HD5L Series
Elevator Controller

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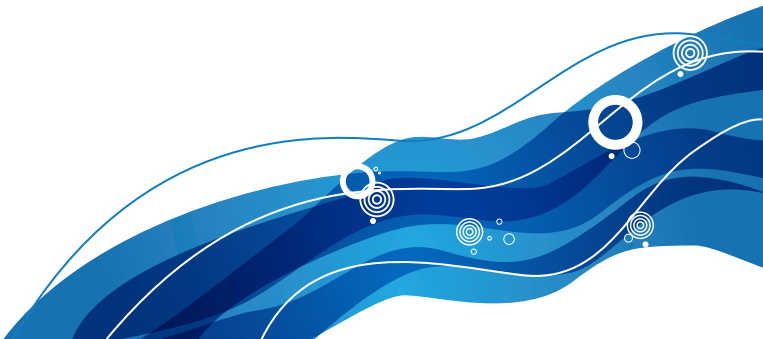
User Manual

V1.2
User manual



FOREWORD

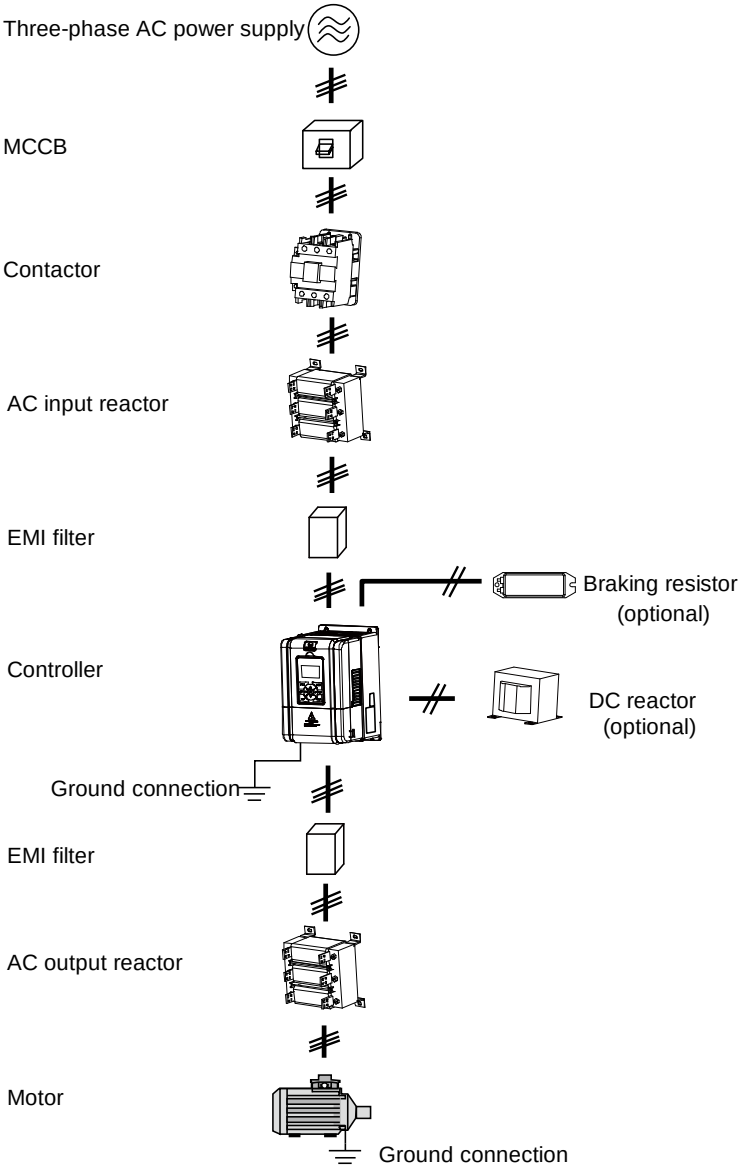
Thank you for purchasing HD5L series elevator controller manufactured by Shenzhen Hpmont Technology Co., Ltd..

This User Manual describes how to use HD5L series elevator controller and their installation wiring, parameter setting, troubleshooting and daily maintenance etc. Before using the product, please read through this User Manual carefully. In addition, please do not use this product until you have fully understood safety precautions.

Note:

- Preserve this Manual for future.
- Due to product upgrade or specification change, and for the purpose of improving convenience and accuracy of this manual, this manual's contents may be modified.
- If you need the User Manual due to damage, loss or other reasons, please contact the regional distributor of our company or directly contact our company Technical Service Center.
- For the first time using, the user should carefully read this manual.
- If you still have some problems during use, please contact our company Technical Service Center.
- **Telephone: 4008-858-959 or 189 4871 3800**
- The product warranty is on the last page of this Manual, please preserve it for future.

Connection with peripheral devices



CONTENTS

Chapter 1 Safety Information and Precautions

1.1 Safety Definition


Danger

Danger: A Danger contains information which is critical for avoiding safety hazard.


Warning

Warning: A Warning contains information which is essential for avoiding a risk of damage to product or other equipments.

Note

Note: A Note contains information which helps to ensure correct operation of the product.

1.2 About Motor and Load

Compared to the standard frequency operation

The HD5L series controllers are voltage-type controllers and their output is PWM wave with certain harmonic wave. Therefore, the temperature, noise and vibration of the motor will be a little higher than that at standard frequency operation.

Motor's overload protecting threshold

When choose the adaptive motor, the controller can effectively implement the motor thermal protection. Otherwise it must adjust the motor protection parameters or other protection measures to ensure that the motor is at a safe and reliable operation.

Lubrication of mechanical devices

At long time low-speed operation, it should provide periodical lubrication maintenance for the mechanical devices such as gear box and geared motor etc. to make sure the drive results meet the site need.

Check the insulation of the motor

For the first time using of the motor or after long time storage, it need check the insulation of the motor to avoid damage the controller because of the worse insulation motor.

Note:

Please use a 500V Mega-Ohm-Meter to test and the insulation resistance must be higher than 5Mohm.

1.3 Installation Limitation

No capacitor or varistor on the output side

Since the controller output is PWM wave, it is strictly forbidden to connect capacitor for improving the power factor or varistor for lightning protection to the output terminals so as to avoid the controller fault tripping or component damage.

Contactors and circuit breakers connected to the output of the controller

If circuit breaker or contactor needs to be connected between the controller and the motor, be sure to operate these circuit breakers or contactor when the controller has no output, so as to avoid any damage to the controller.

Rated voltage

The controller is prohibited to be used beyond the specified range of operation voltage. If needed, please use the suitable voltage regulation device to change the voltage.

Change three-phase input to single-phase input

For three-phase input controller, the users should not change it to be single-phase input.

If you have to use single-phase power supply, you should disable the input phase-loss protection function. And the bus-voltage and current ripple will increase, which not only influences the life of electrolytic capacitor but also deteriorates the performance of the controller. In that case, the controller must be derating and should be within the controller 60% rated value.

Lightning surge protection

The controller internal design has lightning surge overcurrent protection circuit, and has certain self-protection capacity against the lightning.

Altitude and derating

In the altitude exceeded 1000 meters area, since the heatsink efficiency will be reduced because of the tenuous air, the controller should be derating. Figure 1-1 is the derating curve of the controller rated current and the altitude.

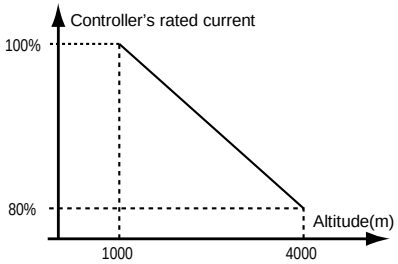
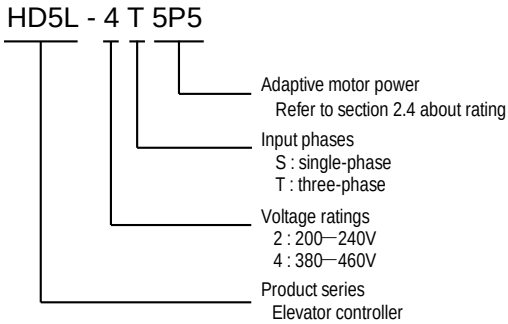


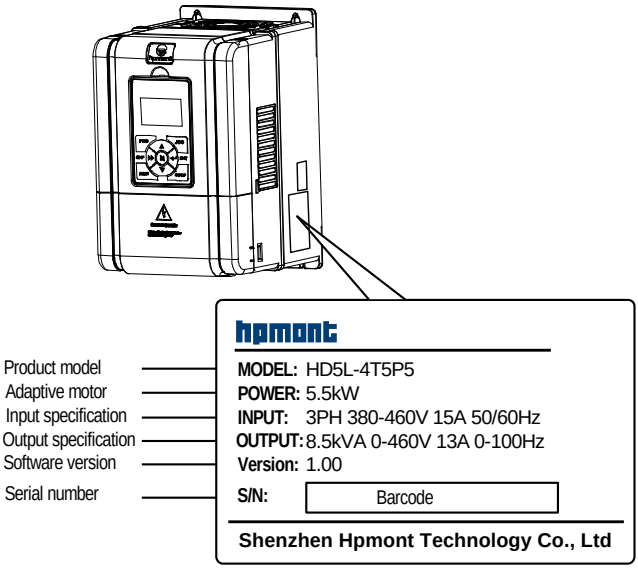
Figure 1-1 Derating curve of controller rated current and altitude

Chapter 2 Product Information

2.1 Model Explanation



2.2 Nameplate



2.3 Specifications

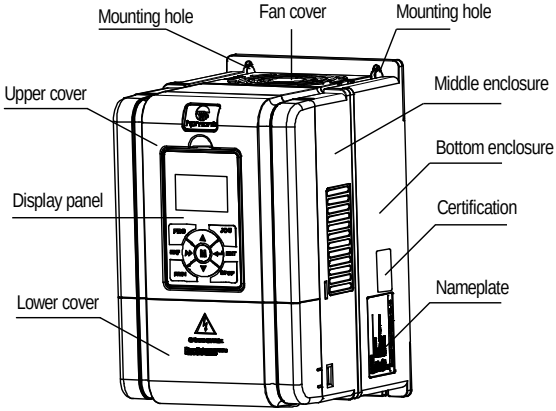
Item		Specification	
Electrical	Rated voltage and frequency	Single-phase: 200－240V, 50/60Hz Three-phase: 380－460V, 50/60Hz	
	Accuracy	Voltage: fluctuation within ± 10%, imbalance rate < 3% Frequency: ± 5%	
	Output voltage	0－input voltage	
	Output frequency	0－100.00Hz	
Performance	Maximum current	150% rated output current for 2 minutes 180% rated output current for 10 seconds	
	Control mode	V/f control; Open-loop vector control (SVC); Closed-loop vector control (VC)	
	Operation command control mode	Panel control; external terminal control; host computer communication control via SCI communication port	
	Speed setting mode	Digital setting, analogue setting, SCI communication setting	
	Speed setting resolution	Digital setting: 0.01Hz Analogue setting: 0.1% × max-frequency	
	Speed control accuracy	SVC: ± 0.5%	VC: ± 0.05%
	Speed control range	SVC: 1:100	VC: 1:1000
	Torque control response	SVC: < 200ms	VC: < 50ms
	Start torque	SVC: 180% rated-torque /0.5Hz	VC: 200% rated-torque /0Hz
Characteristic	Parameter upload and download function	To achieve parameters uploading or downloading	
	Programmable I/O interface	The programmable input interface has up to 34 functions The pragrammable output interface has up to 19 functions	
	Communication protocol	Controller is built-in MODBUS communication protocol	
Protection	Auto-inspection	To eliminate the potential safety problems, safety inspection for the peripheral devices is provided when power is on	
	Over-speed protection	To make sure safe running, elevator over-speed protection is provided	
	Speed deviation protection	To eliminate the potential safety problems, speed deviation detection protection is provided	
	Up/down forced deceleration function	Up/down forced deceleration function, to avoid climbing elevator or plunging elevator	
	I/O phase loss protection	I/O phase loss auto-detect and alarm function	
	Motor temperature detection	Real time detection for the motor temperature	
	Power output grounding fault protection	Power output grounding fault protection is enabled	
	Power output short circuit protection	Power output short circuit protection is enabled	

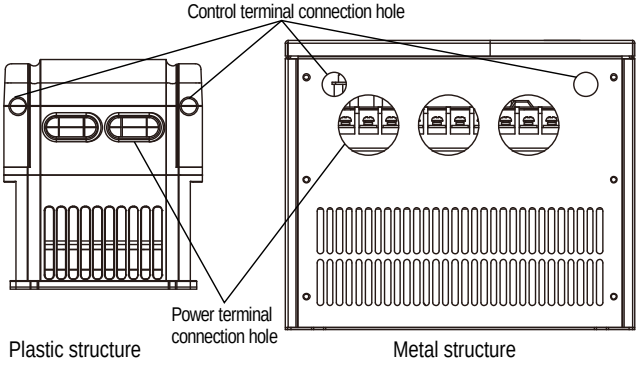
Item		Specification
I/O feature	Analogue supply	+10V, maximum current 100mA -10V, maximum current 10mA
	Digital supply	+24V, maximum current 200mA
	Analogue input	AI1 (control board): voltage 0－10V AI2, AI3 (control board): -10V－+10V/0－20mA (voltage/current is selectable) AI4 (I/O interface board): -10V－+10V/0－20mA (voltage/current is selectable, and differential input is supported)
	Analogue output	AO1, AO2: 0－10V/0－20mA (voltage/current is selectable)
	Digital input	DI1－DI6 (control board); DI7－DI12 (I/O interface board)
	Digital output	DO1, DO2
	Programmable relay output	R1A/R1B/R1C (control board) R2A/R2B/R2C; R3A/R3B/R3C; R4A/R4B/R4C (I/O interface board) Contact rating 250VAC/3A or 30VDC/1A
Communi-cation	SCI communication	RS-485 interface
Panel	LCD display	Function parameter setting, check the state parameters and the fault code etc.
	Parameter copy	To achieve quick parameter copy
Environment	Operation temperature	-10－+40℃, air temperature fluctuation is less than 0.5℃/min The derating value of the output current of the controller shall be 2% for each degree centigrade above 40℃. Max. allowed temperature is 50℃
	Storage temperature	-40－+70℃
	Location for use	Indoor, preventing from direct sunlight, no dust, corrosive, flammable gases, oil mist, water vaper, dripping or salt etc.
	Altitude	Less than 1000 meters, otherwise should be derating use
	Humidity	Less than 95%RH, non-condensing
	Ocsillation	Less than 5.9m/s^2 (0.6g)
Options	Encoder interface board	OC encoder interface board with frequency demultiplication output (HD-PG2-OC-FD) SINCOS encoder interface board with frequency demultiplication output (HD-PG5-SINCOS-FD) Line drive encoder interface board with frequency demultiplication output (HD-PG6-UVW-FD) Serial communication encoder interface board with frequency demultiplication output (HD-PG9-SC-FD) (support Endat)
	About panel	Mounting base to panel (HD-KMB) 1 meter extension cable to panel (HD-CAB-1M) 2 meter extension cable to panel (HD-CAB-2M) 3 meter extension cable to panel (HD-CAB-3M) 6 meter extension cable to panel (HD-CAB-6M)
	Enhanced protection	Protective cover (HD-CK-Frame4)
	Power unit	Power regenerative unit (HDRU)

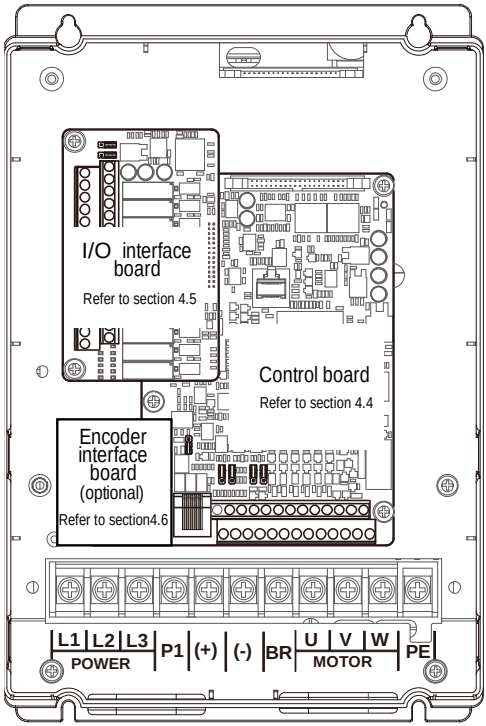
2.4 Ratings

Model	Rated capacity (kVA)	Rated input current (A)	Rated output current (A)	Motor power (kW)
Single-phase power supply: 200—240V, 50/60Hz				
HD5L-2S2P2	3.8	24.1	10	2.2
HD5L-2S3P7	5.9	40	17	3.7
Three-phase power supply: 200—240V, 50/60Hz				
HD5L-2T3P7	5.9	19	17	3.7
HD5L-2T5P5	8.5	28	25	5.5
HD5L-2T7P5	11	35	32	7.5
HD5L-2T011	16	47	45	11
HD5L-2T015	21	62	55	15
HD5L-2T018	24	77	70	18.5
HD5L-2T022	30	92	80	22
HD5L-2T030	39	113	110	30
Three-phase power supply: 380—460V, 50/60Hz				
HD5L-4T2P2	3.4	7.3	5.1	2.2
HD5L-4T3P7	5.9	11.9	9.0	3.7
HD5L-4T5P5	8.5	15	13	5.5
HD5L-4T7P5	11	19	17	7.5
HD5L-4T011	16	28	25	11
HD5L-4T015	21	35	32	15
HD5L-4T018	24	39	37	18.5
HD5L-4T022	30	47	45	22
HD5L-4T030	39	62	60	30
HD5L-4T037	49	77	75	37
HD5L-4T045	59	92	90	45

2.5 Parts of Controller






I/O interface board
Refer to section 4.5
Control board
Refer to section 4.4
Encoder interface board
(optional)
Refer to section4.6
L1 L2 L3
POWER
P1
(+)
(-)
BR
U V W
MOTOR
PE

Chapter 3 Mechanical Installation

3.1 Installation Precautions

Danger

- Do not install if the controller is imcomplete or impaired.
- Make sure that the controller is far from the explosive and combustible things.
- Do not operate the controller until the power is cut-off 10 minutes later.

Warning

- It is required not only carry the panel and the cover but also the controller bottom enclosure.
- Do not play metal into the controller when installing.

3.2 Requirement for the Installation Site

Ensure the installation site meeting the following requirements:

- Do not install at the direct sunlight, moisture, water droplet location;
- Do not install at the combustible, explosive, corrosive gas and liquid location;
- Do not install at the oily dust, fiber and metal powder location;
- Be vertical installation on fire-retardant material with a strong support;
- Make sure adequate cooling space for the controller so as to keep the ambient temperature between - 10—+ 40℃;
- Install at where the vibration is less than 5.9m/s^2 (0.6g).

Note:

1. It needs derating use if the controller operation temperature exceeds 40℃. The derating value of the output current of the controller shall be 2% for each degree centigrade. Max. allowed temperature is 50℃.
2. Keep ambient temperature between -10－+40℃. It can improve the controller operation performance if install at the location with good ventilation or cooling devices.

3.3 Installation Direction and Space Requirements

To achieve good cooling efficiency, install the controller perpendicularly and always provide the following space to allow normal heat dissipation. The requirements on mounting space and clearance are shown in Figure 3-1.

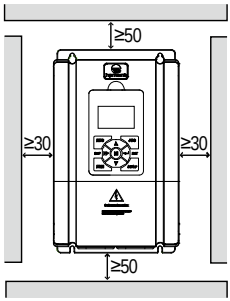
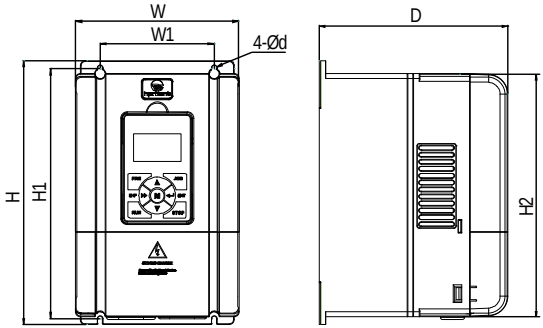
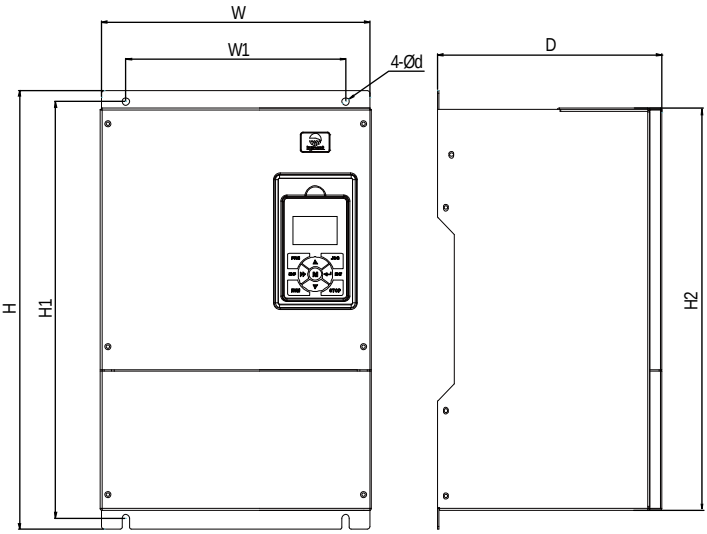


Figure 3-1 Installation of the controller

3.4 Dimensions and Mounting Size



Dimensions figure 1



Dimensions figure 2

Table 3-1 HD5L dimensions

Model	Dimensions (mm)			Mounting size (mm)				GW (kg)	Figure
	W	H	D	W1	H1	H2	d		
HD5L-2S2P2	200	299	210	146	286	280	5	5.8	1
HD5L-2S3P7									
HD5L-2T3P7									
HD5L-2T5P5									
HD5L-4T2P2									
HD5L-4T3P7									
HD5L-4T5P5									
HD5L-4T7P5									
HD5L-4T011									
HD5L-2T7P5	235	353	222	167	337	330	7	8.2	1
HD5L-4T015									
HD5L-4T018									
HD5L-2T011	290	469	240	235	445	430	8	20.4	2
HD5L-2T015									
HD5L-2T018									
HD5L-4T022									
HD5L-4T030									
HD5L-2T022	380	598	290	260	576	550	10	48	2
HD5L-2T030									
HD5L-4T037									
HD5L-4T045									

3.5 Panel Installation and Dismantle

According to the direction of the Figure 3-2, press the panel until hear a “click” sound. Do not install the panel from other directions or it will cause poor contact.

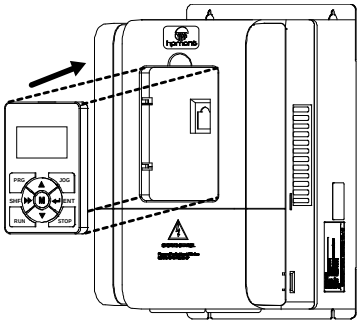


Figure 3-2 Installation of the panel

There are two steps in Figure 3-3.

First, press the hook of the panel according to the direction 1.

Second, take out of the panel according to the direction 2.

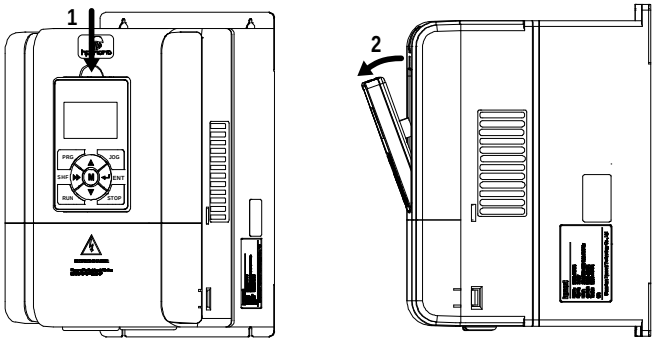
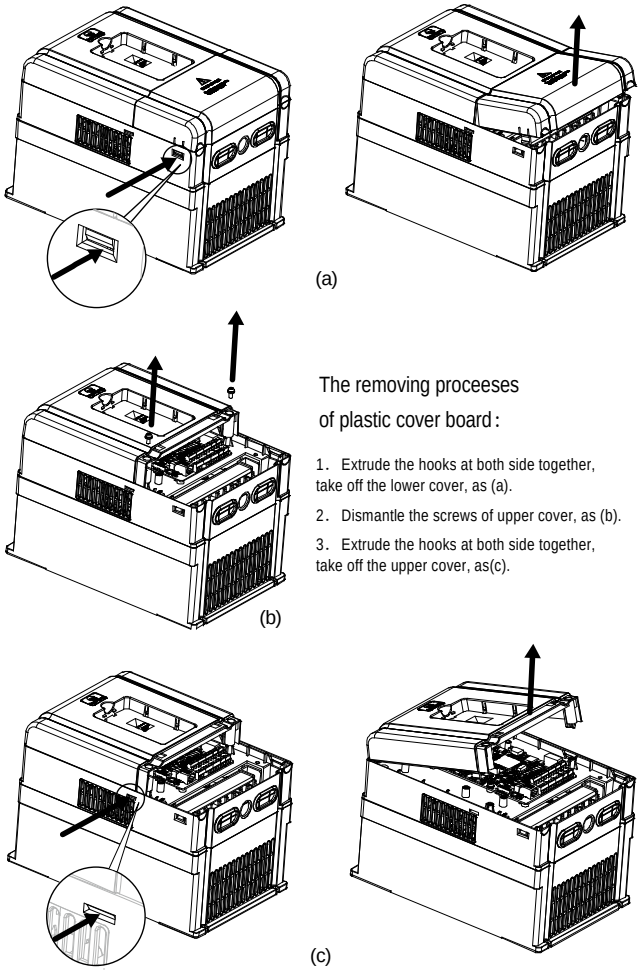


Figure 3-3 Dismantle of the panel

3.6 Plastic Cover Dismantle

The upper cover and the lower cover of the HD5L series controller are removable. The dismantle step is shown as Figure 3-4.

Before removing the upper cover, please take away the panel.



The removing proceeses of plastic cover board:

1. Extrude the hooks at both side together, take off the lower cover, as (a).
2. Dismantle the screws of upper cover, as (b).
3. Extrude the hooks at both side together, take off the upper cover, as(c).

Figure 3-4 Dismantle of the plastic cover

Chapter 4 Electrical Installation

4.1 Wiring Precautions

Danger

- Only qualified electrical engineer can perform wiring job.
- Only when the power supply switch is completely off can you do the wiring job.
- You can't open the controller cover to do wiring operation until the power is cut-off 10 minutes later. Do not wire or detach the controller internal devices at power-on situation.
- Do not do wiring operation until the internal charge indicator of the controller is off and the voltage between (+) and (-) of the main circuit terminals is below 36V.
- Check the wiring carefully before connecting emergency stop or safety circuit.
- The earth terminal PE of the controller must be reliable earthing. It must use two separate earth wire due to the leakage current from the controller to ground.
- It must use Type B mode when utilize earth leakage protection devices(ELCB/RCD).
- Do not touch the wire terminals of the controller when it is live. The main circuit terminals is neither allowed connecting to the enclosure nor short-circuiting.

Warning

- Do not do dielectric strength test on the controller.
- Do wiring connection of the braking resistor or the braking unit according to the wiring figure.
- Make sure the terminals are fixed tightly.
- Do not connect the AC supply cable to the output terminals U/V/W of the controller.
- Do not connect the phase-shifting capacitors to the output circuit.
- The controller DC bus terminals must not be short-circuited.

4.2 Selection of Main Circuit Peripheral Devices

Please refer to the Table 4-1 for the recommended specifications.

Table 4-1 HD5L series controller I/O wiring specification

Model	Input Protection		Main Circuit		Control Circuit (mm^2)
	MCCB (A)	Contactor (A)	Supply Cables (mm^2)	Motor Cables (mm^2)	
HD5L-2S2P2	32	20	4.0	2.5	⩾0.5
HD5L-2S3P7	63	32	4.0	4.0	⩾0.5
HD5L-2T3P7	40	32	4.0	4.0	⩾0.5
HD5L-2T5P5	63	40	6.0	6.0	⩾0.5
HD5L-2T7P5	63	40	6.0	6.0	⩾0.5
HD5L-2T011	100	63	16	16	⩾0.5
HD5L-2T015	125	100	25	25	⩾0.5
HD5L-2T018	160	100	25	25	⩾0.5
HD5L-2T022	200	125	35	35	⩾0.5
HD5L-2T030	200	125	50	50	⩾0.5
HD5L-4T2P2	16	10	1.5	1.5	⩾0.5
HD5L-4T3P7	25	16	2.5	2.5	⩾0.5
HD5L-4T5P5	32	25	4.0	4.0	⩾0.5
HD5L-4T7P5	40	32	4.0	4.0	⩾0.5
HD5L-4T011	63	40	6.0	6.0	⩾0.5
HD5L-4T015	63	40	6.0	6.0	⩾0.5
HD5L-4T018	100	63	10	10	⩾0.5
HD5L-4T022	100	63	16	16	⩾0.5
HD5L-4T030	125	100	25	25	⩾0.5
HD5L-4T037	160	100	25	25	⩾0.5
HD5L-4T045	200	125	35	35	⩾0.5

4.3 Main Circuit Terminals and Wiring

Danger

- The bare portions of the power cables must be bound with insulation tapes.

Warning

- Ensure that AC supply voltage is the same as controller's rated input voltage.

4.3.1 Terminals Description

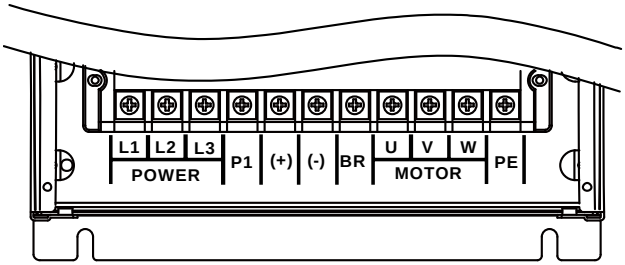


Figure 4-1 Power terminal layout of HD5L controller

Table 4-2 HD5L power terminal function description

Terminal	Function Description
L1、L2、L3	Three-phase AC power input terminals
U、V、W	Output terminals, connect to three-phase AC motor
P1、(+)	DC reactor connection terminals
(+)、(-)	DC supply input terminals; DC input terminals of power regenerative unit
(+)、BR	Braking resistor connection terminals
PE	Earth terminal, connect to the ground

4.3.2 Wiring Terminals

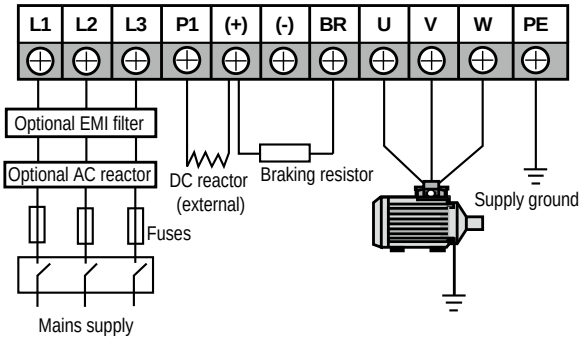


Figure 4-2 HD5L power terminal connection

During trial operation, make sure that the elevator will go up when the UP command is enabled. If the elevator goes down, set the parameter F00.08 (run direction) to be the reverse value.

4.4 Control Terminals and Wire Connection

Danger

- The control circuit is designed as ELV (Extra Low Voltage) circuit and basically isolated with the power circuit. Do not touch the control circuit when the controller is on power.

Warning

- If the control circuit is connected to the external devices with live touchable port (SELV circuit), it should increase an additional isolating barrier to ensure that SELV classification of external devices not be changed.
- If connect the communication terminal of the control circuit to the PC, you should choose the RS485/232 isolating converter which meets the safety requirement.

In order to efficiently suppress the interference to control signals, the length of signal cables should be less than 50m and keep a distance of at least 0.3m from the power lines. Please use twisted-pair shielded cables for analogue input and output signals.

The positions of control terminal, wire jumper and SCI communication port in the control board are shown in Figure 4-3.

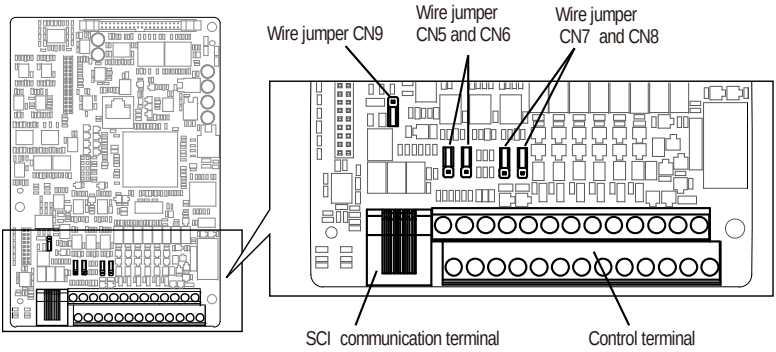


Figure 4-3 Positions of control terminal, wire jumper and SCI port in the control board

4.4.1 Control Terminal Description

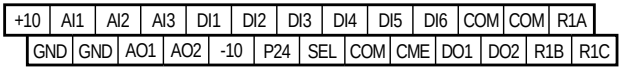


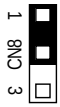
Figure 4-4 Control terminal layout

Table 4-3 Control terminal function description

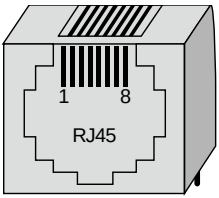
Item	Terminal	Name	Function Description
Analogue input	AI1	Anglogue input 1	Input voltage: 0－10V (input impedance: 34kΩ)
	AI2	Anglogue input 2	Input voltage/current is selectable; Input voltage: -10V－10V (input impedance: 34kΩ); Input current: 0－20mA (input impedance: 500Ω)
	AI3	Anglogue input 3	
Analogue output	AO1	Anglogue output 1	Output voltage/current signal: 0－10V/0－20mA; Programmable output
	AO2	Anglogue output 2	
Digital input	DI1－DI6	Digital input 1－6	Programmable bipolar optional input signal Input voltage: 0－30VDC DI1－DI5 input impedance: 4.7kΩ; DI6 input impedance: 1.6kΩ
Digital output	DO1	Digital output 1	Programmable optical-coupled isolation, open collector output Output voltage: 0－30VDC, max-output current 50mA
	DO2	Digital output 2	
	CME	DO1 reference ground	Isolated from COM, default short connected COM
Relay output	R1A/ R1B/ R1C	Relay contact output	Programmable output, contact rating: 250VAC/3A or 30VDC/1A R1B,R1C: normally closed; R1A,R1C: normally open
Power source	+10V	+10V power supply	Analogue input use +10V as reference supply, maximum output current is 100mA
	-10V	-10V power supply	Analogue input use -10V as reference supply, maximum output current is 10mA
	GND	+/-10V power reference ground	Analogue site, isolated from COM
	P24	+24V power supply	Digital input use +24V as supply, maximum output current is 200mA
	SEL	Digital input common terminal	Factory settings default SEL and P24 are connected. Disconnected SEL and P24 when use external power to drive DI1－DI6
	COM	Digital reference ground	Digital site, isolated from CME

4.4.2 Wire Jumper Description

Table 4-4 Wire jumper function and setting description on the control board

Jumper	Function and setting description	Factory setting
CN5	AI2 analogue input channel can select voltage or current signal. When pin 1 and pin 2 of the CN5 are short-circuited, AI2 channel inputs voltage signal; When pin 2 and pin 3 of the CN5 are short-circuited, AI2 channel inputs current signal.	
CN6	AI3 analogue input channel can select voltage or current signal. When pin 1 and pin 2 of the CN6 are short-circuited, AI3 channel inputs voltage signal; When pin 2 and pin 3 of the CN6 are short-circuited, AI3 channel inputs current signal.	
CN7	AO1 analogue output channel can select voltage or current signal. When pin 1 and pin 2 of the CN7 are short-circuited, AO1 channel outputs voltage signal; When pin 2 and pin 3 of the CN7 are short-circuited, AO1 channel outputs current signal.	
CN8	AO2 analogue output channel can select voltage or current signal. When pin 1 and pin 2 of the CN8 are short-circuited, AO2 channel outputs voltage signal; When pin 2 and pin 3 of the CN8 are short-circuited, AO2 channel outputs current signal.	
CN9	SCI communication can select proper resistance. When pin 2 and pin 3 of the CN9 are short-circuited, no resistance; When pin 1 and pin 2 of the CN9 are short-circuited, select the proper resistance.	

