1 Safety Precautions

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

In this manual, the safety precautions were sorted to “WARNING” or “CAUTION”.

⚠ **WARNING**	Indicates a potentially dangerous situation which, if can not avoid will result in death or serious injury.
⚠ **CAUTION**	Indicates a potentially dangerous situation which, if can not avoid will cause minor or moderate injury and damage the device. This Symbol is also used for warning any un-safety operation.

In some cases, even the contents of “CAUTION” still can cause serious accident. Please follow these important precautions at any situation.

★ NOTE indicate the necessary operation to ensure the device run properly.

Warning Marks are placed on the front cover of the inverter.

Please follow these indications when using the inverter.

WARNING

- May cause injury or electric shock.
- Please follow the instructions in the manual before installation or operation.
- Disconnect all power line before opening front cover of unit. Wait at least 10 minutes until DC Bus capacitors discharge.
- Use proper grounding techniques.
- Never connect AC power to output UVW terminals

TABLE OF CONTENTS

1. INTRODUCTION

1.1 Technology Features

- □ Input Frequency Range: 47~63Hz
- □ Output Voltage Range: 0~rated input voltage
- □ Output Frequency Range: 0~600Hz

● I/O features

- □ Programmable Digital Input:
  Provide 4 terminals to take ON-OFF inputs
- □ Programmable Analog Input:
  FIV: accepts input of 0 ~10V; FIC: accepts input of 0~10V or 0~20mA.
- □ Programmable Open Collector Output:
  Provide 1 output terminal (open collector output or high-speed pulse output)
- □ Relay Output: Provide 1 output terminal.
- □ Analog Output: Provide 1 analog output terminal, whose output scope can be 0/4~20 mA or 0~10 V, as chosen..

● Main Control Function

- □ Control Mode: Sensorless Vector Control (SVC), V/F Control.
- □ Overload Capacity:
  60s at 150% of rated current, 10s at 180% of rated current.
- □ Starting Torque: 150% of rated torque at 0.5Hz (SVC).
- □ Speed Adjusting Range: 1:100 (SVC)
- □ Speed Accuracy: ± 0.5% of maximum speed (SVC)
- □ Carrier Frequency: 0.5kHz ~15.0kHz.
- □ Reference Frequency Source: keypad, analog input, serial communication, multi-step speed, PID and so on.

- □ Torque Control Function: Provide multiple torque setting source.
- □ PID Control Function
- □ Multi-Step Speed Control Function: 8 steps speed can be set.
- □ Traverse Control Function
- □ None-Stop when instantaneous power off.
- □ Speed trace Function: Start the running motor smoothly.
- □ JOG Key: User defines shortcut key.
- □ Automatic Voltage Regulation Function:
  Automatically keep the output voltage stable when input voltage is fluctuating.
- □ Up to 25 fault protections:
  Protect from over current, over voltage, under voltage, over heat, phase failure, over load etc.

1.2 Description of Name Plate

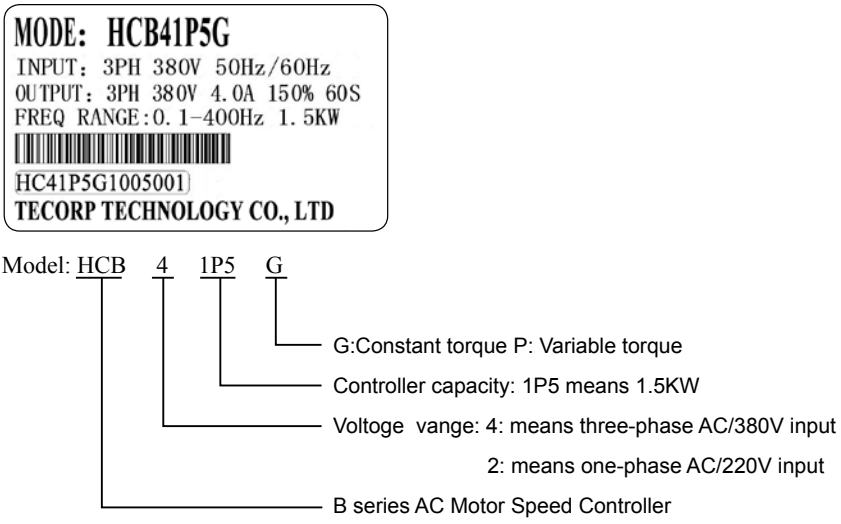


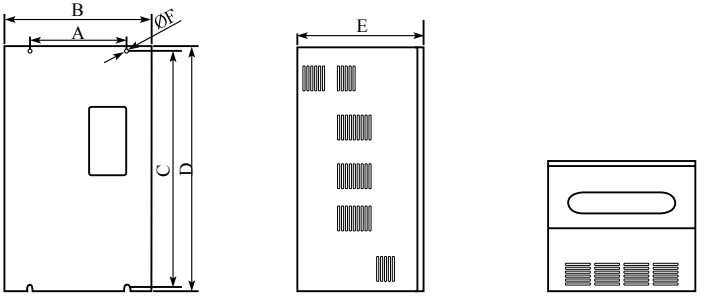
Figure 1.1 Nameplate of inverter.

1.3 Selection Guide

Model No.	Rated Output Power (kW)	Rated Input current (A)	Rated Output current (A)	Motor Power (KW)	Size
1PH/3PH AC 220V -15%~15%					
HCB20P4G/HCB20P7P	0.4	5.4	2.3	0.4	A
HCB20P7G/HCB21P5P	0.75	8.2	4.5	0.75	A
HCB21P5G/HCB22P2P	1.5	14.2	7.0	1.5	B
HCB22P2G/HCB23P7P	2.2	23.0	10	2.2	B
HCB23P7G/HCB25P5P	3.7	35.0	16	3.7	A
HCB25P5G/HCB27P5P	5.5/7.5	26/35	24/33	5.5/7.5	
HCB27P5G/HCB2011P	7.5/11	35/46	33/47	7.5/11	
HCB2011G/HCB2015P	11.0/15.0	46/62	47/65	11.0/15.0	
HCB2015G/HCB2018P	15.0/18.5	62/76	65/80	15.0/18.5	
HCB2018G/HCB2022P	18.5/22.0	76/90	80/90	18.5/22.0	
HCB2022G/HCB2030P	22.0/30.0	90/105	90/136	22.0/30.0	
HCB2030G/HCB2037P	30.0/37.0	105/140	136/152	30.0/37.0	
HCB2037G/HCB2045P	37.0/45.0	140/160	152/176	37.0/45.0	
HCB2045G/HCB2055P	45.0/55.0	160/210	176/210	45.0/55.0	
HCB2055G/HCB2075P	55.0/75.0	210/290	210/305	55.0/75.0	
HCB2075G/HCB2090P	75.0/90.0	290/330	305/340	75.0/90.0	
3PH AC 380V -15%~15%					
HCB40P7G/HCB41P5P	0.75	3.4	2.5	0.75	B
HCB41P5G/HCB42P2P	1.5	5.0	3.7	1.5	B
HCB42P2G/HCB43P7P	2.2	5.8	5	2.2	B
HCB43P7G/HCB45P5P	3.7	10	8.6	3.7	B
HCB45P5G/HCB47P5P	5.5	15	12.5	5.5	C
HCB47P5G/HCB4011P	7.5	20	17.5	7.5	C
HCB4011G/HCB4015P	11	26	24	11	D
HCB4015G/HCB4018P	15	35	33	15	D
HCB4018G/HCB4022P	18.5	38	40	18.5	D
HCB4022G/HCB4030P	22	46	47	22	E
HCB4030G/HCB4037P	30	62	65	30	E
HCB4037G/HCB4045P	37	76	80	37	E

Model No.	Rated Output Power (kW)	Rated Input current (A)	Rated Output current (A)	Motor Power (KW)	Size
HCB4045G/HCB4055P	45	90	90	45	F
HCB4055G/HCB4075P	55	105	110	55	F
HCB4075G/HCB4090P	75	140	152	75	F
HCB4090G/HCB4110P	90	160	176	90	G
HCB4110G/HCB4132P	110	210	210	110	G
HCB4132G/HCB4160P	132	240	255	132	G
HCB4160G/HCB4185P	160	290	305	160	H

1.4 Inverter outline dimension drawings



Unit: mm

Model	A	B	C	D	E	F
HCB20P4G/HCB20P7P	117	125	162	170	140	5
HCB20P7G/HCB21P5P						
HCB21P5G/HCB22P2P						
HCB22P2G/HCB23P7P						
HCB23P7G/HCB40P7P	105	120	208	225	149	5
HCB25P5G/HCB27P5P	213	228	330	347	196	6
HCB27P5G/HCB2011P						
HCB2011G/HCB2015P	147	250	460	480	246	9
HCB2015G/HCB2018P	197	310	482	500	260	9
HCB2018G/HCB2022P						

Model	A	B	C	D	E	F
HCB2022G/HCB2030P	240	360	620	650	280	9
HCB2030G/HCB2037P	260	420	775	800	334	11
HCB2037G/HCB2045P						
HCB2045G/HCB2055P						
HCB2055G/HCB2075P	360	552	840	875	410	13
HCB2075G/HCB2090P						
HCB40P7G/HCB41P5P	117	125	162	170	140	5
HCB41P5G/HCB42P2P						
HCB42P2G/HCB43P7P						
HCB43P7G/HCB45P5P	105	120	208	225	149	5
HCB45P5G/HCB47P5P	168	185	248	260	170	6.5
HCB47P5G						
HCB4011P	213	228	330	347	196	6
HCB4011G/HCB4015P						
HCB4015G/HCB4018P						
HCB4018G/HCB4022P	147	250	460	480	246	9
HCB4022G/HCB4030P						
HCB4030G/HCB4037P	197	310	482	500	260	9
HCB4037G/HCB4045P						
HCB4045G/HCB4055P	240	360	620	650	280	9
HCB4055G/HCB4075P						
HCB4075G/HCB4090P	260	420	775	800	334	11
HCB4090G/HCB4110P						
HCB4110G/HCB4132P	360	552	840	875	410	13
HCB4132G/HCB4160P						
HCB4160G/HCB4185P						

2. INSPECTION

⚠ CAUTION
• Do not install or use any inverter that is damaged or has fault part, otherwise may cause injury.

Check the following items when unpacking the inverter,

1. Inspect entire exterior of the Inverter to ensure there are no scratches or other damage caused by the transportation.
2. Ensure there is operation manual and warranty card in the packing box.
3. Inspect the nameplate and ensure it is what you ordered.
4. Ensure the optional parts are what you need if have ordered any optional parts.

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

3. INSTALLATION

⚠ WARNING

- People who are not passed the fraing program may cause severe injury or property loss at work. Only the people, who has passed the training on the design, installation, commissioning and operation of the device and gotten the certification, is permitted to operate this equipment.
- Input power cable must be connected tightly, and the equipment must be grounded securely.
- Even if the inverter is not running, the following terminals still have dangerous voltage:
  - Power Terminals: R, S, T
  - Motor Connection Terminals: U, V, W.
- When power off, should not install the inverter until 5 minutes later, which can ensure the device discharge completely.
- The section area of grounding conductor must be no less than that of power supply cable.

⚠ CAUTION

- When the invecter is under moving please lift by its base and don't lift by the panel. Otherwise may cause the main unit falls off to result in personal injury.
- Install the inverter on the fireproofing material (such as metal) to prevent fire.
- When need install two or more inverters in one cabinet, cooling fan should be provided to make sure that the air temperature is lower than 45°C. Otherwise it could cause fire or damage the device.

3.1 Environmental Requirement

1. Temperature

Environment temperature range: -10°C ~ +40°C. Inverter will be derated if ambient temperature exceeds 40°C.

2. Humidity

Less than 95% RH, without dewfall.

3. Altitude

Inverter can output the rated power when installed with altitude of lower than 1000m. It will be derated when the altitude is higher than 1000m. For details, please refer to the following figure:

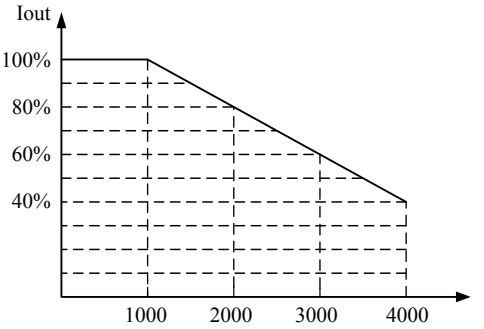


Figure 3.1 Relationship between output current and altitude.

4. Impact and Vibration

It is not allowed that the inverter falls down or suffers from fierce impact or the inverter installed where gets vibration frequently.

5. Electromagnetic Radiation

Keep away from the electromagnetic radiation source.

6. Water

Do not install the inverter at the wringing or dewfall place.

7. Air Pollution

Keep away from air pollution such as dusty, corrosive gas.

8. Storage

Do not store inverter in the environment with direct sunlight, vapor, oil fog and vibration.

3.2 Installation Space

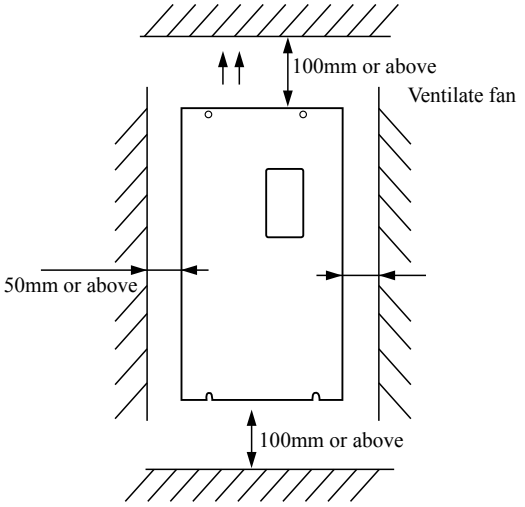


Figure 3.2 Safe space.

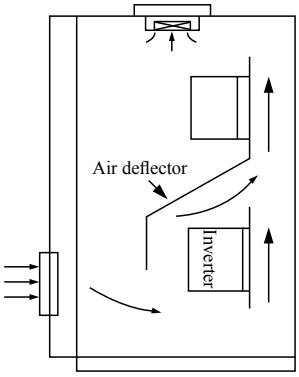


Figure 3.3 Installation of multiple inverters.

Notice: Add the air deflector when apply the up-down installation.

4. WIRING

⚠ WARNING

- Wiring must be performed by the person certified in electrical work.
- Forbid testing the insulation of cable that connects the inverter with high-voltage insulation testing devices.
- Cannot install the inverter until discharged completely after the power supply is switched off for 5 minutes.
- Be sure to ground the ground terminal.
  (200V class: Ground resistance should be 100Ω or less, 400V class: Ground resistance should be 10Ω or less, 660V class: Ground resistance should be 5Ω or less).
  Otherwise, it might cause electric shock or fire.
- Connect input terminals (R, S, T) and output terminals (U, V, W) correctly.
  Otherwise it will cause damage the inside part of inverter.
- Do not wire and operate the inverter by wet hands.
  Otherwise there is a risk of electric shock.

⚠ CAUTION

- Canfirm voltage of the main AC power supply meefs the rated voltage of the Inverter.
  Injury or fire may occur if the voltage is not correct.
- Connect power supply cables and motor cables tightly.

4.1 Connection of Peripheral Devices

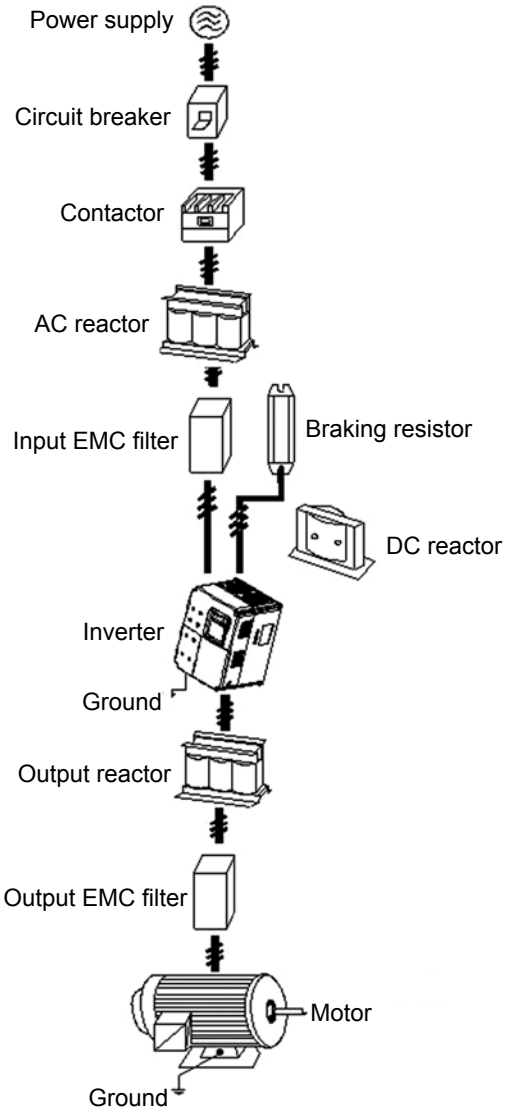


Figure 4.1 Connection of peripheral devices.

4.2 Terminal Configuration

4.2.1 Main Circuit Terminals

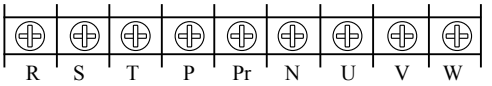


Figure 4.2 Main circuit terminals (0.4~3.7kW).

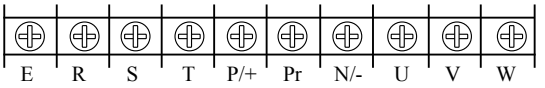


Figure 4.3 Model A (380V/5.5~7.5kW) with plastic cover, and model P (7.5kW) with plastic cover

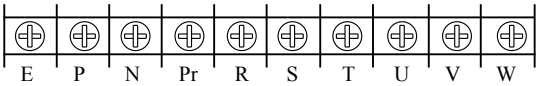


Figure 4.4 Model A (380V/11--15kW) with plastic cover, and model P (11—18.5kW) with plastic cover:

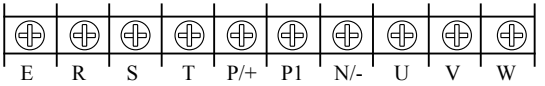


Figure 4.5 Model A, three-phase 380V/18.5~160kW with metal cover

Main circuit terminal functions are summarized according to the terminal symbols in the following table. Wire the terminal correctly for the desired purposes.

Terminal Symbol	Function Description
R. S. T	Terminals of 3 phase AC input
P. N	Spare terminals of external braking unit
P. Pr	Spare terminals of external braking resistor
P1. P/+	Spare terminals of external DC reactor
N	Terminal of negative DC bus
U. V. W	Terminals of 3 phase AC output
⏚	Terminal of ground

4.2.2 Control Circuit Terminals

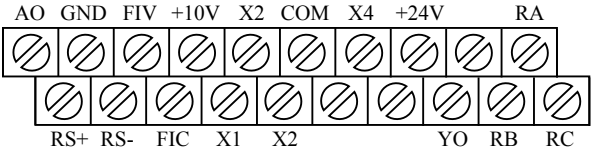


Figure 4.9 Control circuit terminals (3.7Kw~160kw).

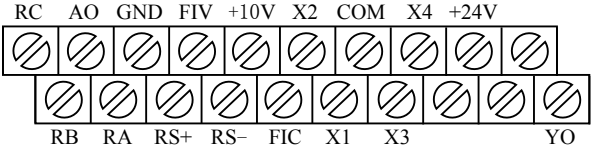


Figure 4.10 Control circuit terminals (0.4~2.2kW).

4.3 Typical Wiring Diagram

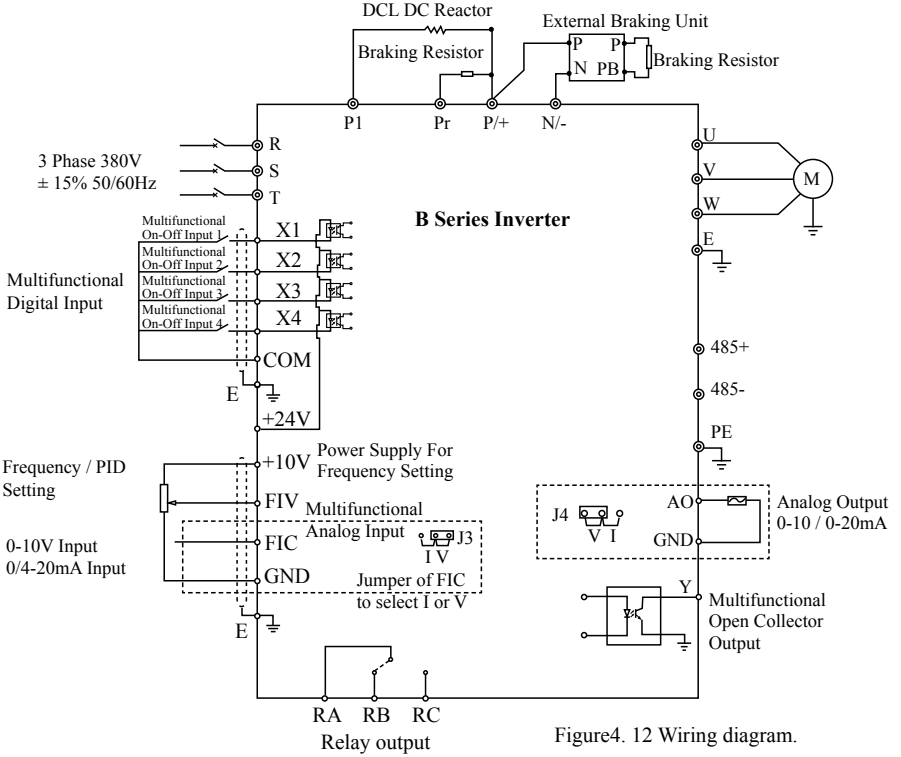


Figure4. 12 Wiring diagram.

