HD5L-PLUS Series

Elevator Controller

User Manual

V1.0 2022.06

FOREWORD

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

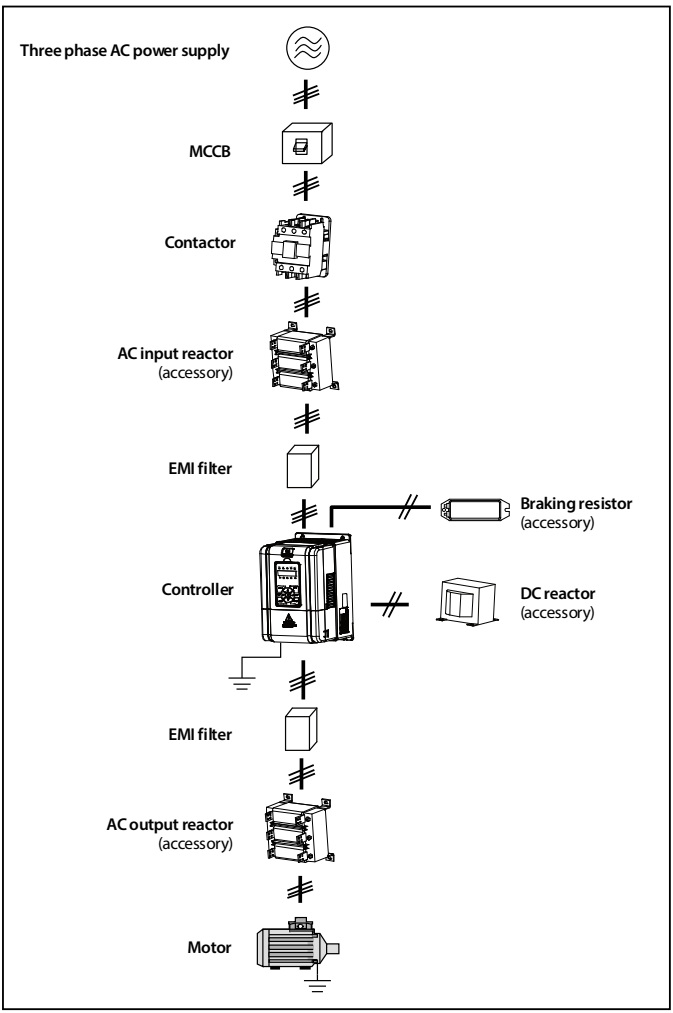
This User Manual describes how to use HD5L-PLUS series elevator controller and their installation wiring, parameter setting, troubleshooting and daily maintenance etc.

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: **marketing@hpmont.com**

Connection with Peripheral Devices



Version and Revision Records

Time: 2022/06

Version: V1.0

Revised Chapter	Revised Contents
	• Version 1.0 is released

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-PLUS 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-PLUS 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-PLUS

User should use the control terminal to start and stop HD5L-PLUS. It is strictly forbidden to use contactor or other switches on the input side of HD5L-PLUS 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-PLUS.

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-PLUS

No Capacitor or Varistor on the Output Side

Since HD5L-PLUS 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-PLUS fault trip or component damage.

Contactors and Circuit Breakers Connected to The Output of HD5L-PLUS

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

Running Voltage

HD5L-PLUS 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-PLUS sustains deadly power for a while. So to disassemble HD5L-PLUS 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-PLUS internal design has lightning surge overcurrent protection circuit, and has certain self-protection capacity against the lightning.

Altitude and Derating

In area where altitude exceeds 1000 meters, HD5L-PLUS 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-PLUS. Figure 1-1 is the derating curve of rated current and the altitude.

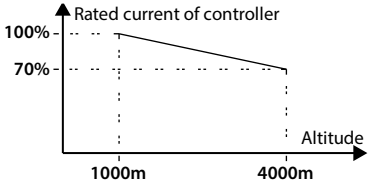
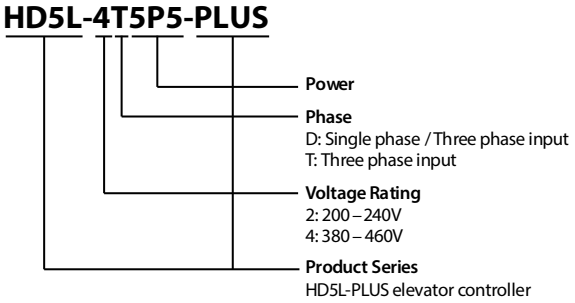


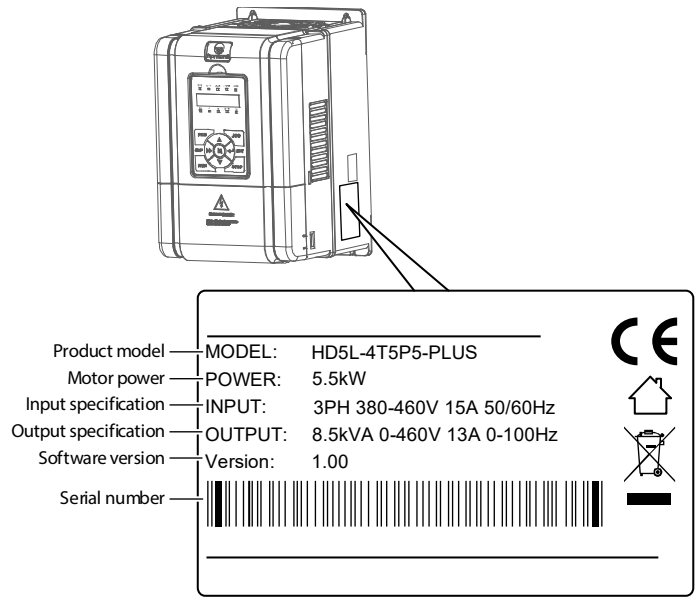
Figure 1-1 Derating curve of rated current and altitude

Chapter 2 Product Information

2.1 Model



2.2 Nameplate



2.3 Rated Value

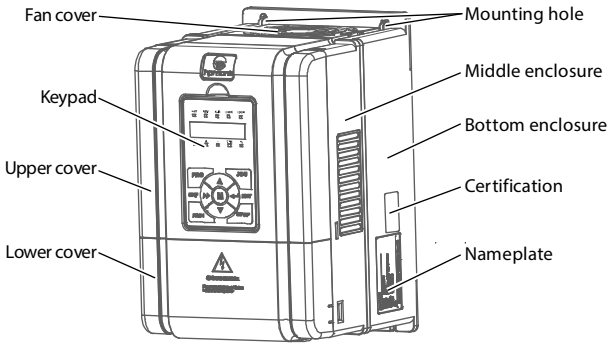
Model	Motor (kW)	Rated Capacity (kVA)	Rated Input Current (A)	Rated Output Current (A)	Size
Single phase/Three phase power supply: 200 - 240V, 50/60Hz					
HD5L-2D2P2-PLUS-	2.2	3.8	24.1/12 (1)	10	F3
HD5L-2D3P7-PLUS	3.7	5.9	40/19 (1)	17	F3
HD5L-2D5P5-PLUS	5.5	8.5	60/28 (1)	25	F3
HD5L-2D7P5-PLUS	7.5	11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

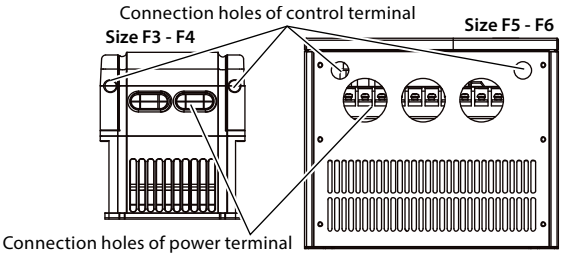
2.4 Technical Data

Electrical		
Input voltage	Single/three phase: 200 - 240V Three phase: 200 - 240V Three phase: 380 - 460V Fluctuating within ±10%, unbalance rate <3%	
Input frequency	50/60Hz ± 5%	
Output voltage	0V - input voltage	
Output frequency	0.00 - 100.00Hz	
Performance		
Maximum current	150% rated output current for 2 minutes 180% rated output current for 10 seconds	
Control mode	V/f, SVC, VC	
Running command	Keypad; Terminal; SCI communication	
Speed setting	Digital; Analog; SCI communication	
Speed resulotion	Digital setting: 0.01Hz Analog 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
Torque control accuracy	±5%	
Characteristic Functions		
Parameter upload and download function	Achieve 2 groups parameters uploading and downloading • From the control board to the keypad • From the keypad to the control board	
Programmable input and output terminals	Edited input/output terminal functions	
Modbus communication	Standard 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 or Down forced speed switch function	Up or Down forced speed switch function, to avoid climbing elevator or plunging elevator	
Input or Output phase loss protection	Input or Output phase loss auto-detect and alarm function	
Motor temperature detection	Real time detection for the motor temperature	
Output GND short circuit protection	Enabled	

Protection Functions	
Output inter-phase short circuit protection	Enabled
Input and Output	
Analog power supply	+10V, the Max. output current is 100mA
Digital supply	+24V, the Max. output current is 200mA
Analog input	AI: Voltage 0 - 10V
Digital input	DI1 – DI10: Voltage 0 - 30VDC
Digital output	DO1, DO2: Voltage 0 - 30VDC, the Max. output current is 50mA
Relay output	Y1: Contact rating 250VAC/5A or 30VDC/5A Y2, Y3: Contact rating 250VAC/3A or 30VDC/1A RA, RB, RC: Contact rating 250VAC/5A or 30VDC/5A
Communication	RJ45 interface MOD+, MOD-: 485 communication
USB	Connect the bluetooth module (MT70-BLE-A), use the mobile phone for debugging
Keypad	
LED display	5 digit LED digital tube, 5 unit indicator lights, 5 status indicator lights • Setting function parameter, checking status parameter, checking fault code etc. • Achieve quick parameter copy
Environment	
Running temperature	-10 - +40℃, the Max. is 50℃, air temperature fluctuation is less than 0.5℃/min The derating value of output current of HD5L-PLUS shall be 2% for each degree centigrade above 40℃.
Storage temperature	-40 - +70℃
Location for use	Indoor, preventing from direct sunlight, no dust, corrosive, flammable gases, oil mist, water vaper, dripping or salt etc.
Altitude	Less than 1000 meters, otherwise should be derating use
Humidity	Less than 95%RH, non-condensing
Vibration resistance	3.5m/s^2 in 2 - 9Hz, it is 10m/s^2 in 9 - 200Hz (IEC 60721-3-3)
Protection class	IP20
Pollution level	Level 2 (dry, non canducting dust pollution)
Remote update	
Remote update	Firmware remote update system download kit (HD-OTA-A)
Mobile phone debug	Bluetooth module (MT70-BLE-A)
PG card	Serial communication PG card with FD output (HD5L-PLUS-PG1-SC) (support Endat) OC PG card with FD output (HD-PG2-OC-FD-A) SINCOS PG card with FD output (HD-PG5-SINCOS-FD-A) Long-line drive PG card with FD output (HD-PG6-UVW-FD)
About keypad	LED keypad (HD-LED)
Power unit	Power regenerative unit [HDRU]

2.5 Parts of Controller





Chapter 3 Mechanical Installation

3.1 Precautions

Danger

- Do not install if controller 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 controller 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 controller 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 controller.
- Do not let wires, screws or residues fall into controller 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 controller so as to keep ambient temperature between -10 - +40°C;
- Install at where the vibration is 3.5m/s^2 in 2 - 9Hz, 10m/s^2 in 9 - 200Hz (IEC 60721-3-3);
- Protection level of controller is IP20 and pollution level is 2 (dry, non-conducting dust pollution).

Note:

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

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

3.3 Installation Direction and Space

To achieve good cooling efficiency, the HD5L-PLUS must be installed vertically.

There must be enough space betweem adjacent objects or baffles (such as walls). The installation space dimensions are shown in Figure 3-1, the unit is mm.

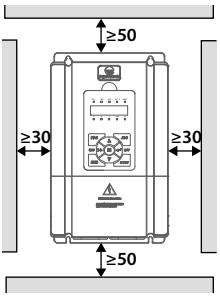
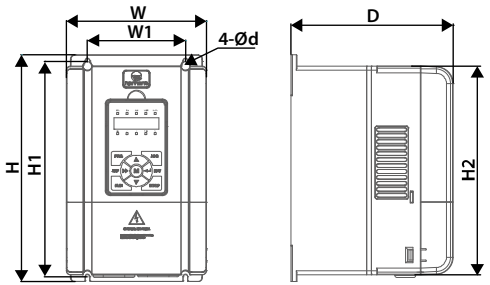


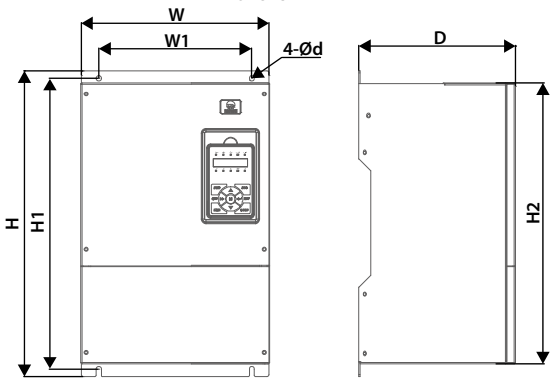
Figure 3-1 HD5L-PLUS installation

3.4 Dimensions and Weight

The dimensions and weight of HD5L-PLUS are as shown in Table 3-1. For the corresponding model of the installation dimension, please refer to section 2.3 Rated Value, on page 6.



Size F3 - F4



Size F5 - F6

Figure 3-2 Size

Table 3-1 HD5L-PLUS 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 3-3, press the keypad until hear a “click” sound.

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

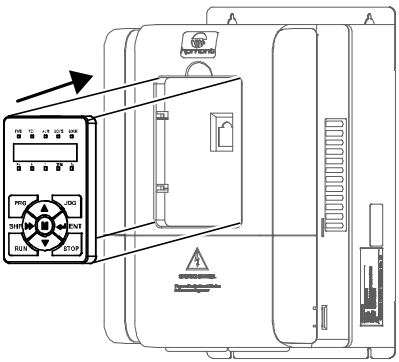


Figure 3-3 Install keypad

There are two steps in Figure 3-4.

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

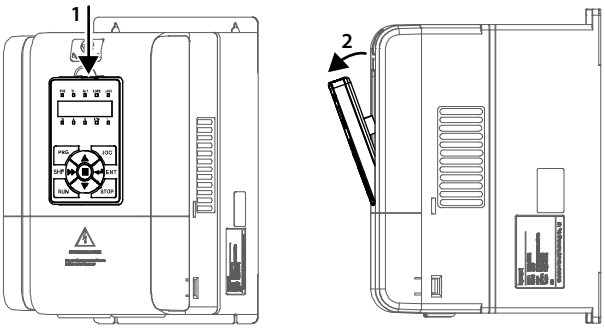


Figure 3-4 Dismantle keypad

3.6 Dismantle Plastic Cover

The upper cover and the lower cover of HD5L-PLUS are removable.

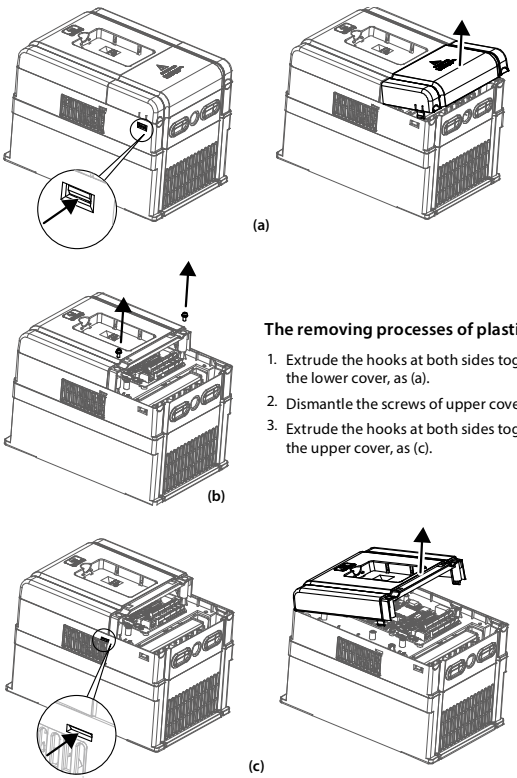
Before electrical installation, the cover must be removed. Before removing the upper cover, please take away the keypad.

Sheet Metal Structure (F5 - F6)

Unscrew the cover plate (counterclockwise) and remove the cover.

Plastic Structure (F3 - F4)

The dismantle steps are shown as Figure 3-5.



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).

Figure 3-5 Dismantle plastic cover

Chapter 4 Electrical Installation

4.1 Precautions

Danger

- Only qualified electrical engineer can perform wiring job.
- To facilitate the input side overcurrent protection and outage maintenance, connect controller with power supply via the MCCB or fuse.
- Do not dismantle controller or do wiring operation until the power is cut-off for more than 10 minutes, the internal charge indicator of controller is off and the voltage between (+) and (-) of the main circuit terminals is below 36V.
- Check the wiring carefully before connecting emergency stop or safety circuit.
- There is more than 3mA leakage current in HD5L-PLUS grounding, depending on the operating conditions. To ensure safety, controller 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 controller 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 controller.
- For controller 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 controller.
- Do not connect the phase-shifting capacitors to the output circuit.
- Be sure controller has ceased output before switching motor or change-over switches.
- The controller 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-PLUS 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 IEC 61800-5-1, as shown in Table 4-1.

Table 4-1 Sectional area of ground protective conductor

Sectional Area S of Phase Conductor (Supply Cable) While Installing (mm^2)	S ≤ 2.5	2.5 < S ≤ 16	16 < S ≤ 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-PLUS I/O wiring specification

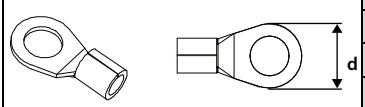
Model	MCCB (A)	Contactor (A)	Power Cable (mm^2)	Motor Cable (mm^2)	Ground Cable (mm^2)	Size
Single phase/Three phase power supply: 200 - 240V, 50/60Hz						
HD5-2D2P2-PLUS	32	20	6/2.5 (1)	2.5	6/2.5 (1)	F3
HD5L-2D3P7-PLUS	63	32	10/4 (1)	4	10/4 (1)	F3
HD5L-2D5P5-PLUS	32	20	25/6 (1)	6	16/6 (1)	F3
HD5L-2D7P5-PLUS	100/40 (1)	63 /32 (1)	35/10 (1)	10	16/10 (1)	F3
HD5L-2D011-PLUS	125/63 (1)	100/40 (1)	25/16 (1)	16	16	F4
(1): Value before / is for single phase model, value after / is for three phase model.						
Three phase power supply: 200 - 240V, 50/60Hz						
HD5L-2T015-PLUS	125	100	25	16	16	F5
HD5L-2T018-PLUS	160	100	35	35	16	F5
HD5L-2T022-PLUS	200	125	35	35	16	F6
HD5L-2T030-PLUS	200	125	50	50	25	F6
Three phase power supply: 380 - 460V, 50/60Hz						
HD5L-4T2P2-PLUS	16	10	1.5	1.0	2.5	F3
HD5L-4T3P7-PLUS	25	16	2.5	1.5	2.5	F3
HD5L-4T5P5-PLUS	32	25	2.5	2.5	4	F3
HD5L-4T7P5-PLUS	40	32	4	4	4	F3
HD5L-4T011-PLUS	63	40	6	6	6	F3
HD5L-4T015-PLUS	63	40	6	10	10	F4
HD5L-4T018-PLUS	100	63	10	10	10	F4
HD5L-4T022-PLUS	100	63	16	16	16	F5
HD5L-4T030-PLUS	125	100	25	25	16	F5
HD5L-4T037-PLUS	160	100	35	35	16	F6
HD5L-4T045-PLUS	200	125	35	35	16	F6

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 cable 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
Ring cable lug Max. Outer Diameter d (mm)	12	15.5	24

4.3 Power Terminals

Danger

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

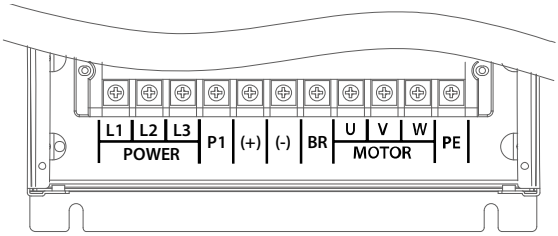
Warning

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

4.3.1 Power Terminal Description

Table 4-4 Power terminal description

- L1, L2, L3: Three phase AC power input terminals
- U, V, W: Output terminals, connect to 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



4.3.2 Power Terminal Connection

The power terminal connection are shown as Figure 4-1.

