WERKAI
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Creating Top
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WKS Series
Vector Universal Frequency Convertor >> www.werkai.com

User Manual

WERKAI
ELECTRICAL(SHANGHAI)CO.,LTD.
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Safety notice

Please refer to the user manual before the installation, operation, maintenance or inspection.

"Warning" and "Caution" are different grades for safety notice in the manual.

⚠ Warning refers to the potential danger and it may lead to death if it were not avoided.

⚠ Caution refers to the potential risk and it may lead minor or serious injury and equipment damage if it were not avoided. This also can be used to alarm unsafe operation.

In some cases, even the notes in caution may lead severe accident, so all the important notices should be obeyed in any case.

★ Note refers to the procedure to ensure correct operation.

Warning is indicated on the cover of frequency convertor.
The above guide should be obeyed in the application of the frequency convertor.

⚠ 警 告 WARNING

- Read operation specifications carefully before installing.
- Don't connect output terminals (U.V.W) to power supply.
- Don't connect megger at the terminals on the printed circuit board.
- Maintenance and inspection be performed only after LED lamp of capacitor turn off.

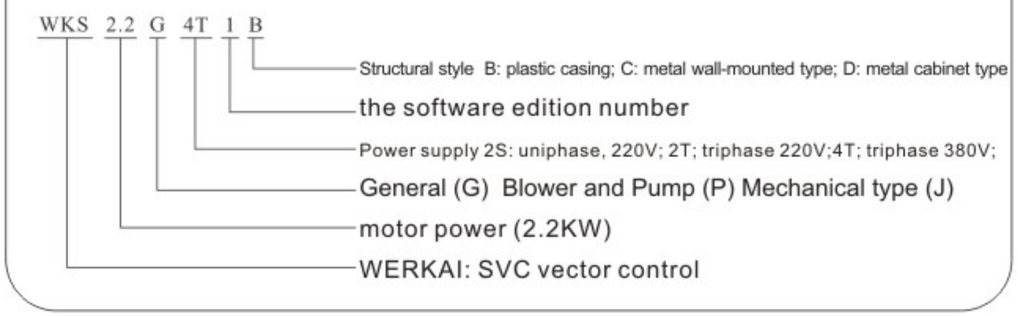
1.Overview

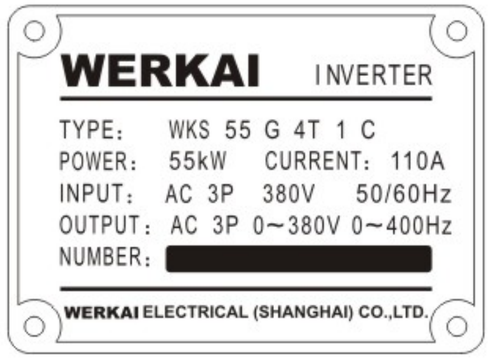
1.1 Overall technical features of frequency convertor

- Power range: 0.75-400KW
- Three control modes: SVC, V/F control, torque control;
- High torque, precision, wide-range speed control drive;
- Anti-tripping property and extremely reliability.
- Flexible input and output terminals, 8 digital inputs, 2 analog inputs, 2 analog outputs, 1 relay output and 2 open collector outputs;
- Multi-speed operation and practical PID;
- Non-stop at momentary interruption;
- AVR function: keep the constant output voltage automatically when the network voltage changes.
- FDP level detection, over-voltage stall current limiting, parameter saving option at power cut or off;
- RS485 communication interface, adopting standard ModBus Industrial Control Bus Protocol;
- Textile wobble frequency control, flux braking, analog combined control;
- To transform renewable sources to electrical energy by common DC bus to achieve energy-saving operation;
- Speed tracing restart can make the revolving motor run the non-impact smooth start;
- Auto carrier-frequency control tech, motor tune regulation tech, and special design of electromagnetic compatibility can satisfy the environmental requirements of low noise and electromagnetic interference;
- Over 20 fault protection so that can protect the equipment or electrical motor timely and effectively.
- WKS series frequency convertor adopts DSP control system and achieve the real SVC, which has more advantages than V/F control.

1.2 Nameplate description

Figure1 Nameplate description of frequency convertor





1.3 Types of frequency convertor

Type	Input voltage	Rated output power (kW)	Rated input current (A)	Rated output current (A)	Adaptive motor
WKS0.4G2S1B	Uniphase 220V±15%	0.4	5.4	2.3	0.4
WKS0.75G2S1B		0.75	8.2	4.5	0.75
WKS1.5G2S1B		1.5	14.2	7.0	1.5
WKS2.2G2S1B		2.2	23.0	10	2.2
WKS0.75G2T1B	Triphase 220V±15%	0.75	5.0	4.5	0.75
WKS1.5G2T1B		1.5	7.7	7	1.5
WKS2.2G2T1B		2.2	11.0	10	2.2
WKS3.7G2T1B		3.7	17.0	16	3.7
WKS5.5G2T1C		5.5	21.0	20	5.5
WKS7.5G2T1C		7.5	31.0	30	7.5
WKS11G2T1C		11.0	43.0	42	11.0
WKS15G2T1C		15.0	56.0	55	15.0
WKS18.5G2T1C		18.5	71.0	70	18.5
WKS22G2T1C		22.0	81.0	80	22.0
WKS30G2T1C		30.0	112.0	110	30.0
WKS37G2T1C		37.0	132.0	130	37.0
WKS45G2T1C		45.0	163.0	160	45.0
WKS55G2TIC		55.0	200.0	200.0	55.0

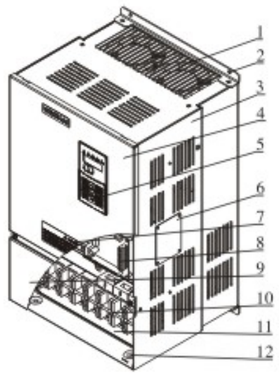
Type	Input voltage	Rated output power (kW)	Rated output current (A)	Adaptive motor
WKS0.75G4T1B	Triphase 380V±15%	0.75	2.5	0.75
WKS0.75P4T1B		0.75	2.5	0.75
WKS1.5G4T1B		1.5	3.7	1.5
WKS1.5P4T1B		1.5	3.7	1.5
WKS2.2G4T1B	Triphase 380V Internal braking unit	2.2	5	2.2
WKS2.2P4T1B		2.2	5	2.2
WKS3.7G4T1B		3.7	9	3.7
WKS3.7P4T1B		3.7	9	3.7
WKS5.5G4T1C		5.5	13	5.5
WKS5.5P4T1C		5.5	13	5.5
WKS7.5G4T1C		7.5	17	7.5
WKS7.5P4T1C		7.5	17	7.5
WKS11G4T1C		11	25	11
WKS11P4T1C		11	25	11
WKS15G4T1C		15	32	15
WKS15P4T1C		15	32	15
WKS18.5G4T1C	Triphase 380V (no internal braking unit)	18.5	37	18.5
WKS18.5P4T1C		18.5	37	18.5
WKS22G4T1C		22	45	22
WKS22P4T1C		22	45	22
WKS30G4T1C		30	60	30
WKS30P4T1C		30	60	30
WKS37G4T1C		37	75	37
WKS37P4T1C		37	75	37
WKS45G4T1C		45	90	45
WKS45P4T1C		45	90	45
WKS55G4T1C		55	110	55
WKS55P4T1C		55	110	55
WKS75G4T1C		75	150	75
WKS75P4T1C		75	150	75

WKS series Universal Vector Variable Frequency Speed Regulator
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Type	Input voltage	Rated output power (kW)	Rated output current (A)	Adaptive motor
WKS90G4T1C	Triphase 380V (no internal braking unit)	90	180	90
WKS90P4T1C		90	180	90
WKS110G4T1C		110	210	110
WKS110P4T1C		110	210	110
WKS132G4T1C		132	250	132
WKS132P4T1C		132	250	132
WKS160G4T1C		160	300	160
WKS160P4T1C		160	300	160
WKS185G4T1C		185	340	185
WKS185P4T1C		185	340	185
WKS200G4T1C		200	380	200
WKS200P4T1C		200	380	200
WKS220G4T1C		220	420	220
WKS220P4T1C		220	420	220
WKS250G4T1C		250	480	250
WKS250P4T1C		250	480	250
WKS280G4T1C		280	540	280
WKS280P4T1C		280	540	280
WKS315G4T1C		315	610	315
WKS315P4T1C		315	610	315
WKS350G4T1C		350	680	350
WKS350P4T1C		350	680	350
WKS400G4T1C		400	800	400
WKS400P4T1C		400	800	400

1.4 Names of parts of frequency convertor

Names of parts:



1 ventilation fence
2 fixing hole
3 case
4 front panel
5 keyboard controller
6 nameplate
7 warning sign
8 control terminal
9 front plate of terminal
10 power terminal
11 cable duct of main circuit
12 cable duct of control circuit

1.5 Dimensions of frequency convertor

Figure 1-9 Dimension of frequency convertor at 3.7kW and below (380V and 220V)

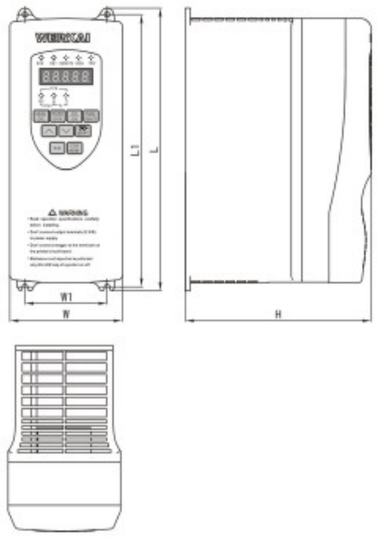


Figure 1-10 Dimension of frequency convertors at 5.5kW-30kW (380V and 220V)

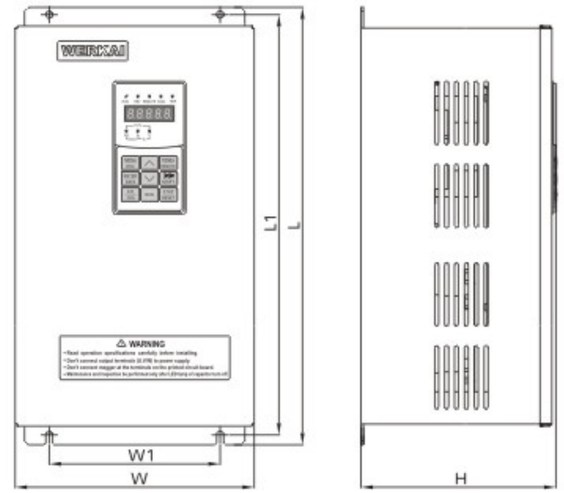
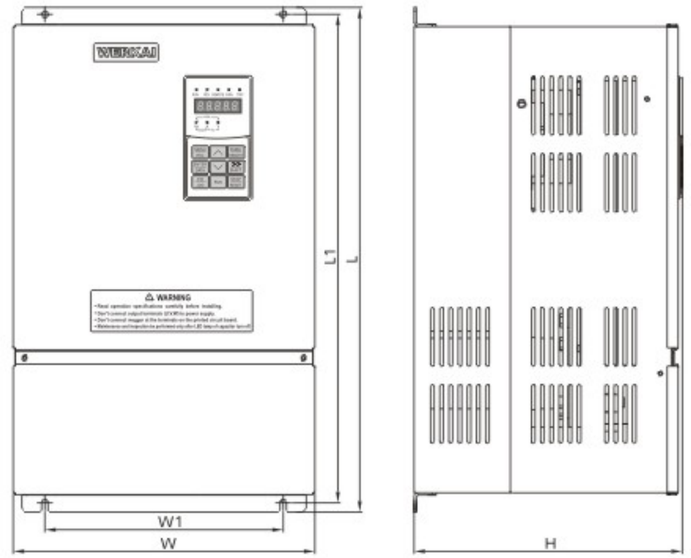


Figure 1-11 Dimension of frequency convertors above 55KW (380V)



Dimensions and installation size of 220VAC

Type	W1(mm)	L1(mm)	W1(mm)	L1(mm)	H(mm)	Installation aperture (mm)
	Installation size		Dimension			
WKS0.75G2S1B	76	252	104	262	172	5
WKS1.5G2S1B						
WKS2.2G2S1B						
WKS0.75G2T1B	76	252	104	262	172	5
WKS1.5G2T1B						
WKS2.2G2T1B						
WKS3.7G2T1B						
WKS5.5G2T1C	170	298	210	311	176	6
WKS7.5G2T1C						
WKS11G2T1C	186	358	234	372	223	7
WKS15G2T1C						
WKS18.5G2T1C	186	438	262	452	222	7
WKS22G2T1C						
WKS30G2T1C						
WKS37G2T1C	260	534	330	550	292	7
WKS45G2T1C						
WKS55G2T1C						

Dimensions and installation size of triphase 380 VAC

Type	W1(mm)	L1(mm)	W1(mm)	L1(mm)	H(mm)	Installation aperture (mm)
	Installation size		Dimension			
WKS0.75G4T1B	76	252	104	262	172	5
WKS0.75P4T1B						
WKS1.5G4T1B						
WKS1.5P4T1B						
WKS2.2G4T1B						
WKS2.2P4T1B						
WKS3.7G4T1B						
WKS3.7P4T1B						

Type	W1(mm)	L1(mm)	W1(mm)	L1(mm)	H(mm)	Installation aperture (mm)
	Installation size		Dimension			
WKS5.5G4T1C	170	298	210	311	176	6
WKS5.5P4T1C						
WKS7.5G4T1C						
WKS7.5P4T1C						
WKS11G4T1C	186	358	234	372	223	7
WKS11P4T1C						
WKS15G4T1C						
WKS15P4T1C						
WKS18.5G4T1C	186	438	262	452	222	7
WKS18.5P4T1C						
WKS22G4T1C						
WKS22P4T1C						
WKS30G4T1C						
WKS30P4T1C						
WKS37G4T1C	260	534	330	550	292	7
WKS37P4T1C						
WKS45G4T1C						
WKS45P4T1C						
WKS55G4T1C						
WKS55P4T1C						
WKS75G4T1C	325	700	450	725	348	11
WKS75P4T1C						
WKS90G4T1C						
WKS90P4T1C						
WKS110G4T1C	370	820	500	850	358	13
WKS110P4T1C						
WKS132G4T1C						
WKS132P4T1C						
WKS160G4T1C	445	855	575	880	448	13
WKS160P4T1C						

Type	W1(mm)	L1(mm)	W1(mm)	L1(mm)	H(mm)	Installation aperture (mm)
	Installation size		Dimension			
WKS185G4T1C	540	1270	710	1305	378	13
WKS185P4T1C						
WKS220G4T1C						
WKS220P4T1C						
WKS250G4T1C	730	1440	916	1475	415	13
WKS250P4T1C						
WKS280G4T1C						
WKS280P4T1C						
WKS315G4T1C						
WKS315P4T1C						
WKS400G4T1C						
WKS400P4T1C						

1.6 Types of braking resistance/braking units

1.6.1 Reference

When the control equipment drived by the frequency convertor brakes quickly, it needs the energy returned to DC bus when consuming motor braking by braking unit. All the frequency convertors below 15kW (including) have inner braking unit and these over 18.5 kW(including) need select braking unit. So please select proper braking resistance in accordance with the capacity of frequency convertor if necessary. The braking torque is 100% and the utilization rate is 10%. See the configuration of braking resistance and braking unit in the table below. The braking power should be readjusted according to the braking torque and the utilization if the equipment works with load under braking status for a long time. Based on long-term work, braking resistance power, P=（P8.32）2/R, where R is the value of braking resistance.

1.6.1.1 220V grade standard and type-choosing reference

Capacity kW (HP)	Braking unit		Braking resistance (100% braking torque,10%utilization)		
	Spec.	Quantity(pc)	Equivalent resistance	Equivalent power	Quanitity(pc)
0.4 (0.5)	inner	1	400Ω	80W	1
0.75 (1)		1	200Ω	80W	1
1.5 (2)		1	130Ω	260W	1
2.2 (3)		1	80Ω	260W	1
4 (5)		1	48Ω	400W	1
5.5 (7.5)		1	35Ω	550W	1
7.5 (11)	DBK-055-2	1	26Ω	780W	1
11 (15)		1	17Ω	1100W	1
15 (20)		1	13Ω	1800W	1
18.5 (25)		1	10Ω	2000W	1
22 (30)		1	8Ω	2500W	1
30 (40)	DBK-055-2	2	13Ω	1800W	2
37 (50)		2	10Ω	2000W	2
45 (60)		2	8Ω	2500W	2
55 (75)		2	6.5Ω	3000W	2

1.6.1.1 380V grade standard and type-choosing reference

Capacity kW (HP)	Braking unit		Braking resistance (100% braking torque,10%utilization)		
	Spec.	Quantity(pc)	Equivalent resistance	Equivalent power	Quanitity(pc)
1.5 (2)	inner	1	400Ω	260W	1
2.2 (3)		1	150Ω	390W	1
4 (5)		1	150Ω	390W	1
5.5 (7.5)		1	100Ω	520W	1
7.5 (11)		1	50Ω	1040W	1
11 (15)		1	50Ω	1040W	1
15 (20)		1	40Ω	1560W	1

Capacity kW (HP)	Braking unit		Braking resistance (100% braking torque,10%utilization)		
	Spec.	Quantity(pc)	Equivalent resistance	Equivalent power	Quanitity(pc)
18.5 (25)	DBK-055-4	1	20Ω	6000W	1
22 (30)		1	20Ω	6000W	1
30 (40)		1	20Ω	6000W	1
37 (50)		1	13.6Ω	9600W	1
45 (60)		1	13.6Ω	9600W	1
55 (75)		1	13.6Ω	9600W	1
75 (100)		2	13.6Ω	9600W	2
90 (120)		2	13.6Ω	9600W	2
110 (150)		2	13.6Ω	9600W	2
132 (180)	DBK-160-4	1	4Ω	30000W	1
160 (215)		1	4Ω	30000W	1
185 (250)	DBK-220-4	1	3Ω	40000W	1
200 (270)		1	3Ω	40000W	1
220 (300)		1	3Ω	40000W	1
250 (340)	DBK-315-4	1	2Ω	60000W	1
280 (380)		1	2Ω	60000W	1
315 (430)		1	2Ω	60000W	1
350 (470)	DBK-220-4	2	3Ω	40000W	2
400 (540)		2	3Ω	40000W	2
500 (680)	DBK-315-4	2	2Ω	60000W	2
560 (760)		2	2Ω	60000W	2
630 (860)		2	2Ω	60000W	2

Note:

Please select resistance and power of braking resistance according to data provided by our company.

Braking torque of frequency convertor will be altered by braking resistance and resistance power in above table is designed according to 100% of braking torque and 10% of braking usage rate. Braking resistance can be reduced and power can be increased properly at the same time if users want a larger braking torque.

Power of braking resistance shall be added properly in locations which need frequent braking (i.e., braking usage rate exceeds 10%) according to detailed working conditions.

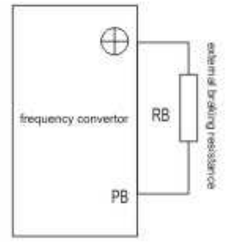
Please refer to "Instructions of Dynamic Braking Unit" to set braking voltage class of braking unit accurately when using the external braking unit and inaccurate setup of voltage class will influence normal operation of frequency convertor.

1.6.2 Connection method

1.6.2.1 Connection of braking resistance

See the connection of braking resistance of D Volume and below and frequency convertor in Figure 1-11.

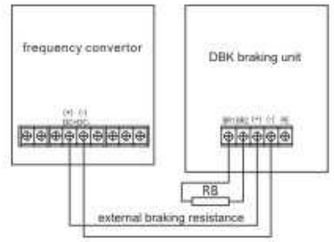
Figure 1-11 Installation of braking resistance



1.6.2.2 Connection of braking unit

See the connection of frequency convertor and braking unit in Figure 1-12.

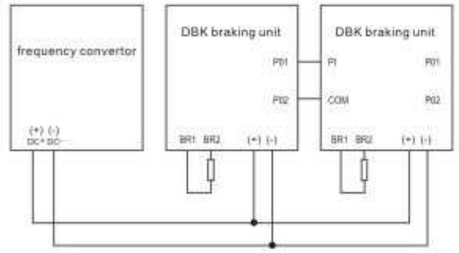
Figure 1-12 Connection of braking unit



1.6.2.3Parallel connection of braking unit

Due to the power limitation of braking unit, parallel connection is necessary in some power range, seeing the connection in Figure 1-13.

Figure 1-13 Parallel connection of braking unite



2.00BA

Caution

- Do not install or operate frequency convertor with any damage or fault parts, otherwise may cause the risk of injury.

Please check the following items after open the box and take out the frequency convertor:

1. Confirm no any damage during the transportation (damage or nick).
2. Confirm User Manual and warranty card in the box.
3. Check the nameplate of frequency convertor and confirm that is the product you ordered.
4. Please confirm the fitting parts are correct if you ordered these parts.

Please call the local dealer promptly if there is any damage on the frequency convertor or fitting parts.

3.Disassembling and installation

Warning

- The design, installation, debugging and operation must be done by authorized staff and all the descriptions in “warning” must be obeyed, otherwise may cause severe personal injury or heavy losses of property.
- The input power supply must be fixed permanently and the equipment must be firmly grounded.
- The following terminals may have dangerous voltage even though it is off.
  --- power supply terminals, R, S, T
  --- terminals connecting the motor, U, V, W
- The installation only can be performed at least 10 min after the power supply is cut off and confirm that LED light is off and the the discharge of frequency convertor finished.
- The minimum sectional area of the grounding conductor is 10mm2 or in accordance with the data below. It is required to select the maximum value between them as the sectional area of grounding conductor.

Sectional area of power wire conductor S mm^2	Sectional area of grounding conductor
S≤16	S
16<S≤35	16
35<S	S/2

Caution

- Raise the cabinet body with the base and do not move the frequency convertor with the front panel, otherwise the main unit may drop off and cause personal injury.
- The frequency convertor should be mounted on fire-retardant material such as metal and far away from thermal source and inflammables to avoid fire hazard.
- If two or more frequency convertors are amounted in a cabinet, the cooling blower in necessary to control the temperature is under 40℃, otherwise, overheat will cause fire hazard or damage.

3.1 Ambient conditions of the frequency convertor

3.1.1 Temperature and humidity

The ambient temperature should be between -10℃~+40℃,and it must be derated if over 40℃ and the maximum is no more than 50℃. Above 40℃, derate 4% for every increase of 1℃.

The relative humidity of the air≤90%, no condensation, avoid to exposure to direct sunlight. Whether Fahrenheit is needed to add.

3.1.2 Altitude

The rated power can be run if install it under altitude of 1000m and see the detail derating range in the figure below if over altitude of 1000m:

Figure 3-1 Altitude of installation site

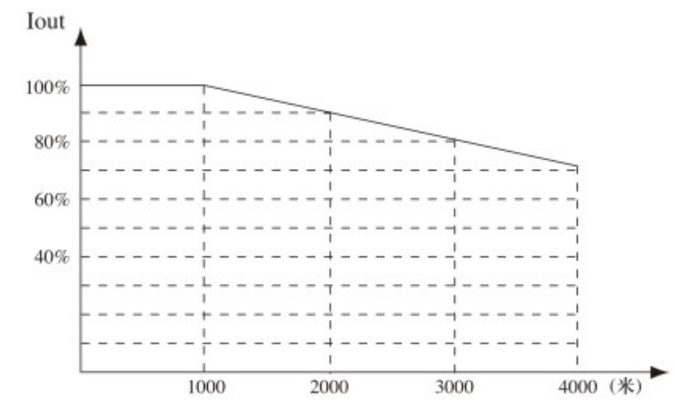
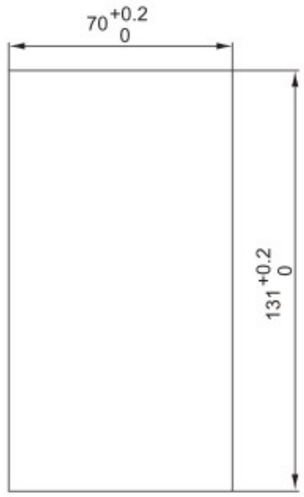


Figure 3-5 Opening size for installing the external keyboard



4.Connection

Warning

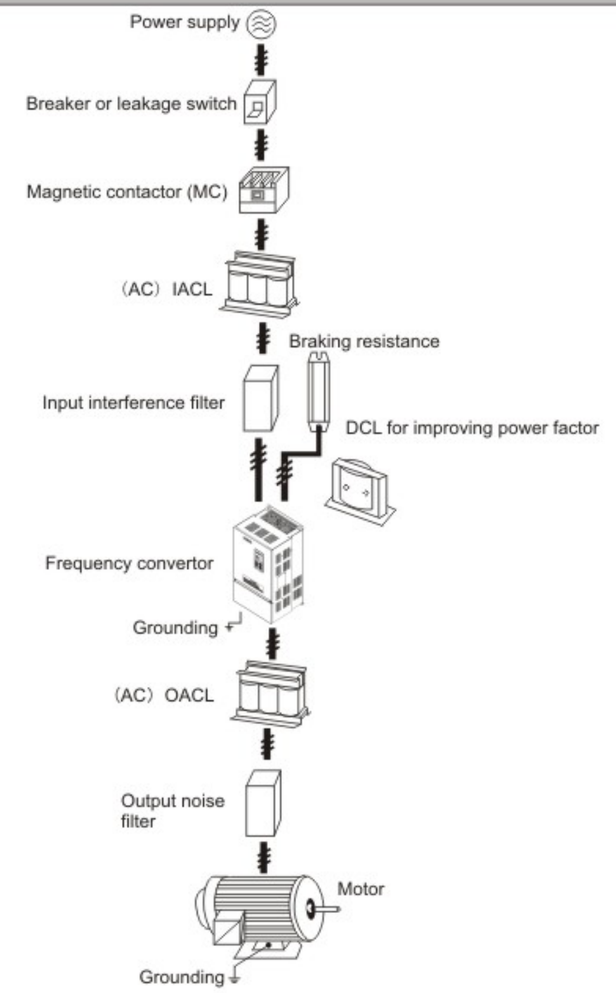
- The frequency convertor must be operated by authorized electric technician in order to guarantee the safe operation.
- It is forbidden to test the insulation of cables connected with the frequency convertor by high voltage insulation test equipment.
- The power input cable, DC circuit terminals and motor terminals may have dangerous voltage even though the frequency convertor does not work. So the installation work is not permissible until the frequency convertor has discharged and CHARGE light is off 10 min after the switch is off.
- The grounding terminal of the frequency convertor must be grounded reliably and the grounding resistance should be less than 10Ω, otherwise may cause electric shock and fire hazard.
- Do not connect triphase to the output terminals (U, V, W) of the frequency convertor, otherwise may cause the damage of the equipment.
- Please confirm the power line and motor cable are correctly connected, i.e., connect the power line to terminal R, S, T and connect the motor cable to terminal U, V, W.
- It is forbidden to touch the frequency convertor with wet hand, otherwise may cause electric shock.