Notice

1. For inverters above 110KW, it is recommended to install DC reactor between P1 and P/+.

2. Inverters below 15KW have built-in braking unit. If need braking, only need to install braking resistor between Pr and P.

3. For inverters above 18.5KW, if need braking, should install external braking unit between P and N

4.4 Specifications of Breaker, Cable, Contactor and Reactor

4.4.1 Specifications of breaker, cable and contactor

Model No.	Circuit Breaker (A)	Input/Output Cable (mm2)	Rated Current of Contactor (A)
1/3PH AC 220V -15~15%			
HCB20P4K	16	2.5	10
HCB20P7G	16	2.5	10
HCB21P5G	16	2.5	10
HCB22P2G	20	4	16
HCB23P7G	32	6	20
3PH AC 380V -15~15%			
HCB40P7G	10	2.5	10
HCB41P5G	16	2.5	10
HCB42P2G	16	2.5	10
HCB43P7G	25	4	16
HCB45P5G	25	4	16
HCB47P5G	40	6	25
HCB4011G	63	6	32
HCB4015G	63	6	50
HCB4018G	100	10	63
HCB4022G	100	16	80
HCB4030G	125	25	95
HCB4037G	160	25	120

Model No.	Circuit Breaker (A)	Input/Output Cable (mm2)	Rated Current of Contactor (A)
HCB4045G	200	35	135
HCB4055G	200	35	170
HCB4075G	250	70	230
HCB4090G	315	70	280
HCB4110G	400	95	315
HCB4132G	400	150	380
HCB4160G	630	185	450

4.4.2 Specifications of AC input reactor, AC output reactor and DC reactor

Model No.	AC Input reactor		AC Output reactor		DC reactor	
	Current (A)	Inductance (mH)	Current (A)	Inductance (mH)	Current (A)	Inductance (mH)
3AC 380V -15~15%						
HCB40P7G	2.0	7.00	2.0	2.0	-	-
HCB41P5G	5.0	3.80	5.0	1.5	-	-
HCB42P2G	7.5	2.50	7.5	1.0	-	-
HCB43P7G	10	1.50	10	0.6	-	-
HCB45P5G	15	1.00	15	0.250	-	-
HCB47P5G	20	0.75	20	0.130	23	3.5
HCB4011G	30	0.60	30	0.087	33	2.4
HCB4015G	40	0.42	40	0.066	33	1.8
HCB4018G	50	0.35	50	0.052	40	1.5
HCB4022G	60	0.28	60	0.045	50	1.5
HCB4030G	80	0.19	80	0.032	65	1.0
HCB4037G	90	0.16	90	0.030	80	0.60
HCB4045G	120	0.13	120	0.023	120	0.48
HCB4055G	150	0.10	150	0.019	150	0.32
HCB4075G	200	0.08	200	0.014	200	0.25
HCB4090G	200	0.08	200	0.014	250	0.16
HCB4110G	250	0.06	250	0.011	300	0.2
HCB4132G	250	0.06	250	0.011	300	0.2
HCB4160G	330	0.04	330	0.008	360	0.17

4.4.3 Specification of braking resistor

Model No.	Braking Resistor (100% of Braking torque)	
	Specifications	Quantity
3AC 380V -15~15%		
HCB40P7G	750Ω/80W	1
HCB41P5G	400Ω/260W	1
HCB42P2G	250Ω/260W	1
HCB43P7G	150Ω/390W	1
HCB45P5G	100Ω/520W	1
HCB47P5G	75Ω/780W	1
HCB4011G	50Ω/1040W	1
HCB4015G	40Ω/1560W	1
HCB4018G	32Ω/4800W	1
HCB4022G	27.2Ω/4800W	1
HCB4030G	20Ω/6000W	1
HCB4037G	16Ω/9600W	1
HCB4045G	13.6Ω/9600W	1
HCB4055G	10Ω/12000W	1
HCB4075G	6.8Ω/12000W	1
HCB4090G	6.8Ω/12000W	1
HCB4110G	6Ω/20000W	1
HCB4132G	6Ω/20000W	1
HCB4160G	5Ω/25000W	2

4.5 Wiring Main Circuits

4.5.1 Wiring at input side of main circuit

1. Circuit breaker

It is necessary to connect a circuit breaker which is compatible with the capacity of inverter between 3ph AC power supply and power input terminals (R, S, T). The capacity of breaker is 1.5~2 times to the rated current of inverter. For details, see <Specifications of Breaker, Cable, and Contactor>.

2. Contactor

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

3. AC reactor

In order to prevent the rectifier from damaging, resulted from the large current, AC reactor should be installed at the input side. It can also prevent rectifier from sudden variation of power voltage or harmonic generated by phase-control load.

4. Input EMC filter

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

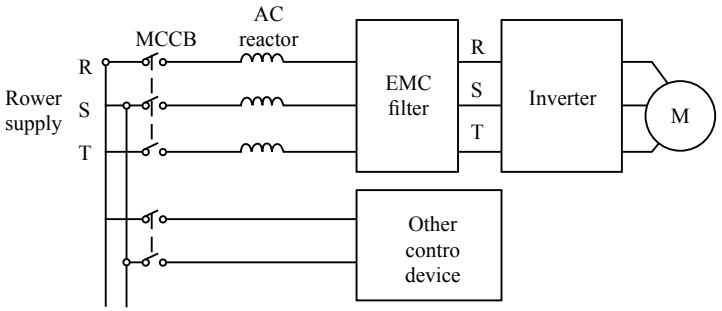


Figure 4.13 Wiring at input side of main circuit.

4.5.2 Wiring at inverter side of main circuit

1. Braking unit and braking resistor

- Inverter of 15KW and below have built-in braking unit. In order to dissipate the regenerative energy generated by dynamic braking, the braking resistor should be installed at P and Pr terminals. The wire length of the braking resistor should be less than 5m.
- Inverter of 18.5KW and above need connect external braking unit which should

be installed at P/+ and N/- terminals. The cable between inverter and braking unit should be less than 5m. The cable between braking unit and braking resistor should be less than 10m.

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

Notice: wake sure that the electric polarity of P/+ N/- terminals is proper; it is not allowed to connect P/+ with N/- terminals directly, otherwise damage or fire could occurs.

4.5.3 Wiring at motor side of main circuit

1) Output Reactor

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

2) Output EMC filter

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

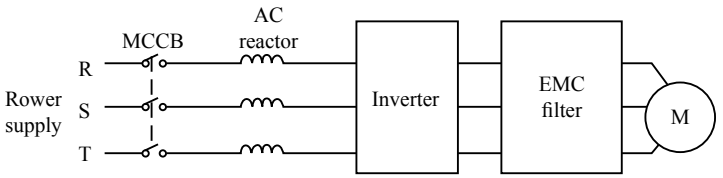


Figure 4.14 Wiring at motor side of main circuit.

4.5.4 Wiring of regenerative unit

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

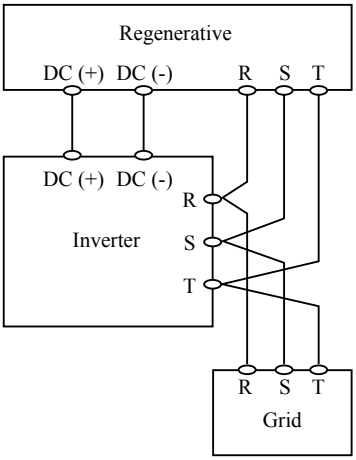


Figure 4.15 Wiring of regenerative unit.

4.5.5 Wiring of Common DC bus

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

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

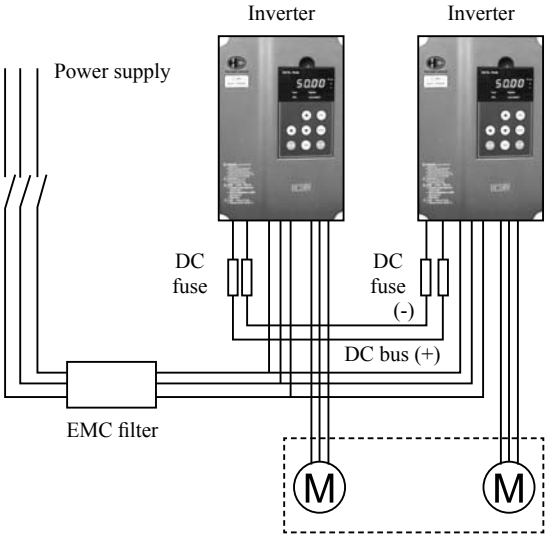


Figure 4.16 Wiring of common DC bus.

Notice: Two inverters must be the same model when connected with Common DC bus method. Be sure they are powered on at the same time.

4.5.6 Ground Wiring (E)

In order to ensure safety and prevent electrical shock and fire, E must be grounded with ground resistance. The ground wire should be big and short, and it is better to use copper wire (>3.5mm2). When multiple inverters need to be grounded, do not loop the ground wire.

4.6 Wiring Control Circuits

4.6.1 Precautions

- Use shielded or twisted-pair cables to connect control terminals.
- Connect the ground terminal (E) with shield wire.
- The cable connected to the control terminal should leave away from the main

circuit and heavy current circuits (including power supply cable, motor cable, relay and contactor connecting cable) at least 20cm and parallel wiring should be avoided. It is suggested to apply perpendicular wiring to prevent inverter malfunction caused by external interference.

4.6.2 Control circuit terminals

Terminal No.	Function
X1~X4	ON-OFF signal input, optical coupling with PW and COM. Input voltage range: 9~30V Input impedance: 3.3kΩ
+24V	Provide output power supply of +24V. Maximum output current: 150mA
FIV	Analog input: 0~10V Input impedance: 10kΩ
FIC	Analog input: 0~10V/ 0~20mA, switched by J16. Input impedance:10kΩ (voltage input) / 250Ω (current input)
GND	Common ground terminal of analog signal and +10V. GND must isolated from COM.
+10V	Supply +10V to inverter.
COM	Common ground terminal for digital signal and +24V (or external power supply).
AO	Provide voltage or current output which can be switched by J15. Output range: 0~10V/ 0~20mA
Y	Open collector output terminal, the corresponding common ground terminal is COM.
RA. RB. RC	Relay output: RA--common; RB--NC, RC—NO. Contact capacity: AC 250V/3A, DC 30V/1A

4.6.3 Jumpers on control board

Jumper	Function
J3	Switch between (0~10V) voltage input and (0~20mA) current input. V connect to GND means voltage input; I connect to GND means current input.
J4	Switch between (0~10V) voltage output and (0~20mA) current output. V connect to OUT means voltage output; I connect to OUT means current output.

4.7 Installation Guidline to EMC Compliance

4.7.1 General description of EMC

EMC is the abbreviation of electromagnetic compatibility, which means the device or system has the ability to work normally in the electromagnetic environment and will not generate any electromagnetic interference to other equipments.

EMC includes two subjects: electromagnetic interference and electromagnetic anti-jamming.

According to the transmission mode, Electromagnetic interference can be divided into two categories: conducted interference and radiated interference.

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

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

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

4.7.2 EMC features of inverter

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

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

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

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

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

4.7.3 EMC Installation Guideline

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

1. Noise control

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

Connect inverter and motor with the shielded wire or the separated cable tray. One side of shield layer of shielded wire or metal cover of separated cable tray

should connect to ground, and the other side should connect to the motor cover. Installing an EMC filter can reduce the electromagnetic noise greatly.

2. Site wiring

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

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

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

3. Ground

Inverter must be ground safely when in operation. Grounding enjoys priority in

all EMC methods because it does not only ensure the safety of equipment and persons, but also is the simplest, most effective and lowest cost solution for EMC problems.

Grounding has three categories: special pole grounding, common pole grounding and series-wound grounding. Different control system should use special pole grounding, and different devices in the same control system should use common pole grounding, and different devices connected by same power cable should use series-wound grounding.

4. Leakage Current

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

Countermeasure:

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

5. EMC Filter

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

For inverter, noise filter has following categories:

1) Noise filter installed at the input side of inverter;
2) Install noise isolation for other equipment by means of isolation transformer or power filter.

5 OPERATION

5.1 Keypad Description

5.1.1 Keypad schematic diagram

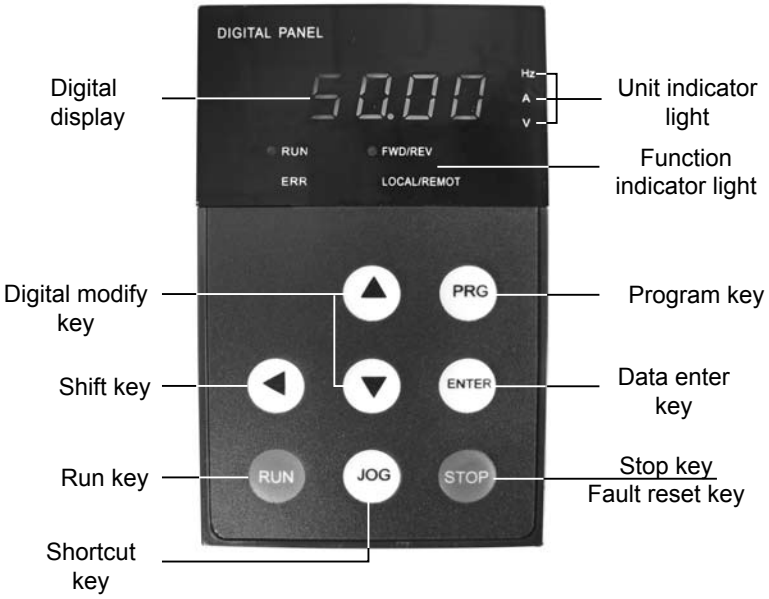


Figure 5.1 Keypad schematic diagram.

5.1.2 Key function description

Button Symbol	Name	Function Description
PRG	Programming Key	Entry or escape of first-level menu.
ENTER	Enter Key	Progressively enter menu and confirm parameters.
▲	UP Increment Key	Progressively increase data or function codes.
▼	DOWN Decrement Key	Progressive decrease data or function codes.
ENTER + JOG	Combination Key	Cyclically displays parameters by left shift, In the stop or running status. Note that when operation, should firstly press and hold the ENTER key and then press the JOG key.
◄	Shift Key	In parameter setting mode, press this button to select the bit to be modified. In other modes, cyclically displays parameters by right shift
RUN	Run Key	Start to run the inverter in keypad control mode.
STOP	Stop Key	In running status, restricted by F7.04, can be used to stop the inverter. When fault alarm, can be used to reset the inverter without any restriction.
JOG	Shortcut Multifunction Key	Determined by Function Code F7.03: 0: Jog operation 1: Switch between forward and reverse 2: Clear the UP/DOWN settings. 3: Quick debugging mode1 (by menu) 4: Quick debugging mode2 (by latest order) 5: Quick debugging mode3 (by non-factory setting parameters)
RUN + STOP	Combination Key	Pressing the RUN and STOP at the same time can achieve to stop.

5.1.3 Indicator light description

1) Function Indicator Light Description

Indicator Light Name	Indicator Light Description
FWD/REV	Extinguished: forward operation Light on: reverse operation.
LOCAL/REMOT	Extinguished: keypad control Flickering: terminal control Light on: communication control

2) Unit Indicator Light Description

Symbol	Description
Hz	Frequency unit
A	Current unit
V	Voltage unit

3) Digital Display

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

5.2 Operation Process

5.2.1 Parameter setting

Three levels of menu are:

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

Remarks:

Press both the (PRG) and the (ENTER) can return to the second-class menu from the third-class menu. The difference is: pressing (PRG) will save the set parameters into the control panel, and then return to the second-class menu with shifting

to the next function code automatically; while pressing (ENTER) will directly return to the second-class menu without saving the parameters, and keep staying at the current function code

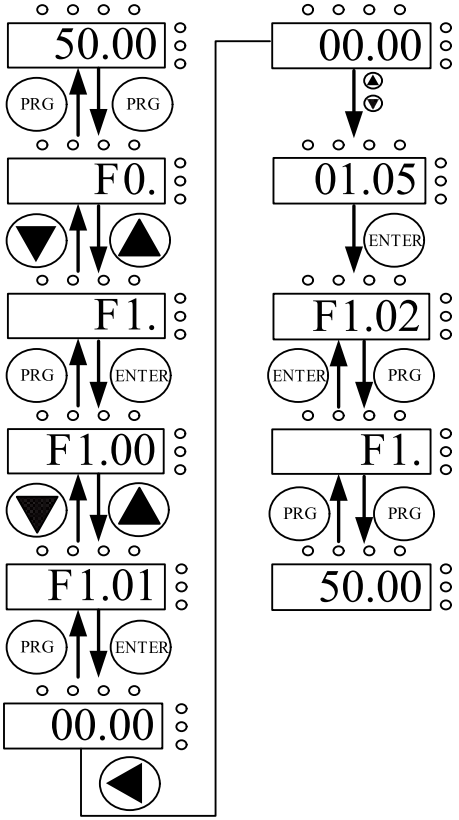


Figure 5.2 Flow chart of parameter setting.

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

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

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

5.2.2 Fault reset

If the inverter has fault, it will prompt the related fault information. User can use STOP or according to terminals determined by F5 Group to reset the fault. After fault reset, the inverter is at stand-by status. If user does not reset the inverter when it is at fault status, the inverter will be in operation protection status, and can not run.

5.2.3 Motor parameter autotuning

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

The procedure of motor parameter autotuning is as follows:

Firstly, choose the keypad command channel as the operation command channel (F0.01).

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

F2.01: motor rated power.
F2.02: motor rated frequency;
F2.03: motor rated speed;
F2.04: motor rated voltage;
F2.05: motor rated current

Notice: the motor should be uncoupled with the load; otherwise, the motor parameters obtained by autotuning may be not correct. Set F0.12 to be 1, and for the detail process of motor parameter autotuning, please refer to the description of Function Code F0.12. And then press RUN on the keypad panel, the inverter will automatically calculate following parameter of the motor:

F2.06: motor stator resistance;

F2.07: motor rotor resistance;

F2.08: motor stator and rotor inductance;

F2.09: motor stator and rotor mutual inductance;

F2.10: motor current without load;

then motor autotuning is finished.

5.2.4 Password setting

B series inverter offers user's password protection function. When F7.00 is set to be non-zero, it will be the user's password, and After exiting function code edit mode, it will become effective is 1 minute. If pressing the PRG again to try to access the function code edit mode, "0.0.0.0.0"will be displayed, and the operator must input correct user's password, otherwise will be unable to access it.

If it is necessary to cancel the password protection function, just setF7.00 to be zero.

5.3 Running Status

5.3.1 Power-on initialization

Firstly the system initializes during the inverter power-on, and LED displays "-00000-". After the initialization is completed, the inverter is on stand-by status.

5.3.2 Stand-by

At stop or running status, parameters of multi-status can be displayed.
Whether or not to display this parameter can be chosen through Function Code F7.06(Running status display selection) andF7.07 (Stop status display selection) according to binary bits, the detailed description of each bit please refer the function code description of F7.06 and F7.07.

In stop status, there are nine parameters which can be chosen to display or

not. They are: reference frequency, DC bus voltage, ON-OFF input status, open collector output status, PID setting, PID feedback, analog input FIV voltage, analog input FIC voltage, step number of multi-step speed. Whether or not to display can be decided by setting the corresponding binary bit of F7.07. Press the ◀ to scroll through the parameters in right order . Press ENTER + JOG to scroll through the parameters in left order.

5.3.3 Motor parameter autotuning

For details, please refer to the description of F0.12.

