

Preface

Thank you for your continuous use and support of our company's products. Our company's R&D group's long-term technical collaboration with domestic research institutes and the world's major companies enables us to steadily work on the research and development of various products. Indeed, Shihlin Electric's FA related products have reached international standard.

With years of effort in promoting inverters and accommodating customer requirements, as well as detailed planning and design, now we are launching the SF020/040 series inverter. Whether it is product R&D stage, final product verification, or product manufacturing, all the processes are conducted under tight and systemic control. The quality of Shihlin Electric products wins customer trust, and thus Shihlin Electric products are your best choice.

Please contact us if you have any special need. For tasks entrusted by our customers, we will design inverters specifically meeting the customers' needs in a short period of time with excellent professional background and rigorous attitude.

To fully deliver the superior performance of the products as well as for the safety considerations for people and equipments, please read this manual carefully and keep it for later calibration or maintenance.

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1. Manual Guide

The Shihlin Electric SF-GT Series inverters have been designed with many complex parameterized functions to meet most of the application requirements in the market. For first-time users, they may experience some problems while using an inverter of such complex nature. Therefore, we recommend each user to read through each part of this manual carefully in order to master the operating methods of the inverters. Please feel free to contact us if you have any question.

Chapter 3 of this manual lists the detailed specifications of Shihlin Electric SF-GT Series inverters. [Section 3.5](#) will guide you on how to install the inverters, with an emphasis on safety precautions that must be noted when using the inverters.

Chapter 4 guides customers on how to use the inverter. In [Section 4.1](#), it gives a brief outline on the operating mode of the inverter and how to use the operation panel. In [section 4.2](#), the simple operating steps are explained. Chapter 5 explains the function of each parameter in detail.

The definitions of terminologies used in this manual are as follow:

1. Output frequency, target frequency, steady output frequency

The actual output current frequency of the inverter is called “output frequency.”

The frequency set by user (through operation panel, multi-speed terminals, voltage signal, and current signal or communication settings) is called “target frequency.”

When the motor starts running, the output frequency of the inverter will gradually accelerate to the target frequency before it finally runs steadily at the target frequency. This output frequency is called “stead output frequency.”

2. Detail explanation on parameter settings are provided in Chapter 5. For users who 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 P.998. For setting procedures of this parameter, please refer to [P.998](#) in Chapter 5.

3. The “operation mode” and “working mode” of the operation panel

The operating mode determines the reference source for the target frequency and the signal source for starting. A total of nine operating modes are provided in each Shihlin inverter. Please refer to [Section 4.1](#) for details.

The operation panel is used mainly for monitoring the numeric values, setting parameters and target frequency. There are a total of five working modes on the Shihlin operation panel. Please refer to [Section 4.1](#) for details.

4. The difference between “terminal name” and “function name”:

Printed letters can be found near the terminals of either the control board or the main board. They are used to distinguish each terminal and are called “terminal name.”

For “multi-function control terminal” and “multi-function output terminal,” besides the terminal name, it is also necessary to define the “function name.” The function name indicates the actual functions of the terminal.

When explaining the function for a terminal, the name used is its “function name.”

5. The difference between “on” and “turn on”:

When explaining the function for the “multi-function control terminal”, two words “on” and “turn on” are often used:

The word “on” is used to indicate that the external switch of the terminal is in close state, and thus it belongs to the description of the state.

The word “turn on” is used to describe the action that the external switch of the terminal is shut from the open state to the close state, and thus belongs to the description of action. Similarly, the words “off” and “turn off” belong to the above-mentioned states and actions.

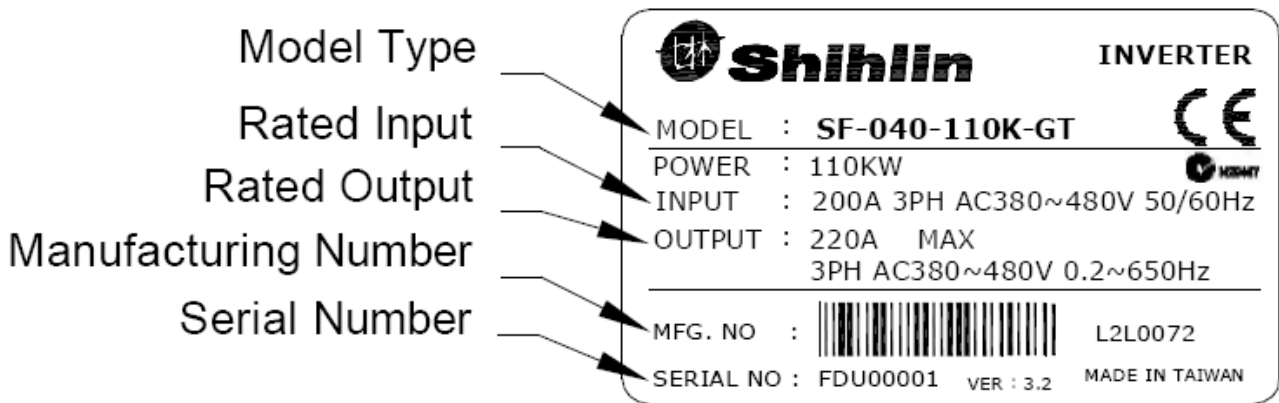
2. Delivery Check

Each SF-GT-TYPE inverter has been checked thoroughly before delivery, and is carefully packed to prevent any mechanical damage. Please check for the following when opening the package.

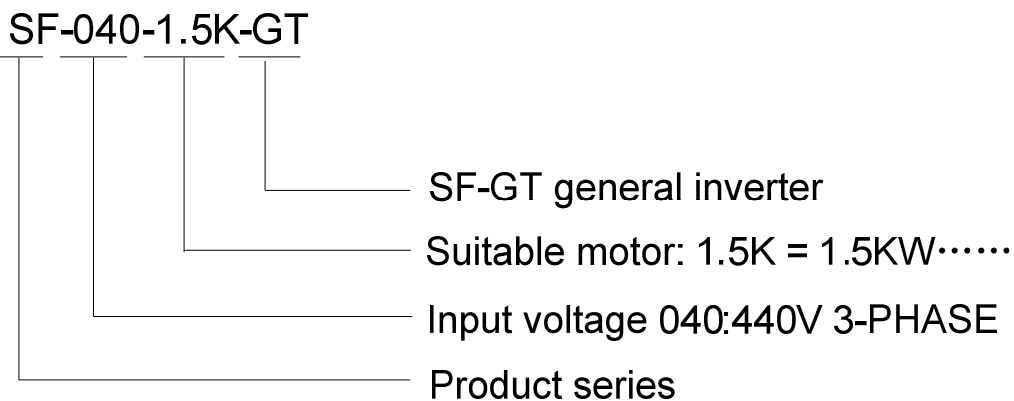
Checking out whether the product was damaged during transportation.

Whether the model of inverter coincide with what is shown on the package.

2.1 Nameplate Instruction



2.2 Type Instruction



2.3 Order Code Description

Example:

Customer requirement	Order code
Inverter specification	
SF-040-1.5K-GT (SF-GT series 440V 1.5kW inverter)	LNKSF0401R5KGT
SF-040-7.5K-GT (SF-GT series 440V 7.5kW inverter)	LNKSF0407R5KGT
SF-040-15K-GT (SF-GT series 440V 15kW inverter)	LNKSF04015KGT

3. Shihlin Inverter Introduction

3.1 Electric Specification

3.1.1 440V Series Three-phase

Model SF-040-□□□K-GT		1.5	2.2	3.7
Applicable motor capacity	HP	2	3	5
	kW	1.5	2.2	3.7
Output	Rated output capacity kVA	3	4.6	6.9
	Rated output current A	4.2	6	9
	Overload current rating	150% 60 seconds (inverse time characteristics)		
	Maximum output voltage	Three-phase 380-480V		
Power supply	Rated power voltage	Three-phase 380-480V 50Hz / 60Hz		
	Power voltage permissible fluctuation	Three-phase 342-528V 50Hz / 60Hz		
	Power frequency permissible fluctuation	±5%		
	Power source capacity kVA	4.5	6.9	10.4
Cooling method		Self cooling	Forced air cooling	
Inverter weight kg		2.8	2.8	2.8

Model SF-040-□□□K-GT		5.5	7.5	11	15	18.5	22
Applicable motor capacity	HP	7.5	10	15	20	25	30
	kW	5.5	7.5	11	15	18.5	22
Output	Rated output capacity kVA	10	14	18	25	29	34
	Rated output current A	13	18	24	32	38	45
	Overload current rating	150% 60 seconds (inverse time characteristics)					
	Maximum output voltage	Three-phase 380~480V					
Power supply	Rated power voltage	Three-phase 380~480V 50Hz / 60Hz					
	Power voltage permissible fluctuation	Three-phase 342~528V 50Hz / 60Hz					
	Power frequency permissible fluctuation	±5%					
	Power source capacity kVA	11.5	16	20	27	32	41
Cooling method		Forced air cooling					
Inverter weight kg		5.6	5.6	5.6	5.6	8.3	8.3

Shihlin Inverter Introduction

Model SF-040-□□□K-GT		30	37	45	55	75	90	110	
Applicable motor capacity		HP	40	50	60	75	100	120	150
		kW	30	37	45	55	75	90	110
Output	Rated output capacity kVA	46	56	69	84	114	137	168	
	Rated output current A	60	73	91	110	150	180	220	
	Overload current rating	150% 60 seconds (inverse time characteristics)							
	Maximum output voltage	Three-phase 380~480V							
Power supply	Rated power voltage	Three-phase 380~480V 50Hz / 60Hz							
	Power voltage permissible fluctuation	Three-phase 342~528V 50Hz / 60Hz							
	Power frequency permissible fluctuation	±5%							
	Power source capacity kVA	52	65	79	100	110	137	165	
Cooling method		Forced air cooling							
Inverter weight kg		25	25	25	37	37	37	67	

Note: The test conditions of rated output current, rated output capacity and frequency converter inverter power consumption are: the carrier frequency (P.72) is at the set value; the frequency converter/inverter output voltage is at 440V; the output frequency is at 60Hz, and the ambient temperature is 40°C.

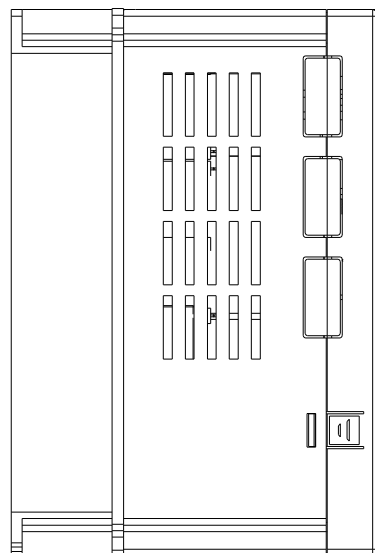
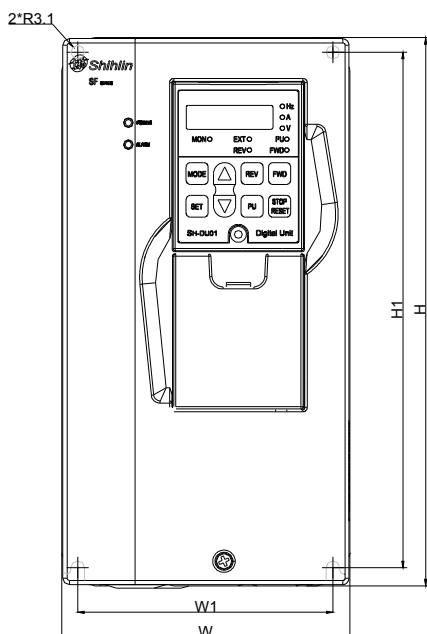
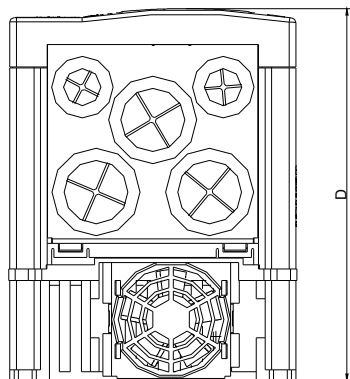
3.2 General Specification (Inverter Characteristics)

Control method		SVPWM control, V/F control, close-loop V/F control (VF+PG), general flux vector control, sensorless vector control (SVC), close-loop vector control (FOC+PG), torque control (TQC+PG).		
Output frequency range		0.2~650Hz (The starting frequency setting range is 0~60Hz).		
Frequency setting resolution	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	Maximum target frequency $\pm 0.01\%$.		
	Analog setting	Maximum target frequency $\pm 0.5\%$.		
Voltage/ Frequency output characteristic		Base frequency voltage (<u>P.19</u>), base frequency (<u>P.3</u>) can be arbitrarily set. Constant torque model and applicable load model can be selected (<u>P.14</u>).		
Start torque		150% 0.5Hz (SVC) , 180% 0Hz (FOC+PG).		
Torque boost		The torque boost setting range is 0~30% (<u>P.0</u>), auto boost, slip compensation.		
Acceleration / deceleration curve characteristics		The resolution (0.01s/0.1s) of acceleration/deceleration time (<u>P.7</u> , <u>P.8</u>) is switched by <u>P.21</u> . The setting range has 0~360s or 0~3600s for selection. And different acceleration/deceleration curve model can be selected by <u>P.29</u> .		
DC braking		The DC braking action frequency is 0~120Hz (<u>P.10</u>); the DC braking time is 0~60s (<u>P.11</u>). The DC braking voltage is 0~30% (<u>P.12</u>).Linear braking and idling braking selection (<u>P.71</u>).		
Stalling protection		The stalling protection level can be set to 0~400% (<u>P.22</u>).		
Target frequency setting		Operation panel setting, DC 0~5V/10V signal, DC -10~+10V signal, DC 4~20 mA signal, multiple speed stage level setting, communication setting, HDI setting.		
PID control		Please refer to P.170~P.182 in chapter 4.		
Input terminals	Multi-function switching signal input	(M0,M1,M2,STF,STR,RES,M3)-SD	<u>P.80~P.84</u> , <u>P.86</u> , <u>P.126</u>	Motor starting (STF, STR), the second function (RT), 16-speed operation (RH, RM, RL, REX), external thermal relay (OH), reset (RES) and so on.
	Pulse input	HDI-SD	<u>P.550</u>	The terminal HDI can accept impulse signal which maximum frequency is 100 kHz.

Output terminal	Multi-function open collector output	SO1-SE	P.40	Inverter running (RUN), output frequency detection (FU), Up to frequency (SU), overload alarm (OL), zero current detection (OMD), alarm (ALARM), section detection (PO1), periodical detection (PO2), and pause detection (PO3), inverter output (BP), work frequency output (GP). Multi-function DC (0~10V/0~20mA) output: output voltage, current. Output the pulse which maximum frequency is 100 kHz.
		SO2-SE	P.129	
	Multi-function relay output	A1-B1-C ₁	P.85	
		A2-B2-C ₂	P.130	
	Analog output	AM1-5	P.54	
		AM2-5	P.537	
Pulse output	HDO-SD	P.54 , P.74		
Operation panel	Operation monitoring	Output frequency monitoring, output current monitoring, output voltage monitoring, abnormality record (Maximum 12 sets).		
	LED indication lamp (8)	Forward rotation indication lamp, reverse rotation indication lamp, frequency monitoring indication lamp, voltage monitoring indication lamp, current monitoring indication lamp, mode switching indication lamp, PU terminals control indication lamp, and external terminals control indication lamp.		
Communication function		RS-485 communication, can select Shihlin/Modbus communication protocol.		
Protection mechanism / alarm function		Output short circuit protection, Over-current protection, (+/P)-(-/N) over-voltage protection, under-voltage protection, motor over-heat protection (P.9), IGBT module over-heat protection, communication abnormality protection, PTC temperature protection etc.		
Environment	Ambient temperature	-10 ~ +40°C (non-freezing).		
	Ambient humidity	Below 90%Rh (non-condensing).		
	Storage temperature	-20 ~ +65°C。		
	Surrounding environment	Indoor, no corrosive gas, no flammable gas, no flammable powder.		
	Altitude and vibration	Altitude below 1000 meters, Vibration below 5.9m/s ² (0.6G).		
	Grade of protection	IP20		
	The degree of environmental pollution	2		
	Class of protection	Class I		

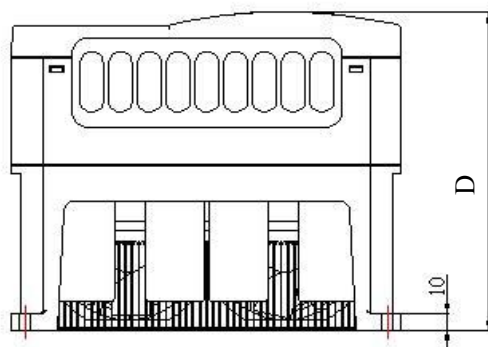
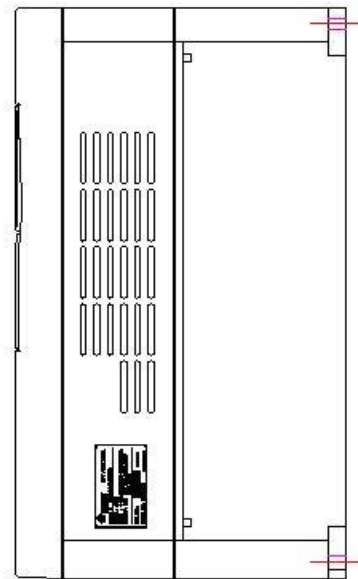
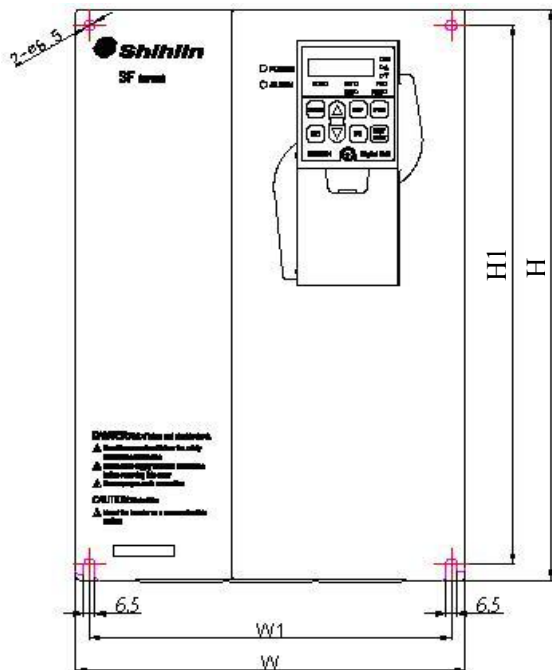
3.3 Appearance and Dimensions

3.3.1 Frame AA



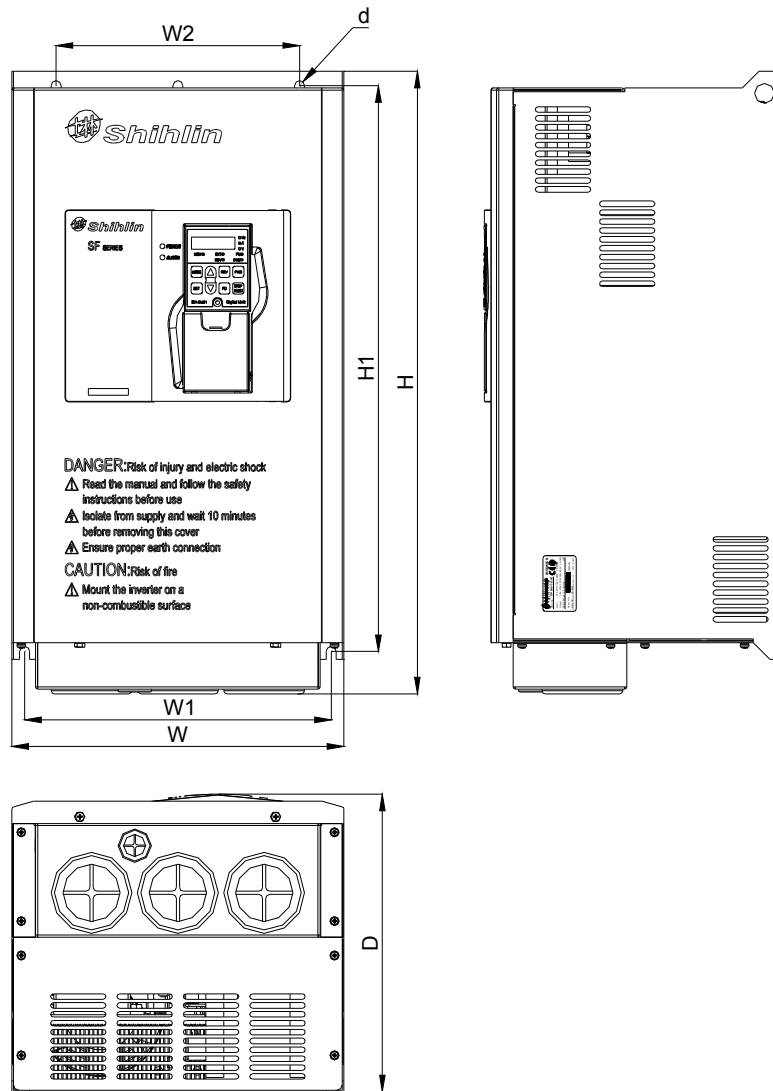
Model	Frame	H (mm)	H1 (mm)	W (mm)	W1 (mm)	D (mm)
SF-040-1.5K-GT	AA	251	236	131	116	170
SF-040-2.2K-GT						
SF-040-3.7K-GT						

3.3.2 Frame A/B



Model	Frame	H (mm)	H1 (mm)	W (mm)	W1 (mm)	D (mm)
SF-040-5.5K-GT	A	323	303	200	186	186
SF-040-7.5K-GT						
SF-040-11K-GT						
SF-040-15K-GT	B	350	330	230	214	195
SF-040-18.5K-GT						

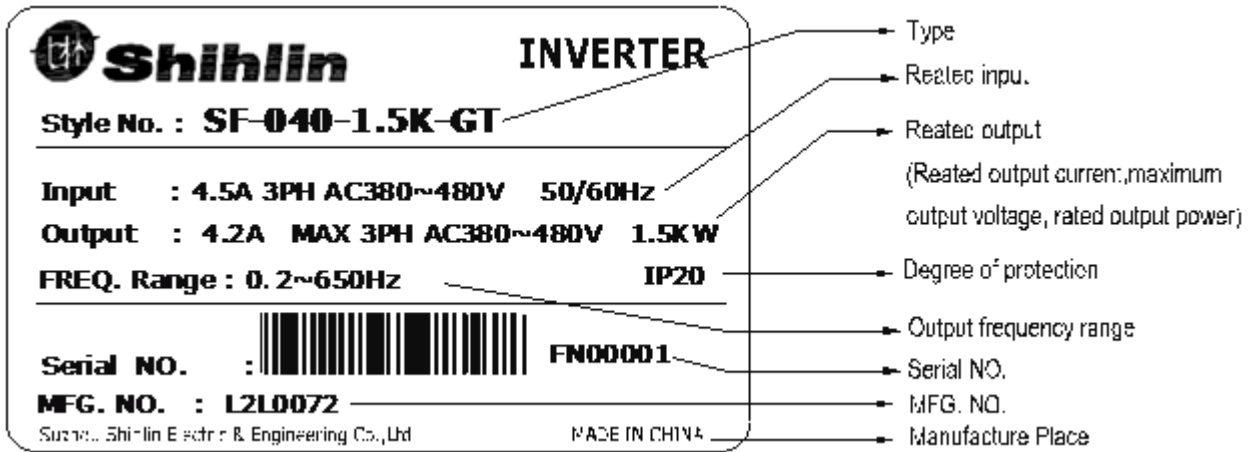
3.3.3 Frame D/E/F



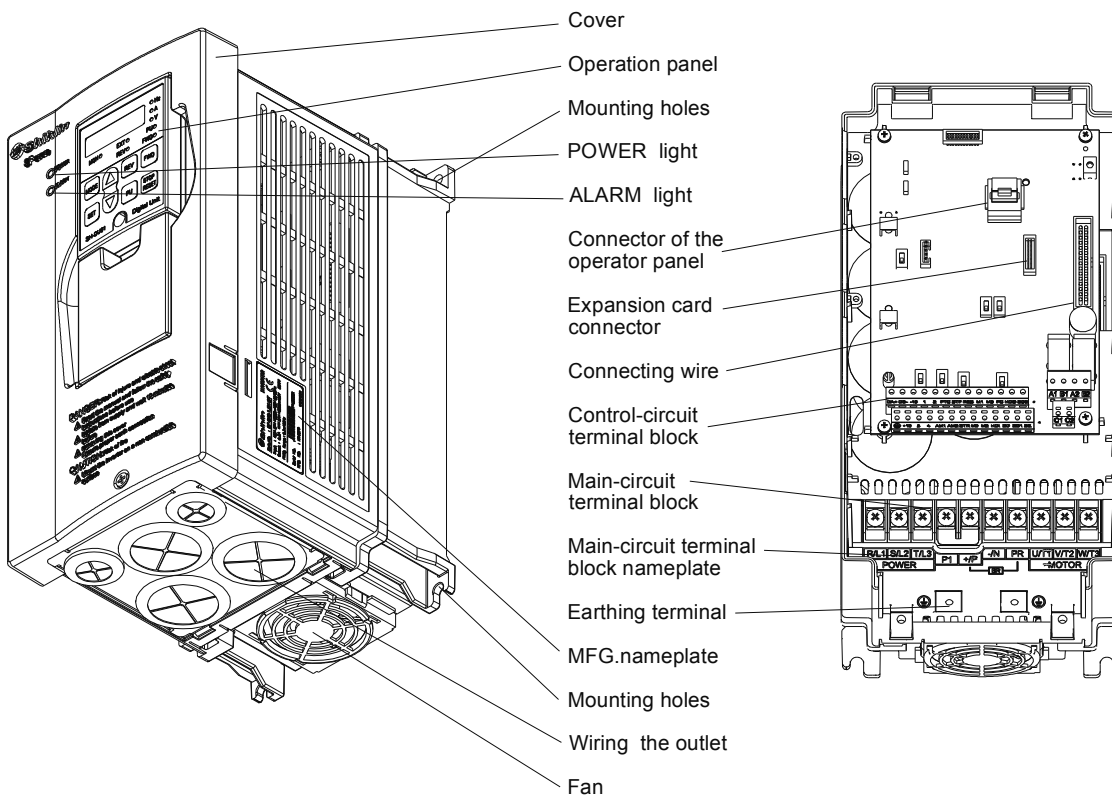
Model	Frame	H (mm)	H1 (mm)	W (mm)	W1 (mm)	W2 (mm)	D (mm)	d (mm)
SF-040-22K-GT	D	561	510	300	277	220	270	9
SF-040-30K-GT								
SF-040-37K-GT								
SF-040-45K-GT	E	595	566	370	336	336	286	13
SF-040-55K-GT								
SF-040-75K-GT								
SF-040-90K-GT	F	850	821	425	381	381	286	13
SF-040-110K-GT								

3.4 Name of Each Component

3.4.1 Nameplate and Model

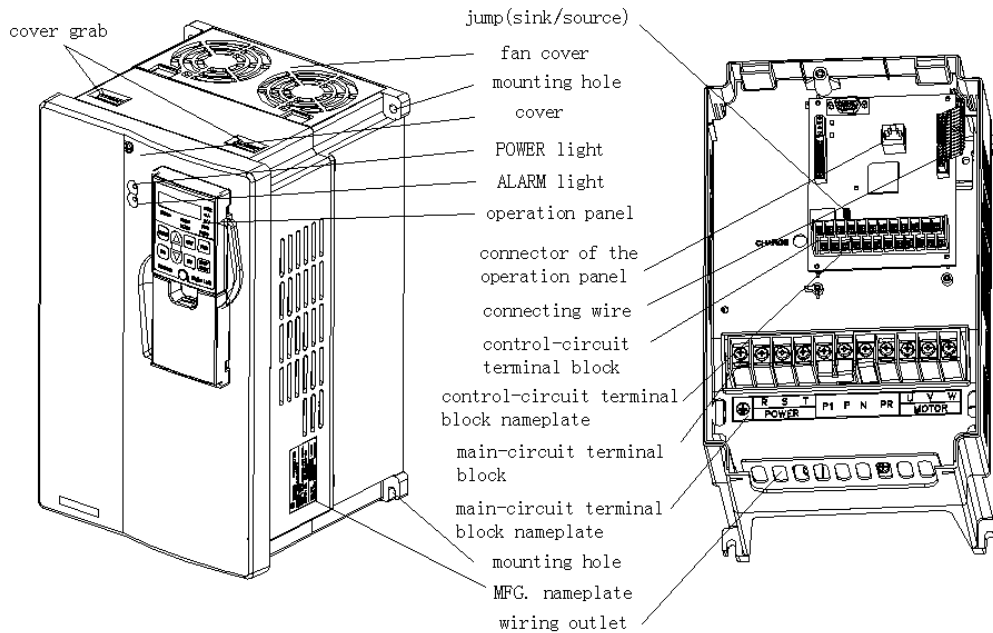


3.4.2 Names of the Components of Frame AA



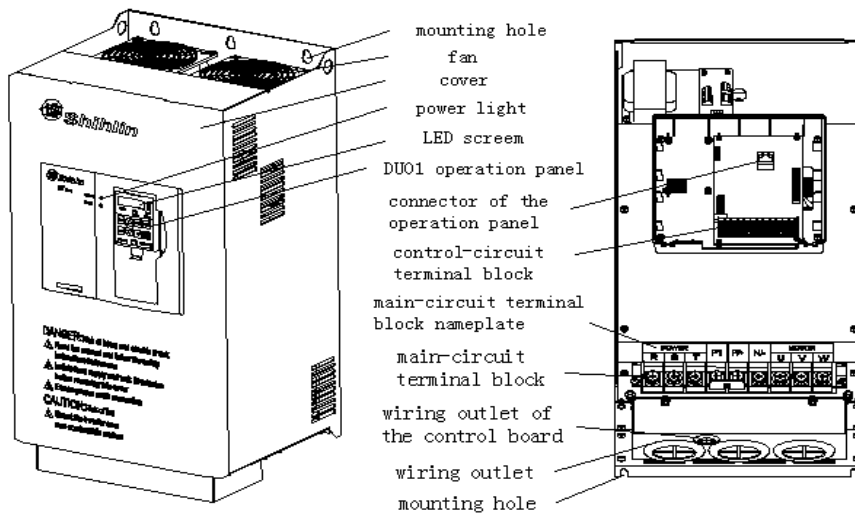
1. The above figure corresponds to all the models of frame AA.
2. Push down the latch on the top cover and pull the latch toward the front of the inverter to remove the top cover.
3. "Wiring Outlet" is designed for fixing and protecting the lead wire. When wiring, the lead wire must pass through the "wiring outlet" and then connected to the terminals. Use cable ties to fix the wires in a bundle.

3.4.3 Names of the Components of Frame A/B



1. The above figure corresponds to all the models of frame A and B.
2. Push down the latch on the top cover and pull the latch toward the front of the inverter to remove the top cover.
3. "Wiring Outlet" is designed for fixing and protecting the lead wire. When wiring, the lead wire must pass through the "wiring outlet" and then be connected to the terminals. Use cable ties to fix the wires in a bundle.

3.4.4 Names of the Components of Frame D/E/F

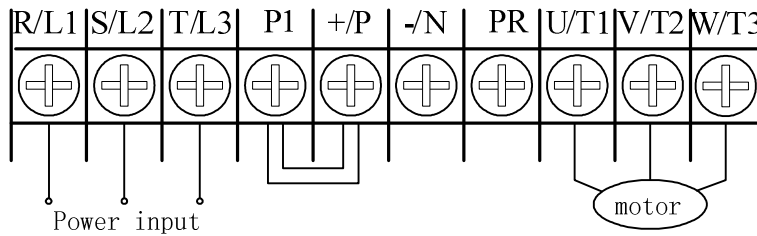


1. The above figure corresponds to all the models of frame D, E and F.
2. Push down the latch on the top cover and pull the latch toward the front of the inverter to remove the top cover.
3. "Wiring Outlet" is designed for fixing and protecting the lead wire. When wiring, the lead wire must pass through the "wiring outlet" and then be connected to the terminals. Use cable ties to fix the wires in a bundle.

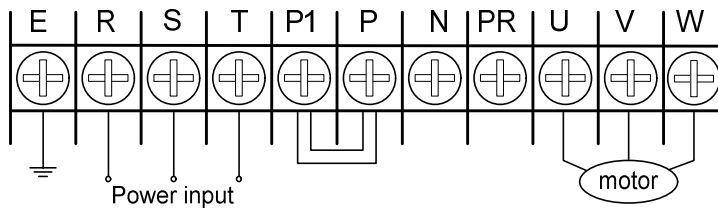
3.4.5 Each Type of Main Loop Terminals Arrangement

- Terminal arrangement

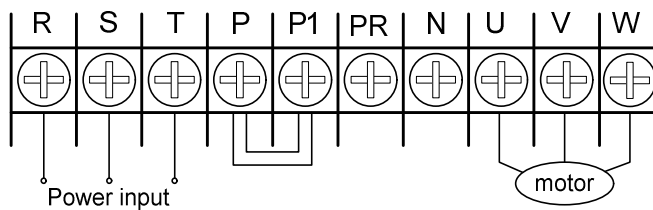
Note: 1. Frame AA



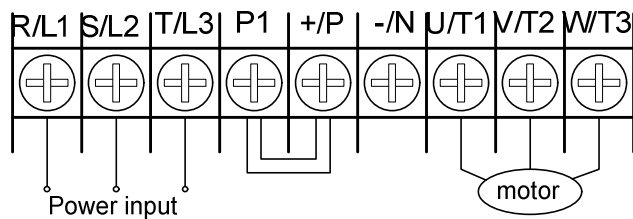
2. Frame A



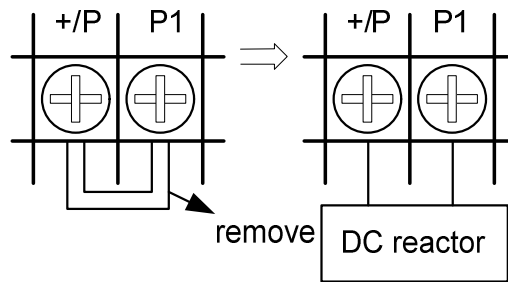
3. Frame B



4. Frame D, E and F

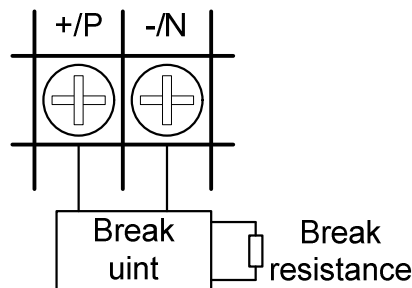


- DC reactor connection



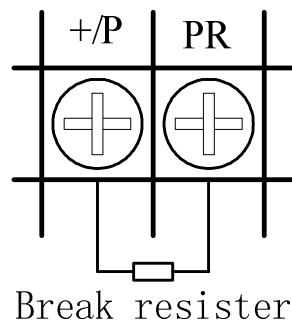
Note: Frame E and F corresponded inverters have built-in DC reactor.

- Brake unit connection



Note: Frame C, D, E and F corresponded inverters have no built-in brake unit. Brake units and brake resistors can be selected for use. The built-in brake unit of frame A and B corresponded inverters can have brake resistors.

- Brake resistor connection



Note: 1. it is only suitable for frame AA, A and B corresponded inverters
 2. Instruction on the frames is presented in Section 3.3.

3.5 Installation and Wiring

3.5.1 Transportation

Take the pedestal when carrying and don't only take the cover or any part of the inverter, otherwise it may drop down.

3.5.2 Stockpile

Keep this product in the packaging before installation and when not in use. To change the frequency that meets the manufacturer's warranty and maintenance conditions, please pay attention to the following regarding storage:

1. Must be placed in dry and without dirt place.
2. The environment temperature for storage position must range from -20°C to $+65^{\circ}\text{C}$.
3. The relative humidity for storage position must range from 0% to 95%, and no condensation.
4. Avoid storing in the environment which contains corrosion gas or liquid.
5. It had better be packed properly and kept on shelf or table.

Note: 1. Even if the humidity meets the standard requirements, icing and condensation can also occur when the temperature changes rapidly. And the place should avoid.

2. Don't place it on the ground, and it should be placed on appropriate shelf. If in the bad surroundings, the desiccant should be placed in the packaging bag.
3. If the custody period is more than 3 months, the ambient temperature should not be higher than 30°C . It is to consider that the character will easily degrade in high temperature when the electrolytic capacitors are deposited without electricity.
4. If the inverter is installed in device or control board when not in use (especially in construction site or the humid and dusty place), the inverter should be removed and put in suitable environment according with the above storage conditions.
5. If the electrolytic capacitors are long-term no electricity, the character will degrade. Do not place it in the state of no electricity for more than one year.

3.5.3 EMC Installation Instructions

Just as other electrical and electronic equipments, an inverter is the source of electromagnetic interference and an electromagnetic receiver when working with a power system. The amount of electromagnetic interference and noise is determined by the working principles of an inverter. In order to guarantee the inverter working reliably in the electromagnetic environment, it must have a certain ability of anti-electromagnetic interference in design. In order to make the drive system work normally, please meet the following several aspects requirements in installation:

1. Field wiring

Power line supply electric independently from power transformer, five or four core line are generally used, null line and ground sharing a single line is forbidden.

Commonly signal wire (weak) and power wire (heavy) are in control cabinet, for the inverter, power wire is divided into input line and output line. Signal wire is easily interfered by power wire, so that causing the misoperation of the device. When wiring, signal wire and power wire should be distributed in different areas, parallel lines and interlaced lines are forbidden at close range (within 20cm), and especially don't bundle up the two lines. If the signal cables must pass through the power lines, the two should keep 90 degree Angle. Interlace lines and banding together is also forbidden for the input and output line of power wire, especially on the occasions which noise filter is installed. It will cause the coupling of electromagnetic noise through the distributed capacitance of the input and output lines, thus the noise filter will out of action.

Generally a control cabinet has different electric equipments such as inverter, filter, PLC, measurement instrument, their ability of emitting and bearing electromagnetic noise are diverse from each other, and this requires classifying these equipments. The classification can be divided into strong noise equipment and noise sensitive equipment, Install the similar equipments in the same area and, and keep a distance more than 20cm among inhomogeneous equipments.

2. Input noise filter, input and output magnet ring (Zero phase reactor)

Adding noise filter to the input terminal, the inverter will be isolated from the other equipments, and its ability of conduction and radiation will be reduced effectively. The better EMI suppression effect will be obtained by installing the input reactor recommended by this manual. By adding winding ferrite bead to the input and output terminal and coordinating with internal filter, the inverters will have a better effect.

3. Shielding

Good shielding and grounding can greatly reduce the interference of inverter, and can improve the anti-interference ability of the inverter. Sealing off the inverter with the good conductive sheet metal and connecting the sheet metal to ground, the radiation interference will be reduced effectively. To reduce the interference of inverter and improve the anti-interference ability, cable with shielding layer should be used in input and output and the both ends of it should be connected to ground. Shielding cable is suggested to be used in control connecting and communication connecting of the inverter external terminals under bad electromagnetic environment. Generally, the both ends of shielding layer should be connected to the control /communication ground, and they can also be connected to ground.

4. Grounding

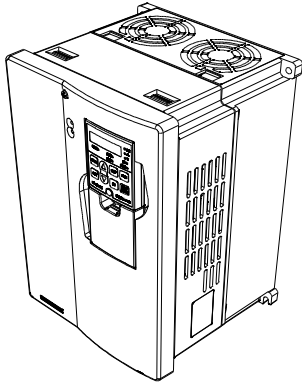
The inverter must be connected to the ground safely and reliably. Grounding is not only for equipment and personal safety, but also the simplest, the most efficient and the lowest cost method to solving the EMC problem, so it should be prioritized. Please refer to the section of "terminal wiring".

5. Carrier wave

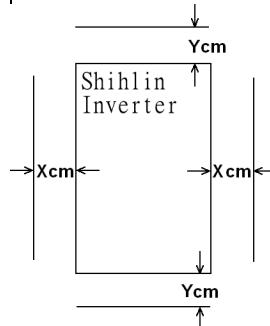
The leakage current contains the leakage current from line to line or over the ground. It depends on the size of the distributed capacitance when wiring and the carrier frequency of the frequency. The higher the carrier frequency, the longer the motor cable, and the larger the cable cross-sectional area is, the larger the leakage current is. Reducing the carrier frequency can effectively reduce the leakage current. When the motor line is long (50m above), the output side should be installed with ac reactor or sine wave filter, when the motor line is longer, a reactor should be installed every other distance. At the same time, reducing carrier frequency can effectively reduce the conduction and radiation interference.

3.5.4 Installation

1. Please install it upward.

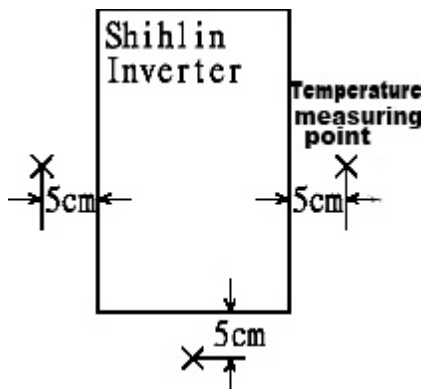


2. Install the inverter with sufficient space at the surroundings.

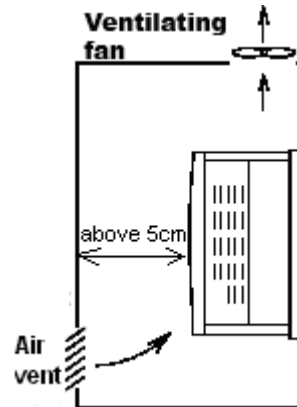


Inverter type	X	Y
Below 3.7k	1	10
5.5~55k	5	10
Above 75	10	20

3. The ambient temperature shall not exceed the permissible value.



4. Install the inverter at a correct position in a protection case.

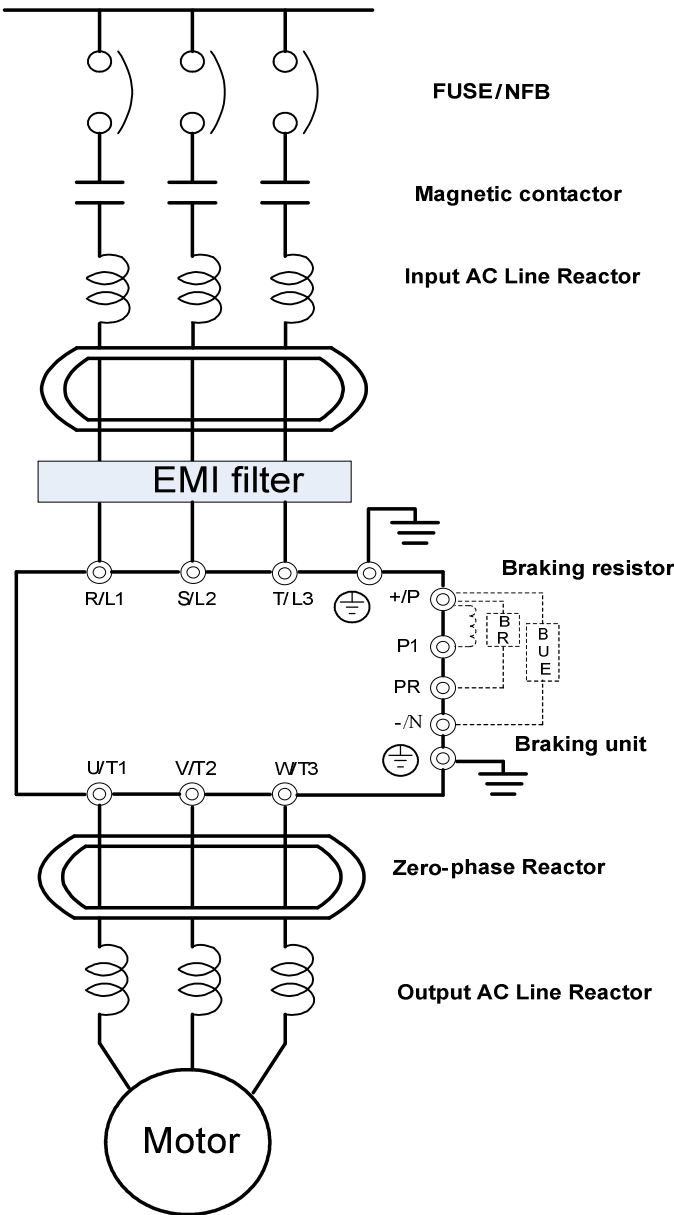


5. Please do not install the inverter on a surface of inflammable material such as wood, etc.
6. Please do not install the inverter at place exposed to explosive gas or inflammable dust.
7. Please do not install the inverter at places with airborne oil mist and dust.
8. Please do not install the inverter at places exposed to corrosive gas or high salt air.
9. Please do not install the inverter in an environment of high temperature and high humidity.

Note: 1. The installation, wire arrangement, dismounting, and maintenance can only be done by qualified electricians.

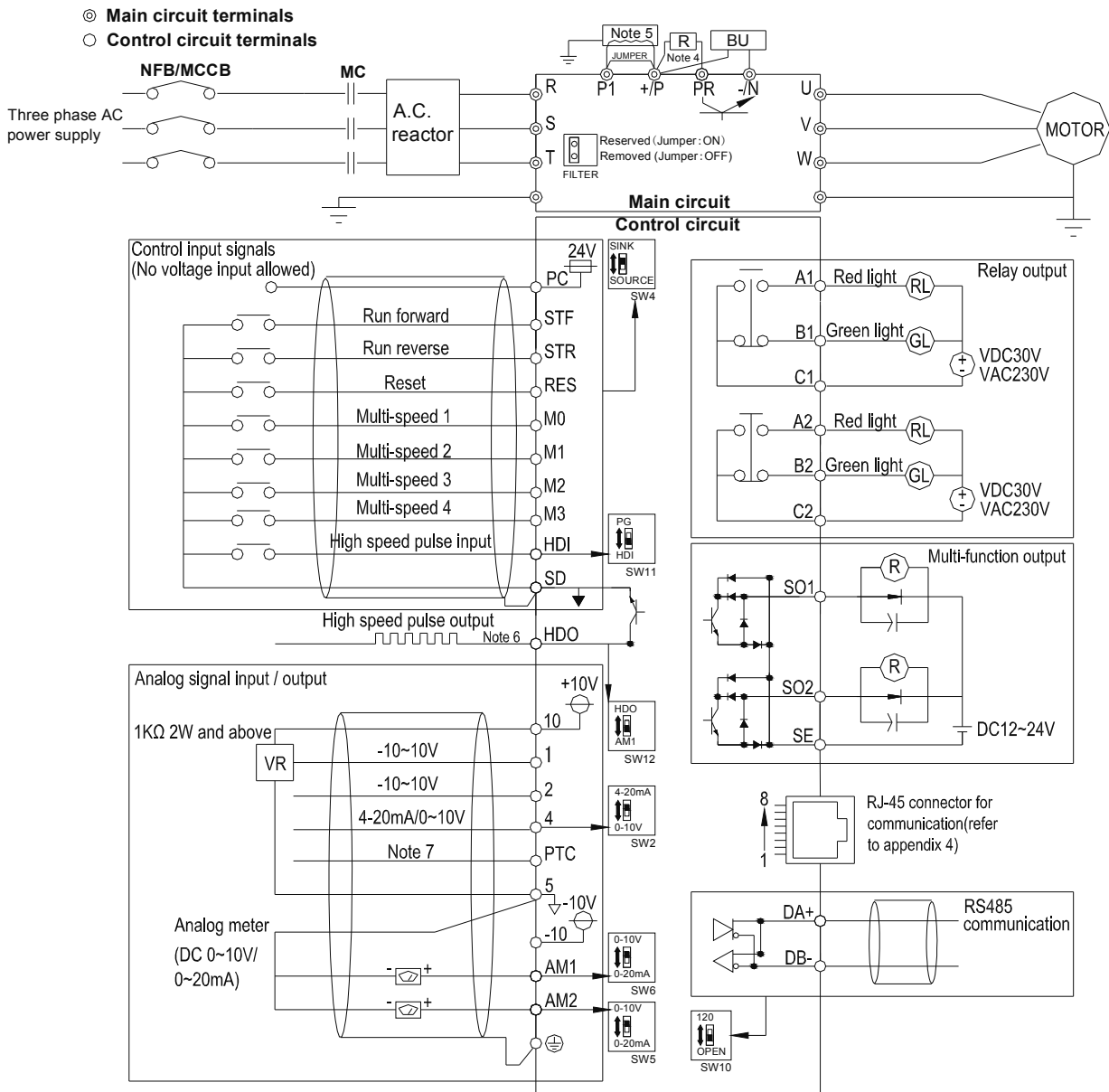
2. Please follow the installation instructions. In the event where installation instructions have not been followed that resulted in damage of the inverter or dangerous accident, the manufacturer shall not be held responsible for any legal responsibility. Please feel free to contact us should you have any question.

3.5.5 System Wire Arrangement



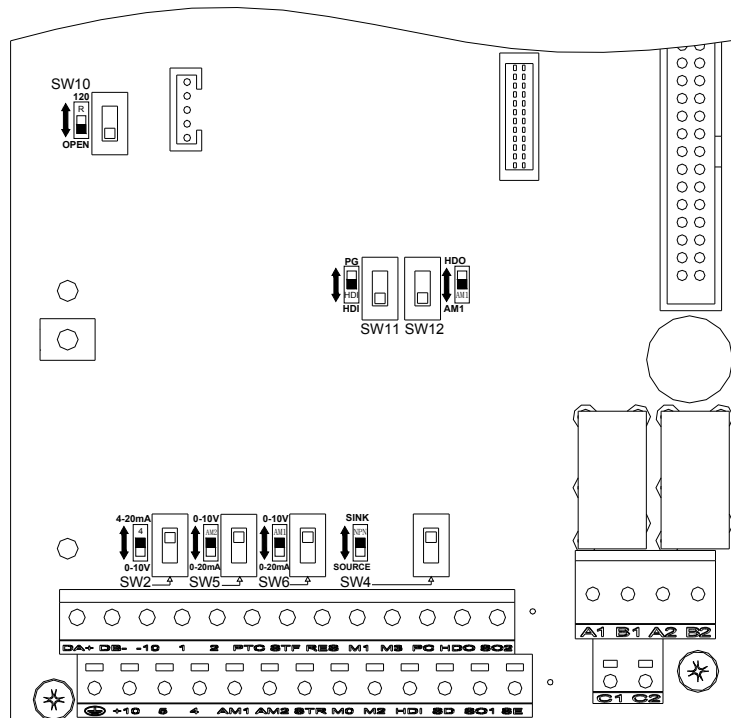
Power supply	Please follow the specific power supply requirement shown in this manual.
Fuse/NFB	There may be an inrush current during power up. Please refer to 3.7.1 and select the correct fuse /NFB.
Magnetic contactor	Please do not use a Magnetic contactor as the I/O switch of the inverter, as it will reduce the operating life cycle of the inverter.
Input AC Line Reactor	AC line reactor should be installed to improve the input power factor. The wiring distance should be less than 10m. Please refer to 3.7.6.
Zero-phase Reactor	Zero-phase reactors are used to reduce radio noise especially when audio equipment installed near the inverter. Effective for noise reduction on both the input and output sides. The frequency band effective range is from 1MHz to 10 MHz. Please refer to 3.7.5.
EMI filter	Used to reduce electromagnetic interference.
Braking unit	Used to reduce stopping time of the motor.
Output AC Line Reactor	Motor surge voltage amplitudes depending on motor cable length. The output AC line reactor is necessary to install on the inverter output side. Please refer to 3.7.6.















3.5.6 Terminal Wire Arrangement



- Note: 1. Please refer to P.80~P.84, P.86, P.126, P.550(OH) of Chapter 5 for the applications of external thermal overload relay.
2. Make sure that 10, -10, SD, SE, 5 and PC are not shorted each other.
3. The DC resistor between +/P and P1 is optional. Please short +/P and P1 when AC reactor is not used.
4. The brake resistor connection approach between +/P and PR is for frames A and B only. For connecting the brake unit of frame D, E, F to between +/P and -/N, please refer to terminal arrangement in 3.4.5
5. Inverters corresponding to frame E、F have build-in DC reactors, you can also refer to DC reactor specification on page 37 before adding DC reactors in addition. (When adding DC reactors, please remove the short circuit piece between P1 and +/P.)
6. Please refer to page 100 for wiring of HDO.
7. Please refer to page 160 for wiring of PTC.

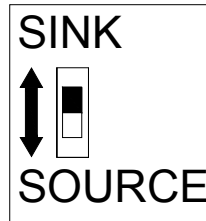
3.5.7 Toggle Switch Introduction



Switch number	Switch state	Explanation	Remarks
SW2	 *	Input 4~20mA current signal into terminal 4-5	Cooperating with P.17, please refer to page 93 .
		Input 0~10V/0~5V voltage signal into terminal 4-5	
SW4	 *	Select the method of Sink Input	Please refer to note 1 in following table.
		Select the method of Source Input	
SW5	 *	Output 0~10V voltage from terminal AM2	Cooperating with P.538, please refer to page 102 .
		Output 0~20mA/4~20mA current from terminal AM2	
SW6	 *	Output 0~10V voltage from terminal AM1	Cooperating with P.64, please refer to page 99 .
		Output 0~20mA/4~20mA current from terminal AM1	
SW10		Using 120Ω terminal resistor	Set the terminal resistor switch on the farthest inverter at “120”, please refer to page 72 .
	 *	Without terminal resistor	
SW11		The terminal A2/B2 on PG03 is valid	Cooperating with P.550, P.356, P.522, please refer to page 117, 166, 169.
	 *	The terminal HDI is valid	
SW12		The terminal HD0 is valid	Cooperating with P.64, please refer to page 99 .
	 *	The terminal AM1 is valid	

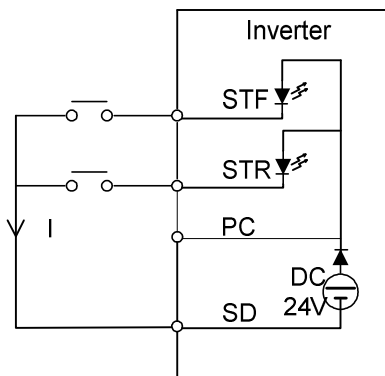
Note: The state with “*” is the default state of switch.

Note: 1. The multi-function control terminal of SF-GT series inverter can select the sink input approach or the source input approach via the toggle switch SW4. The diagram is as follows:

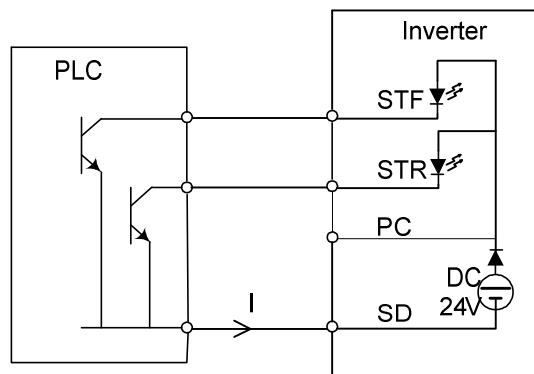


No matter what kind of multi-function control terminal is, all of its outside wire arrangement can be considered as a simple switch. If the switch is “on,” the control signal will be put into the terminal. If the switch is “off,” the control signal is shut off.

