HD5L Series
Elevator Controller

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Elevator Controller

User Manual

V1.5 2018.07

FOREWORD

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

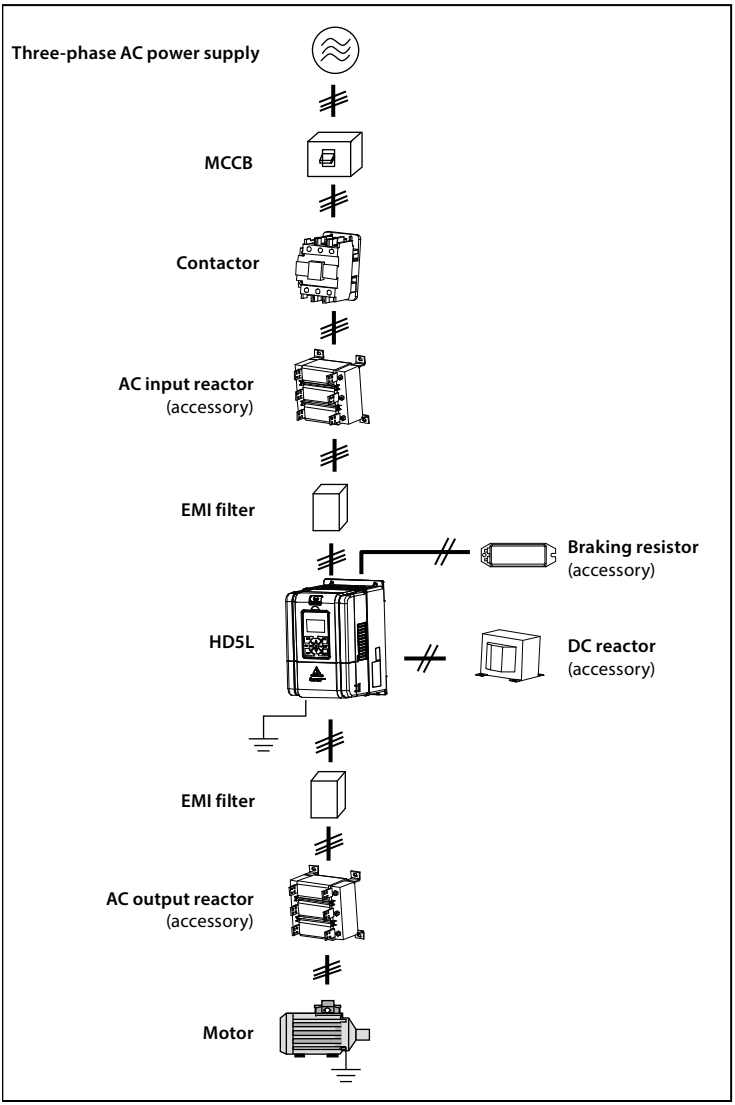
This User Manual describes how to use HD5L series elevator controller and their installation wiring, parameter setting, troubleshooting and daily maintenance etc.

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 use.
- 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.
- If you still have some problems during use, please contact our company Technical Service Center.
- 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.
- Email address: **overseas_1@hpmont.com**

Connection with peripheral devices



Version and Revision Records

Time: 2018/07

Version: V1.5

Revised chapter	Revised contents
Chapter 6 Appendix A	• Adding D04.12 (Pulses monitoring of slip in start), D04.13 (Judgement sources for start stability), D04.15 (Rotating self-tuning encoder pulse change judgment variable), D04.29 (Oftware version for hpmont stuff) • F00.01 (Control mode) adding: 4 (SVC control 2) • Addint F09.04 (Current loop period), F09.05 (Dead zone compensation mode) • Modify F10.01 (Rated power of syn. motor) range as: 0.4 - 400.0kW • Modify F10.09 (Back EMF of syn. motor) default value: 0V • F10.20 (Synchronous performance optimization) addint: Bit5 & Bit4 (Synchronous motor start current limit), Bit12 (Synchronous motor start to suppress oscillation), Bit13 (Start optimization 2), Bit15 (Vibration optimization) • F12.15 - F12.20 (D0 / RLY function) adding: 13 (Overload detection), 21 (Advanced door open signal output) • Modify F15.01 (Display contrast of LCD keypad) default value: 6 • Adding F20.02 - F20.20

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 products or other equipements.

Note

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

1.2 About Motor and Load

Compared to the industrial 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 industrial frequency running.

Thermal protection of motor

When choose the adaptive motor, HD5L 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 running.

Lubrication of mechanical devices

At long time low-speed running, 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.

Start and stop HD5L

User should use the control terminal to start and stop HD5L. It is strictly forbidden to use contactor or other switches on the input side of HD5L to start and stop directly, or it will damage the device.

Check the insulation of the motor

For the first time using the motor or after long time storage, it needs check the insulation of the motor. Worse insulation can cause damage to HD5L.

Note:

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

Requirement for leakage current protector RCD

Since the device generates high leakage current which goes through the protective grounding conductor, please install B type leakage current protector RCD on one side of the power supply.

For the selection of RCD, users need to consider the possible problems of ground leakage current in both transient status and steady status at start and during running. It is recommended to choose either special RCD that can suppress the higher harmonics, or general RCD that has more aftercurrent.

Warning for ground mass leakage current

The device generates mass leakage current, so users need to confirm the reliable grounding before connect to the power supply. The grounding should comply with the local relative IEC standard.

1.3 About HD5L

No capacitor or varistor on the output side

Since HD5L 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 HD5L fault trip or component damage.

Contactors and circuit breakers connected to the output of HD5L

If circuit breaker or contactor needs to be connected between HD5L and the motor, be sure to operate these circuit breakers or contactor when HD5L has no output, so as to avoid any damage to HD5L.

Running voltage

HD5L is prohibited to be used beyond the specified range of running voltage. If needed, please use the suitable voltage regulation device to change the voltage.

Capacitor energy storage

When the AC power supply is cut off, capacitor of HD5L sustains deadly power for a while. So to disassemble HD5L that is powered, please cut off the AC power supply for more than 10 minutes, confirm the internal charge indicator is off and the voltage between (+) and (-) of the main circuit terminals is below 36V.

Generally, the internal circuit enables the capacitor to discharge. However, the discharging may fail in some exceptions. In these cases, users need to consult Hpmont or our regional distributor.

Change three-phase input to single-phase input

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

To use single-phase power supply, 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 60% within rated value of controller.

Lightning surge protection

HD5L internal design has lightning surge over-current protection circuit, and has certain self-protection capacity against the lightning.

Altitude and derating

In area where altitude exceeds 1000 meters, HD5L should be derating since the heatsink efficiency will be reduced because of the tenuous air.

The rated value of output current derates by 1% for each 100m increase of the altitude. I.e for the altitude of 3000m, derated rate is 20% for rated current of HD5L. Figure 1-1 is the derating curve of rated current and the altitude.

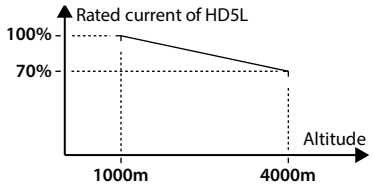
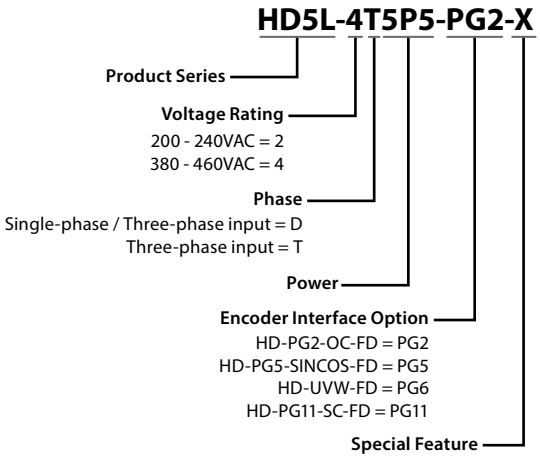


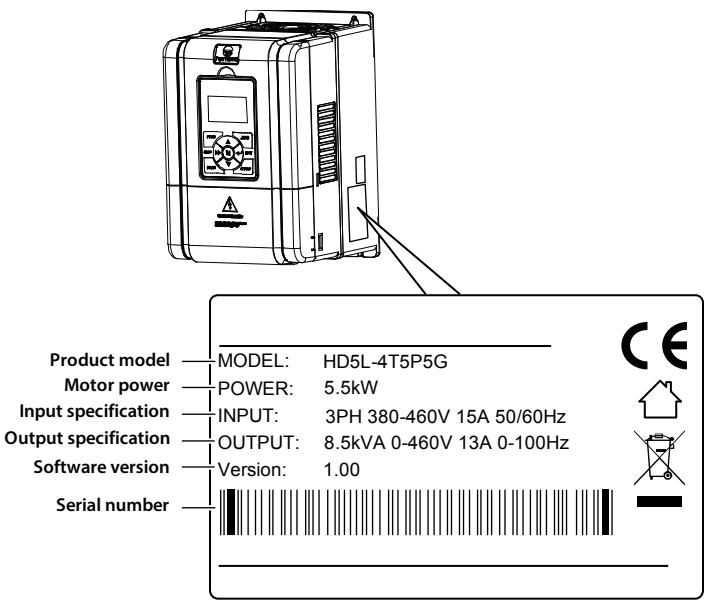
Figure 1-1 Derating curve of rated current and altitude

Chapter 2 Product Information

2.1 Model



2.2 Nameplate



2.3 Technical Data

Electrical		
Input voltage	Single-phase: 200 - 240V Three-phase: 200 - 240V Three-phase: 380 - 460V Fluctuating within ± 10%, unbalance rate < 3%	
Input frequency	50/60Hz ± 5%	
Output voltage	0 - input voltage	
Output frequency	0 - 100.00Hz	
Performance		
Control mode	V/f, SVC, VC	
Maximum current	150% rated output current for 2 minutes 180% rated output current for 10 seconds	
Running command	Keypad; Terminal; SCI communication	
Speed setting	Digital; Analogue; SCI communication	
Speed resulotion	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: 180% rated torque / 0Hz
Characteristic Functions		
Parameter upload and download function	Achieve parameters uploading and downloading	
I/O interface	The programmable input interface has up to 34 functions The pragrammable output interface has up to 19 functions	
Communication protocol	Built-in MODBUS communication protocol	
Protection Functions		
Auto-inspection	To eliminate the potential safety problems, safety inspection for the peripheral devices is provided when power 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 speed switch function	Up / Down forced speed switch function, to avoid climbing elevator or plunging elevator	
Input / Output phase loss protection	Input / Output phase loss auto-detect and alarm function	
Motor temperature detection	Real time detection for the motor temperature	
Output GND short circuit protection	Enabled	
Output inter-phase short circuit protection	Enabled	

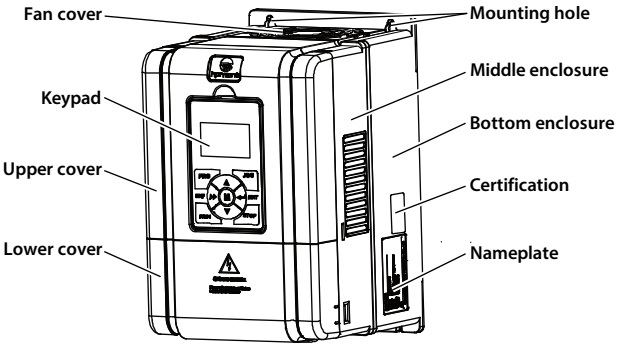
Input / Output	
Analogue power supply	+10V, max. current 100mA - 10V, max. current 10mA
Digital supply	+24V, max. current 200mA
Analogue input	AI1 (Control board): Voltage 0 - 10V AI2, AI3 (Control board): -10V - +10V / 0 - 20mA (selectable voltage / current) AI4 (I/O board): -10V - +10V / 0 - 20mA (selectable voltage / current, supports differential input)
Analogue output	AO1, AO2: 0 - 10V / 0 - 20mA (selectable voltage / current)
Digital input	DI1 - DI6 (Control board); DI7 - DI12 (I/O board)
Digital output	DO1, DO2
Programmable relay output	R1A / R1B / R1C (Control board) R2A / R2B / R2C; R3A / R3B / R3C; R4A / R4B / R4C (I/O board) Contact rating 250VAC / 3A or 30VDC / 1A
SCI communication	RJ45 interface
Keypad	
LCD display	Setting function parameter, checking status parameter, checking fault code etc.
Parameter copy	Achieve quick parameter copy
Environment	
Running temperature	-10 - +40°C, max. 50°C, air temperature fluctuation is less than 0.5°C/min The derating value of output current of HD5L shall be 2% for each degree centigrade above 40°C. Max. allowed temperature is 50°C
Storage temperature	- 40 - +70°C
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
Vibration resistance	It is 3.5m/s^2 in 2 - 9Hz, it is 10m/s^2 (IEC60721-3-3) in 9 - 200Hz
Protection class	IP20
Pollution level	Level 2 (Dry, non canducting dust pollution)
Accessories	
Encoder interface board frequency demultiplication	OC encoder interface board with FD output [HD-PG2-OC-FD] SINCOS encoder interface board with FD output [HD-PG5-SINCOS-FD] Line drive encoder interface board with FD output [HD-PG6-UVW-FD] Serial communication encoder interface board with FD output [HD-PG11-SC-FD] (support Endat)
About keypad	Mounting base to keypad [HD-KMB] 1m / 2m / 3m / 6m extension cable to keypad [HD-CAB-1M / 2M / 3M / 6M]
Power unit	Power regenerative unit [HDRU]

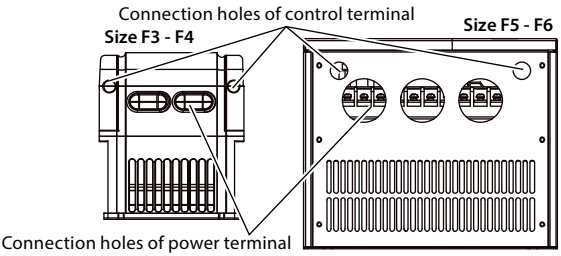
2.4 Rated Value

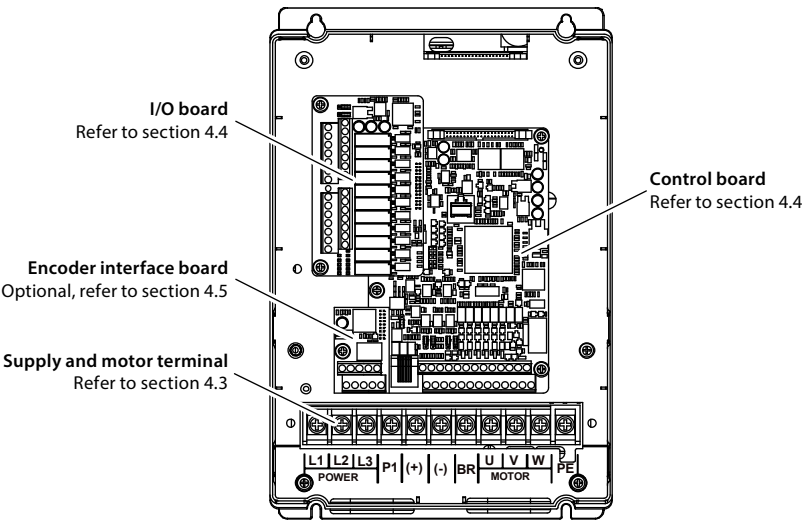
Refer to section 3.4 Dimensions and Weight (on page 12) for size information.

Model	Motor (kW)	Rated capacity (kVA)	Rated input current (A)	Rated output current (A)	Size
Single-phase / Three-phase power supply: 200 - 240V, 50/60Hz					
HD5L-2D2P2	2.2	3.8	24.1 / 12 (1)	10	F3
HD5L-2D3P7	3.7	5.9	40 / 19 (1)	17	F3
HD5L-2D5P5	5.5	8.5	60 / 28 (1)	25	F3
HD5L-2D7P5	7.5	11	75 / 35 (1)	32	F4
HD5L-2D011	11	16	100 / 47 (1)	45	F5
Three-phase power supply: 200 - 240V, 50/60Hz					
HD5L-2T015	15	21	62	55	F5
HD5L-2T018	18.5	24	77	70	F5
HD5L-2T022	22	30	92	80	F6
HD5L-2T030	30	39	113	110	F6
Three-phase power supply: 380 - 460V, 50/60Hz					
HD5L-4T2P2	2.2	3.4	7.3	5.1	F3
HD5L-4T3P7	3.7	5.9	11.9	9.0	F3
HD5L-4T5P5	5.5	8.5	15	13	F3
HD5L-4T7P5	7.5	11	19	17	F3
HD5L-4T011	11	16	28	25	F3
HD5L-4T015	15	21	35	32	F4
HD5L-4T018	18.5	24	39	37	F4
HD5L-4T022	22	30	47	45	F5
HD5L-4T030	30	39	62	60	F5
HD5L-4T037	37	49	77	75	F6
HD5L-4T045	45	59	92	90	F6
(1): Value before / is for single-phase model, value after / is for three-phase model.					

2.5 Parts of Controller







Chapter 3 Mechanical Installation

3.1 Precautions

Danger

- Do not install if HD5L is incomplete or impaired.
- Please see the controller size and weight to take appropriate tools for handing, avoid harming from sharp edges or injured by a dropped controller.
- Make sure that HD5L is far from the explosive and flammable things.
- Do not do wiring operation until power supply is cut off for more than 10 minutes, the internal charge indicator of HD5L is off and the voltage between (+) and (-) of the main circuit terminals is below 36V.

Warning

- It is required not only carry the keypad and the cover but also bottom enclosure of HD5L.
- Do not let wires, screws or residues fall into HD5L when installing.

3.2 Installation Site Requirement

Ensure the installation site meets the following requirements:

- Do not install at the direct sunlight, moisture, water droplet location;
- Do not install at flammable, explosive, corrosive gas and liquid location;
- Do not install at oily dust, fiber and metal powder location;
- Be vertical installed on fire-retardant material with a strong support;
- Make sure adequate cooling space for HD5L so as to keep ambient temperature between -10 - + 40℃;
- Install at where the vibration is 3.5m/s^2 in 2 - 9Hz, 10m/s^2 in 9 - 200Hz (IEC60721-3-3);
- Install at where the humidity is less than 95%RH and non-condensing location;
- Protection level of HD5L is IP20 and pollution level is 2 (Dry, non-conducting dust pollution).

Note:

1. It needs derating use running temperature exceeds 40℃. The derating value of the output current of HD5L shall be 2% for each degree centigrade. Max. allowed temperature is 50℃.

2. Keep ambient temperature between -10 - +40℃. It can improve the running performance if install at location with good ventilation or cooling devices.

3.3 Installation Direction and Space Requirements

To achieve good cooling efficiency, install HD5L 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, the unit is mm.

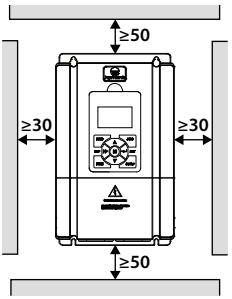
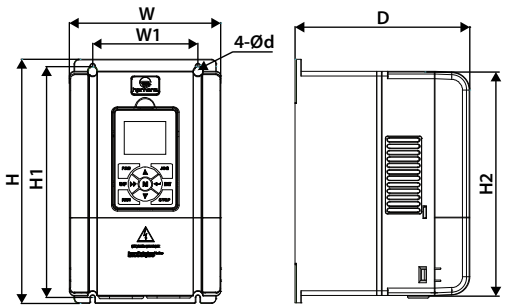


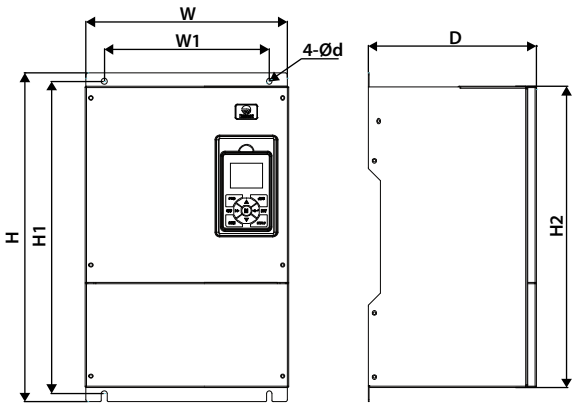
Figure 3-1 HD5L Installation

3.4 Dimensions and Weight

The dimensions and weight of HD5L are as shown in Table 3-1. For the corresponding model of the mounting size, please refer to section 2.4 Rated Value, on page 8.



Size F3 - F4



Size F5 - F6

Table 3-1 HD5L dimensions and weight

Size	Dimension (mm)			Mounting Size (mm)				GW
	W	H	D	W1	H1	H2	d	(kg)
F3	200	299	210	146	286	280	5	5.8
F4	235	353	222	167	337	330	7	8.2
F5	290	469	240	235	445	430	8	20.4
F6	380	598	290	260	576	550	10	48

3.5 Install and Dismantle Keypad

According to the direction of Figure 3-2, press the keypad until hear a "click" sound.

Do not install the keypad from other directions or it will cause poor contact.

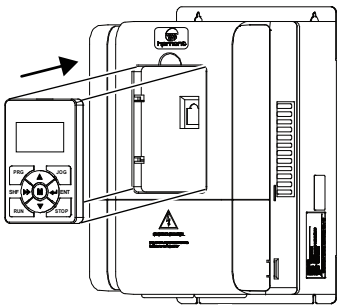


Figure 3-2 Install keypad

There are two steps in Figure 3-3.

First, press the hook of the keypad according to direction 1. Second, take out of the keypad according to direction 2.

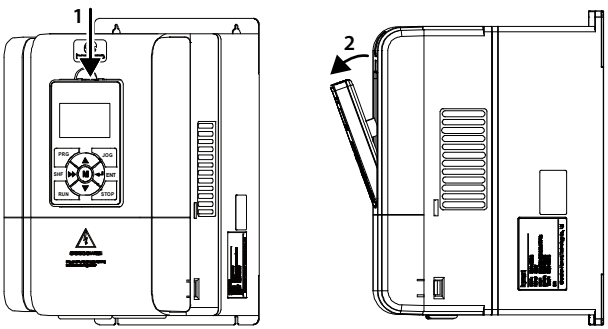
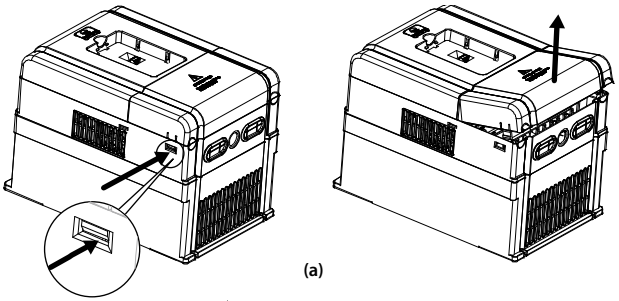


Figure 3-3 Dismantle keypad

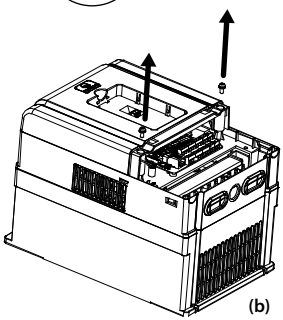
3.6 Dismantle Plastic Cover

The upper cover and the lower cover of HD5L are removable. The dismantle steps are shown as Figure 3-4.

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



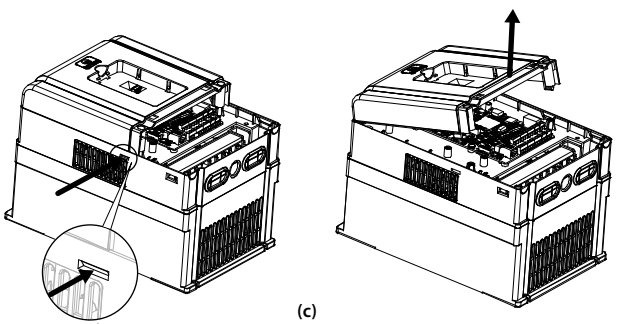
(a)



(b)

The removing processes of plastic cover board:

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



(c)

Figure 3-4 Dismantle plastic cover

Chapter 4 Electrical Installation

4.1 Precautions

Danger

- Only qualified electrical engineer can perform wiring job.
- To facilitate the input side over-current protection and outage maintenance, connect HD5L with power supply via the MCCB or fuse.
- Do not dismantle HD5L or do wiring operation until the power is cut-off for more than 10 minutes, the internal charge indicator of HD5L 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.
- There is more than 3mA leakage current in HD5L grounding, depending on the operating conditions. To ensure safety, HD5L and the motor must connect to separate and independent grounding wire, so as to ground reliably. It must use Type B mode when utilize ground leakage protection devices (ELCB / RCD).
- Do not touch the wire terminals of HD5L when it is live. The main circuit terminals are neither allowed connecting to the enclosure nor short-circuiting.