4.4.3 SCI Communication Terminal Description



Port pin	1	2	3	4	5	6	7	8
Port signal	+5V	485+	+5V	GND	GND	GND	485-	Reserved

Figure 4-5 SCI communication terminal and description

4.4.4 Control Terminal Wiring

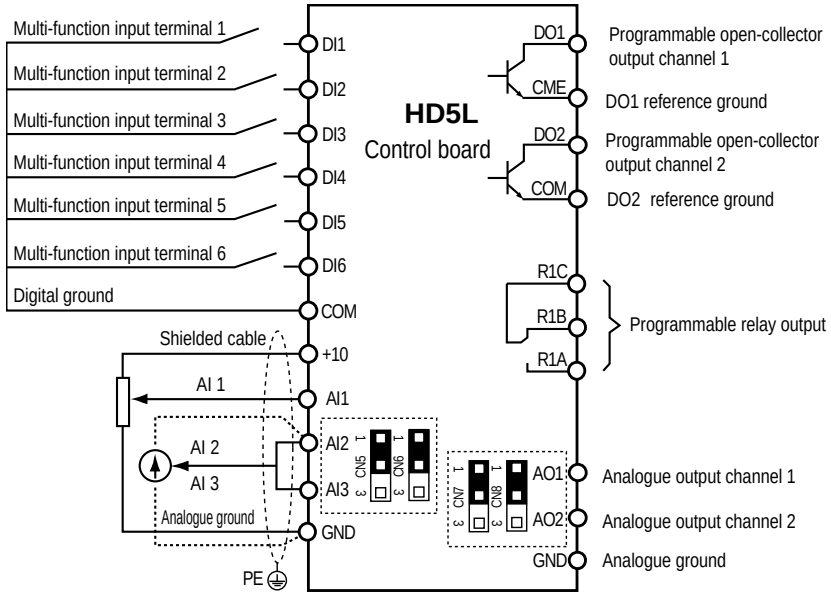


Figure 4-6 HD5L control circuit wiring diagram

Dry contact wiring diagram

1. If the internal 24V power supply is used, the connection is as shown in Figure 4-7. (The SEL and the P24 are short-circuited at factory)

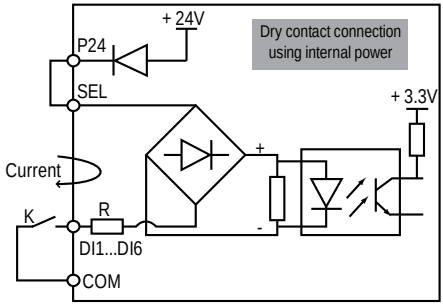


Figure 4-7 Dry contact connection when using internal 24V power

2. If the external power supply is used, the connection is as shown in Figure 4-8. (Note that the SEL and the P24 are not short-circuited)

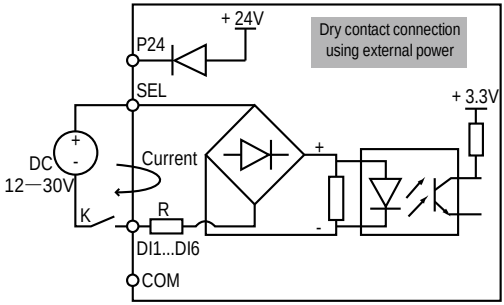


Figure 4-8 Dry contact connection when using external power

Source (Drain) wiring diagram

1. If the external power supply is used, the source connection is as shown in Figure 4-9. (Note that the SEL and the P24 are not short-circuited)

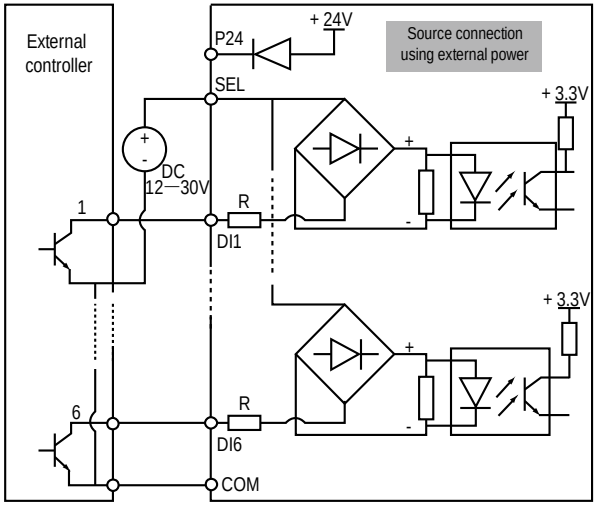


Figure 4-9 Source input connection when using external power

2. If the external power supply is used, the drain connection is as shown in Figure 4-10. (Note that the SEL and the P24 are not short-circuited)

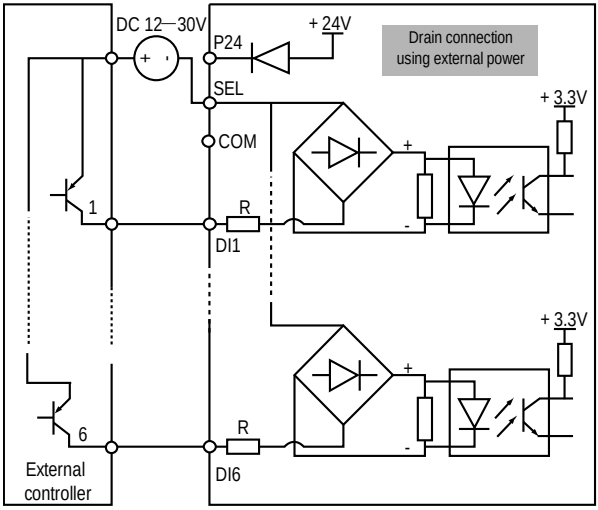


Figure 4-10 Drain input connection when using external power

3. If the controller's internal 24V power supply is used, the common emitter output connection of the NPN transistor in the external controller is as shown in Figure 4-11.

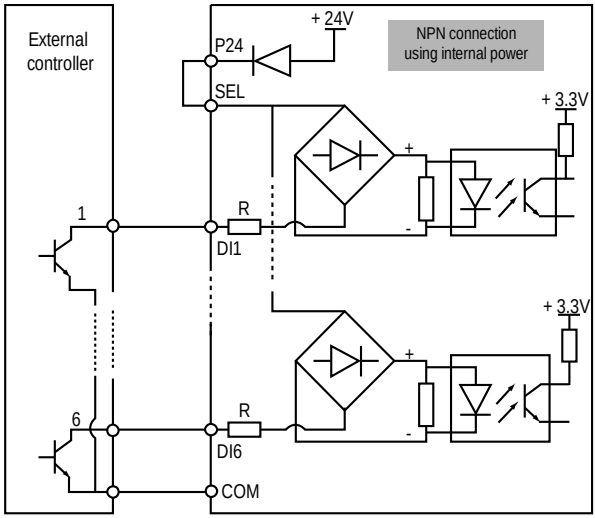


Figure 4-11 NPN signal input connection when using internal 24V power supply

4. If the controller's internal +24V power supply is used, the common emitter output connection of the PNP transistor in the external controller is as shown in Figure 4-12. (Note that the SEL and the P24 are not short-circuited)

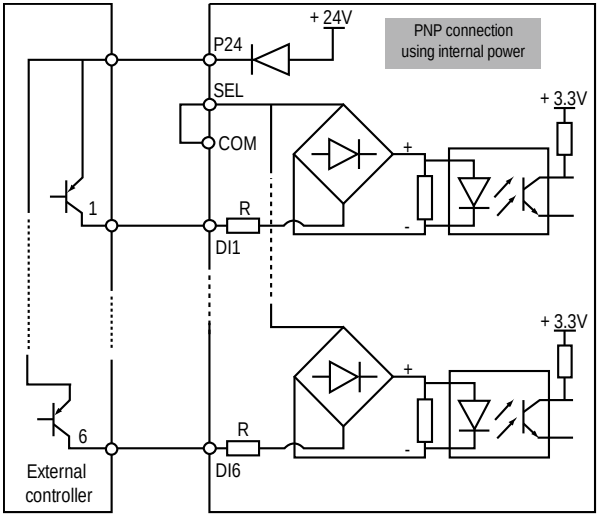


Figure 4-12 PNP signal input connection when using internal 24V power supply

Wiring of analogue input terminal

The analogue input has three input ports: AI1—AI3.

The AI1 is voltage input and the voltage input range is 0—10V.The AI2 and the AI3 are selectable voltage/current input, the input range are -10—+10V/0—20mA.

The input voltage signal can use the control board of internal +/-10V, or be provided by the external.

The AI1 input terminal connection and disposal are shown in Figure 4-13. And the AI2 and the AI3 input terminal connection and disposal are shown in Figure 4-14.

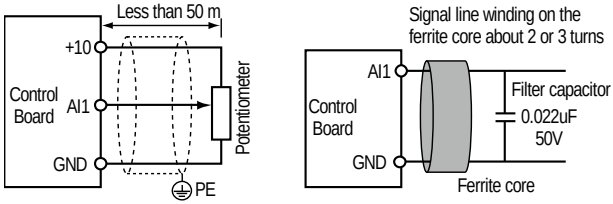


Figure 4-13 AI1 input terminal connection and disposal

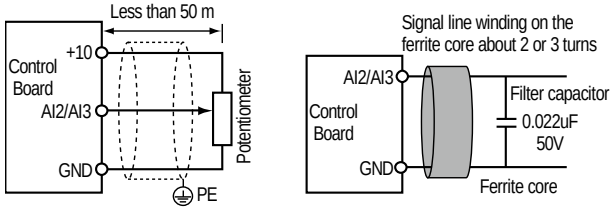


Figure 4-14 AI2 and AI3 input terminal connection and disposal

The shielded cable is recommended due to the analogue input signal is electronic signal and susceptible to external interference. The shielded cable should be no longer than 50m and the PE should be reliable grounded. In some serious interference state, the analogue input signal should take the advantage of the filter capacitor and the ferrite core.

Wiring of multi-function output terminal

The function output terminal DO1 and DO2 can use the controller's internal 24V power supply or the external power supply. The connections are as shown in Figure 4-15.

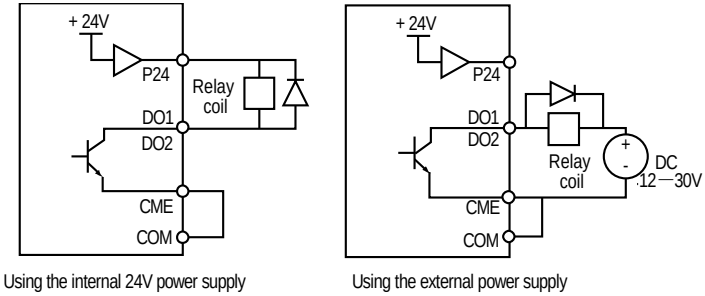


Figure 4-15 DO terminal connection

4.5 I/O Terminals and Wiring Connection

HD5L series elevator controller has I/O interface board which can achieve the extension of analogue input, digital input and relay contact output. I/O interface board is shown as Figure 4-16 and the size unit is mm.

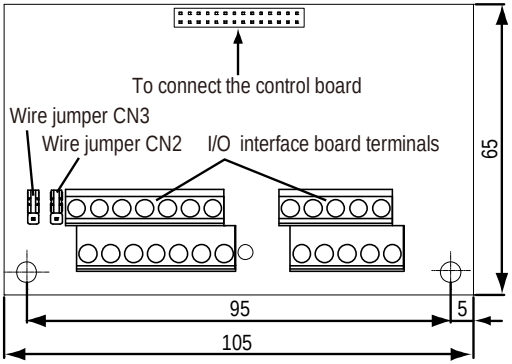


Figure 4-16 I/O interface board

4.5.1 Terminal Description of I/O Interface Board

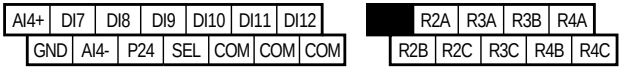


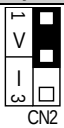
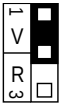
Figure 4-17 Terminal layout of I/O interface board

Table 4-5 Terminal function description of I/O interface board

Item	Terminal	Name	Function Description
Analogue input	AI4+	Analogue differential input	Input voltage/current is selectable Input voltage: -10V－10V (input impedance: 34kΩ); Input current: 0－20mA (input impedance: 500Ω)
	AI4-		
Digital input	DI7－DI12	Digital input 7－12	Programmable bipolar optional input signal Input voltage: 0－30VDC Input impedance: 4.7kΩ
Relay output	R2A/R2B/R2C	Relay contact output	Programmable output, contact rating: 250VAC/3A or 30VDC/1A RB,RC: normally closed; RA,RC: normally open
	R3A/R3B/R3C		
	R4A/R4B/R4C		
Power source	GND	Analogue ground	Analogue site, isolated from COM
	P24	+24V power supply	Digital input use +24V as supply, maximum output current is 200mA
	SEL	Digital input common terminal	Factory settings default SEL and P24 are connected. Disconnected SEL and P24 when use external power to drive DI7－DI12
	COM	Digital reference ground	Digital site, isolated from CME

4.5.2 Wire Jumper Description of I/O Interface Board

Table 4-6 Wire jumper function and setting description on the I/O interface board

Jumper	Function and setting description	Factory setting
CN2	AI4 analogue input channel can select voltage or current signal. When pin 1 and pin 2 of the CN2 are short-circuited, AI4 channel inputs voltage signal; When pin 2 and pin 3 of the CN2 are short-circuited, AI4 channel inputs current signal.	
CN3	AI4 analogue input channel can select thermistor. When pin 1 and pin 2 of the CN3 are short-circuited, AI4 channel is for the user reference analogue input; When pin 2 and pin 3 of the CN3 are short-circuited, AI4 channel is for the motor over-heating detection signal input via the external connected thermistor.	

4.5.3 Terminal Connection of I/O Interface Board

Analogue input terminal connection

When the AI4 is used as the user reference analogue input terminal, the connection is shown as Figure 4-18 and the AI4+ is as analogue input.

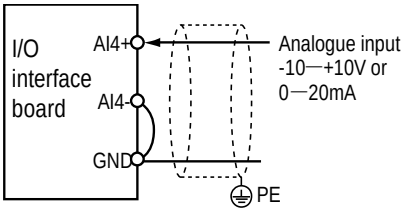


Figure 4-18 AI4 as the analogue input terminal

When the AI4 is used as the motor over-heating detection signal input terminal, the connection is shown as Figure 4-19. The motor stator coil built-in thermistor to access the analogue input and it should be correctly set the wire jumper.

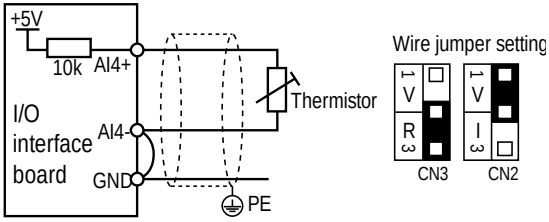


Figure 4-19 AI4 as the over-heating signal detection input terminal

Digital input terminal connection

The digital input terminals (DI7—DI12) of I/O interface board and the digital input terminals (DI1—DI6) of control board have the same connection method. Please refer to 4.4.4 Control Terminal for details.

4.6 Encoder Interface Board

4.6.1 Encoder Interface Board Introduction

There are 4 kind encoder interface boards are provided for the HD5L series controller. And their models and functions are shown as Table 4-7.

Table 4-7 Encoder interface boards

Encoder interface boards	Functions
OC encoder interface board with frequency demultiplication (FD) output (HD-PG2-OC-FD)	Support the differential ABZ signals and the pulse FD output; Apply to asynchronous motor closed-loop vector control (VC)
SINCOS encoder interface board with FD output (HD-PG5-SINCOS-FD)	Support the SINCOS signal and the pulse FD output; Apply to synchronous motor closed-loop vector control (VC)
Line drive encoder interface board with FD output(HD-PG6-UVW-FD)	Support the differential ABZ and UVW signal; Support the pulse FD output; Apply to synchronous motor closed-loop vector control (VC)
SC encoder interface board with FD output (HD-PG9-SC-FD)	Support the serial communication signal; Support the pulse FD output; Apply to synchronous motor closed-loop vector control (VC)

The requirements of encoder interface board connection:

1. Separate encoder interface board cables from power cables, and make sure they do not go parallel.

2. The encoder interface board cables must use independent tube and the metal enclosure must be reliable grounded.

4.6.2 FD Description

To change the FD coefficient is by shifting 6-digit FD switches. When the switch shifts to ON, it will mean “1”, otherwise mean “0”. Converter the 6-digit binary number into decimal number, the resulting number multiplies 2 is the FD coefficient shown as Figure 4-20.

Maximum value is “111111” which is 63*2 FD.

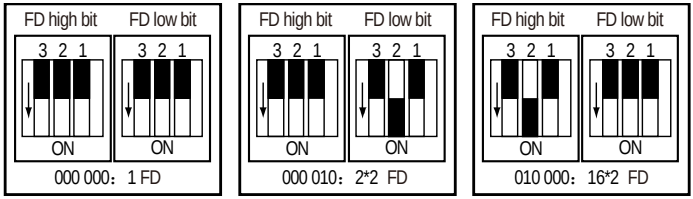


Figure 4-20 Encoder interface board FD description

4.6.3 DB15 Terminal

The HD-PG5-SINCOS-FD and the HD-PG6-UVW-FD both use the DB15 terminal. It will be well to connect the DB15 terminal to the DB15 socket of motor encoder signal cable.

The definition of terminal number is shown as Figure 4-21.

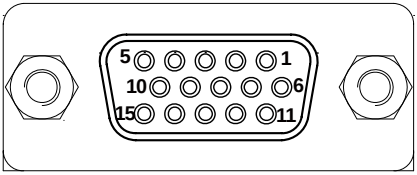


Figure 4-21 DB15 terminal definition

4.6.4 HD-PG2-OC-FD

The OC encoder interface board with frequency demultiplication (FD) output is shown as Figure 4-22. FD switch is shown as the section 4.6.2 FD Description and the size unit is mm.

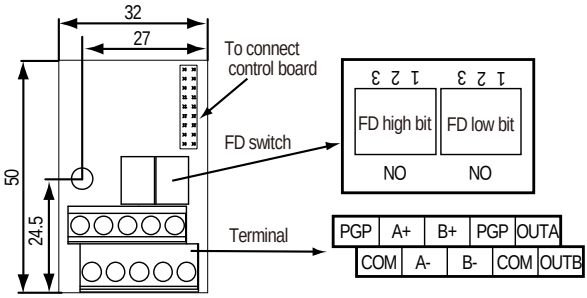


Figure 4-22 OC encoder interface board with frequency demultiplication output

Terminal description

Table 4-8 Terminal function description

Terminal	Name	Terminal	Name
PGP	+12V power output	B+	Encoder B+ signal
COM	Power supply site, isolated from GND	B-	Encoder B- signal
A+	Encoder A+ signal	OUTA	FD output A signal, NPN type OCoutput
A-	Encoder A- signal	OUTB	FD output B signal, NPN type OCoutput

Encoder interface board connection

The connection of differential output encoder and open-collector output encoder are respectively shown as Figure 4-23 and Figure 4-24.

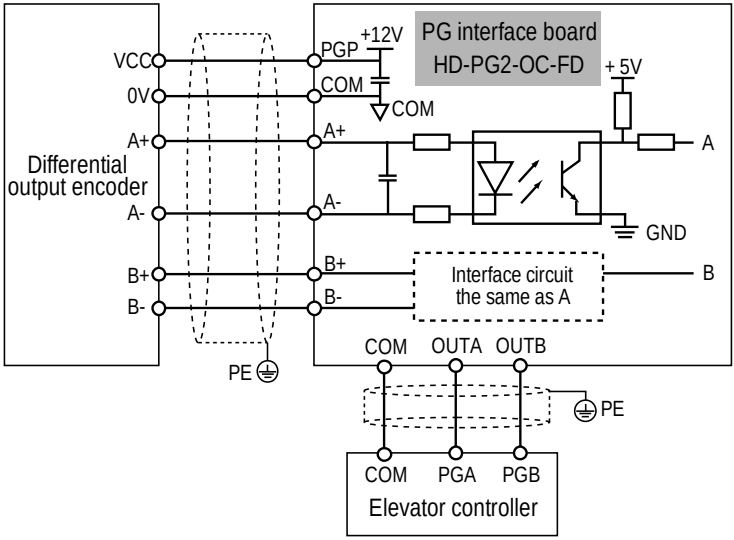


Figure 4-23 Connection of differential output encoder

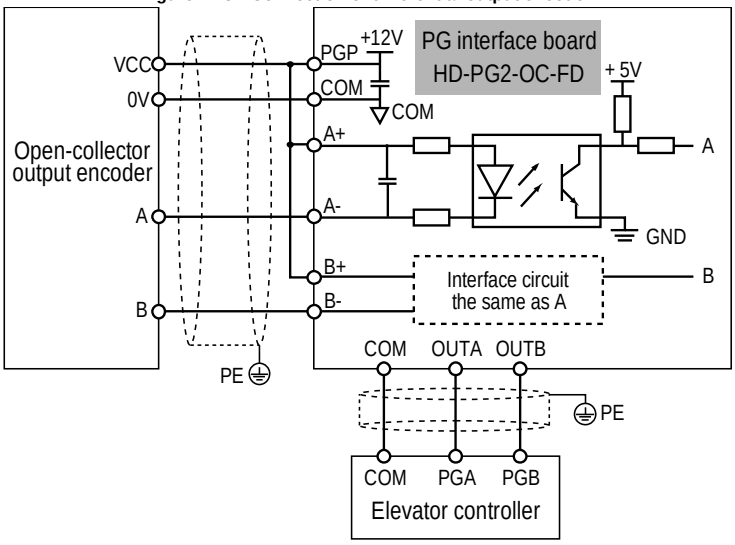


Figure 4-24 Connection of open-collector output encoder

The push-pull signal output encoder is shown as Figure 4-25.

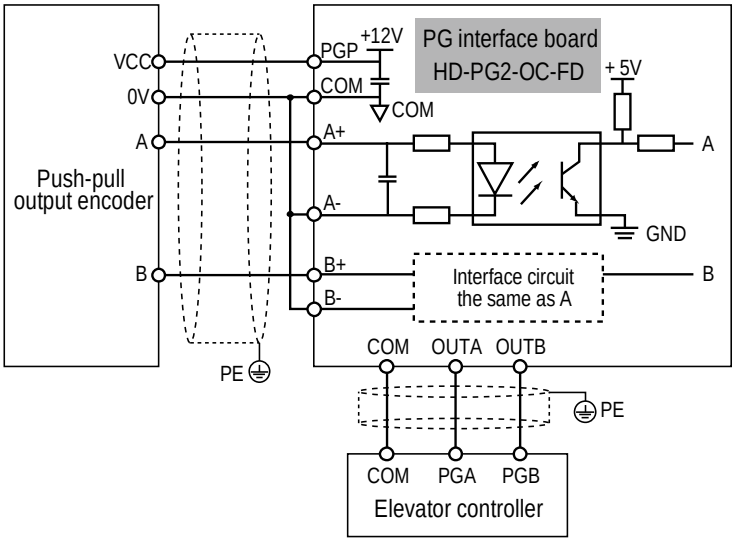


Figure 4-25 Connection of push-pull output encoder

4.6.5 HD-PG5-SINCOS-FD

SINCOS encoder interface board with FD output is shown as Figure 4-26. FD switch is shown as the section 4.6.2 FD Description and the size unit is mm.

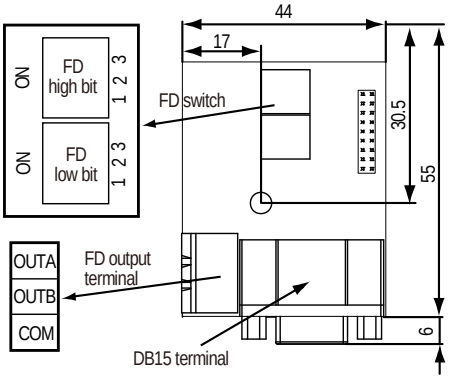


Figure 4-26 SINCOS encoder interface board with FD output

Terminal description

Table 4-9 DB15 terminal signal description

No.	Name	Description	No.	Name	Description
1	B-	Differential signal B-	8	B+	Differential signal B+
2	NC	Invalid	9	PGVCC	+5V power supply
3	R+	Differential signal R+	10	C+	Differential signal C+
4	R-	Differential signal R-	11	C-	Differential signal C-
5	A+	Differential signal A+	12	D+	Differential signal D+
6	A-	Differential signal A-	13	D-	Differential signal D-
7	GND	Power supply site	14、15	NC	Invalid

Table 4-10 FD output terminal signal description

No.	Name	Description
1	OUTA	FD output signal A, NPN type OC output
2	OUTB	FD output signal B, NPN type OC output
3	COM	FD output signal site, isolated from GND

Encoder interface board connection

The connection of SINCOS encoder is shown as Figure 4-27.

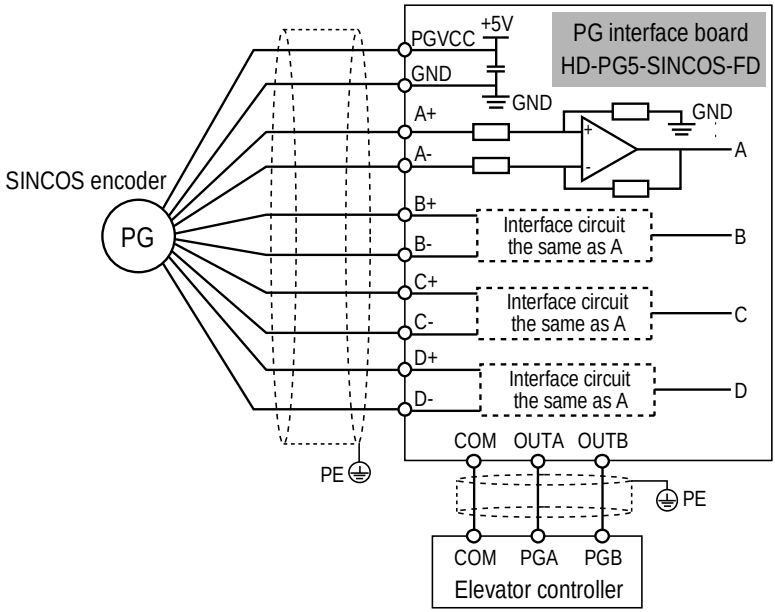


Figure 4-27 Connection of SINCOS encoder

4.6.6 HD-PG6-UVW-FD

The line driver encoder interface board with FD output is shown as Figure 4-28. FD switch is shown as the section 4.6.2 FD Description and the size unit is mm.

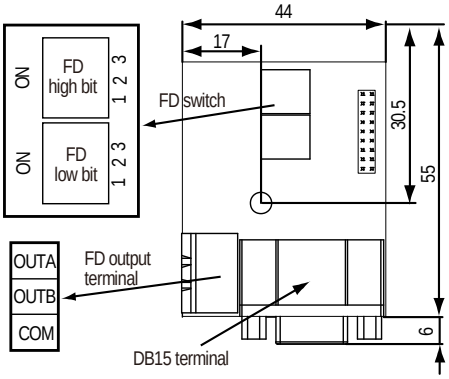


Figure 4-28 Line driver encoder interface board with FD output

Terminal description

Table 4-11 DB15 terminal signal description

No.	Name	Description	No.	Name	Description
1	A+	Differential signal A+	9	V+	Differential signal V+
2	A-	Differential signal A-	10	V-	Differential signal V-
3	B+	Differential signal B+	11	W+	Differential signal W+
4	B-	Differential signal B-	12	W-	Differential signal W-
5	Z+	Differential signal Z+	13	PGVCC	+5V power supply
6	Z-	Differential signal Z-	14	GND	Power supply site
7	U+	Differential signal U+	15	NC	NC
8	U-	Differential signal U-			

Table 4-12 FD output terminal signal description

No.	Name	Description
1	OUTA	FD output signal A, NPN type OC output
2	OUTB	FD output signal B, NPN type OC output
3	COM	FD output signal site, isolated from GND

Encoder interface board connection

The connection of UVW encoder is shown as Figure 4-29.

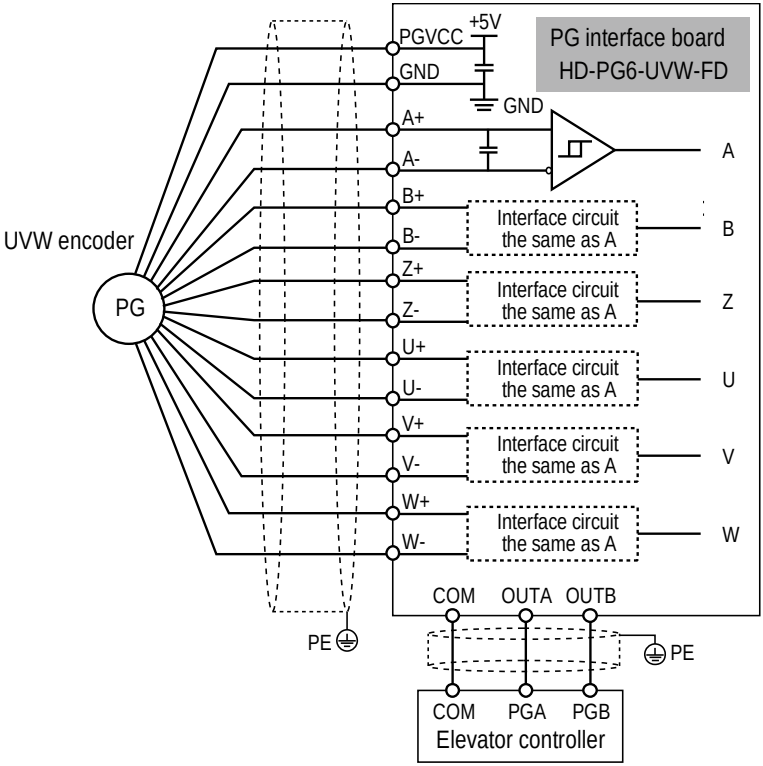


Figure 4-29 Connection of UVW encoder

4.6.7 HD-PG9-SC-FD

The serial communication encoder interface board with FD output (HD-PG9-SC-FD) supported the Endat protocol is shown as Figure 4-30 and the size unit is mm.

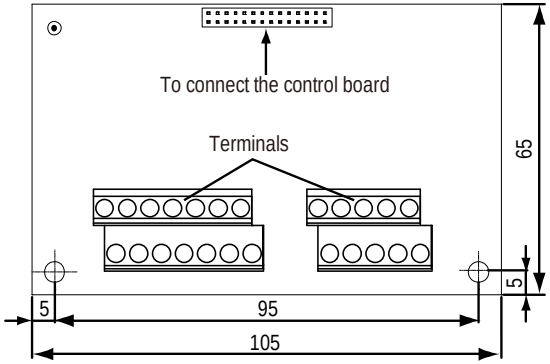


Figure 4-30 Serial communication encoder interface board with FD output

Terminal description

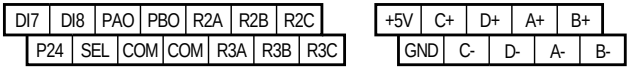


Figure 4-31 Terminal signal description

Table 4-13 FD output terminal signal description

Item	Terminal	Name	Function Description
Digital input	DI7－DI8	Digital input 7－8	Programmable bipolar optional input signal Input voltage: 0－30VDC; Input impedance: 4.7kΩ
FD output	PAO	FD output	FD output signal A, NPN type OC output
	PBO		FD output signal B, NPN type OC output
Relay output	R2A/R2B/R2C	Relay contact output	Programmable output, contact rating: 250VAC/3A or 30VDC/1A RB,RC: normally closed; RA,RC: normally open
	R3A/R3B/R3C		
Power	P24	+24V power supply	Digital input use +24V as supply, maximum output current is 200mA
	SEL	Digital input common terminal	Factory settings default SEL and P24 are connected. Disconnected SEL and P24 when use external power to drive DI7－DI12
	COM	Digital reference ground	Digital site, isolated from CME
Power	+5V	+5V power	+5V power supply for PG
	GND	Reference ground	+5V reference ground
Signal Terminal	C+/C-	CLK	CLK Differential signal C+/C-
	D+/D-	Data	Data Differential signal D+/D-
	A+/A-/B+/B-	Sin/Cos Signal	Differential signal A+/A-/B+/B-

FD description

The FD coefficient of HD-PG9-SC-FD is set by F16.10.