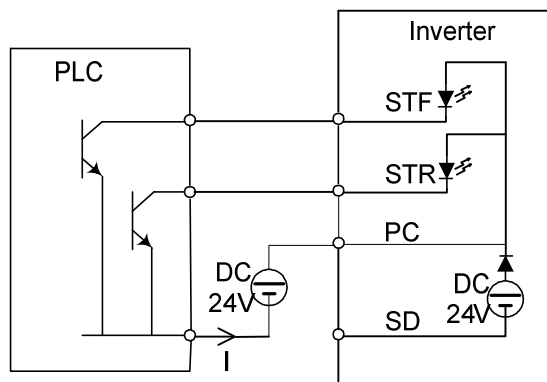
If “Sink Input” mode is selected, the function of the terminal is active when it is shorted with SD or connected with the external PLC. In this mode, the current flows out of the corresponding terminal when it is “on”. Terminal “SD” is common to the contact input signals. When using an external power supply for output transistor, please use terminal PC as a common to prevent misoperation caused by leakage current.



Sink Input: the multi-function control terminal is shorted directly with SD

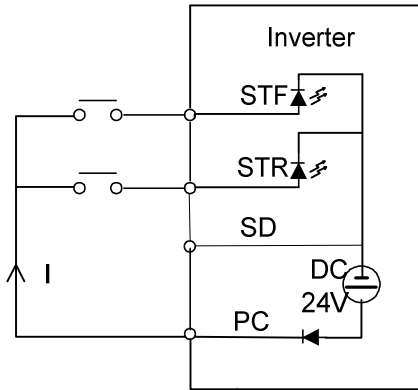


Sink Input: the multi-function control terminal is connected directly with open-collector PLC

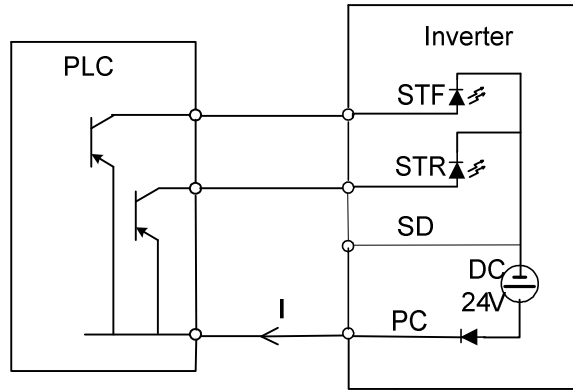


Sink Input: the multi-function control terminal is connected with open-collector PLC and external power supply

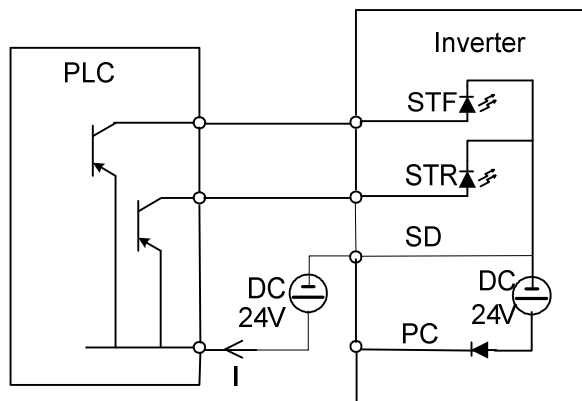
If "Source Input" mode is selected, the function of the terminal is active when it is shorted with PC or connected with the external PLC. In this mode, the current flows into the corresponding terminal when it is "on". Terminal PC is common to the contact input signals. When using an external power supply for transistor, please use terminal SD as a common to prevent misoperation caused by leakage current.



Source Input the multi-function control terminal is shorted directly with PC




Source Input: the multi-function control terminal is connected directly with open-emitter PLC



Source Input: the multi-function control terminal is connected with open-emitter PLC and external power supply

3.5.8 Main-circuit Terminals and Control Terminals Introduction

Main-circuit terminals	
R/L1-S/L2-T/L3	Connect to the commercial power supply
U/T1-V/T2-W/T3	Connect to the three-phase squirrel-cage motor.
+P-P1	Add to the DC reactor.
+P-PR	Connect to the brake resistor. (Note 1, 2)
(+P)-(-N)	Connect to the brake unit. (Note 3)
	Connect the enclosure of the inverter to ground. / For 440V series, special type of grounding shall be adopted. (Note 4)

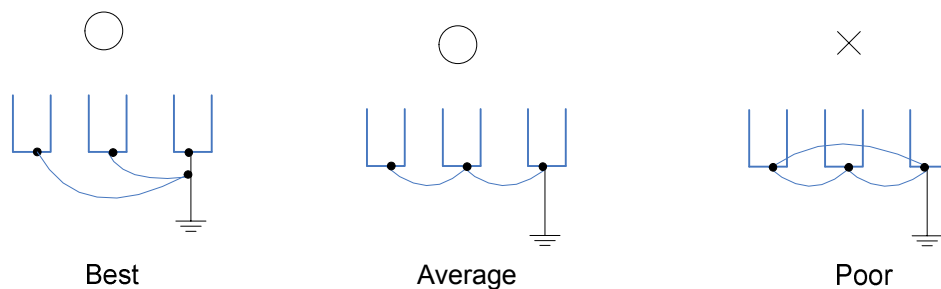
Note: 1. For SF-GT series of inverters, brake resistor is not included. For information related to braking resistor, please refer to section [3.4.5](#) and [3.7.3](#).

2. For information related to regenerative voltage, please refer to [P.30](#) in Chapter 5.

3. +P and -N are the positive and negative terminals of the internal DC voltage of the inverter. In order to strengthen the braking capacity during deceleration, it is suggested to purchase the optional “brake unit” which is mounted between the terminals +P and -N. The “brake unit” can effectively dissipate the feedback energy from the motor to the inverter when decelerating. In case there is any problem on purchasing the “brake unit,” please feel free to contact us.

For safety and to reduce noise, the grounding terminal  of the inverter must be well grounded.

To avoid electric shocks and fire accident, external metal wire of electrical equipment should be short and thick, and should be connected to special grounding terminals of an inverter. If several inverters are placed together, all inverters must be connected to the common ground. Please refer to the following diagrams and ensure that no circuit is formed between grounding terminals.



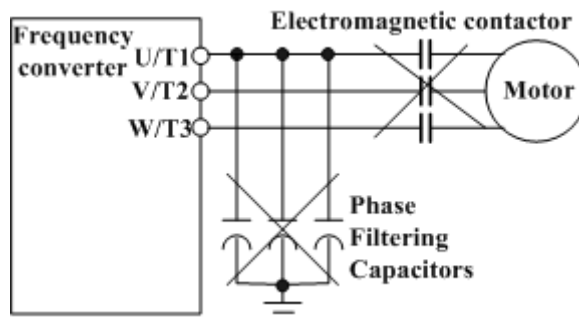
Terminal type	Terminal name	Remarks and function description	Terminal specification	
Switch Signal Input	STF	The terminals are multi-function control terminals, their function can be set by parameter <u>P.80~P.84</u> , <u>P.86</u> , <u>P.126</u> , <u>P.550</u> . (The SINK or SOURCE input approach can be switched)	Input impedance: 4.7 kΩ Action current: 5mA Voltage range: 20~28VDC	
	STR			
	RES			
		M0	The terminal HDI can accept pulse signal (please refer to the instruction of toggle switch SW11 and the parameter <u>P.550</u>), and the function of it can be set by P.503.	Maximum frequency: 100kHz
		M1		
		M2		
		M3		
	HDI			
Analog signal input	10	The internal power is +12V at the terminal	Maximum current: 10mA	
	-10	The internal power is -12V at the terminal	Maximum current: 10mA	
	1	The input terminals of voltage signal -10~10V.	Input impedance: 10kΩ	
	2	They can be used to set the target frequency, and the function can be set by parameter P.38, P.509.		
	4	The input terminal of 4~20mA current signal or 0~10V voltage current. It can be used to set the target frequency, and the function can be set by parameter P.39.	When current is input into, the input impedance is 235Ω. When voltage is input into, the input impedance is 24kΩ	
PTC	The input of PTC temperature protection signal, the function can be set by parameter P.534.	---		
Relay Output	A1	The terminals are multi-function relay output terminals, the function can be set by parameter <u>P.85</u> , <u>P.130</u> . A-C is normal open, B-C is normal closed, and C is the common port.	Maximum voltage: 30VDC or 250VAC Maximum current: 2A	
	B1			
	C1			
	A2			
	B2			
	C2			
Open collector output	SO1	The terminals are the multi-function open collector output terminals, the function can be set by parameter <u>P.40</u> , <u>P.129</u> .	Maximum voltage: 48VDC Maximum current: 50mA	
	SO2			
Analog signal output	AM1	The terminals are the multi-function analog output terminals. The external analog meter can be connected to them to indicate the output frequency, current, etc. The function can be set by parameter P.54, P.64, P.537, P.538. AM1 and HDO can not be used in the meantime, please refer to the toggle switch SW12 instructions.	Output voltage: 0~10VDC Maximum current: 3mA; Output current: 0~20mA Maximum load: 500Ω	
	AM2			

Terminal type	Terminal name	Remarks and function description	Terminal specification
Pulse output	HDO	The output terminal of multi-function pulse. The external frequency counter or analog meter can be connected to it to indicate the output frequency, current, etc. The function can be set by parameter P.54, P.74.	Minimum load: 4.7kΩ Maximum current: 50mA Maximum voltage: 48VDC
Communication terminal	DA+	RS-485 communication interface, the function can be set by parameter P.32, P.33, P.36, P.48~P.53, P.153, P.154.	Highest rate: 19200bps
	DB-		Longest distance: 500m
Common terminal	SD	The common port of the terminals STF, STR, RES, M0, M1, M2, M3, HDI, and HDO. (SINK)	---
	SE	The common port of the open collector output terminals SO1 and SO2.	---
	5	The common port of the terminals 10, -10, 1, 2, 4, PTC, AM1, AM2, DA+, and DB-.	---
	PC	The common port of the terminals STF, STR, RES, M0, M1, M2, M3, and HDI. (SOURCE)	Output voltage: 24VDC±20% Maximum current: 100mA

3.5.9 Wiring Precautions

Main circuit wiring:

1. Do not connect the power supply wires to the “motor connecting terminal U/T1-V/T2-W/T3” or the inverter may be damaged.
2. Please do not mount phase advance capacitor, surge absorbers and electromagnetic contactors at the output terminal of the inverter.

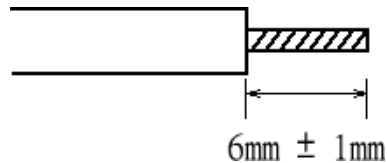


3. Please do not use “electromagnetic contactors” or “no-fuse switches” with an online power to start or stop the motor.
4. Please ensure that the case of the inverter and of the motor are grounded to avoid personnel electric shock.
5. To select appropriate diameter of the main wires and specification of the pressing connection terminal, the no-fuse switch and the electromagnetic contactor, please refer to Section 3.7. If the inverter is far away from the motor, please employ a wire with larger diameter to ensure the voltage drop along the wire is within 2V. (The total length of the wire shall not exceed 500 m)

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 terminals (+/P)-(-/N), so do not touch them within 10 minutes to avoid electric shock.

Control circuit wiring arrangement:

1. For wiring of signal input, use only "insulated wires" with the "metal mesh" corrected grounded.
2. The use of 0.75mm² diameter wire is recommended. For stripping the insulating layer, please comply with the instruction of the following picture.



3. Control board wires (including signal input wire) should be far away from the main circuit board wires. Binding the control board wires together with the main circuit wires is strictly forbidden.
4. In the inverter, "terminal SD", "terminal SE" and "terminal 5" are the referencing grounds for the inner power sources, which are isolated from each other.
5. The best torque force for locking the control line is 2Kgf.cm.

Note: 1. Terminal blow screws must be fastened tightly. Do not leave any off-cut wire pieces inside the inverter.

2. The installation, wire arrangement, dismounting, and maintenance can only be done by qualified electricians.

3. Please follow the installation instructions. In the event where installation instructions have not been followed that resulted in damage of the inverter or dangerous accident, the manufacturer shall not be held responsible for any legal responsibility. Please feel free to contact us should you have any question.

3.6 Mini Jumper Instruction

Main power isolated from earth:

1. If the inverter is supplied with a non-grounded power supply (IT power), the Mini Jumper must be cut off to prevent circuit damage (according to IEC61800-3) and reduce earth leakage current.
2. Do not cut off the Mini Jumper if the input filter is active. This will increase earth leakage current.
3. Cut off the Mini Jumper if the earth leakage current is overlarge. This will decrease the filtering effect.

The Mini Jumper is shown as follows:

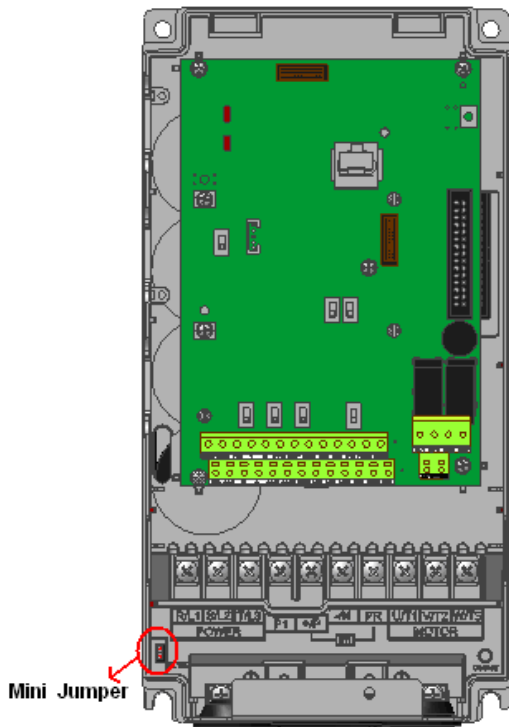


Figure 1: frame AA

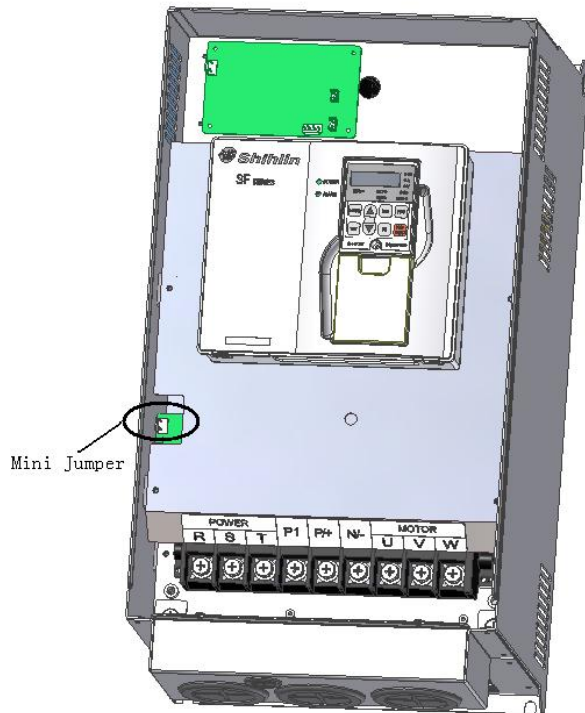


Figure 2: frame D/E/F

=====**Caution:**=====

1. Do not cut off the Mini jumper after applying power to the inverter. Please make sure that the main power has been switched off before cutting of the Mini Jumper.
2. Electric conductivity of the capacitor will be cut off by cutting off the Mini Jumper. Moreover, the electromagnetic capacitance of the inverter will be reduced by cutting of the Mini Jumper.
3. Do not switch off the Mini Jumper when the main power is a grounded power system. To prevent machine damage, the Mini Jumper shall be cut off if the inverter is installed on an ungrounded power system, a high resistance-grounded (over 30 ohms) power system, or a corner grounded TN system.
4. Mini jumper cannot be cut off when performing the Hi-pot tests.

3.7 Selection of Peripheral Equipment

3.7.1 No-fuse switch

Inverter type	Motor capacity	Power source capacity	Applicable no-fuse switch (NFB/MCCB) type (Shihlin Electric)	Applicable electromagnetic contactor (MC) type (Shihlin Electric)
SF-040-1.5K-GT	440V 2HP	4.8 kVA	BM30SN3P10A	S-P11
SF-040-2.2K-GT	440V 3HP	6.9 kVA	BM30SN3P15A	S-P21
SF-040-3.7K-GT	440V 5HP	10.4 kVA	BM30SN3P20A	S-P21
SF-040-5.5K-GT	440V 7.5HP	11.5 kVA	BM30SN3P30A	S-P21
SF-040-7.5K-GT	440V 10HP	16 kVA	BM30SN3P30A	S-P21
SF-040-11K-GT	440V 15HP	20 kVA	BM60SN3P50A	S-P30T
SF-040-15K-GT	440V 20HP	27 kVA	BM60SN3P60A	S-P40T
SF-040-18.5K-GT	440V 25HP	32 kVA	BM100SN3P75A	S-P40T
SF-040-22K-GT	440V 30HP	41 kVA	BM100SN3P100A	S-P50T
SF-040-30K-GT	440V 40HP	52 kVA	BM160SN3P125A	S-P50T
SF-040-37K-GT	440V 50HP	65 kVA	BM160SN3P160A	S-P60T
SF-040-45K-GT	440V 60HP	79 kVA	BM250SN3P175A	S-P80T
SF-040-55K-GT	440V 75HP	100 kVA	BM250SN3P175A	S-P80T
SF-040-75K-GT	440V 100HP	110 kVA	BM250SN3P250A	S-P100T
SF-040-90K-GT	440V 120HP	137 kVA	BM250SN3P250A	S-P150T
SF-040-110K-GT	440V 150HP	165 kVA	BM250SN3P250A	S-P200T

3.7.2 Power cable specification / pressing connection terminal specification

Inverter type	Power cable specification				Pressing connection terminal specification (used by power cables)	
	Power supply terminal (R/L1.S/L2.T/L3)		Loading terminal (U/T1.V/T2.W/T3)		Cables for power supply (R/L1.S/L2.T/L3)	Cables for loading (U/T1.V/T2.W/T3)
	Crimping terminal (mm ²)	Tightening torque (Kgf.cm)	Crimping terminal (mm ²)	Tightening torque (Kgf.cm)		
SF-040-1.5K-GT	2.5	12.2	2.5	12.2	2-3.5	2-3.5
SF-040-2.2K-GT	2.5	18	2.5	18	2-4	2-4
SF-040-3.7K-GT	2.5	18	2.5	18	2-4	2-4
SF-040-5.5K-GT	3.5	30	2	18	3.5 - 5	2 - 5
SF-040-7.5K-GT	3.5	30	3.5	30	3.5 - 5	3.5 - 5
SF-040-11K-GT	5.5	30	5.5	30	5.5 - 5	5.5 - 5
SF-040-15K-GT	14	30	8	30	14 - 5	8 - 5
SF-040-18.5K-GT	14	30	8	30	14 - 6	8 - 6
SF-040-22K-GT	22	30	14	30	22 - 6	14 - 6
SF-040-30K-GT	22	30	22	30	22 - 8	22 - 8
SF-040-37K-GT	22	30	22	30	22 - 8	22 - 8
SF-040-45K-GT	38	30	38	30	38 - 8	38 - 8
SF-040-55K-GT	60	200	60	200	60 - 10	60 - 10
SF-040-75K-GT	60	200	60	200	60 - 10	60 - 10
SF-040-90K-GT	60	200	60	200	60 - 10	60 - 10
SF-040-110K-GT	80	200	80	200	80 - 10	80 - 10

3.7.3 Retrograde Brake Resistor

Inverter type	Retrograde brake resistor specification
SF-040-1.5K-GT	200W 320Ω or above
SF-040-2.2K-GT	300W 160Ω or above
SF-040-3.7K-GT	500W 120Ω or above
SF-040-5.5K-GT	1000W 75Ω or above
SF-040-7.5K-GT	1200W 75Ω or above
SF-040-11K-GT	2400W 50Ω or above
SF-040-15K-GT	3000W 40Ω or above
SF-040-18.5K-GT	4800W 32Ω or above
SF-040-22K-GT	4800W 27.2Ω or above

Note: 1. For brake resistor whose built-in brake unit offers model options, the capacity of the regenerative brake is based on the condition that the regenerative brake duty is 10% (when braking lasts for 5 seconds, the machine has to be stopped for another 45 seconds must be stopped for heat dissipation). For models without a built-in brake unit, the capacity of the regenerative brake is based on the brake duty of the selected brake unit. The regenerative 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 (ohms) listed in the above table (otherwise the inverter will be damaged).

2. In case frequent start and stop operations are required, a larger regenerative brake duty should be set. Meanwhile, a large brake resistor should be employed correspondingly. Please refer to Section 3.4.5 and 3.7.3 for selecting and purchasing the regenerative brake resistors. Please feel free to contact us if there is any problem regarding the selection of brake resistors.

3. Frame D, E and F corresponded inverters have no built-in brake unit. Please select and purchase an external brake unit according to the brake unit section in the manual.

3.7.4 Reactor

- AC input reactor

3-Phase, 440V, 50/60Hz

Inverter type	Recommended reactor		
	Type	Rated current (A)	Inductance (mH)
SF-040-1.5K-GT	ACL-0005-EISC-E5M6	5	5.6
SF-040-2.2K-GT	ACL-0007-EISC-E3M5	7	3.5
SF-040-3.7K-GT	ACL-0010-EISC-E2M8	10	2.8
SF-040-5.5K-GT	ACL-0015-EISH-E1M9	15	1.9
SF-040-7.5K-GT	ACL-0020-EISH-E1M4	20	1.4
SF-040-11K-GT	ACL-0030-EISH-EM93	30	0.93
SF-040-15K-GT	ACL-0040-EISH-EM70	40	0.7
SF-040-18.5K-GT	ACL-0050-EISH-EM56	50	0.56
SF-040-22K-GT	ACL-0060-EISH-EM47	60	0.47
SF-040-30K-GT	ACL-0080-EISH-EM35	80	0.35
SF-040-37K-GT	ACL-0090-EISH-EM31	90	0.31
SF-040-45K-GT	ACL-0120-EISH-EM23	120	0.23
SF-040-55K-GT	ACL-0150-EISH-EM19	150	0.19
SF-040-75K-GT	ACL-0200-EISH-EM14	200	0.14
SF-040-90K-GT	ACL-0250-EISH-EM11	250	0.11
SF-040-110K-GT			

Shihlin Inverter Introduction

- AC output reactor

3-Phase, 440V, 50/60Hz

Inverter type	Recommended reactor		
	Type	Rated current (A)	Inductance (mH)
SF-040-1.5K-GT	OCL-0005-EISC-E2M8	5	2.8
SF-040-2.2K-GT	OCL-0007-EISC-E1M9	7	1.9
SF-040-3.7K-GT	OCL-0010-EISC-E1M4	10	1.4
SF-040-5.5K-GT	OCL-0015-EISC-EM93	15	0.93
SF-040-7.5K-GT	OCL-0020-EISC-EM70	20	0.7
SF-040-11K-GT	OCL-0030-EISH-EM46	30	0.46
SF-040-15K-GT	OCL-0040-EISH-EM35	40	0.35
SF-040-18.5K-GT	OCL-0050-EISH-EM28	50	0.28
SF-040-22K-GT	OCL-0060-EISH-EM23	60	0.23
SF-040-30K-GT	OCL-0080-EISH-EM17	80	0.17
SF-040-37K-GT	OCL-0090-EISH-EM17	90	0.17
SF-040-45K-GT	OCL-0120-EISH-EM11	120	0.11
SF-040-55K-GT	OCL-0150-EISH-EM09	150	0.09
SF-040-75K-GT	OCL-0200-EISH-EM07	200	0.07
SF-040-90K-GT	OCL-0250-EISH-E55U	250	0.055
SF-040-110K-GT			

Note: It is recommended to use the AC input / output reactor which produced by SHANGHAI EAGTOP ELECTRONIC TECHNOLOGY CO., LTD.

Shihlin Inverter Introduction

- DC reactor specification

3-Phase, 440V, 50/60Hz

Inverter type	Recommended reactor		
	Type	Rated current (A)	Inductance (mH)
SF-040-1.5K-GT	DCL-0006-EIDC-E11M	6	11
SF-040-2.2K-GT			
SF-040-3.7K-GT	DCL-0012-EIDC-E6M3	12	6.3
SF-040-5.5K-GT	DCL-0023-EIDH-E3M6	23	3.6
SF-040-7.5K-GT			
SF-040-11K-GT	DCL-0033-EIDH-E2M0	33	2.0
SF-040-15K-GT	DCL-0040-EIDH-E1M3	40	1.3
SF-040-18.5K-GT	DCL-0050-EIDH-E1M1	50	1.1
SF-040-22K-GT	DCL-0065-EIDH-EM80	65	0.80
SF-040-30K-GT	DCL-0078-EIDH-EM70	78	0.70
SF-040-37K-GT	DCL-0095-EIDH-EM54	95	0.54
SF-040-45K-GT	DCL-0115-EIDH-EM45	115	0.45
SF-040-55K-GT	DCL-0160-UIDH-EM36	160	0.36
SF-040-75K-GT	DCL-0180-UIDH-EM33	180	0.33
SF-040-90K-GT	DCL-0250-UIDH-EM26	250	0.26
SF-040-110K-GT	DCL-0340-UIDH-EM17	340	0.17

Note: Frame E and F corresponded model have a built-in DC reactor. External reactors can be added, too, by referring to the above specification table. It is recommended to use the DC reactor which produced by SHANGHAI EAGTOP ELECTRONIC TECHNOLOGY CO., LTD.

3.7.5 Filter

- AC input filter

3-Phase, 440V, 50/60Hz

Inverter type	kW	HP	Rated Amps of reactor	Types of filter
SF-040-1.5K-GT	1.5	2	4.2	NF311A10/01
SF-040-2.2K-GT	2.2	3	6	NF311A20/05
SF-040-3.7K-GT	3.7	5	9	NF311A20/05
SF-040-5.5K-GT	5.5	7.5	13	NF311A20/05
SF-040-7.5K-GT	7.5	10	18	NF311A20/05
SF-040-11K-GT	11	15	24	NF311A36/05
SF-040-15K-GT	15	20	32	NF311A36/05
SF-040-18.5K-GT	18.5	25	38	NF311A50/05
SF-040-22K-GT	22	30	45	NF311A50/05
SF-040-30K-GT	30	40	60	NF311A80/05
SF-040-37K-GT	37	50	73	NF311A80/05
SF-040-45K-GT	45	60	91	NF312C100/05
SF-040-55K-GT	55	75	110	NF312C150/05
SF-040-75K-GT	75	100	150	NF312C150/05
SF-040-90K-GT	90	120	180	NF312C200/05
SF-040-110K-GT	110	150	220	NF312C250/11

Note: Products of CHANGZHOU DUOJI EME TECHNICAL CO., LTD are recommended for the filter used here.

4. Primary Operation

4.1 Operating Modes of the Inverter

The operation modes are related to the reference source of the target frequency and the signal source of the motor starting. The Shihlin SF-TYPE inverter has a total of nine 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".

You can use DU01 operation panel to monitor the output frequency, the output voltage and the output current, as well as to view the alarm message, the parameter setting and the frequency setting. The operator has four work modes, namely, "operation mode", "monitoring mode", "frequency setting mode" and "parameter setting mode".

Related parameters	Values	Operation mode	The reference source of target frequency	The signal source of motor starting	Remarks
Operation mode selection P.79	0	PU mode	DU01 operation panel	The FWD or REV key of DU01 operation panel.	The "PU mode", "JOG mode" and "external mode" are interchangeable.
		JOG mode	The set value of P.15	The FWD or REV key of DU01 operation panel.	
		External mode	"External voltage/current signal", "combination of multi-speed stage levels" and external JOG (P.15)	External forward and reverse terminals	
			Frequency of each section in the programmed operation mode (P.131~P.138)	External STF terminal	
	1	PU mode	Equal to the "PU mode" when <u>P.79</u> = 0		The "PU mode" and "JOG mode" are interchangeable.
		JOG mode	Equal to the "PU mode" when P.79 = 0		
2	External mode	Equal to the "External mode" when P.79 = 0			

Primary Operation

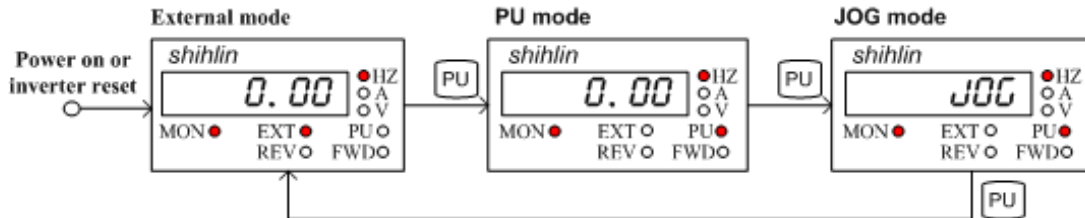
Primary operation

Related parameters	Values	Operation mode	The reference source of target frequency	The signal source of motor starting	Remarks
Operation mode selection P.79	3	Communication mode	Communication	Communication	
	4	Combined Mode 1	DU01 operation panel	External forward and reverse terminals	
	5	Combined Mode 2	“External voltage / current signal”, “combination of multi-speed stage levels”, HDI pulse (P.550), PG card (A2/B2)	The FWD or REV key of DU01 operation panel.	SW11 should be set when the target frequency is given by HDI pulse and PG card.
	6	Combined Mode 3	Communication, “combination of multi-speed stage levels” and External JOG (P.15)	External forward and reverse terminals	
	7	Combined Mode 4	“External voltage / current signal”, “combination of multi-speed stage levels”, HDI pulse (P.550), PG card (A2/B2)	Communication	SW11 should be set when the target frequency is given by HDI pulse and PG card.
	8	Combined Mode 5	DU01 operation panel, “combination of multi-speed stage levels” and External JOG (P.15)	External forward and reverse terminals	

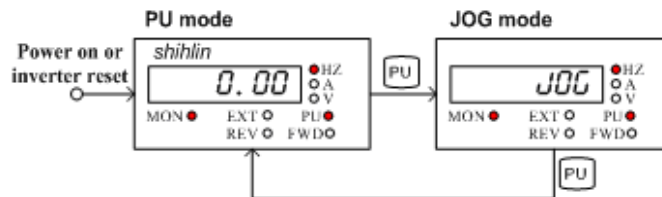
When P.79=0, the external mode is the default mode after the inverter is turned on. Use P.79 to switch the operation mode.

4.1.1 The flow chart for switching the operation mode using DU01 operation panel

When P.79=0:

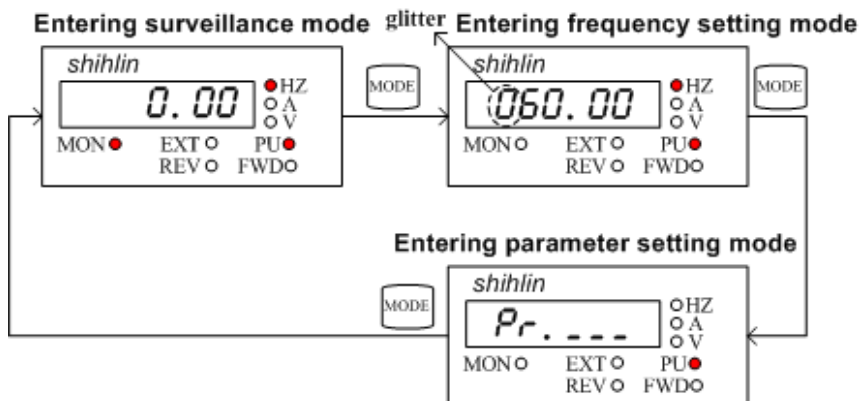


When P.79 = 1:



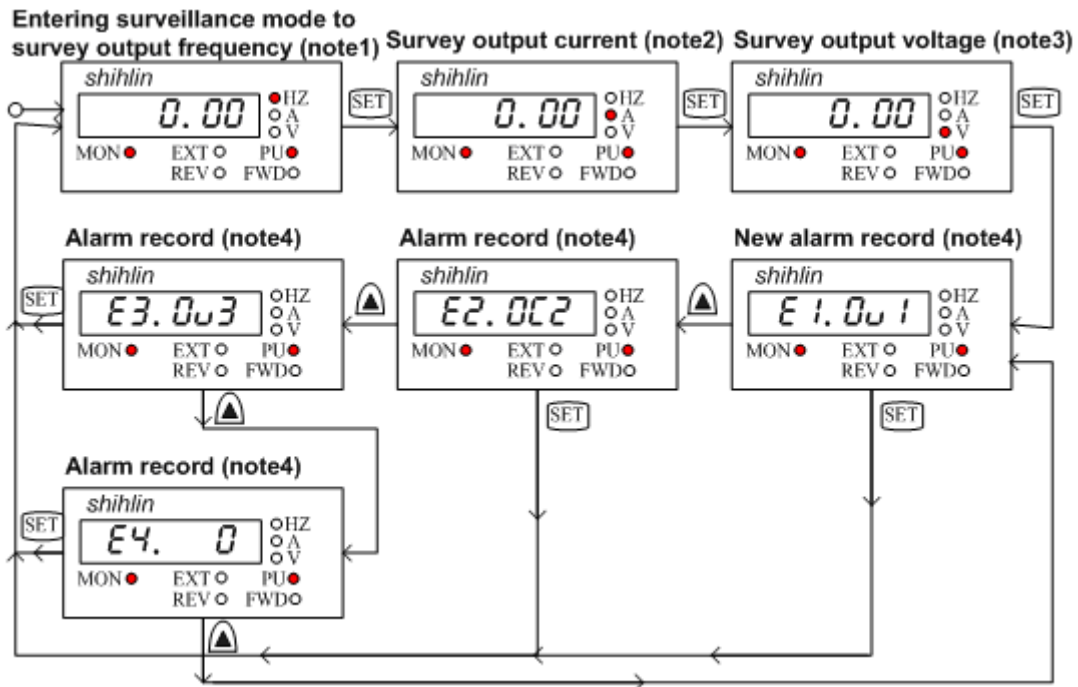
- Note:
1. In “PU mode,” the indicating lamp **PU** will light up on the operation panel.
 2. In “external mode,” indicating lamp **EXT** will light up on the operation panel.
 3. In “combined mode 1, 2, 3, 4, or 5,” the indicating lamp **PU** and **EXT** will light up.
 4. In “JOG mode,” the indicating lamp **PU** will light up, and at the same time, the display screen will display *JOG* while the motor is not running.
 5. No flow chart when P.79=2, 3, 4, 5, 6, 7 or 8 because the operation mode will be constant.

4.1.2 The flow chart for switching the working mode using DU01 operation panel



- Note:
1. Please refer to section 4.1.3 for the detailed operation flow under the monitoring mode.
 2. Please refer to section 4.1.4 for the detailed operation flow under the frequency setting mode.
 3. Please refer to section 4.1.5 for the detailed operation flow under the parameter setting mode.
 4. Please refer to Section 4.1.2 for detailed operation flow under the switching operation mode.

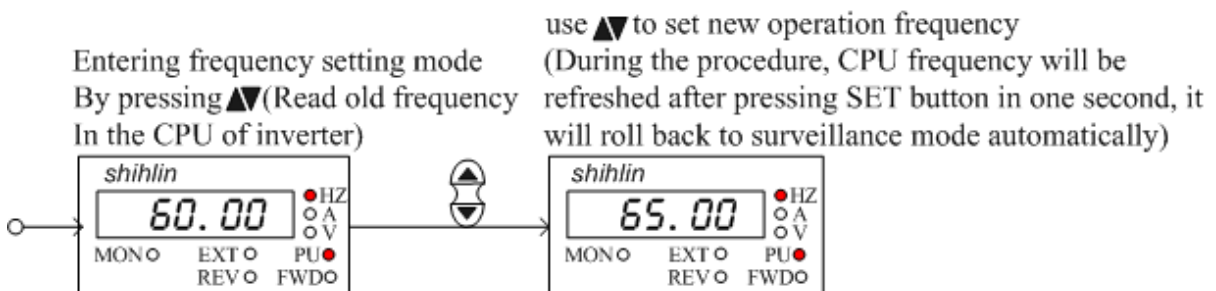
4.1.3 Operation flow charts for monitoring mode with DU01



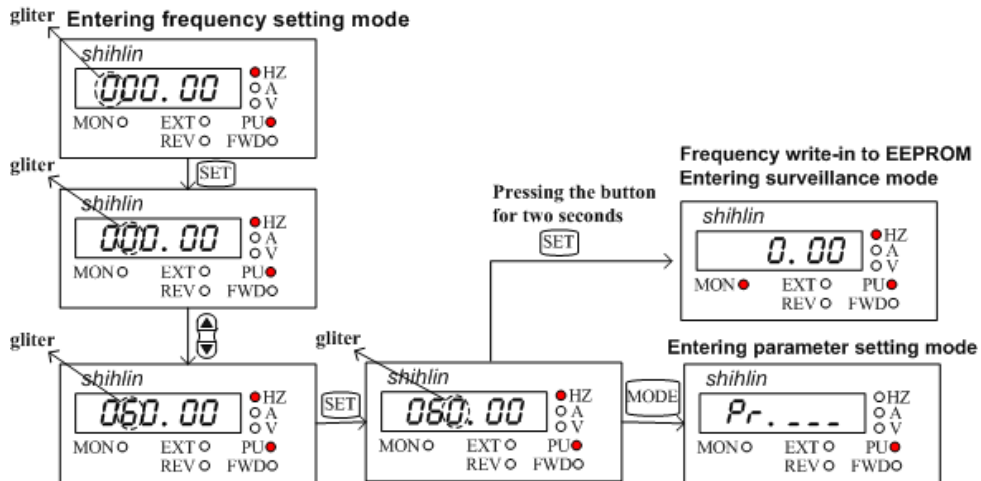
- Note: 1. In the “monitoring output frequency mode”, indicating lamp **MON** and **Hz** will light up, and the screen will display the current output frequency.
2. In the “monitoring output current mode”, indicating lamp **MON** and **A** will light up, and the screen will display the current output current.
3. In the “monitoring output voltage mode”, indicating lamp **MON** and **V** will light up, and the screen will display the current output voltage.
4. When in the “browsing alarm record mode,” indicating lamp **MON** will light up, and the screen will display the current alarm code.
5. For alarm codes, please refer to [Appendix 2](#).

4.1.4 Operation flow charts for frequency setting mode with DU01

Use ▲ or ▼ key for setting up the frequency.

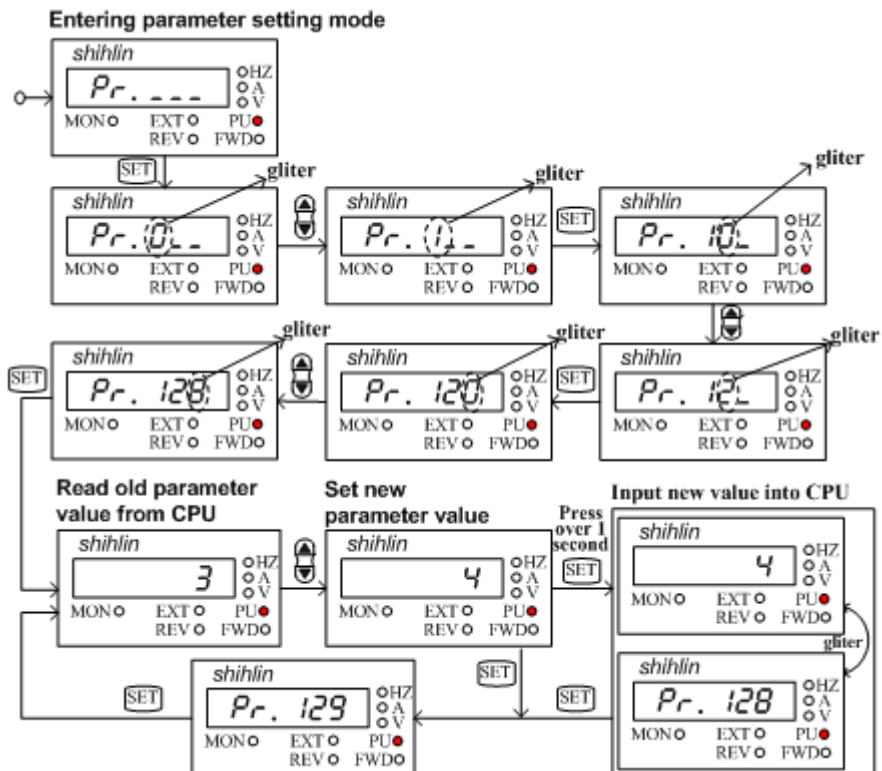




Press the MODE key to enter the frequency setting mode.








- Note: 1. Use ▲ or ▼ to change the frequency when the inverter is running.
2. Indicating lamp ●Hz will light up, but not ●MON under the frequency setting mode.
3. When setting the frequency under the PU mode, the set value can not exceed the upper frequency. When high frequency is needed, the upper frequency should be changed first.
4. When using the MODE key for setting the frequency, the operation panel will stay in the frequency setting mode if the SET key is not pressed within one second to save in input. The user will not return to the parameter setting mode and the monitoring mode until pressing the MODE key.

4.1.5 Operation flow charts for parameter setting mode with DU01











Note: 1. Indicating lamp  Hz will light up, but not **MON**  under the parameter setting mode.


2. When entering the value of a parameter, make sure to press the  key for longer than 1 second.
3. When the parameter is set as 99999, the actual corresponded CPU value will be 65535. Therefore, if the value is set below 99999, the CPU value will gradually decrease from 65535. If so, the operation panel should display 65534, 65533... and so forth.
4. Similar to setting parameters, button  and  are used to increase or decrease the value. The panel will stop when the parameter reaches 99999(0). If there is a need to surpass this value, the user must press button  and  so the parameter value will then either increase to 0 or decrease to 99999.
5. When parameter setting is 99999, "9999" will be displayed on the operation panel of SF-PU series, while "99999" will be displayed on the operation panel of the DU series.

4.2 Basic Operation Procedures for Different Modes

4.2.1 Basic operation procedures for PU mode (P.79=0 or 1)






Step	Description
1	Change the operation mode to PU mode, and indicating lamp PU  will light up. Note: 1. When P.79=0, the inverter will first go into the external mode after the power is switched on or the inverter is reset. 2. For selecting and switching the operation mode, please refer to Section 4.1.
2	Enter the frequency setting mode and enter the target frequency into memory. Note: For detailed setting procedures, please refer to Section 4.1.4.
3	Press  or  to run the motor. At this point, indicating lamp  or REV  will light up, indicating that the motor is running. The DU01 operation panel will automatically go into the monitoring mode and display the current output frequency. Note: 1. For detailed operation flow for the monitoring mode, please refer to Section 4.1.3. 2. While the motor is running, the user can enter the frequency setting mode to change the target frequency for regulating the motor speed.
4	Press  and the motor will begin to decelerate until it comes to a full stop. Indicating lamp FWD  or REV  will not turn off until the inverter stops the output voltage.

4.2.2 Basic operation procedures for external mode (P.79=0 or 2)

Step	Description
1	Change the operation mode to external mode, and indicating lamp EXT  will light up. Note: 1. When P.79=0, the inverter will first go into the external mode after the power is switched on or the inverter is reset. 2. When P.79=2, external mode will be the default for the inverter. 3. For selecting and switching the operation mode, please refer to Section 4.1.
2	The target frequency is set by external terminals (the default priority is from high to low). If the programmable operating mode is chosen, please refer to the multi-function terminals <u>P.80~P.84</u> 、 <u>P.86</u> 、 <u>P.126</u> 、 <u>P.550</u> in Chapter 5. If the target frequency is set by multi-speed stage levels, please refer to <u>P.4</u> in Chapter 5. If the target frequency is set by the input signal of terminal A2/B2 on PG03, please refer to P.356 in Chapter 5. If the target frequency is set by PWM input pulse (switching SW11 to HDI in the meantime), please refer to <u>P.550</u> on Chapter 5. If the target frequency is set by the input signal across terminal 2-5, please refer to <u>P.38</u> in Chapter 5. If the target frequency is set by the input signal across terminal 4-5, please refer to <u>P.39</u> in Chapter 5. If the target frequency is set by the input signal across terminal 1-5, please refer to <u>P.509</u> in Chapter 5. If the target frequency is set by the high-speed pulse input across terminal HDI (switching SW11 to HDI in the meantime), please refer to P.522 on Chapter 5.

Step	Description
3	<p>Turn on STF or STR to run the motor.</p> <p>At this point, indicating lamp FWD or REV will light up, indicating that the motor is running.</p> <p>Note: 1. For setting up the starting terminals STF and STR, please refer to P.78 and multi-function terminal P.80~P.84、P.86、P.126、P.550 in Chapter 5.</p> <p>2. For detailed operation flow for the monitoring mode, please refer to Section 4.1.4.</p> <p>3. If programmed operation mode is chosen, then STF and STR will be come the starting signal and the pause signal, respectively, instead of being the Run Forward or Run Reverse terminals.</p>
4	<p>Turn off STF or STR to decelerate the motor until it comes to a full stop.</p> <p>Indicating lamp FWD or REV will not turn off until the inverter stops the output voltage.</p>

4.2.3 Basic operation procedures for JOG mode (P.79=0 or 1)

Step	Description
1	<p>Change the operation mode to the JOG mode and indicating lamp PU will light up. At this point, the screen will display  before the motor starts to run.</p> <p>Note: For selecting and switching the operation mode, please refer to Section 4.1.</p>
2	<p>Press  or  to run the motor. At this point, indicating lamp FWD or REV will light up, indicating that the motor is running.</p> <p>Release  or  to decelerate the motor until it comes to a full stop. Indicating lamp FWD or REV will not turn off until the inverter stops the output.</p> <p>Note: 1. For detailed operation flow for the monitoring mode, please refer to Section 4.1.4.</p> <p>2. In the JOG mode, the target frequency is the value of P.15, and the acceleration / deceleration time is the value of P.16. Please refer to PR15 in Chapter 5.</p>

4.2.4 Basic operation procedures for communication mode (P.79=0 or 2)

In the communication mode, the user can set the parameters and run/stop or reset the inverters by communication. Please refer to [P.33](#) for details.

4.2.5 Basic operation procedures for combined mode 1 (P.79=4)

Step	Description
1	In Combined Mode 1, indicating lamp PU and EXT will light up. Note: For selecting and switching the operation mode, please refer to Section 4.1.
2	Enter the frequency setting mode and enter the target frequency into memory. Note: For detailed frequency setting procedures, please refer to Section 4.1.4.
3	Set the target frequency via DU01 operation panel and start the inverter by the external terminals. At this point, indicating lamp FWD or REV will light up, indicating that the motor is running. Note: For detailed operation flow for the monitoring mode, please refer to Section 4.1.4.
4	When the external terminals stop the output signals, the motor will decelerate until it comes to a full stop. Indicating lamp FWD or REV will not turn off until the inverter stops the output.

4.2.6 Basic operation procedures for combined mode 2 (P.79=5)

Step	Description
1	In Combined Mode 2, indicating lamp PU and EXT will light up. Note: For selecting and switching the operation mode, please refer to Section 4.1.
2	The target frequency is set by the external terminals (the default priority is from high to low): If the target frequency is set by multi-speed stage levels, please refer to P.4 in Chapter 5. If the target frequency is set by the input signal of terminal A2/B2 on PG03 (switching SW11 to DI in the meantime), please refer to P.356 in Chapter 5. If the target frequency is set by PWM input pulse (switching SW11 to HDI in the meantime), please refer to P.550 on Chapter 5. If the target frequency is set by the input signal across terminal 2-5, please refer to P.38 in Chapter 5. If the target frequency is set by the input signal across terminal 4-5, please refer to P.39 in Chapter 5. If the target frequency is set by the input signal across terminal 1-5, please refer to P.509 in Chapter 5. If the target frequency is set by the high-speed pulse input across terminal HDI (switching SW11 to HDI in the meantime), please refer to P.522 on Chapter 5.
3	Press FWD or REV of DU01 operation panel to run the motor. At this point, indicating lamp FWD or REV will light up, indicating that the motor is running. Note: 1. For detailed operation flow for the monitoring mode, please refer to Section 4.1.4. 2. While the motor is running, the user can enter the frequency setting mode to change the target frequency for regulating the motor speed.
4	Press STOP/RESET and the motor will begin to decelerate until it comes to a full stop. Indicating lamp FWD or REV will not turn off until the inverter stops the output.

4.2.7 Basic operation procedures for combined mode 3 (P.79=6)

The target frequency is determined by communication. When RL, RM, RH and REX of multi-speed stage levels are “on”, the target frequency is determined by combination of multi-speed stage levels (Please refer to P.4~P.6, P.80~P.84, P.86, P.126, P.550). When external JOG is “on”, the target frequency is determined by P.15. Acceleration / deceleration time is set by the value of P.16. The inverter starting is activated by external terminals. The functions of P.996, P.998, and P.999 can be accomplished by communication.

4.2.8 Basic operation procedures for combined mode 4 (P.79=7)

The target frequency of the inverter is determined by the external terminals’ “external voltage signal”, “external current signal”, or “combination of multi-speed stage levels”. The inverter starting is activated by communication (including “Reset”).





4.2.9 Basic operation procedures for combined mode 5 (P.79=8)

The target frequency is determined by DU01 operating panel. When RL, RM, RH and REX of multi-speed stage levels are “on”, the target frequency is determined by combination of multi-speed stage levels (Please refer to P.4~P.6, P.80~P.84, P.86, P.126, P.550). When external JOG is “on”, the target frequency is determined by P.15. Acceleration / deceleration time is set by the value of P.16. The inverter starting is activated by the external forward and reverse terminals.

4.3 Operation

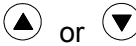
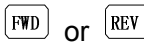
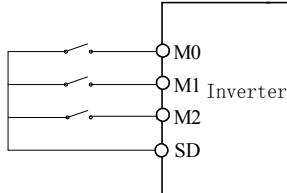
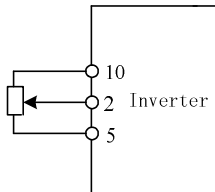
4.3.1 Pre-operation checks and preparation

Before starting the operation, the following shall be examined:

1. Check if the wiring is correct. Check especially the ac motor driver output terminals (U/T1, V/T2, W/T3), which cannot be connected to the power. Confirm that grounding terminal (⊕) is well grounded.
2. Check if there is a short circuit at the terminals or charged exposure.
3. Verify all terminal connections, and check if plug connectors (optional) and screws are all fastened.
4. Verify that no mechanical device is connected to the motor.
5. All switches must be disconnected before power on. Make sure that the inverter will not start and there is no abnormal activity when power on.
6. Turn on the power only after the cover is well placed.
7. Do not operate the switch with a wet hand.
8. Make sure of the following after power on:
 - (1). On the cover of machine, power indicating lamp  will light up but not alarm indicating lamp .
 - (2). On the DU01 operation panel, indicating lamp  Hz and EXT  will both light up.

4.3.2 Operation methods


For various operation methods, please refer to basic operation procedures in chapter 4 and parameter description in Chapter 5. Select the most appropriate operation methods according to the application requirements and regulations. The most commonly used operation methods are shown below:

Operation method	Source of the target frequency	Source of the operating signal
DU01 operation panel operation		
External terminal signal operation	 <p>Parameter setting: P.4=40 P.5=30 P.6=10</p>	Input by external terminals: STF-SD STR-SD
		





Note: RH, RM and RL mentioned in this section are function names of the “multi-function control terminal”. Please refer to P.80~P.84, P.86, P.126, P.550 for function selection and purposes of the multi-function control terminal. For related wiring, please refer to Section 3.5.

4.3.3 Trial run

Check cables and abnormalities before the trial run. After power on, the inverter is in the external mode.

1. After power on, make sure that the indicating lamp power  is on.
2. Connect a switch between STF and SD or STR and SD.
3. Connect a potentiometer between 2-5-10 or provide 0~5V dc between 2 and 5.
4. Adjust potentiometer or 0~5V dc to a minimum value (under 1V).
5. If STF is on, forward rotation is activated. If STR is on, reverse rotation is activated. Turn off STF or STR to decelerate the motor until it stops completely.
6. Check the following:
 - 1) Whether the direction of motor rotation is correct.
 - 2) Whether the rotation is smooth (check for any abnormal noise and vibration).
 - 3) Whether the acceleration / deceleration is smooth.

If there is an optional keyboard panel, do the following:

1. Make sure that the keyboard panel is connected to the inverter properly.
2. Change the operation mode to PU mode after power on, and the screen will display 50/60Hz.
3. Press  button to set the target frequency at about 5Hz.
4. Press  for forward rotation and  for reverse rotation. Press  to decelerate the motor until it stops completely.
5. Check the following:
 - 1). Whether the direction of motor rotation is correct.
 - 2). Whether the rotation is smooth (check for any abnormal noise and vibration).
 - 3). Whether the acceleration / deceleration is smooth.

If no abnormal condition is found, continue the trial run by increasing the frequency and go through the above procedure. Put the machine into operation if no abnormal condition is found.

Note: Stop working immediately if abnormalities are found when running the inverter or the motor. Check for possible causes according to "fault diagnosis". After inverter output is stopped and the power terminals (R/L1, S/L2, and T/L3) of the main circuit are disconnected, electric shock may occur if one touches the inverter's output terminals (U/T1, V/T2, and W/T3). Even if the major loop power is cut off, there is still recharging voltage in the filter capacitors. As a result, discharge takes time. Once the major loop power is disconnected, wait for the power indicating lamp to go off before testing the intermediate dc loop with a dc voltage meter. Once the voltage is confirmed to be below the safe value, it is safe to touch the circuit inside the inverter.

5. Parameter Description

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5.1 Torque Boost (P.0, P.46)

P.0 “Torque boost”

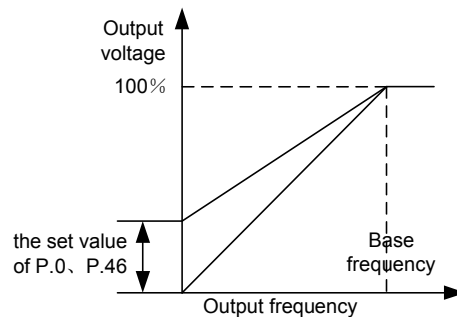
P.46 “The second torque boost”

Related parameters

- P.3 “Base frequency”
- P.19 “Base frequency voltage”
- P.47 “The second base frequency”
- P.80~P.84, P.86, P.126, P.550
“Multi-function terminals selection”

- For an inverter controlled by V/F mode, when the motor starts up, the starting torque is usually inadequate since the output voltage of the inverter is inadequate. In this case, the output voltage can be elevated by properly setting the torque boost (P.0), and thus a better starting torque can be acquired.

Parameter	Factory setting	Setting range	Remarks
0	4% (3.7kW or below)	0~30%	---
	3% (5.5KW~7.5kW)		
	2% (11kW~55kW)		
	1% (75kW or above)		
46	99999	0~30%, 99999	99999: Function invalid



<Setting>

- If P.0=6% and P.19=220V, and when output frequency of the inverter is 0.2Hz, the output voltage is:

$$P.19 \times \left(\frac{100\% - P.0}{P.3} \times f + P.0 \right) = 220V \times \left(\frac{100\% - 6\%}{50Hz} \times 0.2Hz + 6\% \right) = 14.03V$$

- If RT is “on,” “The Second Torque Boost” on P.46 is valid (Note 2).

Note: 1. If the set value of P.0 is too high, it will activate current inverter protection or the activation will be impeded.
 2. The second function is valid on when P.44≠99999.
 3. RT mentioned in this section is the function name of the “multi-function control terminal”. Please refer to P.80~P.84、 P.86、 P.126、 P.550 for function selection and purposes of the multi-function control terminal. For related wiring, please refer to Section 3.5.