Warning

- Do not do dielectric strength test on HD5L.
- For HD5L with more than 2 year's storage, please use regulator to power it slowly.
- 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 HD5L.
- Do not connect the phase-shifting capacitors to the output circuit.
- Be sure HD5L has ceased output before switching motor or change-over switches.
- The HD5L DC bus terminals must not be short-circuited.

4.2 Peripheral Accessories Selection

4.2.1 Wiring Specifications of Input and Output

The AC supply to HD5L must be installed with suitable protection against overload and short-circuits, i.e. MCCB (molded case circuit breaker) or equivalent device.

The recommended specification of MCCB, contactor & cables are shown as Table 4-2.

The size of ground wire should accord with the requirement in 4.3.5.4 of IEC61800-5-1, as shown in Table 4-1.

Table 4-1 Sectional area of ground protective conductor

Sectional area S of phase conductor (power supply cable) while installing (mm^2)	$S \le 2.5$	$2.5 < S \le 16$	$16 < S \le 35$	$S > 35$
Min. sectional area Sp of relative protective conductor (ground cable) (mm^2)	2.5	S	16	S/2

Table 4-2 HD5L I/O wiring specification

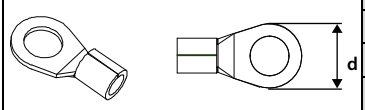
Model	MCCB (A)	Contactor (A)	Supply Cable (mm^2)	Motor Cable (mm^2)	Ground cable (mm^2)	Size
Single-phase / Three-phase power supply: 200 - 240V, 50/60Hz						
HD5L-2D2P2	32	20	6 / 2.5 (1)	2.5	6 / 2.5 (1)	F3
HD5L-2D3P7	63	32	10 / 4 (1)	4	10 / 4 (1)	F3
HD5L-2D5P5	32	20	25 / 6 (1)	6	16 / 6 (1)	F3
HD5L-2D7P5	100 / 40 (1)	63 /32 (1)	25 / 10 (1)	10	16 / 10 (1)	F3
HD5L-2D011	125 / 63 (1)	100 / 40 (1)	25 / 16 (1)	16	16	F4
Three-phase power supply: 380 - 460V, 50/60Hz						
HD5L-2T015	125	100	25	16	16	F5
HD5L-2T018	160	100	25	25	16	F5
HD5L-2T022	200	125	35	35	16	F6
HD5L-2T030	200	125	50	35	25	F6
Three-phase power supply: 380 - 460V, 50/60Hz						
HD5L-4T2P2	16	10	1.5	0.75	2.5	F3
HD5L-4T3P7	25	16	2.5	1.5	2.5	F3
HD5L-4T5P5	32	25	2.5	2.5	2.5	F3
HD5L-4T7P5	40	32	4.0	4	2.5	F3
HD5L-4T011	63	40	6.0	6	2.5	F3
HD5L-4T015	63	40	6.0	10	2.5	F4
HD5L-4T018	100	63	10	10	2.5	F4
HD5L-4T022	100	63	16	16	16	F5
HD5L-4T030	125	100	25	25	16	F5
HD5L-4T037	160	100	25	35	16	F6
HD5L-4T045	200	125	35	35	16	F6
(1): Value before / is for single-phase model, value after / is for three-phase model.						

4.2.2 Power Terminal Lug

Select the lug of power terminal according to the size of terminal, screw size and max. outer diameter of lug. Refer to Table 4-3.

Take the round terminal as an example.

Table 4-3 Selection of power terminal lug



Size	F3 / F4	F5	F6
Screw size	M5	M6	M8
Tightening torque (N. M)	2.5 - 3.0	4.0 - 5.0	9.0 - 10.0
Max. outer diameter of lug d (mm)	12	15.5	24

4.3 Main Circuit

Danger

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

Warning

- Ensure that AC supply voltage is the same as rated input voltage of HD5L.

4.3.1 Supply and Motor Terminal

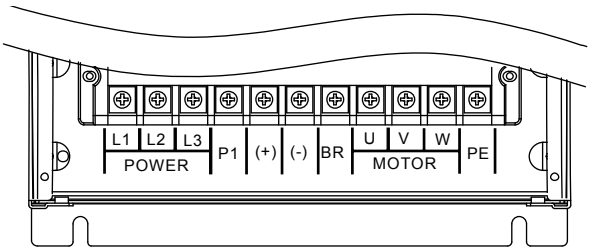


Figure 4-1 Size F3 - F6

Table 4-4 HD5L supply and motor terminal description

Terminal	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	Ground terminal, connect to the ground

4.3.2 Supply and Motor Connection

During trial running, make sure that the elevator will go up when the UP command is enabled.

If the elevator goes down, set F00.08 (Run direction) =1.

The supply and motor connection are shown as Figure 4-2.

For selection of contactor, MCCB, power cable, motor cable and ground cable, refer to section 4.2 Peripheral Accessories Selection (on page 15).

Refer to section 9.3 Braking Resistor (on page 98) for braking resistors.

Refer to section 9.2 Reactor Selection (on page 97) for AC reactors and DC reactors.

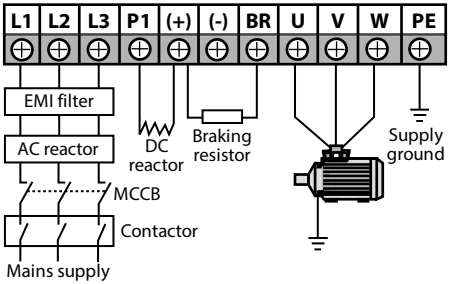


Figure 4-2 Supply and motor connection

4.4 Control Board and I/O Board

Danger

- The control circuit is basically isolated with the power circuit. Do not touch HD5L after it is powered.

Warning

- If the control circuit is connected to external devices with live touchable port, it should increase an additional isolating barrier to ensure that voltage classification of external devices not be changed.
- If connect the communication terminal of the control circuit to the PC, choose the RS485 / 232 isolating converter which meets the safety requirement.
- Only connect the relay terminal to AC 220V voltage signal. Other control terminals are strictly forbiden for this connection.

4.4.1 Control Board Terminal

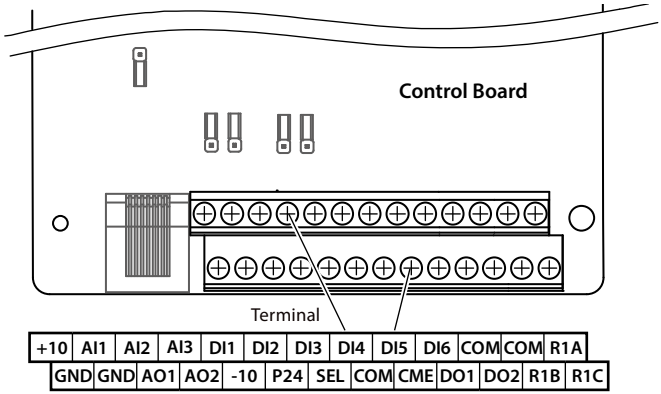


Figure 4-3 Control board terminal

Table 4-5 Control board terminal description

Terminal		Description
+10, GND	+10V power supply	Analogue input use +10V power supply, max. output current is 100mA Analogue input use -10V power supply, max. output current is 10mA GND is isolated to COM
-10, GND	-10V power supply	
AI1, AI2, AI3	Anglogue input	AI1 input voltage: 0 - 10V (input impedance: 34kΩ) AI2, AI3 input voltage: -10V - 10V (input impedance: 34kΩ) AI2, AI3 input current: 0 - 20mA (input impedance: 500Ω) • AI2, AI3 can select voltage / current;
AO1, AO2	Anglogue output	Output voltage / current signal: 0 - 10V / 0 - 20mA Programmable output
GND	Anglogue ground	
DI1 - DI6	Digital input	Programmable bipolar optional input signal Input voltage: 0 - 30VDC DI1 - DI5 input impedance: 4.7kΩ DI6 input impedance: 1.6kΩ
P24, COM	Digital power supply	Digital input use +24V as supply, max. output current is 200mA COM is isolated to CME
SEL	Digital input common terminal	SEL and P24 are connected by default (factory setting) • Disconnect SEL and P24 when use external power to drive DI1 - DI6
DO1, CME	Digital output	Programmable optical-coupled isolation, open collector output Output voltage: 0 - 30VDC, max. output current 50mA CME is isolated to COM, shortly connected to COM by default • Disconnect CME and COM when they are isolating output
DO2, COM	Digital output	
R1A / R1B / R1C	Relay output	Programmable output, contact rating: 250VAC / 3A or 30VDC / 1A • R1B, R1C: Normally closed; R1A, R1C: Normally open

Note:

Limit the current within 3A if the relay terminal is to connect to AC 220V voltage signal.

4.4.2 I/O Board Terminal

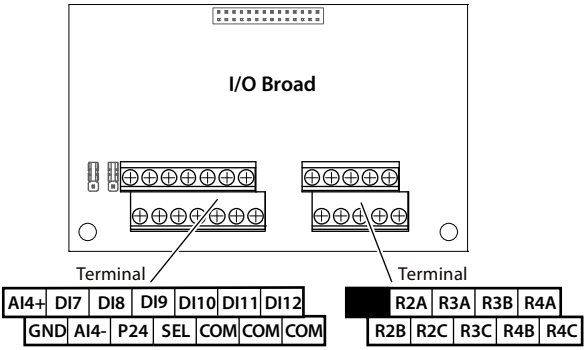


Figure 4-4 I/O board terminal

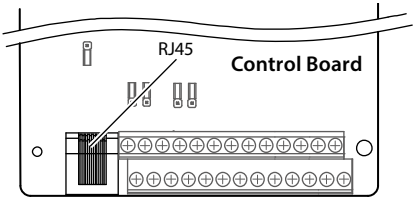
Table 4-6 I/O board terminal description

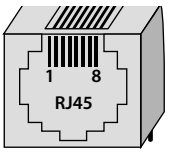
Terminal		Function Description
AI4+, AI4-	Analogue differential input	Selectable input voltage / current Input voltage: -10V - 10V (input impedance: 34kΩ) Input current: 0 - 20mA (input impedance: 500Ω)
GND	Analogue ground	GND is isolated to COM
DI7 - DI12	Digital input	Programmable bipolar optional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

Note:

Limit the current within 3A if the relay terminal is to connect to AC 220V voltage signal.

4.4.3 Modbus Communication Terminal





Pin	Difinition
1,3	+5V
2	485+
4,5,6	GND
7	485-
8	Unused

4.4.4 Jumper

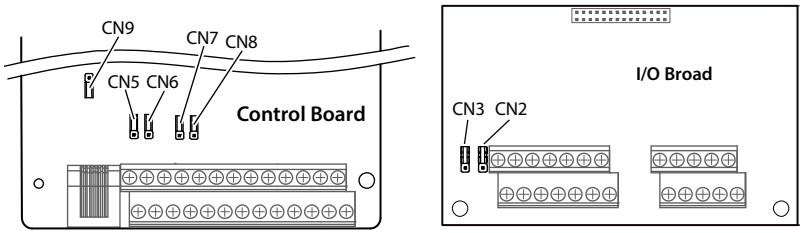
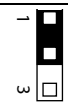
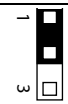
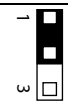
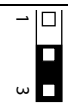
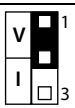
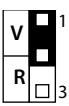


Figure 4-5 Jumper position

Table 4-7 Jumper description

Jumper	Description
Control board CN5 	AI2 can select voltage or current signal. • Pin 1 & 2 are short-connected, AI2 inputs voltage signal (factory setting). • Pin 2 & 3 are short-connected, AI2 inputs current signal.
Control board CN6 	AI3 can select voltage or current signal. • Pin 1 & 2 are short-connected, AI3 inputs voltage signal (factory setting). • Pin 2 & 3 are short-connected, AI3 inputs current signal.
Control board CN7 	AO1 can select voltage or current signal. • Pin 1 & 2 are short-connected, AO1 inputs voltage signal (factory setting). • Pin 2 & 3 are short-connected, AO1 inputs current signal.
Control board CN8 	AO2 can select voltage or current signal. • Pin 1 & 2 are short-connected, AO2 inputs voltage signal (factory setting). • Pin 2 & 3 are short-connected, AO2 inputs current signal.
Control board CN9 	SCI communication can select proper resistance. • Pin 1 & 2 are short-connected, select the proper resistance. • Pin 2 & 3 are short-connected, no resistance (factory setting).
I/O board CN2 	AI4 can select voltage or current signal. • Pin 1 &2 are short-connected, AI4 inputs voltage signal (factory setting). • Pin 2 & 3 are short-connected, AI4 inputs current signal. *Note: Pin 2 &3 of CN3 must be short-connected.*
I/O board CN3 	AI4 can select thermistor. • Pin 1 & 2 are short-connected, AI4 is for the user reference analogue input (factory setting). • Pin 2 & 3 are short-connected, AI4 is for the motor over-heating detection signal input via the external connected thermistor.

4.4.5 Control Terminal Wiring

To reduce the interference and attenuation of control signal, length of control cable should limit within 50m. There should be more than 0.3m between the control cable and the motor cable.

The control cable must be shielded cable. The analogue signal cable must be shielded twisted pair.

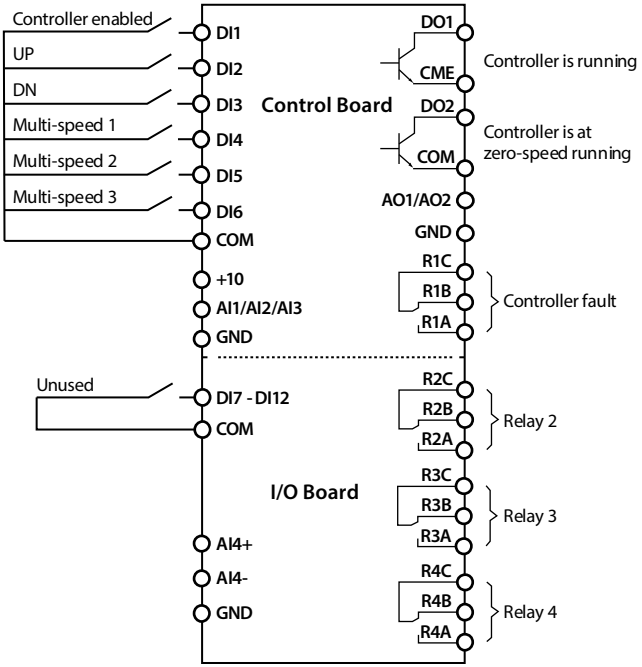


Figure 4-6 HD5L control board connection

Digital Input Connection

Dry contact

Using the internal 24V power supply (SEL and P24 are short-connected at factory) or external power supply (remove the connector between SEL and P24), their connections are shown in Figure 4-7.

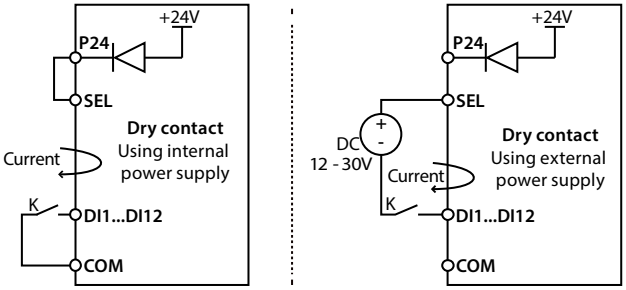


Figure 4-7 Dry contact connection

Source / Drain

Using external power supply, the source / drain connection are shown in Figure 4-8. (Remove the connector between SEL and P24)

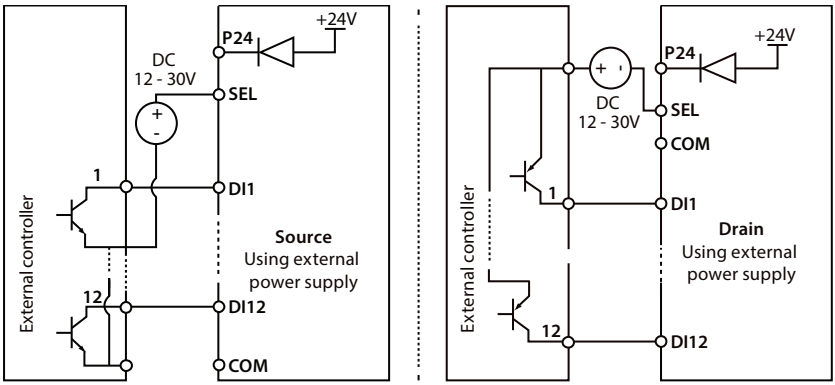


Figure 4-8 Source / Drain connection when using external power

Using internal 24V power supply of HD5L, it is NPN / PNP connection in which external controller is common emitter output, as shown in Figure 4-9. (For PNP, remove the connector between SEL and P24)

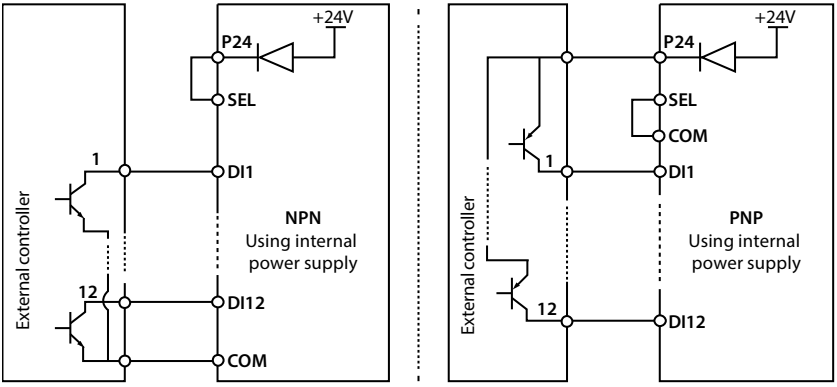


Figure 4-9 NPN (source) / PNP (drain) connection when using internal power supply

Analogue Input Connection

The AI1 is voltage input and the range is 0 - 10V, as shown in Figure 4-10.

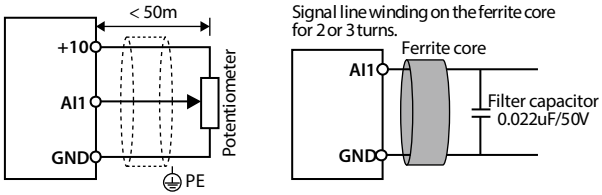


Figure 4-10 AI1 connection

Note:

1. To reduce the interference and attenuation of control signal, length of control cable should limit within 50m, and the shield should be reliably grounded.

2. In serious interference occasions, the analogue input signal should add filter capacitor and ferrite core, as shown in Figure 4-10.

AI2 / AI3 are selected as voltage input and the range is -10 - +10V. When selecting internal +10V of HD5L, refer to Figure 4-10; Selecting +/-10V external supply, refer to Figure 4-11.

AI2 / AI3 are selected as current input and the range is 0 - 20mA, refer to Figure 4-11.

AI3 should correctly set jumper CN2.

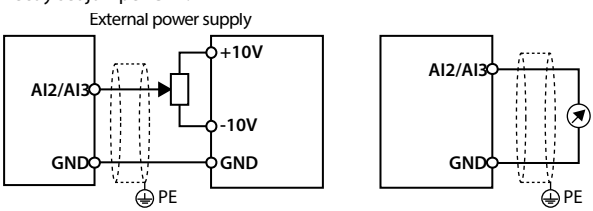


Figure 4-11 AI2 / AI3 connection

When AI4 is used as setting analogue input terminal, the connection is shown as Figure 4-12. (The AI4 + = analogue signal input)

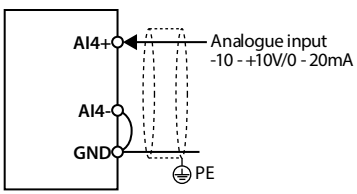


Figure 4-12 AI4 connection (AI4 = analogue input terminal)

When AI4 is used as motor overheat detection signal input terminal, the connection is shown as Figure 4-13. The motor stator coil built-in thermistor to access the analogue input and it should correctly set the jumper.

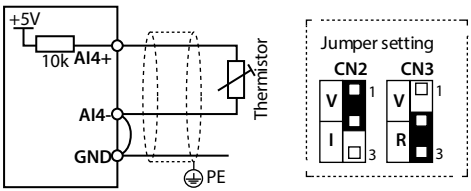


Figure 4-13 AI4 connection (AI4 = overheat detection signal input)

Digital Output Connection

DO1 can use internal 24V power supply of HD5L or external power supply, the connection is shown in Figure 4-14.

DO1 connection also applies to DO2.

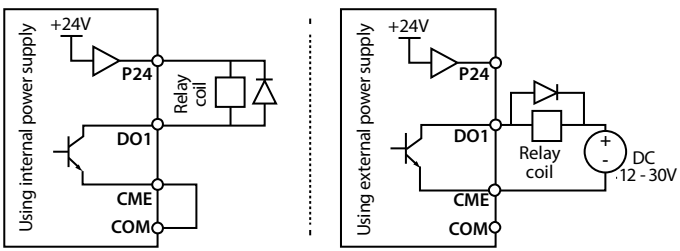


Figure 4-14 DO1 connection

4.5 Encoder Interface Board

4.5.1 Encoder Interface Board Introduction

There are 4 kind encoder interface boards provided for HD5L series controller. And their models and functions are shown as Table 4-8.

Table 4-8 Encoder interface boards

Encoder Interface Boards	Functions
HD-PG2-OC-FD OC encoder interface board with frequency demultiplication (FD) output	• Support the differential ABZ signals and the pulse FD output; • Apply to asyn. motor closed-loop vector control (VC)
HD-PG5-SINCOS-FD SINCOS encoder interface board with FD output	• Support the SINCOS signal and the pulse FD output; • Apply to syn. motor closed-loop vector control (VC)
HD-PG6-UVW-FD Line drive encoder interface board with FD output	• Support the differential ABZ and UVW signal and the pulse FD output; • Apply to syn. motor closed-loop vector control (VC)
HD-PG11-SC-FD SC encoder interface board with FD output	• Support the serial communication signal and the pulse FD output; • Apply to syn. motor closed-loop vector control (VC)

4.5.2 Wiring Requirement

1. Encoder card wire should be laid separately and keep distance from power cables and forbidden to parallel with them.

2. Encoder card wire should be installed inside separated metal conduits and connected to ground firmly.

4.5.3 FD Description

To change the FD coefficient, shift 6-digit FD switches. When the switch shifts to ON, it means "1", otherwise means "0". Convert the 6-digit binary number into decimal number. Multiple the decimal number by 2, the result is FD coefficient, as shown in Figure 4-15.

Maximum value is "111111" which is 63*2 FD.

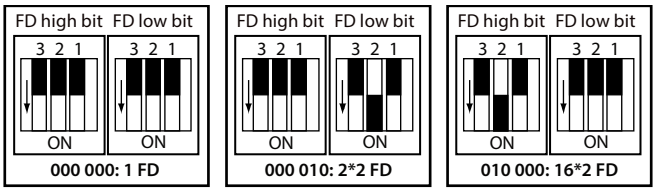


Figure 4-15 Encoder interface board FD description

4.5.4 HD-PG2-OC-FD

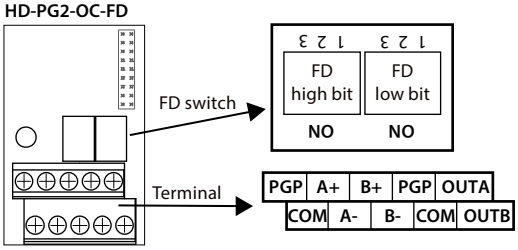


Figure 4-16 HD-PG2-OC-FD

FD Switch

FD switch is shown as section 4.5.3 FD Description.