Caution

- Check whether the rated voltage of the frequency convertor is consistent with AC power supply voltage
- The power line and motor cable must be connected firmly and permanently.

4.1 Connection graph of peripheral units

Figure 4-1 Connection graph of peripheral units



4.2.2Connecting terminals of control circuit

Figure 4-7 TB1 Terminals

KA	KB	KC

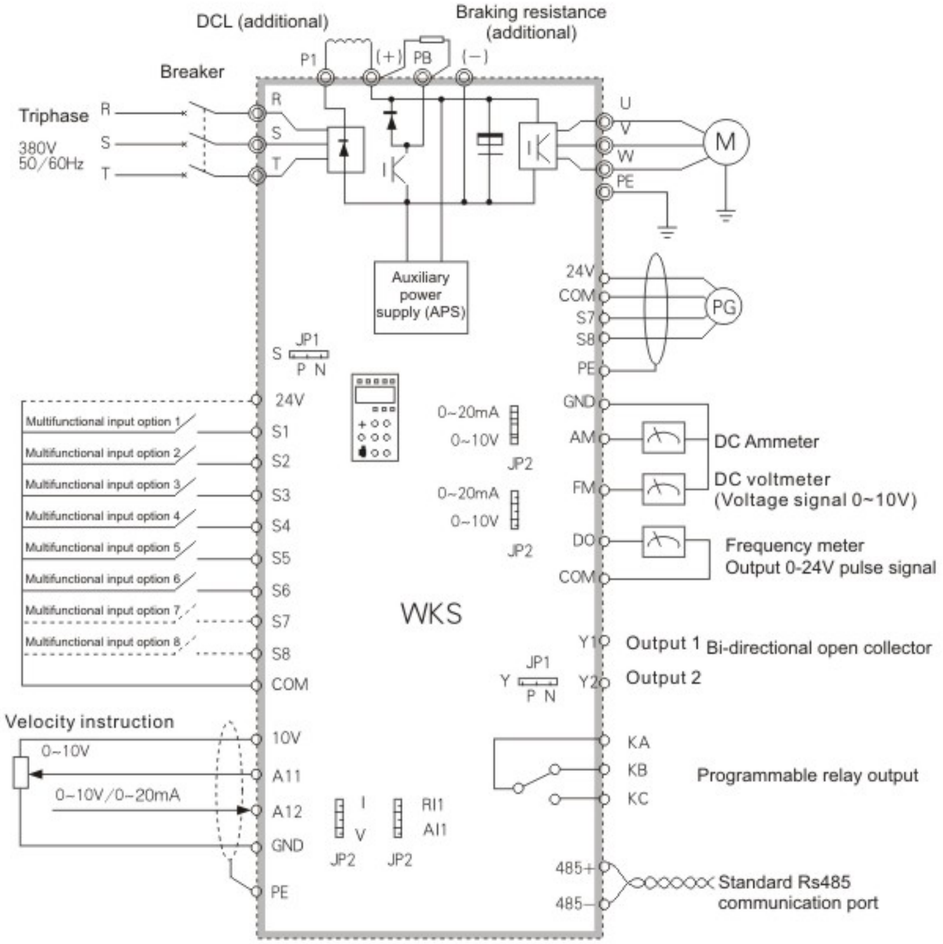
Figure 4-8 TB2 terminals

24V	Y1	Y2	COM	D0	S1	S2	S3	S4	S5	S6	COM	S7	S8

Figure 4-9 TB3 terminals

10V	AI1	AI2	GND	FM	AM	GND	485+	485-	PE

4.3 Standard connection diagram



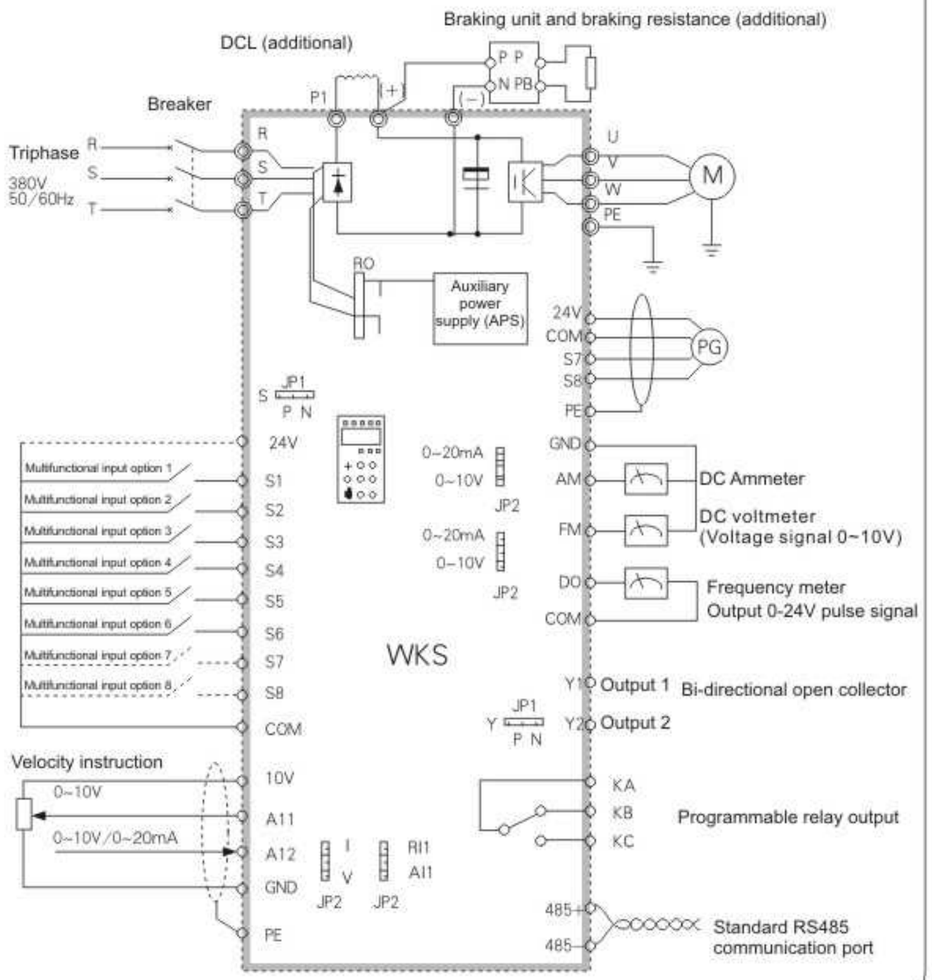
Applicable equipments：equipments of WKS15G4T1C and below

Prompt：1. AI2 may select input voltage or current signal, shifting by JP2 jumper switch on the control panel;

2. Auxiliary power supply (APS) is from positive (+) and (-) negative bus.

3. Contain braking unit, so please connect the braking resistance between (+) and PB.

Figure 4-10 Standard connection diagram



Applicable equipments：equipments of WKS18.5G4T1C and above

Prompt：1. AI2 may select input voltage or current signal, shifting by JP2 jumper switch on the control panel;

2. APS input is from R0, T0, R0, T0 have been short connected with triphase input R and T terminals in the factory, so if the user wants to introduce the control supply, the short connection plates between R and R0, T and T0 should be removed, and then connect the control supply power from R0 and T0.

3. It is forbidden to connect the control supply power without removing the short connection plates in order to avoid short circuit accident;

4. If additional braking parts are necessary, braking unit and braking resistance should be included; pay more attention to positive and negative poles when the braking unit is connected.

4.4 Specifications of breaker, cable, contactor and reactor

4.4.1 Specifications of breaker, cable and contactor

Type	Breaker(A)	Input/output cable (copper core) mm^2	Rated current A of contactor (380V or 220V)
WKS0.75G2T1B	16	2.5	10
WKS1.5G2T1B	20	4	16
WKS2.2G2T1B	32	6	20
WKS3.7G2T1B	40	6	25
WKS5.5G2T1C	63	6	32
WKS7.5G2T1C	100	10	63
WKS11G2T1C	125	25	95
WKS15G2T1C	160	25	120
WKS18.5G2T1C	160	25	120
WKS22G2T1C	200	35	170
WKS30G2T1C	200	35	170
WKS37G2T1C	200	35	170
WKS45G2T1C	250	70	230
WKS0.75G4T1B	16	2.5	10
WKS1.5G4T1B	16	2.5	10
WKS2.2G4T1B	16	2.5	10
WKS0.75/5.5G4T1C	25	4	16
WKS5.5/7.5G4T1C	25	4	16
WKS7.5/11G4T1C	40	6	25
WKS11/15G4T1C	63	6	32
WKS15/18.5G4T1C	63	6	50
WKS18.5/22G4T1C	100	10	63
WKS22/30G4T1C	100	16	80
WKS30/37G4T1C	125	25	95
WKS37/45G4T1C	160	25	120
WKS45/55G4T1C	200	35	135
WKS55/75G4T1C	200	35	170

4.2.2Connecting terminals of control circuit

Figure 4-7 TB1 Terminals

KA	KB	KC

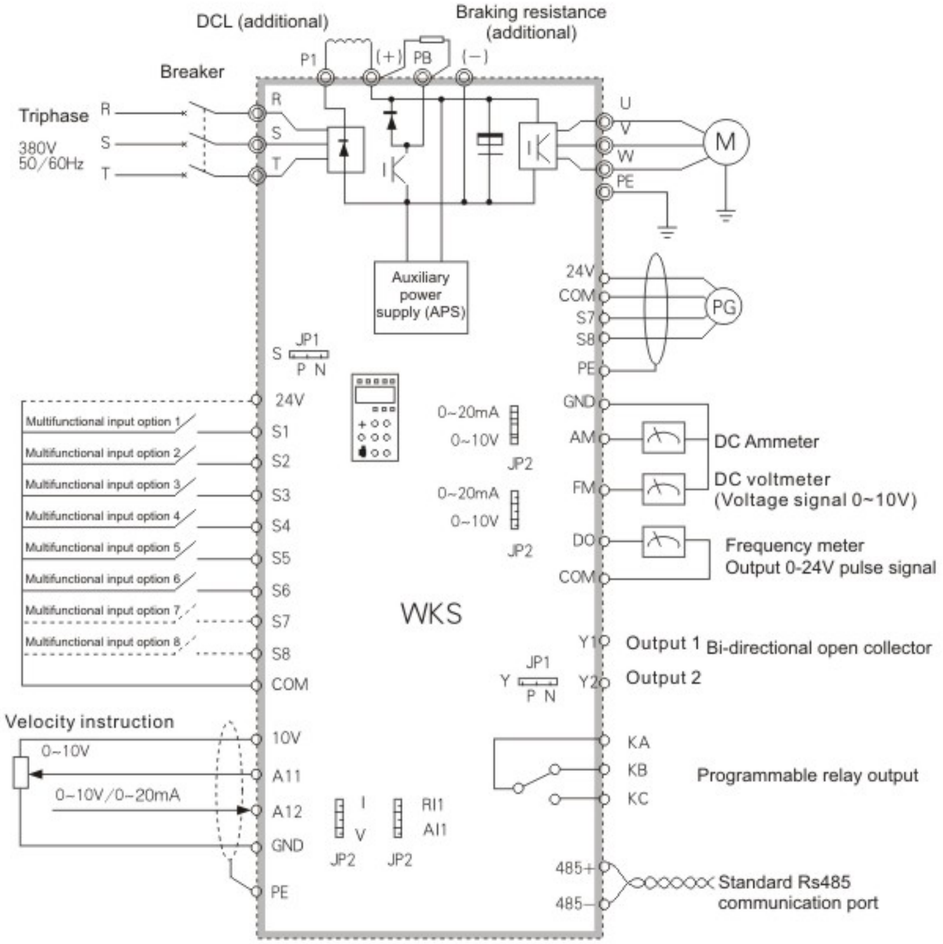
Figure 4-8 TB2 terminals

24V	Y1	Y2	COM	D0	S1	S2	S3	S4	S5	S6	COM	S7	S8

Figure 4-9 TB3 terminals

10V	AI1	AI2	GND	FM	AM	GND	485+	485-	PE

4.3 Standard connection diagram



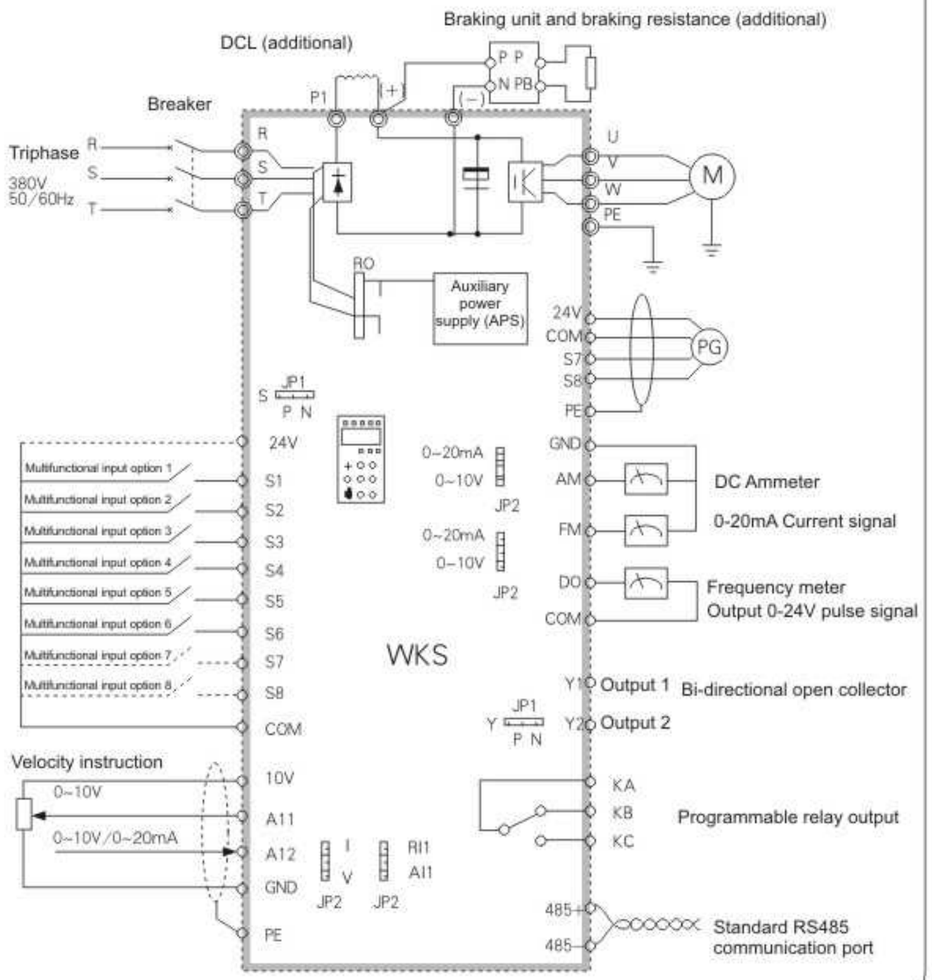
Applicable equipments：equipments of WKS15G4T1C and below

Prompt：1. AI2 may select input voltage or current signal, shifting by JP2 jumper switch on the control panel;

2. Auxiliary power supply (APS) is from positive (+) and (-) negative bus.

3. Contain braking unit, so please connect the braking resistance between (+) and PB.

Figure 4-10 Standard connection diagram



Applicable equipments：equipments of WKS18.5G4T1C and above

Prompt：1. AI2 may select input voltage or current signal, shifting by JP2 jumper switch on the control panel;

2. APS input is from R0, T0, R0, T0 have been short connected with triphase input R and T terminals in the factory, so if the user wants to introduce the control supply, the short connection plates between R and R0, T and T0 should be removed, and then connect the control supply power from R0 and T0.

3. It is forbidden to connect the control supply power without removing the short connection plates in order to avoid short circuit accident;

4. If additional braking parts are necessary, braking unit and braking resistance should be included; pay more attention to positive and negative poles when the braking unit is connected.

4.4 Specifications of breaker, cable, contactor and reactor

4.4.1 Specifications of breaker, cable and contactor

Type	Breaker(A)	Input/output cable (copper core) mm^2	Rated current A of contactor (380V or 220V)
WKS0.75G2T1B	16	2.5	10
WKS1.5G2T1B	20	4	16
WKS2.2G2T1B	32	6	20
WKS3.7G2T1B	40	6	25
WKS5.5G2T1C	63	6	32
WKS7.5G2T1C	100	10	63
WKS11G2T1C	125	25	95
WKS15G2T1C	160	25	120
WKS18.5G2T1C	160	25	120
WKS22G2T1C	200	35	170
WKS30G2T1C	200	35	170
WKS37G2T1C	200	35	170
WKS45G2T1C	250	70	230
WKS0.75G4T1B	16	2.5	10
WKS1.5G4T1B	16	2.5	10
WKS2.2G4T1B	16	2.5	10
WKS0.75/5.5G4T1C	25	4	16
WKS5.5/7.5G4T1C	25	4	16
WKS7.5/11G4T1C	40	6	25
WKS11/15G4T1C	63	6	32
WKS15/18.5G4T1C	63	6	50
WKS18.5/22G4T1C	100	10	63
WKS22/30G4T1C	100	16	80
WKS30/37G4T1C	125	25	95
WKS37/45G4T1C	160	25	120
WKS45/55G4T1C	200	35	135
WKS55/75G4T1C	200	35	170

型号	断路器(A)	输入线/输出线(铜芯电缆)mm²	接触器额定工作电流A(电压380或220V)
WKS75/90G4T1C	250	70	230
WKS90/110G4T1C	315	70	280
WKS110/132G4T1C	400	95	315
WKS132/160G4T1C	400	150	380
WKS160/185G4T1C	630	185	450
WKS185/200G4T1C	630	185	500
WKS200/220G4T1C	630	240	580
WKS220/250G4T1C	800	150x2	630
WKS250/280G4T1C	800	150x2	700
WKS280/315G4T1C	1000	185x2	780
WKS315/350G4T1C	1200	240x2	900
WKS350G4T1C	1280	240x2	960
WKS400G4T1C	1380	185x3	1035

4.4.2 Specifications of IACL/OACL and DCL

Capacity of frequency convertor (kW)	IACL		OACL		DCL	
	Current(A)	Inductance (mH)	Current(A)	Inductance (mH)	Current (A)	Inductance (mH)
WKS0.75G2T1B	2	7	2	7	3	28
WKS1.5G2T1B	5	3.8	5	3.8	6	11
WKS2.2G2T1B	7.5	2.5	7.5	2.5	6	11
WKS1.5G4T1B	5	3.8	5	1.5	6	11
WKS2.2G4T1B	7	2.5	7	1	6	11
WKS0.75/5.5G4T1C	10	1.5	10	0.6	12	6.3
WKS5.5/7.5G4T1C	15	1.0	15	0.25	23	3.6
WKS7.5/11G4T1C	20	0.75	20	0.13	23	3.6
WKS11/15G4T1C	30	0.60	30	0.087	33	2
WKS15/18.5G4T1C	40	0.42	40	0.066	33	2
WKS18.5/22G4T1C	50	0.35	50	0.052	40	1.3

Capacity of frequency convertor (kW)	IACL		OACL		DCL	
	Current(A)	Inductance (mH)	Current(A)	Inductance (mH)	Current (A)	Inductance (mH)
WKS22/30G4T1C	60	0.28	60	0.045	50	1.08
WKS30/37G4T1C	80	0.19	80	0.032	65	0.80
WKS37/45G4T1C	90	0.16	90	0.030	78	0.70
WKS45/55G4T1C	120	0.13	120	0.023	95	0.54
WKS55/75G4T1C	150	0.10	150	0.019	115	0.45
WKS75/90G4T1C	200	0.12	200	0.014	160	0.36
WKS90/110G4T1C	250	0.06	250	0.011	180	0.33
WKS110/132G4T1C	250	0.06	250	0.011	250	0.26
WKS132/160G4T1C	290	0.04	290	0.008	250	0.26
WKS160/185G4T1C	330	0.04	330	0.008	340	0.18
WKS185/200G4T1C	400	0.04	400	0.005	460	0.12
WKS200/220G4T1C	490	0.03	490	0.004	460	0.12
WKS220/250G4T1C	490	0.03	490	0.004	460	0.12
WKS250/280G4T1C	530	0.03	530	0.003	650	0.11
WKS280/315G4T1C	600	0.02	600	0.003	650	0.11
WKS305/350G4T1C	660	0.02	660	0.002	800	0.06
WKS350G4T1C	400*2	0.04	400*2	0.005	460*2	0.12
WKS400G4T1C	490*2	0.03	490*2	0.004	460*2	0.12

Note: internal DCL of 380V series 160-400kW equipments.

4.4.3 Specifications of input filter and output filter

Capacity of frequency convertor kW	Input filter type	Output filter type
WKS0.75G2T1B	NF241B6/01	
WKS1.5G2T1B	NF241B10/01	
WKS2.2G2T1B	NF241B20/01	
WKS1.5G4T1B	NFI-005	NFO-005
WKS2.2G4T1B	NFI-010	NFO-010

Capacity of frequency convertor kW	Input filter type	Output filter type
WKS0.75/5.5G4T1C	NFI-010	NFO-010
WKS5.5/7.5G4T1C	NFI-020	NFO-020
WKS11/15G4T1C	NFI-036	NFO-036
WKS15/18.5G4T1C	NFI-036	NFO-036
WKS18.5/22G4T1C	NFI-050	NFO-050
WKS22/30G4T1C	NFI-050	NFO-050
WKS30/37G4T1C	NFI-065	NFO-065
WKS37/45G4T1C	NFI-080	NFO-080
WKS45/55G4T1C	NFI-100	NFO-100
WKS55/75G4T1C	NFI-150	NFO-150
WKS75/90G4T1C	NFI-150	NFO-150
WKS90/110G4T1C	NFI-200	NFO-200
WKS110/132G4T1C	NFI-250	NFO-250
WKS132/160G4T1C	NFI-250	NFO-250
WKS160/185G4T1C	NFI-300	NFO-300
WKS185/200G4T1C	NFI-400	NFO-400
WKS200/220G4T1C	NFI-400	NFO-400
WKS220/250G4T1C	NFI-600	NFO-600
WKS250/280G4T1C	NFI-600	NFO-600
WKS280/315G4T1C	NFI-900	NFO-900
WKS315/350G4T1C	NFI-900	NFO-900
WKS350G4T1C	NFI-1200	NFO-1200
WKS400G4T1C	NFI-1200	NFO-1200

4.5 Connection of main circuit

4.5.1 Connection of power supply side of main circuit

4.5.1.1 Breaker

Proper MCCB applicable to the frequency convertor should be connected between triphase AC supply and power input terminals (R, S, T). The capacity of breaker should be among 1.5~2 times of the rated current of frequency convertor, seeing further information in Specifications of Breaker, Cable and Contactor.

4.5.1.2 Magnetic contactor

In order to cut off the power supply of the frequency convertor upon any system fault, a magnetic contactor can be mounted on input side to control the main power supply to guarantee the safety.

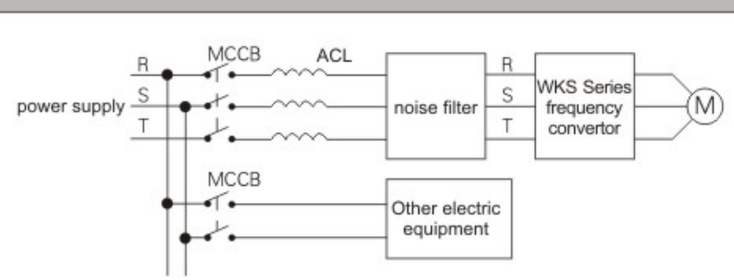
4.5.1.3 IACL

To avoid over-current flow into the power circuit and damage some parts upon the input of spike pulse, an ACL shall be mounted on the input side. In the mean time,the power factor on the input side may be changed. In order to effectively protect the frequency convertor, the input reactor should be mounted onto 380 frequency convertor 110kW (including) and above and 220V 45kW (including) and above.

4.5.1.4 Noise filter on input side

The use of frequency convertor may interfere other electric equipments by power cable, so the noise filter can reduce the interference and see the connection below:

Figure 4-11 Connection on the power side of main circuit



4.5.2 Connection on the frequency convertor side of main circuit

4.5.2.1 ACL

WKS frequency convertors of 18.5kW~90kW (380V) have inner ACL. ACL may change the power factor to avoid the damage of rectifier bridge for over-current of the frequency convertor upon connecting large transformer and avoid damage of rectifier circuit for voltage mutation or harmonic wave of overload.

4.5.2.2 Braking unit and braking resistance

• WKS (380V)frequency convertors of 15 kW and below have inner braking unit in order to release the feedback energy upon braking. It must be (+) and connect PB to braking resistance.

• The cable of braking resistance should be less than 5M in length.

• Braking resistance may rise as the temperature increase upon energy releasing, so pay attention to install the braking resistance in safe protected and well-ventilated environment.

• (+) and (-) of braking unit must be matched with (+)and (-) of frequency convertor when external braking unit is connected, and BR1and BR2 of the braking unit connect the braking resistance.

• The cable between (+), (-) of frequency convertor and (+) ,(-) of braking unit should be less than 5m, and the cable between BR1 ,BR2 and the braking resistance should be less than 10m.

Note: do not reverse (+), (-); (+), (-) are not allowed to be connected to the braking resistance directly, otherwise may cause damage of frequency convertor or fire hazard.

4.5.3 Connection on motor side of main circuit

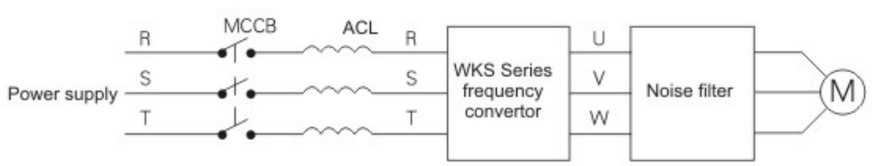
4.5.3.1 Output reactor

If the distance between the frequency convertor and motor is over than 50m so that over current leakage caused by stray capacitances for long cable, frequent over-current protection occurs easily. In addition, an output reactor must be mounted in order to avoid the insulation damage of motor.