- Refer to section 2.5, on page 9 for terminal holes.
- For selection of contactor, MCCB, power cable, motor cable and ground cable, refer to section 4.2.1, on page 15.
- Refer to section 4.2.2, on page 16 for power terminal lug.
- Refer to section 9.1, on page 93 for braking resistors.
- Refer to section 9.2, on page 94 for AC reactors and DC reactors.

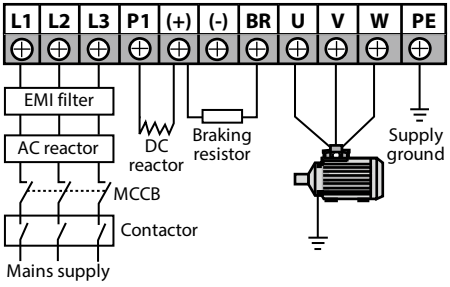


Figure 4-1 Power terminal connection

4.4 Control Board

Danger

- The control circuit is basically isolated with the power circuit. Do not touch HD5L-PLUS 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 LED Description

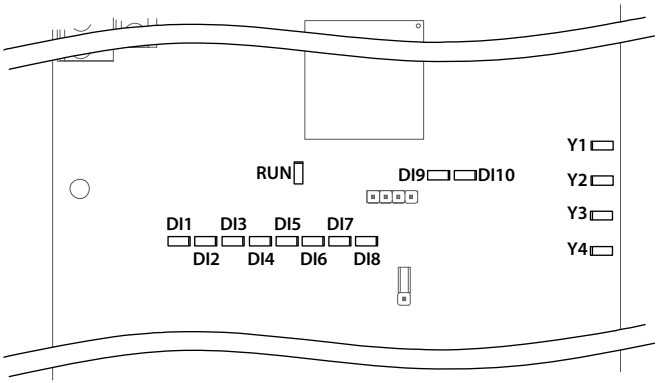


Figure 4-2 Indicator

Table 4-5 LED description

Indicator		Description
RUN (green)	Power Indicator	Flash: Run On: Stop
DI1 - DI10 (green)	Digital input indicator	On: Terminal has input
Y1 - Y3, Y4 (RYL) (green)	Relay output indicator	On: The relay has output

4.4.2 Control Terminal

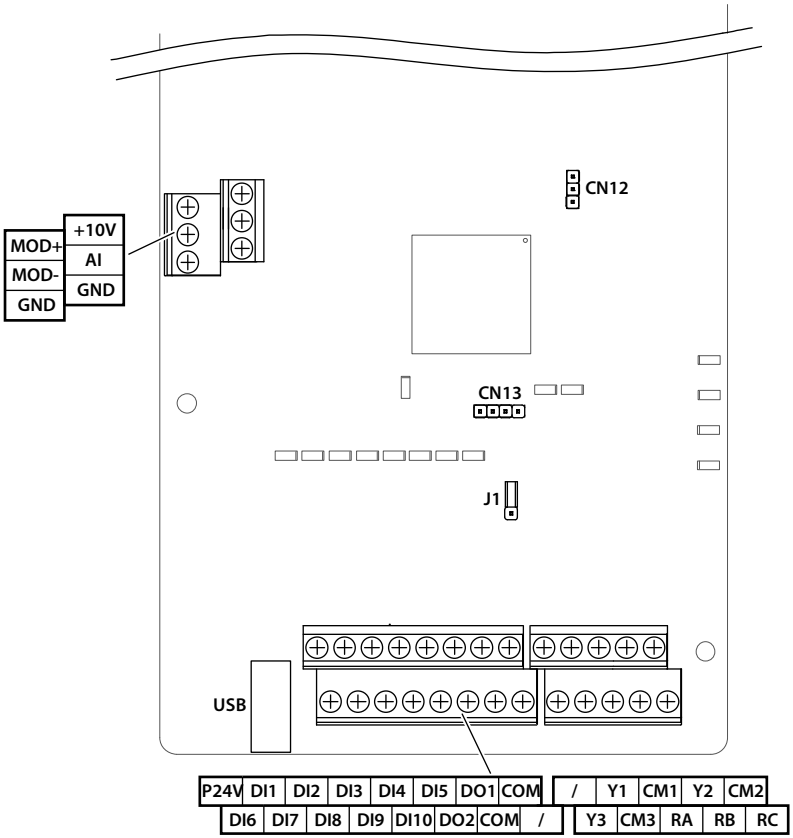


Figure 4-3 Control terminal

Table 4-6 Control terminal

Terminal		Description
+10V, GND	Analog power supply	Analog input use +10V power supply, the Max. output current is 100mA • GND is isolated to COM
P24V, COM	Digital power supply	Digital input use +24V as supply, the Max. output current is 200mA
AI, GND	Analog input	Input voltage: 0 - 10V, input impedance: 32kΩ • F13.00 set function
DI1 - DI10, COM	Digital input	Programmable bipolar optional input signal Input voltage: 0 - 30VDC, input impedance: 4.7kΩ • F12.01 - F12.10 set function Jumper J1 sets the input level • Short connect J1 with pin1,2, low level is valid (default). • Short connect J1 with pin2,3, high level is valid. 
DO1 - DO2, COM	Digital output	Programmable optical-coupled isolation, open collector output Output voltage: 0 - 30VDC, the Max. output current is 50mA • F12.15 - F12.16 set function
Y1, CM1	Relay output	Programmable output Contact rating: 250VAC/5A or 30VDC/5A • F12.17 set function
Y2, CM2 Y3, CM3		Programmable output Contact rating: 250VAC/3A or 30VDC/1A • F12.18 - F12.19 set function
RA, RB, RC		Programmable output Contact rating: 250VAC/5A or 30VDC/5A • RB, RC: Normally closed; RA, RC: Normally open • F12.20 set function
MOD+, MOD-	Modbus communication	485 communication terminal
USB	USB interface	Connect MT70-BLE-A (bluetooth module), use Android phone to debug HD5L-PLUS • See section 5.3, on page 42
CN12, CN13	OTA download port	Optional HP-OTA-A, remote upgrade HD5L-PLUS software by computer or Android phone • See section 7.5, on page 86

4.4.3 Control Terminal Wiring

Control terminal wiring are shown in Figure 4-4, terminal function is default.

- Refer to section 2.5, on page 9 for terminal holes.
- 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 analog signal cable must be shielded twisted pair. The shield should be reliably grounded.

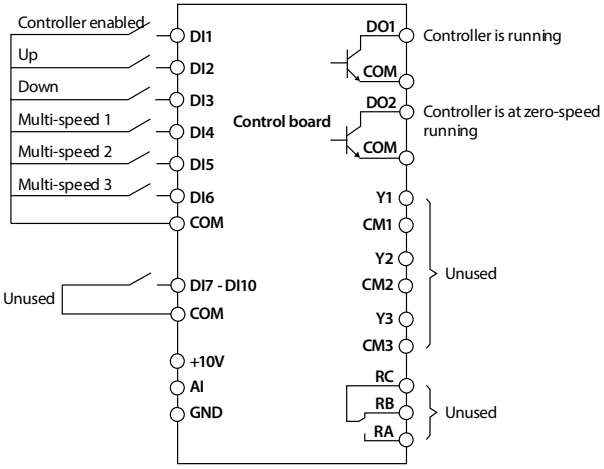


Figure 4-4 HD5L-PLUS control board connection

Digital Input Connection

Dry Contact

Using the internal 24V power supply, connections are shown in Figure 4-5.

- Short-connect J1 with pin 1,2, low level is valid (default).
- Short-connect J1 with pin 2,3, high level is valid.

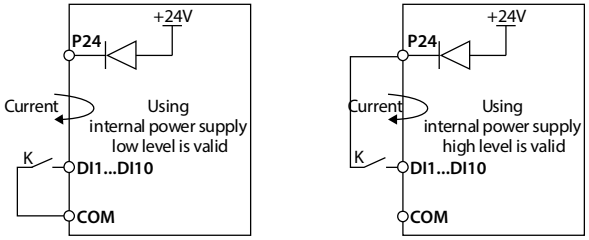


Figure 4-5 Dry contact connection

Source/Drain

When using the internal 24V power supply, the external controller is the common emitter output of NPN type and PNP type, and the wiring is shown in Figure 4-6.

- Short connect J1 with pin1,2, low level is valid (default).
- Short connect J1 with pin 2,3, high level is valid.

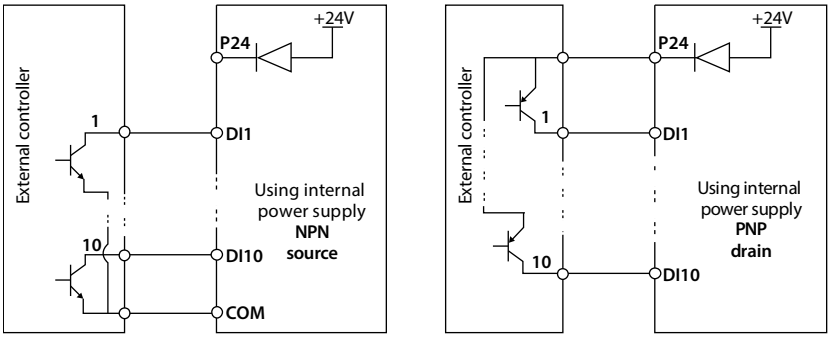


Figure 4-6 Source/Drain connection when using external power

Analog Input Connection

The AI is voltage input and the range is 0 - 10V, as shown in Figure 4-7.

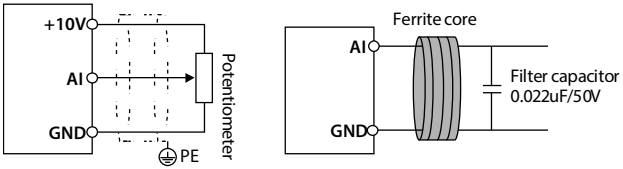


Figure 4-7 AI connection

Note:

1. The analog signal cable must be shielded twisted pair, and the shield should be reliably grounded.

2. In serious interference occasions, the analog input signal should add filter capacitor and ferrite core, the cable is wound 2-3 times in the same direction on the ferrite ring, as shown in Figure 4-7.

Digital Output Connection

DO is open collector output, DO can use internal 24V power supply of HD5L-PLUS, the connection is shown in Figure 4-8.

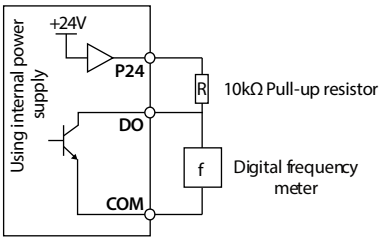


Figure 4-8 DO connection

4.5 PG Card

4.5.1 PG Card Introduction

There are 4 kinds of PG card provided for HD5L-PLUS series controller. And their models and functions are shown as Table 4-7.

Table 4-7 PG card

PG	Functions
Serial communication PG card with frequency division output [HD5L-PG1-SC]	• Support the serial communication encoder; • Support the pulse FD output and EnDat protocol; • Apply to Syn. motor and closed-loop vector control (VC)
OC PG card with frequency demultiplication (FD) output [HD-PG2-OC-FD-A]	• Support AB signals; • Support the pulse FD output; • Apply to Asyn. motor and closed-loop vector control (VC)
SINCOS PG card with FD output [HD-PG5-SINCOS-FD-A]	• Support the SINCOS signal; • Support the pulse FD output; • Apply to Syn. motor and closed-loop vector control (VC)
Long-line drive PG card with FD output [HD-PG6-UVW-FD]	• Support the differential ABZ and UVW signal; • Support the pulse FD output; • Apply to Syn. motor closed-loop vector control (VC)

4.5.2 Wiring Requirement

1. PG card wire should be laid separately and keep distance from power cables and forbidden to parallel with them.
2. PG card wire should be installed inside separated metal conduits and connected to ground firmly.

4.5.3 FD Description

Set FD

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 4-9.

The Max. value is "111111" which is 63 * 2 FD.

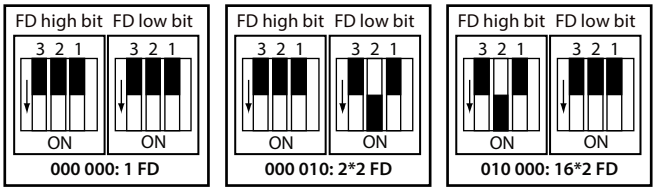


Figure 4-9 FD setting

FD Wiring

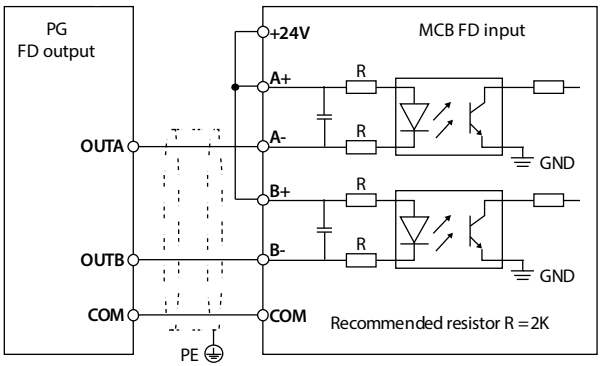


Figure 4-10 FD optocoupler input

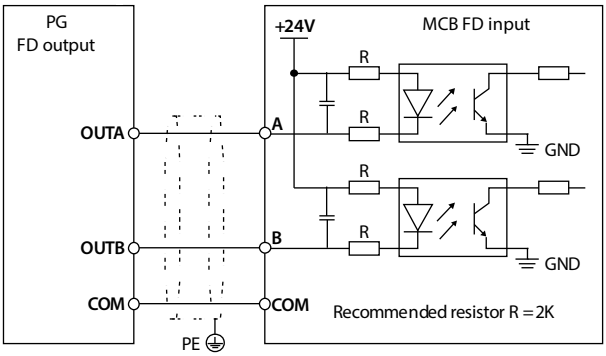


Figure 4-11 Single ended optocoupler input

4.5.4 HD5L-PLUS-PG1-SC

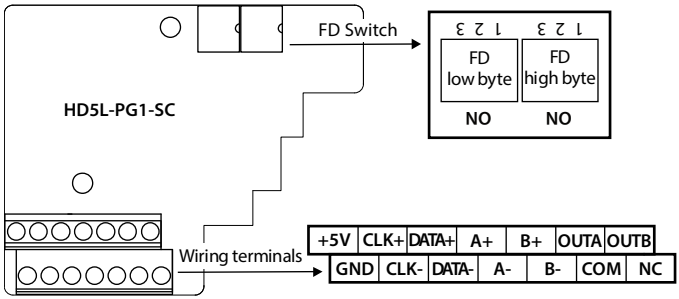


Figure 4-12 HD5L-PG1-SC

FD Switch

Frequency division switch to set frequency division factor, see section 4.5.3 FD Description, on page 24.

Terminal Description

Table 4-8 Terminal description

Terminal	Description	Terminal	Description
+5V	+5V power supply	A+/A-	Encoder differential sine and cosine analog signal A
GND	+5V power ground	B+/B-	Encoder differential sine and cosine analog signal B
CLK+/CLK-	Encoder differential clock signal CLK	OUTA	Output A signal, NPN type OC output
DATA+/DATA-	Encoder differential data signal DATA	OUTB	Output B signal, NPN type OC output
		COM	Output signal ground, isolated from GND

Connection

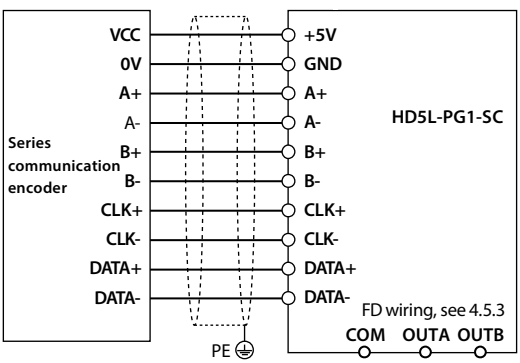


Figure 4-13 Serial communication encoder wiring

4.5.5 HD-PG2-OC-FD-A

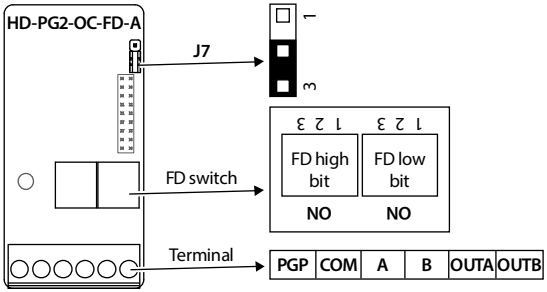


Figure 4-14 HD-PG2-OC-FD-A

FD Switch

Frequency division switch to set frequency division factor, see section 4.5.3 FD Description, on page 24.

Terminal Description

Table 4-9 Terminal description

Terminal	Description	Terminal	Description
PGP	+12V power supply output, jumper J7 sets the voltage • Short connect 1,2 pin, 5V • Short connect 2,3 pin, 12V (default)	A/B	A/B signals of encoder
		OUTA	Output A signal, NPN type OC output
		OUTB	Output B signal, NPN type OC output
COM	Power ground	COM	Output ground

Connection

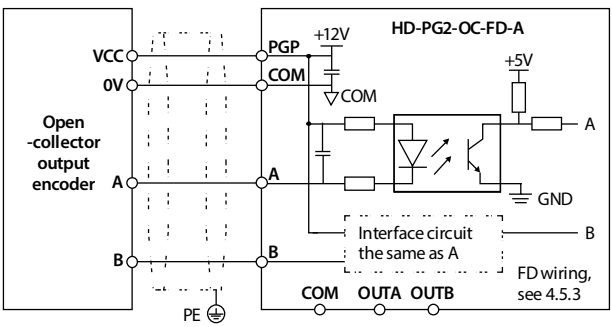


Figure 4-15 Connection of open-collector output encoder

4.5.6 HD-PG5-SINCOS-FD-A

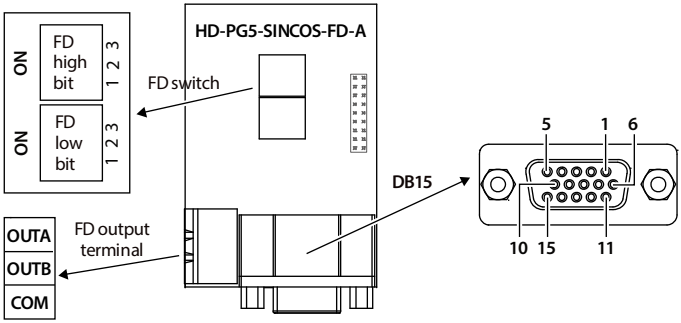


Figure 4-16 HD-PG5-SINCOS-FD-A

FD Switch

Frequency division switch to set frequency division factor, see section 4.5.3 FD Description, on page 24.

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

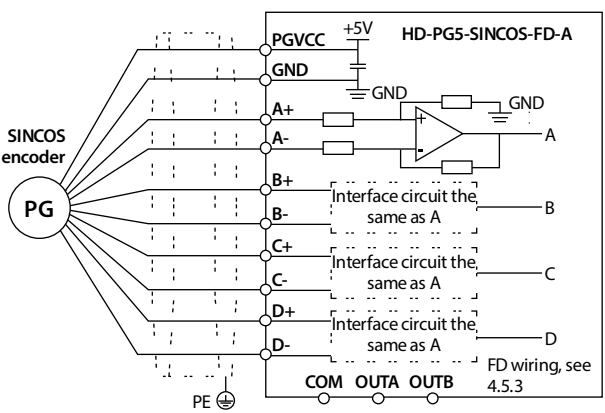


Figure 4-17 Connection of SINCOS encoder

4.5.7 HD-PG6-UVW-FD

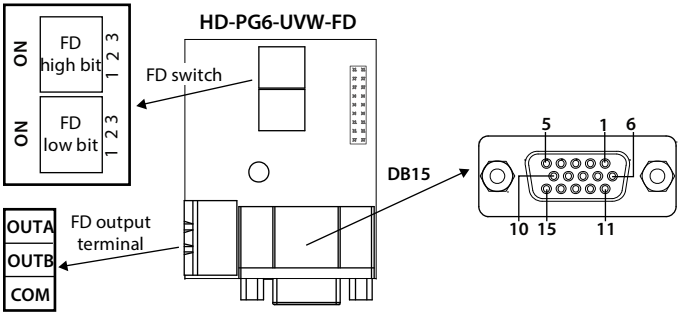


Figure 4-18 HD-PG6-UVW-FD

FD Switch

Frequency division switch to set frequency division factor, see section 4.5.3 FD Description, on page 24.