Terminal Description

Table 4-9 Terminal description

Terminal	Description	Terminal	Description
PGP	+12V power supply output	OUTA	Output A signal, NPN type OC output
COM	Power ground, isolated from GND	OUTB	Output B signal, NPN type OC output
A+ / A-	A+ / A- signals of encoder	COM	Output ground, isolated from GND
B+ / B-	B+ / B- signals of encoder		

Connection

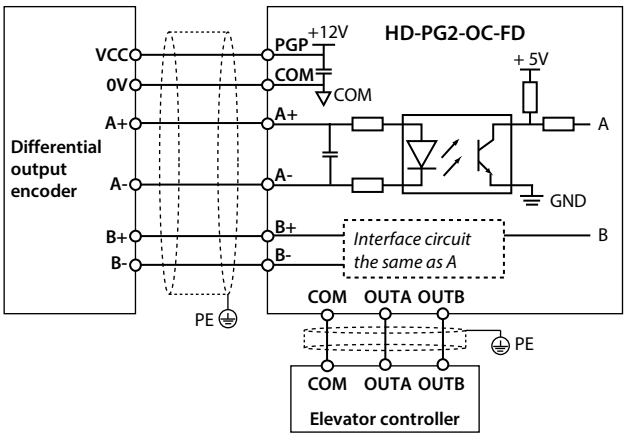


Figure 4-17 Connection of differential output encoder

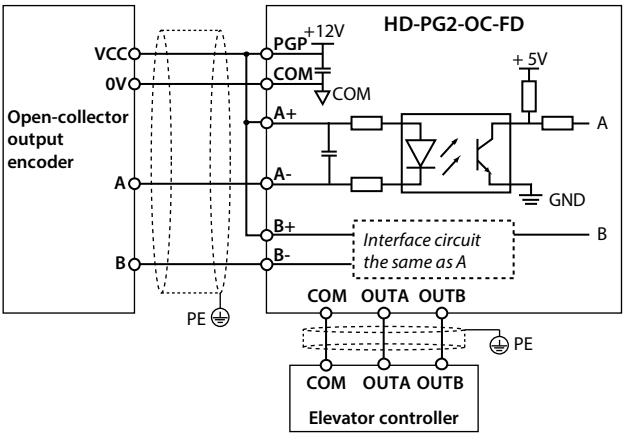


Figure 4-18 Connection of open-collector output encoder

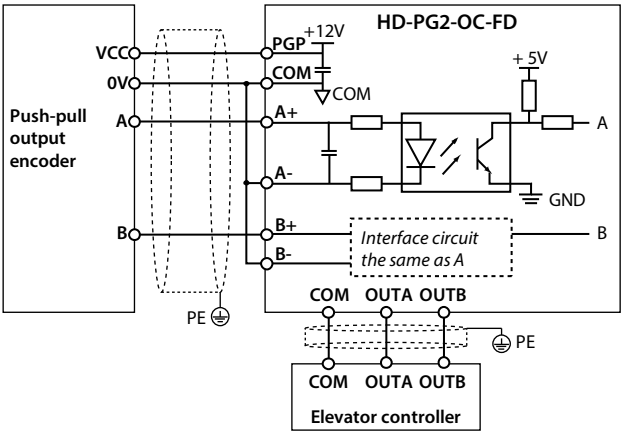


Figure 4-19 Connection of push-pull output encoder

4.5.5 HD-PG5-SINCOS-FD

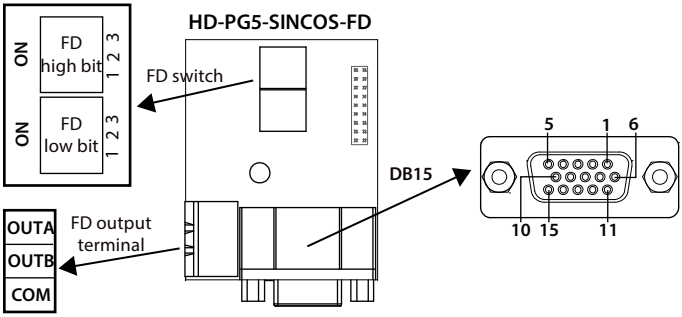


Figure 4-20 HD-PG5-SINCOS-FD

FD Switch

FD switch is shown as section 4.5.3 FD Description.

Terminal Description

Connect the DB15 terminal to the DB15 socket of motor encoder signal cable.

Table 4-10 DB15 terminal and FD output terminal description

Terminal		Description	Terminal		Description
1 / 8	B- / B+	Differential signal B- / B+	12 / 13	D+ / D-	Differential signal D+ / D-
3 / 4	R+ / R-	Differential signal R+ / R-	2 / 14 / 15		Unused
5 / 6	A+ / A-	Differential signal A+ / A-			
7	GND	Power supply ground	OUTA		Output A signal, NPN type OC output
9	PGVCC	+5V power supply	OUTB		Output B signal, NPN type OC output
10 / 11	C+ / C-	Differential signal C+ / C-	COM		Output ground, isolated from GND

Connection

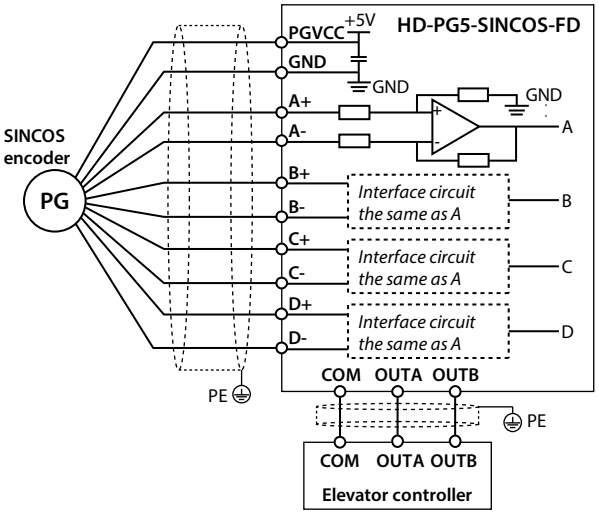


Figure 4-21 Connection of SINCOS encoder

4.5.6 HD-PG6-UVW-FD

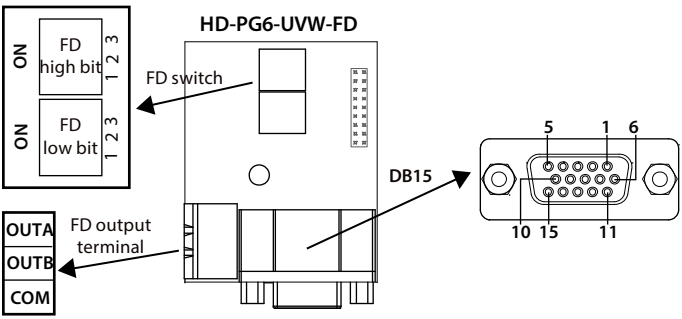


Figure 4-22 HD-PG6-UVW-FD

FD Switch

FD switch is shown as section 4.5.3 FD Description.

Terminal Description

Connect the DB15 terminal to the DB15 socket of motor encoder signal cable.

Table 4-11 DB15 terminal and FD output terminal description

Terminal		Description	Terminal		Description
1 / 2	A+ / A-	Differential signal A+ / A-	13	PGVCC	+5V power supply
3 / 4	B+ / B-	Differential signal B+ / B-	14	PGGND	Power supply ground
5 / 6	Z+ / Z-	Differential signal Z+ / Z-	15		Unused
7 / 8	U+ / U-	Differential signal U+ / U-	OUTA		Output A signal, NPN type OC output
9 / 10	V+ / V-	Differential signal V+ / V-	OUTB		Output B signal, NPN type OC output
11 / 12	W+ / W-	Differential signal W+ / W-	COM		Output ground, isolated from GND

Connection

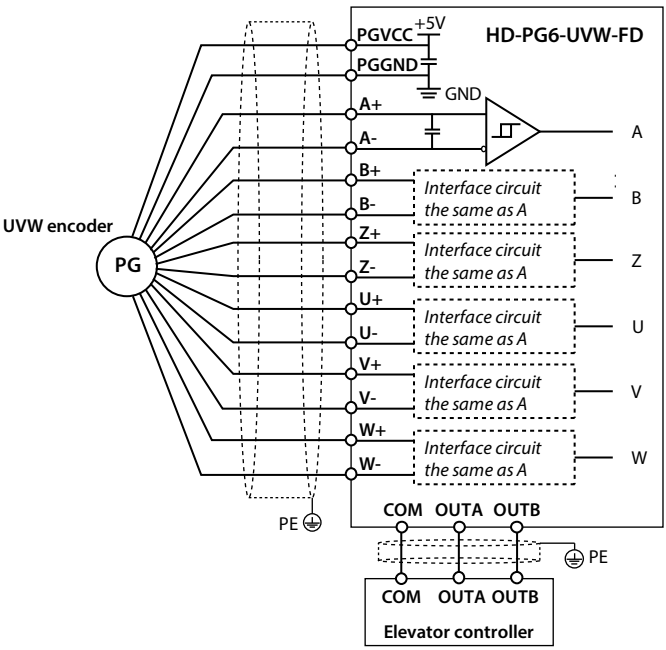


Figure 4-23 Connection of UVW encoder

4.5.7 HD-PG11-SC-FD

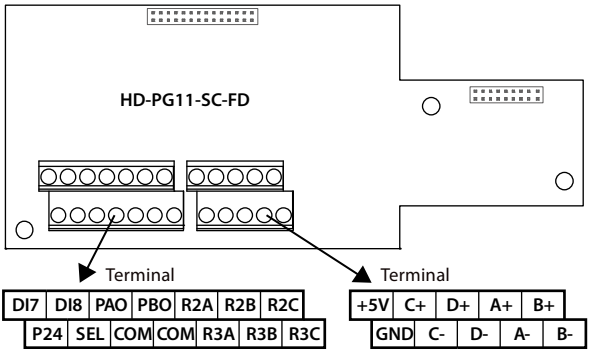


Figure 4-24 HD-PG11-SC-FD

Terminal Description

Table 4-12 FD output terminal signal description

Terminal		Description
DI7 - DI8	Digital input	Programmable bipolar optional input signal Input voltage: 0 - 30VDC (input impedance: 4.7kΩ)
P24, COM	Digital 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 • When DI is drived by external power supply, short jumper between SEL and P24 should be disconnected
PAO / PBO	FD signal	FD output A / B signal
R2A / R2B / R2C R3A / R3B / R3C	Relay output	Programmable output, contact rating: 250VAC / 3A or 30VDC / 1A • RB, RC: Normally closed; RA, RC: Normally open
+5V, GND	+5V power	+5V power supply for PG
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-

Note:

1. Limit the current within 3A if the relay terminal is to connect to AC 220V voltage signal.

2. HD-PG11-SC-FD and I/O board cannot be used at the same time.

FD Description

The FD coefficient of serial communication encoder card with FD output is decided by F16.10.

4.6 Meet EMC Requirement of Installation

4.6.1 Correct EMC Installation

According to 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 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, and the EMI filter and AC 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 electrical characteristics. The recommended installation positions are shown in Figure 4-25.

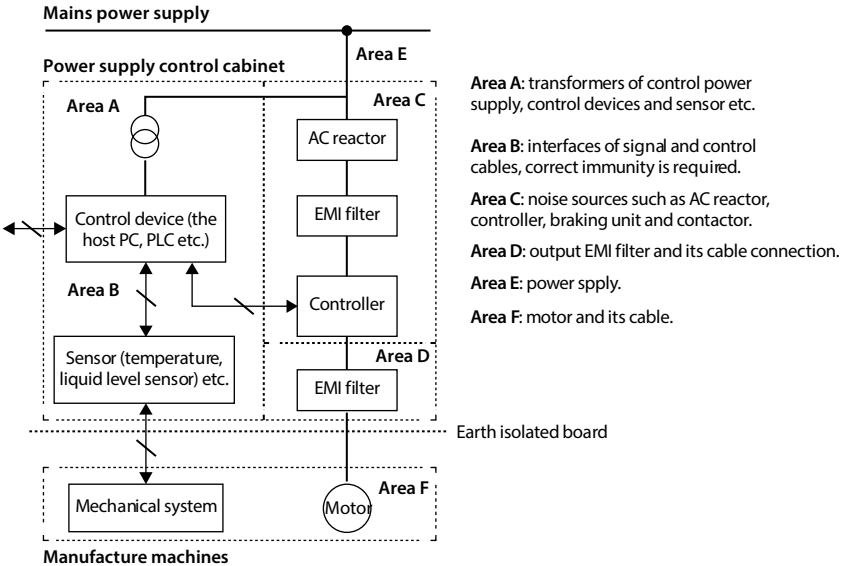


Figure 4-25 System wiring

- All areas should be isolated in space to achieve electromagnetic decoupling effect.
- The min. distance between areas should be 20cm, and use grounding 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.

4.6.2 Wiring Requirement

In order to avoid interference intercoupling, it is recommended to separate the power supply cables, motor cables and the control cables, and keep enough distance among them, especially when the cables are laid in parallel and are long enough.

The signal cables should cross the power supply cables or motor cables, keep it perpendicular (90°) as shown in Figure 4-26.

Distribute the power supply cables, motor cables and control cables in different pipelines.

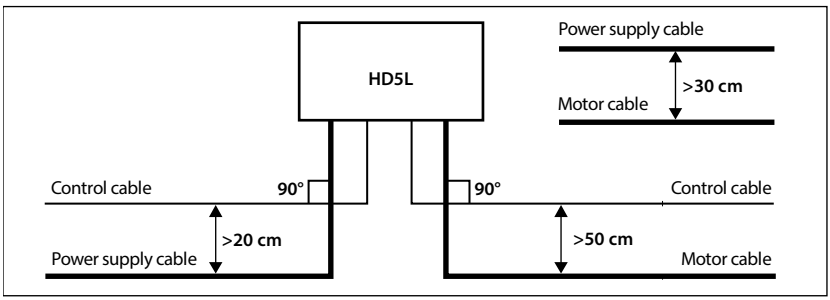


Figure 4-26 System wiring

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 4-27.

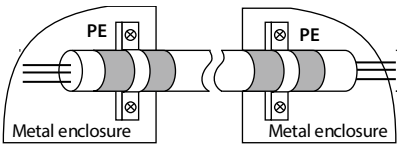


Figure 4-27 Shielded cable connection

4.6.3 Motor Connection

The longer cable between the controller and the motor is, the higher frequency leakage current will be, causing the controller output current to increase as well. This may affect peripheral devices.

When the cable length is longer than 100 meters, it is recommended to install AC output reactor and adjust the carrier frequency according to Table 4-13.

Table 4-13 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 cross sectional area (CSA) of controller cables should refer to Table 4-2, on page 16.

The controller should be derated if motor cables are too long or their CSA is too large. The current should be decreased by 5% when per level of CSA is increased. If the CSA increase, so do the current to ground and capacitance.

4.6.4 Ground Connection

The grounding terminals PE must be connected to ground properly. The grounding cable should be as short as possible (the grounding point should be as close to the controller as possible) and the grounding area should be as large as possible. The grounding resistance should be less than 10Ω.

Do not share the grounding wire with other devices (A). HD5L can share grounding pole with other devices (C). It achieves the best effect if HD5L and other devices use dedicated grounding poles (B), as shown in Figure 4-28.

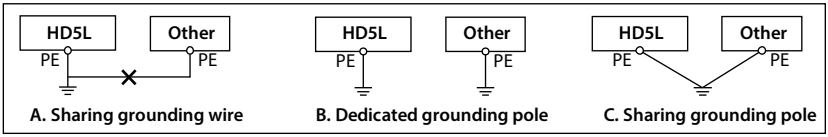


Figure 4-28 Grounding method

When using more than one controller, be careful not to loop the ground wire as shown in Figure 4-29.

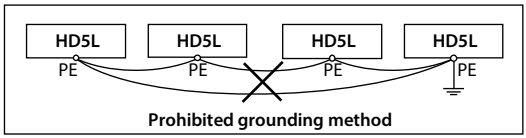


Figure 4-29 Prohibited grounding method

4.6.5 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 is 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 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 grounding of the EMI filter

The enclosure of EMI filter must be grounded properly to the metal case of the controller. In order to achieve better grounding effect, make use of a special grounding terminal on the enclosure. If using one cable to connect the filter to the case, the grounding 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 grounding contact.

4.6.6 Countermeasures for Conduction, Radiation and Radio Frequency Interference

EMI of the Controller

The operating theory of controller 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

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.

Reducing RF Interference

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 4-30.

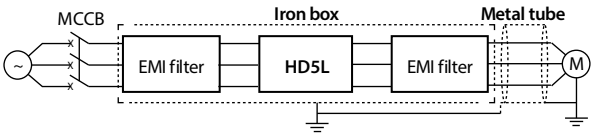


Figure 4-30 Reducing RF interference

4.6.7 Reactor

AC Input Reactor

The purpose of installing an AC input reactor: 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.

DC Reactor

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

AC Output Reactor

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

Chapter 5 Operation Instructions

Danger

- Only when the terminal cover of HD5L 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 HD5L starts.
- To change the MCB, correctly set the parameters before operating.

Warning

- Do not check or detect the signal during HD5L running.
- Do not randomly change HD5L 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 HD5L.
- Do not touch the energy-depletion braking resistor due to the high temperature.

5.1 Function Description

Note:

In the following sections, you may encounter control, running and status of HD3L description many times. Please read this section. It will help you to correctly understand and use the functions to be discussed.

5.1.1 Operation Mode

The operation mode defines how HD5L receives run commands (start or stop command) and speed command. There are selectable through parameter F00.05.

Operation Mode	Description
Keypad control	The run command is controlled by RUN and STOP keys of the keypad; 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 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 have three control modes which are V/f control, SVC control and VC control. (Refer to F00.01 for more detail)

5.1.3 Controller Status

Controller Status	Description
Stop status	After HD5L 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 HD5L and the LCD keypad will be anti-color display STOP under the left.
Run status	The controller will start output from U / V / W terminals after it receives the run command. And the LCD keypad will be anti-color display RUN under the left.
Motor parameters auto-tuning	Set F07.06 / F10.10 = 1 or 2, HD5L will receive the run command then enter motor parameters auto-tuning status. If the auto-tuning process is completed, the controller will enter into stop status.
Fault alarm status	HD5L has fault.
Under-voltage status	HD5L is under-voltage.

5.1.4 Controller Running Mode

Running Mode	Description
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 = 2 or 4.
Inspection running	When inspection signal is valid, the speed will be set by F05.08 (Inspection run speed). This mode is accessible when F00.05 = 1, 2 or 4.
Battery-driven running	When emergency signal is valid, the speed will be set by F05.09 (Battery driven speed). This mode is accessible when F00.05 = 1, 2 or 4.
Normal running	Controlled by keypad (F00.05 = 0) or terminal analogue (F00.05 = 1).

5.2 Operating Instructions

5.2.1 Keypad

The standard HD5L are installed with LCD keypad which is shown in Table 5-1.

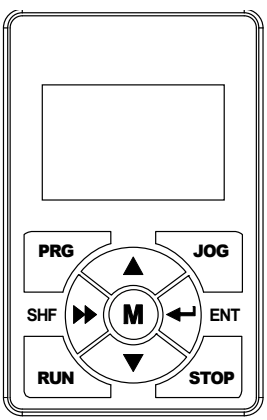


Table 5-1 Key description of keypad

Key	Description
PRG	Entry or exit programming key
JOG	Unused
RUN	In the keypad control, press this key to run HD3L
STOP	a. In the keypad control, press this key to stop HD3L b. In the detection fault, press this key to reset at fault
M	Set certain function by F00.06
▲	Increase value or parameter
▼	Decrease value or parameter
▶▶	a. Select display parameter and shift bit b. Stop in loop / Display the parameter during running
↵	a. Enter lower menu b. Confirm saving the data

5.2.2 Display Status

Note:

LCD anti-color displays: White on black display 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 is changeable. Take* 0.3 5 0 m/s *for example; The units of setting value can be changed.*
2. *If the status is in anti-color displaying, it means that it is in this status. Take* RUN *for example, it means that HD5L is in the run status.*

Parameter display status at stop / run

When HD5l is in stop / run status, the keypad will display stop or run status and its parameters, as shown in Figure 5-1.

Other parameters (F15.08 - F15.13) or (F15.02 - F15.07) can be displayed by pressing ▶▶.

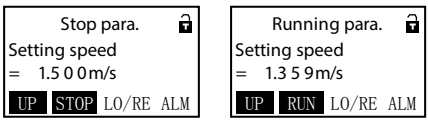


Figure 5-1 Display status of stop (left) and run (right)

Function parameter editing status

At stop, run or fault alarm status, press **PRG** to enter function parameter edit status (see the description of parameter F01.00 and the user password unlock and modify of section 5.2.3), as shown in Figure 5-2.

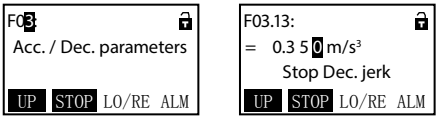


Figure 5-2 Parameter editing status

Fault alarming status

If HD5L detects a fault signal, the keypad will enter the fault alarm status and LCD will display the fault code and name and anti-color display ALM, as shown in Figure 5-3.

The fault history can be checked by entering Group F17.

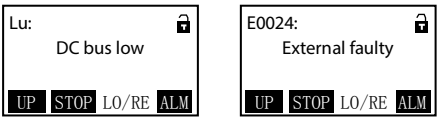


Figure 5-3 Fault alarming status

The reset at fault can be achieved by pressing **STOP** key external terminal.

5.2.3 Keypad Operation Examples

Four-level menu switching operation

The keypad 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 5-4 and the description of the keys is shown in Table 5-2.

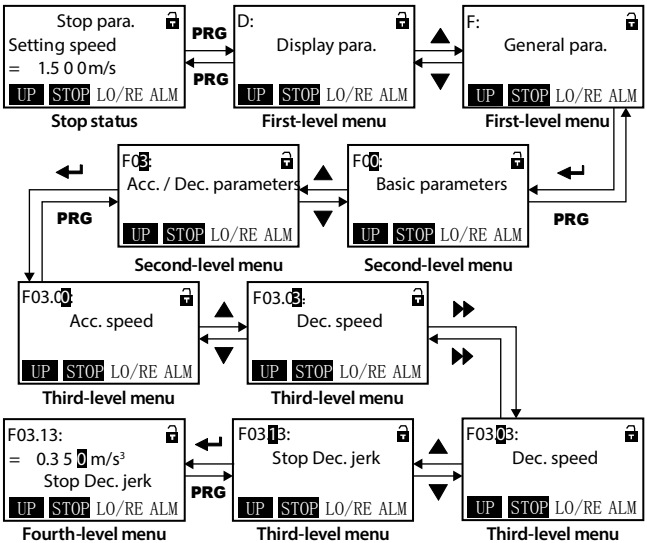


Figure 5-4 Our-level operation process

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 fault display; Fault cleared, return to run or stop status 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

Parameter setting

For example: To modify the setting value of the F00.07 from 1.500m/s to 1.000m/s, refer to Figure 5-5.

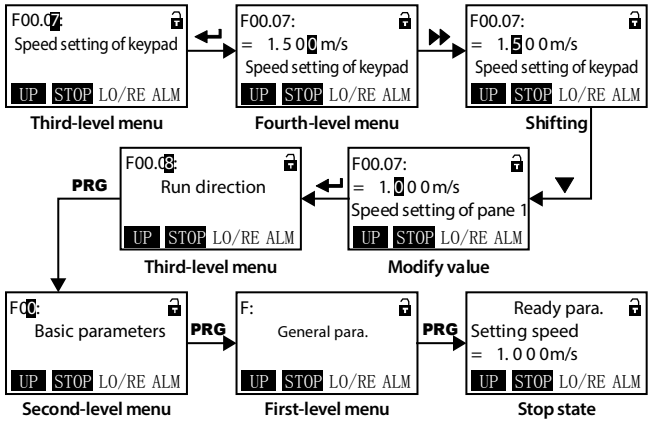


Figure 5-5 Parameter setting

When setting fourth-level menu, 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 the function parameter be modified.
- Only input the correct password can it edit the function parameter due to the valid password.

Switching display parameters at stop status

The keypad can display six stop parameters (F15.08 - F15.13) in loop. Take the default parameter as an example, Figure 5-6 shows the switching process at stop status.

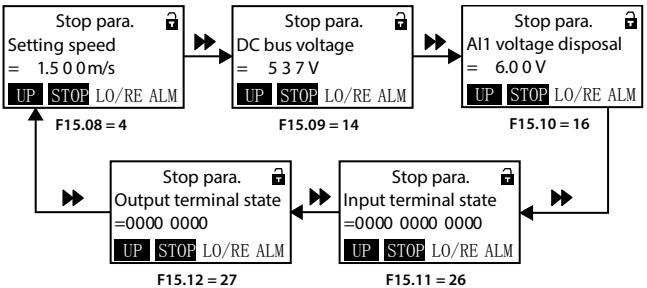


Figure 5-6 Switching display parameters at stop status

Unlock user's password

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

The operation of unlock user's password is as shown in Figure 5-7 which takes 4 as the user's password. The lock identification will be when it successfully unlocks.

