HD3N-L Series

Elevator Controller

User Manual

V1.0 2020.05

FORWARD

Thank you for purchasing HD3N-L series elevator controller (HD3N-L) manufactured by Shenzhen Hpmont Technology Co., Ltd.

This User Manual describes how to use HD3N-L 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**

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Chapter 1 Safety Information

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 Industrial Frequency Operation

The HD3N-L series controllers are voltage-type frequency 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, HD3N-L can effectively implement thermal protection of motor. 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 HD3N-L

User should use the control terminal to start and stop HD3N-L. It is strictly forbidden to use contactor or other switches on the input side of HD3N-L 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 checking the insulation of the motor. Worse insulation can cause damage to HD3N-L.

Note:

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

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 HD3N-L

No Capacitor or Varistor on the Output Side

Since HD3N-L 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 HD3N-L fault trip or component damage.

Contactors and Circuit Breakers Connected to the Output of HD3N-L

If circuit breaker or contactor needs to be connected between HD3N-L and the motor, be sure to operate these circuit breakers or contactor when HD3N-L has no output, so as to avoid any damage to HD3N-L.

Running Voltage

HD3N-L 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 HD3N-L sustains deadly power for a while. So to disassemble HD3N-L 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

HD3N-L internal design has lightning surge over-current protection circuit, and has certain self-protection capacity against the lightning.

Altitude and Derating

In area where altitude exceeds 1000 meters, HD3N-L 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 4000m, derated rate is 30% for rated current of HD3N-L. Figure 1-1 is the derating curve of rated current and the altitude.

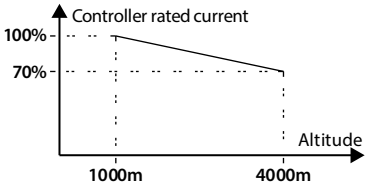
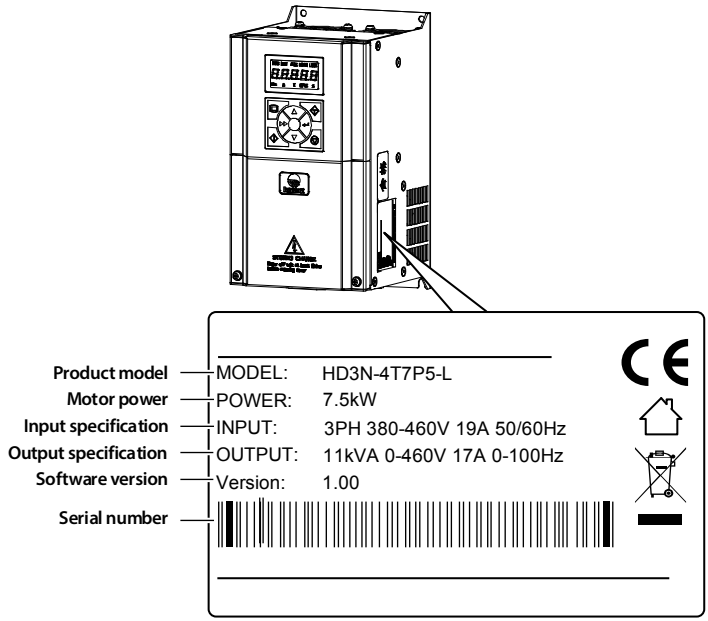


Figure 1-1 Derating curve of rated current and altitude

Chapter 2 Product Information

2.1 Nameplate



2.2 Rated Value

Model	Motor (kW)	Rated Capacity (kVA)	Rated Input Current (A)	Rated Output Current (A)	Size
HD3N-4T7P5-L	7.5	11	19	17	Frame3
HD3N-4T011-L	11	16	28	25	Frame3
HD3N-4T015-L	15	21	35	32	Frame4
HD3N-4T018-L	18.5	24	39	37	Frame4
HD3N-4T022-L	22	30	47	45	Frame5

2.3 Technical Data

Electrical	
Input voltage	Three-phase: 380 - 460V, 50/60Hz Fluctuating within ±10%, unbalance rate <3%
Input frequency	50/60Hz ±5%
Output voltage	0V - input voltage
Output frequency	0 - 100.00Hz
Performance	
Max. current	150% rated output current for 2 minutes 180% rated output current for 10 seconds
Control mode	V/f, SVC
Run command	Keypad, terminals, communication
Speed setting	Digital setting, communication setting
Speed resulotion	Digital setting: 0.01Hz
Speed control accuracy	SVC: ±0.2%
Speed control range	SVC: 1:100
Torque control response	SVC: <200ms
Start torque	SVC: 100% rated torque/0.5Hz
Torque control accuracy	±5%
Characteristic Functions	
Parameter upload and download function	Achieve parameters uploading and downloading (optional keypad)
Programmable input and output interface	Input terminal function can be edited, output terminal function can be edited
Communication	Standard Modbus communication protocol
Protection Functions	
Power-on safety self-test	Power on to conduct security checks on peripheral devices to eliminate potential safety hazards
Overspeed protection	Elevator overspeed protection function to ensure safe operation
Speed deviation protection	With speed deviation detection and protection function, eliminate hidden safety hazards
Up and down forced speed switching function	Have up and down forced speed switching function, to provent running over bottom and top floor
Input and output phase loss protection	Input and output phase loss automatic detection and alarm function
Motor temperature detection	Real-time detection the motor temperature to eliminate safety hazards
Output ground short protection	Effective protection function of output ground short
Output phase short protection	Effective protection function of output phase short

Input and Output	
Digital input	DI1 - DI8
Digital output	DO1, DO2
Analog input	AI
Analog output	AO
Relay output	R1A/R1B/R1C, R2A/R2C Contact capacity: 250VAC/3A or 30VDC/1A
SCI communication	A/B interface, RJ45
Keypad	
LCD display	Function parameter setting, status parameter viewing, fault code viewing, etc.
Parameter copy	Can realize rapid copy of parameters (optional keypad)
Environment	
Running temperature	-10 - +40℃, Max. 50℃, air temperature change less than 0.5℃/min 40 - 50℃ need to use derating: Output current derates by 2% every time it exceeds 1℃
Storage temperature	-40 - +70℃
Application area	Indoor, no direct sunlight. No dust, corrosive gas, flammable gas, oil mist, water vapor, dripping water or salt etc.
Altitude	Less than 1000 meters, otherwise should be derating use
Humidity	Less than 95%RH, non-condensing
Oscillation	3.5m/s^2 at 2- 9Hz, 10m/s^2 at 9 - 100Hz (IEC60721-3-3)
Protection class	IP20
Pollution level	Level 2 (dry, non conducting dust pollution)
Accessories	
About keypad	LCD keypad [MT70-LCD-D] 1m/2m/3m/6m extenion cable to keypad [HD-CAB-1M/2M/3M/6M]

2.4 Braking Resistor

The selection of braking resistor is shown in the table below, and the wiring is in section 4.3.

Model	Motor (kW)	Braking Resistor Value (Ω)			Braking Resistor Power (kW)
		Min.	Max.	Recommended	
HD3N-4T7P5-L	7.5	56	72	64	2
HD3N-4T011-L	11	34	48	40	3.2
HD3N-4T015-L	15	34	41	36	4
HD3N-4T018-L	18.5	17	31	24	5
HD3N-4T022-L	22	17	27	20	6.4

Note:

Please select braking resistor based on the above table.

Bigger resistor can protect the braking system in faulty condition, but oversized resistor may bring a capacity decrease, leading to over voltage protection.

Chapter 3 Machenical Installation

3.1 Precautions

Danger

- Do not install if HD3N-L is incomplete or impaired.
- When conveying HD3N-L, please employ suitable tools according to its weight. Avoid scratch to the product. Be careful: Rollover and drop may cause hurt.
- Make sure that HD3N-L is installed above the flame retardant objects like metal, and far from explosive and flammable things.

Warning

- Do not let wires, screws or residues fall into HD3N-L when installing.

3.2 Installation Site Requirement

Ensure the installation site meets the following requirements:

- Do not install at 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 HD3N-L so as to keep ambient temperature between -10 - +40℃;
- Install at where the vibration is 3.5m/s^2 in 2 - 9Hz, 10m/s^2 in 9 - 100Hz (IEC60721-3-3);
- HD3N-L meets IP20 and pollution level 2 (dry, none conducting dust pollution).

Note:

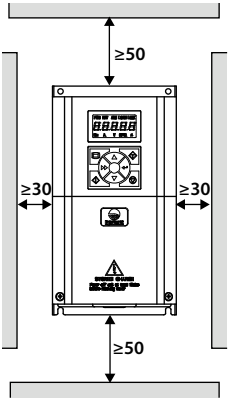
1. It needs derating use if running temperature exceeds 40℃. The derating value of the output current of HD3N-L shall be 2% for each degree centigrade. Max. allowed temperature is 50℃.

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

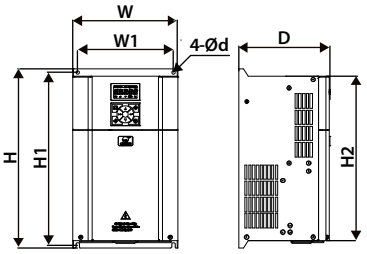
3.3 Installation Direction and Space

To achieve good cooling efficiency, install HD3N-L vertically and always provide the following space to allow normal heat dissipation.

The installation space (mm) is shown on the right figure.



3.4 Dimensions and Weight



Size	Dimension (mm)			Mounting Size (mm)				GW
	W	H	D	W1	H1	H2	d	(kg)
Frame3	140	260	155	122	248	235	6	5.4
Frame4	180	298	175	160	284	270	6	8.3
Frame5	220	375	190	200	360	345	7	13

Chapter 4 Electrical Installation

4.1 Precautions

Danger

- Only qualified electrical engineer can perform wiring job.
- To facilitate the input side over-current protection and outage maintenance, connect HD3N-L with power supply via the MCCB or fuse.
- Make sure whether the action is reliable or effective after external power emergency stop terminal is connected.
- There is more than 3mA leakage current in HD3N-L grounding, depending on the running conditions. To ensure safety, HD3N-L and the motor must connect to two separate and independent grounding wires, 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 HD3N-L when it is live. The main circuit terminals are neither allowed connecting to the enclosure nor short-circuiting.

Warning

- Do not do pressure test on HD3N-L.
- For HD3N-L with more than 2 year's storage, please use regulator to power it slowly.
- Do wiring connection of the braking resistor according to the wiring figure.
- Make sure the terminals are fixed tightly.
- Do not connect the input supply cable to the output terminals U/V/W of HD3N-L.
- Do not connect the phase-shifting capacitors to the output circuit.
- The DC bus terminals of HD3N-L must not be short-circuited.

4.2 Peripheral Accessories Selection

4.2.1 Wiring Specifications of Input and Output

The AC supply to HD3N-L 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 4-1.

The size of ground cable should accord with the requirement in 4.3.5.4 of IEC61800-5-1.