5.2 The Range of the Output Frequency (P.1, P.2 and P.18)

P.1 “Maximum frequency”

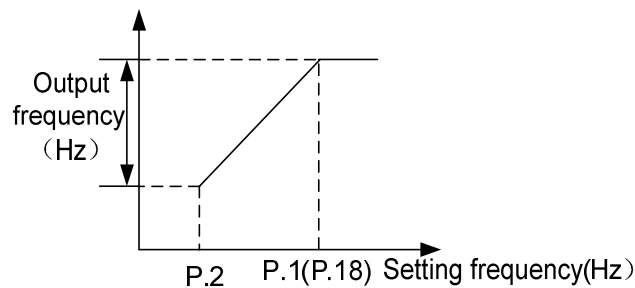
P.2 “Minimum frequency”

P.18 “High-speed maximum frequency”

Related parameters
P.13 “Starting frequency”

- The upper and lower limits of the output frequency can be restricted.

Parameter	Factory setting	Setting range	Remarks
1	120Hz(55kW or below)	0~120Hz	---
	60Hz(75kW or above)		
2	0Hz	0~120Hz	---
18	120Hz	120~650Hz	---



<Setting>

- If the target frequency $\leq P.2$, the steady output frequency equals to P.2.
- If $P.2 < \text{target frequency} \leq P.1$ (P.18), the steady output frequency equals target frequency.
- If $P.1$ (P.18) $<$ target frequency, the steady output frequency equals P.1.

Note: 1. The “maximum frequency” and the “high-speed maximum frequency” are interrelated. If the target upper limit frequency is set below 120Hz, use P.1 as the maximum frequency (the setting range of P.1 is 0~120 Hz). If the target frequency limited to between 120~650 Hz, use P.18 as the maximum frequency (the setting range of P.18 is 120~650 Hz).

2. If $P.1 < P.2$, the steady output frequency will be clamped to P.1.

3. The set frequency value cannot exceed the value of P.1.

5.3 Base Frequency and Base Frequency Voltage (P.3, P.19 and P.47)

P.3 “Base frequency”

P.19 “Base frequency voltage”

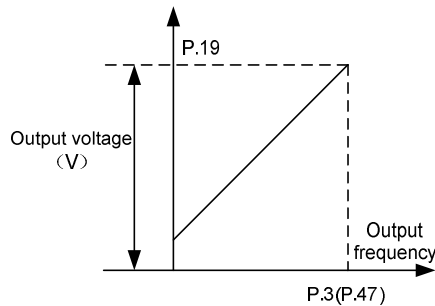
P.47 “The second base frequency”

— Related parameters —

P. 14 “Load pattern selection”
 P. 80~P 84, P.86, P. 126 P. 550
 “Multi-function terminals selection”
 P. 189 “Factory setting function”

- The maximal output voltage of the inverter is called “base frequency voltage”.
- If the output frequency is lower than the base frequency, the output voltage of the inverter will increase with output frequency. If the output frequency has reached the base frequency (P.3/P.47), the output voltage will just be equal to the base frequency voltage. If the output frequency exceeds the base frequency and increase continuously, the output voltage will be clamped to the base frequency voltage.

Parameter	Factory setting	Setting range	Remarks
3	50Hz	0~650Hz	P.189=1
	60Hz		P.189=0
19	99999	0~1000V, 99999	99999: Change according to the power source voltage
47	99999	0~650Hz, 99999	99999: Function invalid



<Setting>

- Use P.3 and P.47 to set up the base frequency.
- If RT is on, P.47 “The Second Base Frequency” is valid.(Note 1)
- Set up the base frequency voltage using P.19.(Note 2)

Note: 1. The second function is valid on when P.44≠99999.
 2. If P.19=99999, the maximum output voltage of the inverter will depend on the value of the power supply voltage.
 3. RT mentioned in this section is the function name of the “multi-function control terminal”. Please refer to P.80~P.84、 P.86、 P.126、 P.550 for function selection and purposes of the multi-function control terminal. For related wiring, please refer to Section 3.5.

5.4 Multi-speed (P.4~P.6, P.24~P.27 and P.142~P.149)

P.4 “Speed 1 (high speed)”

P.5 “Speed 2 (medium speed)”

P.6 “Speed 3 (low speed)”

P.24~P.27 “speed 4 to 7”

P.142~P.149 “speed 8 to 15”

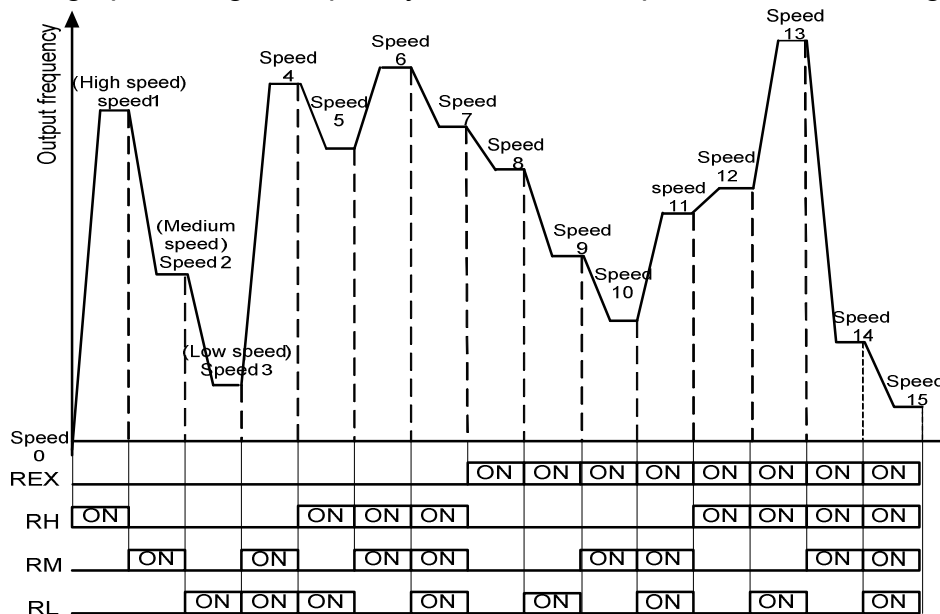
— Related parameters —

P.1 “Maximum frequency”
 P.2 “Minimum frequency”
 P.29 “Acceleration/ deceleration curve selection”
 P.79 “Operation mode selection”
 P.80~P.84, P.86, P.126, P.550
 “Multi-function terminals selection”

Parameter	Factory setting	Setting range	Remarks
4	60Hz	0~650Hz	---
5	30Hz	0~650Hz	---
6	10Hz	0~650Hz	---
24~27	99999	0~650Hz, 99999	99999: not selected
142~149	99999	0~650Hz,99999	99999: not selected

<Setting>

- If all the set values of P.24~P.27 and P.142~P.149 are not 99999, “16-speed operation” is active. It means that with the combination of RL, RM, RH and REX, there are 16 speeds in total. For setting up the target frequency of the inverter, please refer to the figure below:



- Provided that the parameter set values of P.24~P.27 and P.142~P.149 are all 99999, the target frequency will be determined by RL, RM and RH these three speeds. See the table below (the priority of the terminals is RL>RM>RH):

Parameter Description

Parameters Target frequency	P.24= 99999	P.25= 99999	P.26= 99999	P.27= 99999	P.142= 99999	P.143= 99999	P.144= 99999	P.145= 99999	P.146= 99999	P.147= 99999	P.148= 99999	P.149= 99999
RL (P.6)	○	○		○	○	○		○		○		○
RM (P.5)			○				○				○	
RH (P.4)									○			

For example, When P.26=99999, the target frequency is determined by RM (the set value of P.5).

Note: 1. The multi-speed is only valid in the “external mode”, “combination mode 2” or “combined mode 4”.
 2. RL, RM, RH, and REX mentioned in this section are the function names of the “multi-function control terminal”. (For example, when P.80=2, select the RL terminal to perform the RL (function). Please refer to P.80~P.84, P.86, P.126, P.550 for function selection and purposes of the multi-function control terminal. For related wiring, please refer to Section 3.5.

5.5 Acceleration / Deceleration Time (P.7, P.8, P.20, P.21, P.44 and P.45)

P.7 “Acceleration time”

P.8 “Deceleration time”

P.20 “Acceleration / deceleration reference frequency”

P.21 “Acceleration / deceleration time increments”

P.44 “The second acceleration time”

P.45 “The second deceleration time”

—Related parameters—

- P. 3 “Base frequency”
- P. 29 “Acceleration / deceleration curve selection”
- P. 47 “The second base frequency”
- P. 80~P. 84, P.86, P.126, P.550
“Multi-function terminal selection”
- P. 189 “Factory setting function”

- When the output frequency of the inverter is accelerated from 0Hz to P.20 (P.3), the required time is defined as “acceleration time”.
- When the output frequency of the inverter is decelerated from 0Hz to P.20 (P.3), the required time is defined as “deceleration time”.

Parameter Description

Parameter	Factory setting	Setting range	Remarks
7	5s (3.7Kw or below)	0~360s	P.21=0
	20s (5.5Kw or above)	0~3600s	P.21=1
8	5s (3.7Kw or below)	0~360s	P.21=0
	10s (5.5~7.5kW)		
	30s (11kW or above)	0~3600s	P.21=1
20	50Hz	1~650Hz	<u>P.189</u> =1
	60Hz		P.189=0
21	0	0, 1	0 The acceleration / deceleration time increment is 0.01s.
			1 The acceleration / deceleration time increment is 0.1s.
44,45	99999	0~360s	P.21=0
		0~3600s	P.21=1
		99999	Not selected

<Setting>

- If P.21=0, minimum acceleration / deceleration time (P.7, P.8, P.16, P.44, P.45, P.111~P.118) increments is 0.01s.
- If P.21=1, minimum acceleration / deceleration time (P.7, P.8, P.16, P.44, P.45, P.111~P.118) increments is 0.1s.
- When RT is “on”, the second function is valid. For the operation characteristics of the motor, please refer to the second function.
- In this case, even though RT is “on”, the acceleration time is still the set value of P.7, the deceleration time is still the set value of PR8, the torque boost is still the set value of P.0, and the base frequency is still the set value of P.3.
- If P.44≠99999 and P.45=99999, when RT is “on”, the acceleration /deceleration time is the “set value of P.44”.
- If P.44≠99999, P.46=99999, when RT is “on”, the torque boost is the “set value of P.0”.
- If P.44≠99999 and P.46≠99999, when RT is “on”, the torque boost is the “set value of P.46”.
- If P.44≠99999, P.47=99999, when RT is “on”, the base frequency is the “set value of P.3”.
- If P.44≠99999 and P.47≠99999, when RT is “on”, the base frequency is the “set value of P.47”.

Note: RT mentioned in this section is the function name of the “multi-function control terminal”. Please refer to P.80~P.84, P.86, P.126, P.550 for function selection and purposes of the multi-function control terminal. For related wiring, please refer to Section 3.5.

5.6 Electronic Thermal Relay Capacity (P.9)

P.9 “Electronic thermal relay capacity”

Related parameters

P.80~P.84, P.86, P.126, P.550
“Multi-function terminals selection”

- The “electronic thermal relay” uses the program of the inverter to simulate a thermal relay for preventing the motor from overheating.

Parameter	Factory setting	Setting range	Remarks
9	Rated current (Refer to note 1 in appendix 1)	0~500A/5000A (Refer to note 5 in appendix 1)	---

<Setting>

- Please set P.9 as the rated current of the motor at its rated frequency. The rated frequency of a squirrel-cage inductive motor made in different countries and areas is different. Please refer to the nameplate instruction on the motor.
- If P.9=0, the electronic thermal relay is disabled.
 - In case the calculated heat by the electronic thermal relay exceeds the upper limit, an alarm will go off and the DU01 screen will display **Hi**, and the output will be stopped.

Note: 1. After the inverter is reset; the thermal accumulating record of the electronic thermal relay will be reset to zero. Please pay attention in this area.

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

3. When a special motor is employed, the electronic thermal relay is no longer valid. Install an external thermal relay for each motor.

4. About wiring for an external thermal relay, please refer to P.80~P.84、P.86、P.126、P.550.

5.7 DC Injection Brake (P.10, P.11 and P.12)

P.10 “DC injection brake operation frequency”

P.11 “DC injection brake operation time”

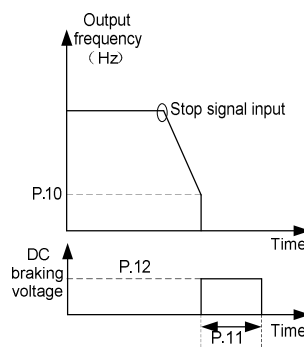
P.12 “DC injection brake operation voltage”

Parameter	Factory setting	Setting range	Remarks
10	3Hz	0~120Hz	---
11	0.5s	0~60s	---
12	4% (7.5kW or below)	0~30%	---
	2% (11kW~55kW)		
	1% (75kW or above)		

<Setting>

- After a stop signal is put in (please refer to Chapter 4 for the primary operation of motor activation and stop), the output frequency of the inverter will decrease gradually. In case the output frequency reaches the “DC injection brake operation frequency (P.10),” the DC injection brake will be activated.
- 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 operation voltage (P.12)”. The larger the P.12 is, the higher the DC brake voltage is, and the stronger the brake capability is.
- The DC brake operation will last a period (the set value of P.11) to overcome the motor inertia.

See the figure below:



Note: To achieve the optimum control characteristics, P.11 and P.12 should be set properly.

5.8 Starting Frequency (P.13)

P.13 “Starting frequency”

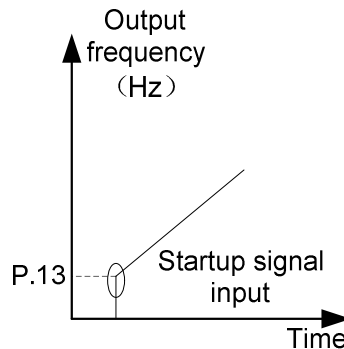
Related parameters
P.2 “Minimum frequency”

- When the motor starts up, the instantaneous output frequency of the inverter is called “starting frequency”.

Parameter	Factory setting	Setting range	Remarks
13	0.5Hz	0~60Hz	---

<Setting>

- If the target frequency of the inverter is lower than the setting value of P.13, the motor will not run. When the signal of the motor starts, the output frequency will go up from the value of P.13.



5.9 Load Pattern Selection (P.14, P.98~P.99, P.162~P.169)

P.14 “Load pattern selection”

P.98 “Middle frequency 1”

P.99 “Output voltage 1 of middle frequency”

P.162 “Middle frequency 2”

P.163 “Output voltage 2 of middle frequency”

P.164 “Middle frequency 3”

P.165 “Output voltage 3 of middle frequency”

P.166 “Middle frequency 4”

P.167 “Output voltage 4 of middle frequency”

P.168 “Middle frequency 5”

P.169 “Output voltage 5 of middle frequency”

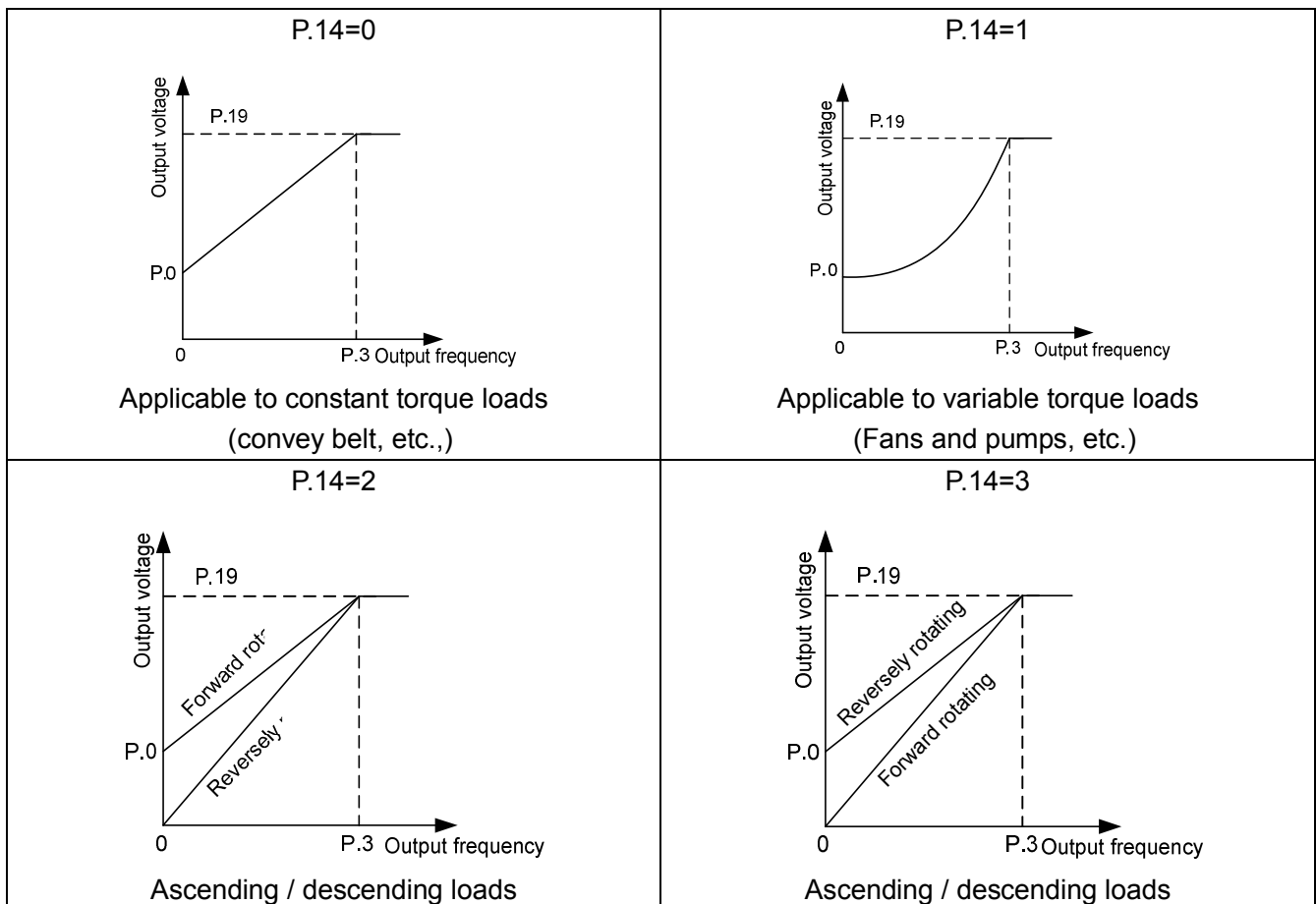
Related parameters
P. 0 “Torque boost”
P. 46 “The second torque boost”
P. 80~P.84, P. 86, P.126, P.550
“Multi-function terminals selection”

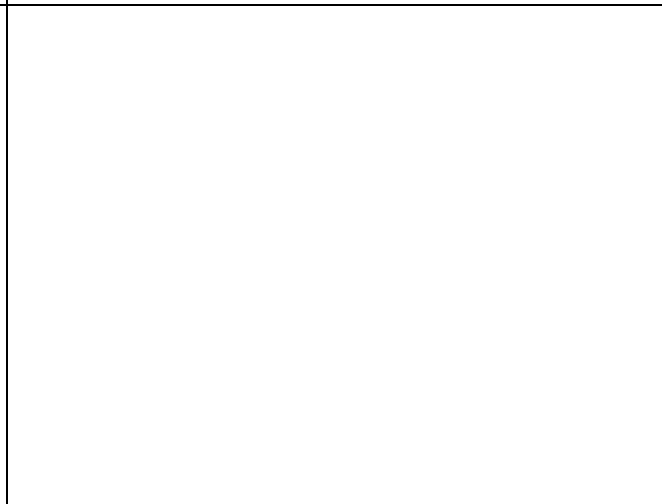
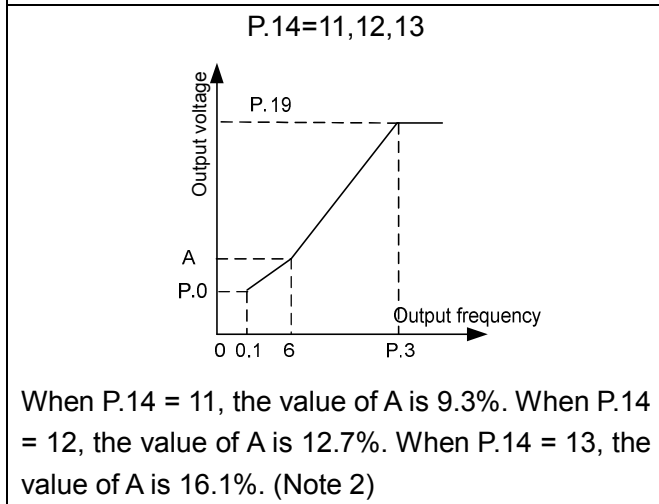
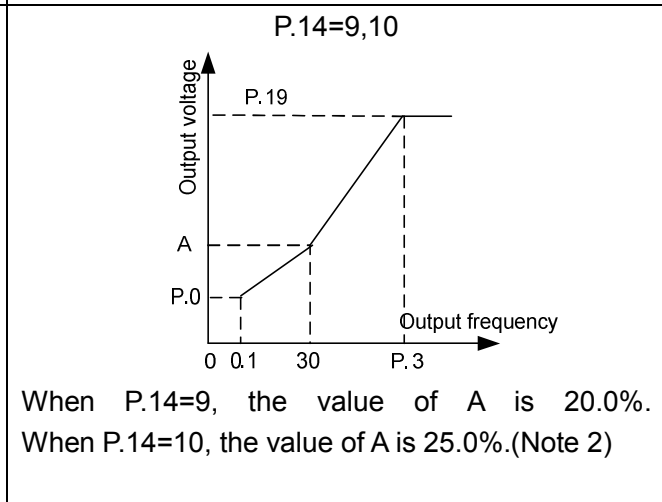
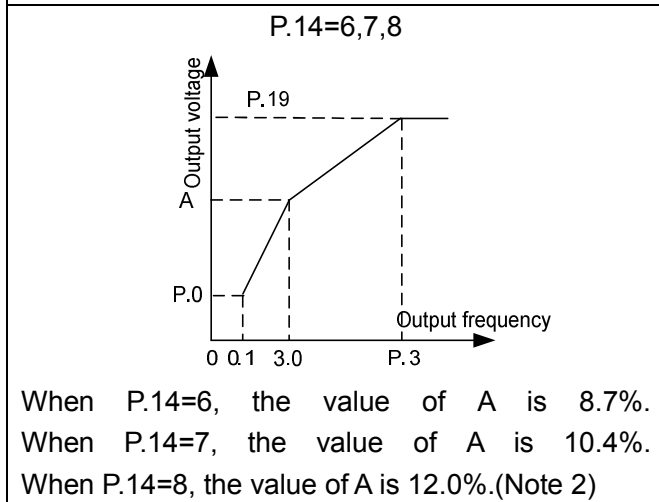
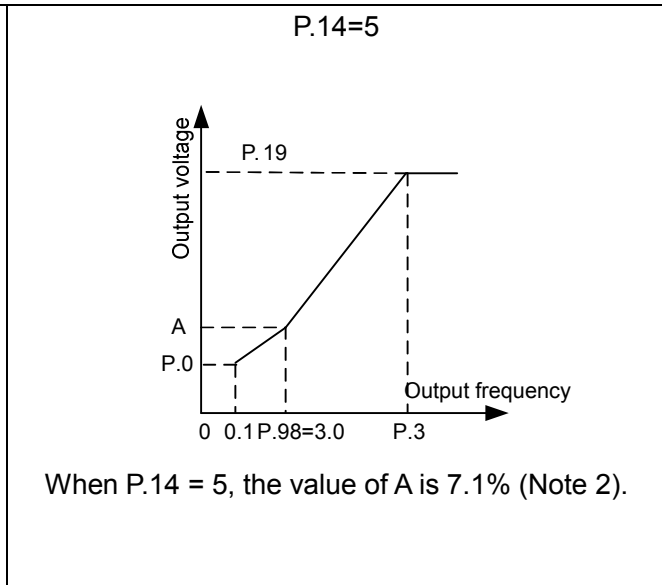
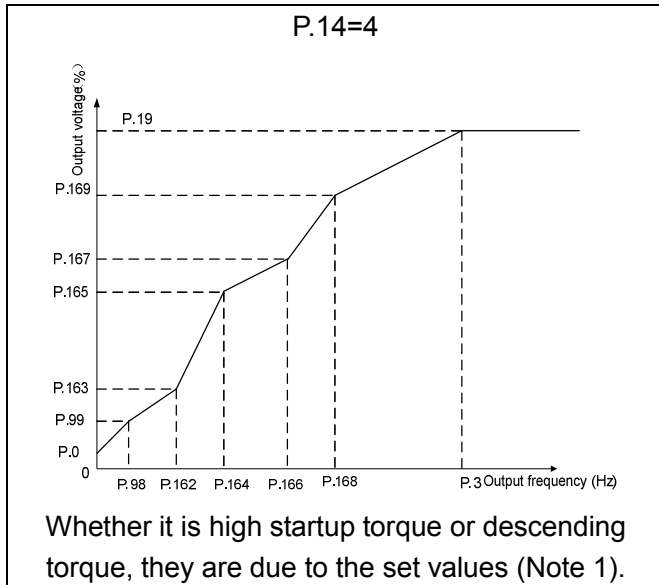
Parameter Description

Parameter	Factory setting	Setting range	Remarks
14	0	0~13	P.14=4~13 are different VF curve options.
98	3Hz	0~650Hz	---
99	10%	0~100%	---
162	99999	0~650Hz, 99999	---
163	0%	0~100%	---
164	99999	0~650Hz, 99999	---
165	0%	0~100%	---
166	99999	0~650Hz, 99999	---
167	0%	0~100%	---
168	99999	0~650Hz, 99999	---
169	0%	0~100%	---

<Setting>

- If P.14=4, suppose that P.19=220V, P.98=5Hz and P.99=10%, when the inverter is running at 5Hz, the output voltage equals $P.19 \times P.99 = 220V \times 10\% = 22V$.
- If RT is "on", P.46 "The Second Torque Boost" is valid.





Note: 1. Referring to the diagrams above, set P.98 and P.99 if one point is needed. Set P.98, P.99, P.162 and P.163 if two points are needed. Set P.98, P.99, P.162, P.163, P.164 and P.165 if three points are needed.

2. If you set P.14 between 4 and 13, the curve will be invalid when P.0 is larger than the point A, where point A equals to P.0.

5.10 JOG Mode (P.15 and P.16)

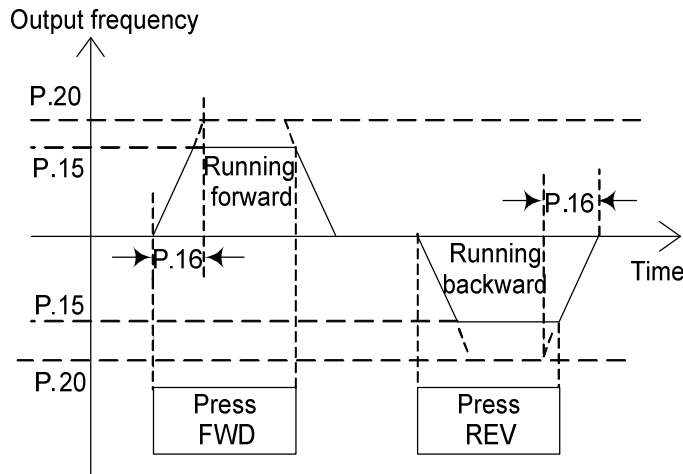
P.15 “JOG frequency”

P.16 “JOG acceleration / deceleration time”

Related parameters
 P.20 “Acceleration/deceleration reference frequency”
 P.21 “Acceleration/deceleration time increments”

- In JOG mode, the output frequency is the set value of P.15, and the acceleration / deceleration time is the set value of P.15.

Parameter	Factory setting	Setting range	Remarks
15	5Hz	0~650Hz	---
16	0.5s	0~360s	<u>P.21=0</u>
		0~3600s	P.21=1



Note: Please refer to Section 4.1.1 for how to enter the JOG mode.

5.11 Stall Prevention (P.22, P.23 and P.66)

P.22 “Stall prevention operation level”

P.23 “Compensation factor at level reduction”

P.66 “Stall prevention operation reduction starting frequency”

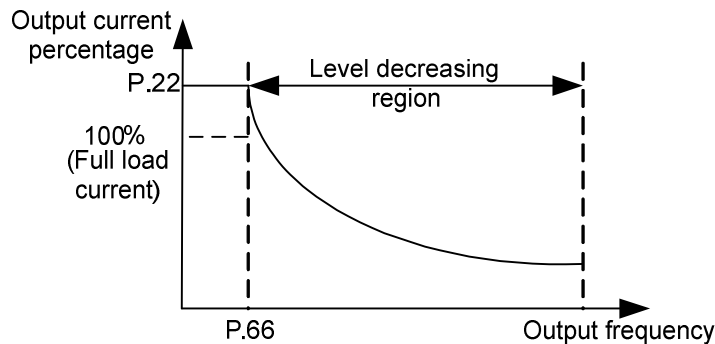
Related parameters
 P.189 “Factory setting function”

- When the motor starts or target frequency is adjusted (increasing) under a heavy load, the motor speed is often unable to follow the output frequency closely. 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, a phenomenon known as “stall”.

Parameter	Factory setting	Setting range	Remarks
22	150%	0~400%	---
23	99999	0~150%, 99999	When P.23=99999, stall prevention operation level is the set value of P.22.
66	50Hz	0~650Hz	P.189=1
	60Hz		P.189=0

<Setting>

- During the time when a motor starts or the output frequency increases, the output current of the inverter will increase. Once the output current exceeds the curve in the diagram below, output frequency adjustment will be paused automatically until the motor attains the output frequency (at this moment, the output current of the inverter will decrease accordingly).



$$\text{Level percentage} = A + B \times \frac{P.22 - A}{P.22 - B} \times \frac{P.23 - 100}{100}$$

$$A = \frac{P.66 \times P.22A}{\text{Output frequency}} \quad B = \frac{P.66 \times P.22A}{400}$$

Note: When P.300=3 for sensorless vector control is selected from P.300 control method, P.22 will be used for the torque limited horizontal operation.

5.12 Output Frequency Filter Constant (P.28)

P.28 “Output frequency filter constant”

- When the acceleration or deceleration time decreases and the output frequency switches from high-frequency to low-frequency, it may produce machine vibration which will affect product quality.
- When output frequency filtering constant P.28 is set, the inverter can filter out the output

Parameter Description

frequency to reduce machine vibration upon high-frequency and low-frequency is switched. The bigger the P.28 is, the better the filtering effect is. But the corresponding response delay will also increase. If P.28 is set to 0, the filtering function is invalid.

Parameter	Factory setting	Setting range	Remarks
28	0	0~31	---

5.13 Acceleration / Deceleration Curve (P.29, P.255~P.258)

P.29 “Acceleration / deceleration curve selection”

P.258 “S pattern time at the end of Deceleration”

P.255 “S pattern time at the beginning of Acceleration”

P.256 “S pattern time at the end of Acceleration”

P.257 “S pattern time at the beginning of Deceleration”

Related parameters

P. 3 “ Base frequency ”
 P. 7 “ Acceleration time ”
 P. 8 “ Deceleration time ”
 P. 20 “ Acceleration / deceleration reference frequency ”
 P. 44 “ The second acceleration time ”
 P. 45 “ The second deceleration time ”

Parameter	Factory setting	Setting range	Remarks
29	0	0~3	---
255	0.2s	0~25s	P.21=0
		0~250s	P.21=1
256	99999	0~25s	P.21=0
		0~250s	P.21=1
		99999	Not selected
257	99999	0~25s	P.21=0
		0~250s	P.21=1
		99999	Not selected
258	99999	0~25s	P.21=0
		0~250s	P.21=1
		99999	Not selected

Note: the parameters P.255~P.258 are valid in the mode of S pattern acceleration/deceleration, they are used to set the acceleration time of S pattern acceleration/deceleration. If the value is 99999, the time value equals to P.255.

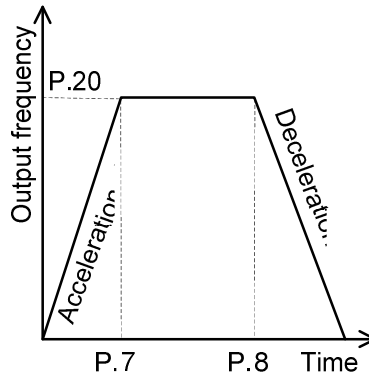
<Setting>

• When P.29=0, “linear acceleration /deceleration curve”

An acceleration slope is constructed by the combination of P.7 and P.20. A deceleration slope is constructed by the combination of P.7 and P.20.

When the target frequency varies, it increases with the “acceleration slope” or decreases

with the “deceleration slope” linearly. See the figure below:



• **When P.29=1, “S pattern acceleration /deceleration curve 1”**

An acceleration slope is constructed by the combination of P.7 and P.20. A deceleration slope is constructed by the combination of P.7 and P.3.

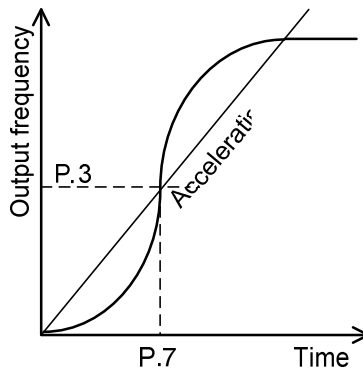
The acceleration / deceleration curve has an S-shape change according to the “acceleration / deceleration slope”. The S-shape equation between 0 and P.3 is:

$$f = [1 - \cos(\frac{90^\circ \times t}{P.7})] \times P.3$$

The S-shape equation of P.3 or above is:

$$t = \frac{4}{9} \times \frac{P.7}{(P.3)^2} \times f^2 + \frac{5}{9} \times P.7$$

t: time; f: output frequency

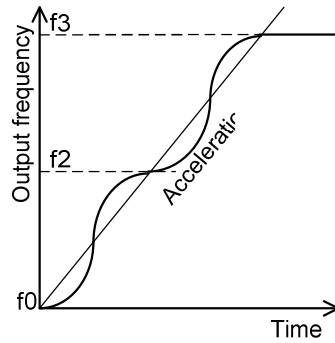


Note: This pattern is applicable to main shafts of the working machines.

• **When P.29=2, “S pattern acceleration /deceleration curve 2”**

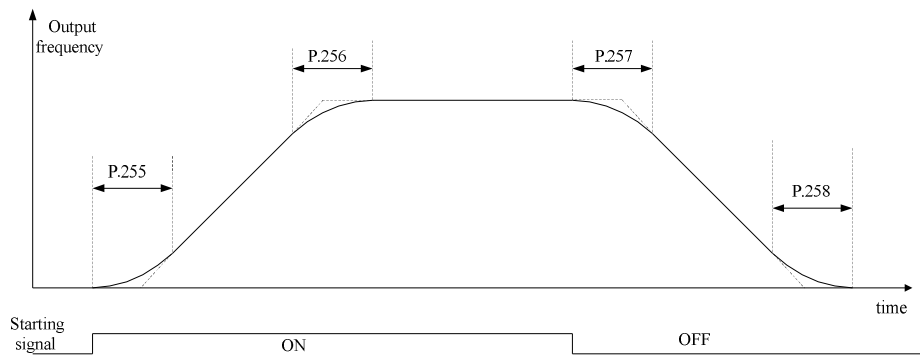
An acceleration slope is formed by the combination of P.7 and P.20. A deceleration slope is formed by the combination of P.8 and P.20.

When the target frequency varies, the acceleration curve has an S-shape ascending according to the “acceleration slope”. The deceleration curve on the other hand has an S-shape deceleration according to the “deceleration slope”. As shown in the figure below, when the setting value of the inverter is adjusted from f0 to f2, an S-shape acceleration is undertaken once, and the time is $P.7 \times (f2-f0)/P.20$. Then if the frequency is set from f2 to f3, a second S-shape acceleration is experienced, and the time is $P.7 \times (f3-f2) / P.20$.



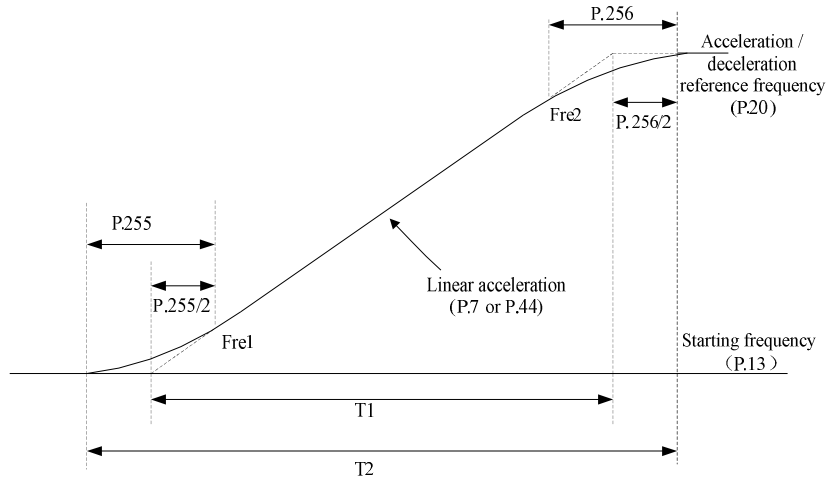
Note: this pattern can effectively reduce motor vibration during the acceleration / deceleration, and thus prevent the belts and gears from broken.

• When P.29=3, “S pattern acceleration /deceleration curve 3”



- 1) The parameters P.255, P.256, P.257 and P.258 are used to start the inverter gradually without impact. And varying degrees of S pattern acceleration/deceleration curve are adjusted by the values. When the S pattern acceleration/acceleration curve is started, the inverter will accelerate/decelerate with different speed according to the primary acceleration/deceleration time.
- 2) When S pattern acceleration/deceleration curve 3 is selected, the acceleration/ deceleration time will be longer, as follows.
- 3) When the selected acceleration time (P.7 or P.44) \geq P.255 and P.256, the actual acceleration time is as follows:
The actual acceleration time = The selected acceleration time + (P.255 + P.256) / 2
- 4) When the selected deceleration time (P.8 or P.45) \geq P.257 and P.258, the actual deceleration time is as follows:
The actual deceleration time = The selected deceleration time + (P.257 + P.258) / 2

Example: When the parameters are initial value (60 Hz system), the actual acceleration time from 0Hz to 60Hz in accordance with S pattern acceleration/deceleration curve 3 is as follows:



The acceleration time being set $T1 = (P.20 - P.13) * P.7 / P.20$
 The actual acceleration time $T2 = T1 + (P.255 + P.256) * (P.20 - P.13) / 2 / P.20$
 So $T1 = (60 - 0.5) * 5 / 60 = 4.96s$ (the actual acceleration time of linear acceleration)
 The actual acceleration time $T2 = 4.96 + (0.2 + 0.2) * (60 - 0.5) / 2 / 60 = 5.16s$

Note: All calculations of acceleration/deceleration time are base on P.20.

5.14 Regenerative Brake (P.30 and P.70)

P. 30 “Regenerative brake function selection”

P. 70 “Special regenerative brake duty”

- At the moment of the inverter output frequency switching from high to low, the rotation speed of the motor will be higher than the output frequency of the inverter due to load inertia, resulting in generator effect. This effect will cause a high voltage between the main-circuit terminals P and N, which will damage the inverter. Therefore, a proper brake resistor shall be mounted between terminals P and PR to dissipate the feedback energy.
- There is a built-in transistor inside the inverter. The conducting time ratio of the transistor is called “regenerative brake duty”. The higher the regenerative brake duty is, the more energy the brake resistor consumes, and the stronger the brake capability is.

Parameter	Factory setting	Setting range	Remarks	
30	0	0~1	0	If regenerative brake duty is fixed at 3%, parameter P.70 will be invalid.
			1	The regenerative brake duty is the set value of P.70.
70	0	0~60%		

Note: 1. In occasions where frequency starts or stops, a high capacity brake resistor is required.
 2. Please refer to Section 3.7.3 for brake resistor selection.

5.15 Carrier Operation Selection (P.31) V/F

P.31 “Carrier operation selection”

- Soft-PWM is a control method that turns motor noises into pleasant complex tones.
- Motor noise modulation control is when the inverter varies its carrier frequency from time to time during the operation. The metal noises generated by the motor are not a single frequency. This function selection is to improve the high peak single frequency noises.
- This function is only valid under the V/F mode; i.e., it is effective when P.300=0.

Parameter	Factory setting	Setting range	Remarks
31	0	0	The rated current decreases with rated carrier change(note 1)
		1	when <u>P.72</u> < 5, Soft-PWM is valid (only apply to V/F control)
		2	When <u>P.72</u> > 9(note 2),the temperature of module is higher than 60 degree, carrier will decrease to 9k automatically (note 2); after the temperature drops to lower than 40 degree, carrier will restore the setting value of P.72

Note: 1. For the function of rated current decreasing with rated carrier change, please refer to the figure of P.72.

2. The decreasing level of carrier is different from different frame, the details: frame AA and frame A/B is 9K; frame D/E is 4k; frame F is 2K.

5.16 Communication Function(P.32, P.33, P.36, P.48~P.53, P.153 and P.154)

P.32 “Serial communication Baud rate selection”

P.36 “Inverter station number”

P. 49 “Stop bit length”

P.51 “CR & LF selection”

P.53 “Communication check time interval”

P.153 “Communication error handling”

P.33 “Communication protocol selection”

P.48 “Data length”

P.50 “Parity check selection”

P.52 “Number of communication retries”

P.154 “Modbus communication data format”

Parameter Description

- When the communication parameters are revised, please reset the inverter. The SF-GT inverters have two communication protocols for selection, namely, Shihlin protocol and Modbus protocol. Parameter P.32, P.36, P.52, P.55 and P.153 are suitable for both protocols. P.48~P.51 is only suitable for the Shihlin protocol, while P.154 is only suitable for the Modbus protocol. Please refer to communication protocols for more details.

Parameter	Factory setting	Setting range	Remarks	
32	1	0, 1, 2, 3	0	Baud rate: 4800bps
			1	Baud rate: 9600bps
			2	Baud rate: 19200bps
			3	Reserved
33	1	0, 1	0	Modbus protocol
			1	Shihlin protocol
36	0	0~254	(Note 1)	
48	0	0, 1	0	Data length: 8 bit
			1	Data length: 7 bit
49	0	0, 1	0	Stop bit length: 1 bit
			1	Stop bit length: 2 bit
50	0	0, 1, 2	0	No parity verification
			1	Odd
			2	Even
51	1	1, 2	1	CR only
			2	Both CR and LF
52	1	0~10	(Note 2)	
53	99999	0~999.8s, 99999	0~999.8	Use the set value for the communication overtime test
			99999	99999: No communication overtime test (Note 3)
153	0	0, 1	0	Warn and call to stop
			1	No warning and keep running
154	4	0~5	0	Protocol, 1, 7, N and 2 (Modbus, ASCII) (Note 4)
			1	1、7、E、1 (Modbus, ASCII)
			2	1、7、O、1 (Modbus, ASCII)
			3	1、8、N、2 (Modbus, RTU)
			4	1、8、E、1 (Modbus, RTU)
			5	1、8、O、1 (Modbus, RTU)

Note: 1. The number of inverters is practically determined by the wiring method and impedance matching. If Modbus protocol is used, please set the value to a nonzero value.

2. If the frequency of communication error exceeds the set value of P.52, and P.153 is set to 0, the alarm will go off and display OPT.

3. When P.53=99999, there is no time limit.

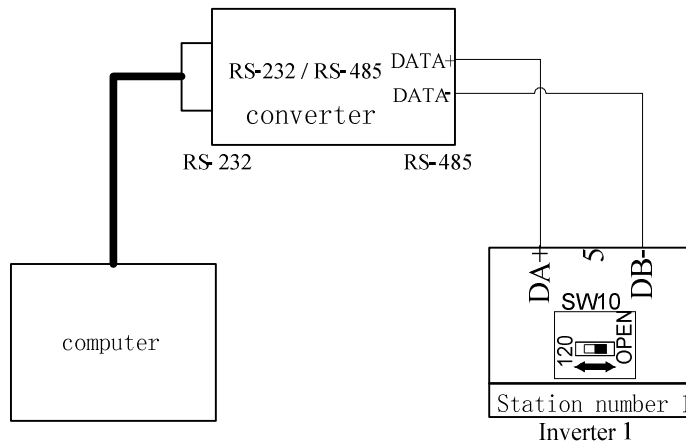
4. Modbus protocol. Displayed according to the starting bit, the data bit, parity check bit, and the stop bit. N: no parity check. E: 1-bit parity check. O: 1-bit odd parity check.

1. SF RS-485 Communication interface constituents and wiring

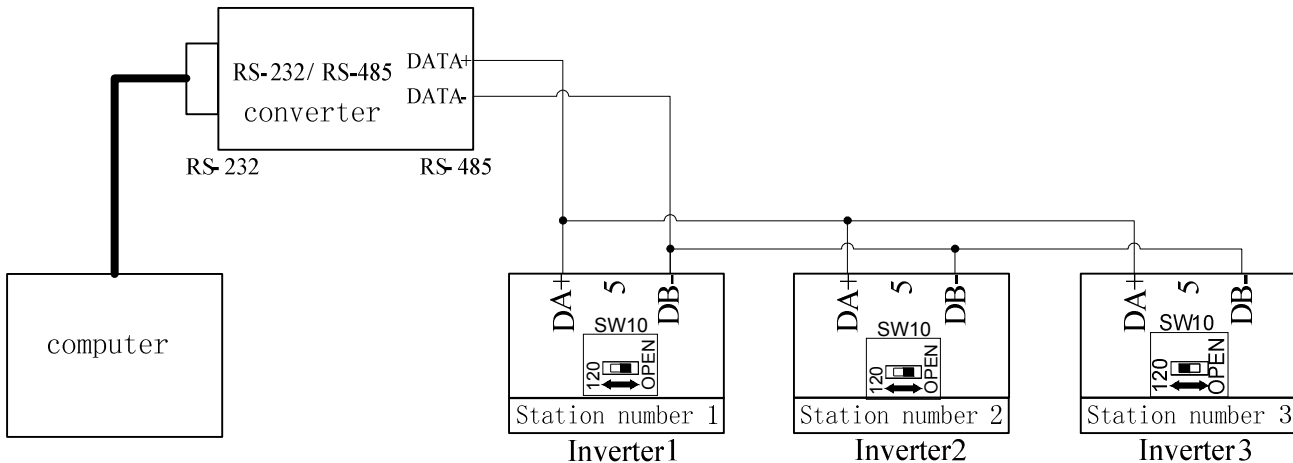
- SF-GT RS-485 communication interface terminal arrangement

Terminal name	explanation
DA+	Inverter transceiver +
DB-	Inverter transceiver -
5	Signal ground

- Communication between the position machine and single inverter (take computer as an example).



- Communication between the position machine and multiple inverters (take computer as an example).



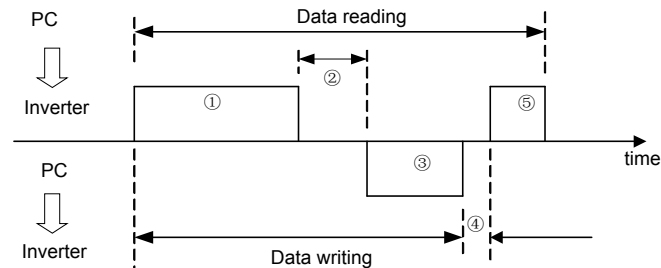
- SF-GT series inverters have two types of communication protocols: Shihlin communication

protocol and MODBUS communication protocol.

Note: Please switch the SW10 on the inverter farthest from the computer to 120.

2. Shihlin communication protocol

- Automatically switch the position machine and the inverter to ASCII codes (hexadecimal) for communication.
- Please follow the following steps for data communication between the position machine and the inverter.



The above steps concerning communication actions and communication data format are explained below:

No.	Action content	Operation command	Frequency write-in	Parameter write-in	Inverter reset	Monitoring	Parameters Read-out	
①	Use the position machine's user procedure to send communication request to the inverter.	A	A	A	A	B	B	
②	Inverter data processing time	Yes	Yes	Yes	No	Yes	Yes	
③	Inverter's replay data (check data ① error)	No error (Accept the request)	(C)	(C)	(C)	No	E	E
		Error exists (Refuse the request)	D	D	D	No	D	D
④	Position machine's processing delay time	No	No	No	No	No	No	
⑤	Reply from the position machine regarding reply data ③ (Check data ③ error)	No error (No processing)	No	No	No	No	(C)	(C)
		Error exists (Output ③)	No	No	No	No	F	F

①. Data of the communication request sent by the position machine to the inverter.

Parameter Description

①. Data of the communication request sent by the position machine to the inverter.

Format	Data number													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
A (Data write-in)	ENQ *1)	Inverter station number		Command code		Waiting time		Data			Check code Sum check *7)		End symbol *3)	
B (Data read-out)	ENQ *1)	Inverter station number		Command code		Waiting time		Check code Sum check *7)		End symbol *3)				

③. Inverter reply data

Data write-in

Format	Data number					
	1	2	3	4	5	6
(C) (No data error)	ACK *1)	Inverter station number		End symbol * 3)		
D (With data error)	NAK *1)	Inverter station number		Error code *5)		End symbol * 3)

Data read-out

Format	Data number												
	1	2	3	4	5	6	7	8	9	10	11	12	13
E (No data error)	STX *1)	Inverter station number		Data read-out				Unit *4)	ETX	Check code Sum check *7)		Check symbol *3)	
D (With data error)	NAK *1)	Inverter station number		Error code *5)		End symbol *3)							

⑤. Reply data from the position machine to the inverter during data read-out.

Format	Data number				
	1	2	3	4	5
(C) (No data error)	ACK *1)	Inverter station number		End symbol *3)	
F (With data error)	NAK *1)	Inverter station number		End symbol *3)	

Parameter Description

*1). Control code

signal	ASCII Code	Content	signal	ASCII Code	Content
NUL	H00	NULL (Empty)	ACK	H06	Acknowledge (No data error)
STX	H02	Start of Text (Data begin)	LF	H0A	Line Feed (Change line)
ETX	H03	End of Text (Data end)	CR	H0D	Carriage Return
ENQ	H05	Enquiry (Communication request)	NAK	H15	Negative Acknowledge (Data errors)

*2). Set the waiting time between 0 and 15 with a 10ms unit. Example: 5 → 50ms

*3). End symbol (CR, LF codes)

When carrying out data communication from the position machine to the inverter, CR and LF codes at the end of the text are automatically set according to method of the position machine. At this time, the inverter has to be set according to the position machine, too. If only CR is selected, only one register will be occupied; if both CR and LF are selected, two registers will be occupied.

*4). Unit: 0---> Unit 1, 1---> Unit 0.1, 2---> Unit 0.01, 3---> Unit 0.001。

*5). Error code

Error code	Error item	Communication error and abnormality
H01	Error	The parity check of the data received by the inverter is different from the parity check set initially.
H02	Sum check Error	The Sum Check calculated by the inverter according to the received data is different from the received Sum Check.
H03	Communication protocol error	The syntax of the data received by the inverter has errors. The data is not completely received during the assigned period of time. CR and LF codes are different from the initial setting.
H04	Frame error	The stop bit of the data received by the inverter does not match to the stop bit set initially.
H05	Overflow error	When the inverter is receiving data, the position machine sends the next set of data before the inverter finishes receiving the current one.
H0A	Abnormal mode	The running inverter or the operation of the inverter disqualifies the requirements of the mode setting.
H0B	Command code error	The user assigns a command code that cannot be processed by the inverter.
H0C	Data range error	When setting the parameters and frequencies, the set values are outside the set range of the data.

*6). When the parameter has the characteristics of 99999, the write-in or read-out of 99999 will be replaced by HFFFF.

*7). Request the sum check code

The converted ASCII codes of the data are summed up in binary digit format. The lower bits (the lower eight bits) of the result (the sum) converted into ASCII binary digits

Parameter Description

(hexadecimal) are termed as the Sum Check Code.

• Communication example

Example 1. The position machine sends a forward rotation command to the inverter:

Step 1. Use the position machine to send a FA command in Format A:

ENQ	Inverter station number 0	Command code HFA	Waiting time	Data H0002	Check code Sum check	CR
H05	H30 H30	H46 H41	H30	H30 H30 H30 H32	H44 H39	H0D

Sum Check calculation is: $H30 + H30 + H46 + H41 + H30 + H30 + H30 + H30 + H32 = H1D9$; take the lower eight bits D9 to convert to ASCII code H44 and H39.

Step 2. After receiving and processing the data without error, the inverter will send a reply to the position machine in Format C:

ACK	Inverter station number 0	CR
H06	H30 H30	H0D

Example 2. The position machine sends a stop rotation command to the inverter:

Step 1. Use the position machine to send a FA command in Format A:

ENQ	Inverter station number 0	Command code HFA	Waiting time	Data H0000	Check code Sum check	CR
H05	H30 H30	H46 H41	H30	H30 H30 H30 H30	H44 H37	H0D

Step 2. After receiving and processing the data without error, the inverter will send a reply to the position machine in Format C:

ACK	Inverter station number 0	CR
H06	H30 H30	H0D

Example 3. The read-out value of the position machine P.195:

Step1. The position machine sends the write-in page break command to the inverter using Format A:

ENQ	Inverter station number 0	Command code HFF	Waiting time	Data H0001	Check code Sum check	CR
H05	H30 H30	H46 H46	H30	H30 H30 H30 H31	H44 H44	H0D

↓
P.195 is on page 1.

Step 2. After receiving and processing the data without error, the inverter will send a reply to the position machine in Format C

Parameter Description

ACK	Inverter station number 0	CR
H06	H30 H30	H0D

Step 3. The position machine requests the inverter for reading the value P.195 using Format B:

ENQ	Inverter station number 0	Command code H5F	Waiting time	Check code Sum check	CR
H05	H30 H30	H35 H46	H30	H30 H42	H0D



First 195 minus 100 equals to 95, then convert 95 to H5F hexadecimal digits. Next convert 5 and into H35 and H46, respectively, in ASCII code.

Step 4. Once the inverter receives and processes the data without error, the value of P.195 will be sent to the position machine in Format E:

STX	Inverter station number 0	Read-out data H1770(60Hz)	Unit	ETX	Check code Sum check	CR
H02	H30 H30	H31 H37 H37 H30	H32	H03	H36 H31	H0D

Example 4. Change the content of P.195 to 50 (the original factory setting is 60).

Step 1 to 2: Omitted (Same as Step 1 to 2 of Example 3);

Step 3: The position machine requests the inverter to write 50 in P.195 in Format A:

ENQ	Inverter station number 0	Command code HDF	Waiting time	Data H1388	Check code Sum check	CR
H05	H30 H30	H44 H46	H30	H31 H33 H38 H38	H45 H45	H0D



First, 195 minus 100 equals to 95;
Concert 95 to H5F hexadecimal digits,
H5F+H80=HDF



because the smallest unit of P.195 is 0.01,
50 x 100 = 5000; then convert 5000 to hexadecimal
digits H13888; Then covert 1, 3, 8 and 8 to ASCII
codes for transmission.