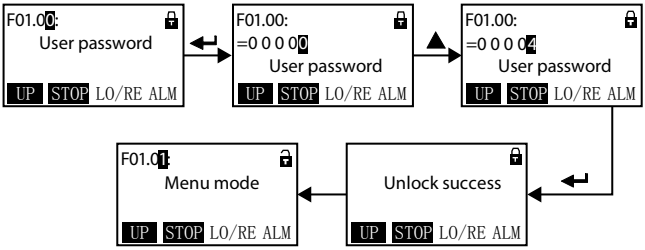


Figure 5-7 Operation of unlocking user's password

Modify user's password

If no password, directly modify the value of F01.00 according to Figure 5-8.

If there is password, unlock the password according to Figure 5-7. When the lock successfully displays the , you can set a new password according to Figure 5-8 which takes "02004" as the new password. When the password is valid, the lock identification will be .

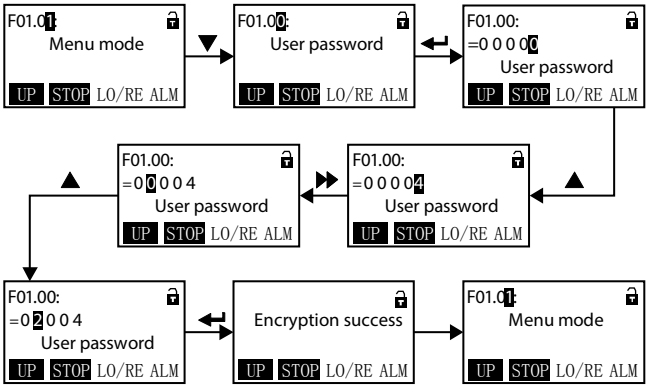


Figure 5-8 Operation of modifying user's password

Clear user's password

If there is password, unlock according to Figure 5-7. When it successfully displays , clear the user's password according to Figure 5-9.

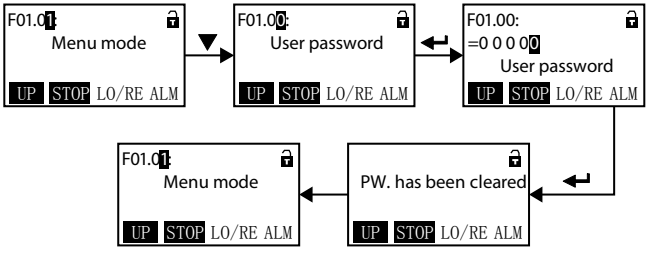


Figure 5-9 Operation of clearing user's password

Upload and download parameters

Upload:

When F01.03 = 1, it uploads the setting value to the keypad. When the upload is finished, the keypad will jump to display F01.00.

Download:

When F01.02 = 2, it downloads the setting value from the keypad. When the download is finished, the keypad will jump to display F01.03.

The upload and download parameters are as shown in.

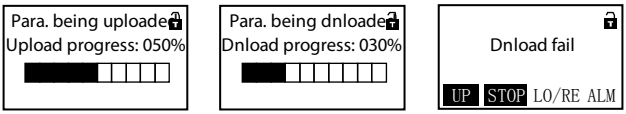


Figure 5-10 Display upload and download parameters

Note:

1. When downloading parameters, it displays "dFAiL" which means that the EEPROM storage parameters of keypad do not match with function parameters of HD5L.
First, upload the setting value of the correct function code to the EEPROM of keypad, and then download.

2. When uploading / downloading parameters, it displays "E0022" (Keypad EEPROM fault). It will jump to next function code 10 seconds later. The troubleshooting is in Chapter 8 (on page 91).

5.3 Initial Power On

It needs 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 initialized. The keypad will display as shown in Figure 5-11.

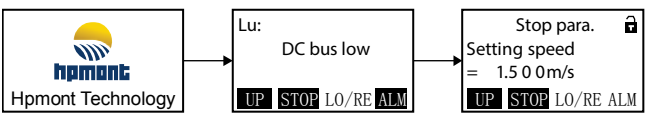


Figure 5-11 Display initialing keypad

Chapter 6 Function Introduction

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

Display Parameters:

General Function Parameters:

6.1 Group D: Display Parameters

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

6.1.1 D00: System Status Parameters

<table>
<tr><th>Ref. Code</th><th colspan="4">Function Description</th><th>Setting Range [Default]</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 controller series.</td></tr>
<tr><td rowspan="2">D00.01</td><td colspan="4">Software version of DSP</td><td>[Actual value]</td></tr>
<tr><td colspan="5">Display software version of DSP.</td></tr>
<tr><td rowspan="2">D00.02</td><td colspan="4">Special software version of DSP</td><td>[Actual value]</td></tr>
<tr><td colspan="5">Display special software version of DSP.</td></tr>
<tr><td rowspan="2">D00.03</td><td colspan="4">Software version of keypad</td><td>[Actual value]</td></tr>
<tr><td colspan="5">Display software version of keypad.</td></tr>
<tr><td rowspan="2">D00.04</td><td colspan="4">Elevator running status</td><td>[Actual value]</td></tr>
<tr><td colspan="5">Display the elevator running status in 16-bit binary. As following:
<table>
<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>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>Bit8: Brake feedback input
0: Invalid
1: Valid</td></tr>
<tr><td colspan="4">Bit7 - bit4: Unused 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>Bit0: Controller enable
0: Disenable
1: Enable</td></tr>
</table></td></tr>
<tr><td rowspan="2">D00.05</td><td colspan="4">Rated current of HD5L</td><td>[Actual value]</td></tr>
<tr><td colspan="5">Display rated current of HD5L.</td></tr>
<tr><td rowspan="2">D00.06</td><td colspan="4">Controller status</td><td>[Actual value]</td></tr>
<tr><td colspan="5">Display HD5L status in 16-bit binary. As following:
<table>
<tr><td>Bit15: Unused</td><td>Bit14: Unused</td><td>Bit13: Stop signal
0: No stop signal
1: Stop signal</td><td>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: Ready</td><td>Bit9: Speed within FAR
0: No
1: Yes</td><td>Bit8: Auto-tuning
0: Not in auto-tuning
1: In auto-tuning</td></tr>
<tr><td>Bit7: Zero-speed running
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: Unused 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>Bit0: Controller fault
0: No fault
1: Fault</td></tr>
</table></td></tr>
</table>

6.1.2 D01: Drive Status Parameters

Ref. Code	Function Description	Setting Range [Default]
D01.00	**Control mode**	[Actual value]
	Display cotrol mode.	
D01.01	**Setting speed (m/s)**	[Actual value]
	Display setting speed.	
D01.02	**Setting speed (after Acc. / Dec.) (m/s)**	[Actual value]
	Display speed which is calculated by Acc. / Dec. S curve.	
D01.03	**Feedback speed (m/s)**	[Actual value]
	Display actual speed of elevator.	
D01.04	**Setting frequency**	[Actual value]
	Display setting frequency.	
D01.05	**Setting frequency (after Acc. / Dec.)**	[Actual value]
	Display frequency (after Acc. / Dec).	
D01.06	**Output frequency**	[Actual value]
	Display output frequency.	
D01.07	**Setting Rpm**	[Actual value]
	Display setting Rpm.	
D01.08	**Running Rpm**	[Actual value]
	Display running Rpm.	
D01.09	**Unused**	
D01.10	**Output voltage**	[Actual value]
	Display output voltage.	
D01.11	**Output current**	[Actual value]
	Display output current.	
D01.12	**Output torque**	[Actual value]
	Display output torque which is the relative percentage of the motor rated torque.	
D01.13	**Output power**	[Actual value]
	Display output power which is the relative percentage of rated power of motor.	
D01.14	**DC bus voltage**	[Actual value]
	Display DC bus voltage.	
D01.15 - D01.16 Unused		

6.1.3 D02: Analogue Status Display Parameters

Ref. Code	Function Description	Setting Range [Default]
D02.00	**AI1 voltage**	**[Actual value]**
	Display AI1 input voltage.	
D02.01	**AI1 voltage (after calculating)**	**[Actual value]**
	Display A1 input voltage which is calculated by the gain, bias and filter.	
D02.02	**AI2 voltage**	**[Actual value]**
	Display AI2 input voltage. When AI2 selects current input, -10.00V corresponds to 0mA, and 10.00V corresponds to 20mA.	
D02.03	**AI2 voltage (after calculating)**	**[Actual value]**
	Display A2 input voltage which is calculated by the gain, bias and filter.	
D02.04	**AI3 voltage**	**[Actual value]**
	Display AI3 input voltage. When AI3 selects current input, -10.00V corresponds to 0mA, and 10.00V corresponds to 20mA.	
D02.05	**AI3 voltage (after calculating)**	**[Actual value]**
	Display A3 input voltage which is calculated by the gain, bias and filter.	
D02.06	**AI4 voltage**	**[Actual value]**
	Display AI4 input voltage. When AI4 selects current input, -10.00V corresponds to 0mA, and 10.00V corresponds to 20mA.	
D02.07	**AI4 voltage (after calculating)**	**[Actual value]**
	Display AI4 input voltage which is calculated by the gain, bias and filter.	
D02.08	**AO1 output**	**[Actual value]**
	Display AO1 output. When AO1 selects current output, 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 D03: Running Status Parameters

<table>
<tr><th>Ref. Code</th><th>Function Description</th><th>Setting Range [Default]</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 status</td><td>[Actual value]</td></tr>
<tr><td></td><td colspan="2">Display input terminal status. Each bit (binary) of this parameter stands for different physical channels which are in the below table.
• 0: Digital input terminals disconnects with common terminals.
• 1: Digital input terminals connects 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 status</td><td>[Actual value]</td></tr>
<tr><td></td><td colspan="2">Display output terminal status. Each bit (binary) of this parameter stands for different physical channels 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 status</td><td>[Actual value]</td></tr>
<tr><td></td><td colspan="2">Display MODBUS communication status.
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 displays 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 HD5L.</td></tr>
<tr><td>D03.07</td><td>Present fault</td><td>[Actual value]</td></tr>
<tr><td></td><td colspan="2">Display present fault.</td></tr>
</table>

6.1.5 D04: Encoder Status Parameters

Ref. Code	Function Description	Setting Range [Default]
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 status of UVW encoder**	**[Actual value]**
	Display the UVW status of UVW encoder.	
D04.05	**Electrical angle**	**[Actual value]**
D04.06 - D04.07 Unused		
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 Unused		
D04.12	**Pulses monitoring of slip in start**	**[Actual value]**
D04.13	**Judgement sources for start stability**	**[Actual value]**
D04.14	**Unused**	
D04.15	**Rotating self-tuning encoder pulse change judgment variable**	**[Actual value]**
	It is used to judge whether the number of encoder pulses of the rotating auto-tuning is correct. According to the parameters of the motor, the formula is calculated. If the result is close to D04.15, the self-tuning is correct. • Formula: 4* encoder line number / (motor pole pair number * 6)	
D04.16 - D04.28 Unused		
D04.29	**Oftware version for hpmont stuff**	**[Actual value]**

6.2 Group F: General Function Parameters

6.2.1 F00: Basic Parameters

Ref. Code	Function Description	Setting Range [Default]
F00.00	**Motor type**	**0,1 [0]**
	0: Asyn. motor. 1: Syn. motor.	
F00.01	**Control mode**	**0 - 4 [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 the control effect is not so good as the vector control. • When select V/f control, 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 asyn. motor. 2: Closed-loop vector control. Sensor vector control. • Closed-loop vector and applicable for high accuracy speed control occasion. Generally the elevator will take this mode. 3: Unused. 4: SVC control 2. ***Note:*** *1. V/f and SVC control are temporary running modes applicable when the motor does not install encoder and the elevator is in inspection running.* *2. Set motor parameter auto-tuning when select SVC or closed-loop vector control mode.* ***Auto-tuning steps:*** *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	**Rated speed of elevator**	**0.100 - 4.000 [1.500m/s]**
	Refers to nominal rated speed of elevator. • All speed setting value in the parameters must < F00.02.	
F00.03	**Max. output frequency of HD5L**	**5.00 - 100.00 [50.00Hz]**
	Defines the max. frequency that HD5L is allowed to output. • Be careful to set reasonable parameters according to the nameplate of the motor and the actual operating conditions.	
F00.04	**Mechanical parameters of motor**	**10.0 - 6000.0 [60.0]**
	Defines the relationship between the elevator speed and the motor rotary speed. • The mechanical parameters are calculated based on the motor parameters. They determine the control precision and must be correctly set. The relationship of elevator speed and rotary speed of motor is: $$\text{Elevator speed (m/s)} = \frac{\text{Rotary speed of motor (rpm)}}{60} \times \frac{\text{F00.04}}{1000}$$ The formula for calculating F00.04 is: $$\text{F00.04} = \frac{\pi \times \text{D}}{\text{i} \times \text{Winding mode}}$$ *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.*	

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Ref. Code	Function Description	Setting Range [Default]
F00.05	**Operating mode**	**0 - 5 [0]**
	0: Keypad control. • Controlled by pressing the RUN or STOP key of the keypad. 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: Unused. 4: SCI control. • The run command and the run multi-step speed are set by PC communication. 5: Unused.	
F00.06	**M-key function**	**0,1 [0]**
	0: Unused. 1: UP / DN switch. • Switch the UP / DN of motor with M key on the keypad.	
F00.07	**Speed setting of keypad**	**0.000 - F00.02 [1.500m/s]**
	F00.05 = 0, it sets 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 F01: Protection of Parameters

Ref. Code	Function Description	Setting Range [Default]
F01.00	**User's 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 keypad within 5 minutes, the user's password will be valid. • To change the parameters, input correct password. Otherwise can not change any parameter via keypad, but only check. 00000: The factory setting and no user's password. • If user unlocks the password, it means clearing the user's password. • To unlock, change and clear the user's password, refer to section 5.2.3.	
F01.01	**Menu mode**	**0,1 [0]**
	0: Full menu mode. • All parameters can be displayed. 1: Checking menu mode. • Only parameters different from factory setting can be displayed.	
F01.02	**Function code parameter initialization**	**0 - 3 [0]**
	0: No operation. HD5L is in regular parameter read / write status. • Whether can change the parameter depends on the user's password status and the actual operating conditions of HD5L. 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. • Steps: If set F01.02 = 1, press ↵ to ensure and the parameters are restored to factory settings. The keypad dispalys "loading defualt para.". Then the keypad will display parameters in stop status 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 cleared.	
F01.03	**Keypad EEPROM parameter initialization**	**0,1 [0]**
	0: No operation. • HD5L is in regular parameter read / write status. 1: Parameter upload. • Upload the current function code settings to the keypad EEPROM parameter. *Note: Group F01, F17.11 - F17.27, Group F18 and Group Y do not upload.*	

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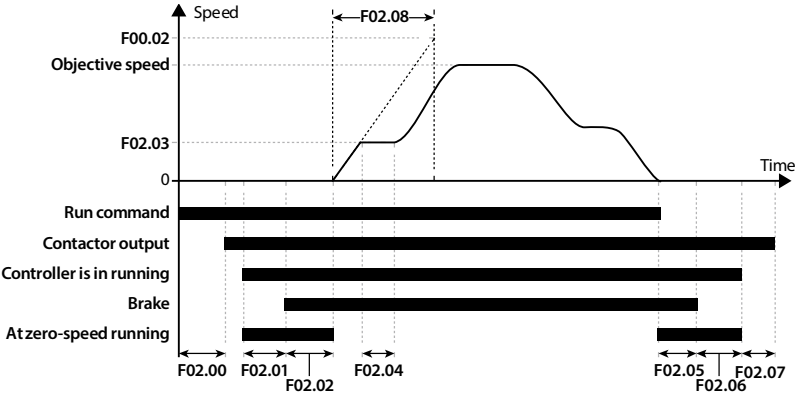
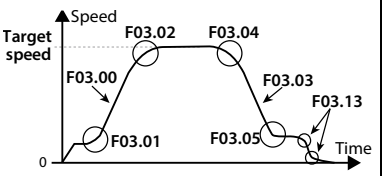
6.2.3 F02: Start & Stop Parameters



Ref. Code	Function Description	Setting Range [Default]
F02.00	**Start delay time**	**0.000 - 4.999 [0.000s]**
	When HD5L receives the run command, it will wait for the delay time set by F02.00 and then start running. • When controlled by keypad (F00.05 = 0), F02.00 is invalid.	
F02.01	**Brake open delay time**	**0.000 - 4.999 [0.000s]**
	Defines the time from zero-speed running to output brake-open command. • F02.01 enables HD5L to enter running status 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]**
	Defines the retention time from brake-open to output with speed. During the retention time, the motor has output torque, which makes more comfortable. • F06.00 = 4 (no weighing auto-compensation is used), the value of F02.02 should exceed 0.5s.	
F02.03	**Start speed**	**0.000 - 0.400 [0.000m/s]**
	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]**
	Defines the time in whichHD5L runs at start speed (F02.03).	
F02.05	**Brake close delay time**	**0.000 - 4.999 [0.200s]**
	Defines the time interval from zero-speed running to output brake-closed command.	
F02.06	**Retention time of stop zero-speed**	**0.000 - 4.999 [0.300s]**
	Defines the time during which the motor runs at zero-speed and has output torgue at stop, which makes more comfortable.	
F02.07	**Contactor close delay time**	**0.000 - 4.999 [0.000s]**
	Defines the running contactor delay release time after the run command is revoked.	
F02.08	**Start ramp time**	**0.000 - 2.000[0.000s]**
	Defines the time that elevator takes to accelerate from zero to the rated speed (F00.02). • F02.08 = 0, the elevator starts from start speed directly.	
F02.09	**Unused**	

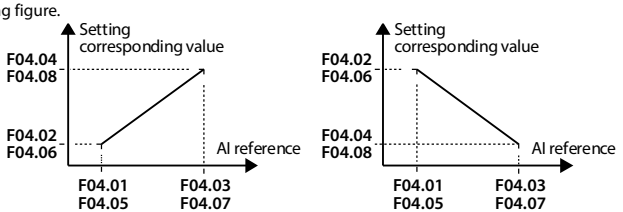
6.2.4 F03: Acc. / Dec. Parameters

Ref. Code	Function Description	Setting Range [Default]
F03.00	**Acc. 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	**Dec. 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 Acc. • 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]**
	Defines the Acc. speed of elevator at inspection run mode.	
F03.07	**Inspection Dec. speed**	**0.020 - 9.999 [1.000m/s²]**
	Defines the Dec. speed of elevator at inspection run mode.	
F03.08	**Battery driven Acc. speed**	**0.020 - 9.999 [1.000m/s²]**
	Defines the Acc. speed of elevator at battery driven mode.	
F03.09	**Battery driven Dec. speed**	**0.020 - 9.999 [1.000m/s²]**
	Defines the Dec. speed of elevator at battery driven mode.	
F03.10	**Asyn. motor auto-tuning Acc. speed**	**0.020 - 9.999 [0.100m/s²]**
	Defines the acceleration speed at auto-tuning of motor.	
F03.11	**Asyn. motor auto-tuning Dec. speed**	**0.020 - 9.999 [0.100m/s²]**
	Defines the deceleration speed at auto-tuning of motor.	
F03.12	**Abnormal Dec. speed**	**0.020 - 9.999 [1.000m/s²]**
	Defines the deceleration speed at valid forced or wrong run mode.	
F03.13	**Stop Dec. jerk**	**0.020 - 9.999 [0.350m/s²]**
	Defines Dec. change rate from non-zero speed to zero speed. It can adjust the smooth stop of the elevator and ass riding comfort.	
F03.14	**Asyn. motor field-weakening optimization**	**0 - 2 [0]**
	0: No field-weakening optimization. 1: Optimize according to voltage. 2: Optimize according to current. F03.14 = 1 or 2, it can reduce the current noise and improve the dynamic performance of asyn. motor.	
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 asyn. motor field-weakening so that user need not regulate them usually.	
F03.18	**Unused**	

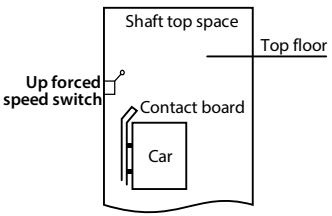
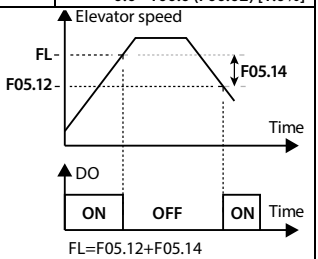
Ref. Code	Function Description	Setting Range [Default]
F03.19	**Sincos encoder CD phase learning**	**0,1 [0]**
	0: Learning. 1: Not learning.	
F03.20	**Unused**	

6.2.5 F04: Analogue Curve Parameters

Ref. Code	Function Description	Setting Range [Default]
F04.00	**Setting curve**	**0000 - 1111 [0000]**
	Unit: AI1 characteristic curve selection. Ten: AI2 characteristic curve selection. Hundred: AI3 characteristic curve selection. Thousand: AI4 characteristic curve selection. Each bit setting: • 0: Line 1. • 1: Line 2.	
F04.01	**Line 1 min. setting**	**0.0 - F04.03 [0.0%]**
F04.02	**Corresponding value of line 1 min. setting**	**0.0 - 100.0 [0.0%]**
F04.03	**Line 1 max. setting**	**F04.01 - 100.0 [100.0%]**
F04.04	**Corresponding value of line 1 max. setting**	**0.0 - 100.0 [100.0%]**
F04.05	**Line 2 min. setting**	**0.0 - F04.07 [0.0%]**
F04.06	**Corresponding value of line 2 min. setting**	**0.0 - 100.0 [0.0%]**
F04.07	**Line 2 max. setting**	**F04.05 - 100.0 [100.0%]**
F04.08	**Corresponding value of line 2 max. setting**	**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.	



6.2.6 F05: Speed Parameters

Ref. Code	Function Description	Setting Range [Default]
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 rated speed of elevator.	
F05.08	**Inspection run speed**	**0.000 - 0.630 [0.200m/s]**
	Defines the running speed of elevator in the inspection mode.	
F05.09	**Battery driven run speed**	**0.000 - F00.02 [0.100m/s]**
	Defines the running speed of elevator in the battery driven run mode.	
F05.10	**Up forced speed switch detection value**	**0.0 - 100.0 (F00.02) [97.0%]**
	Defines the speed detection value at the forced switch action. • After forced switch act, the running speed exceeds speed switch detection value, and decelerates to F05.22 (Creeping speed) according to F03.12 (Abnormal Dec. speed). • Properly set F05.10 to avoid climbing elevator at elevator up.	
F05.11	**Down forced speed switch detection value**	**0.0 - 100.0 (F00.02) [97.0%]**
	To avoid plunging elevator at elevator down. Refer to F05.10.	
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) FL in the right figure, ON indicating signal will output till the running speed is lower than F05.12. • Refer to parameter F05.12 and F05.14 about F05.13 and F05.15.	 FL=F05.12+F05.14

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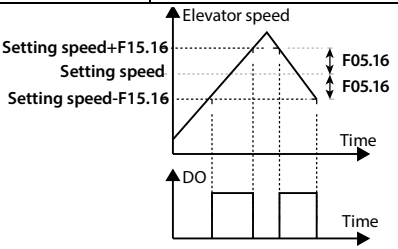
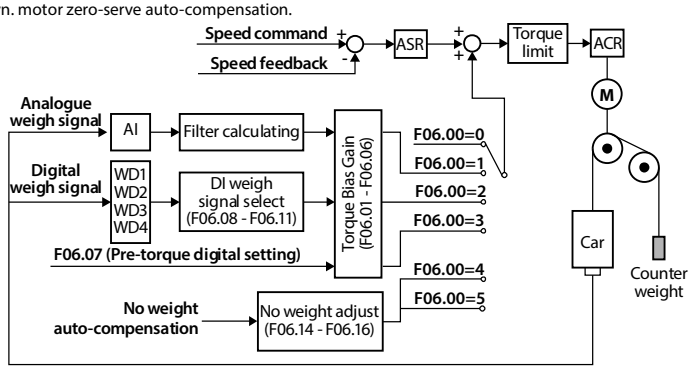
Ref. Code	Function Description	Setting Range [Default]
F05.16	**Speed within FAR range**	**0.0 - 20.0 [1.0%]**
	The pulse signal will output if elevator speed is within the FAR range. As shown in the right figure. 	
F05.17	**Over-speed setting**	**80.0 - 120.0 (F00.02) [115.0%]**
F05.18	**Over-speed detection time**	**0.0 - 2.0 [0.2s]**
	When the actual elevator speed exceeds F05.17 and the duration time exceeds F05.18, HD5L alarms E0032 fault (Motor over speed). • F05.18 = 0, HD5L 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 actual run speed of motor exceeds F05.19 and the duration time exceeds F05.20, HD5L alarms E0018 fault (Excessive speed deviation). • F05.19 or F05.20 = 0, HD5L does not detect the excessive speed deviation fault of motor.	
F05.21	**Unused**	
F05.22	**Creeping speed**	**0.000 - 0.400 [0.050m/s]**
	Defines the running speed at the forced Dec. run.	
F05.23 - F05.25 Unused		

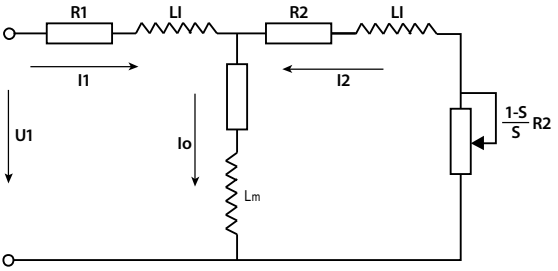
6.2.7 F06: Weighing Compensation Parameters

Ref. Code	Function Description	Setting Range [Default]
F06.00	**Pre-torque selection**	**0 - 5 [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 analogueweight signal. 2: DI setting. • Output balancing torque according to the input digital weight signal. 3: Digital pre-torque. Select 3 if no weighing device is at the elevator. • Then adjust the pre-torque digital setting parameter to make the elevator fully 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: Asyn. 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 load.	
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 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.	