Table 4-1 Input and output wiring specification

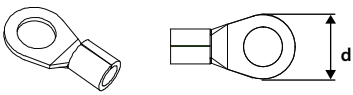
Model	MCCB (A)	Contactor (A)	Supply Cable (mm^2)	Motor Cable (mm^2)	Ground Cable (mm^2)	Size
HD3N-4T7P5-L	40	32	4	4	4	Frame3
HD3N-4T011-L	63	40	6	6	6	Frame3
HD3N-4T015-L	63	40	10	10	10	Frame4
HD3N-4T018-L	100	63	10	10	10	Frame4
HD3N-4T022-L	100	63	16	16	16	Frame5

4.2.2 Power Terminal Lug

Select the lug of power terminal according to the size of terminal, screw size and Max. outer diameter of lug. Refer to Table 4-2.

Take the round terminal as an example.

Table 4-2 Selection of power terminal lug



Size	Frame3	Frame4	Frame5
Screw Size	M4	M5	M6
Tightening Torque (N. M)	1.2 - 1.5	2.3 - 2.5	4.0 - 5.0
Max. Outer Diameter d (mm)	10.2	12.3	17.0

4.3 Main Circuit Terminals and Connection

Danger

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

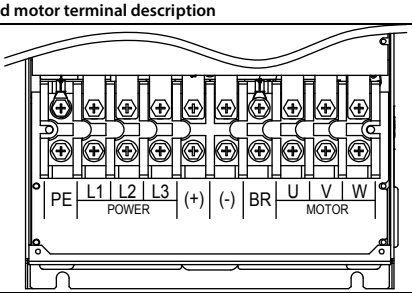
Warning

- Ensure that AC supply voltage is the same as rated input voltage of HD3N-L.

Supply and Motor Terminal

Table 4-3 Supply and motor terminal description

- L1, L2, L3: Three-phase AC power input terminals
- U, V, W: Output terminals, connect to three-phase AC moto
- (+), (-): DC supply input terminals
- (+), BR: Connect to braking resistor
- PE: Ground terminal, connect to the ground



Supply and Motor Connection

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

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

The supply and motor connection are shown as Figure 4-1.

- For selection of wiring, MCCB, power cable, motor cable and ground cable, refer to section 4.2.1 Wiring Specifications of Input and Output, page 11.
- Refer to section 2.4 Braking Resistor, page 7.

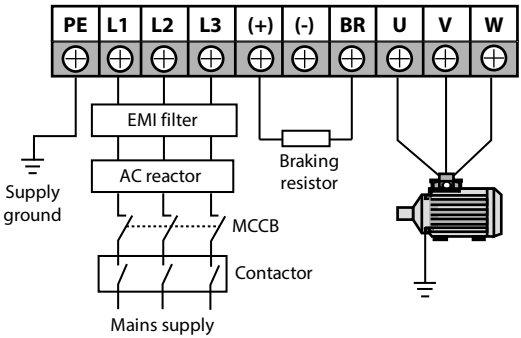


Figure 4-1 Supply and motor connection

4.4 Control Terminals and Connection

Danger

- The control circuit which is designed as ELV (Extra Low Voltage) circuit and power circuit are basically insulated. Do not touch HD3N-L after it is powered.

Warning

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

Control Terminal Description

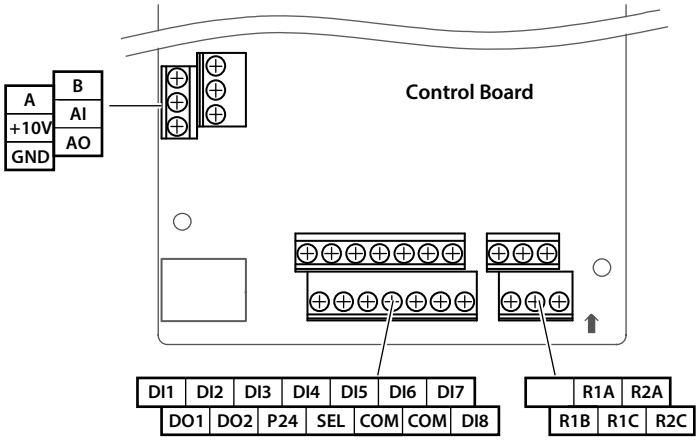


Figure 4-2 Control terminal

Table 4-4 Control terminal description

Terminal		Description
A, B	Communication terminal	A: 485+, B: 485-
P24, COM	Digital power supply	Digital input +24V power supply, Max. output current is 200mA
DI1 - DI8	Digital input	Programmable bipolar optional input signal, compatible with DC/AC input signal DI1 - DI5, DI7 - DI8: • Input voltage: 12 - 30VDC, 12 - 30VAC • Input impedance: 6.2kΩ DI6: • Input voltage: 12 - 30VDC • Can be selectable for high-plush input, max-frequency 50kHz
SEL	Digital input common terminal	SEL and P24 are connected by default • Disconnect SEL and P24 when use external power to drive DI
DO1, COM DO2, COM	Digital output	Programmable optical-couple isolation, open collector output • Output voltage: 0 - 30VDC, max-output current 50mA • DO2 can be selectable for pulse frequency output, max-frequency 10kHz
+10V, GND	Analogue power supply	Analogue input use +10V power supply, Max. output current is 100mA • GND is isolated to COM
AI, GND	Analogue input	Input voltage: 0 - 10V, input impedance: 22kΩ
AO, GND	Analogue output	Programmable output Output voltage: 0 - 10V
R1A/R1B/R1C R2A/R2C	Relay output	Programmable output, contact rating: 250VAC/3A or 30VDC/1A • R1B, R1C normally closed; R1A, R1C normally open, R2A, R2C normally open

Note:

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

Control Terminal Connection

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.

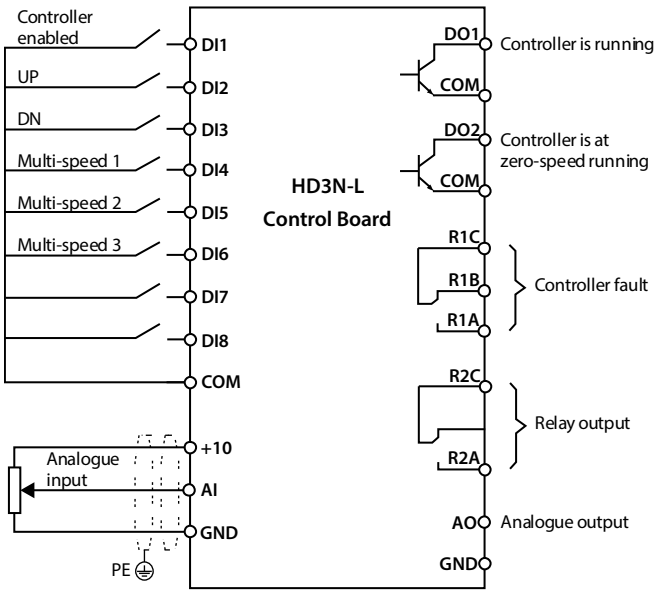
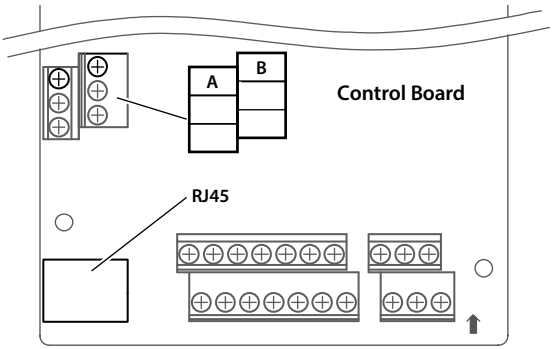
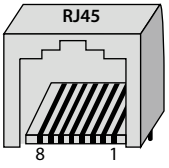


Figure 4-3 Control terminal connection

4.5 Communication Terminal



Terminal	Description
A	485+
B	485-
RJ45 Pin	**Definition**
1,3	+5V
2	485+
4 - 6	GND
7	485-
8	Unused



4.6 Meet EMC Requirement of Installation

4.6.1 Correct EMC Installation

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

HD3N-L 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 should be 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 4-4.

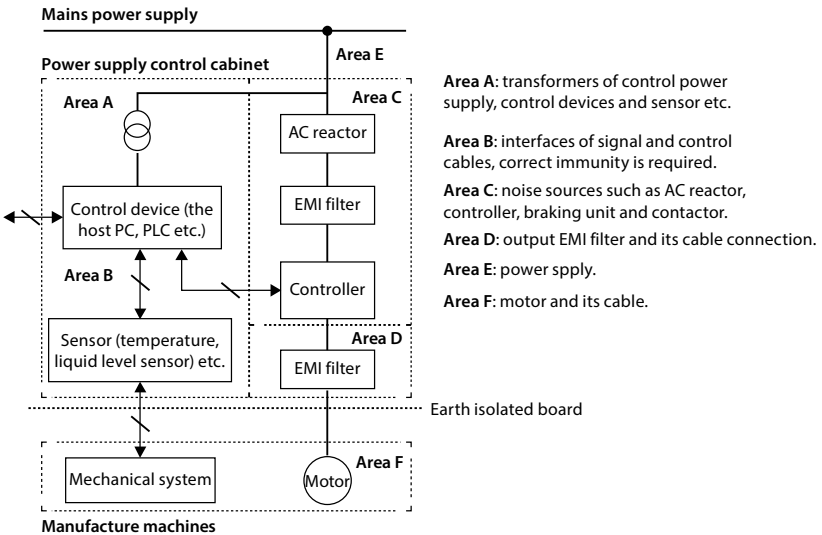


Figure 4-4 System wiring

- 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.
- All of the communication and signal cable from cabinet 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 4-5.

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

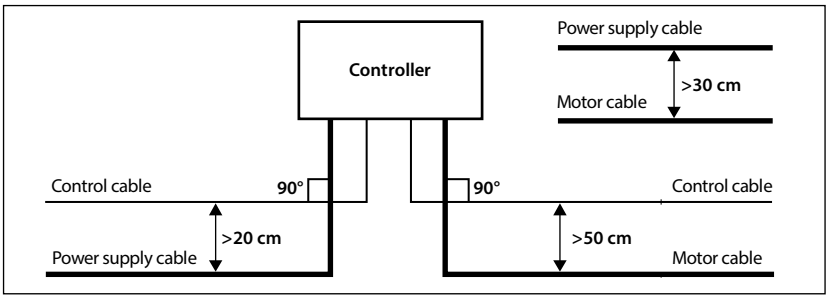


Figure 4-5 System wiring

Shielded or 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 4-6.

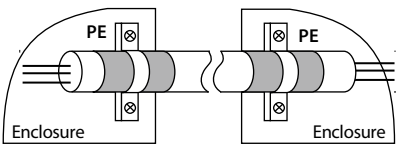


Figure 4-6 Shielded cable connection

4.6.3 Motor Connection

The longer motor cable is, the higher carrier frequency will be, causing the high harmonic leakage current on the cable to increase as well. This may affect peripheral devices.

When the motor cable length is longer than 100 meters, it is recommended to install AC output reactor and adjust the carrier frequency according to Table 4-5.