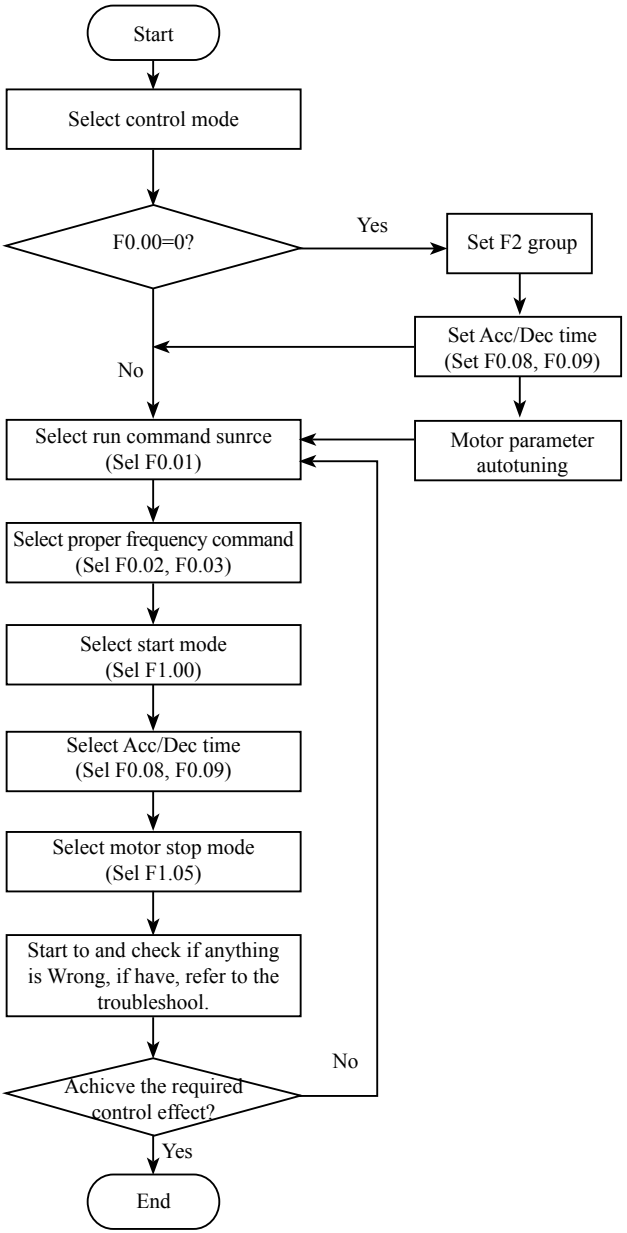
5.3.4 Operation

In running status, there are fourteen running parameters: output frequency, reference frequency, DC bus voltage, output voltage, output current, output power, output torque, PID setting, PID feedback, ON-OFF input status, open collector output status, length value, count value, step number of PLC and multi-step speed, voltage of AI1, voltage of AI2 and step number of multi-step speed. Whether or not to display can be decided by the bit option of Function Code P7.06 (converted into binary system). Press the ◀ to scroll through the parameters in right order . Press ENTER + JOG to scroll through the parameters in left order.

5.3.5 Fault

B series inverter offers a variety of fault information. For details, see inverter faults and their troubleshooting.

5.4 Quick Testing


Start
Select control mode
F0.00=0?
Yes
Set F2 group
Set Acc/Dec time
(Set F0.08, F0.09)
No
Motor parameter
autotuning
Select run command sunrce
(Sel F0.01)
Select proper frequency command
(Sel F0.02, F0.03)
Select start mode
(Sel F1.00)
Select Acc/Dec time
(Sel F0.08, F0.09)
Select motor stop mode
(Sel F1.05)
Start to and check if anything
is Wrong, if have, refer to the
troubleshool.
Achicve the required
control effect?
No
Yes
End

6. DETAILED FUNCTION DESCRIPTION

6.1 F0 Group--Basic Function

Function Code	Name	Description	Setting Range	Factory Setting
F0.00	Control mode selection	0:Sensorless vector control 1:V/F control 2:Torque control	0~2	0

0: Sensorless vector control: It is widely used for the application which requires high torque at low speed, higher speed accuracy, and quicker dynamic response, such as machine tool, injection molding machine, centrifugal machine and wire-drawing machine, etc.
1: V/F control: It is suitable for general purpose application such as pumps, fans etc.
2: Torque control: It is suitable for the application with low accuracy torque control, such as wired-drawing. In torque control mode, the speed of motor is determined by load, the rate of ACC/DEC has nothing to do with the value of F0.08 and F0.09 (or F8.00 and F8.01).

Notice:

1. Inverter can drive only one motor when F0.00 is set to be 0 or 2. When F0.00 is set to be 1, inverter can drive multi motors.
2. The autotuning of motor parameters must be accomplished properly when F0.00 is set for 0 or 2.
3. In order to achieve better control characteristic, the parameters of speed regulator (F3.00~F3.05) must be adjusted according to actual situation when F0.00 is set for 0 or 2.

Function Code	Name	Description	Setting Range	Factory Setting
F0.01	Run command source	0: Keypad (LED extinguished) 1: Terminal (LED flickering) 2: Communication (LED lights on)	0~2	0

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

0: Keypad (LED extinguished);

Both RUN and STOP key are used for running command control. If Multifunction key JOG is set as FWD/REV switching function (F7.03 is set to be 1), it will be used to change the rotating orientation. In running status, pressing RUN and STOP in the same time will make the inverter smoothly stop.

1: Terminal (LED flickering)

The operation, including forward run, reverse run, forward jog, reverse jog etc. can be controlled by multifunctional input terminals.

2: Communication (LED lights on)

The operation of inverter can be controlled by the host through communication.

Function Code	Name	Description	Setting Range	Factory Setting
F0.02	UP/DOWN setting	0: effecfive, save UP/DOWN value when power off 1: effecfive, do not save UP/DOWN value when power off 2: effecfive 3: effecfive during running, clear when stop.	0~3	0

0: User can adjust the reference frequency by UP/DOWN. The value of UP/DOWN can be saved when power off.

1: User can adjust the reference frequency by UP/DOWN, but the value of UP/DOWN will not be saved when power off.

2: User can not adjust the reference frequency by UP/DOWN. The value of UP/DOWN will be cleared if F3.05 is set to 2.

3: User can only adjust the reference frequency by UP/DOWN when the inverter is running. The value of UP/DOWN will be cleared when the inverter stops.

Notice:

1. UP/DOWN function can be achieved by keypad (V and Λ) and multifunctional terminals.

2. Reference frequency can be adjusted by UP/DOWN.

3. UP/DOWN has highest priority which means UP/DOWN is always active no matter which frequency command source is.

4. When the factory setting is restored (F1.03 is set to be 1), the value of UP/DOWN will be cleared

Function Code	Name	Description	Setting Range	Factory Setting
F0.03	Frequency A command source	0: Keypad 1: FIV 2. FIC 3: FIV+FIC 4. Multi-Step speed 5: PID 6: Communication	0~6	0

0: Keypad: Please refer to description of F3.00

1: FIV

2: FIC

3:FIV+FIC

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

Notice:

- When FIC is set as 0~20mA current input, the corresponding voltage range is 0~5V. For detailed relationship between analogue input voltage and frequency, please refer to description of F5.07~F5.11.
- 100% of FIVis corresponding to maximum frequency(F0.04)

4: Multi-step speed

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

Notice:

- Multi-step speed mode will have priority in setting reference frequency if F0.03 is not set to be 4. In this case, only fiom step 1 to step 15 are available.
- If F0.03 is set for 4, step 0 to step 15 will be avuilable.
  Jog has highest priority.

5: PID

The reference frequency is the result of PID adjustment. For details, please refer to description of F9 group

6: Communication

The reference frequency is set through RS485. For details, please refer to description of Chapter 10.

Function Code	Name	Description	Setting Range	Factory Setting
F0.04	Maximum frequency	F0.05~600.00Hz	F0.05~600.00	50.00Hz

Notice:

1. The frequency reference should not exceed maximum frequency.
2. Actual acceleration time and deceleration time are determined by maximum frequency. Please refer to description of F0.08 and F0.09.

Function Code	Name	Description	Setting Range	Factory Setting
F0.05	Upper frequency limit	F0.06~ F0.04	F0.06~F0.04	50.00Hz

Notice:

1. Upper frequency limit should not be greater than the maximum frequency (F0.04).
2. Output frequency should not exceed upper frequency limit.

Function Code	Name	Description	Setting Range	Factory Setting
F0.06	Lower frequency limit	0.00 Hz ~ F0.05	0.00~F0.05	0.00Hz

Notice:

1. Lower frequency limit should not be greater than upper frequency limit (F0.05).

2. If frequency reference is lower than F0.06, the action of inverter is determined by F1.12. Please refer to description of F1.12.

Function Code	Name	Description	Setting Range	Factory Setting
F0.07	Keypad reference frequency	0.00 Hz ~ F0.04	0.00~F0.04	50.00Hz

When F0.03 is set fiv 0, this parameter is the initial value of inverter reference frequency

Function Code	Name	Description	Setting Range	Factory Setting
F0.08	Acceleration time 0	0.0~3600.0s	0.0~3600.0	Depend on model
F0.09	Deceleration time 0	0.0~3600.0s	0.0~3600.0	Depend on model

Acceleration time is the time of accelerating from 0Hz to maximum frequency (F0.04). Deceleration time is the time of decelerating from maximum frequency (F0.04) to 0Hz. Please refer to following.

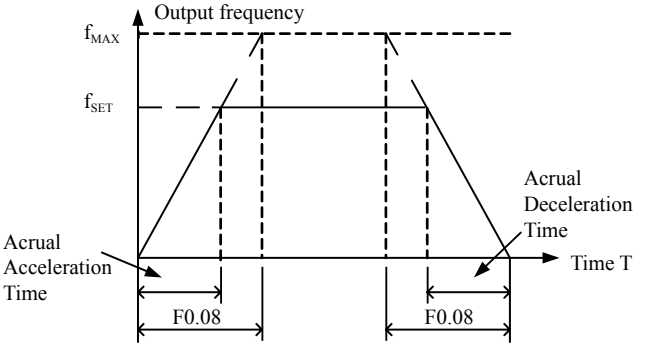


Figure 6.1 Acceleration and deceleration time.

When the reference frequency is equal to the maximum frequency, the actual acceleration and deceleration time will be equal to the F0.08 and F0.09 respectively.

When the reference frequency is less than the maximum frequency, the actual

acceleration and deceleration time will be less than the F0.08 and F0.09 respectively.

The actual acceleration (deceleration) time = F0.08 (F0.09) * reference frequency/ F0.04.

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

1st group: F0.07, F0.08
2nd group: F8.00, F8.01

The acceleration and deceleration time can be selected by combination of multifunctional ON-OFF input terminals determined by F5 Group. The factory setting of acceleration and deceleration time is as follows:

- 5.5kW and below: 10.0s
- 7.5kW~30kW: 20.0s
- 37kW and above: 40.0s

Function Code	Name	Description	Setting Range	Factory Setting
F0.10	Running direction selection	0: Forward 1: Reverse 2: Forbid reverse	0~2	0

Notice:

1. The rotation direction of motor is corresponding to the wiring of motor.
2. When the factory setting is restored (F0.13 is set for 1), the rotation direction of motor may be changed. Please be cautious to use.

If F0.10 is set for 2, user can not change rotation direction of motor by JOG or terminal.

Function Code	Name	Description	Setting Range	Factory Setting
F0.11	Carrier frequency	0.5~15.0kHz	0.5~15.0	Depend on model

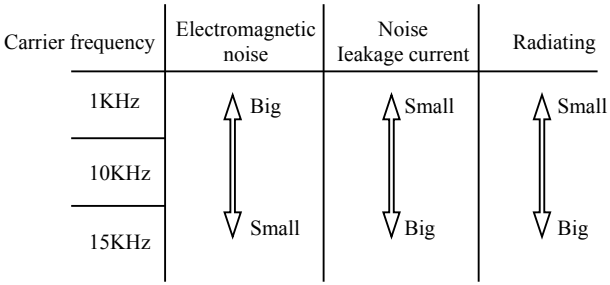


Figure 6.2 Effect of carrier frequency.

The following table is the relationship between power rating and carrier frequency.

Carrier fre / Model	Highest Carrier fre (kHz)	Lowest Carrier fre (kHz)	Factory setting (kHz)
Model: 0.4kW~11kW	15	0.5	8
Model: 15kW~55kW	8	0.5	4
Model: 75kW~160kW	6	0.5	2

Carrier frequency will affect the noise of motor and the EMI of inverter.
If the carrier frequency is increased, it will cause better current wave, less harmonic current and lower noise of motor.

Notice:
1. The factory setting is ideal in most cases. Modification of this parameter is not recommended.
2. If the carrier frequency exceeds the factory setting, the inverter must be derated because the higher carrier frequency will cause more switching loss, higher temperature rise of inverter and stronger electromagnetic interference.

If the carrier frequency is lower than the factory setting, it is possible to cause less output torque of motor and more harmonic current.

Function Code	Name	Description	Setting Range	Factory Setting
F0.12	Motor parameters autotuning	0: No action 1: Rotation autotuning 2: Static autotuning	0~2	0

0: No action: Forbidding autotuning.

1: Rotation autotuning:

- Do not connect any load to the motor when performing autotuning and ensure the motor is in static status.
- Input the nameplate parameters of motor (F2.01~F2.05) correctly before performing autotuning. Otherwise the parameters detected by autotuning will be incorrect; it may influence the performance of inverter.
- Set the proper acceleration and deceleration time (F0.08 and F0.09) according to the motor inertia before performing autotuning. Otherwise it may cause over-current and over-voltage fault in autotuning.
- The operation process is as follows:
  a. Set F0.12 for 1 then press the (ENTER), LED will display "-TUN-" and flickers. During "-TUN-" is flickering, press the (PRG) to exit autotuning.
  b. Press the (RUN) to start the autotuning. LED will display "TUN-0".
  c. After a few seconds the motor will start to run. LED will display "TUN-1" and "RUN" light will flicker.
  d. After a few minutes, LED will display "-END-". That means the autotuning is finished and return to the stop status.
  e. In the autotuning, press the (STOP) will stop the autotuning.

Notice: Only keypad can control the autotuning. F0.12 will restore to 0 automatically when the autotuning is finished or cancelled.

2: Static autotuning:

- If it is difficult to disconnect the load, static autotuning is recommended.
- The operation process is the same as rotation autotuning except step c.

Notice: The Mutual inductance and current without load will not be detected by static autotuning if user should input suitable value according to experience.

Function Code	Name	Description	Setting Range	Factory Setting
F0.13	Restore parameters	0: No action 1: Restore factory setting 2: Clear fault records	0~2	0

0: No action

1: Inverter restores all parameters to factory setting except F2 group.

2: Inverter clear all fault records.

This function code will restore to 0 automatically when complete the function operation.

Function Code	Name	Description	Setting Range	Factory Setting
F0.14	AVR function	0: Disabled 1: Enabled all the time 2: Disabled during deceleration	0~2	1

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

6.2 F1 Group--Start and Stop Control

Function Code	Name	Description	Setting Range	Factory Setting
F1.00	Start Mode	0: Start directly 1: DC braking and start	0~1	0

0: Start directly: Start the motor at the starting frequency determined by F1.01.

1: DC braking and start: Inverter will output DC current firstly and then start the motor at the starting frequency. Please refer to description of F1.03 and F1.04. It is suitable for the motor which has liffle inertia load and may reverse rotation when start.

Function Code	Name	Description	Setting Range	Factory Setting
F1.01	Starting frequency	0.00~10.00Hz	0.00~10.00	0.00Hz
F1.02	Hold time of starting frequency	0.0~50.0s	0.0~50.0	0.0s

- Set proper starting frequency can increase the starting torque.
- If the reference frequency is less than starting frequency, inverter will be at stand-by status. The indicator of RUN lights on, inverter has no output.
- The starting frequency could be less than the lower frequency limit (F0.06).
- F1.01 and F1.02 take no effect in FWD/REV switching.

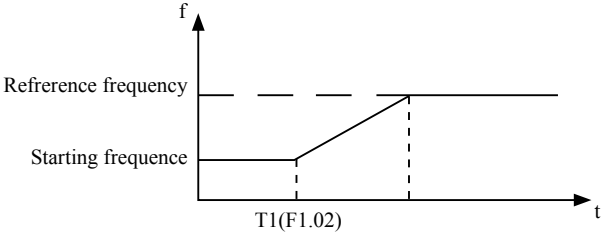


Figure 6.3 Starting diagram.

Function Code	Name	Description	Setting Range	Factory Setting
F1.03	DC Braking current before start	0.0~150.0%	0.0~150.0	0.0%
F1.04	DC Braking time before start	0.0~50.0s	0.0~50.0	0.0s

When inverter starts, it performs DC braking according to F1.03 firstly, then start to accelerate after F1.04.

Notice:

1. DC braking will take effect when F1.00 is set for only 1.
2. DC braking will be ineffectioe when F1.04 is set to be 0.

The value of F1.03 is the percentage of rated current of inverter. The bigger the DC braking current, the greater the braking torque.

Function Code	Name	Description	Setting Range	Factory Setting
F1.05	Stop mode	0: Decelerate to stop	0~1	0

0: Decelerate to stop

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

1: Coast to stop

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

Function Code	Name	Description	Setting Range	Factory Setting
F1.06	Starting frequency of DC braking	0.00~F0.04	0.00~50.00	0.00Hz
F1.07	Waiting time before DC braking	0.0~50.0s	0.0~50.0	0.0s
F1.08	DC braking current	0.0~150.0%	0.0~150.0	0.0%
F1.09	DC braking time	0.0~50.0s	0.0~50.0	0.0s

Starting frequency of DC braking: Start the DC braking when output frequency reaches starting frequency determined by F1.06.

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

DC braking current: The value of F1.08 is the percentage of rated current of inverter. The bigger the DC braking current, the greater the braking torque.

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

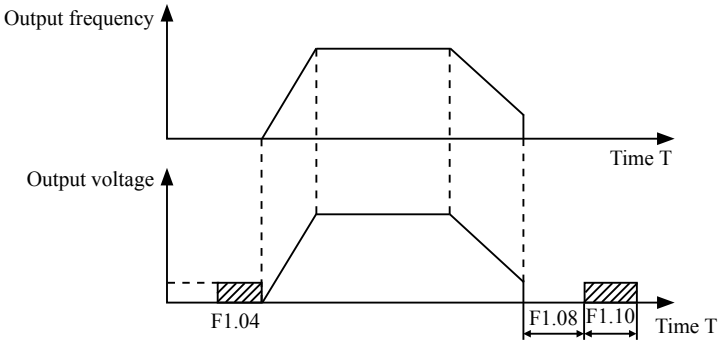


Figure 6.4 DC braking diagram.

Function Code	Name	Description	Setting Range	Factory Setting
F1.10	Dead time of FWD/REV	0.0~3600.0s	0.0~3600.0	0.0s

Set the hold time at zero frequency in the transition between forward and reverse running.

It is shown as following:

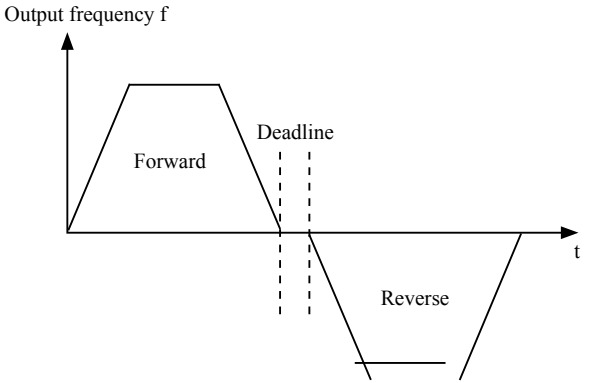


Figure 6.5 FWD/REV deadline diagram.

Function Code	Name	Description	Setting Range	Factory Setting
F1.11	FWD/REV enable option when power on	0: Disabled 1: Enabled	0~1	0

Notice:

1. This function only takes effect if run command source is terminal control.
2. If F1.11 is set for 0, when power on, inverter will not start even if FWD/REV terminal is active, until FWD/REV terminal disabled and enabled again.
3. If F1.11 is set to be 1, when power on and FWD/REV terminal is active, inverter will start automatically.
4. This function may cause the inverter restart automatically, please be cautious.

6.3 F2 Group--Motor Parameters

Function Code	Name	Description	Setting Range	Factory Setting
F2.00	G/P option	0: G model 1: P model	0~1	0

0: Applicable to constant torque load

1: Applicable to variable torque load (i.e. fans, pumps)

B series inverters provide the A/G integration function. The adaptive motor power used for constant torque load (G model) should be one grade less than that used for variable torque load (P model).

To change from A model to P model, procedures are as follow:

① Set F2.00 for 1;

② Input motor parameters in F2 group again..

Function Code	Name	Description	Setting Range	Factory Setting
F2.01	Motor vated power	0.4~900.0kW	0.4~900.0	Depends on model
F2.02	Motor vated frequency	0.01Hz~F0.04	0.01~P0.04	50.00Hz

F2.03	Motor vated speed	0~36000rpm	0~36000	Depends on model
F2.04	Motor vated voltage	0~2000V	0~2000V	Depends on model
F2.05	Motor vated current	0.8~2000.0A	0.8~2000.0	Depends on model

Notice:

1. In order to achieve superior performance, please set these parameters according to motor nameplate, then perform autotuning.
2. The power rating of inverter should match the motor. If the bias is too big, the control performances of inverter will be deteriorated distinctly.

Reset F2.01 can initialize F2.02~F2.10 automatically.

Function Code	Name	Description	Setting Range	Factory Setting
F2.06	Motor stator resistance	0.001~65.535Ω	0.001~65.535	Depends on model
F2.07	Motor rotor resistance	0.001~65.535Ω	0.001~65.535	Depends on model
F2.08	Motor leakage inductance	0.1~6553.5mH	0.1~6553.5	Depends on model
F2.09	Motor mutual inductance	0.1~6553.5mH	0.1~6553.5	Depends on model
F2.10	Current without load	0.01~655.35A	0.01~655.35	Depends on model

After autotuning, the value of F2.06~F2.10 will be automatically updated.

