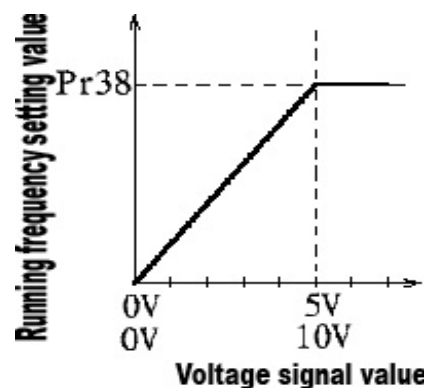
Pr38 Frequency at 5V (10V) input

Pr73 Voltage signal selection

Related parameters	Set value	Description
Pr73	0	The range for the input voltage signal is 0~5V.
	1	The range for the input voltage signal is 0~10V.
Pr38	1~400Hz	The running frequency when the voltage signal is 5V(10V)

(Note 1) In 'external mode', 'combined mode 2' or 'combined mode 4', if AU, RH, RM, and RL are all off, the inverter running frequency is controlled by the voltage signal.

(Note 2) In this paragraph RL, RM, RH, and AU refer to the 'function names of multi-function control terminals'. For the corresponding function selection and features, refer to Pr80-84; for wiring, refer to Section 2-5.



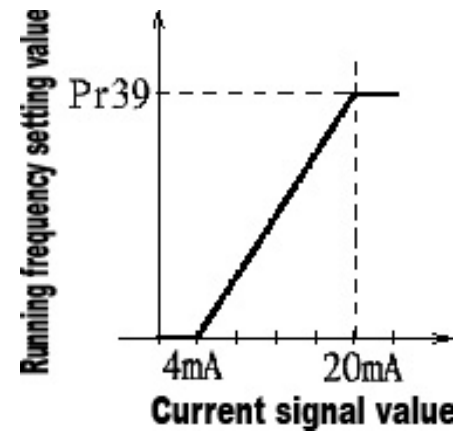
Pr39 Frequency at 20mA input

Related parameters	Set value	Description
Pr39	1~400Hz	The output frequency of the inverter when the input current signal is 20mA.

(Note1) In 'external mode', 'combined mode 2' or 'combined mode 4', if AU is on, the running frequency of the inverter is controlled by the current signal.

(Note2) In 'external mode', 'combined mode 2' or 'combined mode 4', if AU and one of RH, RM and RL are both valid at the same time, the multi-speed has higher priority.

(Note3) In this paragraph RL, RM, RH and AU refer to the 'function names of multi-function control terminals'. For the corresponding function selection and features, refer to Pr80~Pr84; for wiring, refer to Section 2-5.



Pr40 multi-function output terminal pattern

Pr85 Function selection for multi-function relay

Pr120 Delay time of outcoming signal

The multi-function output terminal is SO, its function is set by Pr40. Please refer to section 2-5-2 for wiring. There are 8 settings for Pr40, which is listed below:

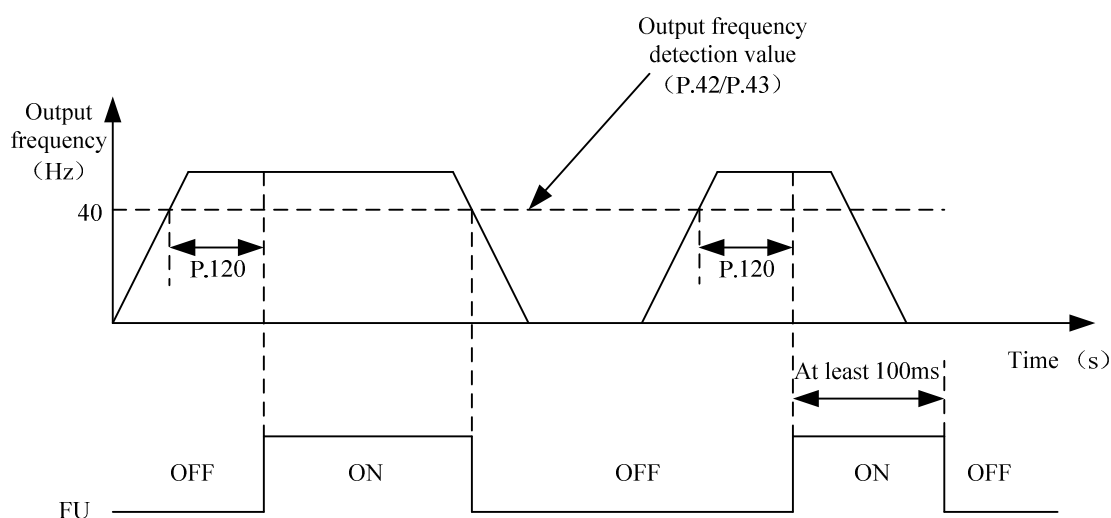
The multi-function terminals for SS-TYPE inverter is A and B. Their function is determined by Pr85. There are nine settings for Pr85, which are listed below:

Related parameter	The set value of each digit	Function code	Function name	Description
Pr40 Pr85	0	RUN	Inverter running	Signal will be put out once the running frequency is above the startup one.
	1	SU	Up to frequency	Signal will be put out once the output frequency reaches the setting frequency. Refer to Pr41
	2	FU	Output frequency detection	Signal will be put out once the detected frequency is above the running one. Refer to Pr42, Pr43
	3	OL	Overload alarm	Signal will be put out once the current limit function is triggered. ---
	4	OMD	Zero current detection	If the output current percentage of the inverter is less than the set value of Pr62, and lasts for the pre-defined time (the setting value of Pr63), OMD will put out signal. Refer to Pr62, Pr63

	5	ALARM	Alarm detection	Alarm detection	
	6	PO1	Section detection	In programmed operation mode, PO1 signal will be put out in the end of each section.	
	7	PO2	Periodical detection	In programmed operation mode, PO2 signal will be put out in the end of each cycle.	
	8	PO3	Pause detection	In programmed operation mode, PO3 signal will be put out when the inverter pauses.	

parameter	Set value	Description
Pr120	0	When P.120=0, if the set condition of P.40 (P.85) is met, the signal will be output directly.
	0.1 ~ 3600s	When P.120=0.1~3600, if the set condition of P.40 (P.85) is met, the signal will be output after the set time.

For example: FU (Output frequency detection) function (For example: P.42/P.43=40Hz)



(Note1) The multi-function output terminal is 'SO'. When Pr40=0 (the default value), it means 'RUN'; when a different value is set, the corresponding function will change as shown in the above table.

(Note2) The internal electrical structures for the multi-function output terminals are 'open collector output'. Please refer to Section 2-5-2 and Section 2-5-3 for wiring,

(Note3) When the set value of P.85 is 5(the default value), the function of the multi-function relay ABC is ALARM. When the value of P.85 is revised, its function changes respectively as the corresponding function list in the table above.

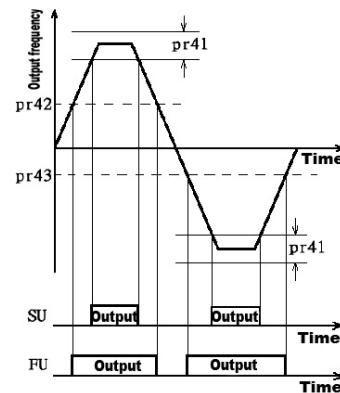
Pr41 Up-to-frequency sensitivity

Pr42 Output frequency detection for forward rotation

Pr43 Output frequency detection for reverse rotation

Related parameters	Set value	Description
Pr41	0~100%	1. If Pr41=5%, when the output frequency enter the ‘5% region near the running frequency’, the SU will put out signals. For example: the running frequency is set to 60Hz, and Pr41=5%; then if the output frequency is between $60 \pm 60 \times 5\% = 63\text{Hz}$ and 57Hz region, the SU will put out signals. 2. If Pr42=30 and Pr43=20, then when the forward rotation output frequency exceeds 30Hz, FU will put out signals; when the reverse rotation output frequency exceeds 20Hz, FU will also put out signals. 3. If Pr42=30 and Pr43=9999 (factory setting default value), then when the forward or reverse rotation output frequency exceeds 30Hz, the FU will put out signals.
Pr42	0~400Hz	
Pr43	0~400Hz, 9999	

(Note) In this paragraph SU and FU are the ‘function names of multi-function output terminals’. Please refer to Pr40 for function selection and features; about wiring please refer to section 2-5.



Pr44 Second acceleration time

Pr45 Second deceleration time

Pr46 Second torque boost

Pr47 Second V/F (base frequency)

1. If RT is on, the second function is valid. In this case the running characteristics of the motor refer to the second function. That is, the acceleration time is the set value of Pr44; the deceleration time is the set value of Pr45; the torque boost is the set value of Pr46; and the base frequency is the set value of Pr47.
2. If Pr44=9999 (default value), all the second function is disabled. In this case, even though RT is on, the acceleration time is still the set value of Pr7; the deceleration time is still the set value of Pr8; the torque boost is still the set value of Pr0; and the

base frequency is still the set value of Pr3.

3. If Pr44≠9999 and Pr45=9999, when RT is on, the deceleration time is the ‘set value of Pr44’.
4. If Pr44≠9999 and Pr46=9999, when RT is on, the torque boost is the ‘set value of Pr0’.
5. If Pr44≠9999 and Pr47=9999, when RT is on, the base frequency is the ‘set value of Pr3’.

(Note) The mentioned RT in this paragraph is the ‘function name of multi-function control terminal’. Please refer to Pr80~Pr84 for function selection and features; about wiring refer to Section 2-5.

Pr54 AM terminal function Selection

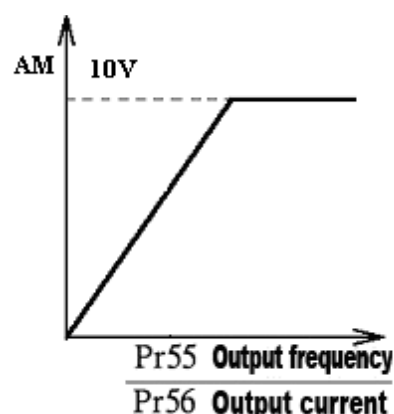
Pr55 Frequency monitoring reference

Pr56 Current monitoring reference

Pr190 AM output bias







Pr191 AM output gain

Between terminal AM and terminal 5, an electric meter can be connected to indicate the output current value or the output frequency.



Pr54	Content	Description
0	Put out frequency	Refer to Pr55
1	Display current(Put out current)	Refer to Pr56
Related parameters	Set value	Description
Pr55	0~400Hz	If the output frequency of the inverter is the set value of Pr55, the terminal AM will put out a voltage of 10V.
Pr56	0~500A	If the output current of the inverter is the set value of Pr56, the terminal AM will put out a voltage of 10V.