Table 4-5 Carrier frequency and the cable length betweencontroller and motor

Cable Length	<30m	30 - 50m	50 - 100m	≥100m
Carrier Frequency	Below 15kHz	Below 10kHz	Below 5kHz	Below 2kHz

The cross sectional area (CSA) of motor cable should refer to section 4.2 Peripheral Accessories Selection, on page 11.

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. so do the leakage current to ground and capacitance.

4.6.4 Ground Connection

The grounding terminals PE must be connected to ground properly for the controller has leakage current to the ground. The grounding point should be as close to the controller as possible, and the grounding area should be as large as possible to make sure that the grounding resistance should be less than 10Ω.

Do not share the grounding wire with other devices (A). HD3N-L can share grounding pole with other devices (C). It achieves the best effect if HD3N-L and other devices use dedicated grounding poles (B), as shown in Figure 4-7.

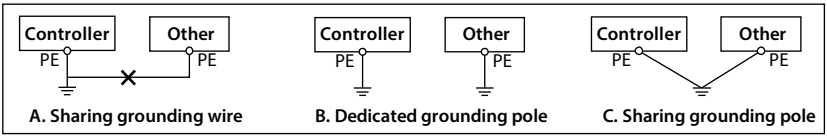


Figure 4-7 Grounding method

When using more than one controller, be careful not to loop the ground wire as shown in Figure 4-8.

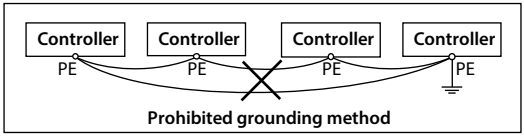


Figure 4-8 Prohibited grounding method

4.6.5 EMI Filter

The EMI filter should be used in equipment that may generate strong EMI or equipment that is sensitive to 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 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 4-9.

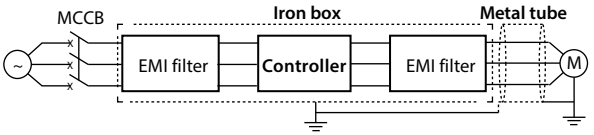


Figure 4-9 Reducing RF interference

Chapter 5 Operation Instructions

5.1 Keypad Description

HD3N-L comes standard with LCD display keypad which is shown as Figure 5-1.

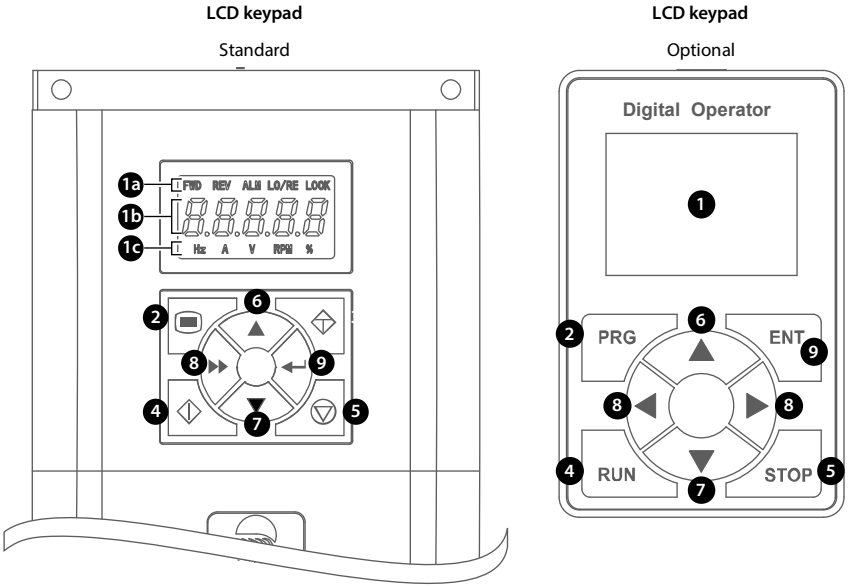


Figure 5-1 Keypad

Table 5-1 Keypad display and key description

No.	Description
1	The standard keypad is LCD display. • There are three states: Steady light, flashing and extinguishing. • The standard LCD keypad cannot be removed. a. Status indicator: Displays the present status. • FWD (Forward status): Displayed when the motor is forward. • REV (Reverse status): Displayed when the motor is reversed. • ALM (Alarm status): Displayed when there is a fault • LO/RE (Remote or local status): Displayed when the controller is in terminal or communication control. • LOCK (Password locked status): Displayed when the user password lock is in effect. b. Display area: Normally display parameters, display fault code when fault. • When a bit value flashes, it means that the bit can be modified. c. Unit indicator: Displays the unit of the currently displayed value. • Respectively: Hz (frequency unit), A (current unit), V (voltage unit), RPM (rotary speed unit), % (% unit)

No.	Description		
2		PRG	**Programming or exit:** Enter or exit menu
4		RUN	**RUN:** Start HD3N-L in keypad control mode
5		STOP	**Stop or reset:** Stop HD3N in keypad mode. Reset fault when fault occurs
6	▲		**Increase:** Increase parameter or value
7	▼		**Decrease:** Decrease parameter or value
8	▶▶	◀ ▶	**Shift:** Shift one bit when selecting parameter or setting the parameter
9	↵	ENT	**Enter or confirm:** Enter lower menu. Confirm saving the data

5.2 Parameter Display Status at Stop or Run

When the HD3N-L is in the stop or run state, press ▶▶ (standard) or ◀ ▶ (optional) to display the stop or run state parameters in a loop.

- Stop state parameters: Setting speed, DC bus voltage, input terminal status.
- Run state parameters: Setting speed (after Acc. and Dec.), output frequency, output voltage, output current.

5.3 Keypad Control Operation

When F00.05 = 0 (keypad control), you can directly start and stop the controller with the keypad to set the run frequency.

Proceed as follows:

1.	Turn on input power.
2.	Set the motor parameters according to the motor nameplate: F07.00 (rated power), F07.01 (rated voltage), F07.02 (rated current), F07.03 (rated frequency), F07.04 (rated RPM).
3.	Set the running speed (F00.07), range 0.000m/s - F00.02.
4.	Press ◇ (standard) or **RUN** (optional), the controller starts.
5.	Press ▽ (standard) or **STOP** (optional), the controller stops.

Chapter 6 Function Introduction

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

Display Parameter:

D00: Status Display Parameter (pages 24 - 25)
D01: Drive Status Parameters (pages 25 - 25)
D02: Analogue Status Display Parameters (pages 25 - 26)
D03: Running Status Parameters (pages 26 - 27)

General Function Parameter:

F00: Basic Parameters (pages 27 - 28)
F01: Protection of Parameters (pages 28 - 29)
F02: Start and Stop Parameters (pages 29 - 30)
F03: Acc. and Dec. Parameter (pages 31 - 31)
F04: Analogue Curve Parameters (pages 31 - 31)
F05: Speed Parameters (pages 31 - 32)
F06: Optimize parameters (pages 32 - 33)
F07: Motor parameters(pages 33 - 35)
F08: Motor Vector Control Speed-loop Parameters (pages 35 - 36)
F09: Current-loop Parameters (pages 36 - 36)
F12: Digital I/O Terminal Parameters (pages 36 - 39)
F13: Analogue I/O Terminal Parameters (pages 39 - 40)
F14: SCI Communication Parameter (pages 40 - 41)
F15: Display Control Parameter (pages 41 - 42)
F16: Function-boost Parameters (pages 42 - 43)
F17: Fault Protection Parameters(pages 43 - 44)
F18: PWM Control Parameter (pages 44 - 45)
F19: Advanced Parameters (pages 45 - 47)
F20: Function-boost Parameters 2 (pages 47 - 47)

Manufacturer Function Parameters (on page 47)

6.1 Group D: Display Parameters

Group D is status display parameter.

6.1.1 D00: Status Display Parameters

<table>
<tr><th>Ref. Code</th><th colspan="4">Function Description</th><th>Setting Range [Default]</th></tr>
<tr><td>D00.00</td><td colspan="4">Controller series</td><td>[Actual value]</td></tr>
<tr><td>D00.01</td><td colspan="4">DSP software version</td><td>[Actual value]</td></tr>
<tr><td>D00.02</td><td colspan="4">DSP non-standard software version</td><td>[Actual value]</td></tr>
<tr><td>D00.03</td><td colspan="4">Keypad Software version</td><td>[Actual value]</td></tr>
<tr><td>D00.04</td><td colspan="4">Elevator running status</td><td>[Actual value]</td></tr>
<tr><td></td><td colspan="5">Display elevator running status.
The standard LCD display is hexadecimal number, and the optional LCD display is a 16-bit binary number, as shown in the following table:
<table>
<tr><td>Bit15: Emergency run
0: No
1: Yes</td><td>Bit14: Multi-speed terminal 3
0: Invalid
1: Valid</td><td>Bit13: Multi-speed terminal 2
0: Invalid
1: Valid</td><td>Bit12: Multi-speed terminal 1
0: Invalid
1: Valid</td></tr>
<tr><td>Bit11: Unused</td><td>Bit10: Unused</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, marked as “0”</td></tr>
<tr><td>Bit3: Analogue run
0: No
1: Yes</td><td>Bit2: Multi-speed run
0: No
1: Yes</td><td>Bit1: Inspection run
0: No
1: Yes</td><td>Bit0: Controller enable
0: Disenable
1: Enable</td></tr>
</table></td></tr>
<tr><td>D00.05</td><td colspan="4">Controller rated current</td><td>[Actual value]</td></tr>
<tr><td>D00.06</td><td colspan="4">Controller status</td><td>[Actual value]</td></tr>
<tr><td></td><td colspan="5">Display controller status.
The standard LCD display is hexadecimal number, and the optional LCD display is a 16-bit binary number, as shown in the following table:
<table>
<tr><td>Bit15: Unused</td><td>Bit14: Unused</td><td>Bit13: Unused</td><td>Bit12: Contactor output
0: Invalid
1: Valid</td></tr>
<tr><td>Bit11: Brake output
0: Invalid
1: Valid</td><td>Bit10: Ready to run
0: Not ready
1: Ready</td><td>Bit9: Speed reached
0: No
1: Yes</td><td>Bit8: Auto-tuning
0: No
1: Yes</td></tr>
<tr><td>Bit7: Zero-speed running
0: No
1: Yes</td><td>Bit6: Zero-speed signal
0: Invalid
1: Valid</td><td colspan="2">Bit5&Bit4: Acceleration/deceleration/constant
00: Constant 01: Acceleration (Acc.)
11: Unused 10: Deceleration (Dec.)</td></tr>
<tr><td>Bit3: DN
0: No
1: Yes</td><td>Bit2: UP
0: No
1: Yes</td><td>Bit1: Run/stop
0: Stop
1: Run</td><td>Bit0: Controller fault
0: No fault
1: Fault</td></tr>
</table></td></tr>
</table>

6.1.2 D01: Drive Status Parameters

Ref. Code	Function Description	Setting Range [Default]
D01.00	Control mode	[Actual value]
D01.01	Setting speed	[Actual value]
D01.02	Setting speed (after Acc. and Dec.)	[Actual value]
D01.03	Feedback speed	[Actual value]
D01.04	Setting frequency	[Actual value]
D01.05	Setting frequency (after Acc. and Dec.)	[Actual value]
D01.06	Output frequency	[Actual value]
D01.07	Setting RPM	[Actual value]
D01.08	Running RPM	[Actual value]
D01.10	Output voltage	[Actual value]
D01.11	Output current	[Actual value]
D01.14	DC bus voltage	[Actual value]