4.7 Meet EMC Requirement of Installation

4.7.1 Correct EMC Installation

According national standards GB/T12668.3, the controller should meet the two requirements of electromagnetic interference (EMI) and anti-electromagnetic interference. The international standards IEC/61800-3 (VVVF drive system part 3: EMC specifications and test methods) are identical to the national standards GB/T12668.3.

HD5L Series Controllers are designed and produced according to the requirements of IEC/61800-3. Please install the controller as per the description below so as to achieve good electromagnetic compatibility (EMC).

In a drive system, the controller, control equipment and sensors are installed in the same cabinet, the electromagnetic noise should be suppressed at the main connecting points with the EMI filter and input reactor installed in cabinet to satisfy the EMC requirements.

The most effective but expensive measure to reduce the interference is to isolate the noise source and the noise receiver, which should be considered in mechanical system design phase. In driving system, the noise source can be controller, braking unit and contactor. Noise receiver can be automation equipment, encoder and sensor etc.

The mechanical/system is divided into different EMC areas according to its electrical characteristics. The recommended installation positions are shown in Figure 4-31.

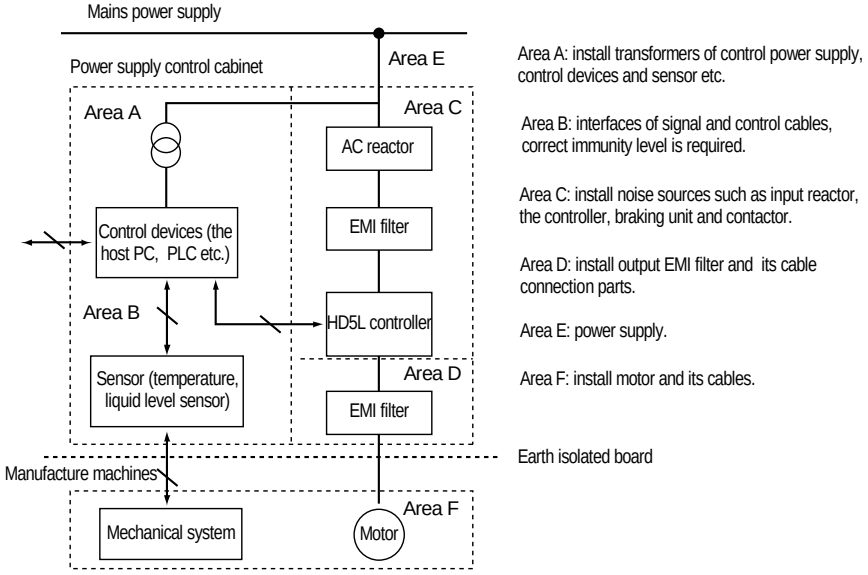


Figure 4-31 System wiring sketch

Remarks:

- All areas should be isolated in space to achieve electromagnetic decoupling effect.
- The minimum distance between areas should be 20cm, and use earthing bars for decoupling among areas, the cables from different area should be placed in different tubes.
- EMI filters should be installed at the interfaces between different areas if necessary.
- Bus cable (such as RS485) and signal cable must be shielded.

4.7.2 Wiring Requirement

In order to avoid interference intercoupling, it is recommended to separate the motor cables and the control cables from power supply cables, and keep enough distance among the cables. Especially when the cables are laid in parallel and the cable length is long, the signal cables should cross the power supply cables perpendicularly as shown in Figure 4-32.

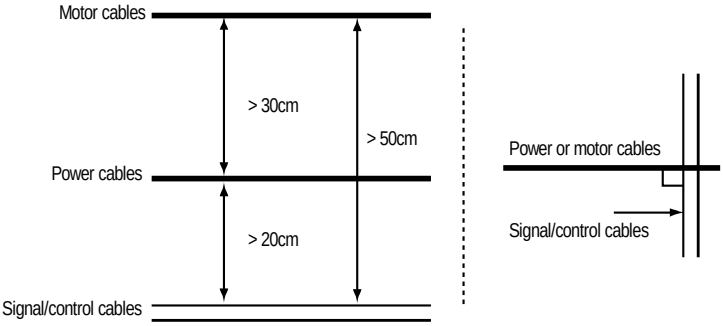


Figure 4-32 System wiring

Shielded/armoured cable: High frequency low impedance shielded cable should be used. For example: copper net, aluminum net or iron net.

Normally, the control cables must use the shielded cables and the shielding metal net must be connected to the metal enclosure of the controller by cable clamps as shown in Figure 4-33.

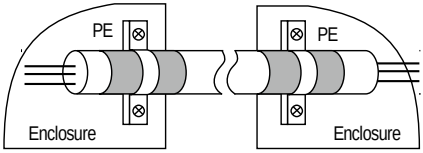


Figure 4-33 Correct connection of the shielded cable

4.7.3 Wiring Motor

Longer the cable between the controller and the motor is, higher the high-frequency leakage current is, causing the controller output current to increase as well. This may affect peripheral devices.

When the cable between the motor and the controller is longer than 100 meters, it is recommended to install output reactor and adjust the carrier frequency as per the instruction in Table 4-14.

Table 4-14 Carrier frequency and the cable length between controller and motor

Cable length	< 30m	30－50m	50－100m	≥ 100m
Carrier frequency	15kHz below	10kHz below	5kHz below	2kHz below

The controller should be derated if the motor cables are too long or their cross sectional area (CSA) is too large. The controller's cables should be the cables with specified CSA (see Table 4-1) because the capacitance of the cable to ground is in proportional to the cable's CSA. If the cable with big CSA is used, its current should be reduced. The current should be decreased by 5% when per level of CSA is increased.

4.7.4 Ground Connections

The earth terminals PE must be connected to earth properly. The earthing cable should be as short as possible (the earthing point should be as close to the controller as possible) and the earthing area should be as large as possible.

The grounding resistance should be less than 10Ω.

Do not share the earth wire with other devices such as welding machines or power tools. It could share the earthing pole, but the motor and the controller each have their own earthing pole, then the earthing effect is better. The recommended and avoided earthing methods are respectively shown in Figure 4-34 and Figure 4-35.

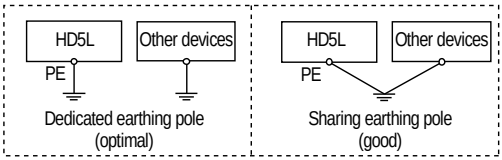


Figure 4-34 Recommended earthing method

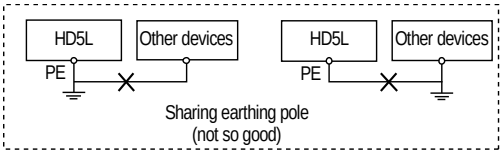


Figure 4-35 Avoided earthing method

When using more than one controllers, be careful not to loop the earth wire as shown in Figure 4-36.

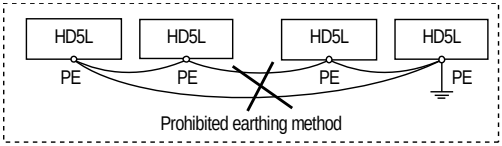


Figure 4-36 Prohibited earthing method

4.7.5 EMI Filter

The EMI filter should be used in the equipment that may generate strong EMI or the equipment that is sensitive to the external EMI. The EMI filter should be a dual-way low pass filter through which lower frequency current can flow while higher frequency current can hardly flow.

Function of EMI filter

1. The EMI filter ensures the equipment not only can satisfy the conducting emission and conducting sensitivity in EMC standard but also can suppress the radiation of the equipment.

2. It can prevent the EMI generated by equipment from entering the power cable and the EMI generated by power cable from entering equipment.

Common mistakes in using EMI filter

1. Too long the power cable is between the EMI filter and the controller

The filter inside the cabinet should be located near to the input power source. The length of the power cables should be as short as possible.

2. Too close the input and output cables of the EMI filter

The distance between input and output cables of the filter should be as far apart as possible. Otherwise the high-frequency noise may be coupled between the cables and bypass the filter. Thus, the filter will become ineffective.

3. Bad earthing of the EMI filter

The EMI filter's enclosure must be earthed properly to the metal case of the controller. In order to achieve better earthing effect, make use of a special earthing terminal on the filter's enclosure. If you use one cable to connect the filter to the case, the earthing is useless for high frequency interference. When the frequency is high, so is the impedance of cable, hence there is little bypass effect.

The correct installation: The filter should be mounted on the enclosure of equipment. Ensure to clear away the insulation paint between the filter case and the enclosure for good earthing contact.

4.7.6 Conduction, Radiation and Radio Frequency Interference Countermeasures

EMI of the controller

The controller's operating theory means that some EMI is unavoidable. The controller is usually installed in a metal cabinet which normally little affects the instruments outside the metal cabinet. The cables are the main EMI source. If connect the cables according to this manual, the EMI can be suppressed effectively.

If the controller and other control equipment are installed in one cabinet, the area rule must be observed. Pay attention to the isolation between different areas, cable layout and shielding.

Reducing conducted interference

Please add a noise filter to suppress conducted interference on the output side. Additionally, conducted interference can be efficiently reduced by threading all the output cables through a grounded metal tube. And conducted interference can be dramatically decreased when the distance between the output cables and the signal cables is above 0.3m.

RF interference clearing

The I/O cables and the controller produce radio frequency interference. A noise filter can be installed both on the input side and output side, and shield them with iron utensil to reduce RF interference.

The wiring distance between the controller and the motor should be as short as possible shown in Figure 4-37.

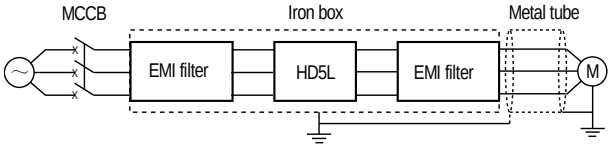


Figure 4-37 RF interference clearing

4.7.7 Input and Output Reactor

AC input reactor

The purpose of installing an AC input reactor is: to increase the input power factor; to dramatically reduce the harmonics on the input side at the high voltage point of common coupling and prevent input current unbalance which can be caused by the phase-to-phase unbalance of the power supply. An AC line reactor which will help to protect the input rectifiers also reduces external line voltage spikes (for example the lightning!).

DC reactor

The installation of a DC reactor can increase the input power factor, improve the controller's overall efficiency and thermal stability, substantially eliminate the upper harmonics influence on the controller's performance, and considerably decrease the conducted and radiated electromagnetic emissions from the controller.

AC output reactor

Generally speaking, when the length of the cable between controller and motor is more than 100m, it will cause leakage current and controller tripping. It suggests that the user should consider installing an AC output reactor.

Chapter 5 Operation Instructions

Danger

- Only when the controller terminal cover has been fitted can you switch on AC power source. Do not remove the cover after power is switched on.
- Ensure the motor and the mechnical device are in the use application before the controller starts.
- Keep away from the controller if the auto-restart function is enabled at power outage.
- If changed the main control PCBA, you should correctly set the parameters before operating.

Warning

- Do not check or detect the signal during the controller operation.
- Do not randomly change the controller parameter setting.
- Please thoroughly complete all control debugging and testing, make all adjustments and conduct a full safety assessment before switching the run command source of the controller.
- Do not touch the energy-depletion braking resistor due to the high temperature.

5.1 Function Description

Note:

1. In the following sections, you may encounter control, running and state of the controller description many times.
2. Please read this section carefully. It will help you to correctly understand and use the functions to be discussed.

5.1.1 Operation Mode

The operation mode defines how the controller receives run commands (start or stop command). There are four operation modes which can be selected through function parameter F00.05.

Panel control: The run command is controlled by RUN and STOP keys of the panel; and the run speed is set by F00.07.

Terminal analogue control: The run command is controlled by UP and DN of the terminal; and the run speed is set by AI1—AI4 analogue input terminals.

Terminal speed control: The run command is controlled by UP and DN of the terminal; and the run speed is set by MS1—MS3 multi-step speed terminal combination.

Communication speed control: The run command and the run multi-step speed are set by PC communication.

5.1.2 Control Mode

HD5L series controllers have three control modes which respectively are V/f control, SVC control and VC control. (Refer to F00.01 for more detail)

5.1.3 Controller State

HD5L series controller states respectively are: Stop, Run, Motor parameters auto-tuning, Fault alarm and Under-voltage.

Stop state: After the controller is switched on and initialized, if no run command inputs or the stop command is given, there will be no output from U/V/W of the controller and the LCD panel will be anti-color display STOP under the left.

Run state: The controller will start output from U/V/W terminals after it receives the run command. And the LCD panel will be anti-color display RUN under the left.

Motor parameters auto-tuning: After set the function parameter F07.06/F10.10 as 1 or 2, the controller will receive the run command then enter into motor parameters auto-tuning state. If the auto-tuning process is completed, the controller will enter into stop state.

Fault alarm state: The controller has failure.

Under-voltage state: The controller is in the under-voltage.

5.1.4 Controller Running Mode

HD5L series controllers have five running modes: Auto-tuning running, MS speed running, Inspection running, Battery-driven running and Normal running.

Auto-tuning running: Set F07.06/F10.10 = 1 or 2 and press RUN key to enter the auto-tuning running.

MS speed running: The run speed is set by MS1－MS3 in combination or communication. This mode is accessible when F00.05 is set as 2 or 4.

Inspection running: When inspection signal is valid, the speed will be determined by F05.08 (inspection run speed). This mode is accessible when F00.05 is set as 1, 2 or 4.

Battery-driven running: When emergency signal is valid, the speed will be determined by F05.09 (battery driven speed). This mode is accessible when F00.05 is set as 1, 2 or 4.

Normal running: Controlled by panel (F00.05 = 0) or terminal analogue (F00.05 = 1).

5.2 Operating Instructions

5.2.1 Panel Description

The standard HD5L series controllers are installed with LCD panel which is shown as Figure 5-1.

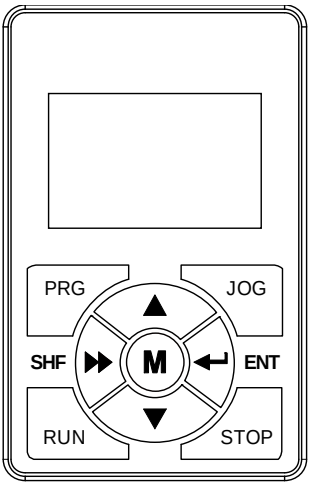


Figure 5-1 Panel of HD5L controller

There are keys on the panel and their functions, as shown in Table 5-1.

Table 5-1 Key function description

Key	Name	Function
PRG	Program/exit	Entry or exit programming key
JOG	Jog key	Reserved
RUN	Run key	In the mode of panel control, press this key to run the controller
STOP	Stop/reset key	In the mode of panel control, to stop controller and reset the fault
M	Multi-function key	Set certain function by F00.06
▲	Increment key	Increase value or parameter
▼	Decrement key	Decrease value or parameter
▶▶	SHF shift key	Selecting display parameter and shift bit
↵	ENT enter/confirm key	Enter lower menu or confirm saving the data

5.2.2 Display State

The panel of HD5L series controller can display the parameters at stopping, running, editing and alarming.

Note:

LCD anti-color displays: display in white on black such as STOP, RUN, F03: , 0.3 5 0 m/s etc.

1. If the parameter or the setting value is in anti-color displaying, it means that it can be changed. Take 0.3 5 0 m/s for example, it means that the units of setting value can be changed.
2. If the state is in anti-color displaying, it means that it is in this state. Take RUN for example, it means that the controller is in the running state.

Parameter display state at stopping

When the controller stops running, the panel will display stopping state and its parameter, as shown in Figure 5-2. Other parameters (F15.08—F15.13) can be displayed by pressing ▶▶.

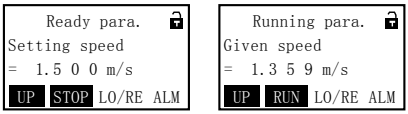


Figure 5-2 Display state of the panel

Parameter display state at running

When the controller is running, the panel will display running state and its parameter, as shown in Figure 5-2. Other parameters (F15.02—F15.07) can be displayed by pressing ▶▶.

Four-level menu switching operation

The panel of HD5L series controller uses four-level menu configuration for parameter setting or other operations.

Configuring mode can be displayed in 4-level menu: mode setting (first-level)→function parameter group setting (second-level)→function parameter setting (third-level)→parameter setting (fourth-level). The operation process is shown in Figure 5-3 and the description of the keys is shown in Table 5-2.

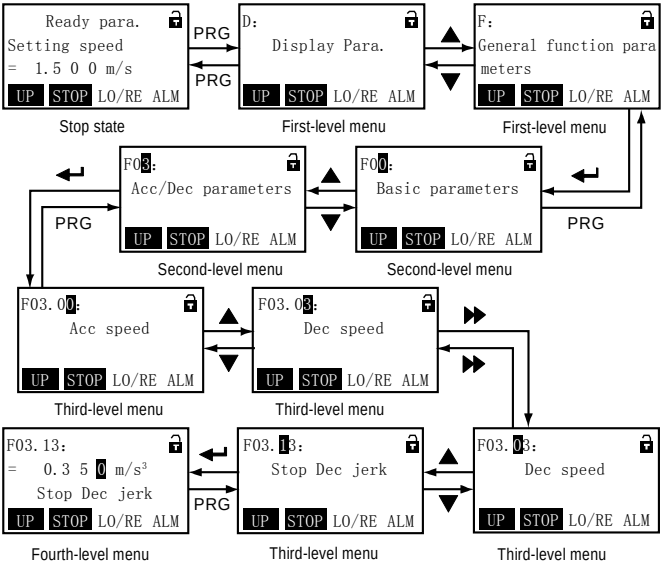


Figure 5-3 Four-level operation process

Table 5-2 Switching four-level description of the key

Key	First-level menu	Second-level menu	Third-level menu	Fourth-level menu
PRG	Fault, return to faulty display; Fault cleared, return to run or stop state display.	Return to first-level menu	Return to second-level menu	Do not save the present value and return to third-level
↵	Enter to second-level menu	Enter to third-level menu	Enter to fourth-level menu	Save the present value and return to third-level
▲	Select function group. Cycle according to D-F- Y	Modify No. function. Increase by 1 when press this key one time	Modify the internal No. of function group. Increase by 1 according to the present modified bit	Modify function value. Increase by 1 according to the present modified bit
▼	Select function group. Cycle according to Y-F-D	Modify No. function. Decrease by 1 when press this key one time	Modify the internal No. of function group. Decrease by 1 according to the present modified bit	Modify function value. Decrease by 1 according to the present modified bit
▶▶	Invalid	Invalid	Switch units and tens	Switch units , ten thousands, thousands, hundreds, tens

5

Function parameter editing state

At stop, run or fault alarm state, press PRG to enter function parameter editing state (see the description of parameter F01.00 and the user password unlock and modify of section 5.2.3), as shown in Figure 5-4.

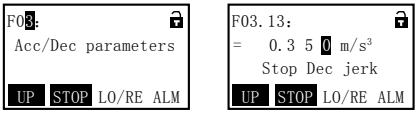


Figure 5-4 Parameter editing state

Fault alarming state

If the controller detects a fault signal, the panel will enter the fault alarming state and LCD will display the fault code and name and anti-color display ALM, as shown in Figure 5-5.

You can enter Group F17 to check the fault history.

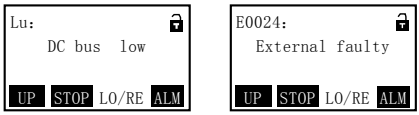


Figure 5-5 Fault alarming state

The controller can be reset by pressing STOP key, or by sending the reset commands via the external terminal or communication reset command.

5.2.3 Panel Operation Examples

Function parameter setting

For example: To modify the setting value of the function parameter F00.07 from 1.500m/s to 1.000m/s, as shown in Figure 5-6.

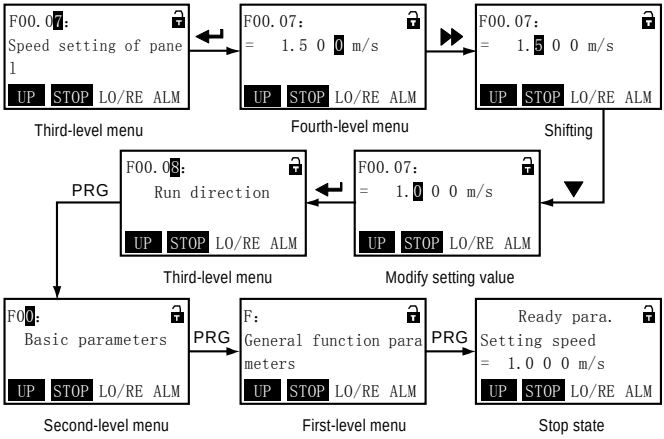


Figure 5-6 Function parameter setting

In the setting fourth-level menu situation, if the parameter is not in anti-color displaying, it indicates that this parameter can't be modified. The possible reasons are as follows:

- The function parameter can't be modified, such as the actual detected parameters or recorded parameters etc.
- Only when the controller stops can it modify the function parameter.
- Only input the correct password can it edit the function parameter due to the valid password.

Switching display parameters at stopping state

There are six stopping parameters(F15.08－F15.13) of the HD5L controller. For example, set the parameter to be default value and the Figure 5-7 describes the operation of displaying parameters.

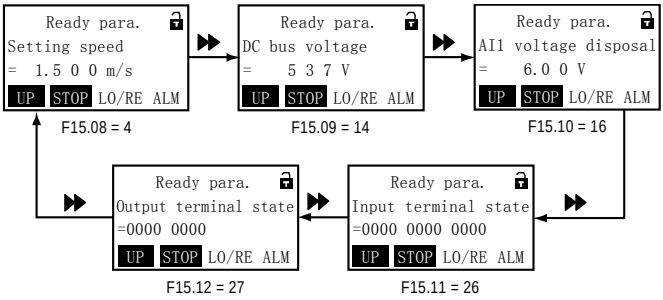


Figure 5-7 Switching display parameters at stopping state

Unlock user's password

When user set F01.00 to non-zero value and detect no press on the panel within 5 minutes, the user's password will be valid. The lock identification of panel will be .

The operation of unlock user's password is as shown in Figure 5-8 which takes 4 as the user's password. The lock identification will be when it successfully unlocks.

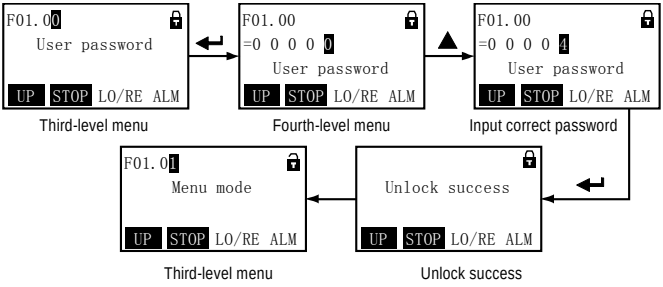


Figure 5-8 Operation of unlocking user's password

Modify user's password

If no password, directly modify the value of F01.00 according to Figure 5-9.

If there is password, you should unlock the password according to Figure 5-8. When the lock successfully displays the 🔓, you can set a new password according to Figure 5-9 which takes "02004" as the new password. When the password is valid, the lock identification will be 🔒.

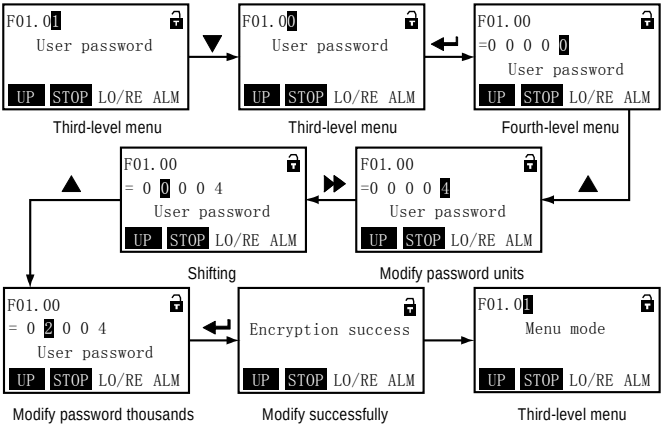


Figure 5-9 Operation of modifying user's password

Clear user's password

If there is password, you should unlock according to Figure 5-8. When it successfully displays 🔓, you can clear the user's password according to Figure 5-10.

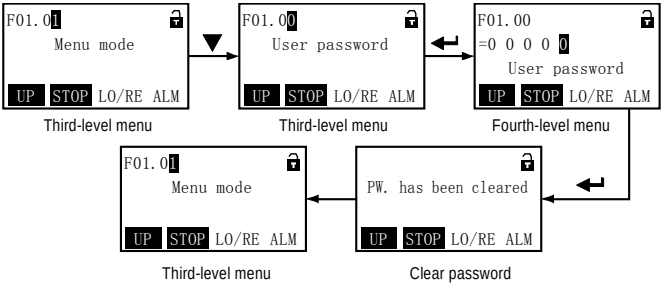


Figure 5-10 Operation of clearing user's password

Panel self-testing

The panel of the HD5L series controller has self-testing function which facilitates periodic inspection for itself and the keys.

The process of panel self-testing:

1. In stopping state, press ▶▶ key and ↵ key simultaneously for 2—3 seconds, the panel will check the LCD whether works well which is as shown in Figure 5-11.

Figure 5-11 Starting panel self-testing

2. Press any key of the panel and if the state is in anti-color display, it means the key is valid. And the correct correspondence is as shown in Figure 5-12.

During this process, if there is no press in 4—5 seconds, it will directly jump to the step 4. If the self-check is success, it will jump to the step 3.

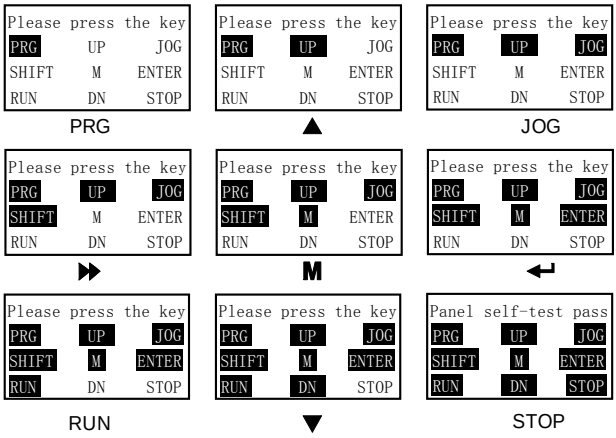


Figure 5-12 Correct correspondence of the keys and the displays

3. If all keys are valid, the panel will display "Panel self-test pass". The "Panel self-test pass" will auto-disappear within 3—5 seconds and back to display state before self-testing.

4. If the key is invalid, the correspondence display will not be in anti-color displaying. The panel will display "Panel self-test fail". The "Panel self-test fail" will auto-disappear within 3—5 seconds and back to display state before self-testing.

The possible reasons of self-testing failure: no press within 5s or invalid key.

Upload and download parameters

Upload: When set the function parameter F01.03 = 1, it uploads the setting value to the panel. When the upload is finished, the panel will jump to display F01.00.

Download: When set the function parameter F01.02 = 2, it downloads the setting value from the panel. When the download is finished, the panel will jump to display F01.03.

The upload and download parameters are as shown in.

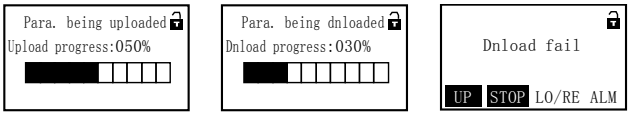


Figure 5-13 Display upload and download parameters

Note:

1. When downloading parameters, it displays "dFAiL" which represents that the EEPROM storage parameters of panel and the function parameters of present controller do not match. First, you need upload the setting value of the correct function code to the EEPROM of panel, and then you can download.
2. When upload or download parameters, the panel displays "E0022" (panel EEPROM fault). It will jump to next function code 10 seconds later. The troubleshooting is in Chapter 8 (Page 99).

5.3 Initial Power On

It need carefully check before power is on. Please wire the controller according to the specifications supplied by this manual.

After checking the wiring and mains supply voltage, switch on the circuit breaker and the controller will be initialization. The panel will display as shown in Figure 5-14.

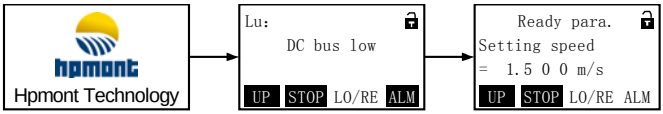


Figure 5-14 Display initialing panel

Chapter 6 Function Introduction

This chapter will provide user with detail function introduction of each group.

Display Parameters:

General Function Parameters:

Manufacturer Function Parameters (on page 85)

6.1 Group D: Display Parameters

Group D is state display parameters. The users can directly check the state parameters by checking the function code of Group D.

6.1.1 Group D00 System State Parameters

<table>
<tr><th>Code</th><th colspan="4">Name Description</th><th>Range【factory setting】</th></tr>
<tr><td rowspan="2">D00.00</td><td colspan="4">Controller series</td><td>【actual value】</td></tr>
<tr><td colspan="5">Display HD5L controller series.</td></tr>
<tr><td rowspan="2">D00.01</td><td colspan="4">DSP software version</td><td>【actual value】</td></tr>
<tr><td colspan="5">Display the DSP software version.</td></tr>
<tr><td rowspan="2">D00.02</td><td colspan="4">DSP special software version</td><td>【actual value】</td></tr>
<tr><td colspan="5">Display the DSP special software version.</td></tr>
<tr><td rowspan="2">D00.03</td><td colspan="4">Panel software version</td><td>【actual value】</td></tr>
<tr><td colspan="5">Display the panel software version.</td></tr>
<tr><td rowspan="6">D00.04</td><td colspan="4">Elevator running state</td><td>【actual value】</td></tr>
<tr><td colspan="5">Display the elevator running state in 16-bit binary. As following:</td></tr>
<tr><td>Bit15: battery driven run
0: no
1: yes</td><td>Bit14: MS terminal 3
0: invalid
1: valid</td><td>Bit13: MS terminal 2
0: invalid
1: valid</td><td colspan="2">Bit12: MS terminal 1
0: invalid
1: valid</td></tr>
<tr><td>Bit11: down forced Dec. input
0: invalid
1: valid</td><td>Bit10: up forced Dec. input
0: invalid
1: valid</td><td>Bit9: contactor feedback input
0: invalid
1: valid</td><td colspan="2">Bit8: brake feedback input
0: invalid
1: valid</td></tr>
<tr><td colspan="5">Bit7－bit4: reserved which means “0”</td></tr>
<tr><td>Bit3: analogue run
0: no
1: yes</td><td>Bit2: MS run
0: no
1: yes</td><td>Bit1: inspection run
0: no
1: yes</td><td colspan="2">Bit0: controller enable
0: disenable
1: enable</td></tr>
<tr><td rowspan="2">D00.05</td><td colspan="4">Controller rated current</td><td>【actual value】</td></tr>
<tr><td colspan="5">Display the controller rated current.</td></tr>
<tr><td rowspan="6">D00.06</td><td colspan="4">Controller state</td><td>【actual value】</td></tr>
<tr><td colspan="5">Display the controller state in 16-bit binary. As following:</td></tr>
<tr><td>Bit15: reserved</td><td>Bit14: reserved</td><td>Bit13: stop signal
0: no stop signal
1: stop signal</td><td colspan="2">Bit12: contactor output
0: invalid
1: valid</td></tr>
<tr><td>Bit11: brake output
0: invalid
1: valid</td><td>Bit10: ready to run
0: not ready
1: be ready</td><td>Bit9: speed arrived
0: no
1: yes</td><td colspan="2">Bit8: auto-tuning
0: no in auto-tuning
1: in auto-tuning</td></tr>
<tr><td>Bit7: run at zero-speed
0: not at zero-speed
1: at zero-speed</td><td>Bit6: zero-speed signal
0: invalid
1: valid</td><td colspan="2">Bit5&Bit4: acceleration/deceleration/constant
00: constant 01: acceleration
11: reserved 10: deceleration</td></tr>
<tr><td>Bit3: DN
0: no
1: yes</td><td>Bit2: UP
0: no
1: yes</td><td>Bit1: run/stop
0: stop
1: run</td><td colspan="2">Bit0: controller fault
0: no fault
1: fault</td></tr>
</table>

6.1.2 Group D01 Drive State Parameters

Code	Name Description	Range【factory setting】
D01.00	**Control mode**	**【actual value】**
	Display the cotrol mode.	
D01.01	**Setting speed (m/s)**	**【actual value】**
	Display the setting speed.	
D01.02	**Setting speed (after acceleration/deceleration) (m/s)**	**【actual value】**
	Display the speed which is disposed by acceleration/deceleration S curve.	
D01.03	**Feedback speed (m/s)**	**【actual value】**
	Display the elevator's actual speed.	
D01.04	**Setting frequency**	**【actual value】**
	Display the setting frequency.	
D01.05	**Setting frequency (after acceleration/deceleration)**	**【actual value】**
	Display the frequency (after acceleration/deceleration).	
D01.06	**Output frequency**	**【actual value】**
	Display the output frequency.	
D01.07	**Setting Rpm**	**【actual value】**
	Display the setting Rpm.	
D01.08	**Running Rpm**	**【actual value】**
	Display the running Rpm.	
D01.09	**Reserved**	
D01.10	**Output voltage**	**【actual value】**
	Display the output voltage.	
D01.11	**Output current**	**【actual value】**
	Display the output current.	
D01.12	**Output torque**	**【actual value】**
	Display the output torque which is the relative percentage of the motor rated torque.	
D01.13	**Output power**	**【actual value】**
	Display the output power which is the relative percentage of the motor rated power.	
D01.14	**DC bus voltage**	**【actual value】**
	Display the DC bus voltage.	
D01.15—D01.16 Reserved		

6.1.3 Group D02 Analogue State Display Parameters

Code	Name Description	Range【factory setting】
D02.00	**AI1 voltage**	【actual value】
	Display AI1 input voltage.	
D02.01	**AI1 voltage (after disposal)**	【actual value】
	Display A1 input voltage which is disposed by the gain, bias and filter.	
D02.02	**AI2 voltage**	【actual value】
	Display AI2 input voltage. When AI2 selects current input, the corresponding relations are: - 10.00V corresponds to 0mA, and 10.00V corresponds to 20mA.	
D02.03	**AI2 voltage (after disposal)**	【actual value】
	Display A2 input voltage which is disposed by the gain, bias and filter.	
D02.04	**AI3 voltage**	【actual value】
	Display AI3 input voltage. When AI3 selects current input, the corresponding relations are: - 10.00V corresponds to 0mA, and 10.00V corresponds to 20mA.	
D02.05	**AI3 voltage (after disposal)**	【actual value】
	Display A3 input voltage which is disposed by the gain, bias and filter.	
D02.06	**AI4 voltage**	【actual value】
	Display AI4 input voltage. When AI4 selects current input, the corresponding relations are: - 10.00V corresponds to 0mA, and 10.00V corresponds to 20mA.	
D02.07	**AI4 voltage (after disposal)**	【actual value】
	Display A4 input voltage which is disposed by the gain, bias and filter.	
D02.08	**AO1 output**	【actual value】
	Display AO1 output. When AO1 selects current output, the corresponding relations are: 0V corresponds to 0mA, and 10.00V corresponds to 20mA.	
D02.09	**AO2 output**	【actual value】
	Display AO2 output. When AO2 selects current output, the corresponding relations are: 0V corresponds to 0mA, and 10.00V corresponds to 20mA.	