AM terminal checking



Step	Description
1	Connect an electric meter whose full graduation is 10V between terminal A and terminal 5, and set Pr54 to 0, then please check the meter because of the difference of the accessory.
2	Set Pr13 to 0, then start up the motor, and fix the output frequency of the inverter at 0Hz.
3	Read the setting value of Pr190, then the screen will display the current AM output bias.
4	<p>Press , the finger of the meter moves upwards, the AM output bias displayed on the screen increases.</p> <p>Press , the finger of the meter moves downwards, the AM output bias displayed on the screen decreases.</p> <p>When the finger of the meter moves to 0, press  and hold for 1.0s to finish the emendation of AM output bias.</p>
5	Adjust and fix the output frequency of the inverter at 60Hz.
6	Read the setting value of Pr191, then the screen will display the current AM output gain.
7	<p>Press   to adjust the AM output gain, and the finger of the meter moves upwards and downwards. When the finger of the meter moves to full range, press  and hold for 1.0s to finish the checking.</p>

Pr57 Restart coasting time



Pr58 Restart voltage rising time

Related parameters	Set value	Description
Pr57	9999	When the motor is running, once the driving power is interrupted, the inverter will stop putting out voltage instantly. When the power is recovered, the inverter will not restart automatically.
	0.1 ~ 5 seconds	When the motor is running, once the driving power is interrupted, the inverter will stop putting out voltage instantly. When the power is recovered, the motor coasts for a while (the setting value of Pr57), then the inverter will restart the motor automatically.
Pr58	0~5 seconds	Once the motor was automatically restarted, the output frequency of the inverter is the running frequency, but the output voltage is zero. Then the voltage will be increased gradually to the expected voltage value. The period for voltage increasing is called 'restart voltage rising time (Pr58)'.

Pr59 Function selection for multi-function control terminals

Parameter	Set value	Instruction
Pr59	0	Running frequency is set by the knob on PU board. The frequency range is set by Pr38.
	1	Running frequency is set by the button  and  on PU board.

(Note): For the special type for external manipulator, if DU03 operation panel is connected, the running

frequency is determined by the knob (Pr59=0) on the panel or the button  and  (Pr59=1).

Pr60 Input signal filter constant

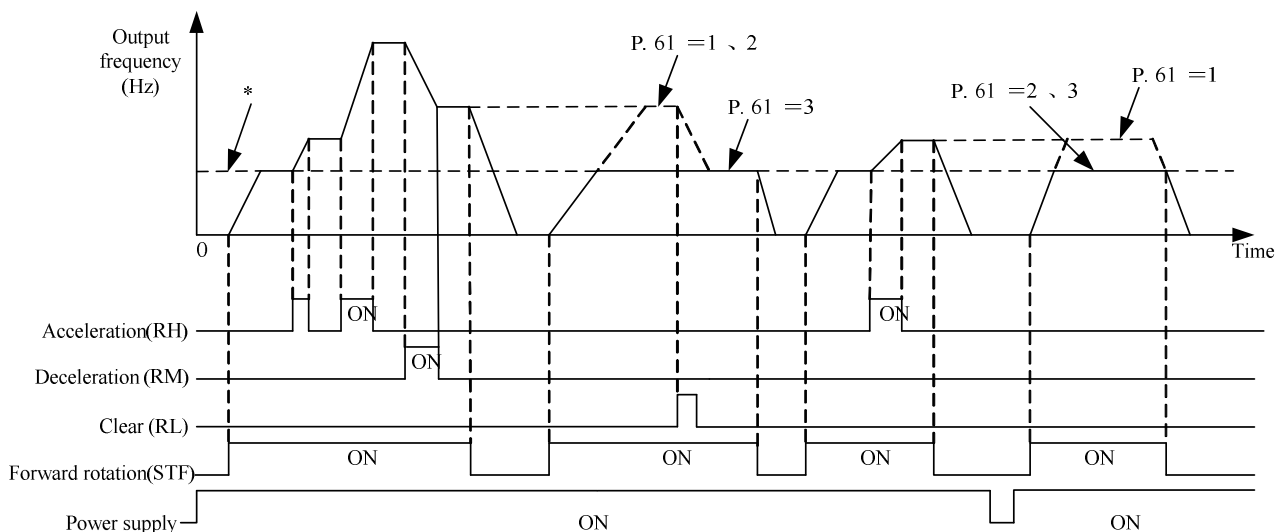
When the running frequency is set by a voltage signal or a current signal, the voltage/current signal would be processed by an A/D converter. Due to the effect of device accuracy or noises, the external voltage signal or current signal may fluctuate and thus the running frequency fluctuates.

The 'Input signal filter constant setting Pr60' is used to filter the fluctuation of the running frequency caused by the above factors. The larger the Pr60 set value is, the better the filter performance, but larger delay is resulted in.

Pr61 Remote setting function selection

If the operation box is located away from the control box, you can use contact signals to perform continuous variable-speed operation, without using analog signals, when in 'external mode', 'combined mode 1' or 'combined mode 5'.

Parameter	Factory setting	Setting range	Remarks		
			Set value	Remote set function	Frequency setting storage function
61	0	0~3	0	No	---
			1	Yes	Yes
			2		No
			3		No (the remote setting frequency is cleaned out by STF/STR 'turn off')

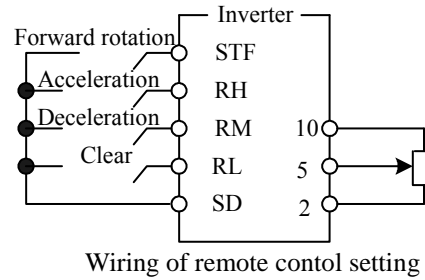


*external target frequency (except multi-speed) or PU target frequency

Remote setting function

- Whether the remote setting function is valid and whether the frequency setting storage function in the remote setting mode is used or not is selected by P.61.

Set P.61=1~3 (remote setting function is valid), the function of terminals RM, RH and RL are changed to acceleration(RH), deceleration(RM) and clear(RL). As shown in the following Figure:



- During remote setting, the output frequency of the inverter is:
(frequency set by RH/RM operation + external set frequency other than multi-speeds/PU set frequency)

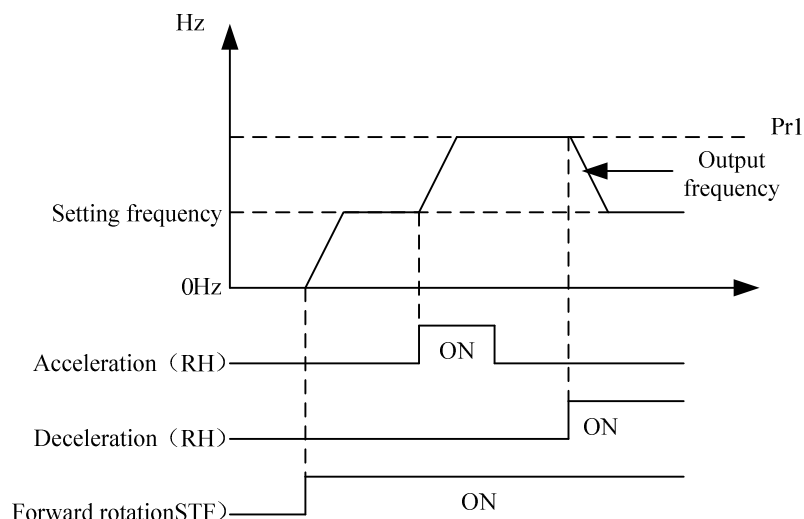
Frequency setting storage function

- The frequency setting storage function is to storage in memory(EEPROM) the remote-set frequency(frequency set by RH/RM operation). Once the power supply is cut off, then on, the inverter can start running again at the remote-set frequency (When P.61=1).

<Frequency setting storage condition>

- The frequency when the start signal (STF/STR) is 'off'
- When the signals RH(acceleration) and RM(deceleration) are both 'off'('on'), the remote-set frequency is stored each minute(The current frequency set value and the last frequency set value are compared each minute. If they are different, then the current frequency set value is written in the memory. If RL is on, write will not perform.).

(Note1) : The frequency can be varied by RH(acceleration) and RM(deceleration) between 0 and the maximum frequency. The upper limit of the setting frequency is the maximum frequency, shoven as follows:



(Note2): When the acceleration or deceleration signal is 'on', the output frequency accetaiaon/deceleration times are determined by P.7 (first acceleration time) and P.8 (first deceleration time) (When RT is 'off').

(Note3): When P.44≠9999(second acceleration time) and P.45≠9999(second deceleration time), the acceleration/deceleration times are due to P.44, P.45.

(Note4): When the start signal(STF/STR) is 'off', if RH(acceleration)/RM(deceleration) is 'on', the target frequency will also change.

(Note5): When the start signal(STF/STR) becomes ‘off’ from ‘on’, or changing the frequency continually through RH/RM, please make the frequency setting storage function invalid (P.61=2,3).

(Note6): If the frequency setting storage function is valid (P.61=1), the life of the EEPROM will be shortened because of frequent write frequency into the EEPROM.

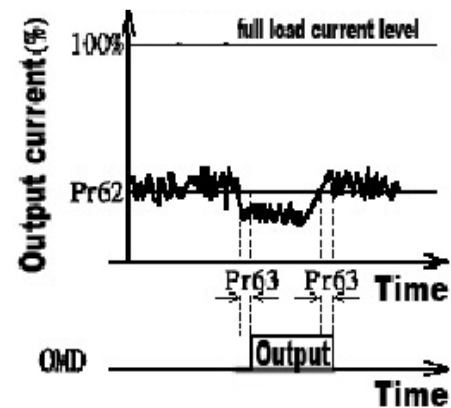
(Note7): Signals RH, RM and RL are determined by P.80~P.84, P.86. If the functions of the terminals are changed, other functions are likely to be affected. Please make sure the functions of the terminals before changing their functions.

Pr62 Zero current detection level

Pr63 Zero current detection period (time)

1. As shown in the right figure, assume that the rated full-load current of the inverter is 20A, Pr62=5% and Pr63=0.5s, in this case if the output current is lower than $20 \times 5\% = 1\text{A}$ for more than 0.5s, the OMD will put out signals, which is depicted in the right figure.

2. If the set value of Pr62 or Pr63 is 9999, the zero current detection is disabled.



(Note) In this paragraph OMD is one of the ‘function names of multi-function output terminals’. Please refer to Pr40 for function selection and features, and section 2-5 for wiring.

Pr65 Retry selection

Pr67 Number of retries at alarm occurrence

Pr68 Retry waiting time

1. When alarm occurs, the previous states before the alarm will be restored automatically, which is called ‘**retry**’. The ‘retry’ is valid only for the alarms of ‘over-current’ and ‘over-voltage between P-N’.

2. The retry shall be executed for limited times. For example, the first alarm occurs and the retry has been executed. Unfortunately, a second alarm occurs successively within 30 seconds. Such a case is defined as ‘continuous alarms’. In case the continuous alarms occur for more times than the pre-defined upper limit, a great malfunction is indicated, thus special measures should be taken manually. At this time, the retry will not be executed any more. The number of pre-defined times is called ‘number of retries at alarm occurrence (Pr67)’.