4.5.3.2 Noise filter on output side

Additional output noise filter can reduce the radio noise and leakage current of the cable between frequency convertor and motor. See the figure below:

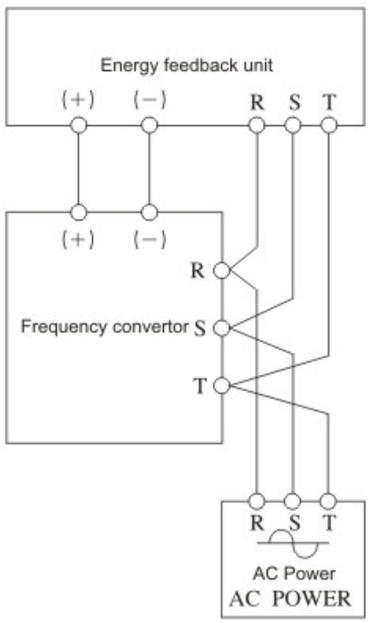
Figure 4-12 Connection diagram on motor side of main circuit



4.5.4 Connection of RBK Series energy feedback unit

RBL Series energy feedback unit can return the power produced by motor under regenerative braking to the power system. Comparing with the traditional triphase antiparallel bridge rectifier and adopting IGBT as the rectifier feedback, the harmonic distortion component of RBK Series is less than 4% of the principle wave and it brings little pollution to the power system. Feedback unit is extensively applied in equipments such as oil extractor, centrifuger, elevator etc. See further information in Specification of RBK Series Energy Feedback Unit.

Figure 4-13 Connection of energy feedback unit

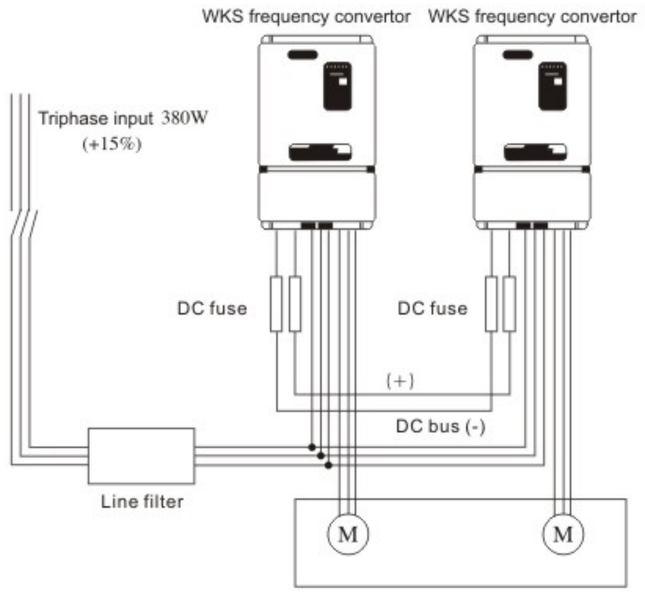


4.5.5Connection of common DC bus

Common DC bus is applied in multi-motor drive in fields such as paper machinery and chemical fiber. Some motors are under operation while others are under regeneration braking (power production), at that time the renewable energy on the DC bus is equivalent automatically and provide energy to running motors so that reduce the energy from power system to save the energy.

The figure below is the diagram of two motors under operation at the same time (such as winding and unwinding). One of them is always under operation and the other is under regeneration braking.Parallel the DC bus of the two requency convertors and the regenerated power can be supplied to the motor under operation so that save the energy.

Figure 4-14 Connection of common DC bus



Note: you are suggested to select the same type to ensure power on at the same time if select two frequency convertors share the common DC bus.

4.5.6 Connection of grounding cable (PE)

The grounding terminal of frequency convertor must be well grounded in order to guarantee the safety, avoid electric shock and fire hazard. The grounding resistance is less than 10Ω. The grounding cable should be thick and short and multi copper-core wire over 3.5mm2 is applicable. You are suggested not to use common grounding cable to avoid circui t formed by grounding wire if multi frequency convertors are grounded.

4.6 Connection of control circuit

4.6.1 Note

Please use multi-core shielded cable or twisted pair cable to connect the control terminals. The shielded cable (end approach to frequency convertor) should be connected to the grounding terminal (PE) of frequency convertor. The control cable should be over 20cm away from main circuit and strong current circuit (including power supply cable, motor cable, relay cable and contactor cable etc.) and avoid parallel layout. You are suggested to wire vertically to avoid error of frequency convertor caused by external interference.

4.6.2 Specification of terminals on the control panel

Functions of TB3 terminals on the control panel

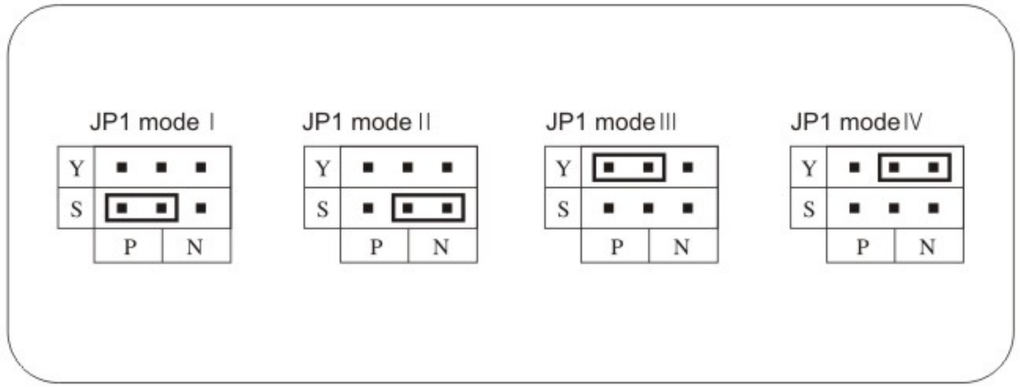
Terminal label	Designation	Functions	Specification
RS485	Rs485 communication interface	495 includes (+) and (-), RS232 communication interface needs additional convertor plate	Please use twisted pair cable and shielded cable to connect RS485 communication interface
AI1	Analog input AII	Accept analog voltage input (GND)	Input voltage: 0~10v Input resistance: 100kΩ Resolution: 1/2000
AI2	Analog input AI2	Accept analog voltage/current input, shifting by jumper JP2. the default current (GND)	输入电压范围：0~10V （输入阻抗：100KΩ） 输入电流范围：0~20mA (输入阻抗：165Ω) 分辨率：1/2000
FM	Analog output 1	Provide analog voltage /current output, indicates 12 values, shifting by jumper JP2, the default output voltage (GND)	Current output: 0/4-20mA Voltage output: 0/2-10V
AM	Analog output 2	Provide analog voltage /current output, indicates 12 values, shifting by jumper JP2, the default output current (GND)	
+10V	+10V power supply	Provide +10V reference supply	Isolate the internal with COM
PE	Shielding ground	Used to ground the shielding layer of terminal cable, analog signal wire, 485 communication line, the insulation layer of motor cable can be connected to this terminal	Connect with PE of main circuit internally

Specification of TB1 and TB2 on the control panel

Terminal label	Designation	Function	Specification
S1	Multifunctional input terminal1	Can be programmed and defined as multifunctional switching value input terminals (common terminal S)	Optical coupling isolation input Input resistance: R=2KΩ Maxi input frequency:20HZ Input voltage: 9-30V
S2	Multifunctional input terminal2		
S3	Multifunctional input terminal3		
S4	Multifunctional input terminal4		
S5	Multifunctional input terminal5		
S6	Multifunctional input terminal6		
S7	Multifunctional input terminal7	S7, S8 can be used as common multifunctional terminals (like S1-S6), and also can be high-speed pulse input terminals	Optical coupling isolation input Input resistance: R=2KΩ Maxi input frequency:100KHZ (uniphase)/50KHZ (biphase) Input voltage: 15-30V
S8	Multifunctional input terminal8		
Y1	Bidirectional open collector Output terminal 1	Can be programmed and defined as multifunctional switching value output terminals (common terminal Y)	Optical coupling isolation output Working voltage: 9-30V Maxi output current: 50mA
Y2	Bidirectional open collector Output terminal 2		
D0	Open collector pulse output terminal	Can be programmed and defined as multifunctional pulse signal output terminals (COM)	Output frequency Max: 50KHZ
KA	Relay output	Can be programmed and defined as multifunctional relay output terminals	KA-KB: normal closed KA-KC: normal open Contact capacity: KA-KB: NC KA-KB: No AC250V/2A (COS=1)
KB			
KC			
24V	+24V power supply	Provide+24Vpowersupply	Max output current:200mA
COM	+24V power supply	Provide+24Vpowersupply	Internal isolation of COM &GND
PE	Shielding ground	Shielding grounding term.	Connect with PE(main circuit)

4.6.3Specification of jumper JP1 and JP2 on the control panel

Jp1 multi-functional digital input/output terminals jumper has four modes:



JP1 mode I:

Short circuit between the common terminal S of multifunctional digital input to output voltage 24V,he signal input is effective upon short circuit between S1-S8 and COM,applicable to external PNP switching signal input. The signal input is sourcing current.

JP1 mode II:

Short circuit between the common terminal S of multifunctional digital input to output voltage COM,he signal input is effective upon short circuit between S1-S8 and 24V,applicable to external PNP switching signal input. The signal input is sink current.

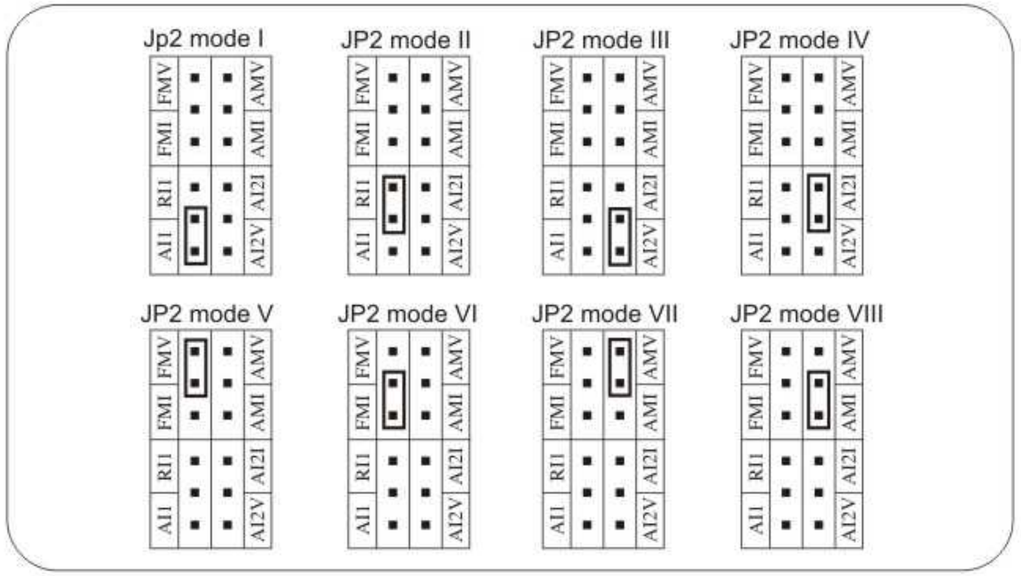
JP1 mode III:

Short circuit between common terminal Y of multifunctional digital output and output voltage 24V,24V voltage difference occur with COM if Y1-1Y2 signal output is effective, applicable to PNP loading type. The signal output is sink current.

JP1 mode IV:

Short circuit between common terminal Y of multifunctional digital output and output voltage COM, 24V voltage difference occur with 24V if Y1-1Y2 signal output is effective, applicable to PNP loading type. The signal output is sourcing current.

modes of jumper of JP2 multifunctional analog input/output terminal



Specification of JP2 mode I:

Analog input AI1 selected 0-10V voltage input mode, then the potentiometer input on the control panel is ineffective. The GND of control terminal TB3 is the common terminal of analog input.

Specification of JP2 mode II:

Analog input AI1 selected the potentiometer input on the control panel, then theterminal AI1 is ineffective.

Specification of JP2 mode III:

Analog AI2 selected 0-10V voltage input mode, then only AI2 can receive current input mode. The GND of control terminal TB3 is the common terminal of analog input.

Specification of JP2 mode IV:

Analog AI2 selected 0/4-20mA current input mode, then the according voltage is 3.3V if the current is 20mA. The GND of control terminal TB3 is the common terminal of analog input.

Specification of JP2 mode V:

Analog output FM selected 0-10V voltage output mode, then the GND of control terminal TB3 is the common terminal of analog output.

Specification of JP2 mode VI:

Analog output FM selected 0/4-20mA current output mode, then the GND of control terminal TB3 is the common terminal of analog output.

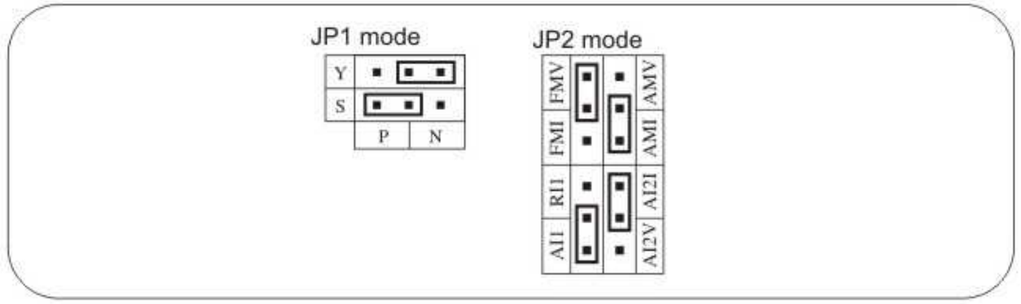
Specification of JP2 mode VII:

Analog output FM selected 0-10V voltage output mode, then the GND of control terminal TB3 is the common terminal of analog output.

Specification of JP2 mode VIII:

Analog output FM selected 0/4-20mA current output mode, then the GND of control terminal Tb3 is the common terminal of analog output.

Factory default mode of the terminal jumper



Short circuit between common S of multifunctional digital input terminal and output voltage of 24V, then the signal input is effective upon the short circuit between S1-S8 and COM;

Short circuit between common Y of multifunctional digital input terminal and output voltage COM, then 24V voltage difference occurs with 24V upon the effective output of signal Y1-Y2;

Analog input AI1 selected 0-10V voltage input mode, then the potentiometer input on the control panel is ineffective;

Analog input AI2 selected 0/4-20mA current input mode, then the according voltage is 3.3V if the current is 20mA;

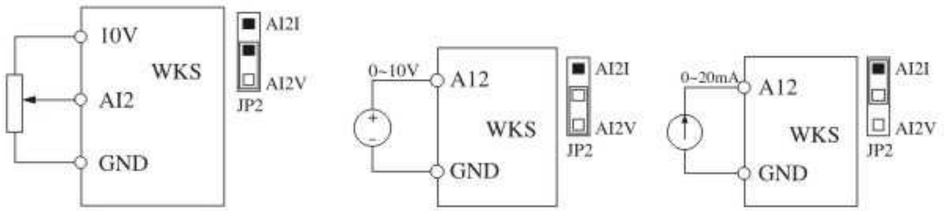
Analog output FM selected 0-10V voltage output mode;

Analog output AM selected 0/4-20mA current output mode.

4.6.4Connection of uniphase 220V 0.4~0.75kW control terminals

Under the three circumstances, connect the potentiometer to analog input terminal, 0-10V and 0-20mA, it can work correctly only with the operation of JP2. See the connection below:

Figure 4-19 Connection of uniphase 0.4~0.75kW control terminals



Short circuit of AI2V of JP2 upon inputting potentiometer signal to external potentiometer

Short circuit of AI2V of JP2 upon inputting analog voltage of 0~10V

Short circuit of AI2I of JP2 upon inputting signal of 0~20mA

he external potentiometer should be>3K and the power >1/4W, 5~10KΩ is recommended.

Note: in the above three analog signal input modes, the signal input of two former ones correspond to 0~10V voltage inside and the latter one corresponds to 0~3.3V voltage.

4.7 Installation instruction complies with requirements of EMC

4.7.1 Common sense of EMC

EMC is the abbreviation of electromagnetic compatibility, referring to that the equipment or system can work in electromagnetic environment and does not interfere any other objects in the environment which have no ability to bear electromagnetic interference. EMC includes two meanings: electromagnetic interference and electromagnetic immunity.

Electromagnetic interference can be divided into two types according to its transmission route: conducted interference and radiated interference.

Conducted interference refers to the interference along with the conductor transmission, so all conductors, such as conducting wire, transmission line, inducer and capacitor, are the transmission route of interference.

Radiated interference refers to the interference in the form of electromagnetic wave and the transport energy is inversely proportional to squared distance.

Radiated interference must satisfy three conditions or three factors at the same time: interference source, transmission route and sensitive receiver. Any one of them is indispensible. EMC problems are mainly solved from the three aspects. For users, due to the unchangeable interference source or receiver, so EMC problems mainly can be solved by transmission route.

EMC capacities of different electric and electronic equipments diversify for the different EMC standard or class they comply to.

4.7.2 EMC features of frequency convertor

Like other electric and electronic equipments, in a power distribution system, the frequency convertor is not only an electromagnetic interference source, but also an electromagnetic receiver. Its operating principle leads certain noise of electromagnetic interference, so the frequency convertor must have the ability of anti electromagnetic interference in its deign in order to ensure that it can work reliably in the environment with certain electromagnetic inference. The frequency convertor has the following EMC features under its operation:

• The input current is non-sinusoidal wave, with rich upper harmonic which may cause electromagnetic interference externally and lower the power factor of power system and increase circuit loss.

• The output voltage is HF-PMW which may cause temperature rise and reduce the service life: increasing the current leakage and leading error action of leakage protection unit in the circuit. In the mean time, it also may cause strong electromagnetic interference externally and influence the reliability of other electric equipments.

• Over-strong external interference may cause error action, even damage of the frequency convertor as the electromagnetic receiver so that influence the normal use.

• In the wiring system, the external interference and self interference immunity of the frequency convertor are complementing each other. Reducing the external interference of the frequency is also a process to improving its anti interference immunity.

4.7.3EMC installation instruction

Combing wit the EMC features of the frequency convertor, in order to make the electric equipments in a system work reliably, this section is going to introduce EMC installation instruction from aspects such as noise suppression, field wiring, grounding, current leakage and use of power filter for reference. Better EMC effect can be reached only if the five aspects are implemented.

4.7.3.1 Noise suppression

The connection of all control terminals of the frequency convertor adopts shielding wires. The shielding layer should be grounded nearby at the entrance of the frequency convertor and the cable clips are used to form 360°. It is forbidden to twist the shielding layer to braid to ground with the frequency convertor, because it may greatly reduce the shielding effect and even lose the shielding effect.

The connection wire between frequency convertor and motor adopts shielding wire or individual duct. The shielding layer of motor cable or one metal casing end of the duct should be grounded nearby with the frequency convertor and the other end connected with motor casing. In the mean time, the installation of noise filter can greatly reduce the electromagnetic noise.

4.7.3.2 Field wiring

Power wiring: indifferent control systems, the power incoming wire adopt stand-alone power supply from the power transformer. Generally 5-fore wire is used, including 3 live wires, 1 zero wire and 1 ground wire. A common wire is forbidden to be used for zero and ground wire.

Equipment types: there are diverse electric equipments such as the frequency convertor, filter, PLC, instrumentation in a control cabinet and its ability to launch electromagnetic noise and bear noise is variable. So it is required to classify these equipments. They are divided into strong noise and sensitive noise equipments. The same type can be installed in one area and others should be over 20cm away.

Wiring in the control cabinet: there are signal (weak current) and power (strong current) wires in the cabinet. To the frequency convertor, the power wire can be divided into incoming and outgoing wire. The signal wire is easy to be interfered by power wire to lead error action. Therefore, the signal and power wires should be distributed in different area and parallel wiring within a short distance (20cm), cross wiring and bunching are forbidden. The angle should be 90°if the signal wire must cross the power wire. Neither the incoming and outgoing wires of the power wire can be crossed or bunched, especially in the site with noise filter., otherwise may couple the electromagnetic noise across the incoming and outgoing wires and capacity.

4.7.3.3 Grounding

The frequency convertor must be grounded reliably in operation. It is not only for personal safety and equipment protection, but also the simplest, most effective and most cost-effective solution for EMC problem, so it the priority to be considered.

Three ways for grounding: special grounding electrode, common grounding electrode or grounding wire series connection. The proper pole should be elected for different control system. Equipments in one control system should adopt common grounding pole to connect, and equipments in the same power supply wire should adopt grounding wire series connection.

4.7.3.4 Leakage current

Leakage current includes the leakage among wires and the leakage to the ground. Its volume is decided by the volume of electric capacity of the system wiring and carrier frequency of the convertor. Leakage to the ground refers to the leakage current flowing by common grounding wire. Not only dose it flow into the frequency convertor, but also it may flow into other equipments by the grounding wire. The leakage current may cause error action of leakage circuit breaker, relay or other equipments. Leakage among wires refers to the leakage current flowing by the electric capacity distributed among wires of input and output of the frequency convertor. The volume of leakage current is related to the carrier frequency, length of motor cable and sectional area of the cable. The higher the carrier frequency is, the longer the motor cable is, the larger sectional area of the cable is, the larger the leakage volume is.

Countermeasure:

Lowering the carrier frequency may reduce the leakage current effectively. The AC reactor or sine-wave filter should be installed on the output side of the frequency convertor if the motor cable is over 50m. And reactors should be installed at intervals of the cable is too long.

4.7.3.5Noise filter

Noise filter plays a good role in electromagnetic decoupling, so it is suggested to install even if the working conditions are satisfied.

There are two types of noise filter:

• Installing the noise filter on the output side of the frequency convertor to isolate it from other equipments.

• Installing the noise filter or isolating transformer on the input side of other equipments to isolate them from the frequency convertor.

4.7.4Based on the installing and wiring requirements in the manual, the following conditions should be satisfied upon the installation of the frequency convertor and EMI filter:

• En6 1000-6-4: Electromagnetic Interference Detection of Products in Industrial Environment;

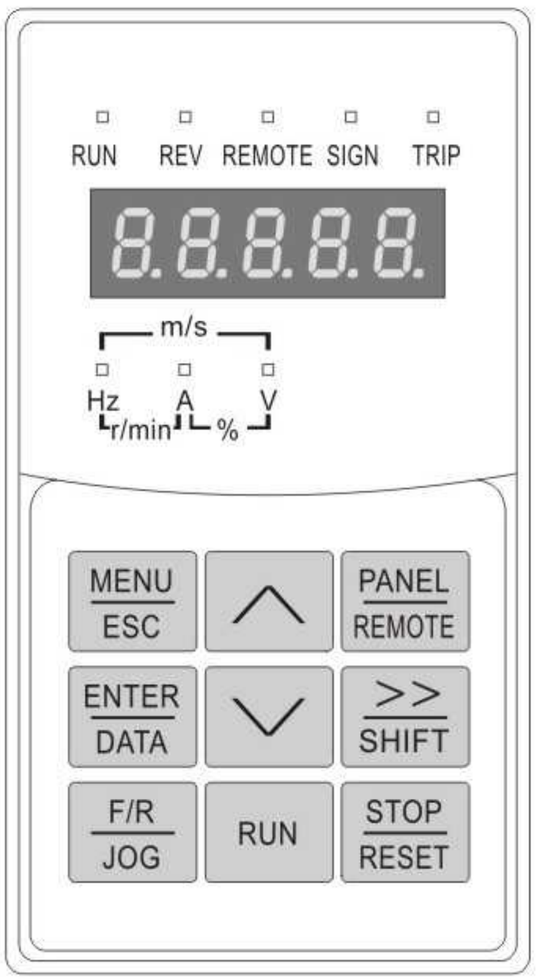
• En6 1800-3: satisfy En6 1800-3 Electromagnetic Interference Standard (II environment) . EMC filter may comply to EN6 1000—6-3 Electromagnetic Interference Standard (residential environment) and EN6 1000-6-4 Electromagnetic Interference Standard (Industrial environment).

5.Operation

5.1 Description of operational panel

5.1.1 Panel diagram

Figure 5-1 Operation panel diagram



5.1.2 Keyboard function

Keys	Designation	Function
MENU / ESC	Programming key	Enter or exit the primary menu, shortcut key to delete parameter
ENTER / DATA	OK key	Enter the menu gradually, confirm the parameter set
∧	UP key	Increase of data or functional code
∨	DOWN key	Reduce of data or functional code
>> / SHIFT	Shift key	Elect the display parameters circularly on the stop interface and operation interface; the modified bit can be elected upon modifying the parameters
RUN	Run key	Used to be run the operation under keyboard operation mode
STOP / RESET	Stop/reset key	Under operation, the key can be used to stop the operation and limited by functional code H7.04; under error alarming mode, it can be used to reset the error and not limited by functional code H7.04
F/R / JOG	Shortcut multifunctional key	The function of the key is defined by functional code H7.03: 0: inch move, inch move key, the direction is decided by H0.10 1: forwardand reversal shift, forwardand reversal shift key 2: cancel UP/DOWN set. Cancel the frequency value set by UP/DOWN
RUN + STOP / RESET	Combination	Press Run key and STOP/RESET key simultaneously, then the frequency convertor stops

5.1.3 Instruction of indicator light

1) Instruction of functional indicator light

Light designation	Instruction of the light
RUN	Under operation indicator light: The frequency convertor is down when it is off; the frequency convertor is under parameter self-studying mode if it is flashing; the frequency convertor is under operation if it is on.
REV	Forwardand reversal indicator light: It is under normal operation if the light is off; it is under reversal mode.
REMOTE	Control mode indicator light: It is under keyboard control mode if the light is off; it is under terminal control mode if the light is flashing; it is under remote control mode if the light is on.
SIGN	Indicator light of system operation:
TRIP	Error indicator light: It is under normal operation mode if the light is off; it is under overload alarming mode if the light is flashing; it is under error mode if the light is on.

2) Instruction of the unit of indicator light:

Symbol	Description
Hz	Unit of frequency
A	Unit of current
V	Unit of voltage
r/min	Unit of rotation speed
%	Percentage
m/s	Unit of linear speed

3) Digital display area:

5-bit LED display: display all monitoring data such as the set frequency, output frequency, and alarming code.

5.2 Operation flow

5.2.1 Parameter setting

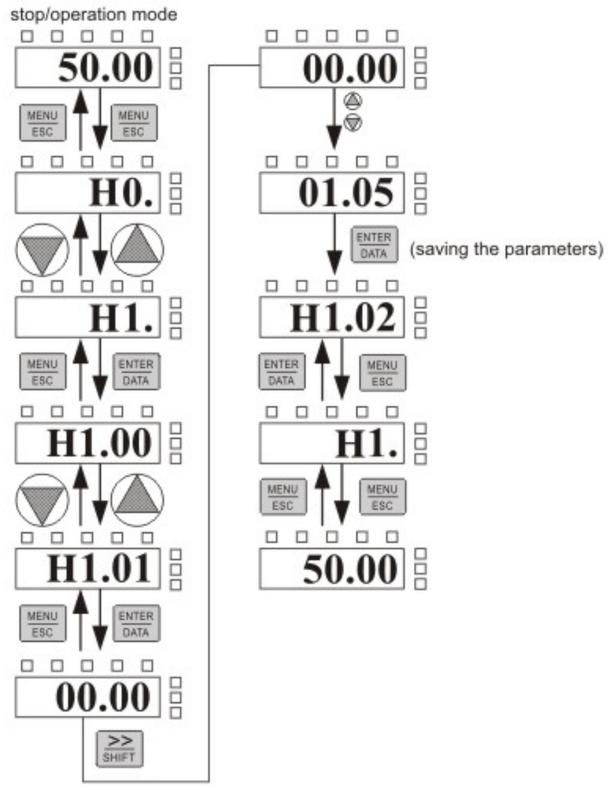
Three-level menus are:

1、Functional code group number (primary menu)
2、Functional code mark number (secondary menu)
3、Functional code setting value (third-level menu)

Description: you may back to secondary menu by pressing MENU ESC and ENTER DATA key when you are under third-level menu. The difference is: when you ENTER DATA press key, the parameter setting is saved into the control panel and then back to the secondary menu and step into next functional code automatically; when you press MENU ESC key, you will back to the secondary menu directly and do not save the parameters, and remain at the current functional code.