6.1.4 Group D03 Running State Parameters

<table>
<tr><th>Code</th><th>Name Description</th><th>Range【factory setting】</th></tr>
<tr><td>D03.00</td><td>Heatsink temperature</td><td>【actual value】</td></tr>
<tr><td></td><td colspan="2">Display heatsink temperature.</td></tr>
<tr><td>D03.01</td><td>Input terminal state</td><td>【actual value】</td></tr>
<tr><td></td><td colspan="2">Display input terminal state. Each bit(binary) of this function parameter stands for different physical sources which are in the below table.
• 0: Multi-function input terminals are not connected with common terminals.
• 1: Multi-function input terminals are connected with common terminals.
<table>
<tr><td>Bit11</td><td>Bit10</td><td>Bit9</td><td>Bit8</td><td>Bit7</td><td>Bit6</td><td>Bit5</td><td>Bit4</td><td>Bit3</td><td>Bit2</td><td>Bit1</td><td>Bit0</td></tr>
<tr><td>DI12</td><td>DI11</td><td>DI10</td><td>DI9</td><td>DI8</td><td>DI7</td><td>DI6</td><td>DI5</td><td>DI4</td><td>DI3</td><td>DI2</td><td>DI1</td></tr>
</table></td></tr>
<tr><td>D03.02</td><td>Output terminal state</td><td>【actual value】</td></tr>
<tr><td></td><td colspan="2">Display output terminal state. Each bit(binary) of this function parameter stands for different physical sources which are in the below table.
• Positive logic: 0 stands for invalid while 1 stands for valid.
• Negative logic: 0 stands for valid while 1 stands for invalid.
<table>
<tr><td>Bit5</td><td>Bit4</td><td>Bit3</td><td>Bit2</td><td>Bit1</td><td>Bit0</td></tr>
<tr><td>RLY4</td><td>RLY3</td><td>RLY2</td><td>RLY1</td><td>DO2</td><td>DO1</td></tr>
</table></td></tr>
<tr><td>D03.03</td><td>MODBUS state</td><td>【actual value】</td></tr>
<tr><td></td><td colspan="2">Display MODBUS communication state.
0: Normal.
1: Communication timeout.
2: Incorrect data frame head.
3: Incorrect data frame checking.
4: Incorrect data frame content.</td></tr>
<tr><td>D03.04</td><td>Total time at power-on</td><td>【actual value】</td></tr>
<tr><td>D03.05</td><td>Total running time</td><td>【actual value】</td></tr>
<tr><td></td><td colspan="2">D03.04 display total time at power-on; D03.05 displays total running time. The unit is hour.</td></tr>
<tr><td>D03.06</td><td>Running times</td><td>【actual value】</td></tr>
<tr><td></td><td colspan="2">Display the running times of the controller.</td></tr>
<tr><td>D03.07</td><td>Present fault</td><td>【actual value】</td></tr>
<tr><td></td><td colspan="2">Display the present fault.</td></tr>
</table>

6.1.5 Group D04 Encoder State Parameters

Code	Name Description	Range【factory setting】
D04.00	**C phase value of SINCOS encoder**	【actual value】
	Display the actual AD sample value of SINCOS encoder C phase.	
D04.01	**D phase value of SINCOS encoder**	【actual value】
	Display the actual AD sample value of SINCOS encoder D phase.	
D04.02	**A phase value of SINCOS encoder**	【actual value】
	Display the actual AD sample value of SINCOS encoder A phase.	
D04.03	**B phase value of SINCOS encoder**	【actual value】
	Display the actual AD sample value of SINCOS encoder B phase.	
D04.04	**UVW state of UVW encoder**	【actual value】
	Display the UVW state of UVW encoder.	
D04.05	**Electrical angle**	【actual value】
D04.06—D04.07	**Reserved**	
D04.08	**Pulses of PG**	【actual value】
	Displaying number of encoder pulses can be used to check the encoder is connected correctly. If the encoder is connected correctly, when the motor is rotated, D04.08 value is incremented or decremented in accordance with the running direction.	
D04.09—D04.11	**Reserved**	

6.2 Group F: General Function Parameters

6.2.1 Group F00 Basic Parameters

Code	Name Description	Range【factory setting】
F00.00	**Motor type**	**0,1【0】**
	0: Asynchronous motor. 1: Synchronous motor.	
F00.01	**Control mode**	**0—2【2】**
	0: V/f control. Constant voltage/frequency ratio control. • It is applicable for special elevator occasion. This mode does not need the encoder and its control effect is not so good as the vector control. • When select V/f control, please properly set the V/f control parameter of Group F07 to achieve proper efficiency. 1: SVC control. Sensorless vector control. It is only applicable for the asynchronous motor. 2: Closed-loop vector control. Sensor vector control. • Closed-loop vector and applicable for elevator high accuracy of speed control. In generally the elevator will take this mode. **Note:** **1. V/f and SVC control are applicable for the motor without installing encoder which are one temporary running mode when the elevator is in inspection running.** **2. When select SVC or closed-loop vector control mode, you should do motor parameter auto-tuning.** **Auto-tuning process: Correctly set the motor nameplate parameters (F07.00 – F07.04 / F10.00 – F10.05), then start the motor parameter auto-tuning to obtain the right parameters. Meanwhile set vector control parameters of Group F08 to achieve excellent vector control efficiency.**	
F00.02	**Elevator rated speed**	**0.100—4.000【1.500m/s】**
	The elevator nominal rated speed. • All speed setting value in the function parameters must not exceed this value.	
F00.03	**Controller max output frequency**	**5.00—100.00【50.00Hz】**
	It defines the maximum frequency that the controller is allowed to output. • It should be careful to set reasonable parameters according to the nameplate of the motor and the actual operating conditions.	
F00.04	**Traction machine mechanical parameters**	**10.0—6000.0【60.0】**
	It defines the relationship between the elevator speed and the motor rotation speed. • The traction machine mechanical parameters are calculated based on the traction machine parameters. They determine the control precision and must be correctly set. The elevator speed and motor rotation speed relationship is shown below: $\text{Elevator speed (m/s)} = \frac{\text{Motor rotation speed (rpm)}}{60} \times \frac{\text{F00.04}}{1000}$ The formula for calculating motor mechanical parameters is as below: $\text{F00.04} = \frac{\pi \times \text{D}}{\text{i} \times \text{Winding mode}}$ D: Diameter of motor (mm); i: Dec. rate; Winding mode: The way that the hoist cable is wound, set according to the actual elevator setting.	

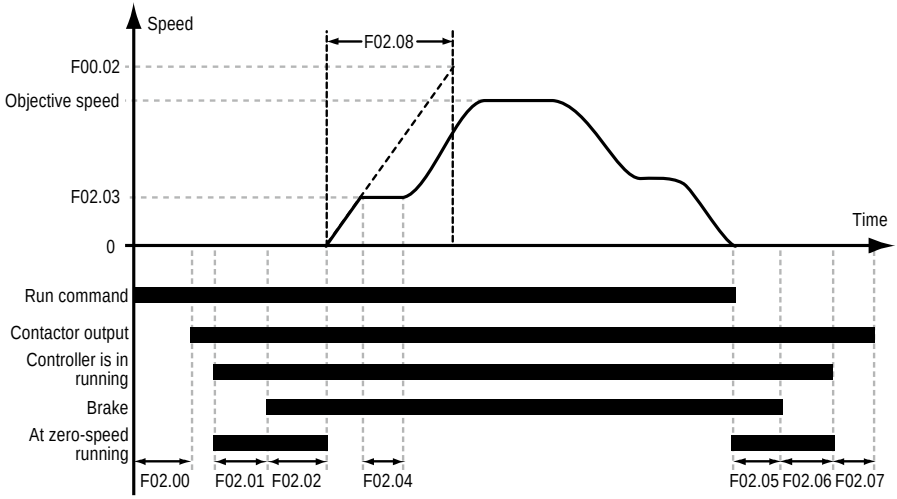
6

Code	Name Description	Range【factory setting】
F00.05	**Operating mode**	**0—5【0】**
	0: Panel control. • Controlled by pressing the RUN or STOP key of the panel. Set the run speed in F00.07. 1: Terminal analogue control. • The run command is controlled by UP and DN of the terminal; and the run speed is set by analogue input terminals. 2: Terminal MS control. • The run command is controlled by UP and DN of the terminal; and the run speed is set by MS1—MS3 multi-step speed terminal combination. 3: Reserved. 4: SCI control. • The run command and the run multi-step speed are set by PC communication. 5: Reserved.	
F00.06	**M-key function**	**0,1【0】**
	0: Disable. 1: UP/DN switch.	
F00.07	**Speed setting of panel**	**0.000—F00.02【1.500m/s】**
	When F00.05 = 0, it set the objective speed at running.	
F00.08	**Run direction**	**0,1【0】**
	0: The same as run command. 1: Opposite to run command.	

6.2.2 Group F01 Protection of Parameters

Code	Name Description	Range【factory setting】
F01.00	**User password**	**00000－65535【00000】**
	XXXXX: To enable the password protection function, set any non-zero number as the password. • Once the password is set, and detect that there is no press on the panel within 5 minutes, the user's password will be valid. • It is necessary to input correct password if you want to change the parameters. Otherwise you can not change any parameter via panel, but only check. 00000: The factory setting and no user's password. • If the user unlocks the password, it means clearing the user's password. • To unlock, change and clear the user's password, see section 5.2.3.	
F01.01	**Menu mode**	**0,1【0】**
	0: Full menu mode. All function parameters can be displayed in this menu. 1: Checking menu mode. Only different from factory setting parameters can be displayed.	
F01.02	**Parameter initialization**	**0－3【0】**
	0: No operation. The controller is in regular parameter read/write state. • Whether can change the parameter it depends on the user's password state and the actual operating conditions. 1: Restore to factory settings. • Except Group F01, F07.00－F07.14, Group F10, Group F11, F15.00, F17.11－F17.27, Group F18 and Group Y. • Operation steps: If set F01.02 = 1, press ↵ to ensure and the parameters are restored to factory settings. The panel dispalys "loading defualt para.". Then the panel will display parameters in stop state after finish restoring to factory setting. 2: Parameter download. • Except Group F01, F17.11－F17.27, Group F18 and Group Y. • Motor parameters, encoder parameters and magnetic pole angle etc. will be downloaded. Record the original parameters such as motor parameters, encoder parameters and magnetic pole angle etc. Or restart parameter auto-tuning. 3: Clear fault information. The fault history of F17.11－F17.27 will be clear.	
F01.03	**Panel EEPROM parameter initialization**	**0,1【0】**
	0: No operation. The controller is in regular parameter read/write state. 1: Parameter upload. Upload the present function code settings to the panel EEPROM parameter. **Note: Group F01, F17.11 – F17.27, Group F18 and Group Y do not upload.**	

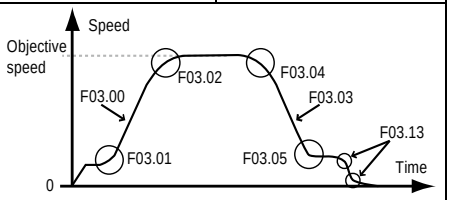
6.2.3 Group F02 Start & Stop Parameters



Code	Name Description	Range【factory setting】
F02.00	**Start delay time**	**0.000—4.999【0.000s】**
	When the controller receives the run command, it will wait for the delay time set by F02.00 and then start running. • When controlled by panel (F00.05 = 0), F02.00 is invalid.	
F02.01	**Brake open delay time**	**0.000—4.999【0.000s】**
	It defines the time interval from controller's zero-speed running to output brake-open command. • This function enables the controller to enter running state before the brake open, so as to alleviate the impact at start.	
F02.02	**Retention time of start zero-speed**	**0.000—4.999【0.500s】**
	F02.02 defines the retention time from brake-open to output with speed. During the retention time, the motor has output torque, which makes more comfortable. • When F06.00 set 4(No weighing auto-compensation is used), the value of F02.02 should be exceeded 0.5s.	
F02.03	**Start speed**	**0.000—0.400【0.000m/s】**
	It defines the initial speed required for starting the controller. • The start speed, when properly set, can minimize the start jerk.	
F02.04	**Retention time of start speed**	**0.000—4.999【0.000s】**
	The start time is the time in which the controller runs at start speed (F02.03).	
F02.05	**Brake close delay time**	**0.000—4.999【0.000s】**
	It defines the time interval from controller's zero-speed running to output brake-closed command.	
F02.06	**Retention time of stop zero-speed**	**0.000—4.999【0.000s】**
	When stopping, the motor runs at zero-speed and has output torque during the retention time, which makes more comfortable.	
F02.07	**Contactor close delay time**	**0.000—4.999【0.000s】**
	It defines the running contactor delay release time after the run command is revoked.	

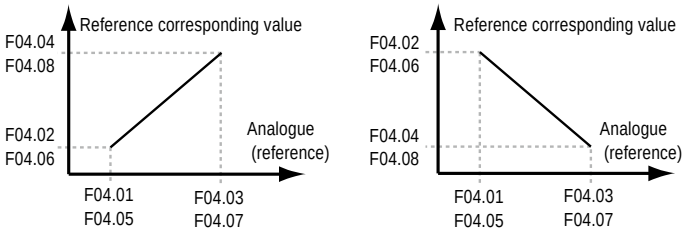
Code	Name Description	Range【factory setting】
F02.08	**Start ramp time**	0.000—2.000【0.000s】
	The start ramp time is the time that elevator takes to accelerate from zero to the rated speed (F00.02). • When F02.08 is set as 0, the elevator starts from start speed directly.	
F02.09	**Reserved**	

6.2.4 Group F03 Acceleration/Deceleration Parameters

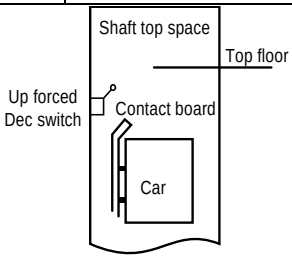
Code	Name Description	Range【factory setting】
F03.00	**Acceleration speed**	0.020—9.999【0.700m/s²】
F03.01	**Start Acc jerk**	0.020—9.999【0.350m/s³】
F03.02	**End Acc jerk**	0.020—9.999【0.600m/s³】
F03.03	**Deceleration speed**	0.020—9.999【0.700m/s²】
F03.04	**Start Dec jerk**	0.020—9.999【0.600m/s³】
F03.05	**End Dec jerk**	0.020—9.999【0.350m/s³】
	F03.00—F03.05 adjust the elevator speed via S-curve which can cushion the shock at elevator start/stop and improve riding comfort. • Acc jerk: The change ratio of acceleration. • See the right figure for the adjustment of S-curve. • The S-curve becomes steeper when parameter values are raised; • The S-curve becomes slower when parameter values are decreased.	
F03.06	**Inspection Acc speed**	0.020—9.999【0.200m/s²】
	It defines the Acc speed of elevator at the inspection running mode.	
F03.07	**Inspection Dec speed**	0.020—9.999【1.000m/s²】
	It defines the Dec speed of elevator at the inspection running mode.	
F03.08	**Battery driven Acc speed**	0.020—9.999【1.000m/s²】
	It defines the Acc speed of elevator at the battery driven mode.	
F03.09	**Battery driven Dec speed**	0.020—9.999【1.000m/s²】
	It defines the Dec speed of elevator at the battery driven mode.	
F03.10	**Asynchronous motor auto-tuning Acc speed**	0.020—9.999【0.100m/s²】
	It defines the deceleration time of emergency stop.	
F03.11	**Asynchronous motor auto-tuning Dec speed**	0.020—9.999【0.100m/s²】
	It defines the deceleration time of emergency stop.	
F03.12	**Abnormal Dec speed**	0.020—9.999【1.000m/s²】
	It defines the deceleration time of emergency stop.	
F03.13	**Stop Dec jerk**	0.020—9.999【0.350m/s²】
	It defines the deceleration time of emergency stop.	
F03.14	**Asynchronous motor field-weakening optimization**	0—2【0】
	0: No field-weakening optimization. 1: Optimize according to voltage. 2: Optimize according to current. When set to 1 or 2, it can reduce the current noise and improve the dynamic performance of asynchronous motor.	

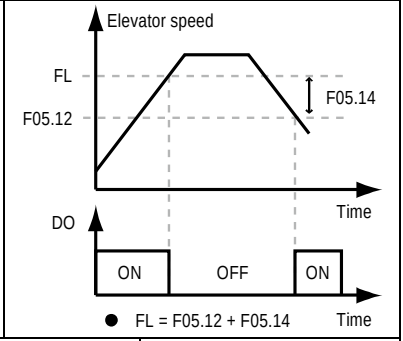
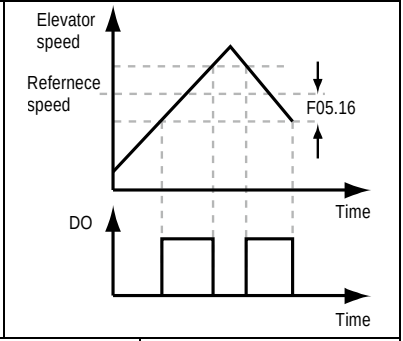
Code	Name Description	Range【factory setting】
F03.15	Field-weakening Kp	0—5000【4000】
F03.16	Field-weakening Ki	0—5000【1000】
F03.17	Field-weakening voltage limit	4000—5000【4126】
	F03.15—F03.17 is uesd to adjust the effect of asynchronous motor field-weakening so that user need not regulate them usually.	
F03.18	Reserved	
F03.19	Sincos encoder CD phase learning	0,1【0】
	0: Learning. 1: Not learning.	
F03.20	Reserved	

6.2.5 Group F04 Analogue Curve Parameters

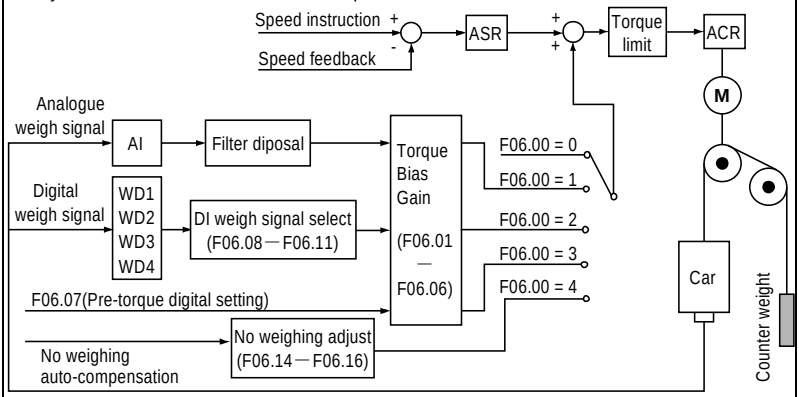
Code	Name Description	Range【factory setting】
F04.00	Reference curve	0000—1111【0000】
	Units: AI1 characteristic curve selection. Tens: AI2 characteristic curve selection. Hundreds: AI3 characteristic curve selection. Thousands: AI4 characteristic curve selection. Ten thousands: Pulse input characteristic curve selection. Each bit setting: • 0: Line 1. • 1: Line 2.	
F04.01	Line 1 minimum reference	0.0—F04.03【0.0%】
F04.02	Corresponding value of line 1 minimum reference	0.0—100.0【0.0%】
F04.03	Line 1 maximum reference	F04.01—100.0【100.0%】
F04.04	Corresponding value of line 1 maximum reference	0.0—100.0【100.0%】
F04.05	Line 2 minimum reference	0.0—F04.07【0.0%】
F04.06	Corresponding value of line 2 minimum reference	0.0—100.0【0.0%】
F04.07	Line 2 maximum reference	F04.05—100.0【100.0%】
F04.08	Corresponding value of line 2 maximum reference	0.0—100.0【100.0%】
	F04.01—F04.04 define the line 1. F04.05—F04.08 define the line 2. • Both line 1 and line 2 can independently achieve positive and negative characteristics as shown in following figure. Positive and negative characteristics of line 	

6.2.6 Group F05 Speed Parameters

Code	Name Description	Range【factory setting】
F05.00	**Multi-speed 0**	**0.000—F00.02【0.000m/s】**
F05.01	**Multi-speed 1**	**0.000—F00.02【0.000m/s】**
F05.02	**Multi-speed 2**	**0.000—F00.02【0.000m/s】**
F05.03	**Multi-speed 3**	**0.000—F00.02【0.000m/s】**
F05.04	**Multi-speed 4**	**0.000—F00.02【0.000m/s】**
F05.05	**Multi-speed 5**	**0.000—F00.02【0.000m/s】**
F05.06	**Multi-speed 6**	**0.000—F00.02【0.000m/s】**
F05.07	**Multi-speed 7**	**0.000—F00.02【0.000m/s】**
	F05.00—F05.07 define the MS running speed which use in MS run mode. F00.02 defines the elevator rated speed.	
F05.08	**Inspection run speed**	**0.000—0.630【0.200m/s】**
	It defines the elevator's running speed in the inspection mode.	
F05.09	**Battery driven run speed**	**0.000—F00.02【0.100m/s】**
	It defines the elevator's running speed in the battery driven run mode.	
F05.10	**Up forced Dec detection value**	**0.0—100.0 (F00.02)【97.0%】**
	It defines the speed detection value at the forced switch action. • After forced switch act, the running speed exceeds Dec detection value, and decelerate to F05.22 (creeping speed) according to F03.12 (abnormal Dec speed). • Properly set this parameter to avoid climbing elevator at elevator up.	
F05.11	**Down forced Dec detection value**	**0.0—100.0 (F00.02)【97.0%】**
	To avoid plunging elevator at elevator down. Refer to parameter F05.10.	

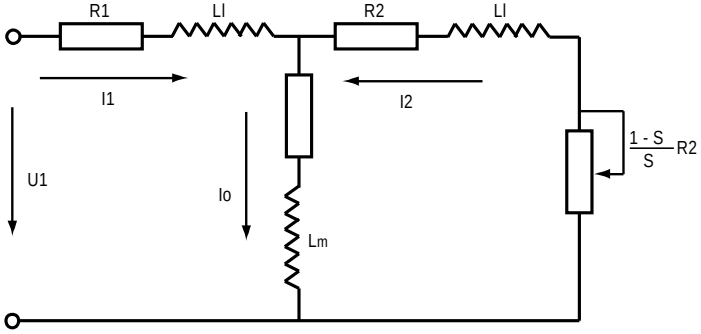
Code	Name Description	Range【factory setting】
F05.12	FDT1	0.0—100.0 (F00.02)【90.0%】
F05.13	FDT2	0.0—100.0 (F00.02)【90.0%】
F05.14	FDT1 delay level	0.0—100.0 (F00.02)【1.0%】
F05.15	FDT2 delay level	0.0—100.0 (F00.02)【1.0%】
	When running speed is lower than one speed (F05.12 + F05.14) as figure's FL, ON indicating signal will be output till the running speed is lower than F05.12. • Refer to parameter F05.12 and F05.14 about F05.13 and F05.15.	
F05.16	FAR range	0.0—20.0【1.0%】
	The pulse signal will be output if the controller's output frequency is within the FAR range. As shown in the right figure.	
F05.17	Over-speed setting	80.0—120.0(F00.02)【115.0%】
F05.18	Over-speed detection time	0.0—2.0s【0.2】
	When the elevator actual speed exceeds F05.17 setting value and the duration time exceeds F05.18 setting value, the controller alarms E0032 fault (motor over speed). • Set F05.18 as 0, the controller does not detect motor over speed fault.	
F05.19	Detected value of speed deviation	0.0—30.0(F00.02)【20.0%】
F05.20	Detected time of speed deviation	0.0—2.0【1.0s】
	When the deviation of setting speed (after Acc/Dec) and motor actual run speed exceeds F05.19 setting value and the duration time exceeds F05.20 setting value, the controller alarms E0018 fault (excessive speed deviation). • Set F05.19 or F05.20 as 0, the controller does not detect the excessive speed deviation fault of motor.	
F05.21	Reserved	
F05.22	Creeping speed	0.000—0.400【0.050m/s】
	It defines the running speed at the forced Dec run.	
F05.23—F05.25 Reserved		

6.2.7 Group F06 Weighing Compensation Parameters

Code	Name Description	Range【factory setting】
F06.00	**Pre-torque selection**	**0—4【4】**
	The pre-torque function can output the load balancing torque in advance to avoid reverse and reduce the start impact. 0: No pre-torque function. 1: Analogue setting. Output balancing torque according to the input analog weight signal. 2: DI setting. Output balancing torque according to the input digital weight signal. 3: Digital pre-torque. If no weighing device is at the elevator, you can use the digital pre-torque mode. • Then adjust the pre-torque digital setting parameter to make the elevator complete excitation before open brake, therefore improve the starting comfort. • Compensation value = Pre-torque bias - Pre-torque digital setting. 4: No weighing auto-compensation. Suitable for all PG. 5: Asynchronous motor zero-serve auto-compensation. 	
F06.01	**Up pre-torque bias**	**0.0—100.0【50.0%】**
F06.02	**Down pre-torque bias**	**0.0—100.0【50.0%】**
	Pre-torque bias = (Elevator counter weight – Car weight)/ Rated weight.	
F06.03	**Up electrical pre-torque gain**	**0.000—9.000【1.000】**
F06.04	**Up brake pre-torque gain**	**0.000—9.000【1.000】**
F06.05	**Down electrical pre-torque gain**	**0.000—9.000【1.000】**
F06.06	**Down brake pre-torque gain**	**0.000—9.000【1.000】**
F06.07	**Pre-torque digital setting**	**-100.0—100.0【10.0%】**
	At no weighing device, set the pre-torque value via changing the value of F06.07.	
F06.08	**DI weighing signal 1**	**0.0—100.0【10.0%】**
F06.09	**DI weighing signal 2**	**0.0—100.0【30.0%】**
F06.10	**DI weighing signal 3**	**0.0—100.0【70.0%】**
F06.11	**DI weighing signal 4**	**0.0—100.0【90.0%】**
	When digital weighing signal termianl input is enabled, its value is the percentage of rated load. **For example:** If DI weighing signal 1 is enabled, it expresses that the present load is F06.08% of the rated load. • If numbers of terminals are enabled simultaneously, the max number terminal will be considered as the valid one.	

Code	Name Description	Range【factory setting】
F06.12	Reserved	
F06.13	Reserved	
F06.14	No weighing current coefficient	0—9999【3000】
F06.15	No weighing speed-loop KP	1—9999【2000】
F06.16	No weighing speed-loop KI	1—9999【2000】
	F06.14—F06.16 are used to adjust the effect of no weighing auto-compensation (F06.00 = 4). • The system's response can be expedited through increasing F06.14—F0616, but system's oscillation and overshoot may occur if the value of F06.14—F0616 is too high. • Generally, it can smoothly start elevator via adjusting F06.14 when debugging. • Increase F06.14 so as to avoid sliding vehicle at starting moment. Decrease F06.17 so as to avoid shake at starting moment.	
F06.17—F06.20 Reserved		

6.2.8 Group F07 Asynchronous Motor Parameters



- R1 = F07.07 (Stator resistance) Ll = F07.09 (Leakage inductance)
  R2 = F07.08 (Rotor resistance) Lm = F07.10 (Mutual inductance)
  Io = F07.11 (Excitation current) S = Slip ratio

The relationship among rated torque current, excitation current and motor's rated current is as follows:

$$\text{Rated torque current} = \text{F07.05} \times \text{F07.02}$$

$$\text{Excitation current F07.11} = \sqrt{1 - \text{F07.05}^2} \times \text{F07.02}$$

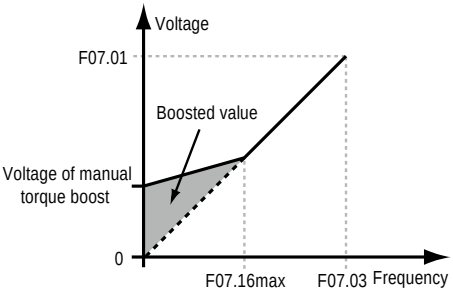
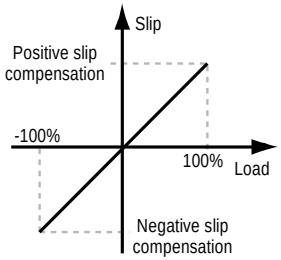
$$\text{Mutual inductance F07.10} = \frac{\text{F07.01}}{2\sqrt{3}\pi \times \text{F07.03} \times \text{F07.11}} - \text{F07.09}$$

Code	Name Description	Range【factory setting】
F07.00	Asynchronous motor rated power	0.2—400.0kW 【Depend on controller model】
F07.01	Asynchronous motor rated voltage	0V—Controller rated voltage 【Depend on controller model】
F07.02	Asynchronous motor rated current	0.0—999.9A 【Depend on controller model】
F07.03	Asynchronous motor rated frequency	1.00—100.00【50.00Hz】

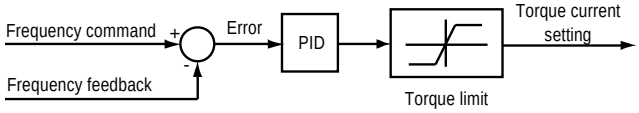
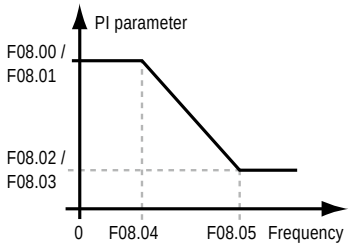
Code	Name Description	Range【factory setting】
F07.04	Asynchronous motor rated Rpm	1—24000【1440rpm】
F07.05	Asynchronous motor power factor	0.001—1.000 【Depend on controller model】
F07.06	Asynchronous motor parameter auto-tuning	0—2【0】

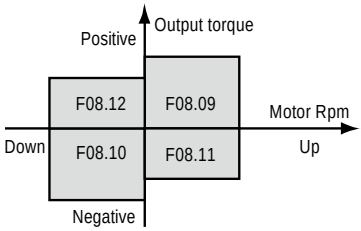
	0: No action.
	1: Motor static auto-tuning.
	2: Motor rotation auto-tuning.
	Motor auto-tuning:
	• In the process of motor static auto-tuning, the stator resistance (F07.07), rotor resistance (F07.08) and leakage inductance (F07.09) will be auto-measured and written into corresponding parameters automatically.
	• For mutual inductance (F07.10) and excitation current (F07.11),
	  • If at static auto-tuning (F07.06 = 1), it will auto calculate according to F07.05 and F07.02, then write the result into F07.10 and F07.11;
	  • If at rotation auto-tuning (F07.06 = 2), the motor will be at rotation state and the auto-measured value will be written into F07.10 and F07.11.
	• When the motor is in rotation state, the oscillation and even the overcurrent might occur. In this case, please press the STOP key to stop auto-tuning and then properly adjust the F07.21 (oscollation-suppression mode) and F07.22 (oscollation-suppression coefficient) to mitigate the possible oscillation.
	Note: The auto-tuning is enabled only in panel control mode (F00.05 = 0).
	Auto-tuning procedures:
	1. Input correct motor parameters as per its nameplate (F07.00－F07.04).
	2. When F07.06 is set as 2, please set the proper Acc speed(F03.10) and Dec speed (F03.11) and make sure the motor is disconnected with the load for security.
	3. Set F07.06 as 1 or 2 firstly, then press the ↵ key, and therewith press RUN key to start auto-tuning. The LCD will display “Motor para. auto-tuning”.
	4. When the auto-tuning is completed, the panel will return to stop display state and the F07.06 will be reset to 0.	

F07.07	Asynchronous motor stator resistance	0.000—65.535Ω 【Depend on controller model】
F07.08	Asynchronous motor rotor resistance	0.000—65.535Ω 【Depend on controller model】
F07.09	Asynchronous motor leakage inductance	0.0—6553.5mH 【Depend on controller model】
F07.10	Asynchronous motor mutual inductance	0.0—6553.5mH 【Depend on controller model】
F07.11	Asynchronous motor excitation current	0.0—999.9A 【Depend on controller model】
F07.12	Asynchronous motor of core saturation coefficient 1	0.00—0.50【0.50】
F07.13	Asynchronous motor of core saturation coefficient 2	0.00—0.75【0.75】
F07.14	Asynchronous motor of core saturation coefficient 3	0.00—1.20【1.20】

Code	Name Description	Range【factory setting】
F07.15	**Asynchronous motor torque boost**	**0.1—30.0【0.1%】**
F07.16	**Asynchronous motor torque boost end-point**	**0.1—50.0 (F07.03)【2.0%】**
	In order to compensate the torque drop at low frequency, the controller can boost the voltage so as to boost the torque. F07.16 is relative to percentage of motor rated frequency (F07.03).  • F07.16max = 50% F07.03	
F07.17	**Asynchronous motor of slip compensation gain**	**0.0—300.0【100.0%】**
F07.18	**Asynchronous motor of slip compensation filter time**	**0.1—10.0【0.1s】**
F07.19	**Asynchronous motor of slip compensation limitation**	**0.0—250.0【200.0%】**
	The motor's slip changes with the load torque, which results in the variance of motor speed. Through slip compensation (the controller will auto adjust its output frequency according to the motor load torque) to reduce the influence. • In driving state (the actual speed is lower than the setting speed) and in generating state (the actual speed is higher than the setting speed), the slip compensation gain (F07.17) should be increased gradually. • The value of auto slip compensation depends on the motor's rated slip, consequently make sure the motor's rated frequency (F07.03) and rated Rpm (F07.04) are set correctly. Range of slip compensation = Slip compensation limit (F07.19) × Rated slip. Rated slip = F07.03 - F07.04 × Np / 60. • Np is the number of motor pole pairs. 	
F07.20	**AVR function**	**0—2【1】**
	0: No action. 1: Action all the time. 2: No action in deceleration process. • The output voltage can be regulated to maintain constant via AVR. Thus, normally the AVR function should be enabled, especially when the input voltage is higher than the rated voltage. • In deceleration process, if the F07.20 = 0 or F07.20 = 2, the running current will be a little higher; while if the F07.20 =1, the motor will decelerate steadily and the current will be smaller.	
F07.21	**Asynchronous motor of oscillation-suppression mode**	**0,1【0】**
	0: Oscillation suppression is dependent on the motor's exciting current component. 1: Oscillation suppression is dependent on the motor's torque current component.	
F07.22	**Asynchronous motor of oscillation-suppression coefficient**	**0—200【100】**
	This function is used to damp oscillation when output current is continually unstable. This function helps to keep the motor running smoothly through correctly adjusting the setting of F07.22.	