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

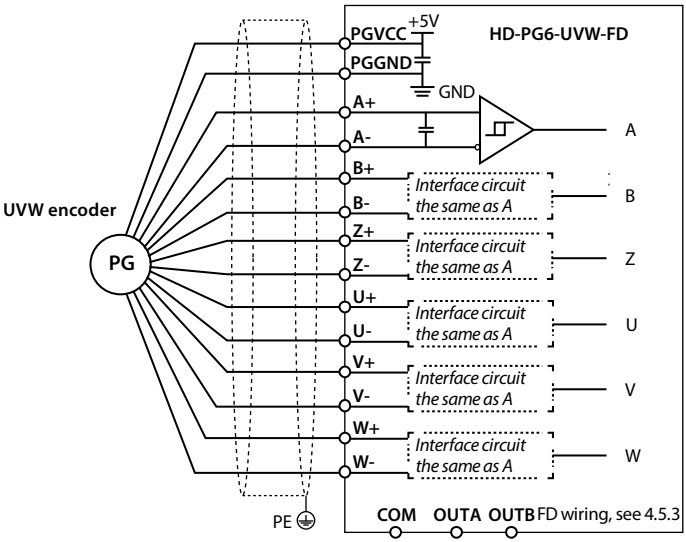


Figure 4-19 Connection of UVW encoder

4.6 Meet EMC Requirement of Installation

4.6.1 Correct EMC Installation

According to national standards GB/T 12668.3, 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/T 12668.3.

HD5L-PLUS 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 4-20.

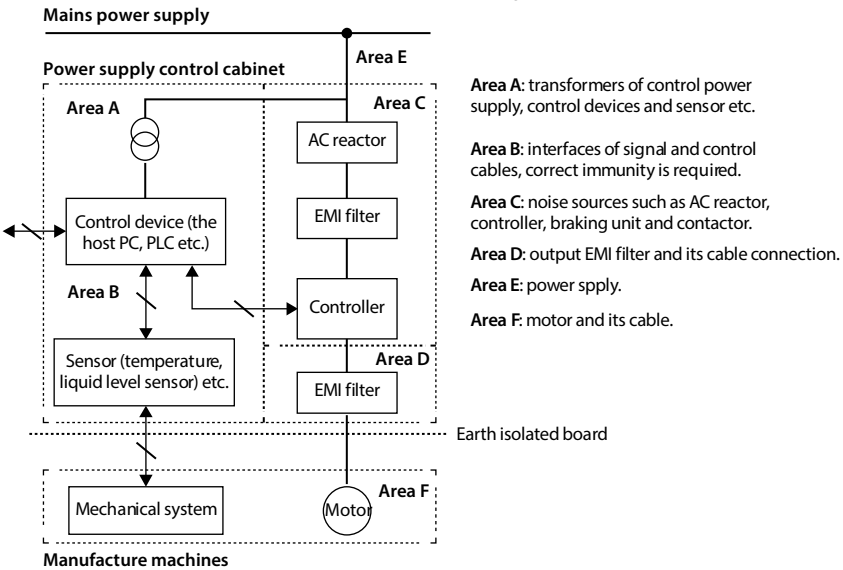


Figure 4-20 System wiring

- 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 4-21.

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

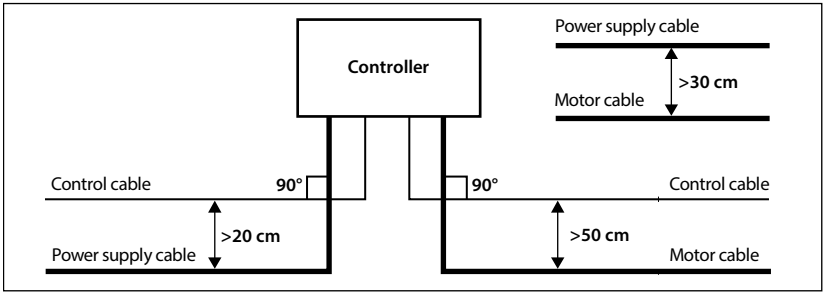


Figure 4-21 System wiring

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 4-22.

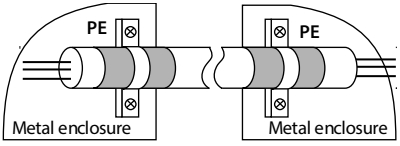


Figure 4-22 Shielded cable connection

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 4-12.

Table 4-12 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 motor cable should use the cable with the specified area, see section 4.2 Peripheral Accessories Selection, on page 15.

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 controller has leakage current to the ground. The grounding terminal PE must be grounded, and it is as close as possible to the grounding point, the grounding area is as large as possible, and the grounding resistance value is less than 10Ω.

Do not share the grounding wire (A) with other power equipment. The grounding electrode (C) can be shared, but each has a dedicated grounding electrode (B) for the best effect, as shown in Figure 4-23.

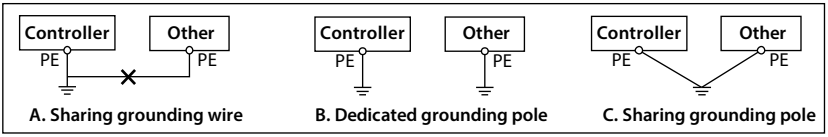


Figure 4-23 Grounding method

When using more than one controller, be careful not to loop the ground wire as shown in Figure 4-24.

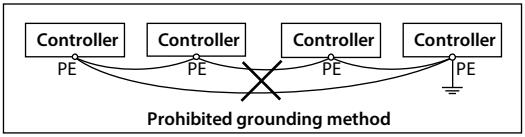


Figure 4-24 Prohibited grounding method

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 4-25.

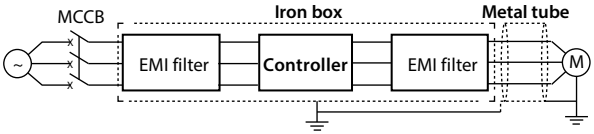


Figure 4-25 Reducing RF interference

4.6.7 Reactor

Reactor selection, see section 9.2, on page 94 for details.

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-PLUS 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-PLUS starts.
- To change the MCB, correctly set the parameters before operating.

Warning

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

5.1 Function Description

Note:

In the following chapters, the noun description related to the operation, control, operation and status of the controller will be mentioned 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-PLUS 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, STOP, JOG** keys of the keypad; And the run speed is set by F00.07.
Terminal analog control	The run command is controlled by UP and DN of the terminal; And the run speed is set by AI 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 Controller Status

Controller Status	Description
Stop status	After HD5L-PLUS 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-PLUS and the **FWD** or **REV** indicator of the keypad flashes.
Run status	The controller will start output from U/V/W terminals after it receives the run command. And the **FWD** or **REV** indicator of the keypad is always on.
Motor parameters auto-tuning	Set F07.06/F10.10 = 1 or 2, HD5L-PLUS will enter motor parameters auto-tuning status. If the process is completed, the controller will enter into stop status.
Fault alarm status	HD5L-PLUS has fault.
Under-voltage status	HD5L-PLUS is under-voltage.

5.1.3 Control Mode

HD5L-PLUS series have four control modes: V/f control, SVC control, VC control and SVC5 control, F00.01 setting.

5.1.4 Controller Running Mode

Running Mode	Description
Auto-tuning running	Set F07.06/F10.10 = 1 or 2, press **RUN** key to enter the auto-tuning running.
MS speed running	The run speed is set by MS1 - MS3 in combination or communication. • F00.05 = 2 or 4.
Inspection running	When inspection signal is valid, the speed will be set by F05.08 (inspection run speed). • F00.05 = 1, 2 or 4.
Emergency running	When emergency signal is valid, the speed will be set by F05.09 (emergency running speed). • F00.05 = 1, 2 or 4.
Normal running	Controlled by keypad (F00.05 = 0) or terminal analog (F00.05 = 1).

5.2 Keypad Debugging

5.2.1 Keypad Description (LED)

The standard HD5L-PLUS are installed with LED keypad which is shown in Figure 5-1.

Key description of keypad is shown in Table 5-1.

Table 5-1 Key description

Key	Description
PRG	Enter or exit programming key
RUN	In the keypad control, press this key to run HD5L-PLUS
STOP	a. In the keypad control, press this key to stop controller b. In the detection fault, press this key to reset 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

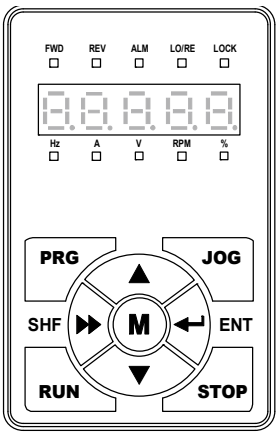


Figure 5-1 Standard keypad

The optional keypad consists of 5 status indicators and 5 unit indicators and shown as Table 5-2.

Table 5-2 Indicator description of the keypad

Indicator		■: Lighting	▣: Flashing	□: Lightless
FWD	Forward status	Controller is forward running at the moment	The start of controller is forward running next time	
REV	Reverse status	Controller is reverse running at the moment	The start of controller is reverse running next time	
ALM	Alarm status	Controller is faulty at the moment		Controller is well at the moment
LO/RE	Remote/local status	The controller is not keypad control at the moment		Controller is in keypad control mode
LOCK	Password locked status	The user password lock of controller is avail		There is no user password or unlocked
Hz	Frequency unit	The unit of the present parameter is Hz		
A	Current unit	The unit of the present parameter is A		
V	Voltage unit	The unit of the current parameter is V		
RPM	Rotary speed unit	The unit of the present parameter is rpm	The present parameter is rotary speed unit	
%	Percentage unit	The unit of the present function parameter is %		

The keypad has 5-digit LED, and the display meaning is shown in Table 5-3.

Table 5-3 LED description

Display	Meaning	Display	Meaning	Display	Meaning	Display	Meaning
0	0	H	A	J	J	U	U
1	1	b	b	L	L	u	u
2	2	C	C	n	n	y	y
3	3	c	c	o	o	-	-
4	4	d	d	P	P	.	Dot
5	5	E	E	q	q	.	Full display
6	6	F	F	r	r		No display
7	7	H	H	S	S	.	Flash modifable
8	8	h	h	T	T		
9	9	i	i	t	t		

5.2.2 Display Status

Parameter Display Status at Stop or Run

When HD5L-PLUS is in stop or run status, the keypad will display stop or run status and its parameters, as shown in Figure 5-2.

Press ▶▶ key to display different stop (F15.08 - F15.13)/running state parameters (F15.02 - F15.07) cyclically.

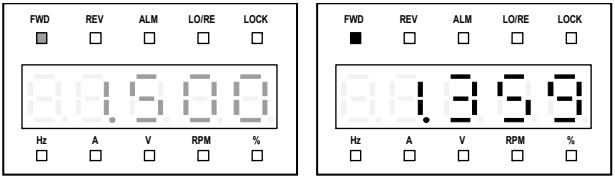


Figure 5-2 Display status of stop (left) and run (right)

Parameter Editing Display Status

At stop, run or fault alarm status, press **PRG** to enter function parameter editing status , as shown in Figure 5-3.

If there is a user password, please enter the password to unlock first, and F01.00 sets the user password.

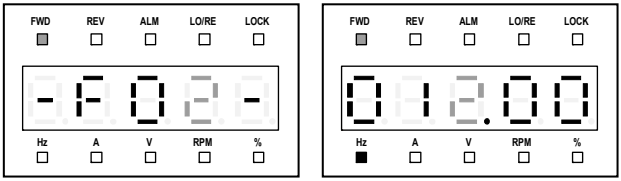


Figure 5-3 Parameter editing status

Fault Alarming Display Status

When a fault alarm occurs in the HD5L-PLUS, the keypad enters the fault alarm display state, the fault code is flashed, and the **ALM** indicator light is on.

The fault history can be checked by entering Group F17, reset fault see section 8.1.3, on page 90.

5.2.3 Keypad Operation Examples

Switching Four-level Menu Operation

The keypad uses four-level menu configuration for parameter setting or other operations.

The order of the four-level menu is: **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 5-4.

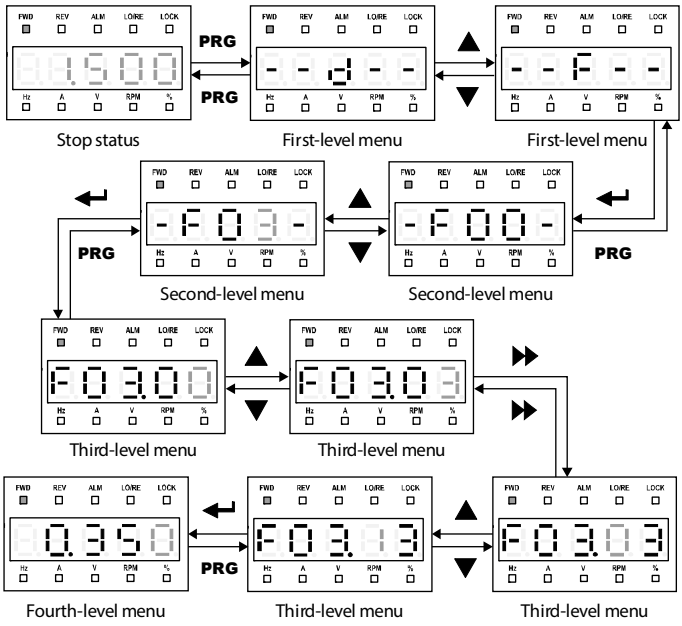


Figure 5-4 Four-level menu

Table 5-4 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 parameter. 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 parameter. Decrease by 1 according to the present modified bit	Modify function value. Decrease by 1 according to the present modified bit
▶▶	Invalid	Invalid	Switch unit and ten	Switch unit, ten thousand, thousand, hundred, ten

Setting Parameter

For example: To modify F00.07 from 1.500m/s to 1.000m/s, as shown in Figure 5-5.

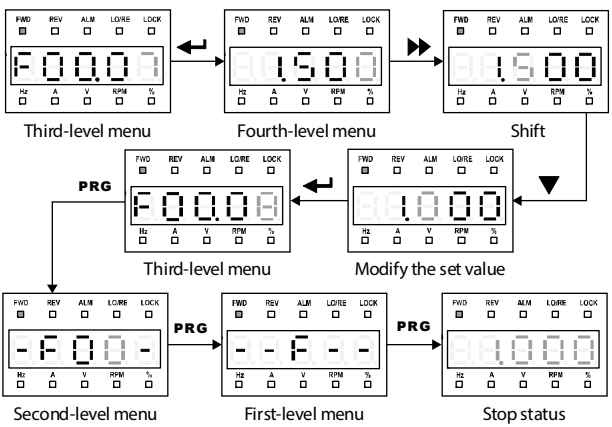


Figure 5-5 Parameter setting

In the fourth level menu, if the parameter does not flash, it means that the parameter cannot be modified. The possible reasons are as follows:

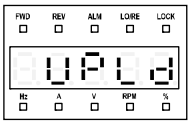
- The parameter can't be modified, such as the actual detected parameters, running record parameters, etc.
- Only when the controller stops can the function parameter be modified in running status.
- Only input the correct password can it edit the function parameter due to the valid password.

Upload and Download Parameters

Upload:

Set F01.03 = 1 and the keypad displays "UPLd".

When finished, the keypad displays F01.00.



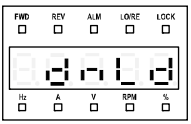
Uploading parameter

Figure 5-6 Display upload parameters

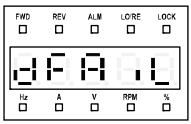
Download:

Set F01.02 = 2, and the keypad displays "dnLd".

When finished, the keypad displays F01.03.



Downloading parameter



Parameter download failed

Figure 5-7 Display download parameters

Note:

1. When downloading parameters, it displays "dFAiL", see Figure 5-7, which means that the EEPROM storage parameters of keypad do not match with function parameters of HD5L-PLUS. First, upload the setting value of the correct function code to the EEPROM of keypad, and then download.

2. When parameters are uploaded or downloaded, "E22" will be displayed flashing, indicating that the EEPROM of the operation panel is faulty. After 10s, the next parameter is displayed. The troubleshooting is in section 8.1 (on page 87).

5

5.3 Bluetooth APP Mobile Phone Debugging

The supporting Bluetooth module (MT70-BLE-A) uses the mobile phone to debug the HD5L-PLUS.

The Bluetooth APP debugging software is developed based on the Android 4.3 platform and Bluetooth 4.0. The main functions are shown in Table 5-5.

Table 5-5 Bluetooth APP function description

Function	Description
Bluetooth module connection	Search for the Bluetooth device MT70-BLE-A, connect the mobile phone with the controller
Elevator monitoring	Display the current elevator system status, fault reset operation
Function parameter	Common application macro parameters, fast debugging
Expert debugging	Controller parameter reading and writing, restoring factory parameters, clearing fault information, parameter uploading and downloading operations
Failure handing	Current fault, historical fault, formulating fault, fault assistance, operation

1. Get the Bluetooth APP installation file:
   Browser to visit www.hpmont.com, click **Download Center** > **Application Software**, search in **searching box**.
2. Use your Android phone to install the Bluetooth APP and log in to the APP.
   Android phone recommended configuration:
   - CPU: Main frequency above 1G
   - Memory: More than 512MB
   - Mobile phone built-in capacity: At least 256MB free space, screen resolution: Above 960*540
   - Recommended mobile phone brands: Huawei, Samsung, Sony, Xiaomi, Nexus
   - Operating system: Android 4.3 or above
3. Set the language of the Bluetooth APP:
   - The Bluetooth APP displays Simplified Chinese, set the phone system language to Simplified Chinese;
   - The Bluetooth APP displays English, set the phone system language to other languages.
4. Open the lower cover of HD5L-PLUS, insert the Bluetooth module (MT70-BLE-A) into the USB, see Figure 5-8.
   - The Bluetooth module cannot be used as a U disk and cannot be inserted into the USB port of the computer.

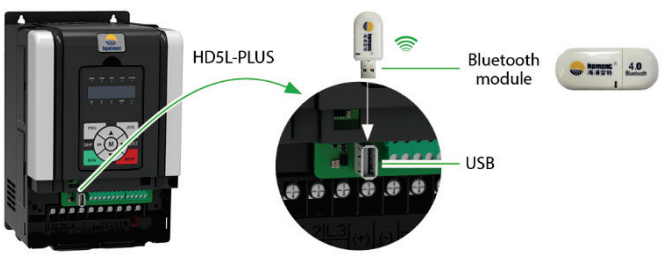


Figure 5-8 Bluetooth connection HD5L-PLUS

5. Open the Bluetooth APP and debug HD5L-PLUS.

   The elevator monitoring interface is shown in Figure 5-9, and the detailed description is shown in Table 5-6, on the next page.

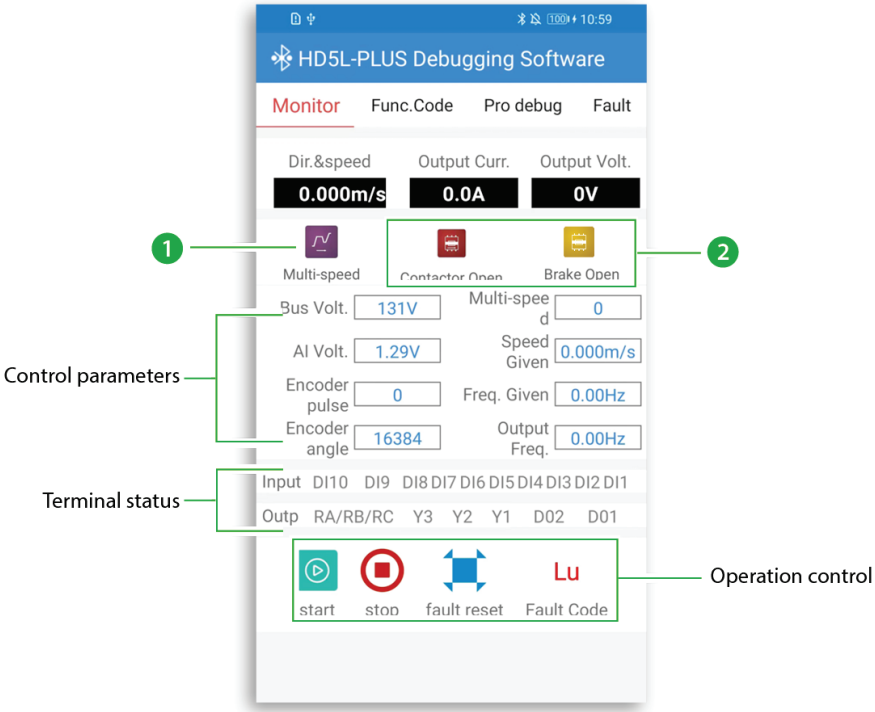


Figure 5-9 Elevator monitoring interface

Table 5-6 Elevator monitoring interface description

Function		Description
① Operation method		 Keypad control  Terminal multi-speed control  AI terminal analog control  SCI communication speed control
② Contactor status		 Brake contactor open  Brake contactor closed  Run contactor open  Run contactor closed
Direction and speed		Display the current running direction and speed of the elevator.
Output voltage, current		Display the current output voltage and current of HD5L-PLUS.
Control parameter		Display the current control parameters of HD5L-PLUS.
Terminal status		Display the current status of input and output terminals of HD5L-PLUS. • 0 is invalid, 1 is valid.
Operation control	start	When operating the keypad, click "**start**", the elevator will run at the keypad control speed.
	stop	During operation the keypad, click "**stop**", the elevator will decelerate and stop.
	fault reset	When the elevator fails, click "**fault reset**" to reset the current fault.
	Fault Code	Display fault code, such as current detection circuit fault E14, display "E14". • Click "**Fault Code**" to enter the "**fault code and countermeasure interface**".