6.1.3 D02: Analogue Status Display Parameters

Ref. Code	Function Description	Setting Range [Default]
D02.00	AI voltage	[Actual value]
D02.01	AI voltage (after calculating)	[Actual value]
D02.08	AO output	[Actual value]

6.1.4 D03: Running Status Parameters

<table>
<tr><th>Ref. Code</th><th>Function Description</th><th>Setting Range [Default]</th></tr>
<tr><td>D03.01</td><td>Input terminal status</td><td>[Actual value]</td></tr>
<tr><td></td><td colspan="2">Display input terminal status.
Standard LCD display is hexadecimal number, optional LCD display is 16-bit binary number.
Each bit (binary) represents a different input terminal, see the table below.
• 0: DI terminals disconnects with common terminals.
• 1: DI terminals connects with common terminals.
<table>
<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>DI8</td><td>DI7</td><td>DI16</td><td>DI5</td><td>DI4</td><td>DI3</td><td>DI2</td><td>DI1</td></tr>
</table></td></tr>
<tr><td>D03.02</td><td>Output terminal status</td><td>[Actual value]</td></tr>
<tr><td></td><td colspan="2">Display output terminal status.
Standard LCD display is hexadecimal number, optional LCD display is 16-bit binary number.
Each bit (binary) represents a different output terminal, see the table below.
• Positive logic: 0 means invalid, 1 means valid.
• Negative logic: 0 means valid, 1 means invalid.
<table>
<tr><td>Bit3</td><td>Bit2</td><td>Bit1</td><td>Bit0</td></tr>
<tr><td>RLY2</td><td>RLY1</td><td>DO2</td><td>DO1</td></tr>
</table></td></tr>
<tr><td>D03.03</td><td>Modbus status</td><td>[Actual value]</td></tr>
<tr><td></td><td colspan="2">Display Modbus communication status.
0: Normal.
1: Communication timeout.
2: Incorrect data frame head.
3: Incorrect data frame checking.
4: Incorrect data frame content.</td></tr>
<tr><td>D03.04</td><td>Total time at power-on (h)</td><td>[Actual value]</td></tr>
<tr><td>D03.05</td><td>Total running time (h)</td><td>[Actual value]</td></tr>
<tr><td>D03.06</td><td>Running times</td><td>[Actual value]</td></tr>
<tr><td>D03.07</td><td>Present fault</td><td>[Actual value]</td></tr>
</table>

6.2 Group F: General Parameters

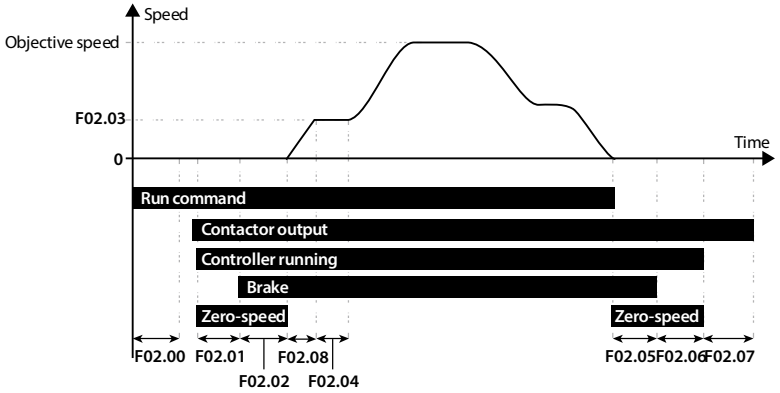
6.2.1 F00: Basic Parameters

Ref. Code	Function Description	Setting Range [Default]
F00.00	**Motor type**	**[0]**
	0: Asynchronous motor (Asy. motor).	
F00.01	**Control mode**	**0 - 6 [1]**
	0: V/f control. Constant control voltage/frequency rat. • Suitable for special elevator applications. This mode does not need the encoder, and the control effect is not as good as vector control. • When select V/f control, please set gropu F07 (V/f control parameters), to achieve good control effect. 1: SVC1 control, open-loop vector control. 2 - 4: Unused. 5: SVC5 control, optimized flux vector control. 6: SVC6 control, current vector control. *Note:* *1. V/f and SVC control is suitable for a temporary run mode where the encoder is not installed on themotor and the elevator needs to inspection run.* *2. When selecting SVC, you need to first perform autotuning of the motor parameters, please refer to F07.06. At the same time, set the vector control parameters (group F08) to exert excellent vector control effect.*	
F00.02	**Elevator rated speed**	**0.100 - 4.000 [1.500m/s]**
F00.03	**Controller Max. output frequency**	**5.00 - 100.00 [50.00Hz]**
	Defines the Max. frequency that the controller is allowed to output. • Be careful to set reasonable parameters according to the nameplate of the motor and the actual operating conditions.	
F00.04	**Motor mechanical parameter**	**10.0 - 6000.0 [60.0]**
F00.05	**Operating mode**	**0 - 5 [0]**
	0: Keypad control. • Controlled by pressing the ◇ (standard) / **RUN** (optional) or ▽ (standard) / **STOP** (optional), set the run speed in F00.07. 1: Terminal analogue control. • The running command is controlled by the terminal (UP and DN) • The run speed is set by analogue input terminals. 2: Terminal multi-speed (MS) control. • The running command is controlled by the terminal (UP and DN). • the run speed is set by the combination of terminals (MS1, MS2, MS3). 3 - 5: Unused.	
F00.07	**Speed setting of keypad**	**0.000 - F00.02 [1.500m/s]**
	F00.05 = 0, set the objective speed at running.	
F00.08	**Run direction**	**0,1 [0]**
	0: The same as run command. 1: Opposite to run command.	

6.2.2 F01: Protection of Parameters

Ref. Code	Function Description	Setting Range [Default]
F01.00	**User's password**	**00000 - 65535 [0]**
	XXXXX: To enable the password protection function, set any non-zero number as the password. • Once the password is set, and detect that there is no press on the keypad within 5 minutes, the user's password will be valid. • To change the parameters, input correct password. Otherwise can not change any parameter via keypad, but only check. 00000: The factory setting, and no user's password. • If user unlocks the password, it means clearing the user's password.	
F01.01	**Menu mode**	**0,1 [0]**
	0: Full menu mode. Display all function parameters. 1: Checking menu mode. Only display the parameters that are different from factory setting.	
F01.02	**Function parameter initialization**	**0 - 3 [0]**
	0: No operation. • The controller is in a normal parameter reading and writing state. • Whether the parameter can be changed depends on the user's password status and the actual running conditions of the controller. 1: Restore to factory settings. • Except group F01, F07.00 - F07.14, F15.00, F17.11 - F17.27, group F18 and group Y. • **Steps:** Set F01.02 = 1, press ↵ (standard) or **ENT** (optional) to ensure and the parameters are restored to factory settings, the keypad dispalys "rESEt". After finish restoring to factory setting, the keypad will display stop status parameters. 2: Download the keypad EEPROM parameter to the current function code settings. • MT70-LCD-D is required for external use. • Except group F01, F17.11 - F17.27, group F18 and group Y. • When downloading parameters, download the motor parameters. At the scene, you need to record the original motor parameters, or restart parameter auto-tuning. 3: Clear fault information. • Clear the fault information recorded in F17.11 - F17.27.	
F01.03	**Keypad EEPROM parameter initialization**	**0,1 [0]**
	0: No operation. • The controller is in a normal parameter reading and writing state. 1: Upload the current function code settings to the keypad EEPROM parameter. • MT70-LCD-D is required for external use. *Note: Group F01, F17.11 - F17.27, group F18 and group Y do not upload.*	

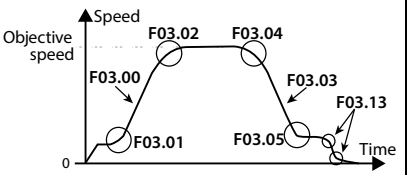
6.2.3 F02: Start and Stop Parameters



Ref. Code	Function Description	Setting Range [Default]
F02.00	**Start delay time**	**0.000 - 4.999 [0.000s]**
	Defines the delay time from the running command to the controller in the running state. • F00.05 = 0 (keypad control), F02.00 is invalid.	
F02.01	**Brake open delay time**	**0.000 - 4.999 [0.500s]**
F02.02	**Start zero-speed hold time**	**0.000 - 4.999 [0.000s]**
	It defines the time from when the brake is opened to when there is speed output, and the motor has output torque during this period. • It can improve the comfort when starting.	
F02.03	**Start speed**	**0.000 - 0.400 [0.030m/s]**
F02.04	**Start speed hold time**	**0.000 - 4.999 [0.300s]**
F02.05	**Brake close delay time**	**0.000 - 1.999 [0.300s]**
	Defines the time from when the controller runs from zero speed to when the brake close command is output.	
F02.06	**Stop zero-speed hold time**	**0.000 - 4.999 [0.300s]**
	Defines the time to keep the motor at zero speed and output torque when stopping. • It can improve the comfort when parking.	
F02.07	**Run contactor close delay time**	**0.000 - 4.999 [0.000s]**
	Defines the delayed close time of the run contactor after the running command is cancelled.	
F02.08	**Starting ramp time**	**0.001 - 2.000 [0.500s]**
	It defines the time required for the elevator to accelerate from zero speed to the rated speed (F00.02). • Invalid when set to 0.	

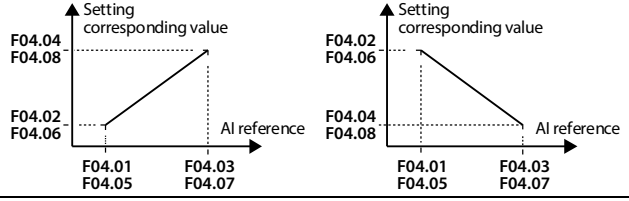
6.2.4 F03: Acc. and Dec. Parameters

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. It can cushion the shock at elevator start/stop and improve riding comfort.
	• 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.
	 	

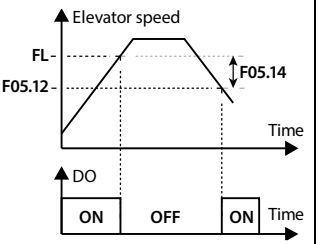
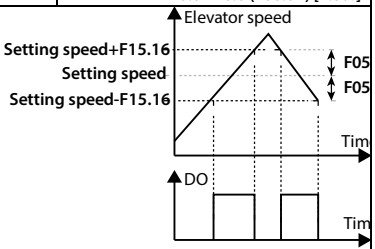
F03.06	**Inspection Acc. speed**	**0.020 - 9.999 [0.200m/s²]**
F03.07	**Inspection Dec. speed**	**0.020 - 9.999 [1.000m/s²]**
	Defines the Acc. and Dec. speed of the elevator in inspection run mode.	
F03.08	**Emergency run Acc. speed**	**0.020 - 9.999 [0.200m/s²]**
F03.09	**Emergency run Dec. speed**	**0.020 - 9.999 [0.200m/s²]**
	Defines the Acc. and Dec. speed of the elevator in emergency run mode.	
F03.10	**Motor auto-tuning Acc. speed**	**0.020 - 9.999 [0.100m/s²]**
F03.11	**Motor auto-tuning Dec. speed**	**0.020 - 9.999 [0.100m/s²]**
	Defines the Acc. and Dec. speed of the elevator in motor auto-tuning.	
F03.13	**Stop Dec. jerk**	**0.020 - 9.999 [0.350m/s²]**
	Defines the deceleration speed from non-zero speed to zero speed. • It can adjust the smooth stop of the elevator and add riding comfort.	