6.2.9 Group F08 Motor Vector Control Speed-loop Parameters

Code	Name Description	Range【factory setting】
F08.00	Low speed ASR Kp	1—9999【500】
F08.01	Low speed ASR KI	0—9999【500】
F08.02	High speed ASR Kp	1—9999【500】
F08.03	High speed ASR KI	0—9999【500】
F08.04	ASR PI swithcing frequency 1	0.00—50.00【10.00Hz】
F08.05	ASR PI swithcing frequency 2	0.00—50.00【15.00Hz】
	The parameters of F08.00—F08.05 and F08.07 comfirm the PID parameters of ASR. The structure of ASR is shown in figure.  As the right figure: • When the controller operates with frequency in a range of 0—F08.04, the PI parameters of vector control are F08.00 and F08.01; • When the controller operates with frequency above the value of F08.05, the PI parameters of vector control are F08.02 and F08.03; • When the controller operates with frequency in a range of F08.04—F08.05, P is the linear interpolation between F08.00 and F08.02, while I is the linear interpolation between F08.01 and F08.03.  • The system's response can be expedited through increasing the ASR KP (F08.00, F08.02), but oscillation may occur if the value of KP is too high. • The system's response can be expedited through increasing the ASR KI (F08.01, F08.03), but oscillation and high overshoot happen easily if the value of KI is too high. • If F08.01/F08.03 = 0 and the integral function is disabled, the speed-loop works only as a proportional regulator. • Generally, the KP should be adjusted firstly to the maximum on condition that the system does not vibrate, and then the KI should be adjusted to shorten the response time without overshoot. • It need increase KP and KI, on condition that shorter dynamic response time is required during low frequency operation.	
F08.06	ASR integral limitation	0.0—200.0 (Motor rated current)【180.0%】
	It is used to limit the maximum value of the vector control speed-loop integral.	
F08.07	ASR differential time	0.000—1.000【0.000s】
	It defines the vector control speed-loop differential time. • Generally, it doesn't need to set F08.07 except for expediting the dynamic response. • There isn't speed-loop differential when F08.07 = 0.	
F08.08	ASR output filter time	0.000—1.000【0.008s】
	It is used to filter the output of ASR regulator. • When F08.08 = 0, the speed-loop filter is disabled.	

Code	Name Description	Range【factory setting】
F08.09	UP electrical torque limitation	0.0—200.0 (F07.02)【180.0%】
F08.10	DN electrical torque limitation	
F08.11	UP regenerative torque limitation	
F08.12	DN regenerative torque limitation	
	F08.09—F08.12 are the relative percentage of motor rated current (F07.02). As the right figure: • The bigger torque output, the bigger curren toutput. • If the torque is too big, over-current is easy to occur. • If the torque is too small, the run speed and the Acc/Dec speed may deviate from the setting value.	

6.2.10 Group F09 Current-loop Parameters

Code	Name Description	Range【factory setting】
F09.00	Current-loop KP	1—4000【500】
F09.01	Current-loop KI	1—4000【500】
	F09.00 and F09.01 are the PI regulator parameter of current ring (ACR). • Increasing F09.00 or F09.01 can fasten the system dynamic response to the output torque, while decreasing F09.00 or F09.01 can build up system stability. • Too big F09.00 or F09.01 makes the system apt to oscillate, while too small F09.00 or F09.01 affects the system torque output.	
F09.02	Current-loop output filter time	0.000—1.000【0.000s】
F09.03—F09.07 Reserved		

6.2.11 Group F10 Synchronous Motor Parameters

Code	Name Description	Range【factory setting】
F10.00	Synchronous motor type	0,1【0】
	0: IPM. 1: SPM.	
F10.01	Synchronous motor rated power	0.2—400.0kW【Depend on controller model】
F10.02	Synchronous motor rated voltage	0—Controller rated voltage【Depend on controller model】
F10.03	Synchronous motor rated current	0.0—999.9A【Depend on controller model】
F10.04	Synchronous motor rated frequency	1.00—100.00【19.20Hz】
F10.05	Synchronous motor rated rpm	1—24000【96rpm】
F10.06	Synchronous motor stator resistance	0.000—9.999【0.000Ω】
F10.07	Synchronous motor quadrature axis inductance	0.0—999.9【0.0mH】
F10.08	Synchronous motor direct axis inductance	0.0—999.9【0.0mH】

Code	Name Description	Range【factory setting】
F10.09	**Synchronous motor Back EMF**	**0—Controller rated voltage 【380V】**
F10.10	**Synchronous motor of angle auto-tuning**	**0—2【0】**
	0: No action. 1: Static auto-tuning. 2: Rotation auto-tuning. • Refer to section 7.1.3 about parameter auto-tuning.	
F10.11	**Synchronous motor static auto-tuning voltage setting**	**0.0—100.0 (F10.02)【100.0%】**
	If synchronous motor alarms over-current at static auto-tuning, the setting value should be smaller.	
F10.12	**Synchronous motor initial angle**	**0.0—359.9【0.0° 】**
F10.13	**Synchronous motor of Z pulse initial angle**	**0.0—359.9【0.0° 】**
F10.14	**Synchronous motor SINCOS encoder C amplitude**	**0—9999【2048】**
F10.15	**Synchronous motor SINCOS encoder C zero-bias**	**0—9999【2048】**
F10.16	**Synchronous motor SINCOS encoder D amplitude**	**0—9999【2048】**
F10.17	**Synchronous motor SINCOS encoder D zero-bias**	**0—9999【2048】**
F10.18	**Sincos encoder CD phase**	**0,1【0】**
	0: C phase ahead of the D phase. 1: D phase ahead of the C phase. **Note: At the motor parameter auto-tuning , the F10.18 can be self-learning whitout manual changes.**	
F10.19	**Reserved**	
F10.20	**Synchronous performance optimization**	**0—65535【0】**
	Bit0—Bit1: Reserved **Bit2: Optimization for detecting speed** 0: No optimization. 1: Optimization. **Bit3—Bit15: Reserved**	

6

6.2.12 Group F11 PG Parameters

In elevator application, the PG is necessary for the motor. Please refer to section 4.6 for PG.

Code	Name Description	Range【factory setting】
F11.00	**HD5L PG interface board**	**1—4【4】**
	1: HD-PG2-OC-FD is valid. Only for asynchronous motor. 2: HD-PG6-UVW-FD is valid. Only for synchronous motor. 3: HD-PG5-SINCOS-FD is valid. Only for synchronous motor. 4: HD-PG9-SC-FD is valid. Only for synchronous motor. (support Endat)	
F11.01	**PG P/R**	**1—9999【2048】**
F11.02	**PG direction setting**	**0,1【0】**
	It defines the connection sequence of PG whether the same as that of the drive-motor connection. • In order to change the connection of AB two phases of the PG, you can change this parameter. 0: The same direction. 1: The reverse direction.	

Code	Name Description	Range【factory setting】
F11.03	**PG signal filter coefficient**	**0x00—0x77【0x11】**
	Units: Low-speed filter coefficient. Tens: High-speed filter coefficient.	
F11.04	**The protocol of serial communication PG**	**0—9【0】**
	0: Endat. 1: Rotary transformer protocol. 2—9: Reserved.	
F11.05	**Detecting time of PG wire disconnection**	**0.00—2.00s【1.00】**
	F11.05 specifies the duration time for detecting PG wire disconnection fault. The controller detects the PG wire disconnection and the duration time exceed F11.05, then the controller alarms E0031 fault (PG disconnection). • No detection will be conducted when F11.05 is set as 0.	

6.2.13 Group F12 Digital I/O Terminal Parameters

Code	Name Description	Range【factory setting】
F12.00	**Input terminal filter time**	**0.000—1.000【0.010s】**
	This function code is to define filter time of digital input termianl and to set input terminal sensibility. • The input terminals are susceptible to interference which will result in misoperation so that you could increase this parameter setting value. However, too long filter time will affect adjustment sensibility.	
F12.01	**DI1 terminal function**	**000—134【1】**
F12.02	**DI2 terminal function**	**000—134【2】**
F12.03	**DI3 terminal function**	**000—134【3】**
F12.04	**DI4 terminal function**	**000—134【4】**
F12.05	**DI5 terminal function**	**000—134【5】**
F12.06	**DI6 terminal function**	**000—134【6】**
F12.07	**DI7 terminal (I/O interface board terminal) function**	**000—134【0】**
F12.08	**DI8 terminal (I/O interface board terminal) function**	**000—134【0】**
F12.09	**DI9 terminal (I/O interface board terminal) function**	**000—134【0】**
F12.10	**DI10 terminal (I/O interface board terminal) function**	**000—134【0】**
F12.11	**DI11 terminal (I/O interface board terminal) function**	**000—134【0】**
F12.12	**DI12 terminal (I/O interface board terminal) function**	**000—134【0】**
	Note: When hundreds is set as 0, it means normally open input; while set as 1 it means normally closed input. 0: Disable. It disables the terminal's function. The controller ignores the signal input via this terminal. • The unwanted terminal is recommended to be set as 0 so as to avoid wrong connection or action. 1: Controller enabled. (EN) • When enabled, the controller is enabled to run; • When disabled, the controller is disabled to run and will be in auto stop state. • When no terminal selects this function, it defaults that the controller is at enabled state.	

Code	Name Description	Range【factory setting】

2,3: UP/DN.

- You can set control terminal to control the controller's up and down.

UP Terminal	DN Terminal	Selection
0	0	Stop
0	1	Down
1	0	Up
1	1	Stop

4－6: MS1－MS3.

- You can achieve 8-step speed running curve via terminals logic combination, as follow table.

MS3 Terminal	MS2 Terminal	MS1 Terminal	Multi-speed setting
0	0	0	Multi-speed 0 (F05.00)
0	0	1	Multi-speed 1 (F05.01)
0	1	0	Multi-speed 2 (F05.02)
0	1	1	Multi-speed 3 (F05.03)
1	0	0	Multi-speed 4 (F05.04)
1	0	1	Multi-speed 5 (F05.05)
1	1	0	Multi-speed 6 (F05.06)
1	1	1	Multi-speed 7 (F05.07)

7: Inspection input (INS).

- If enabled, elevator will do inspection running.
- This signal, when used together with UP/DN (No. 2 or No. 3 function) command, can control the elevator to go up or down during inspection.

8: Battery-driven input (BAT).

- If enabled, elevator will enter battery-driven running state.

9: Contactor feedback input (CSM).

10: Brake feedback input (BSM).

11－14: Weighing signal input 1－4 (WD1－WD4).

- The switch weight signals can be input through this terminal. Based on these signals, the controller sets the torque bias and starts the elevator stably.
- Select among WD1－WD4 according to the actual number of weighing devices and set the load of switches based on the setting of F6.08－F6.11 (DI weighing signal 1－4).
- If many terminals are enabled, the max No. terminal will be enabled.
- **For example:** When WD1 and WD2 are enabled simultaneously, only WD2 is the valid one.

15: Motor over-heating input (OH).

16: Fault reset input (RST).

- Upon controller fault alarms, you can reset the fault by this terminal.
- The function of RST terminal is the same as the STOP key on the panel.

17: Up forced Dec input (UPF).

18: Down forced Dec input (DNF).

19－33: Reserved.

34: External fault (EXT).

- The fault signal of external equipment can be input through this terminal, so that controller can monitor that equipment and respond accordingly. When the controller receives the EXT signal, E0024 fault (external faulty) will be displayed.

6

Code	Name Description	Range【factory setting】
F12.13	**MS in combination of filter time**	**0.000－2.000【0.010s】**
	This parameter defines the MS in combination of filter time to make up for the time error of MS input terminals. • Change this parameter value according to the change asynchronous level of numbers of MS input terminals.	
F12.14	**Reserved**	
F12.15	**DO1 terminal function**	**0－19【2】**
F12.16	**DO2 terminal function**	**0－19【3】**
F12.17	**RLY1 relay function**	**0－19【14】**
F12.18	**RLY2 relay (I/O interface board relay) function**	**0－19【0】**
F12.19	**RLY3 relay (I/O interface board relay) function**	**0－19【0】**
F12.20	**RLY4 relay (I/O interface board relay) function**	**0－19【0】**
	0: Disable. The output terminals will be at no function state and no any action. 1: Controller is ready. • Signal ON will be output if controller has no error. 2: Controller is running. • Indication signal will be output if controller is at running state. 3: Controller is at zero-speed running. • ON signal will be output if controller output speed is zero but at running state. 4: Zero-speed. • ON signal will be output if controller output speed is zero. 5: Contactor output control. • This function is used to open/close the output contactor. 6: Brake output control. • This function is used to open/close the brake. 7,8: FDT1, FDT2. • Refer to parameters F05.12－F05.13. 9: Speed arrived signal (FAR). • The indication signal will be output when the controller's output frequency is within the FAR range. The detect range is set by F05.16 (FAR range). • The indication signal will be output too after the controller stops. 10: Up signal output. • When the elevator is at up running, the controller will output ON signal. 11: Down signal output. • When the elevator is at down running, the controller will output ON signal. 12: Under-voltage. • ON signal will be output when the controller is during under-voltage state. 13: Reserved. 14: Controller fault. • ON signal will be output when the controller is faulty. 15: Elevator stop. • When the elevator stops, the controller will stop and output an 2s pulse. The controller will disable the running command according to this signal. 16－19: Reserved.	
F12.21	**Output terminal logic setting**	**00－0x3F【0】**
	It defines that each bit (binary) of this function represents different physical sources. • Positive logic: When multi-function input terminals are connected to corresponding common port,	

Code	Name Description	Range【factory setting】
	this logic is enabled. Otherwise the logic is disabled. • Negative logic: When multi-function input terminals are connected to corresponding common port, this logic is disabled. Otherwise the logic is enabled.	

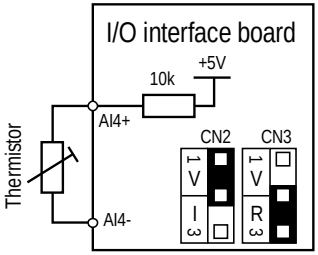
Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
RLY4	RLY3	RLY2	RLY1	DO2	DO1

• 0 represents positive logic, while 1 represents negative logic.

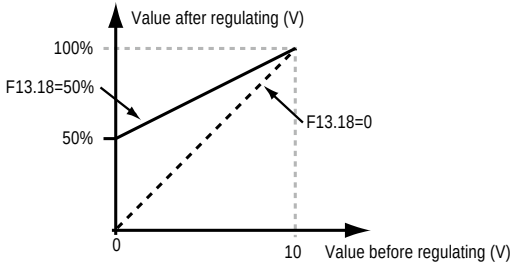
F12.22—F12.24 Reserved	

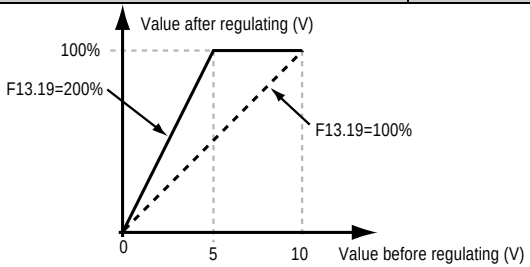
6.2.14 Group F13 Analogue I/O Terminal Parameters

Code	Name Description	Range【factory setting】
F13.00	**AI1 function**	**0—2【0】**
F13.01	**AI2 function**	**0—2【0】**
F13.02	**AI3 function**	**0—2【0】**
F13.03	**AI4 function**	**0—3【0】**
	0: Disable. 1: Speed setting. 2: Weighing signal. 3: Motor over-heating signal input (only AI4 enabled). • Connect the electronic thermistor embedded motor stator coils to the controller's analogue input, as the right figure. • Refer to parameters F17.01 and F17.02 about the thermistor. • AI1 input range: 0—10V. • AI2—AI4 input range: -10—+10V.	
F13.04	**AI1 bias**	**-100.0—100.0【0.0%】**
F13.07	**AI2 bias**	
F13.10	**AI3 bias**	
F13.13	**AI4 bias**	
F13.05	**AI1 gain**	**-10.00—10.00【1.00】**
F13.08	**AI2 gain**	
F13.11	**AI3 gain**	
F13.14	**AI4 gain**	
F13.06	**AI1 filter time**	**0.01—10.00【0.05s】**
F13.09	**AI2 filter time**	
F13.12	**AI3 filter time**	
F13.15	**AI4 filter time**	
	When select AI1—AI4 as open-loop frequency setting source, the relationship between the analogue input and the analogue value after compulting is shown as figure: Analogue actual value → Analogue input filtering → Analogue input gain Analogue input bias → Analogue value after computing • The formula of analogue input gain and bias and analogue value is: Y=kX+b • Here: Y is the analogue value after computing, X is the value before adjusting, k is the analogue input gain (F13.05, F13.08, F13.11, F13.14), b is the analogue input bias (F13.04, F13.07, F13.10, F13.13).	



6

Code	Name Description	Range【factory setting】
	• F13.06, F13.09, F13.12 and F13.15 define the source filter time. It is used to filter the analogue signal.The bigger the constant, the higher the immunity level, but the response time is prolonged with the increase of this constant. That is, the smaller the constant, the shorter the response time, but the lower the immunity level.	
F13.16	**AO1 terminal output function**	**0—9【0】**
F13.17	**AO2 terminal output function**	**0—9【0】**
	0: Disable. 1: Running speed (0—max output speed). 2: Setting speed (0—max output speed). **Note:** **1. At up, up limit of No. 1 and No. 2 function is corresponding to 10V, while down limit is corresponding to 5V;** **2. At down, up limit of No. 1 and No. 2 function is corresponding to 0V, while down limit is corresponding to 5V.** 3: Output current (0—twice of controller rated current). 4: Output voltage (0—1.2 times of controller rated voltage). 5: DC bus voltage (0—2.2 times of controller rated voltage). **Note: Up limit of No. 3 − 5 functions is corresponding to max output voltage 10V.** 6: AI1 input (0—10V). 7: AI2 input (-10—10V/0—20mA). 8: AI3 input (-10—10V/0—20mA). 9: AI4 input (-10—10V/0—20mA). **Note: When the negative voltage of No. 7 − 9 function is as input, the AO will output its absolute value.**	
F13.18	**AO1 bias**	**-100.0—100.0【0.0%】**
F13.19	**AO1 gain**	**0.0—200.0【100.0%】**
	• This parameter is used to realise the proportional relation adjustment of AO1 analogue output. • The formula is: Y=kX+b • Y is actual output value, X is output value before being adjusted, k is analogue output gain (F13.19), b is analogue output bias (F13.18). The relationship between analogue output and bias is shown as following figure.  The relationship between analogue output and gain is shown as following figure.	

Code	Name Description	Range【factory setting】
		
F13.20	**AO2 bias**	**-100.0—100.0【0.0%】**
F13.21	**AO2 gain**	**0.0—200.0【100.0%】**
	Refer to parameters F13.18 and F13.19.	

6.2.15 Group F14 SCI Communication Parameters

Refer to Appendix B (Page 129) for the communication function.

Code	Name Description	Range【factory setting】
F14.00	**Data format**	**0—5【0】**
	0: 1-8-2 format, no parity, RTU. 1: 1-8-1 format, even parity, RTU. 2: 1-8-1 format, odd parity, RTU. 3: 1-7-2 format, no parity, ASCII. 4: 1-7-1 format, even parity, ASCII. 5: 1-7-1 format, odd parity, ASCII.	
F14.01	**Baud rate selection**	**0—5【3】**
	0: 1200bps. 1: 2400bps. 2: 4800bps. 3: 9600bps. 4: 19200bps. 5: 38400bps.	
F14.02	**Local address**	**0—247【2】**
	When F14.02 = 0, it means broadcast address.	
F14.03	**Host PC response time**	**0—1000【0ms】**
F14.04	**Detection time of communication timeout**	**0.0—1000.0【0.0s】**
	When the time at no communication data exceeds the setting time of F14.04, it will be considered as E0028 fault (SCI timeout faulty). • When F14.04 = 0, it will not detect communication time out.	
F14.05	**Detection time ofcommunication error**	**0.0—1000.0【0.0s】**
	When the time at communication error exceeds the setting time of F14.05, it will be considered as E0029 fault (SCI faulty). • When F14.05 = 0, it will not detect the communication error.	
F14.06—F14.47 Reserved		

6

6.2.16 Group F15 Display Control Parameters

Code	Name Description	Range【factory setting】
F15.00	**Language selection**	**0,1【0】**
	It defines the displaying language on the LCD panel. 0: Chinese. 1: English. 2－9: Reserved.	
F15.01	**LCD panel display contrast**	**1－10【5】**
	To select LCD display contrast.	
F15.02	**Run display parameter 1 set**	**0－32【5】**
F15.03	**Run display parameter 2 set**	**0－32【6】**
F15.04	**Run display parameter 3 set**	**0－32【10】**
F15.05	**Run display parameter 4 set**	**0－32【11】**
F15.06	**Run display parameter 5 set**	**0－32【0】**
F15.07	**Run display parameter 6 set**	**0－32【0】**
F15.08	**Stop display parameter 1 set**	**0－32【4】**
F15.09	**Stop display parameter 2 set**	**0－32【14】**
F15.10	**Stop display parameter 3 set**	**0－32【16】**
F15.11	**Stop display parameter 4 set**	**0－32【26】**
F15.12	**Stop display parameter 5 set**	**0－32【27】**
F15.13	**Stop display parameter 6 set**	**0－32【0】**
	The panel displays parameters which difine the run state (F15.02－F15.07) and stop state (F15.08－F15.13). • It can be cycling displayed by ▶▶ key on the panel. • Each display parameter of content can be set corresponding to 32 states. • For instance: when set F15.08 as 7, the stop display parameter is setting Rpm at initial power on. 0: Disable. 1: Controller rated current. 2: Controller state. 3: Operate channel. 4: Setting speed. 5: Setting speed. (after Acc/Dec) 6: Output frequency. 7: Setting Rpm. 8: Actual Rpm. 9: Reserved. 10: Output voltage. 11: Output current. 12: Output torque. 13: Output power. 14: DC bus voltage. 15: AI1 voltage. 16: AI1 voltage (after disposal). 17: AI2 voltage. 18: AI2 voltage (after disposal). 19: AI3 voltage. 20: AI3 voltage (after disposal). 21: AI4 voltage. 22: AI4 voltage (after disposal). 23: AO1 output. 24: AO2 output. 25: Heatsink temperature. 26: Input terminal state. 27: Output terminal state. 28: MODBUS state. 29: Total time at power on (hour). 30: Total running time (hour). 31, 32: Reserved.	

6.2.17 Group F16 Enhance Function Parameters

Code	Name Description	Range【factory setting】
F16.00	**Zero-speed running signal delay time**	**0.00－10.00【0.30s】**
	It defines the delay time from the controller at zero-speed run state to zero-speed run signal output.	
F16.01	**Zero-speed signal delay time**	**0.00－10.00【0.30s】**
	It defines the delay time from the controller at zero-speed state to zero-speed signal output.	
F16.02	**Current keep time after stop command**	**0－9999【0ms】**
	To eliminate the motor current noise at stop, when the brake is over, the cut-off run signal will reduce the current to zero after the time defined by F16.02.	
F16.03	**Fan control mode**	**0－2【0】**
	It defines the fan control mode. If there is over-heat protection, the fan will run all the time. 0: Auto stop. • The fan runs all the time when the controller is in running state. After the controller stops for the time set by F16.04, the fan will auto stop if there isn't over-heat protection. 1: Immediately stop. • The fan runs all the time when the controller is in running state, but stops when the controller stops. 2: Run when power on. • The fan runs continuously after the controller is switched on.	
F16.04	**Fan keep time**	**0.0－600.0【30.0s】**
F16.05	**Brake unit action voltage**	**380－750V【Depend on controller model】**
	For 380V voltage class controller, the braking voltage range is 630－750V. For 220V voltage class controller, the braking voltage range is 380－450V. **Note: The braking action enable only in the controller run state.**	
F16.06	**Contator fault detect time**	**0.1－10.0【2.0s】**
F16.07	**Multi-speed inspection select**	**0－7【0】**
	When the digital input terminals are not enough, the combinations of MS1－MS3 can achieve the inspection run. • When there is digital input terminal set as inspection terminal INS (No. 7 function), only need set F16.07 as 0 to enter terminal inspection run. • When there isn't digital input terminal set as inspection terminal INS (No. 7 function), the inspection run can be achieved via the combination of MS1－MS3. • When the value of MS1－MS3 is equal to the value of F16.07, enter MS inspection run at MS run speed (F05.00－F05.07). **Note: When the MS run speed (F05.00－F05.07) exceeds 0.630m/s, run at 0.630m/s.**	
F16.08	**Zero-speed threshold**	**0.001－0.010【0.003m/s】**
	When the present run speed does not exceed F16.08, the system run speed will be condidered as 0. After zero-speed delay signal, the zero-speed signal will be output.	
F16.09	**Selection at motor overheat fault**	**0,1【0】**
	0: When detect that the motor is overheated, report E0020 (motor overheated) after motor stop. 1: When detect that the motor is overheated, report E0020 (motor overheated) at once.	
F16.10	**The coefficient of frequency demultiplication of HD-PG9-SC-FD**	**1－256【1】**
	To set the coefficient of frequency demultiplication of HD-PG9-SC-FD.	

Code	Name Description	Range【factory setting】
F16.11	Synchronous motor static auto-tuning and current limit	20—200【120%】
F16.12	Delay time of run output signal	0.00—1.00【0.00s】
	Note: F16.12 is used to delay the drive controller running (multifunction output is set to the 2nd function) signals so as to control the elevator controller to open the brake.	
F16.13	UPS running direction auto-determine enable	0,1【0】
	0: Not enable. 1: Enable. In the UPS mode, the controler will not run in the direction given by the terminal and auto-detemine the the elevator light-load running direction. In the UPS mode, the controler will automatically up, and down, and then run according to the light-load direction of detemining.	
F16.14	Running minumum current limit	0—100 (F07.11)【20%】
F16.15	Running minumum detect time	0.0—5.0【0.0s】
	When the elevator run current is less than F16.14 and duratuon exceed F16.05, the controller will alarm E0025 fault (running current too small).	
F16.14—F16.24 Reserved		

6.2.18 Group F17 Fault Protect Parameters

Motor overheated fault (F17.00—F17.02)

It can connect the electronic thermistor embedded motor stator coils to the controller's analogue input AI4 in order to protect motor overheating. The connection is shown as 4.5.3 of Terminal Connection of I/O Interface Board.

Code	Name Description	Range【factory setting】
F17.00	Input voltage at motor overheated	0.00—10.00【0.00V】
F17.01	Thermistor type	0—2【0】
	0: Does not detect the motor overheating (NC). 1: Positive charateristic (PTC). • When AI4 input is exceeded F17.00, the controller will alarm E0020 fault (motr overheated). 2: Negative charateristic (NTC). • When AI4 input is less than F17.00, the controller will alarm E0020 fault (motr overheated). **Note: Only when correctly set CN2 and CN3 of I/O interface board will do the motor overheated detection.**	
F17.02	Threshold resistance at motor overheated	0—10.0【5.0kΩ】

Input and output phase loss fault (F17.03—F17.06)

Code	Name Description	Range【factory setting】
F17.03	The detect base of lack of input	0—100【30%】
F17.04	The detect time of lack of input	0.0—5.0【1.0s】
	F17.03 value is a percentage of the controller's rated voltage. When the controller detects certain input voltage not hit the preset detect base (F17.03) and exceed the preset detect time (F17.04), the controller will alarm E0015 fault (lack of input). • When F17.03 or F17.04 is set as 0 or in the battery driven run mode, the controller will not detect input phase loss fault.	

Code	Name Description	Range【factory setting】
F17.05	**The detect base of lack of output**	**0—100【20%】**
F17.06	**The detect time of lack of output**	**0.0—20.0【3.0s】**
	F17.05 value is a percentage of the controller's rated current. When the controller detects certain output current not hit the preset detect base (F17.05) and exceed the preset detect time (F17.06), the controller will alarm E0016 fault (lack of output). • When F17.05 or F17.06 is set as 0, the controller will not detect output phase loss fault.	

Motor fault (F17.07)

Code	Name Description	Range【factory setting】
F17.07	**Motor overload protect factor**	**20.0—110.0【100.0%】**
	The motor overload protection factor can be set as 100% when the controller drives a motor of the same power class. To protect the motor when the motor power is smaller than the standard matched power, you need to set a proper motor overload protection factor (F17.07). The factor can derive from the following formula: $\text{Motor overload protect factor (F17.07)} = \frac{\text{Motor rated current (F07.02 or F10.03)}}{\text{Controller rated output current}} \times 100\%$	

Fault auto-reset function and fault relay action (F17.08—F17.10)

Auto reset function enables the controller to reset the fault as per the preset times (F17.08) and interval (F17.09).

The following faults do not have the auto reset function:

E0008: Power module faulty
E0010: Brake unit faulty
E0013: Soft start failed
E0014: Current detect faulty
E0021: Control board EEPROM faulty
E0023: Parameter setting faulty
E0024: External faulty
E0036: Contactor faulty

Code	Name Description	Range【factory setting】
F17.08	**Fault auto reset times**	**0—100【0】**
F17.09	**Fault auto reset interval**	**2.0—20.0【5.0s/times】**
	When F17.08 = 0, it means "auto reset" is disabled and the protective device will be activated in case of fault. • If no other fault is detected within 5 minutes, the auto reset count will be automatically cleared. • On condition of external fault reset, auto reset count will be cleared.	
F17.10	**Fault relay action select**	**00—11【00】**
	Units: During auto reset • 0: Fault relay doesn't act. • 1: Fault relay acts. **Tens: During DC bus low** • 0: Fault relay doesn't act. • 1: Fault relay acts. **Note: It need preset the relay function as No. 14 function. (Controller fault)**	

Fault history (F17.11－F17.27)

F17.12－F17.19 record the controller state parameters at the last fault.

F17.20－F27 record the type and interval per time of four faults before the latest. The interval's unit is 0.1 hour.

Code	Name Description	Range【factory setting】
F17.11	NO.5 fault type	【actual value】
F17.12	Setting freqency at NO.5 fault	
F17.13	Output freqency at NO.5 fault	
F17.14	DC bus vlotage at NO.5 fault	
F17.15	Output voltage at NO.5 fault	
F17.16	Output current at NO.5 fault	
F17.17	Input terminal state at NO.5 fault	
F17.18	Output terminal state at NO.5 fault	
F17.19	NO.5 fault interval	
F17.20	NO.4 fault type	
F17.21	NO.4 fault interval	
F17.22	NO.3 fault type	
F17.23	NO.3 fault interval	
F17.24	NO.2 fault type	
F17.25	NO.2 fault interval	
F17.26	NO.1 fault type	
F17.27	NO.1 fault interval	

6.2.19 Group F18 PWM Parameters

<table>
<tr><th>Code</th><th>Name Description</th><th>Range【factory setting】</th></tr>
<tr><td>F18.00</td><td>Carrier frequency</td><td>1－16kHz
【depend on controller model】</td></tr>
<tr><td></td><td colspan="2">F23.00 defines the carrier frequency of PWM output wave.
<table>
<tr><th>Controller power</th><th>Setting range</th><th>Factory setting</th></tr>
<tr><td>0.2－22kW</td><td>1－16kHz</td><td>8kHz</td></tr>
<tr><td>30－45kW</td><td>1－12kHz</td><td>6kHz</td></tr>
<tr><td>55－90kW</td><td>1－6kHz</td><td>4kHz</td></tr>
<tr><td>110kW and above</td><td>1－4kHz</td><td>2kHz</td></tr>
</table>
• The carrier frequency will affect the operating noise of the motor. The higher the carrier frequency, the lower the noise made by the motor. Please properly set the carrier frequency.
• When the value is higher than the factory setting, the controller should be derated by 5% when per 1kHz is increased compared to the factory setting.</td></tr>
<tr><td>F18.01</td><td>Carrier freqency auto adjust enable</td><td>0,1【0】</td></tr>
<tr><td></td><td colspan="2">0: Disable.
1: Enable.</td></tr>
<tr><td>F18.02</td><td>PWM overmodulation enable</td><td>0,1【1】</td></tr>
<tr><td></td><td colspan="2">0: Disable.
1: Enable.</td></tr>
<tr><td>F18.03</td><td>PWM overmodulation mode</td><td>0,1【0】</td></tr>
<tr><td></td><td colspan="2">0: Two phase / Three phase swtich.
1: Three phase.</td></tr>
</table>

6.2.20 Group F19 Reserved

6.2.21 Group F20 Reserved

6.3 Group Y Manufacturer Function Parameters

The Group y is the manufacturer parameters group for debugging at the factory before delivery.

Chapter 7 Elevator Application Guidance

This chapter will guide you through the basic procedures of system design and functional code configuration when the controller is applied in elevator control system.

7.1 Basic Debug Procedures

7.1.1 System Analysis and Wire

We recommend you to analyze the actual application requirements before the wiring design.