Chapter 6 Function Introduction

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>Function Description</th><th>Setting Range [Default]</th></tr>
<tr><td>D00.00</td><td>Controller series</td><td>[Actual]</td></tr>
<tr><td>D00.01</td><td>Software version of DSP</td><td>[Actual]</td></tr>
<tr><td>D00.02</td><td>Special software version of DSP</td><td>[Actual]</td></tr>
<tr><td>D00.03</td><td>Software version of keypad</td><td>[Actual]</td></tr>
<tr><td>D00.04</td><td>Elevator running status</td><td>[Actual]</td></tr>
<tr><td></td><td colspan="2">Display the elevator running status in 16-bit binary. As following:
<table>
<tr><td>Bit15: Emergency 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, represented by “0”</td></tr>
<tr><td>Bit3: Analog 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: Disable
1: Enable</td></tr>
</table></td></tr>
<tr><td>D00.05</td><td>Rated current of HD5L-PLUS</td><td>[Actual]</td></tr>
<tr><td>D00.06</td><td>Controller status</td><td>[Actual]</td></tr>
<tr><td></td><td colspan="2">Display HD5L-PLUS status in 16-bit binary. As following:
<table>
<tr><td>Bit15: Unused</td><td>Bit14: Unused</td><td>Bit13: Stop signal
0: No
1: Yes</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: No
1: Yes</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]
D01.01	Setting speed (m/s)	[Actual]
D01.02	Setting speed (after Acc./Dec.) (m/s)	[Actual]
D01.03	Feedback speed (m/s)	[Actual]
D01.04	Setting frequency	[Actual]
D01.05	Setting frequency (after Acc./Dec.)	[Actual]
D01.06	Output frequency	[Actual]
D01.07	Setting Rpm	[Actual]
D01.08	Running Rpm	[Actual]
D01.10	Output voltage	[Actual]
D01.11	Output current	[Actual]
D01.12	Output torque	[Actual]
	Display output torque which is the relative percentage of the motor rated torque.	
D01.13	Output power	[Actual]
	Display output power which is the relative percentage of rated power of motor.	
D01.14	DC bus voltage	[Actual]

6.1.3 D02: Analog Status Display Parameters

Ref. Code	Function Description	Setting Range [Default]
D02.00	AI voltage	[Actual]
	Display AI input voltage.	
D02.01	AI voltage (after calculating)	[Actual]
	Display AI input voltage which is calculated by the gain, bias and filter.	

6.1.4 D03: Running Status Parameters

Ref. Code	Function Description	Setting Range [Default]
D03.00	Heatsink temperature	[Actual]
D03.01	Input terminal status	[Actual]

Displays the input terminal status. The corresponding input terminals of each bit (binary) are shown in the table below.

- 0: Disconnects with common terminals.
- 1: Connects with common terminals.

Bit11	Bit10	Bit9	Bit8	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
-	-	DI10	DI9	DI8	DI7	DI6	DI5	DI4	DI3	DI2	DI1

D03.02	Output terminal status	[Actual]

Displays the output terminal status. The corresponding output terminals of each bit (binary) are shown in the table below.

- Positive logic: 0 stands for invalid while 1 stands for valid.
- Negative logic: 0 stands for valid while 1 stands for invalid.

Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Y4 (RLY)	Y3	Y2	Y1	DO2	DO1

Ref. Code	Function Description	Setting Range [Default]
D03.03	**Modbus status**	[Actual]
	0: Normal. 1: Communication timeout. 2: Incorrect data frame head. 3: Incorrect data frame checking. 4: Incorrect data frame content.	
D03.04	**Total time at power-on (h)**	[Actual]
D03.05	**Total running time (h)**	[Actual]
D03.06	**Running times**	[Actual]
D03.07	**Present fault**	[Actual]

6.1.5 D04: Encoder Status Parameters

Ref. Code	Function Description	Setting Range [Default]
D04.00	**C phase AD sampling value of SINCOS encoder**	[Actual]
D04.01	**D phase AD sampling value of SINCOS encoder**	[Actual]
D04.02	**A phase AD sampling value of SINCOS encoder**	[Actual]
D04.03	**B phase AD sampling value of SINCOS encoder**	[Actual]
D04.04	**UVW status of UVW encoder**	[Actual]
D04.05	**Electrical angle**	[Actual]
D04.08	**Encoder pulses**	[Actual]
	Displays the encoder pulses for checking the encoder connection. • If the wiring is connected correctly, when the motor rotates, D04.08 will increase or decrease according to the running direction.	
D04.12	**Pulses monitoring of slip in start**	[Actual]
D04.13	**Judgement sources for start stability**	[Actual]
D04.15	**Auto-tuning without load encoder pulse change judgment variable**	[Actual]
	Used to judge the encoder pulses for auto-tuning without load. Calculate according to the following formula, if the result is close to D04.15, the auto-tuning is correct. • Formula: 4 × encoder resolution / (motor pole pair number × 6)	
D04.18	**Current position signal (Q13 format)**	[Actual]
D04.19	**Current position signal (Q16 format)**	[Actual]
	D04.18 one circle corresponds to the number of pulses 8192. • When the elevator runs for 1 pulse (2048 lines, 8192 pulses of internal 4 times frequency), the change amount is 1 pulse. D04.19 one circle corresponds to 65536 pulses. • When the elevator runs for 1 pulse (2048 lines, 8192 pulses of internal 4 times frequency), the change amount is 8 pulses.	
D04.20	**SINCOS encoder AB signal synthesis amplitude**	[Actual]
D04.21	**SINCOS encoder CD signal synthesis amplitude**	[Actual]
	Conduct disconnection detection on the synthesized AB and CD signals. • When abnormal AB signal is detected, it will report E39 (SINCOS encoder AB synthesis error). • When abnormal CD signal is detected, it will report E40 (SINCOS encoder CD synthesis error) after the elevator stops.	
D04.29	**Software built-in version**	[Actual]

6.2 Group F: General Function Parameters

6.2.1 F00: Basic Parameters

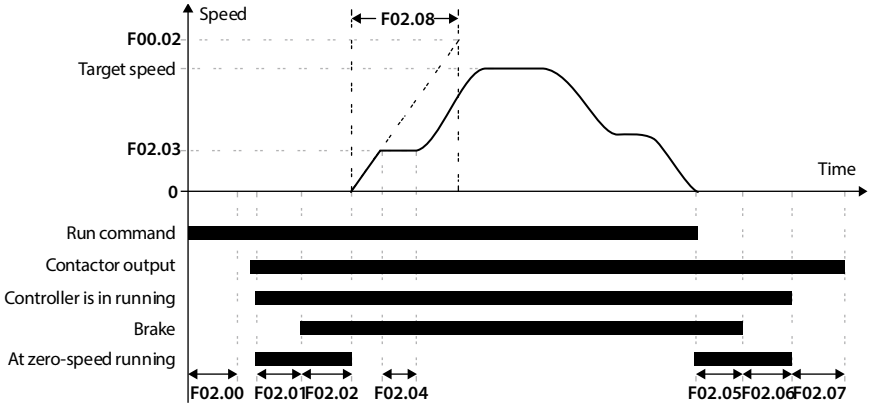
Ref. Code	Function Description	Setting Range [Default]
F00.00	**Motor type**	**0,1 [0]**
	0: Asyn. motor. 1: Syn. motor.	
F00.01	**Control mode**	**0 - 6 [2]**
	0: V/f control. Constant voltage/frequency ratio control. • It is applicable for special elevator occasion. This mode does not need the encoder and the control effect is not so good as the vector control. • When select V/f control, properly set the V/f control parameter (F07) to achieve proper efficiency. 1: SVC control. Sensorless vector control. It is only applicable for Asyn. motor. 2: VC 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: SVC4 control. 5: SVC5 control. 6: SVC6 control. ***Note:*** 1. *V/f control are temporary running modes applicable when the motor does not install encoder and the elevator is in inspection running.* 2. *SVC control is only available for Asyn. motor.* 3. *Set motor parameter auto-tuning when select SVC or VC control.* ***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 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 must < F00.02.	
F00.03	**The Max. output frequency of HD5L-PLUS**	**5.00 - 100.00 [50.00Hz]**
	Defines the Max. frequency that HD5L-PLUS 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. • Calculated according to the parameters of the motor, to determine the accuracy of the control, F00.04 must be set correctly. $$\text{Elevator speed (m/s)} = \frac{\text{Rotary speed of motor (rpm)}}{60} \times \frac{\text{F00.04}}{1000}$$ 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.	

Ref. Code	Function Description	Setting Range [Default]
F00.05	**Operating mode**	**0 - 5 [0]**
	0: Keypad control. • The **RUN** and **STOP** keys of the keypad control the start and stop, and F00.07 sets the running speed. 1: Terminal analog control. • The UP and DN terminal control start and stop, and the analog input terminal determines the running speed. 2: Terminal MS control. • The UP and DN terminal control start and stop, the terminal MS1-MS3 combination given running speed. 4: SCI control. • The PC communication controls start and stop, and set the multi-step speed. 3, 5: Unused.	
F00.06	**M key function**	**0,1 [0]**
	0: Unused. 1: Switch the running direction. Press the **M** key to switch the running direction of the motor.	
F00.07	**Speed setting of keypad**	**0.000 - F00.02 [1.500m/s]**
	When 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

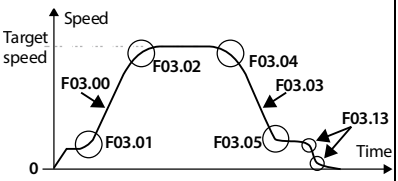
Ref. Code	Function Description	Setting Range [Default]
F01.00	**User's password**	**00000 - 65535 [00000]**
	XXXXX: To enable the password protection function, set any non-zero number as the password. • Once the password is set, and detect that there is no press on the keypad within 5 minutes, the user's password will take effect. • To change the parameters, input correct password, otherwise can only view it. 00000: Indicates that there is no user password. • If user unlocks the password, it means clearing the user's password.	
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-PLUS is in regular parameter read and write status. • Whether can change the parameter depends on the user's password status and the actual operating conditions of HD5L-PLUS. 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 Y. • **Steps:** Set F01.02 = 1, press ↵, the keypad will display "dnLd", and the stop state parameters will be displayed after completion. 2: Download the keypad EEPROM parameter to the current function code. • Except group F01, F17.11 - F17.27, group F18 and 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-PLUS is in regular parameter read and write status. 1: Upload the current function code settings to the keypad EEPROM parameter. • Group F01, F17.11 - F17.27, group F18 and Y do not upload.	

6.2.3 F02: Start&Stop Parameters

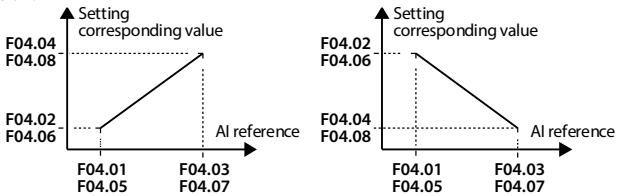


Ref. Code	Function Description	Setting Range [Default]
F02.00	**Start delay time**	**0.000 - 4.999 [0.000s]**
	Delay time from running command to controller running. • When controlled by keypad (F00.05 = 0), F02.00 is invalid.	
F02.01	**Brake open delay time**	**0.000 - 4.999 [0.000s]**
	Defines the time from zero-speed running to output brake-open command. • Set F02.01 to make the HD5L-PLUS enter running status before the brake is opened to prevent shock during starting.	
F02.02	**Retention time of start zero-speed**	**0.000 - 4.999 [0.500s]**
	The time from when the brake is opened to when there is speed output, the motor has output torque during this time. • Improves comfort when starting. • When 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 for maintaining the running start speed (F02.03) during the starting process of the controller.	
F02.05	**Brake close delay time**	**0.000 - 4.999 [0.200s]**
	The time from the controller running at zero speed to the output of the brake release command.	
F02.06	**Retention time of stop zero-speed**	**0.000 - 4.999 [0.300s]**
	When stopping, keep the motor at zero speed and output torque. • Improves comfort when stopping.	
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). • Invalid when F02.08 = 0.	

6.2.4 F03: Acc./Dec. Parameters

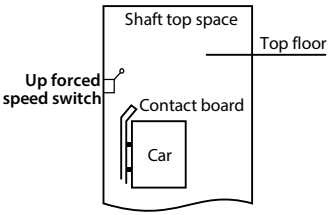
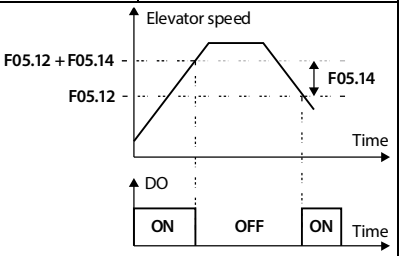
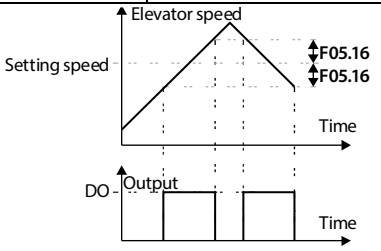
Ref. Code	Function Description	Setting Range [Default]
F03.00	**Acc. speed**	0.020 - 9.999 [0.700m/s²]
F03.01	**Start Acc. jerk**	0.020 - 9.999 [0.350m/s³]
F03.02	**End Acc. jerk**	0.020 - 9.999 [0.600m/s³]
F03.03	**Dec. speed**	0.020 - 9.999 [0.700m/s²]
F03.04	**Start Dec. jerk**	0.020 - 9.999 [0.600m/s³]
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]
F03.07	**Inspection Dec. speed**	0.020 - 9.999 [1.000m/s²]
	Defines the Acc. or Dec. speed of elevator at inspection run mode.	
F03.08	**Emergency running Acc.**	0.020 - 9.999 [1.000m/s²]
F03.09	**Emergency running Dec.**	0.020 - 9.999 [1.000m/s²]
	Defines the Acc./Dec. speed of elevator at emergency running mode.	
F03.10	**Asyn. motor auto-tuning Acc. speed**	0.020 - 9.999 [0.100m/s²]
F03.11	**Asyn. motor auto-tuning Dec. speed**	0.020 - 9.999 [0.100m/s²]
	Defines the Acc./Dec. speed in auto-tuning of motor.	
F03.12	**Abnormal Dec. speed**	0.020 - 9.999 [1.000m/s²]
	Defines the deceleration when the forced deceleration is valid or the operation mode is wrong.	
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 to increase ride 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.	
F03.19	**SINCOS encoder CD phase learning**	0,1 [0]
	0: Learning. 1: Not learning.	

6.2.5 F04: Analog Curve Parameters

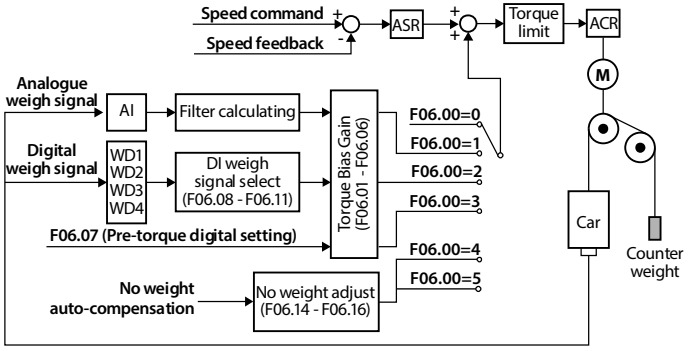
Ref. Code	Function Description	Setting Range [Default]
F04.00	**Setting curve**	**0000 - 1111 [0000]**
	Unit: AI characteristic curve selection **Ten, hundred, thousand: Unused** Each bit setting: • 0: Line 1. • 1: Line 2.	
F04.01	**Line 1 min. setting**	**0.0 - F04.03 [0.0%]**
F04.02	**Corresponding 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 the figure below. 	

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**	0.0 **- 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 running speed**	**0.000 - 0.630 [0.200m/s]**
	Defines the running speed of elevator in the inspection mode.	
F05.09	**Emergency running speed**	**0.000 - F00.02 [0.100m/s]**
	Defines the running speed of elevator in emergency running mode.	
F05.10	**Up forced speed switch detection value**	**0.0 - 100.0 (F00.02) [97.0%]**

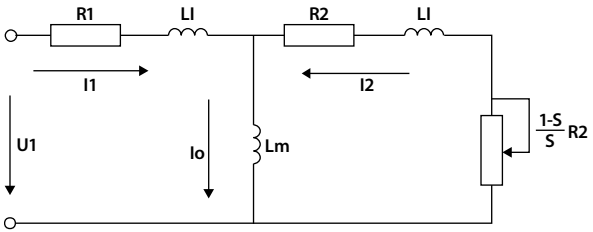
Ref. Code	Function Description	Setting Range [Default]
F05.11	**Down forced speed switch detection value**	0.0 - 100.0 (F00.02) [97.0%]
	Defines the speed detection value at the forced switch action. • After the forced switch is activated, when the running speed > the speed switch detection value, press F03.12 (abnormal Dec.) to decelerate to F05.22 (creeping speed). • Reasonable setting of F05.10 can prevent the elevator from hitting the top when it goes up. • Reasonable setting of F05.11 can prevent the elevator from squatting when it goes up.	
F05.12	**Speed detection level 1 (FDT1)**	0.0 - 100.0 (F00.02) [90.0%]
F05.13	**Speed detection level 2 (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 < F05.12 + F05.14, output ON indication signal. No output when running speed > F05.12 + F05.14, until running speed < F05.12. • Refer to F05.12 and F05.14 about F05.13 and F05.15.	
F05.16	**Speed within FAR range**	0.0 - 20.0 [1.0%]
	When the running speed is within the positive and negative detection width of the given speed, the pulse signal is output.	
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 > F05.17 and the duration time > F05.18, HD5L-PLUS alarms E32 fault (motor over speed). • F05.18 = 0, HD5L-PLUS 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-PLUS alarms E18 fault (excessive speed deviation). • F05.19 or F05.20 = 0, HD5L-PLUS does not detect the excessive speed deviation fault of motor.	
F05.22	**Creeping speed**	0.000 - 0.400 [0.050m/s]
	Defines the running speed at the forced Dec. run.	

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: Analog setting. • Output corresponding torque according to the input analog weight signal. 2: DI setting. • Output corresponding 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 encoder. 5: Asyn. motor zero-servo 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%]**
	In no weighing device, F06.07 sets the pre-torque value.	
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%]**

Ref. Code	Function Description	Setting Range [Default]
F06.11	**DI weighing signal 4**	**0.0 - 100.0 [90.0%]**
	Defines the percentage of the corresponding rated load when the digital weighing signal terminal input is valid. **For example:** If DI weighing signal 1 is enabled, it indicates the present load = the rated load × F06.08. • If multiple DI terminals are valid at the same time, the one with the largest terminal number is valid.	
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.	