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

6.4 F3 Group—Vector Control

Function Code	Name	Description	Setting Range	Factory Setting
F3.00	ASR proportional gain Kp1	0~100	0~100	20

F3.01	ASR integral time Ki1	0.01~10.00s	0.01~10.00	0.50s
F3.02	ASR switching point 1	0.00Hz~F3.05	0.00~F3.05	5.00Hz
F3.03	ASR proportional gain Kp2	0~100	0~100	25
F3.04	ASR integral time Ki2	0.01~10.00s	0.01~10.00	1.00s
F3.05	ASR switching point 2	F3.02~F0.04	F3.02~F0.04	10.00Hz

F3.00~F3.05 are only valid for vector control and torque control and invalid for V/F control. Through F3.00~F3.05, user can set the proportional gain Kp and integral time Ki of speed regulator (ASR), so as to change the speed response characteristic. ASR's structure is shown in following.

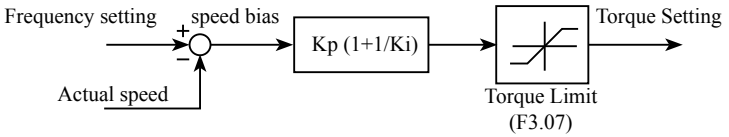


Figure 6.6 ASR diagram.

F3.00 and F3.01 only take effect when output frequency is less than F3.02. F3.03 and F3.04 only takes effect when output frequency is greater than F3.05. When output frequency is between F3.02 and F3.05, Kp and KI are proportional to the bias between F3.02 and F3.05. For details, please refer to following.

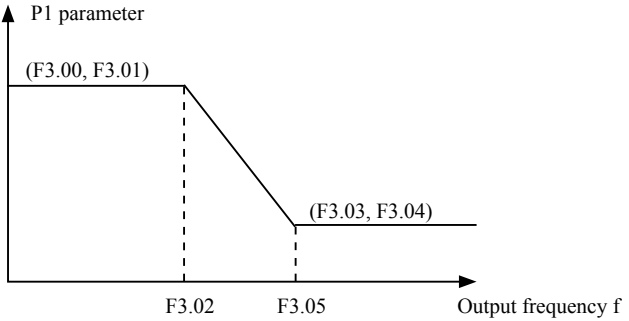


Figure 6.7 PI parameter diagram.

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

F3.00 and F3.01 are corresponding to Kp and Ki in low frequency, while F3.03 and F3.04 are corresponding to Kp and Ki in high frequency. Please adjust these parameters according to actual situation. The adjustment procedure is as follows:

1. Increase the proportional gain (Kp) as far as possible without creating oscillation.
2. Reduce the integral time (Ki) as far as possible without creating oscillation.
For more details about fine adjustment, please refer to description of F9 group.

Function Code	Name	Description	Setting Range	Factory Setting
F3.06	Slip compensation rate of VC	50.0~200.0%	50.0~200.0	100%

The parameter is used to adjust the slip frequency of vector control and improve the precision of speed control. Properly adjusting this parameter can effectively restrain the static speed bias.

Function Code	Name	Description	Setting Range	Factory Setting
F3.07	Torque limit	0.0~200.0%	0.0~200.0	150.0%

This parameter is used to limit the torque current output by speed regulator.
Torque limit value 0.0-200% is the inverter's rated current percentage.

6.5 F4 Group-- V/F Control

Function Code	Name	Description	Setting Range	Factory Setting
F4.00	V/F curve selection	0:Linear curve 1: Torque_stepdown curve (2.0 order)	0~1	0

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

1: Torque_stepdown curve. It is applicable for variable torque load, such as blower, pump and so on. Please refer to following illustration.

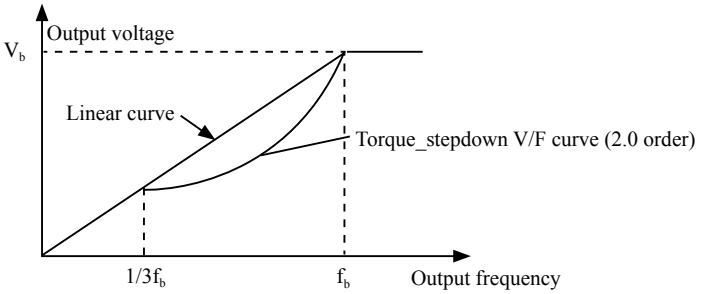


Figure6.8 V/F curve diagram.

Function Code	Name	Description	Setting Range	Factory Setting
F4.01	Torque boost	0.0%: (auto) 0.1%~10.0%	0.0~10.0	0.0%
F4.02	Torque boost cut-off	0.0%~50.0% (motor vated frequency)	0.0~50.0	20.0%

Torque boost will take effect when output frequency is less than cut-off frequency of torque boost (F4.02). Torque boost can improve the torque performance of V/F control at low speed.

The value of torque boost should be determined by the load. The heavier the load, the larger the value.

Notice: F4.01 should not be too large, otherwise the motor would be over-heat or the inverter would be tripped by over-current or over-load.

If F4.01 is set for 0, the inverter will boost the output torque according to the load automatically.

Please refer to following diagram.

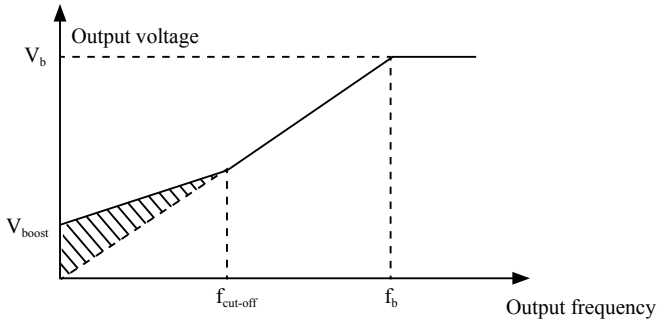


Figure 6.9 Manual torque boost diagram.

Function Code	Name	Description	Setting Range	Factory Setting
F4.03	V/F Slip compensation limit	0.00~200.0%	0.00~200.00	0.0%

The slip compensation function calculates the torque of motor according to the output current and compensates for output frequency. This function is used to improve speed accuracy when operating with a load. F4.03 sets the slip compensation limit as a percentage of motor rated slip, with vated motor slip taken as 100%.

Function Code	Name	Description	Setting Range	Factory Setting
F4.04	Auto energy saving selection	0: Disabled 1: Enabled	0~1	0

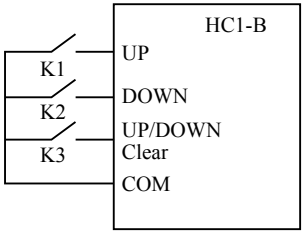
When F4.04 is set for 1, while there is a light load, it will reduce the inverter output voltage and saves energy.

6.6 F5 Group--Input Terminals

Function Code	Name	Description	Setting Range	Factory Setting
F5.00	X1 Terminal function	Programmable multifunctional terminal	0~25	1

F5.01	X2 Terminal function	Programmable multifunctional terminal	0~25	4
F5.02	X3 Terminal function	Programmable multifunctional terminal	0~25	7
F5.03	X4 Terminal function	Programmable multifunctional terminal	0~25	0

The meaning of each setting is shown in following table.

Setting value	Function	Description
0	Invalid	Please set unused terminals to be ineffective for avoiding malfunction.
1	Forward	Please refer to description of F5.05.
2	Reverse	
3	3-wire control	Please refer to description of F5.05.
4	Jog forward	Please refer to description of F8.02~F8.04.
5	Jog reverse	
6	Coast to stop	The inverter blocks the output immediately. The motor coasts to stop by its mechanical inertia.
7	Reset fault	Resets faults that have occurred. It is the same function as STOP.
8	External fault input	Stop the inverter and output a alarm when a fault occurs in a peripheral device.
9	Up command	The reference frequency of inverter can be adjusted by UP command and DOWN command.
10	DOWN command	
11	Clear UP/DOWN	 Use this terminal to clear UP/DOWN setting. Please refer to description of F0.02.

<table>
<tr><th>Setting value</th><th>Function</th><th>Description</th></tr>
<tr><td>12</td><td>Multi-step speed reference1</td><td rowspan="3">8 steps speed control can be realized by the combination of these four terminals. For details, please refer to: Multi-step speed reference terminal status and according step value table:</td></tr>
<tr><td>13</td><td>Multi-step speed reference 2</td></tr>
<tr><td>14</td><td>Multi-step speed reference 3</td></tr>
<tr><td>15</td><td>ACC/DEC time selection</td><td>2 groups of ACC/DEC time can be selected by the combination of these two terminals.
<table>
<tr><th>Terminal</th><th>ACC/DEC time</th><th>Corresponding Parameter</th></tr>
<tr><td>OFF</td><td>Acceleration Time 0</td><td>F0.08~F0.09</td></tr>
<tr><td>ON</td><td>Acceleration Time 1</td><td>F8.00~F8.01</td></tr>
</table></td></tr>
<tr><td>16</td><td>Pause PID</td><td>PID adjustment will be paused and inverter keeps output frequency unchanged.</td></tr>
<tr><td>17</td><td>Pause traverse operation</td><td>Inverter keeps output frequency unchanged. If this terminal is disabled, inverter will continue traverse operation from current frequency.</td></tr>
<tr><td>18</td><td>Reset traverse operation</td><td>Reference frequency of inverter will be forced as center frequency of traverse operation.</td></tr>
<tr><td>19</td><td>ACC/DEC ramp hold</td><td>Pauses acceleration or deceleration and maintains output frequency. When this terminal is disabled, acceleration/ deceleration is restarted.</td></tr>
<tr><td>20</td><td>Disable torque control</td><td>Torque control is disabled. Inverter will work in speed control mode.</td></tr>
<tr><td>21</td><td>UP/DOWN invalid temporarily</td><td>UP/DOWN setting is ineffective and will not be cleared. When this terminal is disabled, UP/DOWN setting before will be ineffective again.</td></tr>
<tr><td>22~25</td><td>Reserved</td><td>Reserved</td></tr>
</table>

Multi-step speed reference terminal status and according step value table:

Terminal Step	Multi-step speed reference1	Multi-step speed reference2	Multi-step speed reference3
0	OFF	OFF	OFF
1	ON	OFF	OFF
2	OFF	ON	OFF
3	ON	ON	OFF
4	OFF	OFF	ON
5	ON	OFF	ON
6	OFF	ON	ON
7	ON	ON	ON

Function Code	Name	Description	Setting Range	Factory Setting
F5.04	ON/OFF filter times	1~10	1~10	5

This parameter is used to set filter strength of terminals (S1~S4). When interference is heavy, user should increase this value to prevent from malfunction.

Function Code	Name	Description	Setting Range	Factory Setting
F5.05	FWD/REV control mode	0: 2-wire control mode 1 1: 2-wire control mode 2 2: 3-wire control mode 1 3: 3-wire control mode 2	0~3	0

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

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

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

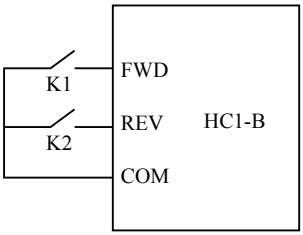


Figure 6.10 2-wire control mode1.

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

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

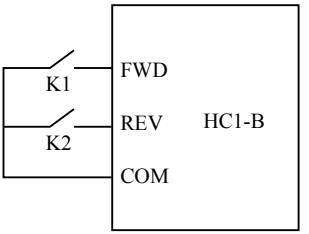


Figure 6.11 2-wire control mode 2.

2: 3-wire control mode 1:

SB1: Start button

SB2: Stop button (NC)

K: Run direction button

Terminal SIn is the multifunctional input terminal of X1~X4. The terminal function should be set for 3 (3-wire control).

K	Run command
OFF	Stop
ON	FWD

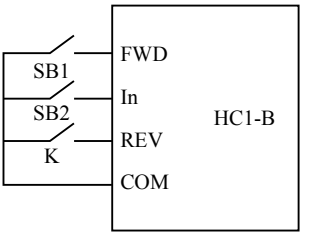


Figure 6.12 3-wire control mode 1.

3: 3-wire control mode 2:

SB1: Forward run button

SB2: Stop button (NC)

SB3: Reverse run button

Terminal SIn is the multifunctional input terminal of X1~X4. The terminal function should be set to be 3 (3-wire control)

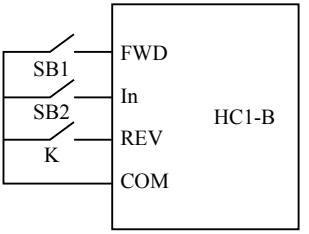


Figure 6.13 3-wire control mode2.

Notice: When 2-wire control mode is active, the inverter will not run in following situation even if FWD/REV terminal is enabled:

- Coast to stop (press RUN and STOP at the same time).
- Stop command from serial communication.

FWD/REV terminal is enabled before power on. Please refer to description of F1.11.

Function Code	Name	Description	Setting Range	Factory Setting
F5.06	UP/DOWN setting change rate	0.01~50.00Hz/s	0.01~50.00	0.50Hz/s

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

Function Code	Name	Description	Setting Range	Factory Setting
F5.07	FIV lower limit	0.00V~10.00V	0.00~10.00	0.00V
F5.08	FIV lower limit corresponding setting	-100.0%~100.0%	-100.0~100.0	0.0%
F5.09	FIV upper limit	0.00V~10.00V	0.00~10.00	10.00V
F5.10	FIV upper limit corresponding setting	-100.0%~100.0%	-100.0~100.0	100.0%
F5.11	FIV filter time constant	0.00s~10.00s	0.00~10.00	0.10s

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

The analog input FIV can only provide voltage input, and the range is 0V~10V.

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

Notice: FIV lower limit must be less or equal to FIV upper limit.

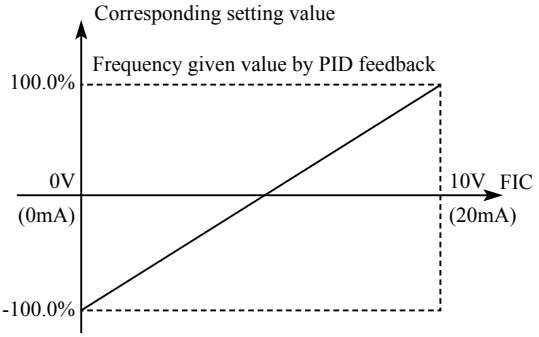


Figure 6.14 Relationship between FIV and corresponding setting.

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

Function Code	Name	Description	Setting Range	Factory Setting
F5.12	FIC lower limit	0.00V~10.00V	0.00~10.00	0.00V
F5.13	FIC lower limit corresponding setting	-100.0%~100.0%	-100.0~100.0	0.0%
F5.14	FIC upper limit	0.00V~10.00V	0.00~10.00	10.00V
F5.15	FIC upper limit corresponding setting	-100.0%~100.0%	-100.0~100.0	100.0%
F5.16	FIC filter time constant	0.00s~10.00s	0.00~10.00	0.10s

Please refer to description of FIV. When FIC is set as 0~20mA current input, the corresponding voltage range is 0~5V.

6.7 F6 Group--Output Terminals

Function Code	Name	Description	Setting Range	Factory Setting
F6.00	Y output selection	Open-collector output	0~10	1
F6.01	Relay output selection	Relay output	0~10	3

OC/Relay output functions are indicated in the following table.

Setting Value	Function	Description
0	No output	Output terminal has no function
1	Run forward	ON: During forward run.
2	Run reverse	ON: During reverse run.
3	Fault output	ON: Inverter is in fault status.
4	FDT reached	Please refer to description of F8.13 and F8.14.
5	Frequency reached	Please refer to description of F8.15.
6	Zero speed running	ON: The running frequency of inverter is zero.
7	Upper frequency limit reached	ON: Running frequency reaches the value of F0.05.
8	Lower frequency limit reached	ON: Running frequency reaches the value of F0.06.
9~10	Reserved	Reserved

Function Code	Name	Description	Setting Range	Factory Setting
F6.02	AO selection	Multifunctional analog output	0~10	0

Current (0~20mA) or voltage (0~10V) output can be selected by Jumper J4.

AO functions are indicated in the following table:

Setting Value	Function	Range
0	Running frequency	0~maximum frequency (F0.04)
1	Reference frequency	0~ maximum frequency (F0.04)
2	Motor speed	0~2* rated synchronous speed of motor
3	Output current	0~2* inverter rated current
4	Output voltage	0~1.5* inverter rated voltage
5	Output power	0~2* rated power
6	Output torque	0~2*rated current
7	FIV voltage	0~10V
8	FIC voltage/current	0~10V/0~20mA
9~10	Reserved	Reserved

Function Code	Name	Description	Setting Range	Factory Setting
F6.03	AO lower limit	0.0%~100.0%	0.0~100.0	0.0%
F6.04	AO lower limit corresponding output	0.00V ~10.00V	0.00~10.00	0.00V
F6.05	AO upper limit	0.0%~100.0%	0.0~100.0	100.0%
F6.06	AO upper limit corresponding output	0.00V ~10.00V	0.00~10.00	10.00V

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

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

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

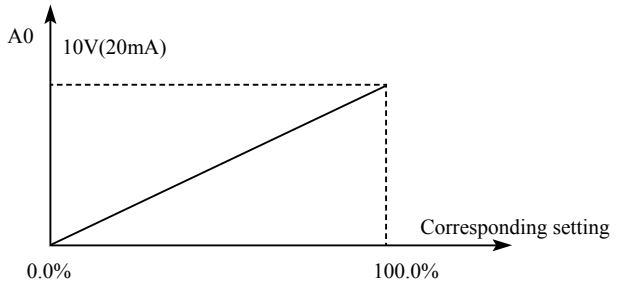


Figure 6.15 Relationship between AO and corresponding setting.

6.8 F7 Group--Display Interface

Function Code	Name	Description	Setting Range	Factory Setting
F7.00	User password	0~65535	0~65535	0

The password protection function will be effective when set for any nonzero data. When F7.00 is set for 00000, user's password set before will be cleared and the password protection function will be disabled.

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

Function Code	Name	Description	Setting Range	Factory Setting
F7.03	JOG function selection	0: Jog 1: FDW/REV switching 2: Clear UP/DOWN setting	0~2	0

JOG is a multifunctional key, of which function can be defined by the value of F7.03.

0: Jog: Press JOG , the inverter will jog.

1: FWD/REV switching: Press JOG , the running direction of inverter will reverse. It is only valid if F0.03 is set for 0.

2: Clear UP/DOWN setting: Press JOG , the UP/DOWN setting will be cleared.

Function Code	Name	Description	Setting Range	Factory Setting
F7.04	STOP function option	0: effective when keypad control (F0.01=0) 1: effective when keypad or terminal control (F0.01=0 or 1) 2: Valid when keypad or communication control (F0.01=0 or 2) 3: Always effective	0~3	0

Notice:

1. The value of F7.04 only determines the STOP function of STOP.
2. The RESET function of STOP is always effective.

Function Code	Name	Description	Setting Range	Factory Setting
F7.05	Keypad display selection	0: Preferential to external keypad 1: Both display, only external key effective. 2: Both display, only local key effective. 3: Both display and key effective.	0~3	0

0: When external keypad exists, local keypad will be effective.

1: Local and external keypad display simultaneously, only the key of external keypad is effective.

2: Local and external keypad display simultaneously, only the key of local keypad is effective.

3: Local and external keypad display simultaneously, both keys of local and external keypad are effective. Notice: This function should be used cautiously, otherwise it may cause malfunction.

Notice:

1: When F7.05 is set for 1, local keypad is effective if external keypad is not connected.

Function Code	Name	Description	Setting Range	Factory Setting
F7.06	Running status display selection	0~0x7FFF	0~0x7FFF	0xFF

P7.06 defines the parameters that can be displayed by LED in running status. If Bit is 0, the parameter will not be displayed; If Bit is 1, the parameter will be displayed. Press (SHIFT) to scroll through these parameters in right order . Press (ENTER) + (JOG) to scroll through these parameters in left order.

The display content corresponding to each bit of F7.06 is described in the following table:

BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
Output torque	Output power	Rotation speed	Output current	Output voltage	DC bus voltage	Reference frequency	Output frequency
BIT15	BIT14	BIT13	BIT12	BIT11	BIT10	BIT9	BIT8
Reserved	Step No. of multi-step	FIC	FIV	Output terminal status	Input terminal status	PID feedback	PID preset

For example, if user wants to display output voltage, DC bus voltage, Reference frequency, Output frequency, Output terminal status, the value of each bit is as the following table:

BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
0	0	0	0	1	1	1	1
BIT15	BIT14	BIT13	BIT12	BIT11	BIT10	BIT9	BIT8
0	0	0	1	0	0	0	0

The value of F7.06 is 100Fh.

Notice: I/O terminal status is displayed in decimal. For details, please refer to description of F7.18 and F7.19.

Function Code	Name	Description	Setting Range	Factory Setting
F7.07	Stop status display selection	0~0x1FF	0~0x1FF	0xFF

F7.07 determines the display parameters in stop status. The setting method is similar to F7.06.