(Note) Assume that all alarms are not continuous alarms, then the retry can be executed for unlimited times.

3. The period from the moment of alarm to that of retry is defined ‘retry waiting time’.

Related parameters	Value	Description
Pr65	0	Retry is invalid. When alarm occurs, the output is stopped, the 'Alarm' lamp is lit, and all the inverter functions are disabled.
	1	In case 'over-voltage between P-(-)/N' occurs, the output is stopped. After a period of waiting time (the set value of Pr68), the retry is executed.
	2	Once 'over-current' occurs, the output is stopped. After a period of waiting time (the set value of Pr68), the retry is executed.
	3	In case 'over-voltage between P-(-)/N' or 'over-current' occurs, the output is stopped. After a period of waiting time (the set value of Pr68), the retry is executed.
Pr67	0 time	Retry is invalid.
	1~10 times	Given continuous alarm occurs for times within the pre-defined upper limit of Pr67, retries will be valid; However, once the upper limit is exceeded, the retry is valid no more.
Pr68	0~360 second	Retry waiting time

Pr66 Stall prevention operation reduction frequency

Refer to Pr22

Pr69 Retry accumulation times

1. For each time the retry occurs, the value of Pr69 will be increased by 1 automatically, so the number of Pr69 read from the memory just indicates the number of retry accumulation times.
2. If Pr69 is rewritten with 0, the number of retry executed is erased.

Pr70 Special regenerative brake duty

Refer to Pr30

Pr71 Racing brake and beeline brake selection

Parameter	Set value	Instruction
Pr71	0	It is now racing brake. The output of the inverter will terminate immediately after pressing STOP , and the motor will be 'racing'
	1	It is now beeline brake. The output of the inverter will follow the acceleration/deceleration curve after pressing STOP .

Pr72 Carrier frequency





1. The higher the carrier frequency is, the lower the motor acoustic noise is; unfortunately, greater leakage current and larger noises generated by the inverter are resulted in.
2. The higher the carrier frequency is, the more energy is dissipated, and the higher the temperature of the inverter is.
3. In case a mechanical resonance occurs in a system with the inverter, Pr72 is helpful for improved the performance just by adjusting its value.

(Note) The optimum carrier frequency shall be over 8 times greater than the running frequency.

Pr73 Voltage signal selection

Refer to Pr38

Pr75 Reset selection

Set value of Pr75	Suitable modes	STOP	
		Braking	Reset
0	PU、H2	Press  to brake	Only occur at mistake state. Press  for 1.0s to reset.
1(default)	Any modes	Press  to brake	Only occur at mistake state. Press  for 1.0s to reset.

(Note1)

In normal or abnormal conditions, the reset can be executed by Pr997.

(Note2)There are two built-in program emulational thermally-accumulating relay, namely, ‘electronic thermal relay’ and ‘IGBT module thermal relay’. Once reset occurs, the values of the two relay for ‘electronic thermal relay’ and ‘IGBT module thermal relay’ will be set to zero.

(Note 3)In any modes except External mode or H2 mode, when Pr75=1, the motor can be stopped by pressing **STOP**, then the inverter displays E0, and all the functions of the inverter are disabled. It can restart as follows:

1. Terminate external STF/STR command (In programmed operation mode, there’s no need to terminate the start signal. The inverter will continue to run at the section where it stopped after reset.)
2. Press **STOP** for 1.0s.

Pr77 Parameter- writing disable selection

Related parameter	Value	Definition
Pr77	0	In PU mode, when the motor stopped, the parameters could be written. (Note1)
	1	The parameter-writing is forbidden. (Note2)
	2	The parameter-writing is enabled. (Note3)

(Note 1)

1. When the motor stops, all parameters can be written.
2. When the motor runs, only Pr4~Pr6, Pr24~Pr27, Pr54~Pr56, Pr190 and Pr191 can be written.

(Note 2)

1. When the motor runs, only Pr77 and Pr79 can be written.
2. The parameter-writing is forbidden when the motor runs.

(注 3)

1. When motor stops, all parameters can be written.
2. When motor runs, only Pr22、Pr78 and Pr79 can not be written.

Pr78 Selection of forward/ reverse rotation prevention

Related parameter	Value	Description
Pr78	0	Forward rotation and reverse rotation are both permitted.
	1	Reverse rotation is prohibited (Press REV , the motor will stop).
	2	Forward rotation is prohibited (Press FWD , the moter will stop).

Pr79 Operation mode selection

Related parameters	Values	Remarks
Operation mode selection, Pr79	0	In this case the 'PU mode', 'external mode' and 'JOG mode' are valid and interchangeable.
	1	PU mode' and 'JOG mode' are active and interchangeable.
	2	Only 'external mode' is valid.
	3	Only communication mode' is valid.
	4	Only 'combined mode 1' is valid.
	5	Only 'combined mode 2' is valid.
	6	Only 'combined mode 3' is valid.
	7	Only 'combined mode 4' is valid.
	8	Only 'combined mode 5' is valid.

Please refer to Section 3-1 for details.

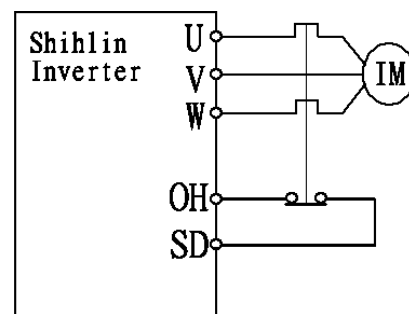
Pr80~Pr84、Pr86 Multi-function terminals selection

Parameter	Terminal	Default Value	Range	Value	name	Function	Instruction
Pr80	M0	2	0~34	0	STF	In external or combined 1, 3 mode, connect STF and SD, the inverter runs forwards.	In programmed operation mode, it is used as start signal terminal.
				1	STR	In external or combined 1, 3 mode, connect STF and SD, the inverter runs reverse.	In programmed operation mode, it is used as pause signal terminal.
				2	RL	Multi-speed	Please refer to Pr4-Pr6
				3	RM	Multi-speed	Please refer to Pr4-Pr6
				4	RH	Multi-speed	Please refer to Pr4-Pr6
Pr81	M1	3	0~34	5	AU	In external or combined 2,4 modes, when AU is on, the inverter running frequency is set by the current signal between terminal 4 and terminal 5.	Please refer to Pr39
				6	OH	(Note 3)	
				7	MRS	When MRS is on, the output terminates.	
				8	RT	When RT is on, the characteristics is the same as the second function.	Please refer to Pr44
				9	EXJ (External JOG)	In external mode, when EXJ is on, the running frequency is set by Pr15, acceleration/ deceleration time is set by Pr16 (Note 4).	
Pr82	M2	4	0~34	10	STF+EXJ	Multiplexed function	
				11	STR+EXJ		
				12	STF+RT		
				13	STR+RT		
				14	STF+RL		
			0~34	15	STR+RL		The multiplexed function is the complex of
				16	STF+RM		
				17	STR+RM		

Pr83	STF	0		18	STF+RH	Multiplexed function	several basic functions. It means that we can use one multiplexed terminal to realize several basic functions.
				19	STR+RH		
				20	STF+RL +RM		
				21	STR+RL +RM		
Pr84	STR	1	0~34	22	STF+RT +RL		
				23	STR+RT +RL		
				24	STF+RT +RM		
				25	STR+RT +RM		
				26	STF+RT + RL+RM		
				27	STR+RT + RL+RM		
				28	RUN	In external mode, when RUN is on, the inverter runs.	
Pr86	RES	30	0~34	29	STF/STR	In external mode, it is used with RUN. The inverter runs forwards when STF/STR is on, and runs reverse when STF/STR is OFF.	
				30	RES	External RESET	
				31	STOP	In external mode, it can be used as three-wire mode with RUN signal or STF/STR terminal. (note 4)	
				32	REX	Multi-speed	
				33	PO	In external mode, when PO is ON, programmed operation mode is chosen.	
				34	RES_E	External reset signal is only available when alarm happened	

(Note 1) When it is the default value, Pr80=2(RL), Pr81=3(RM), Pr82=4(RH), Pr83=0(STF), Pr84=1(STR), Pr86=30(RES).

(Note 2) When changing the value of Pr80-Pr84、Pr86, the functions of the terminals are changed. For example, Pr80=2 means that the function of M0 is RL, but if Pr80=8, its function changes to RT, as a second function selection terminal; Pr83=0 means that the STF terminal is chosen as running forward terminal, when Pr83=6, its function changes to ‘OH’, it is then external thermal relay terminal.



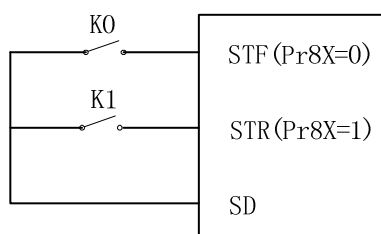
(Note 3) Wiring for external thermal relay(OH):

In traditional wiring, a thermal relay is added to the motor to prevent the motor from being too hot. Its wiring is on the right figure. When the external thermal relay is separated, the inverter will indicate alarm, and ‘OHT’ will be displayed on the screen.

(Note 4) There are 4 kinds of operating modes to drive the inverter(‘1’ means the terminal closes, ‘0’ means the terminal opens, X=0,1,2,3,4,6):

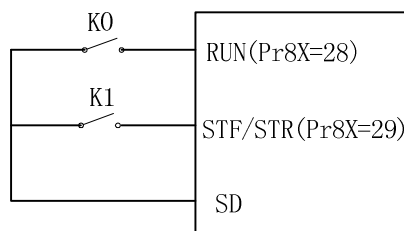
1. two-wire control mode1:

K0	K1	Operating Instructions
0	0	Stop
1	0	Run Forward
0	1	Run Reverse
1	1	Stop

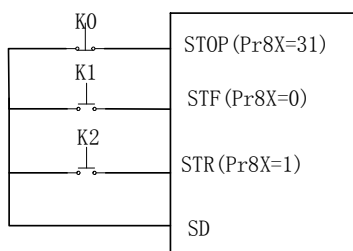


2. two-wire control mode2:

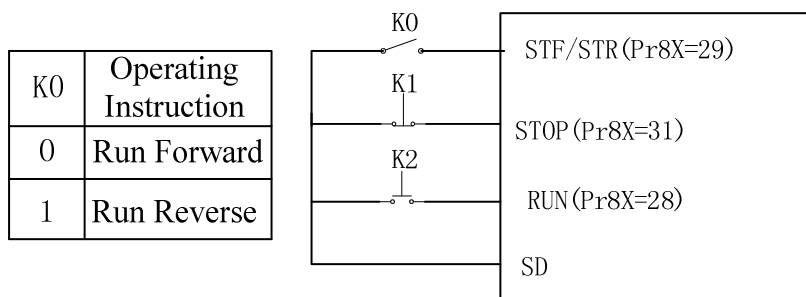
K0	K1	Operating Instructions
0	0	Stop
0	1	Sop
1	0	Run Forward
1	1	Run Reverse



3. three-wire control mode1(with self maintaining function):K0:STOP signal, normally close. If it is open, the inverter will stop. K1,K2: Run Forward and Run Reverse signal, normally open, and the pulse signal is active.