Ref. Code	Function Description	Setting Range [Default]
F06.12	Unused	
F06.13	Unused	
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 response can be expedited through increasing F06.14 - F06.16, but system oscillation and overshoot may occur if the value of F06.14 - F06.16 is too high. • Generally, it can smoothly start elevator via adjusting F06.14 when debugging. • Increase F06.14 to avoid sliding vehicle at starting moment. Decrease F06.17 to avoid shake at starting moment.	
F06.17 - F06.20 Unused		

6.2.8 F07: Asyn. Motor Parameters



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

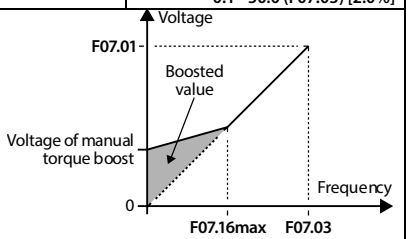
The relationship between rated torque current, excitation current and rated current of motor is:

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

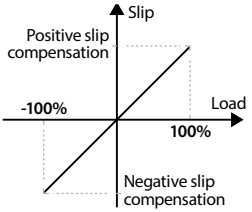
$$\text{Excitation current F07.11} = \sqrt{1 - \text{F07.05}^2} \times \text{F07.02}$$

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

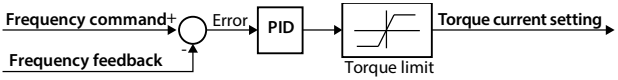
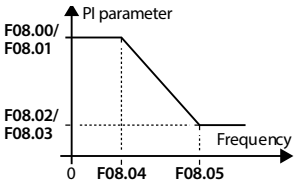
Ref. Code	Function Description	Setting Range [Default]
F07.00	Rated power of asyn. motor	0.2 - 500.0kW [Depend on HD5L]
F07.01	Rated voltage of asyn. motor	0V - Controller rated voltage [Depend on HD5L]
F07.02	Rated current of asyn. motor	0.0 - 999.9A [Depend on HD5L]
F07.03	Rated frequency of asyn. motor	1.00 - 100.00 [50.00Hz]
F07.04	Rated Rpm of asyn. motor	1 - 24000 [1440rpm]
F07.05	Power factor of asyn. motor	0.001 - 1.000 [Depend on HD5L]

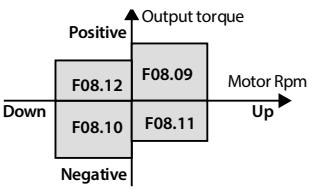
Ref. Code	Function Description	Setting Range [Default]
F07.06	**Parameter auto-tuning of asyn. motor**	**0 - 2 [0]**
	0: No action. 1: Stationary auto-tuning. 2: Rotary auto-tuning. **Motor auto-tuning:** • In the process of motor stationary auto-tuning, the stator resistance (F07.07), rotor resistance (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). • At stationary 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; • At rotary auto-tuning (F07.06 = 2), the motor will be at rotary status and the auto-measured value will be written into F07.10 and F07.11. • When the motor is in rotary status, the oscillation and even the overcurrent might occur. In this case, 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 keypad control mode (F00.05 = 0).* **Auto-tuning steps:** 1. Input correct motor parameters as per its nameplate (F07.00 - F07.04). 2. F07.06 = 2, set proper Acc. speed (F03.10) and Dec. speed (F03.11) and make sure the motor is disconnected with the load for security. 3. F07.06 = 1 or 2, 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 keypad will return to stop display status and F07.06 resets to 0.	
F07.07	**Stator resistance of asyn. motor**	**0.000 - 65.535Ω [Depend on HD5L]**
F07.08	**Rotor resistance of a syn. motor**	**0.000 - 65.535Ω [Depend on HD5L]**
F07.09	**Leakage inductance of asyn. motor**	**0.0 - 6553.5mH [Depend on HD5L]**
F07.10	**Mutual inductance of asyn. motor**	**0.0 - 6553.5mH [Depend on HD5L]**
F07.11	**Excitation current of asyn. motor**	**0.0 - 999.9A [Depend on HD5L]**
F07.12	**Core saturation coefficient 1 of asyn. motor**	**0.00 - 0.50 [0.50]**
F07.13	**Core saturation coefficient 2 of asyn. motor**	**0.00 - 0.75 [0.75]**
F07.14	**Core saturation coefficient 3 of asyn. motor**	**0.00 - 1.20 [1.20]**
F07.15	**Asyn. motor torque boost**	**0.1 - 30.0 [0.1%]**
F07.16	**Torque boost end-point of asyn. motor**	**0.1 - 50.0 (F07.03) [2.0%]**
	To compensate the torque drop at low frequency, HD5L can boost the voltage so as to boost the torque. F07.16 is relative to percentage of rated frequency of motor (F07.03).	

6

Ref. Code	Function Description	Setting Range [Default]
F07.17	**Slip compensation gain of asyn. motor**	**0.0 - 300.0 [100.0%]**
F07.18	**Slip compensation filter time of asyn. motor**	**0.1 - 10.0 [0.1s]**
F07.19	**Slip compensation limit of asyn. motor**	**0.0 - 250.0 [200.0%]**
	The slip of motor changes with the load torque, which results in the variance of motor speed. Through slip compensation (HD5L will auto adjust its output frequency according to the motor load torque) can reduce the influence. • In driving status (actual speed < setting speed) and in generating status (the actual speed > setting speed), the slip compensation gain (F07.17) can be increased gradually. • The value of auto slip compensation depends on rated slip of motor, so make sure the rated frequency (F07.03) and rated Rpm (F07.04) are set correctly. • Range of slip compensation = 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: Disabled. 1: Enabled all the time. 2: Disabled in Dec. 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 Dec. process, if F07.20 = 0 or 2, the running current will be a little higher; While if F07.20 =1, the motor will decelerate steadily and the current will be smaller.	
F07.21	**Oscillation-suppression mode of asyn. motor**	**0,1 [0]**
	0: Depend on exciting component. 1: Depend on torque component.	
F07.22	**Oscillation-suppression coefficient of asyn. motor**	**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 F08: Motor Vector Control Speed-loop Parameters

Ref. Code	Function Description	Setting Range [Default]
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 switching frequency 1	0.00 - 50.00 [10.00Hz]
F08.05	ASR PI switching frequency 2	0.00 - 50.00 [15.00Hz]
	F08.00 - F08.05 and F08.07 confirm the PID parameters of ASR. The structure of ASR is shown in figure.  As the right figure: • When HD5L operates with 0 - F08.04, the PI parameters of vector control are F08.00 and F08.01; • WhenHD5L operates above F08.05, the PI parameters of vector control are F08.02 and F08.03; • When HD5L operates within 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 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 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, adjust the KP firstly to the max. condition that the system does not vibrate, and then adjust the KI to shorten the response time without overshoot. • To shorten dynamic response time during low frequency running, increase KP and KI.	
F08.06	ASR integral limit	0.0 - 200.0 (F07.02) [180.0%]
	It is used to limit the max. value of the vector control speed-loop integral.	
F08.07	ASR differential time	0.000 - 1.000 [0.000s]
	Defines the vector control speed-loop differential time. • Generally, it doesn't need to set F08.07 except for expediting the dynamic response. • F08.07 = 0, there is no speed-loop differential.	
F08.08	ASR output filter time	0.000 - 1.000 [0.008s]
	It is used to filter the output of ASR regulator. • F08.08 = 0, the speed-loop filter is unused.	

Ref. Code	Function Description	Setting Range [Default]
F08.09	UP electrical torque limit	0.0 - 200.0 (F07.02) [180.0%]
F08.10	DN electrical torque limit	
F08.11	UP regenerative torque limit	
F08.12	DN regenerative torque limit	
	F08.09 - F08.12 are the relative percentage of motor rated current (F07.02). As the right figure: • The bigger torque output, the bigger current output. • 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 F09: Current-loop Parameters

Ref. Code	Function Description	Setting Range [Default]
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	Unused	
F09.04	Current loop period	2 - 10 [6]
F09.05	Dead zone compensation mode	0 - 2 [1]
F09.06 - F09.07 Unused		

6.2.11 F10: Syn. Motor Parameters

Ref. Code	Function Description	Setting Range [Default]
F10.00	Syn. motor type	0,1 [0]
	0: IPM. 1: SPM.	
F10.01	Rated power of syn. motor	0.4 - 400.0kW [Depend on HD5L]
F10.02	Rated voltage of syn. motor	0 - Rated voltage of HD5L [Depend on HD5L]
F10.03	Rated current of syn. motor	0.0 - 999.9A [Depend on HD5]
F10.04	Rated frequency of syn. motor	1.00 - 100.00 [19.20Hz]
F10.05	Rated rpm of syn. motor	1 - 24000 [96rpm]
F10.06	Stator resistance of syn. motor	0.000 - 9.999 [0.000Ω]
F10.07	Quadrature axis inductance of syn. motor	0.0 - 999.9 [0.0mH]
F10.08	Direct axis inductance of syn. motor	0.0 - 999.9 [0.0mH]
F10.09	Back EMF of syn. motor	0 - Rated voltage of HD5L [0V]

Ref. Code	Function Description	Setting Range [Default]
F10.10	**Angle auto-tuning of syn. motor**	**0 - 2 [0]**
	0: No action. 1: Stationary auto-tuning. 2: Rotary auto-tuning. • Refer to section 7.1.3 about parameter auto-tuning.	
F10.11	**Stationary auto-tuning voltage setting of syn. motor**	**0.0 - 100.0 (F10.02) [100.0%]**
	If syn. motor reports over-current fault at stationary auto-tuning, the setting value should be smaller.	
F10.12	**Start angle of syn. motor**	**0.0 - 359.9 [0.0°]**
F10.13	**Z pulse start angle of syn. motor**	**0.0 - 359.9 [0.0°]**
F10.14	**SINCOS encoder C amplitude of syn. motor**	**0 - 9999 [2048]**
F10.15	**SINCOS encoder C zero-bias of syn. motor**	**0 - 9999 [2048]**
F10.16	**SINCOS encoder D amplitude of syn. motor**	**0 - 9999 [2048]**
F10.17	**SINCOS encoder D zero-bias of syn. motor**	**0 - 9999 [2048]**
F10.18	**Sincos encoder CD phase**	**0,1 [0]**
	0: C phase ahead of D phase. 1: D phase ahead of C phase. *Note: At motor parameter auto-tuning , F10.18 can self-learn whitout manual changes.*	
F10.19	**Optimize 1313 encoder start algorithm**	**0,1 [0]**
	0: Optimize. 1: Do not optimize.	
F10.20	**Synchronous performance optimization**	**0 - 65535 [1028]**
	Bit0 - Bit1: Unused **Bit2: Segmentation test function** 0: Not open. 1: Open. **Bit3: Unused** **Bit5 & Bit4: Synchronous motor start current limit** 00: Normal. 01: 2 times. 10: 4 times. 11: 8 times. **Bit6: Start comfortable** 0: Way 0. 1: Way 1. **Bit7 - Bit8: Unused** **Bit10 - Bit9: Performance optimized** 00: Way 0. 01: Way 1. 10: Way 2. 11: Way 3. **Bit11: Unused** **BIT12: Synchronous motor starts to suppress oscillation** 0: Not inhibited. 1: Suppress the shock. **BIT13: Start optimization 2** 0: Not enabled. 1: Enabled. **Bit14: Unused** **BIT15: Vibration optimization** 0: The old method of vibration optimization. 1: New method of vibration optimization.	

6.2.12 F11: PG Parameters

In elevator application, the PG is necessary for the motor. Please refer to section 4.5 for PG.

Ref. Code	Function Description	Setting Range [Default]
F11.00	**HD5L PG interface board**	**1 - 4 [4]**
	1: HD-PG2-OC-FD is valid. • Only for asyn. motor. 2: HD-PG6-UVW-FD is valid. • Only for syn. motor. 3: HD-PG5-SINCOS-FD is valid. • Only for syn. motor. 4: HD-PG11-SC-FD is valid. • Only for syn. motor. (support Endat)	
F11.01	**PG P/R**	**1 - 9999 [2048]**
F11.02	**PG direction setting**	**0,1 [0]**
	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.	
F11.03	**PG signal filter coefficient**	**0x00 - 0x77 [0x11]**
	Unit: Low-speed filter coefficient. Ten: High-speed filter coefficient.	
F11.04	**The protocol of serial communication PG**	**0 - 9 [0]**
	0: Endat. 1: Rotary transformer protocol. 2 - 9: Unused.	
F11.05	**Detecting time of PG wire disconnection**	**0.00 - 2.00 [1.00s]**
	F11.05 specifies the duration time for detecting PG wire disconnection fault. HD5L detects the PG wire disconnection and the duration time exceeds F11.05, then the controller reports E0031 fault (PG disconnection). • No detection will be conducted when F11.05 = 0.	

6.2.13 F12: Digital I/O Terminal Parameters

Ref. Code	Function Description	Setting Range [Default]
F12.00	**Input terminal filter time**	**0.000 - 1.000 [0.010s]**
	Defines 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 F12.00 can be increased. But too long filter time will affect sensibility.	
F12.01	**DI1 function**	**000 - 134 [1]**
F12.02	**DI2 function**	**000 - 134 [2]**
F12.03	**DI3 function**	**000 - 134 [3]**
F12.04	**DI4 function**	**000 - 134 [4]**
F12.05	**DI5 function**	**000 - 134 [5]**
F12.06	**DI6 function**	**000 - 134 [6]**
F12.07	**DI7 (I/O board) function**	**000 - 134 [0]**
F12.08	**DI8 (I/O board) function**	**000 - 134 [0]**
F12.09	**DI9 (I/O board) function**	**000 - 134 [0]**
F12.10	**DI10 (I/O board) function**	**000 - 134 [0]**
F12.11	**DI11 (I/O board) function**	**000 - 134 [0]**
F12.12	**DI12 (I/O board) function**	**000 - 134 [0]**

Note: Hundred digit = 0, normally open input selected; Hundred digit = 1, normally closed input selected.

0: Unused. Terminal function is unused. HD5L ignores the signal input via this terminal.

- The unused terminal is recommended to be set as 0 so as to avoid wrong connection or action.

1: Controller enabled. (EN)

- When enabled, HD5L is enabled to run.
- When unused, HD5L is unused to run and will be in coasts to stop status.
- When no terminal selects this function, it defaults that HD5L is at enabled status.

2, 3: UP / DN.

- Set control terminal to control up and down of elevator. The terminals are in below table.

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

4 - 6: MS1 - MS3.

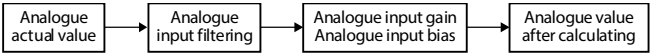
- Achieve 8-speed running curve via terminals logic combination, as follow table.

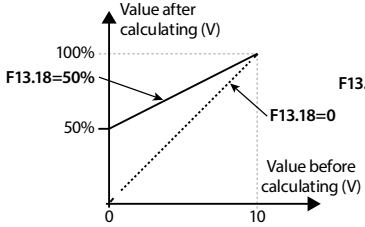
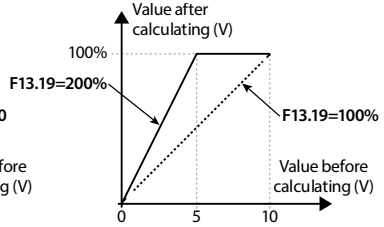
MS3 terminal	MS2 terminal	MS1 terminal	Multi-speed setting
0	0	0	Multi-speed 0 (F05.00)
0	0	1	Multi-speed 1 (F05.01)
0	1	0	Multi-speed 2 (F05.02)
0	1	1	Multi-speed 3 (F05.03)
1	0	0	Multi-speed 4 (F05.04)
1	0	1	Multi-speed 5 (F05.05)
1	1	0	Multi-speed 6 (F05.06)
1	1	1	Multi-speed 7 (F05.07)

Ref. Code	Function Description	Setting Range [Default]
	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 status. 9: Contactor feedback input (CSM). 10: Brake feedback input (BSM). 11 - 14: Weighing signal input 1 - 4 (WD1 - WD4). • The switch weight signals can input through this terminal. Based on these signals, HD5L 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 F06.08 - F06.11 (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 overheat input (OH). 16: Fault reset input (RST). • When HD5L alarms fault, reset it by this terminal. • The function of RST terminal is the same as the STOP key. 17: Up forced speed input (UPF). 18: Down forced speed input (DNF). 19: Governor feedback input(OSG). 20 - 33: Unused. 34: External fault (EXT). • The fault signignal. The fault signal of external equipment can be input through this terminal, so HD5L can monitor that equipment and respond accordingly. HD5L alarms E0024 fault (Fault of external equipment) when receives the EXT signal.	
F12.13	**Filter time of multi-speed terminal**	**0.000 - 2.000 [0.010s]**
	Defines the MS filter time to make up for the time error of MS input terminals. • Change F12.13 according to the change asynchronous level of numbers of MS input terminals.	
F12.14	**Unused**	
F12.15	**DO1 function**	**0 - 21 [2]**
F12.16	**DO2 function**	**0 - 21 [3]**
F12.17	**RLY1 function**	**0 - 21 [14]**
F12.18	**RLY2 (I/O board) function**	**0 - 21 [0]**
F12.19	**RLY3 (I/O board) function**	**0 - 21 [0]**
F12.20	**RLY4 (I/O board) function**	**0 - 21 [0]**
	0: Unused. 1: Controller is ready. • Signal ON will output if HD5L has no fault. 2: Controller is running. • HD5L is in running status and outputs indicating signal. 3: Zero-speed running. • ON signal will output if output speed of HD5L is zero but HD5L is in run status. 4: Zero-speed. • ON signal will output if output speed of HD5L is zero.	

<table>
<tr><th>Ref. Code</th><th>Function Description</th><th>Setting Range [Default]</th></tr>
<tr><td></td><td>5: Contactor output control.
• To open / close the output contactor.
6: Brake output control.
• To open / close the brake.
7, 8: FDT1, FDT2.
• Refer to F05.12 - F05.13.
9: Speed within FAR signal.
• The indication signal will output when output speed of HD5L is within the FAR range. The detect range is set by F05.16 (Speed within FAR range).
• The indication signal will also output at stop.
10: Up signal output.
• ON signal will output when the elevator is at up running.
11: Down signal output.
• ON signal will output when the elevator is at down running.
12: Under-voltage.
• ON signal will output when HD5L is in Under-voltage status.
13: Overload detection.
• When the drive controller is overloaded, it outputs an ON signal.
14: Controller fault.
• ON signal will output when HD5L has fault.
15: Elevator stop signal.
• When the elevator stops, HD5L will stop and outputs 2s pulse signal, according to which HD5L revokes run command.
16 - 19: Unused.
20: Speed outputs.
21: Advanced door open signal output.
• When the elevator reference speed < F20.11 (pre-open door running speed threshold), the pre-opening door signal output is valid. When the elevator stops, after the delay of F20.12, the pre-opening door signal output becomes invalid.
• After the local elevator is restarted, the early opening signal is invalid.</td><td></td></tr>
<tr><td>F12.21</td><td>Output terminal logic setting</td><td>00 - 0x3F [0]</td></tr>
<tr><td></td><td>Defines that each bit (binary) represents different physical sources.
• 0: Positive logic. When output terminals are connected to corresponding common port, this logic is enabled. Otherwise the logic is disabled.
• 1: Negative logic. When output terminals are connected to corresponding common port, this logic is disabled. Otherwise the logic is enabled.
<table>
<tr><th colspan="4">Ten</th><th colspan="4">Unit</th></tr>
<tr><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>-</td><td>-</td><td>RLY4</td><td>RLY3</td><td>RLY2</td><td>RLY1</td><td>DO2</td><td>DO1</td></tr>
</table></td><td></td></tr>
<tr><td colspan="2">F12.22 - F12.24 Unused</td><td></td></tr>
</table>

6.2.14 F13: Analogue I/O Terminal Parameters

Ref. Code	Function Description	Setting Range [Default]
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: Unused. 1: Speed setting. 2: Weighing signal. 3: Motor overheat signal input (only AI4 enabled). • Connect the electronic thermistor embedded motor stator coils to AI4, refer to Figure 4-13, on page 25. • 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 calculating is shown as figure:  • The formula is: Analogue value after calculating = Gain × Analogue actual value + Bias • F13.06, F13.09, F13.12 and F13.15 define the filter time. • The longer filter time is, the higher immunity level is, the response time is prolonged. The shorter filter time is, the quicker response time is, the lower the immunity level is.	

Ref. Code	Function Description	Setting Range [Default]
F13.16	**AO1 function**	**0 - 9 [0]**
F13.17	**AO2 function**	**0 - 9 [0]**
	0: Unused. 1: Running speed (0 - max output speed). 2: Setting speed (0 - max output speed). 3: Output current (0 - twice rated current of HD5L). 4: Output voltage (0 - 1.2 times rated voltage of HD5L). 5: DC bus voltage (0 - 2.2 times rated voltage of HD5L). 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:*** *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. Up limit of No.3 - 5 functions is corresponding to max. output voltage 10V;* *4. When the negative voltage of No.7 - 9 function inputs, 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%]**
	The proportional relation of output can be adjusted by output gain, as shown in the figure below. • The formula is: AO1 actual output = F13.19 × Value before calculating + F13.18  **Analogue output and bias**  **Analogue output and gain**	
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 F14: SCI Communication Parameters

Refer to Appendix B (page 119) for the communication function.

Ref. Code	Function Description	Setting Range [Default]
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**	**0 - 5 [3]**
	0: 1200bps. 1: 2400bps. 2: 4800bps. 3: 9600bps. 4: 19200bps. 5: 38400bps.	
F14.02	**Local address**	**0 - 247 [2]**
	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]**
	Time at no communication data > setting time of F14.04, it will be considered as E0028 fault (SCI communication timeout). • F14.04 = 0, it will not detect communication time out.	
F14.05	**Detection time of communication error**	**0.0 - 1000.0 [0.0s]**
	Time at communication error > setting time of F14.05, it will be considered as E0029 fault (SCI communication error). • F14.05 = 0, it will not detect the communication error.	
F14.06 - F14.47 Unused		

6.2.16 F15: Display Control Parameters

Ref. Code	Function Description	Setting Range [Default]
F15.00	**Language selection**	**0,1 [0]**
	Defines the displaying language on the LCD keypad. 0: Chinese. 1: English. 2 - 9: Unused.	
F15.01	**Display contrast of LCD keypad**	**1 - 10 [6]**
	To select LCD display contrast.	
F15.02	**Set parameter 1 of run status**	**0 - 32 [5]**
F15.03	**Set parameter 2 of run status**	**0 - 32 [6]**
F15.04	**Set parameter 3 of run status**	**0 - 32 [10]**
F15.05	**Set parameter 4 of run status**	**0 - 32 [11]**
F15.06	**Set parameter 5 of run status**	**0 - 32 [0]**
F15.07	**Set parameter 6 of run status**	**0 - 32 [0]**
F15.08	**Set parameter 1 of stop status**	**0 - 32 [4]**
F15.09	**Set parameter 2 of stop status**	**0 - 32 [14]**
F15.10	**Set parameter 3 of stop status**	**0 - 32 [16]**
F15.11	**Set parameter 4 of stop status**	**0 - 32 [26]**
F15.12	**Set parameter 5 of stop status**	**0 - 32 [27]**
F15.13	**Set parameter 6 of stop status**	**0 - 32 [0]**
	The keypad displays parameters which is the run status (F15.02 - F15.07) and stop status (F15.08 - F15.13). • It can be cycling displayed by ▶▶ key on the keypad. • Each display parameter of content can be set corresponding to 32 statuses. • For instance: When set F15.08 as 7, the stop parameter is setting Rpm at initial power on. 0: Unused. 1: Rated current of HD5L. 2: Controller status. Refer to D00.06. 3: Operate channel. 4: Setting speed. 5: Setting speed (after Acc. / Dec.) 6: Output frequency. 7: Setting Rpm. 8: Actual Rpm. 9: Unused. 10: Output voltage. 11: Output current. 12: Output torque. 13: Output power. 14: DC bus voltage. 15: AI1 voltage. 16: AI1 voltage (after calculating). 17: AI2 voltage. 18: AI2 voltage (after calculating). 19: AI3 voltage. 20: AI3 voltage (after calculating). 21: AI4 voltage. 22: AI4 voltage (after calculating). 23: AO1 output. 24: AO2 output. 25: Heatsink temperature. 26: Input terminal status. 27: Output terminal status. 28: MODBUS status. 29: Total time at power on (hour). 30: Total running time (hour). 31, 32: Unused.	