Model: change and set the functional code H1.01 from 00.00Hz to 01.05Hz.

Figure 5-2 Operation flow of third-level menu



Under the third-level menu mode, if there is no flashing at the parameter, it means the functional code can not be changed, and it may have the flowing reasons:

1) The functional code is unchangeable, such as real monitoring parameter, operation record, etc.
2) The functional code can not be changed under operation mode and can be changed under stop mode.

5.2.2Error reset

The error information will be displayed once the frequency convertor has any error. The user can reset the error by STOP RESET key or terminal function (H5 group). The frequency convertor is under standby mode after the reset. If the frequency convertor is under error mode and the user did not reset, the frequency convertor is under operation protection mode and can not run.

5.2.3 Parameter copy

After the access of LCD keyboard, it can copy functional parameters. This function can make the parameters setting of multiple frequency convertors keep consistent. So you just need to set one of tem if common setting is necessary, and then upload it, next, download the functional parameters in other frequency convertors. It is simple to complete.

5.2.4 Motor parameter self-studying

When non-PG vector control mode is elected, the nameplate parameters must be input accurately so that the frequency convertor will match standard motor parameters according to the nameplate parameters. You are suggested to perform the motor parameters self-studying in order to obtain excellent control performance. The procedure is:

First select the operation route (H0.01) at keyboard instruction route.
Then input the following motor parameters:
H2.01: rated power of the motor
H2.02: rated frequency of the motor
H2.03: rated speed of motor
H2.04: rated voltage of the motor
H2.05: rated current of the motor

Under self-studying mode, the keyboard displays “step1, step2”. The self-studying is finished if the keyboard displays “over”.

Note: under self-studying mode, the motor should be separated from load, otherwise, the parameters you obtain by self-studying may be incorrect.

5.2.5 Password setting

This series of frequency convertors have the function of password protection. If H7.00 is nonzero, it is the user password, and then exit the functional code editing mode , the password production takes effect. When you enter functional code editing mode by pressing MENU/ESC key, it displays “0.0.0.0.0”. The operator must input the correct user password, otherwise you can not enter.

If you want to cancel password protection function, set H7.00 at 0. The user password has no protection function to the parameter setting in the shortcut menu.

The password protection takes effect 1 min after you exit functional code editing mode. Once the password takes effect, press MENU/ESC key to enter functional code editing mode, it displays “0.0.0.0.0”. Then the operator must input the correct password, otherwise you can not enter.

5.3 Operation mode

5.3.1 Power on initialization

Under the power on process, the system starts initializing and LED displays “8.8.8.8.8” and all 7 lights are on. Then the frequency convertor is in standby mode after its initialization.

5.3.2 Standby mode

It may display multiple mode parameters under stop or operation mode. You may select whether to display the parameter according to binary system by functional code H7.06 (operational parameters), H7.07 (stop parameter).

Under stop mode , there are 9 parameters for you to select whether to display: the frequency, bus voltage, switching value input mode, open collector output mode, PID setting, PID feedback, analog input AI1 voltage, analog input AI2 voltage, multi-speed phases, torque value setting. You may select whether to display by functional code H7.07 (transform I nto binary system), press >>/SHIFT to shift the selected parameter orderly, and press ENTER/DATA + F/R/JOG key to shift the selected parameter towards left.

5.3.3 Motor parameter self-studying

Please refer to detail instruction of functional code H0.12.

5.3.4 Operation

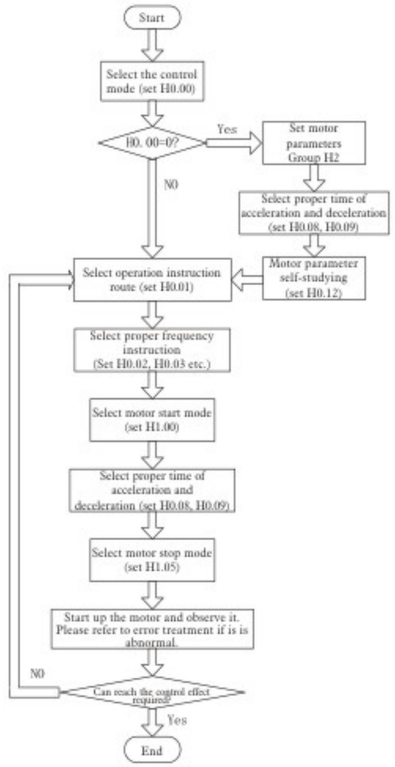
Under operation mode, there are 40 mode parameters for option whether to display or not: running frequency, set frequency, bus voltage, output voltage, output current, output speed, output power, output torque, PID setting, PID feedback, switching value input mode, open collector output mode, analog input AI1 voltage,analog input AI2 voltage, multi-speed phases, torque value setting. You may select whether to display by functional code H7.06 (transform into binary system), press >>/SHIFT to shift the selected parameter orderly, and press ENTER/DATA + F/R/JOG key to shift the selected parameter towards left.

5.3.5 Error

The series of frequency convertor provide information of kinds of errors. Please refer to vector common frequency convertor errors and countermeasures.

5.4 Rapid debugging

Figure 5-6 Flow chart of rapid debugging



6. Description of detail functions

H0Group Basic functions

Functional code	Designation	Setting scope
H0.00	Speed control mode	0~2【0/1】

Select the running mode of frequency convertor.

0: non-PG vector control

Refers to open loop vector. It is applicable to high-performance common occasion without encoder PG. A frequency convertor only can drive a motor, such as a machine tool, centrifuger, wire-drawing machine, injection machine etc. with load.

1: V/F control

It is applicable to occasion with no requirements of higher precision, such as blower and bump with load and can be used in occasion that a frequency convertor drives multiple motors.

2: Torque control (non-PG vector control)

It is applicable to occasion with no requirements of higher precision, such as wire-wound and wire-drawing. Under torque control mode, the speed of motor is decided by the load and the fast or slow acceleration or deceleration is not decided by the time of acceleration and deceleration of the frequency convertor.

Prompt: the motor self-studying must be performed before select the vector control mode. Only if the correct parameters you get, the advantages of the vector control mode can be shown and more excellent performance you will get by adjusting the parameter (H3 Group) of speed regulator.

Functional code	Designation	Setting scope
H0.01	Running instruction route	0~2【0】

Control instruction route of the frequency convertor.

The frequency convertor includes control commands such as start-up, stop, forward, reversal, inching move and error reset.

0: keyboard instruction route (“REMOTE” indicator light is off) ;

Run the control command by RUN, STOP/RESET on the keyboard. If the multifunctional key F/R/JOG is set as FWD/REV shift (H7.03 is 1), it can be used to change the running direction.

Under operation mode, press RUN + STOP/RESET simultaneously, the frequency convertor will stop.

1.Terminal instruction route (“REMOTE” indicator light is on);

Run the control commands such as corotation, reversal, normal inching move, reversal inching move by multifunctional terminals.

2. Communication command route (“REMOTE” indicator light is red):

Run the command by the communication mode of host computer.

Functional code	Designation	Setting scope
H0.02	Keyboard and terminal UP/DOWN setting	0~3【0】

Set the frequency by ∧ / ∨ or UP/DOWN (increase or reduce). This function has high permission and can be combined with other frequency setting routes. It is mainly used to adjust the output power of the frequency convertor during the debugging.

0: valid, and the system saves upon power fail. And the system can save the frequency setting value upon power fail. It will combine with the current frequency automatically after the next power-on.

1: valid, and the system does not save upon power fail. The frequency command can be set, but it can not be saved upon power off.

2: null, the system automatically becomes zero and ∧ / ∨ or UP/DOWN are invalid.

3: under operation mode, ∧ / ∨ or UP/DOWN are valid, while the setting of ∧/∨ or UP/DOWN becomes zero under stop mode.

Note: after the user restores the default setting of the frequency convertor, the frequency value set by keyboard and UP/DOWN become zero automatically.

Functional code	Designation	Setting scope
H0.03	Frequency command option	0~6【0】

Select Frequency A input route of the frequency convertor. 7 specified frequency routes are given:

0: keyboard setting

Modify the value of functional code H0.07 “keyboard setting frequency” to set the keyboard setting frequency.

1.The analog quantity AI1 setting (Single-phase 220V0.4-0.75KW is corresponding to the potentiometer of the local mode keyboard, if used the outer 485 communication keyboard, then which is corresponding to the potentiometer on 485 communication keyboard, the function of the local mode potentiometerthe will be automatic ineffective)

2: Analog AI2 setting

3: Analog AI1+AI2 setting

The frequency can be set by analog input terminal. The series of frequency convertors provide 2 analog input terminals as the standard parts. AI1 is 0~10V voltage input and AI2 is 0~10V/0 (4) ~20mA input. The two terminals can be shifted by JP2.

Note: when Analog AI2 selects 0~20mA input, the according voltage of 20mA is 3.3V.

100%analog input setting is corresponding to max frequency(H0.04),-100%is corresponding to the reversal max frequency.

4. Multi-speed running setting

The frequency convertor runs in multi-speed mode if you select this frequency setting mode. It is required to set the parameters of "multi-speed control group" of H5 and HA group to define the relation between the given percentage and the given frequency.

5. PID control setting

The frequency convertor runs in PID control mode if you select this parameter. Then, it is required to set "PID control group" of H9 group. The operation frequency of the convertor is the frequency value after the effect of PID. Please refer to the introduction of "PID Functions" of H9 Group to know the meaning of the given source, given proportion and feedback source.

6. Remote communication setting

The frequency command is given by the upper computer by communication mode. Please refer to 11 Protocol.

Functional code	Designation	Setting scope
H0.04	Max output frequency	H0.05~600.00【50.00Hz】

It is used to set the max output frequency of the frequency convertor. It is the foundation to set the frequency and speed of acceleration or deceleration. Please note.

Functional code	Designation	Setting scope
H0.05	Upper limit of the operation frequency	H0.06~H0.04【50.00Hz】

t is the upper limit of the output frequency value of the convertor. The value should be less or equivalent to the max output frequency.

Functional code	Designation	Setting scope
H0.06	Lower limit of the operation frequency	0.00~H0.05【0.00Hz】

It is the lower limit of the output frequency of the convertor.

It runs on lower limit frequency if the frequency you set is lower than the lower limit value.

Max output frequency ⩾ upper limit ⩾ lower limit

Functional code	Designation	Setting scope
H0.07	Keyboard setting frequency	0.00Hz~H0.04【50.00Hz】

The functional code is the initial value of the frequency convertor if you select the "keyboard setting".

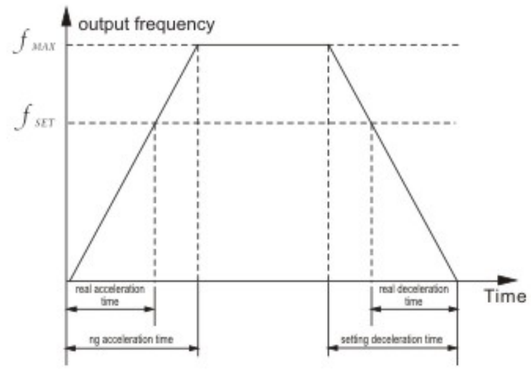
Functional code	Designation	Setting scope
H0.08	Acceleration time 1	0.1~3600.0【model setting】
H0.09	Deceleration time 1	0.1~3600.0【model setting】

Acceleration time refers to the required time t1used to accelerate from 0Hz to the max output frequency (H0.04).

Deceleration time refers to the required time t2 used to decelerate from the max output frequency (H0.04) to 0Hz.

See the figure below:

Figure 6-1 Diagram of acceleration and deceleration time



If the setting frequency= max frequency, real acceleration and deceleration time is consistent with the setting value.

If the setting frequency < max frequency, real acceleration and deceleration time is consistent with the setting value.

Real acceleration and deceleration time= setting acceleration and deceleration time X (setting frequency/ max frequency)

The series of frequency convertors has two groups of acceleration and deceleration time:

Group I : H0.08, H0.09

Group II: H8.00, H8.01.

The acceleration and deceleration time can be selected by combinations acceleration and deceleration time option terminals among the multifunctional digital input terminals.

Functional code	Designation	Setting scope
H0.10	Direction option	0~2【0】

0: default direction. The frequency convertor runs in the real direction as it is power-on.

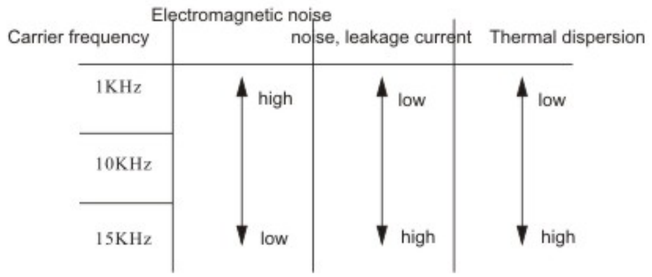
1: in reverse direction. It is used to change the change direction of the motor and with the same principle that change the direction of the motor by adjusting any two lead-in wires.

Note: the direction of the motor will back to its original mode after its initialization. It is forbidden to change the direction of the motor after the debugging, which should be cautious.

2: reversal is forbidden. It is forbidden to run in reversal and should be used in specific occasion where reversal is forbidden.

Functional code	Designation	Setting scope
H0.11	Carrier frequency setting	0.5~15.0【机型设定】

Figure 6-2 Effect of carrier frequency on environment



Relationship between model and carrier frequency

Model	Max	Min	Factory value
1.5~11kW	15	0.5	8kHz
15~55kW	8	0.5	4kHz
15~185kW	6	0.5	2kHz
200~315kW	6	0.5	1kHz

Advantage of high carrier frequency: the current wave is ideal with less harmonics and small motor noise.

Disadvantage of high carrier frequency: larger switch loss, larger temperature rise, the output capacity of the frequency convertor is influenced and it should be derated with high carrier frequency; in the mean time, the leakage current increases and the external electromagnetic interference is reinforced.

It is opposite with the above situation if you adopt low carrier frequency and lower carrier frequency will cause unstable operation with low frequency. The torque lowers and even oscillationoccurs.

The carrier frequency of the frequency convertor has been set properly before leaving the factory. In general, the user needs not modify the parameter.

The frequency convertor must be derated of you use the carrier frequency over the default. Derate 20% as you increase 1K carrier frequency.

Functional code	Designation	Setting scope
H0.12	Motor parameter self-studying	0~2【0】

0: no operation.

1: rotation parameter self-studying

You must input the correct nameplate parameter of the motor (H2.01~H2.05) and isolate the load to make the motor static an unloading before the parameter self-studying, otherwise the result may be inaccurate.

Prior to the parameter self-studying, you should set the acceleration and deceleration time (H0.08, H0.09) properly base don the inertia of the motor, otherwise over-current or over-voltage may occur during the self-studying process.

Set H0.12 to 1 and press [ENTER DATA] ,then the motor starts the parameter self-studying, with the LED displaying “start” and flashing. Next, press [RUN] to start-up, then it displays “step.0” and the motor stars to run as it displays “step.1”, with the “RUN” light flashing. As self-studying ends, it displays “over”. At last it backs to the stop mode interface. Press [MENU ESC] and exit from parameter self-studying mode when the “start” flashing.

You may press [STOP RESET] to stop the operation during self-studying process.

Note: you only can control the start-up or stop of self-studying by keyboard; then the functional code recovers to zero after the self-studying.

2. Static parameter self-studying

It is unnecessary to isolate the load from the motor during the static parameter self-studying. Prior to the parameter self-studying, you must input he correct nameplate parameter (H2.01~H2.05). After the self-studying, it can detect the stator resistance, rotor resistance and the leakage inductance of motor, while it can not detect the mutual inductance of the motor and non-load current. The user may input the corresponding values based on your experience.

Functional code	Designation	Setting scope
H0.13	Functional parameter recovery	0~2【0】

0:no operation
1: the frequency convertor recovers all the parameters to their default values.
2:Recent troubleshooting archives of transducer
Note: the functional code becomes 0 as the operation completed; the recovery of default values will not recover the parameter in H2 Group.

Functional code	Designation	Setting scope
H0.14	AVR function option	0~2【0】

AVR Function is the automatic adjusting function of output voltage. When AVR function is null, the output voltage varies with the change of input voltage (or DC bus voltage); when AVR function is valid, the output voltage does not vary with the change of input voltage (or DC bus voltage) and is basically constant within the scope of its capacity.

Note: when the motor decelerates and stop, AVR function will be stopped automatically and no over-voltage occurs.

H1Group On-off control group

Functional code	Designation	Setting scope
H1.00	Start the operation mod	0~2【0】

0:start directly: start from the starting frequency.
1: DC braking first and then start: DC braking according to the mode set in H1.03 and H1.04, and then start from the starting frequency. It is applicable to occasion where reversal may occur as it starts with small inertia load.

Functional code	Designation	Setting scope
H1.01	Start the starting frequency directly	0.00~10.00Hz【0.5Hz】
H1.02	Start the frequency holding time	0.0~50.00S 【0.0S】

The frequency convertor starts from the starting frequency (H1.01) and accelerates to the target frequency within the setting acceleration time after starting frequency holding time (H1.02). If the target frequency is less than starting frequency, the frequency convertor will be in standby mode. The starting frequency is not limited by lower limit frequency.

Functional code	Designation	Setting scope
H1.03	Braking current prior to the start	0.0~150.0%【0.0%】
H1.04	Braking time prior to the start	0.0~50.0s【0.0s】

The increased DC current is the percentage of rated current of the frequency convertor when DC braking is performed prior to the H1.03 start. H1.04 DC current holding time, If set the DC braking time at 0, DC braking is invalid. The larger DC braking current is, the large the braking force is.

Functional code	Designation	Setting scope
H1.05	Stop mode option	0~1【0】

0:ecelerate to stop
As the stop command takes effect, the frequency convertor decelerates and lowers the output powe rbased on the specified deceleration time until the power is 0 and the equipments stops.
1: free stop
As the stop command takes effect, the frequency convertor stops immediately and the load stops in its mechanical inertia.

Functional code	Designation	Setting scope
H1.06	Initial frequency of braking	0.00 ~ H0.04【0.00Hz】(max frequency)
H1.07	Holding time of braking	0.0~50.0s【0.0s】
H1.08	DC braking current of stop	0.0~150.0%【0.0%】
H1.09	DC braking time of stop	0.0~50.0s【0.0s】

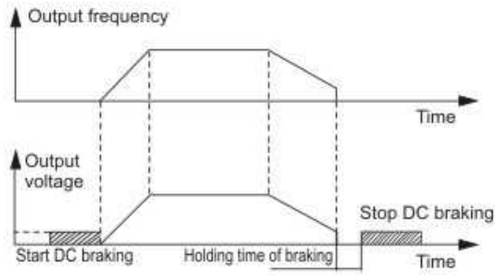
Initial frequency of braking: during the deceleration and stop, as it is up to the frequency, the equipments stops and DC brakes. The initial frequency is 0 and DC braking is invalid. The frequency convertor stops at the deceleration time set previously.

Holding time of braking: prior to DC braking, the frequency convertor locks the output and starts DC braking after the holding time in order to avoid over-current error caused by higher speed at the beginning of the DC braking.

DC braking current of stop: refers to the additional DC braking volume. The higher the value s, the larger the torque is.

DC braking time of stop: duration of DC braking volume.

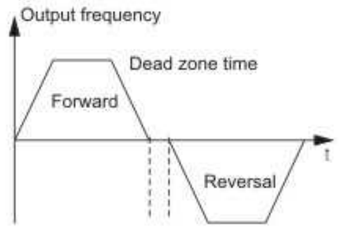
Figure 6-3 Diagram of DC braking



Functional code	Designation	Setting scope
H1.10	Forwardand reversal time in dead zone	0.0~3600.0【0.0s】

During setting the transition of forwardand reversal of the frequency convertor, see the transition time of 0 output frequency in the figure below:

Figure 6-4 Diagram of forwardand reversal time in dead zone



Functional code	Designation	Setting scope
H1.11	Terminal function testing option at power-on	0~1【0】

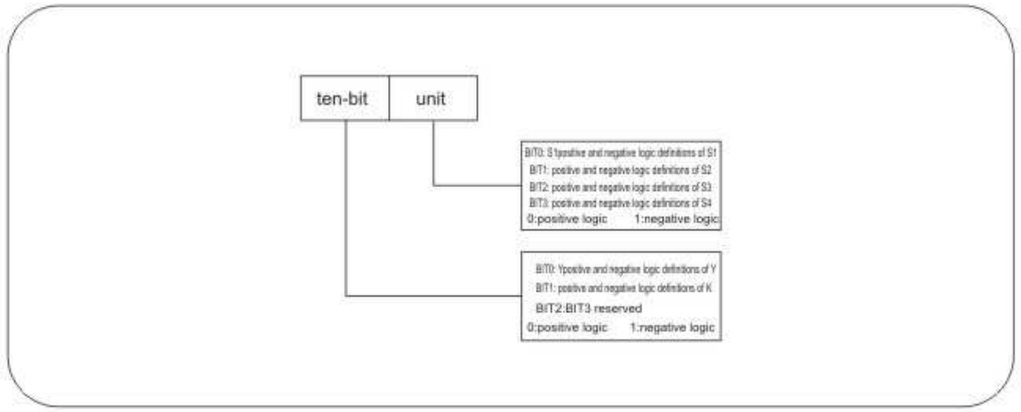
If the running instruction route is controlled by terminals, the system detects the status of the terminals automatically during the power-on process of the frequency convertor.

0: the terminal command is invalid during power-on process. Even if it is detected that the terminal command is valid in this process, the frequency convertor can not run and under protection mode until cancel the terminal command and the restart the terminal, then the frequency convertor runs.

1: the terminal command is invalid during power-on process. If it is detected that the terminal command is valid, the system will start the frequency convertor after the initialization.

Note: the users must select the function prudently otherwise may cause serious result.

Functional code	Designation	Setting scope
H1.12	Option of input/output pole	0x00~0x3F【0x00】



The functional code defines the positive and negative logic of terminals.

Positive logic: terminals such as SI and common terminal is valid upon connection, while invalid upon disconnection;

Negative logic: terminals such as SI and common terminal is invalid upon connection,while valid upon disconnection.

If S1~S4 are positive logics, Y is positive logic, K is negative logic, see the setting below:

The logic state of S1~S4 is 0000, with the corresponding HEX 0 and the LED displays 0 in unit; the logic state of K and Y is 0010, with the corresponding HEX2 and the LED displays 2 in tens-bit; then set the functional code H1.12 to 20.

H2 Group motor parameter group

Functional code	Designation	Setting scope
H2.00	Model option	0~1【0】

0:applicable to constant torque load at specified rated parameters

1: applicable to variable torque load at rated parameters (blower and pump with load)

Note: the users can set the parameters in this group to change the model to achieve G/P integration. Only model G is available for 220V frequency convertor.

Functional code	Designation	Setting scope
H2.01	Rated current of the motor	0.4~900.0kW【model setting】
H2.02	Rated frequency of the motor	0.01~H0.04【50.00Hz】
H2.03	Rated speed of the moto	1~36000rpm【1460rpm】
H2.04	Rated voltage of the moto	0~460V【380V】
H2.05	Rated power of the motor	0.1~2000.0A【model setting】

Note: please set according to the nameplate on the motor. The excellent control performance of vector control needs accurate parameters.

Frequency convert provides parameter self-learning function.accurate parameter self-learning is the result of correct input of motor nameplate parameter.

Please ensure that the power of the frequency convertor matches with power of the motor in order to guarantee the control performance. If the disparity is large, the control performance of the frequency convertor reduced obviously.

Note: if you reset the rated power of the motor (H2.01), the parameters H2.06~H2.10 of the motor will be initialized.

Functional code	Designation	Setting scope
H2.06	Stator resistance of the motor	0.001~65.535Ω【model setting】
H2.07	Rotor resistance of the motor	0.001~65.535Ω【model setting】
H2.08	Stator, rotor inductance of the motor	0.1~6553.5mH【model setting】
H2.09	Stator, rotor mutual inductance of the motor	0.1~6553.5mH【model setting】
H2.10	No load current of the motor	0.01~655.35A【model setting】

After the normal end of motor parameter self-studying, the setting values of H2.06~H2.10 will update automatically. These parameters are the reference parameters of high-performance vector control and can bring direct effect on the control performance.

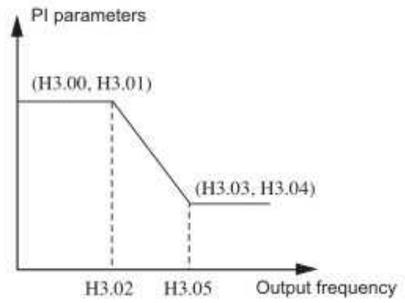
Note: it is recommended that users not to change the parameters in this group.

H3 Group vector control parameters

Functional code	Designation	Setting scope
H3.00	Speed cycle proportion gain	0~100【20】
H3.01	Speed integral time 1	0.01~10.00s【0.50s】
H3.02	Shifting low frequency	0.00~H3.05【5.00Hz】
H3.03	Speed cycle proportion gain	0~100【15】
H3.04	Speed integral time 2	0.01~10.00s【1.00s】
H3.05	Shifting high frequency	H3.02~H0.07【10.00Hz】

The above parameters are only applicable to vector control mode. Under shifting frequency 1 (H3.02), the speed cycle PI parameter is: H3.00 and H3.01. If the shifting frequency is over 2 (H3.05), the speed cycle PI parameter is: H3.03 and H3.04. And between them, PI parameters are obtained from the linear change of the two groups, see the figure below:

Figure 6-5 Diagram of PI parameters



The speed cycle dynamic response characteristics of the vector control can be adjusted by setting the proportion coefficient and integral time of the speed regulator. The dynamic response of speed cycle can be speeded up either by the increase of proportion gain or reducing of the integral time, but it is easy to cause system oscillationand over-strike either by higher proportion gain or less integral time. Smaller proportion gain is also easy to cause stable oscillationin the system and speed static error may occur.

Speed cycle PI parameters has a lot to do with the inertia of the system, so adjust it to satisfy kinds of demands based on the default PI parameters to different load characteristics.