Step 4. After receiving and processing the data without error, the inverter will send a reply to the position machine in Format C:

ACK	Inverter station number 0	CR
H06	H30 H30	H0D

Parameter Description

Example 5. Write P.195 into 500 (this parameter range is set between 0 and 400)

Step 1 to 2: Omitted (same as Step 1 and 2 of Example 3);

Step 3: The position machine requests the inverter to write 500 in P.195 in Format A:

ENQ	Inverter station number 0	Command code HDF	Waiting time	Data HC350	SUM CHECK	CR
H05	H30 H30	H44 H46	H30	H43 H33 H35 H30	H46 H35	H0D

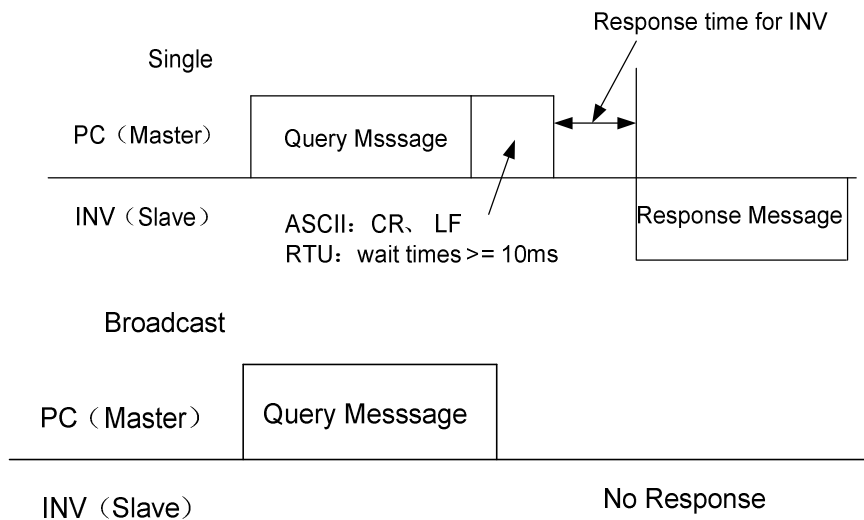
Step 4. After the inverter receives and processes the information, because the data exceed the set range of P.195, the data range is incorrect. The inverter will reply the error to the position machine in Format D:

NAK	Inverter station number 0	Error code H0C	CR
H15	H30 H30	H43	H0D

3. MODBUS communication protocol

1). Message format

- MODBUS serial transmission can be divided into two types: ASCII (American Standard Code for Information Interchange) and RTU (Remote Terminal Unit).



(1). Query

Position machine (main address) sends messages to the inverter of the assigned address (from the address).

(2). Normal response

After receiving the query from the Master, the Slave will execute the requested function and ask the Master to send the normal response.

(3). Error response

When receiving invalid function codes, address or data, the inverter will send the response to the Master.

(4). Broadcast

The Master will assign the address 0, and the slave will send the message to all the Slaves. Once receiving a message from the Master, all the Slaves will execute the requested function without responding to the Master.

2). Communication format

- Basically, the Master will send Query Message to the inverter, which will send the response message to the Master. The address and function codes are duplicated for regular communication. Bit 7 of functional code during abnormal communication is positioned as “1” (=H80). The data rate is set to be the error code.
- Message constituents :

Format	Start	①Address	②Function	③Data	④Error check	Stop
ASCII	H3A	8 bits	8 bits	n×8 bits	2×8 bits	0D 0A
RTU	>=10ms					>=10ms

Message	Content															
①Address message set	<p>Set range: 0~254.0 is the broadcasting address; 1~254 are the equipment (inverter) address.</p> <p>The setup of P.36 is based on the equipment address. The set up is carried out when the main equipment sends messages to the equipments and when the equipment sends reply message to the main equipment.</p>															
②Function message set	<p>Only three functions have been done so far. The equipment carries out actions according to the request from the equipment. The main equipment sets functional codes excluded from the table below. The equipment returns error response. It is determined by the response from the equipment; regular function codes are the response for regular responses; H80 + function codes are the response for error responses.</p> <table border="1"> <thead> <tr> <th>Function name</th> <th>Function code</th> <th>Function description</th> </tr> </thead> <tbody> <tr> <td>Read multiple registers</td> <td>H03</td> <td>Read slave machine's continuous register content.</td> </tr> <tr> <td>Write single register</td> <td>H06</td> <td>Write data into slave machine's single register.</td> </tr> <tr> <td>Function diagnosis</td> <td>H08</td> <td>Function diagnosis (only for communication calibration)</td> </tr> <tr> <td>Write multiple registers</td> <td>H10</td> <td>Write data into slave machine's multiple registers.</td> </tr> </tbody> </table>	Function name	Function code	Function description	Read multiple registers	H03	Read slave machine's continuous register content.	Write single register	H06	Write data into slave machine's single register.	Function diagnosis	H08	Function diagnosis (only for communication calibration)	Write multiple registers	H10	Write data into slave machine's multiple registers.
Function name	Function code	Function description														
Read multiple registers	H03	Read slave machine's continuous register content.														
Write single register	H06	Write data into slave machine's single register.														
Function diagnosis	H08	Function diagnosis (only for communication calibration)														
Write multiple registers	H10	Write data into slave machine's multiple registers.														
③Data message set	Changes, including the starting address, the number of the write-in or read-out registers, and the write-in data, are made according to the function codes.															
④Error check message set	ASCII is the check method for LRC, while RTU is the check method for CRC.(For more details concerning the verification calculation for LRC and CRC, please refer to Standard MODBUS Protocol specification.)															

Parameter Description

ASCII mode's LRC check value calculation:

LRC check is simpler and it is used in the ASCII mode for checking the content of the message domain, excluding the colon at the beginning and the line change enter symbol at the end. It only sums up all the data to be transmitted according to the bite (not the ASCII code). If the result is greater than H100 of the hexadecimal digit, remove the exceeded part (e.g., if the result is H136 of the hexadecimal digit, then take H36 only) and add one.

RTU mode, CRC check value calculation:

1. Add one hexadecimal digit register. All the digits are 1.
2. Carry out XOR calculation for the higher bit of the hexadecimal digit register and the eight bits. The calculated result is entered to the hexadecimal digit register.
3. Shift this hexadecimal digit register one bit to the right.
4. If the right shifted bit (the marked bit) is 1, then polynomial 101000000000001 and this register will carry out the XOR calculation. If the right shifted bit is 0, then it will return to 3.
5. Repeat 3 and 4 until 8 bits are shifted.
6. The other eight bits and the hexadecimal register carry out the XOR calculation.
7. Repeat 3~7 until all the bytes of the text carries out the XOR calculation with the hexadecimal register and was shifted for eight times.
8. The hexadecimal register content is the 2-byte CRC error checking, and it is added to the highest valid bit of the text.

When CRC is added to the message, lower bytes are added first, followed by the higher bytes.

● Communication format:

(1). Data read-out (H03)

Mode	Start	Address *1)	Function*2)	Start Address *3)	Number of register *4)	Check	Stop
ASCII	H3A	2char	2char	4char	4char	2char	0D 0A
RTU	>=10ms	1byte	1byte	2byte	2byte	2byte	>=10ms

Regular response

Mode	Start	Address *1)	Function *2)	Read-out data number *5)	Read-out data *6)	Check	Stop
ASCII	H3A	2char	2char	2char	...2N×1char	2char	0D 0A
RTU	>=10ms	1byte	1byte	1byte	...2N×1byte	2byte	>=10ms

Message	Content
1) Address	Set up the address for the to-be delivered message; 0 for invalid.
2) Function code	H03
3) Starting address	Set up the address of the register for reading the message.
4) Number of register	Set up the number of register for reading. Maximum number: 12.
5) Amount of data to be	Twice the amount of 4)
6) Data to-be read	Set the data for 4); the data will be read according to the descending sequence

Parameter Description

(2). Data write-in (H06)

Mode	Start	Address *1)	Function *2)	Start Address *3)	Write-in data *4)	Check	Stop
ASCII	H3A	2char	2char	4char	4char	2char	0D 0A
RTU	>=10ms	1byte	1byte	2byte	2byte	2byte	>=10ms

Regular response

Mode	Start	Address *1)	Function *2)	Start Address *3)	Write-in data *4)	Check	Stop
ASCII	H3A	2char	2char	4char	4char	2char	0D 0A
RTU	>=10ms	1byte	1byte	2byte	2byte	2byte	>=10ms

Message	Content
1) Address	Set up the address for the to-be delivered message; 0 for invalid.
2) Function code	H06
3) Starting address	Set up the starting address of the register to be engaged in the write-in function.
4) Write-in data	Write the data in the assigned register. The data have to be 16bit (fixed).

Note: Regular response content and the inquired message are the same.

(3). Write multiple registers (H10)

Mode	Start	Address *1)	Function *2)	Starting Address *3)	Number of register *4)	Data *5)	Write-in data *6)		Check	Stop
ASCII	H3A	2char	2char	4char	4char	2char	4char	...2N×1char	2char	0D 0A
RTU	>=10ms	1byte	1byte	2byte	2byte	1byte	2byte	...2N×1byte	2byte	>=10ms

Regular response

Mode	Starting	Address *1)	Function *2)	Start Address *3)	Number of register *4)	Check	Stop
ASCII	H3A	2char	2char	4char	4char	2char	0D 0A
RTU	>=10ms	1byte	1byte	2byte	2byte	2byte	>=10ms

Message	Content

Parameter Description

1) Address	Set up the address for the to-be delivered message; 0 for invalid.
2) Function code	H10
3) Starting address	Set up the starting address of the register to be engaged in the write-in function.
4) Number of register	Set up the number of register for reading. Maximum number: 12.
5) Amount of data	The range should be between 2 and 24. Set Twice the amount of *4).
Write-in data	Set the assigned data in *4), write the data according to the sequence of the Hi byte and the Lo byte and the data of the starting address: According to the order of the data of the starting address +1, data of the starting address +2..., etc.

(4). Function Diagnosis (H08)

By sending query information and getting the same query information back (the function of the subroutine code H00), it can do communication calibration.

The subroutine code H00 (for inquiring the return of data)

The query information

Mode	Start	Address *1)	Function *2)	Subroutine *3)	Data *4)	Check	End
ASCII	H3A	2char	2char	4char	4char	2char	0D 0A
RTU	>=10ms	1byte	1byte	2byte	2byte	2byte	>=10ms

Normal response

Mode	Start	Address *1)	Function *2)	Subroutine *3)	Data *4)	Check	End
ASCII	H3A	2char	2char	4char	4char	2char	0D 0A
RTU	>=10ms	1byte	1byte	2byte	2byte	2byte	>=10ms

Setting of the query information

Information	Content
*1) Address	Set the address for the information to be sent to, not able to radio communications(0 invalid)
*2)Function code	H08
*3) Subroutine code	H0000
*4) Data	If the data is 2 byte, it can be set arbitrarily. Set range from H0000 to HFFFF.

(5). Error response

Carry out error response according to the error in the function, address and data of the query message received by the equipment.

There will be no errors if one or more addresses can be operated when they are accessed by the function code H03 or H10.

Parameter Description

Mode	Starting	Address *1)	Function*2) H80+function	Error code * 3)	Check	Stop
ASCII	H3A	2char	2char	2char	2char	0D 0A
RTU	>=10ms	1byte	1byte	1byte	2byte	>=10ms

Message	Content
1) Address	Set up the address for the to-be delivered message; 0 for invalid.
2) Function code	The function code set for the main equipment + H80
3) Error code	Set the codes listed in the table below.

The list of error codes:

Source	Code	Meaning	Remarks
Slave reply	H01	Invalid function code	Set up function codes that cannot be handled by the equipment in the query message sent by the main equipment. Function codes that are not H03, H06, H08 and H10 (temporarily).
	H02	Invalid data address	Set up addresses that cannot be handled by the equipment in the query message sent by the main equipment (Asides from the addresses listed in the address table of the register; preserve the parameters, prohibit parameter reading, prohibit parameter writing).
	H03	Invalid data value	Set up data that cannot be handled by the equipment in the query message sent by the main equipment (parameters written outside the range, exist assigned mode, other errors, etc.).

Note: When performing multi-parameter reading, reading a preserved parameter is not a mistake.

Data sent to the main equipment will be tested by the inverter for the following mistakes, but the inverter will make no response for any detected error.

The list of the error test items:

Error item	Error content
Parity error	The parity test for data received by the inverter is different from the parity test set at the initial stage.
Frame error	The stop byte of the data received by the inverter mismatches the stop byte set at the initial stage.
Overflow error	When the inverter is receiving data, the position machine sends the next set of data before the inverter finishes receiving the current one.
Error test	The LRC/CRC calculated by the inverter according to the received data is different from the received LRC/CRC.

● Communication example

Example 1. The operation mode written by the communication is the CU (communication) mode.

Parameter Description

Step 1: The position machine modifies the mode of the inverter.

Mode	Starting	Address	Function	Starting address		Write-in data		Check	Stop
ASCII	H3A	H30 H31	H30 H36	H31H30	H30 H30	H30 H30	H30 H30	H45 H39	0D 0A
RTU	>=10ms	01	06	10	00	00	00	8D 0A	>=10ms

Step 2. After receiving and processing the data without error, the inverter will send a reply to the position machine:

Mode	Starting	Address	Function	Starting address		Write-in data		Check	Stop
ASCII	H3A	H30 H31	H30 H36	H31H30	H30 H30	H30 H30	H30 H30	H45 H39	0D 0A
RTU	>=10ms	01	06	10	00	00	00	8D 0A	>=10ms

Example 2. Read the parameter P.195 value by the position machine

Step 1. The position machine sends message to the inverter for reading the value of P.195. The address of P.195 is H00C3.

Mode	Starting	Address	Function	Starting address		Number of registers		Check	Stop
ASCII	H3A	H30 H31	H30 H33	H30H30	H43 H33	H30 H30	H30 H31	H33 H38	0D 0A
RTU	>=10ms	01	03	00	C3	00	01	74 36	>=10ms

Step 2. Once the message is received and processed without mistake, the inverter will send the content of P.195 to the position machine.

Mode	Starting	Address	Function	Number of data read	Read-out data		Check	Stop
ASCII	H3A	H30 H31	H30 H33	H30 H32	H31 H37	H37 H30	H37 H33	0D 0A
RTU	>=10ms	01	03	02	17	70	B6 50	>=10ms

Because the decimal form of H1770 is 6000 and the unit of P.195 is 0.01, P.195 is 60 (6000 x 0.01 = 60).

Example 3. Change the content of P.195 to 50.

Step 1. The position machine sends message to the inverter for writing 50 into P.195.

Mode	Starting	Address	Function	Starting address		Write-in data		Check	Stop
ASCII	H3A	H30 H31	H30 H36	H30H30	H43 H33	H31 H33	H38 H38	H39 H42	0D 0A
RTU	>=10ms	01	06	00	C3	13	88	74 A0	>=10ms

Step 2. After receiving and processing the data without error, the inverter will send a reply to the position machine:

Mode	Starting	Address	Function	Starting address		Write-in data		Check	Stop
ASCII	H3A	H30 H31	H30 H36	H30H30	H43 H33	H31 H33	H38 H38	H39 H42	0D 0A
RTU	>=10ms	01	06	00	C3	13	88	74 A0	>=10ms

Example 4. Read the values of parameters P.0~P.11 by the position machine

Step 1. The position machine sends message to the inverter for reading the value of

Parameter Description

P.0~P.11.Starting address is H0000.

Mode	Starting	Address	Function	Starting address		Number of registers		Check	Stop
ASCII	H3A	H30 H31	H30 H33	H30H30	H30 H30	H30 H30	H30 H43	H46 H30	0D 0A
RTU	>=10ms	01	03	00	00	00	0C	45 CF	>=10ms

Step 2. After receiving and processing the data without error, the inverter will send a reply to the position machine:

Mode	Starting	Address	Function	Number of data read	Read-out data	Check	Stop
ASCII	H3A	H30 H31	H30 H33	H31 H38	...12×4 char	4char	0D 0A
RTU	>=10ms	01	03	18	...12×2 byte	2byte	>=10ms

Example 5. Rewrite the values of parameters P.0~P.11 by the inverter

Step 1. The position machine sends message to the inverter for writing the value of P.0~P.11.

Mode	Starting	Address	Function	Starting address		Number of registers		Data volume	Write-in data	Check	Stop
ASCII	H3A	H30 H31	H31 H30	H30 H30	H30 H30	H30 H30	H30 H43	H31 H38	...N×4 char	4char	0D 0A
RTU	>=10ms	01	10	00	00	00	0C	18	...N×2 byte	2byte	>=10ms

Step 2. After receiving and processing the data without error, the inverter will send a reply to the position machine:

Mode	Starting	Address	Function	Starting address		Number of registers		Check	Stop
ASCII	H3A	H30 H31	H31 H30	H30H30	H30 H30	H30 H30	H30 H43	H45 H33	0D 0A
RTU	>=10ms	01	10	00	00	00	0C	00 18	>=10ms

4. The list of communication commands

- The following commands and data are set for carrying out assorted operation control and monitoring.

Item		Shihlin protocol Command code	Modbus Command code	Modbus address	Data content and function description														
Operation mode read-out		H7B	H03	H1000	H0000: Communication mode; H0001: External mode; H0002: JOG Mode; H0003: Combination 1, combination 3 and combination 5 modes; H0004: Combination 2 and combination 4 modes														
Operation mode write-in		HFB	H06/H10																
Inverter status monitoring		H7A	H03	H1001	H0000~H00FF b8~b15: Preservation b7: Abnormality occurred b6: Frequency test b5: Ended by restoring the default value of the parameter b4: Overloaded b3: Reached the frequency b2: During reverse rotation b1: During forward rotation b0: During rotation														
Target frequency write-in	EEPROM	HEE	H06/H10	H1009	H0000~ HFDE8: 0~650Hz														
	RAM	HED		H1002															
Special monitor select codes read out		H7D	H03	H1013	H0000~H0010: Monitor selected information Special monitor select read out codes as described in the special monitoring code table (H0009 is reserved)														
Special monitor select codes write in		HF3	H06/H10																
Monitor the external operation condition		H7C	H03	H1012	H0000~H000F: <table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td colspan="3">b15-b4</td> <td>b3</td> <td>b2</td> <td>b1</td> <td>b0</td> </tr> <tr> <td>0000</td> <td>0000</td> <td>0000</td> <td>MRS</td> <td>STR</td> <td>STF</td> <td>RES</td> </tr> </table>	b15-b4			b3	b2	b1	b0	0000	0000	0000	MRS	STR	STF	RES
b15-b4			b3	b2	b1	b0													
0000	0000	0000	MRS	STR	STF	RES													

Parameter Description

Item	Shihlin protocol Command code	Modbus Command code	Modbus address	Data content and function description
Monitor the INV real-time data	---	H03	H1014 H1025	<p>The corresponding monitoring value of each Modbus Address is as follows:</p> <p>H1014: external terminal input state H1015: external terminal output state H1016: 2-5 terminal input voltage H1017: 4-5 terminal input current/voltage H1018: AM1-5 terminal output voltage/current H1019: DC bus voltage H101A: the electronic thermal accumulation rate of inverter H101B: inverter output power H101C: the temperature rising accumulation rate of inverter H101D: the NTC temperature accumulation of inverter (the inverter in the mode of 3.7kW or below) H101E: the electronic thermal accumulation rate of motor H101F: target pressure when PID control H1020: feedback pressure when PID control H1021: rotating speed fed back by PG H1022: HDI terminal input frequency H1023: 1-5 terminal input voltage H1024: AM2-5 terminal output voltage / current H1025: output torque of inverter</p>

Parameter Description

Item		Shihlin protocol Command code	Modbus Command code	Modbus address	Data content and function description						
Monitoring	Frequency setup	EEPROM	H73	H03	H1009	H0000~HFDE8 (Two decimal points when P.37=0; One decimal point when non-zero.)					
		RAM	H6D				H1002				
	Output frequency		H6F		H1003	H0000~H9C40 (Same as above)					
	Output current		H70		H1004	H0000~HFFFF (two decimal points)					
	Output voltage		H71		H1005	H0000~HFFFF (two decimal points)					
	Abnormal content		H74		H1007	H1008	H0000~HFFFF : Abnormal codes from the last two times H0000~HFFFF: H74: Error code 1 and 2 b15 b8 b7 b0 <table border="1" style="margin-left: 40px;"> <tr> <td>Error code 2</td> <td>Error code 1</td> </tr> </table> H75: Error code 3 and 4 b15 b8 b7 b0 <table border="1" style="margin-left: 40px;"> <tr> <td>Error code 4</td> <td>Error code 3</td> </tr> </table> For abnormal codes, please refer to the abnormal code list in the abnormal record parameter P.288~P.291.	Error code 2	Error code 1	Error code 4	Error code 3
			Error code 2		Error code 1						
Error code 4	Error code 3										
H75											
Operation command write-in		HFA	H06/ H10	H1001	H0000~HFFFF b8~b15: Preservation b7: Inverter emergency stop (MRS) b6: The second function (RT) b5: High speed (RH) b4: Medium speed (RM) b3: Low speed (RL) b2: Reverse rotation (STR) b1: Forward rotation (STF) b0: Preservation						
Inverter reset		HFD	H06/ H10	H1101	H9696: P.997 function When communicating with the position machine, resetting the inverter will cause the inverter to be incapable of sending data back to the position machine.						
Parameter delete		HFC	H06/ H10	H1104	H5A5A	For details, please refer to the parameter restoration status table.					
				H1103	H9966						
				H1106	H9696						
				H1105	H55AA						
				H1102	HA5A5						

Parameter Description

Item	Shihlin protocol Command code	Modbus Command code	Modbus address	Data content and function description
Parameter read-out	H00~H63	H03	H0000 H02BB	For P.0~P.699, the data range and the position of the decimal point, please refer to the parameter table. The MODBUS address of each parameter corresponds to the hexadecimal digit of the parameter number. For example, the MODBUS address of P.138 is H008A.
Parameter write-in	H80~HE3	H06/H10		
Line speed feedback read-out	---	H03	H100A	H0000~HFDE8
Line speed feedback write-in		H06/H10		
Line speed target value read-out	---	H03	H100B	H0000~HFDE8
Line speed target value write-in		H06/H10		
Tension reference read-out	---	H03	H100C	H0000~H7530
Tension reference write-in		H06/H10		
Torque reference read-out	---	H03	H100D	HD8F0~H2710(-100.00%~100.00%)
Torque reference write-in		H06/H10		
Page change for parameter reading and writing	Read	H7F	---	H0000: P.0~P.99; H0001: P.100~P.199; H0002: P.200~P.299; H0003: P.300~P.399; H0004: P.400~P.499; H0005: P.500~P.599; H0006: P.600~P.699。
	Write	HFF		
Loopback test for asynchronous serial communication	---	H08	H0000 (sub function code for loopback test)	The content value is arbitrary (H0000~HFFFF)

Parameter Description

● Parameter restoration condition table

Data content	Parameter P operation	Communication Parameter P (Note)	<u>P.21</u> , <u>P.125</u> , <u>P.188~P.199</u> , <u>P.292</u> , <u>P.293</u> , <u>P.300~P.326</u> and communication parameter P excluded	Other P parameters	Error codes
H5A5A	<u>P.999</u>	o	o	x	x
H9966	P.999	o	o	o	x
H9696	Communication 999	x	o	x	x
H55AA	Communication 998	x	o	o	x
HA5A5	P.999	x	x	x	o

Note: Communication P parameters include P.32, P.33, P.36, P.48~P.53, P.79, P.153 and P.154.

● The table of the special monitor code

Information	Content	Unit
H0000	Monitor the external terminal input port state.	Note1
H0001	Monitor the external terminal output port state.	Note2
H0002	Monitor the voltage which can be input across terminal 2-5.	0.01V
H0003	Monitor the voltage/current which can be input across terminal 4-5.	0.01A/0.01V
H0004	Monitor the voltage which can be output across terminal AM1-5.	0.01V
H0005	Monitor the busbar voltage value.	0.1V
H0006	Monitor the electronic thermal accumulation rate	---
H0007	The temperature rising accumulation rate of inverter	0.01
H0008	The inverter output power	0.01kW
H000A	The electronic thermal accumulation rate of motor	---
H000B	Target pressure when PID control	0.1%
H000C	Feedback pressure when PID control	0.1%
H000D	The rotating speed fed back by PG	0.01Hz
H000E	The input frequency of terminal HDI	0.01kHz
H000F	The input voltage of terminal 1-5	0.01V
H0010	The output voltage of terminal AM2-5	0.01V

Note: 1. Details of the external terminal input port state.

b15																		b0
						HDI	Reserve	Reserve	M3	RES	M2	M1	M0	STR	STF			

2. Details of the external terminal output port state.

b15																			b0
											Reserve	Reserve	A2B2C2	SO2	A1B1C1	SO1			

5.17 Speed Display (P.37, P.259)

P.37 “Speed display”

P.259 “Speed unit selection”

- In the “output frequency monitoring mode” of DUO1 operation panel, the screen will display the corresponding mechanical speed.

Parameter	Factory setting	Setting range	Remarks	
37	0 r/min	0~5000r/min	0	Output frequency
			0.1~5000.0r/min	P.259=1
		0~9999 r/min	1~9999 r/min	P.259=0
259	1	0, 1	---	

<Setting>

- The set value of P.37 is the mechanical speed of the inverter when its output frequency is 60Hz.
For example: If the transmitting belt speed is 950 m/minute when the inverter output frequency is 60Hz, P.37 shall be set to 950. In the “output frequency monitoring mode” of DUO1 operation panel, the screen will display the speed of the transmitting belt.

Note: 1. There's minute discrepancy between the displayed mechanical speed and the actual one.
2. Please refer to Section [4.1.2](#) for detailed operation of the “operation panel working mode.”

5.18 Function Selection of HDI Terminal and Analog Terminal (P.500, P.501, P.502, P.503)

P.500 “Function selection of terminal 2-5”

P.501 “Function selection of terminal 4-5”

P.502 “Function selection of terminal 1-5”

P.503 “Function selection of terminal HDI”

Parameter	Factory setting	Setting range	Remarks
500	1	0~10	0: non-function
501	1		1: frequency command
502	0		2: torque command
503	0		3: PID target value
			4: PID feedback signal
			5: target tension setting
			6: line speed setting
			7: feedback line speed
			8: real-time curling radius
			9: initial curling radius
			10: material thickness

<Setting>

- When frequency command is selected, 0~±10V/4~20mA corresponds to 0~the maximum output frequency setting.

Note: 1. The default priority level of terminal function selection is 2-5 > 4-5 > 1-5 > HDI, so if you want to set the terminal 1-5 as frequency command, P.500 and P.501 should be set at 0 and P.502 should be set at 1.

2. The function selection of terminal HDI (P.503) is only valid in the mode of tension.

5.19 The Voltage Signal Selection across Terminal 2-5 and Target Frequency (P.38, P.73)

P.38 “The maximum output frequency (the target frequency is set by the input signal across terminal 2-5)”

P.73 “The selection of voltage signal across terminal 2-5”

Related parameters

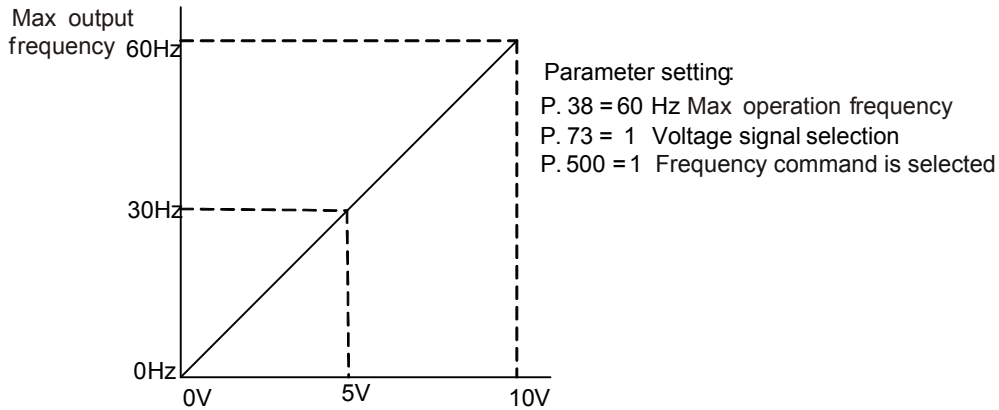
P. 79 “Operation mode selection”
 P. 80~ P.84 ,P. 86,P.126, P. 550
 “Multi-function terminals selection”
 P.189 “ Factory setting function”
 P.500 “Function selection of terminal 2-5”

- The set value of P.38 is the target frequency value of the inverter when the input signal of terminal 2-5 is 5V (10V).

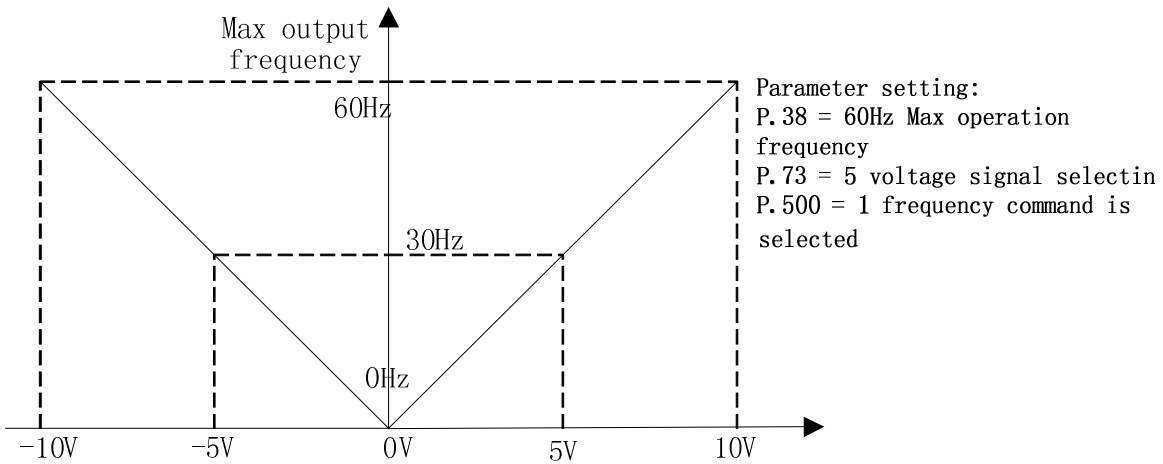
Parameter	Factory setting	Setting range	Remarks	
38	50Hz	1~650Hz	P.189=1	
	60Hz		P.189=0	
73	0	0~5	0	The valid range of signal sampling (terminal 2-5) is 0~5V.
			1	The valid range of voltage signal sampling (terminal 2-5) is 0~10V.
			2	The valid range of voltage signal sampling (terminal 2-5) is 0~ -5V.
			3	The valid range of voltage signal sampling (terminal 2-5) is 0~ -10V.
			4	The valid range of voltage signal sampling (terminal 2-5) is -5~+5V.
			5	The valid range of voltage signal sampling (terminal 2-5) is -10~+10V.

<Setting>

Example 1: This example is the most commonly used method of adjustment. It is used when the inverter is in the “external mode”, “combined mode 2” or “combined mode 4”, and the frequency are set by terminal 2-5.



Example 2: The value of P.73 needs to be changed if the terminal 2-5 connects to negative voltage. The frequency arithmetic is the same as positive voltage and the rotation direction is invariant.



- Note: 1. In “External mode”, “combined mode 2” or “combined mode 4”, the target frequency of the inverter will be determined by the signal between 1-5/2-5/4-5 terminal when RH, RM, RL and REX are all “off.” (the default priority is 2-5>4-5>1-5, please refer to P.500~P.502)
2. RL, RM, RH, REX, AU, RT and RUN mentioned at the end of this section are the function names of “multi-function control terminal”. For the options and functions of multi-function control terminals, please refer to [P.80~P.84](#), [P.86](#), [P.126](#), [P.550](#). For related wiring, please refer to [Section 3.5](#).
3. The selection of range of voltage signal sampling across terminal 2-5 by parameter P.73 will affect the parameters value of 2-5 terminal input signal in section 5.56.

5.20 The Input Signal Selection across Terminal 4-5 and the Target Frequency (P.17, P.39)

P.39 “The maximum operation frequency of terminal 4-5 (the target frequency is set by the input signal of terminal 4-5)”

terminal 4-5

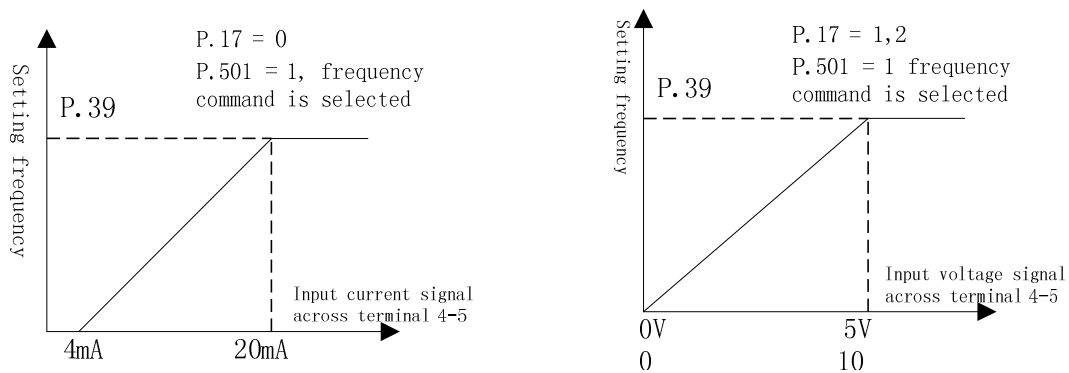
Related parameters
 P.79 “Operation mode selection”
 P. 80~ P.84 ,P. 86,P.126, P.550
 “Multi-function terminals selection”
 P.189 “Factory setting function”
 P.501 “Function selection of terminal 4-5”

P.17 “The selection of current/voltage signal across

- The set value of P.39 is the target frequency value of the inverter when the input signal of terminal 4-5 is 20mA (5V/10V). The input signal across terminal 4-5 is switched by P.17 and toggle switch SW2 on control board, please refer to note 4. When voltage signal is input to the terminal 4-5 and the toggle switch SW2 is set to 0~10V, the effective range of voltage signal sampling is determined by P.17, please refer to P.39.

Parameter	Factory setting	Setting range	Remarks	
39	50Hz	1~650Hz	P.189=1	
	60Hz		P.189=0	
17	0	0~2 (note 4)	0	the effective range of signal sampling across terminal 4-5 is 4~20mA。
			1	the effective range of voltage signal sampling across terminal 4-5 is 0~10V。
			2	the effective range of voltage signal sampling across terminal 4-5 is 0~5V。

<Setting>



- Note: 1. In "external mode", "combined mode 2" or "combined mode 4", if AU is "on" and P.501=1, target frequency of the inverter will be set by the input signal across terminal 4-5. If AU is "off", please refer to [P.500~P.502](#).
2. In "external mode", "combined mode 2" or "combined mode 4", if AU and either one of RH, RM, RL and REX are valid concurrently, multi-speed has higher priority.
3. RL, RM, RH, REX, AU, RT and RUN mentioned at the end of this section are the function names of "multi-function control terminal". For the options and functions of multi-function control terminals, please refer to [P.80~P.84](#), [P.86](#), [P.126](#), [P.550](#). For related wiring, please refer to Section [3.5](#).
4. When P.17=0, the toggle switch SW2 on the control board is set to 4~20mA;
When P.17=1 or 2, the toggle switch SW2 on the control board is set to 0~10V.
5. The selection of the range of signal sampling across terminal 4-5 by parameter P.17 will affect the parameters value of 4-5 terminal input signal in section 5.57.

5.21 The Voltage Signal Selection across Terminal 1-5 and the Target Frequency (P.509, P.530)

P.509 “The maximum operation frequency of terminal 1-5 (the target frequency is set by the input signal of terminal 1-5)”

P.530 “The selection of voltage signal across terminal 1-5”

Related parameters

P. 79 “Operation mode selection”
 P. 80~ P.84 ,P. 86,P.126, P.550
 “Multi-function terminals selection”
 P. 189 “Factory setting function”
 P.501 “Function selection of terminal 4-5”

•The set value of P.509 is the target frequency value of the inverter when the input signal of terminal 1-5 is 5V (10V).

Parameter	Factory setting	Setting range	Remarks	
509	50Hz	1~650Hz	P.189=1	
	60Hz		P.189=0	
530	0	0~5	0	The valid range of signal sampling (terminal 1-5) is 0~5V.
			1	The valid range of voltage signal sampling (terminal 1-5) is 0~10V.
			2	The valid range of voltage signal sampling (terminal 1-5) is 0~ -5V.
			3	The valid range of voltage signal sampling (terminal 1-5) is 0~ -10V.
			4	The valid range of voltage signal sampling (terminal 1-5) is -5~+5V.
			5	The valid range of voltage signal sampling (terminal 1-5) is -10~+10V.

• Please refer to the terminal 2-5 for the function setting of analog input terminal 1-5.

Note: 1. In “external mode”, “combined mode 2” or “combined mode 4”, if RH, RM, RL and REX are all “off”, target frequency of the inverter will be set by the input signal across terminal 1-5/2-5/4-5. If AU is “off”, please refer to P.500~P.502.

2. RL, RM, RH, REX, AU, RT and RUN mentioned at the end of this section are the function names of “multi-function control terminal”. For the options and functions of multi-function control terminals, please refer to P.80~P.84, P.86, P.126, P.550. For related wiring, please refer to Section 3.5.

3. The selection of range of voltage signal sampling across terminal 1-5 by parameter P.530 will affect the parameters value of 1-5 terminal input signal in 5.58 section.

5.22 Multi-function Output (P.40, P.85, P.120, P.129, P.130)

P.40 “Multi-function output terminal SO1-SE function selection”

P.85 “Function selection for multi-function relay A1-B1-C1”

P.120 “Output signal delay time”

P.129 “Function selection for multi-function output terminal SO2-SE”

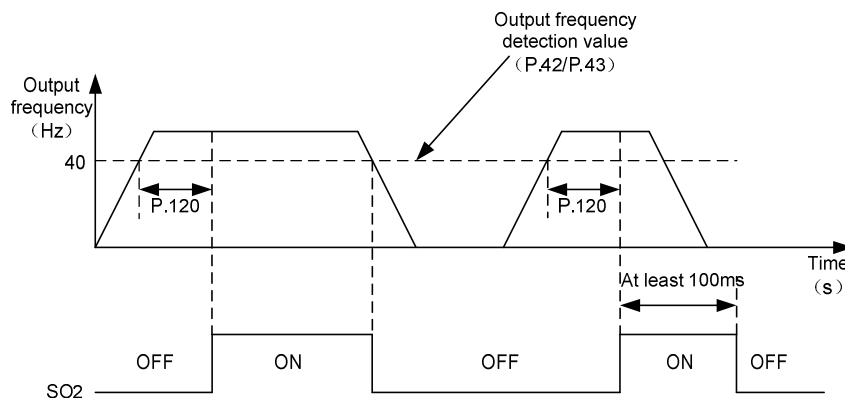
P.130 “Function selection for multi-function relay A2-B2-C2”

Parameter	Factory setting	Setting range	Remarks	
40	1	0~10, 16~18	0	RUN (Inverter running): Signals will be sent out when the output frequency is equal to or higher than the starting frequency.
			1	SU (Reaching the output frequency): Signals will be sent out once the output frequency reaches the set frequency.
			2	FU (Output frequency detection): It is the output signal when detecting the frequency exceeding the assigned frequency during the operation.
85	5		3	OL (Overload detection): It is the output signal when the current limit function is triggered.
			4	OMD (Zero current detection): If the current output percentage of the inverter is less than the set value of <u>P.62</u> and has exceeded <u>P.63</u> for a period of time, OMD will output the signal.
129	2		5	ALARM (Alarm detection): An alarm signal detected.
			6	PO1 (Section detection): In the programmed operation mode, the signal will be sent out at the end of each frequency operation.
			7	PO2 (Periodical detection): In the programmed operation mode, the signal will be sent out at the end of each operation cycle.
130	0		8	PO3 (Pause detection): In the programmed operation mode, the signal will be sent out when the operation is suspended.
			9	BP (Inverter output): Switch between the inverter operation and the commercial power-supply operation function; in inverter operation, BP will send out signals.
		10	GP (Commercial power-supply output): Switch between the inverter operation and the commercial power-supply operation function; in the commercial power-supply operation, GP will send out signals.	
		16	FAN (Abnormal signal of fan): the output signal when the fan detection return circuit has a problem.	
		17	RY (The accomplishment of inverter running preparation): the output signal when resetting is accomplished after the inverter is powered on. (the starting signal ON is in the started state)	
		18	Maintenance alarm detection	

Parameter	Factory setting	Setting range	Remarks
120	0 s	0.1~3600s	1). When P.120=0 and the setting requirements of P.40 (P.85, P.129~P.130) is met, the signal will output directly. 2). When P.120=0.1~3600 and the setting requirements of P.40 (P.85, P.129~P.130) is met, the signal will output after a setting delay time.

<Setting>

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



- Note: 1. For the multi-function output terminal SO1, the default value of P.40 is 1 which means the “SU” function. When changing the value of P.40, the corresponding function will change as shown in the above table.
2. For the multi-function output terminal SO2, the default value of P.129 is 2 which means the “FU” function. When changing the value of P.129, the corresponding function will change as shown in the above table.
3. The internal structures for multi-function output terminals SO1/SO2-SE are “open collector output.” Please refer to Section 3.5.6 and Section 3.5.7.
4. For multi-function relay A1-B1-C1, the default set value of P.85 is 5 (i.e., the alarm function). When the value of P.85 is revised, its function will change respectively according to the function listed in the table above.
5. For multi-function relay A2-B2-C2, the default set value of P.130 is 0 (i.e., the run function). When the value of P.130 is revised, its function will change respectively according to the function listed in the table above.

5.23 Up-to-frequency Sensitivity (P.41)

P.41 “Up-to-frequency sensitivity”

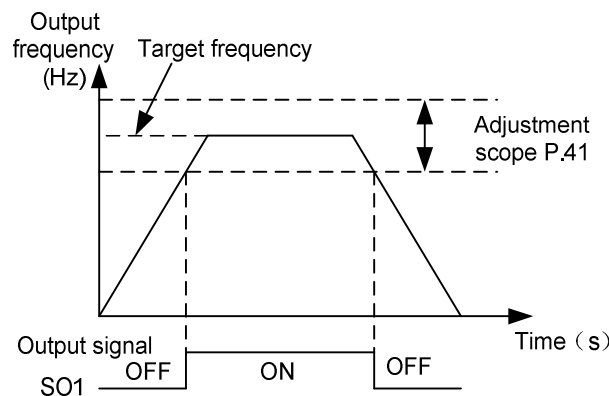
Related parameters

- P.40 “Multi-function output terminal SO1-SE function selection”
- P.85 “Function selection for multi-function relay A1-B1-C1”
- P.129 “Function selection for multi-function output terminal SO2-SE”
- P.130 “Function selection for multi-function relay A2-B2-C2”

Parameter	Factory setting	Setting range	Remarks
41	10%	0~100%	---

<Setting>

- If P.41=5%, SU will send out signals when the output frequency enters the “5% region near the target frequency”. For example, when the target frequency is set to 60Hz and P.41=5%, then if the output frequency is between $60 \pm 60 \times 5\% = 57\text{Hz}$ and 63Hz, a SU signal will be sent out.



Note: In this paragraph, SU is the function name for “multi-function output terminal”. Please refer to [P.40](#) and [P.130](#). For wiring, please refer to Section [3.5](#).

5.24 Output Frequency Detection (P.42 and P.43)

P.42 “Output frequency detection for forward rotation”

P.43 “Output frequency detection for reverse rotation”

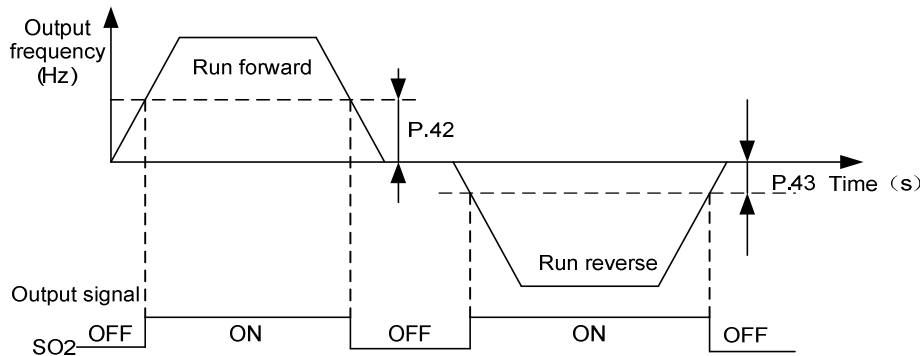
Related parameters

- P.40 “Multi-function output terminal SO1-SE function selection”
- P.85 “Function selection for multi-function relay A1-B1-C1”
- P.129 “Function selection for multi-function output terminal SO2-SE”
- P.130 “Function selection for multi-function relay A2-B2-C2”

Parameter	Factory setting	Setting range	Remarks
42	6Hz	0~650Hz	---
43	99999	0~650Hz, 99999	99999; same as P.42 setting

<Setting>

- If P.42=30 and P.43=20, then SO2 will send signals when the forward rotation output frequency exceeds 30Hz or when the reverse rotation output frequency exceeds 20Hz.
- If P.42=30 and P.43=99999 (factory default), then SO2 will send out signals when the forward or reverse rotation output frequency exceeds 30Hz.



Note: In this paragraph, SO2 is the function name for “multi-function output terminal”. Please refer to [P.40](#).
For wiring, please refer to Section [3.5](#).

5.25 AM1/HDO Terminal (P.54~P.56, P.64, P.74, P.187, P.190 and P.191)

[P.54 “AM1/HDO terminal function selection”](#)

[P.187 “FM calibration parameter”](#)

[P.55 “Frequency display reference”](#)

[P.190 “AM1 output bias”](#)

[P.56 “Current monitoring reference”](#)

[P.191 “AM1 output gain”](#)

[P.64 “AM1 output terminal selection”](#)

[P.74 “HDO output terminal selection”](#)

- When the toggle switch SW12 is set to AM1 and P.64=0, 2, 3, the external terminal AM1 is valid (please refer to note 1, 2). The following explanations about terminal AM1 are all based on the premise.
- When the toggle switch SW12 is set to HDO and P.64=1, the external terminal HDO is valid (please refer to note 3, 4). The following explanations about terminal HDO are all based on the premise.

Parameter Description

Parameter	Factory setting	Setting range	Remarks	
54	0	0~4	0	Output frequency, the frequency display reference P.55 is 100%.
			1	Output current, the current monitoring reference P.56 is 100%.
			2	Output DC busbar voltage, the OV level is 100%.
			3	Output the temperature rising accumulation rate of inverter, the NTC level is 100%.
			4	Output the electronic thermal rate of the inverter, the electronic thermal relay running (when P.9≠0) or the electronic thermal relay of the inverter's IGBT module running (when P.9=0) is 100%.
55	50Hz	0~650Hz	P.189=1	
	60Hz		P.189=0	
56	Rated current	0~500A	---	
64	0	0~3	0	AM function, 0~10V voltage can be output across terminal AM1-5.
			1	The terminal HDO output function
			2	AM function, 0~20mA current can be output across terminal AM1-5.
			3	AM function, 4~20mA current can be output across terminal AM1-5.
74	0	0~9000	0	Select FM function as the output function of terminal HDO
			1~9000	Select the square-wave pulse which is P.74 times of running frequency as the output of terminal HDO
187	---	0~9998	The factory adjusted value	
190	---	0~2500	The factory adjusted value	
191	---	0~2500	The factory adjusted value	

<Setting>

- The current/voltage output of terminal AM1 is set by both the toggle switch SW6 on control board and P.64. When the user need to select the output type of terminal AM1, please turn the toggle switch SW6 to the corresponding type at first and then set the value of P.64
- When P.74=0 and P.64=1, the terminal HDO select FM function, wiring shown as figure 6, Which displays the output current or frequency of the inverter.
- The output of the terminal AM1 and the output of the terminal HDO with FM function are shown as follows:

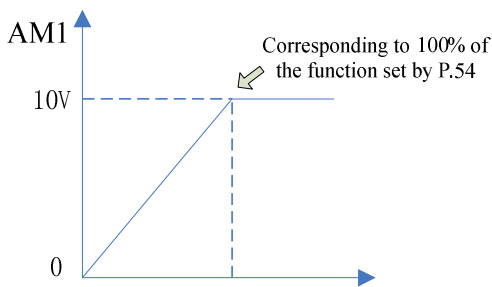


Figure 1. AM1-5 output 0~10V voltage

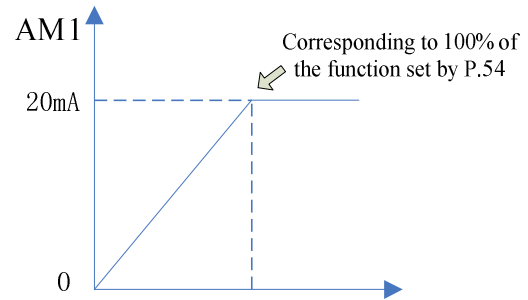


Figure 2. AM1-5 output 0~20mA current

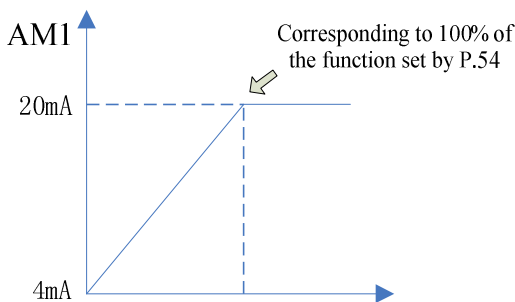


Figure 3. AM1-5 output 4~20mA current

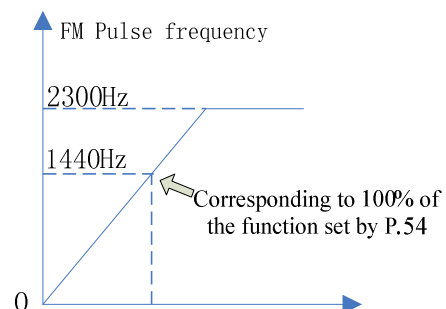


Figure 4. FM pulse output

- The voltage/current calibration procedures of AM1 terminal:
 1. Set the toggle switch SW6 to 0~10V/0~20mA, then set P.64 at 0 or 2.
 2. Insert an electric meter with a full graduation of 10V/20mA across terminal AM1 and terminal 5. Set P.54 at 0. Calibrate the header due to accessory variation.
 3. Set P.13 at 0. Start the motor. Fix the output frequency of the inverter to 0 Hz.
 4. Press \blacktriangle to adjust the value of P.190. The screen will display the accumulated output bias voltage of AM1. Press $\boxed{\text{SET}}$ for more than 1 second, and the pointer will move upward. Press \blacktriangle to reduce the value of P.190, and the screen will display the progressively decreased output bias voltage of AM1. Press $\boxed{\text{SET}}$ for more than 1second, and the pointer will move downward. When the pointer is adjusted to 0, the calibration of AM1 output bias voltage is completed.
 5. Adjust and fix the output frequency of the inverter at 60 Hz.
 6. Read the set value of P.191, and the screen will display the current output gain of AM1.
 7. Press \blacktriangle or \blacktriangledown to adjust the value of P.191. Press $\boxed{\text{SET}}$ for more than 1 second, and the pointer will move upward or downward. When the pointer moves to the full-scale position, the calibration is completed.
- HDO terminal calibration procedures:
 1. Wiring as figure 6 shown, and set P.64 at 1 and P.54 at 0. Calibrate the header for accessory variation.
 2. Start the motor and fix the output frequency of the inverter to 60 Hz.
 3. When the motor runs steadily, read the set value of P.187. At this point, the screen will

display the FM correction index. Press \blacktriangle to adjust the value of P.187. The screen will display a progressively increase of the FM correction index. Press \square SET for more than 1 second, and the pointer will move upward. Press \blacktriangledown to adjust the value of P.187 downward, and the screen will display a progressively decrease of the FM correction index. Press \square SET for more than 1 second and the pointer will move downward.

- When P.64 = 1 and P.74 is set to 1~9000, the external terminal HDO select the frequency multiplication output function which maximum frequency is 100 kHz.
- When P.64=1, P.74 is set at 5 and the instantaneous frequency of operation is 20Hz, the output pulse wave between terminal HDO and terminal SD is as following diagram:

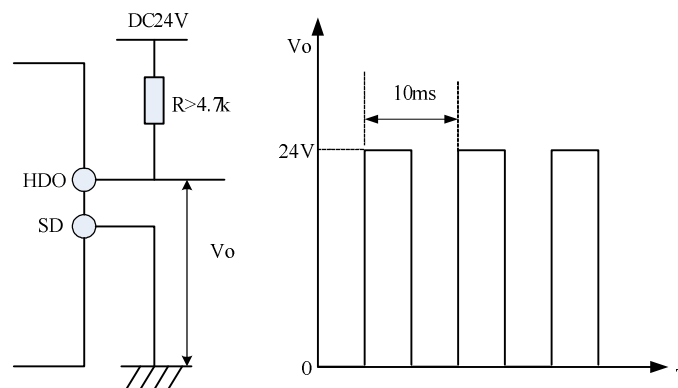


Figure 5

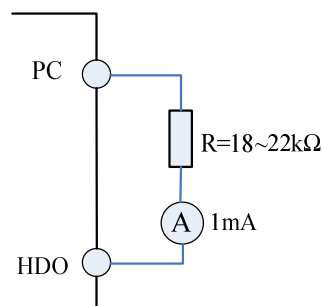


Figure 6

- Note: 1. Whether the terminal AM1 or the terminal HDO is valid is determined by both the toggle switch SW12 on control board and the parameter P.64. The factory default value is that the terminal AM1 is valid.
2. When P.64=1 or SW12 is set to HDO, the terminal AM1 is invalid.
3. When P.64 = 0, 2, 3 or SW12 is set to AM1, the terminal HDO is invalid.
4. Functions of FM and frequency multiplication share a hardware terminal. Changing the value of P.74 can switch the function between FM and frequency multiplication.
5. When P.64=1 and P.74=1, the output is one time of the running frequency. And the inverter can provide the output from 1~650Hz which precision is 1%. The bigger the value of P.74 and the bigger the running frequency is, the worse the precision will be.

5.26 AM2 Terminal (P.535 ~ P.538)

P.535 “AM2 output bias”

P.536 “AM2 output gain”

P.537 “AM2 terminal function selection”

P.538 “AM2 output terminal selection”

Parameter	Factory setting	Setting range	Remarks	
535	---	0~2500	Factory default value	
536	---	0~2500	Factory default value	
537	0	0~4	Refer to P.54	
538	0	0, 2, 3	0	0~10V voltage is selected to be outputted from the terminal AM2
			2	0~20mA current is selected to be outputted from the terminal AM2
			3	4~20mA current is selected to be outputted from the terminal AM2

Note: 1. Please refer to the instruction of AM1 for this terminal function. The operation of adjusting the bias voltage and gain of AM2 is similar to AM1. P.535 corresponds to P.190, and P.536 corresponds to P.191.

2. The output current/voltage of terminal AM2 is controlled by both the toggle switch SW5 on the control board and the parameter P.538. The factory default value is 0~10V.