6.2.17 F16: Function-boost Parameters

Ref. Code	Function Description	Setting Range [Default]
F16.00	**Zero-speed running signal delay time**	**0.00 - 10.00 [0.30s]**
	Defines the delay time of HD5L from zero-speed run status to zero-speed run signal output.	
F16.01	**Zero-speed signal delay time**	**0.00 - 10.00 [0.30s]**
	Defines the delay time of HD5L from zero-speed status to zero-speed signal output.	
F16.02	**Current keep time after stop**	**0 - 9999 [300ms]**
	To eliminate the current noise of motor at stop, when the brake is finished, the cut-off run signal will reduce the current to zero after the time of F16.02.	
F16.03	**Fan control mode**	**0 - 2 [0]**
	Defines the fan control mode. If there is overheat protection, the fan will run all the time. 0: Auto stop. • The fan runs all the time when HD5L is in run status. After HD5L stops for the time of F16.04, the fan continues running if overheat protection is activated. 1: Immediately stop. • The fan runs all the time when HD5L is in running status, but stops when HD5L stops. 2: Run when power on. • The fan runs continuously after HD5L is switched on.	
F16.04	**Fan control delay time**	**0.0 - 600.0 [30.0s]**
F16.05	**Brake unit action voltage**	**380 - 750V [Depend on HD5L]**
	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 enables only in run status of HD5L.*	
F16.06	**Contactor fault detect time**	**0.1 - 10.0 [2.0s]**
F16.07	**Multi-speed inspection**	**0 - 7 [0]**
	When the DI terminals are not enough, the MS1 - MS3 can achieve the inspection run. • DI terminal = Inspection terminal INS (No.7 function), only need set F16.07 as 0 to enter terminal inspection run. • DI terminals ≠ Inspection terminal INS (No.7 function), the MS1 - MS3 can achieve inspection run. • Value of MS1 - MS3 = Value of F16.07, enter MS inspection run at MS run speed (F05.00 - F05.07). *Note: When 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 ≤ F16.08, the system run speed will be condidered as 0. After zero-speed delay signal, the zero-speed signal will output.	
F16.09	**Selection at motor overheat fault**	**0,1 [0]**
	0: When detect that the motor is overheated, alarms E0020 fault (Motor overheat) after motor stops. 1: When detect that the motor is overheated, alarms E0020 fault (Motor overheat) at once.	
F16.10	**The coefficient of frequency demultiplication of HD-PG11-SC-FD**	**1 - 256 [1]**
	To set the coefficient of frequency demultiplication of HD-PG11-SC-FD.	
F16.11	**Stationary auto-tuning and current limit of syn. motor**	**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 controller running signal (output = No.2 function) so as to control HD5L to open the brake.	

Ref. Code	Function Description	Setting Range [Default]
F16.13	**UPS running direction auto-determine enable**	**0 - 4 [0]**
	0: Not enable. 1: UPS running judges its direction in according with current. 2: UPS running judges its direction in according with encoder direction. 3: UPS running judges its direction in according with current. 4: UPS running judges its direction in according with encoder direction (no start compensation and zero-speed keeping). *Note: Method 2 and 4 must use closed loop vector control (F00.01 = 2). And the elevator brake is controlled by HD5L.*	
F16.14	**Running minimum current limit**	**0 - 100 (F07.11) [20%]**
F16.15	**Running minimum detect time**	**0.0 - 5.0 [0.0s]**
	When the elevator run current is less than F16.14 and duration exceed F16.05, HD5L will alarm E0025 fault (Too small running current).	
F16.16	**Governor fault detection time**	**0.0 - 2.0 [1.0s]**
	When the detection terminal of governor detects signal and exceed F16.16, HD5L alarms E0037 fault (Governor fault).	
F16.17	**DC braking current at stop**	**0 - 150 [100%]**
F16.18	**Starting frequency of DC braking current at stop**	**0.20 - 10.00 [0.50Hz]**
F16.19	**Brake release frequency**	**0.00 - 10.00 [0.00Hz]**
F16.20 - F16.24 Unused		

6.2.18 F17: Fault Protect Parameters

Motor overheat fault (F17.00 - F17.02)

Ref. Code	Function Description	Setting Range [Default]
F17.00	**Input voltage at motor overheat**	**0.00 - 10.00 [0.00V]**
F17.01	**Thermistor type**	**0 - 2 [0]**
	0: Not detect the motor overheat (NC). 1: Positive charateristic (PTC). • When AI4 input exceeds F17.00, HD5L alarms E0020 fault (Motor overheat). 2: Negative charateristic (NTC). • When AI4 input is less than F17.00, HD5L alarms E0020 fault (Motor overheat). *Note: Only when correctly set CN2 and CN3 of I/O board can do the motor overheat detection.*	
F17.02	**Threshold resistance at motor overheat**	**0.0 - 10.0 [5.0kΩ]**

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

Ref. Code	Function Description	Setting Range [Default]
F17.03	**The detection base of lack of input**	**0 - 100 [30%]**
F17.04	**The detection time of lack of input**	**0.0 - 5.0 [1.0s]**
	F17.03 is a percentage of rated voltage of HD5L. When HD5L detects certain input voltage does not hit the detection base (F17.03) and exceeds the preset detection time (F17.04), HD5L alarms E0015 fault (Input voltage phase loss). • F17.03 or F17.04 = 0 or in the battery driven run mode, HD5L will not detect input phase loss fault.	
F17.05	**The detection base of lack of output**	**0 - 100 [20%]**
F17.06	**The detection time of lack of output**	**0.0 - 20.0 [3.0s]**
	F17.05 is a percentage of rated current of HD5L. When HD5L detects certain output current does not hit the detection base (F17.05) and exceeds the detection time (F17.06), HD5L alarms E0016 fault (Output voltage phase loss). • F17.05 or F17.06 = 0, HD5L will not detect output phase loss fault.	

Motor fault (F17.07)

Ref. Code	Function Description	Setting Range [Default]
F17.07	**Motor overload protect factor**	**20.0 - 110.0 [100.0%]**
	The motor overload protection factor can be set as 100% when HD5L drives a motor of the same power class. To protect the motor when the motor power is smaller than the standard matched power, user needs to set proper motor overload protection factor (F17.07). The factor can derive from the following formula: $\text{Motor overload protect factor (F17.07)} = \frac{\text{Rated current of motor (F07.02 / F10.03)}}{\text{Rated output current of HD5L}} \times 100\%$	

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

Auto reset function enables HD5L to reset the fault as per the preset times and interval.

The following faults do not have the auto reset function:

E0008: Power module fault
E0010: Brake unit fault
E0013: Soft start contactor failed
E0014: Current detection fault
E0021: Read / Write fault of control board EEPROM
E0022: Read / Write fault of keypad EEPROM
E0024: Fault of external equipment
E0036: Contactor fault

Ref. Code	Function Description	Setting Range [Default]
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 unused 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	**Faulty relay action**	**00 - 11 [00]**
	Unit: In auto reset process • 0: Faulty relay doesn't act. • 1: Faulty relay acts. **Ten: In undervoltage process** • 0: Faulty relay doesn't act. • 1: Faulty relay acts. *Note: Relay needs to be set as No.14 function. (Controller fault)*	

Fault history (F17.11 - F17.27)

Ref. Code	Function Description	Setting Range [Default]
F17.11	Five times fault type	[Actual value]
F17.12	Setting freqency at the recent 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 status at NO.5 fault	
F17.18	Output terminal status 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	
	F17.12 - F17.19 record status parameters of HD5L at the last fault. F17.20 - F17.27 record the type and interval per time of four faults before the latest. The unit of interval is 0.1 hour.	

6

6.2.19 F18: PWM Parameters

Ref. Code	Function Description	Setting Range [Default]
F18.00	**Carrier frequency**	**1 - 16kHz [Depend on HD5L]**
	Defines the carrier frequency of PWM output wave. **Controller power** / **Setting range** / **Factory setting** 0.2 - 22kW / 1 - 16kHz / 8kHz 30 - 45kW / 1 - 12kHz / 6kHz • 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, HD5L should be derated by 5% when per 1kHz is increased compared to the factory setting.	
F18.01	**Carrier freqency auto adjust selection**	**0,1 [0]**
F18.02	**PWM overmodulation enable**	**0,1 [1]**
	0: Disable. 1: Enable.	
F18.03	**PWM overmodulation mode**	**0,1 [0]**
	0: Two phase / Three phase swtich. 1: Three phase.	

6.2.20 F19: Unused

6.2.21 F20: Enhance Parameter Group 2

Ref. Code	Function Description	Setting Range [Default]
F20.00	**Start DC braking current**	**50 - 150 [100%]**
F20.01	**Start DC braking current keeping time**	**0.0 - 3.0 [0.0s]**
	F20.20 / F20.21 works in F00.01 = 0 (V/f control) / 1 (SVC control). F20.01 = 0, start DC brake function is not valid.	
F20.02	**DI enable function**	**0,1 [0]**
	0: Original plan. • There is an enable signal to output the running contactor. 1: New program. • There is a running command signal to open the running contactor. When the open contactor signal is received, if the enable signal is detected, it can continue to run. • Used when the inverter controls the running contactor and uses the contactor feedback contact as an enable signal.	
F20.03	**Output contactor opening time**	**0 - 9 [0s]**
	After the directional signal contactor is turned on for a period of F20.03, after the enable signal is still invalid, the output contactor is turned off. • When F20.03 = 0, it is always on.	
F20.04	**Output ground detection before operation**	**0,1 [0]**
F20.05	**Encoder C, D disconnection detection**	**0,1 [0]**
	0: Detection. 1: Not detected.	
F20.06	**Speed control proportional gain 1**	**0 - 100 [30]**
F20.07	**Speed control integration time 1**	**0.01 - 10.00 [0.50s]**
F20.08	**Speed control proportional gain 2**	**0 - 100 [20]**
F20.09	**Speed control integration time 2**	**0.01 - 10.00 [1.00s]**
F20.10	**Static self-tuning method for identifying no-load current**	**0,1 [0]**
	0: Calculated according to power factor. 1: Estimated based on pole logarithmic power.	
F20.11	**Open door speed threshold**	**0.000 - 0.250 [0.100m/s]**
F20.12	**Output delay time after early door open relay output shutdown**	**0 - 3000 [500ms]**
F20.13	**Elevator enable function quickly detects on**	**0,1 [0]**
	0: Do not open. 1: Open. *Note: Only the DI1 - DI6 selection enable input signal (function No.1) is valid.*	
F20.14	**UPS running undervoltage setting**	**170 - 220 [190V]**
F20.15 - F20.19 Unused		
F20.20	**E013 fault shielding**	**0,1 [0]**
	0: Not blocked. 1: Shielded.	

6.3 Group Y: Manufacturer Function Parameters

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

Chapter 7 Elevator Application Guidance

7.1 Basic Commissioning Procedures

7.1.1 System Analysis and Wire

It is recommended to analyze the actual application requirements before the wiring design.

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

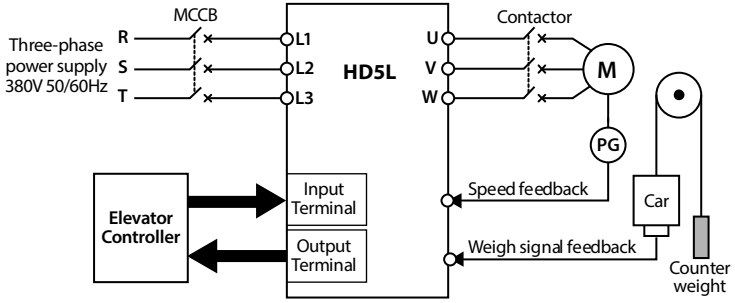


Figure 7-1 Elevator system

7.1.2 Set Basic Parameters

1. Correctly set F00.00 (Motor type) and F00.01 (Control mode) according to motor type.
2. Set Group F07 for the asyn. motor, set Group F10 for the syn. motor.
3. Set F00.02 (Rated speed of elevator) and F00.04 (Mechanical parameters of motor) 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 terminal 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 parameters of Group F05 according to the actual requirement of elevator 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 actual requirement of elevator 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 Auto-tuning

Note:

The crane car is needed for the rotary auto-tuning but not for the stationary auto-tuning.

Syn. motor rotary auto-tuning with A / B / Z / U / V / W encoder

1. Set F00.05 as 0 (keypad control).

2. Set F10.10 as 2 (rotary angle auto-tuning), then press RUN key to start parameter auto-tuning.

3. Auto-tuning steps: 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 (Start angle of syn. motor) 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 syn. motor radial contactor, the short-circuit signal of radial contactor should be removed. Otherwise it will cause over-current fault.

Syn. motor stationary auto-tuning with A / B / Z / U / V / W encoder

1. Set F00.05 as 0 (keypad control).

2. Set F10.10 as 1 (stationary angle auto-tuning), then press RUN key to start 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 keypad returns to stop status, 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 successful. Otherwise check the encoder connection and then restart step 2 - 4.

Note of step 4:

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

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 (Start angle of syn. motor) will be obtained the auto-tuning process is finished.

Pay attention to the following circumstances at step 6 inspection running:

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 needs manually open the run contactor.

2. If the system has syn. 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 step 6 finishes, restart auto-tuning.

Syn. motor rotary auto-tuning with SINCOS encoder

1. Set F00.05 as 0 (keypad control).

2. Set F10.10 as 2 (rotary angle auto-tuning), then press RUN key to start parameter auto-tuning.

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

Note:

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

Syn. motor stationary auto-tuning with SINCOS encoder

1. Set F00.05 as 0 (keypad control).

2. Set F10.10 as 1 (stationary angle auto-tuning), then press RUN key to start 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 keypad returns to stop status, 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 successful. Otherwise check the encoder connection and then restart step 2 - 4.

Note of step 4:

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

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 (Start angle of syn. motor).

Pay attention to the following circumstances at step 6 of low speed running:

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 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 needs open the run contactor manually.

2. If the system has syn. 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 step 7 finishes, restart auto-tuning.

Syn. motor rotary auto-tuning with serial communication encoder

1. Set F00.05 as 0 (keypad control).

2. Set F10.10 as 2 (rotary angle auto-tuning), then press RUN key to start parameter auto-tuning.

3. Auto-tuning steps: The controller with DC fixes the motor to one direction, then slowly starts the motor for a while and finally stops. When auto-tuning finishes, F10.12 (Start angle of syn. motor) 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 syn. motor radial contactor, the short-circuit signal of radial contactor should be removed. Otherwise it will cause over-current fault.

Syn. motor stationary auto-tuning with serial communication encoder

1. Set F00.05 as 0 (keypad control).

2. Set F10.10 as 1 (stationary angle auto-tuning), then press RUN key to start 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 keypad returns to stop status, 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 successful. Otherwise 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 also successful.

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 (Start angle of syn. motor) will be obtained the auto-tuning process is finished.

Pay attention to the following circumstances at step 6 of inspection running:

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 needs manually open the run contactor.

2. If the system has syn. 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 step 6 finishes, restart auto-tuning.

Asyn. motor parameter auto-tuning

1. Set F00.05 as 0 (keypad control).

2. Set F07.06 as 1 (stationary auto-tuning) or 2 (rotary auto-tuning), then press RUN key to start parameter auto-tuning. The motor will rotate at rotary auto-tuning, while it will not rotate at stationary auto-tuning.

Note:

When auto-tuning, it needs open the run contactor; If at rotary auto-tuning, it needs open the brake contactor manually too.

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 running direction of motor is not the command direction, set F00.08 (Run direction) = 1.

2. 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 do high speed running.

7.1.5 High Speed Running

1. Give the floor normal 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 asyn. motor, adjust Group F02 to avoid obviously shaking at start & stop.
- For syn. motor, set Group F06 additionally to avoid elevator brake at start.
- If syn. 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, properly adjust Group F08.

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

7.2 Terminal MS Run Application

The elevator controller can calculate the motor present running direction (digital) and objective speed (digital) according to the elevator control logic and send them to HD5L. HD5L receives the objective speed of MS form and calculate the speed curve according to the S-curve parameter setting, then 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 output signal of HD5L 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 syn. 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.

Control Part Connection

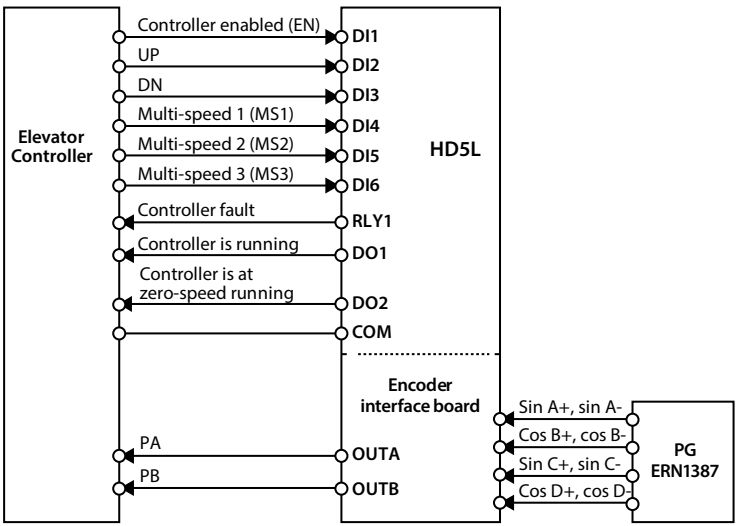


Figure 7- 2 Terminal MS running connection

Set Parameter

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

Table 7-1 General parameter

Ref. Code	Function	Value	Remark
F00.00	Motor type	Depend on actual value	
F00.01	Control mode	Depend on actual value	
F00.02	Rated speed of elevator	Depend on actual value	
F00.03	Max output freqency	Depend on actual value	
F00.04	Mechanical parameters of motor	Depend on actual calculate value	
F07.00 / F10.01	Rated power of motor	Depend on actual value	Motor nameplate parameters.
F07.01 / F10.02	Rated voltage of motor	Depend on actual value	
F07.02 / F10.03	Rated current of motor	Depend on actual value	
F07.03 / F10.04	Rated frequency of motor	Depend on actual value	
F07.04 / F10.05	Rated rpm of motor	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 limit	180.0%	Adjust according to running effect. Generally use the default value.
F08.10	DN electrical torque limit	180.0%	
F08.11	UP regenerative torque limit	180.0%	
F08.12	DN regenerative torque limit	180.0%	
F11.00	HD5L PG 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 Terminal MS run

Ref. Code	Function	Value	Remark
F00.05	Operating mode	2	Terminal MS control
F02.02	Retention time of start zero-speed	0.5s	Adjust according the situation of running contactor and brake at motor start & stop.
F02.06	Retention time of stop zero-speed	0.5s	
F03.00	Acc. speed	0.700m/s^2	Set according the elevator speed and running effect.
F03.01	Start Acc. jerk	0.350m/s^3	
F03.02	End Acc. jerk	0.600m/s^3	
F03.03	Dec. 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 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	Commission 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 function	1	Controller enabled (EN)
F12.02	DI2 function	2	UP
F12.03	DI3 function	3	DN
F12.04	DI4 function	4	MS1
F12.05	DI5 function	5	MS2
F12.06	DI6 function	6	MS3
F12.15	DO1 function	2	Controller is running
F12.16	DO2 function	3	Controller is at zero-speed running
F12.17	RLY1 function	14	Controller fault
F16.07	Multi-speed inspection	4	Multi-speed inspection select

7.3 Terminal Analogue Run Application

The elevator controller can calculate the motor present running direction (digital) and running speed (analogue) according to the elevator control logic and send them to HD5L. 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.

Control Part Connection

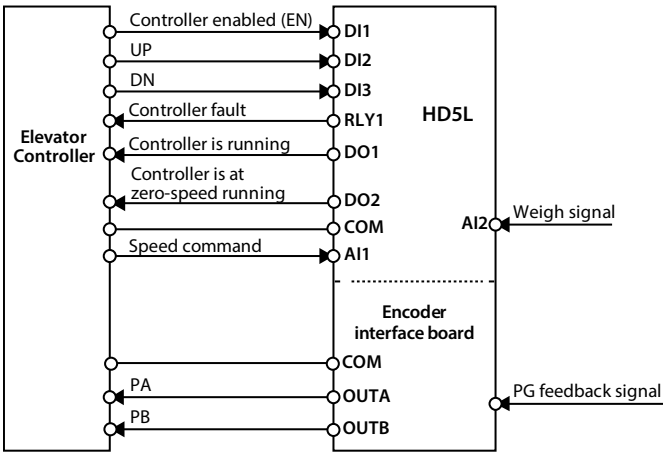


Figure 7-3 Terminal analogue running connection

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 parameter

Ref. Code	Function	Value	Remark
F00.05	Operating mode	1	Terminal analogue control.
F02.02	Retention time of start zero-speed	0.5s	Adjust according the situation of running contactor and brake at motor start & stop.
F02.06	Retention time of stop zero-speed	0.5s	

Ref. Code	Function	Value	Remark
F03.00	Acc. speed	0.700m/s^2	If the controller can not fast-track speed command of the elevator controller, increase 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	Setting curve	00000	Change according to the characteristics of analoguecurve.
F04.01	Line 1 min. setting	0.0%	
F04.02	Corresponding value of line 1 min. setting	0.0%	
F04.03	Line 1 max. setting	100.0%	
F04.04	Corresponding value of line 1 max. setting	100.0%	
F04.05	Line 2 min. setting	0.0%	
F04.06	Corresponding value of line 2 min. setting	0.0%	
F04.07	Line 2 maxi. setting	100.0%	
F04.08	Corresponding value of line 2 max. setting	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 function	1	Controller enabled (EN)
F12.02	DI2 function	2	UP
F12.03	DI3 function	3	DN
F12.15	DO1 function	2	Controller is running
F12.16	DO2 function	3	Controller is at zero-speed running
F12.17	RLY1 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 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.

Connection

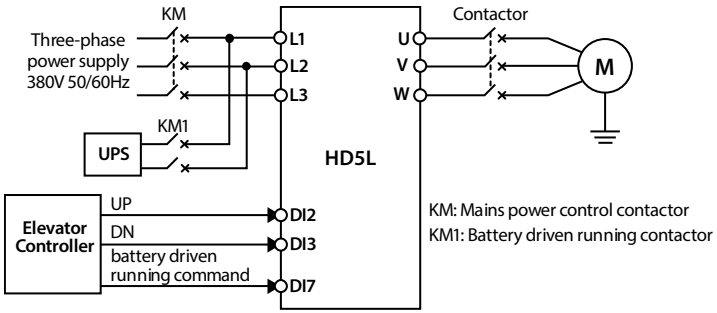


Figure 7-4 Battery driven run connection

Running Time Sequence

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

2. After some time delay, the elevator controller outputs running command (UP / DN). When HD5L receives the command, the running contactor will be closed and the brake will be opened. HD5L accelerates 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 elevator 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 than150VAC to ensure normal running.

2. In the battery driven running mode, the controller does not detect the input phase failure.

Chapter 8 Troubleshooting and Maintenance

8.1 Troubleshooting

If a fault occurs, the keypad will display the fault alarm status. Meanwhile, faulty relay acts, accordingly HD5L stops output and the motor coasts to stop.