Functional code	Designation	Setting scope
H3.06	VC slip compensation factor	50%~200%【100%】

The slip compensation factor is used to adjust the slip frequency of the vector control and improve the speed control precision of the system, so proper adjustment of the parameter can control the speed static error effectively.

Functional code	Designation	Setting scope
H3.07	Upper limit of torque setting	0.0~200.0%【150.0%】

Set that 100% is corresponding to the rated output current.

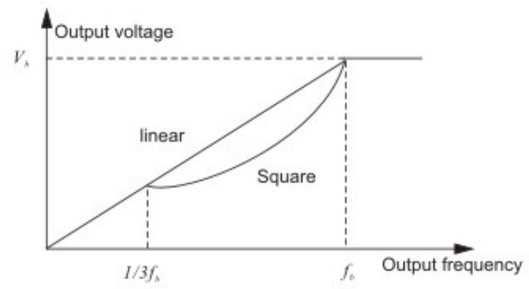
H4 Group V/F control parameter

This group of functional codes are effect to V/F control (H0.001=1).

Functional code	Designation	Setting scope
H4.00	V/F curve setting	0~1【0】

0: linear V/F curve, is applicable to common torque with constant load.
1: 2.0-th power V/F curve, is applicable to centrifugal load of blower, pump, etc.

Figure 6-6 Diagram of V/F curve



Functional code	Designation	Setting scope
H4.01	Torque hoist	0.0~10.0%【1.0%】
H4.02	Cut-off point of torque hoist	0.0~50.0%【20.0%】

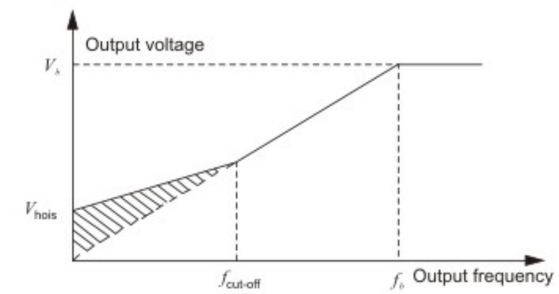
The torque hoist is mainly applicable to frequency under the cut-off value H4.02. See the V/F curve after the hoist in the figure below. Torque hoist can improve the low frequency characteristics of V/F.

Select proper torque in accordance with the load. Large load may increase the hoist, but should not be overlarge, otherwise, the motor will run in over excitation. The larger the output current of the frequency convertor,the larger the motor heating is and the lower the efficiency is.

The frequency convertor hoists the torque automatically if you set the torque hoist at 0.0%.

The cut-off point of torque hoist: the torque hoist is effective under this point andineffective if over the value.

Figure 6-7 Diagram of manual torque hoist



Functional code	Designation	Setting scope
H4.03	V/F slip compensation limit	0.00~10.00Hz【0.00Hz】

Setting this parameter can compensate the speed change caused by load under V/F control to improve the hardness of the mechanical characteristics of the motor. The value should be set as the rated slip frequency of the motor, see the formula below to calculate the rated slip frequency:

H4.03=fb -*p/60

Where fb is the rated frequency of the motor, with the functional code is H2.01; n is the rated speed of the motor with the functional code of H2.02; p is the number of pole-pairs.

Functional code	Designation	Setting scope
H4.04	Energy-saving operation option	0~1【0】

During the operation with no load or light load, you may adjust the output voltage properly by detecting the load current to save the energy.

Note: the function is especially effective to blower and pump with load.

H5 Group Input terminal group

The series of frequency convertors have 8 multifunctional digital input terminals and 2 analog input terminals in the standard units.

Functional code	Designation	Setting scope
H5.00	Function of S1	0～25【12】
H5.01	Function of S2	0～25【13】
H5.02	Function of S3	0～25【14】
H5.03	Function of S4	0～25【1】
H5.04	Function of S5	0～25【2】
H5.05	Function of S6	0～25【7】
H5.06	Function of S7	0～25【4】
H5.07	Function of S8	0～25【5】

The parameters are used to set the functions of these multifunctional input terminals.

0: null.

1: FWD

2: REV

The operation command of the frequency convertor is given by the above terminals when the operation instruction route is terminal control.

3: Three-wire operation control

Please refer to Introduction of H5.09 Three-wire Functional code about three-wire control input terminals.

4. Forward inching

5. Reversal inching

Please refer to the instruction of H8.02~H8.04 to see the specific inching frequency and acceleration and deceleration time.

6. Free stop

As the command takes effect, the frequency convertor blocks output immediately and the stop process of motor is not controlled by the frequency convertor.It is recommended to adopt this mode for super inertia load and without requirements to stop time. The mode has the same meaning with free stop described in H1.05.

7. Error reset

External error reset is applicable to remote error reset and has the same function with STOP/RESET on the keyboard.

8. External error input

The frequency convertor reports the external error (Eto. E) and stops since the signal takes effect.

9. Increase the frequency (UP)

10. Reduce the frequency (DOWN)

11: Clear the increase and reducing setting

The above three functions are mainly used to modify the given frequency by external terminals. UP is the increasing command and DOWN is the reducing command. And the clearing function is used to clear up the clear the frequency value set by UP/DOWN so that to recover the given frequency to the specified frequency given by the frequency instruction route.

12, 13, 14: multi-speed terminals 1~3

8-level speed can be set by the combination of the three terminals.

Note: 1 is the lower level and 3 is the higher level among the multi-speed terminals.

Multi-speed 3	Multi-speed 2	Multi-speed 1
BIT2	BIT1	BIT0

15: Terminal of acceleration and deceleration time

Select acceleration and deceleration time group through the state of this terminal:

Termina	Acceleration and deceleration time	Parameters
OFF	Acceleration and deceleration time 0	H0.08、H0.09
ON	Acceleration and deceleration time 1	H8.00、H8.01

16: PID control the pause

The frequency convertor remains the current frequency output if PID is invalid temporarily.

17: Wobble frequency pause

The frequency converter proceeds to run at the current frequency after its pause at the current output and the cancellation of this function.

18: Wobble frequency reset

The setting frequency of the convertor backs to the center frequency.

19: Acceleration and deceleration forbidden

To ensure that the frequency convertor not be influenced by external signal (except the stop command) and remains the current output frequency.

20: torque control forbidden

The frequency convertor shifts from torque control mode to speed control mode.

21: The frequency change setting is cleared temporarily and the frequency set by UP/DOWN can be cleared when the terminal is closed, it recovers the given frequency to the specified frequency given by the frequency instruction route. When the terminal is off,it backs to the frequency set by UP/DOWN.

22: DC braking of stop

During the deceleration and stopping of the frequency convertor, the frequency convertor will starts DC braking immediately when the terminal is closed. The braking state is decided by H1.07~H1.09.

23~25: reservation

Functional code	Designation	Setting scope
H5.08	Filtering number of switching value	0~10【5】

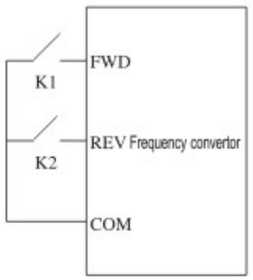
Set the filtering time of S1~S8. the parameter should be increased to avoid error action under severe interference.

Functional code	Designation	Setting scope
H5.09	Terminal control mode	0~3【0】

The parameter defined four modes of the frequency convertor controlled by external terminals.

0: two-wire control and integration of enabling and direction. The model is the most common two-wire mode and the forward and reversal of the motor are decided by FWD and REV terminals.

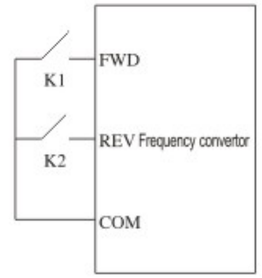
Figure 6-8 Two-wire control (integration of enabling and direction)



K1	K2	Run command
OFF	OFF	Stop
ON	OFF	Forward run
OFF	ON	Reversal run
ON	ON	Stop

1: Two-wire control and separation of enabling and direction. FWD defined by this mode is enabling terminal and the direction is defined by REV state.

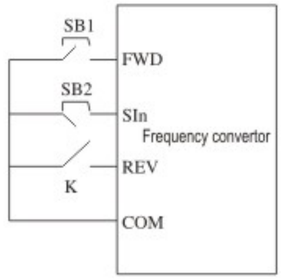
Figure 6-9 Two-wire control (separation of enabling and direction)



K1	K2	Run command
OFF	OFF	Stop
ON	OFF	Forward run
OFF	ON	Reversal run
ON	ON	Stop

2: Three-wire control 1. The mode SIn is the enabling terminal and run command is from FWD, while the direction is controlled by REV. SIn is normal closed input.

Figure 6-10 Three-wire control mode 1



K	Run command
OFF	Forward run
ON	Reversal run

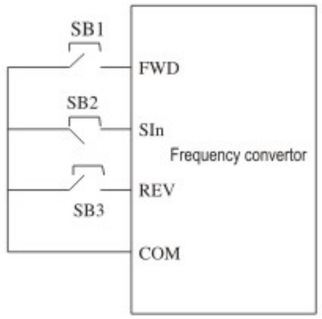
Where K：FRW and REV switch SB1: Run key

Sb2: stop key

SIn is the multifunctional input terminal of “three-wire run control”, Function 3.

3: Three-wire control 2. SIn under this mode is the enabling terminal and the run command is from SB1 or Sb3, and the two terminals control the run direction simultaneously. Stop command is from the normal input Sb2.

Figure 6-11 Three-wire control mode 2



Where SB1: FRW key SB2: stop key SB3: REV key

Prompt: under two-wire run mode, when FWD/REV is effective, if the stop command is from other sources and the frequency convertor stops, the frequency convertor can not run after cancel the stop command even if the FWD/REV is still effective. FWD/REV needs to be activated again if you want to restart the frequency convertor.

Functional code	Designation	Setting scope
H5.10	UP/DOWN change rate of frequency	0.01~50.00【0.50 Hz/s】

Change rate the frequency set by UP/DOWN terminal.

Functional code	Designation	Setting scope
H5.11	Lower limit value of AI1	0.00～10.00【0.00V】
H5.12	Corresponding setting of lower limit value of AI1	-100.0～100.0【0.0%】
H5.13	Upper limit of AI1	0.00～10.00【10.00V】
H5.14	Corresponding setting of upper limit value of AI1	-100.0～100.0【100.0%】
H5.15	Input filtering time of Ai1	0.00～10.00【0.10s】

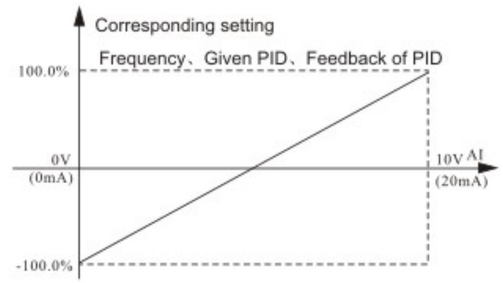
The above functional code defines the relationship between analog input voltage and its corresponding setting value.When the analog input voltage is over the max input or mini input scope you set, the extra will be counted into the max or mini input.

If the analog current is the input current, 0mA~20mA is corresponding to 0V~3.3 V.

In different occasions, the corresponding nominal value diversifies. Please refer to the instruction of each application part.

The following diagrams indicated several setting occasions:

Figure 6-12 Corresponding relationship between analog given value and setting value



Ai1 input filtering time: adjusting the sensitivity of analog input. Proper increasing the value can reinforce the anti-inference of the analog value, but reduce the sensitivity of the analog input.

Functional code	Designation	Setting scope
H5.16	Lower limit of AI2	0.00～10.00【0.00V】
H5.17	Corresponding setting of lower limit of AI2	-100.0～100.0【0.0%】
H5.18	Upper limit of AI2	0.00～10.00【10.00V】
H5.19	Corresponding setting of upper limit of AI2	-100.0～100.0【100.0%】
H5.20	Input filtering time of Ai2	0.00～10.00【0.10s】

The function setting mode of AI2 is similar with AI1. The analog AI2 can support 0~10V or 0~20mA input and when AI2 selects 0~20mA input, 20mA is corresponding to 3.3V.

H6 Group output terminal group

The series of frequency convertor has two multifunctional digital output terminals,1 multifunctional relay output terminal and 2 multifunctional analog output terminals in standard system.

Functional code	Designation	Setting scope
H6.00	Y1 input option	0～10【1】
H6.01	Y2 output option	0～10【5】
H6.02	Relay K output option	0～10【3】

0: no output.

1: the frequency convertor is under forward operation, then it outputs ON signal if there is frequency output.

2: the frequency convertor is under reversal operation, then it outputs ON signal if there is frequency output.

3: error output. It outputs ON signal when there is any error.

4: frequency level detection FDT arrives. Please refer to the detail instruction of functional code H8.13 and H8.14.

5: the frequency arrives. Please refer to detail instruction of functional code H8.15.

6: Under zero speed. Both the output frequency and given frequency are 0. The system outputs ON signal.

7: the upper limit of frequency arrives. When the running frequency arrives to the upper limit of the frequency, it outputs ON signal.

8: the lower limit of frequency arrives.When the running frequency arrives to the lower limit of the frequency, it outputs ON signal.

9~10: reservation.

Functional code	Designation	Setting scope
H6.03	FM output option	0～14【0】
H6.04	AM output option	0～14【3】
H6.05	DO output option	0～14【0】

The standard of analog output is 0~20mA (or 0~10V) and current or voltage output can be shifted by JP2. See the corresponding scope in the table below:

Setting value	Function	Scope
0	Running frequency	1~max output frequency
1	Setting frequency	0~max output frequency
2	Running speed	0~twice rated speed of the motor
3	Output current	0~twice rated current of the frequency convertor
4	Output voltage	0~twice rated voltage of the frequency convertor
5	Output power	0~twice rated power
6	Output torque	0~twice rated current of the motor
7	Analog AI1 input	0~10V
8	Analog AI2 input	0~10V/0~20mA
9~10	Reservation	Reservation

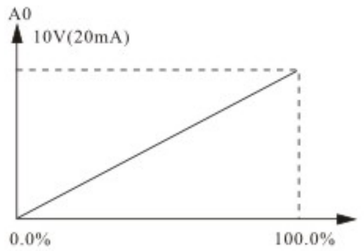
Functional code	Designation	Setting scope
H6.06	Lower limit of FM output	0.0～100.0【0.0%】
H6.07	Corresponding FM output of the lower limit	0.00～10.00【0.00V】
H6.08	Upper limit of FM output	0.0～100.0【100.0%】
H6.09	Corresponding FM output of upper limit	0.00～10.00【10.00V】
H6.10	Lower limit of AM output	0.0～100.0【0.0%】
H6.11	Corresponding AM output of lower limit	0.00～10.00【0.00V】
H6.12	Upper limit of AM outpu	0.0～100.0【100.0%】
H6.13	Corresponding AM output of upper limit	0.00～10.00【10.00V】
H6.14	DO max output frequency	0.1～50.0【10.0KHz】

The above functional codes define the relationship between the output value and analog output value. The extra is counted according to the upper or lower limit output when the output value is over than the max output or mini output scope.

When the analog output is current output, 1mA is corresponding to 0.5V voltage.

In different occasions, the corresponding analog output value of 100% of the output value diversifies. Please refer to the instruction in each application part.

Figure 6-13 Relationship between the given value and analog output



H7 Group human-computer interface

Functional code	Designation	Setting scope
H7.00	User password	0~65535【0】

H7.00 user password 0~65535【0】

Set any non-zero number and then the password protection takes effect.

00000: clearing the previous user password and the password protection is invalid. The recovery of factory setting also can clear the password.

When the users set the password and takes effect, the users can not enter the parameter menu if put the incorrect password. Only with the correct password, the users can check and modify the parameters. Please remember the user password you set.

The password protection takes effect 1 min after you exit from the functional editing mode. Press MENU ESC to enter the functional editing mode since the password takes effect, it displays "0.0.0.0.0". The operator must input the correct password, otherwise fails to enter.

Functional code	Designation	Setting scope
H7.01	LCD language option	0~1【0】

0: Chinese

1: English

The above functions are limited to LCD external keyboard to select the display language on LCD.

Functional code	Designation	Setting scope
H7.02	Functional parameters copy	0~2【0】

The functional code defines the copy mode of the parameters. And the parameter copy function is embedded in the external keyboard of LCD.

1: upload the functional parameters of the equipment to LCD keyboard. The functional parameters of the equipment are copied to the external keyboard of the LCD.

2: download the functional parameters of LCD keyboard to the equipment. The parameters in the external keyboard of LCD are copied to the equipment.

Note: the parameter becomes 0 after the copy.

Functional code	Designation	Setting scope
H7.03	F/R JOG functional	0~2【0】

F/R JOG is the multifunctional key. The function of F/R JOG can be set by parameters.

0: inching move. Press F/R JOG to achieve inching move.

1: forward、reversal shift。 Press F/R JOG to achieve the shift of frequency instruction.

Note: press F/R JOG to set FWD/REV shift. The frequency convertor can not remember the shifted state upon power-fail. The frequency convertor will run in the direction set by H0.10 upon the next power-on.The direction set by H0.10 will be saved upon power-fail.

2: clearing UP/DOWN setting. Press F/R JOG to clear the setting value by UP/DOWN.

Functional code	Designation	Setting scope
H7.04	STOP RESET stop function option	0~3【0】

The functional code defines the effective option of STOP RESET.

0: only be effective to the control panel

1: be effective to both terminal control and panel

2: be effective to both terminal control and panel

3: be effective to all modes

STOP RESET is effective in all modes for error reset.

Functional code	Designation	Setting scope
H7.05	Reservation	0~3【0】

Functional code	Designation	Setting scope
H7.06	Parameters option under operation mode	0~0x7FFF【0x3FF】

Under operation mode, the parameter display of the frequency convertor is influenced by the functional code, i.e., a 16-bit binary number. If any bit is 1, the corresponding parameter may be under operation and you can examine by >> SHIFT. If the bit is 0, the corresponding parameter is not available. Please convert the binary number to hex and input the functional code when the functional code is H7.06.

See the display content below:

BIT15	BIT14	BIT13	BIT12	BIT11	BIT10	BIT9	BIT8	BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
torque setting value	Current speed at multi-speed	Analog Ai2 value	Analog AI1 value	Output terminal state	Input terminal state	Feedback of PID	Given value of PID	Output torque	Output power	Running speed	Output current	Output voltage	Bus voltage	Setting frequency	Running frequency

corresponding to the lowest bit. For instance, if the input state displays 3,it means terminal S1 and S2 are closed and other terminals are open. Please refer to the instruction of H7.18, H7.19.

Functional code	Designation	Setting scope
H7.07	Parameter option displayed under stop mode	0~0x1FF【0xFF】

The function setting is as the same as H7.06. If the frequency convertor is under stop state, the parameter display is controlled by the functional code.

See the display content in the table below:

BIT15	BIT14	BIT13	BIT12	BIT11	BIT10	BIT9	BIT8	BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
Reserv	Reserv	Reserv	Reserv	Reserv	Reserv	Setting value of torque	Current speed at multi-speed	Analog Ai2	Analog Ai1	Feedback value of PID	Given value of PID	Output terminal state	Input terminal state	Bus voltage	Setting frequency

Functional code	Designation	Setting scope
H7.08	Rectifier module temperature	0~100.0℃
H7.09	Inversion module temperature	0~100.0℃
H7.10	Software version	
H7.11	Accumulated running time of the equipment	

he above functional codes only can be examined but can not be modified.

Rectifier module temperature: refers to the temperature of the rectifier module. For different models, the over-temperature protection value of rectifier module may diversify.

Inversion module temperature: indicates the temperature of the inversion module. For different models, the over-temperature protection value of inversion module may diversify.

Software version: software version of the CPU.

Accumulated running time of the equipment:indicated the accumulated running time by now.

Functional code	Designation	Setting scope
H7.12	Error type of the former two	0~24
H7.13	Error type of the previous one	0~24
H7.14	Present error type	0~24

It records the recent three error types: 0 means no error. See the details in Error Analysis.

Functional code	Designation	Setting scope
H7.15	Running frequency under present error	
H7.16	Output current under present error	
H7.17	Bus voltage under present error	
H7.18	Input terminal state under present error	
H7.19	Output terminal state under present error	

The terminal state under present error is decimal system. It displays the latest state of all digital input terminals. The order is:

BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
S8	S7	S6	S5	S4	S3	S2	S1

When the input terminal is ON, the corresponding place is 1 and OFF is 0. You may know the state of input signal by the values under present error.

When the state of output terminal is decimal system under present error, it displays the latest state of all digital output terminals. The order is:

BIT2	BIT1	BIT0
Y2	K	Y1

When the output terminal is ON, the corresponding place is 1 and OFF is 0. you may know the state of the digital output signal by the values under present error.

H8 Group reinforced functions

Functional code	Designation	Setting scope
H8.00	Acceleration time 2	0.0～3600.0s【20.0s】
H8.01	Deceleration time 2	0.0～3600.0s【20.0s】

The above acceleration and deceleration time can be selected,as well as H0.08 and H0.09. They have the same meaning. Please refer to the relevant instruction of H0.08 and H0.09.

You may shift between acceleration and deceleration time 1 and 2 by multifunctional digital input terminals. Please refer to the parameters H5 group of multifunctional digital input terminals.

Functional code	Designation	Setting scope
H8.02	Inching running frequency	0.00～H0.04【5.00Hz】
H8.03	Inching acceleration time	0.0～3600.0s【20.0s】
H8.04	Inching deceleration time	0.0～3600.0s【20.0s】

The parameters are used to define the given frequency and acceleration and deceleration time of the frequency convertor during inching movement. The on-off mode under inching movement includes direct start mode and deceleration stop mode.

The inching acceleration time refers to the time for acceleration from 0Hz to the max output frequency (H0.04)

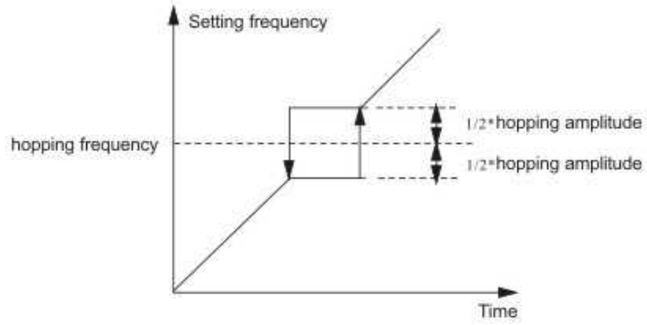
The inching deceleration time refers to the time for deceleration from the max output frequency (H0.04) to 0Hz.

Functional code	Designation	Setting scope
H8.05	Hopping frequency	0.00～H0.04【0.00Hz】
H8.06	Amplitude of hopping frequency	0.00～H0.04【0.00Hz】

When the frequency is set during the scope of the hopping frequency, the actual running frequency will be the border of the hopping frequency.

Make the frequency convertor avoid mechanical resonance point with load by setting the hopping frequency. The frequency convertor can set 1 hopping frequency point. If you set the hopping frequency point at 0, the function is invalid.

Figure 6-14 Diagram of hooping frequency

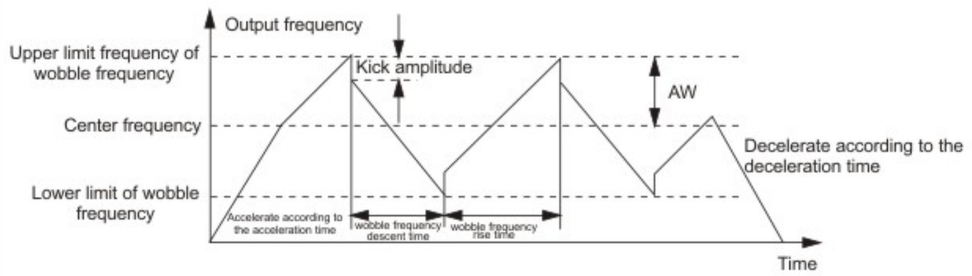


Functional code	Designation	Setting scope
H8.07	Wobble frequency amplitude	0.0～100.0【0.0%】
H8.08	Kick frequency amplitude	0.0～50.0%【0.0%】
H8.09	Wobble frequency rise time	0.1～3600.0s【5.0s】
H8.10	Wobble frequency descent time	0.1～3600.0s【5.0s】

The wobble frequency is applicable to industrials such as textile and chemical fiber and fields such as traversing and winding.

Wobble frequency function refers to that the output of the frequency convertor wobbles around the setting frequency. See the trace of the running frequency on t axle in the figure below, where the wobble amplitude can be set by H8.07; when H8.07 is 0, the amplitude is 0 and the wobble frequency is invalid.

Figure 6-15 Running diagram of wobble frequency



Wobble frequency amplitude: the running frequency of wobble frequency is controlled by the upper and lower limit of frequency values.

AW to center frequency: AW= center frequency x amplitude H8.07.

Kick frequency = AW x kick frequency amplitude H8.08. When the wobble frequency runs, the kick frequency is corresponding to the value of amplitude.

Wobble frequency rise time: the time of the wobble frequency runs from the lowest point to the highest one.

Wobble frequency descent time: the time of the wobble frequency runs the highest point to the lowest one.

Functional code	Designation	Setting scope
H8.11	Error automatic reset number	0～3【0】
H8.12	Interval setting of the error automatic reset time	0.1～100.0s【1.0s】

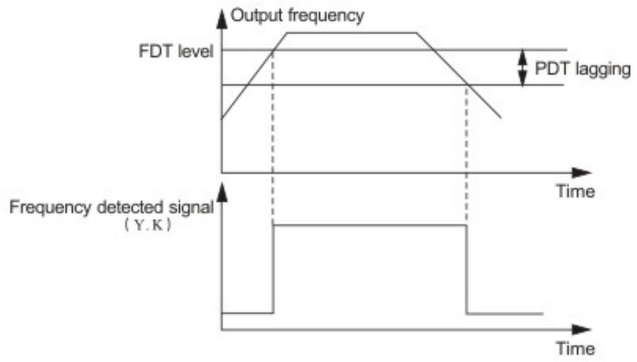
Error automatic reset number: you may set the number of automatic reset when the frequency convertor selects error automatic reset.And if the number of automatic reset is over the value,the frequency convertor will be in error standby mode and need manual interference.

Interval setting of the error automatic reset time: select the interval from the beginning of the error to the reset action.

Functional code	Designation	Setting scope
H8.13	FDT level detected value	0.00～H0.04【50.00Hz】
H8.14	FDT lagging detected value	0.0～100.0【5.0%】

If the output frequency surpasses a setting frequency FDT level, the system outputs the signal until the output frequency reduces to a frequency below of FDT level (FDT level-FDT lagging detected value), see the wave in the figure below:

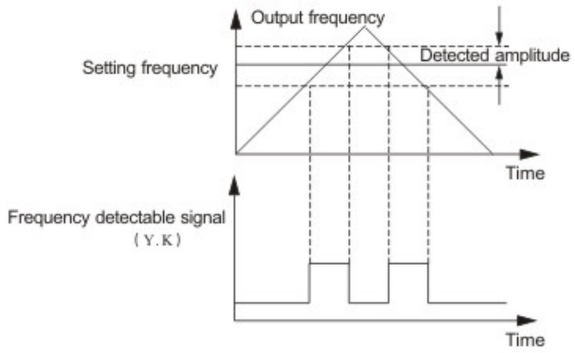
Figure 6-16 Diagram of FDT level



Functional code	Designation	Setting scope
H8.15	Detected amplitude as the frequency arrives	0.0~100.0%【0.0%】

When the output frequency of the frequency convertor detects the output pulse signal at positive and negative pole, see the figure below:

Figure 6-17 Diagram of frequency arriving at detected amplitude.