6.2.5 F04: Analogue Curve Parameters

Ref. Code	Function Description	Setting Range [Default]
F04.00	Setting curve	0,1 [0]
	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 line 1. F04.05 - F04.08 define line 2. Both can independently realize the positive and negative characteristics, as shown in the figure below. 	

6.2.6 F05: Speed Parameters

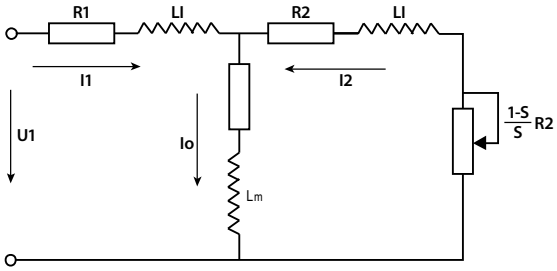
Ref. Code	Function Description	Setting Range [Default]
F05.00	Multi-speed 0	0.000 - F00.02 [0.000m/s]
F05.01	Multi-speed 1	0.000 - F00.02 [0.000m/s]
F05.02	Multi-speed 2	0.000 - F00.02 [0.000m/s]
F05.03	Multi-speed 3	0.000 - F00.02 [0.000m/s]
F05.04	Multi-speed 4	0.000 - F00.02 [0.000m/s]
F05.05	Multi-speed 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	0.000 - F00.02 [0.000m/s]
	F05.00 - F05.07 define the MS running speed which is used in MS run mode. F00.02 is the rated speed of elevator.	
F05.08	Inspection run speed	0.000 - 0.630 [0.200m/s]
	Defines the running speed of elevator in the inspection run mode.	
F05.09	Emergency run speed	0.000 - F00.02 [0.100m/s]
	Defines the running speed of elevator in the emergency run mode.	

Ref. Code	Function Description	Setting Range [Default]
F05.12	FDT1	0.0 - 100.0 (F00.02) [90.0%]
F05.13	FDT2	0.0 - 100.0 (F00.02) [90.0%]
F05.14	FDT1 delay level	0.0 - 100.0 (F00.02) [1.0%]
F05.15	FDT2 delay level	0.0 - 100.0 (F00.02) [1.0%]
	When running speed is lower than one speed (F05.12 + F05.14) as FL in the right figure, ON indicating signal will output till the running speed is lower than F05.12. • F05.13, F05.15 refer to F05.12 and F05.14.	
F05.16	Speed within FAR range	0.0 - 20.0 (F00.02) [1.0%]
	If the elevator speed is within the FAR range, a pulse signal is output. As shown in the right figure.	
F05.17	Over-speed setting	80.0 - 120.0 (F00.02) [115.0%]
F05.18	Over-speed detection time	0.0 - 2.0 [0.2s]
	When the actual elevator speed exceeds F05.17, and the duration time exceeds F05.18, HD3N-L alarms E0032 fault (motor over speed). • F05.18 = 0, HD3N-L does not detect motor over speed fault.	
F05.19	Detection value of speed deviation	0.0 - 30.0 (F00.02) [20.0%]
F05.20	Detection time of speed deviation	0.0 - 2.0 [1.0s]
	When the deviation of setting speed (after Acc. and Dec.) and actual run speed of motor exceeds F05.19, and the duration time exceeds F05.20, HD3N-L alarms E0018 fault (excessive speed deviation). • F05.19 or F05.20 = 0, HD3N-L does not detect the excessive speed deviation fault of motor.	

6.2.7 F06: Optimize parameters

Ref. Code	Function Description	Setting Range [Default]
F06.19	Brake premature close run time	0.000 - 1.999 [0.000s]

6.2.8 F07: Motor parameters



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

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

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

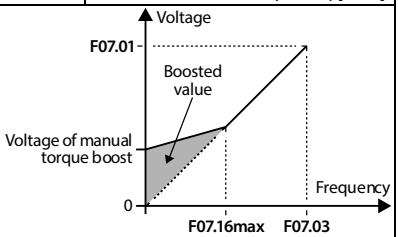
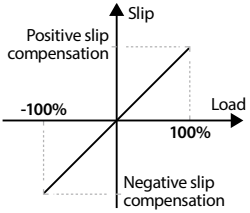
$$\text{Idling excitation current F07.11} = \sqrt{1 - F07.05^2} \times F07.02$$

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

Ref. Code	Function Description	Setting Range [Default]
F07.00	**Motor rated power**	**0.2 - 500.0kW [Depend on HD3N-L]**
F07.01	**Motor rated voltage**	**0V - controller rated voltage [Depend on HD3N-L]**
F07.02	**Motor rated current**	**0.0 - 999.9A [Depend on HD3N-L]**
F07.03	**Motor rated frequency**	**1.00 - 100.00 [50.00Hz]**
F07.04	**Motor rated RPM**	**1 - 24000 [1440rpm]**
F07.05	**Motor power facto**	**0.001 - 1.000 [Depend on HD3N-L]**
F07.06	**Motor parameter auto-tuning**	**0 - 2 [0]**

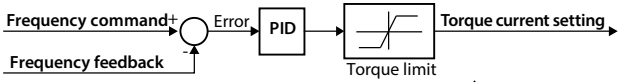
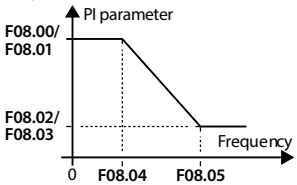
	0: No action.
	1: Static auto-tuning.
	2: Rotational auto-tuning.
	• In the process of static auto-tuning, the stator resistance (F07.07), rotor resistance (F07.08) and leakage inductance (F07.09) will be written into F07.07, F07.08 and F07.09 automatically.
	• For mutual inductance (F07.10) and idling excitation current (F07.11):
	  • Static auto-tuning (F07.06 = 1), it will auto calculate according to F07.05 and F07.02, then write the result into F07.10 and F07.11.
	  • Rotational auto-tuning (F07.06 = 2), the motor will be at rotary status and the auto-measured value will be written into F07.10 and F07.11.
	• In the process of rotational auto-tuning, oscillation and even overcurrent might occur. At this time, press ▽ (standard) or **STOP** (optional) to stop auto-tuning, and adjust 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 (F00.05 = 0).	

6

Ref. Code	Function Description	Setting Range [Default]
	Auto-tuning steps: 1. Set the motor parameters (F07.00 - F07.04). 2. When F07.06 = 2, set proper Acc. speed (F03.10) and Dec. speed (F03.11), remove the motor shaft from the load, carefully confirm its safety. 3. F07.06 = 1 or 2, press ↵ (standard) or **ENT** (optional), then press ◇ (standard) or **RUN** (optional) to start auto-tuning, the keypad display "tunE". 4. After auto-tuning is completed, the keypad displays the stop status parameters, F07.06 resets to 0.	
F07.07	**Motor stator resistance**	**0.000 - 65.535Ω [Depend on HD3N-L]**
F07.08	**Motor rotor resistance**	**0.000 - 65.535Ω [Depend on HD3N-L]**
F07.09	**Motor leakage inductance**	**0.0 - 6553.5mH [Depend on HD3N-L]**
F07.10	**Motor mutual inductance**	**0.0 - 6553.5mH [Depend on HD3N-L]**
F07.11	**Motor Idling excitation current**	**0.0 - 999.9A [Depend on HD3N-L]**
F07.12	**Motor core saturation coefficient 1**	**0.00 - 0.50 [0.50]**
F07.13	**Motor core saturation coefficient 2**	**0.00 - 0.75 [0.75]**
F07.14	**Motor core saturation coefficient 3**	**0.00 - 1.20 [1.20]**
	F07.12 - F07.14 set the core saturation coefficient when the magnetic flux is 50%, 75%, 120%.	
F07.15	**Motor torque boost**	**0.1 - 30.0 [0.1%]**
F07.16	**Motor manual torque boost end-point**	**0.1 - 50.0 (F07.03) [2.0%]**
	To compensate the torque drop at low frequency, boost the voltage so as to boost the torque. F07.16 is relative to percentage of motor rated frequency (F07.03). 	
F07.17	**Motor slip compensation gain**	**0.0 - 300.0 [100.0%]**
F07.18	**Motor slip compensation filter time**	**0.1 - 10.0 [0.1s]**
F07.19	**Motor slip compensation limitation**	**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 (HD3N-L will auto adjust its output frequency according to the motor load torque) can reduce the influence. • In driving status (actual speed < setting speed) and in generating status (actual speed > setting speed), the slip compensation gain (F07.17) can be increased gradually. • The value of auto slip compensation depends on rated slip of motor, so make sure the rated frequency (F07.03) and rated RPM (F07.04) are set correctly. Slip compensation range = slip compensation limit (F07.19) × rated slip. Rated slip = F07.03 - F07.04 × Np / 60. • Np is the number of motor pole pairs. 	

Ref. Code	Function Description	Setting Range [Default]
F07.20	**AVR (Automatic Voltage Regulation) function**	**0 - 2 [1]**
	0: No action. 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	**Motor oscillation-suppression mode**	**0,1 [0]**
	0: Depend on exciting component. 1: Depend on torque component.	
F07.22	**Motor oscillation-suppression coefficient**	**0 - 200 [100]**
	It is used to suppress the natural oscillation generated when the controller and the motor cooperate. • If the output current changes repeatedly during constant load operation, F07.22 can be set on the basis of factory parameters to eliminate oscillation, and make the motor run smoothly.	

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 swithcing frequency 1**	**0.00 - 50.00 [10.00Hz]**
F08.05	**ASR PI swithcing frequency 2**	**0.00 - 50.00 [15.00Hz]**
	F08.00 - F08.05, F08.07 sets the PID parameters of the ASR (speed loop). The structure of ASR is shown in figure:  • When HD3N-L operates within 0 - F08.04, the PI parameters of vector control are F08.00 and F08.01; • When HD3N-L operates above F08.05, the PI parameters of vector control are F08.02 and F08.03; • When HD3N-L operates within F08.04 - F08.05, P is the linear interpolation between F08.00 and F08.02, while I is the linear interpolation between F08.01 and F08.03.  • Increasing the ASR KP (F08.00, F08.02) can speed up the dynamic response of the system. But if KP is too large, it is easy to produce oscillation. • Increasing the ASR KI (F08.01, F08.03) can speed up the dynamic response of the system. But if KP is too large, it is easy to produce oscillation and overshoot. • F08.01/F08.03 = 0, the integral function is unused, the ASR works only as a proportional regulator. • Generally, adjust the KP firstly to the max. on condition that the system does not vibrate, then adjust the KI to shorten the response time without overshoot. • To shorten dynamic response time during lowe frequency running, increase KP and KI.	