6.2.8 F07: Asyn. Motor Parameters



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

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

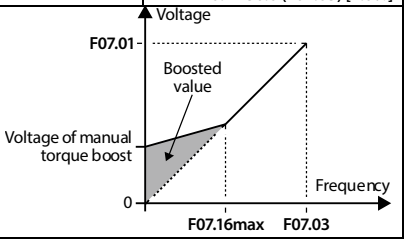
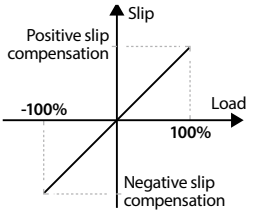
$$\text{Rated torque current} = \text{F07.05} \times \text{F07.02}$$

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

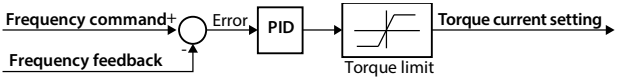
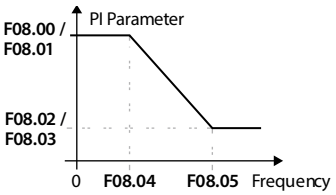
$$\text{Mutual inductance F07.10} = \frac{\text{F07.01}}{2\sqrt{3}\pi \times \text{F07.03} \times \text{F07.11}} - \text{F07.09}$$

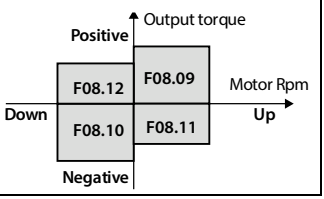
Ref. Code	Function Description	Setting Range [Default]
F07.00	**Rated power of Asyn. motor**	**0.2 - 500.0kW [Depend on HD5L-PLUS]**
F07.01	**Rated voltage of Asyn. motor**	**0V - Controller rated voltage [Depend on HD5L-PLUS]**
F07.02	**Rated current of Asyn. motor**	**0.0 - 999.9A [Depend on HD5L-PLUS]**
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-PLUS]**

Ref. Code	Function Description	Setting Range [Default]
F07.06	**Parameter auto-tuning of Asyn. motor**	**0 - 2 [0]**
	0: No action. 1: Auto-tuning with load. 2: Auto-tuning without load. • The motor is in auto-tuning with load first, and automatically measures the stator resistance (F07.07), rotor resistance (F07.08) and leakage inductance (F07.09), and automatically writes the corresponding parameters. • For mutual inductance (F07.10) and excitation current (F07.11): • At auto-tuning with load (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 auto-tuning without load (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 (oscillation-suppression mode) and F07.22 (oscillation-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 nameplate parameters (F07.00 - F07.04). 2. when 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, then press **RUN** key to start auto-tuning. The keypad will display "tunE". 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-PLUS]**
F07.08	**Rotor resistance of a Syn. motor**	**0.000 - 65.535Ω [Depend on HD5L-PLUS]**
F07.09	**Leakage inductance of Asyn. motor**	**0.0 - 6553.5mH [Depend on HD5L-PLUS]**
F07.10	**Mutual inductance of Asyn. motor**	**0.0 - 6553.5mH [Depend on HD5L-PLUS]**
F07.11	**Excitation current of Asyn. motor**	**0.0 - 999.9A [Depend on HD5L-PLUS]**
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]**
	F07.12 - F07.14 set the iron core saturation coefficient when the magnetic flux is 50%, 75% and 120%.	
F07.15	**Asyn. motor torque boost**	**0.1 - 30.0 [0.1%]**

Ref. Code	Function Description	Setting Range [Default]
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-PLUS can boost the voltage so as to boost the torque. F07.16 is relative to percentage of rated frequency of motor (F07.03). 	
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. Slip compensation (automatically adjusting the output frequency of the controller according to the load torque of the motor) can reduce this effect. • 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. • 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 (Automatic Voltage Regulation) 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.  • When the running frequency is 0 - F08.04, the vector control PI parameters are F08.00 and F08.01; • When the running frequency > F08.05, the vector control PI parameters are F08.02 and F08.03; • When the running frequency is F08.04-F08.05, the vector control P parameter is the linear interpolation between F08.00 and F08.02, and the I parameter 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). The bigger torque output, the bigger current output. • If the torque is too big, overcurrent 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). • Increase F09.00 or F09.01 to speed up the dynamic response of the output torque and reduce it to enhance the stability of the system. • If F09.00 or F09.01 is too large, the system will easily oscillate; if it is too small, it will affect the torque output capability of the system.	
F09.02	Current-loop output filter time	0.000 - 1.000 [0.000s]
F09.04	Current loop period	2 - 10 [6]
F09.05	Dead zone compensation mode	0 - 2 [1]
F09.06	Magnetic flux compensation method	0 – 2 [0]
	0: Way 0. 1: Way 1. 2: Way 2.	

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-PLUS]
F10.02	Rated voltage of Syn. motor	0V - Rated voltage of HD5L-PLUS [Depend on HD5L-PLUS]
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]

Ref. Code	Function Description	Setting Range [Default]
F10.08	**Direct axis inductance of Syn. motor**	**0.0 - 999.9 [0.0mH]**
F10.09	**Back EMF of Syn. motor**	**0V - Rated voltage of HD5L-PLUS [0V]**
F10.10	**Angle auto-tuning of Syn. motor**	**0 - 2 [0]**
	0: No action. 1: Auto-tuning with load. 2: Auto-tuning without load. • Refer to section 7.1.2 Motor Auto-tuning.	
F10.11	**Auto-tuning with load voltage setting of Syn. motor**	**0.0 - 100.0 (F10.02) [100.0%]**
	If Syn. motor reports overcurrent fault at auto-tuning with load, the F10.11 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 without manual changes.*	
F10.19	**Optimize 1313 encoder start algorithm**	**0,1 [0]**
	0: Optimize. 1: Do not optimize.	
F10.20	**Syn. performance optimization**	**0 - 65535 [1028]**
	Bit0: Unused **Bit1: Current loop parameter automatic optimization** • 0: Manual optimization. • 1: Automatic optimization. After parameter auto-tuning, automatic update F09.00, F09.01, F09.06, F09.07. **Bit2: Segmentation test function** • 0: Not open. • 1: Open. **Bit3: Unused** **Bit5&Bit4: Syn. motor start current limit** • 00: Normal. • 01: 2 times. • 10: 4 times. • 11: 8 times. **Bit6: Starting comfort** • 0: Way 0. • 1: Way 1. **Bit8&Bit7: Unused** **Bit10&Bit9: Performance optimized** • 00: Way 0. • 01: Way 1. • 10: Way 2. • 11: Way 3. **Bit11: Unused** **Bit12: Syn. motor starts to suppress oscillation** 0: No suppression. 1: Inhibit. **Bit13: Start optimization 2** 0: Not enabled. 1: Enabled. **Bit14: Unused** **Bit15: Vibration optimization** 0: The old method. 1: New method.	

6.2.12 F11: Encoder Parameters

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

Ref. Code	Function Description	Setting Range [Default]
F11.00	**PG card selection**	**1 - 4 [1]**
	1: HD-PG2-OC-FD-A, the OC PG card with frequency division output. • Only for Asyn. motor. 2: HD-PG6-UVW-FD, the long-line driver PG card with frequency division output. • Only for Syn. motor. 3: HD-PG5-SINCOS-FD-A, the SINCOS PG card with frequency division output. • Only for Syn. motor. 4: Unused.	
F11.01	**Encoder pulses per revolution**	**1 - 9999 [2048]**
F11.02	**Emergency encoder rotation direction setting operation**	**0,1 [0]**
	Defines whether the direction represented by the wiring sequence of the controller and the motor is consistent with the direction represented by the wiring sequence of the PG card. • Change F11.02 is equivalent to changing the encoder AB two-phase phase sequence 0: The same direction. 1: The reverse direction.	
F11.03	**Encoder signal filter coefficient**	**0x00 - 0x77 [0x11]**
	Unit: Low-speed filter coefficient. Ten: High-speed filter coefficient.	
F11.04	**Serial communication encoder protocol**	**0 - 9 [0]**
	0: Endat. 1: Rotary transformer protocol. 2 - 9: Unused.	
F11.05	**Encoder disconnection detection time**	**0.00 - 2.00 [1.00s]**
	When the controller detects that the encoder is disconnected, and the duration > F11.05, the controller reports E31 (encoder disconnection). • When F11.05 = 0, the HD5L-PLUS does not detect encoder disconnection.	

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 DI terminal and to set input terminal sensibility. • If the DI terminal is easily disturbed and causes malfunction, F12.00 can be increased, but the sensitivity of the terminal will be reduced.	
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 function**	**000 - 134 [0]**
F12.08	**DI8 function**	**000 - 134 [0]**
F12.09	**DI9 function**	**000 - 134 [0]**
F12.10	**DI10 function**	**000 - 134 [0]**

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

0: Unused.

- Does not operate even if there is a signal input.
- 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-PLUS is enabled to run.
- When diasbled, the running operation is prohibited in the stop state, and the running state is coast to stop.
- When no terminal selects this function, default controller enabled.

2, 3: UP/DN.

- Set control terminal to control up and down of elevator, see the table below.

UP Terminal (No. 2)	DN Terminal (No. 3)	Elevator Status
0	0	Stop
0	1	Down
1	0	Up
1	1	Stop

4 - 6: MS1 - MS3.

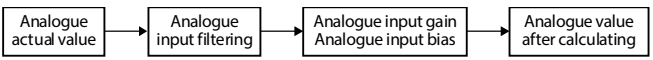
- Achieve 8-speed running curve via terminals logic combination, see the table below.

MS3 Terminal (No. 6)	MS2 Terminal (No. 5)	MS1 Terminal (No. 4)	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 performs inspection running. • Control the elevator inspection up or down together with up/down (DN) (No. 2 and 3 function). 8: Emergency running input (BAT). • If enabled, elevator will enter emergency running status. 9: Contactor feedback input (CSM). 10: Brake feedback input (BSM). 11 - 14: Weighing input 1 - 4 (WD1 - WD4). • Input the weighing signal of the switching value through this terminal, the controller outputs the corresponding bias torque according to the signal, and controls the elevator to start smoothly • Select WD1-WD4 according to the actual number of weighing switches used, and set the corresponding load weight of each switch with F06.08 - F06.11 (DI weighing signal). • If multiple terminals are enabled, the max No. terminal will be enabled. **For example:** If WD1 and WD2 are valid at the same time, only WD2 is valid 15: Motor overheat input (OH). 16: Fault reset input (RST). • When HD5L-PLUS 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). • Input the fault signal of external equipment through this terminal, the controller can monitor the fault of external equipment. After the controller receives the EXT signal, it will report E24 (external equipment fault).	
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. • F12.13 can be modified according to the degree of asynchrony between multiple multi-speed input terminals.	
F12.15	**DO1 function**	**0 - 21 [2]**
F12.16	**DO2 function**	**0 - 21 [3]**
F12.17	**Y1 function**	**0 - 21 [0]**
F12.18	**Y2 unction**	**0 - 21 [0]**
F12.19	**Y3 function**	**0 - 21 [0]**
F12.20	**Y4 (RLY) function**	**0 - 21 [0]**
	0: Unused. No any other actions. 1: Controller is ready. • ON signal will output if HD5L-PLUS has no fault. 2: Controller is in running. • HD5L-PLUS is in running status and outputs indicating signal. 3: Zero-speed running. • ON signal will output if output speed of HD5L-PLUS is zero but HD5L-PLUS is in run status. 4: Zero-speed. • ON signal will output if output speed of HD5L-PLUS is zero.	

<table>
<tr><th>Ref. Code</th><th>Function Description</th><th>Setting Range [Default]</th></tr>
<tr><td></td><td colspan="2">5: Contactor output control.
• To open/close the output contactor.
6: Brake output control.
• To open/close the brake.
7, 8: Speed level detection signal 1, 2 (FDT1, FDT2).
• Refer to F05.12 - F05.13.
9: Speed arrival signal (FAR).
• The indication signal will output when the output speed of HD5L-PLUS is within the FAR range. The detect range is set by F05.16 (speed arrival 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-PLUS is in under-voltage status.
13: Unused.
14: Controller fault.
• ON signal will output when HD5L-PLUS has fault.
15: Elevator stop signal.
• When the elevator stops, HD5L-PLUS will stop and outputs 2s pulse signal, according to which HD5L-PLUS 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 elevator is restarted, the early opening signal is invalid.</td></tr>
<tr><td>F12.21</td><td>Output terminal logic setting</td><td>00 - 0x3F [0]</td></tr>
<tr><td></td><td colspan="2">See the table below for the corresponding output terminal of each bit (binary).
• 0: Positive logic. When output terminals are connected to common port, this logic is enabled. Otherwise the logic is disabled.
• 1: Negative logic. When output terminals are connected to 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>Y4 (RLY)</td><td>Y3</td><td>Y2</td><td>Y1</td><td>DO2</td><td>DO1</td></tr>
</table></td></tr>
</table>

6.2.14 F13: Analog Input Terminal Parameters

Ref. Code	Function Description	Setting Range [Default]
F13.00	**AI function**	**0 - 3 [0]**
	0: Unused. 1: Speed setting. 2: Weighing signal. 3: Unused.	
F13.04	**AI bias**	**-100.0 - +100.0 [0.0%]**
F13.05	**AI gain**	**-10.00 - +10.00 [1.00]**
F13.06	**AI filter time**	**0.01 - 10.00 [0.05s]**
	When select AI as open-loop frequency setting source, the relationship between the analog input and the analog value after calculating is shown as figure:  • The formula is: Analog value after calculating = gain × analog actual value + bias • Y is the analog value after operation, x is the value before adjustment, K is F13.05, b is F13.04. • F13.06 define the filter time, filter the input signal. • 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.	

6.2.15 F14: SCI Communication Parameters

Refer to Appendix B (page 117) 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 > F14.04, HD5L-PLUS alarms E28 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 > F14.05, HD5L-PLUS alarms E29 fault (SCI communication error). • F14.05 = 0, it will not detect the communication error.	
F14.39	**Performance parameter**	**0 – 65535 [0]**
	Bit0: Auto-tuning for AD channel correction • 0: Not corrected. • 1: Correct. **Bit1: AD channel selection** • 0: Normal sampling. • 1: F14.45 correction data. **Bit2 - Bit4: Unused** **Bit5: PWM double update enable** • 0: Unable. • 1: Enable. *Note: Only valid when F18.00 (carrier frequency) ≤ 8k.* **Bit7&Bit6: Syn. motor identification** • 00: Syn. motor parameters are not identified. • 01: Identify Syn. motor parameters. • 10, 11: Identify the parameters of the Syn. motor magnetic pole angle. **Bit8: Subdivision speed measurement with F14.41 - F14.44 to participate in speed measurement calculation** • 0: Not involved. • 1: Involved. **Bit9: SinCos velocimetry** • 0: Method 0 (the old method). • 1: Method 1 (new method). **Bit10: Oscillation suppression on** • 0: Not turn on. • 1: Turn on **Bit11: SINCOS encoder startup optimization** • 0: Original method. • 1: New method. **Bit12: Low frequency speed measurement** • 0: Original method. • SINCOS encoder: Use analog subdivision. • Other encoders: Use M method. • 1: New method. • SINCOS encoder: 1 pulse is not captured in 2ms, the analog quantity is subdivided, and the T method is used for 2-3 pulses. • Other encoders: use T method for speed measurement. **Bit13 - Bit15: Unused**	
F14.41	**SINCOS encoder phase A zero offset**	**0 - 65535 [0]**
F14.42	**SINCOS encoder phase A amplitude**	**0 - 65535 [0]**
F14.43	**SINCOS encoder phase B zero offset**	**0 - 65535 [0]**

Ref. Code	Function Description	Setting Range [Default]
F14.44	**SINCOS encoder phase B amplitude**	**0 - 65535 [0]**
	When F14.39 Bit8 = 1, F14.41 - F14.44 are automatically learned during auto-tuning of synchronous motor. After completion, optimize the analog AB signal of the SINCOS encoder.	

6.2.16 F15: Display Control Parameters

Ref. Code	Function Description	Setting Range [Default]
F15.00	**Language selection**	**0 - 9 [0]**
	Defines the language displayed on the LCD keypad. An optional LCD eypad is required. 0: Chinese. 1: English. 2 - 9: Unused.	
F15.01	**Display contrast of LCD keypad**	**1 - 10 [6]**
	Select LCD display contrast. An optional LCD keypad is required.	
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) or stop status (F15.08 - F15.13). • It can be cycling displayed by ▶▶ key on the keypad. • 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-PLUS. 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: AI input voltage. 16: AI input voltage (after calculating). 17 - 24: Unused. 25: Heatsink temperature. 26: Input terminal status. • Bit0 - Bit9 correspond to DI1 - DI10. 27: Output terminal status. • Bit0 - Bit5 correspond to DO1, DO2, Y1 - Y3, Y4 (RLY). 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-PLUS 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-PLUS 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-PLUS is in run status. After HD5L-PLUS stops for the time of F16.04, the fan will stop automatically if there is no overheat protection. 1: Immediately stop. • The fan runs all the time when HD5L-PLUS is in running status, but stops when HD5L-PLUS stops. 2: Run when power on. • The fan runs continuously after HD5L-PLUS is powered on.	
F16.04	**Fan control delay time**	**0.0 - 600.0 [30.0s]**
F16.05	**Brake unit action voltage**	**380 - 750V [Depend on HD5L-PLUS]**
	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-PLUS.*	
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. • When there is a DI terminal set as the inspection terminal INS (No. 7 function), only need to set F16.07 = 0 to enter the terminal inspection operation.. • When there is no DI terminal set as the inspection terminal INS (No. 7 function), the inspection operation can be realized through the combination of MS1-MS3. • 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 = 0. After zero-speed delay signal, the zero-speed signal will output.	
F16.09	**Selection at motor overheat fault**	**0,1 [0]**
	Action when motor overheating is detected. 0: Alarms E20 fault (motor overheat) after motor stops. 1: Alarms E20 fault (motor overheat) at once.	
F16.11	**Running current limit of Syn. motor auto-tuning with load**	**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-PLUS 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: The current judges the running direction. 2: The encoder direction judges the running direction. 3: The current judges the running direction (without start compensation and zero speed hold). 4: The encoder direction judges the running direction (without start compensation and zero-speed hold). *Note: Method 2 and 4 must select closed loop vector control (F00.01 = 2) and HD5L-PLUS control elevator brake output.*	
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 < F16.14 and duration > F16.05, HD5L-PLUS will alarm E25 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 duration > F16.16, HD5L-PLUS alarms E37 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]**

6.2.18 F17: Fault Protect Parameters

Motor Overheat Fault (F17.00, F17.01)

Ref. Code	Function Description	Setting Range [Default]
F17.00	**Input voltage at motor overheat**	**0.00 - 10.00 [0.00V]**
F17.01	**Motor overheat analog signal input type**	**0 - 2 [0]**
	0: Not detect the motor overheat. 1: Positive charateristic (PTC). 2: Negative charateristic (NTC).	

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-PLUS. When HD5L-PLUS detects a phase input voltage < F17 03 and the holding time > F17.04, it alarms E15 fault (input voltage phase loss). • F17.03 or F17.04 = 0 or in emergency operation mode, HD5L-PLUS 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 relative to the rated current of HD5L-PLUS. When HD5L-PLUS detects a phase output current < F17.05 and the holding time > F17.06, it alarms E16 fault (output voltage phase loss). • F17.05 or F17.06 = 0, HD5L-PLUS 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%]**
	F17.07 can be set as 100% when HD5L-PLUS drives a motor of the same power class. When the controller is adapted to the motor with less than the standard capacity, it is necessary to set F17.07 reasonably to ensure effective overload protection for the loaded motor. The formula: $\text{Motor overload protect factor (F17.07)} = \frac{\text{Rated current of motor (F07.02/F10.03)}}{\text{Rated output current of HD5L} - \text{PLUS}} \times 100\%$	

Fault Auto-reset Function and Fault Relay Action (F17.08 - F17.10)

The faults that occur during operation will be reset automatically according to the set times (F17.08) and interval time (F17.09).

The following faults do not have the auto reset function:

E08: Power module fault	E21: Read/Write fault of control board EEPROM
E10: Brake unit fault	E22: Read/Write fault of keypad EEPROM
E13: The power-on buffer contactor is not closed	E24: Fault of external equipment
E14: Current detection fault	E36: Contactor suction/disconnection 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 prohibited, and fault protection is performed immediately. • If no other fault is detected within 5 minutes, the auto reset count will be automatically cleared. • On condition of external fault reset, F17.08 will be cleared.	
F17.10	**Faulty relay action**	**00 - 11 [00]**
	Unit: In auto reset process **Ten: In undervoltage process** • 0: Doesn't act. • 1: 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 (at the recent) fault type	[Actual]
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-PLUS 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.	

6.2.19 F18: PWM Parameters

Ref. Code	Function Description	Setting Range [Default]
F18.00	**Carrier frequency**	**1 - 16kHz [Depend on HD5L-PLUS]**
	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 properly.
- When the carrier frequency > the default value, HD5L-PLUS should be derated by 5% for every 1kHz increase.

F18.01	**Carrier freqency auto adjust selection**	**0,1 [0]**
	0: Prohibited. 1: Allowed.	
F18.02	**PWM overmodulation enable**	**0,1 [1]**
	0: Disable. 1: Enable.	
F18.03	**PWM overmodulation mode**	**0,1 [0]**
	0: Two phase and three phase swtich. 1: Three phase.	