Basic configuration for elevator system with HD5L is shown in Figure 7-1:

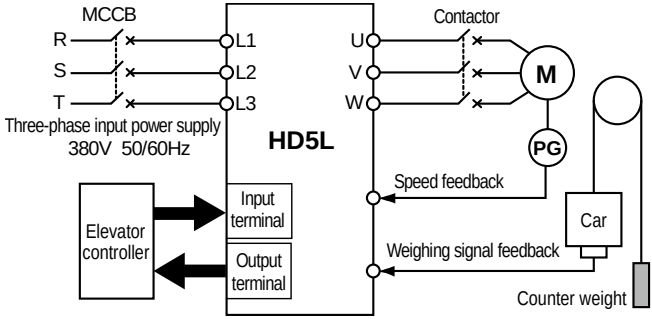


Figure 7-1 Basic configuration for elevator system with HD5L

7.1.2 Set Basic Parameters

1. Correctly set F00.00 (motor type) and F00.01 (control mode) according to motor type.

2. Set relevant parameters of motor. For the asynchronous motor, set Group F07. For the synchronous motor, set Group F10.

3. Set F00.02 (elevator rated speed) and F00.04 (traction machine mechanical parameters) according to the elevator requirement and motor parameters.

4. Set encoder relevant parameters of Group F11 according to the encoder configured to motor.

5. Set digital I/O function parameters of Group F12 according to the actual wiring.

6. Set the parameter according to the actual running mode:

- **Terminal MS running mode:** Set MS relevant parameters of Group F05 according to the elevator actual requirement and the controller. Set Acc/Dec curve parameters of Group F03 according to the elevator speed.
- **Terminal analogue running mode:** Set analogue curve parameters of Group F04 and analogue I/O terminal parameters of Group F13 according to the elevator actual requirement and the controller. The bigger Acc/Dec curve parameters of Group F03 are set, the quicker HD5L catch the speed command of elevator controller.

7.1.3 Motor Parameter Auto-tuning

Note: The crane car is needed for the rotation auto-tuning but not for the static auto-tuning.

Asynchronous motor parameter auto-tuning

1. You should set F00.05 as 0 (panel control).

2. Set F07.06 as 1 (static auto-tuning) or 2 (rotation auto-tuning), then press RUN key of panel to do parameter auto-tuning. The motor does not rotate at static auto-tuning but rotate at rotation auto-tuning.

Note: When auto-tuning, it need open the run contactor; if at rotation auto-tuning, it need open the brake contactor manually too.

Synchronous motor rotation auto-tuning with A/B/Z/U/V/W encoder

1. You should set F00.05 as 0 (panel control).

2. Set F10.10 as 2 (rotation angle auto-tuning), then press RUN key of panel to do parameter auto-tuning.

3. Auto-tuning process: The controller with DC fixes the motor to one direction, then slowly starts the motor for a while and finally stops. When finishes auto-tuning, F10.12 (motor initial angle) will be obtained.

Note:

1. During step 2 and step 3, manually open the brake contactor and the run contactor together.
2. If the system has synchronous motor radial contactor, the short-circuit signal of radial contactor should be removed. Otherwise it will cause over-current fault.

Synchronous motor static auto-tuning with A/B/Z/U/V/W encoder

1. You should set F00.05 as 0 (panel control).

2. Set F10.10 as 1 (static angle auto-tuning), then press RUN key of panel to do parameter auto-tuning.

3. During auto-tuning, the controller will make a serial pulse voltage and the motor will buzz. When buzz is over and the panel returns to stop state, please check and record D04.05.

4. Restart step 2 and step 3, check and record D04.05. Then compare the twice obtained value of D04.05.

If the comparison value is smaller than 5000, it means that the steps are success. Otherwise you should check the encoder connection and then restart step 2－4.

Note of step 4:

If the comparison value is too large, you could count it according to the following formula. And if the result is smaller than 5000, it means that the above steps are success too.

Formula: 65535 + smaller value – larger value ＜ 5000

5. Set F00.05 according to elevator control mode, and set F06.00 as 0 (no pre-torque compensation).

6. Set inspection run command and direction so that the motor slowly runs, F10.12 (motor initial angle) will be obtained the auto-tuning process is finished.

We should also pay attention to the following circumstances at step 6 of low speed operation:

1. The setting direction and the actually running direction are not the same.

Take measures: Set the reverse value of F00.08 (run direction), then restart auto-tuning.

2. There is fault such as over-current or encoder reversion enabled etc. It may be encoder reversion enabled.

Take measures: Set F11.02 as 1 (the reverse direction of PG interface board), then restart auto-tuning.

Note:

1. During step 2 and step 3, it need manually open the run contactor.
2. If the system has synchronous motor radial contactor, the short-circuit signal of radial contactor should be removed. Otherwise it will cause over-current fault.
3. If the system is power off before finish the step 6, you should restart auto-tuning.

Synchronous motor rotation auto-tuning with SINCOS encoder

1. You should set F00.05 as 0 (panel control).

2. Set F10.10 as 2 (rotation angle auto-tuning), then press RUN key of panel to do parameter auto-tuning.

3. Auto-tuning process: The controller with DC fixes the motor to one direction, then slowly starts the motor for one cycle and finally stops. When finishes auto-tuning, F10.14－F10.17 (encoder relevant parameters) and F10.12 (motor initial angle) will be obtained.

Note: During step 2 and step 3, manually open the brake contactor and the run contactor together.

Synchronous motor static auto-tuning with SINCOS encoder

1. You should set F00.05 as 0 (panel control).

2. Set F10.10 as 1 (static angle auto-tuning), then press RUN key of panel to do parameter auto-tuning.

3. During auto-tuning, the controller will make a serial pulse voltage and the motor will buzz. When buzz is over and the panel returns to stop state, please check and record D04.05.

4. Restart step 2 and step 3, check and record D04.05. Then compare the twice obtained value of D04.05.

If the comparison value is smaller than 5000, it means that the steps are success. Otherwise you should check the encoder connection and then restart step 2—4.

Note of step 4:

If the comparison value is too large, you could count it according to the following formula. And if the result is smaller than 5000, it means that the above steps are success too.

Formula: 65535 + smaller value – larger value ＜ 5000

5. Set F00.05 according to elevator control mode, and set F06.00 as 0 (no pre-torque compensation).

6. Set inspection run command and direction so that the motor slowly runs for a circle then keeps at zero-speed. When revoke run command and direction at the moment, the auto-tuning process is finished, and obtain F10.14—F10.17 (encoder relevant parameters) and F10.12 (motor initial angle).

We should also pay attention to the following circumstances at step 6 of low speed operation:

1. The setting direction and the actually running direction are not the same.

Take measures: Set the reverse value of F00.08 (run direction), then restart auto-tuning.

2. There is fault such as over-current or encoder reversion enabled etc. It may be encoder reversion enabled.

Take measures: Set F11.02 as 1 (the reverse direction of PG interface board), then restart auto-tuning.

7. When auto-tuning is finished, give inspection running and direction signal again to observe that the motor runs normally. If not, check encoder C and D phase connection, then restart step 2—7.

Note:

1. During step 2 and step 3, it need open the run contactor manually.
2. If the system has synchronous motor radial contactor, the short-circuit signal of radial contactor should be removed. Otherwise it will cause over-current fault.
3. If the system is power off before finish the step 7, you should restart auto-tuning.

Synchronous motor rotation auto-tuning with serial communication encoder

1. You should set F00.05 as 0 (panel control).

2. Set F10.10 as 2 (rotation angle auto-tuning), then press RUN key of panel to do parameter auto-tuning.

3. Auto-tuning process: The controller with DC fixes the motor to one direction, then slowly starts the motor for a while and finally stops. When finishes auto-tuning, F10.12 (motor initial angle) will be obtained.

Note:

1. During step 2 and step 3, manually open the brake contactor and the run contactor together.
2. If the system has synchronous motor radial contactor, the short-circuit signal of radial contactor should be removed. Otherwise it will cause over-current fault.

Synchronous motor static auto-tuning with serial communication encoder

1. You should set F00.05 as 0 (panel control).

2. Set F10.10 as 1 (static angle auto-tuning), then press RUN key of panel to do parameter auto-tuning.

3. During auto-tuning, the controller will make a serial pulse voltage and the motor will buzz. When buzz is over and the panel returns to stop state, please check and record D04.05.

4. Restart step 2 and step 3, check and record D04.05. Then compare the twice obtained value of D04.05.

If the comparison value is smaller than 5000, it means that the steps are success. Otherwise you should check the encoder connection and then restart step 2—4.

Note of step 4:

If the comparison value is too large, you could count it according to the following formula. And if the result is smaller than 5000, it means that the above steps are success too.

Formula: 65535 + smaller value – larger value < 5000

5. Set F00.05 according to elevator control mode, and set F06.00 as 0 (no pre-torque compensation).

6. Set inspection run command and direction so that the motor slowly runs, F10.12 (motor initial angle) will be obtained the auto-tuning process is finished.

We should also pay attention to the following circumstances at step 6 of low speed operation:

1. The setting direction and the actually running direction are not the same.

Take measures: Set the reverse value of F00.08 (run direction), then restart auto-tuning.

2. There is fault such as over-current or encoder reversion enabled etc. It may be encoder reversion enabled.

Take measures: Set F11.02 as 1 (the reverse direction of PG interface board), then restart auto-tuning.

Note:

1. During step 2 and step 3, it need manually open the run contactor.
2. If the system has synchronous motor radial contactor, the short-circuit signal of radial contactor should be removed. Otherwise it will cause over-current fault.
3. If the system is power off before finish the step 6, you should restart auto-tuning.

7.1.4 Inspection Running

Before inspection running

Make sure the follow steps:

1. After motor parameter auto-tuning, motor output U/V/W connections and encoder connection are not changed.

2. Set F03.06 (inspection Acc speed) and F03.07 (inspection Dec speed).

Inspection running

1. If the actual motor running direction is not the command direction, you can change the value of F00.08 (run direction).

2. Carefully make sure that the motor can run normally.

3. Make sure the motor can run normally and the signals of the brake and power circuit etc. can act normally, then it will run fast.

7.1.5 Run Fast

1. Give the normal floor run command so that to the elevator can run normally. Then set Group F02 of start & stop parameters, start stopping parameters, adjust starting & stopping brake and motor running time sequence to make sure that the elevator does not shake at start & stop.

- For the asynchronous motor, adjust Group F02 to avoid obviously shaking at start &stop.
- For the synchronous motor, it also need set Group F06 to avoid elevator brake at start.
- If the synchronous motor has SINCOS encoder, it can achieve elevator smooth start using weigh less method (Group F06). And F02.02 (Retention time of start zero-speed) is set at least as 0.5s.

2. If the elevator has slight shake at running, please properly adjust Group F08.

3. To adjust leveling precision, terminal MS control (F00.05 = 2) can adjust Acc/Dec curve (Group F03) to unify level and adjust F03.13 (stop Dec jerk) to make leveling precision.

7.2 Terminal MS Run Mode Application

The elevator controller can calculate the motor present running direction and objective speed according to the elevator control logic and send them to HD5L in the form of digital. HD5L get the objective speed of MS form and calculate the speed curve according to the S-curve parameter setting, the control the motor to run.

Example: A certain elevator with rated speed of 1.750m/s uses a controller in terminal MS control (F00.05 = 2).

The brake and the contactor are controlled by the controller. The controller receives the HD5L output signal at drive zero-speed running and controls the brake to close.

The inspection running is controlled by drive's INS MS command, and the running speed is obtained by MS terminal's speed combination.

If use gearless permanent magnet synchronous motor with SINCOS encoder, HD5L needs the SINCOS encoder interface board with FD. HD5L receive the sine-cosine signal from the encoder as speed signal, meanwhile HD5L can output pulse signal of no-FD or 2－126 odd-times FD to the elevator controller without any weigh compensation device.

7.2.1 Control Part Connection

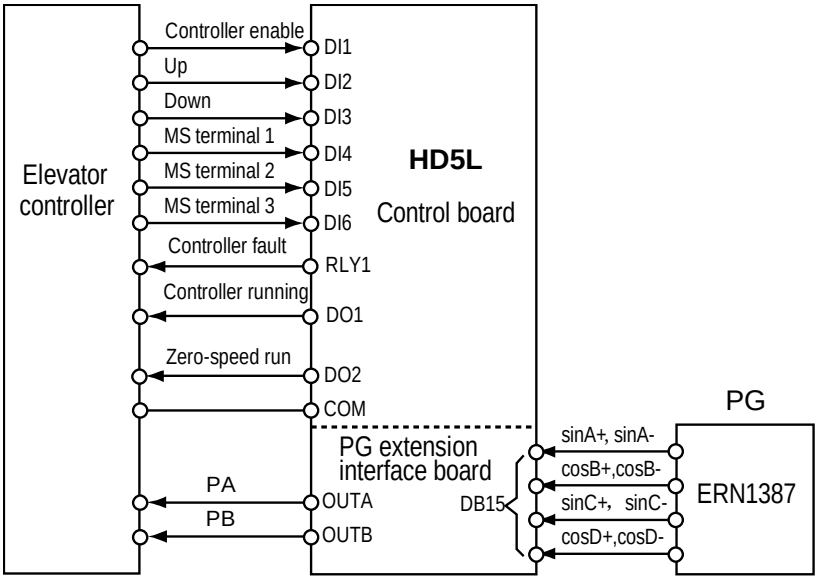


Figure 7-2 Terminal MS running connection

7.2.2 Set Parameter

The terminal MS general function code setting content is shown as Table 7-1 and special function code setting content is shown as Table 7-2.

Table 7-1 General function code setting table

Code	Name	Recommended value	Remark
F00.00	Motor type	Depend on actual value	
F00.01	Control mode	Depend on actual value	
F00.02	Elevator rated speed	Depend on actual value	
F00.03	Max output freqency	Depend on actual value	
F00.04	Traction machine mechanical parameters	Depend on actual calculate value	
F07.00 / F10.01	Motor rated power	Depend on actual value	Motor nameplate parameters.
F07.01 / F10.02	Motor rated voltage	Depend on actual value	
F07.02 / F10.03	Motor rated current	Depend on actual value	
F07.03 / F10.04	Motor rated frequency	Depend on actual value	
F07.04 / F10.05	Motor rated rpm	Depend on actual value	
F08.00	ASR proportional gain 1	500	Adjust according to running effect. Generally use the default value.
F08.01	ASR integral coefficient 1	500	
F08.02	ASR proportional gain 2	500	
F08.03	ASR integral coefficient 2	500	
F08.04	ASR swithcing frequency 1	10.00Hz	
F08.05	ASR swithcing frequency 2	15.00Hz	
F08.09	UP electrical torque limitation	180.0%	Adjust according to running effect. Generally use the default value.
F08.10	DN electrical torque limitation	180.0%	
F08.11	UP regenerative torque limitation	180.0%	
F08.12	DN regenerative torque limitation	180.0%	
F11.00	HD5L PG interface board	Depend on actual value	
F11.01	PG P/R	Depend on actual value	
F11.02	PG direction setting	Depend on actual value	

Table 7-2 Special function code setting table of terminal MS run

Code	Name	Recommended value	Remark
F00.05	Operating mode	2	Terminal MS control
F02.02	Retention time of start zero-speed	0.5s	According the situation of running contactor and brake at motor start & stop to adjust.
F02.06	Retention time of stop zero-speed	0.5s	
F03.00	Acceleration speed	0.700m/s^2	According the elevator speed and running effect to set.
F03.01	Start Acc jerk	0.350m/s^3	
F03.02	End Acc jerk	0.600m/s^3	
F03.03	Deceleration speed	0.700m/s^2	
F03.04	Start Dec jerk	0.600m/s^3	
F03.05	End Dec jerk	0.350m/s^3	
F03.06	Inspection Acc speed	0.200m/s^2	
F03.07	Inspection Dec speed	1.000m/s^2	
F03.13	Stop Dec jerk	0.350 m/s^3	
F05.00	Multi-speed 0	0	As deisgn
F05.01	Multi-speed 1	Re-leveling speed	
F05.02	Multi-speed 2	Creeping speed	
F05.03	Multi-speed 3	Battery driven speed	
F05.04	Multi-speed 4	Inspection speed	
F05.05	Multi-speed 5	Normal low speed	
F05.06	Multi-speed d 6	Normal mid speed	
F05.07	Multi-speed 7	Normal high speed	
F06.00	Pre-torque selection	4	No weighing auto-compensation
F06.14	No weighing current coefficient	3000	Debug according to the running effect; Increase the three parameter values in the motor non oscillatory situation.
F06.15	No weighing speed-loop KP	2000	
F06.16	No weighing speed-loop KI	2000	
F12.01	DI1 terminal function	1	Controller enabled (EN)
F12.02	DI2 terminal function	2	UP
F12.03	DI3 terminal function	3	DN
F12.04	DI4 terminal function	4	MS1
F12.05	DI5 terminal function	5	MS2
F12.06	DI6 terminal function	6	MS3
F12.15	DO1 terminal function	2	Controller is running
F12.16	DO2 terminal function	3	Controller is at zero-speed running
F12.17	RLY1 terminal function	14	Controller fault
F16.07	Multi-sped inspection select	4	Multi-speed inspection select

7.3 Terminal Analogue Run Mode Application

The elevator controller can calculate the motor present running direction and running speed according to the elevator control logic and send them to HD5L respectively in the form of digital and analogue. HD5L control the motor to run according to the controller's command and speed.

Example: A certain elevator with rated speed of 1.750m/s uses a drive in analogue run mode. The brake and the running contactor are controlled by the elevator controller. The controller sends the direction signal to HD5L in the form of digital and output the running speed to drive in the form of analogue.

Use analogue weighing device and AI1 as analogue speed setting and AI2 as analogue weigh.

7.3.1 Control Part Connection

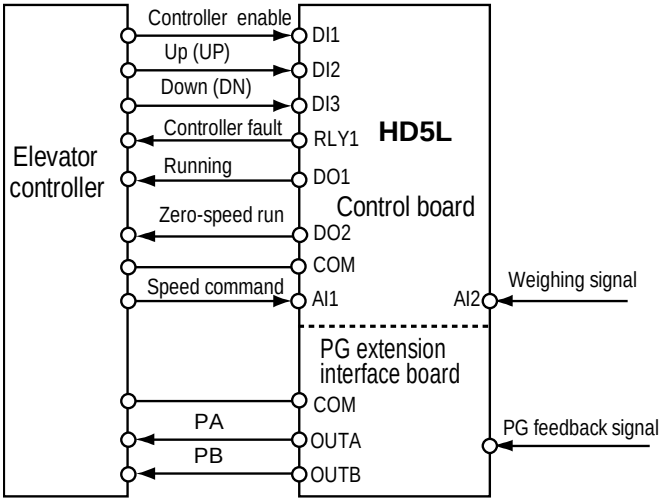


Figure 7-3 Terminal analogue running connection

7.3.2 Set Parameter

Refer to Table 7-1 for the general function code.

The terminal analogue special function code setting content is shown as Table 7-3.

Table 7-3 Terminal analogue run special function code

Code	Name	Recommended value	Remark
F00.05	Operating mode	1	Terminal analogue control.
F02.02	Retention time of start zero-speed	0.5s	According the situation of running contactor and brake at motor start& stop to adjust.
F02.06	Retention time of stop zero-speed	0.5s	

Code	Name	Recommended value	Remark
F03.00	Acceleration speed	0.700m/s^2	If the controller can not fast-track speed command of the elevator controller, please add more the values of F03.00－F03.05.
F03.01	Start Acc jerk	0.350m/s^3	
F03.02	End Acc jerk	0.600m/s^3	
F03.03	Deceleration speed	0.700m/s^2	
F03.04	Start Dec jerk	0.600m/s^3	
F03.05	End Dec jerk	0.350m/s^3	
F04.00	Reference curve	00000	Change according to the characteristics of analog curve.
F04.01	Line 1 minimum reference	0.0%	
F04.02	Corresponding value of line 1 minimum reference	0.0%	
F04.03	Line 1 maximum reference	100.0%	
F04.04	Corresponding value of line 1 maximum reference	100.0%	
F04.05	Line 2 minimum reference	0.0%	
F04.06	Corresponding value of line 2 minimum reference	0.0%	
F04.07	Line 2 maximum reference	100.0%	
F04.08	Corresponding value of line 2 maximum reference	100.0%	
F06.00	Pre-torque selection	1	Analogue weighing feedback.
F06.01	Up pre-torque bias	50.0%	Set according to actual situation and debug according to running effect.
F06.02	Down pre-torque bias	50.0%	
F06.03	Up electrical pre-torque gain	1.000	
F06.04	Up brake pre-torque gain	1.000	
F06.05	Down electrical pre-torque gain	1.000	
F06.06	Down brake pre-torque gain	1.000	
F12.01	DI1 terminal function	1	Controller enabled (EN)
F12.02	DI2 terminal function	2	UP
F12.03	DI3 terminal function	3	DN
F12.15	DO1 terminal function	2	Controller is running
F12.16	DO2 terminal function	3	Controller is at zero-speed running
F12.17	RLY1 terminal function	14	Controller fault
F13.00	AI1 function	1	Speed setting
F13.01	AI2 function	2	Weighing signal
F13.04	AI1 bias	0.0%	Adjust according to actual situation
F13.05	AI1 gain	1.00	
F13.06	AI1 filter time	0.05s	
F13.07	AI2 bias	0.0%	
F13.08	AI2 gain	1.00	
F13.09	AI2 filter time	0.05s	

7.4 Power-off Battery Driven Run Mode Application

During using elevator, if the system power is off, passengers will be shut in car. HD5L provide battery driven run mode to resolve this problem.

7.4.1 Basic Connection

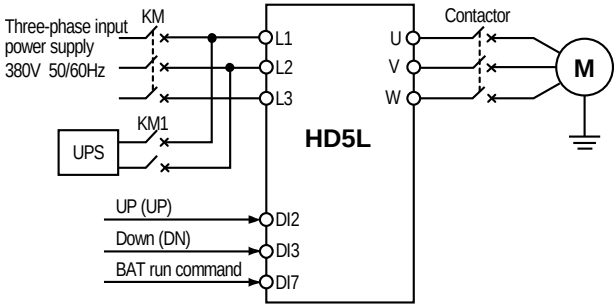


Figure 7-4 Basic connection of battery driven run

In the Figure 7-4, the terminal definition is shown as Table 7-4:

Table 7-4 Battery driven running terminal definition

Terminal	Definition
DI2	Input terminal signal: UP
DI3	Input terminal signal: DN
DI7	Input terminal signal: Battery driven run command (BAT)
KM	Mains power control contactor
KM1	Battery-driven running contactor

7.4.2 Running Time Sequence

1. When mains power fails, the mains power control contactor (KM) opens, and the elevator controller outputs battery driven running command (BAT), and controls KM1 to close.

2. After some time delay, the controller outputs running command (UP/DN). When HD5L receive the command, the running contactor will be closed and the brake will be opened. HD5L accelerate at the line rate of F03.08 (Battery driven Acc speed) till the speed of F05.09 (Battery driven run speed).

3. When the elevator runs near a leveling area, the controller cuts off the battery driven run command (BAT), and HD5L begin to Dec at the rate of F03.09 (Battery driven Dec speed) to stop.

4. The controller outputs the brake close signal after the speed decelerates to zero. After some time delay, controller cuts off the running command (UP/DN) and HD5L releases the contactor. A complete battery driven running process is over.

Note:

1. The battery voltage should be bigger than150VDC to ensure normal operation.
2. In the battery driven running mode, the controller does not detect the input phase failure.

Chapter 8 Troubleshooting

If a fault occurs, the panel will display the fault alarm state. At the same time, fault relay acts, accordingly the controller stops output and the motor coasts to stop.

When fault alarm occurs, please record the fault in detail and take proper action according to the Table 8-1. If you need some technical help, please contact to the suppliers or directly call Shenzhen Hpmont Technology Co., Ltd.

After the fault is eliminated, please reset the controller by any of the following methods:

1. Panel reset.
2. External reset terminal (multi-function terminal set as No. 16 function).
3. Communication fault reset.
4. Switching on the controller after completely power off.

Table 8-1 Fault alarm description and counter-measures

Fault code	Fault name	Possible reasons of fault	Counter-measures
-Lu-	DC bus undervoltage	• At the begining of power on and at the end of power off • Input voltage is too low • Improper wiring leads to undervoltage of hardware	• It is normal state of power on and power off • Please check input power voltage • Please check wiring and wire the controller properly
E0001	Acc overcurrent	• Improper connection between controller and motor • Improper motor parameters • The rating of the used controller is too small • Acceleration/deceleration time is too short	• Connect the controller and motor properly • Please set correct motor parameters • Select controller with higher rating • Please set proper acceleration time and deceleration time
E0002	Dec overcurrent		
E0003	Constant speed overcurrent		
E0004	Acc over voltage	• Input voltage is too high • Decelearation time is too short • Improper wiring leads to overvoltage of hardware	• Please check power input • Please set a proper value for deceleration time • Please check wiring and wire the controller properly
E0005	Dec over voltage		
E0006	Constant speed over voltage		
E0008	Power module faulty	• Short circuit between phases output or the ground • Output current is too high • Power module is damaged	• Please check the connection and connect the wire properly • Please check the connection and mechanism • Please contact the supplier for repairing
E0009	Heatsink overheated	• Ambient temperature is too high • Controller external ventilation is not good • Fan fault • Fault occurs to temperature detection circuit	• Please use controller with higher power capacity • Improve the ventilation around the controller • Replace the cooling fan • Please seek technical support
E0010	Braking unit fault	• Circuit fault of braking unit	• Please seek technical support

Fault code	Fault name	Possible reasons of fault	Counter-measures
E0011	CPU faulty	• CPU abnormal	• Please detect at power on after completely power outage • Please seek technical support
E0012	Motor auto-tuning fault	• Parameter auto-tuning is time out	• Please check the motor's connection • Input the correct nameplates parameters • Please seek technical support
E0013	Soft start failed	• Contactor fault • Fault of control circuit	• Replace the contactor • Please seek technical support
E0014	Current detect faulty	• Current detection circuit is damaged	• Please contact the supplier for repairing
E0015	Lack of input	• For three-phase input controller, input phase loss fault occurs to power input	• Please check the three-phase power input • Please seek technical support
E0016	Lack of output	• Output phase disconnection or loss • Heavy imbalance of controller's three-phase load	• Please check the connection between controller and motor • Please check the quality of motor
E0017	Controller overloaded	• Acceleration time is too short • Improper setting of V/f curve or torque boost leads to over current • Mains supply voltage is too low • Motor load is too high	• Adjust acceleration time • Adjust V/f curve or torque boost • Please check mains supply voltage • Please use controller with proper power rating
E0018	Excessive speed deviation	• Brake fault or contactor fault • PG pulse number fault • Improper setting of F05.19 and F05.20 • Inadequate controller torque • Speed-loop PI parameter setting isn't correct	• Change contactor • Set proper PG P/R • Correct the setting of F05.19 and F05.20 • Select biger capacity controller • Correctly set speed-loop PI parameter
E0019	Motor overload	• Improper setting of V/f curve • Mains supply voltage is too low • Motor's overload protection factor is not set properly • Motor runs with blocked torque or load is too heavy	• Adjust the setting of V/f curve • Check the power input • Please properly set the overload protection factor of the motor • Please check the load and mechanical transmission devices
E0020	Motor overheat	• Motor overheat • Motor overheat terminal (digital or analogue input terminal) incorrect connection • The setting of motor paramteters is incorrect	• Reduce the load; Increas the acceleration/deceleration time; Repaire or replace the motor • Detect the overheat detection input signal whether correct • Set the motor parameter according to the motor's nameplates
E0021	Controlboard EEPROM faulty	• Memory circuit fault of control board EEPROM	• Please contact the supplier for repairing

Fault code	Fault name	Possible reasons of fault	Counter-measures
E0022	Panel EEPROM faulty	• Memory circuit fault of panel EEPROM	• Replace the panel • Please contact the supplier for repairing
E0023	Parameter setting faulty	• The power rating between motor and controller is too different • Improper setting of motor parameters	• Select a controller with suitable power rating • Please set correct value of motor parameters
E0024	External faulty	• Fault terminal of external equipment operates	• Please check external equipment
E0025	Running current too small	• Improper setting of F16.14 and F16.15	• Correct the setting of F16.14 and F16.15 • Please check the connection between controller and motor • Detect the controller whether output • Detect the output contactor work is nomal or not
E0028	SCI timeout faulty	• Connection fault of Communication cable • Disconnected or not well connected	• Please check the connection
E0029	SCI faulty	• Connection fault of Communication cable • Disconnected or not well connected • Communication setting error • Communication data error	• Please check the connection • Please check the connection • Please correctly set the communication format and the baud rate • Send the data according to MODBUS protocol
E0030	PG direct wrong	• PG wire phase and motor phase are not match	• Set the reverse value of F11.02
E0031	PG disconnection	• PG without input signal	• Check the PG connection
E0032	Motor over speed	• PG pulse number fault • Inadequate controller torque • Speed-loop PI parameter setting isn't correct	• Set proper PG pulse number • Select biger capacity controller • Correctly set speed-loop PI parameter
E0033	Loss of Z signal of ABZ encoder	• Connection problem • Severe interference	• Check the connection
E0034	UVW signal wrong of UVW encoder	• UVW PG fan-area error	• Check the UVW connection
E0035	CD phase wrong of SINCOS encoder	• PG fault • PG disconnection	• Check the PG • Check the PG connection
E0036	Contator faulty	• Contactor damage • Feedback contact connection problem	• Change the contactor • Check the connection

Mark: E0022 doesn't affect the controller normal operation.

Chapter 9 Maintenance

Many factors such as ambient temperature, humidity, dust, oscillation, internal component aging, wear and tear will give rise to the occurrence of potential faults. Therefore, it is necessary to conduct daily maintenance to the controller.

- If the controller has been transported for a long distance, please check whether the components of the controller are complete and the screws are well tightened.
- Please periodically clean the dust inside the controller and check whether the screws are loose.

Danger

- Only a trained and qualified professional person can maintain the controller.
- Maintenance personnel should take off all metal jewellery before carrying out maintenance or internal measurements in the controller. Suitable clothes and tools must be used.
- High voltage exists when the controller is powered up or running.
- Checking and maintaining can only be done after the controller's AC power is cut off and wait for at least 10 minutes. The cover maintenance can only be done after ensured that the charge indicator inside the controller and the indicators on the panel are off and the voltage between power terminals (+) and (-) is below 36V.

Warning

- For the controller stored for more than 2 years, please use voltage regulator to increase the input voltage gradually.
- Do not leave metal parts like screws or pads inside the controller.
- Do not make modification on the inside of controller without instruction from the supplier.
- There are IC components inside the controller, which are sensitive to static electricity. Directly touch the components on the PCB board is forbidden.

9.1 Daily Maintenance

The controller must be operated in the specified environment (refer to section 3.2, page 9). Besides, some unexpected accidents may occur during operation.

Therefore you should maintain the controller conditions according to the Table 9-1, record the operation data, and investigate problems immediately.

Table 9-1 Daily checking items

Items	Content	Criteria
Operating environment	Temperature and humidity	-10—+40℃, derating at 40—50℃
	Dust and water dripping	No water dripping
	Gas	No strange smell
Controller	Oscillation and heating	Stable oscillation and proper temperature
	Noise	No abnormal sound
Motor	Heating	No overheating
	Noise	Low and regular noise
Operating state parameters	Output current	Within rated range
	Output voltage	Within rated range

9.2 Periodical Maintenance

Customer should check the controller in short time or every 3 to 6 months according to the actual environment so as to avoid hidden problems and make sure the controller runs well for a long time.

General Inspection:

- Check whether the screws of control terminals are loose. If so, tighten them with a screw driver;
- Check whether the main circuit terminals are properly connected; whether the mains cables are over heated;
- Check whether the power cables and control cables are damaged, check especially for any wear on the cable tube;
- Check whether the insulating tapes around the cable lugs are stripped, and for signs of overheating near terminations;
- Clean the dust on PCBs and air ducts with a vacuum cleaner.

Note:

1. Dielectric strength test of the controller has already been conducted in the factory. Do not do the test again. Otherwise, the controller might be damaged.
2. If insulation test to the motor is necessary, it should be done after the motor's input terminals U/V/W have been detached from the controller. Otherwise, the controller will be damaged.
3. For controllers that have been stored for a long time, they must be powered up every 2 years. When supplying AC power to the controller, use a voltage regulator to gradually raise the input voltage to rated input voltage at least 5 hours.

9.3 Replacing Damaged Parts

The components that are easily damaged are: cooling fan and electrolytic capacitors of filters. Their lifetime depends largely on their application environment and preservation. The users can decide the time when the components should be replaced according to their service time.

Cooling fan

Life: 60,000 hours.

Possible cause of damages: Wear of the bearing, aging of the fan vanes.

Criteria: After the controller is switched off, check if the abnormal conditions such as crack existing on fan vanes and other parts. When the controller is switched on, check if controller running is normal, and check if there is any abnormal oscillation.

Electrolytic capacitors

Life: 50,000 hours

Possible cause of damages: High ambient temperature, aging of electrolyte and large pulse current induced by rapid changing loads.

Criteria: Check if frequent overcurrent or overvoltage failures occur during controller start-up with load. Check if there is any leakage of liquids. Check if the safety valve protrudes. Measure the static capacitance and insulation resistance.

9.4 Unwanted Controller Recycling

When disposing the controller, please pay attention to the following factors:

The capacitors may explode if they are burnt.

Poisonous gas may be generated when the plastic parts like front covers are burnt.

Disposing method: Please dispose unwanted controllers as industrial waste.

Chapter 10 Accessories

10.1 Panel Installation Assembly

The panel installation assembly includes mounting base and extension cable.

10.1.1 Mounting Base

The panel mounting base is an accessory. If needed, please order goods.

Model: HD-KMB. The mounting base and its size are shown as Figure 10-1, the unit is mm.