Ref. Code	Function Description	Setting Range [Default]
F08.06	**ASR integral limitation**	**0.0 - 200.0 (F07.02) [180.0%]**
	It is used to limit the Max. value of the vector control ASR.	
F08.07	**ASR differential time**	**0.000 - 1.000 [0.000s]**
	Defines the vector control ASR 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.	
F08.09	**Torque limit**	**0.0 - 200.0 (F07.02) [180.0%]**

6.2.10 F09: Current-loop Parameters

Ref. Code	Function Description	Setting Range [Default]
F09.00	**ACR KP**	**1 - 4000 [500]**
F09.01	**ACR KI**	**1 - 4000 [500]**
	Defines the PI regulator parameters of the ACR (current-loop). • Increasing the F09.00 or F09.01 can accelerate the dynamic response of output torque, and decreasing the F09.00 or F09.01 can enhance the stability of the system. • If F09.00 or F09.01 is too large, the system is prone to oscillation; If F09.00 or F09.01 is too small, it will affect the system torque output capability.	
F09.04	**ACR execution frequency**	**2 - 6 [4k]**

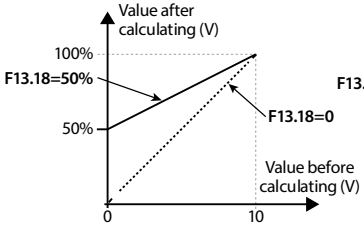
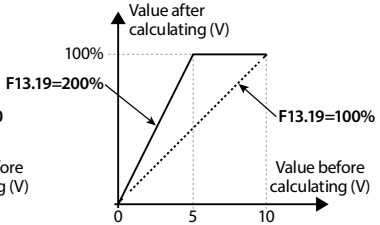
6.2.11 F12: Digital I/O Terminal Parameters

Ref. Code	Function Description	Setting Range [Default]
F12.00	**Input terminal filter time**	**0.000 - 1.000 [0.010s]**
	Defines filter time of digital input termian, used to set input terminal sensibility. • The input terminals are susceptible to interference which will result in misoperation, so F12.00 can be increased. But too long filter time will affect sensibility.	
F12.01	**DI1 function**	**000 - 134 [1]**
F12.02	**DI2 function**	**000 - 134 [2]**
F12.03	**DI3 function**	**000 - 134 [3]**
F12.04	**DI4 function**	**000 - 134 [4]**
F12.05	**DI5 function**	**000 - 134 [5]**
F12.06	**DI6 function**	**000 - 134 [6]**
F12.07	**DI7 function**	**000 - 134 [0]**
F12.08	**DI8 function**	**000 - 134 [0]**
	Note: Hundred digit = 0, normally open (NO) input selected; = 1, normally closed (NC) input selected. 0: Unused. • Terminal function is unused. HD3N-L ignores the signal input via this terminal. • The unused terminal is recommended to be set as 0 so as to avoid wrong connection or action. 1: Controller enabled (EN). • When enabled, HD3N-L is enabled to run. • When unused, HD3N-L is unused to run and will be in coasts to stop status. • When no terminal selects this function, it defaults that HD3N-L is at enabled status.	

<table>
<tr><th>Ref. Code</th><th>Function Description</th><th>Setting Range [Default]</th></tr>
<tr><td></td><td colspan="2">
2,3: UP/DN.
Set control terminal to control up and down of elevator. The terminals are in below table.
<table>
<tr><th>UP Terminal (No.2)</th><th>DN Terminal (No.3)</th><th>Elevator status</th></tr>
<tr><td>0</td><td>0</td><td>Stop</td></tr>
<tr><td>0</td><td>1</td><td>Down</td></tr>
<tr><td>1</td><td>0</td><td>Up</td></tr>
<tr><td>1</td><td>1</td><td>Stop</td></tr>
</table>
4 - 6: Multi-speed 1 - 3 (MS1 - MS3).
Achieve 8-speed running curve via terminals logic combination, as follow table.
<table>
<tr><th>MS3 Terminal (No.6)</th><th>MS2 Terminal (No.5)</th><th>MS13 Terminal (No.4)</th><th>Multi-speed Setting</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>Multi-speed 0 (F05.00)</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>Multi-speed 1 (F05.01)</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>Multi-speed 2 (F05.02)</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>Multi-speed 3 (F05.03)</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>Multi-speed 4 (F05.04)</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>Multi-speed 5 (F05.05)</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>Multi-speed 6 (F05.06)</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>Multi-speed 7 (F05.07)</td></tr>
</table>
7: Inspection input (INS).
If enabled, elevator will do inspection running.
This signal, when used together with UP/DN (No.2 or No.3 function) command, can control the elevator to go up or down during inspection.
8: Emergency run input (BAT).
If enabled, elevator will enter emergency running status.
9: Run contactor feedback input (CSM).
10: Brake feedback input (BSM).
11 - 14: Unused.
15: Motor overheat input (OH).
16: Fault reset input (RST).
When HD3N-L alarms fault, reset it by this terminal.
The function of RST terminal is the same as the ▽ (standard) or STOP (optional) of the keypad.
17 - 33: Unused.
34: External fault (EXT).
The fault signal of external equipment can input through this terminal, so HD3N-L can monitor that equipment and respond accordingly. HD3N-L alarms E0024 (external fault) when receives the EXT signal.
</td></tr>
<tr><td>F12.13</td><td>Filter time of multi-speed terminal</td><td>0.000 - 2.000 [0.010s]</td></tr>
<tr><td></td><td colspan="2">Defines the MS filter time to make up for the time error of MS input terminals.
Change F12.13 according to the change unsynchronization level of numbers of MS input terminals.</td></tr>
</table>

<table>
<tr><th>Ref. Code</th><th>Function Description</th><th>Setting Range [Default]</th></tr>
<tr><td>F12.15</td><td>DO1 function</td><td>0 - 21 [2]</td></tr>
<tr><td>F12.16</td><td>DO2 function</td><td>0 - 21 [3]</td></tr>
<tr><td>F12.17</td><td>RLY1 function</td><td>0 - 21 [14]</td></tr>
<tr><td>F12.18</td><td>RLY2 function</td><td>0 - 21 [0]</td></tr>
<tr><td></td><td colspan="2">0: Unused.
• Leave the output terminals in a state of no function and do nothing.
1: Controller is ready.
• When the controller is not faulty, outputs ON signal.
2: Controller is running.
• The controller is in the running state, output indicator signal.
3: Zero-speed running.
• The controller output speed is 0, but when it is in the running state, outputs ON signal.
4: Zero-speed.
• The controller output speed is 0, output ON signal.
5: Run contactor output control.
• To open or close the output contactor.
6: Brake output control.
• To open or close the brake.
7,8: FDT1, FDT2.
• Refer to F05.12 - F05.13.
9: Speed within signal (FAR).
• When output speed of the controller is within the FAR detect range (F05.16), output indicator signal.
• The indication signal will also output at stop.
10: Up signal output.
• When the elevator runs up, outputs ON signal.
11: Down signal output.
• When the elevator runs down, outputs ON signal.
12: Under-voltage.
• When the controller is in the process of undervoltage, output ON signal.
13: Unused.
14: Controller fault.
• When the controller has fault, output ON signal.
15 - 19: Unused.</td></tr>
<tr><td>F12.21</td><td>Output terminal logic setting</td><td>0 - 0xF [0]</td></tr>
<tr><td></td><td colspan="2">Defines that each bit (binary) represents different output terminal.
• 0: Positive logic. When output terminals are connected to corresponding common port, this logic is enabled. Otherwise the logic is disabled.
• 1: Negative logic. When output terminals are connected to corresponding common port, this logic is disabled. Otherwise the logic is enabled.
<table>
<tr><td>Bit3</td><td>Bit2</td><td>Bit1</td><td>Bit0</td></tr>
<tr><td>RLY2</td><td>RLY1</td><td>DO2</td><td>DO1</td></tr>
</table></td></tr>
</table>

6.2.12 F13: Analogue I/O Terminal Parameters

Ref. Code	Function Description	Setting Range [Default]
F13.00	**AI function**	**0,1 [0]**
	0: Unused. 1: Speed setting.	
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 AI sets frequency, the relationship between the analogue input and the analogue value after calculating is shown as figure: Analogue actual value → Analogue input filtering → Analogue input gain / Analogue input bias → Analogue value after calculating • The formula is: Analogue value after calculating = gain × analogue actual value + bias. • F13.06 define the filter time. • The longer filter time is, the higher immunity level is, the response time is prolonged. The shorter filter time is, the quicker response time is, the lower the immunity level is.	
F13.16	**AO function**	**0 - 6 [0]**
	0: Unused. 1: Running speed (0 - Max. output speed). 2: Setting speed (0 - Max. output speed). 3: Output current (0 - twice rated current of HD3N-L). 4: Output voltage (0 - 1.2 times rated voltage of HD3N-L). 5: Bus voltage (0 - 2.2 times rated voltage of HD3N-L). 6: AI input (0 - 10V). *Note:* *1. At up, up limit of No.1 and No.2 function is corresponding to 10V, while down limit is corresponding to 5V.* *2. At down, up limit of No.1 and No.2 function is corresponding to 0V, while down limit is corresponding to 5V.* *3. Up limit of No. 3 - 5 functions is corresponding to Max. output voltage 10V.*	
F13.18	**AO bias**	**-100.0 - +100.0 [0.0%]**
F13.19	**AO gain**	**0.0 - 200.0 [100.0%]**
	The proportional relation of output can be adjusted by output gain, as shown in the figure below. • The formula is: AO actual output = F13.19 × value before calculating + F13.18.  Analogue output and bias  Analogue output and gain	

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6.2.13 F14: SCI Communication Parameters

Refer to Appendix B, on page 77 for communication function.

Ref. Code	Function Description	Setting Range [Default]
F14.00	**Data format**	**0 - 5 [0]**
	0: 1-8-2 format, no parity, RTU. 1: 1-8-1 format, even parity, RTU. 2: 1-8-1 format, odd parity, RTU. 3: 1-7-2 format, no parity, ASCII. 4: 1-7-1 format, even parity, ASCII. 5: 1-7-1 format, odd parity, ASCII.	
F14.01	**Baud rate**	**0 - 5 [3]**
	0: 1200bps. 1: 2400bps. 2: 4800bps. 3: 9600bps. 4: 19200bps. 5: 38400bps.	
F14.02	**Local address**	**0 - 247 [2]**
	F14.02 = 0, it means broadcast address.	
F14.03	**Host PC response time**	**0 - 1000 [0ms]**
F14.04	**Detection time of communication timeout**	**0.0 - 1000.0 [0.0s]**
	Time at no communication data > setting time of F14.04, it will be considered as E0028 fault (SCI communication timeout). • F14.04 = 0, it will not detect communication timeout.	
F14.05	**Detection time of communication error**	**0.0 - 1000.0 [0.0s]**
	Time at communication error > setting time of F14.05, it will be considered as E0029 fault (SCI communication error). • F14.05 = 0, it will not detect the communication error.	