6.2.20 F19: Enhance Parameters

Ref. Code	Function Description	Setting Range [Default]
F19.43	**Optimize 1313 encoder CD signal**	**0,1 [0]**
	0: Not optimized. 1: Optimize.	
F19.44	**SVC5 control selection**	**0,1 [0]**
	0: Normal processing. 1: Optimized processing.	
F19.45	**Hardware circuit detection method**	**0,1 [0]**
	0: Sample 1. 1: Sample 2.	
F19.46	**SVC flux cutoff frequency**	**0.30 - 3.00 [0.50Hz]**
F19.47	**SVC velocity estimation filter coefficients**	**0 - 2 [0]**
	0: 8. 1: 16. 2: 32.	
F19.48	**SVC velocity observation period**	**0,1 [0]**
	0: 1ms. 1: Interrupt.	
F19.49	**SVC no-load current boost**	**0,1 [0]**
	0: Boost. 1: Not boost.	
F19.50	**SVC5/SVC6 low-speed variable carrier enable**	**0,1 [0]**
	0: Unable. 1: Enable.	
F19.51	**Motor overload protection percentage**	**150 - 200 [170%]**
F19.52	**Motor overload protection time**	**0 – 10 [5s]**
	0 - 3: Not work. 4 - 10: Protect.	
F19.53	**Modify the no-load current to automatically update the mutual inductance value**	**0,1 [0]**
	0: Auto change. 1: Do not change automatically.	
F19.54	**Maintenance operation command to remove the processing method**	**0,1 [0]**
	0: Downtime processing. 1: Switch to multi-speed operation.	
F19.55	**Electric and power generation slip compensation gain compensation enable respectively**	**0,1 [0]**
	0: Unable. 1: Enable.	
F19.56	**Electric slip compensation gain**	**20.0 - 200.0 [100.0%]**
F19.57	**Power generation slip compensation gain**	**20.0 - 200.0 [100.0%]**

Ref. Code	Function Description	Setting Range [Default]
F19.58	**Allow the speed setting to exceed the rated speed of the motor**	**0,1 [0]**
	0: Not allow. 1: Allow.	
F19.63	**Starting DC current for emergency operation**	**50 - 100 [70%]**
F19.64	**Starting DC braking time of emergency operation**	**0.0 - 3.0 [0.0s]**
F19.65	**DC current of emergency operation shutdown**	**50 - 100 [70%]**
F19.66	**DC braking time of emergency operation shutdown**	**0.0 - 3.0 [1.5s]**
F19.67	**Emergency operation current search torque limit**	**40.0 - 200.0 [100.0%]**
F19.68	**Emergency operation torque increase**	**0.1 - 30.0 [0.1%]**
F19.69	**Cut off point for emergency operation torque raising**	**0.1 - 50.0% (rated motor frequency) [25.0%]**
F19.70	**Emergency operation V/F output rated voltage percentage**	**60.0 - 100.0 [100.0%]**
F19.71	**Open short floor function**	**0,1 [0]**
	0: Not open. 1: Open.	
F19.72	**Virtual speed running time**	**0.0 - 3.0 [0.0s]**
F19.73	**Virtual speed**	**0.000 - 1.500 [1.000m/s]**
F19.74	**High speed multi terminal speed setting**	**0 - 7 [0]**
F19.75	**Multi speed setting of creeping speed**	**0 - 7 [0]**
F19.77	**Enable abnormal judgment of CD phase auto-tuning process of SINCOS encoder**	**0,1 [0]**
	0: Check the CD signal. 1: Does not detect.	
F19.78	**Safety gear unlocking mode power level limit**	**0,1 [0]**
	0: The HD5L-PLUS has at least one power level of the motor, F19.79 (safety gear unlock mode) works. 1: F19.79 (safety gear unlocking mode) is not limited by power. This mode needs to be used carefully and may cause damage to the HD5L-PLUS. After power on, F19 78 automatically reverts to 0.	
F19.79	**Safety gear unlocking mode**	**0 - 3 [0]**
	Effective premise: The HD5L-PLUS is at least one gear higher than the power level of the motor. For example: The power of the motor is 5.5kW, and the controller is at least 7.5kW. 0: Not turn on unlocking mode. 1: Open unlocking mode 1. 2: Open unlocking mode 2. 3: Open unlocking mode 3. F19.79 is restored to 0 after power on, and automatically resets to 0 after unlocking.	
F19.80	**Safety gear unlocking duration**	**0 - 10 [5s]**
F19.81	**Safety gear unlocking mode stop time**	**0 - 5 [2min]**
	When F19.79 = 1 - 3 (unlocking mode is turned on), after starting operation, if the unlocking is completed, the next unlocking operation can only be carried out after the shutdown time exceeds F19.81.	
F19.82	**Safety gear unlocking continuous maximum torque current setting**	**200 - 300 (rated motor current) [220%]**
F19.88	**SVC6 I/F control enable**	**0,1 [1]**
	0: Unable. 1: Enable.	

Ref. Code	Function Description	Setting Range [Default]
F19.89	SVC6 I/F control frequency cutoff point	2.00 - 10.00 [4.00Hz]
F19.90	SVC6 I/F control torque given	0 – 200 [100Hz]
F19.91	Maintenance password	0 – 65535 [53214]
F19.92	Maintenance function activation option	0,1 [0]
	0: Not activated. 1: Activating the maintenance function and shutting down due to failure.	
F19.93	Maintenance method	0 – 2 [0]
	0: Invalid. 1: According to the number of runs. 2: According to the power-on time.	
F19.94	Maintenance times	0 – 65535 [20000]
F19.95	Maintenance set power-on time	0 – 2700 [90 days]
F19.96	SVC6 IF control transition optimization	0,1 [1]
F19.98	SVC5 start processing	0,1 [1]
	0: Normal processing. 1: Optimized processing.	

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 is valid only when F00.01 ≠ 2 (VC control). When F20.01 = 0, the DC braking function is disabled.	
F20.02	DI enable function	0,1 [0]
	0: Original plan. • There is an enable signal to output the running contactor. 1: New plan. • 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 controller controls the running contactor and uses the contactor feedback contact as an enable signal.	
F20.03	Output contactor opening time	0 - 9 [0s]
	0: Always on.. 1 - 9: With direction signal, and contactor open time > F20.03, after the enable signal is still invalid, close the output contactor.	
F20.04	Output ground detection before operation	0,1 [0]
F20.05	Encoder C, D disconnection detection	0,1 [0]
	0: Detect. 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]

Ref. Code	Function Description	Setting Range [Default]
F20.10	**Static self-tuning method for identifying no-load current**	**0,1 [0]**
	0: Calculated according to power factor. 1: Estimated according to 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 - DI0 selection* enable input signal (function No.1) *is valid.*	
F20.14	**UPS running undervoltage setting**	**170 - 220 [190V]**
F20.15	**Judgment method of light load current in emergency operation**	**000 - 111 [111]**
	Unit: Emergency operation light load current search up and down switch brake control 0: Not close the holding brake. 1: Close the holding brake. *Note: It is only valid when F16.13 = 1 or 3 (current judgment running direction).* **Ten: Emergency operation torque limit** 0: F20.19 does not work. 1: F20.19 works. **Hundred: Emergency operation mode determination** 0: Determined by F00.01. 1: V/f control. **Thousand, Ten thousand: Unuesd**	
F20.16	**Detection method of light load current in emergency operation**	**0,1 [0]**
	0: According to the output current. 1: According to the state change of electric power generation.	
F20.17	**Search speed of light load current method in emergency operation**	**0.020 - 0.200 [0.100m/s]**
F20.18	**Search time of light load current in emergency operation**	**0.020 - 0.200 [0.100m/s]**
F20.19	**Torque limit in mergency operation**	**70.0 - 200.0 [100.0%]**

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

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

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

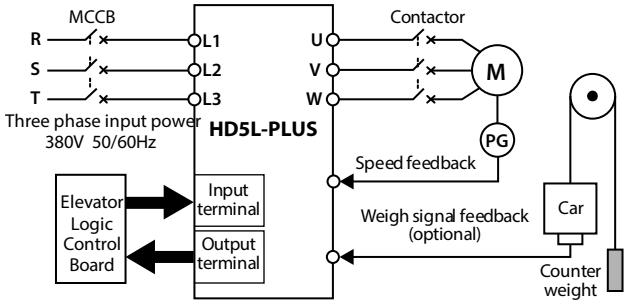


Figure 7-1 Elevator system

7.1 Basic Debugging Procedures

7.1.1 Set Basic Parameters

1.	Correctly set F00.00 (motor type) and F00.01 (control mode).
2.	Set the relevant parameters of the motor. • 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 the group F11 parameters (encoder) according to the encoder configured to motor.
5.	Set group F12 (digital I/O terminal parameters) according to the actual wiring.
6.	**Terminal MS running mode (section 7.2):** • Set the parameters of group F05 (MS) according to the elevator demand and elevator controller. • Set the parameters of group F03 (Acc./Dec.) according to the elevator speed. **Terminal analog running mode (section 7.3)** • Set analog curve parameters of group F04 and analog I/O terminal parameters of group F13 according to the actual requirement of elevator and the controller. • Set the F03 group parameters as large as possible, so that the HD5L-PLUS can follow the speed command of the elevator controller at the fastest speed.

7.1.2 Motor Auto-tuning

Auto-tuning Fault (E12) Processing

Fault		Fault Reasons	Counter-measures
E12	Motor auto-tuning fault	• Parameter auto-tuning is time out	• Check the motor connection • Input correct nameplate parameters • Seek technical support

Asyn. Motor (Auto-tuning With Load)

1.	Set F00.05 = 0 (keypad control), set F07.06 = 1 (auto-tuning with load).
2.	Manually make the contactor ON run, press **RUN** key to start parameter auto-tuning. • The motor will make a whistling sound, which lasts about 90s. *Note: Any output terminal of the control board F12.12 - F12.20 = 5(running contactor output control), during auto-tuning, the system automatically controls the running contactor without manual operation.*
3.	After the auto-tuning is completed, the motor parameters are learned and there is no fault, indicates that the auto-tuning is successful.

Asyn. Motor (Auto-tuning Without Load)

1.	Make sure there is no load on the motor sheave.
2.	Set F00.05 = 0 (keypad control), set F07.06 = 2 (auto-tuning without load).
3.	Manually enable the running contactor and the brake contactor ON, press **RUN** key to start parameter auto-tuning. • The motor rotates. *Note: Any output terminal of the control board F12.12 - F12.20 = 5(running contactor output control), during auto-tuning, the system automatically controls the running contactor without manual operation.*
4.	After the auto-tuning is completed, the motor parameters are learned and there is no fault, indicates that the auto-tuning is successful.

Syn. Motor (Auto-tuning With Load)

1.	Set F00.05 = 0 (keypad control), F10.10 = 1 (auto-tuning with load).
2.	Manually make the contactor ON run, press **RUN** key to start parameter auto-tuning. • The controller will make a serial pulse voltage and the motor will buzz, until the buzzing ends. *Note: Any output terminal of the control board F12.12 - F12.20 = 5 (running contactor output control), during auto-tuning, the system automatically controls the running contactor without manual operation.*
3.	Confirm that the parameter has data, record F10.12 (not 0). • ABZ/UVW encoder: Get F10.12 (start angle of Syn. motor), indicates that the auto-tuning is correct. • SINCOS encoder: Get F10.14 - F10.17 (encoder parameters) and F10.12 (start angle of Syn. motor), indicates that the auto-tuning is correct.
4.	Repeat the auto-tuning twice (steps 1-3), record the value of F10.12, and subtract the two values of three times. • ABZ/UVW encoder: The difference is within 30°, otherwise it needs to be re-tuned. • SINCOS encoder: The difference is within 5°, or within 5° of 360° / the integer multiple of the number of pole pairs of the motor, otherwise it needs to be re-tuned.
Note	
1.	System power down when not complete, restart auto-tuning.
2.	The setting direction and the actually running direction are not the same. **Take measures:** Set the reverse value of F00.08 (run direction).
3.	There is fault such as overcurrent or encoder reversion enabled etc. It may be encoder reversion enabled. **Take measures:** Set F11.02 = 1 (the reverse direction of PG interface board), then restart auto-tuning.

Syn. Motor (Auto-tuning Without Load)

1.	Make sure there is no load on the motor sheave.
2.	Set F00.05 = 0 (keypad control), set F10.10 = 2 (auto-tuning without load).
3.	Manually enable the running contactor and the brake contactor ON, press **RUN** key to start parameter auto-tuning. • The controller will make a serial pulse voltage and the motor will buzz, rotates once after the buzzing ends. Note: Any output terminal of the control board F12.12 - F12.20 = 5 (running contactor output control), during auto-tuning, the system automatically controls the running contactor without manual operation.
4.	Confirm that the parameter has data, and record the value of F10.12 (not 0). • ABZ/UVW encoder: Get F10.12 (start angle of Syn. motor), indicates that the auto-tuning is correct. • SINCOS encoder: Get F10.14 - F10.17 (encoder relevant parameters) and F10.12 (start angle of Syn. motor), indicates that the auto-tuning is correct.
5.	Repeat the auto-tuning twice (steps 2 - 4), record the value of F10.12, and subtract the two values of three times. • ABZ/UVW Encoder: The difference is within 30°, otherwise self-tuning is required. • SINCOS Encoder: The difference is within 5°, or within 5° of 360° / the integer multiple of the number of pole pairs of the motor, otherwise it needs to be re-tuned.

7.1.3 Inspection Operation

1.	Set F03.06 (inspection Acc. speed) and F03.07 (inspection Dec. speed).
2.	Give the inspection command and direction signal, the elevator inspection is running, and confirm: • The elevator can run normally, the motor can run normally and in the correct direction, then it success. • Brake, safety circuit and other signals operate normally.
Note:	
1.	The motor is running in the wrong direction. **Take measures:** Set the reverse value of F00.08 (run direction).

7.1.4 High Speed Operation

1.	Give the floor normal run command so that the elevator can run normally.
2.	Set the parameters of group F02, adjust the brake and the running sequence of the motor when starting and stopping, and ensure that the elevator does not shake when starting and stopping. • For Asyn. motor, adjust group F02 to avoid obviously shaking at start or stop. • For Syn. motor, set group F06 additionally to avoid elevator car rolls when the brake is released at start. • Syn. motor has SINCOS encoder: it can achieve elevator smooth start using weigh less method (group F06), F02.02 (retention time of start zero-speed) is set at least as 0.5s. • Adjust the parameters of group F08 (speed loop) to solve the slight jitter when the elevator is running.
3.	To adjust leveling precision, terminal MS control (F00.05 = 2): • Adjust Acc./Dec. curve (group F03) to the basic flat level. • Adjust F03.13 (stop Dec. jerk) to achieve precise leveling.

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-PLUS. HD5L-PLUS 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:

The rated speed of an elevator is 1.750m/s, and the terminal MS control (F00.05 = 2) is used to form the elevator control system.

The brake and the run contactor are controlled by the controller. Open the holding brake after receiving the "controller in running" signal output by HD5L-PLUS. The controller receives output signal of HD5L-PLUS at "controller zero-speed running" and controls the brake to close.

- In inspection operation, the controller outputs inspection operation MS command, and the running speed is obtained from the speed combination of MS terminals.
- If the permanent magnet Syn. motor with SINCOS encoder, HD5L-PLUS needs the SINCOS PG card with frequency division output. HD5L-PLUS receive the sin/cos signal from the encoder as the speed signal, and can also output pulse signal without frequency division or 2-126 even times frequency division to the elevator controller. No weighing compensation device is required.

Control Part Wiring

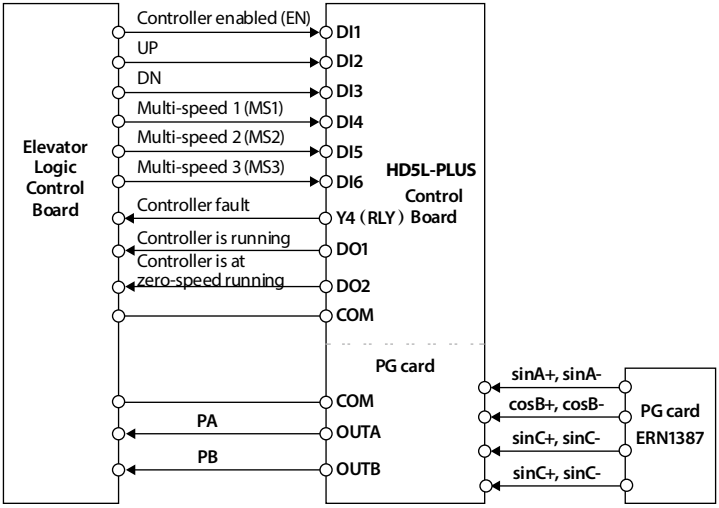


Figure 7- 7-2 Terminal MS running connection

Set Parameter

See Table 7-1 for general parameter settings for terminal operation, and see Table 7-2 for special parameter settings.

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	The Max. output freqency	Depend on actual value	
F00.04	Mechanical parameters of motor	Depend on actual 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/F08.02	ASR proportional gain 1/2	500	Adjust according to running effect. • Generally use the default value
F08.01/F08.03	ASR integral coefficient 1/2	500	
F08.04	ASR swithcing frequency 1	10.00Hz	
F08.05	ASR swithcing frequency 2	15.00Hz	
F11.00	PG card selection	Depend on actual value	
F11.01	Encoder pulses per revolution	Depend on actual value	
F11.02	Encoder rotation 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	0.350m/s^3	

Ref. Code	Function	Value	Remark
F05.00	Multi-speed 0	0	Determined by design
F05.01	Multi-speed 1	Re-leveling speed	
F05.02	Multi-speed 2	Creeping speed	
F05.03	Multi-speed 3	Emergency speed	
F05.04	Multi-speed 4	Inspection speed	
F05.05	Multi-speed 5	Normal low speed	
F05.06	Multi-speed 6	Normal middle 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	Debugging according to the running effect • Increase the value when the motor does not oscillate
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 in running
F12.16	DO2 function	3	Controller is in zero-speed running
F12.20	Y4 (RLY) output function	14	Controller fault
F16.07	Multi-speed inspection	4	Multi-speed inspection select

7.3 Terminal Analog Run Application

The elevator controller can calculate the motor present running direction (digital) and running speed (analog) according to the elevator control logic and send them to HD5L-PLUS. HD5L-PLUS controls the motor to run at the command and speed of the controller.

Example:

The rated speed of an elevator is 1.750m/s, and the terminal analog operate (F00.05 = 2) is used to form the elevator control system.

The elevator controller controls the brake and running contactor, and outputs direction signal (digital) and running speed (analog) to HD5L-PLUS.

Control Part Connection

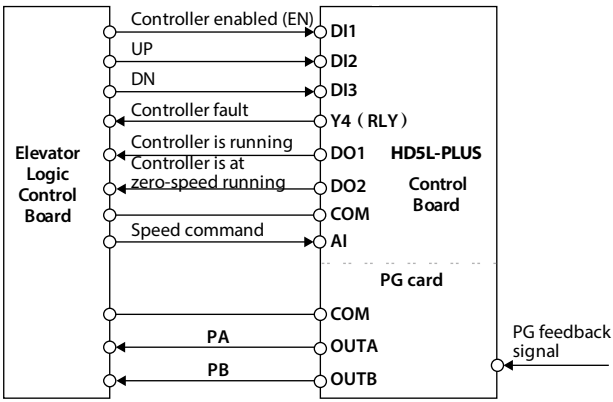


Figure 7-3 Terminal analog running connection

Set Parameter

See Table 7-1 for general parameter settings for terminal operation, and see Table 7-3 for special parameter settings.

Table 7-3 Terminal analog run parameter

Ref. Code	Function	Value	Remark
F00.05	Operating mode	1	Terminal analog 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	Dec. 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 analog curve
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 max. setting	100.0%	
F04.08	Corresponding value of line 2 max. setting	100.0%	
F06.00	Pre-torque selection	1	Analog 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 in running
F12.16	DO2 function	3	Controller is at zero-speed running
F12.20	Y4 (RLY) output function	14	Controller fault
F13.00	AI function	1	Speed setting
F13.04	AI bias	0.0%	Adjust according to actual situation
F13.05	AI gain	1.00	
F13.06	AI filter time	0.05s	

7.4 Power-off Emergency Operation Run Application

When the elevator is in use, if the power supply of the system is suddenly cut off, passengers may be locked in the car.

HD5L-PLUS provides emergency operation mode to solve this problem.

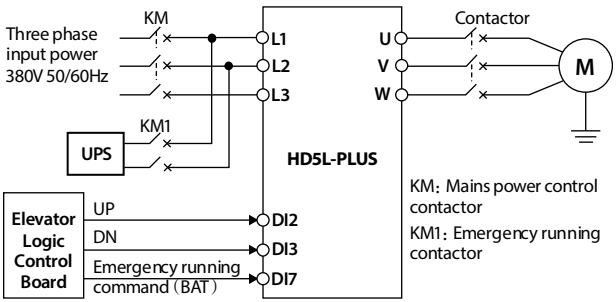


Figure 7-4 Emergency run wiring

See running time sequence below.