5.27 Restart Function (P.57, P.58, P.150 and P.160)

P.57 “Restart coasting time”

P.58 “Restart cushion time”

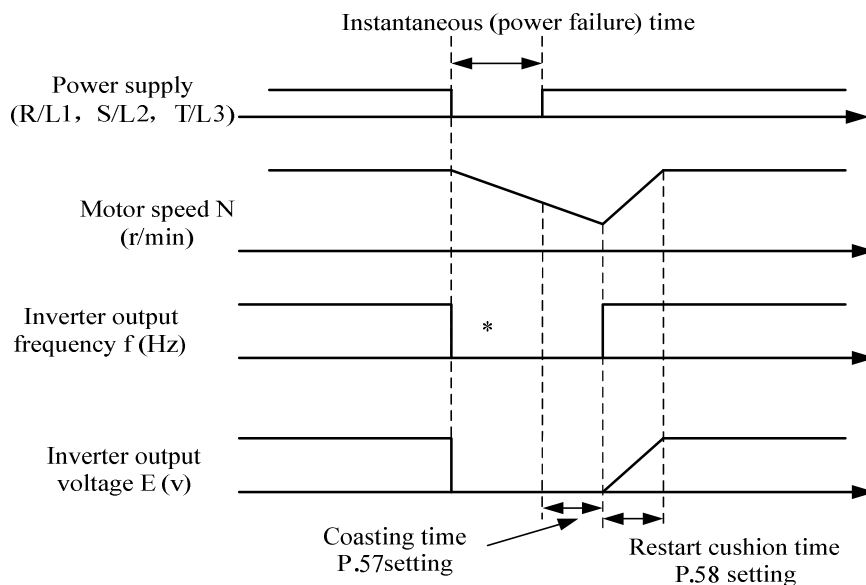
P.150 “Restart mode selection”

P.160 “Stall prevention operation level when restart”

Parameter	Factory setting	Setting range	Remarks
57	99999	0~30s, 99999	99999: No restart function
58	5s (7.5kW or below)	0~60s	---
	10s (11kW~55kW)		
	20s (75kW or above)		
150	0	0~221	---
160	100%	0~150%	Stall prevention operation level when restarting the machine

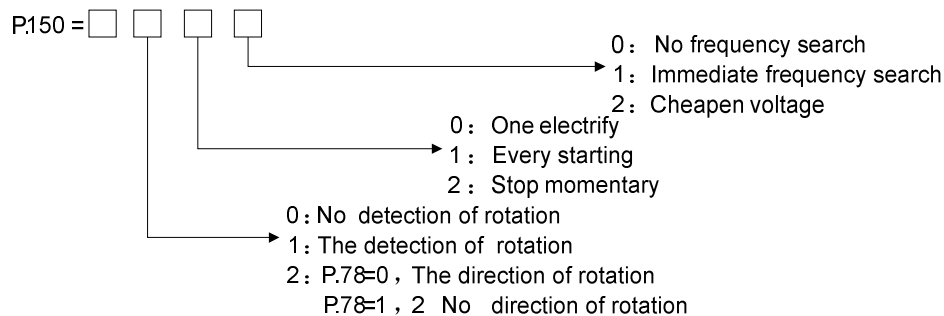
<Setting>

- Once the driving power is interrupted while the motor is still running, voltage output will be stopped instantly. When the power is recovered and P.57=99999, the inverter will not restart automatically. When P.57=0.1~30, the motor will coast for a while (the set value of P.57) before the inverter restarts the motor automatically.
- Once the motor is restarted automatically, the output frequency of the inverter will be the target frequency, but the output voltage will be zero. Then the voltage will be increased gradually to the expected voltage value. The period for voltage increase is called “Restart cushion time (P.58)”.



* The output shut off timing differs according to the load condition

- There are four digits in P.150, and every digit has a different meaning and relevant position as following:



- Note: 1. When one needs an instant restart function, P.150 must be set.
 2. When P.150 is nonzero, linear acceleration / deceleration curve is the default.
 3. The direction detection position of P.150 is only valid for direct frequency search.
 4. This function is only valid under the V/F mode; i.e., it is effective when P.300=0.

5.28 Input Signal Filter Constant (P.60, P.528, P.529)

P.60 “2-5 Input signal filter constant”

P.529 “1-5 Input signal filter constant”

P.528 “4-5 Input signal filter constant”

Parameter	Factory setting	Setting range	Remarks
60	31	0~31	---
528	31	0~31	---
529	31	0~31	---

<Setting>

- 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 cause a fluctuating operation frequency. This will make the output frequency unstable.
- The parameters P.60, P.528, P.529 are used to filter the fluctuation of the running frequency caused by the above factors. The larger set value can improve the filter performance yet delay the effect.

5.29 Remote Setting Function (P.61)

P.61 “Remote setting function selection”

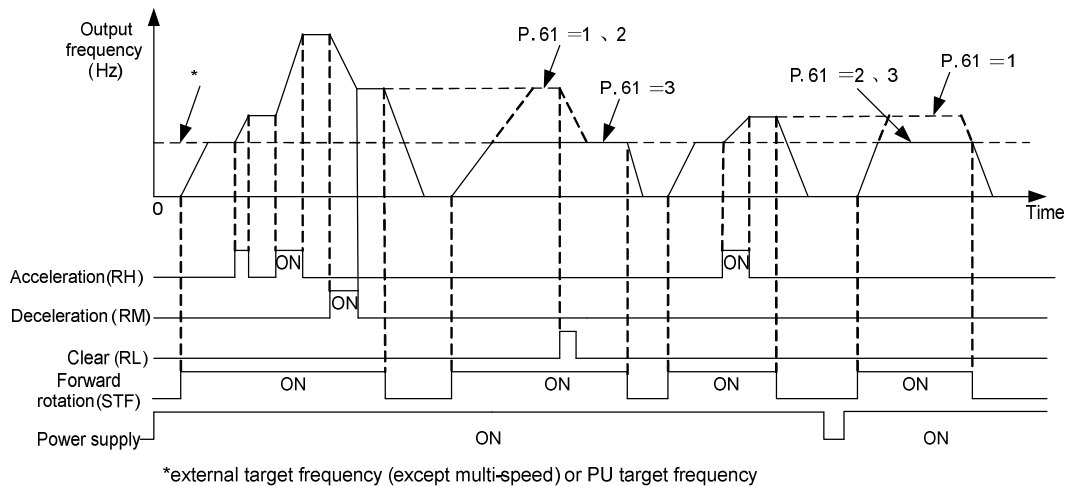
Related parameters

P.1 “Maximum frequency”
 P.7 “Acceleration time”
 P.8 “Deceleration time”
 P.18 “High-speed maximum frequency”
 P.44 “The second acceleration time”
 P.45 “The second deceleration time”

- If the operation box is located away from the control box, one can use contact signals to perform variable-speed operation without using analog signals under the external mode, PU mode, combined mode 1 and combined mode 4.

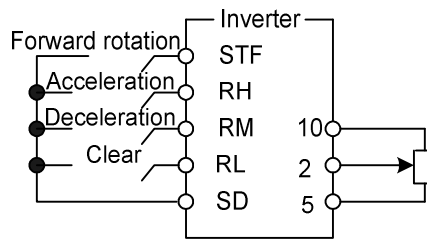
Parameter	Factory setting	Setting range	Remarks		
			Values	Remote setting function	Frequency setup storage function
61	0	0~3	0	No	---
			1	Yes	Yes
			2		No
			3		No(the remote setting frequency is cleared by STF/STR “turn off”)

<Setting>



• Remote setting function

1. Whether the remote setting function is valid and whether the frequency setting storage function in the remote setting mode is used or not are determined by P.61. Set P.61=1~3 (valid remote setting function), the function of terminal RM, RH and RL will be changed to acceleration (RH), deceleration (RM) and clear (RH). See the following figure:



Wiring of the remote control setting

2. In the 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)

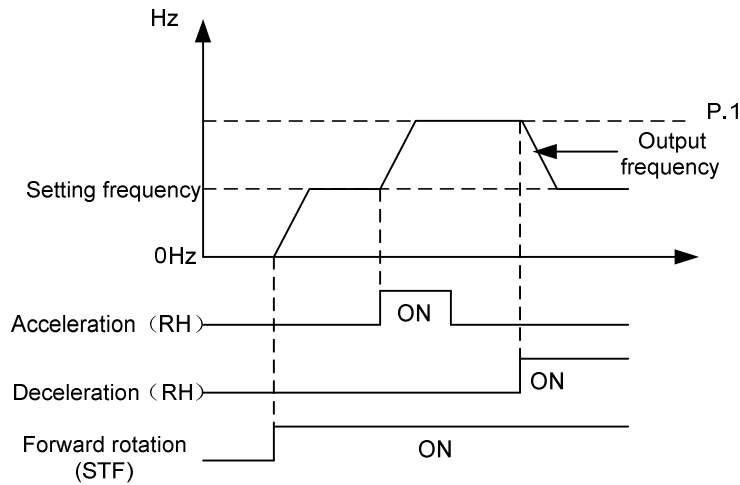
• Frequency setting storage condition

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

<Frequency setting storage condition>

- (1). It is the frequency when the start signal (STF/STR) is "off".
- (2). When the signal RH (acceleration) and RM (deceleration) are both "off" and "on", the remote-set frequency is stored every minute. (Current frequency set value and the last frequency set value are compared ever minute. If they are different, then the current frequency set value is written in the memory. If RL is on, write-in will unavailable).

Note: 1. The frequency can be varied by RH (acceleration) and RM (deceleration) between 0 and (the maximum frequency – frequency set by the main speed). The output frequency is limited by P.1.



2. When the acceleration or deceleration signal is “on”, the acceleration / deceleration time will be determined by the set value of P.7 (the first acceleration time) and P.8 (the first deceleration time).
3. When RT signal is “on” and P.44≠99999 (the second acceleration time), P.45≠99999 (the second deceleration time), the acceleration / deceleration time will be determined by the set value of P.44 and P.45.
4. When the start signal (STF/STR) is “off” and RH (acceleration) / RM (deceleration) is “on”, the target frequency will also change.
5. When the start signal (STF/STR) becomes “off”, make the frequency setting storage function invalid (P.61=2, 3) if the frequency has to be changed continuously through RH/RM. If the frequency setting storage function is valid (P.61=1), the life of EEPROM will be shortened by frequent EEPROM data writing.
6. RH, RM and RL mentioned in this chapter are function names of “multi-function control terminal”. If the functions of the terminals are changed, other functions are likely to be affected. Please verify the functions of the terminals before changing the options and functions of the multi-function control panel (please refer to P.80~P.84、P.86、P.126、P.550). For wiring, please refer to Section 3.5.

5.30 Zero Current Detection (P.62 and P.63)

P.62 “Zero current detection level”

P.63 “Zero current detection time”

Related parameters

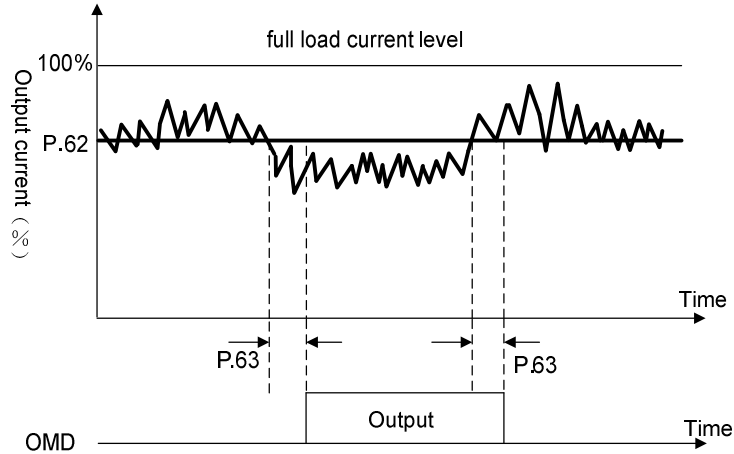
- P.40 “Multi-function output terminal SO1-SE function selection”
- P.85 “Function selection for multi-function relay A1-B1-C1 ”
- P.129 “Function selection for multi-function output terminal SO2-SE”
- P.130 “Function selection for multi-function relay A2-B2-C2”

Parameter	Factory setting	Setting range	Remarks
62	5%	0~200%, 99999	Function invalid
63	0.5s	0.05~1s, 99999	Function invalid

<Setting>

- Assume the inverter's rated is full-loaded, the current is 20A, P.62=5% and P.63=0.5s, then when the output current is smaller than $20 \times 5\% = 1A$ and exceeding 0.5s, OMD will send out signals.

See the figure below:



- If the set value of P.62 or P.63 is 99999, the zero current detection function is disabled.

Note: In this paragraph, OMD is the function name for “multi-function output terminal”. Please refer to [P.40](#). For wiring, please refer to [Section 3.5](#).

5.31 Retry Function (P.65, P.67, P.68, P.69)

P.65 “Retry selection”

P.67 “Number of retries at alarm occurrence”

P.68 “Retry waiting time”

P.69 “Retry accumulation time at alarm”

- When an alarm goes off, a “retry” will take place to restore the previous setting.
- Inverter's retry is performed conditionally. When the alarm goes off and the inverter has an automatic retry, the re-occurrence of alarm going off before a set time is called a “continuous alarm”. If continuous alarms happen for more than a set time, there is a significant malfunction. In this case, manual trouble shooting is necessary. The inverter at this point will perform no more the retry function. The number of Pre-defined occurrence is called “number of retries at abnormality (P.67)”.
- If none of the alarm belongs to "continuous alarms", the inverter will perform retry for unlimited times.
- The period from the moment of alarm to that of retry is defined as “retry waiting time”.

Parameter Description

Parameter	Factory setting	Setting range	Remarks	
65	0	0~4	0	When P.65=0, retry is invalid. When alarm occurs, the voltage output is stopped, and all the inverter functions are disabled.
			1	When P.65=1, in case of “over-voltage between +/P and -/N”, the voltage output is stopped. After a period of waiting time (the set value of P.68), the inverter will perform the retry function.
			2	When P.65=2 and “over-current” occurs, voltage output is stopped. After a period of waiting time (the set value of P.68), the inverter will perform the retry.
			3	When P.65=3, in case of “over-voltage between +/P and -/N”, the voltage output is stopped. After a period of waiting time (the set value of P.68), the inverter will perform the retry.
			4	When P.65=4, all the alarms have the retry function. When the alarm goes off, the voltage output will be stopped. After a period of waiting time (the set value of P.68), the inverter will perform the retry.
67	0	0~10	0	When P.67=0, retry is invalid.
			1~10	When P.67≠0, given continuous alarm occurs for times within the set value of P.67, the inverter will perform the retry function. However, once the set value of P.67 is exceeded, the inverter will not perform the retry function.
68	1s	0~360s	---	

<Setting>

- For each time a retry happens, the value of P.59 will be increased by one automatically. Therefore, the number of P.69 read from the memory indicates the number of retries that have occurred.
- If P.69 is rewritten with 0, the number of retry executed is cleared.

Note: The inverter will perform retry only after the retry waiting time of P.68. Therefore when using this function, please be aware of the possible danger when operating the inverter.

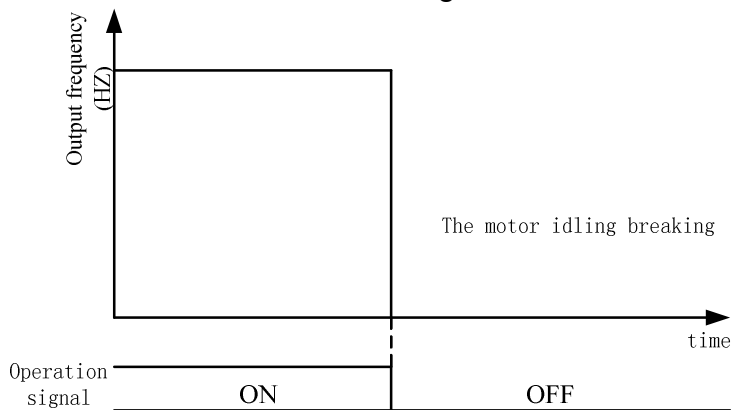
5.32 Brake Selection (P.71)

P.71 “Idling braking and linear braking selection”

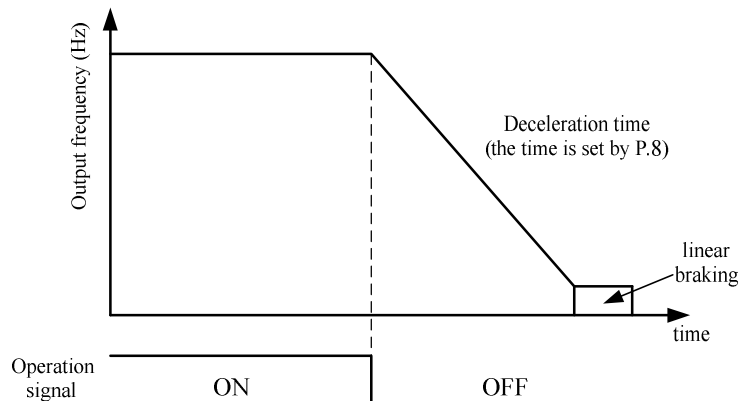
Parameter	Factory setting	Setting range	Remarks
71	1	0, 1	---

<Setting>

- P.71=0 is now idling braking. The inverter will terminate the output immediately after the stop sign is pressed, and the motor will be “racing”.



- P.71=1, it is now linear braking. The output of the inverter will follow the acceleration / deceleration curve after the stop sign is pressed.



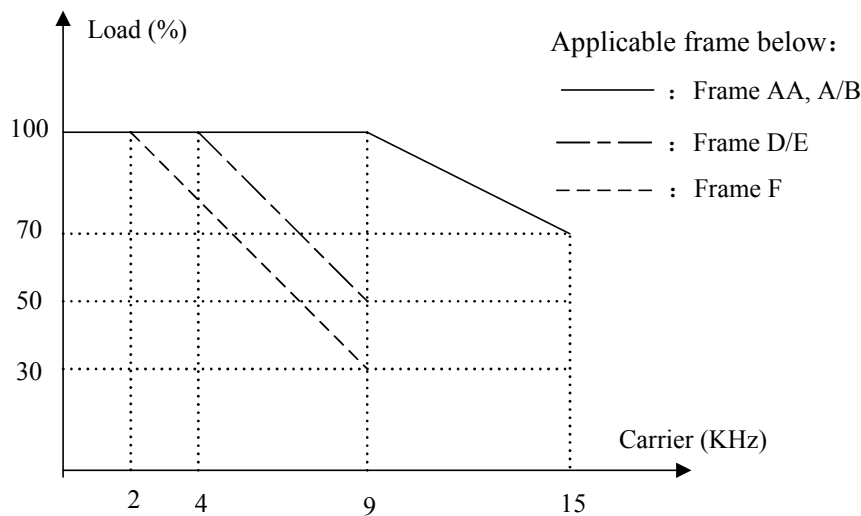
5.33 Carrier Frequency (P.72)

P.72 “Carrier frequency”

Parameter	Model	Factory setting	Setting range	Remarks
72	Frame AA, Frame A/B	5kHz	1~15 kHz	---
	Frame D/E	4kHz	1~9 kHz	
	Frame F	2kHz	1~9 kHz	

<Setting>

- The higher the carrier frequency, the lower the motor acoustic noise. Unfortunately, it will result in greater leakage current and larger noises generated by the inverter.
- The higher the carrier frequency, the more energy dissipated, and the higher the temperature of the inverter.
- In case of a mechanical resonance occurring in a system within the inverter, P.72 is helpful for improving the performance by adjusting its value.
- The derating curve is as follows:



1. For the frame AA, A/B: the carrier is 9K, and the load is 100%.The load will decrease 5% as the carrier increases 1K each time. For example: the carrier is 15K, and the load is 70%.
2. For frame D/E, the carrier is 4K, and the load is 100%.The load will decrease 10% as the carrier increases 1K each time. For example: the carrier is 9K, and the load is 50%.
3. For frame F, the carrier is 2K, and the load is 100%.The load will decrease 10% as the carrier increases 1K each time. For example: the carrier is 9K, and the load is 30%.
4. For the inverter type the frame includes, please refer to the introduction of “Appearance and Dimension” in section 3.3.




Note: 1. The optimum carrier frequency shall be 8 times greater than the target frequency.

5.34 Stop or Reset Function Selection (P.75)

P.75 “Stop or reset function selection”


Parameter	Factory setting	Setting range	Remarks
75	1	0, 1	---


<Setting>

- When P.75=0, it is only suitable for the PU and H2 mode (combined mode 2). Press  to stop the operation.
- When P.75=1, it is only suitable for the chosen mode. Press  to stop the motor.
- When the alarm goes off, press  for 1 second to reset the inverter.

Note: 1. In normal or abnormal condition reset the inverter by parameter P.997.

2. There are two built-in programs simulating the thermally-accumulating relay in the inverter, namely, the "electronic thermal relay" and "IGBT module thermal relay". After resetting the inverter, the values of the two relays of "electronic thermal relay" and "IGBT module thermal relay" will be set to zero.

3. In any modes except the PU and the H2 mode and when P.75=1, the motor can be stopped by pressing . The inverter then displays E0 and all functions of the inverter are disabled. To restart in the external mode, follow the procedures below:

Press  (The external STF/STR command will remove E0 to continue the operation). There is a start signal in the programmed operation mode. Once E0 is removed, the inverter will run at the section where it stopped after reset.)

4. To remove E0 in other modes, please turn the power off and on.

5.35 Parameters Write Protection (P.77)

P.77 “Parameters write protection”

Parameter	Factory setting	Setting range	Remarks
77	0	0~2, 4	---

<Setting>

- If P.77=0 and the motor stops, all parameters can be rewritten except P.188 and P.90. When the motor is running, only P.4~P.6, P.24~P.27, P.54~P.56, P.77, P.131~P.138, P.142~P.149, P.161, P.187, P.190~P.199, P.221~P.225, P.230, P.232, P.288, P.290, P.510~P.525, P.535~538, P.401 and P.605.
- If P.77=1 and when the motor stops, only P.77 and P.79 can be rewritten. When the motor is running, parameter-writing is forbidden except P.77 and P.79.
- If P.77=2 and when the motor stops, all parameters can be written except P.188 and P.90. When the motor is running, some parameters, including P.22, P.72, P.78, P.79, P.90, P.155, P.160, P.188, P.402, P.403 cannot be written.

- If P.77=4, there is password(P.295). In the condition of lock, other parameters besides only-read ones can not be read; In the condition of no password set or password unlocked, the situation is the same with P.77=0

5.36 Forward/Reverse Rotation Prevention Selection (P.78)

P.78 “Forward/reverse rotation prevention selection”

Parameter	Factory setting	Setting range	Remarks	
78	0	0~2	0	Forward rotation and reverse rotation are both permitted.
			1	Reverse rotation is prohibited (Press the reverse command to decelerate and stop the motor).
			2	Forward rotation is prohibited (Press the forward rotation command to decelerate and stop the motor).

5.37 Operation Mode Selection (P.79)

P.79 “Operation mode selection”

Parameter	Factory setting	Setting range	Remarks	
79	0	0~8	0	“PU mode”, “external mode” and “Jog mode” are interchangeable.
			1	“PU mode” and “JOG mode” are interchangeable.
			2	“External mode” only
			3	“Communication mode” only
			4	“Combined mode 1” only
			5	“Combined mode 2” only
			6	“Combined mode 3” only
			7	“Combined mode 4” only
			8	“Combined mode 5” only

Please refer to Section [4.1](#) for details.

5.38 Multi-function Terminal Function Selection

(P.80~P.84, P.86, P.126, P.550)

P.80~P.84, P.86, P.126, P.550 “Multi-function terminal function selection”

Relevant Parameters	Corresponding terminal	Factory setting	Setting range	Value	Function name	Function description	Remarks
80	M0	2	0~40, 43~53, 55~56	0	STF	In “external mode”, “combined mode 1”, or “combined mode 3”, and when STF is on, the inverter runs forward.	In programmed operation mode, it is used as the start signal terminal.
				1	STR	In “external mode”, “combined mode 1”, or “combined mode 3”, and when STF is on, the inverter runs forward.	In programmed operation mode, it is used as the pause signal terminal.
				2	RL	Multi-speed	Please refer to P.4~P.6 for multi-speed instruction.
				3	RM	Multi-speed	
81	M1	3	0~40, 43~53, 55~56	4	RH	Multi-speed	Refer to P.39
				5	AU	In “external mode”, “combined mode 2” or “combined mode 4”, the inverter target frequency is set by the signal input across terminal 4 -5.	
				6	OH	(Note 3)	
				7	MRS	When MRS is “turned on”, the output of the inverter will be terminated immediately.	
				8	RT	When RT is “on”, the characteristics are the same as the second function.	Refer to P.44

Parameter Description

Relevant Parameters	Corresponding terminal	Factory setting	Setting range	Values	Function name	Function description	Remarks
82	M2	4	0~40, 43~53, 55~56	9	EXJ (External JOG)	In "external mode" and when EXJ is "on", the target frequency is set by P.15, and the acceleration / deceleration time is set by P.16.	
				10	STF+EXJ	Multiplexed function	
83	STF	0	0~40, 43~53, 55~56	11	STR+EXJ		The multiplexed function of the external terminal is the complex of several basic functions.
				12	STF+RT		
				13	STR+RT		
				14	STF+RL		
				15	STR+RL		
84	STR	1	0~40, 43~53, 55~56	16	STF+RM		
				17	STR+RM		
				18	STF+RH		
				19	STR+RH		
				20	STF+RL+RM		
				21	STR+RL+RM		
86	RES	30	0~40, 43~53, 55~56	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" and when Run is "on", the motor will have a forward rotation.	

Parameter Description

Relevant Parameters	Corresponding terminal	Factory setting	Setting range	Values	Function name	Function description	Remarks
126	M3	5	0~40, 43~53, 55~56	29	STF/STR	In "external mode", it is used with RUN. The inverter has a reverse rotation when STF/STR is "on", but a forward rotation when STF/STR is "off".	Forward /reverse rotation control signal
				30	RES	External reset function	
				31	STOP	In "external mode", it can be used as a three-wire mode with the RUN signal or the STF-STR terminal (Note 4).	
				32	REX	Multi-speed set (16 levels)	
550	HDI	57	0~41, 43~57	33	PO	In "external mode" and when PO is "on", programmed operation mode is chosen (Note 5).	
				34	RES_E	When alarms occur, external reset become valid only when the alarm goes off.	
				35	MPO	In "external mode" and when MPO is "on", the manually operation cycle mode is chosen.	
				36	TRI	When TRI is on, triangle wave function is chosen.	

Parameter Description

Relevant Parameters	Corresponding terminal	Factory setting	Setting range	Values	Function name	Function description	Remarks
550	HDI	57	0~41, 43~57	37	GP_BP	Automatic switchover frequency between inverter and commercial power-supply operation.	
				38	CS	Manual switch to commercial power supply	
				39	STF/STR +STOP	The motor has a reverse rotation when the RUN signal is integrated into the external mode. Stop the motor and then run the motor for forward rotation.	
				40	P_MRS	The inverter output the instant stopping function	The MRS is pulse signal input
				41	P_FRE	PWM setting frequency (note 7)	Only valid for the terminal HDI
				43	RUN_EN	The external terminal running enable	The external running signal is valid only when RUN_EN is valid.

Parameter Description

Parameters

Relevant Parameters	Corresponding terminal	Factory setting	Setting range	Values	Function name	Function description	Remarks
550	HDI	57	0~41 , 43~57	44	PID_OFF	The external terminal stopping PID enable	The signal is sent, PID calculation stops at once
				45		Reserve	
				46	ROLL_1	Initial curling radius selection terminal 1	
				47	ROLL_2	Initial curling radius selection terminal 2	
				48	MAT_TH_1	Thickness selection terminal 1	
				49	MAT_TH_2	Thickness selection terminal 2	
				50	DRAW_REL	Wind-up roll-down switching	
				51	PREDRIVE	Predrive command	
				52	TQC_MEMORY	Torque memory	
				53	TQC_MEM_ENABLE	Torque memory enable	
				54	CYCLE_CNT	Turn counting signal	Only valid for the terminal HDI
				55	SWITCH_TS	Switch speed/Torque control (note 10)	
				56	ROLL_RES	Curling radius restore	
				57	HDI_FRQ	High-speed pulse input function(note 8)	Only valid for the terminal HDI

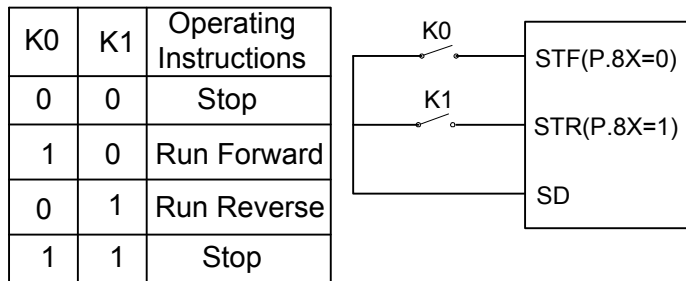
Note: 1. The default value are P.80=2 (RL), P.81=3 (RM), P.82=4 (RH), P.83=0 (STF), P.84=1 (STR), P.86=30 (RES), P.126=5 (AU), P.550=57 (HDI_FRQ) .

2. If the setting of P.80~P.84, P.86, P.126 and P.550 are changed, the functions of the terminals are modified too. For example, when P.80 is equal to 2, the M0 terminal is used for RL. When P.80 is changed to 8, than the M0 terminal function will be changed to RT, i.e., the second function selection terminal. Take another example, if P.83 is equal to 0, the STF terminal will be STF forward rotation function. When P.83 is changed to 6, then STF terminal function will be changed OH, i.e., the external thermal relay terminal.

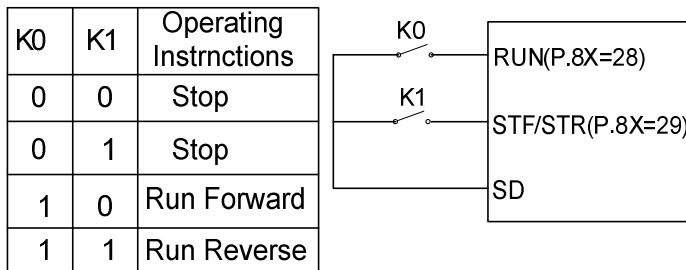
3. Wiring for the external thermal relay (OH): for the conventional motor wiring, the external thermal relay is often placed at the front of the motor to prevent the motor from overheating. When the external thermal relay is separated, the alarm of the inverter will be tripped off and "OHT" will be displayed on the screen.

4. The operation of the inverter can be controlled by four means ("1" for terminal close, "0" for terminal open, and X = 0, 1, 2, 3, 4, 5, 6).

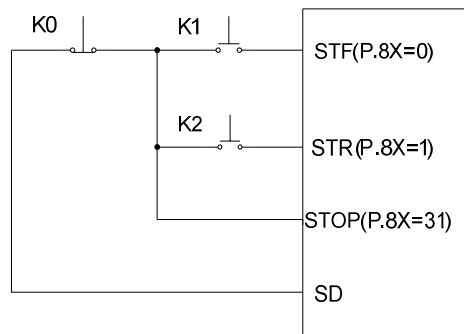
(1) Two-wire control mode 1:



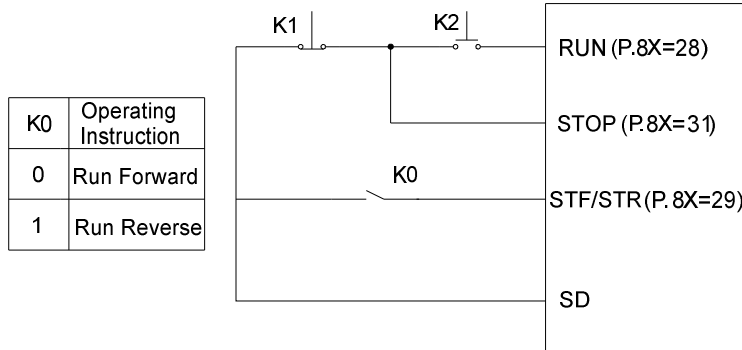
(2). Two-wire control mode 2:



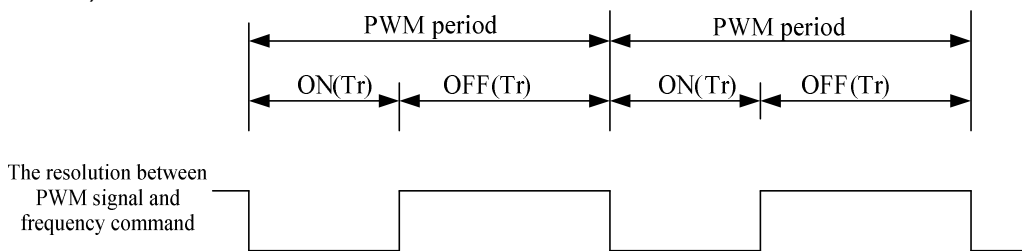
(3). Three-wire control mode 1 (with self-maintenance function): K0 is for the STOP function that is normally close. When it is open, the inverter will stop. K1 and K2 is the forward and reverse signals that are normally open. They indicate that pulse signal is active, i.e., jog is valid.



(4). Three-wire control mode 2 (with self-maintenance function): K1 is for the STOP function that is normally close. When it is open, the inverter will stop. K2 is the RUN signal that is normally open. It indicates that pulse signal is active, i.e., jog is valid. For the direction changing signal (STF/STR), the parameter corresponds to the external terminals is 39. When changing the direction, stop the inverter first, RUN the inverter before activating it.



- In "external mode" and when PO is "on", select the programmed operation mode. At this stage, the STF terminal is the source of the start signal. When STF is "on", the inverter begins to run in the programmed operation mode at the first section. When STF is "off", the inverter stops running, and STR becomes the pause signal source. When STR is "on", the operation will be suspended. When STR is "off", the operation will be continued (continues from the suspended section). For details, please refer to [P.100~P.108](#), [P.111~P.118](#), [P.121~P.123](#), [P.131~P.138](#).
- In the external mode, the manual operation cycle mode is selected when MPO is "on". For details on parameter and operation, please refer to [P.100~P.108](#), [P.111~P.118](#), [P.121~P.123](#), [P.131~P.138](#).
- PWM setting frequency (P.550 = 41): the inverter will measure and calculate the time of ON and OFF every PWM period as the frequency command. (The PWM period within 0.9ms ~ 1100ms admissible)



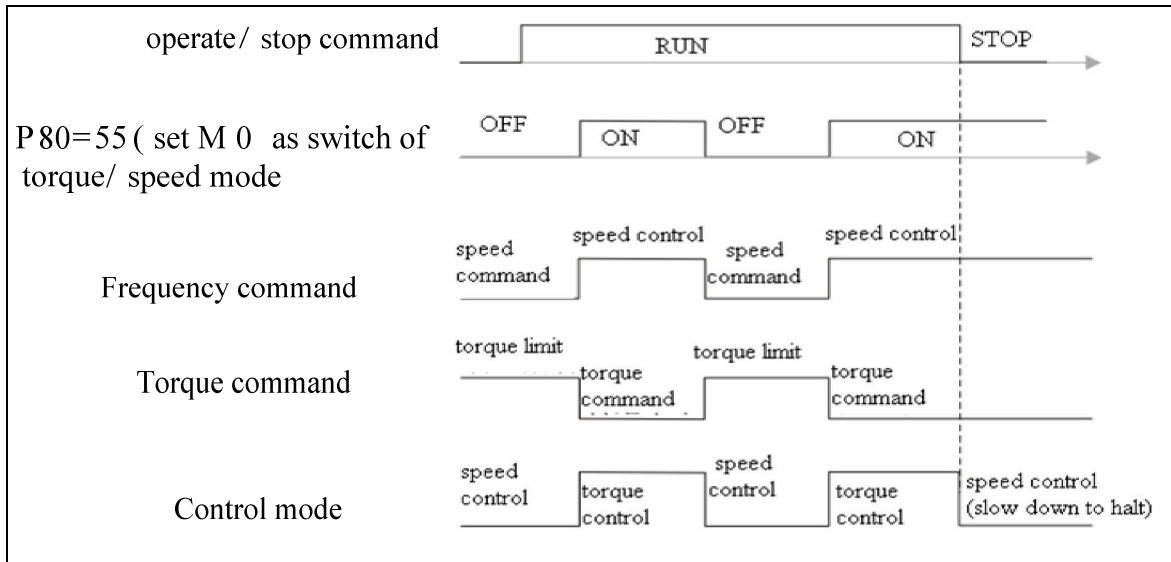
$$\text{Frequency command (Hz)} = \frac{\text{ON time}}{\text{PWM period}} \times \text{upper limit frequency P.1 (Hz)}$$

The function is only valid for the terminal HDI. Near the minimum frequency and the maximum frequency, the precision of the output frequency will be reduced relative to the input signal, please avoid using on the occasion needed rigorous frequency control.

- When P.550=57 and the toggle switch HDI is set to HDI, the high-speed pulse mode is valid. As the high-speed pulse input terminal, HDI is used to give the target frequency, please refer to P.522.
- When P.550 = 54, the toggle switch SW11 must be switched to HDI. The function is under the tension control mode and it is used to calculate the turns of the winding shaft rotation when calculating the curling radius with the sickness accumulation method.
- External terminals switch "speed/torque control": when switch speed-control to torque-control,

torque limit turns to torque command, and speed command turns to speed limit. When return torque control back to speed control, torque command turns to torque limit, and speed limit turns to speed command. If you operate the switch of speed control/ torque control, please be in the mode of closed-loop vector speed control (P.300=4) and set P.400=0. If you set P.400=1 and external terminals=55 at the same time, the switch function will be invalid and only torque-control operates.

The figure as below:



5.39 Slip Compensation Coefficient (P.89)

P.89 “Slip compensation coefficient”

- Setting up this parameter appropriately enables the rotation speed of the motor under rated current to be closer to the set rotation speed.
- This function is only valid under the V/F mode; i.e., It is effective when P.300 = 0.

Parameter	Factory setting	Setting range	Remarks	
89	0	0~10	0	Slip compensation is forbidden.
			10	The compensation value is 3% of the target frequency when P.89 = 10.

5.40 The Inverter Model (P.90)

P.90 “The inverter model”

- P.90 is used to show the type and capacity of inverter, and the parameter can only be read.

P.90 =

Applicable motor capacity: please refer to the following table

Input voltage: 1: 220V 1-PHASE
2: 220V 3-PHASE
3: 440V 3-PHASE

The applicable motor capacity is as following table:

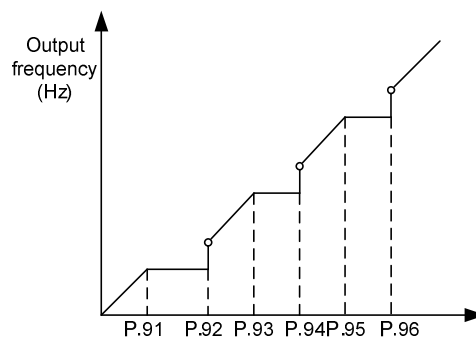
Value (value of the two low-order bits of P.90)	capacity (kw)	Value (value of the two low-order bits of P.90)	capacity (kw)
4	1.5	12	22
5	2.2	13	30
6	3.7	14	37
7	5.5	15	45
8	7.5	16	55
9	11	17	75
10	15	18	90
11	18.5	19	110

5.41 Frequency Jump (P.91~P.96)

P.91~P.96 “Frequency jump”

- To avoid system’s mechanical resonance frequency when running the motor, the inverter provides three sets of jump frequencies, namely, P.91 (the first set), P.92 (the second set), and P.95 and P.96 (the third set).

Parameter	Factory setting	Setting range	Remarks
91~96	99999	0~650Hz, 99999	99999: invalid



<Setting>

- For example: assuming P.91=45 and P.92=50;

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

Note: 1. During the acceleration / deceleration period, the output frequency of the inverter will still pass through the jump frequency.
 2. When P.91=99999 or P.92=99999, the first set of frequency jump is invalid.
 When P.93=99999 or P.94=99999, the second set of frequency jump is invalid.
 When P.95=99999 or P.96=99999, the third set of frequency jump is invalid.

5.42 Programmed Operation Mode (P.100~P.108, P.111~P.118,

P.121~P.123, P.131~P.138)

P.100 “Minute/second selection” section”

P.101~P.108 “Runtime of each section”

P.111~P.118

“Acceleration/deceleration time of each section”

P.121 “Run direction in each section”

P.122 “Cycle selection”

P.123 “Acceleration/deceleration time setting selection”

P.131~P.138 “Frequency of each

Related parameters

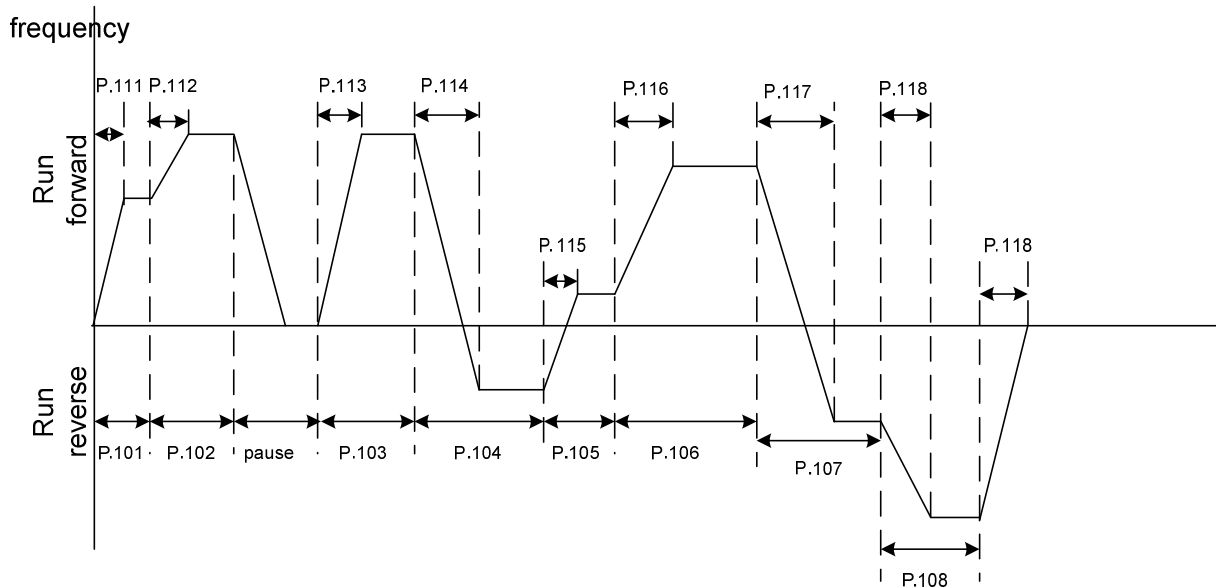
P.7 “Acceleration time”
 P.8 “Deceleration time”
 P.21 “Acceleration/deceleration time increments”
 P.80~P.84, P.86, P.126, P.550
 “Multi-function terminals selection”

Parameter	Factory setting	Setting range	Remarks	
100	1	0, 1	0	The minimum increment of run time is 1 minute.
			1	The minimum increment of run time is 1 second.
101~108	0s	0.1~3600s	---	
111~118	0s	0~600s	<u>P.21=0</u>	
		0~6000s	P.21=1	
121	0	0~225	---	
122	0	0~8	0: Cycle function invalid; 1~8: Run circularly	
123	0	0, 1	---	
131~138	0 Hz	1~650Hz	---	

<Setting>

1. Programmed operation mode

- The calculation of runtime and acceleration/deceleration time in each section is presented in the figure below:



- The run direction is set in binary form (8-bit), and then translated to decimal form and stored in P.121. “1” means run forward, and “0” means run reversely. The highest bit is the run direction of section 8, while the lowest bit is the direction of the section 1.

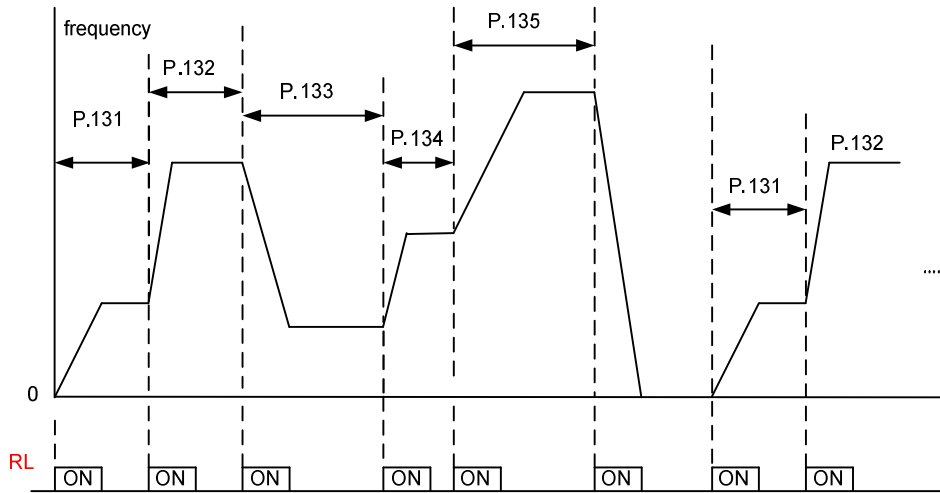
For example: Suppose that section 1 is run forward, section 2 is run reverse, section 3 is run reverse, section 4 is run forward, section 5 is run reverse, section 6 is run forward, section 7 is run forward, section 8 is run reverse, then the value in binary form is 01101001.

$$P.121 = 0 \times 2^7 + 1 \times 2^6 + 1 \times 2^5 + 0 \times 2^4 + 1 \times 2^3 + 0 \times 2^2 + 0 \times 2^1 + 1 \times 2^0 = 105$$

- When P.122=0, it will not run in circular motion.
- When P.122 is 1~8, it is the initial sectional speed at the beginning of the cycle.
For example: When P.122=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.
- When P.123 = 0, the acceleration time is determined by P.7, and the deceleration time is determined by P.8.
- When P.123 = 1, the acceleration time and deceleration time are both determined by P.111~P.118.

2. Manual operation cycle mode

- Insert an impulse type switch between M0 and SD.
- After turning on the power, set P.80=35 according to terminals wiring. Set corresponding parameter P.80 to 35. The inverter is on standby at this point.
- The mode of operation is shown in the figure below:



- Note: 1. The inverter can run eight levels of speed in the procedure, and the frequency is determined by P.131~P.138.
2. If there is any section set to zero, the inverter will be on standby in this section. In other word, P.131 has to be nonzero when this mode is selected. Like the figure above, regardless of the value of P.137 and P.138, the inverter sills stop when the switch is pressed for the sixth time.
3. The rotation of the manual operation cycle mode is unilateralism. It has nothing to do with P.121 or the signals of STF and STR.

5.43 Operation Panel Monitoring Selection (P.110)

P.110 “Operation panel monitoring selection”

Parameter	Factory setting	Setting range	Remarks	
110	1	0, 1, 2	0	When the inverter starts, the operation panel enters the monitoring mode automatically, and the screen displays the output frequency.
			1	When the inverter starts, the screen of the operation panel displays the target frequency.
			2	When the inverter starts, the operation panel enters the monitoring mode automatically, and the screen displays the current pressure and feedback pressure of the constant pressure system (note).

Note: When P.110 = 2, the screen display shows two sections. A decimal point is used to separate the boundaries. What is on the left is the target pressure of the constant pressure system and what is on the right is the feedback pressure of the constant pressure system. As is shown in this figure,



, 20 denotes that the target pressure of the constant pressure system is 2.0kg/cm²; 30 denotes that the feedback pressure of the constant pressure system is 3.0kg/cm².

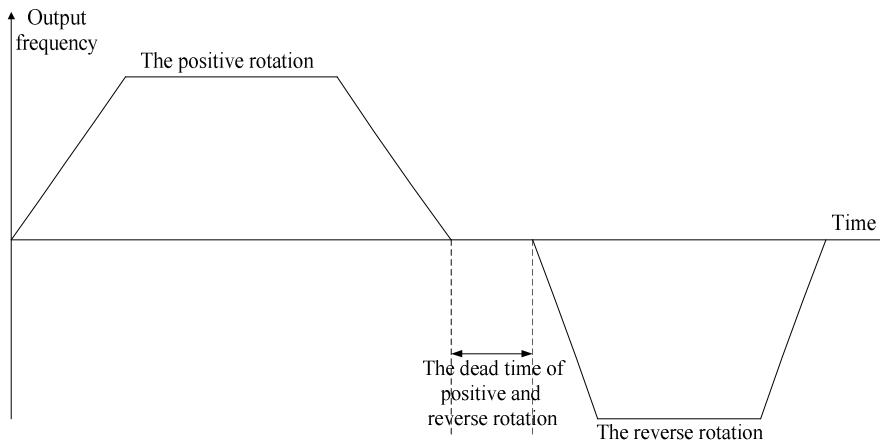
5.44 The selection of positive and reverse rotation dead time (P.119)

P.119 “The dead time of positive and reverse rotation”

- When the inverter is running and receive the reverse rotation command, the output frequency will decrease to 0 in the process of switching from the current rotation direction to the opposite rotation direction. The dead time of positive and reverse rotation is the waiting or holding time after the output frequency decreases to 0.

Parameter	Factory setting	Setting range	Remarks	
119	0	0~3000.0s	0	Without the function
			1~3000	The waiting or holding time after the output frequency decreases to 0 when the positive and reverse rotation is switching.

- The diagram is as follows:



5.45 Zero-Speed Function (P.151~P.152)

P.151 “Zero-speed control function selection”

P.152 “Voltage instruction at zero-speed control”

- Make sure that P.13 (Start frequency) is set to zero when using this function.

Parameter	Factory setting	Setting range	Remarks	
151	0	0, 1	0	There is no output at zero-speed.
			1	(Note 1, 3 and 4)
152	4% (7.5kW or below)	0~30%	(Note 2)	
	2% (11kW~55kW)			
	1% (75kW or above)			

Note: 1. The output mode is selected by the value of P.151. When P.151 is 0, then there is no output. When P.151 is 1, then the voltage of output DC voltage of P.152 is the keep torque.
 2. Suppose that P.152 = 6%, then the output voltage of zero speed is 6% of base frequency voltage P.19.
 3. This function is valid only at V/F, close-loop V/F control system, and close-loop vector control mode. For more details, please refer to the motor control mode parameter P.300 and the feedback control parameter P.350~P.354.
 4. When P.151=1, the zero-speed running is carried out in close-loop vector control mode, DC voltage breaking is carried out in V/F close-loop control mode.

5.46 Over Torque Detection (P.155~P.156)

P.155 “Over torque detection level”

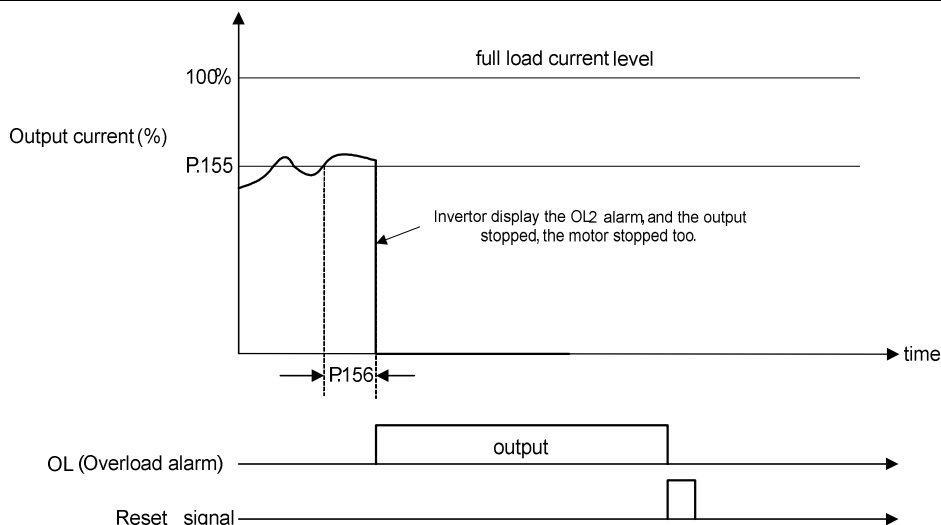
P.156 “Over torque detection time

Related parameters

- P.40 “Multi-function output terminal SO1-SE function selection”
- P.85 “Function selection for multi-function relay A1-B1-C1 ”
- P.129 “Function selection for multi-function output terminal SO2-SE”
- P.130 “Function selection for multi-function relay A2-B2-C2”

- When the value of P.155 is nonzero, the function of over torque detection is selected.
- When the output current exceeds the detection level of over torque (P.155) and the detection time of over torque (P.156), then inverter alarm OL2 will go off and the inverter will stop the operation. If multi-function output terminal SO1-SE(P.40), SO2-SE(P.129), multi-function relay A1-B1-C1(P.85), A2-B2-C2(P.130) are set as over-load alarm (set the value to 3), then the inverter will send out signals. For details, please refer to P.40, P.85, P.129~P.130 in Chapter 5

Parameter	Factory setting	Setting range	Remarks	
155	0%	0~200%	0	No detection of over torque
			0.1~200%	During over torque detection, OL2 alarm is displayed and the motor stops.
156	2s	0.1~60s		



5.47 External Terminals Filter Adjusting Function (P.157)

P.157 “External terminals filter adjusting function”

Parameter	Factory default value	Setting range
157	4 ms	0~200ms

- P.157 is used to select response time to the signal of external terminals.

5.48 External Terminal Power Enable Function (P.158)

P.158 “External terminal power enable”

Parameter	Factory default value	Setting range
158	0	0~1

- If P.158=1, select power enables on the external terminals. In this situation, if the functions of the multi-function control terminals before turning on the power are STF, STR, RUN and MPO, and the corresponded external terminals are short circuit, and then the inverter will not run immediately after turning on the power. The inverter will run only after short circuit these terminals again. When P.158=0, make these terminal short circuit before turning on the power, and the inverter will run immediately after the power is turned on.

5.49 Energy-Saving Control Function (P.159)

P.159 “Energy-saving control function”

Parameter	Factory setting	Setting range	Remarks
159	0	0	Normal running mode
		1	Energy-saving running mode

- Under the energy-saving running mode, the inverter will control the output voltage automatically in order to reduce the output power losses to the minimum when the inverter is run at a constant speed.

Note: 1. After selecting the energy-saving running mode, the deceleration time may be longer than the setting value. In addition, the properties of the regular torque load will produce abnormal voltage more easily. Please slightly prolong the deceleration time.

2. In the energy-saving running mode, only the V/F control mode is available. That is, only P.300=0 is valid.

3. For big load purposes or machines with frequent acceleration/deceleration, the energy-saving effect may be poor.

5.50 Multi-Function Display (P.161)

P.161 “Multi-function display selection”

Parameter	Factory setting	Setting range	Remarks	
161	0	0~20	0	Output voltage. (V)
			1	Voltage between P and N terminals. (V)
			2	Temperature rising accumulation rate of inverter. (%)
			3	Target pressure of the constant pressure system. (%)
			4	Feedback pressure of the constant pressure system. (%)
			5	Operation frequency. (Hz)
			6	Electronic thermal accumulation rate. (%)
			7	Signal value (V) of 2-5 simulating input terminals.
			8	Signal value (mA) of 4-5 simulating input terminals. (mA/V)
			9	Output power (kW).
			10	PG card's feedback rotation speed. (Hz)
			11	Positive and reverse rotation signal. Then 1 represents positive rotation, 2 represents reverse rotation, and 0 represents stopping state.
			12	NTC temperature (°C)
			13	Electronic thermal accumulation rate of motor. (%)
			14	Signal value of analog input terminal 1-5. (V)
			15	Input frequency of terminal HDI. (kHz)
			16	Real-time curling radius value. (mm)
			17	Real-time line speed. (m/min)
			18	Output torque of inverter (%)
			19	External terminal input state(about the sort of terminal, please refer to the table of the special monitor code in the communication part)
20	External terminal output state(about the sort of terminal, please refer to the table of the special monitor code in the communication part)			

Note: The multi-function display selection is realized in the monitoring voltage mode. Please refer to Page42 for monitoring mode selection (4.1.3 Operation flow charts for monitoring mode with DU01).