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

After the fault is eliminated, reset HD5L by any of the following methods:

1. Keypad reset.

2. External reset terminal (DI terminal = No.16 function).

3. Communication fault reset.

4. Switching on HD5L after completely power off.

Table 8-1 Fault and counter-measures

Fault		Fault reasons	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 status of power on and power off • Check input power voltage • Check wiring and wire HD5L properly
E0001	Acc. overcurrent	• Improper connection between controller and motor • Improper motor parameters • The rating of the used HD5L is too small • Acc. / Dec. time is too short	• Connect HD5L and motor properly • Set correct motor parameters • Select controller with higher rating • Set proper Acc. time and Dec. time
E0002	Dec. overcurrent		
E0003	Constant speed overcurrent		
E0004	Acc. over voltage	• Input voltage is too high • Dec. time is too short • Improper wiring leads to overvoltage of hardware	• Check power input • Set a proper value for Dec. time • Check wiring and wire HD5L properly
E0005	Dec. over voltage		
E0006	Constant speed over voltage		
E0008	Power module fault	• Short circuit between phases output or the ground • Output current is too high • Power module is damaged	• Check the connection and connect the wire properly • Check the connection and mechanism • Contact the supplier for repairing
E0009	Heatsink overheat	• Ambient temperature is too high • Poor external ventilation of HD5L • Fan fault • Fault occurs to temperature detection circuit	• Use controller with higher power capacity • Improve the ventilation around HD5L • Replace the cooling fan • Seek technical support
E0010	Braking unit fault	• Circuit fault of braking unit	• Seek technical support

Fault		Fault reasons	Counter - measures
E0011	CPU fault	• CPU abnormal	• Detect at power on after completely power outage • Seek technical support
E0012	Motor auto-tuning fault	• Parameter auto-tuning is time out	• Check the motor connection • Input correct nameplate parameters • Seek technical support
E0013	Soft start contactor failed	• Contactor fault • Control circuit fault	• Replace the contactor • Seek technical support
E0014	Current detection fault	• Current detection circuit is damaged	• Contact the supplier for repairing
E0015	Input voltage phase loss	• For three-phase input HD5L, input phase loss fault occurs to power input	• Check the three-phase power input • Seek technical support
E0016	Output voltage phase loss	• Output voltage phase disconnection or loss • Three-phase load of HD5L is severely unbalanced	• Check the connection between HD5L and motor • Check the quality of motor
E0017	Controller overload	• Acc. 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 Acc. time • Adjust V/f curve or torque boost • Check mains supply voltage • Use controller with proper power rating
E0018	Excessive speed deviation	• Brake fault or contactor fault • PG pulse number fault • Improper setting of F05.19, F05.20 • Inadequate controller torque • Speed-loop PI parameter setting is incorrect	• Change contactor • Set proper PG P/R • Correct the setting of F05.19 - F05.20 • Select bigger capacity • Correctly set speed-loop PI parameter
E0019	Motor overload	• Improper setting of V/f curve • Mains supply voltage is too low • Overload protection factor of motor is not set properly • Motor blocked-rotor torque or overload	• Adjust V/f curve • Check the power input • Properly set the overload protection factor of the motor • Check the load and mechanical transmission devices
E0020	Motor overheat	• Motor overheat • Motor overheat terminal (DI or AI terminal) connects incorrectly • The setting of motor paramteter is incorrect	• Reduce the load; Increas the Acc. / Dec. time; Repair or replace the motor • Detect whether the overheat detection input signal is correct • Set the motor parameter according to nameplate
E0021	Read / Write fault of control board EEPROM	• Memory circuit fault of control board EEPROM	• Contact the supplier for repairing
E0022	Read / Write fault of keypad EEPROM	• Memory circuit fault of keypad EEPROM	• Replace the keypad • Contact the supplier for repairing

Fault		Fault reasons	Counter - measures
E0023	Faulty setting of parameters	• The power rating between motor and controller is too different • Improper setting of motor parameters	• Select a controller with suitable power rating • Set correct value of motor parameters
E0024	Fault of external equipment	• Fault terminal of external equipment operates	• Check external equipment
E0025	Too small running current	• Improper setting of F16.14, F16.15	• Correct the setting of F16.14, F16.15 • Check the connection between HD5L and motor • Detect HD5L whether output • Detect whether the output contactor work is normal
E0026	Internal logic error	• Contact the manufacturer	• Contact the manufacturer
E0028	SCI communication timeout	• Connection fault of communication cable • Disconnected or not well connected	• Check the connection
E0029	SCI communication error	• Connection fault of communication cable • Disconnected or not well connected • Communication setting error • Communication data error	• Check the connection • Check the connection • Correctly set the communication format and the baud rate • Send the data according to MODBUS protocol
E0030	Wrong PG direction	• PG wire phase and motor phase do not match	• Set the reverse value of F11.02
E0031	PG direction reverse	• PG without input signal	• Check the PG connection
E0032	Motor over speed	• PG pulse number fault • Inadequate controller torque • Speed-loop PI parameter setting is incorrect	• Set proper PG pulse number • Select bigger capacity controller • Correctly set speed-loop PI parameter
E0033	Z signal loss 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	Contactor fault	• Contactor damaged • Feedback contact connection problem	• Change the contactor • Check the connection
E0037	Governor fault	• Check external governor • Check feedback signal	• Replace governor • Replace circuit

Note:

E0022 does not affect normal run of controller.

8.2 Maintenance

Factors such as ambient temperature, humidity, PH, 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 HD5L has been transported for a long distance, check whether the components of HD5L are complete and the screws are well tightened.
- Periodically clean the dust inside HD5L 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 AC power of HD5L is cut off and wait for at least 10 minutes. The cover maintenance can only be done after ensured that the charge indicator inside HD5L and the indicators on the keypad are off and the voltage between power terminals (+) and (-) is below 36V.

Warning

- For HD5L with more than 2 years storage, please use voltage regulator to increase the input voltage gradually.
- Do not leave metal parts like screws or pads inside HD5L.
- 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 stationary electricity. Directly touch the components on the PCB board is forbidden.

Daily Maintenance

HD5L must be operated in the specified environment (refer to section 3.2, on page 11). Besides, some unexpected accidents may occur during running.

Therefore maintain it according to the Table 8-2. To prolong the lifetime of HD5L, keep good running environment, record the daily run data and detect any abnormal behavior.

Table 8-2 Daily checking items

Items	Content	Criteria
Running environment	Temperature and humidity	-10 - +40°C, derating at 40 - 50°C Less than 95%RH, non-condensing
	Dust and water dripping	No conductive dust accumulating, no water dripping
	Gas	No strange smell
HD5L	Oscillation and heating	Stable oscillation and proper temperature
	Noise	No abnormal sound
Motor	Heating	No overheat
	Noise	Low and regular noise
Running status parameters	Output current	Within rated range
	Output voltage	Within rated range

Periodical Maintenance

Customer should check HD5L in every 3 to 6 months according to the actual environment so as to avoid hidden problems and make sure HD5L 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 copper bar and mains cables are overheated;
- 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 input terminals U / V / W of motor have been detached from HD5L. Otherwise, HD5L 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.

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. Users can decide the time when the components should be replaced according to their service time.

Easily damaged	Cooling fan	Electrolytic capacitors
Life	60, 000 hours	50, 000 hours
Possible cause of damages	Wear of the bearing, aging of the fan vanes	High ambient temperature, aging of electrolyte and large pulse current induced by rapid changing loads
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	Check if frequent over-current 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

Unwanted Controller Recycling

When disposing HD5L, 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: Dispose unwanted controllers as industrial waste.

Chapter 9 Accessories

9.1 Keypad Installation Assembly

The keypad installation assembly includes mounting base and extension cable.

Mounting Base

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

Model: HD-KMB. The mounting base and its size are shown as Figure 9-1, the unit is mm.

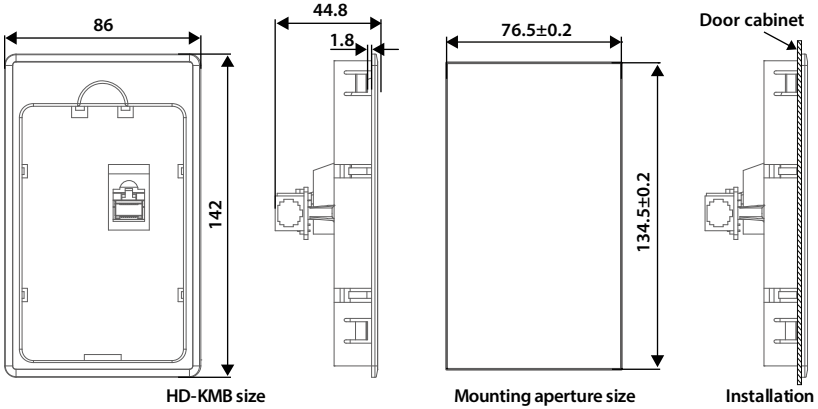


Figure 9-1 Mounting base and its size

Extension Cable

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

The models are as follows:

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

9.2 Reactor Selection

Table 9-1 Reactor selection

Model	AC input reactor		AC output reactor		DC reactor	
	Model	Parameter (mH - A)	Model	Parameter (mH - A)	Model	Parameter (mH - A)
HD5L-4T037	HD-AIL-4T037	0.19 - 75	HD-AOL-4T037	0.08 - 80	HD-DCL-4T037	0.35 - 100
HD5L-4T045	HD-AIL-4T045	0.16 - 90	HD-AOL-4T045	0.06 - 100	HD-DCL-4T045	0.29 - 120

9.3 Braking Resistor

The braking resistor selection is listed as Table 9-2.

Refer to section 4.3.2 for the brake resistor connection.

Table 9-2 Braking resistor selection

Model	Motor (kW)	Recommend value (Ω)			Recommend power (kW)	
		Min	Max	Recommended	Synchronous	Asynchronous
HD5L-2D2P2	2.2	26	130	50	1	1
HD5L-2D3P7	3.7	26	50	30	1.6	1.2
HD5L-2D5P5	5.5	17	27	20	2.0	1.6
HD5L-2D7P5	7.5	11	20	15	3.2	2.0
HD5L-2D011	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-2T030	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

Note:

1. Please select braking resistor based on the above table.
Bigger resistor can protect the braking system in fault condition, but oversized resistor may bring a capacity decrease, lead to over voltage protection.

2. The braking resistor should be mounted in a ventilated metal housing to prevent inadevertent contact during it works, for the temperature is high.

9.4 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 of this parameter cannot be modified when the controller is in run status.

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

Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
D00: System Status Parameters (on pages 46 - 47)						
D00.00	Controller series	HD5L	Actual		*	
D00.01	Software version of DSP	0.00 - 9.99	Actual		*	
D00.02	Special software version of DSP	0.00 - 9.99	Actual		*	
D00.03	Software version of keypad	0.00 - 9.99	Actual		*	
D00.04	Elevator running status	Display in 16-bit binary: Bit0: Controller enable Bit1: Inspection run Bit2: MS run Bit3: Analogue run Bit4 - Bit7: Unused Bit8: Brake feedback input Bit9: Contactor feedback input Bit10: Up forced speed switch input Bit11: Down forced speed switch input Bit12: MS terminal 1 Bit13: MS terminal 2 Bit14: MS terminal 3 Bit15: Battery driven run	Actual		*	
D00.05	Rated current of HD5L	0.1 - 999.9A	Actual		*	
D00.06	Controller status	Display in 16-bit binary: Bit0: Controller fault Bit1: Run / stop Bit2: UP Bit3: DN Bit4 & 5: Acceleration / Deceleration / Constant speed Bit6: Zero-speed signal Bit7: Run at zero-speed Bit8: Auto-tuning Bit9: Speed within FAR Bit10: Ready to run Bit11: Brake output Bit12: Contactor output Bit13: Stop signal	Actual		*	

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Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
		Bit14, Bit15: Unused				
D01: Drive Status Parameters (on pages 47 - 48)						
D01.00	Control mode	0 - 5	Actual		*	
D01.01	Setting speed (m/s)	0.000 - 9.999	Actual		*	
D01.02	Setting speed (after Acc. / Dec.) (m/s)	0.000 - 9.999	Actual		*	
D01.03	Feedback speed (m/s)	0.000 - 9.999	Actual		*	
D01.04	Setting frequency (Hz)	0.01 - 100.00Hz	Actual		*	
D01.05	Setting frequency (after Acc. / Dec.)	0.01 - 100.00Hz	Actual		*	
D01.06	Output frequency	0.01 - 100.00Hz	Actual		*	
D01.07	Setting Rpm	0 - 24000rpm	Actual		*	
D01.08	Running Rpm	0 - 24000rpm	Actual		*	
D01.09	Unused				*	
D01.10	Output voltage	0 - 999V	Actual		*	
D01.11	Output current	0.1 - 999.9A	Actual		*	
D01.12	Output torque	0.0 - 300.0% (motor rated torque)	Actual		*	
D01.13	Output power	0.0 - 200.0% (motor rated power)	Actual		*	
D01.14	DC bus voltage	0 - 999V	Actual		*	
D01.15 - D01.16 Unused						
D02: Analogue Status Display Parameters (on pages 48 - 49)						
D02.00	AI1 voltage	0.00 - 10.00V	Actual		*	
D02.01	AI1 voltage (after calculating)	0.00 - 10.00V	Actual		*	
D02.02	AI2 voltage	0.00 - 10.00V	Actual		*	
D02.03	AI2 voltage (after calculating)	0.00 - 10.00V	Actual		*	
D02.04	AI3 voltage	0.00 - 10.00V	Actual		*	
D02.05	AI3 voltage (after calculating)	0.00 - 10.00V	Actual		*	
D02.06	AI4 voltage	0.00 - 10.00V	Actual		*	
D02.07	AI4 voltage (after calculating)	0.00 - 10.00V	Actual		*	
D02.08	AO1 output	0.00 - 10.00V	Actual		*	
D02.09	AO2 output	0.00 - 10.00V	Actual		*	
D03: Running Status Parameters (on pages 49 - 50)						
D03.00	Heatsink temperature	0.0 - 999.9°C	Actual		*	
D03.01	Input terminal status	Display in 16-bit binary: Bit15 - Bit12: Unused Bit11 - Bit0 correspond to DI12 - DI1 0: Disconnects with common terminals	Actual		*	

Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
		1: Connects with common terminals				
D03.02	Output terminal status	Display in 16-bit binary: Bit15 - Bit6: Unused Bit5 - Bit2 correspond to RLY4 - RLY1 Bit1 - Bit0 correspond to DO2 - DO1	Actual		*	
D03.03	MODBUS status	0: Normal 1: Communication timeout 2: Incorrect data frame head 3: Incorrect data frame checking 4: Incorrect data frame content	Actual		*	
D03.04	Total time at power-on (hour)	0 - 65535	Actual		*	
D03.05	Total running time (hour)	0 - 65535	Actual		*	
D03.06	Run times	0 - 65535	Actual		*	
D03.07	Present fault	0 - 100	Actual		*	
D04: Encoder Status Parameters (on pages 50 - 51)						
D04.00	C phase value of SINCOS encoder	0 - 4095	Actual		*	
D04.01	D phase value of SINCOS encoder	0 - 4095	Actual		*	
D04.02	A phase value of SINCOS encoder	0 - 4095	Actual		*	
D04.03	B phase value of SINCOS encoder	0 - 4095	Actual		*	
D04.04	UVW status of UVW encoder	0 - 7	Actual		*	
D04.05	Electrical angle	0 - 65535	Actual		*	
D04.06 - D04.07 Unused						
D04.08	Pulses of PG	0 - 65535	Actual		*	
D04.09 - D04.11 Unused						
D04.12	Pulses monitoring of slip in start	0 - 65535	Actual			
D04.13	Judgement sources for start stability	0 - 20	Actual			
D04.14	Unused					
D04.15	Rotating self-tuning encoder pulse change judgment variable	0 - 65535	Actual			
D04.16 - D04.28 Unused						
D04.29	Oftware version for hpmont stuff	0.01 - 0.99	Actual			

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Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
F00: Basic Parameters (on pages 51 - 53)						
F00.00	Motor type	0: Asynchronous 1: Synchronous	0	1	×	
F00.01	Control mode	0: V/F control 1: SVC control 2: VC control 3: Unused 4: SVC control 2	2	1	×	
F00.02	Rated speed of elevator	0.100 - 4.000m/s	1.500m/s	0.001m/s	×	
F00.03	Max output freqency of HD5L	5.00 - 100.00Hz	50.00Hz	0.01Hz	×	
F00.04	Mechanical parameters of motor	10.0 - 6000.0	60.0	0.1	×	
F00.05	Operating mode	0: Keypad control 1: Terminal analogue control 2: Terminal MS control 3: Unused 4: SCI control 5: Unused	0	1	×	
F00.06	M-key function	0: Unused 1: UP / DN swtich	0	1	○	
F00.07	Speed setting of keypad	0.000m/s - F00.02	1.500m/s	0.001m/s	○	
F00.08	Run direction	0: The same as run command 1: Opposite to run command	0	1	×	
F01: Protection of Parameters (on pages 53 - 54)						
F01.00	User's 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	Keypad EEPROM parameter initialization	0: No operation 1: Parameters upload	0	1	○	
F02: Start & Stop Parameters (on pages 54 - 55)						
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	0.001m/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	0.200s	0.001s	×	

Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
F02.06	Retention time of stop zero-speed	0.000 - 4.999s	0.300s	0.001s	×	
F02.07	Contac tor 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	Unused					
F03: Acc. / Dec. Parameters (on pages 55 - 56)						
F03.00	Acc. speed	0.020 - 9.999m/s^2	0.700m/s^2	0.001m/s^2	×	
F03.01	Start Acc. jerk	0.020 - 9.999m/s^3	0.350m/s^3	0.001m/s^3	×	
F03.02	End Acc. jerk	0.020 - 9.999m/s^3	0.600m/s^3	0.001m/s^3	×	
F03.03	Dec. speed	0.020 - 9.999m/s^2	0.700m/s^2	0.001m/s^2	×	
F03.04	Start Dec. jerk	0.020 - 9.999m/s^3	0.600m/s^3	0.001m/s^3	×	
F03.05	End Dec. jerk	0.020 - 9.999m/s^3	0.350m/s^3	0.001m/s^3	×	
F03.06	Inspection Acc. speed	0.020 - 9.999m/s^2	0.200m/s^2	0.001m/s^2	×	
F03.07	Inspection Dec. speed	0.020 - 9.999m/s^2	1.000m/s^2	0.001m/s^2	×	
F03.08	Battery driven Acc. speed	0.020 - 9.999m/s^2	1.000m/s^2	0.001m/s^2	×	
F03.09	Battery driven Dec. speed	0.020 - 9.999m/s^2	1.000m/s^2	0.001m/s^2	×	
F03.10	Asyn. motor auto-tuning Acc. speed	0.020 - 9.999m/s^2	0.100m/s^2	0.001m/s^2	×	
F03.11	Asyn. motor auto-tuning Dec. speed	0.020 - 9.999m/s^2	0.100m/s^2	0.001m/s^2	×	
F03.12	Abnormal Dec. speed	0.020 - 9.999m/s^2	1.000m/s^2	0.001m/s^2	×	
F03.13	Stop Dec. jerk	0.020 - 9.999m/s^3	0.350m/s^3	0.001m/s^3	×	
F03.14	Asyn. 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	Unused					
F03.19	Sincos encoder CD phase learning	0: Learning 1: Not learning	0	1	×	
F03.20	Unused					
F04: Analogue Curve Parameters (on pages 56 - 57)						
F04.00	Setting curve	Unit: AI1 characteristic curve Ten: AI2 characteristic curve Hundred: AI3 characteristic curve Thousand: AI4 characteristic curve	0000	1	×	

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Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
F04.00	Setting curve	0: Line 1 1: Line 2	0000	1	×	
F04.01	Line 1 min. setting	0.0 - F04.03%	0.0%	0.1%	○	
F04.02	Corresponding value of line 1 min. setting	0.0 - 100.0%	0.0%	0.1%	○	
F04.03	Line 1 max. setting	F04.01 - 100.0%	100.0%	0.1%	○	
F04.04	Corresponding value of line 1 max. setting	0.0 - 100.0%	100.0%	0.1%	○	
F04.05	Line 2 min. setting	0.0 - F04.07%	0.0%	0.1%	○	
F04.06	Corresponding value of line 2 min. setting	0.0 - 100.0%	0.0%	0.1%	○	
F04.07	Line 2 max. setting	F04.05 - 100.0%	100.0%	0.1%	○	
F04.08	Corresponding value of line 2 max. setting	0.0 - 100.0%	100.0%	0.1%	○	
F05: Speed Parameters (on pages 57 - 59)						
F05.00	Multi-speed 0	0.000 - F00.02m/s	0.000m/s	0.001m/s	○	
F05.01	Multi-speed 1	0.000 - F00.02m/s	0.000m/s	0.001m/s	○	
F05.02	Multi-speed 2	0.000 - F00.02m/s	0.000m/s	0.001m/s	○	
F05.03	Multi-speed 3	0.000 - F00.02m/s	0.000m/s	0.001m/s	○	
F05.04	Multi-speed 4	0.000 - F00.02m/s	0.000m/s	0.001m/s	○	
F05.05	Multi-speed 5	0.000 - F00.02m/s	0.000m/s	0.001m/s	○	
F05.06	Multi-speed 6	0.000 - F00.02m/s	0.000m/s	0.001m/s	○	
F05.07	Multi-speed 7	0.000 - F00.02m/s	0.000m/s	0.001m/s	○	
F05.08	Inspection run speed	0.000 - 0.630m/s	0.200m/s	0.001m/s	○	
F05.09	Battery driven run speed	0.000 - F00.02m/s	0.100m/s	0.001m/s	○	
F05.10	Up forced speed switch detection value	0.0 - 100.0% (F00.02)	97.0%	0.1%	○	
F05.11	Down forced speed switch 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%	○	
F05.15	FDT2 delay level	0.0 - 100.0% (F00.02)	1.0%	0.1%	○	
F05.16	Speed within 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	Unused					
F05.22	Creeping speed	0.000 - 0.400m/s	0.050m/s	0.001m/s	○	

Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
F05.23 - F05.25 Unused						
F06: Weighing Compensation Parameters (on pages 59 - 60)						
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: Asyn. 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 Unused						
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 KI	1 - 9999	2000	1	○	
F06.17 - F06.20 Unused						
F07: Asyn. Motor Parameters (on pages 60 - 63)						
F07.00	Rated power of asyn. motor	0.2 - 500.0kW	Depend on HD5L	0.1kW	×	
F07.01	Rated voltage of asyn. motor	0V - rated voltage of HD5L		1V	×	
F07.02	Rated current of asyn. motor	0.0 - 999.9A		0.1A	×	
F07.03	Rated frequency of asyn. motor	1.00 - 100.00Hz	50.00Hz	0.01Hz	×	
F07.04	Rated rpm of asyn. motor	1 - 24000rpm	1440rpm	1rpm	×	
F07.05	Rated power factor of syn. motor	0.001 - 1.000	Depend on HD5L	0.001	×	
F07.06	Parameter auto-tuning of asyn. motor	0: No action 1: Stationary auto-tuning 2: Rotary auto-tuning	0	1	×	
F07.07	Stator resistance of asyn. motor	0.000 - 65.355Ω	Depend on HD5L	0.001Ω	×	

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Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
F07.08	Rotor resistance of asyn. motor	0.000 - 65.535Ω	Depend on HD5L	0.001Ω	×	
F07.09	Leakage inductance of asyn. motor	0.0 - 6553.5mH		0.1mH	×	
F07.10	Mutual inductance of asyn. motor	0.0 - 6553.5mH		0.1mH	×	
F07.11	Excitation current of asyn. motor	0.0 - 999.9A		0.1A	×	
F07.12	Core saturation coefficient 1 of asyn. motor	0.00 - 0.50 (magnetic flux is set as 50%)	0.50	0.01	×	
F07.13	Core saturation coefficient 2 of asyn. motor	0.00 - 0.75 (magnetic flux is set as 75%)	0.75	0.01	×	
F07.14	Core saturation coefficient 3 fo asyn. motor	0.00 - 1.20 (magnetic flux is set as 120%)	1.20	0.01	×	
F07.15	Asyn. motor torque boost	0.1 - 30.0%	0.1%	0.1%	○	
F07.16	Torque boost end-point of asyn. motor	0.0 - 50.0% (F07.03)	2.0%	0.1%	○	
F07.17	Slip compensation gain of asyn. motor	0.0 - 300.0%	100.0%	0.1%	○	
F07.18	Slip compensation filter time of asyn. motor of asyn. motor	0.1 - 10.0s	0.1s	0.1s	○	
F07.19	Slip compensation limit of asyn. motor	0.0 - 250.0%	200.0%	0.1%	×	
F07.20	AVR function	0: Disabled 1: Enabled the time 2: Disabled in Dec. speed	1	1	○	
F07.21	Oscillation-suppression mode of asyn. motor	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	Oscillation-suppression coefficient of asyn. motor	0 - 200	100	1	○	
F08: Motor Vector Control Speed-loop Parameters (on pages 63 - 64)						
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 limit	0.0 - 200.0% (rated current of motor)	180.0%	0.1%	○	
F08.07	ASR differential time	0.000 - 1.000s *0.000: ASR without differential*	0.000s	0.001s	○	

Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
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 limit	0.0 - 200.0% (F07.02)	180.0%	0.1%	×	
F08.10	DN electrical torque limit	0.0 - 200.0% (F07.02)	180.0%	0.1%	×	
F08.11	UP regenerative torque limit	0.0 - 200.0% (F07.02)	180.0%	0.1%	×	
F08.12	DN regenerative torque limit	0.0 - 200.0% (F07.02)	180.0%	0.1%	×	
F09: Current-loop Parameters (on pages 64 - 64)						
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 without filter*	0.000s	0.001s	○	
F09.03	Unused					
F09.04	Current loop period	2 - 10	6	1	×	
F09.05	Dead zone compensation mode	0 - 2	1	1	×	
F09.03 - F09.07 Unused						
F10: Syn. Motor Parameters (on pages 64 - 66)						
F10.00	Syn. motor type	0: IPM 1: SPM	0	1	×	
F10.01	Rated power of syn. motor	0.4 - 400.0kW	Depend on HD5L	0.1kW	×	
F10.02	Rated voltage of syn. motor	0V - rated voltage of HD5L		1V	×	
F10.03	Rated current of syn. motor	0.0 - 999.9A		0.1A	×	
F10.04	Rated frequency of syn. motor	1.00 - 100.00Hz	19.20Hz	0.01Hz	×	
F10.05	Rated rpm of syn. motor	1 - 24000rpm	96rpm	1rpm	×	
F10.06	Stator resistance of syn. motor	0.000 - 9.999Ω	0.000Ω	0.001Ω	×	
F10.07	Quadrature axis inductance of syn. motor	0.0 - 999.9mH	0.0mH	0.1mH	×	
F10.08	Direct axis inductance of syn. motor	0.0 - 999.9mH	0.0mH	0.1mH	×	
F10.09	Back EMF of syn. motor	0V - rated voltage of HD5L	0V	1V	×	
F10.10	Angle auto-tuning of syn. motor	0: No action 1: Stationary auto-tuning 2: Rotary auto-tuning	0	1	×	
F10.11	Stationary auto-tuning voltage setting of syn. motor	0.0 - 100.0% (F10.02)	100.0%	0.1%	×	
F10.12	Angle of syn. motor	0.0 - 359.9°	0.0°	0.1°	×	
F10.13	Pulse start angle of syn. motor	0.0 - 359.9°	0.0°	0.1°	×	
F10.14	SINCOS encoder C amplitude of syn. motor	0 - 9999	2048	1	×	
F10.15	SINCOS encoder C zero-bias of syn. motor	0 - 9999	2048	1	×	

A

Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
F10.16	SINCOS encoder D amplitude of syn. motor	0 - 9999	2048	1	×	
F10.17	SINCOS encoder D zero-bias of syn. motor	0 - 9999	2048	1	×	
F10.18	Sincos encoder CD phase	0: C phase ahead of D phase 1: D phase ahead of C phase	0	1	×	
F10.19	Optimize 1313 encoder start algorithm	0: Optimize 1: Do not optimize	0	1	×	
F10.20	Synchronous performance optimization	Bit0: Unused Bit1: Unused Bit2: Segmentation test function 0: Not open 1: Open Bit3: Unused BIT5 & BIT4: Synchronous motor start current limit 00: Normal 01: 2 times 10: 4 times 11: 8 times Bit6: Start comfortable 0: Way 0 1: Way 1 Bit7 - bit8: Unused Bit10 & bit9: Performance optimized 00: Way 0 01: Way 1 10: Way 2 11: Way 3 BIT11: Unused BIT12: Synchronous motor starts to suppress oscillation 0: Not inhibited 1: Suppress the shock BIT13: Start optimization 2 0: Not enabled 1: Enabled Bit14: Unused	0	1	×	

Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
		BIT15: Vibration Optimization 0: The old method of vibration optimization 1: New method of vibration optimization				
F11: PG Parameters (on pages 66 - 67)						
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-PG11-SC-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 Unit: Low-speed filter coefficient Ten: High-speed filter coefficient	0x11	1	○	
F11.04	The protocol of serial communication PG	0: Endat 1: Rotary transformer protocol 2 - 9: Unused	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	×	
F12: Digital I/O Terminal Parameters (on pages 67 - 69)						
F12.00	Input terminal filter time	0.000 - 1.000s	0.010s	0.001s	×	
F12.01	DI1 function	0: Unused 1: Controller enabled (EN) 2 / 3: UP / DN 4 - 6: MS1 - MS3 7: Inspection input (INS) 8: Battery-driven input (BAT) 9: Contactor feedback input (CSM) 10: Brake feedback input (BSM) 11 - 14: Weighing signal input 1 - 4 (WD1 - WD4) 15: Motor overheat input (OH) 16: Fault reset input (RST) 17: Up forced speed input (UPF) 18: Down forced speed input (DNF) 19: Governor feedback input (OSG)	1	1	×	
F12.02	DI2 function		2	1	×	
F12.03	DI3 function		3	1	×	
F12.04	DI4 function		4	1	×	
F12.05	DI5 function		5	1	×	
F12.06	DI6 function		6	1	×	
F12.07	DI7 function		0	1	×	
F12.08	DI8 function		0	1	×	
F12.09	DI9 function		0	1	×	

A

Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
F12.10	DI10 function	20 - 33: Unused 34: External fault (EXT) *Hundred digit = 0, normally open input selected; = 1, normally closed input selected*	0	1	×	
F12.11	DI11 function		0	1	×	
F12.12	DI12 function		0	1	×	
F12.13	Filter time of multi-speed terminal	0.000 - 2.000s	0.010s	0.001s	×	
F12.14	Unused					
F12.15	DO1 function	0: Unused 1: Controller is ready 2: Controller is running 3: Zero-speed running 4: Zero-speed 5: Contactor output control 6: Brake output control 7: FDT1 8: FDT2 9: Speed within FAR signal (FAR) 10: Up signal output 11: Down signal output 12: Under-voltage 13: Overload detection 14: Controller fault 15: Elevator stop 16 - 19: Unused 20: Speed outputs 21: Advanced door open signal output	2	1	×	
F12.16	DO2 function		3	1	×	
F12.17	RLY1 function		14	1	×	
F12.18	RLY2 (I/O board) function		0	1	×	
F12.19	RLY3 (I/O board) function		0	1	×	
F12.20	RLY4 (I/O board) function		0	1	×	
F12.21	Output terminal logic setting	Bit0, Bit1: DO1,DO2 output terminal positive or negative logic setting Bit2 - Bit5: RLY1 - RLY4 relay output positive or negative logic setting 0: Positive logic 1: Negative logic	00	1	○	
F12.22 - F12.24 Unused						
F13: Analogue I/O Terminal Parameters (on pages 69 - 72)						
F13.00	AI1 function	0: Unused 1: Speed setting 2: Weighing signal 3: Motor overheat 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	○	

Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
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 function	0: Unused 1: Running speed (0 - max output speed) 2: Setting speed (0 - max output speed) 3: Output current (0 - twice rated current of controller) 4: Output voltage (0 - 1.2 times rated voltage of controller) 5: DC bus voltage (0 - 2.2 times rated voltage of controller) 6: AI1 input (0 - 10V) 7 - 9: AI2 - AI4 input (-10 - 10V / 0 - 20mA)	0	1	○	
F13.17	AO2 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%	○	
F13.21	AO2 gain	0.0 - 200.0%	100.0%	0.1%	○	
F14: SCI Communication Parameters (on pages 72 - 73)						
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	0: 1200bps 1: 2400bps 2: 4800bps 3: 9600bps 4: 19200bps 5: 38400bps	3	1	×	
F14.02	Local address	0 - 247	2	1	×	

A

Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
F14.03	Host PC response time	0 - 1000ms	0ms	1ms	×	
F14.04	Detection time of communication timeout	0.0 - 1000.0s *0.0: Not detect at timeout*	0.0s	0.1s	×	
F14.05	Detection time of communication error	0.0 - 1000.0s *0.0: Not detect at error*	0.0s	0.1s	×	
F14.06 - F14.47 Unused						
F15: Display Control Parameters (on pages 73 - 74)						
F15.00	Language selection	0: Chinese 1: English 2 - 9: Unused	0	1	○	
F15.01	Display contrast of LCD keypad	1 - 10	6	1	○	
F15.02	Set parameter 1 of run status	0: Unused 1: Rated current of HD5L 2: Controller status 3: Operate channel 4: Setting speed 5: Setting speed (after Acc. / Dec.) 6: Output frequency 7: Setting Rpm 8: Actual Rpm 9: Unused 10: Output voltage 11: Output current 12: Output torque 13: Output power 14: DC bus voltage 15: AI1 voltage 16: AI1 voltage (after calculating) 17: AI2 voltage 18: AI2 voltage (after calculating) 19: AI3 voltage 20: AI3 voltage (after calculating) 21: AI4 voltage 22: AI4 voltage (after calculating) 23: AO1 output 24: AO2 output 25: Heatsink temperature 26: Input terminal status 27: Output terminal status 28: MODBUS status	5	1	○	
F15.03	Set parameter 2 of run status		6	1	○	
F15.04	Set parameter 3 of run status		10	1	○	
F15.05	Set parameter 4 of run status		11	1	○	
F15.06	Set parameter 5 of run status		0	1	○	
F15.07	Set parameter 6 of run status		0	1	○	
F15.08	Set parameter 1 of stop status		4	1	○	
F15.09	Set parameter 2 of stop status		14	1	○	
F15.10	Set parameter 3 of stop status		16	1	○	
F15.11	Set parameter 4 of stop status		26	1	○	
F15.12	Set parameter 5 of stop status		27	1	○	

Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
F15.13	Set parameter 6 of stop status	29: Total time at power-on (Hour) 30: Total running time (hour) 31, 32: Unused	0	1	○	
F16: Function-boost Parameters(on pages 74 - 75)						
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	0 - 9999ms	300ms	1ms	×	
F16.03	Fan control mode	0: Auto stop 1: Immediately stop 2: Run when power on	0	1	○	
F16.04	Fan control delay time	0.0 - 600.0s	30.0s	0.1s	○	
F16.05	Brake unit action voltage	220V: 380 - 450V 380V: 630 - 750V	Depend on HD5L	1V	×	
F16.06	Contactor 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	0.001m/s	○	
F16.09	Selection at motor overheat fault	0: Report E0020 after motor stop 1: Report E0020 at once	0	1	○	
F16.10	The coefficient of frequency demultiplication of HD-PG11-SC-FD	1 - 256	1	1	×	
F16.11	Stationary auto-tuning and current limit of syn. motor	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: UPS running judges its direction in according with current 2: UPS running judges its direction in according with encoder direction 3: UPS running judges its direction in according with current (no compansation and zero-speed keeping) 4: UPS running judges its d irection in according with encoder direction (no start compensation and zero-speed keeping)	0	1	×	
F16.14	Running min. current limit	0 - 100% (F07.11)	20%	1%	×	
F16.15	Running min. detect time	0.0 - 5.0s	0.0s	0.1s	×	

A

Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
F16.16	Governor fault detection time	0.0 - 2.0s	1.0s	0.1s	×	
F16.17	DC braking current at stop	0 - 150%	100%	1%	×	
F16.18	Starting frequency of DC braking current at stop	0.20 - 10.00Hz	0.50Hz	0.01Hz	×	
F16.19	Brake release frequency	0.00 - 10.00Hz	0.00Hz	0.01Hz	×	
F16.20 - F16.24 Unused						
F17: Fault Protect Parameters (on pages 75 - 77)						
F17.00	Input voltage at motor overheat	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 overheat	0.0 - 10.0kΩ	5.0kΩ	1.0kΩ	×	
F17.03	The detection base of lack of input	0 - 100% (rated voltage of controller)	30%	1%	×	
F17.04	The detection time of lack of input	0.0 - 5.0s	1.0s	1.0s	×	
F17.05	The detection base of lack of output	0 - 100% (rated current of controller)	20%	1%	×	
F17.06	The detection 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	0.1s/time	×	
F17.10	Faulty relay action	Unit: in auto reset process Ten: in undervoltage process 0: Faulty relay doesn't act 1: Faulty relay acts	00	1	○	
F17.11	NO.5 fault type	Lu: DC bus undervoltage E0001: Acc. overcurrent E0002: Dec. overcurrent E0003: Constant speed overcurrent E0004: Acc. over voltage E0005: Dec. over voltage E0006: Constant speed over voltage E0008: Power module fault E0009: Heatsink overheat E0010: Braking unit fault E0011: CPU fault E0012: Motor auto-tuning fault E0013: Soft start contactor failed	0	1	*	

Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
F17.11	NO.5 fault type	E0014: Current detection fault E0015: Input voltage phase loss E0016: Output voltage phase loss E0017: Controller overload E0018: Excessive speed deviation E0019: Motor overload E0020: Motr overheat E0021: Read / Write fault of control borad EEPROM E0022: Read / Write fault of keypad EEPROM E0023: Faulty setting of parameter E0024: Fault of external equipment E0025: Too small running current E0026: Internal logic error E0028: SCI communication timeout E0029: SCI communication error E0030: PG direction reverse E0031: PG disconnection E0032: Motor over speed E0033: Z signal loss of ABZ encoder E0034: UVW signal wrong of UVW Encoder E0035: CD phase wrong of SINCOS encoder E0036: Contactor fault E0037: Governor fault *E0008, E0010, E0013, E0014, E0021, E0022, E0024, E0036 can't auto reset*	0	1	*	
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 status at NO.5 Fault	0 - 0x1FF	0	1	*	
F17.18	Output terminal status at NO.5 fault	0 - 0x3F	0	1	*	
F17.19	NO.5 fault interval	0.0 - 6553.5 hour	0.0h	0.1h	*	

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Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
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	*	
F18: PWM Parameters (on pages 77 - 78)						
F18.00	Carrier fregency	1 - 16kHz	Depend on HD5L	1kHz	×	
F18.01	Carrier freqency auto adjust selection	0: Unused 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	×	
F20: Enhance Parameter Group 2 (on page 78)						
F20.00	Start DC braking current	50 - 150%	100%	1%	×	
F20.01	Start DC brake current duratiion time	0.0 - 3.0s	0.0s	0.1s	×	
F20.02	DI enable function	0: Original plan 1: New program	0	1	×	
F20.03	Output contactor opening time	0 - 9s *0: It is always on*	0s	1s	×	
F20.04	Output ground detection before operation	0: Detection 1: Not detected	0	1	×	
F20.05	Encoder C, D disconnection detection		0	1	×	
F20.06	Speed control proportional gain 1	1 - 100	30	1	○	
F20.07	Speed control integration time 1	0.01 - 10.00s	0.50s	0.01s	○	
F20.08	Speed control proportional gain 2	1 - 100	20	1	○	
F20.09	Speed control integration time 2	0.01 - 10.00s	1.00s	0.01s	○	
F20.10	Static self-tuning method for identifying no-load current	0: Calculated according to power factor 1: Estimated based on pole logarithmic power	0	1	×	
F20.11	Open door speed threshold	0.00 - 0.250m/s	0.100m/s	0.001m/s	○	

Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
F20.12	Output delay time after early door open relay output shutdown	0 - 3000ms	500ms	1ms	○	
F20.13	Elevator enable function quickly detects on	0: Do not open 1: Open *Only the DI1 - DI6 selection enable input signal (function No.1) is valid*	0	1	×	
F20.14	UPS running undervoltage setting	170 - 220V	190V	1V	×	
F20.15 - F20.19 Unused						
F20.20	E013 fault shielding	0: Not blocked 1: Shielded	0	1	×	

A

Appendix B Communication Protocol

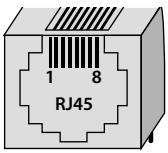
1. Introduction

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 status parameters and write the control command etc. The controller is in slave mode when it is communicating.

Communication Terminal

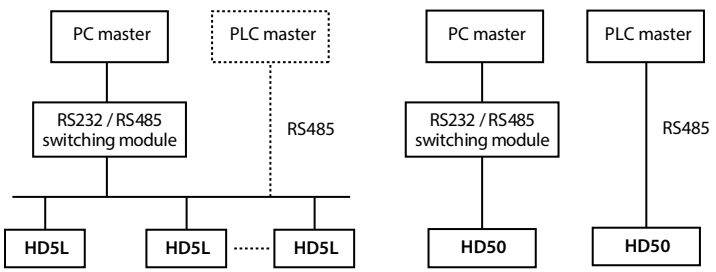
The SCI terminal is shown in following table.

Type	Name	Terminal description	
	SCI terminal	**Pin**	**Difinition**
		1,3	+5V
		2	485+
		4,5,6	GND
		7	485-
		8	Unused

The transmitting mode is shown in following table.

Port	Asyn, half-duplex
Format	1-8-2 (1 start bit, 8 data bits, 2 stop bits), no parity, RTU
Baut rate	9600bps
Relative setting	Refe to F14: SCI Communication Parameters, on page 72

Network Mode

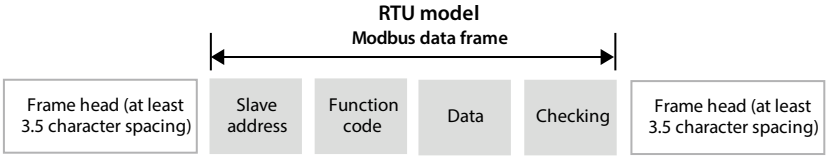


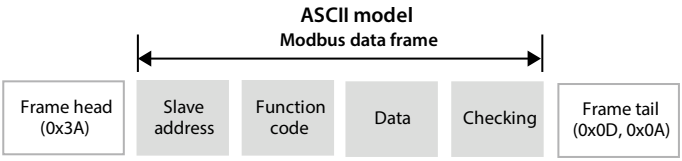
Single-master and multi-slave **Single-master and single-slave**

B

Protocol Format

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





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

In the RTU mode

- The idle time of frame head and frame tail passing bus should be not less than 3.5 bytes.
- Slave address = 0, it means broadcast address.
- Data checking relies on CRC-16. The whole information need be checked. The concrete CRC checking is referred to the page 125.

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

Command frame	Address	Parameter	Register address		Read char no.		Checksum	
	0x01	0x03	0x00	0x08	0x00	0x01	0x35	0xCB
Response frame	**Address**	**Parameter**	**Response byte**		**Content of register**		**Checksum**	
	0x01	0x03	0x02		0x5	0xDC	0xBA	0x8D

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.
- 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.
- 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.

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

2. 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.

3. Protocol Function

Supported function

MODBUS protocol supports the below parameter operation:

Supported function	Code	Instructions
To read function parameters and status parameter	0x03	
To rewrite single function parameter or control parameter	0x06	Not saved at power off
	0x41	Saved at power off
To rewrite numbers of function parameters or control parameters	0x43	Saved at power off

To read function parameters and status parameter

Function code 0x03, command frame and response frame are in below table (take RTU as an example).

Command frame	Address	Code	Starting register address	No. of register	CRC / LRC checking
Data frame bytes	1	1	2	2	2/1
Value or range	0 - 247	0x03	0x0000 - 0xFFFF	0x0001 - 0x0004	

Response frame	Address	Code	Read byte no.	Register content	CRC / LRC checking
Data frame bytes	1	1	1	2* no. of registers	2/1
Value or range	1 - 247	0x03	2* no. of registers		

To rewrite single function parameter or control parameter

Function code 0x06 (save at power off) or 0x41 (not save at power off); Command frame and response frame are in below table (take RTU as an example).

Command frame	Address	Code	Register address	Register content	CRC / LRC checking
Data frame bytes	1	1	2	2	2/1
Value or range	0 - 247	0x06, 0x41	0x0000 - 0xFFFF	0x0000 - 0xFFFF	

Response frame	Address	Code	Register address	Register content	CRC / LRC checking
Data frame bytes	1	1	2	2	2/1
Value or range	1 - 247	0x06, 0x41	0x0000 - 0xFFFF	0x0000 - 0xFFFF	

To rewrite numbers of function parameters or control parameters

Function code 0x43 (save at power off); Command frame and response frame are in below table (take RTU as an example).

Command frame	Address	Code	Starting register address	No. of register	Byte no. of register content	Register content	CRC / LRC checking
Data frame bytes	1	1	2	2	1	2* no. of operation registers	2/1
Value or range	0 - 247	0x43	0x0000 - 0xFFFF	0x0000 - 0x0004	2* no. of operation registers		

Response frame	Address	Code	Starting register address	No. of operation registers	CRC checking
Data frame bytes	1	1	2	2	2/1
Value or range	1 - 247	0x43	0x0000 - 0xFFFF	0x0000 - 0x0004	

This command rewrites the contents of continuous data unit from starting register address where is mapped as function parameter and control parameter of controller, 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 will return from the firstly failed address if the saving process isn't completely successful.

Fault and exception code

If the operation command fails, the response is fault code. The fault code is + 0x80. Below is the instruction for the exception codes.

Exception code	Instructions
0x01	Illegal function parameters.
0x02	Illegal register address.
0x03	Data fault. Data is exceeded the upper / lower limit.
0x04	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 status 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 status.
0x22	Parameters are protected by password.

4. Address Mapping

The function parameters and status parameters are all mapped as MODBUS's read-write register

Function code address mapping

Their group numbers are mapped as higher bytes of register address while the relationships are shown as below table.

The intergroup indexes are mapped as lower bytes. Please refer to user manual for index of F00 - F20.

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

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

Control parameter (0x33) address mapping

The status parameters (0x33) are mapped as higher bytes of the register address, and the intergroup indexes are as following:

Address	Function	Address	Group No.
0x3300	Controller series	0x331A	AI2 voltage
0x3301	Software version of DSP	0x331B	AI2 voltage (after calculating)
0x3302	Special software version of DSP	0x331C	AI3 voltage
0x3303	Software version of keypad	0x331D	AI3 voltage (after calculating)
0x3304	Elevator running status	0x331E	AI4 voltage
0x3305	Rated current of HD5L	0x331F	AI4 voltage (after calculating)
0x3306	Controller status	0x3320	AO1 output
0x3307	Control mode	0x3321	AO2 output
0x3308	Setting speed	0x3322	Heatsink temperature
0x3309	Setting speed (after Acc. / Dec.)	0x3323	Input terminal status
0x330A	Feedback speed	0x3324	Output terminal status
0x330B	Setting frequency	0x3325	MODBUS status
0x330C	Setting frequency (after Acc. / Dec.)	0x3326	Total time at power-on (hour)
0x330D	Output frequency	0x3327	Total running time (hour)
0x330E	Setting Rpm	0x3328	Run times
0x330F	Running Rpm	0x3329	Present fault
0x3311	Output voltage	0x332A	C phase value of SINCOS encoder
0x3312	Output current	0x332B	D phase value of SINCOS encoder
0x3313	Output torque	0x332C	A phase value of SINCOS encoder
0x3314	Output power	0x332D	B phase value of SINCOS encoder
0x3315	DC bus voltage	0x332E	UVW status of UVW encoder
0x3318	AI1 voltage	0x332F	Electrical angle
0x3319	AI1 voltage (after calculating)	0x3332	Pulses of PG

5. 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.

6. CRC checking

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));
}
```

7. 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)

Command frame	Address	Code	Register address		Word no. of read		Checksum	
	0x02	0x03	0x00	0x06	0x00	0x01	0x64	0x38
Response frame	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 status parameter D01.14)

Command frame	Address	Code	Register address		Word no. of read		Checksum	
	0x02	0x03	0x33	0x15	0x00	0x01	0x9A	0Xb9
Response frame	Address	Code	Answer byte		Register content		Checksum	
	0x02	0x03	0x02		0x02	0x19	0x3C	0xEE

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

Command frame	Address	Code	Register address		Register content		Checksum	
	0x02	0x41	0x00	0x07	0x04	0xB0	0x8F	0x43
Response 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 response frame:

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

5. Emergency to stop command of address 2

Command frame	Address	Code	Register address		Register content		Checksum	
	0x02	0x41	0x32	0x00	0x00	0x0B	0x72	0x89
Response 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.

6. Inspection up run command of address 2

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

7. Controller fault reset of address 2

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

8. Battery driven up run of address 2

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