4. three-wire control mode2(with self maintaining function):K1: STOP signal, normally close. If it is open, the inverter will stop. K2: RNU signal, normally open, and the pulse signal is active.



(Note 5) In external mode, when PO is ON, the programmed operation mode is chosen. Terminal STF becomes the startup signal. When STF is ON, the inverter begins to run in programmed operation mode at the first section. When STF is OFF, the inverter stops running, and STR becomes the pause signal. When STR is ON, the inverter pauses and continues to run at the section where the inverter paused when STR is OFF. For details, please refer to Pr100、Pr101~Pr108、Pr111~Pr118、Pr121~Pr123、Pr131~Pr138.

Pr87 Stator resistance

Pr88 Auto-voltage upgrade coefficient

Parameter	Value	Instruction
Pr87	0.0~20.0	Stator resistance of a star connected asynchronous motor (Note 1)
Pr88	0~10	Voltage upgrade level selection (Note 2)

(Note 1) Measurement of stator resistance

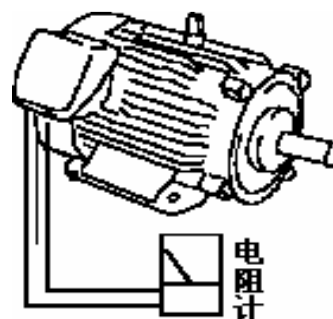
440v series: Set value=measured value of resistance meter/2

220v series: Set value=measured value of resistance meter/3

(Note 2) When the inverter runs, the auto-upgraded voltage results in greater torque.

0: Auto-voltage upgrade is disabled.

We can compensate the changes of the frequency when the load of the motor becomes heavier by setting this parameter properly.



Pr89 Slip compensation coefficient

Parameter	Value	Instruction
Pr89	0~10	0: Slip compensation is forbidden; (Note) 10: compensation value is 3% of the target frequency

(Note) We can make the speed of the motor, which runs with rated current, to be much closer to the setting speed by setting this parameter properly.

Pr91~Pr96 Frequency jump

1.To avoid the system mechanical resonance frequency, 3 sets of jump frequencies are presented, namely, the first by Pr91 and Pr92 , the second by Pr93 and Pr94 and the last by Pr95 and Pr96.

2. For example:

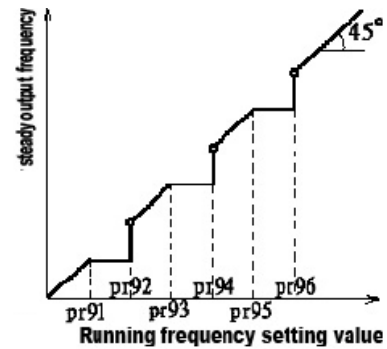
When Pr91=45 and Pr92=50,

If the running frequency $\leq 45\text{Hz}$, the steady output frequency = the running frequency.

If $45\text{Hz} < \text{running frequency} \leq 50\text{Hz}$, the steady output frequency = 45Hz.

If $50\text{Hz} < \text{running frequency}$, the steady output frequency = the running frequency.

The case is diagramed in the upper right figure.



(Note1) During acceleration/ deceleration, the output frequency of the inverter will still pass through the jump frequency.

(Note2) If pr91=9999 or pr92=9999, the first set of frequency jump is invalid.

If pr93=9999 or pr94=9999, the second set of frequency jump is invalid.

If pr95=9999 or pr96=9999, the third set of frequency jump is invalid.

Pr100 Minute/second select

Pr101~Pr108 Runtime of each section

Pr111~Pr118 Acceleration/deceleration time of each section

Pr121 Run direction in each section

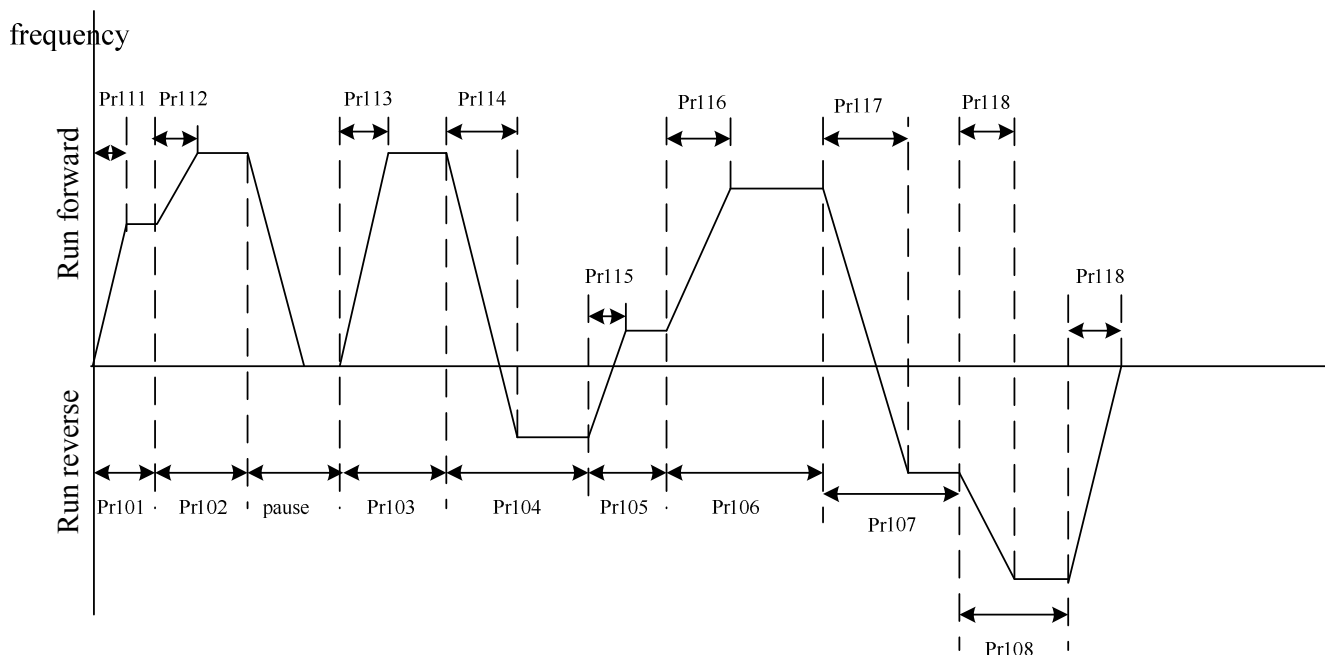
Pr122 Cycle selection

Pr123 Acceleration/deceleration time setting select

Pr131~Pr138 Frequency of each section

parameter	Value	instruction
Pr100	0	Time unit: minute
	1	Time unit: second
Pr101~Pr108	0~6000	runtime of each section (note1)
Pr111~Pr118	0~6000	Acceleration/deceleration time of each section (note 1)
Pr121	0~255	run direction (note 2)
Pr122	0~8	0: do not run circularly; 1~8: run circularly (note 3)
Pr123	0	Acceleration time is determined by Pr7, deceleration time is determined by Pr8
	1	Acceleration time and deceleration time are both determined by Pr111~Pr118
Pr131~Pr138	0~400	frequency of each section

(Note1) The calculation method of runtime and acceleration/deceleration time in each section is in the figure below:



(Note2) The run direction is set in binary form (8-bit), then translated to decimal form and stored in Pr121. ‘1’ means run forward, and ‘0’ means run reverse. The highest bit is the run direction of section 8, and the lowest bit is the direction of section 1.

For example: suppose that section 1: run forward, section 2: run reverse, section 3: run reverse, section 4: run forward, section 5: run reverse, section 6: run forward, section 7: run forward, section 8: run reverse, then the value in binary form is 01101001

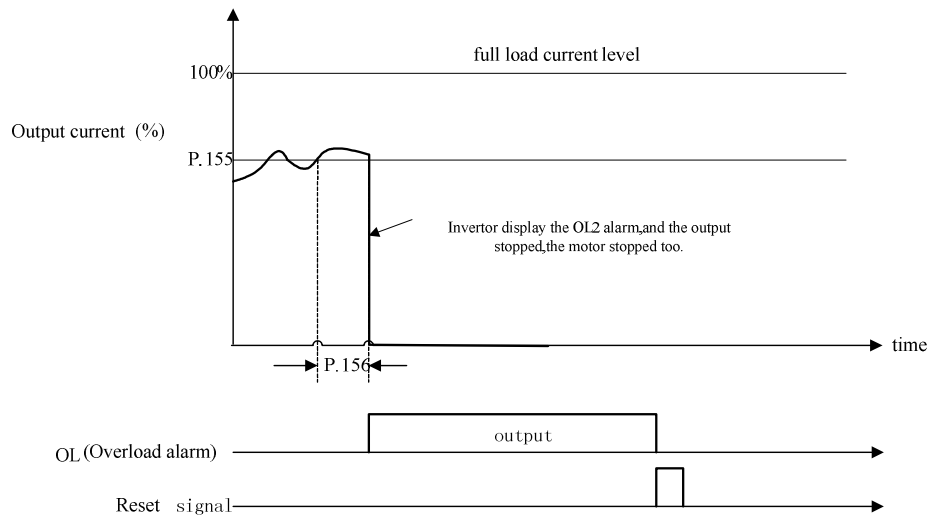
$$\text{Pr121} = 0 \times 2^7 + 1 \times 2^6 + 1 \times 2^5 + 0 \times 2^4 + 1 \times 2^3 + 0 \times 2^2 + 0 \times 2^1 + 1 \times 2^0 = 105$$

(Note3) When the value of Pr122 is 1~8, it is the initialization section of the cycle running. For example: When Pr122=3, the inverter will run circularly from the third section to the eighth section after it finishes its running from the first section to the eighth section.

Pr142~Pr149→Please refer to Pr4
Pr155 “Over torque detection level”
Pr156 “Over torque detection time”

- When the value of P.155 is not 0, the function of over torque detection is selection.
- When the output current is in excess of over torque detection level P.155 and over torque detection time P.156, the display screen of the inverter will display $\overline{O\overline{L}\overline{2}}$ and the motor stop.