1.	When the main power is cut off, the KM is disconnected, and elevator controller outputs emergency operation running command (BAT) to controls KM1 to close.
2.	After the elevator controller delays for a period of time, it outputs the running command (UP/DN). After HD5L-PLUS receives the running command, it closes the running contactor, opens the brake, and accelerates linearly with F03.08 (emergency running acceleration) to F05.09 (emergency running speed).
3.	When running to the leveling area, the elevator controller removes the emergency running command (BAT), and the HD5L-PLUS decelerates and stops in a straight line at F03.09 (emergency running deceleration).
4.	After decelerating to zero speed, HD5L-PLUS closes the brake, after a delay, the controller removes the running command (UP/DN), HD5L-PLUS releases the contactor, and the emergency operation ends.
Note	
1.	Make sure that the emergency power supply voltage > 150VAC for the controller to control the power supply to work properly.
2.	In the emergency operation running mode, the controller does not detect the input phase loss.

7.5 OTA Remote Software Upgrate

Use HP-OTA-A by computer or android phone, remotely upgrade the software of HD5L-PLUS.

The computer client is a compressed package, and the Android phone is an apk program.

See Table 7-4 for the HP-OTA-A connection, and see the "HP-OTA-A User Guide" for the steps to upgrade the software.

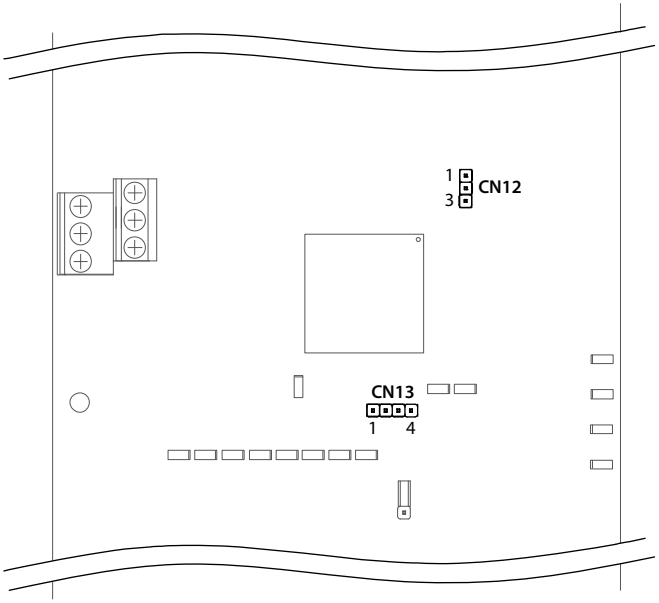


Figure 7-5 HDD5L-PLUS control board is connected to the OTA terminal

Table 7-4 HP-OT-A connection steps

1.	Confirm that the HD5L-PLUS to be upgraded is powered off.
2.	Confirm that the computer or mobile phone network connection is normal.
3.	Open the lower cover and upper cover of the HD5L-PLUS.
4.	Use jumper caps to short-circuit pins 2 and 3 of CN12. See Figure 7-5 for CN12.
5.	The download port of HP-OTA-A is connected to CN13 of the control board. Pin 1 of the download port corresponds to pin 1 of CN13. See Figure 7-5 for CN13.
6.	The USB port of HP-OTA-A is connected to the operation terminal, in one of the following ways: • Software upgrade via PC: Connect to PC via USB port. • Mobile phone serial port to upgrade software: The USB port is connected to the mobile phone through the USB conversion module. • Mobile phone Bluetooth to upgrade software: The USB port is connected to a USB port that can supply power, such as mobile phones and computers.
7.	After connecting correctly, the power indicator of HP-OTA-A is always on, and the Bluetooth indicator is flashing.

Chapter 8 Troubleshooting and Maintenance

8.1 Troubleshooting

8.1.1 Fault Phenomenon

If a fault occurs, the keypad will display the fault code, **ALM** indicator lights on. Meanwhile, faulty relay acts, HD5L-PLUS stops output and the motor coasts to stop.

8.1.2 Troubleshooting

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.

Table 8-1 Fault and counter-measures

Fault		Fault Reasons	Counter-measures
No display when power up		• Input grid voltage is too low or none • The power supply of the drive board is faulty • The wiring of the control board, drive board and keypad is disconnected • The rectifier bridge is damaged • The controller buffer resistance is damaged • The control board and keypad are faulty	• Check the input power voltage • Check the bus voltage • Reconnect the keypad, or check the wiring of the control board, drive board, and keypad • Contact factory for repair
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-PLUS properly
E01	Acc. overcurrent	• Improper connection between controller and motor • Improper motor parameters • The rating of the used HD5L-PLUS is too small • Acc./Dec. time is too short	• Connect HD5L-PLUS and motor properly • Set correct motor parameters • Select controller with higher rating • Set proper Acc. time and Dec. time
E02	Dec. overcurrent		
E03	Constant speed overcurrent		
E04	Acc. overvoltage	• 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-PLUS properly
E05	Dec. overvoltage		
E06	Constant speed overvoltage		
E08	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

Fault		Fault Reasons	Counter-measures
E09	Heatsink overheat	• Ambient temperature is too high • Poor external ventilation of HD5L-PLUS • Fan fault • Fault occurs to temperature detection circuit	• Use controller with higher power capacity • Improve the ventilation around HD5L-PLUS • Replace the cooling fan • Seek technical support
E10	Braking unit fault	• Circuit fault of braking unit	• Seek technical support
E11	CPU fault	• CPU abnormal	• Detect at power up after completely power down • Seek technical support
E12	Motor auto-tuning fault	• Parameter auto-tuning is time out	• Check the motor connection • Input correct nameplate parameters • Seek technical support
E13	The power-on buffer contactor is not closed	• Contactor fault • Control circuit fault	• Replace the contactor • Seek technical support
E14	Current detection fault	• Current detection circuit is damaged	• Contact the supplier for repairing
E15	Input voltage phase loss	• For three phase input HD5L-PLUS, input phase loss fault occurs to power input	• Check the three phase power input • Seek technical support
E16	Output voltage phase loss	• Output voltage phase disconnection or loss • Three phase load of HD5L-PLUS is severely unbalanced	• Check the connection between HD5L-PLUS and motor • Check the quality of motor
E17	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
E18	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
E19	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

Fault		Fault Reasons	Counter-measures
E20	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
E21	Read/Write fault of control board EEPROM	• Memory circuit fault of control board EEPROM	• Contact the supplier for repairing
E22	Read/Write fault of keypad EEPROM	• Memory circuit fault of keypad EEPROM	• Replace the keypad • Contact the supplier for repairing
E23	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
E24	Fault of external equipment	• Fault terminal of external equipment operates	• Check external equipment
E25	Too small running current	• Improper setting of F16.14, F16.15	• Correct the setting of F16.14, F16.15 • Check the connection between HD5L-PLUS and motor • Detect HD5L-PLUS whether output • Detect whether the output contactor work is normal
E26	Internal logic error	• Contact the manufacturer	• Contact the manufacturer
E28	SCI communication timeout	• Connection fault of communication cable • Disconnected or not well connected	• Check the connection
E29	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
E30	Encoder reverse	• Encoder wire phase and motor phase do not match	• Set the reverse value of F11.02
E31	Encoder disconnection	• The encoder has no input signal	• Check the encoder connection
E32	Motor over speed	• Encoder pulse number setting error • Inadequate controller torque • Speed-loop PI parameter setting is incorrect	• Set proper encoder pulse number • Select bigger capacity controller • Correctly set speed-loop PI parameter

Fault		Fault Reasons	Counter-measures
E33	Z signal loss of ABZ encoder	• Connection problem • Severe interference	• Check the connection
E34	UVW signal wrong of UVW encoder	• UVW encoder fan-area error	• Check the UVW connection
E35	CD phase wrong of SINCOS encoder	• Encoder fault • Encoder disconnection	• Check the encoder • Check the encoder connection
E36	Contactor fault	• Contactor damaged • Feedback contact connection problem	• Change the contactor • Check the connection
E37	Governor fault	• Check external governor • Check feedback signal	• Replace governor • Replace circuit
E39	SINCOS encoder AB synthesis error	• Encoder fault • Encoder disconnection	• Check the encoder • Check the encoder connection
E40	SINCOS encoder CD synthesis error	• Encoder fault • Encoder disconnection	• Check the encoder • Check the encoder connection

Note:

E22 does not affect normal run of controller.

8.1.3 Reset Fault

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

- Press the **STOP** key on the keypad.
- External reset terminal (DI terminal = No.16 function).
- Communication fault reset.
- Switching on HD5L-PLUS after completely power off.

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-PLUS has been transported for a long distance, check whether the components of HD5L-PLUS are complete and the screws are well tightened.
- Periodically clean the dust inside HD5L-PLUS 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-PLUS 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-PLUS and the indicators on the keypad are off and the voltage between power terminals (+) and (-) is below 36V.

Warning

- For HD5L-PLUS 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-PLUS.
- 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-PLUS must be operated in the specified environment (refer to section 3.2, on page 11).

Please carry out daily maintenance according to Table 8-2, so as to find abnormal phenomena in time and prolong the service life of HD5L-PLUS.

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-PLUS	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-PLUS in every 3 to 6 months according to the actual environment so as to avoid hidden problems and make sure HD5L-PLUS 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 power terminals are properly connected; Whether the copper bar and cables are overheated;
- Check whether the power cables and control cables are damaged, check especially for any wear on the cable tube;
- The insulation wrapping tapes of the power cables and control cables are not peeled off or broken;
- 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-PLUS. Otherwise, HD5L-PLUS 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: 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 overcurrent or overvoltage failures occur during controller start-up with load. Check if there is any leakage of liquids. Check if the safety valve protrudes. Measure the static capacitance and insulation resistance

Unwanted Controller Recycling

When disposing HD5L-PLUS, 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 Braking Resistor

The braking resistor selection is listed as Table 9-1.

Refer to section 4.3.2, page 17 for the brake resistor connection.

Table 9-1 Braking resistor selection

Model	Motor (kW)	Recommend Value (Ω)			Recommend Power (kW)	
		Min.	Max.	Recommended	Synchronous	Asynchronous
HD5L-2D2P2-PLUS	2.2	26	130	50	1	1
HD5L-2D3P7-PLUS	3.7	26	50	30	1.6	1.2
HD5L-2D5P5-PLUS	5.5	17	27	20	2.0	1.6
HD5L-2D7P5-PLUS	7.5	11	20	15	3.2	2.0
HD5L-2D011-PLUS	11	11	20	15	4.0	3.2
HD5L-2T015-PLUS	15	10	16	12	5.0	4.0
HD5L-2T018-PLUS	18.5	10	16	12	6.4	5.0
HD5L-2T022-PLUS	22	7	10	9	8.0	6.4
HD5L-2T030-PLUS	30	7	10	9	10.0	8.0
HD5L-4T2P2-PLUS	2.2	56	210	100	1	1
HD5L-4T3P7-PLUS	3.7	56	144	80	1.6	1.2
HD5L-4T5P5-PLUS	5.5	56	100	70	2	1.6
HD5L-4T7P5-PLUS	7.5	56	72	64	3.2	2
HD5L-4T011-PLUS	11	34	48	40	4	3.2
HD5L-4T015-PLUS	15	34	41	36	5	4
HD5L-4T018-PLUS	18.5	17	31	24	6.4	5
HD5L-4T022-PLUS	22	17	27	20	8	6.4
HD5L-4T030-PLUS	30	11	20	15	10	8
HD5L-4T037-PLUS	37	10	16	12	12	10
HD5L-4T045-PLUS	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 overvoltage 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.

9.2 Reactor

Table 9-2 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-PLUS	HD-AIL-4T037	0.19 - 75	HD-AOL-4T037	0.08 - 80	HD-DCL-4T037	0.35 - 100
HD5L-4T045-PLUS	HD-AIL-4T045	0.16 - 90	HD-AOL-4T045	0.06 - 100	HD-DCL-4T045	0.29 - 120

9.3 Power Regenerative Unit

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

Appendix A Parameters

Attributes are changed:

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

"×": It denotes that the setting parameter cannot be modified when the controller is in run 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 page 45 - 46)						
D00.00	Controller series	HD5L-PLUS	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	Bit0: Controller enable Bit1: Inspection run Bit2: MS run Bit3: Analog 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: Emergency run	Actual		*	
D00.05	Rated current of HD5L-PLUS	0.1 - 999.9A	Actual		*	
D00.06	Controller status	Bit0: Controller fault Bit1: Run/stop Bit2: UP Bit3: DN Bit4&5: Acceleration/Deceleration/Constant Bit6: Zero-speed signal Bit7: Zero-speed running Bit8: Auto-tuning Bit9: Speed within FAR Bit10: Ready to run Bit11: Brake output Bit12: Contactor output Bit13: Stop signal Bit14, Bit15: Unused	Actual		*	

A

Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
D01: Drive Status Parameters (on page 46 - 46)						
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		*	
D01.10	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		*	
D02: Analog Status Display Parameters (on page 46 - 46)						
D02.00	AI1 voltage	0.00 - 10.00V	Actual		*	
D02.01	AI1 voltage (after calculating)	0.00 - 10.00V	Actual		*	
D03: Running Status Parameters (on page 46 - 47)						
D03.00	Heatsink temperature	0.0 - 999.9°C	Actual		*	
D03.01	Input terminal status	Bit9 - Bit0 correspond to DI12 - DI1 Bit15 - Bit11: Unused 0: Disconnects with common terminals 1: Connects with common terminals	Actual		*	
D03.02	Output terminal status	Bit1&Bit0 correspond to DO2&DO1 Bit4 - Bit2 correspond to Y3 - Y1 Bit5 corresponds to Y4 (RLY) Bit15 - Bit6: Unused	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		*	

Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
D03.04	Total time at power-on (hour)	0 - 65535	Actual		*	
D03.05	Total running time (hour)	0 - 65535	Actual		*	
D03.06	Running times	0 - 65535	Actual		*	
D03.07	Present fault	0 - 100	Actual		*	
D04: Encoder Status Parameters (on page 47 - 48)						
D04.00	C phase AD sampling value of SINCOS encoder	0 - 4095	Actual		*	
D04.01	D phase AD sampling value of SINCOS encoder	0 - 4095	Actual		*	
D04.02	A phase AD sampling value of SINCOS encoder	0 - 4095	Actual		*	
D04.03	B phase AD sampling value of SINCOS encoder	0 - 4095	Actual		*	
D04.04	UVW status of UVW encoder	0 - 7	Actual		*	
D04.05	Electrical angle	0 - 65535	Actual		*	
D04.08	Encoder pulses	0 - 65535	Actual		*	
D04.12	Pulses monitoring of slip in start	0 - 65535	Actual			
D04.13	Judgement sources for start stability	0 - 20	Actual			
D04.15	Auto-tuning without load encoder pulse change judgment variable	0 - 65535	Actual			
D04.18	Curren t position signal (Q13 format)	0 - 65535	Actual		*	
D04.19	Current position signal (Q16 format)	0 - 65535	Actual		*	
D04.20	SINCOS encoder AB signal synthesis amplitude	0 - 65535	Actual		*	
D04.21	SINCOS encoder CD signal synthesis amplitude	0 - 65535	Actual		*	
D04.29	Software built-in version	0.01 - 0.99	Actual			

Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
F00: Basic Parameters (on page 48 - 50)						
F00.00	Motor type	0: Asyn. motor 1: Syn. motor	0	1	×	
F00.01	Control mode	0: V/f control 1: SVC control 2: VC control 3: Unused 4: SVC4 control 5: SVC5 control 6: SVC6 control	2	1	×	
F00.02	Rated speed of elevator	0.100 - 4.000m/s	1.500m/s	0.001m/s	×	
F00.03	The Max. output freqency of HD5L-PLUS	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 analog control 2: Terminal MS control 4: SCI control 3, 5: Unused	0	1	×	
F00.06	M key function	0: Unused 1: Switch the running direction	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 page 50 - 51)						
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: Download the keypad EEPROM parameter to the current function code 3: Clear fault information	0	1	×	
F01.03	Keypad EEPROM parameter initialization	0: No operation 1: Upload the current function code settings to the keypad EEPROM parameter	0	1	○	
F02: Start&Stop Parameters (on page 51 - 52)						
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	×	

Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
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	×	
F02.06	Retention time of stop zero-speed	0.000 - 4.999s	0.300s	0.001s	×	
F02.07	Contactor 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	×	
F03: Acc./Dec. Parameters (on page 52 - 53)						
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	Emergency running Acc.	0.020 - 9.999m/s^2	1.000m/s^2	0.001m/s^2	×	
F03.09	Emergency running Dec.	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	×	
F03.19	SINCOS encoder CD phase learning	0: Learning 1: Not learning	0	1	×	

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Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
F04: Analog Curve Parameters (on page 53 - 53)						
F04.00	Setting curve	Unit: AI characteristic curve selection Ten, hundred, thousand: Unused 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 page 53 - 55)						
F05.00	Multi-speed 0	0.000m/s - F00.02	0.000m/s	0.001m/s	○	
F05.01	Multi-speed 1	0.000m/s - F00.02	0.000m/s	0.001m/s	○	
F05.02	Multi-speed 2	0.000m/s - F00.02	0.000m/s	0.001m/s	○	
F05.03	Multi-speed 3	0.000m/s - F00.02	0.000m/s	0.001m/s	○	
F05.04	Multi-speed 4	0.000m/s - F00.02	0.000m/s	0.001m/s	○	
F05.05	Multi-speed 5	0.000m/s - F00.02	0.000m/s	0.001m/s	○	
F05.06	Multi-speed 6	0.000m/s - F00.02	0.000m/s	0.001m/s	○	
F05.07	Multi-speed 7	0.000m/s - F00.02	0.000m/s	0.001m/s	○	
F05.08	Inspection running speed	0.000m/s - F00.02	0.200m/s	0.001m/s	○	
F05.09	Emergency running speed	0.000m/s - F00.02	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	Speed detection level 1 (FDT1)	0.0 - 100.0% (F00.02)	90.0%	0.1%	○	
F05.13	Speed detection level 2 (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	×	

Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
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	×	
F05.22	Creeping speed	0.000 - 0.400m/s	0.050m/s	0.001m/s	○	
F06: Weighing Compensation Parameters (on page 55 - 56)						
F06.00	Pre-torque selection	0: No pre-torque 1: Analog 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%	×	
F06.14	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	○	
F07: Asyn. Motor Parameters (on page 56 - 59)						
F07.00	Rated power of Asyn. motor	0.2 - 500.0kW	Depend on HD5L-PLUS	0.1kW	×	
F07.01	Rated voltage of Asyn. motor	0V - rated voltage of HD5L-PLUS		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	Power factor of Syn. motor	0.001 - 1.000	Depend on HD5L-PLUS	0.001	×	

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Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
F07.06	Parameter auto-tuning of Asyn. motor	0: No action 1: Auto-tuning with load 2: Auto-tuning without load	0	1	×	
F07.07	Stator resistance of Asyn. motor	0.000 - 65.355Ω	Depend on HD5L-PLUS	0.001Ω	×	
F07.08	Rotor resistance of Asyn. motor	0.000 - 65.535Ω		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	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 (Automatic Voltage Regulation) 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 page 59 - 60)						
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	○	

Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
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	○	
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 page 60 - 60)						
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	○	
F09.04	Current loop period	2 - 10	6	1	×	
F09.05	Dead zone compensation mode	0 - 2	1	1	×	
F09.06	Magnetic flux compensation method	0: Way 0 1: Way 1 2: Way 2	0	1	×	
F10: Syn. Motor Parameters (on page 60 - 62)						
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-PLUS	0.1kW	×	
F10.02	Rated voltage of Syn. motor	0V - rated voltage of HD5L-PLUS		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-PLUS	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	Auto-tuning with load voltage setting of Syn. motor	0.0 - 100.0% (F10.02)	100.0%	0.1%	×	

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Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
F10.12	Start angle of Syn. motor	0.0 - 359.9°	0.0°	0.1°	×	
F10.13	Z 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	×	
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	Syn. performance optimization	Bit0: Unused Bit1: Current loop parameter automatic optimization 0: Manual optimization 1: Automatic optimization Bit2: Segmentation test function 0: Not open 1: Open Bit3: Unused Bit5&Bit4: Syn. motor start current limit 00: Normal 01: 2 times 10: 4 times 11: 8 times Bit6: Starting comfort 0: Way 0 1: Way 1 Bit8&Bit7: Unused Bit10&Bit9: Performance optimized 00: Way 0 01: Way 1 10: Way 2 11: Way 3 Bit11: Unused	1028	1	×	

Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
		Bit12: Syn. motor starts to suppress oscillation 0: No suppression 1: Inhibit Bit13: Start optimization 2 0: Not enabled 1: Enabled Bit14: Unused Bit15: Vibration optimization 0: The old method 1: New method				
F11: Encoder Parameters (on page 62 - 63)						
F11.00	PG card selection	1: HD-PG2-OC-FD-A, the OC PG card with frequency division output 2: HD-PG6-UVW-FD, the long-line driver PG card with frequency division output 3: HD-PG5-SINCOS-FD-A, the SINCOS PG card with frequency division output 4: Unused	1	1	×	
F11.01	Encoder pulses per revolution	1 - 9999	2048	1	×	
F11.02	Emergency encoder rotation direction setting operation	0: The same direction 1: The reverse direction	0	1	×	
F11.03	Encoder signal filter coefficient	0x00 - 0x77 Unit: Low-speed filter coefficient Ten: High-speed filter coefficient	0x11	1	○	
F11.04	Serial communication encoder protocol	0: Endat 1: Rotary transformer protocol 2 - 9: Unused	0	1	×	
F11.05	Encoder disconnection detection time	0.00 - 2.00s *0.00: Do not detect the PG wire disconnection*	1.00s	0.01s	×	
F12: Digital I/O Terminal Parameters (on page 63 - 65)						
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: Emergency running input (BAT)	1	1	×	
F12.02	DI2 function		2	1	×	
F12.03	DI3 function		3	1	×	
F12.04	DI4 function		4	1	×	

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Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
F12.05	DI5 function	9: Contactor feedback input (CSM) 10: Brake feedback input (BSM) 11 - 14: Weighing 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) 20 - 33: Unused 34: External fault (EXT) *Hundred digit = 0, normally open input selected; = 1, normally closed input selected*	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	×	
F12.10	DI10 function		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	×	
F12.15	DO1 function	0: Unused 1: Controller is ready 2: Controller is in running 3: Zero-speed running 4: Zero-speed 5: Contactor output control 6: Brake output control 7: Speed level detection signal 1 (FDT1) 8: Speed level detection signal 2 (FDT2) 9: Speed arrival signal (FAR) 10: Up signal output 11: Down signal output 12: Under-voltage 13: Unused 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	Y1 function		14	1	×	
F12.18	Y2 function		0	1	×	
F12.19	Y3 function		0	1	×	
F12.20	Y4 (RLY) function		0	1	×	
F12.21	Output terminal logic setting	Bit0, Bit1: DO1, DO2 Bit2 - Bit5: Y1 – Y3, Y4 (RLY) 0: Positive logic 1: Negative logic	00	1	○	

Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
F13: Analog Input Terminal Parameters (on page 65 - 67)						
F13.00	AI1 function	0: Unused 1: Speed setting 2: Weighing signal 3: Unused	0	1	×	
F13.04	AI1 bias	-100.0 - +100.0%	0.0%	0.1%	○	
F13.05	AI1 gain	-10.00 - +10.00	1.00	0.01	○	
F13.06	AI1 filter time	0.01 - 10.00s	0.05s	0.01s	○	
F14: SCI Communication Parameters (on page 67 - 68)						
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	×	
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	×	
F14.39	Performance parameter	Bit0: Auto-tuning for AD channel correction 0: Not corrected 1: Correct Bit1: AD channel selection 0: Normal sampling 1: F14.45 correction data Bit2 - Bit4: Unused Bit5: PWM double update enable 0: Unable 1: Enable	0	1	×	

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Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
		Bit7&Bit6: Syn. motor identification 00: Syn. motor parameters are not identified 01: Identify Syn. motor parameters 10, 11: Identify the parameters of the Syn. motor magnetic pole angle Bit8: Subdivision speed measurement with F14.41 - F14.44 to participate in speed measurement 0: Not involved 1: Involved Bit9: SinCos velocimetry 0: Method 0 (the old method) 1: Method 1 (new method) Bit10: Oscillation suppression on 0: Not turn on 1: Turn on Bit11: SINCOS encoder startup optimization 0: Original method 1: New method Bit12: Low frequency speed measurement 0: Original method 1: New method Bit13 - Bit15: Unused				
F14.41	SINCOS encoder phase A zero offset	0 - 65535	0	1	×	
F14.42	SINCOS encoder phase A amplitude	0 - 65535	0	1	×	
F14.43	SINCOS encoder phase B zero offset	0 - 65535	0	1	×	
F14.44	SINCOS encoder phase B amplitude	0 - 65535	0	1	×	

Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
F15: Display Control Parameters (on page 68 - 69)						
F15.00	Language selection	0: Chinese 1: English 2 - 9: Unused	0	1	○	
F15.01	Display contrast of LED keypad	1 - 10	6	1	○	
F15.02	Set parameter 1 of run status	0: Unused 1: Rated current of HD5L-PLUS 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 input voltage 16: AI1 input voltage (after calculating) 17 - 24: Unused 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	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	○	
F15.13	Set parameter 6 of stop status		0	1	○	

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Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
F16: Function-boost Parameters (on page 69 - 70)						
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-PLUS	1V	×	
F16.06	Contactor fault detect time	0.1 - 10.0s	2.0s	0.1s	×	
F16.07	Multi-speed inspection	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: Alarms E20 fault after motor stops 1: Alarms E20 fault at once	0	1	○	
F16.11	Running current limit of Syn. motor auto-tuning with load	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: The current judges the running direction 2: The encoder direction judges the running direction 3: The current judges the running direction (without start compensation and zero speed hold) 4: The encoder direction judges the running direction (without start compensation and zero-speed hold)	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	×	
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	×	

Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
F17: Fault Protect Parameters (on page 70 - 72)						
F17.00	Input voltage at motor overheat	0.00 - 10.00V	0.00V	0.01V	×	
F17.01	Motor overheat analog signal input type	0: Not detect 1: Positive charateristic (PTC) 2: Negative charateristic (NTC)	0	1	×	
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: Doesn't act 1: Acts	00	1	○	
F17.11	NO.5 fault type	Lu: DC bus undervoltage E01: Acc. overcurrent E02: Dec. overcurrent E03: Constant speed overcurrent E04: Acc. overvoltage E05: Dec. overvoltage E06: Constant speed overvoltage E08: Power module fault E09: Heatsink overheat E10: Braking unit fault E11: CPU fault E12: Motor auto-tuning fault E13: The power-on buffer contactor is not closed E14: Current detection fault E15: Input voltage phase loss E16: Output voltage phase loss E17: Controller overload E18: Excessive speed deviation E19: Motor overload	0	1	*	

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Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
		E20: Motr overheat E21: Read/Write fault of control borad EEPROM E22: Read/Write fault of keypad EEPROM E23: Faulty setting of parameter E24: Fault of external equipment E25: Too small running current E26: Internal logic error E28: SCI communication timeout E29: SCI communication error E30: Encoder reverse E31: Encoder disconnection E32: Motor over speed E33: Z signal loss of ABZ encoder E34: UVW signal wrong of UVW encoder E35: CD phase wrong of SINCOS encoder E36: Contactor fault E37: Governor fault *E08, E10, E13, E14, E21, E22, E24, E36 can't auto reset*				
F17.12	Setting freqency at NO.5 fault	0.00 - 100.00Hz	0.00Hz	0.01Hz	*	
F17.13	Output freqency at NO.5 fault	0.00 - 100.00Hz	0.00Hz	0.01Hz	*	
F17.14	DC bus vlotage at NO.5 fault	0 - 999V	0V	1V	*	
F17.15	Output voltage at NO.5 fault	0 - 999V	0V	1V	*	
F17.16	Output current at NO.5 fault	0.0 - 999.9A	0.0A	0.1A	*	
F17.17	Input terminal 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 - 6553.5h	0.0h	0.1h	*	
F17.20	NO.4 fault type	0 - 36	0	1	*	
F17.21	NO.4 fault interval	0.0 - 6553.5h	0.0h	0.1h	*	
F17.22	NO.3 fault type	0 - 36	0	1	*	
F17.23	NO.3 fault interval	0.0 - 6553.5h	0.0h	0.1h	*	
F17.24	NO.2 fault type	0 - 36	0	1	*	
F17.25	NO.2 fault interval	0.0 - 6553.5h	0.0h	0.1h	*	
F17.26	NO.1 fault type	0 - 36	0	1	*	
F17.27	NO.1 fault interval	0.0 - 6553.5h	0.0h	0.1h	*	

Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
F18: PWM Parameters (on page 72 - 73)						
F18.00	Carrier fregency	1 - 16kHz	Depend on HD5L-PLUS	1kHz	×	
F18.01	Carrier freqency auto adjust selection	0: Prohibited 1: Allowed	0	1	×	
F18.02	PWM overmodulation enable	0: Disable 1: Enable	1	1	×	
F18.03	PWM overmodulation mode	0: Two phase and three phase swtich 1: Three phase	0	1	×	
F19: Enhance Parameters (on page 73 - 75)						
F19.43	Optimize 1313 encoder CD signal	0: Not optimized 1: Optimize	0	1	×	
F19.44	SVC5 control selection	0: Normal processing 1: Optimized processing	1	1	×	
F19.45	Hardware circuit detection method	0: Sample 1 1: Sample 2	0	1	×	
F19.46	SVC flux cutoff frequency	0.30 - 3.00Hz	0.50Hz	0.01Hz	×	
F19.47	SVC velocity estimation filter coefficients	0: 8 1: 16 2: 32	0	1	×	
F19.48	SVC velocity observation period	0: 1ms 1: Interrupt	0	1	×	
F19.49	SVC no-load current boost	0: Boost 1: Not boost	0	1	×	
F19.50	SVC5/SVC6 low-speed variable carrier enable	0: Unable 1: Enable	0	1	×	
F19.51	Motor overload protection percentage	120 - 200%	170%	1%	×	
F19.52	Motor overload protection time	0 - 3: Not work. 4 - 10: Protect.	5s	1s	×	
F19.53	Modify the no-load current to automatically update the mutual inductance value	0: Auto change 1: Do not change automatically	0	1	×	
F19.54	Maintenance operation command to remove the processing method	0: Downtime processing 1: Switch to multi-speed operation	0	1	×	
F19.55	Electric and power generation slip compensation gain compensation enable respectively	0: Unable 1: Enable	0	1	×	
F19.56	Electric slip compensation gain	20.0 - 200.0%	100.0%	0.1%	×	

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Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
F19.57	Power generation slip compensation gain	20.0 - 200.0%	100.0%	0.1%	×	
F19.58	Allow the speed setting to exceed the rated speed of the motor	0: Not allow 1: Allow	0	1	×	
F19.63	Starting DC current for emergency operation	50 - 100%	70%	1%	×	
F19.64	Starting DC braking time of emergency operation	0.0 - 3.0s	0.0s	0.1s	×	
F19.65	DC current of emergency operation shutdown	50 - 100%	70%	1%	×	
F19.66	DC braking time of emergency operation shutdown	0.0 - 3.0s	1.5s	0.1s	×	
F19.67	Emergency operation current search torque limit	40.0 - 200.0%	100.0%	0.1%	×	
F19.68	Emergency operation torque increase	0.1 - 30.0%	0.1%	0.1%	×	
F19.69	Cut off point for emergency operation torque raising	0.1 - 50.0% (rated motor frequency)	25.0%	0.1%	×	
F19.70	Emergency operation V/F output rated voltage percentage	60.0 - 100.0%	100.0%	0.1%	×	
F19.71	Open short floor function	0: Not open 1: Open	0	1	×	
F19.72	Virtual speed running time	0.0 - 3.0s	0.0s	0.1s	×	
F19.73	Virtual speed	0.000 - 1.500 m/s	1.000m/s	0.001m/s	×	
F19.74	High speed multi terminal speed setting	0 - 7	0	1	×	
F19.75	Multi speed setting of creeping speed	0 - 7	0	1	×	
F19.77	Enable abnormal judgment of CD phase auto-tuning process of SINCOS encoder	0: Check the CD signal. 1: Does not detect.	0	1	×	
F19.78	Safety gear unlocking mode power level limit	0: The HD5L-PLUS shall have at least one power level of large motor, F19 79 works 1: F19.79 is not limited by power (use with caution)	0	1	×	
F19.79	Safety gear unlocking mode	0: Not turn on unlocking mode 1: Open unlocking mode 1 2: Open unlocking mode 2 3: Open unlocking mode 3	0	1	×	
F19.80	Safety gear unlocking duration	0 - 10s	5s	1s	×	
F19.81	Safety gear unlocking mode stop time	0 - 5min	2min	1min	×	
F19.82	Safety gear unlocking continuous maximum torque current setting	200 - 300% (rated motor current)	220%	1%	×	

Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
F19.88	SVC6 I/F control enable	0: Unable 1: Enable	1	1	×	
F19.89	SVC6 I/F control frequency cutoff point	2.00 - 10.00Hz	4.00Hz	0.01Hz	×	
F19.90	SVC6 I/F control torque given	0 - 200Hz	100Hz	1Hz	×	
F19.91	Maintenance password	0 - 65535	53214	1	×	
F19.92	Maintenance function activation option	0: Not activated. 1: Activating the maintenance function and shutting down due to failure.	0	1	×	
F19.93	Maintenance method	0: Invalid. 1: According to the number of runs. 2: According to the power-on time	0	1	×	
F19.94	Maintenance times	0 - 65535	20000	1	×	
F19.95	Maintenance set power-on time	0 - 2700 days	90 days	1 day	×	
F19.96	SVC6 IF control transition optimization	0: Normal processing 1: Optimized processing	1	1	×	
F19.98	SVC5 start processing		1	1	×	
F20: Enhance Parameter Group 2 (on page 75)						
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 plan	0	1	×	
F20.03	Output contactor opening time	0 - 9s	0s	1s	×	
F20.04	Output ground detection before operation	0: Detect 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	○	
F20.12	Output delay time after early door open relay output shutdown	0 - 3000ms	500ms	1ms	○	

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Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
F20.13	Elevator enable function quickly detects on	0: Do not open 1: Open	0	1	×	
F20.14	UPS running undervoltage setting	170 - 220V	190V	1V	×	
F20.15	Judgment method of light load current in emergency operation	Unit: Emergency operation light load current search up and down switch brake control 0: Not close the holding brake 1: Close the holding brake Ten: Emergency operation torque limit 0: F20.19 does not work 1: F20.19 works Hundred: Emergency operation mode determination 0: Determined by F00.01 1: V/f control Thousand, ten thousand: Unused	111	1	×	
F20.16	Detection method of light load current in emergency operation	0: According to the output current 1: According to the state change of electric power generation	0	1	×	
F20.17	Search speed of light load current method in emergency operation	0.020 - 0.200m/s	0.100m/s	0.001m/s	×	
F20.18	Search time of light load current in emergency operation	0.300 - 3.000s	0.500s	0.001s	×	
F20.19	Torque limit in mergency operation	70.0 - 200.0%	100.0%	0.1%	×	

Appendix B Modbus Communication Protocol

1. Introduction

HD5L-PLUS 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.

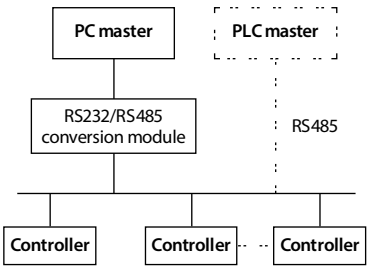
Communication Terminal

Communication terminal MOD+/MOD-, see section 4.4.2,on page 19.

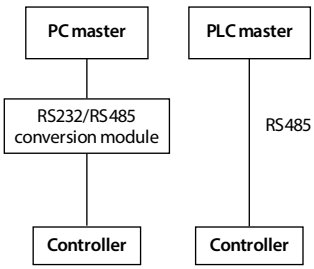
The transmitting mode is shown in following table.

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 67

Network Mode



Single-master, multi-slave

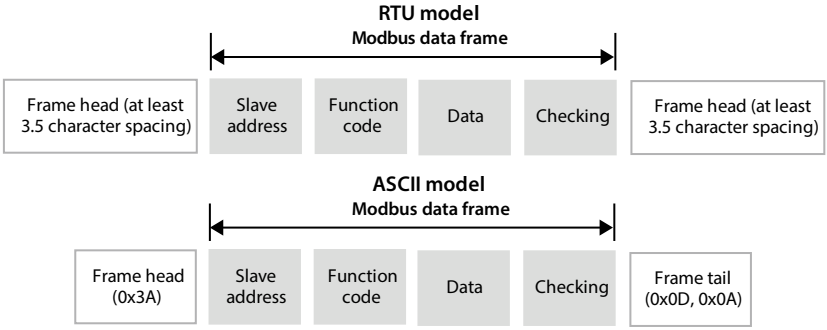


Single-master, single-slave

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 123.

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 parameters 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		

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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 request fails, the response is an error code, and the error code is the function code + 0x80.

The next byte of the error code is the exception code, which has the following meaning:

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.

If the operation request fails, the response is an error code. For example, if 13 function parameters are continuously read from F00.00, the response frame is:

Address	Fault Code	Exception Code	Checksum	
0x01	0x83	0x03	0x01	0x31

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4. Address Mapping

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

Parameter Address Mapping

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

The index in the group is mapped to the low byte of the register address, the index of parameters F00 - F20 refer to the user manual.

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

Status 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	0x3315	DC bus voltage
0x3301	Software version of DSP	0x3318	AI voltage
0x3302	Special software version of DSP	0x3319	AI voltage (after calculating)
0x3303	Software version of keypad	0x3322	Heatsink temperature
0x3304	Elevator running status	0x3323	Input terminal status
0x3305	Rated current of HD5L-PLUS	0x3324	Output terminal status
0x3306	Controller status	0x3325	Modbus status
0x3307	Control mode	0x3326	Total time at power-on (hour)
0x3308	Setting speed	0x3327	Total running time (hour)
0x3309	Setting speed (after Acc./Dec.)	0x3328	Run times
0x330A	Feedback speed	0x3329	Present fault
0x330B	Setting frequency	0x332A	SINCOS encoder C phase AD sampling value
0x330C	Setting frequency (after Acc./Dec.)	0x332B	SINCOS encoder D phase AD sampling value
0x330D	Output frequency	0x332C	SINCOS encoder A phase AD sampling value
0x330E	Setting Rpm	0x332D	SINCOS encoder B phase AD sampling value
0x330F	Running Rpm	0x332E	UVW status of UVW encoder
0x3311	Output voltage	0x332F	Electrical angle
0x3312	Output current	0x3332	Pulses of PG
0x3313	Output torque	0x3336	Start rolling pulse monitoring
0x3314	Output power	0x3337	Start the stability judgment source

Address	Function	Address	Group No.
0x3339	No-load auto-tuning encoder pulse change judgment variable	0x333E	SINCOS encoder AB signal synthesis amplitude
0x333C	Current position signal (Q13 format)	0x333F	SINCOS encoder CD signal synthesis amplitude
0x333D	Current position signal (Q16 format)	0x3348	Software built-in number

5. Special Instruction

- For the data frame in ASCII mode, if the frame length is an even number, the frame is abandoned.
- 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.
- 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	Address	Code	Register Address		Word No. of Read		Checksum	
Frame	0x02	0x03	0x00	0x06	0x00	0x01	0x64	0x38
Response	Address	Code	Answer Byte		Register Content		Checksum	
Frame	0x02	0x03	0x02		0x00	0x01	0X3D	0x84

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

Command	Address	Code	Register Address		Word No. of Read		Checksum	
Frame	0x02	0x03	0x33	0x15	0x00	0x01	0x9A	0Xb9
Response	Address	Code	Answer Byte		Register Content		Checksum	
Frame	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	Address	Code	Register Address		Register Content		Checksum	
Frame	0x02	0x41	0x00	0x07	0x04	0xB0	0x8F	0x43
Response	Address	Code	Register Address		Register Content		Checksum	
Frame	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	Address	Code	Register Address		Register Content		Checksum	
Frame	0x02	0x41	0x32	0x00	0x00	0x0B	0x72	0x89
Response	Address	Code	Register Address		Register Content		Checksum	
Frame	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	Address	Code	Register Address		Register Content		Checksum	
Frame	0x02	0x41	0x32	0x00	0x10	0x0D	0xFF	0x4B
Response	Address	Code	Register Address		Register Content		Checksum	
Frame	0x02	0x41	0x32	0x00	0x10	0x0D	0xFF	0x4B

7. Controller fault reset of address 2

Command	Address	Code	Register Address		Register Content		Checksum	
Frame	0x02	0x41	0x32	0x00	0x00	0x40	0x32	0xBE
Response	Address	Code	Register Address		Register Content		Checksum	
Frame	0x02	0x41	0x32	0x00	0x00	0x40	0x32	0xBE

8. Emergency running up run of address 2

Command	Address	Code	Register Address		Register Content		Checksum	
Frame	0x02	0x41	0x32	0x00	0x20	0x0D	0xEB	0x4B
Response	Address	Code	Register Address		Register Content		Checksum	
Frame	0x02	0x41	0x32	0x00	0x20	0x0D	0xEB	0x4B

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