6.2.14 F15: Display Control Parameters

Ref. Code	Function Description	Setting Range [Default]
F15.00	**Language selection**	**0 - 9 [0]**
	Defines the language displayed on the optional LCD keypad. 0: Chinese. 1: English. 2 - 9: Unused.	
F15.01	**Display contrast of the LCD keypad**	**1 - 10 [6]**
	Defines the display contrast of the optional LCD keypad.	
F15.02	**Set run status parameter 1**	**0 - 30 [5]**
F15.03	**Set run status parameter 2**	**0 - 30 [6]**
F15.04	**Set run status parameter 3**	**0 - 30 [10]**
F15.05	**Set run status parameter 4**	**0 - 30 [11]**
F15.06	**Set run status parameter 5**	**0 - 30 [0]**
F15.07	**Set run status parameter 6**	**0 - 30 [0]**
F15.08	**Set stop status parameter 1**	**0 - 30 [4]**
F15.09	**Set stop status parameter 2**	**0 - 30 [14]**
F15.10	**Set stop status parameter 3**	**0 - 30 [16]**
F15.11	**Set stop status parameter 4**	**0 - 30 [26]**
F15.12	**Set stop status parameter 5**	**0 - 30 [27]**
F15.13	**Set stop status parameter 6**	**0 - 30 [0]**
	The keypad displays parameters which is the run status (F15.02 - F15.07) and stop status (F15.08 - F15.13). It can be cycling displayed by ▶▶ (standard) or ◀ ▶ (optional) on the keypad. • For instance: When set F15.08 = 7, the stop parameter is setting RPM at initial power on. 0 - 3: Unused. 4: Setting speed. 5: Setting speed (after Acc. and Dec.). 6: Output frequency. 7: Setting RPM. 8: Running RPM. 9: Unused. 10: Output voltage. 11: Output current. 12 - 13: Unused. 14: DC bus voltage. 15: AI voltage. 16: AI voltage (after calculating). 17 - 22: Unused. 23: AO output. 24 - 25: Unused. 26: Input terminal status. • Bit0 - Bit7 correspond to DI1 - DI8. 27: Output terminal status. • Bit0 - Bit3 correspond to DO1, DO2, RLY1 - RLY2. 28 - 30: Unused.	

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6.2.15 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 the controller 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 the controller from zero-speed status to zero-speed signal output.	
F16.02	**Current keep time after stop**	**0 - 9999 [0ms]**
	To eliminate the current noise of motor at stop, when the brake finished, the cut-off run signal will reduce the current to zero after the time of F16.02.	
F16.03	**Fan control**	**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 the controller is in run status. After the controller stops for the time of F16.04, the fan continues running if overheat protection is activated. 1: Immediately stop. • The fan runs all the time when the controller is in running status, but stops when the controller stops. 2: Run when power on. • The fan runs continuously after the controller is switched on.	
F16.04	**Fan control delay time**	**0.0 - 600.0 [30.0s]**
F16.05	**Brake unit action voltage**	**630 - 750 [720V]**
	Note: The braking action enables only in run status of the controller.	
F16.06	**Contactor fault detection 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 inspection run. • DI terminal = INS (No. 7 function), only need set F16.07 = 0 to enter terminal inspection run. • DI terminal ≠ INS (No. 7 function), the inspection run can be achieved via the MS1 - MS3. • Value of MS1 - MS3 = F16.07, enter MS inspection run at MS run speed (F05.00 - F05.07). *Note: When MS run speed (F05.00 - F05.07) exceeds 0.630m/s, run at 0.630m/s.*	
F16.08	**Zero-speed threshold**	**0.001 - 0.010 [0.003m/s]**
	When the present run speed ≤ F16.08, the system run speed will be considered as 0. After zero-speed delay signal, the zero-speed signal will output.	
F16.09	**Selection at motor overheat fault**	**0,1 [0]**
	0: When detect that the motor is overheated, alarm E0020 fault (motor overheat) after motor stops. 1: When detect that the motor is overheated, alarm E0020 fault (motor overheat) at once.	
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 the elevator controller to open the brake.	
F16.13	**Emergency run direction auto-determine enable**	**0,1 [0]**
	0: Not enable. 1: Determine the running direction according to the current.	
F16.14	**Running Min. current limit**	**0 - 100 (F07.11) [20%]**
F16.15	**Running Min. detection time**	**0.0 - 5.0 [0.0s]**
	When the elevator run current < F16.14 and duration exceeds F16.05, the controller alarms E0025 fault (too small running current).	
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]**

6.2.16 F17: Fault Protection Parameters

Input and Output Voltage 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 controller rated voltage. When the controller detects certain input voltage < detect base (F17.03) and exceeds the detect time (F17.04), the controller alarms E0015 fault (lack of input). • F17.03 or F17.04 = 0 or in the emergency run, the controller will not detect 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 [4.0s]**
	F17.05 value is a percentage of controller rated current. When the controller detects certain output current < detect base (F17.05) and exceeds the detect time (F17.06), the controller alarms E0016 fault (lack of output). • F17.05 or F17.06 = 0, the controller will not detect 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 the controller drives a motor of the same power class. To protect the motor when the motor power is smaller than the standard matched power, user needs to set proper F17.07. The factor can derive from the following formula: $$\text{F17.07} = \frac{\text{Motor rated current (F07.02)}}{\text{Controller rated output current}} \times 100\%$$	

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

Auto reset function enables HD3N-L to reset the fault as per the reset times and interval.

The following faults do not have the auto reset function:

E0010: Braking unit fault
E0014: Current detection fault
E0021: Read/write fault of control board EEPROM
E0022: Read/write fault of keypad EEPROM
E0024: External equipment fault
E0036: Contator 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/tines]**
	When F17.08 = 0, it means "auto reset" is unused and the protective device will be activated in case of fault. • If no other fault is detected within 5 minutes, the auto reset count will be automatically cleared. • On condition of external fault reset, auto reset count will be cleared.	
F17.10	**Faulty relay action**	**00 - 11 [00]**
	Unit: In auto reset process **Ten: In undervoltage process** • 0: Faulty relay doesn't act • 1: Faulty relay acts. *Note: Relay needs to be set as No. 14 function (controller fault).*	

Fault History (F17.11 - F17.27)

Ref. Code	Function Description	Setting Range [Default]
F17.11	NO.5 fault type	[Actual value]
F17.12	Setting freqency at NO.5 fault	
F17.13	Output frequency 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 the controller 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.	

6.2.17 F18: PWM Control Parameters

Ref. Code	Function Description	Setting Range [Default]
F18.00	Carrier frequency	1 - 16 [8kHz]
	Defines the carrier frequency of PWM output wave. • The carrier frequency will affect the operating noise of the motor. The higher the carrier frequency, the lower the noise made by the motor. Please properly set the carrier frequency. • When the value > the factory setting, the controller should be derated by 5% when per 1kHz is increased compared to the factory setting.	
F18.01	Carrier freqency auto adjust selection	0,1 [0]
	0: Reserved. 1: Enable.	
F18.02	PWM overmodulation enable	0,1 [1]
	0: Disabled. 1: Enable.	
F18.03	PWM overmodulation mode	0,1 [0]
	0: Two phase/three phase swtich. 1: Three phase.	

6.2.18 F19: Advanced Parameters

Ref. Code	Function Description	Setting Range [Default]
F19.09	**Frequency and speed switch selection**	**0,1 [0]**
	0: The given way is speed (m/s). 1: The given way is frequency (Hz).	
F19.10	**Multi-speed frequency 0**	**0.00 - F00.03 [0.00Hz]**
F19.11	**Multi-speed frequency 1**	**0.00 - F00.03 [0.00Hz]**
F19.12	**Multi-speed frequency 2**	**0.00 - F00.03 [0.00Hz]**
F19.13	**Multi-speed frequency 3**	**0.00 - F00.03 [0.00Hz]**
F19.14	**Multi-speed frequency 4**	**0.00 - F00.03 [0.00Hz]**
F19.15	**Multi-speed frequency 5**	**0.00 - F00.03 [0.00Hz]**
F19.16	**Multi-speed frequency 6**	**0.00 - F00.03 [0.00Hz]**
F19.17	**Multi-speed frequency 7**	**0.00 - F00.03 [0.00Hz]**
F19.18	**Inspection run frequency**	**0.00 - 21.00 [6.66Hz]**
F19.19	**Emergency run frequency**	**0.00 - F00.03 [3.33Hz]**
F19.20	**Start run frequency**	**0.00 - 10.00 [0.00Hz]**
F19.44	**SVC5 mode**	**0,1 [1]**
	0: Formal mode. 1: Optimization mode.	
F19.46	**SVC flux cutoff frequency**	**0.30 - 8.00 [0.50Hz]**
F19.47	**SVC speed estimation filter coefficient**	**0 - 2 [0]**
	0: 8. 1: 16. 2: 32.	
F19.48	**SVC speed observation period**	**0,1 [0]**
	0: 1ms. 1: Interrupt.	
F19.49	**SVC Idling current boost**	**0,1 [0]**
	0: Boost. 1: No boost.	
F19.50	**Low-speed variable carrier enable**	**0,1 [1]**
	0: Disenable. 1: Enable.	
F19.51	**Motor overload protection percentage**	**150 - 200 [170%]**
F19.52	**Motor overload protection time**	**0 - 10 [5s]**
	0 - 3: Disenable. 4 - 10: Protection.	
F19.53	**Modify automaticly updated mutual inductance of no-load current**	**0,1 [0]**
	0: Change automatically. 1: No change automatically.	
F19.55	**Enable about the compensation gains of the electric and power generation slip are compensated separately**	**0,1 [0]**
	0: Disenable. 1: Enable.	

Ref. Code	Function Description	Setting Range [Default]
F19.56	Motorized slip compensation gain	200.0 - 20.0 [100.0%]
F19.57	Power generation slip compensation gain	200.0 - 20.0 [100.0%]
F19.63	Start DC current when emergency operation	50 - 100 [70%]
F19.64	Start DC brake time when emergency run	0.0 - 3.0 [0.0s]
F19.65	Stop DC current when emergency run	50 - 100 [70%]
F19.66	Stop DC brake time when emergency run	0.0 - 3.0 [1.5s]
F19.67	Current search and torque limit when emergency run	40.0 - 200.0 [100.0%]
F19.68	Torque boost when emergency run	0.1 - 30.0 [2.0%]
F19.69	Torque boost cut-off point when emergency run	0.1 - 50.0 [40.0%]
F19.70	VF output rated voltage percentage when emergency run	60.0 - 100.0 [100.0%]
F19.88	SVC6 I/F control enable	0,1 [0]
	0: Forbidden. 1: Enable.	
F19.89	SVC6 I/F control frequency cut-off point	2.00 - 10.00 [4.00Hz]
F19.90	Given SVC6 I/F control torque	0 - 200 [100%]
F19.96	SVC6 I/F control transition optimization	0,1 [1]
	0: Normal optimization. 1: Over optimization.	
F19.98	SVC5 startup processing	0,1 [1]
	0: Normal processing. 1: Over processing.	