Functional code	Designation	Setting scope
H8.16	Voltage of braking valve	115~140% 【380V:130%】 【220V:120%】

he functional code is used to set the starting bus voltage of dynamic braking and the proper change of the value may be effective to braking with load.

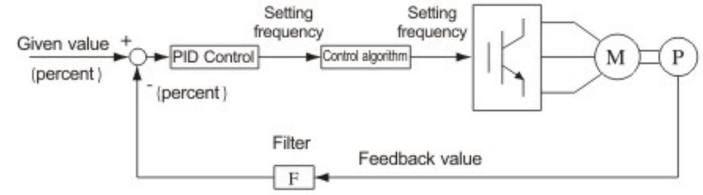
Functional code	Designation	Setting scope
H8.17	Display coefficient of the speed	0.1~999.9% 【100.0%】

Mechanical speed = 120* running frequency* H8.17/ number of pole-pairs of the motor. The functional code is used to calibrate the display error of the speed dial and has no influence to the actual speed.

H9 Group PID control group

PID control is a common way applied in the process control. It uses proportional, integral and differential calculation of the deviation between the feedback signal of the controlled value and signal of the target signal to adjust the output frequency of the frequency convertor and from the negative feedback system so that stabilize the controlled value at the target value. It is applicable to the process control such as flow control, pressure control and temperature control. See the control principle in the figure below:

Figure 6-18 Diagram of PID principle



Functional code	Designation	Setting scope
H9.00	PID given source option	0~4【0】

0: given by keyboard (H9.01)
1: given by analog route AI1
2: given by analog route AI2
3: given by remote communication
4: given by multiphase

When the frequency source selects PID, i.e., H0.03 is 5 and the functional group takes effect. The parameter decides the specified route of the target value of PID.

The setting target value of PID is the relative and 100% is corresponding to 100% of t he feedback signal of the controlled system.

The system is calculated by the relative value (0~100%).

Note: given multiphase can be set by the parameter of HA group.

Functional code	Designation	Setting scope
H9.01	Preset PID given by keyboard	-100.0~100.0【0.0%】

If H9.00=0, the target source is given by the keyboard. The parameter needs to be set. The reference value of the parameter is the feedback of the system.

Functional code	Designation	Setting scope
H9.02	PID feedback source option	0~3【0】

0: feedback of analog route Ai1
1: feedback of analog route AI2
2: feedback of AI1+AI2
3: feedback of remote communication
The parameter is used to select the PID feedback route.
Note: the given route and feedback route can not be coincided, otherwise PID control is invalid.

Functional code	Designation	Setting scope
H9.03	PID output characteristics option	0~1【0】

0: PID output is positive characteristic. It is required to reduce the output frequency of the frequency convertor to balance PID if the feedback signal is higher than the given PID value, such as the tension PID control of winding.

1: PID output is negative characteristic. It is required to increase the output frequency of the frequency convertor if the feedback signal is higher than the given PID value, such as the tension PID control of unwinding.

Functional code	Designation	Setting scope
H9.04	Proportional gain (Kp)	0.00～100.00【0.10】
H9.05	Integral time (Ti)	0.01～10.00s【0.10s】
H9.06	Differential time (Td)	0.00～10.00s【0.00s】

Proportional gain (Kp): decides the adjustment strength of the whole PID regulator. The higher P value is, the higher adjustment strength is. If the parameter is 100, it indicates that when the deviation between PID feedback value and given value is 100%, the adjustment amplitude of the output frequency of the PID regulator is the max frequency (integral and differential effect is neglected).

Integral time (Ti): used to adjust the speed of integral adjustment of the deviation between PID feedback value and given value. The integral time refers to that when the deviation between PID feedback and given value is 100%, the integral regulator (proportional and differential effect is neglected) can continuously adjust by the time to reach the max frequency (H0.04). The shorter the integral time is, the larger the adjustment strength is.

Differential time (Td):used to adjust the strength of the change rate of the deviation between PID feedback value and given value. Differential time refers that if the feedback value change 100% within the time, then the adjustment value of the differential regulator is the max frequency (H0.04) (proportional and differential effect is neglected). The longer the differential time is, the larger the adjust strength is.

PID is the commonest control way in the process control and each part plays its own function. See the introduction of operating principle and adjusting method:

Proportional adjustment (P): if there is the deviation between the feedback and given value, the output and deviation are proportional adjustment. If the deviation is constant, then the adjustment value is constant. The proportional adjustment can response the feedback change quickly, but can not reach non-error control only by proportional adjustment. The more the proportional gain is, the faster the adjustment speed of the system is, but the excessive may cause vibration. The adjusting method: set a longer integral time set the differential time as 0, run the system only by the proportional adjustment and change the given value, then check the stable deviation(static error)between the feedback signal and given value.If the static error is in the change direction of the given value (such as increase of the given value, the feedback is always less than the given value under stable mode), the proportional gain is increasing, and on the contrary, the proportional gain is reducing. Repeat the above procedure till that it reaches lower static error (non-error is hard).

Integral time (I): if there is deviation between the feedback and given value, the output adjustment is continuously increasing. If the deviation remains , proceed to increase the adjustment value till no deviation.The integral regulator can eliminate the static error effectively. Repeated overshoot may occur and the system is not stable till vibrating occurs if the integral regulator is too strong. Because the characteristics of the oscillationcaused by integral effect excessive integral effect are: the feedback signal is around the given value and the amplitude increasing till the vibration, the parameter of the integral time is generally adjusted from up to down. During the process, monitor the effect of the system adjustment till the stable speed of the system satisfies the requirements.

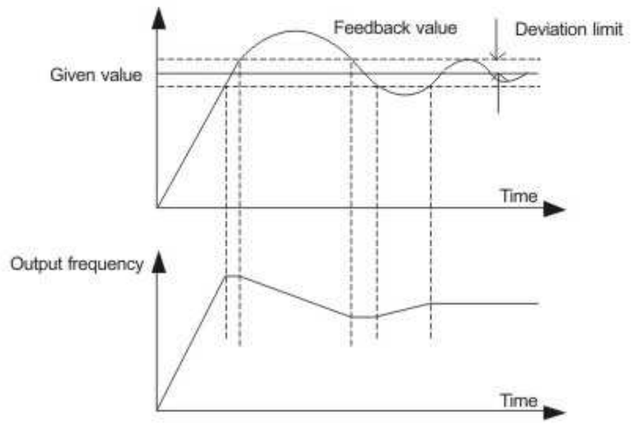
Differential time (D): if the deviation between the feedback and given value changes, the output and the change rate of deviation are proportional adjustment value, which is only relevant to the direction and the value of deviation change and is not relevant to the direction and value of the deviation. The function of differential adjustment is that it can adjust according to the change trend to control the change of the feedback signal. Please use the differential adjustment prudently because the integral regulator is easy to enlarge the interference of the system, especially for the interference of the higher changing frequency.

Functional code	Designation	Setting scope
H9.07	Sampling period (T)	0.01~100.00s【0.50s】
H9.08	Limit deviation of PID control	0.0~100.0s【0.0%】

Sampling period (T): refers to the sampling period of the feedback value and the regulator calculates once in each sampling period. The longer the period is, the slower the response is.

Limit deviation of PID control: refers to the permissible max deviation between PID output value and given value of closed loop. As indicated in the figure below, PID regulator stops adjusting within the limit deviation. The proper setting of the function can adjust the precision and stability of PID system.

Figure 6-19: Relationship between limit deviation and output frequency



Detecting time upon feedback break

Functional code	Designation	Setting scope
H9.09	Detected value upon feedback break	0.0～100.0%【0.0%】
H9.10	Detecting time upon feedback break	0.0～3600.0s【1.0s】

Detected value upon feedback break: the detected value is correspond to the full range (100%). The system is detecting the feedback value of PID and if the feedback value is less or equivalent to detected value upon feedback break, the system starts detecting and timing. If the detecting time is beyond the detecting time upon feedback break, the system reports PID feedback break error (Pid.E).

HA Group and multi-speed control group

Simple PLC function is a multi-speed generator. The frequency convertor can change the frequency and direction according to the running time to satisfy the technical requirements. The function needed to be executed with he assistance of external PLC before, while now it can achieve the function by the frequency convertor itself.

The series of frequency convertor can achieve 16-bit multi-speed control 4 groups of acceleration and deceleration time can be selected.

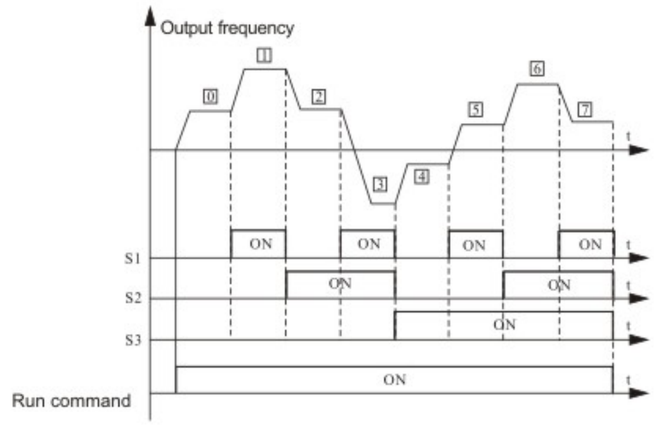
After the preset PLC finish a cycle (or a phase), an ON signal can be output by multifunctional digital output or multifunctional relay.

Functional code	Designation	Setting scope
HA.00	Multi-speed 0	-100.0～100.0【0.0%】
HA.01	Multi-speed 1	-100.0～100.0【0.0%】
HA.02	Multi-speed 2	-100.0～100.0【0.0%】
HA.03	Multi-speed 3	-100.0～100.0【0.0%】
HA.04	Multi-speed 4	-100.0～100.0【0.0%】
HA.05	Multi-speed 5	-100.0～100.0【0.0%】
HA.06	Multi-speed 6	-100.0～100.0【0.0%】
HA.07	Multi-speed 7	-100.0～100.0【0.0%】

Instruction: the symbol of multi-speed decides the running direction. If it is the negative value, the system suns in the opposite direction. 100% frequency setting is corresponding to the max frequency (H0.04).

When S1=S2=S3=OFF, the frequency mode can be selected by H0.03. if all S1, S2, S3 are not OFF,and the system runs in multi-speed phase,the priority of the multi-speed is higher than the input of keyboard, analog and communication. The highest 8-pahse speed can be selected by the combination of S1, S2 and S3.

Figure 6-20 Logic diagram of multi-speed operation



The start and stop route under multi-speed mode is also defined by H0.01. See the multi-speed control process in Figure 6-20. The relationship between S1, S2, S3 and multi-speed phase is indicated in the figure below.

Relationship between S1, S2, S3 and multi-speed phase

S1	OFF	ON	OFF	ON	OFF	ON	OFF	ON
S2	OFF	OFF	ON	ON	OFF	OFF	ON	ON
S3	OFF	OFF	OFF	OFF	ON	ON	ON	ON
Phase	0	1	2	3	4	5	6	7

HB Group protection parameter group

Functional code	Designation	Setting scope
Hb.00	Motor overload protection option	0～2【2】

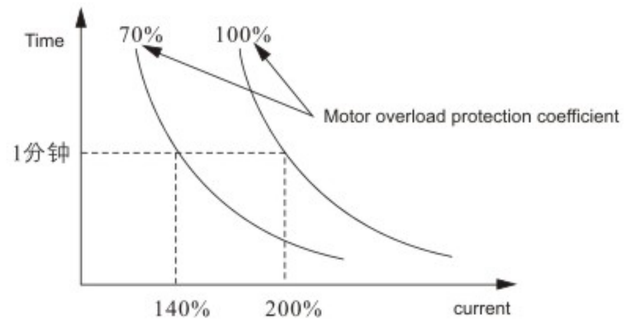
no protection. No motor overload protection function (use it prudently). Then the frequency convertor has no overload protection to the motor with load.

1: common motor (with low-speed compensation). Because common motor is weak in heat dissipation under low speed, so the corresponding electric heat protection value should be adjusted.The low-speed compensation function refers to you can lower the overload protection threshold if the running frequency is less than 30Hz.

2: frequency motor (without low-speed compensation). Because the heating dissipation for the special motor of frequency convertor is not influenced by the speed,so it is unnecessary to adjust the protection value under low-speed running mode.

Functional code	Designation	Setting scope
Hb.01	Motor overload protection current	20.0~120.0【100.0%】

Figure 6-21 Motor overload protection coefficient setting



The value can be defined by the formula below:

Motor overload protection current= (permissible max load current/rated current of the frequency convertor) * 100%.

When large frequency convertor is used to drive the small motor, it is necessary to set the functional code to protect the motor.

Functional code	Designation	Setting scope
Hb.02	Lower frequency point upon momentary power-fail	400.0~600.0V【450.0V】
Hb.03	Descend rate of frequency upon momentary power-fail	0.00~H0.04【0.00Hz】

If the descend rate of frequency upon momentary power-fail is 0, the lower frequency function is invalid.

Lower frequency point upon momentary power-fail: when the bus voltage descends to the lower frequency point upon momentary power-fail after the power-fail,the frequency convertor starts to lower the running frequency according to the descend rate (Hb.03)of frequency upon power-fail to make the motor under power generation mode so that the feedback power can remain the bus voltage to ensure the normal operation of the frequency convertor until the next power-on.

Note: proper adjustment of the two parameters can avoid production downtime caused by the protection of the frequency convertor when the power system is shifted.

Functional code	Designation	Setting scope
Hb.04	Over voltage stalling protection	0~1【1】
Hb.05	Over voltage stalling protection voltage	120~150% 【380V:130%】 【380V:120%】

Hb.04:

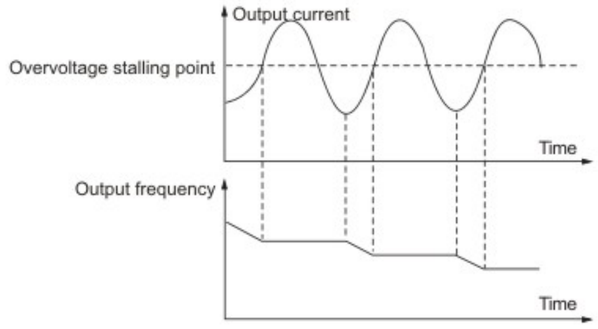
0: forbidden protection

1: permissible protection

During the deceleration running of the frequency convertor, the actual descend rate of the motor speed may be lower than the descend rate of output frequency because of the influence of load inertia. Then the motor feedbacks power to the frequency convertor to increase the bus voltage. It may cause the increase of bus voltage to lead the overvoltage error of the frequency convertor if no any action.

Overvoltage stalling protection: under the operation of the frequency convertor, the system detects the bus voltage and compares it with overvoltage stalling point defined by Hb.05 (corresponding to standard bus voltage). If it surpasses the overvoltage stalling point, the output frequency of the frequency convertor stops descending and then proceeds to descend until it is detected that the bus voltage is lower than the overvoltage stalling point. See the figure below:

Figure 6-22 Overvoltage stalling function

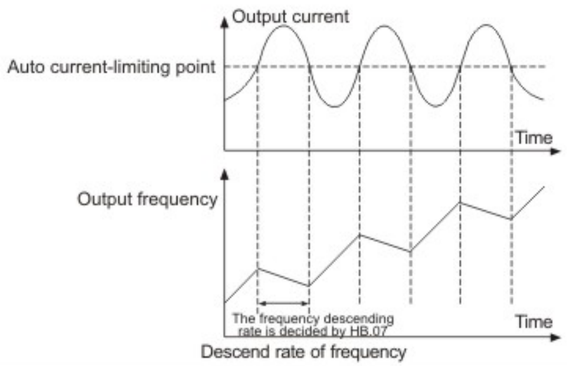


Functional code	Designation	Setting scope
Hb.06	Auto current-limiting level	100~200%【160】
Hb.07	Descend rate of overvoltage frequency	0.00~50.00【1.00Hz/s】

Under the operation mode, if the frequency convertor loads too much, the actual increasing rate of the motor speed is lower than the increasing rate of output frequency. It may cause acceleration over-current error and lead the trip of the frequency convertor if no any action.

The auto current-limiting function can detect the output current under operation mode of the frequency convertor and compare it with the current-limiting point defined by Hb.06. If it surpasses the current-limiting point, the output frequency of the frequency convertor lowers according to the descend rate (Hb.07) of over-current frequency. And it recovers the normal operation when it is detected that the output current is lower than current-limiting point. See the figure below:

Figure 6-23 Over-current stalling function



HC Group serial communication

Functional code	Designation	Setting scope
HC.00	Communication address of the equipment	0~247【1】

When the host is in the editing frame and set the communication address of the slave at 0, i.e., broadcast communication address, all the slaves on MODBUS accept the frame, but no response. Note: the address of slaves can not be set at 0.

The communication address of this equipment is unique in the communication network, which is the foundation to achieve the point-to–point communication between upper computer and the frequency convertor.

Functional code	Designation	Setting scope
HC.01	Communication baud rate option	0~5【4】

0: 1200bps
1: 2400bps
2: 4800bps
3: 9600bps
4: 19200bps
5: 38400bps

The parameter is used to set the speed of data transmission between the upper computer and the frequency convertor. Note: the baud rate of the upper computer and the frequency convertor you set must be consistent. Otherwise, the communication can not be performed. The higher the baud rate is, the faster the communication speed is.

Functional code	Designation	Setting scope
HC.02	Data check setting	0~17【1】

0: no check (N, 8, 1) for RTU

1: even parity check (E, 8, 1) for RTU

2: odd parity check (0, 8, 1) for RTU

3: no check (N, 8, 2) for RTU

4: even parity check (E, 8, 2) for RTU

5: odd p5arity check (0, 8, 2) for RTU

6: no check (N, 7, 1) for ASCII 7: even parity check (E, 7, 1) for ASCII

8: odd parity check (0, 7, 1) for ASCII 9: no check (N, 7, 2) for ASCII

10: even parity check (E, 7, 2) for ASCII 11: odd parity check (0, 7, 2) for ASCII

12: no check (N, 8, 1) for ASCII 13: even parity check (E, 8, 1) for ASCII

14: odd parity check (0, 8, 1) for ASCII 15: no check (N, 8, 2) for ASCII

16: even parity check (E, 8, 2) for ASCII

17: odd parity check (0, 8, 2) for ASCII

The data form of the upper computer and the frequency convertor must be consistent. Otherwise the communication can not be performed.

Functional code	Designation	Setting scope
HC.03	Response delay in the communication	0~200ms【5ms】

Response delay: refers to the interval when the frequency convertor ends the acceptance of the data and sends response to the upper computer. If the response delay is less than the system processing time, the respond delay should be subject to the system processing time; while if the response delay is longer than the system processing time,the system needs delay holding after the data process until the respond time is up, it will send the data toward the upper computer.

Functional code	Designation	Setting scope
HC.04	Error time of the communication overtime	0.0~200.0s【0.0s】

When the functional code is set at 0.0s, the communication overtime parameter is invalid.

When the functional code is set at its valid value, the system reports the communication error(Con.E)if the interval between one communication and the next communication surpasses the communication overtime.

Generally, set the functional code at 0. If the parameter is set in continuous communication system, the communication state can be monitored.

Functional code	Designation	Setting scope
HC.05	Transmission error handling	0~3【1】

0: alarm and free stop
1: no alarm and continuous running
2: no alarm and stop in stop mode (limit under communication control mode)
3: no alarm and stop in stop mode (under all control modes)

The frequency convertor can select shielding Con.E, stop or continuous running by setting the communication error handling under abnormal condition.

Functional code	Designation	Setting scope
HC.06	Transmission respond handling	0000~1111【0000】

When the LED unit of the functional code is set at 0, the frequency convertor can respond to READ/WRITE command from the upper computer.

When the LED unit of the functional code is set at 1, the frequency convertor only can respond to READ command from the upper computer and no response to WRITE command. It can promote the communication efficiency by this mode.

When the LED ten's place of the functional code is set at 0, the frequency convertor will not save the communication setting value upon power-fail.

HD Group Supplement functions

Functional code	Designation	Setting scope
Hd.00	Lower frequency threshold of restrain oscillation	0~500【5】
Hd.01	Higher frequency threshold of restrain oscillation	0~500【100】

Current oscillation often occurs in some frequency phases for most motors, which lead the motor can not run or even cause over-current of the frequency convertor.If Hd.04=0,it enables restrain oscillation, when Hd.00 and Hd.01 are lower, the restrain effect is obvious and the current increase is obvious; while the y are set higher, the restrain effect is weak.

Functional code	Designation	Setting scope
Hd.02	Amplitude limit of restrain oscillation	0~10000【5000】

Voltage increase upon restrain oscillation can be limited by setting Hd.02.

Functional code	Designation	Setting scope
Hd.03	Demarcation point of high and low frequency of restrain oscillation	0.00~H0.04【12.5Hz】

Hd.03 is the demarcation point of Hd.00 and Hd.01.

Functional code	Designation	Setting scope
Hd.04	Restrain oscillation	0~1【1】

0: restrain oscillation is valid.
1: restrain oscillation is invalid.

The function of restrain oscillation is corresponding to V/F control,. Current oscillation often occurs to common motor running with no or light load to cause the abnormal operation of the motor, even over-current of the frequency convertor. If Hd.04=0, it enables restrain oscillation, then the frequency convertor will restrains the oscillation of the motor according to the parameters in Hd.00 and Hd.03 groups.

Functional code	Designation	Setting scope
Hd.05	PWM mode option	0~2【0】

0: PWM mode 1, the normal PWM mode, with lower noise under lower frequency and higher noise with under frequency.

1: PWM mode 2. The motor runs with lower noise under this mode, but with high temperature, so the frequency convertor needs to be derated under this mode.

2: PWM mode 3. the motor runs with higher noise under this mode, but with better restrain effect on motor oscillation.

Functional code	Designation	Setting scope
Hd.06	Torque setting mode	0~5【0】
Hd.07	Torque setting by keyboard	-200.0~200.0【50.0%】

Option of Hd.06 torque setting route:
0: torque setting by keyboard (Hd.07)
1: torque setting by analog AI1(100.0% is correspond to twice rated current of the frequency convertor)
2: torque setting by analog AI2 (as above)
3: torque setting by analog AI1+AI2 (as above)
4: multi-torque setting (as above)
5: torque setting by remote communication (as above)

Only if H0.00=2, the torque control is valid and Hd0.6 is valid. Under torque control, the frequency convertor output the torque according to the preset command and the output frequency is limited by the upper limit frequency. If the load speed is greater than the preset upper limit frequency, the output frequency is limited and the output torque will be different from the preset value.

When the torque command is set by keyboard (Hd.06=0), the torque command is set by Hd.07. The motor reverses upon negative torque value. 100.0% of analog, multi-speed and communication setting is corresponding to twice rated current of the frequency convertor and -100.0% is corresponding to negative twice rated current of the frequency convertor.

The torque control and speed control can be shifted by multifunctional input terminal.

If the preset torque is greater than the load torque, the output frequency of the frequency convertor will increase. The frequency convertor will runs at the upper limit frequency when the output frequency is up to the upper limit.

If the preset torque is less than load torque, the frequency convertor will descend. The frequency convertor will runs at the lower limit frequency when the output frequency is at the lower limit.

Note: under stop mode, the frequency convertor shifts from torque control to speed control automatically.

Functional code	Designation	Setting scope
Hd.08	Setting source option of the upper limit frequency	0~4【0】

Setting source option of the upper limit frequency. The output frequency of the frequency convertor can be changed by modifying the upper limit frequency.

0: upper frequency set by keyboard (H0.05)

1: upper limit set by analog AI1 (100% is corresponding to the max frequency)

2: upper limit set by analog AI2

3: upper limit set by multi-phase

4: upper limit set by remote communication

Functional code	Designation	Setting scope
Hd.09	Current-limiting option	0~1【0】

Auto current-limiting function is valid under acceleration and deceleration mode, while whether the auto current-limiting option is valid is decided by auto current-limiting option (Hd.09) under operation with constant speed.

Hd.09=0 means auto current-limiting is valid under operation with constant speed.

Hd.09=1 means auto current-limiting is invalid under operation with constant speed.

When the auto current-limiting is valid, the output frequency may vary, so auto current-limiting function is not applicable to the environment with stable output frequency under operation with constant speed.

When the auto current-limiting is valid, the lower setting of the current-limiting may influence the overload capacity of the frequency convertor.

HE Group Functions of manufacturer

These parameters are functions of manufacture,so please do not open them.Otherwise,it may cause abnormal operation or damage of the frequency convertor.