Parameter	Factory setting	Setting range	Remarks	
155	0%	0~200%	0	No detection of over torque
			0.1~200%	When over torque detection, $\overline{O\overline{L}\overline{2}}$ alarm is display and the motor stop
156	1s	0.1~60s		



Pr160 PID selection

Pr161 PID proportion Gain

Pr162 PID integration Gain

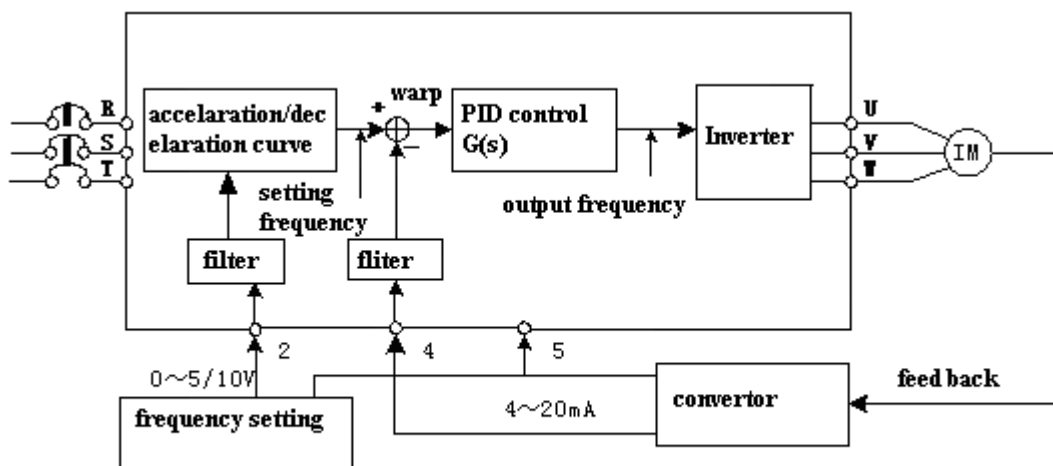
Pr163 PID differential Gain

- 1.** During the operation of PID control, the frequency displayed on the screen is the output frequency of the inverter.
- 2.** The function of Stall Prevention operates according to the setting frequency before PID control. Please pay attention to the Gain setting during the process of PID Gain setting, for there is case in which the output current can not be limited absolutely.
- 3.** Under PID control, the output frequency is also limited between maximum frequency and minimum frequency.
- 4.** Please refer to the instructions of Pr60 about the input signal filter on terminal 4-5 and terminal 2-5.
- 5.** The sketch map of PID function is as follows:

Transfer function:
$$G(s) = \text{Pr161} + \frac{\text{Pr162}}{sT_s} + sT_s \text{Pr163}$$

Sampling period: $T_s = 10\text{ms}$

Parameter	Value	Instruction
Pr160	0	PID is forbidden
	1	PID function is for voltage fed-back (terminal 2-5)
	2	PID function is for current feedback (terminal 4-5)
Pr161	0.00~99.99	PID proportional GAIN
Pr162	0.00~99.99	PID integral GAIN
Pr163	0.00~99.99	PID differential GAIN



Pr164 Total motor running time (minute)

Pr165 Total motor running time (day)

Parameter	Factory setting	Setting range
Pr164	0	0~1439 minute。
Pr165	0	0~9999 day。

1. Motor running time recorded by Pr164 and Pr165 , when the motor running time is less than 60 second ,the time will be not recorded.
2. If set 0 into Pr164 and Pr165 the motor running time can be clear, but any other value can not be setting.

Pr189 Default function

Parameter	Factory setting	Setting range	Remarks	
189	1	0 , 1	0	Apply to the 60Hz system
			1	Apply to the 50Hz system

User can select the value 50Hz or 60Hz which factory setting according to the power frequency or the frequency of the motor.

Ralated parameter instruction is in the figure below:

Parameter	name	Setting range	Minimum setting unit
Pr3	Base frequency	0~400Hz	0.01Hz
Pr20	Acceleration/deceleration reference frequency	1~400Hz	0.01Hz
Pr38	The maximum output frequency(the target frequency is set by the input signal across terminal 2-5/panel knob)	1~400Hz	0.01Hz
Pr39	The maximum output frequency(the target frequency is set by the input signal across terminal 4-5)	1~400Hz	0.01Hz
Pr55	Frequency monitoring reference	0~400Hz	0.01Hz
Pr66	Stall prevention operation reduction starting frequency	0~400Hz	0.01Hz
Pr195	Gain of input signal across terminal 2-5	1~400Hz	0.01Hz
Pr197	Gain of input signal across terminal 4-5	1~400Hz	0.01Hz

- (Note1) Because of exchanging the factory setting which to effect the acceleration/ deceleration time, output voltage and input analog voltage, the user have problem probability, solution is below:
The user should the corresponding parameters Pr7 and Pr8 such as reasonable value readjustment
- (Note2) If the user need 60Hz which the factory setting, the step is below:
1. Setting Pr189=0;
 2. Execute the Pr998 to reinstate the factory setting.
- (Note3) When the (note 2) is finished, the Pr189=0;
- (Note4) If the user need to the 50Hz system, setting Pr189=1, then execute (note 2), this time Pr189=1.

Pr194 Frequency setting voltage bias

Pr195 Frequency setting voltage gain

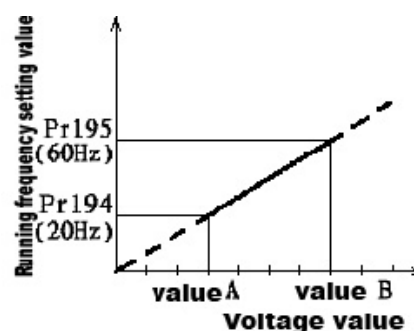
Step1. Make sure that the voltage signal is correctly put in.

Step2. Assume that 'the input voltage equals Value A, and the expected output frequency is 20Hz.

Then adjust the signal to Value A, and write 20 into Pr194.

Step3. Assume that the input voltage equals Value B, and the expected output frequency is 60Hz.

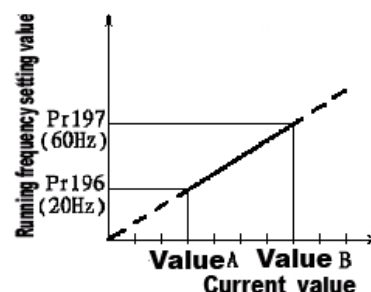
Then adjust the signal to Value B, and write 60 into Pr195.



(Note1) The equation for the above curve is:

$$\frac{\text{Running frequency} - \text{Pr194}}{\text{Voltage value} - \text{value A}} = \frac{\text{Pr195} - \text{Pr194}}{\text{value B} - \text{value A}}$$

(Note2) After Pr194 and 195 are reset, the curve of Pr38 is invalid.



Pr196 Frequency setting current bias

Pr197 Frequency setting current gain

Step1. Make sure that the current signal is correctly put in.

Step2. Assume that the input current equals Value A, and the expected output frequency is 20Hz.

Then adjust the signal to Value A, and write 20 into Pr194.

Step3. Assume that the input current equals Value B, and

the expected output frequency is 60Hz. Then adjust the signal to Value B, and write 60 into Pr195.

(Note1) The equation for the above figure is:

$$\frac{\text{Running frequency} - \text{Pr196}}{\text{Voltage value} - \text{value A}} = \frac{\text{Pr197} - \text{Pr196}}{\text{value B} - \text{value A}}$$

(Note2) After Pr196 and Pr197 are reset, the curve of Pr38 is invalid.

Pr996 Alarm log erasure

Once Pr996 is read out (after read out, the screen will display **Er.LL**) and rewritten in, all the abnormal event logs are erased.

Pr997 Reset

Once Pr997 is read out (after read out, the screen will display **rr.ESr**) and rewritten in, the inverter is reset. Once the inverter is reset, the values of the 'electronic thermal relay' and the 'IGBT module thermal relay' will be set to zero.

Pr998 Parameter total- initialization

Once Pr998 is read out (after read out, the screen will display **RLLL**) and rewritten in, all parameters will be restored to the default values.

Please make sure that any other operations should not be carried out before the screen displays **End**, which indicates that the corresponding parameters has been restored to the default values.

(Note) Pr998 must be executed at PU mode , Please refer to section 3-1-1 for details

Pr999 Parameter partial- initialization

Once Pr999 is read out (after read out, the screen will display **Pr.Lr**) and rewritten in, all parameters except Pr192 or Pr194~Pr197 will be restored to the default values.

Chapter 5. Inspection and Maintenance

In order to avoid the malfunction and security problems resulting from aging of the devices which is caused by environmental factors such as temperature, oil fog, dust, vibration, humidity and etc., 'daily inspection' and 'periodical inspection' are necessary. (Note) Only fully-qualified electrical professional personnel can carry out installation, wiring, dismounting and maintenance.

5-1 Daily inspection

1. Check whether the surrounding conditions are normal (including temperature, humidity, dust density and etc.) at the installment place.
2. Check whether the power supply voltage is normal (the voltages among R, S and T)
3. Check whether wiring is ok (whether the external wiring for the main-circuit board and the control-board terminal is loose).
4. Check whether the cooling system is abnormal (Whether there's any abnormal acoustic noise when operating. whether the wiring is ok.).
5. Check the indicating lamp (Whether the control-board indicating LED lamp, the manipulator indicating LED lamp and the manipulator screen LED are normal).
6. Check whether the expected performance is maintained.
7. Check whether there's any abnormal vibration, acoustic noise or smell during running.
8. Check whether there is liquid leaking from the filter capacitors.

5-2 Periodical inspection (during stop)

1. Check the connector and wiring (whether the connector and wiring between the main-circuit board and control board is ok).
2. Check whether components on the main-circuit board and the control board are overheated.
3. Check whether the electrolytic capacitors on the main-circuit board and control board have liquid leaking out.
4. Check the IGBT module on the main-circuit board.
5. Clean the dust and contaminants on the circuit board.
6. Check the insulation resistor.
7. Check the cooling system (Whether the wiring is firm; clean the air filter, etc)
8. Check screws and bolts.
9. Check the external wires and the terminal banks for damage.

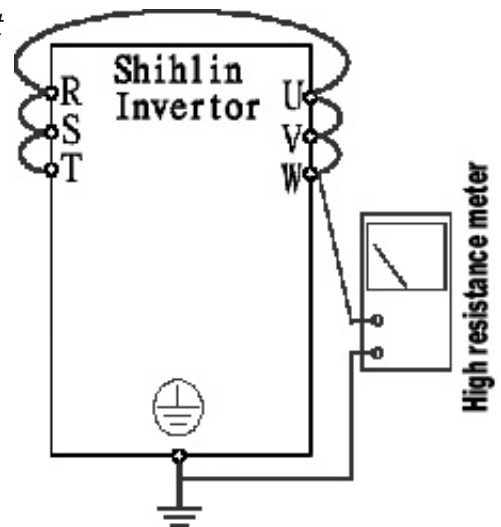
5-3 Regular replacement of parts (components)

Items	The corresponding period for replacement	Description
Cooling fan	2 years	For the axle of a fan, the standard lifetime is about 10~35 thousand hours. With reference to the time of 24 hours one day, it is sure that the fan should be replaced every 2 years .
Filter capacitor	5 years	The filter capacitor is an electrolytic capacitor, and will deteriorate with time. The deterioration speed is contingent on the ambient conditions. Generally, it shall be replaced every 5 years.
Relay	---	If bad contact occurs, please replace it immediately.