5.51 PID Parameters 1 (P.170~P.183, P.223~P.225, P.241)

P.170 "PID function selection"

P.171 "PID feedback control method selection"

P.172 "PID proportion Gain"

P.182 "Integral upper limit"

P.173 "PID Integral Gain"

P.183 "Deceleration step length with stable pressure"

P.174 "PID Differential Gain"

P.175 "Abnormal deviation level"

P.223 "Analog feedback bias pressure"

P.176 "Exception duration time"

P.224 "Analog feedback gain pressure"

P.177 "Exception handling mode "

P.178 "Sleep detects deviation"

P.225 "Panel command"

P.179 "Sleep detects duration time"

P.180 "Revival level"

P.241 "Sampling period controled by PID"

P.181 "Outage level"

- During the operation of PID control, the frequency displayed on the screen is the output frequency of the inverter.
- The output frequency during the operation is similar to output frequency during the normal operation. They are both limited within the upper limit P.182 and the lower limit P.2.
- For input signal filtering of terminal 2-5 and terminal 4-5, please refer to the instructions for P.60.
- The sketch map of PID function is shown as follows:

Parameter Description

Parameter	Factory setting	Setting range	Remarks					
170	0	0~3,12,13,21,23,31,32	0 PID function non-selected					
			Ten - digit	0	Parameter P.225 sets target value			
				1	Take the input of terminal 2-5 as target source	Single - digit	1	Take the input of terminal 2-5 as feedback source
				2	Take the input of terminal 4-5 as target source		2	Take the input of terminal 4-5 as feedback source
				3	Take the input of terminal 1-5 as target source		3	Take the input of terminal 1-5 as feedback source
171	0	0, 1	0	Negative feedback control Target value minus feedback value is the deviation. When the deviation value is positive, the output frequency should be increased. When the deviation value is negative, the output frequency should be decreased.				
			1	Positive feedback control Target value minus feedback value is the deviation. When the deviation value is negative, the output frequency should be increased. When the deviation value is positive, the output frequency should be decreased.				
172	20	1~100	This gain determines the proportion controller's impact on feedback deviation. The greater the gain, the faster the impact. Yet a gain that is too big will cause vibration.					
173	1s	0~100s	This parameter is use to set integral controller's integral time. When the integral gain is too big, the integral effect will be too weak to eliminate steady deviation. When the integral gain is too small, the system vibration frequency will increase, and therefore the system may be unstable.					
174	0 ms	0~1000ms	This gain determines deviation controller's impact on the amount of change of the deviation. Appropriate deviation time can reduce the overshooting between the proportion controller and the integral controller. Yet when the deviation time is too large, system vibration may be induced.					

Parameter Description

Parameter	Factory setting	Setting range	Remarks	
175	0	0~100%	---	
176	30s	0~600s	---	
177	0	0, 1, 2	0	Free stop
			1	Decelerate and stop
			2	Continue to run when the alarm goes off
178	0	0~100%	---	
179	1s	0~255s	---	
180	90%	0~100%	---	
181	40Hz	0~120Hz	---	
182	100.0%	0~200.0 %	When the deviation value accumulated with the integral time, an upper limit for deviation accumulation should be set. For example, the upper integral limit of frequency is equal to P.33*P.182	
183	0.5Hz	0~10Hz	When the feedback pressure satisfies the deviation value for stopping the machine and the set time (in seconds) for stopping the machine for detection is reached, the inverter will take the P.183 step to reduce the frequency.	
223	0%	100%	Revising the feedback signal to unify the signal range of inverter's feedback terminal and actual feedback, so that the inverter display in accordance with the feedback meter.	
224	100%			
225	20%	0~100%	The target value is set by P.225 when the ten-digit of P.170 value is 0, and the single-digit is not 0.	
241	20ms	0~6000ms	The parameter is the sampling period for feedback signal. The adjuster computes once every sampling period. The longer the sampling period, the slower the response.	

<Setting>

- The revising instruction of the analog feedback bias pressure and gain pressure:
 - The system default value can be used to revise without connecting with feedback signal, the default value is as follows:

The feedback of terminal 2-5		The feedback of terminal 4-5		The feedback of terminal 1-5	
Revising voltage	Revising proportion	Revising current	Revising proportion	Revising voltage	Revising proportion
0.1V	P.223	4mA	P.223	0.1V	P.223
5V	P.224	20mA	P.224	5V	P.224

Note: 1. The range of default setting is 0.1~5V. If there is a mismatch between the default setting range and the user's range, P.223 and P.224 can be set and P.170 must be set at last to unify the range.
2. If take terminal 4-5 as the target or feedback source, please must set the value of P.17 at first, and determine whether terminal 4-5 signal is voltage or current according to the switch SW2, and then take other operations.

Example: When the 0~7V feedback signal is given by terminal 2-5 or 1-5:

1). When P.171=0 (negative feedback control), $P.223 = 0.1 / 7 * 100.0 = 1.4$

$$P.224 = 5 / 7 * 100.0 = 71.4$$

2). When P.171=1 (positive feedback control), $P.223 = (7 - 0.1) / 7 * 100.0 = 98.6$

$$P.224 = (7 - 5) / 7 * 100.0 = 28.6$$

By setting P.223 and P.224 as the above calculated value, and then setting P.170 at 1, the revised range is 0~7V.

Example: When the 0~20mA feedback signal is given by terminal 4-5:

1). When P.171=0 (negative feedback control), $P.223 = 4 / 20 * 100.0 = 20.0$

$$P.224 = 20 / 20 * 100.0 = 100.0$$

2). When P.171=1 (positive feedback control), $P.223 = (20 - 4) / 20 * 100.0 = 80.0$

$$P.224 = (20 - 20) / 20 * 100.0 = 0$$

By setting P.223 and P.224 as the above calculated value, and then setting P.170 at 2, the revised range is 0~20mA.

2. When the feedback signal need to be revised by the user:

Please adjust the feedback signal to a certain value and then calculate the proportion of the value to the feedback range, then write the proportion value into P.223.

After that, adjust the feedback signal to a new value and then calculate the proportion of the value to the feedback range, then write the proportion value into P.224.

Example: When the user's feedback range is 0~10kg:

When the feedback signal is adjusted to 4kg, $P.223 = (4/10) * 100.0 = 40$,

When the feedback signal is adjusted to 6kg, $P.224 = (6/10) * 100.0 = 60$

Note: The actual feedback signal must be connected and the value of P.170 must be set before revising like this.

• The instruction for the target pressure given by external analog terminal:

1. When the target value is set by terminal 2-5 (P.500=3)

When P.73 = 0, the given range is 0~5V corresponding to 0~100%;

When P.73 = 1, the given range is 0~10V corresponding to 0~100%.

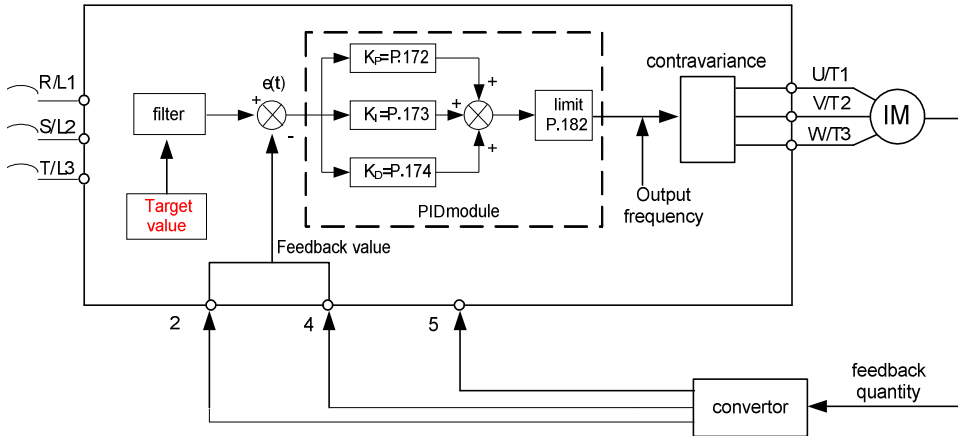
2. When the target value is set by terminal 4-5 (P.501=3)

The given range is 4~20mA corresponding to 0~100%.

Example: Set P.170 = 1, P.171 = 0.

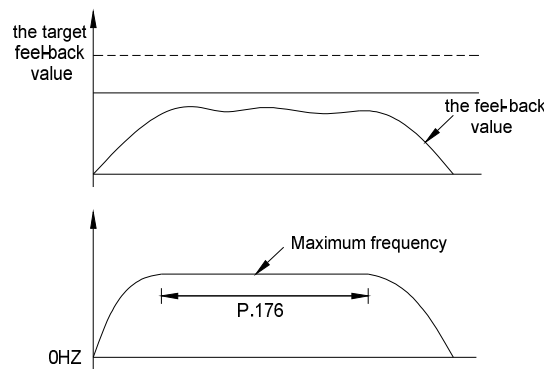
It indicates that the PID target value is given by the current of terminal 4-5 (4~20mA).

If 8mA is given by the user, the corresponding given proportion is $(8-4) / (20-4) * 100.0 = 25.0$.



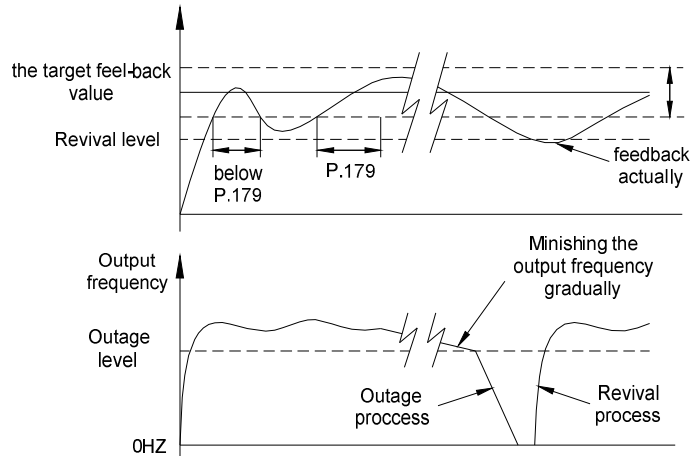
- When the output frequency reaches the value of $P.3 \cdot P.182$, the feedback value will be less than the product of the target value and P.172. In addition, when the duration lasts more than the set value of P.176, PID will be considered as abnormal and handled according to the set value of P.177.

For example, when $P.175=60\%$, $P.176=30s$, $P.177=0$ and $P.182=50Hz$, the output frequency reaches 50Hz, and the feedback value is lower than 60% of the target feedback value for 30 seconds continuously, **P i d** alarm will be display and the inverter will be stopped freely.



- If P.176 is set to 0, then the set values of P.179, P.180, P.181 and P.183 are invalid. If the set value of P.178 is nonzero, than PID's sleep function will be activated. When the absolute value of the deviation between the feedback value and the target feedback value is less than the sleep detected deviation value for the duration of P.179's sleep detection time, the inverter will steadily reduce the output frequency. Once the output frequency of the inverter is less than the machine stop level of P.181, the inverter will decelerate and stop. When the feedback value is lower than the wake-up level, the output frequency of the inverter will again be controlled by PID.

For example, if $P.178=5\%$, $P.179=1.0s$, $P.180=90\%$, $P.181=40Hz$, and $P.183=0.5Hz$, and when the feedback value is at a stable zone, i.e., larger than 95% of the target feedback value but less than 105% of the target feedback value, the inverter at the stable zone will reduce the output frequency by 0.5Hz/second. When the output frequency of the inverter is less than 40Hz, the inverter will directly decelerate and stop. When the feedback value lower than 90% of the target feedback value, the inverter will wake up and the output frequency will again be controlled by PID.



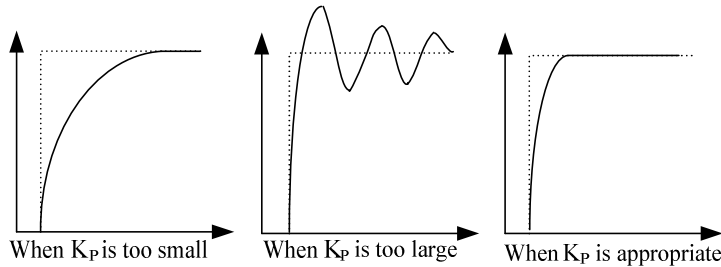
• PID gain easy setting:

(1)After changing target, response is slow

---Increase P-gain ($K_P = P.172$)

response is quick but unstable

---Decrease P-gain ($K_P = P.172$)



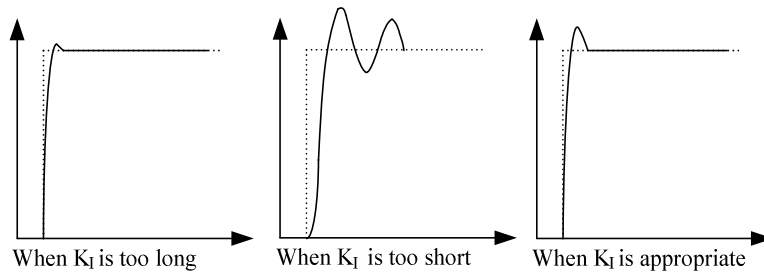
(2)Target and feedback

do not become equal

---Decrease Integration time ($K_I = P.173$)

become equal after unstable vibration

---Increase Integration time ($K_I = P.173$)



(3)Even after increasing K_P , response is still slow

---Increase D-gain ($K_D = P.174$)

It is still unstable

---Decrease D-gain ($K_D = P.174$)

Note: 1. When P.177=2, the panel has no alarm display but the multi-function output terminal has alarm detection. To turn off the alarm, reset P.997 or turn down the power.

2. When selecting the target source and feedback source, please pay attention to the setting of P.170 and P.500~P.502, the terminals' priority are 2-5>4-5>1-5.

5.52 4-5 Terminal Disconnection Handling Function (P.184)

P.184 “4-5 terminal disconnection handling”

Parameter	Factory setting	Setting range	Remarks
184	0	0~3	---

<Setting>

- When P.184=0, the inverter will decelerate to 0Hz when disconnected. After reconnecting the inverter, the inverter will accelerate to the corresponding frequency.
- When P.184=1, the inverter will decelerate to 0Hz when disconnected. After reconnecting the inverter, the inverter will accelerate to the corresponding frequency. Meanwhile, the multi-function output terminal will set off the alarm. Reconnection will clear the alarm.
- When P.184=2, the panel will display the “AEr” alarm when disconnected. The inverter will stop immediately. Reset to clear the alarm.
- When P.184=3, the inverter will run continuously according to the frequency command before the disconnection. The multi-function output terminal will set off the alarm. Reconnect to clear the alarm.

Note: Please refer to P.40, P.129 and P.130. For wiring, please refer to Section 3.5.

5.53 The Proportion Linkage Function and The Auxiliary Frequency Function (P.185, P.240)

P.185 “Proportion linkage gain”

P.240 “Auxiliary frequency function”

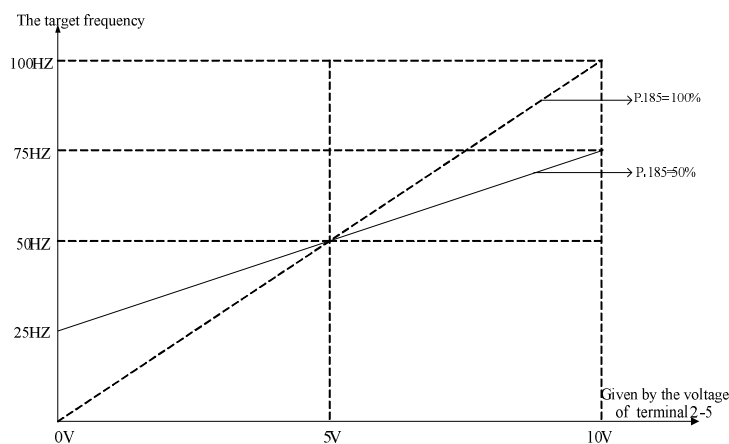
Parameter	Factory setting	Setting range	Remarks
185	0%	0~100%	The function is used to multiply the setting frequency by the external analog input terminal. When many inverters run proportionally, the command frequency from the master inverter to the slave inverter can be fine tuned effectively with the function. When P.185 = 0, the function is invalid.
240	0	0~9	0 No auxiliary frequency function is available.
			1 operation frequency = basic frequency + auxiliary frequency (given by the 2-5 terminal)
			2 operation frequency = basic frequency + auxiliary frequency (given by the 4-5 terminal)
			3 operation frequency = basic frequency - auxiliary frequency (given by the 2-5 terminal)

Parameter	Factory setting	Setting range	Remarks	
240	0	0~9	4	operation frequency = basic frequency - auxiliary frequency (given by the 4-5 terminal)
			5	operation frequency = given by the terminal 2-5 as the proportion linkage signal
			6	operation frequency = given by the terminal 4-5 as the proportion linkage signal
			7	operation frequency = given by the terminal 1-5 as the proportion linkage signal
			8	operation frequency = basic frequency + auxiliary frequency (given by the terminal 1-5)
			9	operation frequency = basic frequency - auxiliary frequency (given by the terminal 1-5)

<Setting>

- When the operation frequency is smaller than P.2, the operation frequency will be equal to the minimum limited frequency P.2. When the operation frequency is larger than P.1, the operation frequency will be equal to the maximum limited frequency P.1
- After multiplying the setting frequency by the set value of P.185, then addition and subtraction can be performed as following shows:

For example: When the setting frequency is 50Hz, P.185=50% and the external analog input signal is 0~10V.



In the above figure, when 0V is given, the target frequency is $50\text{Hz} - (50\text{Hz} \times 50\%) = 25\text{Hz}$;
 When 5V is given, the target frequency is $50\text{Hz} - (50\text{Hz} \times 0\%) = 50\text{Hz}$;
 When 10V is given, the target frequency is $50\text{Hz} + (50\text{Hz} \times 50\%) = 75\text{Hz}$.

- Note: 1. The basic frequency is set by DU01 which is the target frequency reference source, communication or multi-speed combination.
 2. Please refer to the instruction of P.240 for the proportion linkage signal input.
 3. When the analog current/voltage signal of external terminal 4-5 is taken as the proportion linkage input signal, please refer to the parameter P.17. For the frequency range setting of external analog signal, please refer to the parameters P.38, P.39, P.509, P.17, P.73, P.530.

5.54 Firmware version and expansion board message (P.124, P.188)

P.124 “Expansion board version”

P.188 “Firmware version”

- It is used to display the current Firmware version or type of the inverter/expansion board which is readable only.

5.55 Factory Setting Function (P.189)

P.189 “Factory setting function”

Parameter	Factory setting	Setting range	Remarks	
189	1	0, 1	0	The default value of frequency-related parameter belongs to the 60Hz system.
			1	The default value of frequency-related parameter belongs to the 50Hz system.

- According to different power frequency and the default motor frequency, the user can select frequency related parameters. The default value is either 50Hz or 60Hz. Description on relevant parameters are presented in the table below:

Parameter	Name	Setting range	Minimum value
P.3	Base frequency	0~650Hz	0.01Hz
P.20	Acceleration / deceleration reference frequency	1~650Hz	0.01Hz
P.38	The maximum operation frequency (the target frequency is set by the input signal of terminal 2-5)	1~650Hz	0.01Hz
P.39	The maximum operation frequency (the target frequency is set by the input signal of terminal 4-5)	1~650Hz	0.01Hz
P.55	Frequency display reference	0~650Hz	0.01Hz
P.66	Stall prevention operation reduction starting frequency	0~650Hz	0.01Hz
P.305	Motor rated frequency	0~650Hz	0.01Hz
P.307	Motor rated speed	0~65535 r/min	1 r/min
P.509	The maximum operation frequency of terminal 1-5 (the target frequency is set by the input signal of terminal 1-5)	1~650Hz	0.01Hz

Note: 1. Adjusting the default values from the table above would affect the acceleration/deceleration time, the output voltage, the voltage signal rated frequency, etc., and bring problems to the customers. In this case, the customers have to adjust the corresponding parameters, such as P.7, P.8, to more reasonable values.

2. If the customer would like to adjust the factory setting to 60Hz, please follow the following steps:
 - (1). Set P.189=0.
 - (2). Set P.998 to the factory default value (at this point, frequency-related parameters of the inverter will be reset to 60Hz. The factory default value of P.189 is 0). For details on P.998 procedures, please refer to P.998 in Chapter 5.

3. To resume the 50Hz system, the customer should set P.189 to 1 and then follow Step 2 in Note 2 (at this time, the factory setting of P.189 is 1).

5.56 2-5 Terminal Input Signal (P.139, P.192~P.195, P.510~P.513)

P.139 “The bias rate of 2-5 voltage signal”

P.192 “The minimum input positive voltage of 2-5 terminal”

P.193 “The maximum input positive voltage of 2-5 terminal”

P.194 “The setting corresponding to the minimum positive voltage of terminal 2-5”

P.195 “The setting corresponding to the maximum positive voltage of terminal 2-5”

P.510 “The setting corresponding to the minimum negative voltage of

terminal 2-5”

P.511 “The setting corresponding to the maximum negative voltage of terminal 2-5”

P.512 “The minimum input negative voltage of terminal 2-5”

P.513 “The maximum input negative voltage of terminal 2-5”

Related parameters
 P.38 “The maximum output frequency of terminal 2-5”
 P. 73 “The selection of voltage signal across terminal 2-5”
 P. 80~P. 84 ,P.86
 “Multi-function terminals selection”
 P.500 “Function selection of terminal 2-5”

Parameter	Factory setting	Setting range	Remarks
139	0.0%	-100.0%~100.0%	---
192	0	0~10	---
193	5V	0~10	---
194	0.0%	-100.0%~100.0%	---
195	100.0%	-100.0%~100.0%	---
510	0.0%	-100.0%~100.0%	---
511	0.0%	-100.0%~100.0%	---
512	0	0~10	---
513	0	0~10	---

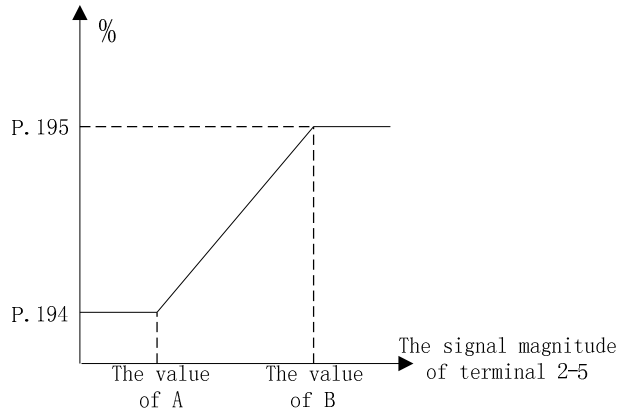
<Setting>

1. The parameters above define the relationship between analog input voltage and the setting value what analog input represents. When the analog input voltage exceeds the maximum or minimum range of the setting value, the excess will be computed as the maximum or minimum input.
2. There are two setting order when the maximum or minimum percentage is set:
 - a. If the users hope to adjust the analog input magnitude to correspond to a certain proportion relationship, the analog input need to be adjusted before setting the corresponding proportion parameters. Now the inverter will compute automatically

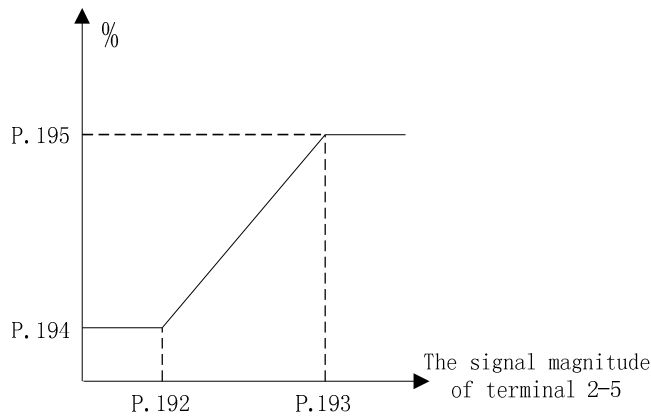
without setting the voltage parameters. Please refer to the example 1.1.

- b. If the users skip adjusting analog input to set the proportion relationship, the proportion parameter should be set before setting the voltage parameters. Please refer to the example 1.2.

Example 1.1: Adjust the analog input voltage to the minimum value A and set the parameter P.194. Then adjust the input voltage to the maximum value B and set the parameter P.195. The figure is shown as follows:



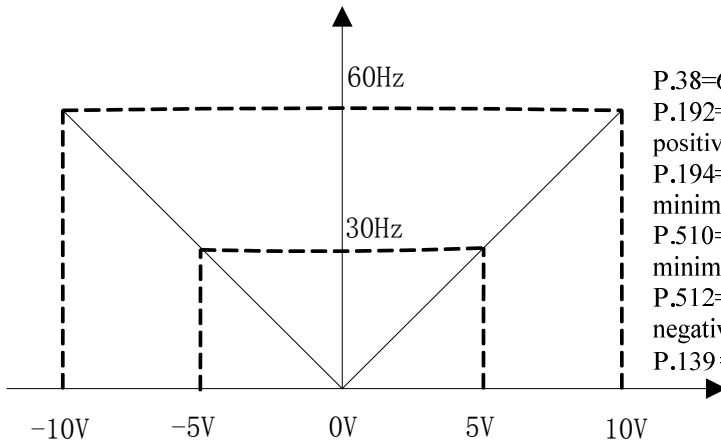
Example 1.2: Set the value of P.194 and P.195, then set P.192 and P.193. The figure is shown as follows:



If P.500 is set at 1, the analog input of terminal 2-5 corresponds to frequency function, that is to say the actual frequency input value is equal to the product of the proportion worked out in the above figure and P.38 (the bias rate P.139 is 0).

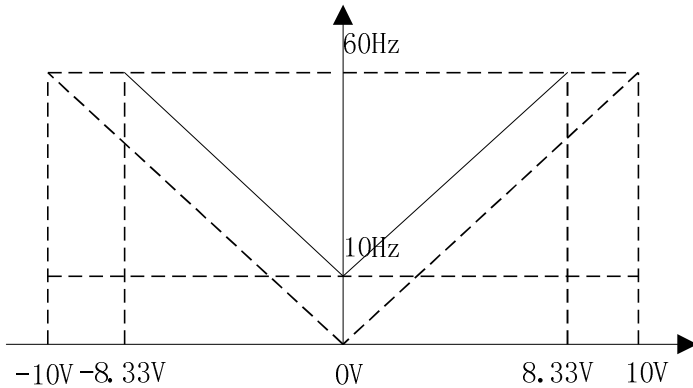
- 3. The positive voltage setting can be referred to for the negative voltage setting, as above.

Example 2: This example is the most commonly used method of adjustment. It is used when the inverter is in the “external mode”, “combined mode 2” or “combined mode 4”, and the frequency are set by terminal 2-5.



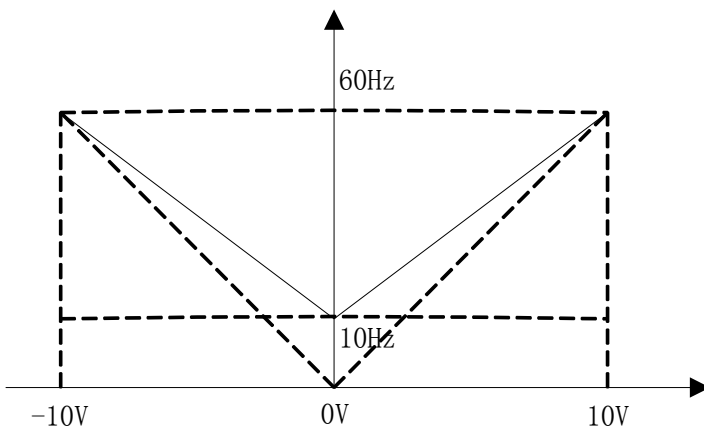
P.38=60Hz Max operation frequency
 P.192=0V, P.193=10V The minimum/maximum input positive voltage of terminal 2-5
 P.194=0%, P.195=100% The setting corresponding to the minimum/maximum positive voltage of terminal 2-5
 P.510=0%, P.511=100% The setting corresponding to the minimum/maximum negative voltage of terminal 2-5
 P.512=0V, P.513=10V The minimum/maximum input negative voltage of terminal 2-5
 P.139= 0% The bias rate of 2-5 voltage signal

Example 3: This example is used by the industry for operating the ac motor drive. The goal is to have the set potentiometer equals to 10Hz when rotating to the far left. In other words, when activating, the lowest output of the ac motor drive has to be 10Hz. Other frequencies can be adjusted by the industry freely.



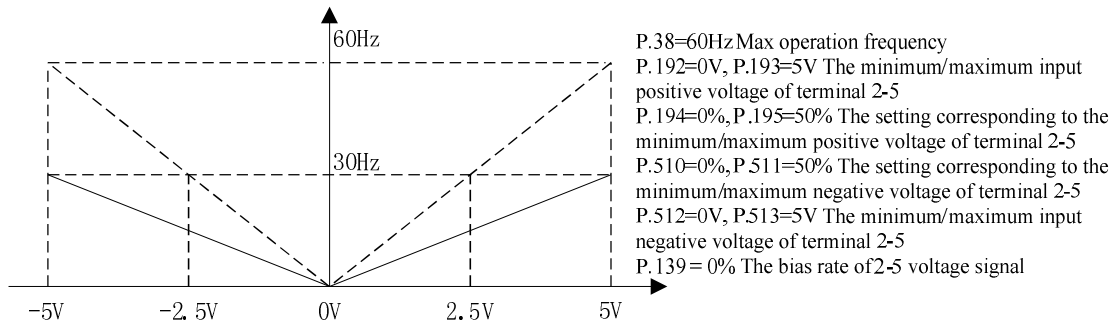
P.38=60Hz Max operation frequency
 P.192=0V, P.193=8.33V The minimum/maximum input positive voltage of terminal 2-5
 P.194=16.7%, P.195=100% The setting corresponding to the minimum/maximum positive voltage of terminal 2-5
 P.510=16.7%, P.511=100% The setting corresponding to the minimum/maximum negative voltage of terminal 2-5
 P.512=0V, P.513=8.33V The minimum/maximum input negative voltage of terminal 2-5
 $P.194 = P.510 = 10\text{Hz} / 60\text{Hz} * 100$
 $P.193 = P.511 = 10\text{V} * (100.0 - P.194) / 100$

Example 4: This example is also frequently used by the industry. The comprehensive usage for all domain of the potentiometer setup elevates the flexibility.

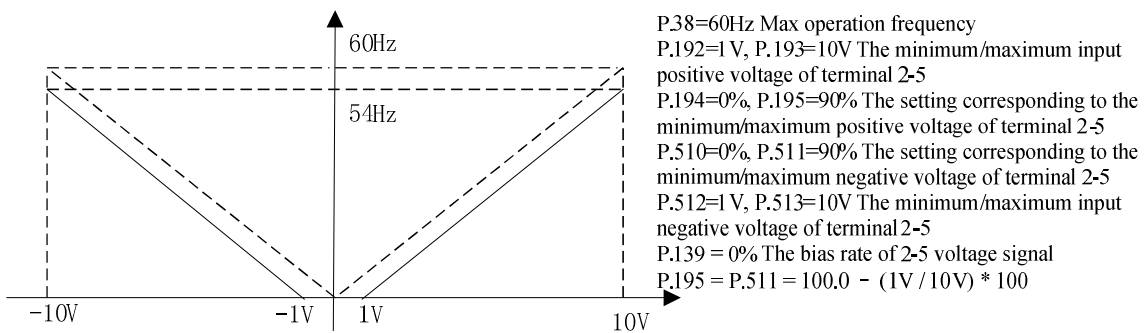


P.38=60Hz Max operation frequency
 P.192=0V, P.193=10V The minimum/maximum input positive voltage of terminal 2-5
 P.194=16.7%, P.195=100% The setting corresponding to the minimum/maximum positive voltage of terminal 2-5
 P.510=16.7%, P.511=100% The setting corresponding to the minimum/maximum negative voltage of terminal 2-5
 P.512=0V, P.513=10V The minimum/maximum input negative voltage of terminal 2-5
 P.139= 0% The bias rate of 2-5 voltage signal
 $P.194 = P.510 = 10\text{Hz} / 60\text{Hz} * 100$

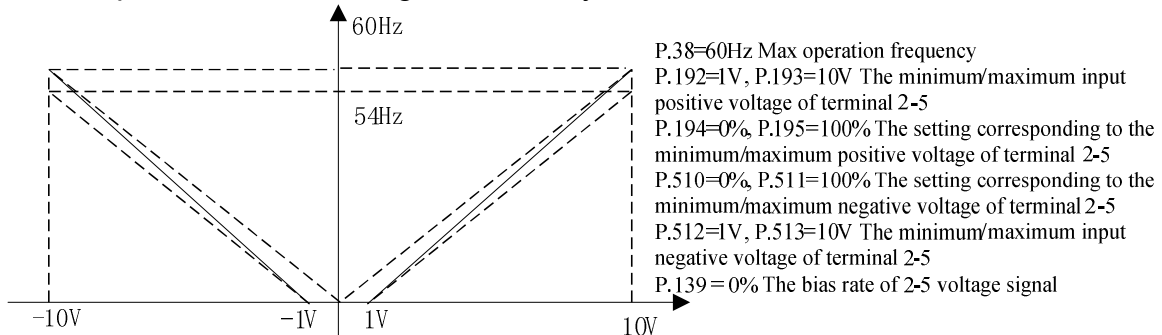
Example 5: This example uses 0~5V to set the frequency.



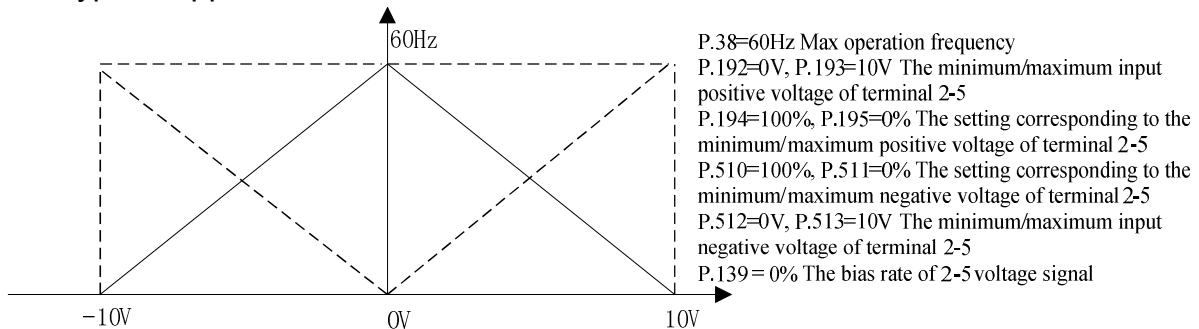
Example 6: This example is recommended to avoid using a signal that is less than 1V to set up the operation frequency of the AC motor drive under an unfavorable application environment, so that the anti-noise interference effect will be better.



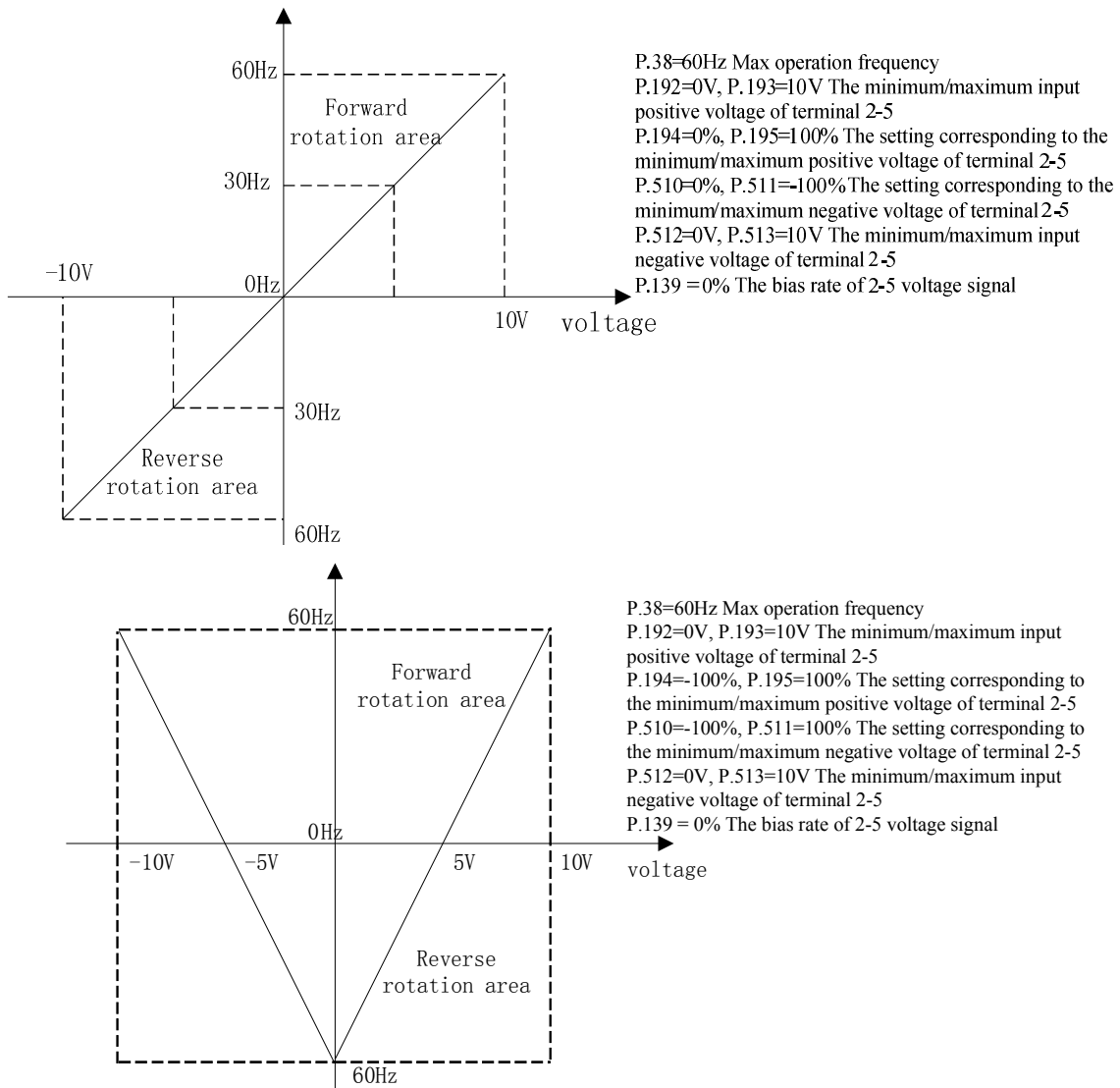
Example 7: This example is an extension of Example 6. The wide application of this example offers the users good flexibility.



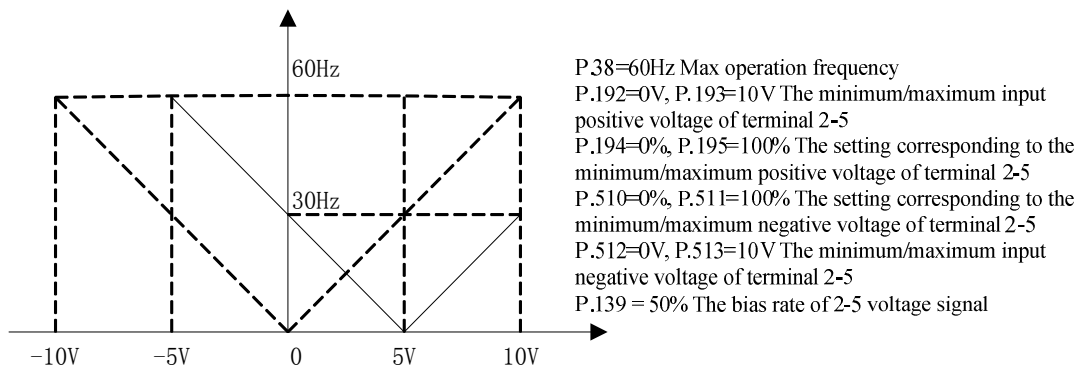
Example 8: This example is an application of negative slop setup. The industry often uses sensors for pressure, temperature or flow control. Some of the sensors output a 10V signal at high voltage or high flow. This signal acts as a command for the AC motor drive to decelerate or to stop. The setup presented in Example 8 can satisfy this type of application.



Example 9: This example integrates all the application of potentiometer. Together with the application of forward and reverse rotation, it fits in the system easily for assorted complicated application.



Example 10: This example is the application with bias voltage. The bias voltage is set by P.139. When P.139=0%, there is no bias voltage; When P.139>0%, there is the positive bias voltage; When P.139<0%, there is the negative voltage.



Note: 1. The examples above are in the condition that P.500 is 1. It is also applicable when P.500 is other nonzero value. Please refer to the definition instruction of P.500 for details.

2. The selection of range of voltage signal sampling across terminal 2-5 by parameter P.73 will affect the parameters value of 2-5 terminal input signal in this part.

5.57 4-5 Terminal Input Signal (P.196~P.199, P.505)

P.196 “The setting corresponding to the minimum current/voltage of terminal 4-5”

P.197 “The setting corresponding to the maximum current/voltage of terminal 2-5”

P.198 “The minimum input current/voltage of 4-5 terminal”

P.199 “The maximum input current/voltage of 4-5 terminal”

P.505 “The bias rate of 4-5 current/voltage signal”

Related parameters

P.39 “The maximum operation frequency of terminal 4-5”
 P. 17 “ The selection of signal across terminal 4-5 ”
 P. 80~P. 84 ,P. 86
 “Multi-function terminals selection”
 P.501 “Function selection of terminal 4-5”

Parameter	Factory setting	Setting range	Remarks
196	0%	-100%~100%	Refer to P.194
197	100%	-100%~100%	Refer to P.195
198	4mA	0~20	Refer to P.192
199	20mA	0~20	Refer to P.193
505	0%	-100%~100%	Refer to P.139

<Setting>

- The setting of 4-5 terminal input current/voltage is similar to the setting of 2-5. And they also have the same effect except that the terminal 4-5 can't give the negative voltage and the minimum input current is 4mA.
- Please refer to 5.19 The Voltage Signal Selection across Terminal 2-5 and Target Frequency (P.38, P.73) for the setting of the input current/voltage across terminal 4-5.

Note: operating the 4-5 terminal function mentioned above, you must flip the switch SW2 to corresponding position at first and make sure it matches the setting value of parameter P.17.

5.58 1-5 Terminal Input Signal (P.506, P.514~P.521)

P.506 “The bias rate of 1-5 voltage signal”

P.514 “The setting corresponding to the minimum positive voltage of terminal 1-5”

P.515 “The setting corresponding to the maximum positive voltage of terminal 1-5”

P.516 “The minimum input positive voltage of terminal 1-5”

P.517 “The maximum input positive voltage of terminal 1-5”

P.518 “The setting corresponding to the minimum negative voltage of

terminal 1-5”

P.519 “The setting corresponding to the maximum negative voltage of terminal 1-5”

P.520 “The minimum input negative voltage of terminal 1-5”

P.521 “The maximum input negative voltage of terminal 1-5”

Related parameters

P.509 “The maximum operation frequency of terminal 1-5”

P.530 “The selection of voltage signal across terminal 1-5”

P.80~P.84, P.86

“Multi-function terminals selection”

P.502 “Function selection of terminal 1-5”

Parameter	Factory	Setting range	Remarks
506	0%	-100%~100%	Refer to P.139
514	0%	-100%~100%	Refer to P.194
515	100%	-100%~100%	Refer to P.195
516	0	0~10V	Refer to P.192
517	5V	0~10V	Refer to P.193
518	0%	-100%~100%	Refer to P.510
519	0%	-100%~100%	Refer to P.511
520	0	0~10V	Refer to P.512
521	0	0~10V	Refer to P.513

<Setting>

- The setting of 1-5 terminal input voltage is similar to the setting of 2-5. And they also have the same effect.

Note: The selection of range of voltage signal sampling across terminal 1-5 by parameter P.530 will affect the parameters value of 1-5 terminal input signal in this part.

5.59 Backlash Compensation Function (P.229~P.233)

P.229 “Backlash compensation function selection”

P.230 “The backlash compensation acceleration interrupt frequency”

P.231 “The backlash compensation acceleration interrupt time”

P.232 “The backlash compensation deceleration interrupt frequency”

P.233 “The backlash compensation deceleration interrupt time”

Parameter	Factory setting	Setting range	Remarks
229	0	0~1	---
230	1Hz	0~650Hz	---
231	0.5s	0~360s	---
232	1Hz	0~650Hz	---
233	0.5s	0~360s	---

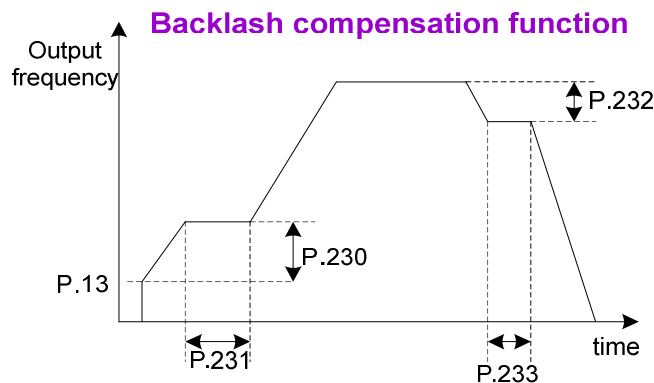
● Backlash countermeasures:

What is backlash compensation?

Reduction gears have an engagement gap and a dead zone between forward and reverse rotation. This dead zone is called backlash, and the gap disables a mechanical system from following motor rotation.

More specifically, a motor shaft develops excessive torque when the direction of rotation changes or when constant-speed operation shifts to deceleration, resulting in a sudden motor current increase or regenerative status.

To avoid backlash, acceleration/deceleration is temporarily stopped. Set the acceleration/deceleration stopping frequency and time in P.229 and P.233.



Note: 1. The setting of the backlash compensation will only prolong the acceleration/deceleration time during the period of interruption.
 2. This function is only valid under the V/F mode; i.e., it is effective when P.300 = 0.

5.60 Triangular Wave Function (P.234~P.239)

P.234 “Triangular wave function selection”

P.235 “Maximum amplitude”

P.236 “Amplitude compensation for deceleration”

P.237 “Amplitude compensation for acceleration”

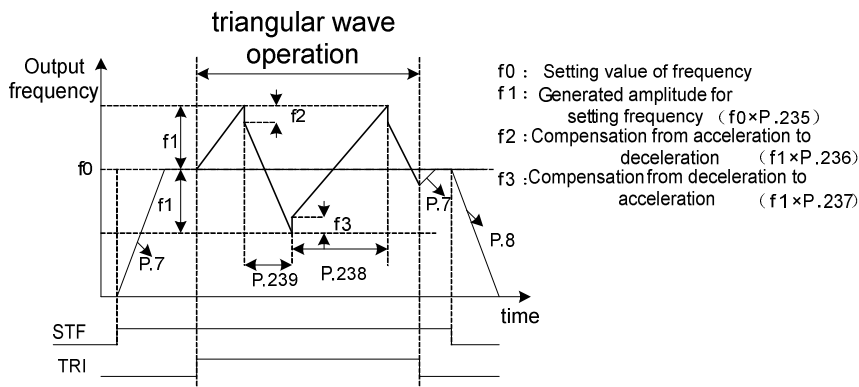
P.238 “Amplitude acceleration time”

P.239 “Amplitude deceleration time”

Parameter	Factory setting	Setting range	Remarks
234	0	0~2	---
235	10%	0~25%	---
236	10%	0~50%	---
237	10%	0~50%	---
238	10s	0~360s/0~3600 s	When <u>P.21=0</u> , the unit of P.238 and P.239 is 0.01s.
239	10s	0~360s/0~3600 s	When <u>P.21=1</u> , the unit of P.238 and P.239 is 0.1s.

<Setting>

- If P.234 “Triangular wave function selection” is “1” and triangular wave operation signal (TRI) is turned on, triangular wave function will be valid. Set any parameter in P.80~P.84, P.86, P.126, P.550 “Input terminal selection function” to “36” and then assign the TRI signal for the external terminal.
- If P.234 “triangular wave function selection” is equal to “2,” the triangular wave function is effective at any given time.



Note: 1. During the movement of the triangular wave, the output frequency is limited by the maximum and the minimum frequency.

2. If the amplitude compensation, i.e., P.236 and P.237, is too big, over-voltage will be tripped off and the stall prevention action will be executed automatically. Consequently, the set method will not be carried out.

3. This function is only valid under the V/F mode; i.e., it is effective when P.300=0.

5.61 DC Brake Function before Starting (P.242~P.244)

P.242 “DC injection brake function before starting selection”

P.243 “DC injection brake time before starting”

P.244 “DC injection brake voltage before starting”

Related parameters

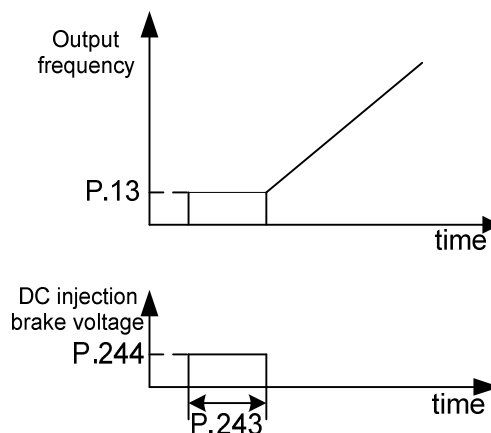
P.13 “Starting frequency”

Parameter	Factory setting	Setting range	Remarks
242	0	0~1	---
243	0.5s	0~60s	---
244	4% (7.5kW or below)	0~30%	---
	2% (11kW~55kW)		
	1% (75kW or above)		

<Setting>

- If P.242=0, DC injection brake function is not available before starting. If P.242=1, DC brake injection function is selected before starting. When the output frequency reaches the starting frequency P.13, a DC voltage (the set value of P.244) will be injected into the motor windings by the inverter, which is used to lock the motor rotor. The DC brake operation will last a period (the set value of P.243) before the motor starts.

See the figure below:



Note: This function is only valid under the V/F mode; i.e., it is effective when P.300=0.

5.62 Options for Stopping the Cooling Fan (P.245)

P.245 "Cooling fan operation selection"

Parameter	Factory setting	Setting range	Remarks
245	0	0~3	There is the output of fan abnormal alarm
		10~13	There is only the detection of fan abnormal signal

<Setting>

- When P.245=0 or 10, the fan will be turned on by the RUN signal. The fan will be turned off 30 seconds after the inverter stops.
- When P.245=1 or 11, turning on the power will turn on the fan. When the power is turned off, the fan will be off, too.
- When P.245=2 or 12, the fan will be turned on if the temperature of the heat sink is higher than 40°C. When the fan is turned off, the fan will be turned off, too.
- When P.245=3 or 13, the fan will be turned on when the temperature of the heat sink is higher than 60°C. When the temperature of the heat sink is lower than 40°C, the fan will be turned off.

Note: please refer to the parameter P.40, P.85, P.129, P.130.

5.63 Modulation Coefficient (P.246)

P.246 "Modulation coefficient"

Parameter	Factory setting	Setting range	Remarks
246	1	0.90~1.20	---

<Setting>

- P.246 is used to determine the ratio between the maximum output voltage and the input voltage. The users can use this parameter to obtain an output voltage that is higher than the input voltage. But the output voltage waveform at this point will generate distortion and contain assorted harmonics. It may also increase the motor torque harmonics and noises.

5.64 Commercial Power Supply Frequency Operation Function

(P.247~P.250)

P.247 “MC switchover interlock time”

P.248 “Start waiting time”

P.249 “Automatic switchover frequency from inverter to commercial power supply frequency”

P.250 “Automatic switchover frequency range from commercial power supply to inverter”

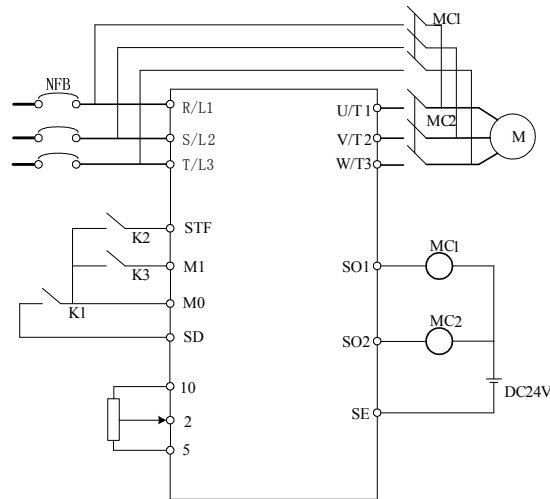
Parameter	Factory setting	Setting range	Remarks
247	1s	0.1~100s	---
248	0.5 s	0.1~100 s	---
249	99999	0~60Hz, 99999	---
250	99999	0~10Hz, 99999	---

<Setting>

- P.249 is used to switch the frequency from inverter operation to commercial power supply operation. Between starting and P.249 inverter operation, an output frequency greater than P.249 will automatically change the inverter operation to commercial power supply operation. When P.249 is set to 99999, there is no automatic switchover.
- When P.250≠99999, automatic switchover is valid during the operation (P.249≠99999). After the inverter operation is switched bypass operation, if the frequency command is lower than (P.249–P.250), the operation will be switched to inverter operation and run by the frequency of the frequency command. Inverter activation when the inverter start command (STF/STR) is turned off, the operation is also switched to the inverter operation.
- When P.250=99999, it is valid during automatic switchover operation (P.249≠99999). When the inverter start command (STF/STR) is turned off after the operation is changed from inverter operation to commercial power supply operation, the operation will be changed to the inverter operation and the motor will decelerate until it stops.

Examples for the commercial power supply frequency switchover function:

Assume that P.80=37, P.81=38, P.40=10 and P.129 = 9. The wiring diagram is presented below:



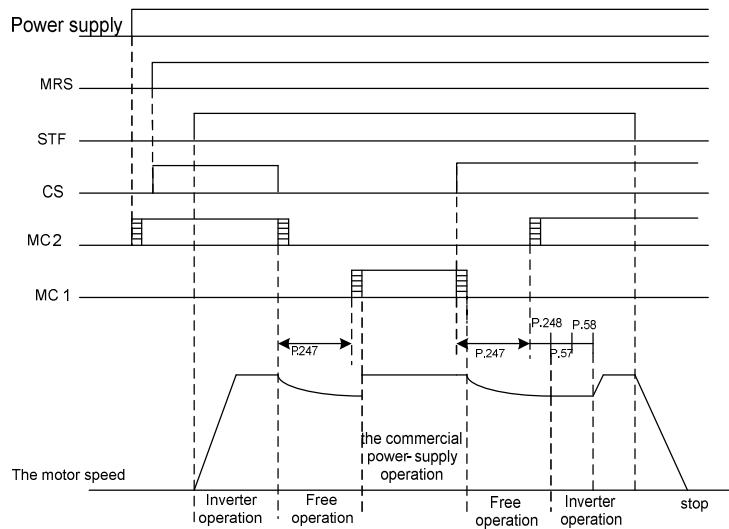
Please be cautious of the capacity of the output terminals. The used terminals vary according to the setup of P.40, P.85, P.129 and P.130 (output terminal function selection). When 10 is selected for the output terminal function, connect the relay that drives the commercial power supply frequency operation. When 9 is selected for the output terminal function, connect the relay that drives the inverter operation. When 37 is selected for the input terminal function, commercial power-supply operation switchover function is selected. When 38 is selected for the input terminal function, commercial power supply frequency operation switchover signal CS is selected.