7. Trouble shooting

7.1 Trouble and elimination

Error code	Error type	Possible cause	Countermeasure
Fo	Inverter unit error	1. Faster acceleration 2. IGBT inner damage 3. Error action caused by interference	1. Extend the acceleration time 2. Seek support 3. Check whether any external equipments have strong interference
oC.1	Over-current under accelerated operation	1. Faster acceleration 2. Lower voltage of power system 3. Lower power of the frequency convertor	1. Extend the acceleration time 2. Check the input power supply 3. Use the frequency convertor with larger power
oC.2	Over-current under constant speed	1. Faster deceleration 2. Larger load inertia torque 3. Lower power of the frequency convertor	1. Extend the deceleration time 2. Check the input power supply 3. Use the frequency convertor with larger power
oC.3	Over-current under constant speed	1. Mutation with load or abnormal 2. Lower voltage of power system 3. Lower power of the frequency convertor	1. Check the mutation of with load or reducing load 2. Check the input power supply 3. Use the frequency convertor with larger power
oE.1	Overvoltage under acceleration	1. Abnormal input voltage 2. Restart the running motor after momentary power-off	1. Check the input power supply 2. Avoid restart after stop
oE.2	Overvoltage under deceleration	1. Faster deceleration 2. Greater load inertia 3. Abnormal input voltage	1. Extend the deceleration time 2. Extend dynamic braking units 3. Check the input power supply
oE.3	Overvoltage under constant speed	1. Abnormal input voltage 2. Greater load inertia	1. Install the input reactor 2. Install proper dynamic braking units
Lu	Bus under-voltage	1. Lower voltage of power system	1. Check input power system
oL.1	Overload of the motor	1. Lower voltage of power system 2. Incorrect rated current setting 3. Motor blocked running or over load mutation 4. The motor is improper	1. Check the voltage of power system 2. reset the rated current of the motor 3. Check the load and adjust torque promotion 4. Select proper motor
oL.2	Overload of the frequency convertor	1. Faster acceleration 2. Restart the running motor 3. Lower voltage of power system 4. Overload	1. Extend the acceleration time 2. Avoid restart after stop 3. Check the voltage of power system 4. Select larger frequency convertor

Error code	Error type	Possible cause	Countermeasure
PF.i	Input default phase	Default in input R, S, T	1. Check the input power supply 2. Check the wiring
PF.o	Output default phase	Default in output U, V, W (or seriously asymmetric load triphase)	1. Check the input power supply 2. Check the motor and cable
oH.1	Overheat rectifier module	1. Momentary over-current of the frequency convertor 2. Interphase or grounded short circuit of the output triphase 3. Air duct blockage or damaged blower 4. Higher ambient temperature 5. Loosening cable or plug-in on the control panel 6. Damaged APS, under-voltage of drive voltage 7. Direct connection of bridge arm in power module 8. Abnormal control board	1. Refer to countermeasures for over-current 2. Wiring again 3. Clear the air duct or change a blower 4. Lower the ambient temperature 5. Check and connect again 6. Seek support 7. Seek support 8. Seek support
oH.2	Overheat in inversion module		
Eto.E	External error	1. S1 external error of input terminal action	1. Check the external equipment input
Con.E	Communication error	1. Improper baud rate setting 2. Serial communication error 3. Long communication break	1. Set a proper baud rate 2. Press STOP RESET to reset, seek support 3. Check the wring of the communication interface
Atc.E	Circuit error on current detecting	1. Loose contact of connectors on control panel 2. Damaged APS 3. Damaged hall device 4. Abnormal amplifying circuit	1. Check the connector and rewire 2. Seek support 3. Seek support 4. Seek support
Pud.E	Motor self-studying error	1. Motor capacity can not match with the capacity of the frequency convertor 2. Improper rated parameter setting of the motor 3. Larger deviation between self-studying parameters and standard parameter 4. Overtime self-studying	1. Change the frequency convertor 2. Set the rated parameters according to the nameplate of the motor 3. Make the motor non-load and identify again 4. Check the motor cable and parameter setting
EPr.E	EEPROM READ/ WRITE error	1. READ/WRITE error of the control parameters 2. Damaged EEPROM	1. Press STOP RESET to reset, seek support 2. Seek support
Pid.E	PID feedback break	1. PID feedback break 2. Loss of PID feedback source	1. Check PID feedback signal wire 2. Check PID feedback source
Fdc.E	Braking unit error	1. Wire error of braking unit or damaged brake pipe 2. Lower external braking resistance	1. Check the braking unit and change a new braking pipe 2. Increase the braking resistance
ovEr	Reservation		

7.2 Common trouble and solution

Errors may occur in the application of the frequency convertor. Please refer to the methods to analyze the error:

No display for power-on:

Check whether the input power of the frequency convertor is consistent with rated voltage by multimeter. Please examine and solve the problem.

Check whether the triphase rectifier bridge is good. If the rectifier was blasted, please seek support.

Check whether the charge light is on. If the light is not on, please seek support.

Air switch of the power supply breaks off after power-on:

Check whether there is any grounded or short circuit among the input power supply and eliminate the problem.

Check whether the rectifier bridge is punctured. Please seek support if it is damaged.

The motor does not work after the operation of the frequency convertor:

Check whether balanced triphase output among U, V, W. If yes, please check whether any damage or blockage of the motor.If no,please confirm whether the parameter setting is correct.

Please seek support if there is output voltage but unbalanced.

Please seek support if no output voltage.

Normal display of the frequency convertor after power-on, but the air switch breaks off after operation:

Check whether any short circuit among modules. Please seek support if yes.

Check whether any short circuit or grounded state among lead-in wires of the motor.Please eliminate if yes.

If the trip is occasional and the motor is far from the frequency convertor, additional AC reactor should be taken into account.

8. Maintenance

Warning

- The maintainer must maintain according to the specified method.
- The maintainer must be professional authorized personnel.
- The power of the frequency convertor must be cut down prior to the maintenance. The maintenance work must be started 10 min after the power-off.
- The components on PCB board can not be touched directly, otherwise may cause static damage to the frequency convertor.
- All screws must be tightened after the maintenance.

8.1 Daily maintenance

In order to avoid errors,ensure the normal operation of the equipment and extend the service life of the frequency convertor, daily maintenance is necessary and see the content below:

Items	Content
Temperature/ Humidity	Confirm the temperature between 0~40℃, humidity between 20~90% no vapor condensation
Oil mist and dust	Confirm no oil mist and dust in the frequency convertor, no water condensation
Frequency convertor	Check whether any abnormal heat or abnormal oscillation
Blower	Confirm the normal operation of the blower and no blockage, etc.
Input power supply	Confirm the voltage and frequency of the input power are permissible
Motor	Check whether any abnormal oscillation, heat, noise and default phase etc.

8.2 Regular maintenance

In order to prevent the frequency changer breakdown and to guarantee its long time high performance steady operation, the user must carry on the inspection for the frequency changer regularly (in one half year), the inspection content is as follows :

Items	Content	Elimination method
Screws on external terminal	Whether they are loosing	Tighten
PCB panel	Dust and dirt	Clear the dust and dirt by dry compressed air
Blower	Abnormal noise and oscillation, whether the accumulated time is over 20, 000 h	1. Clear the dust and dirt 2. Change the blower
Electrolytic capacitor	Whether any discoloration or peculiar smell	Change the electrolytic capacitor
Heat radiator	Dust and dirt	Clear the dust and dirt by dry compressed air
Power components	Dust and dirt	Clear the dust and dirt by dry compressed air

8.3 Quick-wear parts change of the frequency convertor

The blower and electrolytic capacitor are the quick-wear parts and needs to be changed regularly in order to ensure the frequency convertor can run safely without error in long run. See the changing time below:

- Blower: must be changed after 20, 000 h
- Electrolytic capacitor: must be changed after 30,000 ~40,000 h

8.4 Guarantee of frequency convertor

The series of frequency convertors will be guaranteed for 18 months upon the production date.

9. Protocol

The series of frequency convertors provide Rs485 interface and adopt server - client communication in accordance with MODBUS Protocol under international standard. The user can centrally control (set the control command of the frequency convertor, running frequency, modify the parameters of relevant functional code,the working state of the frequency convertor and error information monitoring) by PC/PLC and the upper computer to adapt special application requirements.

9.1 Content

MODBUS Serial Protocol defines the content and application form if the frame of asynchronous transmission in serial communication, including: host polling and broadcast frame, the response frame form of slaves; the frame content organized by the host includes: slave address (or broadcast address), command execution, data and error check etc. The response of slave adopts the same structure including: action confirmation,returning data and error check. If there is any error when the slave is receiving frame or can not accomplish the action, required by host, it will organize an error frame to feed backed to the host.

9.2 Application mode

The series of frequency convertors can access the “uni-host and multi - slave” control network with RS485 bus.

9.3 Bus structure

(1) Interface

RS485 hardware interface

(2) Transmission mode

Asynchronous serial and semi-duplex, only the host or slave can send and the other can receive the data simultaneously. During the serial asynchronous communication, the data is transmitted frame by frame in the form of message.

(3) Topology structure

Uni-host and multi-slave system.Set the salve address betwen1~24 and 0 is the broadcast communication address. The address of each slave in the network is unique, which is the foundation to ensure MODBUS serial communication.

9.4 Protocol specification

The Protocol of the series of frequency convertors is an asynchronous serial master-slave protocol and only one unit (the host) can build the protocol (called “inquiry/command”). Other equipments (slaves) only can respond to the “inquiry/demand” by providing data, or take actions according to the “inquiry/command” of the host. The host here refers to the PC, industrial control device, or programmable logic controller (PLC) etc. Slave refers to the series of frequency convertors or other control devices with similar protocol. The host can communicate with a single slave or send broadcast information all slaves. The slave should respond a message (response) to single “inquiry/command” of the host. And for the broadcast information, the slaves need not respond the information to the host.

9.5 Frame structure

The communication data of the MODBUS protocol of the series of frequency convertors has two forms, RTU (Remote Control Unit) and ASCII (American Standard Code for Information International Interchange).

Two models

See the byte form in RTU mode below:

Coding system: 8-bit binary system, in each 8-bit frame field, there are two hex characters, hex 0~9, A~F.

See the form of each byte in ASCII mode below:

Coding system: the protocol is hex. The meaning of ASCII information: “0”~“9”, “A”~“F” each hex is indicated by corresponding character information in ASCII.

Character	'0'	'1'	'2'	'3'	'4'	'5'	'6'	'7'	'8'	'9'	'A'	'B'	'C'	'D'	'E'	'F'
ASCII CODE	0x30	0x31	0x32	0x33	0x34	0x35	0x36	0x37	0x38	0x39	0x41	0x42	0x43	0x44	0x45	0x46

Data from: start bit, 7/8 data bit, check bit and stop bit.

See the description of data form below:

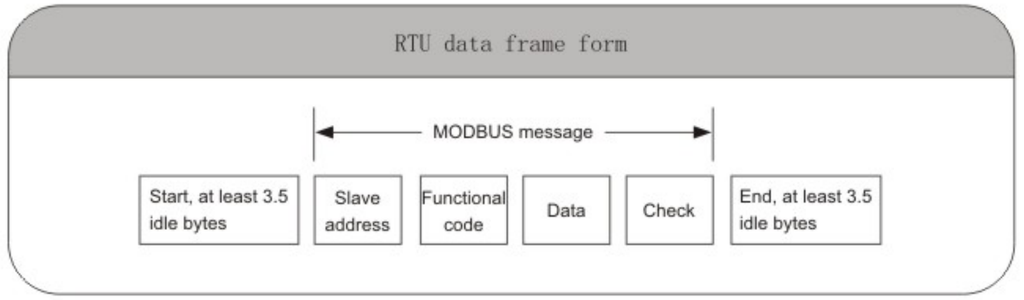
11-bit character frame:

Start bit	BIT1	BIT2	BIT3	BIT4	BIT5	BIT6	BIT7	BIT8	Check bit	Stop bit

10-bit character frame:

Start bit	BIT1	BIT2	BIT3	BIT4	BIT5	BIT6	BIT7	Check bit	Stop bit

In RTU mode, new frame usually starts at the transmission time of at least 3.5 bytes. The transmission time of 3.5 bytes can be easily controlled on the internet whose transmission speed is calculated by baud rate. And then the data fields are In order: slave address, operation command code, data and CRC check word, the transmission byte in each field is hex 0…0, A…F. the internet always is monitoring the activity of the communication bus. Each internet device will confirm the byte as receive the first field (address information). As the last byte finished, an interval occurs between it and a similar transmission time of 3.5 byte to indicate the end of the frame. After that, a new frame will be transmitted.

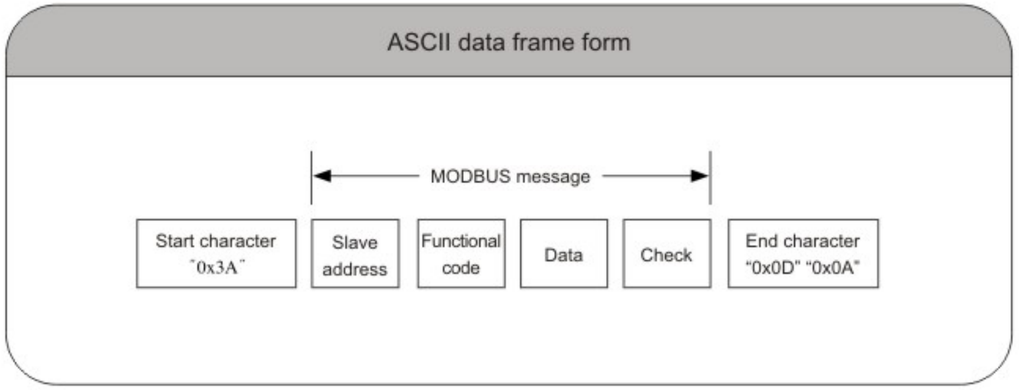


The information of a frame must be transmitted by a continuous data flow. If there is a interval over1.5bytes prior to the end of the transmission,the receiver will clear the incomplete information and mistakes the last byte for the address of a new frame. Similarly, if the interval between the start of a new frame and the previous frame is less than 3.5 bytes, the receiver mistakes it for the continuing of the previous one. So the mistake of frame finally cause incorrect CRC test value and communication error.

Standard structure of RTU frame:

Frame START	T1-T2-T3-T4 (transmission time of 3.5 bytes)
Slave ADDR	Communication address: 0~247 (decimal system) (0 is the broadcast address)
Functional field CMD	03H: read slave parameter; 06H: write slave parameter
DATA field (N-1)… Data (0)	2* a data with n bytes, it is the main content of the communication and also is the core of data exchange in the communication.
CRC CHK lowr bit	Check value: CRC calibration value (16BIT)
CRC CHK high nit	
Frame END	T1-T2-T3-T4 (transmission time of 3.5 bytes)

In ASCII mode, the frame start is ":" (0x3A) and the END default is "CRLF" ("0x0D" "0x0A"). In ASCII mode, all the data bytes are transmitted by ASCII code except the frame start and end: sending high 4-bit byte first and then sending low 4-bit byte. The data is 8-bit in length under ASCII mode. For 'A'~ 'F', the capital letter of ASCII is adopted. Then the data is tested by LRC check which covering from the slave address to the data information. The checksum is the complement code of bytes sum (the carry bit is neglected) all data involved in the check.



Standard structure of ASCII:

START	':' (0x3A)
Address Hi	Communication address: 8-bit address is combined by 2 ASCII codes
Address Lo	
Function Hi	Functional code: 8-bit address is combined by 2 ASCII codes
Function Lo	
DATA (N-1) ... DATA (0)	Data content: nx8-bit data content is combine by 2n ASCII codes N<=16, the max is 32 ASCII codes
LRC CHK Hi	LRC check code: 8-bit check code is combined by 2 ASCII codes
LRC CHK Lo	
END Hi	END character: END Hi=CR (0x0D), END Lo=LF (0x0A)
END Lo	

9.6 Command code and communication data

9.6.1 Command code: 03H (0000 0011), read N words (16 words can be continuously read)

For example: for the frequency convertor with the slave address of 01H, and the start address of the internal memory is 0004, 2 words can be continuously read. See the structural description of this frame below:

RTU host command information

START	T1-T2-T3-T4
ADDR	01H
CMD	03H
HIGH BIT OF START ADDR.	00H
LOW BIT OF START ADDR	04H
HIGH BIT OF DATA NUMBER	00H
LOW BIT OF DATA NUMBER	02H
LOW BIT OF CRC CHK	85H
HIGH BIT OF CRC CHK	CAH
END	T1-T2-T3-T4

RTU slave response message

START	T1-T2-T3-T4
ADDR	01H
CMD	03H
BYTE NUMBER	04H
HIGH BIT OF DATA ADDR 0004H	13H
LOW BIT OF DATA ADDR 0004H	88H
HIGH BIT OF DATA ADDR 0005H	13H
LOW BIT OF DATA ADDR 0005H	88H
LOW BIT OF CRC CHK	73H
HIGH BIT OF CRC CHK	CBH
END	T1-T2-T3-T4

ASCII HOST command information

START	':'
ADDR	'0'
	'1'
CMD	'0'
	'3'
HIGH BIT OF START ADDR	'0'
	'0'
LOW BIT OF START ADDR	'0'
	'4'
HIGH BI TOF DATA NUMBER	'0'
	'0'
LOW BIT OF DATA NUMBER	'0'
	'2'
LRC CHK Hi	'F'
LRC CHK Lo	'6'
END Hi	CR
END Lo	LF

ASCII slave responding information

START	':'
ADDR	'0'
	'1'
CMD	'0'
	'3'
BYTE NUMBER	'0'
	'4'
HIGH BIT OF DATA ADDR 0004H	'1'
	'3'
LOW BIT OF DATA ADDR 004H	'8'
	'8'
HIGH BIT OF DATA ADDR 0005H	'1'
	'3'
LOW BIT OF DATA ADDR 0005H	'8'
	'8'
LRC CHK Hi	'C'
LRC CHK Lo	'2'
END Hi	CR
END Lo	LF

9.6.2 Command code: 06H (0000 0110), write a word

For example: write 5000 (1388H) to the slave addr. 02H frequency convertor to 0008H. See the structural description of the frame:

RTU host command information

START	T1-T2-T3-T4
ADDR	02H
CMD	06H
HIGH BIT OF START ADDR.	00H
LOW BIT OF START ADDR	05H
HIGH BIT OF DATA CONTENT	13H
LOW BIT OF DATA CONTENT	88H
LOW BIT OF CRC CHK	94H
HIGH BIT OF CRC CHK	AEH
END	T1-T2-T3-T4

RTU slave response message

START	T1-T2-T3-T4
ADDR	02H
CMD	06H
HIGH BIT OF DATA ADDR	00H
LOW BIT OF DATA ADDR	05H
HIGH BIT OF DATA CONTENT	13H
LOW BIT OF DATA CONTENT	88H
LOW BIT OF CRC CHK	94H
HIGH BIT OF CRC CHK	AEH
END	T1-T2-T3-T4

ASCII HOST command information

START	':'
ADDR	'0'
	'2'
CMD	'0'
	'6'
HIGH BIT OF DATA ADDR	'0'
	'0'
LOW BIT OF DATA ADDR	'0'
	'5'
HIGH BITOF DATA CONTENT	'1'
	'3'
LOW BIT OF DATA CONTENT	'8'
	'8'
LRC CHK Hi	'5'
LRC CHK Lo	'8'
END Hi	CR
END Lo	LF

ASCII slave responding information

START	':'
ADDR	'0'
	'2'
CMD	'0'
	'6'
HIGH BIT OF DATA ADDR	'0'
	'0'
LOW BIT OF DATA ADDR	'0'
	'5'
HIGH BIT OF DATA CONTENT	'1'
	'3'
LOW BIT OF DATA CONTENT	'8'
	'8'
LRC CHK Hi	'5'
LRC CHK Lo	'8'
END Hi	CR
END Lo	LF

9.6.3 Command code: 08H (0000 1000), diagnose the meaning of sub-functional code:

Sub-functional code	Description
0000	Back to the inquiry message data

For example: the word string content of 01H detecting circuit is similar with that of the responding information and see the form below:

RTU host command information

START	T1-T2-T3-T4
ADDR	01H
CMD	08H
HIGH BIT of sub-functional code	00H
LOW BIT of sub-functional code	00H
HIGH BIT OF DATA CONTENT	12H
LOW BIT OF DATA CONTENT	ABH
LOW BIT OF CRC CHK	ADH
HIGH BIT OF CRC CHK	14H
END	T1-T2-T3-T4

RTU slave response message

START	T1-T2-T3-T4
ADDR	01H
CMD	08H
HIGH BIT OF SUB-FUNCTIONAL CODE	00H
LOW BIT OF SUN-FUNCTIOANL CODE	00H
HIGH BIT OF DATA CONTENT	12H
LOW BIT OF DATA CONTENT	ABH
LOW BIT OF CRC CHK	ADH
HIGH BIT OF CRC CHK	14H
END	T1-T2-T3-T4

ASCII HOST command information

START	':'
ADDR	'0'
	'1'
CMD	'0'
	'8'
HIGH BIT OF SUB-FUNCTIONAL CODE	'0'
	'0'
LOW BIT OF SUB-FUNCTIONAL CODE	'0'
	'0'
HIGH BITOF DATA CONTENT	'1'
	'2'
LOW BIT OF DATA CONTENT	'A'
	'B'
LRC CHK Hi	'3'
LRC CHK Lo	'A'
END Hi	CR
END Lo	LF

ASCII slave responding information

START	':'
ADDR	'0'
	'1'
CMD	'0'
	'8'
HIGH BIT OF SUB-FUNCTIONAL CODE	'0'
	'0'
LOW BIT OF SUB-FUNCTIONAL CODE	'0'
	'0'
HIGH BIT OF DATA CONTENT	'1'
	'2'
LOW BIT OF DATA CONTENT	'A'
	'B'
LRC CHK Hi	'3'
LRC CHK Lo	'A'
END Hi	CR
END Lo	LF

9.6.4 Frame error verification mode

The error verification mode of the frame mainly includes the verifications of two parts: i.e. bit check of the byte (even/odd parity check) and the whole data check of the frame (CRC check or LRC check).

9.6.4.1 Byte bit check

The user can select different check mode or no check as required, which may influence the verification bit place of each byte.

The meaning of even parity check: add an even parity bit prior to the data transmission used to indicate that the number of "1" in the data is odd or even. The check bit is 0 if it is even, "1" for the odd. It is used to remain the parity of the data.

The meaning of odd parity check: add an odd parity bit prior to the data transmission used to indicate that the number of "1" in the data is odd or even. The check bit is 0 if it is odd, "1" for the even. It is used to remain the parity of the data.

For instance, if you want to transmit "11001110" . There are 5 "1", the even parity bit is "1" if use even parity check, while the odd parity bit is "0" if use odd parity check. The parity check bit is put in the place if the check bit of the frame during data transmission, then the receiver also needs parity check. If the parity of the received data is inconsistent with the preset one, communication error occurred.

9.6.4.2 CRC (Cyclical Redundancy Check)

Using RTU form, the frame contains frame error detection based on CRC algorithm. CRC detected all the content of the frame. CRC contains two bytes and 16-bit binary value. It is added into the frame after calculated by the transmission device. The receiver will calculate the CRC of the frame it received and compare it with the one it received. Transmission error occurs of the two CRC values are not equivalent.

CRC is saved to 0xFFFF firstly, and then use a continuous over 6-bit byte to process the present value in the register. Then only 8-bit data in each character is valid to CRC while the start bit, end bit and parity check bit are invalid.

During the CRC production, each 8-bit character is individually different or {XOR} from the content in the register, and the result moves toward the lowest effective bit while the highest effective bit is filled with 0. LSB is picked up to detect. If LSB is 1, the individual value in the register is different from the preset one; if LSB is 0, no this performance. The whole process needs to be repeated for 8 times. As the last bit (8th bit) finished, the next 8-bit is individually different from the present value in the register. At last, the value in the register is the CRC value after the performance of all bytes.

The algorithm of CRC adopts the international standard CRC check rule. The user may refer to the relevant CRC algorithm to edit the proper CRC algorithm as required when editing the CRC algorithm.

Here provides a simple function of CRC for your reference (C-language programming):

```
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);
}
```

In the stair logic, CKSM calculates CRC value according to the frame content by LUT which is simple and fast, but needs larger ROM space, so please be prudent to use in the environment where the space is required.

9.6.4.3 ASCII mode check (LRC check)

LRC check is the accumulated value from ADDRESS to DADTA, such as the above check code in 1.6.2: 0x02+0x06+0x00+0x08+

0x13+0x88=oxAB, and then select the compliment of 2=0x55.

Here provides a simple LRS algorithm and function for your reference (C-language programming):

```
Static unsigned char
LRC(auchMsg,usDataLen)
unsigned char *auchMsg;
unsigned short usDataLen;
{
  unsigned char uchLRC=0;
  while(usDataLen--)
     uchLRC+=*auchMsg++;
  return((unsigned char)(~
  ((char)uchLRC)));
}
```

9.6.5 Definition of data addr.

This part is the definition of the communication data addr. which is used to control the operation of the frequency convertor and obtain the state information and the relevant parameter setting etc.

(1) Indicating rules of the parameter addr.

With the functional code, but it needs to be converted to hex. If the code of H5.05 is 58, the hex indication of the functional addr. Is 003AH.

The scopes of high and low byte are: high-bit byte -00~01; low-bit byte—00~FF.

Note: HE Group: the parameters set by the manufacturer, so they are unreadable or unchangeable; some parameters can not be modified when the frequency convertor is under operation; some parameters never can be modified in any state; the setting scope, unit and relevant instructions should be noted if you want to change the functional code.

In addition, because EEPROM is saved frequently, it may decrease the service life if EEPROM. For users, some functional codes are unnecessary to save under communication mode and just need to modify the value in RAM to satisfy the application requirements. You can achieve the function only by changing 0 in the highest bit of the functional code to 1. For instance, the functional code H0.07 is not saved to EEPROM, just changing the value in RAM to set the address at 8007; the address can only be used write in RAM, but without read function, i.e. it is invalid address for read.

(2) Address instruction of other functions

Function	Address definition	Data meaning instruction	R/W feature
Communication control command	1000H	001H: forward operation	W/R
		002H: reversal operation	
		003H: forward inching	
		004H: reversal inching	
		005H: stop	
		006H: free stop (urgent stop)	
		007H: error default	
		008H: stop inching	
Frequency state	1001H	0001H: under forward operation	R
		0002H: under reversal operation	
		0003H: under standby mode	
		0004H: error	

Function	Address definition	Data meaning instruction	R/W feature
Address of communication setting value	2000H	The communication setting value scope (-10000~10000) Note: the communication setting value is the relative percentage (-100.00%~100.00%) and can be used for write action. When set it as the frequency source, the corresponding value is the percentage of the max frequency (H0.07); when it is used as the given torque, the corresponding value id the percentage of the upper limit torque (H3.14). when it is use das the PID given or feedback value, the corresponding value is the percentage of PID.	W/R
Input function setting of analog terminal	2001H	Reservation	W/R
	3000H	Running speed	R
	3001H	Preset speed	R
	3002H	Bus voltage	R
	3003H	Output voltage	R
	3004H	Output current	R
	3005H	Running rotational speed	R
	3006H	Output power	R
	3007H	Output torque	R
	3008H	PID GIVEN VALUE	R
	3009H	PID feedback value	R
	300AH	Flag state of terminal input	R
	300BH	Flag state of terminal output	R
	300CH	Analog AI1 value	R
	300DH	Analog AI2 value	R
	300EH	Analog AI3 value	R
	300FH	Analog AI4 value	R
	3010H	High-speed pulse frequency (HDI1)	R
	3011H	High-speed pulse frequency (HDI2)	R
	3012H	Multi-speed and the present phase of PLC	R
	3013H	Length	R
	3014H	Input value of the external counter	R
	3015H	Torque direction (0: positive; 1: negative)	R
	3016H	Equipment code	R

Function	Address definition	Data meaning instruction	R/W feature
Check address of parameters locked password	4000H	****	
Command address of parameters locked password	4001H	55AAH	W
Error address	5000H	The error code is consistent with the error type code in the functional code menu. But the returning data here to the upper computer is hex data, but no the error character.	R

Note: see the comparison table of number read from 5000H and the actual error:

Number	Error type
0x00	No error
0x01	Inverter unit protection (Fo)
0x02	RESERVATION
0x03	RESERVATION
0x04	Acceleration over-current （oC.1）
0x05	Deceleration over-current (oC.2)
0x06	Constant over-current (oC.3)
0x07	Acceleration overvoltage (oE.1)
0x08	Deceleration over voltage (Oe.2)
0x09	Constant overvoltage (oE.3)
0x0A	Bus under-voltage error (Lu)
0x0B	Overload of the motor (oL.1)
0x0C	Overload of the frequency convertor (oL.2)

Number	Error type
0x0D	Input default phase (PH.i)
0x0E	Output default phase (PF.o)
0x0F	Overheat error of the rectifier module (oH.1)
0x10	Overheat error of inverter module (oH.2)
0x 11	External error (Eto,E)
0x 12	Communication error (Con,E)
0x 13	Current detected error (Atc.E)
0x 14	Motor self-studying error (Pud.E)
0x 15	EEPROM operation error (EPr. E)
0x 16	PID break error (Pid.E)
0x 17	Braking unit error (Fdc.E)
0x 18	Stop (ovEr)

The parameters you read in the frequency convertor are hex and the values are: the actual value *10K, where K is the number after the decimal point.

es are: the actual value *10K, where K is the number after the decimal point.