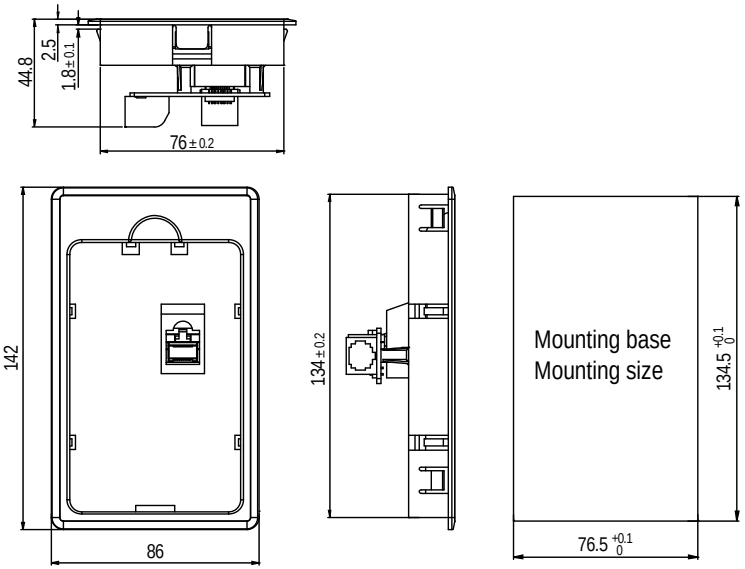


Figure 10-1 Mounting base and its size

10.1.2 Extension Cable

The panel extension cable is an accessory. If needed, please order goods.

The models are as follows:

- 1m extension cable to panel: HD-CAB-1M
- 2m extension cable to panel: HD-CAB-2M
- 3m extension cable to panel: HD-CAB-3M
- 6m extension cable to panel: HD-CAB-6M

10

10.2 Braking Resistor Selection

The braking resistor selection is listed as Table 10-1.

Refer to section 4.3.2 for the brake resistor connection.

Table 10-1 Braking resistor selection

Model	Motor (kW)	Recommend value（Ω）			Recommend power（kW）	
		Min	Max	Recomm-ended	Synchro-nous	Asynchro-nous
HD5L-2S2P2	2.2	26	130	50	1	1
HD5L-2S3P7	3.7	26	90	30	1.6	1.2
HD5L-2T3P7	3.7	26	50	30	1.6	1.2
HD5L-2T5P5	5.5	17	27	20	2.0	1.6
HD5L-2T7P5	7.5	11	20	15	3.2	2.0
HD5L-2T011	11	11	20	15	4.0	3.2
HD5L-2T015	15	10	16	12	5.0	4.0
HD5L-2T018	18.5	10	16	12	6.4	5.0
HD5L-2T022	22	7	10	9	8.0	6.4
HD5L-2T30	30	7	10	9	10.0	8.0
HD5L-4T2P2	2.2	56	210	100	1	1
HD5L-4T3P7	3.7	56	144	80	1.6	1.2
HD5L-4T5P5	5.5	56	100	70	2	1.6
HD5L-4T7P5	7.5	56	72	64	3.2	2
HD5L-4T011	11	34	48	40	4	3.2
HD5L-4T015	15	34	41	36	5	4
HD5L-4T018	18.5	17	31	24	6.4	5
HD5L-4T022	22	17	27	20	8	6.4
HD5L-4T030	30	11	20	15	10	8
HD5L-4T037	37	10	16	12	12	10
HD5L-4T045	45	7	10	9	18	15

10.3 Protective Cover

The protective cover is an accessory. If needed, please order goods.

Model: HD-CK-Frame4. The protective cover is applied to plastic structure controller (18.5kW and below model), and each controller needs 2 protective covers.

10.4 Power Regenerative Unit

Please refer to HDRU Series Power Regenerative Unit User Manual for more details.

Appendix A Parameters

Attributes are changed:

"*": It denotes that the value of this parameter is the actual value which cannot be modified.

"×": It denotes that the setting parameter cannot be modified when the controller is in run state.

"○": It denotes that the setting parameter can be modified when the controller is in run state.

Code	Name	Range	Default	Unit	Attributes	Setting
Group D00 System State Parameters (on pages 54—55)						
D00.00	Controller series	HD5L	Actual value		*	
D00.01	DSP software version	0.00—9.99	Actual value		*	
D00.02	DSP special software version	0.00—9.99	Actual value		*	
D00.03	Panel software version	0.00—9.99	Actual value		*	
D00.04	Elevator running state	Display in 16-bit binary: Bit0: Controller enable Bit1: Inspection run Bit2: MS run Bit3: Analogue run Bit4—Bit7: Reserved Bit8: Brake feedback input Bit9: Contactor feedback input Bit10: Up forced Dec input Bit11: Down forced Dec input Bit12: MS terminal 1 Bit13: MS terminal 2 Bit14: MS terminal 3 Bit15: Battery driven run	Actual value		*	
D00.05	Rated current	0.1—999.9A	Actual value		*	
D00.06	Controller state	Display in 16-bit binary: Bit0: Controller fault Bit1: Run/stop Bit2: UP Bit3: DN Bit4&5: Acc/Dec/constant Bit6: Zero-speed signal Bit7: Run at zero-speed Bit8: Auto-tuning Bit9: Speed arrived Bit10: Ready to run Bit11: Brake output Bit12: Contactor output Bit13: Stop signal Bit14,Bit15: Reserved	Actual value		*	
Group D01 Drive State Parameters (on pages 55—56)						
D01.00	Control mode	0—5	Actual value		*	
D01.01	Setting speed(m/s)	0.000—9.999	Actual value		*	
D01.02	Setting speed (after acc/dec)(m/s)	0.000—9.999	Actual value		*	
D01.03	Feedback speed(m/s)	0.000—9.999	Actual value		*	
D01.04	Setting frequency (Hz)	0.01—100.00Hz	Actual value		*	
D01.05	Setting frequency (after	0.01—100.00Hz	Actual value		*	

Code	Name	Range	Default	Unit	Attributes	Setting
	acc/dec)					
D01.06	Output frequency	0.01－100.00Hz	Actual value		*	
D01.07	Setting Rpm	0－24000rpm	Actual value		*	
D01.08	Actual Rpm	0－24000rpm	Actual value		*	
D01.09	Reserved				*	
D01.10	Output voltage	0－999V	Actual value		*	
D01.11	Output current	0.1－999.9A	Actual value		*	
D01.12	Output torque	0.0－300.0%(motor rated torque)	Actual value		*	
D01.13	Output power	0.0－200.0%(motor rated power)	Actual value		*	
D01.14	DC bus voltage	0－999V	Actual value		*	
D01.15－D01.16 Reserved						
Group D02 Analogue State Display Parameters (on pages 56－57)						
D02.00	AI1 voltage	0.00－10.00V	Actual value		*	
D02.01	AI1 voltage(After disposal)	0.00－10.00V	Actual value		*	
D02.02	AI2 voltage	0.00－10.00V	Actual value		*	
D02.03	AI2 voltage(After disposal)	0.00－10.00V	Actual value		*	
D02.04	AI3 voltage	0.00－10.00V	Actual value		*	
D02.05	AI3 voltage(After disposal)	0.00－10.00V	Actual value		*	
D02.06	AI4 voltage	0.00－10.00V	Actual value		*	
D02.07	AI4 voltage(After disposal)	0.00－10.00V	Actual value		*	
D02.08	AO1 output	0.00－10.00V	Actual value		*	
D02.09	AO2 output	0.00－10.00V	Actual value		*	
Group D03 Running State Parameters (on pages 57－58)						
D03.00	Heatsink temperature	0.0－999.9℃	Actual value		*	
D03.01	Input terminal state	Display in 16-bit binary, from high to low bit is as follows: Bit15－Bit12: Reserved Bit11－Bit0 corresponds to DI12－DI1 0: Connected 1: Unconnected	Actual value		*	
D03.02	Output terminal state	Display in 16-bit binary, from high to low bit is as follows: Bit15－Bit6: reserved Bit5－Bit2 corresponds to RLY4－RLY1 Bit1－Bit0 corresponds to DO2－DO1	Actual value		*	

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Code	Name	Range	Default	Unit	Attributes	Setting
D03.03	MODBUS state	0: Normal 1: Communication timeout 2: Incorrect data frame head 3: Incorrect data frame checking 4: Incorrect data frame content	Actual value		*	
D03.04	Total time at power-on(Hour)	0－65535	Actual value		*	
D03.05	Total running time	0－65535	Actual value		*	
D03.06	Run times	0－65535	Actual value		*	
D03.07	Present fault	0－100	Actual value		*	
Group D04 Encoder State Parameters (on pages 58－59)						
D04.00	C phase value of SINCOS encoder	0－4095	Actual value		*	
D04.01	D phase value of SINCOS encoder	0－4095	Actual value		*	
D04.02	A phase value of SINCOS encoder	0－4095	Actual value		*	
D04.03	B phase value of SINCOS encoder	0－4095	Actual value		*	
D04.04	UVW state of UVW encoder	0－7	Actual value		*	
D04.05	Electrical angle	0－65535	Actual value		*	
D04.06－D04.7 Reserved						
D04.08	Pulses of PG	0－65535	Actual value		*	
D04.09－D04.11 Reserved						
Group F00 Basic Parameters (on pages 59－61)						
F00.00	Motor type	0: Asynchronous 1: Synchronous	0	1	×	
F00.01	Control mode	0: V/f 1: Sensorless vector control 2: Closed-loop vector control	2	1	×	
F00.02	Elevator rated speed	0.100－4.000m/s	1.500m/s	0.001 m/s	×	
F00.03	Controller max output freqency	5.00－100.00Hz	50.00Hz	0.01Hz	×	
F00.04	Traction machine mechanical parameters	10.0－6000.0	60.0	0.1	×	
F00.05	Operating mode	0: Panel control 1: Terminal analogue control 2: Terminal MS control 3: Reserved 4: SCI control 5: Reserved	0	1	×	

Code	Name	Range	Default	Unit	Attributes	Setting
F00.06	M-key function	0: Disable 1: UP/DN swtich	0	1	○	
F00.07	Speed setting of panel	0.000m/s－F00.02	1.500m/s	0.001 m/s	○	
F00.08	Run direction	0: The same as run command. 1: Opposite to run command.	0	1	×	
Group F01 Protection of Parameters (on pages 61－62)						
F01.00	User password	00000－65535	00000	1	○	
F01.01	Menu mode	0: Full menu mode 1: Checking menu mode. Only different from factory setting parameters can be displayed.	0	1	○	
F01.02	Parameter initialization	0: No operation 1: Restore to factory settings 2: Parameter download 3: Clear fault information	0	1	×	
F01.03	Panel EEPROM parameter initialization	0:No operation 1: Parameters upload	0	1	○	
Group F02 Start & Stop Parameters (on pages 62－63)						
F02.00	Start delay time	0.000－4.999s	0.000s	0.001s	×	
F02.01	Brake open delay time	0.000－4.999s	0.000s	0.001s	×	
F02.02	Retention time of start zero-speed	0.000－4.999s	0.500s	0.001s	×	
F02.03	Start speed	0.000－0.400m/s	0.000m/s	0.001 m/s	×	
F02.04	Retention time of start speed	0.000－4.999s	0.000s	0.001s	×	
F02.05	Brake close delay time	0.000－4.999s	0.000s	0.001s	×	
F02.06	Retention time of stop zero-speed	0.000－4.999s	0.000s	0.001s	×	
F02.07	Contator close delay time	0.000－4.999s	0.000s	0.001s	×	
F02.08	Start ramp time	0.000－2.000s 0.000: No ramp	0.000s	0.001s	×	
F02.09	Reserved					
Group F03 Acceleration/Deceleration Parameters (on pages 63－64)						
F03.00	Acceleration speed	0.020－9.999m/s^2	0.700m/s^2	0.001 m/s^2	×	
F03.01	Start Acc jerk	0.020－9.999m/s^3	0.350m/s^3	0.001 m/s^3	×	
F03.02	End Acc jerk	0.020－9.999m/s^3	0.600m/s^3	0.001 m/s^3	×	
F03.03	Deceleration speed	0.020－9.999m/s^2	0.700m/s^2	0.001	×	

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Code	Name	Range	Default	Unit	Attributes	Setting
				m/s^2		
F03.04	Start Dec jerk	0.020－9.999m/s^3	0.600m/s^3	0.001 m/s^3	×	
F03.05	End Dec jerk	0.020－9.999m/s^3	0.350m/s^3	0.001 m/s^3	×	
F03.06	Inspection Acc speed	0.020－9.999m/s^2	0.200m/s^2	0.001 m/s^2	×	
F03.07	Inspection Dec speed	0.020－9.999m/s^2	1.000m/s^2	0.001 m/s^2	×	
F03.08	Battery driven Acc speed	0.020－9.999m/s^2	1.000m/s^2	0.001 m/s^2	×	
F03.09	Battery driven Dec speed	0.020－9.999m/s^2	1.000m/s^2	0.001 m/s^2	×	
F03.10	Asynchronous motor auto-tuning Acc speed	0.020－9.999m/s^2	0.100m/s^2	0.001 m/s^2	×	
F03.11	Asynchronous motor auto-tuning Dec speed	0.020－9.999m/s^2	0.100m/s^2	0.001 m/s^2	×	
F03.12	Abnormal Dec speed	0.020－9.999m/s^2	1.000m/s^2	0.001 m/s^2	×	
F03.13	Stop Dec jerk	0.020－9.999m/s^3	0.350m/s^3	0.001 m/s^3	×	
F03.14	Asynchronous motor field-weakening optimization	0: No field-weakening optimization. 1: Optimize according to voltage. 2: Optimize according to current.	0	1	×	
F03.15	Field-weakening Kp	0－5000	4000	1	×	
F03.16	Field-weakening Ki	0－5000	1000	1	×	
F03.17	Field-weakening voltage limit	4000－5000	4126	1	×	
F03.18	Reserved					
F03.19	Sincos encoder CD phase learning	0: Learning 1: Not learning	0	1	×	
F03.20	Reserved					
Group F04 Analogue Curve Parameters (on pages 64－65)						
F04.00	Reference curve	Units: AI1 characteristic curve Tens: AI2 characteristic curve Hundreds: AI3 characteristic curve Thousands: AI4 characteristic curve 0: Line 1 1: Line 2	0000	1	×	
F04.01	Line 1 minimum reference	0.0－F04.03%	0.0%	0.1%	○	

Code	Name	Range	Default	Unit	Attributes	Setting
F04.02	Corresponding value of line 1 minimum reference	0.0－100.0%	0.0%	0.1%	○	
F04.03	Line 1 maximum reference	F04.01－100.0%	100.0%	0.1%	○	
F04.04	Corresponding value of line 1 maximum reference	0.0－100.0%	100.0%	0.1%	○	
F04.05	Line 2 minimum reference	0.0－F04.07%	0.0%	0.1%	○	
F04.06	Corresponding value of line 2 minimum reference	0.0－100.0%	0.0%	0.1%	○	
F04.07	Line 2 maximum reference	F04.05－100.0%	100.0%	0.1%	○	
F04.08	Corresponding value of line 2 maximum reference	0.0－100.0%	100.0%	0.1%	○	
Group F05 Speed Parameters (on pages 65－67)						
F05.00	Multi-speed 0	0.000－F00.02m/s	0.000m/s	0.001 m/s	○	
F05.01	Multi-speed 1	0.000－F00.02m/s	0.000m/s	0.001 m/s	○	
F05.02	Multi-speed 2	0.000－F00.02m/s	0.000m/s	0.001 m/s	○	
F05.03	Multi-speed 3	0.000－F00.02m/s	0.000m/s	0.001 m/s	○	
F05.04	Multi-speed 4	0.000－F00.02m/s	0.000m/s	0.001 m/s	○	
F05.05	Multi-speed 5	0.000－F00.02m/s	0.000m/s	0.001 m/s	○	
F05.06	Multi-speed 6	0.000－F00.02m/s	0.000m/s	0.001 m/s	○	
F05.07	Multi-speed 7	0.000－F00.02m/s	0.000m/s	0.001 m/s	○	
F05.08	Inspection run speed	0.000－0.630m/s	0.200m/s	0.001 m/s	○	
F05.09	Battery driven run speed	0.000－F00.02m/s	0.100m/s	0.001 m/s	○	
F05.10	Up forced Dec detection value	0.0－100.0%(F00.02)	97.0%	0.1%	○	
F05.11	Down forced Dec detection value	0.0－100.0%(F00.02)	97.0%	0.1%	○	
F05.12	FDT1	0.0－100.0%(F00.02)	90.0%	0.1%	○	
F05.13	FDT2	0.0－100.0%(F00.02)	90.0%	0.1%	○	
F05.14	FDT1 delay level	0.0－100.0%(F00.02)	1.0%	0.1%	○	

Code	Name	Range	Default	Unit	Attributes	Setting
F05.15	FDT2 delay level	0.0－100.0%(F00.02)	1.0%	0.1%	○	
F05.16	FAR range	0.0－20.0%(F00.02)	1.0%	0.1%	○	
F05.17	Over-speed setting	80.0－120.0%(F00.02)	115.0%	0.1%	×	
F05.18	Over-speed detection time	0.0－2.0s 0.0: No over-speed detection	0.2s	0.1s	×	
F05.19	Detected value of speed deviation	0.0－30.0%(F00.02)	20.0%	0.1%	×	
F05.20	Detected time of speed deviation	0.0－2.0s 0.0: no speed deviation detection	1.0s	0.1s	×	
F05.21	Reserved					
F05.22	Creeping speed	0.000－0.400m/s	0.050m/s	0.001 m/s	○	
F05.23－F05.25 Reserved						
Group F06 Weighing Compensation Parameters (on pages 67－68)						
F06.00	Pre-torque selection	0: No pre-torque 1: Analogue setting 2: DI setting 3: Digital pre-torque 4: No weighing auto-compensation 5: Asynchronous motor zero-serve auto-compensation	4	1	×	
F06.01	Up pre-torque bias	0.0－100.0%	50.0%	0.1%	×	
F06.02	Down pre-torque bias	0.0－100.0%	50.0%	0.1%	×	
F06.03	Up electrical pre-torque gain	0.000－9.000	1.000	0.001	×	
F06.04	Up brake pre-torque gain	0.000－9.000	1.000	0.001	×	
F06.05	Down electrical pre-torque gain	0.000－9.000	1.000	0.001	×	
F06.06	Down brake pre-torque gain	0.000－9.000	1.000	0.001	×	
F06.07	Pre-torque digital setting	-100.0－100.0%	10.0%	0.1%	×	
F06.08	DI weighing signal 1	0.0－100.0%	10.0%	0.1%	×	
F06.09	DI weighing signal 2	0.0－100.0%	30.0%	0.1%	×	
F06.10	DI weighing signal 3	0.0－100.0%	70.0%	0.1%	×	
F06.11	DI weighing signal 4	0.0－100.0%	90.0%	0.1%	×	
F06.12－F06.13 Reserved						
F06.14	No weighing current coefficient	0－9999	3000	1	×	
F06.15	No weighing speed-loop KP	1－9999	2000	1	○	
F06.16	No weighing speed-loop	1－9999	2000	1	○	

Code	Name	Range	Default	Unit	Attributes	Setting
	KI					
F06.17－F06.20 Reserved						
Group F07 Asynchronous Motor Parameters (on pages 68－71)						
F07.00	Asynchronous motor rated power	0.2－400.0kW	Depend on controller model	0.1kW	×	
F07.01	Asynchronous motor rated voltage	0V－controller rated voltage		1V	×	
F07.02	Asynchronous motor rated current	0.0－999.9A		0.1A	×	
F07.03	Asynchronous motor rated frequency	1.00－100.00Hz	50.00Hz	0.01Hz	×	
F07.04	Asynchronous motor rated rpm	1－24000rpm	1440rpm	1rpm	×	
F07.05	Asynchronous motor rated power factor	0.001－1.000	Depend on controller model	0.001	×	
F07.06	Asynchronous motor parameter auto-tuning	0: No action 1: Motor static auto-tuning 2: Motor rotation auto-tuning	0	1	×	
F07.07	Asynchronous motor stator resistance	0.000－65.535Ω	Depend on controller model	0.001Ω	×	
F07.08	Asynchronous motor rotor resistance	0.000－65.535Ω		0.001Ω	×	
F07.09	Asynchronous motor leakage inductance	0.0－6553.5mH		0.1mH	×	
F07.10	Asynchronous motor mutual inductance	0.0－6553.5mH		0.1mH	×	
F07.11	Asynchronous motor excitation current	0.0－999.9A		0.1A	×	
F07.12	Asynchronous motor of core saturation coefficient 1	0.00－0.50 (Magnetic flux is set as 50%)	0.50	0.01	×	
F07.13	Asynchronous motor of core saturation coefficient 2	0.00－0.75 (Magnetic flux is set as 75%)	0.75	0.01	×	
F07.14	Asynchronous motor of core saturation coefficient 3	0.00－1.20 (Magnetic flux is set as 120%)	1.20	0.01	×	
F07.15	Asynchronous motor torque boost	0.1－30.0%	0.1%	0.1%	○	
F07.16	Asynchronous motor torque boost end-point	0.0－50.0%(F07.03)	2.0%	0.1%	○	
F07.17	Asynchronous motor of slip compensation gain	0.0－300.0%	100.0%	0.1%	○	
F07.18	Asynchronous motor of slip compensation filter	0.1－10.0s	0.1s	0.1s	○	

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Code	Name	Range	Default	Unit	Attributes	Setting
	time					
F07.19	Asynchronous motor of slip compensation limitation	0.0－250.0%	200.0%	0.1%	×	
F07.20	AVR function	0: No action 1: Action all the time 2: Only act at Dec speed	1	1	○	
F07.21	Asynchronous motor of oscillation-suppression mode	0: Oscillation suppression is dependent on the motor's exciting current component 1: Oscillation suppression is dependent on the motor's torque current component	0	1	○	
F07.22	Asynchronous motor of oscillation-suppression coefficient	0－200	100	1	○	
Group F08 Motor Vector Control Speed-loop Parameters (on pages 71－72)						
F08.00	Low speed ASR Kp	1－9999	500	1	○	
F08.01	Low speed ASR KI	0－9999	500	1	○	
F08.02	High speed ASR Kp	1－9999	500	1	○	
F08.03	High speed ASR KI	0－9999	500	1	○	
F08.04	ASR PI swithcing frequency 1	0.00－50.00Hz	10.00Hz	0.01Hz	○	
F08.05	ASR PI swithcing frequency 2	0.00－50.00Hz	15.00Hz	0.01Hz	○	
F08.06	ASR integral limitation	0.0－200.0% (motor rated current)	180.0%	0.1%	○	
F08.07	ASR differential time	0.000－1.000s 0.000: ASR without differential	0.000s	0.001s	○	
F08.08	ASR output filter time	0.000－1.000s 0.000: ASR output without filter	0.008s	0.001s	○	
F08.09	UP electrical torque limitation	0.0－200.0%(F07.02)	180.0%	0.1%	×	
F08.10	DN electrical torque limitation	0.0－200.0%(F07.02)	180.0%	0.1%	×	
F08.11	UP regenerative torque limitation	0.0－200.0%(F07.02)	180.0%	0.1%	×	
F08.12	DN regenerative torque limitation	0.0－200.0%(F07.02)	180.0%	0.1%	×	
Group F09 Current-loop Parameters (on pages 72－72)						
F09.00	Current-loop KP	1－4000	500	1	○	
F09.01	Current-loop KI	1－4000	500	1	○	
F09.02	Current-loop output filter time	0.000－1.000s 0.000: current-loop output	0.000s	0.001s	○	

Code	Name	Range	Default	Unit	Attributes	Setting
		without filter				
F09.03－F09.07 Reserved						
Group F10 Synchronous Motor Parameters (on pages 72－73)						
F10.00	Synchronous motor type	0: IPM 1: SPM	0	1	×	
F10.01	Synchronous motor rated power	0.2－400.0kW	Depend on controller model	0.1kW	×	
F10.02	Synchronous motor rated voltage	0V－controller rated voltage		1V	×	
F10.03	Synchronous motor rated current	0.0－999.9A		0.1A	×	
F10.04	Synchronous motor rated frequency	1.00－100.00Hz	19.20Hz	0.01Hz	×	
F10.05	Synchronous motor rated rpm	1－24000rpm	96rpm	1rpm	×	
F10.06	Synchronous motor stator resistance	0.000－9.999Ω	0.000Ω	0.001Ω	×	
F10.07	Synchronous motor quadrature axis inductance	0.0－999.9mH	0.0mH	0.1mH	×	
F10.08	Synchronous motor direct axis inductance	0.0－999.9mH	0.0mH	0.1mH	×	
F10.09	Synchronous motor Back EMF	0V－ controller rated voltage	380V	1V	×	
F10.10	Synchronous motor of angle auto-tuning	0: No action 1: Static auto-tuning 2: Rotation auto-tuning	0	1	×	
F10.11	Synchronous motor static auto-tuning voltage setting	0.0－100.0%(F10.02)	100.0%	0.1%	×	
F10.12	Synchronous motor initial angle	0.0－359.9°	0.0°	0.1°	×	
F10.13	Synchronous motor of Z pulse initial angle	0.0－359.9°	0.0°	0.1°	×	
F10.14	Synchronous motor SINCOS encoder C amplitude	0－9999	2048	1	×	
F10.15	Synchronous motor SINCOS encoder C zero-bias	0－9999	2048	1	×	
F10.16	Synchronous motor SINCOS encoder D amplitude	0－9999	2048	1	×	
F10.17	Synchronous motor SINCOS encoder D zero-bias	0－9999	2048	1	×	

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Code	Name	Range	Default	Unit	Attributes	Setting
F10.18	Sincos encoder CD phase	0: C phase ahead of the D phase 1: D phase ahead of the C phase	0	1	×	
F10.19	Reserved					
F10.20	Synchronous performance optimization	Bit0－Bit1: Reserved Bit2: Optimization for detecting speed 0: No optimization. 1: Optimization. Bit3－Bit15: Reserved	0	1	×	
Group F11 PG Parameters (on pages 73－74)						
F11.00	HD5L PG interface board	1: HD-PG2-OC-FD is valid 2: HD-PG6-UVW-FD is valid 3: HD-PG5-SINCOS-FD is valid 4: HD-PG9-FC-FD is valid (support Endat)	4	1	×	
F11.01	PG P/R	1－9999	2048	1	×	
F11.02	PG direction setting	0: the same direction 1: the reverse direction	0	1	×	
F11.03	PG signal filter coefficient	0x00－0x77 Units: low-speed filter coefficient Tens: high-speed filter coefficient	0x11	1	○	
F11.04	The protocol of serial communication PG	0: Endat 1: Rotary transformer protocol 2－9: Reserved	0	1	×	
F11.05	Detecting time of PG wire disconnection	0.00－2.00s 0.00: Do not detect the PG wire disconnection	1.00s	0.01s	×	
Group F12 Digital I/O Terminal Parameters (on pages 74－77)						
F12.00	Input terminal filter time	0.000－2.000s	0.010s	0.001s	×	
F12.01	DI1 terminal function	0: Disable 1: Controller enabled(EN) 2: UP 3: DN 4: MS1 5: MS2 6: MS3 7: Inspection input (INS) 8: Battery-driven input (BAT) 9: Contactor feedback input (CSM)	1	1	×	
F12.02	DI2 terminal function		2	1	×	
F12.03	DI3 terminal function		3	1	×	
F12.04	DI4 terminal function		4	1	×	

Code	Name	Range	Default	Unit	Attributes	Setting
F12.05	DI5 terminal function	10: Brake feedback input (BSM) 11: Weighing signal input 1 (WD1) 12: Weighing signal input 2 (WD2) 13: Weighing signal input 3 (WD3) 14: Weighing signal input 4 (WD4) 15: Motor over-heating input (OH) 16: Fault reset input (RST) 17: Up forced Dec input (UPF) 18: Down forced Dec input (DNF) 19－33: Reserved 34: External fault (EXT) Hundreds: 0 normally open input; 1 normally closed input For example: set DI1 to 107, the inspection input disconnection is valid.	5	1	×	
F12.06	DI6 terminal function		6	1	×	
F12.07	DI7 terminal function		0	1	×	
F12.08	DI8 terminal function		0	1	×	
F12.09	DI9 terminal function		0	1	×	
F12.10	DI10 terminal function		0	1	×	
F12.11	DI11 terminal function		0	1	×	
F12.12	DI12 terminal function		0	1	×	
F12.13	MS in combination of filter time	0.000－2.000s	0.010s	0.001s	×	
F12.14	Reserved					
F12.15	DO1 terminal function	0: Disable 1: Controller is ready 2: Controller is running 3: Controller is at zero-speed running 4: Zero-speed 5: Contactor output control 6: Brake output control 7: FDT1 8: FDT2 9: Speed arrived signal (FAR) 10: Up signal output 11: Down signal output 12: Under-voltage 13: Reserved 14: Controller fault 15: Elevator stop 16－19: Reserved	2	1	×	
F12.16	DO2 terminal function		3	1	×	
F12.17	RLY1 relay function		14	1	×	
F12.18	RLY2 relay function		0	1	×	
F12.19	RLY3 relay function		0	1	×	
F12.20	RLY4 relay function		0	1	×	
F12.21	Output terminal logic setting	Bit0,Bit1: DO1,DO2 output terminal positive or negative	00	1	○	

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Code	Name	Range	Default	Unit	Attributes	Setting
		logic setting Bit2－Bit5: RLY1－RLY4 relay output positive or negative logic setting 0: Positive logic 1: Negative logic				
F12.22－F12.24 Reserved						
Group F13 Analogue I/O Terminal Parameters (on pages 77－79)						
F13.00	AI1 function	0: Disable 1: Speed setting 2: Weighing signal 3: Motor over-heating signal input (only AI4)	0	1	×	
F13.01	AI2 function		0	1	×	
F13.02	AI3 function		0	1	×	
F13.03	AI4 function		0	1	×	
F13.04	AI1 bias	-100.0－100.0%	0.0%	0.1%	○	
F13.05	AI1 gain	-10.00－10.00	1.00	0.01	○	
F13.06	AI1 filter time	0.01－10.00s	0.05s	0.01s	○	
F13.07	AI2 bias	-100.0－100.0%	0.0%	0.1%	○	
F13.08	AI2 gain	-10.00－10.00	1.00	0.01	○	
F13.09	AI2 filter time	0.01－10.00s	0.05s	0.01s	○	
F13.10	AI3 bias	-100.0－100.0%	0.0%	0.1%	○	
F13.11	AI3 gain	-10.00－10.00	1.00	0.01	○	
F13.12	AI3 filter time	0.01－10.00s	0.05s	0.01s	○	
F13.13	AI4 bias	-100.0－100.0%	0.0%	0.1%	○	
F13.14	AI4 gain	-10.00－10.00	1.00	0.01	○	
F13.15	AI4 filter time	0.01－10.00s	0.05s	0.01s	○	
F13.16	AO1 terminal output function	0: Disable 1: Running speed (0－max output speed) 2: Setting speed (0－max output speed) 3: Output current (0－twice of controller rated current) 4: Output voltage (0－1.2 times of controller rated voltage) 5: DC bus voltage (0－2.2 times of controller rated voltage) 6: AI1 input (0－10V) 7－9: AI2－AI4 input (-10－10V/0－20mA)	0	1	○	
F13.17	AO2 terminal output function		0	1	○	
F13.18	AO1 bias	-100.0－100.0%	0.0%	0.1%	○	
F13.19	AO1 gain	0.0－200.0%	100.0%	0.1%	○	
F13.20	AO2 bias	-100.0－100.0%	0.0%	0.1%	○	

Code	Name	Range	Default	Unit	Attributes	Setting
F13.21	AO2 gain	0.0－200.0%	100.0%	0.1%	○	
Group F14 SCI Communication Parameters (on pages 79－80)						
F14.00	Data format	0: 1-8-2 format, no parity, RTU 1: 1-8-1 format, even parity, RTU 2: 1-8-1 format, odd parity, RTU 3: 1-7-2 format, no parity, ASCII 4: 1-7-1 format, even parity, ASCII 5: 1-7-1 format, odd parity, ASCII	0	1	×	
F14.01	Baud rate selection	0: 1200bps 1: 2400bps 2: 4800bps 3: 9600bps 4: 19200bps 5: 38400bps	3	1	×	
F14.02	Local address	0－247	2	1	×	
F14.03	Host PC response time	0－1000ms	0ms	1ms	×	
F14.04	Detection time of communication timeout	0.0－1000.0s 0.0: No detect at timeout	0.0s	0.1s	×	
F14.05	Detection time of communication error	0.0－1000.0s 0.0: No detect at error	0.0s	0.1s	×	
F14.06－F14.47 Reserved						
Group F15 Display Control Parameters (on pages 80－81)						
F15.00	Language select	0: Chinese 1: English 2－9: Reserved	0	1	○	
F15.01	LCD panel display contrast	1－10	5	1	○	
F15.02	Run display parameter 1 set	0: Disable 1: Controller rated current 2: Controller state 3: Operate channel 4: Setting speed 5: Setting speed (after acc/dec) 6: Output frequency 7: Setting Rpm 8: Actual Rpm 9: Reserved 10: Output voltage	5	1	○	
F15.03	Run display parameter 2 set		6	1	○	
F15.04	Run display parameter 3 set		10	1	○	
F15.05	Run display parameter 4 set		11	1	○	

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Code	Name	Range	Default	Unit	Attributes	Setting
F15.06	Run display parameter 5 set	11: Output current 12: Output torque 13: Output power 14: DC bus voltage 15: AI1 voltage 16: AI1 voltage(After disposal) 17: AI2 voltage 18: AI2 voltage(After disposal) 19: AI3 voltage 20: AI3 voltage(After disposal) 21: AI4 voltage 22: AI4 voltage(After disposal) 23: AO1 output 24: AO2 output 25: Heatsink temperature 26: Input terminal state 27: Output terminal state 28: MODBUS state 29: Total power-on time(Hour) 30: Total running time(Hour) 31,32: Reserved	0	1	○	
F15.07	Run display parameter 6 set		0	1	○	
F15.08	Stop display parameter 1 set		4	1	○	
F15.09	Stop display parameter 2 set		14	1	○	
F15.10	Stop display parameter 3 set		16	1	○	
F15.11	Stop display parameter 4 set		26	1	○	
F15.12	Stop display parameter 5 set		27	1	○	
F15.13	Stop display parameter 6 set		0	1	○	
Group F16 Enhance Function Parameters(on pages 81—82)						
F16.00	Zero-speed running signal delay time	0.00—10.00s	0.30s	0.01s	×	
F16.01	Zero-speed signal delay time	0.00—10.00s	0.30s	0.01s	×	
F16.02	Current keep time after stop command	0—9999ms	0ms	1ms	×	
F16.03	Fan control mode	0: Auto stop 1: Immediately stop 2: Run when power on	0	1	○	
F16.04	Fan keep time	0.0—600.0s	30.0s	0.1s	○	
F16.05	Brake unit action voltage	220V: 380—450V 380V: 630—750V	Depend on controller model	1V	×	
F16.06	Contator fault detect time	0.1—10.0s	2.0s	0.1s	×	
F16.07	Multi-speed inspection select	0—7	0	1	×	
F16.08	Zero speed threshold	0.001—0.010m/s	0.003m/s	0.001 m/s	○	
F16.09	The selection at the fault	0: Report E0020 after motor	0	1	○	