The display content corresponding to each bit of F7.07 is described in the following table:

BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
FIC	FIV	PID feedback	PID preset	Output terminal status	Input terminal status	DC bus voltage	Reference frequency

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

Function Code	Name	Description	Setting Range	Factory Setting
F7.08	Rectifier module temperature	0~100.0℃		
F7.09	IGBT module temperature	0~100.0℃		
F7.10	Software version			
F7.11	Accumulated running time	0~65535h		

Rectify module temperature: Indicates the temperature of rectify module.

Overheat protection point of different inverter may be different.

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

Software version: Indicates current software version of DSP.

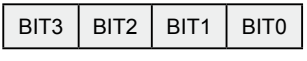
Accumulated running time: Displays accumulated running time of inverter.

Notice: Above parameters are read only.

Function Code	Name	Description	Setting Range	Factory Setting
F7.12	Third latest fault type	0~24		
F7.13	Second latest fault type	0~24		
F7.14	Latest fault type	0~24		

These parameters record three recent fault types. For details, please refer to description of chapter 7.

Function Code	Name	Description	Setting Range	Factory Setting
F7.15	Output frequency at current fault	Output frequency at current fault.		
F7.16	Output current at current fault	Output current at current fault.		
F7.17	DC bus voltage at current fault	DC bus voltage at current fault.		
F7.18	Input terminal status at current fault	This value records ON-OFF input terminal status at current fault. The meaning of each bit is as below: BIT3 BIT2 BIT1 BIT0 X4 X3 X2 X1 1 indicates corresponding input terminal is ON, while 0 indicates OFF. Notice: This value is displayed as decimal.		

F7.19	Output terminal status at current fault	This value records output terminal status at current fault. The meaning of each bit is as below:  1 indicates corresponding output terminal is ON, while 0 indicates OFF. Notice: This value is displayed in decimal.		

6.9 F8 Group--Enhanced Function

Function Code	Name	Description	Setting Range	Factory Setting
F8.00	Acceleration time 1	1.0~3600.0s	1.0~3600.0	20.0s
F8.01	Deceleration time 1	1.0~3600.0s	1.0~3600.0	20.0s

For details, please refer to description of F0.08 and F0.09.

Function Code	Name	Description	Setting Range	Factory Setting
F8.02	Jog reference	0.00~F0.04	0.00~ F0.04	5.00Hz
F8.03	Jog acceleration time	0.1~3600.0s	0.1~3600.0	Depend on model
F8.04	Jog deceleration time	0.1~3600.0s	0.1~3600.0	Depend on model

The meaning and factory setting of F8.03 and F8.04 is the same as F0.08 and F0.09. No matter what the value of F1.00 and F1.05 are, jog will start as start directly mode and stop as deceleration to stop mode.

Function Code	Name	Description	Setting Range	Factory Setting
F8.05	Skip frequency	0.00~F0.04	0.00~F0.04	0.00Hz
F8.06	Skip frequency bandwidth	0.00~F0.04	0.00~F0.04	0.00Hz

By means of setting skip frequency, the inverter can keep away from the

mechanical resonance with the load. F8.05 is centre value of frequency to be skipped.

Notice:

1. If F8.06 is 0, the skip function is inefficefive.
2. If F8.05 is 0, the skip function is inefficefive no matter what F8.06 is.
3. Operation is prohibited within the skip frequency bandwidth, but changes during acceleration and deceleration are smooth without skip.

The relation between running frequency and reference frequency is shown in following figure.

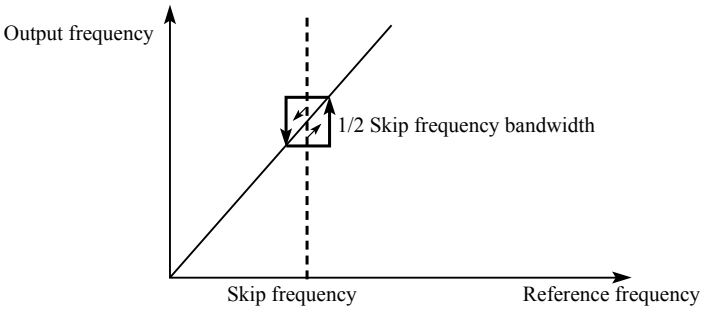


Figure 6.16 Skip frequency diagram.

Function Code	Name	Description	Setting Range	Factory Setting
F8.07	Traverse amplitude	0.0~100.0%	0.0~100.0	0.0%
F8.08	Wobble frequency	0.0~50.0%	0.0~50.0	0.0%
F8.09	Rise time of traverse	0.1~3600.0s	0.1~3600.0	5.0s
F8.10	Fall time of traverse	0.1~3600.0s	0.1~3600.0	5.0s

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

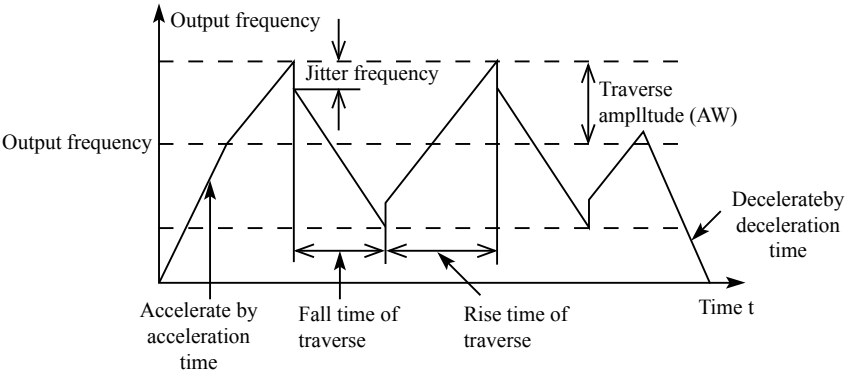


Figure 6.17 Traverse operation diagram.

Center frequency (CF) is reference frequency.

Traverse amplitude (AW) =center frequency (CF) * P8.08%

Mobble frequency = traverse amplitude (AW) * P8.08%

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

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

Notice:

1. F8.07 determines the output frequency range which is as below:

(1-F8.07%) * reference frequency ≤ output frequency ≤ (1+F8.07%) * reference frequency

2. The output frequency of traverse is limited by upper frequency limit (F0.05) and lower frequency limit (F0.06).

Function Code	Name	Description	Setting Range	Factory Setting
F8.11	Auto reset times	0~3	0~3	0
F8.12	Reset interval	0.1~100.0s	0.1~100.0	1.0s

Auto reset function can reset the fault in preset times and interval. When F8.11 is set to be 0, it means “auto reset” is disabled and the protective device will be activated in case of fault.

Notice: The fault such as OUT 1, OUT 2, OUT 3, OH1 and OH2 cannot be reset automatically.

Function Code	Name	Description	Setting Range	Factory Setting
F8.13	FDT level	0.00~ P0.04	0.00~ P0.04	50.00Hz
F8.14	FDT lag	0.0~100.0%	0.0~100.0	5.0%

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

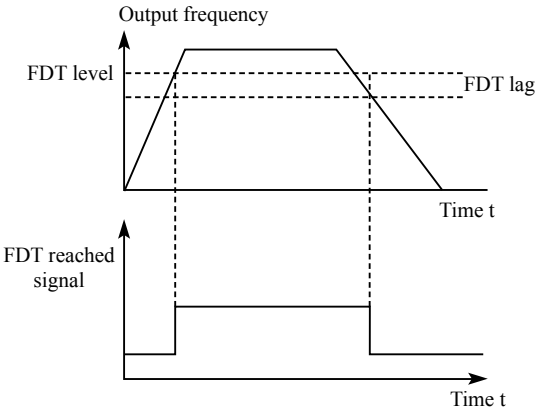


Figure 6.18 FDT level and lag diagram.

Function Code	Name	Description	Setting Range	Factory Setting
F8.15	Frequency arrive detecting range	0.0~100.0% (maximum frequency)	0.0~100.0	0.0%

When output frequency is within the detecting range of reference frequency, an ON-OFF signal will be output.

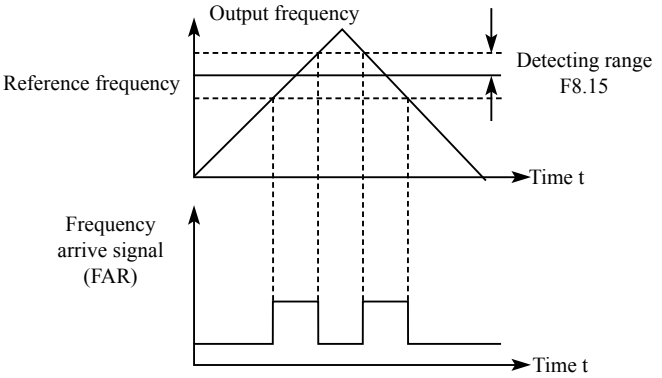


Figure 6.19 Frequency arriving signal diagram.

Function Code	Name	Description	Setting Range	Factory Setting
F8.16	Brake threshold voltage	115.0~140.0%	115.0~140.0	Depends on model

When the DC bus voltage is greater than the value of F8.16, the inverter will start dynamic braking.

Notice:

1. Factory setting is 120% if rated voltage of inverter is 220V.
2. Factory setting is 130% if rated voltage of inverter is 380V.
3. The value of F8.16 is corresponding to the DC bus voltage at rated input voltage.

Function Code	Name	Description	Setting Range	Default Value
F8.17	Coefficient of rotation speed	0.1~999.9%	0.1~999.9%	100.0%

This parameter is used to calibrate the bias between actual mechanical speed and rotation speed. The formula is as below:

Actual mechanical speed = 120 * output frequency *F8.17 / Number of poles of motor

6.10 F9 Group--PID Control

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

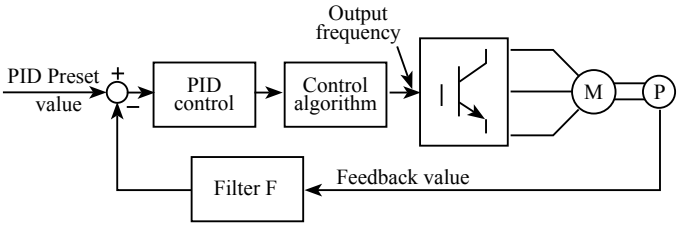


Figure 6.20 PID control diagram.

Function Code	Name	Description	Setting Range	Factory Setting
F9.00	PID preset source selection	0: Keypad 1: FIV 2: FIC 3: Communication 4: Multi-step	0~4	0
F9.01	Keypad PID preset	0.0%~100.0%	0.0~100.0	0.0%
F9.02	PID feedback source selection	0: FIV 1: FIC 2: FIV+FIC 3: Communication	0~3	0

These parameters are used to select PID preset and feedback source.

Notice:

1. Preset value and feedback value of PID are percentage value.

2. 100% of preset value is corresponding to 100% of feedback value.

3. Preset source and feedback source must not be same, otherwise PID will be malfunctional.

Function Code	Name	Description	Setting Range	Factory Setting
F9.03	PID output characteristics	0: Positive 1: Negative	0~1	0

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

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

Function Code	Name	Description	Setting Range	Factory Setting
F9.04	Proportional gain (Kp)	0.00~100.00	0.00~100.00	0.10
F9.05	Integral time (Ti)	0.01~10.00s	0.01~10.00	0.10s
F9.06	Differential time (Td)	0.00~10.00s	0.00~10.00	0.00s

Optimize the responsiveness by adjusting these parameters while driving an actual load.

Adjusting PID control:
Use the following procedure to activate PID control and then adjust it while monitoring the response.
3. Enabled PID control (F0.03=5)
4. Increase the proportional gain (Kp) as far as possible without creating oscillation.
5. Reduce the integral time (Ti) as far as possible without creating oscillation.
6. Increase the differential time (Td) as far as possible without creating oscillation.

Making fine adjustments:

First set the individual PID control constants, and then make fine adjustments.

- Reducing overshooting

If overshooting occurs, shorten the differential time and lengthen the integral time.

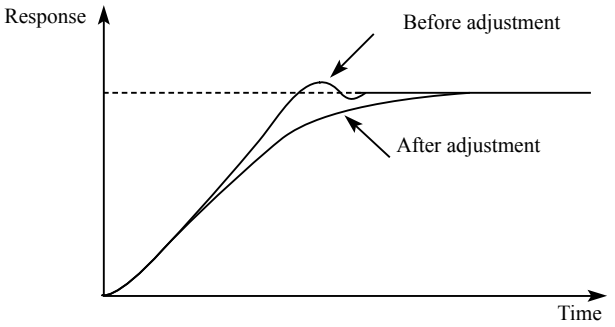


Figure 6.21 Reducing overshooting diagram.

● Rapidly stabilizing control status

To rapidly stabilize the control conditions even when overshooting occurs, shorten the integral time and lengthen the differential time.

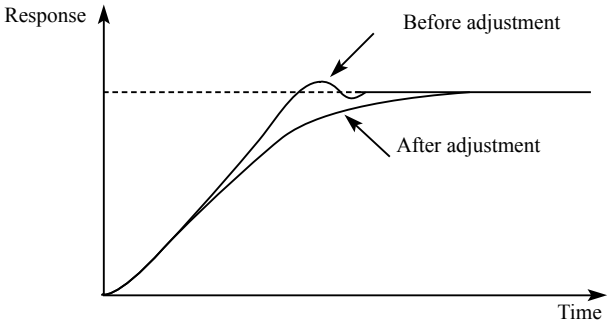


Figure 6.23 Reducing long-cycle oscillation diagram.

● Reducing long-cycle oscillation

If oscillation occurs with a longer cycle than the integral time setting, it means that integral operation is strong. The oscillation will be reduced as the integral time is lengthened.

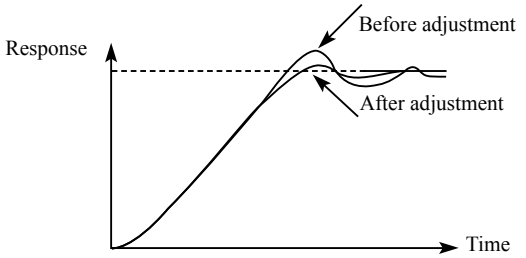


Figure 6.23 Reducing long-cycle oscillation diagram.

- Reducing short-cycle oscillation

If the oscillation cycle is short and oscillation occurs with a cycle approximately the same as the differential time setting, it means that the differential operation is strong. The oscillation will be reduced as the differential time is shortened.

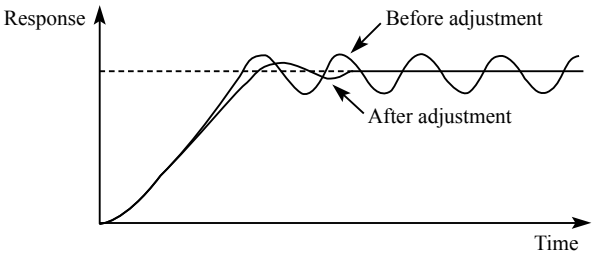


Figure 6.24 Reducing short-cycle oscillation diagram.

If oscillation cannot be reduced even by setting the differential time to 0, then either lower the proportional gain or raise the PID primary delay time constant.

Function Code	Name	Description	Setting Range	Factory Setting
F9.07	Sampling cycle (T)	0.01~100.00s	0.01~100.00	0.10s
F9.08	Bias limit	0.0~100.0%	0.0~100.0	0.0%

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

Bias limit defines the maximum bias between the feedback and the preset. PID

stops operation when the bias is within this range. Setting this parameter correctly is helpful to improve the system output accuracy and stability.

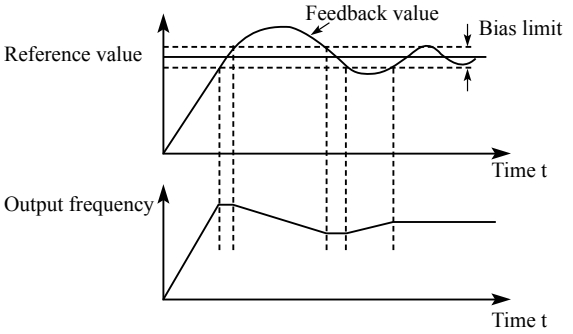


Figure 6.25 Relationship between bias limit and output frequency.

Function Code	Name	Description	Setting Range	Factory Setting
F9.09	Feedback lost detecting value	0.0~100.0%	0.0~100.0	0.0%
F9.10	Feedback lost detecting time	0.0~3600.0s	0.0~3600.0	1.0s

When feedback value is less than F9.09 continuously for the period determined by F9.10, the inverter will alarm feedback lost failure (PIDE).

Notice: 100% of F9.09 is the same as 100% of F9.01.

6.11 FA Group-- Multi-step Speed Control

Function Code	Name	Description	Setting Range	Factory Setting
FA.00	Multi-step speed 0	-100.0~100.0%	-100.0~100.0	0.0%
FA.01	Multi-step speed 1	-100.0~100.0%	-100.0~100.0	0.0%
FA.02	Multi-step speed 2	-100.0~100.0%	-100.0~100.0	0.0%
FA.03	Multi-step speed 3	-100.0~100.0%	-100.0~100.0	0.0%
FA.04	Multi-step speed 4	-100.0~100.0%	-100.0~100.0	0.0%
FA.05	Multi-step speed 5	-100.0~100.0%	-100.0~100.0	0.0%
FA.06	Multi-step speed 6	-100.0~100.0%	-100.0~100.0	0.0%
FA.07	Multi-step speed 7	-100.0~100.0%	-100.0~100.0	0.0%

Notice:

1. 100% of multi-step speed x corresponds to the maximum frequency (F0.04).

2. If the value of multi-step speed x is negative, the direction of this step will be reverse, otherwise it will be forward.

3. Multi-step speed function has highest priority

Selection of step is determined by combination of multi-step terminals. Please refer to following figure and table.

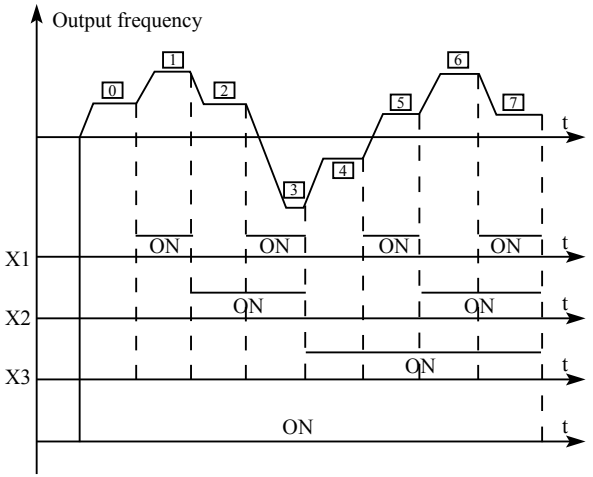


Figure 6.26 Multi-steps speed operating diagram.

Terminal / Step	Multi-step speed reference1	Multi-step speed reference2	Multi-step speed reference3
0	OFF	OFF	OFF
1	ON	OFF	OFF
2	OFF	ON	OFF
3	ON	ON	OFF
4	OFF	OFF	ON
5	ON	OFF	ON
6	OFF	ON	ON
7	ON	ON	ON

6.12 Fb Group-- Protection Function

Function Code	Name	Description	Setting Range	Factory Setting
Fb.00	Motor overload protection	0: Disabled 1: Normal motor 2: Variable frequency motor	0~2	2

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

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

Function Code	Name	Description	Setting Range	Factory Setting
Fb.01	Motor overload protection current	20.0%~120.0%	20.0~120.0	100.0%

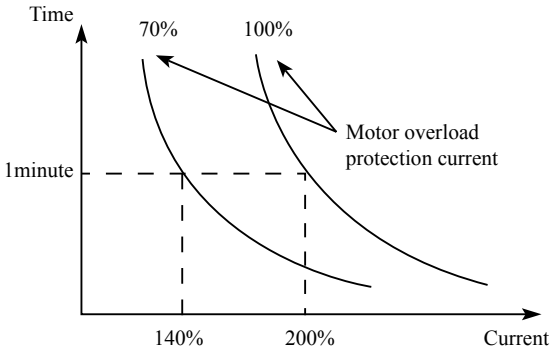


Figure 6.27 Motor overload protection curve.

The value can be determined by the following formula:

Motor overload protection current = (motor rated current / inverter rated current) * 100%

Notice:

1. This parameter is normally used when rated power of inverter is greater than

rated power of motor.

2. Motor overload protection time: 60s with 200% of rated current. For details, please refer to above figure.

Function Code	Name	Description	Setting Range	Factory Setting
Fb.02	Threshold of trip-free	70.0~110.0%	70.0~110.0	80.0%
Fb.03	Decrease rate of trip-free	0.00Hz~P0.04	0.00Hz~P0.04	0.00Hz

If Fb.03 is set for 0, the trip-free function is ineffective.

Trip-free function enables the inverter to perform low-voltage compensation when DC bus voltage drops below Fb.02. The inverter can continue to run without tripping by reducing its output frequency and feedback energy via motor.

Notice: If Fb.03 is too big, the feedback energy of motor will be too large and may cause over-voltage fault. If Fb.03 is too small, the feedback energy of motor will be too small to achieve voltage compensation effect. So please set Fb.03 according to load inertia and the actual load.