Warning:

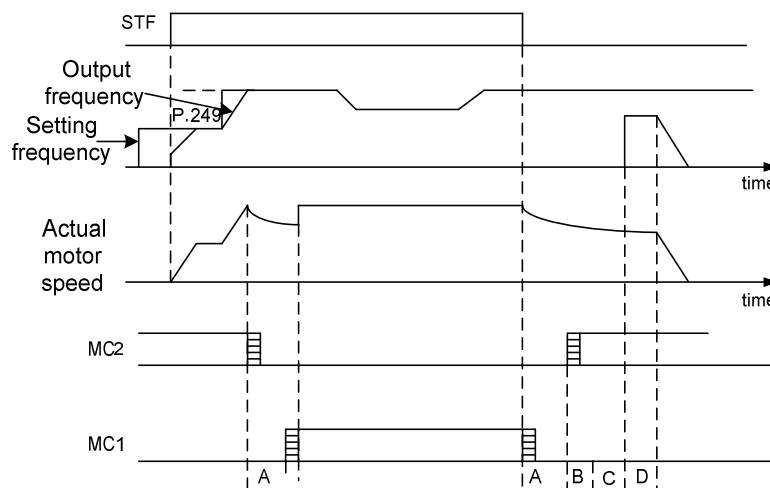
1. **MC1 and MC2 must be mechanically interlocked; the running direction of the inverter operation and the commercial power supply operation should be consistent.**
2. **Use the commercial power operation switchover function under the external operation mode.**
3. **STF/STR is effective when the CS signal is ON.**

Here are some typical sequence diagrams for the switchover of the commercial power supply frequency:

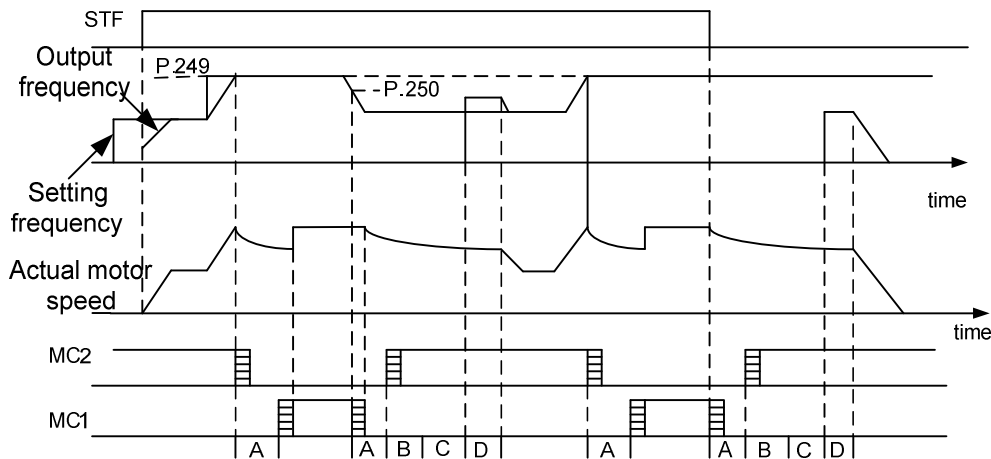
1. No action sequence for the automatic switchover sequence (P.249=99999).



2. With action sequence for the automatic switchover sequence (P.249≠99999, P.250=99999).



3. With action sequence for the automatic switchover sequence series (P.249≠99999, P.250 ≠ 99999).



During the automatic switchover, A: P.247 MC switchover interlocking time; B: P.248 starting waiting time; C: P.57 restarting free operation time; D: P.58 restarting elevating time.

- Note:
1. When the motor runs at 50Hz (or 60Hz), the commercial power supply will offer a more efficient operation than the inverter will. Moreover, during the inverter maintenance/inspection period, the commercial power supply circuit should be installed to prevent the motor from being stopped for too long.
 2. To prevent the inverter from setting off the over-current alarm when changing between the inverter operation and the commercial power supply operation, the interlock measure has to be taken. Once the motor stops, it will be activated via the inverter. Switchover and interlock can be carried out through the inverter and a complicated commercial power supply if commercial power supply switchover sequence function that can send out the signal for electromagnetic contactor actions is used.
 3. This function is only valid under the V/F mode; i.e., it is effective when P.300=0.

5.65 Maintenance Alarm Function (P.261)

P.261 "Maintenance Alarm Time"

- When Multi-function output terminal (P.40, P.85, P.129, P.130) equals 18, maintenance alarm is detecting. It means that when the inverter runs for the days that reach the parameter P.261 set value of maintenance alarm time, the multi-function terminal SO-SE or multi-function relay will send out signal.

Parameter	Factory setting	Setting range	Remarks	
P.261	0	0~9998 day	0	No maintenance alarm
			1~9998	Used to set time when maintenance alarm sends out signal

5.66 Input Phase Failure Protection (P.281)

P.281 “Input Phase Failure Protection”

- The inverter has built-in input protection from phase failure. When P.281 is set to 1, input out of phase, the inverter will alarm IPF; When P.281 is set to 0, the function will be cancelled.

Parameter	Factory setting	Setting range	Remarks	
P.281	1	0,1	0	No Phase Failure Protection
			1	Phase Failure Protection

5.67 Vibration Inhibition Factor (P.285 and P.286)

P.285 “Low frequency vibration inhibition factor”

P.286 “High frequency vibration inhibition factor”

Parameter	Factory setting	Setting range	Remarks
P.285	1	0~3	---
P.286	0	0~15	---

<Setting>

1. If motor vibration is generated at lower frequency, adjust the set value of P.285. The recommended value is 1.
2. If motor vibration is generated at higher frequency, adjust the set value of P.286. Gradually increase the set value by the unit of 1.
3. For the actual application, use the vibration-generating frequency that is lower or higher than half of the motor rated frequency to determine whether the occurred vibration is a low-frequency vibration or a high-frequency vibration. That is, if the rated frequency on the name plate of the motor is 50Hz and the vibration-generating frequency is lower than 25Hz, then this is a low-frequency vibration. On the other hand, if the vibration-generating frequency is higher than 25Hz, then this is a high-frequency vibration.

Note: 1. When the motor load is light, current flow may happen at certain specific operation frequency. This situation may cause the motor to vibrate slightly. The user can neglect it if this trivial vibration has no impact on the application.

2. If the current flow is serious (generating vibration), it may cause serious motor vibration or even inverter over-current. The user can try to adjust the vibration inhibition factor to improve the situation (Large power motors' current flow zone mostly happens at the low frequency zone).

5.68 Short Circuit Protection Function (P.287)

P.287 “Short circuit protection function selection”

Parameter	Factory setting	Setting range	Remarks
287	1	0~1	---

<Setting>

- Set P.287 to 0 to cancel the output end short-circuits protection function.
- When P.287 is set to 1, if the output end is short, the operation panel will display the “SCP” abnormal alarm and the inverter will stop the output.

5.69 Alarm History Parameters (P.288~P.291)

P.288 “Alarm code display option”

P.289 “Alarm code”

P.290 “The latest alarm status selection”

P.291 “The latest alarm message”

- This paragraph provides the users with parameter-related information on alarm codes for frequency, current, voltage, as well as the 12 alarm codes mentioned earlier. If P.996 operation is executed, the abnormal codes and the status messages for the occurred alarms recorded by this set of parameters will be all cleared.

Parameter	Factory setting	Setting range	Remarks
288	0	0~12	The value of P.288, 1~12, corresponds to the abnormal codes of P.289's alarm E1~E12.
289	0	---	
290	0	0~7	When P.290=1, P.291 corresponds to the frequency when the alarm goes off. When P.290=2, P.291 corresponds to the current when the alarm goes off. When P.290=3, P.291 corresponds to the output voltage when the alarm goes off. When P.290=4, P.291 corresponds to the accumulation rate of temperature increase when the alarm goes off. When P.290=5, P.291 corresponds to the (+/P)-(-/N) voltage when the alarm goes off. When P.290=6, P.291 corresponds to the length of time the inverter has run before the alarm goes off. When P.290=7, P.291 corresponds to the operation status code when the alarm goes off.
291	0	---	

Parameter Description

If both P.288 and P.290 are 0, P.289 and P.291 will be displayed as 0.

Abnormal code corresponded alarm condition:

Abnormal code	Alarm type	Abnormal code	Alarm type	Abnormal code	Alarm type	Abnormal code	Alarm type	Abnormal code	Alarm type
00	No alarm	32	OV1	49	THN	82	IPF	144	OHT
16	OC1	33	OV2	50	NTC	97	OLS	160	OPT
17	OC2	34	OV3	64	EEP	98	OL2	179	SCP
18	OC3	35	OV0	65	FAN	112	BE	192	CPU
19	OC0	48	THT	66	PID	129	AER	193	CPR
209	PG1	210	PG2	211	PG3				

5.70 Accumulative Motor Operation Time Function (P.292 and P.293)

P.292 “Accumulative motor operation time (minutes)”

P.293 “Accumulative motor operation time (days)”

Parameter	Factory setting	Setting range	Remarks
292	0 min	0~1439min	---
293	0 day	0~9999day	---

<Setting>

- P.292 is about the accumulative motor operation time in minutes. The updated value cannot be modified by executing P.998 or power shutdown. To clear the accumulated time, make P.292=0.
- P.293 is about the accumulative motor operation time in days. The updated value cannot be modified by executing P.998 or power shutdown. To clear the accumulated time, make P.293=0.

5.71 Password Protection Function (P.294 and P.295)

P.294 “Decryption parameter”

P.295 “Password setup”

Parameter	Factory setting	Setting range	Remarks
294	0	0~65535	---
295	0	2~65535	---

<Setting>

- P.294 is the parameter that provides the decrypt function. P.294 will be zero if the decryption is successful. Use P.295 to set the password. Enter the initial password into P.294 to decrypt the parameter password and to modify or to set up various parameters.
- P.295 is the parameter for setting up the password. The password has to be greater than 1. Once the password setup is completed, P.295 will display 1. After deleting the password, P.295 will display 0. Once the password is set, no parameter can be modified, except P.294. P.998 and power shutdown have no effect on the password. The parameters can be revised only after the decryption.

Note: Bring the inverter to the factory for decryption if the password is forgotten.

5.72 Motor Control Mode (P.300 and P.301)

P.300 “Motor control mode selection”

P.301 “Motor parameter auto-tuning function selection”

Parameter	Factory setting	Setting range	Remarks	
300	0	0~4	0	V/F control
			1	Close-loop V/F control (VF + PG)
			2	General flux vector control
			3	Sensorless vector control (SVC)
			4	Close-loop vector control (FOC + PG)
301	0	0~4	0	Parameter auto-tuning function with no motor
			1	Motor parameter auto-tuning measuring the running motor
			2	Motor parameter auto-tuning measuring the stopped motor
			3	Online auto-tuning function
			4	The system inertia auto-tuning measuring in the mode of closed loop vector control

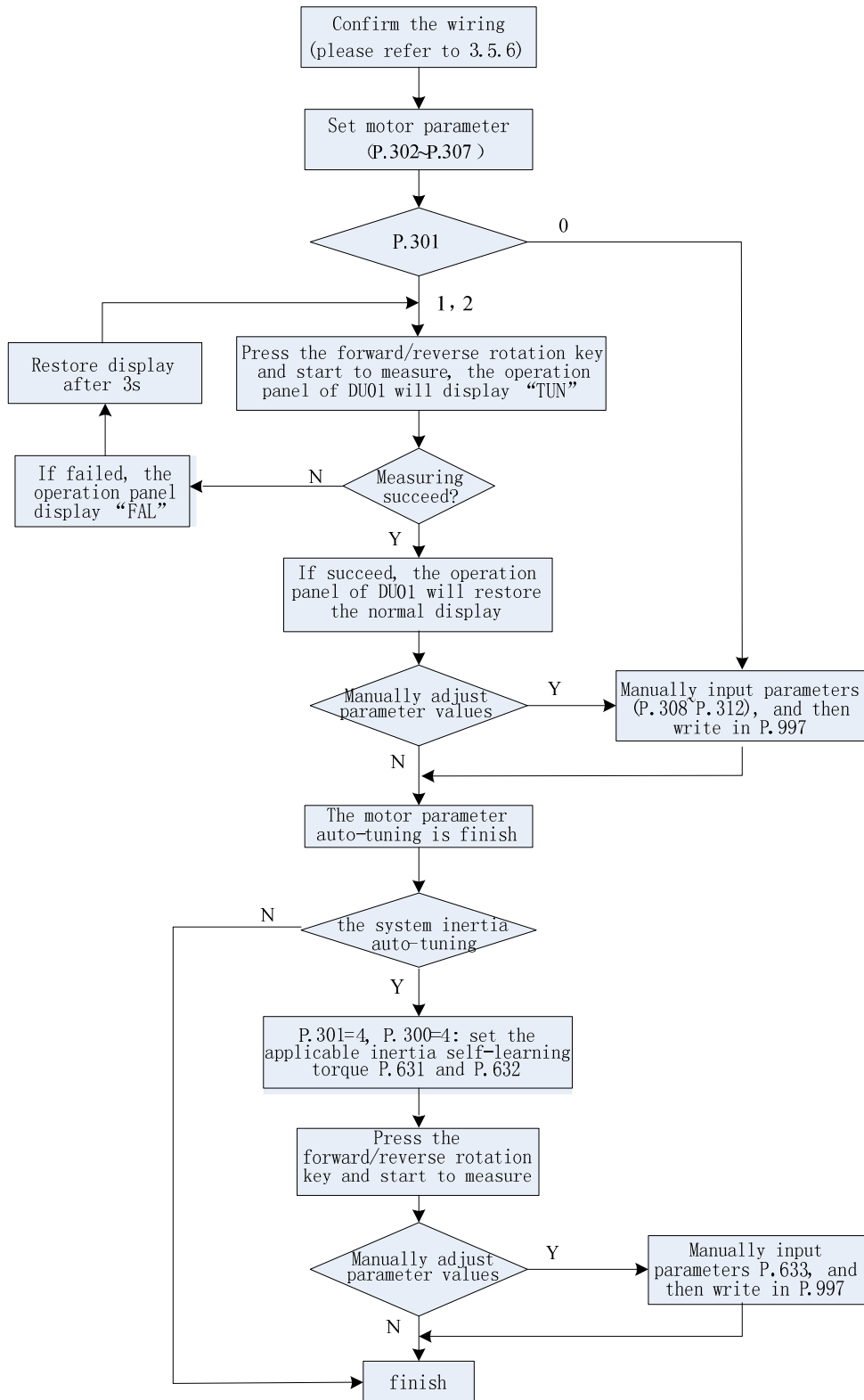
<Setting>

- When P.300=0, no motor parameter auto-tuning function is required for normal V/F curve operation.
- For general magnetic vector control, please set P.300 to 2. The frequency will be altered due to elevated voltage and increased compensatory motor load.
- For executing the motor parameter auto-tuning function, set P.301 to 1 or 2 and press the forward rotation or the reverse rotation key. During the measuring process, the operation panel will flicker and display “TUN”. If the measurement fails, the operation panel will flicker

“FAL” for three seconds and then return to normal display.

- For executing the system inertia auto-tuning function, set P.301 to 4 in the mode of closed loop vector control and set the inertia self-learning torque P.631 and P.632 respectively, then press the forward rotation or the reverse rotation key. The measuring result will be different due to the different setting of self-learning torque. The principle of setting self-learning torque is that the difference between self-learning torque P.631 and P.632 can't be too small and the measuring torque can't be set too big, or the acceleration time will be too short that the measuring result will have a large error.

• Procedures for motor parameter auto-tuning are presented below:



• If high accuracy sensorless control is required, set P.300 to 3 for sensorless vector control.

Note: 1. The motor capacity has to be at the same level or one level below of the level of the capacity of the inverter.

2. For the auto-tuning function, if motor operation is permitted, set P.301 to 1 (dynamic measurement). At this point, the load has to be separated from the motor. If the load environment

- does not permit auto-tuning, set P.301 to 2 (static measurement) if motoring is running.
3. Sensorless vector control: Auto-tuning function can be used to enhance the control function. Before setting P.300 to 3 or 4, first set the motor parameters or the auto-tuning function to improve the control accuracy.
 4. When P.300=1 and the mode of Close-loop V/F control (VF + PG) is selected, please make sure that the motor poles P.303 is correct.

5.73 Motor Parameter (P.302~P.312)

P.302 “Motor rated power”

P.308 “Motor excitation current”

P.303 “Motor poles”

P.309 “Stator resistance”

P.304 “Motor rated voltage”

P.310 “Rotor resistance”

P.305 “Motor rated frequency”

P.311 “Leakage inductance”





P.306 “Motor rated current”

P.312 “Mutual inductance”

P.307 “Motor rated rotation speed”

Parameter	Factory setting	Setting range	Remarks
302	0	0~160	---
303	4	0~8	---
304	220/440V	0~440V	---
305	50Hz	0~650Hz	P.189=1
	60Hz		P.189=0
306	Horsepower-based	0~500A	---
307	1410 r/min	0~65535 r/min	P.189=1
	1710 r/min		P.189=0
308	Horsepower-based	0~500A	---
309	Horsepower-based	0~65535mΩ	---
310	Horsepower-based	0~65535mΩ	---
311	Horsepower-based	0~6553.5mH	---
312	Horsepower-based	0~6553.5mH	---

<Setting>

- When the motor can be fully separated from the load, select P.301=1. When the motor is running, the motor parameter will carry out auto-tuning. Then press  or  on the keyboard panel for the inverter to automatically calculate the following parameter: P.308~P.312.
- When the motor cannot be fully separated from the load, select P.301=2. When the motor is stopped, the motor parameter will carry out auto-tuning. Then press  or  on the keyboard

panel for the inverter to automatically calculate the following parameter: P.308~P.312.

- The users can use the motor's nameplate to calculate the two parameters. The motor nameplate parameters used in the calculation are: rated voltage U , rated current I , rated frequency f and power factor η .
- The calculation of motor idling excitation current and of motor mutual induction is presented below: L_δ is motor leakage induction.

Idling current: $I_0 = I \times \sqrt{1 - \eta^2}$

Mutual inductance calculation: $L_m = \frac{U}{2\sqrt{3} \cdot \pi \cdot f \cdot I_0} - L_\delta$

I_0 is the idling current, whereas L_m is mutual inductance, L_δ is leakage inductance.

Note: 1. When the inverter is used with a motor of a different level, verify the input motor's nameplate parameter P.302~P.307. The vector control method is heavily dependent upon motor parameters. To achieve a good control performance, the controlled motor's correct parameters have to be acquired.

2. When any or many values of P.302~P.312 are manually revised, perform the function of P.997 to reload the new values of the parameters.

5.74 Gain Adjustment at Speed Control (P.320~P.325)

P.320 "Speed control proportion coefficient 1"

P.323 "Speed control proportion coefficient 2"

P.321 "Speed control integral coefficient 1"

P.324 "Speed control integral coefficient 2"

P.322 "Switching frequency 1"

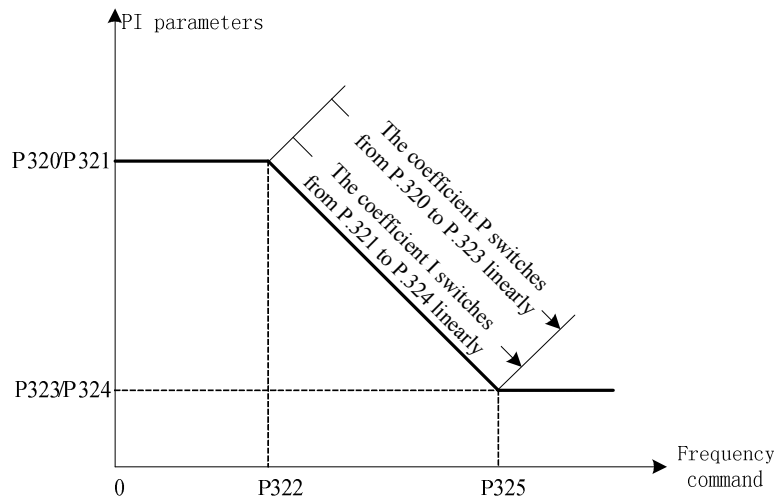
P.325 "Switching frequency 2"

Parameter	Factory setting	Setting range	Remarks
320	100%	0~2000%	---
321	0.3s	0~20s	---
322	5.00HZ	0.00~P.325	---
323	100%	0~2000%	---
324	0.3s	0~20s	---
325	5.00HZ	P.322~the maximum output frequency	---

<Setting>

- P.320 and P.321 are the PI adjusting parameter when the running frequency is less than the switching frequency 1 (P.322). P.323 and P.324 are the PI adjusting parameter when the running frequency is greater than the switching frequency 2 (P.325). When the running frequency is between the switching frequency 1 and the switching frequency 2, the two PI

parameters switch linearly.



The diagram of the two PI parameter variation

- P.320/P.323 is used to set the proportion gain of speed control.(Set the value slightly larger to better follow changes on the speed command and to reduce speed change due to external interference.)
- P.321/P.324 is used to set the integral time of speed control.(Due to external interference-generated speed change, set the value smaller to shorten the time spent on returning to the original speed).

Note: 1. Use P.320/P.323 to increase the set value of speed control gain can elevate the effecting time. But a set value too high can generate vibration and noises.
 2. Reduce speed control integral coefficient P.321/P.324 to shorten the time required to go back to the original speed. But if the value is too small, overshoot can happen.

5.75 Torque limit range setting (P.326)

P.326“Torque limit range level under vector control ”

Parameter	Factory setting	Setting range	Remarks
326	200%	0~400%	---

<Setting>

- When P.326=100%, the maximum output torque under the vector control is the motor rated torque.

Motor rated torque calculation: $T(N.M) = \frac{P(W)}{\omega(rad/s)}$,

P(W) is on the basis of P.302, $\omega(rad/s)$ can be worked out according to the parameter P.307:
 $\frac{2\pi \times P.307}{60} (rad/s)$.

5.76 Feedback Control Parameters (P.350~P.359)

P.350 “Number 1 of pulses per revolution of the encoder”

P.351 “Encoder input mode setup 1”

P.352 “PG signal abnormality (zero speed) detection time”

P.353 “Motor over-speed detection frequency”

P.354 “PG over-speed detection time”

P.355 “Number 2 of pulses per revolution of the encoder”

P.356 “Encoder input mode setup 2”

P.357 “Dividing frequency output setting (denominator)”

P.358 “Dividing frequency filter coefficient”

P.359 “Electronic gear ratio”

Parameter	Factory setting	Setting range	Remarks
P.350	2500	1~20000	P.350 and P.351 are used to set the encoder signal which connects to the A1/B1 interface on PG03. When the closed loop controls, the encoder signal for feedback can only be connected to the A1/B1 on PG03.
P.351	0	0~4	
P.352	1s	0~100s	---
P.353	4Hz	0~30Hz	---
P.354	1s	0~100s	---
P.355	2500	1~20000	P.355 and P.356 are used to set the encoder signal which connects to the A2/B2 interface on PG03.
P.356	0	0~4	
P.357	1	1~255	The multiple setting for PG03 feedback and output
P.358	0	0~255	The setting of PG03 dividing frequency filter coefficient
P.359	1.00	0.01~300	Note 4

<Setting>

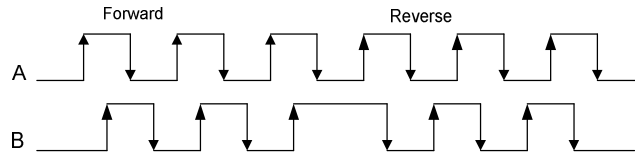
- When the switch SW11 is set to PG, the terminal A2/B2 on PG03 card is valid.
- When using the PG card, P.350 and P.355 are applied for setting up the number of pulses to be generated by the encoder per revolution of the motor. That is, the number of pulses generated by one cycle of Phase A/Phase B. When carrying out PG feedback control, if the detected frequency is 0, and with duration longer than the time set by P.352, and then the PG card’s feedback signal is abnormal. The inverter will display alarm PG2 and stop the operation. If PG signal abnormal (zero speed) detection time P.352 is set to 0, then there is no PG card feedback signal abnormal function, i.e., no alarm PG2.
- When carrying out PG feedback control, if the difference between the detected frequency and the output frequency exceeds P.353, and with duration longer than the set time of P.354, then the speed deviation is too big. The inverter will display alarm PG3 and stop the operation. If PG over-speed detection time P.354 is set to 0, then alarm PG3 function is

not available.

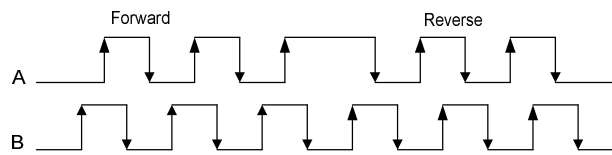
- P.351 and P.356 are applied for setting up the encoder's input mode. The following encoder input modes are used as some examples:

0: No function;

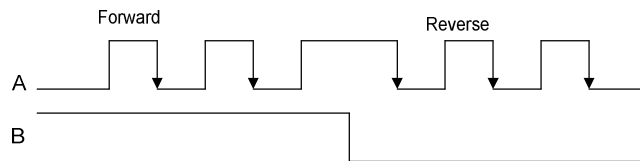
1: Phase A/B pulse train, Phase A is 90° ahead of Phase B and is forward rotation.



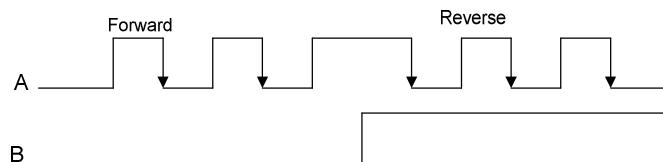
2: Phase A/B pulse train, Phase B is 90° ahead of Phase A and is forward rotation.



3. Phase A is a pulse train. Phase B is a direction sign. L is reverse rotation and H is forward rotation



4. Phase A is a pulse train. Phase B is a direction sign. L is forward rotation and H is reverse rotation.



- P.357 is the multiple setting for the feedback and output of PG card. If the feedback is 1024PPR and P.357 is set to 2, the output of PG OUT (pulse output) on PG card is 512PPR.

Note: 1. If closed-loop control is selected but P.351=0, then the inverter will display alarm PG1 and stop the operation.

2. When P.300=1, execute the V/F closed-loop control; when P.300=4, execute the closed-loop vector control.

3. When P.151=1, zero-speed operation is executed under the closed-loop control; DC voltage brake is executed under the V/F closed-loop control.

4. When P.356 is not equal to 0, the A2/B2 pulse input is taken as the frequency command (the target frequency (0.01Hz) =the pulse frequency (Hz) /P.355*P.359); After starting the inverter, the actual rotation direction of motor is related to the setting of P.356.

5.77 Torque control parameters (P.400~P.406)

<u>P.400 “The torque control parameter”</u>	<u>limit for torque control”</u>
<u>P.401 “Torque command”</u>	<u>P.404 “Torque filter coefficient”</u>
<u>P.402 “The positive direction speed limit for torque control”</u>	<u>P.405 “Torque setting source”</u>
<u>P.403 “The negative direction speed</u>	<u>P.406 “Selection of speed limit”</u>

Parameter	Factory setting	Setting range	Remarks	
400	0	0~1	0	Torque control is invalid
			1	Torque control is valid (in the mode of close-loop vector control)
401	0%	-100%~100%	Torque command	
402	30.00Hz	0~650.00Hz	The positive direction speed limit for torque control	
403	30.00Hz	0~650.00Hz	The negative direction speed limit for torque control	
404	0	0~31	Torque filter coefficient	
405	0	0~2	0	The torque is given by the parameter P.401
			1	The torque is given by the analog or pulse input
			2	The torque is given by the communication mode
406	0	0~1	0	The speed is limited according to P.402 and P.403.
			1	Frequency command source(it is decided according to P.79)

<Setting>

- When P.400=0, the torque control is invalid and the inverter will do the general close-loop vector speed control. When P.400=1, the torque control is valid and the inverter will do the torque control. When the torque control is valid, the inverter need to work in the mode of close-loop vector control and the speed encoder must be installed. And if the torque command is larger than the load torque, the motor will accelerate until the motor speed is equal to the speed limit. Now the inverter will switch to speed control mode to avoid accelerating the motor continually.
When P.400=1, “the switch function of external terminal speed /torque control” is invalid, and only the torque control function can be operated.
- P.401 is used to set the torque command, the actual torque command =P.401* the motor rated torque;

According to the motor rated torque method: $T(N.M) = \frac{P(W)}{\omega(rad/s)}$,

P(W) is on the basis of P.302, $\omega(\text{rad/s})$ can be worked out according to the parameter

P.307: $\frac{2\pi \times P.307}{60} (\text{rad/s})$ 。

- If the torque command is positive direction, the speed limit is positive direction P.402; If the torque command is negative direction, the speed limit is negative direction P.403.
- P.404 is the torque filter coefficient. When a bigger coefficient is set, the control will be stable, but the control response will be worse. When the coefficient is too small, the response will be quick, but the control can be unstable. If the best setting value is unknown, you can adjust the setting value appropriately according to the level of unstable control and response delay.
- When P.405=1, the torque is given by the analog or pulse input. The maximum value of analog and pulse setting correspond to the motor rated torque. When P.405=2, the torque is given by the communication mode. There are two ways to set the torque by communication mode, one is changing the value of P.401 when P.405 is set to 0, another is setting by the communication address 100DH when P.405 is set to 2. When the communication address 100DH is set to -10000~10000, it represents -100%~100% of the motor rated torque.
- When P.406=0, please limit the speed under torque control by parameter P.402 and P.403; when P.406=1, please limit the speed under torque control by the frequency source, which is set by P.79.

5.78 HDI terminal input signal (P.522~P.526)

P.522 “The setting corresponding to the minimum frequency of terminal HDI”

P.524 “The minimum input frequency of terminal HDI”

P.523 “The setting corresponding to the maximum frequency of terminal HDI”

P.525 “The maximum input frequency of terminal HDI”

P.526 “The HDI filter coefficient”

Parameter	Factory setting	Setting range	Remarks
522	0%	-100%~100%	----
523	100%	-100%~100%	----
524	0kHz	0~100kHz	----
525	100kHz	0~100kHz	----
526	1	0~31	----

<Setting>

- P.526 (the HDI filter coefficient) is used to filter out the operation frequency jitter generated by component accuracy, noise or other factors. The larger the set value of P.526 is, the

better the filter ability is, and the slow response will be caused.

Note: 1. When P.550 =57 and the toggle switch SW11 is switched to HDI, the HDI input function is valid.
 2. The frequency computing method of HDI input signal is similar to 2-5 analog input, the formula is $P.1 * ((P.525-P.524)*(P.523-P.522))/(\text{the input frequency} - P.524) + P.522$.

5.79 PTC (P.532~P.534)

P.532 “PTC filter coefficient”

PTC alarm”

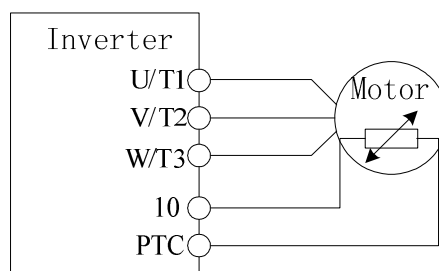
P.533 “The process mode selection of

P.534 “The percentage of PTC level”

Parameter	Factory setting	Setting range	Remarks	
532	31	0~31	----	
533	0	0~3	0	Alarm and continue to run
			1	Alarm and decelerate to stop
			2	Alarm and stop freely
			3	No alarm
534	0%	0~100%	0	No PTC alarm
			0.1%~100%	The motion level of PTC function The 100% corresponds to the maximum analog input.

<Setting>

- P.532 is “PTC filter coefficient”, and it is used to filter out the operation frequency jitter generated by component accuracy, noise or other factors. The larger the set value of P.532 is, the better the filter ability is, and the slow response will be caused.



The diagram of PTC wiring

5.80 The tension control mode selection (P.600~P.603)

P.600 “The tension control mode during roll-down”
selection”

P.603 “Mechanical transmission ratio”

P.601 “The curling mode”

P.602 “Selection of inverse take-up

Parameter	Factory setting	Setting range	Remarks	
600	0	0~4	0	The tension control is invalid
			1	Open-loop torque control mode (in the mode of close-loop vector control)
			2	Close-loop speed control mode
			3	Close-loop torque control mode (in the mode of close-loop vector control)
			4	Constant line speed control mode
601	0	0~1	0	Wind-up
			1	Roll-down
602	0	0~1	0	Active inverse material take-up is not allowed during startup
			1	Active inverse material take-up is allowed during startup
603	1.00	0.01~300.00	Mechanical transmission ratio	

<Setting>

- When P.600=0, the tension control is inactive, and the inverter is used as general inverter.
- When P.600=1, the open-loop torque control mode is active. The inverter controls the constant tension through controlling the motor output torque. No tension feedback is required. The speed encoder must be installed when the inverter works in the mode of close-loop vector control.
- When P.600=2, the close-loop speed control mode is active. The controlling result is to make the tension (position) feedback signal stable at the value given by PID. Close loop means that the tension (position) detection feedback forms a close loop for adjustment. Speed control mode means that the inverter realizes the control by adjusting the output frequency according to the feedback signal. This mode can work in any motor control mode, that is to say P.300 can be set to 0~4.
- When P.600=3, the close-loop torque control mode is active. The tension feedback close-loop adjustment is added on the basis of open-loop tension control. The tension signal fed back by the tension detection device and the tension setting value constitute the PID close-loop adjustment which is used to adjust the inverter output torque command. The control method of it works in the mode of close-loop vector control method, and the speed encoder must be installed.
- When P.600=4, the constant line speed control method is active. It is a special application

to realize constant line speed control without PID adjustment, which is more stable than general close-loop control and applicable to the filed requiring smooth operation rather than fast line speed adjustment. This mode can work in any motor control mode, that is to say P.300 can be set to 0~4.

- P.601 is used to select the curling mode which can be combined with the switching terminal of wind-up and roll-down. If the switching terminal of wind-up and roll-down is inactive, the set of actual curling mode is the same with the function mode. If it is valid, the set of the actual curling mode is the same with the switching terminal of wind-up and roll-down.
- P.602 is used to select whether support active take-up of material through inverse running of motor. If “not allowed” is selected, during the roll-down control, the inverter can only output torque when material is running forward. During the roll-down, the frequency for inverse take-up can be limited by setting the upper limit frequency.
- P.603 is the mechanical transmission ratio. Mechanical transmission ratio=motor rotation speed/winding shaft rotation speed, the mechanical transmission ratio must be correctly set during the tension control.

5.81 Tension setting (P.604~ P.609, P.654)

P.604 “Tension setting source”

P.608 “Zero-speed threshold”

P.605 “Tension setting”

P.609 “Tension taper”

P.606 “Maximum tension”

P.654 “Taper compensation

P.607 “Zero-speed tension increase”

correction”

Parameter	Factory setting	Setting range	Remarks
604	0	0~2	0 The parameter P.605 setting
			1 The analog value or pulse input setting
			2 Communication setting
605	0	0~30000N	The tension set value
606	0	0~30000N	The maximum tension
607	0.0%	0.0%~50.0%	Zero-speed tension increase
608	0Hz	0~30Hz	Zero-speed threshold
609	0.0%	0.0%~100.0%	Tension taper
654	0	1~10000mm	Taper compensation correction

<Setting>

The parameters in this part are only applicable in open-loop torque mode.

- When P.604=0, the tension is set by the parameter P.605.
- When P.604=1, the tension is set by the analog value or pulse input terminal. If set the

tension through this mode, the maximum tension P.606 must be set. In general, the maximum value set by analog value and set in maximum pulse both correspond to the maximum tension. The pulse can be set by terminal HDI.

- When P.604=2, the tension is set by communication. If perform the control with upstream equipment, the tension can be set by communication. There are two ways to realize communication setting of tension: 1) Change value of P.605, then P.604 shall be set to 0; 2) Set the tension through communication address 100CH, P.604 shall be set to 2 and the communication address shall be set between 0 and 30000.
- P.607 is the zero-speed tension increase. It is used to set the tension of the system when it is at zero-speed. It is mainly for overcoming static friction when startup or keep certain tension when the system is at zero-speed. If the control tension is small and it is hard to start, it is allowed to properly increase the setting value of the parameter.
- P.608 is the zero-speed threshold. When the running speed of the inverter is below the set speed of the parameter, it is considered that the inverter is under zero-speed operation status.
- P.609 is the tension taper. The parameter is only used for wind-up control. For the wind-up control, sometimes, it is needed to reduce the tension while increasing the curling radius to ensure a good curling of the material. Formula of tension taper:

$$F=F0*\{1-K*[1-(D0+D1)/(D+D1)]\}$$

Wherein, F is the actual tension, F0 is the setting tension, D0 is the diameter of winding shaft, D is the actual curling radius, D1 is the taper compensation correction of P.654 set tension, and K is the tension taper.

- P.654 is the taper compensation correction of tension which can relay the reduction curvature of tension.

5.82 Curling Radius Calculation (P.610~P.626, P.650)

P.610 “curling radius calculation method selection”

P.611 “Maximum curling radius”

P.619 “Number of pulses each turn”

P.612 “Winding shaft diameter”

P.620 “Number of turns each layer”

P.613 “Initial curling radius source”

P.621 “Material thickness setting source”

P.614 “Initial curling radius 1”

P.622 “Material thickness 0”

P.615 “Initial curling radius 2”

P.623 “Material thickness 1”

P.616 “Initial curling radius 3”

P.624 “Material thickness 2”

P.617 “Curling radius filtering coefficient”

P.625 “Material thickness 3”

P.618 “Current value of curling radius”

P.626 “Maximum thickness”

P.650 "Curling radius memory"

Parameter	Factory setting	Setting range	Remarks	
610	0	0~3	0	Calculation through line speed
			1	Calculation through thickness accumulation (the encoder on side of the motor), the pulse signal is connected to the A1/B1 on PG03 card.
			2	Calculation through thickness accumulation (the encoder on the side of curling shaft), the pulse signal is connected to the high-speed pulse input terminal HDI.
			3	Analog value or pulse input
611	500	1~10000mm	The maximum curling radius	
612	100	1~10000mm	Winding shaft diameter	
613	0	0~1	0	Initial curling radius is set by the parameter P.614~P.616.
			1	Initial curling radius is set by the analog value.
614	100	1~10000mm	Initial curling radius 1	
615	100	1~10000mm	Initial curling radius 2	
616	100	1~10000mm	Initial curling radius 3	
617	0	0~31	Curling radius filtering coefficient	
618	---	1~10000mm	Current value of curling radius	
619	1	1~60000	Number of pulses each turn	
620	1	1~10000	Number of turns each layer	
621	0	0~1	0	The material thickness is set by the parameter P.622~P.625.
			1	The material thickness is set by the analog value.
622	0.01	0.01~100.00mm	Material thickness 0	
623	0.01	0.01~100.00mm	Material thickness 1	
624	0.01	0.01~100.00mm	Material thickness 2	
625	0.01	0.01~100.00mm	Material thickness 3	
626	1.00	0.01~100.00mm	Maximum thickness	
650	0	0~1	Curling radius memory	

<Setting>

- In every tension control method, the curling radius is needed to be calculated. The curling radius can be acquired through the curling radius calculation module built in the inverter or through the external curling radius sensor.

- P.610=0, the calculation through line speed: the curling radius is calculated by the system current line speed and the inverter output frequency. The equation is as follows:

$$D = (i \times V) / (\pi \times n)$$

Wherein D is the curling radius, I is the mechanical transmission ratio, V is the line speed, n is the motor speed.

When the system operation speed is slow, the line speed of material and the output frequency of the inverter will be low. Then a little detection error will cause a big error in the curling radius calculation, so that a lowest line speed P.629 must be set. When the line speed of material is lower than P.629, the curling radius is stopped to calculate and the current value of curling radius remains unchanged. The value should be set below the normal working line speed.

- P.610=1, the calculation of thickness accumulation: the curling radius is worked out through the encoder on the motor side and the gear feedback. In this condition, connect the pulse signal to A1/B1 on PG03 and set the encoder input mode setup (P.351), the mechanical transmission ratio (P.603), the number of pulses per revolution of the encoder (P.350), the number of turns each layer (P.620) and the material thickness 0 (P.622).
- P.610=2, the calculation through thickness accumulation: the curling radius is worked out through the encoder on the winding shaft. In this condition, connect the pulse signal to the terminal HDI of the inverter and calculate the curling radius through the number of pulses each turn (P.619), the number of turns each layer (P.620) and the material thickness 0 (P.622).
- P.610=3, when testing the curling radius with curling radius test sensor, the input channel of curling radius sensor can be the analog value or the pulse input.
- P.611 is used to set the maximum curling radius. When P.610=3, the parameter must be set and the maximum of the analog value or pulse signal corresponds to the set value of the parameter P.611.
- P.612 is used to set the winding shaft diameter. The curling radius calculated by the curling radius calculation module of the inverter is limited by P.611 and P.612.
- P.613 is used to select the input channel of initial curling radius.

1) When P.613=0, the initial curling radius is set by the parameter P.614~P.616. The initial value of curling radius can be determined through two multi-function terminals, the selection of initial curling radius is as follows:

The external terminal 1	The external terminal 2	The initial curling radius source
0	0	P.612
0	1	P.614
1	0	P.615
1	1	P.616

2) When P.613=1, the initial curling radius is determined by the analog value. When the initial curling radius does not count from the hollow curling radius, the initial curling radius can be selected by the external terminal. For wind-up control, the system default initial curling radius is the diameter of winding shaft (P.612). For roll-down

control, the system default initial curling radius is the maximum curling radius (P.611).

- P.617 is used to set the curling radius filtering coefficient to avoid fast change of curling radius calculation (or input) result.
- P.618 is used to display the current curling radius in real time. It is able to know the current actual curling radius through the parameter.
- Only when P.610=1 or P.610=2, the parameters P.619~P.626 are related to the parameter.
 - 1) P.619 represents pulse number when winding shaft turns a round. It needs to be set when P.610=2.
 - 2) P.612 shows the rounds of winding shaft turning after the material wraps one layer. It is used for wire.
 - 3) When the material thickness is analog input (P.621=1), the maximum analog input corresponds to the set value of P.626.
 - 4) When P.621 =0, the system default material thickness is determined by the parameter P.622. The different material thickness source can also be selected by the combination of external terminals and P.622~P.625, the selection relationship is as follows:

External terminal 1	External terminal 2	Initial thickness source
0	0	P.622
0	1	P.623
1	0	P.624
1	1	P.625

- When P.650 =0, it does not memorize the curling radius when you turn off the power or stop calculating the curling radius, and it takes curling radius(P.612) or original curling radius(P.614) as initial value of calculation when you re-turn on the power or begin to calculate. When P.650 =1, it memorizes previous calculation value to P.618 when you turn off the power or stop calculating the curling radius, and it takes the memorized curling radius as initial value when you re-turn on the power or begin to calculate.

5.83 Line Speed Input (P.627~P.630)

P.627 “Line speed input source”

P.628 “Maximum line speed”

P.629 “Minimum line speed for curling radius calculation”

P.630 “Actual line speed”

Parameter	Factory setting	Setting range	Remarks	
627	0	0~2	0	No line speed input
			1	The analog value or pulse input
			2	The communication setting
628	1000.0m/min	0.1~6500.0m/min	The maximum line speed	
629	200.0m/min	0.1~6500.0m/min	Minimum line speed for curling radius calculation	
630	---	0~6500.0m/min	Actual line speed	

<Setting>

- If the curling radius source selects line speed calculation or tension control mode as the close-loop speed control, it is required to obtain correct line speed signal. In general, the convenient way for obtaining line speed is through analog output of operation frequency of traction (constant speed) inverter. The operation frequency of traction inverter corresponds with the line speed in linear. It only needs to set the maximum line speed (P.628) to the corresponding line speed of maximum frequency of operation frequency of traction (constant speed) inverter.
- P.627 is used to select the way or channel for obtaining line speed.
 - 1) When P.627=0, no line speed is input.
 - 2) When the line speed is obtained through the analog value or pulse input (P.627=1), the maximum line speed P.628 must be correctly set. The maximum value of analog or pulse input corresponds with the maximum line speed.
 - 3) When the line speed is obtained through the communication method (P.627=2), it is set by the communication address 100AH and the setting range is 0.1~6500.0m/min.
- P.629 is used to set the minimum speed for starting calculation of curling radius. When the inverter detects that the line speed is lower than the value, inverter will stop curling radius calculation. Correct setting of the value will effectively avoid great deviation of curling radius calculation when the speed is reduced. In general, the value shall be set to over 20% of maximum line speed.
- P.630 is used to display the actual line speed in real time. The current actual line speed can be known by the parameter.

5.84 Tension compensation (P.631~P.636)

P.631 “Inertia self learning torque setting 1”

P.632 “Inertia self learning torque setting 2”

P.633 “Mechanical inertia compensation coefficient”

P.634 “Material density”

P.635 “Material width”

P.636 “Friction compensation coefficient”

Parameter	Factory setting	Setting range	Remarks
631	30.0%	0.0%~P.632	Inertia self learning torque setting 1
632	60.0%	P.631~100.0%	Inertia self learning torque setting 2
633	0	0~65535	Mechanical inertia compensation coefficient
634	0	0~60000kg/m ³	Material density
635	0	0~60000mm	Material width
636	0.0%	0.0%~50.0%	Friction compensation coefficient

<Setting>

- When the tension control adopts the open loop torque mode, during the system acceleration/deceleration, additional torque shall be provided to overcome the rotation inertia of the whole system. Otherwise, too small tension upon wind-up acceleration and too large tension upon deceleration, or too large tension upon roll-down acceleration and too small tension upon deceleration will be caused.
- For the instruction of P.631 and P.632, please refer to the instruction part of P.301=4.
- P.633 is used to set the mechanical inertia compensation coefficient. It is used to compensate the rotation inertia of the system, including inertia of the motor, rotation system and the shaft. Such inertias are fixed and independent of the curling radius. This parameter can be obtained automatically by the system inertia self learning or manually set based on the actual working situation.
- P.634 and P.635 are relevant to the material inertia compensation. The inverter will automatically calculate the material inertia compensation value according to the parameter and the curling radius.
- P.636 is used to set the friction compensation coefficient. Take wind-up as an example. Because of the frictional resistance, the material tension reduces, which is more obvious upon small roll, and the tension will be nonlinear. This situation can be improved by setting the parameter.

5.85 Parameters of Material Supply Interrupt Auto Detection

(P.637~P.640)

P.637 “Material supply interrupt auto detection function selection”

P.639 “Material supply interrupt auto detection error range”

P.638 “Material supply interrupt auto detection minimum line speed”

P.640 “Material supply interrupt auto detection judgment delay”

Parameter	Factory setting	Setting range	Remarks	
637	0	0~1	0	Material supply interrupt auto detection function selection is inactive
			1	Material supply interrupt auto detection function selection is active
638	200.0m/min	0.1~6500.0m/min	Material supply interrupt auto detection minimum line speed	
639	10.0%	0.1%~50.0%	Material supply interrupt auto detection error range	
640	2.0s	0.1~60.0s	Material supply interrupt auto detection judgment delay	

<Setting>

- The group of parameters is used for the inverter to automatically detect the material supply interrupt. It is an auxiliary function. Only when line speed is use for curling radius calculation can the inverter have the material supply interrupt detection basis. And not in all situations can the material supply interrupt be detected effectively. If good result can not be achieved after proper effort, set P.637 to 0.
- If the system line speed is higher than P.638, and the abnormal change of the curling radius (the variation range of the curling radius calculated in the current corresponding to the last one is too large) exceeds the setting range of P.639, and the lasting time of the abnormal change of the curling radius exceeds the delay time set by P.640, the inverter reports material supply interrupt failure (bEb).

5.86 PID Parameters 2 (P.641~P.644)

P.641 “Proportional gain P2”

P.644 “Auto adjustment basis for PID parameters”

P.642 “Integral time I2”

P.643 “Differential time D2”

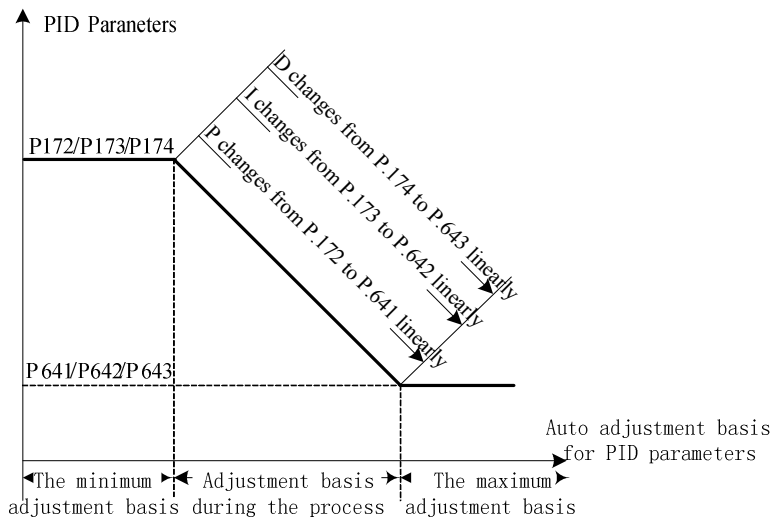
Parameter	Factory setting	Setting range	Remarks	
641	20	1~100	This gain determines the proportion controller’s impact on feedback deviation. The greater the gain, the faster the impact. Yet a gain that is too big will cause vibration.	
642	1s	0~100s	This parameter is use to set integral controller’s integral time. When the integral gain is too big, the integral effect will be too weak to eliminate steady deviation. When the integral gain is too small, the system vibration frequency will increase, and therefore the system may be unstable.	
643	0	0~1000 ms	This gain determines differential controller’s impact on the amount of change of the deviation. Appropriate differential time can reduce the overshooting between the proportion controller and the integral controller. Yet when the differential time is too large, system vibration may be induced.	
644	0	0~3	0	PID parameters 1 are active (please refer to page 128)
			1	Adjust according to the curling radius
			2	Adjust according to the operation frequency
			3	Adjust according to the line speed

<Setting>

- This group of parameters is only related to the close loop speed mode.
- P.644 is the auto adjustment basis for PID parameters.
 - 1) When P.644=0, only the first group of PID parameters is used, and the second group is inactive.
 - 2) When P.644=1, the adjustment is according to the curling radius. The first group of PID parameters is used for empty roll, while the second group of PID parameters is used for full roll. The PID parameters change continuously during the process.
 - 3) When P.644=2, the adjustment is according to the operation frequency. This first group of PID parameters is used upon zero speed, while the second group of parameters is used upon maximum frequency. The PID parameters change continuously during the process.
 - 4) When P.644=3, the adjustment is according to the line speed. This first group of PID parameters is used upon zero speed, while the second group of parameters is used upon maximum line speed. The PID parameters change continuously during the

process.

- The relationship between PID auto adjustment basis and PID parameters is shown as following diagram:



5.87 Pre-drive control parameters (P.645~P.647)

P.645 “Pre-drive speed gain”

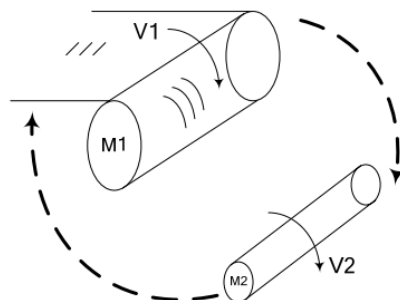
P.646 “Pre-drive torque increase proportion”

P.647 “Pre-drive torque increase delay time”

Parameter	Factory setting	Setting range	Remarks
645	0.0%	-50.0%~50.0%	Pre-drive speed gain
646	0.0%	-50.0%~50.0%	Pre-drive torque increase proportion
647	0	0~65535ms	Pre-drive torque increase delay time

<Setting>

- The diagram of auto roll alternation is as follows, there are two inverters to control the replacing upper roll and replacing lower roll.



M1 is “replacing lower roll”, M2 is “replacing upper roll” or “pre-drive roll”

- To enhance productivity, generally, the winding shaft will be switched without stopping the machine (auto winding up and rolling down the material). To realize the smooth and well-off auto roll alternation and avoid causing too large shock, it is necessary to rotate the wind-up roll (roll-down roll) in advance and the rotating line speed shall be consistent with the line speed of the materials in operation ($V1 \approx V2$). This is the pre-drive function.
- Auto roll alternation control logic
On the occasion of continuous working, the auto roll alternation control logic is used to alternate the roll smoothly to enhance productivity. The auto roll alternation function is realized with the cooperation of the control signal provided by external controller. Wherein, the motion of B, C and D is only active when the replacing lower roll inverter works in the close loop vector control mode (P.300=4).
 - A. Pre-drive process
When the replacing upper roll inverter receives the pre-drive command, no matter what value P.600 is set, it will operate according to the matching frequency calculated by the given line speed and the initial curling radius until the line speed of replacing upper roll is consistent with the system line speed. When the pre-drive signal disappears, the control mode switches to the setting tension control mode.
 - B. Torque memory signal
Before replacing the roll, the torque memory signal makes the replacing lower roll inverter remember the current output torque for the use of later process.
 - C. Torque memory enable
When the replacing upper roll has contacted with the material and the replacing lower roll hasn't been replaced, no matter which torque control mode is adopted, the replacing lower roll inverter will be switched to the torque control mode by the torque memory enable signal. The given torque command is the torque remembered by the previous inverter.
 - D. Torque increase function
When the torque memory enable signal is valid, the inverter will control the torque according to the memory torque. After the setting torque increase delay time, the output torque will increase according to the setting torque increase proportion to keep a large line tension at the moment for easy cutting off.
At the end of roll alternation, the pre-drive signal of the replaced upper roll inverter is revoked. Then the replaced upper roll inverter operates in the setting tension control mode. The process of roll alternation is end after the replacing lower roll inverter stops.
- The pre-drive command, torque memory signal and torque memory enable signal mentioned above in the point 3 are realized all by setting the corresponding function of external terminals.
- P.645 is use to set the pre-drive speed gain. For meeting the technological requirements and revising the line speed error, it can be adjusted on the basis of synchronous matching frequency. The adjustment formula: $V2 = V1 * (1 + P.645)$.
When $P.645 < 0$, the line speed of pre-drive roll will be lower than the material line speed.

- In the process of auto roll alternation, when the torque memory enable signal is valid, the replacing lower roll inverter will control the torque according to the memory torque at first. And then after the delay time set by P.647, the output torque will be increased according to the torque increase proportion set by P.646.

5.88 Constant line speed mode parameter (P.656)

P.656 “Line speed setting source”

Parameter	Factory setting	Setting range	Remarks	
656	0	0~2	0	The line speed setting is invalid
			1	The line speed is obtained by analog value or pulse input
			2	The line speed is obtained by communication mode

<Setting>

- The parameter is only valid when P.600=4. P.656 is used to select the method or channel for acquiring the target speed of constant line speed.
 - 1) When P.656=1, the line speed is obtained by analog value or pulse input. The maximum line speed P.628 must be set correctly now. The maximum of analog value or pulse input corresponds to the maximum line speed.
 - 2) When P.656=2, the line speed is obtained by communication mode. It is set by the communication address 100BH which setting range is 0~6500.0m/min.

5.89 Alarm History Clear (P.996)

P.996 “Alarm history clear”

- Once P.996 is read-out (after reading out the parameter, the screen will display $\overline{E} \cdot \overline{r} \cdot \overline{L}$) and rewrite it. All the abnormal record will be erased.

5.90 Inverter Reset (P.997)

P.997 “Inverter reset”

- Once P.997 is read-out (after the read-out, the screen will display $\overline{E} \cdot \overline{S} \cdot \overline{r}$) and rewritten-in, the inverter is reset. After resetting the inverter, the values of the two relays, “electronic thermal relay” and “IGBT module thermal relay”, will be set to zero.

5.91 Restoration of the Parameters to the Default Values (P.998 and P.999)

P.998 “Restoring all parameters to default values”

P.999 “Restoring some parameters to default values”

- Once P.998 is read-out (after the read-out, the screen will display \overline{ALL}) and rewritten-in, all the parameters will be restored to the default values except P.21, P.90, P.188, P.189, P.285, P.286, P.292 and P.293.
- Once P.999 is read-out (after the read-out, the screen will display \overline{Pr}) and rewritten-in, all the parameters will be restored to the default values except P.21, P.90, P.188, P.189, P.190, P.191, P.192~P.195, P.196~P.199, P.285, P.286, P.292, P.293, P.300~P.312, P.320~P.326.
- After performing P.998 and P.999, the screen will display $\overline{0.00}$, indicating that the parameters have been restored to the default values.

Note: The parameter P.998 is only executable in the PU mode. For the flow chart of transferring operation modes, please refer to 4.1.1.

6. Inspection and Maintenance

In order to avoid malfunction and security problems resulting from device aging caused by environmental factors such as temperature, oil fog, dust, vibration, humidity and etc., “daily inspection” and “periodical inspection” are necessary.

Note: The installation, wire arrangement, dismounting, and maintenance can only be done by qualified electricians.

6.1 Daily Inspection

1. Check whether the surrounding conditions are normal (including temperature, humidity, dust density, etc.) at the place of the installation.
2. Check whether the power supply voltage is normal (the voltage between R/L1, S/L2 and T/L3).
3. Check whether the wiring is secured (whether the external wiring for the main-circuit board and the control-board terminal are secured).
4. Check whether the cooling system is normal (whether there's any abnormal noise during the operation and whether the wiring is well secured).
5. Check whether the indicator lamp is normal (whether the indicator lamp of the control board and of the operation panel and the LED monitor of the operation panel are normal).
6. Check whether the operation is as expected.
7. Check whether there is any abnormal vibration, noise or odor during the operation.
8. Check whether there is any leakage from the filter capacitor.