9.6.6 Response of error information

When the slave responds, the functional code or error address are used to show it is normal response (no error) or there is any mistake (objection response). For normal response, the corresponding functional code, data address and sub-functional code are used; for objection response, it is the same with normal code, but the first bit is logic1.

For instance, a host sends a message to read a group of address data, and the functional codes are as follow:

00000011 (hex 03H)

For normal response, the slave returns the same functional code while for objection response, just return.

000011 (hex 83H)

Besides the modified objection error, the equipment will respond the abnormal code with 1 byte, which defines the cause of the abnormal operation.

After the host is answered by the slaves, the typical way is to resend the information or modify the corresponding command.

Meaning of error cod

MODBUS abnormal code		
Code	Designation	Meaning
01H	Illegal function	The functional code received from the upper computer is forbidden to operate; the salve also may process the request in error state.
02H	Illegal data address	The requiring address is forbidden, especially the register address and combination of transmitted bytes are invalid.
03H	Illegal data value	If the data you received is forbidden. Note: it does not mean that an extra value out of the application is in the data saved in the register.
06H	Busy slave	Busy frequency convertor (EPPROM is saving)
10H	Incorrect password	The written password of verification address is different from the user's preset by H7..00
11H	Check error	During the frame information sent by the upper computer, CRC in RTU, or LRC in ASCII are different from the checked value of the slave computer, and reports error information.
12H	Parameter modification is null	During the write command sent by the upper computer, the data is beyond the parameter scope or the write address is unchangeable presently.
13H	Locked system	When the upper computer read or write, if the users set the password and unlocked password, the system reports being locked.

9.6.7Coding rule of equipment code:

The code is composed of 16bit numbers: high 8-bit and low 8-bit. The high 8-bit is the model and the low 8-bit is the derived models.

Meaning of the equipment code:

High 8-bit	Meaning	Low 8-bit	Meaning
00	PG vector Series	01	Frequency convertor with PG vector
		02	Water supply
		03	IF 1500HZ
		04	IF 3000HZ
		05	TENSION
		06	WITH PG 18A
		07	With PG 13A
		08	WITH PG17A
01	Non PG vector series	01	Vector frequency convertor
		02	IF1500HZ
02	V/F series	01	Common frequency converto

Appendix: functional parameters listr

The function parameters of the series of vector frequency convertor can be divided into 15 groups such as H0~H9, HA, HB, HC, HD and HE. Each functional group contains several functional codes which are indicated in the form: Group number of the functional code+ number of functional code. X.YZ in the documents means YZ functional code in X group. For instance, "H5.08" means the functional code 8 in Group 5. The functional group number is corresponding to the primary menu; the functional code number to secondary menu and the functional code is corresponding to third-level menu for convenience setting of the functional code during operation panel.

1. See the instruction of the column in functional list below:

Column 1 "functional code": the number of functional parameter group and the parameter

Column 2: "designation": full name of the functional parameter;

Column 3: "detail instruction of parameters": the detail description of the functional parameter.

Column 4: "factory setting value": original setting value of the functional parameter.

Column 5: "change": the change attributes of the functional parameter (whether the change is allowed to perform) . See the instruction below:

"o": the setting value of the parameter convertor can be changed when the frequency is either under stop or operation mode.;

"x": the setting value of the parameter can not be changed under the operation mode of the frequency convertor.

"*" : the parameter is actual detected value can not be changed.

"-": refers to "factory parameter", limited to be set by the manufacturer and users are forbidden to operate;

(the frequency convertor has set the auto detection constraint to the changing attributes of each parameter, which helps users avoid mistaken change).

Column 6; "serial number": the sequence number of the functional code among all functional codes. In the mean time, it refers to the register address of the communication.

2. "Parameter system" contains DEC and HEX. If the parameter adopts hex, the data at each bit is independent and the scope of some bits can be hex (0~F).

3. "Factory setting value" indicates the updated value when you recover the factory setting:but the detected value or recorded value will be updated continuously.

4. In order to protect the parameters effectively, the frequency convertor provides password protection for the functional code。After you set the password (i.e. the parameter of H7.00 is not 0), the user enter the password verification state first prior to entering the functional code editing state by pressing MENU ESC. The operator can enter only if input the correct password. For the factory setting zone, the factory password is necessary. (prompt: do not try to change the factory setting parameter because improper parameter setting may cause abnormal operation or damage of the frequency convertor).

After you set your password, the password protection takes effect only without other keys operation within 5 min; similarly, after you input the correct password, if no any key operation within 5 min, the password protection will be locked again. you may modify the user's password any time during the unlocked state of the password protection, and the last password you input is effective.

Set H7.00 at 0, the user's password can be cancelled; the parameter is protected by the password upon power-on mode if H7.00 IS NOT 0.

5. The above rules also should be complied to for the change of user's password and functional word in serial communication

Functional code	Designation	Detail description of parameters	Factory value	Change	Number
H0 Group basic functions					
H0.00	Speed control mode	0: speedless sensor vector control 1: high-performance space voltage vector control 2: torque control (no PG vector control)	0l1	×	0.
H0.01	Running command route	0: keyboard command (LED is off) 1: terminal command (LED flashing) 2: communication command (LED is on)	0	×	1.
H0.02	UP/DOWN set by keyboard and terminal	0: valid and save upon power-fail of the convertor 1: valid and not save upon power-fail of the convertor 2: invalid of UP.DOWN SETTING 3: the setting is valid under operation mode and becomes 0 upon stop.	0	○	2.
H0.03	Frequency command option	0: set by keyboard 1: set by analog AI1 (the potentiometer can be selected by the jumper) 2: set by analog AI2 (V/I input can be selected by the jumper) 3: AI1+AI2 4: set multi-speed setting 5: PID control setting 6: remote control setting	0	○	3.
H0.04	Max output frequency	10.00~600.00Hz	50.00Hz	×	4.
H0.05	Upper limit of frequency	H0.06~H0.04 (max frequency)	50.00Hz	○	5.
H0.06	Lower limit frequency	0.00Hz~H0.05 (upper limit of frequency)_	0.00Hz	○	6.
H0.07	Keyboard setting frequency	0.00Hz~H0.05 (max frequency)	50.00Hz	○	7.
H0.08	Acceleration time 1	0.1~3600.0s	Model setting	○	8.
H0.09	Deceleration time 1	0.1~3600.0s	Model setting	○	9.
H0.10	Direction option	0: default 1: opposite direction 2: reversal is forbidden	0	×	10.
H0.11	Carrier frequency setting	1.0~15.0kHz	Model setting	○	11.
H0.12	Motor parameter self-studying	0: no operation 1: complete self-studying 2: static self-studying	0	×	12.
H0.13	Functional parameter recovery	0: no operation 1: recover the default –phase value 2: eliminating the error record	0	×	13.
H0.14	AVR option	O: null 1: always valid 2: invalid upon deceleration	2	○	14.

Functional code	Designation	Detail description of parameters	Factory value	Change	Number
H1 Group: start-off control group					
H1.00	Start operation mode	0: start directly 1: DC braking first and then restart 2: speed tracing and then restart	0	×	15.
H1.01	Initial frequency of direct start	0.00~10.00Hz	0.50Hz	○	16.
H1.02	Holding time of the start frequency	0.0~50.0s	0.0s		17.
H1.03	Braking current prior to the start	0.0~150.0%	0.0%	○	18.
H1.04	Braking time prior to the start	0.0~50.0s	0.0s		19.
H1.05	Stop mode option	0: slow down and stop 1: free stop	0	○	20.
H1.06	Start frequency of braking	0.00~H0.04 (max frequency)	0.00Hz		21.
H1.07	Holding time of braking	0.0~50.0s	0.0s	○	22.
H1.08	DC braking current	0.0~150.0%	0.0%		23.
H1.09	DC braking time	0.0~50.0s	0.0s	○	24.
H1.10	Dead zone of FWD/REV	0.0~3600.00.0s	0.0s		25.
H1.11	Protection option upon power-on	0: the terminal command is invalid upon power-on 1: the terminal command is valid upon power-on	0	○	26.
H1.12	Poles option of input and output terminals	0x00~0x3F	3F	○	27.
H2 Group: motor parameters					
H2.00	Type of the frequency convertor	0：G**type** 1：P **type**	Model setting	×	28.
H2.01	Motor rated power	0.4 ~ 900.0kW	Model setting	×	29.
H2.02	Motor rated frequency	0.01Hz ~ H0.04 (**max**)	Model setting	×	30.
H2.03	Motor rated speed	0 ~ 36000rpm	Model setting	×	31.
H2.04	Motor rated voltage	0 ~ 460V	Model setting	×	32.
H2.05	Motor rated current	0.1 ~ 2000.0A	Model setting	×	33.
H2.06	Stator resistance	0.001 ~ 65.535Ω	Model setting	○	34.
H2.07	Rotor resistance	0.001 ~ 65.535Ω	Model setting	○	35.
H2.08	Stator, rotor inductance	0.1 ~ 6553.5mH	Model setting	○	36.
H2.09	Mutual inductance of stator and rotor	0.1 ~ 6553.5mH	Model setting	○	37.
H2.10	Non-load current	0.01 ~ 655.35A	Model setting	○	38.

Functional code	Designation	Detail description of parameters	Factory value	Change	Number
H3 Group: vector control group					
H3.00	Speed proportional gain1	0 ~ 100	20	○	39.
H3.01	Speed integral time1	0.01 ~ 10.00s	0.50s	○	40.
H3.02	Shift low frequency	0.00Hz ~ H3.05	5.00Hz	○	41.
H3.03	Speed proportional gain 2	0 ~ 100	15	○	42.
H3.04	Speed integral time2	0.01 ~ 10.00s	1.00	○	43.
H3.05	Shift high frequency	H3.02 ~ H0.04 (max)	10.00Hz	○	44.
H3.06	VC slip compensation factor	50% ~ 200%	100%	○	45.
H3.07	Upper limit if the torque	0.0 ~ 200.0% (rated current of the frequency convertor)	150.0%	○	46.
H4 Group: V/F control					
H4.00	V/F CURVE	0: linear V/F curve 1: 2.0 th-power torque v/f curve	0	×	47.
H4.01	Torque hoist	0.0%: (auto) 0.1% ~ 30.0%	0.0%	○	48.
H4.02	Torque hoist end	0.0% ~ 50.0% (corresponding to the motor rated frequency)	20.0%	×	49.
H4.03	V/F slip compensation limit	0.0 ~ 200.0%	0.0%	○	50.
H4.04	Energy-saving option	0: no action 1: auto energy-saving operation	0	×	51.
H4.05				*	52.
H5 Group input terminals					
H5.00	S1 function option	0: null 1: FWD 2:REV 3: three-wire control 4: FWD inching 5:REV inching 6: free stop 7: error reset 8: external error input 9: increasing frequency (UP) 10: deceasing frequency (DOWN)	12	×	53.
H5.01	S2 function option		13	×	54.
H5.02	S3 function option		14	×	55.
H5.03	S4 function option		1	×	56.

Functional code	Designation	Detail description of parameters	Factory value	Change	Number
H5.04	S5 function option	11. UP/DOWN frequency clearing 12: multi-speed terminal1 13: multi-speed terminal2 14: multi-speed terminal 3 15: acceleration and deceleration time option 16:PID control pause 17: wobble frequency pause (at present frequency) 18: wobble frequency reset (back to central frequency) 19: acceleration and deceleration forbidden 20: torque control forbidden 21: temporary clearing of UP/Down frequency 22: stop DC braking 23~25: reservation	2	×	57.
H5.05	S6 function option		7	×	58.
H5.06	S7 function option		4	×	59.
H5.07	D8 function option		5	×	60.
H5.08	Switching filtering number	1~10	5	○	61.
H5.09	Terminal control mode	0: two-wire control 1 1: two-wire control 2 2: three-wore control 1 3: three-wire control 2	0	×	62.
H5.10	Change rate of frequency by UP/DOWN	0.01 ~ 50.00Hz/s	0.50Hz/s	○	63.
H5.11	Lower limit of AI1	0.00V ~ 10.00V	0.00V	○	64.
H5.12	Corresponding setting of AI1 lower limit	-100.0% ~ 100.0%	0.0%	○	65.
H5.13	Upper limit of AI1	0.00V ~ 10.00V	10.00V	○	66.
H5.14	Corresponding setting of upper limit if AI1	-100.0% ~ 100.0%	100.0%	○	67.
H5.15	AI1 input filtering time	0.00s ~ 10.00s	0.10s	○	68.
H5.16	LOER LIMIT OF AI2	0.00V ~ 10.00V	0.00V	○	69.
H5.17	Corresponding setting of AI2 lower limit	-100.0% ~ 100.0%	0.0%	○	70.
H5.18	Upper limit of AI2	0.00V ~ 10.00V	10.00V	○	71.
H5.19	Corresponding setting of AI2 upper limit	-100.0% ~ 100.0%	100.0%	○	72.
H5.20	AI2 Input filtering time	0.00s ~ 10.00s	0.10s	○	73.

Functional code	Designation	Detail description of parameters	Factory value	Change	Number
H6 Group: output terminals					
H6.00	Y1 output option	0: no output 1: the motor is under FWD operation 2: the motor is under REV operation 3: error output 4: frequency level detecting FDT output 5: arrival frequency 6: zero speed operation 7: arrival frequency of upper limit 8: arrival frequency of lower limit 9~10; reservation	1	○	74.
H6.01	Y2 output option		5	○	75.
H6.02	Relay K output option		3	○	76.
H6.03	FM output option	0: running frequency 1: setting frequency 2: running speed 3 output current 4: output voltage 5: output power 6: output torque 7: input value of analog AI1 8: input value of analog AI2 9~10: reservation	0	○	77.
H6.04	AM output option		3	○	78.
H6.05	DO output option		0	○	79.
H6.06	Lower limit of FM output	0.0%~100.0%	0.0%	○	80.
H6.07	Corresponding value of lower FM limit	0.00V~10.00V	0.00V	○	81.
H6.08	Upper limit FM output	0.0%~100.0%	100.0%	○	82.
H6.09	Corresponding value of upper FM limit	0.00V~10.00V	10.00V	○	83.
H6.10	Lower limit of AM output	0.0%~100.0%	0.0%	○	84.
H6.11	Corresponding value of lower limit of AM output	0.00V~10.00V	0.00V	○	85.
H6.12	Upper limit of AM output	0.0%~100.0%	100.0%	○	86.
H6.13	Corresponding value of upper limit of AM output	0.00V~10.00V	10.00V	○	87.
H6.14	DO max output frequency	0.1~50.0 (MAX: 50KHZ)	10.0kHz	○	88.
H7 Group human-computer interface					
H7.00	User password	0 ~ 65535	0	○	89.
H7.01	LCD language display	0：Chinese 1：English	0	○	90.

Functional code	Designation	Detail description of parameters	Factory value	Change	Number
H7.02	Functional parameter copy	0: no operation 1: upload the functional parameter to LCD keyboard 2: download the LCD keyboard parameter to this device Note: the parameter becomes 0 after the implementation of 1~2 actions	0	×	91.
H7.03	F/R/JOG functional option	0: inching 1; FWD/REV shift 2: clear UP/DOWN setting	0	×	92.
H7.04	STOP/RST Stop functional option	0: limited to panel control 1: valid both for panel and terminal control 2: valid both for panel and terminal control 3: valid for all modes	0	○	93.
H7.05	Reservation	0~3	0	○	94.
H7.06	Display parameters option under operation mode	0~0x7FFF BIT0: running frequency BIT1: setting frequency BIT2: bus voltage BIT3: output voltage BIT4: output current BIT5: running speed BIT6: output power BIT7: output torque BIT8: PID given value BIT9: PID feedback value BIT10: input terminal state BIT11: output terminal state BIT 12: analog AI1 value BIT 13: analog AI2 value BIT14: present phase of multi-speed BIT15: torque setting value	0x3FF	○	95.
H7.07	Display parameters option under stop mode	1~0x1FF BIT0: setting frequency BIT1: BUS voltage BIT2: input terminal state BIT3: output terminal state BIT4: PID given value BIT5: PID feedback value BIT6: analog AI1 value BIT7: analog Ai2 value BIT8: present phase of multi-speed BIT9: torque setting value BIT10~BIT15: RESERVATION	0xFF	○	96.

Functional code	Designation	Detail description of parameters	Factory value	Change	Number
H7.08	Temperature of rectifier module	0 ~ 100.0℃		*	97.
H7.09	Temperature of inverter module	0 ~ 100.0℃		*	98.
H7.10	Software version			*	99.
H7.11	Accumulated running time of the device	0 ~ 65535h	0	*	100.
H7.12	the previous two error type	0~24 0: no error 1: output protection of inverter unit (Fo) 2~3 reservation 4: Over-current upon acceleration(Oc.1) 5: over-current upon deceleration(oC.2) 6: over-current at constant speed(oC.3) 7: overvoltage upon acceleration(oE.1)		*	101.
H7.13	Previous error	8: overvoltage upon deceleration(oE.2) 9: over voltage at constant speed (oE.3) 10: bus under-voltage error (Lu) 11: motor overload (oL.1) 12: overload of frequency convertor (oL.2) 13: Input default phase (PF.i) 14: Output default phase (PF.o) 15: overheat of rectifier module (oH.1) 16: overheat of inverter module (oH.2)		*	102.
H7.14	Present error	17: external error (Eto.E) 18: communication error (Con.E) 19: current detected error (Atc.E) 20: motor self-studying error (Pud.E) 21: EEPROM operation error (EPr.E) 22: PID feedback break error (PID.E) 23: Braking unit error (Fdc.E) 24: stop error (over.)		*	103.
H7.15	Present error running frequency		0.00Hz	*	104.
H7.16	Present error output current		0.0A	*	105.
H7.17	Present error bus voltage		0.0V	*	106.
H7.18	Present error input terminal state		0	*	107.
H7.19	Present error output terminal state		0	*	108.

Functional code	Designation	Detail description of parameters	Factory value	Change	Number
H8 Group : Strengthening functions					
H8.00	Acceleration time2	0.1～3600.0s	Model setting	○	109.
H8.01	Deceleration time 2	0.1～3600.0s	Model setting	○	110.
H8.02	Inching frequency	0.00～H0.04 (max frequency)	5.00Hz	○	111.
H8.03	Acceleration time of inching	0.1～3600.0s	Model setting	○	112.
H8.04	Deceleration time of inching	0.1～3600.0s	Model setting	○	113
H8.05	Hooping frequency	0.00～H0.04 (max frequency)	0.00Hz	○	114.
H8.06	Amplitude of hopping frequency	0.00～H0.04 (max frequency)	0.00Hz	○	115.
H8.07	Amplitude of wobble frequency	0.0～100.0% (relative setting frequency)	0.0%	○	116.
H8.08	Amplitude of kick frequency	0.0～50.0% (relative setting frequency)	0.0%	○	117.
H8.09	Wobble frequency promotion time	0.1～3600.0s	5.0s	○	118.
H8.10	Wobble frequency descending time	0.1～3600.0s	5.0s	○	119.
H8.11	Number of auto error reset	0～3	0	○	120.
H8.12	Interval of error auto reset	0.1~100.0s	1.0s	○	121.
H8.13	FDT level detecting value	0.00～ H0.04 (max frequency)	50.00Hz	○	122.
H8.14	PDT lagging detecting value	0.0～100.0% (FDT level)	5.0%	○	123.
H8.15	Detecting amplitude upon the arrival frequency	0.0～100.0% (max frequency)	0.0%	○	124.
H8.16	Voltage of braking valve	115.0～140.0% (standard bus voltage 380V series)	130.0%	○	125.
		115.0～140.0% (standard bus voltage 220V series)	120.0%		
H8.17	Display coefficients of speed	0.1~999.9% Mechanical speed =120x running frequency x H8.17/number of motor poles	100.0%	○	126.
H9 Group: PID given source option					
H9.00	PID given source option	0: keyboard given (H9.01) 1: analog route AI1 given 2: analog route Ai2 given 3: remote communication given 4: multi-phase given	0.0%	○	127.
H9.01	Keyboard preset PID given	0.0%~100.0%	0	○	128.

Functional code	Designation	Detail description of parameters	Factory value	Change	Number
H9.02	Pid feedback source option	0: analog route AI1 feedback 1: analog route AI2 feedback 2: AI1+AI2 feedback 3: remote communication feedback	0	○	129.
H9.03	PID output feature option	0: positive output 1: negative output	0	○	130.
H9.04	Proportional gain	0.00~100.00	1.00	○	131.
H9.05	Integral time (Ti)	0.01~10.00s	0.10s	○	132.
H9.06	Differential time (Td)	0.00~10.00s	0.00s	○	133.
H9.07	Sampling period (T)	0.01~100.00s	0.10s	○	134.
H9.08	Deviation limit of PID control	0.0~100.0%	0.0%	○	135.
H9.09	Detected value of feedback break	0.0~100.0%	0.0%	○	136.
H9.10	Detecting time of feedback break	0.0~3600.0s	1.0s	○	137.
HA Group: multi-speed control group					
HA.00	Multi-speed 0	-100.0~100.0%	0.0%	○	138.
HA.01	Multi-speed 1	-100.0~100.0%	0.0%	○	139.
HA.02	Multi-speed 2	-100.0~100.0%	0.0%	○	140.
HA.03	Multi-speed 3	-100.0~100.0%	0.0%	○	141.
HA.04	Multi-speed 4	-100.0~100.0%	0.0%	○	142.
HA.05	Multi-speed 5	-100.0~100.0%	0.0%	○	143.
HA.06	Multi-speed 6	-100.0~100.0%	0.0%	○	144.
HA.07	Multi-speed 7	-100.0~100.0%	0.0%	○	145.
Hb group : protection parameters					
Hb.00	Motor overload protection option	0: no protection 1: common motor (with low-speed compensation) 2: frequency motor (without low-speed compensation)	2	×	146.
Hb.01	Current protection upon overload	20.0%~120.0% (motor rated current)	100.0%	○	147.
Hb.02	Frequency descend point upon momentary power-fail	70.0~110.0%	80.0%	○	148.
Hb.03	Frequency descend rate upon momentary power-fail	0.00Hz~H0.04 (max frequency)	0.00Hz	○	149.
Hb.04	Overvoltage stalling protection	0; forbidden 1: permissible	0	○	150.

Functional code	Designation	Detail description of parameters	Factory value	Change	Number
Hb.05	Voltage protection upon over voltage stalling	110~150% (380V series) 110~150% (220V series)	130% 120%	○	151.
Hb.06	Auto current-limiting level	100~200%	G Type: 160% P Type: 12%	○	152.
Hb.07	Frequency descend rate upon current limiting	0.00~100.00Hz/s	10.00Hz/s	○	153.
HC Group serial communication group					
HC.00	Communication addr of the device	1~247.0is the broadcast address	1	○	154.
HC.01	Baud rate setting	0: 1200bps 1: 2400bps 2: 4800bps 3: 9600bps 4: 19200bps 5: 38400bps	4	○	155.
HC.02	Data bit check	0: no check (N, 8, 1) for RTU 1: even parity (E, 8, 1) for RTU 2: odd parity (0, 8, 1) for RTU 3: no check (N, 8, 2) for RTU 4: even parity (E, 8, 2) for RTU 5: odd parity (0, 8, 2) for RTU 6: no check (N, 7, 1) for ASCII 7: even parity (E, 7, 1) for ASCII 8: odd parity (0, 7, 1) for ASCII 9: no check (N, 7, 2) for ASCII 10: even parity (E, 7, 2) for ASCII 11: odd parity (0, 7, 2) for ASCII 12: no check (N, 8, 1) for ASCII 13: even parity (E, 8, 1) for ASCII 14: odd parity (0, 8, 1) for ASCII 15: no check (N, 8, 2) for ASCII 16: even parity (E, 8, 2) for ASCII 17: odd parity (0, 8, 2) for ASCII	1	○	156.
HC.03	Response delay	0~200ms	5ms	○	157.
HC.04	Overtime error time	0.0 (null), 0.1~100.0s	0.0s	○	158.
HC.05	Transmission error handling	0: alarming and free stop 1: no alarm and continuous run 2: no alarm and stop in stop mode (limited under communication control mode) 3: no alarm and stop in stop mode (all control modes)	1	○	159.

Functional code	Designation	Detail description of parameters	Factory value	Change	Number
HC.06	Response handling	0: response for write action 1: no response for write action	0	○	160.
Hd Group: complement functions					
Hd.00	Low frequency threshold of restrain oscillation	0~5000	5	○	161.
Hd.01	High frequency threshold of restrain oscillation	0~5000	100	○	162.
Hd.02	Amplitude limit of restrain oscillation	0~10000	5000	○	163.
Hd.03	Low/high boundary f requency of restrain oscillation	0.00Hz~H0.04 (max frequency)	12.50Hz	○	164.
Hd.04	Restrain oscillation	0: restrain oscillation is valid 1: restrain oscillation is invalid	1	○	165.
Hd.05	PWM mode	0: PWM mode 1 1: PWM mode 2 2 PWM mode 3	0	×	166.
Hd.06	Torque setting mode option	0: keyboard setting torque (corresponding to Hd.07) 1: analog AI1 setting torque (100% corresponds to twice rated current of the frequency convertor) 2: analog AI2 setting torque (as 1) 3: analog AI1+AI2 setting torque (as 1) 4: multi-phase torque setting 5: remote communication setting torque (as 1)	0	○	167.
Hd.07	Keyboard setting torque	-200.0%~200.0% (rated current of the frequency convertor)	50.0%	○	168.
Hd.08	Setting source option of upper frequency limit	0: keyboard setting the upper limit frequency (H0.05) 1: analog AI1 setting the upper limit frequency (100% correspond to max frequency) 2: analog AI2 setting the upper limit frequency (as 1) 3: multi-phase setting the upper limit frequency (as 1) 4: remote communication setting the upper limit frequency (as1)	0	○	169.
Hd.09	Current-limiting option	0: current-limiting is always valid 1: current-limiting is invalid at constant speed	0	○	170.
HE Group Factory function group					
HE.00	Factory password	0~65535	*****	—	171.