Function Code	Name	Description	Setting Range	Factory Setting
Fb.04	Over-voltage stall protection	0: Disabled 1: Enabled	0~1	1
Fb.05	Over-voltage stall protection point	110~150%	110~150	380V:130% 220V:120%

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

During deceleration, the inverter detects DC bus voltage and compares it with over-voltage stall protection point. If DC bus voltage exceeds Fb.05, the inverter will stop reducing its output frequency. When DC bus voltage become lower than Fb.05, the deceleration will continue, as shown in following figure.

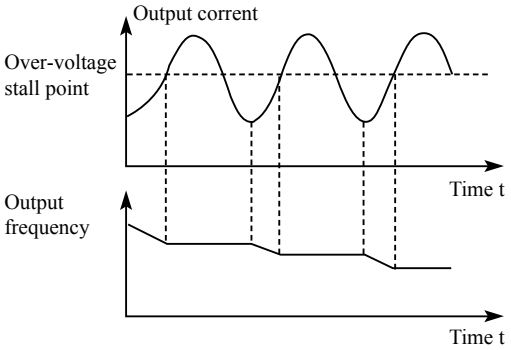


Figure 6.28 Over-voltage stall function.

Function Code	Name	Description	Setting Range	Factory Setting
Fb.06	Auto current limiting threshold	50~200%	50~200	A Model: 160% P Model: 120%
Fb.07	Frequency decrease rate in limifing cuwent	0.00~100.00Hz/s	0.00~100.00	10.00Hz/s

Auto current limiting is used to limit the current of inverter smaller than the value determined by Fb.06 in real time. Therefore the inverter will not trip due to surge over-current. This function is especially useful for the applications with big load inertia or step change of load.

Fb.06 is a percentage of the inverter's rated current.

Fb.07 defines the decrease rate of output frequency when this function is active. If Fb.06 is too small, overload fault may occur. If it is too big, the frequency will change too sharply therefore, the feedback energy of motor will be too large and may cause over-voltage fault. This function is always enabled during acceleration or deceleration.

Notice:

1. During auto current limiting process, the inverter's output frequency may change; therefore, it is recommended not to enable the function when requiring the inverter's output frequency stable.

2. During auto current limiting process, if Fb.06 is too low, the overload capacity will be impacted.

Please refer to following figure.

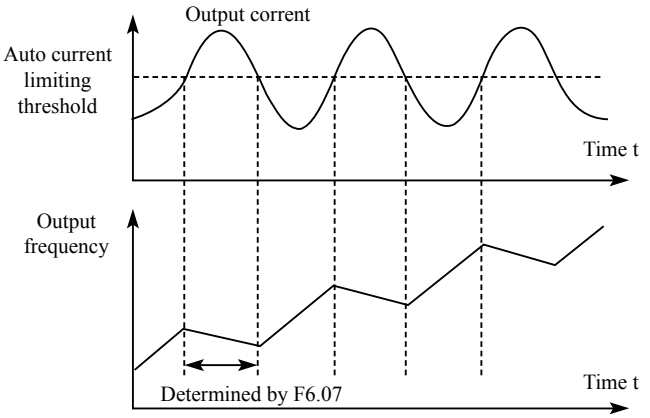


Figure 6.29 Current limiting protection function.

6.13 FC Group--Serial Communication

Function Code	Name	Description	Setting Range	Factory Setting
FC.00	Local address	1~247	0~247	1

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

Function

Code	Name	Description	Setting Range	Factory Setting
FC.01	Baud rate selection	0: 1200BPS 1: 2400BPS 2: 4800BPS 3: 9600BPS 4: 19200BPS 5: 38400BPS	0~5	3

This parameter can set the data transmission rate during serial communication.

Notice: The baud rate of master and slave must be the same.

Function

Code	Name	Description	Setting Range	Factory Setting
FC.02	Data format	0~17	0~17	0

This parameter defines the data format used in serial communication protocol.

0: RTU, 1 start bit, 8 data bits, no parity check, 1 stop bit.

1: RTU, 1 start bit, 8 data bits, even parity check, 1 stop bit.

2: RTU, 1 start bit, 8 data bits, odd parity check, 1 stop bit.

3: RTU, 1 start bit, 8 data bits, no parity check, 2 stop bits.

4: RTU, 1 start bit, 8 data bits, even parity check, 2 stop bits.

5: RTU, 1 start bit, 8 data bits, odd parity check, 2 stop bits.

6: ASCII, 1 start bit, 7 data bits, no parity check, 1 stop bit.

7: ASCII, 1 start bit, 7 data bits, even parity check, 1 stop bit.

8: ASCII, 1 start bit, 7 data bits, odd parity check, 1 stop bit.

9: ASCII, 1 start bit, 7 data bits, no parity check, 2 stop bits.

10: ASCII, 1 start bit, 7 data bits, even parity check, 2 stop bits.

11: ASCII, 1 start bit, 7 data bits, odd parity check, 2 stop bits.

12: ASCII, 1 start bit, 8 data bits, no parity check, 1 stop bit.

13: ASCII, 1 start bit, 8 data bits, even parity check, 1 stop bit.

14: ASCII, 1 start bit, 8 data bits, odd parity check, 1 stop bit.

15: ASCII, 1 start bit, 8 data bits, no parity check, 2 stop bits.

16: ASCII, 1 start bit, 8 data bits, even parity check, 2 stop bits.

17: ASCII, 1 start bit, 8 data bits, odd parity check, 2 stop bits.

Function

Code	Name	Description	Setting range	Factory Setting
PC.03	Communication delay time	0~200ms	0~200	5ms

This parameter can be used to set the response delay in communication in order to adapt to the MODBUS master. In RTU mode, the actual communication delay

should be no less than 3.5 characters' interval; in ASCII mode, 1ms.

Function

Code	Name	Description	Setting Range	Factory Setting
FC.04	Communication timeout delay	0.0: Disabled 0.1~100.0s	0~100.0	0.0s

When the value is zero, this function will be disabled. When communication interruption is longer than the non-zero value of FC.04, the inverter will alarm communication error (CE).

Function

Code	Name	Description	Setting Range	Factory Setting
FC.05	Communication error action	0: Alarm and coast to stop 1: No alarm and continue to run 2: No alarm but stop according to F1.05 (if F0.01=2) 3: No alarm but stop according to F1.05	0~3	1

0: When communication error occurs, inverter will alarm (CE) and coast to stop.

1: When communication error occurs, inverter will omit the error and continue to run.

2: When communication error occurs, if F0.01=2, inverter will not alarm but stop according to stop mode determined by F1.05. Otherwise it will omit the error.

3: When communication error occurs, inverter will not alarm but stop according to stop mode determined by F1.05.

Function

Code	Name	Description	Setting Range	Factory Setting
FC.06	Response action	Unit's place of LED 0: Response to writing 1: No response to writing Ten's place of LED 0: Reference not saved when power off 1: Reference saved when power off	0~1	0~1

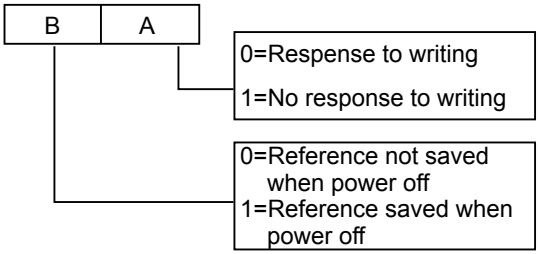


Figure 6.30 Meaning of FC.06.

A stands for: Unit's place of LED.

B stands for: Ten's place of LED

6.14 Fd Group—Supplementary Function

Function

Code	Name	Description	Setting Range	Factory Setting
Fd.00	Low-frequency threshold of restraining oscillation	0~500	0~500	5
Fd.01	High-frequency threshold of restraining oscillation	0~500	0~500	100

This function is efficetive only when Fd.04 is set for 0. The smaller the value of Fd.00 and Fd.01, the stronger the restraining effects.

Notice: Most motor may have current oscillation at some frequency point. Please be cautious to adjust these parameters to weaken oscillation.

Function

Code	Name	Description	Setting Range	Factory Setting
Fd.02	Amplitude of restraining oscillation	0~10000	0~10000	5000

This parameter is used to limit the strength of restraining oscillation. If the value of Fd.02 is too big, it may cause inverter over current. It should be set a little bit smaller for large power motor, vice versa.

Function

Code	Name	Description	Setting Range	Factory Setting
Fd.03	Boundary of restraining oscillation	0.0~F0.04	0.0HZ~F0.04	12.5HZ

If output frequency which is greater than Fd.03, Fd.00 takes effect, otherwise Fd.01 takes effect.

Function Code	Name	Description	Setting Range	Factory Setting
Fd.04	Restrain oscillation	0: Enabled 1: Disabled	0~1	0

Motor always has current oscillation when its load is light. This will cause abnormal operation even over-current. For details, please refer to description of Fd.00~Fd.03.

Function Code	Name	Description	Setting Range	Factory Setting
Fd.05	PWM mode	0: PWM mode 1 1: PWM mode 2 2: PWM mode 3	0~2	0

The features of each mode, please refer the following table:

Mode	Noise in lower frequency	Noise in higher frequency	Others
PWM mode 1	Low	high	
PWM mode 2	low		Need to be derated, because of higher temperature rise.
PWM mode 3	high		Can more effectively restrain the oscillation

Function

Code	Name	Description	Setting Range	Factory Setting
Fd.06	Torque setting source	0: Keypad 1: FIV 2: FIC 3: FIV+FIC 4: Multi-step setting 5: Communication	0~5	0

Fd.07	Keypad torque setting	-100.0%~100.0%	-100.0%~100.0%	50.0%

- When torque control takes effect,
  if Tset > Tload, output frequency will increase continuously until it reaches upper frequency limit.
  If Tset < Tload, output frequency will decrease continuously until it reaches lower frequency limit.
  Inverter can run at any frequency between upper and lower frequency limit only when Tset = Tload.
- Torque control can be switched to speed control, vice versa.
  - □ Switching by multifunctional terminal: For example, if torque control is enabled (F0.00=2), torque setting source is FIV, the value of multifunction terminal X4 is set for 20 (Disable torque control). When X4 is effective, control mode will switch from torque control to speed control, vice versa.
  - □ When running at torque control mode, press STOP, it will switch to speed control automatically.
- If torque setting is positive, inverter will run forward; otherwise it will run reverse.

Notice:

1. When running at torque control mode, the acceleration time has nothing to do with F0.08.
2. The 100% of torque setting is corresponding to 100% of F3.07 (Torque limit). For example, if torque setting source is keypad (Fd.06=0), Fd.07=80% and F3.07=90%, then

Actual torque setting = 80% (Fd.07) * 90% (F3.07) = 72%.

Function Code	Name	Description	Setting Range	Factory Setting
Fd.08	Upper frequency limit selection	0: Keypad 1: FIV 2: FIC 3: Multi-step setting 4: Communication	0~4	0

The 100% of this parameter is corresponding to 100% of F0.04 (maximum frequency).

When running at torque control mode, output frequency can be adjusted by changing upper frequency limit.

Function Code	Name	Description	Setting Range	Factory Setting
Fd.09	Auto current limiting selection	0: Enabled 1: Disabled when constant speed	0~1	0

Auto current limiting function is used to prevent inverter to trip over-current from surge current. It is especially useful for the applications with big load inertia or step change of load. This function is always enabled during acceleration or deceleration period.

Notice: During auto current limiting process, the inverter's output frequency may change; therefore, it is recommended not to enable the function when output frequency needs stable.

6.15 FE Group—Factory Setting

This group is the factory-set parameter group. The user DO NOT try to open these group parameters, otherwise it will cause the inverter abnormal operation or damage.

7. TROUBLE SHOOTING

7.1 Fault and Trouble shooting

Fault Code	Fault Type	Reason	Solution
E001	IGBT Ph-U fault	1. Acc/Dec time is too short. 2. IGBT module fault. 3. Malfunction caused by interference. 4. Grounding is not properly.	1. Increase Acc/Dec time. 2. Ask for support. 3. Inspect external equipment and eliminate interference.
E002	IGBT Ph-V fault		
E003	IGBT Ph-W fault		
E004	Over-current when acceleration	1. Short-circuit or ground fault occurred at inverter output. 2. Load is too heavy or Acc/Dec time is too short. 3. V/F curve is not suitable. 4. Sudden change of load.	1. Inspect whether motor damaged, insulation worn or cable damaged. 2. Increase Acc/Dec time or select bigger capacity inverter. 3. Check and adjust V/F curve. Check the load.
E005	Over-current when deceleration		
E006	Over-current when constant speed running		
E007	Over-voltage when acceleration	1. Dec time is too short and regenerative energy from the motor is too large. 2. Input voltage is too high.	1. Increase Dec time or connect braking resistor 2. Decrease input voltage within specification.
E008	Over-voltage when deceleration		
E009	Over-voltage when constant speed running		
E0010	DC bus Under-voltage	1. Open phase occurred with power supply. 2. Momentary power loss occurred 3. Wiring terminals for input power supply are loose. 4. Voltage fluctuations in power supply are too large.	Inspect the input power supply or wiring.

Fault Code	Fault Type	Reason	Solution
E0011	Motor overload	1. Motor drive heavy load at low speed for a long time. 2. Improper V/F curve 3. Improper motor's overload protection threshold (PB.01) 4. Sudden change of load.	1. Select variable frequency motor. 2. Check and adjust V/F curve. 3. Check and adjust PB.01 4. Check the load.
E 0012	Inverter overload	1. Load is too heavy or Acc/Dec time is too short. 2. Improper V/F curve 3. Capacity of inverter is too small.	1. Increase Acc/Dec time or select bigger capacity inverter. 2. Check and adjust V/F curve. 3. Select bigger capacity inverter.
E0013	Input phase failure	1. Open-phase occurred in power supply. 2. Momentary power loss occurred. 3. Wiring terminals for input power supply are loose. 4. Voltage fluctuations in power supply are too large. 5. Voltage balance between phase is bad.	Check the wiring, installation and power supply.
E0014	Output phase failure	1. There is a broken wire in the output cable 2. There is a broken wire in the motor winding. 3. Output terminals are loose.	Check the wiring and installation.
E0015	External fault	Xx: External fault input terminal take effect.	Inspect external equipment.
E0016	Rectify overheat	1.Ambient temperature is too high. 2. Near heat source. 3. Cooling fans of inverter stop or damaged. 4. Obstruction of ventilation channel 5. Carrier frequency is too high.	1. Install cooling unit. 2. Remove heat source. 3. Replace cooling fan 4. Clear the ventilation channel. 5. Decrease carrier frequency.
E0017	IGBT overheat		

Fault Code	Fault Type	Reason	Solution
E0018	Communication fault	1. Improper baud rate setting. 2. Receive wrong data. 3. Communication is interrupted for Long time	1. Set proper baud rate. 2. Check communication devices and signals.
E0019	Current detection fault	1. Wires or connectors of control board are loose 2. Hall sensor is damaged. 3. Amplifying circuit is abnormal.	1. Check the wiring. 2. Ask for support.
E0020	Autotuning fault	1. Improper setting of motor rated parameters. 2. Overtime of autotuning.	1. Set rated parameters according to motor nameplate. 2. Check motor's wiring.
E0021	EEPROM fault	1. R/W fault of control parameters	Press STOP to reset Ask for support
E0022	PID feedback fault	1. PID feedback disconnected. 2. PID feedback source disappears.	1. Inspect PID feedback signal wire. 2. Inspect PID feedback source.
E0023	Brake unit fault	1. Braking circuit failure or brake tube damaged. 2. Too low resistance of externally connected braking resistor.	1. Inspect braking unit, replace braking tube. 2. Increase braking resistance.
	Factory Reserved		

7.2 Common Faults and Solutions

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

No display after power on:

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

- Inspect whether the three-phase rectify bridge is in good condition or not. If the rectification bridge is burst out, ask for support.
- Check the CHARGE light. If the light is off, the fault is mainly in the rectify bridge or the buffer resistor. If the light is on, the fault may be lies in the switching power supply. Please ask for support.

Power supply air switch trips off when power on:

- Inspect whether the input power supply is grounded or short circuit. Please solve the problem.
- Inspect if the rectify bridge has been burnt or not. If it is damaged, ask for support.

Motor doesn't move after inverter running:

- Inspect if there is balanced three-phase output among U, V, W. If yes, then motor could be damaged, or mechanically locked. Please solve it.
- If the output is unbalanced or lost, the inverter drive board or the output module may be damaged, ask for support..

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

- Inspect whether the output side of inverter is short circuit. If yes, ask for support.
- Inspect whether ground fault exists. If yes, solve it.
- If trip happens occasionally and the distance between motor and inverter is too far, it is recommended to install output AC reactor.

Chapter 8 MAINTENANCE

⚠ WARNING

- Maintenance must be performed according to designated maintenance methods.
- Maintenance, inspection and replacement of parts must be performed only by authorized personnel.
- After turning off the main circuit power supply, take10 minutes waiting before performance maintenance or inspection.
- DO NOT directly touch components or devices of PCB board. Otherwise inverter can be damaged by electrostatic.
- After maintenance, all screws must be tightened.

8.1 Daily Maintenance

In order to prevent inverter from getting fuilde, and to make it operate smoothly in high-performance for a long time, user must inspect the inverter periodically (within half year). The following table indicates the inspection content.

Items to be checked	Main inspections		Criteria
	Inspection content	Frequency	Means/methods
Operation environment	1. temperature, humidity 2. dust, vapor, leakage 3. gases	1. point thermometer, hygrometer 2. observation 3. visual examination and smelling	1. ambient temperature shall be lower than 40 2. , otherwise, the rated values should be decreased. Humidity shall meet the requirement 3. no dust accumulation, no traces of water leakage and no condensate. 4. no abnormal color and smell.

Items to be checked	Main inspections		Criteria
	Inspection content	Frequency	Means/methods
Motor	1. vibration 2. heat 3. noise	1. comprehensive observation Listening 2. point thermometer 3. listening	1. No abnormal vibration and no abnormal noise. 2. No abnormal heat. 3. No abnormal noise.
Operation status parameters	1. power input voltage 2. inverter output voltage 3. inverter output current 4. internal temperature	1. voltmeter 2. rectifying voltmeter 3. ammeter 4. point thermometer	1. satisfying the specification 2. satisfying the specification 3. satisfying the specification 4. temperature rise is lower than 40℃

8.2 Periodic Maintenance

Customer should check the drive every 3 months or 6 months according to the actual environment

1. Check if the screws of control terminals are loose. If so, tighten them with a screwdriver;

2. Check if the main circuit terminals are properly connected; whether the mains cables are over heated;

3. Check if the power cables and control cables are damaged, check especially for any wear on the cable tube;

4. Check if the insulating tapes around the cable lugs are stripped;

5. Clean the dust on PCBs and air ducts with a vacuum cleaner;

6. For drives that have been stored for a long time, it must be powered on every 2 years. When supplying AC power to the drive, use a voltage regulator to raise the input voltage to rated input voltage gradually. The drive should be powered for 5 hours without load.

7. Before performing insulation tests, all main circuit input/output terminals should

be short-circuited with conductors. Then proceed insulation test to the ground. Insulation test of single main circuit terminal to ground is forbidden; otherwise the drive might be damaged. Please use a 500V Mega-Ohm-Meter.

8. Before the insulation test of the motor, disconnect the motor from the drive to avoid damaging it.

8.3 Replacement of wearing parts

Fans and electrolytic capacitors are wearing part, please make periodic replacement to ensure long term, safety and failure-free operation. The replacement periods are as follows:

- Fan: Must be replaced when using up to 20,000 hours;
- Electrolytic Capacitor: Must be replaced when using up to 30,000~40, 000 hours.

8.4 Warranty

The manufacturer warrants its products for a period of 18 months from the date of purchase.

Chapter 9 LIST OF FUNCTION PARAMETERS

Notice:

1.FE group is factory reserved, users are forbidden to access these parameters.

2.The column “Modify” determines the parameter can be modified or not.

“○” indicates that this parameter can be modified all the time.

“◎”indicates that this parameter cannot be modified during the inverter is running.

“●” indicates that this parameter is read only.

3.“Factory Setting” indicates the value of each parameter while restoring the factory parameters, but those detected parameters or record values cannot be restored.