(Note) Please send the inverters to the factory when replacement of the parts is necessary.

5-4 Inverter insulation resistance measurement

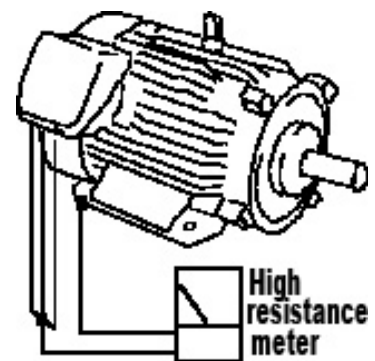
1. Before measurement, first dismount the 'wiring of the main-circuit terminals' and the 'control board'.
Then execute wiring in the way as the right figure.
2. The measurement is only suitable for the main circuit. Such measurement is prohibited for control board terminals.
3. The value of the insulation resistance shall be greater than 5MΩ.



(Note) Please do not carry out a high-voltage test, because the built-in semiconductor components will be damaged by such a test.

5-5 Motor insulation resistance measurement

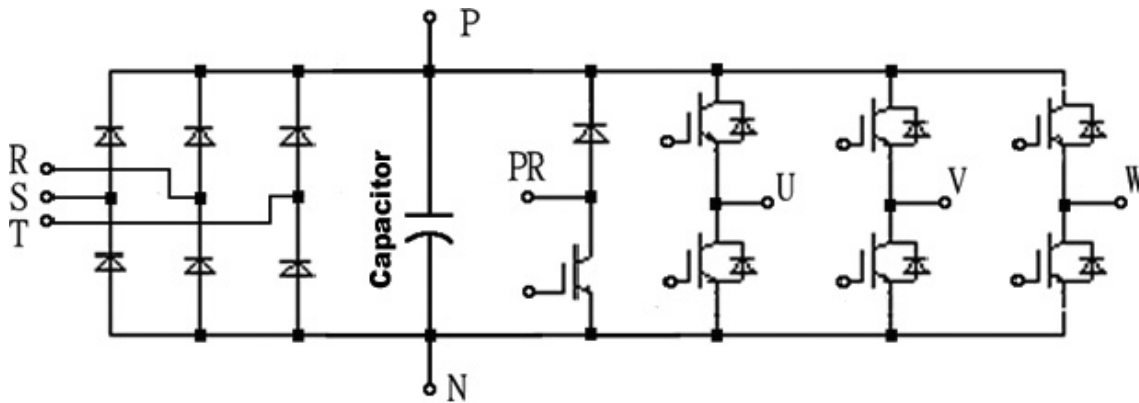
1. Before measurement, please dismount the motor, and demonstrate wiring in the way as the right figure.
2. The insulation resistance shall be greater than 5MΩ.



5-6 Check IGBT modules

Before check, first dismount the external wires for the main-circuit terminals. Then, set your multi-meter to the ohm-testing position.

	Positive voltage	Negative voltage	Normal result		Positive voltage	Negative voltage	Normal result
Terminal mark	R	P	Conducting	Terminal mark	U	P	Conducting
	S	P	Conducting		V	P	Conducting
	T	P	Conducting		W	P	Conducting
	P	R	Not conducting		P	U	Not conducting
	P	S	Not conducting		P	V	Not conducting
	P	T	Not conducting		P	W	Not conducting
	R	(-)/N	Not conducting		U	(-)/N	Not conducting
	S	(-)/N	Not conducting		V	(-)/N	Not conducting
	T	(-)/N	Not conducting		W	(-)/N	Not conducting
	(-)/N	R	Conducting		(-)/N	U	Conducting
	(-)/N	S	Conducting		(-)/N	V	Conducting
	(-)/N	T	Conducting		(-)/N	W	Conducting



Appendix 1 Parameter List

Parameter number	Name	Setting range	Minimum setting unit	Default value	User setting value	Reference page
Pr0	Torque boost	0~30%	0.1%	6.0		P27
Pr1	Maximum frequency	0~120Hz	0.01Hz	120Hz		P28
Pr2	Minimum frequency	0~120Hz	0.01Hz	0Hz		P28
Pr3	Base frequency	0~400Hz	0.01Hz	60Hz		P27
Pr4	Speed 1 (high speed)	0~400Hz	0.01Hz	60Hz		P28
Pr5	Speed 2 (middle speed)	0~400Hz	0.01Hz	30Hz		P28
Pr6	Speed 3 (low speed)	0~400Hz	0.01Hz	10Hz		P28
Pr7	Acceleration time	0~3600s	0.1s	5s		P29
Pr8	Deceleration time	0~3600s	0.1s	5s		P29
Pr9	Electronic thermal relay capacity	0~500A	0.01A	Rated output current(Note1)		P31
Pr10	DC injection brake operation frequency	0~120Hz	0.01Hz	3Hz		P31
Pr11	DC injection brake operation time	0~60s	0.1s	0.5s		P31
Pr12	DC injection brake voltage	0~30%	0.1%	4%		P31
Pr13	Starting frequency	0~60Hz	0.01Hz	0.5Hz		P32
Pr14	Load pattern selection	0~4	1	0		P32
Pr15	JOG frequency	0~400Hz	0.01Hz	5Hz		P32
Pr16	JOG acceleration / deceleration time	0~3600s	0.1s	0.5s		P32
Pr17	Reserved					
Pr18	High-speed maximum frequency	120~400Hz	0.01Hz	120Hz		P28
Pr19	Base frequency voltage	0~1000V、9999	0.1V	9999		P32
Pr20	Acceleration/deceleration reference frequency	1~400Hz	0.01Hz	60Hz		P33
Pr21	Reserved					
Pr22	Stall prevention operation level	0~200%	0.1%	150%		P33
Pr23	Stall prevention level at double speed	0~200%、9999	0.1%	9999		P33
Pr24	Speed 4	0~400Hz、9999	0.01Hz	9999		P33
Pr25	Speed 5	0~400Hz、9999	0.01Hz	9999		P33
Pr26	Speed 6	0~400Hz、9999	0.01Hz	9999		P33
Pr27	Speed 7	0~400Hz、9999	0.01Hz	9999		P33
Pr28	Reserved					
Pr29	Acceleration/deceleration pattern selection	0、1、2	1	0		P33
Pr30	Regenerative function selection	0、1	1	0		P34
Pr31	Communication selection	0、1	1	0		P34

Parameter number	Name	Setting range	Minimum setting unit	Default value	User setting value	Reference page
Pr32	Serial communication speed (baud rate)	0、1、2	1	1		P34
Pr33	Reserved					
Pr34	Reserved					
Pr35	Reserved					
Pr36	Station number	0~99	1	0		P34
Pr37	Speed display	0~5000r/min	0.1r/min	0		P40
Pr38	Frequency at 5V(10V) input	1~400Hz	0.01Hz	60Hz		P40
Pr39	Frequency at 20 mA input	1~400Hz	0.01Hz	60Hz		P41
Pr40	Multi-function output terminal pattern	0~7	1	0		P41
Pr41	Up-to-frequency sensitivity	0~100%	0.1%	10%		P43
Pr42	Output frequency detection for forward rotation	0~400Hz	0.01Hz	6Hz		P43
Pr43	Output frequency detection for reverse rotation	0~400Hz、9999	0.01Hz	9999		P43
Pr44	Second acceleration time	0~3600s、9999	0.1s	9999		P43
Pr45	Second deceleration time	0~3600s、9999	0.1s	9999		P43
Pr46	Second torque boost	0~30%、9999	0.1%	9999		P43
Pr47	Second base frequency	0~400Hz、9999	0.01Hz	9999		P43
Pr48	Data length	0、1	1	0		P34
Pr49	Stop bit length	0、1	1	0		P34
Pr50	Parity check selection	0、1、2	1	0		P34
Pr51	CR and LF selection	1、2	1	1		P34
Pr52	Number of communication retries	0~10	1	1		P34
Pr53	Communication check time interval	0~999.8s、9999	0.1s	9999		P34
Pr54	AM terminal function selection	0、1	1	0		P44
Pr55	Frequency monitoring reference	0~400Hz	0.01Hz	60Hz		P44
Pr56	Current monitoring reference	0~500A	0.01A	Rated output current		P44
Pr57	Retry coasting time	0~5s、9999	0.1s	9999		P45
Pr58	Retry voltage rising time	0~5s	0.1s	5s		P45
Pr59	Frequency source selection in PU panel	0、1	1	1		P45
Pr60	Input signal filtering constant	0~31	1	31		P46

Parameter number	Name	Setting range	Minimum setting unit	Default value	User setting value	Reference page
Pr61	Reserved					
Pr62	Zero current detection	0~200%、9999	0.1%	5%		P46
Pr63	Zero current detection time	0.05~1s、9999	0.01s	0.5s		P46
Pr64	Reserved					
Pr65	Retry selection	0、1、2、3	1	0		P48
Pr66	Stall prevention operation reduction frequency	0~400Hz	0.01Hz	60Hz		P48
Pr67	Number of retries at alarm occurrence	0、1~10	1	0		P48
Pr68	Retry waiting time	0~360s	0.1s	1s		P48
Pr69	Retry accumulation times	---	1	0		P49
Pr70	Special regenerative brake duty	0~30%	0.1%	0		P49
Pr71	Racing brake and beeline brake selection	0、1	1	1		P49
Pr72	Carrier frequency	0.7~14.5kHz	0.1KHz	5.0		P50
Pr73	Voltage signal selection	0、1	1	0		P50
Pr74	Reversed					
Pr75	Reset selection	0~1	1	1		P50
Pr76	Reserved					
Pr77	Parameter-writing disable selection	0、1、2	1	0		P51
Pr78	Forward /reverse rotation prevention selection	0、1、2	1	0		P51
Pr79	Operation mode selection	0~8	1	0		P51
Pr80	Multi-function terminal M0 selection	0~34	1	2		P52
Pr81	Multi-function terminal M1 selection	0~34	1	3		P52
Pr82	Multi-function terminal M2 selection	0~34	1	4		P52
Pr83	Function selection of control terminal STF	0~34	1	0		P52
Pr84	Function selection of control terminal STR	0~34	1	1		P52
Pr85	Function selection for multi-function relay	0~8	1	5		P41
Pr86	Function selection of control terminal RES	0~33	1	30		P52
Pr87	Stator resistance	0~20	0.01	Value of stator resistance (Note 1)		P55
Pr88	Auto-voltage upgrade coefficient	0~10	1	0		P55