6.2 Periodical Inspection (During Machine Shutdown) Items

1. Check the connectors and wiring (whether the connectors and wiring between the main-circuit board and control board are secured and without damage).
2. Check whether the 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 leakage.
4. Check the IGBT module on the main-circuit board.
5. Clean the dust and foreign substance on the circuit board.
6. Check the insulation resistor.
7. Check whether the cooling system is normal (whether the wiring is secured; clean the air filter, etc.)
8. Check the screws and belts.
9. Check the external wires and the terminal banks for damage.

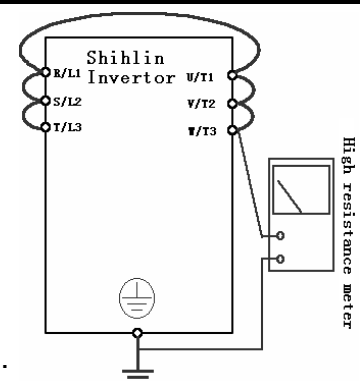
6.3 Regular Replacement for Some Components

Items	Standard replacing time	Description
Cooling fan	2 years	For the axle of a fan, the standard lifetime is about 10 – 35 thousand hours. Assuming that the fan operates 24 hours per day, the fan should be replaced every 2 years.
Filter capacitor	5 years	The filter capacitor is an electrolytic capacitor that deteriorates with time. The deterioration speed is contingent on the ambient conditions. Generally, it should be replaced every 5 years.
Relay	---	If bad contact occurs, please replace it immediately.

Note: please send the inverters to the factory fore complement replacement.

6.4 Inverter Insulation Resistance Measurement

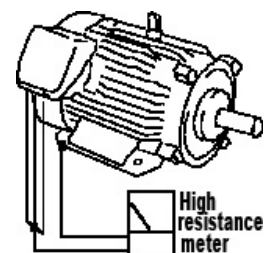
1. Before measuring the inverter insulation resistance, first dismount the “wiring of all the main-circuit terminals” and the “control board.” Then execute the wiring as shown in the right picture.
2. The measurement is only suitable for the main circuit. It is prohibited to use a high-resistance meter for measuring terminals on the control board.
3. The value of the insulation resistance shall be greater than 5MΩ.



Note: Please do not carry out a high-voltage test; as such test will damage the built-in semiconductor components.

6.5 Motor Insulation Resistance Measurement

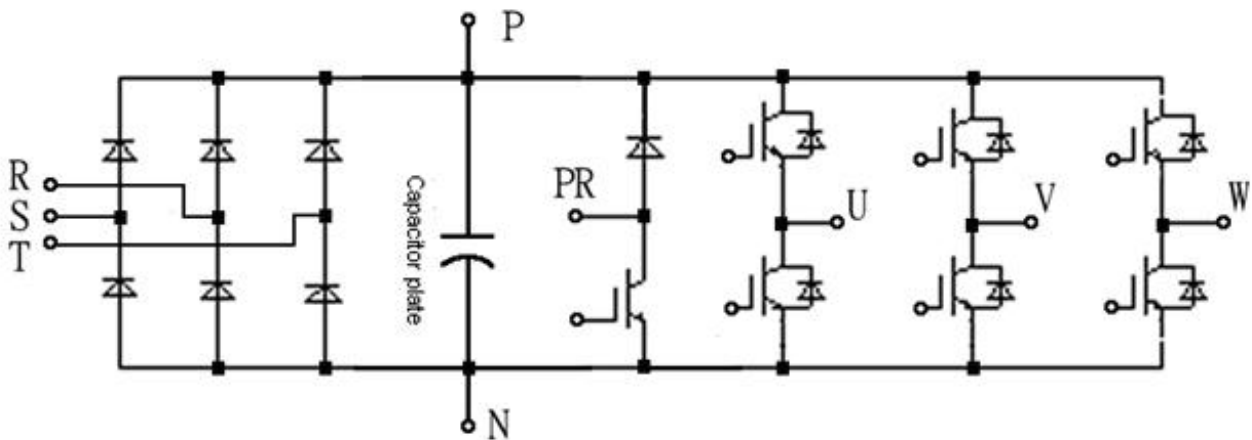
1. Before the measurement, please dismount the motor, and execute the wiring as shown in the diagram on the right.
2. The value of the insulation resistance shall be greater than 5MΩ.



6.6 IGBT Module Test

Before conducting the IGBT module test, first dismantle the external wires from the main-circuit terminals. Then set the multi-meter to the ohm-testing position.

	Positive voltage	Negative voltage	Normal result		Positive voltage	Negative voltage	Normal result
Terminal mark	R	P	Conductive	Terminal mark	U	P	Conductive
	S	P	Conductive		V	P	Conductive
	T	P	Conductive		W	P	Conductive
	P	R	Non-conductive		P	U	Non-conductive
	P	S	Non-conductive		P	V	Non-conductive
	P	T	Non-conductive		P	W	Non-conductive
	R	N	Non-conductive		U	N	Non-conductive
	S	N	Non-conductive		V	N	Non-conductive
	T	N	Non-conductive		W	N	Non-conductive
	N	R	Conductive		N	U	Conductive
	N	S	Conductive		N	V	Conductive
	N	T	Conductive		N	W	Conductive



Note: The above diagram is the schematic diagram for frame A and B.

Appendix 1 Parameter Table

Appendix 1 Parameter Table

Parameter Number	Name	Setting Range	Minimum Setting Unit	Default Value	User Setting Value	Reference Page
<u>P.0</u>	Torque boost	0~30%	0.1%	Model-based (Note 1)		P54
<u>P.1</u>	Maximum frequency	0~120Hz	0.01Hz	120Hz (55kW or below) 60Hz (75kW or above)		P55
<u>P.2</u>	Minimum frequency	0~120Hz	0.01Hz	0Hz		P55
<u>P.3</u>	Base frequency	0~650Hz	0.01Hz	50Hz/60Hz (Note 2)		P56
P.4	Speed 1 (high speed)	0~650Hz	0.01Hz	60Hz		P57
P.5	Speed 2 (medium speed)	0~650Hz	0.01Hz	30Hz		P57
P.6	Speed 3 (low speed)	0~650Hz	0.01Hz	10Hz		P57
P.7	Acceleration time	0~360s/ 0~3600s	0.01s/0.1s	5s (3.7Kw or below) 20s (5.5Kw or above)		P58
P.8	Deceleration time	0~360s/ 0~3600s	0.01s/0.1s	5s (3.7Kw or below) 10s (5.5~7.5kW) 30s (11Kw or above)		P58
P.9	Electronic thermal relay capacity	0~500A	0.01A	Motor rated current (Note 1)		P60
<u>P.10</u>	DC injection brake operation frequency	0~120Hz	0.01Hz	3Hz		P61
<u>P.11</u>	DC injection brake operation time	0~60s	0.1s	0.5s		P61
<u>P.12</u>	DC injection brake operation voltage	0~30%	0.1%	4% (7.5kW or below) 2% (11kW~55kW) 1% (75kW or above)		P61
<u>P.13</u>	Starting frequency	0~60Hz	0.01Hz	0.5Hz		P62
P.14	Load pattern selection	0~13	1	0		P62
P.15	JOG frequency	0~650Hz	0.01Hz	5Hz		P65
P.16	JOG acceleration/deceleration time	0~360s/ 0~3600s	0.01s/0.1s	0.5s		P65

Appendix 1 Parameter Table

Parameter Table

Parameter Number	Name	Setting Range	Minimum Setting Unit	Default Value	User Setting Value	Reference Page
P.17	The selection of currnt/voltage signal across terminal 4-5	0~2	1	0		P96
P.18	High speed maximum frequency	120~650Hz	0.01Hz	120Hz		P55
P.19	Base frequency voltage	0~1000V, 99999	0.1V	99999		P56
P.20	Acceleration / deceleration reference frequency	1~650Hz	0.01Hz	50Hz/60Hz (Note 2)		P58
P.21	Acceleration/ deceleration time increments	0、1	1	0		P58
P.22	Stall prevention operation level	0~400%	0.1%	150%		P65
P.23	Compensation factor at level reduction	0~150%, 99999	0.1%	99999		P65
P.24	Speed 4	0~650Hz, 99999	0.01Hz	99999		P57
P.25	Speed 5	0~650Hz, 99999	0.01Hz	99999		P57
P.26	Speed 6	0~650Hz, 99999	0.01Hz	99999		P57
P.27	Speed 7	0~650Hz, 99999	0.01Hz	99999		P57
P.28	Output frequency filter constant	0~31	1	0		P66
P.29	Acceleration/ deceleration curve selection	0~3	1	0		P67
P.30	Regenerative brake function selection	0, 1	1	0		P70
P.31	Carrier operation selection	0~2	1	0		P71
P.32	Serial communication Baud rate selection	0, 1, 2	1	1		P71
P.33	Communication protocol selection	0, 1	1	1		P71
P.34	Reserved					
P.35	Reserved					
P.36	Inverter station number	0~254	1	0		P71
P.37	Speed display	0~5000.0r/min	0.1r/min	0 r/min		P92
		0~9999 r/min	1 r/min			
P.38	The maximum output frequency (the target frequency is set by the input signal across terminal 2-5)	1~650Hz	0.01Hz	50Hz/60Hz (Note 2)		P94

Appendix 1 Parameter Table

Parameter Table

Parameter Number	Name	Setting Range	Minimum Setting Unit	Default Value	User Setting Value	Reference Page
<u>P.39</u>	The maximum operation frequency (the target frequency is set by the input signal of terminal 4-5)	1~650Hz	0.01Hz	50Hz/60Hz (Note 2)		P96
<u>P.40</u>	Multi-function output terminal SO1-SE function selection	0~10, 16~18	1	1		P99
P.41	Up-to-frequency sensitivity	0~100%	0.1%	10%		P101
P.42	Output frequency detection for forward rotation	0~650Hz	0.01Hz	6Hz		P101
P.43	Output frequency detection for reverse rotation	0~650Hz, 99999	0.01Hz	99999		P101
P.44	The second acceleration time	0~360s/ 0~3600s, 99999	0.01s/0.1s	99999		P58
P.45	The second deceleration time	0~360s/ 0~3600s, 99999	0.01s/0.1s	99999		P58
P.46	The second torque boost	0~30%, 99999	0.1%	99999		P54
P.47	The second base frequency	0~650Hz, 99999	0.01Hz	99999		P56
P.48	Data length	0, 1	1	0		P71
P.49	Stop bit length	0, 1	1	0		P71
P.50	Parity check selection	0, 1, 2	1	0		P71
P.51	CR & LF selection	1, 2	1	1		P71
P.52	Number of communication retries	0~10	1	1		P71
P.53	Communication check time interval	0~999.8s, 99999	0.1s	99999		P71
<u>P.54</u>	AM1/HDO terminal function selection	0~4	1	0		P102
<u>P.55</u>	Frequency display reference	0~650Hz	0.01Hz	50Hz/60Hz (note 2)		P102
<u>P.56</u>	Current monitoring reference	0~500A	0.01A	Rated output current		P102
<u>P.57</u>	Restart coasting time	0~30s, 99999	0.1s	99999		P106

Appendix 1 Parameter Table

Parameter Table

Parameter Number	Name	Setting Range	Minimum Setting Unit	Default Value	User Setting Value	Reference Page
P.58	Restart cushion time	0~60s	0.1s	5s (7.5kW or below)		P106
				10s (11kW~55kW)		
				20s (75kW or above)		
P.59	Reserved					
P.60	Input signal filter constant	0~31	1	31		P108
P.61	Remote setting function selection	0~3	1	0		P108
P.62	Zero current detection level	0~200%, 99999	0.1%	5%		P110
P.63	Zero current detection time	0.05~1s, 99999	0.01s	0.5s		P110
P.64	AM1 output terminal selection	0~3	1	0		P102
P.65	Retry selection	0~4	1	0		P111
P.66	Stall prevention operation reduction starting frequency	0~650Hz	0.01Hz	50Hz/60Hz (note2)		P65
P.67	Number of retries at alarm occurrence	0~10	1	0		P111
P.68	Retry waiting time	0~360s	0.1s	1s		P111
P.69	Retry accumulation time at alarm	0	0	0		P111
P.70	Special regenerative brake duty	0~60%	0.1%	0		P70
P.71	Idling braking and linear braking selection	0, 1	1	1		P113
P.72	Carrier frequency	3.7kW or below:1~15 kHz	1kHz	7.5kW or below:5 kHz		P113
		5.5~7.5kW:1~10 kHz		11~22kW: 5 kHz		
		11~22kW :1~9 kHz		30~90kW: 4 kHz		
		30~90kW :1~9 kHz		110kW: 2 kHz		
		110kW :1~9 kHz				
P.73	The selection of voltage signal across terminal 2-5	0~5	1	0		P94

Appendix 1 Parameter Table

Parameter Table

Parameter Number	Name	Setting Range	Minimum Setting Unit	Default Value	User Setting Value	Reference Page
P.74	HDO output terminal selection	0~9000	1	0		P102
P.75	Stop or reset function selection	0~1	1	1		P115
P.76	Reserved					
P.77	Parameters write protection	0~2, 4	1	0		P115
P.78	Forward/reverse rotation prevention selection	0, 1, 2	1	0		P116
P.79	Operation mode selection	0~8	1	0		P116
P.80	Multi-function terminal RL function selection	0~40, 43~53,55~56	1	2		P117
P.81	Multi-function terminal RM function selection	0~40, 43~53,55~56	1	3		P117
P.82	Multi-function terminal RH function selection	0~40, 43~53,55~56	1	4		P117
P.83	Multi-function terminal STF function selection	0~40, 43~53,55~56	1	0		P117
P.84	Multi-function terminal STR function selection	0~40, 43~53,55~56	1	1		P117
P.85	Function selection for multi-function relay A1-B1-C1	0~10, 16~18	1	5		P99
P.86	Multi-function terminal RES function selection	0~40, 43~53,55~56	1	30		P117
P.87	Reserved					
P.88	Reserved					
P.89	Slip compensation coefficient	0~10	1	0		P124
P.90	The inverter model	---	---	---		P124
P.91	Frequency jump 1A	0~650Hz, 99999	0.01Hz	99999		P125
P.92	Frequency jump 1B	0~650Hz, 99999	0.01Hz	99999		P125
P.93	Frequency jump 2A	0~650Hz, 99999	0.01Hz	99999		P125
P.94	Frequency jump 2B	0~650Hz, 99999	0.01Hz	99999		P125
P.95	Frequency jump 3A	0~650Hz, 99999	0.01Hz	99999		P125
P.96	Frequency jump 3B	0~650Hz, 99999	0.01Hz	99999		P125

Appendix 1 Parameter Table

Parameter Table

Parameter Number	Name	Setting Range	Minimum Setting Unit	Default Value	User Setting Value	Reference Page
P.97	Reserved					
P.98	Middle frequency 1	0~650Hz	0.01Hz	3Hz		P62
P.99	Output voltage 1 of middle frequency	0~100%	0.1	10%		P62
P.100	Minute/second selection	0, 1	1	1		P126
P.101	Runtime of Section 1 in programmed operation mode	0~6000s	0.1s	0s		P126
P.102	Runtime of Section 2 in programmed operation mode	0~6000s	0.1s	0s		P126
P.103	Runtime of Section 3 in programmed operation mode	0~6000s	0.1s	0s		P126
P.104	Runtime of Section 4 in programmed operation mode	0~6000s	0.1s	0s		P126
P.105	Runtime of section 5 in programmed operation mode	0~6000s	0.1s	0s		P126
P.106	Runtime of section 6 in programmed operation mode	0~6000s	0.1s	0s		P126
P.107	Runtime of Section 7 in programmed operation mode	0~6000s	0.1s	0s		P126
P.108	Runtime of Section 8 in programmed operation mode	0~6000s	0.1s	0s		P126
P.110	Operation panel monitoring selection	0, 1, 2	1	1		P128
P.111	Acceleration/deceleration time of section 1	0~600s/0~6000s	0.01s/0.1s	0s		P126
P.112	Acceleration/deceleration time of section 2	0~600s/0~6000s	0.01s/0.1s	0s		P126
P.113	Acceleration/deceleration time of Section 3	0~600s/0~6000s	0.01s/0.1s	0s		P126
P.114	Acceleration/deceleration time of Section 4	0~600s/0~6000s	0.01s/0.1s	0s		P126
P.115	Acceleration/deceleration time of Section 5	0~600s/0~6000s	0.01s/0.1s	0s		P126
P.116	Acceleration/deceleration time of Section 6	0~600s/0~6000s	0.01s/0.1s	0s		P126

Appendix 1 Parameter Table

Parameter Table

Parameter Number	Name	Setting Range	Minimum Setting Unit	Default Value	User Setting Value	Reference Page
P.117	Acceleration/deceleration time of Section 7	0~600s/0~6000s	0.01s/0.1s	0s		P126
P.118	Acceleration/deceleration time of Section 8	0~600s/0~6000s	0.01s/0.1s	0s		P126
<u>P.119</u>	The dead time of positive and reverse rotation	0~3000s	0.1s	0s		P129
<u>P.120</u>	Output signal delay time	0~3600s	0.1s	0s		P99
P.121	Run direction in each section	0~255	1	0		P126
P.122	Cycle selection	0~8	1	0		P126
P.123	Acceleration/deceleration time setting selection	0, 1	1	0		P126
P.124	Expansion board version	---	---	---		P141
P.126	Multi-function terminal M3 function selection	0~40, 43~53, 55~56	1	5		P117
<u>P.128</u>	Reserved					
<u>P.129</u>	Multi-function output terminal SO2-SE function selection	0~10, 16~18	1	2		P99
<u>P.130</u>	Function selection for multi-function relay A2-B2-C2	0~10, 16~18	1	0		P99
<u>P.131</u>	Frequency of section 1	0~650Hz	0.01Hz	0Hz		P126
<u>P.132</u>	Frequency of section 2	0~650Hz	0.01Hz	0Hz		P126
<u>P.133</u>	Frequency of section 3	0~650Hz	0.01Hz	0Hz		P126
<u>P.134</u>	Frequency of section 4	0~650Hz	0.01Hz	0Hz		P126
<u>P.135</u>	Frequency of section 5	0~650Hz	0.01Hz	0Hz		P126
<u>P.136</u>	Frequency of section 6	0~650Hz	0.01Hz	0Hz		P126
<u>P.137</u>	Frequency of section 7	0~650Hz	0.01Hz	0Hz		P126
<u>P.138</u>	Frequency of section 8	0~650Hz	0.01Hz	0Hz		P126
<u>P.139</u>	The bias rate of 2-5 voltage signal	-100.0%~100.0%	0.1%	0%		P142
<u>P.142</u>	Speed 8	0~650Hz,99999	0.01Hz	99999		P57
P.143	Speed 9	0~650Hz , 99999	0.01Hz	99999		P57
P.144	Speed 10	0~650Hz , 99999	0.01Hz	99999		P57
P.145	Speed 11	0~650Hz , 99999	0.01Hz	99999		P57

Appendix 1 Parameter Table

Parameter Table

Parameter Number	Name	Setting Range	Minimum Setting Unit	Default Value	User Setting Value	Reference Page
P.146	Speed 12	0~650Hz , 99999	0.01Hz	99999		P57
P.147	Speed 13	0~650Hz , 99999	0.01Hz	99999		P57
P.148	Speed 14	0~650Hz , 99999	0.01Hz	99999		P57
P.149	Speed 15	0~650Hz , 99999	0.01Hz	99999		P57
P.150	Restart mode selection	0~221	1	0		P106
P.151	Zero-speed control function selection	0, 1	1	0		P129
P.152	Voltage instruction at zero-speed control	0~30%	0.1%	4%(7.5kW or below)		P129
				2%(11kW~55kW)		
				1%(75kW or above)		
P.153	Communication error handling	0, 1	1	0		P71
P.154	Modbus communication data format	0~5	1	4		P71
P.155	Over-torque detection level	0~200%	0.1%	0%		P130
P.156	Over-torque detection time	0.1~60s	0.1s	1s		P130
P.157	External terminals filter adjusting function	0~200	1	4		P131
P.158	External terminal power enable	0, 1	1	0		P131
P.159	Energy-saving control function	0, 1	1	0		P131
P.160	Stall prevention operation level when restart	0~150%	0.1%	100%		P106
P.161	Multi-function display selection	0~20	1	0		P132
P.162	Middle frequency 2	0~650Hz , 99999	0.01Hz	99999		P62
P.163	Output voltage 2 of middle frequency	0~100%	0.1	0		P62
P.164	Middle frequency 3	0~650Hz , 99999	0.01Hz	99999		P62
P.165	Output voltage 3 of middle frequency	0~100%	0.1	0		P62
P.166	Middle frequency 4	0~650Hz , 99999	0.01Hz	99999		P62
P.167	Output voltage 4 of middle frequency	0~100%	0.1	0		P62
P.168	Middle frequency 5	0~650Hz , 99999	0.01Hz	99999		P62

Appendix 1 Parameter Table

Parameter Table

Parameter Number	Name	Setting Range	Minimum Setting Unit	Default Value	User Setting Value	Reference Page
P.169	Output voltage 5 of middle frequency	0~100%	0.1	0		P62
P.170	PID function selection	0~3,12,13,21,23,31,32	1	0		P133
P.171	PID feedback control method selection	0, 1	1	0		P133
P.172	PID proportion Gain	1~100	1	20		P133
P.173	PID integral Gain	0~100s	0.1s	1s		P133
P.174	PID differential Gain	0~1000ms	1ms	0		P133
P.175	Abnormal deviation level	0~100%	0.1%	0		P133
P.176	Exception duration time	0~600s	0.1s	30s		P133
P.177	Exception handling mode	0, 1, 2	1	0		P133
P.178	Sleep detects deviation	0~100%	0.1%	0		P133
P.179	Sleep detects duration time	0~255s	0.1s	1s		P133
P.180	Revival level	0~100%	0.1%	90%		P133
P.181	Outage level	0~120Hz	0.01Hz	40Hz		P133
P.182	Integral upper limit frequency	0~200%	0.1%	100%		P133
P.183	Deceleration step length with stable pressure	0~10Hz	0.01Hz	0.5Hz		P133
P.184	4-5 terminal disconnection handling	0~3	1	0		P139
<u>P.185</u>	Proportion linkage gain	0~100%	1%	0%		P139
<u>P.187</u>	FM calibration parameter	0~9998	1	---		P102
P.188	Firmware version	---	---	---		P141
P.189	Factory setting function	0、1	1	60Hz	0	P141
				50Hz	1	
<u>P.190</u>	AM1 output bias	0~2500	1	---		P102
<u>P.191</u>	AM1 output gain	0~2500	1	---		P102
<u>P.192</u>	The minimum input positive voltage of 2-5 terminal	0~10	0.01	0		P142
<u>P.193</u>	The maximum input positive voltage of 2-5 terminal	0~10	0.01	5V		P142
<u>P.194</u>	The setting corresponding to the minimum positive voltage of terminal 2-5	-100.0%~100.0%	0.1%	0.0%		P142

Appendix 1 Parameter Table

Parameter Table

Parameter Number	Name	Setting Range	Minimum Setting Unit	Default Value	User Setting Value	Reference Page
P.195	The setting corresponding to the maximum positive voltage of terminal 2-5	-100.0%~100.0%	0.1%	100.0%		P142
P.196	The setting corresponding to the minimum current/voltage of terminal 4-5	-100.0%~100.0%	0.1%	0%		P147
P.197	The setting corresponding to the maximum current/voltage of terminal 4-5	-100.0%~100.0%	0.1%	100%		P147
P.198	The minimum input current/voltage of 4-5 terminal	0~20	0.01	4mA		P147
P.199	The maximum input current/voltage of 4-5 terminal	0~20	0.01	20mA		P147
P.223	Analog feedback bias pressure	0~100%	0.1%	0%		P133
P.224	Analog feedback gain pressure	0~100%	0.1%	100%		P133
P.225	Panel command	0~100%	0.1%	20%		P133
P.229	Backlash compensation function selection	0~1	1	0		P149
P.230	The backlash compensation acceleration interrupt frequency	0~650Hz	0.01Hz	1Hz		P149
P.231	The backlash compensation acceleration interrupt time	0~360 s	0.1s	0.5s		P149
P.232	The backlash compensation deceleration interrupt frequency	0~650Hz	0.01Hz	1Hz		P149
P.233	The backlash compensation deceleration interrupt time	0~360 s	0.1s	0.5s		P149
P.234	Triangular wave function selection	0~2	1	0		P150
P.235	Maximum amplitude	0~25%	0.1%	10%		P150
P.236	Amplitude compensation for deceleration	0~50%	0.1%	10%		P150
P.237	Amplitude compensation for acceleration	0~50%	0.1%	10%		P150

Appendix 1 Parameter Table

Parameter Table

Parameter Number	Name	Setting Range	Minimum Setting Unit	Default Value	User Setting Value	Reference Page
P.238	Amplitude acceleration time	0~360s /0~3600 s	0.01 s/0.1s	10s		P150
<u>P.239</u>	Amplitude deceleration time	0~360s /0~3600s	0.01 s/0.1s	10s		P150
<u>P.240</u>	Auxiliary frequency function	0~9	1	0		P139
<u>P.241</u>	Sampling period controlled by PID	0~6000ms	1ms	20ms		P133
P.242	DC injection brake function before starting selection	0~1	1	0		P151
P.243	DC injection brake time before starting	0~60s	0.1s	0.5s		P151
P.244	DC injection brake voltage before starting	0~30%	0.1%	4% (7.5Kw or below)		P151
				2% (11kW~55kW)		
				1%(75kW or above)		
P.245	Cooling fan operation selection	0~3,10~13	0	0		P152
P.246	Modulation coefficient	0.90~1.20	0.01	1		P152
P.247	MC switchover interlock time	0.1~100s	0.1s	1s		P153
P.248	Start waiting time	0.1~100s	0.1s	0.5s		P153
P.249	Automatic switchover frequency from inverter to commercial power supply frequency	0~60Hz,99999	0.01	99999		P153
P.250	Automatic switchover frequency range from commercial power supply to inverter	0~10Hz,99999	0.01	99999		P153
<u>P.255</u>	S pattern time at the beginning of Acceleration	0~25s/0~250s	0.01s/0.1s	0.2s		P67
<u>P.256</u>	S pattern time at the end of Acceleration	0~25s/0~250s ,99999	0.01s/0.1s	99999		P67
<u>P.257</u>	S pattern time at the beginning of Deceleration	0~25s/0~250s ,99999	0.01s/0.1s	99999		P67

Appendix 1 Parameter Table

Parameter Table

Parameter Number	Name	Setting Range	Minimum Setting Unit	Default Value	User Setting Value	Reference Page
P.258	S pattern time at the end of Deceleration	0~25s/0~250s, 99999	0.01s/0.1s	99999		P67
P.259	Speed unit selection	0, 1	1	1		P92
P.261	Maintenance Alarm Time	0~9998 day	1	0		P156
P.281	Input phase failure protection	0, 1	1	1		P157
P.285	Low frequency vibration inhibition factor	0~3	1	1		P157
P.286	High frequency vibration inhibition factor	0~15	1	0		P157
P.287	Short circuit protection (SCP) function selection	0~1	1	1		P158
P.288	Alarm code display option	0~12	1	0		P158
P.289	Alarm code	---	---	0		P158
P.290	The latest alarm status selection	0~7	1	0		P158
P.291	The latest alarm message	---	---	0		P158
P.292	Accumulative motor operation time (minutes)	0~1439min	1min	0		P159
P.293	Accumulative motor operation time (days)	0~9999day	1day	0		P159
P.294	Decryption parameter	0~65535	1	0		P159
P.295	Password setup	2~65535	1	0		P159
P.300	Motor control mode selection	0~4	1	0		P160
P.301	Motor parameter auto-tuning function selection	0~4	1	0		P160
P.302	Motor rated power	0~160	0.01	0		P163
P.303	Motor poles	0~8	1	4		P163
P.304	Motor rated voltage	0~440V	1 V	220/440V		P163
P.305	Motor rated frequency	0~650Hz	0.01Hz	50Hz/60Hz (note 2)		P163
P.306	Motor rated current	0~500A	0.01A	Horsepower-based		P163
P.307	Motor rated rotation speed	0~65535 r/min	1 r/min	1410/1710 r/min (note 2)		P163
P.308	Motor excitation current	0~500A	0.01A	Horsepower-based		P163
P.309	Stator resistance	0~65535mΩ	1	Horsepower-based		P163

Appendix 1 Parameter Table

Parameter Table

Parameter Number	Name	Setting Range	Minimum Setting Unit	Default Value	User Setting Value	Reference Page
P.310	Rotor resistance	0~65535mΩ	1	Horsepower-based		P163
P.311	Leakage inductance	0~6553.5mH	0.1	Horsepower-based		P163
P.312	Mutual inductance	0~6553.5mH	0.1	Horsepower-based		P163
P.320	Speed control proportion coefficient 1	0~2000%	1%	100%		P164
P.321	Speed control integral coefficient 1	0~20s	0.01s	0.3s		P164
P.322	Switching frequency 1	0.00~P.325	0.01Hz	5.00Hz		P164
P.323	Speed control proportion coefficient 2	0~2000%	1%	100%		P164
P.324	Speed control integral coefficient 2	0~20s	0.01s	0.3s		P164
P.325	Switching frequency 2	P.322~maximum output frequency	0.01Hz	5.00Hz		P164
<u>P.326</u>	Torque limit range level under vector control	0~400%	0.1%	200%		P165
P.350	Number 1 of pulses per revolution of the encoder	1~20000	1	2500		P166
P.351	Encoder input mode setup 1	0~4	1	0		P166
P.352	PG signal abnormality (zero speed) detection time	0~100s	0.1s	1s		P166
P.353	Motor over-speed detection frequency	0~30Hz	0.01Hz	4Hz		P166
<u>P.354</u>	PG over-speed detection time	0~100s	0.1s	1s		P166
<u>P.355</u>	Number 2 of pulses per revolution of the encoder	1~20000	1	2500		P166
<u>P.356</u>	Encoder input mode setup 2	0~4	1	0		P166
<u>P.357</u>	Dividing frequency output setting (denominator)	1~255	1	1		P166
<u>P.358</u>	Dividing frequency filter coefficient	0~255	0	0		P166
<u>P.359</u>	Electronic gear ratio	0.01~300	0.01	1.00		P166

Appendix 1 Parameter Table

Parameter Table

Parameter Number	Name	Setting Range	Minimum Setting Unit	Default Value	User Setting Value	Reference Page
<u>P.400</u>	The torque control parameter	0~1	1	0		P168
<u>P.401</u>	Torque command	-100%~100%	1%	0%		P168
<u>P.402</u>	The positive direction speed limit for torque control	0~650.00Hz	0.01Hz	30.00Hz		P168
<u>P.403</u>	The negative direction speed limit for torque control	0~650.00Hz	0.01Hz	30.00Hz		P168
<u>P.404</u>	Torque filter coefficient	0~31	1	0		P168
<u>P.405</u>	Torque setting source	0~2	1	0		P168
<u>P.406</u>	Selection of speed limit	0~1	1	0		P168
<u>P.500</u>	Function selection of terminal 2-5	0~10	1	1		P93
<u>P.501</u>	Function selection of terminal 4-5	0~10	1	1		P93
<u>P.502</u>	Function selection of terminal 1-5	0~10	1	0		P93
<u>P.503</u>	Function selection of terminal HDI	0~10	1	0		P93
<u>P.505</u>	The bias rate of 4-5 voltage signal	-100%~100%	0.1%	0%		P147
<u>P.506</u>	The bias rate of 1-5 voltage signal	-100%~100%	0.1%	0%		P148
<u>P.509</u>	The maximum operation frequency of terminal 1-5 (the target frequency is set by the input signal of terminal 1-5)	1~650Hz	0.01Hz	50Hz/60Hz (note 2)		P98
<u>P.510</u>	The setting corresponding to the minimum negative voltage of terminal 2-5	-100.0%~100.0%	0.1%	0.0%		P142
<u>P.511</u>	The setting corresponding to the maximum negative voltage of terminal 2-5	-100.0%~100.0%	0.1%	0.0%		P142
<u>P.512</u>	The minimum input negative voltage of terminal 2-5	0~10V	0.01V	0 V		P142
<u>P.513</u>	The maximum input negative voltage of terminal 2-5	0~10V	0.01V	0 V		P142
<u>P.514</u>	The setting corresponding to the minimum positive voltage of terminal 1-5	-100%~100%	0.1%	0%		P148

Appendix 1 Parameter Table

Parameter Number	Name	Setting Range	Minimum Setting Unit	Default Value	User Setting Value	Reference Page
<u>P.515</u>	The setting corresponding to the maximum positive voltage of terminal 1-5	-100%~100%	0.1%	100%		P148
<u>P.516</u>	The minimum input positive voltage of terminal 1-5	0~10V	0.01V	0 V		P148
<u>P.517</u>	The maximum input positive voltage of terminal 1-5	0~10V	0.01V	5V		P148
<u>P.518</u>	The setting corresponding to the minimum negative voltage of terminal 1-5	-100%~100%	0.1%	0%		P148
<u>P.519</u>	The setting corresponding to the maximum negative voltage of terminal 1-5	-100%~100%	0.1%	0%		P148
<u>P.520</u>	The minimum input negative voltage of terminal 1-5	0~10V	0.01V	0 V		P148
<u>P.521</u>	The maximum input negative voltage of terminal 1-5	0~10V	0.01V	0 V		P148
<u>P.522</u>	The setting corresponding to the minimum frequency of terminal HDI	-100%~100%	0.1%	0%		P169
<u>P.523</u>	The setting corresponding to the maximum frequency of terminal HDI	-100%~100%	0.1%	100%		P169
<u>P.524</u>	The minimum input frequency of terminal HDI	0~100kHz	0.01kHz	0 kHz		P169
<u>P.525</u>	The maximum input frequency of terminal HDI	0~100kHz	0.01kHz	100kHz		P169
<u>P.526</u>	The HDI filter coefficient	0~31	1	1		P169
<u>P.528</u>	4-5 Input signal filter constant	0~31	1	31		P108
<u>P.529</u>	1-5 Input signal filter constant	0~31	1	31		P108
<u>P.530</u>	The selection of voltage signal across terminal 1-5	0~5	1	0		P98
<u>P.532</u>	PTC filter coefficient	0~31	1	31		P170
<u>P.533</u>	The process mode selection of PTC alarm	0~3	1	0		P170

Appendix 1 Parameter Table

Parameter Table

Parameter Number	Name	Setting Range	Minimum Setting Unit	Default Value	User Setting Value	Reference Page
<u>P.534</u>	The percentage of PTC level	0~100%	0.1%	0%		P170
<u>P.535</u>	AM2 output bias	0~2500	1	---		P106
<u>P.536</u>	AM2 output gain	0~2500	1	---		P106
<u>P.537</u>	AM2 terminal function selection	0~4	1	0		P106
<u>P.538</u>	AM2 output terminal selection	0,2,3	1	0		P106
P.550	Multi-function terminal HDI function selection	0~41, 43~57	1	57		P117
<u>P.600</u>	The tension control mode selection	0~4	1	0		P171
<u>P.601</u>	The curling mode	0~1	1	0		P171
<u>P.602</u>	Selection of inverse take-up during roll-down	0~1	1	0		P171
<u>P.603</u>	Mechanical transmission ratio	0.01~300	0.01	1.00		P171
<u>P.604</u>	Tension setting source	0~2	1	0		P172
<u>P.605</u>	Tension setting	0~30000N	1 N	0 N		P172
<u>P.606</u>	Maximum tension	0~30000N	1 N	0 N		P172
<u>P.607</u>	Zero-speed tension increase	0.0%~50.0%	0.1%	0.0%		P172
<u>P.608</u>	Zero-speed threshold	0~30Hz	0.01 Hz	0 Hz		P172
<u>P.609</u>	Tension taper	0.0%~100.0%	0.1%	0.0%		P172
<u>P.610</u>	curling radius calculation method selection	0~3	1	0		P173
<u>P.611</u>	Maximum curling radius	1~10000mm	1 mm	500 mm		P173
<u>P.612</u>	Winding shaft diameter	1~10000mm	1 mm	100 mm		P173
<u>P.613</u>	Initial curling radius source	0~1	1	0		P173
<u>P.614</u>	Initial curling radius 1	1~10000mm	1 mm	100 mm		P173
<u>P.615</u>	Initial curling radius 2	1~10000mm	1 mm	100 mm		P173
<u>P.616</u>	Initial curling radius 3	1~10000mm	1 mm	100 mm		P173
<u>P.617</u>	Curling radius filtering coefficient	0~31	1	0		P173
<u>P.618</u>	Current value of curling radius	0~10000mm	1 mm	---		P173
<u>P.619</u>	Number of pulses each turn	1~60000	1	1		P173
<u>P.620</u>	Number of turns each layer	1~10000	1	1		P173
<u>P.621</u>	Material thickness setting source	0~1	1	0		P173

Appendix 1 Parameter Table

Parameter Table

Parameter Number	Name	Setting Range	Minimum Setting Unit	Default Value	User Setting Value	Reference Page
P.622	Material thickness 0	0.01~100.00mm	0.01 mm	0.01 mm		P173
P.623	Material thickness 1	0.01~100.00mm	0.01 mm	0.01 mm		P173
P.624	Material thickness 2	0.01~100.00mm	0.01 mm	0.01 mm		P173
P.625	Material thickness 3	0.01~100.00mm	0.01 mm	0.01 mm		P173
P.626	Maximum thickness	0.01~100.00mm	0.01 mm	1.00 mm		P173
P.627	Line speed input source	0~2	1	0		P177
P.628	Maximum line speed	0.1~6500.0m/min	0.1m/min	1000.0m/min		P177
P.629	Minimum line speed for curling radius calculation	0.1~6500.0m/min	0.1m/min	200.0m/min		P177
P.630	Actual line speed	0~6500.0m/min	0.1m/min	---		P177
P.631	Inertia self learning torque setting 1	0.0%~P.632	0.1%	30%		P178
P.632	Inertia self learning torque setting 2	P.631~100%	0.1%	60%		P178
P.633	Mechanical inertia compensation coefficient	0~65535	1	0		P178
P.634	Material density	0kg/m ³ ~60000kg/m ³	1 kg/m ³	0 kg/m ³		P178
P.635	Material width	0~60000mm	1mm	0mm		P178
P.636	Fiction compensation coefficient	0.0%~50.0%	0.1	0		P178
P.637	Material supply interrupt auto detection function selection	0~1	1	0		P179
P.638	Material supply interrupt auto detection minimum line speed	0.1~6500.0m/min	0.1m/min	200m/min		P179
P.639	Material supply interrupt auto detection error range	0.1%~50.0%	0.1%	10.0%		P179
P.640	Material supply interrupt auto detection judgment delay	0.1~60.0s	0.1s	2.0s		P179
P.641	Proportional gain P2	1~100	1	20		P180
P.642	Integral time I2	0~100s	1s	1s		P180
P.643	Differential time D2	0~1000ms	1ms	0ms		P180
P.644	Auto adjustment basis for PID parameters	0~3	1	0		P180
P.645	Pre-drive speed gain	-50.0%~50.0%	0.1%	0%		P181

Appendix 1 Parameter Table

Parameter Table

Parameter Number	Name	Setting Range	Minimum Setting Unit	Default Value	User Setting Value	Reference Page
<u>P.646</u>	Pre-drive torque increase proportion	-50.0%~50.0%	0.1%	0%		P181
<u>P.647</u>	Pre-drive torque increase delay time	0~65535ms	1ms	0ms		P181
<u>P.650</u>	Curling radius memory	0~1	1	0		P173
<u>P.654</u>	Taper compensation correction	0~10000mm	1mm	0mm		P172
<u>P.656</u>	Line speed setting source	0~2	1	0	---	P183
P.996	Alarm history clear	Refer to chapter 5	---	---	---	P183
P.997	Inverter reset	Refer to chapter 5	---	---	---	P183
P.998	Restoring all parameters to default values	Refer to chapter 5	---	---	---	P184
P.999	Restoring some parameters to default values	Refer to chapter 5	---	---	---	P184

Appendix 1 Parameter Table

Note: 1. The torque boost, motor rated current and stator resistance values are shown in the table as follows

Inverter type	P.0	P.9
SF-040-1.5K-GT	4	4.2
SF-040-2.2K-GT	4	6
SF-040-3.7K-GT	4	9
SF-040-5.5K-GT	3	13
SF-040-7.5K-GT	3	18
SF-040-11K-GT	2	24
SF-040-15K-GT	2	32
SF-040-18.5K-GT	2	38
SF-040-22K-GT	2	45
SF-040-30K-GT	2	60
SF-040-37K-GT	2	73
SF-040-45K-GT	2	91
SF-040-55K-GT	2	110
SF-040-75K-GT	1	150
SF-040-90K-GT	1	180
SF-040-110K-GT	1	220

2. The default value is determined by the set value of P.189. When P.189 = 0, the default value is 60Hz, which is applicable to 60Hz systems. When P.189 = 1, the default value is 50Hz, which is applicable to 50Hz systems.
3. Parameters P.190 and P.191 are the calibrating values. Therefore the default value for each machine may differ slightly.

Appendix 2 Alarm Code List

Code	Screen Display	Cause	Troubleshooting
ERROR	Error	<ol style="list-style-type: none"> Under-voltage for power supply The reset function "RES" is on Bad connection between the operation panel and main machine Internal circuit malfunction Wrong CPU operation 	<ol style="list-style-type: none"> Provide a normal power supply Shut off "RES" Ensure firm connection between the operation panel and the main machine Replace the inverter. Restart the inverter
OC0 Over-current when stop	OC0	The output current is two times larger than the rated current of the inverter.	Please restart the inverter. If the alarm repeated, please send the inverter back to the factory.
OC1 Over-current during acceleration	OC1		<ol style="list-style-type: none"> In case the time for acceleration or deceleration is too short, extend it as necessary. Avoid abrupt increase of load. Check Terminals U/T1, V/T2 and W/T3 for short circuit.
OC2 Over-current at constant speed	OC2		
OC3 Over-current during deceleration	OC3		
OV0 Over-voltage when stop	OV0	Over-voltage between Terminals P and N.	Check whether the power supply is normal or abnormal.
OV1 Over-voltage during acceleration	OV1		<ol style="list-style-type: none"> In case the time for acceleration or deceleration is too short, extend it as necessary. Check the brake resistor between Terminals +/P and PR for loose connection. Check whether the values of <u>P.30</u> and <u>P.70</u> are correct or not.
OV2 Over-voltage at constant speed	OV2		
OV3 Over-voltage during deceleration	OV3		

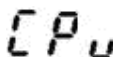
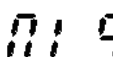
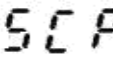

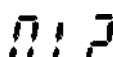


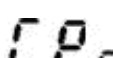
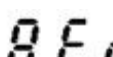

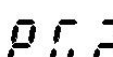
Appendix 2 Alarm Code List

Alarm code list

Code	Screen Display	Cause	Troubleshooting
THT Overheated IGBT module	THT	IGBT module thermal accumulation relay operation	Avoid prolonged inverter operation when overloaded.
THN Overheated motor	THN	Electronic thermal relay operation	<ol style="list-style-type: none"> 1. Check whether the set value of <u>P.9</u> is correct or not (according to the externally connected motor). 2. Reduce load.
FAN Cooling fan alarm	FAN	Cooling fan failure	<ol style="list-style-type: none"> 1. The cooling fan is damaged. Please replace it with a new fan. 2. Please clean the fan if it is blocked by foreign substances. 3. Check if fans wiring is broken/loose, or replace it with a new fan.
OHT External thermal relay operation	OHT	External thermal relay operation	<ol style="list-style-type: none"> 1. Check whether the capacity of the external thermal relay and of the motor coordinates well. 2. Reduce the load.
OPT Abnormal peripheral devices	OPT	<ol style="list-style-type: none"> 1. Abnormal communication; Exceeding the number of communication retries 2. Interrupted communication; Exceeding the permitted communication time interval 	Correctly set the communication parameters.
EEP Abnormal memory	EEP	ROM malfunction	Send the inverter back to the factory if this type of alarm happens frequently.
PID Abnormal PID	PID	<ol style="list-style-type: none"> 1. Insufficient inverter and motor capacity 2. PID target value or feedback value set unreasonably 3. Peripheral devices malfunction 	<ol style="list-style-type: none"> 1. Enlarge the inverter and motor capacity. 2. Check the feedback gain setup. Reset the target value according to the feedback. 3. Check the system's peripheral feedback devices (e.g., sensors, potentiometer) and whether the wiring is correct.

Appendix 2 Alarm Code List

Alarm code list

Code	Screen Display	Causes	Troubleshooting
CPU Abnormal CPU		Serious peripheral electromagnetic interference	Reduce peripheral interference.
OLS Stall prevention and protection		Over-loaded motor	<ol style="list-style-type: none"> 1. Reduce motor load. 2. Increase P.22 value.
SCP Short circuit over-current		Output-end short circuit	Check whether the inverter output has short circuit (e.g., the motor wiring).
NTC Overheated module		The temperature of the IGBT module is too high.	<ol style="list-style-type: none"> 1. Reduce the environment temperature and improve the air condition. 2. Check whether the fan of the inverter is damaged.
OL2 Abnormal over-torque		<ol style="list-style-type: none"> 1. Over-loaded motor 2. <u>P.155, P.156</u> set unreasonably. 	<ol style="list-style-type: none"> 1. Reduce motor load. 2. Adjust the set value of <u>P.155, P.156</u> properly.
bE Abnormal brake-resistor (Abnormal relay)		Abnormal brake-resistor (Abnormal relay)	Return it to the factory for repair.
IPF Abnormal power supply input		Abnormal power supply input	Check whether power supply input is normal.
CPr Abnormal CPU		Abnormal PU procedures	<ol style="list-style-type: none"> 1. Check the wiring. 2. Check the parameter setup. 3. Reduce peripheral interference.
AEr Abnormal 4-5 terminal		Abnormal disconnection of 4-5 terminal's analog output	Please refer to the description for <u>P.184</u> .
PG1 Abnormal encoder model		Abnormal encoder model	Check the set value of <u>P.351</u> .
PG2 Abnormal PG card feedback signals		Abnormal PG card feedback signals	Please refer to the feedback control parameter description for <u>P.350~P.354</u> .

Appendix 2 Alarm Code List

Alarm code list

Code	Screen Display	Causes	Troubleshooting
PG3 Too large speed deviation under closed-loop control	PG3	Too large speed deviation under closed-loop control	Please refer to the feedback control parameter description for <u>P.350~P.354</u> .
PTC Overheated motor	PTC	The motor is over heat	1. Reduce motor load 2. Amend P.534
BEB Material line breaking	BEB	Material line breaking	Detect whether the material feedback signal line is broken

Note: 1. For the types below 40HP, "BE" alarm is a brake-resistor alarm, and relay alarm for types above 40HP.
2. When the above alarms occur, the inverter will stop. Please handle these alarms according to the methods mentioned above.
3. Refer to P.288~P.291 for abnormal alarm codes.

Appendix 3 Troubles and Solutions

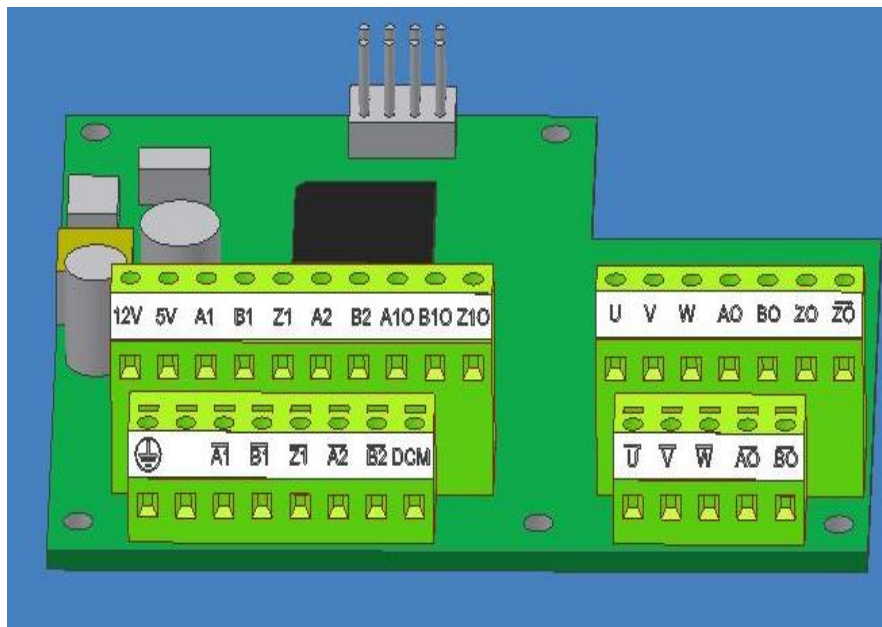
Appendix 3 Troubles and Solutions

Troubles	Check points	
Motionless motor	Main circuit	Check whether the power supply voltage between Terminals R/L1, S/L2 and T/L3 is normal. Check whether the Power light is on. Check whether the wiring between the inverter and the motor is correct.
	Load	Check whether the load is too heavy. Check whether the motor rotor is locked.
	Parameters Setting	Check whether the starting frequency (P.13) is set too big. Check whether the operation mode (P.79) is correct. Check whether the maximum frequency (P.1) is zero. Check whether the reverse rotation prevention is restricted. Check whether the bias and gain (P.192~P.199) setting is correct. Check that the frequency jump (P.91~P.96) setting is correct.
	Control circuit	Check whether the output stop signal "MRS" is on. (Related parameter P.80~P.84, P.86, P.126, P.550). Check whether the "RES" function is ON. (Related parameter P.80~P.84, P.86, P.126, P.550). Check whether the external thermal relay is operating or not. Check whether the reset has been performed or not after the set-off of the alarm (the ALARM light in on). Check whether the voltage/current signals are correctly wired. Check whether the functions of STF and STR are correct (related parameter P.80~P.84, P.86, P.126, P.550). Check whether the wiring for the control circuit is disconnected or has a poor contact.
Reversed motor rotation	Check whether the phase sequence of output terminals U/T1, V/T2 and W/T3 is correct. Check whether the start signal (STF and STR) are connected correctly.	
Failure to increase the rotation speed of the motor	Check whether the load is too heavy. Check whether the stall prevention level (P.22) is correct. Check whether the torque boost (P.0) is set too high. Check whether the maximum frequency (P.1) is effective.	
Unsmoothed acceleration / deceleration	Check whether the acceleration / deceleration time (P.7, P.8) is correct. Check whether the acceleration / deceleration curve selection (P.29) is correct. Check whether the voltage / current input signals are affected by noises.	
Overlarge motor current	Check whether the load is too heavy. Check whether the capacity of the inverter and of the motor are well matched. Check whether the torque boost (P.0) is set too high.	
Speed variation during the operation	Check whether the voltage / current input signals are affected by noises. Check whether the load varies. Check whether the wiring length of the main circuit is too long.	

Appendix 4 Optional Equipment

1. Expansion board (Please set the parameters according to the expansion board and the function)

1). PG03 expansion card



Name	Explanation
Power source	<ol style="list-style-type: none"> Supplied by the noumenon supply 5V and 12V ($\pm 5\%$) power supply in the meantime, the maximum supply is 200mA
Input terminals	<ol style="list-style-type: none"> A1, $\overline{A1}$, B1, $\overline{B1}$, Z1, $\overline{Z1}$, U, \overline{U}, V, \overline{V}, W, \overline{W} : The input of encoder signal support open collector, voltage, line drive and push-pull input type, the maximum acceptable is 500KP/Sec. A2, $\overline{A2}$, B2, $\overline{B2}$: The input of pulse signal connect to the upper controller and support open collector, voltage, line drive and push-pull input type, the maximum acceptable is 500 KP/Sec.
Output terminals	<ol style="list-style-type: none"> AO, \overline{AO}, BO, \overline{BO}, ZO, \overline{ZO} : The line drive dividing frequency output which is 1~255 times dividing frequency. The maximum output current is 50mA, the output voltage is 5V, the maximum output frequency is 500 KP/Sec. A10, B10, Z10: The open collector dividing frequency output which is 1~255 times dividing frequency. The maximum output current is 50mA, the maximum output frequency is 500 KP/Sec.

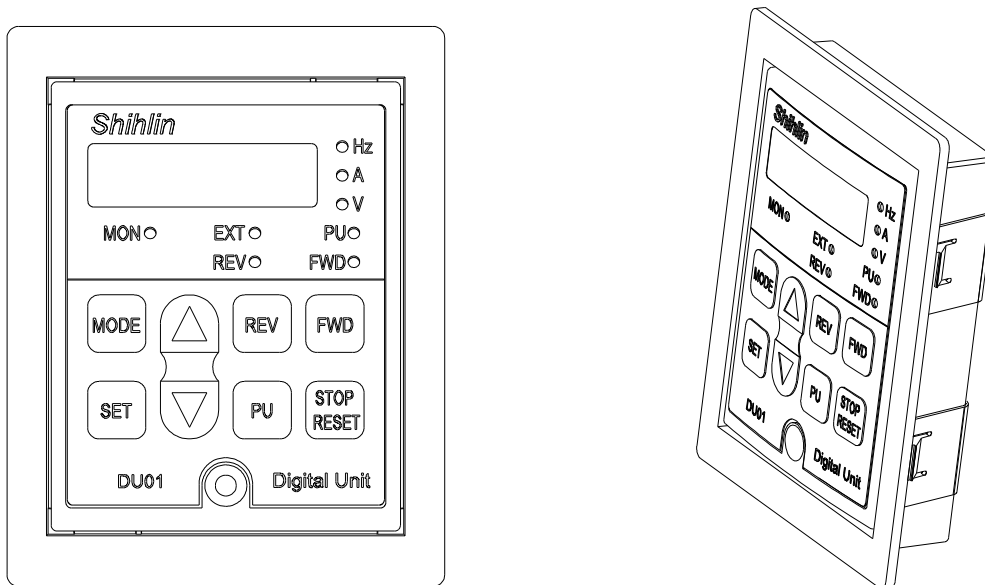
The explanation of ordering code:

NO.	Type	Name	Ordering Code
1	PG03	PG03 expansion card	SNKPG03

Appendix 4 Optional Equipment

2. Operation panel, operation panels' fixed base and the data transmission line

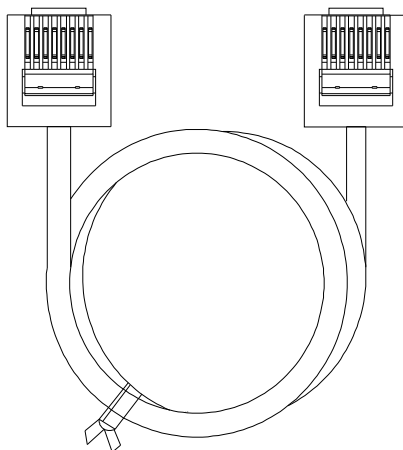
1). DU01S: DU01 operation panel set (operation panel (DU01) and the fixed base (GMB01))



Description on the ordering code:

NO.	Model	Item Name	Ordering Code
1	DU01S	DU01 operation panel set	SNKDU01S

2). CBL: Data transmission line (coordinated with the operation panel)



Description on the ordering code:

NO.	Model	Item name	Ordering code
1	CBL1R5GT	Data transmission line (Length: 1.5M)	SNKCBL1R5GT
2	CBL03GT	Data transmission line (Length: 3M)	SNKCBL03GT
3	CBL05GT	Data transmission line (Length: 5M)	SNKCBL05GT

Revision Record

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