Function Code	Name	Description	Factory Setting	Modify	Serial No.
P0 Group: Basic Function					
F0.00	Control mode selection	0:Sensorless vector control 1:V/F control 2:Torque control	0	◎	0
F0.01	Run command source	0: Keypad (LED extinguishes) 1: Terminal (LED flickers) 2: Communication (LED lights up)	0	◎	1
F0.02	UP/DOWN setting	0: Valid, save UP/DOWN value when power off 1: Valid, do not save UP/DOWN value when power off 2: Invalid 3: Valid during running, clear when stop.	0	○	2

Function Code	Name	Description	Factory Setting	Modify	Serial No.
F0.03	Frequency A command source	0: Keypad 1: FIV 2. FIC 3: FIV+FIC 4. Multi-Step speed 5: PID 6: Communication	0	○	3
F0.04	Maximum frequency	10.00~600.00Hz	50.00Hz	◎	4
F0.05	Upper frequency limit	F0.06~ F0.04	50.00Hz	○	5
F0.06	Lower frequency limit	0.00 Hz ~ F0.05	0.00Hz	○	6
F0.07	Keypad reference frequency	0.00 Hz ~ F0.04	50.00Hz	○	7
F0.08	Acceleration time 0	0.0~3600.0s	Depend on model	○	8
F0.09	Deceleration time 0	0.0~3600.0s	Depend on model	○	9
F0.10	Running direction selection	0: Forward 1: Reverse 2: Forbid reverse	0	◎	10
F0.11	Carrier frequency	1.0~15.0kHz	Depend on model	○	11
F0.12	Motor parameters autotuning	0: No action 1: Rotation autotuning 2: Static autotuning	0	◎	12
F0.13	Restore parameters	0: No action 1: Restore factory setting 2: Clear fault records	0	◎	13
F0.14	AVR function	0: Disabled 1: Enabled all the time 2: Disabled during deceleration	2	○	14
F1 Group: Start and Stop Control					
F1.00	Start Mode	0: Start directly 1: DC braking and start	0	◎	15

Function Code	Name	Description	Factory Setting	Modify	Serial No.
F1.01	Starting frequency	0.00~10.00Hz	0.00Hz	○	16
F1.02	Hold time of starting frequency	0.0~50.0s	0.0s	○	17
F1.03	DC Braking current before start	0.0~150.0%	0.0%	○	18
F1.04	DC Braking time before start	0.0~50.0s	0.0s	○	19
F1.05	Stop mode	0: Deceleration to stop 1: Coast to stop	0	○	20
F1.06	Starting frequency of DC braking	0.00~F0.04	0.00Hz	○	21
F1.07	Waiting time before DC braking	0.0~50.0s	0.0s	○	22
F1.08	DC braking current	0.0~150.0%	0.0%	○	23
F1.09	DC braking time	0.0~50.0s	0.0s	○	24
F1.10	Dead time of FWD/REV	0.0~3600.0s	0.0s	○	25
F1.11	FWD/REV enable when power on	0: Disabled 1: Enabled	0~1	○	26
F1.12	Reserved		0	◎	27
F2 Group: Motor Parameters					
F2.00	G/P option	0: G model 1: P model	Depend on model	◎	28
F2.01	Motor rated power	0.4~900.0kW	Depend on model	◎	29
F2.02	Motor vated frequency	0.01Hz~F0.04	50.00Hz	◎	30
F2.03	Motor vated speed	0~36000rpm	Depend on model	◎	31
F2.04	Motor vated voltage	0~2000V	Depend on model	◎	32
F2.05	Motor vated current	0.8~2000.0A	Depend on model	◎	33
F2.06	Motor stator resistance	0.001~65.535Ω	Depend on model	○	34

Function Code	Name	Description	Factory Setting	Modify	Serial No.
F2.07	Motor rotor resistance	0.001~65.535Ω	Depend on model l	○	35
F2.08	Motor leakage inductance	0.1~6553.5mH	Depend on model	○	36
F2.09	Motor mutual inductance	0.1~6553.5mH	Depend on model	○	37
F2.10	Current without load	0.01~655.35A	Depend on model	○	38
F3 Group: Vector Control					
F3.00	ASR proportional gain Kp1	0~100	20	○	39
F3.01	ASR integral time Ki1	0.01~10.00s	0.50s	○	40
F3.02	ASR switching point 1	0.00Hz~F3.05	5.00Hz	○	41
F3.03	ASR proportional gain Kp2	0~100	15	○	42
F3.04	ASR integral time Ki2	0.01~10.00s	1.00s	○	43
F3.05	ASR switching point 2	F3.02~F0.04	10.00Hz	○	44
F3.06	Slip compensation rate of VC	50.0~200.0%	100%	○	45
F3.07	Torque limit	0.0~200.0%	150.0%	O	46
F4 Group: V/F Control					
F4.00	V/F curve selection	0:Linear curve 1: Torque_stepdown curve (2.0 order)	0	◎	47
F4.01	Torque boost	0.0%: (auto) 0.1%~10.0%	0.0%	○	48
F4.02	Torque boost cut-off	0.0%~50.0% (motor rated frequency)	20.0%	◎	49
F4.03	V/F Slip compensation limit	0.00~200.0%	0.0%	○	50
F4.04	Auto energy saving selection	0: Disabled 1: Enabled	0	◎	51

Function Code	Name	Description	Factory Setting	Modify	Serial No.
F4.05	Reserved			●	52
F5 Group: Input Terminals					
F5.00	X1 terminal function	0: Ineffective 1: Forward 2: Reverse 3: 3-wire control 4: JOG forward 5: JOG reverse 6: Coast to stop 7: Reset fault 8: External fault input 9: UP command 10: DOWN command 11: Clear UP/DOWN 12: Multi-step speed reference 1 13: Multi-step speed reference 2 14: Multi-step speed reference 3 15: ACC/DEC time selection 16: Pause PID 17: Pause traverse operation 18: Reset traverse operation 19: ACC/DEC ramp hold 20: Disable torque control 21: UP/DOWN Ineffective temporarily 22-25: reserved	1	◎	53
F5.01	X2 terminal function		4	◎	54
F5.02	X3 terminal function		7	◎	55
F5.03	X4 terminal function		0	◎	56
F5.04	ON/OFF filter times	1~10	5	○	57
F5.05	FWD/REV control mode	0: 2-wire control mode 1 1: 2-wire control mode 2 2: 3-wire control mode 1 3: 3-wire control mode 2	0	◎	58
F5.06	UP/DOWN setting change rate	0.01~50.00Hz/s	0.50Hz/s	○	59
F5.07	FIV lower limit	0.00V~10.00V	0.00V	○	60
F5.08	FIC lower limit corresponding setting	-100.0%~100.0%	0.0%	○	61
F5.09	FIV upper limit	0.00V~10.00V	10.00V	○	62

Function Code	Name	Description	Factory Setting	Modify	Serial No.
F5.10	FIV upper limit corresponding setting	-100.0%~100.0%	100.0%	○	63
F5.11	FIV filter time constant	0.00s~10.00s	0.10s	○	64
F5.12	FIC lower limit	0.00V~10.00V	0.00V	○	65
F5.13	FIC lower limit corresponding setting	-100.0%~100.0%	0.0%	○	66
F5.14	FIC upper limit	0.00V~10.00V	10.00V	○	67
F5.15	FIC upper limit corresponding setting	-100.0%~100.0%	100.0%	○	68
F5.16	FIC filter time constant	0.00s~10.00s	0.10s	○	69
F6 Group: Output Terminals					
F6.00	Y output selection	0: No output 1: Run forward 2: Run reverse 3: Fault output 4: FDT reached 5: Frequency reached 6: Zero speed running 7: Upper frequency limit reached 8: Lower frequency limit reached 9~10: reserved	1	○	70
F6.01	Relay output selection		3	○	71
F6.02	AO selection	0: Running frequency 1: Reference frequency 2: Motor speed 3: Output current 4: Output voltage 5: Output power 6: Output torque 7FIV voltage 8:FIC voltage/current 9~10: reserved	0	○	72
F6.03	AO lower limit	0.0%~100.0%	0.0%	○	73

Function Code	Name	Description	Factory Setting	Modify	Serial No.
F6.04	AO lower limit corresponding output	0.00V ~10.00V	0.00V	○	74
F6.05	AO upper limit	0.0%~100.0%	100.0%	○	75
F6.06	AO upper limit corresponding output	0.00V ~10.00V	10.00V	○	76
F7 Group: Display Interface					
F7.00	User password	0~65535	0	○	77
F7.01	Reserved		0	○	78
F7.02	Reserved		0	◎	79
F7.03	JOG function selection	0: Jog 1: FDW/REV switching 2: Clear UP/DOWN setting	0	◎	80
F7.04	STOP function option	0: effective when keypad control F0.01=0) 1: effective when keypad or terminal control (F0.01=0 or 1) 2: effective when keypad or communication control (F0.01=0 or 2) 3: Always effective	0	○	81
F7.05	Keypad display selection	0: Preferential to external keypad 1: Both display, only external key effective. 2: Both display, only local key effective. 3: Both display and key effective.	0	○	82
F7.06	Running status display selection	0~0X7FFF BIT0: Output frequency BIT1: Reference frequency BIT2: DC bus voltage BIT3: Output voltage BIT4: Output current BIT5: Rotation speed BIT6: Output power BIT7: Output torque BIT8: PID preset	0XFF	○	83

F7.06	Running status display selection	BIT9: PID feedback BIT10: Input terminal status BIT11: Output terminal status BIT12: FIV BIT13: FIC BIT14: Step No. of multi-step BIT15: Reserved	0XFF	○	83
F7.07	Stop status display selection	0~0X1FF BIT0: Reference frequency BIT1: DC bus voltage BIT2: Input terminal status BIT3: Output terminal status BIT4: PID preset BIT5: PID feedback BIT6: FIV BIT7:FIC BIT8: Step No. of multi-step BIT9~15: Reserved	0xFF	○	84
F7.08	Rectifier module temperature	0~100.0℃		●	85
F7.09	IGBT module temperature	0~100.0℃		●	86
F7.10	Software version			●	87
F7.11	Accumulated running time	0~65535h		●	88
F7.12	Third latest fault type	0: Not fault 1: IGBT Ph-U fault(E001) 2: IGBT Ph-V fault(E002) 3: IGBT Ph-W fault(E003) 4: Over-current when acceleration(E004) 5: Over-current when deceleration(E005) 6: Over-current when constant speed running (E006) 7: Over-voltage when acceleration(E007) 8: Over-voltage when deceleration(E008) 9: Over-voltage when constant speed running(E009) 10: DC bus Under-voltage(E0010)		●	89
F7.13	Second latest fault type			●	90

Function Code	Name	Description	Factory Setting	Modify	Serial No.
		11: Motor overload (E0011) 12: Inverter overload (E0012) 13: Input phase failure (E0013) 14: Output phase failure (E0014) 15: Rectify overheat (E0015) 16: IGBT overheat (E0016) 17: External fault (E0017)			
F7.14	Current fault type	18: Communication fault (E0018) 19: Current detection fault (E0019) 20: Autotuning fault (E0020) 21: EEPROM fault (E0021) 22: PID feedback fault (E0022) 23: Brake unit fault (E0023) 24: Reserved		●	91
F7.15	Output frequency at current fault	Output frequency at current fault.		●	92
F7.16	Output current at current fault	Output current at current fault.		●	93
F7.17	DC bus voltage at current fault	DC bus voltage at current fault.		●	94
F7.18	Input terminal status at current fault	BIT3 BIT2 BIT1 BIT0 X4 X3 X2 X1		●	95
F7.19	Output terminal status at current fault	BIT3 BIT2 BIT1 BIT0 R0 Y		●	96
F8 Group: Enhanced Function					
F8.00	Acceleration time 1	0.1~3600.0s	Depend on model	○	97
F8.01	Deceleration time 1	0.1~3600.0s	Depend on model	○	98
F8.02	Jog reference	0.00~F0.04	5.00Hz	○	99
F8.03	Jog acceleration time	0.1~3600.0s	Depend on model	○	100
F8.04	Jog deceleration time	0.1~3600.0s	Depend on model	○	101

Function Code	Name	Description	Factory Setting	Modify	Serial No.
F8.05	Skip frequency	0.00~F0.04	0.00Hz	○	102
F8.06	Skip frequency bandwidth	0.00~F0.04	0.00Hz	○	103
F8.07	Traverse amplitude	0.0~100.0%	0.0%	○	104
F8.08	Jitter frequency	0.0~50.0%	0.0%	○	105
F8.09	Rise time of traverse	0.1~3600.0s	5.0s	○	106
F8.10	Fall time of traverse	0.1~3600.0s	5.0s	○	107
F8.11	Auto reset times	0~3	0	○	108
F8.12	Reset interval	0.1~100.0s	1.0s	○	109
F8.13	FDT level	0.00~ F0.04	50.00Hz	○	110
F8.14	FDT lag	0.0~100.0%	5.0%	○	111
F8.15	Frequency arrive detecting range	0.0~100.0%(maximum frequency)	0.0%	○	112
F8.16	Brake threshold voltage	115.0~140.0%	Depend on model	○	113
F8.17	Coefficient of rotation speed	0.1~999.9%	100.0%	○	114
F9 Group: PID Control					
F9.00	PID preset source selection	0: Keypad 1: FIV 2: FIC 3: Communication 4: Multi-step	0	○	115
F9.01	Keypad PID preset	0.0%~100.0%	0.0%	○	116
F9.02	PID feedback source selection	0: FIV 1: FIC 2: FIV+FIC 3: Communication	0	○	117
F9.03	PID output characteristics	0: Positive 1: Negative	0	○	118
F9.04	Proportional gain (Kp)	0.00~100.00	1.00	○	119
F9.05	Integral time (Ti)	0.01~10.00s	0.10s	○	120

Function Code	Name	Description	Factory Setting	Modify	Serial No.
F9.06	Differential time (Td)	0.00~10.00s	0.00s	○	121
F9.07	Sampling cycle (T)	0.01~100.00s	0.10s	○	122
F9.08	Bias limit	0.0~100.0%	0.0%	○	123
F9.09	Feedback lost detecting value	0.0~100.0%	0.0%	○	124
F9.10	Feedback lost detecting time	0.0~3600.0s	1.0s	○	125
FA Group: Multi-step Speed Control					
FA.00	Multi-step speed 0	-100.0~100.0%	0.0%	○	126
FA.01	Multi-step speed 1	-100.0~100.0%	0.0%	○	127
FA.02	Multi-step speed 2	-100.0~100.0%	0.0%	○	128
FA.03	Multi-step speed 3	-100.0~100.0%	0.0%	○	129
FA.04	Multi-step speed 4	-100.0~100.0%	0.0%	○	130
FA.05	Multi-step speed 5	-100.0~100.0%	0.0%	○	131
FA.06	Multi-step speed 6	-100.0~100.0%	0.0%	○	132
FA.07	Multi-step speed 7	-100.0~100.0%	0.0%	○	133
Fb Group: Protection Function					
Fb.00	Motor overload protection	0: Disabled 1: Normal motor 2: Variable frequency motor	2	◎	134
Fb.01	Motor overload protection current	20.0%~120.0%	100.0%	○	135
Fb.02	Threshold of trip-free	70.0~110.0%	80.0%	○	136
Fb.03	Decrease rate of trip-free	0.00Hz~F0.04	0.00Hz	○	137
Fb.04	Over-voltage stall protection	0: Disabled 1: Enabled	0	○	138
Fb.05	Over-voltage stall protection point	110~150%	Depend on model	○	139
Fb.06	Auto current limiting threshold	50~200%	G:160% P:120%	○	140

Function Code	Name	Description	Factory Setting	Modify	Serial No.
Fb.07	Frequency decrease rate when current limiting	0.00~100.00Hz/s	10.00 Hz/s	○	141
FC Group: Serial Communication					
FC.00	Local address	0~247	1	○	142
FC.01	Baud rate selection	0: 1200BPS 1: 2400BPS 2: 4800BPS 3: 9600BPS 4: 19200BPS 5: 38400BPS	3	○	143
FC.02	Data format	0: RTU, 1 start bit, 8 data bits, no parity check, 1 stop bit. 1: RTU, 1 start bit, 8 data bits, even parity check, 1 stop bit. 2: RTU, 1 start bit, 8 data bits, odd parity check, 1 stop bit. 3: RTU, 1 start bit, 8 data bits, no parity check, 2 stop bits. 4: RTU, 1 start bit, 8 data bits, even parity check, 2 stop bits. 5: RTU, 1 start bit, 8 data bits, odd parity check, 2 stop bits. 6: ASCII, 1 start bit, 7 data bits, no parity check, 1 stop bit. 7: ASCII, 1 start bit, 7 data bits, even parity check, 1 stop bit. 8: ASCII, 1 start bit, 7 data bits, odd parity check, 1 stop bit. 9: ASCII, 1 start bit, 7 data bits, no parity check, 2 stop bits. 10: ASCII, 1 start bit, 7 data bits, even parity check, 2 stop bits.	0	○	144

Function Code	Name	Description	Factory Setting	Modify	Serial No.
		11: ASCII, 1 start bit, 7 data bits, odd parity check, 2 stop bits. 12: ASCII, 1 start bit, 8 data bits, no parity check, 1 stop bit. 13: ASCII, 1 start bit, 8 data bits, even parity check, 1 stop bit. 14: ASCII, 1 start bit, 8 data bits, odd parity check, 1 stop bit. 15: ASCII, 1 start bit, 8 data bits, no parity check, 2 stop bits. 16: ASCII, 1 start bit, 8 data bits, even parity check, 2 stop bits. 17: ASCII, 1 start bit, 8 data bits, odd parity check, 2 stop bits.			
FC.03	Communication delay time	0~200ms	5	○	145
FC.04	Communication timeout delay	0.0: Disabled 0.1~100.0s	0.0s	○	146
FC.05	Communication error action	0: Alarm and coast to stop 1: No alarm and continue to run 2: No alarm but stop according to P1.05 (if F0.01=2) 3: No alarm but stop according to P1.05	1	○	147
FC.06	Response action	Unit's place of LED 0: Response to writing 1: No response to writing Ten's place of LED 0: Reference not saved when power off 1: Reference saved when power off	0	○	148

Function Code	Name	Description	Factory Setting	Modify	Serial No.
Fd Group: Supplementary Function					
Fd.00	Low-frequency threshold of restraining oscillation	0~500	5	○	149
Fd.01	High-frequency threshold of restraining oscillation	0~500	100	○	150
Fd.02	Amplitude of restraining oscillation	0~10000	5000	○	151
Fd.03	Boundary of restraining oscillation	0.0~F0.04	12.5Hz	○	152
Fd.04	Restrain oscillation	0: Enabled 1: Disabled	0	○	153
Fd.05	PWM mode	0: PWM mode 1 1: PWM mode 2 2: PWM mode 3	0	◎	154
Fd.06	Torque setting source	0: Keypad 1: FIV 2: FIC 3: FIV+FIC 4: Multi-step setting 5: Communication	0	○	155
Fd.07	Keypad torque setting	-100.0%~100.0%	0	○	156
Fd.08	Upper frequency limit selection	0: Keypad F0.05) 1: FIV 2: FIC 3: Multi-step setting 4: Communication	0	○	157
Fd.09	Auto current limiting selection	0: Enabled 1: Disabled when constant speed	0	○	158
FE Group: Factory Setting					
FE.00	Factory password	0~65535	*****	●	159

Chapter 10 COMMUNICATION PROTOCOL

10.1 Interfaces

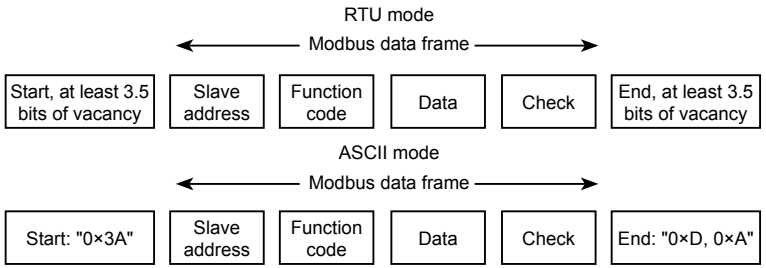
RS485: asynchronous, half-duplex.
Default: 8-E-1, 19200bps. See Group PC parameter settings.

10.2 Communication Modes

1) The protocol is Modbus protocol. Besides the common register Read/Write operation, it is supplemented with commands of
parameters management.
2) The drive is a slave in the network. It communicates in ‘point to point’ master-slave mode. It will not respond to the
command sent by the master via broadcast address.
3. In the case of multi-drive communication or long-distance transmission, connecting a 100~120Ω resistor in parallel with the
master signal line will help to enhance the immunity to interference.

10.3 Protocol Format

Modbus protocol supports both RTU and ASCII mode. The frame format is illustrated as follows:



Modbus adopts “Big Endian” representation for data frame. This means that when a numerical quantity larger than a byte is transmitted, the most significant byte is sent first.

RTU mode

In RTU mode, the Modbus minimum idle time between frames should be no less than 3.5 bytes. The checksum adopts CRC-16 method. All data except checksum itself sent will be counted into the calculation. Please refer to section: CRC Check for more information. Note that at least 3.5 bytes of Modbus idle time should be kept and the start and end idle time need not be summed up to it.

The table below shows the data frame of reading parameter 002 from slave node address 1.

Node addr.	Command	Data addr.		Read No.		CRC	
0x01	0x03	0x00	0x02	0x00	0x01	0x25	0xCA

The table below shows the reply frame from slave node address 1

Node addr.	Command	Bytes No.	Data		CRC	
0x01	0x03	0x02	0x00	0x00	0xB8	0x44

ASCII mode

In ASCII mode, the frame head is “0x3A”, and default frame tail is “0x0D” or “0x0A”. The frame tail can also be configured by users. Except frame head and tail, other bytes will be sent as two ASCII characters, first sending higher nibble and then lower nibble. The data have 7/8 bits. “A”~“F” corresponds to the ASCII code of respective capital letter. LRC check is used. LRC is calculated by adding all the successive bytes of the message except the head and tail, discarding any carriers, and then two’s complementing the result.