Parameter number	Name	Setting range	Minimum setting unit	Default value	User setting value	Reference page
Pr89	Slip compensation coefficient	0~10	1	0		P55
Pr90	Reserved					
Pr91	Frequency jump 1A	0~400Hz、9999	0.01Hz	9999		P56
Pr92	Frequency jump 1B	0~400Hz、9999	0.01Hz	9999		P56
Pr93	Frequency jump 2A	0~400Hz、9999	0.01Hz	9999		P56
Pr94	Frequency jump 2B	0~400Hz、9999	0.01Hz	9999		P56
Pr95	Frequency jump 3A	0~400Hz、9999	0.01Hz	9999		P56
Pr96	Frequency jump 3B	0~400Hz、9999	0.01Hz	9999		P56
Pr97	Reserved					
Pr98	Middle frequency	0~400	0.01	3		P27
Pr99	Voltage output at middle frequency	0~100%	0.1	10		P27
Pr100	Minute/second select	0,1	1	1		P56
Pr101	Runtime of section 1 in programmed operation mode	0~6000	0.1s	0		P56
Pr102	Runtime of section 2 in programmed operation mode	0~6000	0.1s	0		P56
Pr103	Runtime of section 3 in programmed operation mode	0~6000	0.1s	0		P56
Pr104	Runtime of section 4 in programmed operation mode	0~6000	0.1s	0		P56
Pr105	Runtime of section 5 in programmed operation mode	0~6000	0.1s	0		P56
Pr106	Runtime of section 6 in programmed operation mode	0~6000	0.1s	0		P56
Pr107	Runtime of section 7 in programmed operation mode	0~6000	0.1s	0		P56
Pr108	Runtime of section 8 in programmed operation mode	0~6000	0.1s	0		P56
Pr111	Acceleration/deceleration time of section 1	0~6000	0.1s	0		P56
P112	Acceleration/deceleration time of section 2	0~6000	0.1s	0		P56
Pr113	Acceleration/deceleration time of section 3	0~6000	0.1s	0		P56
Pr114	Acceleration/deceleration time of section 4	0~6000	0.1s	0		P56













Parameter number	Name	Setting range	Minimum setting unit	Default value	User setting value	Reference page
Pr115	Acceleration/deceleration time of section 5	0~6000	0.1s	0		P56
Pr116	Acceleration/deceleration time of section 6	0~6000	0.1s	0		P56
Pr117	Acceleration/deceleration time of section 7	0~6000	0.1s	0		P56
Pr118	Acceleration/deceleration time of section 8	0~6000	0.1s	0		P56
Pr120	The output signal delay time	0~3600s	0.1s	0s		P41
Pr121	Run direction	0~255	1	0		P56
P122	Cycle selection	0~8	1	0		P56
Pr123	Acceleration/deceleration time setting select	0,1	1	0		P56
Pr131	Frequency of section 1	0~400Hz	0.01Hz	0		P56
Pr132	Frequency of section 2	0~400Hz	0.01Hz	0		P56
Pr133	Frequency of section 3	0~400Hz	0.01Hz	0		P56
Pr134	Frequency of section 4	0~400Hz	0.01Hz	0		P56
Pr135	Frequency of section 5	0~400Hz	0.01Hz	0		P56
Pr136	Frequency of section 6	0~400Hz	0.01Hz	0		P56
Pr137	Frequency of section 7	0~400Hz	0.01Hz	0		P56
Pr138	Frequency of section 8	0~400Hz	0.01Hz	0		P56
Pr142	Speed 8	0~400Hz	0.01Hz	0		P28
Pr143	Speed 9	0~400Hz、9999	0.01Hz	9999		P28
Pr144	Speed 10	0~400Hz、9999	0.01Hz	9999		P28
Pr145	Speed 11	0~400Hz、9999	0.01Hz	9999		P28
Pr146	Speed 12	0~400Hz、9999	0.01Hz	9999		P28
Pr147	Speed 13	0~400Hz、9999	0.01Hz	9999		P28
Pr148	Speed 14	0~400Hz、9999	0.01Hz	9999		P28
Pr149	Speed 15	0~400Hz、9999	0.01Hz	9999		P28
Pr155	Over torque detection level	0~200%	0.1%	0%		P55
Pr156	Over torque detection time	0.1~60s	0.1s	1		P55
Pr160	PID selection	0、1、2	1	0		P57
Pr161	PID proportion coefficient	0~99.99	0.01	1		P57
Pr162	PID integration coefficient	0~99.99	0.01	1		P57
Pr163	PID differential coefficient	0~99.99	0.01	0		P57
Pr164	Total motor running time(minute)	0~1439 minute	1	0		P58
Pr165	Total motor running time(day)	0~9999 day	1	0		P58
Pr189	Default function	0, 1	1	1		P59

Parameter number	Name	Setting range	Minimum setting unit	Default value	User setting value	Reference page
Pr190	AM output bias	Please refer to chapter 4	1	-		P44
Pr191	AM output gain	Please refer to chapter 4	1	-		P44
Pr192	Reserved					
Pr194	Frequency setting voltage bias	0~60Hz	0.01Hz	0Hz		P60
Pr195	Frequency setting voltage gain	1~400Hz	0.01Hz	60Hz		P60
Pr196	Frequency setting current bias	0~60Hz	0.01Hz	0Hz		P60
Pr197	Frequency setting current gain	1~400Hz	0.01Hz	60Hz		P60
Pr198	Reserved					
Pr199	Reserved					
Pr996	Alarm log erasure	Refer to Chapter 4	---	---	---	P61
Pr997	Reset	Refer to Chapter 4	---	---	---	P61
Pr998	Parameter initialization total	Refer to Chapter 4	---	---	---	P61
Pr999	Parameter partial-initialization	Refer to Chapter 4	---	---	---	P61

Note 1: the motor rated current and the stator resistance values are in the table as follows:

Inverter Type	Pr0	Pr9(A)	Pr87(Ω)
SS-021-0.4KW	6	2.55	2.5
SS-021-0.75KW	6	4.25	2.0
SS-021-1.5KW	4	7	1.1
SS-021-2.2KW	4	11	0.8
SS-023-0.4KW	6	2.55	2.5
SS-023-0.75KW	6	4.25	2.0
SS-023-1.5KW	4	8	1.1
SS-023-2.2KW	4	11	0.8
SS-023-3.7KW	4	17.5	1
SS-043-0.4KW	6	1.11	2.5
SS-043-0.75KW	6	2.21	2.0
SS-043-1.5KW	4	4	1.1
SS-043-2.2KW	4	6	0.8
SS-043-3.7KW	4	9	1
SS-043-5.5KW	3	12	1

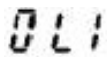

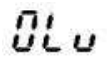


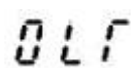
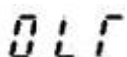
Appendix 2 Alarm Code List

Code	Cause	Troubleshooting
	<ol style="list-style-type: none"> Under-voltage for power supply. The RES terminal is connected. Bad connection between the manipulator and main machine. Internal circuit malfunction Wrong operation of CPU 	<ol style="list-style-type: none"> Provide a normal power supply Shut off RES Ensure firm connection between the manipulator and the main machine Replace the inverter Restart the inverter
 Over-current during acceleration	The output current is two times larger than the rated current of the inverter.	<ol style="list-style-type: none"> In case the time for acceleration or deceleration is too short, please prolong it. Avoid abrupt increase of load. Check Terminals U, V and W for short circuit.
 Over-current at constant speed		
 Over-current during deceleration		
 Over-voltage during acceleration	Over-voltage between Terminal P and Terminal (-)/N	<ol style="list-style-type: none"> In case the time for acceleration or deceleration is too short, please prolong it. Check the brake resistor between terminal P and PR for loose connection. Check whether the values of Pr30 and Pr70 are right or not.
 Over-voltage at constant speed		
 Over-voltage during deceleration		
 The IGBT module is overheating	The IGBT module thermal accumulating relay acts	Avoid the inverter long timely operating under overload condition
 Motor overheating	The electronic thermal relay operates	<ol style="list-style-type: none"> Check whether the setting value of the Pr9 is correct or not (the setting should comply the actual motor) Reduce load
 The brake transistor is abnormal	The brake transistor is abnormal	Please send it back to the factory.
 The external thermal relay operates.	The external thermal relay operates	<ol style="list-style-type: none"> Check the capacity of the external thermal relay and the motor for matching. Reduce the load
 Peripheral devices are abnormal	<ol style="list-style-type: none"> Abnormal communication. The maximum communication retry number is violated. Interrupted communication. The maximum communication check time interval is violated. 	Correctly set the communication parameters

Code	Cause	Troubleshooting
EEP Memory is abnormal	The memory ROM fails	Send it back to the factory.
CPV CPU error	External electromagnetic disturbance is too strong	Improve external disturbance
OL5 Stall prevention protection	The load of the motor is too heavy	1. Reduce the load of the motor. 2. Increase the value of Pr22.
HTC IGBT module is too hot	The temperature of IGBT module is too high	1. Reduce the environment temperature and improve the air condition 2. check whether the fan of the inverter is damaged
OL2 Over torque abnormal	1. Too heavy load of motor. 2. The setting value of P.155 and P.156 is unreasonable.	1. Reduce the load of motor. 2. Adjustment the setting value of P.155 and P.156 properly

(Note)When the alarms occur, the inverter will stop, please deal it with as the instructions above.

Appendix 3 Warning code list

Code	Display	Cause	Troubleshooting
OLI Current stall		When the output current is larger than the set value, it will display  to indicate that the inverter is in current stall mode. In this case the motor may not run smoothly.	<ol style="list-style-type: none"> 1. Check if the values of Pr22、Pr23、Pr66 are proper. 2. Check if the values of Pr7、Pr8 are too small
OLV Voltage stall		When the voltage between P and (-)/N is too high, the inverter will display  . Then the motor may not run smoothly.	<ol style="list-style-type: none"> 1. add a brake resistor between P and Pr 2. Check if the values of Pr7 and Pr8 are too small
LV Low voltage		Input voltage is low	<ol style="list-style-type: none"> 1. supply with the specified voltage
OLT LT motion		When the output current is more than twice the rated current, but it doesn't reach the stall level, the inverter will display  . Then the motor may not run smoothly.	<ol style="list-style-type: none"> 1. Please increase the acceleration/deceleration time in case of abrupt acceleration/deceleration. 2. avoid abrupt load increasing. 3. Check whether there is short circuit among U,V and W.

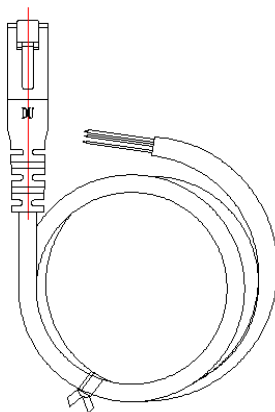
(Note) The above phenomena is to show the working state of the inverter, and the inverter will not stop. To get around the above troubles, please adjust the parameters properly or check the power supply and load carefully.