Code	Name	Range	Default	Unit	Attributes	Setting
	of Motor overheat	stop 1: Report E0020 at once				
F16.10	The coefficient of frequency demultiplication of HD-PG9-SC-FD	1－256	1	1	×	
F16.11	Synchronous motor static auto-tuning and current limit	20－200%	120%	1%	×	
F16.12	Delay time of run output signal	0.00－1.00s	0.00s	0.01s	×	
F16.13	UPS running direction auto-determine enable	0: Not enable 1: Enable	0	1	×	
F16.14	Running minumum current limit	0－100% (F07.11)	20%	1%	×	
F16.15	Running minumum detect tiome	0.0－5.0s	0.0s	0.1s	×	
F16.16－F16.24 Reserved						
Group F17 Fault Protect Parameters (on pages 82－85)						
F17.00	Input voltage at motor overheated	0.00－10.00V	0.00V	0.01V	×	
F17.01	Thermistor type	0: NC 1: Positive 2: Negative	0	1	×	
F17.02	Threshold resistance at motor overheated	0.0－10.0kΩ	5.0kΩ	1.0kΩ	×	
F17.03	The detect base of lack of input	0－100%(controller rated voltage)	30%	1%	×	
F17.04	The detect time of lack of input	0.0－5.0s	1.0s	1.0s	×	
F17.05	The detect base of lack of output	0－100%(controller rated current)	20%	1%	×	
F17.06	The detect time of lack of output	0.0－20.0s	3.0s	1.0s	×	
F17.07	Motor overload protect factor	20.0－110.0%	100.0%	1.0%	×	
F17.08	Fault auto restet times	0－100 0: No auto reset function	0	1	×	
F17.09	Fault auto reset interval	2.0－20.0s/time	5.0s/time	0.1 s/time	×	
F17.10	Fault relay action select	Units: during auto reset 0: Fault relay don't act 1: Fault relay act Tens: during DC bus low 0: Fault relay don't act	00	1	○	

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Code	Name	Range	Default	Unit	Attributes	Setting
		1: Fault relay act				
F17.11	NO.5 fault type	Lu: DC bus low E0001: Acc overcurrent E0002: Dec overcurrent E0003: Constant speed overcurrent E0004: Acc overvoltage E0005: Dec overvoltage E0006: Constant speed overvoltage E0008: Power module faulty E0009: Heatsink overheated E0010: Brake unit faulty E0011: CPU faulty E0012: Motor auto-tuning faulty E0013: Soft start failed E0014: Current detect faulty E0015: Lack of input E0016: Lack of output E0017: Controller overloaded E0018: Excessive speed deviation E0019: Motor overloaded E0020: Motr overheated E0021: Controlborad EEPROM faulty E0022: Panel EEPROM faulty E0023: Parameter setting faulty E0024: External faulty E0025: Running current too small E0028: SCI timeout faulty E0029: SCI faulty E0030: PG direct wrong E0031: PG disconnection E0032: Motor over speed E0033: Loss of Z signal of ABZ Encoder E0034: UVW signal wrong of UVW Encoder E0035: CD phase wrong of SINCOS encoder E0036: Contactor faulty E0008、E0010、E0013、	0	1	*	

Code	Name	Range	Default	Unit	Attributes	Setting
		E0014、E0021、E0022、E0024、E0036 can't auto reset				
F17.12	Setting freqency at NO.5 fault	0.00－100.00Hz	0.00Hz	0.01Hz	*	
F17.13	Output freqency at NO.5 fault	0.00－100.00Hz	0.00Hz	0.01Hz	*	
F17.14	DC bus vlotage at NO.5 fault	0－999V	0V	1V	*	
F17.15	Output voltage at NO.5 fault	0－999V	0V	1V	*	
F17.16	Output current at NO.5 fault	0.0－999.9A	0.0A	0.1A	*	
F17.17	Input terminal state at NO.5 Fault	0－0x1FF	0	1	*	
F17.18	Output terminal state at NO.5 fault	0－0x3F	0	1	*	
F17.19	NO.5 fault interval	0.0－6553.5 hour	0.0h	0.1h	*	
F17.20	NO.4 fault type	0－36	0	1	*	
F17.21	NO.4 fault interval	0.0－6553.5 hour	0.0h	0.1h	*	
F17.22	NO.3 fault type	0－36	0	1	*	
F17.23	NO.3 fault interval	0.0－6553.5 hour	0.0h	0.1h	*	
F17.24	NO.2 fault type	0－36	0	1	*	
F17.25	NO.2 fault interval	0.0－6553.5 hour	0.0h	0.1h	*	
F17.26	NO.1 fault type	0－36	0	1	*	
F17.27	NO.1 fault interval	0.0－6553.5 hour	0.0h	0.1h	*	
Group F18 PWM Parameters (on pages 85－85)						
F18.00	Carrier fregency	1－16kHz	Depend on controller model	1kHz	×	
F18.01	Carrier freqency auto adjust enable	0: Disable 1: Enable	0	1	×	
F18.02	PWM overmodulation enable	0: Disable 1: Enable	1	1	×	
F18.03	PWM overmodulation mode	0: Two phase / Three phase swtich 1: Three phase	0	1	×	

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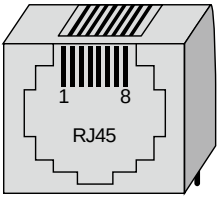
Appendix B Communication Protocol

1. Peripherals Support

HD5L series controllers provide one RS485 communication interface which uses the standard MODBUS communication protocol. By using the host computer (including communication devices such as computer and PLC) the user can operate to read-write the controller's function code, read the state parameters and write the control command etc. The controller is in slave mode when it is communicating.

2. Interfaces

Interface mode and pin definition



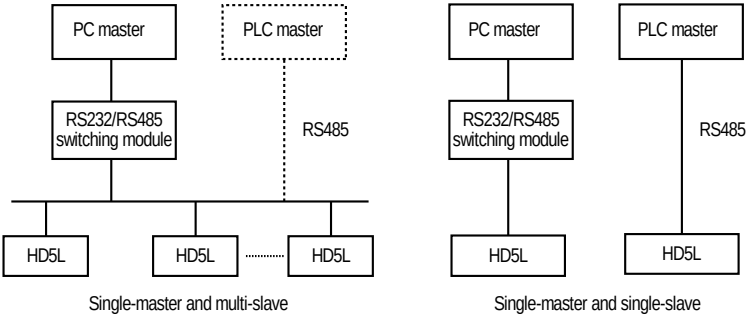
Port pin	1	2	3	4	5	6	7	8
Port signal	+5V	485+	+5V	GND	GND	GND	485-	Reserved

Communication mode

RS485 interface: asynchronous, semi-duplex.

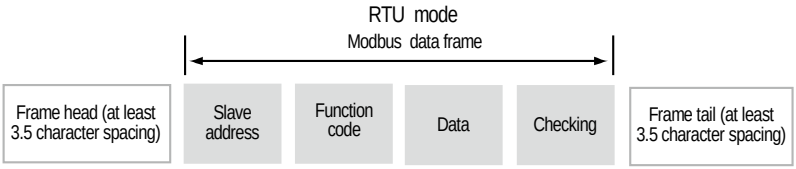
Default: 8-N-2, 9600bps.

3. Network Mode

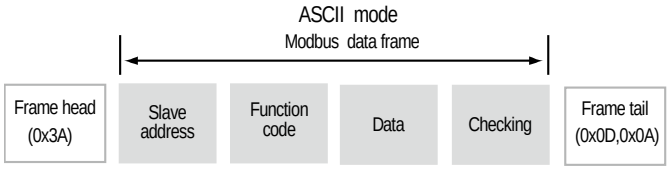


4. Protocol Format

The MODBUS protocol simultaneously supports RTU mode and ASCII mode, with corresponding frame format as shown below:



B



MODBUS adopts “Big Endian” encoding mode, higher byte prior to lower byte at sending.

1. RTU mode

In the RTU mode, the idle time of frame head and frame tail passing bus should be not less than 3.5 bytes, and data checking relies on CRC-16. The whole information need be checked. The concrete CRC checking is referred to the page 140.

Take RTU data for example: To read the slave internal register F00.08=1.500m/s of No. 1 address:

The command frame:

Address	Parameter	Register Address		Read char no.		Checksum	
0x01	0x03	0x00	0x07	0x00	0x01	0x35	0xCB

The response frame:

Address	Parameter	Response Byte	Content of register		Checksum	
0x01	0x03	0x02	0x5	0xDC	0xBA	0x8D

2. ASCII mode

In ASCII mode, the frame head is “0x3A”, while the frame tail default is “0x0D”“0x0A” and the frame tail can be set by the users. In ASCII mode, all the data bytes will be sent via ASCII code except frame head and frame tail, higher 4-byte prior to lower 4-byte at sending. In ASCII mode, data is 7-byte and for the “A”—“F” will adopt their uppercase of the ASCII code. The data adopts LRC checking, covering the slave address and data. Checksum is the character of data that is involved in checking and the complement code of carry bit.

Take ASCII data for example: Write 4000 (0x0FA0) to the internal register F00.07 of Slave 1.

LRC checking = the complement code of (0x01+0x41+0x00+0x07+0x0F+0xA0) =0x07

	Frame head	Address		Code		Register address				Written content				LRC checking		Frame tail	
Character	:	0	1	4	1	0	0	0	7	0	F	A	0	0	8	CR	LF
ASCII	3A	30	31	34	31	30	30	30	37	30	46	41	30	30	38	0D	0A

5. Scaling of Drive Transmitting Values

Except the parameters of the remarks, all other function codes can define the scaling relationship of the specified function code via referring the manual’s minimum unit.

Remarks:

Communication data 0—2000 of F06.07, F13.04, F13.05, F13.07, F13.08, F13.10, F13.11, F13.18 and F13.20 corresponds to data -1000 — +1000.

6. Protocol Function

a. Supported function

MODBUS protocol supports the below parameter operation:

Function code	Instructions
0x03	To read the controller's function parameters and parameters in operating state
0x06	To rewrite single function parameter (saved at power off) or control parameter
0x08	Circuit diagnosis
0x41	To rewrite single function parameter (not saved at power off)or control parameter
0x42	Parameter management
0x43	To rewrite numbers of function parameters (saved at power off) or control parameters

If the operation command fails, the response is fault code. For instance, continuously read 5 function codes from F00.00 then the return frame will be as follows:

Address	Error code	Exception code	Checksum	
0x01	0x83	0x03	0x01	0x31

The error code is the same as (function code＋0x80), and its instruction is as follows:

Exception code	Instructions
0x1	Illegal function parameters.
0x2	Illegal register address.
0x3	Data fault. Data is exceeded the upper/lower limit.
0x4	Slave operation fails (including fault caused by data invalid).
0x16	Unsupported operation (unsupported to read the attributes, factory default and upper/lower limit for the control parameter and state parameter).
0x17	The register number of command frame is fault.
0x18	Incorrect information frame, including incorrect information length and incorrect checking.
0x20	Parameters cannot be modified.
0x21	Parameters are unchangeable when the controller is in running state.
0x22	Parameters are protected by password.

b. The command and response frame of MODBUS protocol parameter (in RTU mode)

1) To read controller parameters

	Protocol date unit	Length of data (byte)	Range
Command frame	Address	1	0－247, 0 is broadcast address
	Function code	1	0x03
	Starting register address	2	0x0000－0xFFFF
	No. of register	2	0x0001－0x0004
	CRC/LRC checking	2/1	
Response frame	Address	1	1－247
	Function code	1	0x03
	Read byte no.	1	2* no. of registers
	Read content	2* no. of registers	
	CRC/LRC checking	2/1	

2) To rewrite single function parameter (saved at power off) or control parameter of controller

	Protocol date unit	Length of data (byte)	Range
Command frame	Address	1	0－247, 0 is broadcast address
	Function code	1	0x06
	Register address	2	0x0000－0xFFFF
	Register content	2	0x0000－0xFFFF
	CRC /LRC checking	2/1	
Response frame	Address	1	1－247
	Function code	1	0x06
	Register address	2	0x0000－0xFFFF
	Register content	2	0x0000－0xFFFF
	CRC /LRC checking	2/1	

3) Circuit diagnosis

	Protocol date unit	Length of data (byte)	Range
Command frame	Address	1	0－247, 0 is broadcast address
	Function code	1	0x08
	Subfunction code	2	0x0000－0x0030
	Data	2	0x0000－0xFFFF
	CRC /LRC checking	2/1	
Response frame	Address	1	1－247
	Function code	1	0x08
	Subfunction code	2	0x0000－0x0030
	Data	2	0x0000－0xFFFF
	CRC /LRC checking	2/1	

Subfunction code of circuit diagnosis:

Subfunction code	Data (command)	Data (response)	Subfunction meanings
0x0001	0x0000	0x0000	Reinitialize communication, disabling no-response mode
	0xFF00	0xFF00	Reinitialize communication, disabling no-response mode
0x0003	"New frame tail" and "00" occupy higher and lower bytes respectively	"New frame tail" and "00" occupy higher and lower bytes respectively	Set ASCII frame tail, and the new frame tail will replace the old newline characters, but it will not be retained at power loss. Note: new frame tail cannot be larger than 0x7F, and shouldn't be 0x3A.
0x0004	0x0000	No response	After select no-response mode, the slaves then only answer to "reinitialize communication command". It can tell and isolate the faulted slaves.
0x0030	0x0000	0x0000	To set slave no-response invalid command and fault command.
	0x0001	0x0001	To set slave response invalid command and fault command.

4) To rewrite single function parameter (not saved at power off) or control parameter of controller

	Protocol date unit	Length of data (byte)	Range
Command frame	Address	1	0－247, 0 is broadcast address
	Function code	1	0x41
	Register address	2	0x0000－0xFFFF
	Register content	2	0x0000－0xFFFF
	CRC /LRC checking	2/1	
Response frame	Address	1	1－247
	Function code	1	0x41
	Register address	2	0x0000－0xFFFF
	Register content	2	0x0000－0xFFFF
	CRC /LRC checking	2/1	

5) To rewrite numbers of function parameters (saved at power off) or control parameters of controller

	Protocol date unit	Length of data (byte)	Range
Command frame	Address	1	0－247, 0 is broadcast address
	Function code	1	0x43
	Starting register address	2	0x0000－0xFFFF
	No. of register	2	0x0001－0x0004
	Byte no. of register content	1	2* no. of operation registers
	Register content	2* no. of operation registers	
	CRC /LRC checking	2/1	
Response frame	Address	1	1－247
	Function code	1	0x43
	Starting register address	2	0x0000－0xFFFF
	No. of operation registers	2	0x0001－0x0004
	CRC /LRC checking	2/1	

This command rewrites the contents of continuous data unit from starting register address where is mapped as controller's function parameter and control parameter etc. The controller will start to save from low address to high address of the register when it continuously saves many register parameters. The saving operation will return from the first faulty address if it isn't completely success.

6) Parameter management

The controller parameter management includes reading the upper/lower limit of parameters, to read parameter characteristics, to read the biggest intergroup index of function parameters, to read the previous and next function parameter group number, to read index of the parameter being displayed and to display next state parameter. The parameter characteristics include read-write ability, parameter units and scaling.

The command and response frames of parameter management are as follows:

	Protocol date unit	Length of data (byte)	Range
Command frame	Address	1	0－247, 0 is broadcast address
	Function code	1	0x42
	Subfunction code	2	0x0000－0x0008
	Data	2	Depend on controller model
	CRC /LRC checking	2/1	
Response frame	Address	1	1－247
	Function code	1	0x42
	Subfunction code	2	0x0000－0x0008
	Data	2	0x0000－0xFFFF
	CRC /LRC checking	2/1	

On condition that the operation command fails, response is error code and exception code.

Parameter management supports the Subfunction as follows. But it does not support control parameter operation.

Subfunction code	Data (command)	Data (response)	Subfunction meanings
0x0000	The function parameter group no. and intergroup index occupy the higher and lower bytes respectively.	The upper limit of function parameter.	To read the upper limit of function parameter. (state parameters unsupport this operation)
0x0001	The function parameter group no. and intergroup index occupy the higher and lower bytes respectively.	The lower limit of function parameter.	To read the lower limit of function parameter. (state parameters unsupport this operation)
0x0002	The parameter group no. and intergroup index occupy the higher and lower bytes respectively.	Characteristics of parameters and see the table of parameter's characteristics for more details	To read the characteristic of parameters.
0x0003	The function parameter group no. occupies the higher byte, and the lower byte is "00".	The max. value of intergroup index.	To read the max value of intergroup index. (state parameters unsupport this operation)
0x0004	The function parameter group no. occupies the higher byte, and the lower byte is "00".	Next function parameter group no. occupies the higher byte, and the lower byte is "00".	To read next function parameter group no. (state parameters unsupport this operation)
0x0005	The function parameter group no. occupies the higher byte, and the lower byte is "00".	Previous function parameter group no. occupier the higher byter, and the lower byte is "00".	To read previous function parameter group no. (state parameters unsupport this operation)
0x0006	0x3300	The state parameter index at present display.	To read state parameter index at present display.
0x0007	0x3300	The parameter index at next state.	To display next state parameter.
0x0008	The parameter group no. and intergroup index occupy the higher and lower bytes respectively.	Factory default.	To read factory default of function parameter. (state parameters unsupport this operation)

The function parameter characteristics are 2-byte, with definition shown as below:

Characteristics (Bit)	Value	Definition
Bit0	0B	To modify the upper limit as per character restriction
	1B	To modify the upper limit as per 4-byte restriction
Bit2－Bit1	00B	without decimal fraction
	01B	1 decimal fraction
	10B	2 decimal fraction
	11B	3 decimal fraction

B

Characteristics (Bit)	Value	Definition
Bit5－Bit3	001B	To display length 1
	010B	To display length 2
	011B	To display length 3
	100B	To display length 4
	101B	To display length 5
	Reserved	
Bit7－Bit6	00B	Actual parameters, unchangeable
	01B	Changeable
	10B	Unchangeable in running state
	11B	Set by factory, cannot be modified
Bit12－Bit8	00000B	Without char
	00001B	Unit is Hz
	00010B	Unit is A
	00011B	Unit is V
	00100B	Unit is rpm
	00101B	Unit is %
	00110B	Unit is s
	00111B	Unit is Ω
	01000B	Unit is ms
	01001B	Unit is kHz
	01010B	Unit is k kW.h
	01011B	Unit is kW.h
	01100B	Unit is mH
	01101B	Unit is m
	01110B	Unit is cm
	01111B	Unit is kΩ
	10000B	Unit is Hz/s
	10001B	Unit is h
	10010B	Unit is kW
	10011B	Unit is℃
	10100B	Unit is s/times
	10101B	Unit is m/s
	10110B	Unit is m/s^2
	10111B	Unit is m/s^3
	11000B	Unit is mm
	11001B	Unit is m/min
	11010B	Unit is kg/m^3
	11011B	Unit is N
	Others reserved	

7. Address Mapping

The controller's function parameters, control parameters and state parameters are all mapped as MODBUS's read-write register. And their group numbers are mapped as the higher bytes of register address while the relationships are shown as below table.

High bytes of register address	Group number	High bytes of register address	Group number
0x00	F00	0x01	F01
0x02	F02	0x03	F03
0x04	F04	0x05	F05
0x06	F06	0x07	F07
0x08	F08	0x09	F09
0x0a	F10	0x0b	F11
0x0c	F12	0x0d	F13
0x0e	F14	0x0f	F15
0x10	F16	0x11	F17
0x12	F18	0x13	F19
0x14	F20		
0x32	Control parameter group	0x33	State parameter group

Their intergroup indexes are mapped as the lower bytes. Please refer to the instruction manual for more details on function parameters F00—F20.

The users can realize the controller's starting, stopping and running speed setting through the control parameter, and obtain the controller's running speed, output current, voltage etc. through indexing the controller's state parameters.

1. Control parameters

The controller's control parameter intergroup indexes are as follows:

Register address	Parameter name	Retained or not at power loss
0x3200	Control command character	No
0x3201	Main setting	No

Definition of controller control command words:

Note:

The controller operating mode must be SCI control (F00.05 = 4).

B

Control word (Bit)	Value	Definition	Function description
bit0	1	Run command enabled	This bit co-work with controller's enable bit to run the controller. The controller will close the running contactor, release the brake and start to run. This bit becomes invalid only after the controller stops.
	0	Run command disabled	Stop output and output released brake signal.
bit1	1	Down	Elevator running direction. The same function as terminal UP/DN.
	0	Up	
bit2	1	No emergency stop	Controller runs normally.
	0	Emergency stop	Controller controls drive to stop.
bit3	1	SCI control enabled	If the terminal EN is enabled, controller can run normally.
	0	SCI control disabled	Drive stop output and release brake signal.
bit4	1	With new run speed	Indicates a change in running speed, as determined by main setting.
	0	Without new run speed	Keep present speed.
bit5	0	Reserved	
bit6	1	Reset enabled	Fault reset control
	0	Reset disabled	
bit7	1	Reserved	
	0	Main setting of this frame is speed	Main setting of this frame is speed.
Bit8－bit11	0	Reserved	
bit12	1	Inspection run mode enabled	Indicates inspection running mode. Function the same as terminal INS.
	0	Inspection run mode disabled	
bit13	1	Battery run mode enabled	Indicates battery driven mode. Function the same as terminal BAT.
	0	Battery run mode disabled	
bit15, bit14	0	Reserved	

Drive main setting is as following:

Control word (bit7)	Run setting data value	Description
0	0	Speed corresponding to parameter F05.00
	1	Speed corresponding to parameter F05.01
	2	Speed corresponding to parameter F05.02
	3	Speed corresponding to parameter F05.03
	4	Speed corresponding to parameter F05.04
	5	Speed corresponding to parameter F05.05
	6	Speed corresponding to parameter F05.06
	7	Speed corresponding to parameter F05.07
1	0	Reserved

2. State parameter

The high-bytes address of control state register is 0x33 and the low-bytes address is as following:

Low-bytes address	Group No.	Low-bytes address	Group No.
0x00	D00.00	0x01	D00.01
0x02	D00.02	0x03	D00.03
0x04	D00.04	0x05	D00.05
0x06	D00.06	0x07	D01.00
0x08	D01.01	0x09	D01.02
0x0a	D01.03	0x0b	D01.04
0x0c	D01.05	0x0d	D01.06
0x0e	D01.07	0x0f	D01.08
0x10	D01.09	0x11	D01.10
0x12	D01.11	0x13	D01.12
0x14	D01.13	0x15	D01.14
0x16	D01.15	0x17	D01.16
0x18	D02.00	0x19	D02.01
0x1a	D02.02	0x1b	D02.03
0x1c	D02.04	0x1d	D02.05
0x1e	D02.06	0x1f	D02.07
0x20	D02.08	0x21	D02.09
0x22	D03.00	0x23	D03.01
0x24	D03.02	0x25	D03.03
0x26	D03.04	0x27	D03.05
0x28	D03.06	0x29	D03.07
0x2a	D04.00	0x2b	D04.01
0x2c	D04.02	0x2d	D04.03
0x2e	D04.04	0x2f	D04.05
0x30	D04.06	0x31	D04.07
0x32	D04.08	0x33	D04.09
0x34	D04.10	0x35	D04.11

For instance: The register address of function parameter F03.02 is 0x0302, and that of function parameter D01.01 is 0x3308.

8. Special instruction

1. For the data frame in ASCII mode, if the frame length is an even number, the frame is abandoned.

2. Group F07, Group F10 and Group F14 (SCI communication parameters) are the controller parameters which can be read but cannot be modified by the host computer.

3. If many multi-function input terminals setting are the same, it may cause dysfunction. Therefore, the user should avoid this case when modify the multi-function terminal function via the MODBUS.

9. CRC checking

In order to satisfy speed increase needs, CRC-16 normally adopts form mode. The following is CRC-16 C language channel code. Please note the final result has exchanged the higher and lower bytes. That is the right CRC checksum to be sent.

```
unsigned short CRC16 ( unsigned char *msg, unsigned char length)
/* The function returns the CRC as a unsigned short type */
{
    /* high byte of CRC initialized */
    unsigned char uchCRCHi = 0xFF ;
    /* low byte of CRC initialized */
    unsigned char uchCRCLo = 0xFF ;
    /* index into CRC look up table */
    unsigned uIndex ;
    /* pass through message buffer */
    While (length--)
    {
        /* calculate the CRC */
        uIndex = uchCRCLo ^ *msg++ ;
        uchCRCLo = uchCRCHi ^ (crcvalue[uIndex] >>8);
        uchCRCHi =crcvalue[uIndex]&0xff;
     }
     return (uchCRCHi | uchCRCLo<<8) ;
}
/* Table of CRC values */
const unsigned int crcvalue[ ] = {
0x0000,0xC1C0,0x81C1,0x4001,0x01C3,0xC003,0x8002,0x41C2,0x01C6,0xC006,0x8007,
0x41C7,0x0005,0xC1C5,0x81C4,0x4004,0x01CC,0xC00C,0x800D,0x41CD,0x000F,0xC1CF,
0x81CE,0x400E,0x000A,0xC1CA,0x81CB,0x400B,0x01C9,0xC009,0x8008,0x41C8,0x01D8,
0xC018,0x8019,0x41D9,0x001B,0xC1DB,0x81DA,0x401A,0x001E,0xC1DE,0x81DF,0x401F,
0x01DD,0xC01D,0x801C,0x41DC,0x0014,0xC1D4,0x81D5,0x4015,0x01D7,0xC017,0x8016,
0x41D6,0x01D2,0xC012,0x8013,0x41D3,0x0011,0xC1D1,0x81D0,0x4010,0x01F0,0xC030,
0x8031,0x41F1,0x0033,0xC1F3,0x81F2,0x4032,0x0036,0xC1F6,0x81F7,0x4037,0x01F5,
0xC035,0x8034,0x41F4,0x003C,0xC1FC,0x81FD,0x403D,0x01FF,0xC03F,0x803E,0x41FE,
0x01FA,0xC03A,0x803B,0x41FB,0x0039,0xC1F9,0x81F8,0x4038,0x0028,0xC1E8,0x81E9,
0x4029,0x01EB,0xC02B,0x802A,0x41EA,0x01EE,0xC02E,0x802F,0x41EF,0x002D,0xC1ED,
0x81EC,0x402C,0x01E4,0xC024,0x8025,0x41E5,0x0027,0xC1E7,0x81E6,0x4026,0x0022,
0xC1E2,0x81E3,0x4023,0x01E1,0xC021,0x8020,0x41E0,0x01A0,0xC060,0x8061,0x41A1,
0x0063,0xC1A3,0x81A2,0x4062,0x0066,0xC1A6,0x81A7,0x4067,0x01A5,0xC065,0x8064,
0x41A4,0x006C,0xC1AC,0x81AD,0x406D,0x01AF,0xC06F,0x806E,0x41AE,0x01AA,0xC06A,
0x806B,0x41AB,0x0069,0xC1A9,0x81A8,0x4068,0x0078,0xC1B8,0x81B9,0x4079,0x01BB,
```

0xC07B,0x807A,0x41BA,0x01BE,0xC07E,0x807F,0x41BF,0x007D,0xC1BD,0x81BC,0x407C,
0x01B4,0xC074,0x8075,0x41B5,0x0077,0xC1B7,0x81B6,0x4076,0x0072,0xC1B2,0x81B3,
0x4073,0x01B1,0xC071,0x8070,0x41B0,0x0050,0xC190,0x8191,0x4051,0x0193,0xC053,
0x8052,0x4192,0x0196,0xC056,0x8057,0x4197,0x0055,0xC195,0x8194,0x4054,0x019C,
0xC05C,0x805D,0x419D,0x005F,0xC19F,0x819E,0x405E,0x005A,0xC19A,0x819B,0x405B,
0x0199,0xC059,0x8058,0x4198,0x0188,0xC048,0x8049,0x4189,0x004B,0xC18B,0x818A,
0x404A,0x004E,0xC18E,0x818F,0x404F,0x018D,0xC04D,0x804C,0x418C,0x0044,0xC184,
0x8185,0x4045,0x0187,0xC047,0x8046,0x4186,0x0182,0xC042,0x8043,0x4183,0x0041,
0xC181,0x8180,0x4040}

It takes a comparatively long time to online calculate the CRC checksum of each byte, but it will save program space. Code of online calculating CRC is shown below:

```
unsigned int crc_check(unsigned char *data,unsigned char length)
{
    int i;
    unsigned crc_result=0xffff;
    while(length--)
    {
        crc_result^=*data++;
        for(i=0;i<8;i++)
        {
            if(crc_result&0x01)
                crc_result=(crc_result>>1)^0xa001;
            else
                crc_result=crc_result>>1;
        }
    }
    return (crc_result=((crc_result&0xff)<<8)|(crc_result>>8));
}
```

10. Application case

Remarks: Please verify all the hardware equipments are connected well before controlling the controller via communication. In addition, please preset the communication data format, baud rate and communication address. In the following examples the communication address is “2”.

1. To read the M-key function of address 2 (to read the command frame of F00.06)

Address	Code	Register address		Word no. of read		Checksum	
0x02	0x03	0x00	0x06	0x00	0x01	0x64	0x38

Corresponding answer frame (F00.06=1):

Address	Code	Answer byte	Register content		Checksum	
0x02	0x03	0x02	0x00	0x01	0X3D	0x84

2. To read the DC bus voltage of address 2 (to read state parameter D01.14)

Address	Code	Register address		Word no. of read		Checksum	
0x02	0x03	0x33	0x15	0x00	0x01	0x9A	0Xb9

Corresponding answer frame (the DC bus voltage is 537V)

Address	Code	Answer byte	Register content		Checksum	
0x02	0x03	0x02	0x02	0x19	0x3C	0xEE

3. To write the panel digital setting of address 2 (set F00.07 as 1.200m/s)

Address	Code	Register address		Register content		Checksum	
0x02	0x41	0x00	0x07	0x04	0xB0	0x8F	0x43

Corresponding answer frame:

Address	Code	Register address		Register content		Checksum	
0x02	0x41	0x00	0x07	0x04	0xB0	0x8F	0x43

4. Controller is at MS 2 up run of address 2.

Add.	Code	Register address		Register number		Register bytes No.	Register content				Checksum	
0x02	0x43	0x32	0x00	0x00	0x02	0x04	0x00	0x1D	0x00	0x02	0x53	0x3

Corresponding answer frame:

Address	Code	Register address		Operate register number		Checksum	
0x02	0x43	0x32	0x00	0x00	0x02	0xCB	0x4F

5. Controller is at MS 2 down run of address 2.

Add.	Code	Register address		Register number		Register bytes No.	Register content				Checksum	
0x02	0x43	0x32	0x00	0x00	0x02	0x04	0x00	0x1F	0x00	0x02	0xF2	0xC3

Corresponding answer frame:

Address	Code	Register address		Register content		Checksum	
0x02	0x43	0x32	0x00	0x00	0x02	0xCB	0x4F

6. Emergency to stop command of address 2.

Address	Code	Register address		Register content		Checksum	
0x02	0x41	0x32	0x00	0x00	0x0B	0x72	0x89

Corresponding answer frame:

Address	Code	Register address		Register content		Checksum	
0x02	0x41	0x32	0x00	0x00	0x0B	0x72	0x89

At actual running, first set MS as zero-speed and wait for that the controller is at zero-speed running, then send the emergency stop command.

7. Inspection up run command of address 2

Address	Code	Register address		Register content		Checksum	
0x02	0x41	0x32	0x00	0x10	0x0D	0xFF	0x4B

Corresponding answer frame:

Address	Code	Register address		Register content		Checksum	
0x02	0x41	0x32	0x00	0x10	0x0D	0xFF	0x4B

8. Controller fault reset of address 2

Address	Code	Register address		Register content		Checksum	
0x02	0x41	0x32	0x00	0x00	0x40	0x32	0xBE

Corresponding answer frame:

Address	Code	Register address		Register content		Checksum	
0x02	0x41	0x32	0x00	0x00	0x40	0x32	0xBE

9. Battery driven up run of address 2.

Address	Code	Register address		Register content		Checksum	
0x02	0x41	0x32	0x00	0x20	0x0D	0xEB	0x4B

Corresponding answer frame:

Address	Code	Register address		Register content		Checksum	
0x02	0x41	0x32	0x00	0x20	0x0D	0xEB	0x4B

Shenzhen Hpmont Technology Co., Ltd.

Product Warranty Card

Clinet info	Unit:	
	Add. Of unit:	
	P.C.:	Contact person:
	Tel.:	Fax:
Product info	Barcode on the product body (paste here):	
	Power:	Model:
	Contrat number:	Purchasing date:
Service unit info	Service unit:	
	Contact person:	Tel.:
	Maintenance staff:	Tel.:
	Maintenance date:	

User's quality evaluation for the service:

☐ Better ☐ Good ☐ Common ☐ Poor

Other opinions:

User signature: Date:

Interview record of Customer Service Center:

☐ Interviewed by telephone ☐ Interviewed by letters

Others:

Technical service engineer signature: Date:

Shenzhen Hpmont Technology Co., Ltd.

Warranty Agreement

1. The warranty period of the product is 18 months (refer to the barcode on the product body). During the warranty period, if the product fails or it is damaged under condition of normal use by following the user's manual, our company will be responsible for free maintenance.
2. The starting time of the warranty period is manufacturing date (see the barcode on the product body), but we could negotiate settlement under special condition.
3. Within warranty period, maintenance will be charged for damages caused by the following reasons:
   A. The damage is caused by improper use or repair/modification without prior permission;
   B. The damage is caused by abnormal voltage, fire, flood, other disasters and second disasters;
   C. The damage is caused by dropped or transportation after purchase;
   D. The damage is caused by the operation not following this user's manual;
   E. The damage or failure is caused by the trouble out of the equipment (e.g. external device).
4. If there is any failure or damage to the product, please correctly fill out the Product Warranty Card in detail.
5. The maintenance fees are charged according to the newly adjusted Maintenance Price List by our company.
6. In general, the warranty card will not be reissued. Please keep the card and present it to the maintenance personnel when asking for maintenance.
7. If there is any problem during the service, please contact the agent of our company or our company directly.
8. This agreement should be interpreted by Shenzhen Hpmont Technology Co., Ltd..

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