Example of Modbus data frame in ASCII mode:

The command frame of writing 0x0003 into address “0x1000” of slave node

address 1 is shown in the table below:

LRC checksum = the complement of (01+06+10+00+0x00+0x03) = 0xE5

	Frame head	Node addr.		Command		Data addr.			
Code		0	1	0	6	1	0	0	0
ASCII	3A	30	31	30	36	31	30	30	30
Data to write				LRC		Frame tail			
0	0	0	3	E	5	CR		LF	
30	30	30	33	45	35	0D		0A	

10.4 Protocol function

Different respondent delay can be set through drive's parameters adapt to different needs. For RTU mode, the respond delay should be no less than 3.5 bytes interval, and for ASCII mode, no less than 1ms.

The main function of Modbus is to read and write parameters. The Modbus protocol supports the following commands:

0x03	Read inverter's function parameter and status parameters
0x06	Write single function parameter or command parameter to inverter

All drive's function parameters, control and status parameters are mapped to Modbus R/W data address.

The data addresses of each function parameters please refer the sixth column of chapter 9.

The data address of control and status parameters please refer to the following table.

Parameter Description	Address	Meaning of value	R/W Feature
Control command	1000H	0001H: Forward 0002H: Reverse 0003H: JOG forward 0004H: JOG reverse 0005H: Stop 0006H: Coast to stop 0007H: Reset fault 0008H: JOG stop	W/R
Inverter status	1001H	0001H: Forward running 0002H: Reverse running 0003H: Standby 0004H: Fault	R
Communication setting	2000H	Communication Setting Range (-10000~10000) Note: the communication setting is the percentage of the relative value (-100.00%~100.00%). If it is set as frequency source, the value is the percentage of the maximum frequency (P0.04). If it is set as PID (preset value or feedback value), the value is the percentage of the PID.	W/R
Status parameters	3000H	Output frequency	R
	3001H	Reference frequency	R
	3002H	DC Bus voltage	R
	3003H	Output voltage	R
	3004H	Output current	R
	3005H	Rotation speed	R
	3006H	Output power	R
	3007H	Output torque	R
	3008H	PID preset value	R
	3009H	PID feedback value	R
	300AH	Input terminal status	R
	300BH	Output terminal status.	R
	300CH	Input of AI1	R
	300DH	Input of AI2	R
	300EH	Reserved	R
	300FH	Reserved	R
	3010H	HDI frequency	R

Parameter Description	Address	Meaning of value	R/W Feature
Status parameters	3011H	Reserved	R
	3012H	Step No. of PLC or multi-step	R
	3013H	Length value	R
	3014H	External counter input	R
	3015H	Reserved	R
	3016H	Device code	R
Fault info address	5000H	This address stores the fault type of inverter. The meaning of each value is same as P7.15.	R
ModBus communication fault info address	5001H	0000H: No fault 0001H: Wrong password 0002H: Command code error 0003H: CRC error 0004H: Invalid address 0005H: Invalid data 0006H: Parameter change invalid 0007H: System locked 0008H: Busy (EEPROM is storing)	R

The above shows the format of the frame. Now we will introduce the Modbus command and data structure in details, which is called protocol data unit for simplicity. Also MSB stands for the most significant byte and LSB stands for the least significant byte for the same reason. The description below is data format in RTU mode. The length of data unit in ASCII mode should be doubled.

Protocol data unit format of reading parameters:

Request format:

Protocol data unit	Data length(bytes)	Range
Command	1	0x03
Data Address	2	0~0xFFFF
Read number	2	0x0001~0x0010

Reply format (success):

Protocol data unit	Data length(bytes)	Range
Command	1	0x03

Returned byte number	2	2* Read number
Content	2* Read number	

If the command is reading the type of inverter (data address 0x3016), the content value in reply message is the device code:
The high 8 bit of device code is the type of the inverter, and the low 8 bit of device code is the sub type of inverter.

If the operation fails, the inverter will reply a message formed by failure command and error code. The failure command is (Command + 0x80). The error code indicates the reason of the error; see the table below.

Value	Name	Mean
01H	Illegal command	The command from master can not be executed. The reason would be: 1.This command is only for new version and this version can not be available. 2.Slave is in fault status and can not execute it.
02H	Illegal data address.	Some of the operation addresses are ineffective or not allowed to access.
03H	Illegal value	When there are ineffective data in the message framed received by slave. Note: This error code does not indicate the data value to write exceed the range, but indicate the message frame is a illegal frame.
06H	Slave busy	Inverter is busy(EEPROM is storing)
10H	Password error	The password written to the password check address is not same as the password set by F7.00.
11H	Check error	The CRC (RTU mode) or LRC (ASCII mode) check not passed.
12H	Written not allowed.	It only happens in writing command, the reason would be: 1.the data to write exceed the range of according parameter 2.The parameter should not be modified now. 3.The terminal has already been in use.
13H	System locked	When password protection takes effect and user does not unlock, write/read the function parameter will get this error recponded.

Protocol data unit format of writing single parameter:

Request format:

Protocol data unit	Data length(bytes)	Range
Command	1	0x06
Data Address	2	0~0xFFFF
Write Content	2	0~0xFFFF

Reply format (success):

Protocol data unit	Data length(bytes)	Range
Command	1	0x06
Data Address	2	0~0xFFFF
Write Content	2	0~0xFFFF

If the operation fails, the inverter will reply a message formed by failure command and error code. The failure command is (Command + 0x80). The error code indicates the reason of the error; see table 1.

10.5 Note:

1. .Between frames, the span should not less than 3.5 bytes interval, otherwise, the message will be discarded.

2. Be cautious to modify the parameters of FC group through communication, otherwise may cause the communication interrupted.

3. In the same frame, if the span between two .near bytes more than 1.5 bytes interval, the behind bytes will be assumed as the start of next message so that communication will failure.

10.6 CRC Check

For higher speed, CRC-16 uses tables. The following are C language source code for CRC-16.

unsigned int crc_cal_value(unsigned char *data_value,unsigned char data_length)

```
{
int i;
unsigned int crc_value=0xffff;
while(data_length--)
{
crc_value^=*data_value++;
                    for(i=0;i<8;i++)
                    {
if(crc_value&0x0001)crc_value=(crc_value>>1)^0xa001;
                    else crc_value=crc_value>>1;
                    }
          }
return(crc_value);
}
```

10.7 Example

1.RTU mode, read 2 data from 0004H

The request command is:

START	T1-T2-T3-T4 (transmission time of 3.5 bytes)
Node address	01H
Command	03H
High byte of start address	00H
Low byte of start address	04H
High byte of data number	00H
Low byte of data number	02H
Low byte of CRC	85H
High byte of CRC	CAH
END	T1-T2-T3-T4 (transmission time of 3.5 bytes)

The reply is :

START	T1-T2-T3-T4 (transmission time of 3.5 bytes)
Node address	01H
Command	03H
Returned byte number	04H
Higher byte of 0004H	00H
Low byte of 0004H	00H
High byte of 0005H	00H
Low byte of 0005H	00H
Low byte of CRC	43H
High byte of CRC	07H
END	T1-T2-T3-T4 (transmission time of 3.5 bytes)

2.ASCII mode, read 2 data from 0004H:

The request command is:

START	':'
Node address	'0'
	'1'
Command	'0'
	'3'
High byte of start address	'0'
	'0'
Low byte of start address	'0'
	'4'
High byte of data number	'0'
	'0'
Low byte of data number	'0'
	'2'
LRC CHK Hi	'F'
LRC CHK Lo	'6'
END Lo	CR
END Hi	LF

The reply is

START	':'
Node address	'0'
	'1'
Command	'0'
	'3'
Returned byte number	'0'
	'4'
Higher byte of 0004H	'0'
	'0'
Low byte of 0004H	'0'
	'0'
High byte of 0005H	'0'
	'0'
Low byte of 0005H	'0'
	'0'
LRC CHK Lo	'F'
LRC CHK Hi	'8'
END Lo	CR
END Hi	LF

3.RTU mode, write 5000(1388H) into address 0008H, slave node address 02.
The request command is:

START	T1-T2-T3-T4 (transmission time of 3.5 bytes)
Node address	02H
Command	06H
High byte of data address	00H
Low byte of data address	08H
High byte of write content	13H
Low byte of write content	88H
Low byte of CRC	05H
High byte of CRC	6DH
END	T1-T2-T3-T4 (transmission time of 3.5 bytes)

The reply command is:

START	T1-T2-T3-T4 (transmission time of 3.5 bytes)
Node address	02H
Command	06H
High byte of data address	00H
Low byte of data address	08H
High byte of write content	13H
Low byte of write content	88H
Low byte of CRC	05H
High byte of CRC	6DH
END	T1-T2-T3-T4 (transmission time of 3.5 bytes)

4.ASCII mode, write 5000(1388H) into address 0008H, slave node address 02.
The request command is:

START	':'
Node address	'0'
	'2'
Command	'0'
	'6'
High byte of data address	'0'
	'0'
Low byte of data address	'0'
	'8'
High byte of write content	'1'
	'3'
Low byte of write content	'8'
	'8'
LRC CHK Hi	'5'
LRC CHK Lo	'5'
END Lo	CR
END Hi	LF

The reply command is:

START	':'
Node address	'0'
	'2'
Command	'0'
	'6'
High byte of data address	'0'
	'0'
Low byte of data address	'0'
	'8'
High byte of write content	'1'
	'3'
Low byte of write content	'8'
	'8'
LRC CHK Hi	'5'
LRC CHK Lo	'5'
END Lo	CR
END Hi	LF

11 Extra Accessories Selection

Name	Function
Vacuum and Leakage switch	Protect the AC motor drive wiring, good for installation and maintenance.
Electromagnetic contactor	For Convenient to cut off the power between AC motor drive for safety.
Surge absorber	Absorbing the electromagnetic exposure and the surge current of control relay switch
Isolating transformer	Isolate the input and output of AC motor drive to reduce interference
DC smoothing reactor	Protect the AC motor drive and restrain the high harmonics
AC smoothing reactor	Protect the AC motor drive to restrain high harmonics, and prevent the surge voltage shock
Brake unit, Brake resistor	Absorbing renewable energy
Noise filter	To reduce the electromagnetic interference caused by inverter
Magnetic ring	To reduce the electromagnetic interference caused by inverter

11-1 DC smoothing reactor

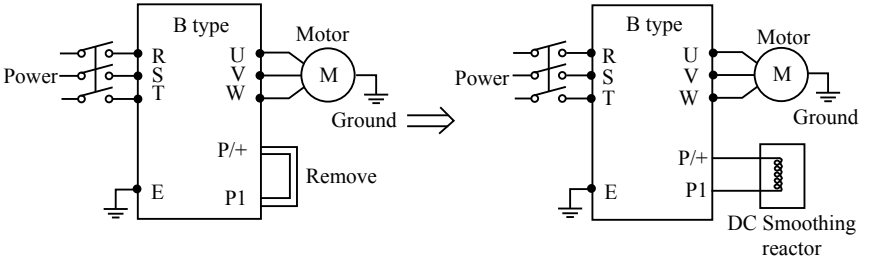
220V optional DC smoothing reactor spec	
Product Model KW	Order No.
HCB20P4G	DCL-L0.4
HCB20P7G	DCL-L0.75
HCB21P5G	DCL-L1.5
HCB22P2G	DCL-L2.2

400V optional DC smoothing reactor spec	
Product Model KW	Order No.
HCP40P7G	DCL-H0.75
HCP41P5G	DCL-H1.5
HCP42P2G	DCL-H2.2
HCP43P7G	DCL-H3.7

HCB23P7G	DCL-L3.7
HCB25P5G	DCL-L5.5
HCB27P5G	DCL-L7.5
HCB2011G	DCL-L11
HCB2015G	DCL-L15
HCB2018G	DCL-L18
HCB2022G	DCL-L22
HCB2030G	DCL-L30
HCB2037G	DCL-L37
HCB2055G	DCL-L55
HCB2075G	DCL-L75

HCP45P5G	DCL-H5.5
HCP47P5G	DCL-H7.5
HCP4011G	DCL-H11
HCP4015G	DCL-H15
HCP4018G	DCL-H18
HCP4022G	DCL-H22
HCP4030G	DCL-H30
HCP4037G	DCL-H37
HCP4055G	DCL-H55
HCP4075G	DCL-H75
HCP4090G	DCL-H90
HCP4110G	DCL-H110
HCP4132G	DCL -H132
HCP4160G	DCL -H160
HCP4110G	DCL -H110

Wiring Installation



11-2 Input AC smoothing reactor

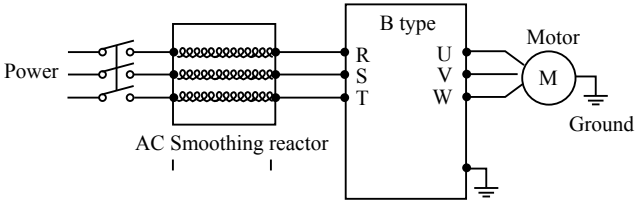
220V optional input AC smoothing reactor spec	
Product Model KW	Order No.
HCB20P4G	ACL-L0.4
HCB20P7G	ACL-L0.75
HCB21P5G	ACL-L1.5

400V optional input AC smoothing reactor spec	
Product Model KW	Order No.
HCP20P7G	ACL-H0.75
HCP41P5G	ACL-H1.5
HCP42P2G	ACL-H2.2

HCB22P2G	ACL-L2.2
HCB23P7G	ACL-L3.7
HCB25P5G	ACL-L5.5
HCB27P5G	ACL-L7.5
HCB2011G	ACL-L11
HCB2015G	ACL-L15
HCB2018G	ACL-L18
HCB2022G	ACL-L22
HCB2030G	ACL-L30
HCB2037G	ACL-L37
HCB2055G	ACL-L55
HCB2075G	ACL-L75

HCP43P7G	ACL-H3.7
HCP45P5G	ACL-H5.5
HCP47P5G	ACL-H7.5
HCP4011G	ACL-H11
HCP4015G	ACL-H15
HCP4018G	ACL-H18
HCP4022G	ACL-H22
HCP4030G	ACL-H30
HCP4037G	ACL-H37
HCP4055G	ACL-H55
HCP4075G	ACL-H75
HCP4090G	ACL-H90
HCP4110G	ACL-H110
HCP4132G	ACL-H132
HCP4160G	ACL-H160

Installation



11-3 Output AC smoothing reactor

220V optional output AC smoothing reactor spec	
Product Model KW	Order No.
HCB20P4G	ACL-L0.4 OUT
HCB20P7G	ACL-L0.75 OUT
HCB21P5G	ACL-L1.5 OUT
HCB22P2G	ACL-L2.2 OUT
HCB23P7G	ACL-L3.7 OUT

400V optional output AC smoothing reactor spec	
Product Model KW	Order No.
HCP20P7G	ACL-H0.75 OUT
HCP41P5G	ACL-H1.5 OUT
HCP42P2G	ACL-H2.2 OUT
HCP43P7G	ACL-H3.7 OUT
HCP45P5G	ACL-H5.5 OUT

HCB25P5G	ACL-L5.5 OUT
HCB27P5G	ACL-L7.5 OUT
HCB2011G	ACL-L11 OUT
HCB2015G	ACL-L15 OUT
HCB2018G	ACL-L18 OUT
HCB2022G	ACL-L22 OUT
HCB2030G	ACL-L30 OUT
HCB2037G	ACL-L37 OUT
HCB2055G	ACL-L55 OUT
HCB2075G	ACL-L75 OUT

HCP47P5G	ACL-H7.5 OUT
HCP4011G	ACL-H11 OUT
HCP4015G	ACL-H15 OUT
HCP4018G	ACL-H18 OUT
HCP4022G	ACL-H22 OUT
HCP4030G	ACL-H30 OUT
HCP4037G	ACL-H37 OUT
HCP4055G	ACL-H55 OUT
HCP4075G	ACL-H75 OUT
HCP4090G	ACL-H90 OUT
HCP4110G	ACL-H110 OUT
HCP4132G	ACL-H132 OUT
HCP4160G	ACL-H160 OUT

11-4 Filter

11-4.1 Input Three Phase Noise Filter

220V optional input three phase noise filter spec	
Product Model KW	Order No.
0.4~1.5	NFS32010
2.2~3.7	NFS32020
5.5	NFS32040
7.5~11	NFS32060
15~18.5	NFS32090
22	NFS32130
30~37	NFS32180
40	NFS32220
55	NFS32270
75	NFS32400

400V optional input three phase noise filter spec	
Product Model KW	Order No.
0.75~3.7	NFS34010
5.5~7.5	NFS34020
11~15	NFS34040
18.5~22	NFS34060
30~37	NFS34090
40~55	NFS34130
75	NFS34180
90	NFS34220
110	NFS34270
132	NFS34320

11-4.2 Output Three Phase Noise Filter

220V optional output three phase noise filter spec	
Product Model KW	Order No.
0.4~1.5	RFI32010
2.2~3.7	RFI32020
5.5	RFI 32040
7.5~11	RFI 32060
15~18.5	RFI 32090
22	RFI 32130
30~37	RFI 32180
40	RFI 32220
55	RFI 32270
75	RFI 32400

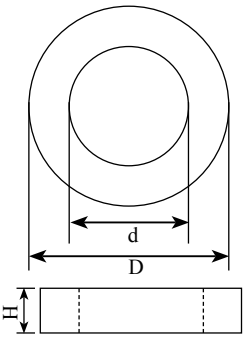
400V optional output three phase noise filter spec	
Product Model KW	Order No.
0.75~3.7	RFI 34010
5.5~7.5	RFI 34020
11~15	RFI 34040
18.5~22	RFI 34060
30~37	RFI 34090
40~55	RFI 34130
75	RFI 34180
90	RFI 34220
110	RFI 34270
132	RFI 34320

11-4.3 Output Three Phase Noise Filter

Zero phase filters

The ordering method please according to the wire diameter whether can pass through or not. And then depends on the KW capacity to select it, which divided into With the base P/N: ZFM5046M , Without the base P/N: ZFM5038D.

Sample of penetrable type	d	D	H
ZFM5038D	38	63	12.5
ZFM5050D	50	80	20



Unit: mm

11-5 Brake Resistor

The brake resistor list of the general machinery applications may not suitable for heavy duty machinery, elevator and crane applications.

AC motor drive controller	Brake Resistor		Brake Unit CDBR	Braking torque (10%ED)	Applicable motor (KW)	Remark
	Power W	Resistance Ω				
HCB20P4G	70	200	Built-In	125	0.4	
HCB20P7G	70	200	Built-In	125	0.75	
HCB21P5G	260	100	Built-In	125	1.5	
HCB22P2G	260	70	Built-In	125	2.2	
HCB23P7G	390	40	Built-In	125	3.7	
HCB25P5G	520	30	Built-In	125	5.5	
HCB27P5G	780	20	Built-In	125	7.5	
HCB2011G	2400	13.6	2015×1	125	11	
HCB2015G	3000	10	2015×1	125	15	
HCB2018G	4800	8	2022×1	125	18.5	
HCB2022G	4800	6.8	2022×1	125	22	
HCB2030G	3000×2	10×2	2015×2	125	30	
HCB2037G	3000×2	10×2	2015×2	125	37	
HCB2045G	4800×2	6.8×2	2022×2	125	45	
HCB2055G	4800×2	6.8×2	2022×2	125	55	
HCB2075G	4800×2	6.8×2	2022×2	125	75	
HCB40P7G	70	750	Built-In	125	0.75	
HCB41P5G	260	400	Built-In	125	1.5	
HCB42P2G	260	250	Built-In	125	2.2	
HCB43P7G	400	150	Built-In	125	3.7	
HCB45P5G	520	100	Built-In	125	5.5	
HCB47P5G	780	75	Built-In	125	125	
HCB4011G	1040	50	Built-In	125	11	
HCB4015G	1560	40	Built-In	125	15	Plastic shell
HCB4018G	4800	32	4030×1	125	18.5	

AC motor drive controller	Brake Resistor		Brake Unit CDBR	Braking torque (10%ED)	Applicable motor (KW)	Remark
	Power W	Resistance Ω				
HCB4022G	4800	27.2	4030×1	125	22	
HCB4030G	6000	20	4030×1	125	30	
HCB4037G	9600	16	4045×1	125	37	
HCB4045G	1600	13.6	4045×1	125	45	
HCB4055G	6000×2	20×2	4045×2	125	55	
HCB4075G	9600×2	13.6×2	4045×2	125	75	
HCB4090G	9600×3	20×3	4045×3	125	90	
HCB4110G	9600×3	20×3	4045×3	125	110	
HCB4132G	9600×4	13.6×4	4045×4	125	132	
HCB4160G	9600×4	13.6×4	4045×4	125	160	

Brake resistance calculation:

The brake resistance value is related to the DC voltage of AC motor drive braking. For 380V voltage class, when braking the DC voltage is 800V~820V; for 220V, it DC voltage is 400V. Besides, the brake resistance is related to the brake torque Mbr%, difference brake torque will have different brake value. The Calculated formula as following shows:

$$R = \frac{U_{dc}^2 \times 100}{P_{Motor} \times M_{br}\% \times \eta_{AC\ motor\ drive} \times \eta_{Motor}}$$

U_{dc} —— Brake DC voltage

P_{Motor}—— Motor power

M_{br}—— Brake torque

η_{Motor}—— Motor efficiency

$\eta_{AC\ motor\ drive}$—— AC motor drive controller

The brake efficiency is related to the brake torque and brake frequency. The above form shows the given brake torque is 125%, and frequency is 10%. Due to different loads will have different situation; therefore, the form details just for reference.