Appendix 4 Troubles and Solutions

Trouble	Check points	
Motor remains stopped	Check the Main circuit	<ul style="list-style-type: none"> • Check that a proper power supply voltage is applied. • Check that the Power Lamp is lit. • Check that the motor is connected properly.
	Check the load	<ul style="list-style-type: none"> • Check that the load is not too heavy. • Check that the shaft is not locked.
	Check the parameter settings	<ul style="list-style-type: none"> • Check that the starting frequency (Pr13) setting is not greater than the running frequency. • Check that the operation mode (Pr79) setting is correct. • Check that the reverse rotation prevention (Pr78) is not selected. • Check that the bias and gain (Pr194~Pr197) setting is correct. • Check that the frequency jump (Pr91~Pr96) setting is correct.
	Check the control circuit	<ul style="list-style-type: none"> • Check that the output stop signal (MRS) or reset signal (RES) is not on. • Check that the external thermal relay does not operate. • Check that the ALARM lamp is off and the reset is not executed. • Check that voltage/current start signal is input. • Check that the signal input STF/STR is correct.(The related parameter is Pr74). • Check that wiring for the control circuit is ok.
Motor rotates in opposite direction	<ul style="list-style-type: none"> • Check that the phase sequence of output terminals U, V and W is correct. • Check that the start signals(STF and STR) are connected properly. 	
Speed does not increase.	<ul style="list-style-type: none"> • Check that the load is not too heavy. • Check that the stall prevention level (Pr22) setting is correct. • Check that the torque boost (Pr0) setting is correct. • Check that the maximum frequency (Pr1) setting is correct. 	
Acceleration/ deceleration is not smooth	<ul style="list-style-type: none"> • Check that the acceleration/ deceleration time (Pr7, Pr8) settings are not too short. • Check that the acceleration/ deceleration pattern(Pr29) setting is correct. • Check that the voltage/current input signal is affected by noises. 	
Motor current is large	<ul style="list-style-type: none"> • Check that the load is not too heavy. • Check that the torque boost setting is not too large. 	
Speed varies during operation	<ul style="list-style-type: none"> • Check that the frequency setting signal is not affected by noise. • Check that the load is not varying. • Check that the wiring length for the main circuit is correct. 	

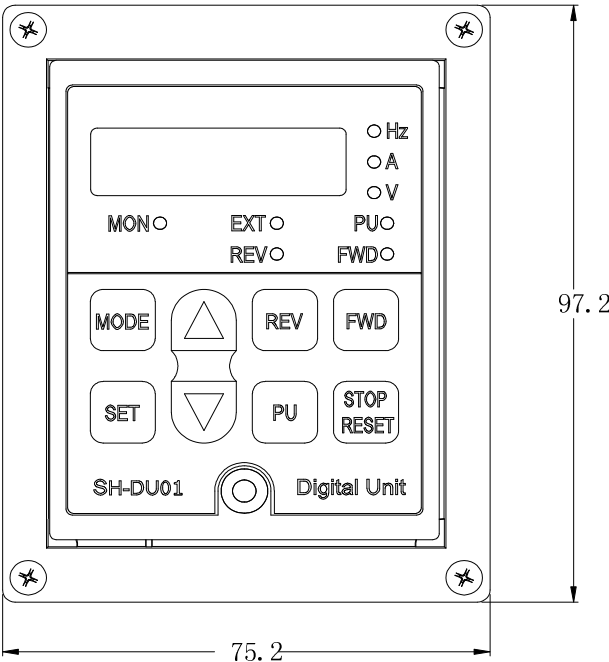
Appendix 5 Optional equipment

1. transmission cable (with DU01, used in standard type):



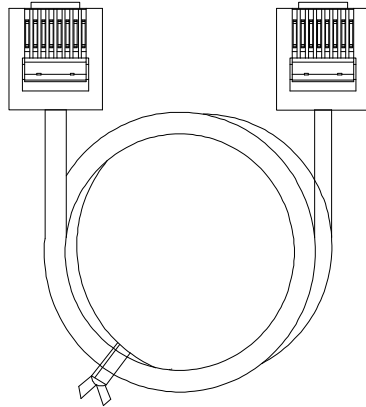
NO.	Model	Name	length
1	SNKCBL1R5ST	Transmission cable(1.5M)	1.5M
2	SNKCBL03ST	Transmission cable(3M)	3M
3	SNKCBL05ST	Transmission cable(5M)	5M

2. DU01-operation panel sets(operation panel and fixing pedestal) (used in standard type):



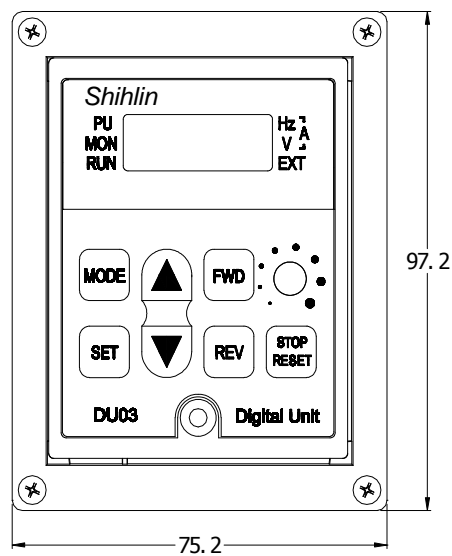
NO.	Model	Name
1	SNKDU01S	DU01 operation panel sets

3. transmission cable (with DU03/DU05, used in special type for external manipulator)



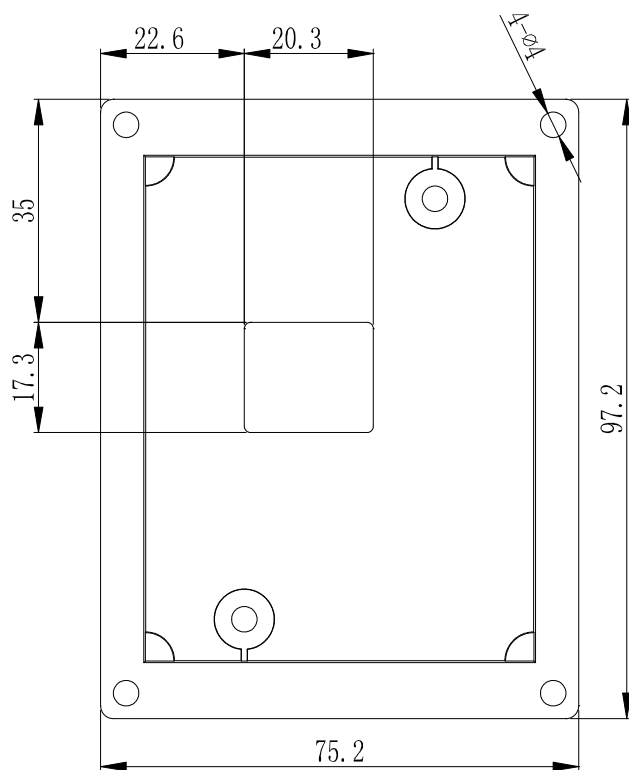
NO.	Model	Name	Length
1	SNKCBL1R5GT	Transmission cable(1.5M)	1.5M
2	SNKCBL03GT	Transmission cable(3M)	3M
3	SNKCBL05GT	Transmission cable(5M)	5M

4.DU03 -operation panel sets (operation panel and fixing pedestal) (used in special type for external manipulator):

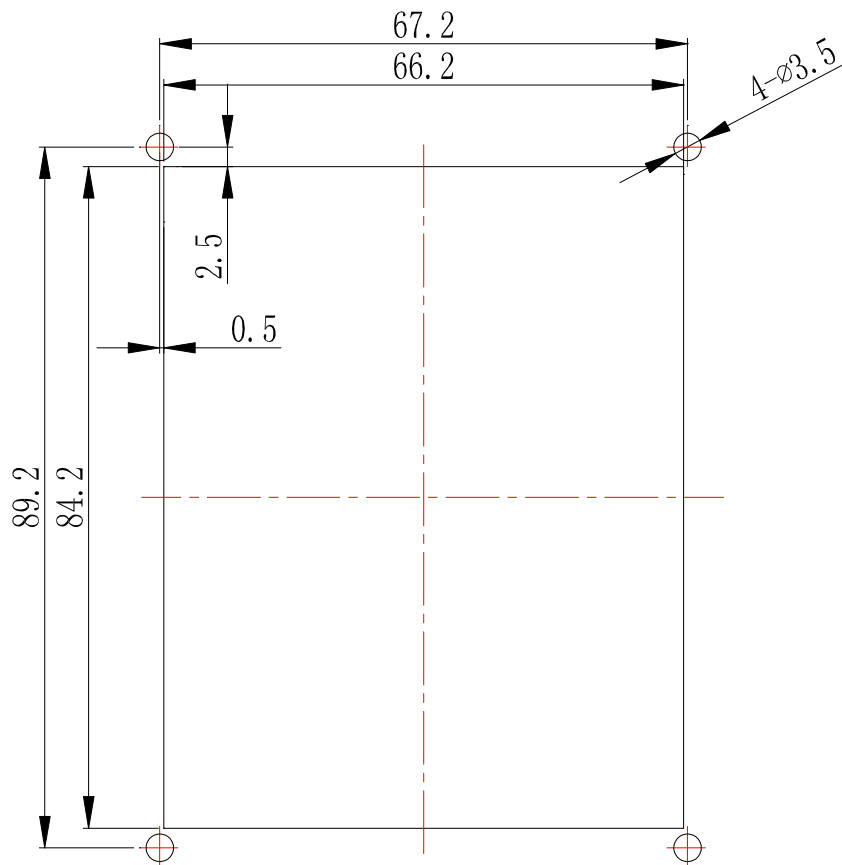


NO.	Model	Name
1	SNKDU03S	DU03 operation panel sets

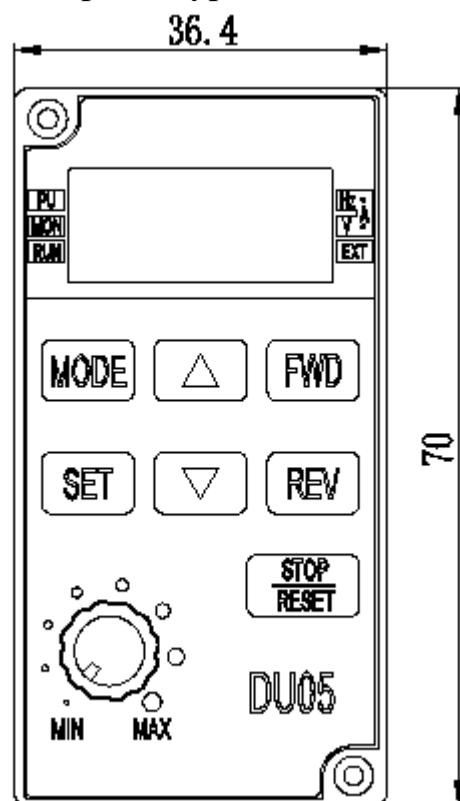
5. Supplemental explanation for the dimension of fixing pedestal of the DU03-operation panel



6. Proposed dimension of the hole on the fixing pedestal of the DU03-operation panel



7.DU05-operation panel (used in special type for external manipulator):



NO.	Model	Name
1	SNKDU05	DU05 operation panel

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