6.2.19 F20: Function-boost Parameters 2

Ref. Code	Function Description	Setting Range [Default]
F20.00	**Start DC brake current**	**50 - 150 [100%]**
F20.01	**Duration of start DC brake current**	**0.0 - 3.0 [0.0s]**
	When F00.01 ≠ 2 (VC control), F20.00 and F20.01 are valid. When F20.01 = 0, start DC braking function is invalid.	
F20.02	**DI enable function**	**0,1 [0]**
	0: Original plan. • The run contactor can be output only when there is an enable signal. 1: New plan. • When there is a running command signal, open the run contactor. when the run contactor signal is turned on, if the enable signal is detected, it can continue to run. • It is used when the controller controls the run contactor, and uses the run contactor feedback contact as an enable signal.	
F20.03	**Output contactor open time**	**0 - 9 [0s]**
	0: Keep open. 1 - 9: After the directional signal contactor opens for F20.03, the output contactor is closed after the enable signal is still invalid.	
F20.04	**Ground detection before running**	**0,1 [0]**
	0: Detection. 1: No detection.	
F20.05	**Brake open frequency**	**0.00 - 10.00 [0.00Hz]**
F20.06	**Brake open current**	**0 - 150 [0%]**
F20.07	**Restore customized parameters**	**0 - 9 [0]**
F20.13	**Emergency run torque limit**	**70.0 - 200.0 [0.0%]**
F20.14	**Emergency run undervoltage point setting**	**160 - 220 [190V]**
F20.15	**Emergency run parameter**	**000 - 110 [110]**
	Unit: Unused **Ten: Emergency run torque limited (F20.19)** • 0: F20.19 no functional. • 1: F20.19 functional. **Hundred: Emergency run mode determine** • 0: F00.01. • 1: V/f control.	
F20.17	**Search speed of light load current method when emergecy run**	**0.020 - 0.200 [0.150m/s]**
F20.18	**Search time of light-load current method when emergency run**	**0.300 - 3.000 [0.500s]**
F20.19	**Emergency run torque limited**	**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 HD3N-L is shown in Figure 7-1.

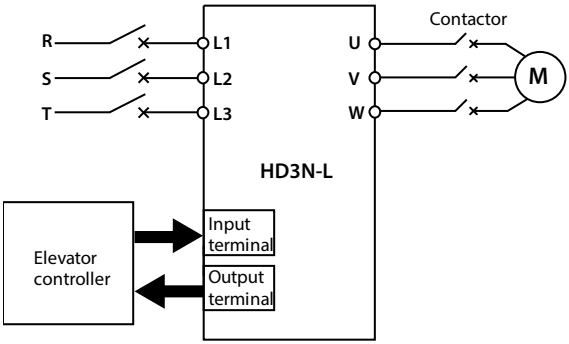


Figure 7-1 Elevator system

7.1 Basic Commissioning Steps

7.1.1 Set Basic Parameters

1.	Correctly set F00.01 (control mode).
2.	Correctly set the motor parameters (group F07).
3.	According to the actual wiring, set the digital input and output function parameters (group F12).
4.	**Terminal MS running mode:** • According to the actual requirement of elevator and the elevator controller, set MS parameters (group F05). • According to the elevator speed, set Acc. and Dec. curve parameters (group F03). **Terminal analogue running mode:** • According to the actual requirement of elevator and the elevator controller, set analogue curve parameters (group F04) and analogue input and output function parameters (group F13). • The bigger Acc. and Dec. curve parameters (group F03) are set, the quicker HD3N-L catch the speed command of elevator controller.

7

7.1.2 Motor Auto-tuning

Note:

The static auto-tuning does not need to lift the car, while the rotational auto-tuning needs to lift the car.

1.	Set F00.05 = 0 (keypad control).
2.	Set F07.06 = 1 (static auto-tuning) or 2 (rotational auto-tuning), press ◇ (standard) or **RUN** (optional) to start auto-tuning. • Among them, static auto-tuning, the motor does not need to rotate. Rotational auto-tuning, the motor needs to rotate.
Note	
1.	*When auto-tuning, it needs open the run contactor.* *If at rotational auto-tuning, it needs open the brake contactor manually too.*

7.1.3 Inspection Running

Before Inspection Running	
1.	Confirm that the motor auto-tuning has been completed.
2.	Set F00.05 = 2 (terminal MS control).
3.	Set F03.06 (inspection Acc. speed) and F03.07 (inspection Dec. speed).
Inspection Running	
1.	Observe the running direction of the motor, and confirm that it is consistent with the required running direction. • If it is inconsistent, set F00.08 (running direction) = 1.
2.	Observe and confirm the motor can run normally.
3.	After confirming that the motor run normal, the brakes, safety circuits and other signals are run normally, then it will do high speed running.

7.1.4 High Speed Running

1.	Give normal floor running commands to make the elevator run normally.
2.	Set run and stop parameters (group F02), adjust brake and motor running time sequence when starting and stopping, make sure that the elevator does not shake at start and stop. • If the elevator has slight shake at running, properly adjust speed-loop parameters (group F08).
3.	Adjust leveling precision. • In terminal MS run mode (F00.05 = 2), the Acc. and Dec. curve (group F03) can be adjusted to make the elevator enter the leveling at the leveling speed. • Adjust F03.13 (stop Dec. jerk) to accurately adjust the leveling accuracy.

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 HD3N-L.

HD3N-L receives the objective speed of MS form and calculate the speed curve according to the S-curve parameter setting, then control the motor to run.

Example

A certain elevator with rated speed of 1.000m/s uses a controller in terminal MS control (F00.05 = 2).

The elevator controller controls the run contactor and HD3N-L controls the brake. Receiving the signal of "running", the brake opens. Receiving the signal of "zero-speed running", the brake closes.

The inspection running is controlled by inspection MS command of elevator controller, and the running speed is obtained by speed combination of MS terminal.

Control Part Connection

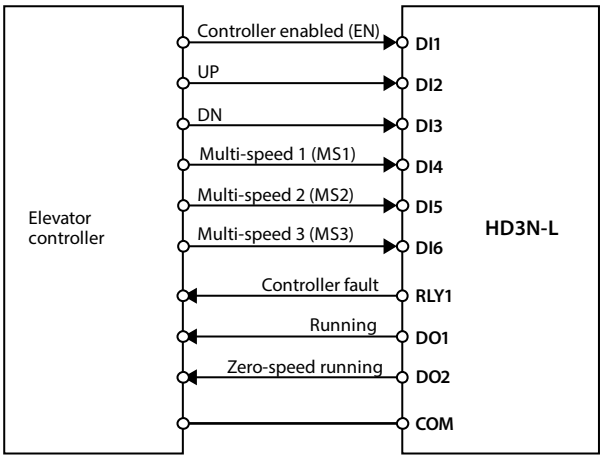


Figure 7-2 Terminal MS running connection

Set Parameters

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

Table 7-1 General parameter

Ref. Code	Function	Value	Remark
F00.01	Control mode	Depend on actual value	
F00.02	Elevator rated speed	Depend on actual value	
F00.03	Controller Max. output frequency	Depend on actual value	
F00.04	Motor mechanical parameter	Depend on actual calculate value	
F07.00	Motor rated power	Depend on actual value	Motor nameplate parameters
F07.01	Motor rated voltage	Depend on actual value	

Ref. Code	Function	Value	Remark
F07.02	Motor rated current	Depend on actual value	
F07.03	Motor rated frequency	Depend on actual value	
F07.04	Motor rated RPM	Depend on actual value	
F08.00/F08.02	Low/high speed ASR KP	500	Adjust according to running effect. Generally use the default value
F08.01/F08.03	Low/high speed ASR KI	500	
F08.04	ASR PI swithcing frequency 1	10.00Hz	
F08.05	ASR PI swithcing frequency 2	15.00Hz	

Table 7-2 Terminal MS run parameter

Ref. Code	Function	Value	Remark
F00.05	Operating mode	2	Terminal MS control
F02.02	Start zero-speed hold time	0.5s	Adjust according to the situation of run contactor and brake at motor start and stop
F02.06	Stop zero-speed hold time	0.5s	
F03.00	Acc. speed	0.700m/s^2	Set according to the elevator speed and running effect
F03.01	Start Acc. jerk	0.350m/s^3	
F03.02	End Acc. jerk	0.600m/s^3	
F03.03	Dec. speed	0.700m/s^2	
F03.04	Start Dec. jerk	0.600m/s^3	
F03.05	End Dec. jerk	0.350m/s^3	
F03.06	Inspection Acc. speed	0.200m/s^2	
F03.07	Inspection Dec. speed	1.000m/s^2	
F03.13	Stop Dec. jerk	0.350 m/s^3	
F05.00	Multi-speed 0	0	As actual value
F05.01	Multi-speed 1	Releveling speed	
F05.02	Multi-speed 2	Creep speed	
F05.03	Multi-speed 3	Emergency stop	
F05.04	Multi-speed 4	Inspection speed	
F05.05	Multi-speed 5	Normal low speed	
F05.06	Multi-speed 6	Normal speed	
F05.07	Multi-speed 7	Normal high speed	
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	Multi-speed 1 (MS1)
F12.05	DI5 function	5	Multi-speed 2 (MS2)
F12.06	DI6 function	6	Multi-speed 3 (MS3)
F12.15	DO1 function	2	Running
F12.16	DO2 function	3	Zero-speed running
F12.17	RLY1 function	14	Controller fault
F16.07	Multi-speed inspection	4	Multi-speed inspection run

7.3 Terminal Analogue Run Application

The elevator controller can calculate the motor present running direction (digital) and objective speed (analogue) according to the elevator control logic and send them to HD3N-L.

HD3N-L control the motor to run according to the controller's command and speed.

Example

A certain elevator with rated speed of 1.750m/s uses a controller in terminal analogue control (F00.05 = 1).

The elevator controller controls the brake and run contactor, sends the direction signal (digital) and running speed (analogue) to HD3N-L.

AI set the speed (analogue).

Control Part Connection

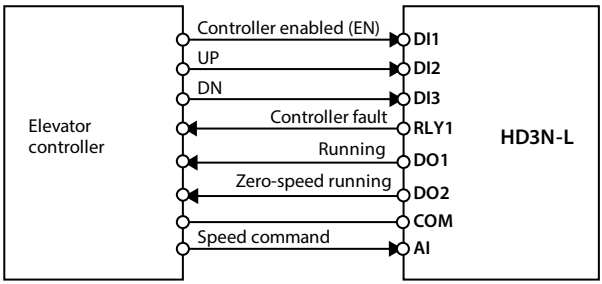


Figure 7-3 Terminal analogue running connection

Set Parameters

Refer to Table 7-1 for the general function. The terminal analogue special function setting content is shown as Table 7-3.

Table 7-3 Terminal analogue run parameter

Ref. Code	Function	Value	Remark
F00.05	Operating mode	1	Terminal analogue control
F02.02	Start zero-speed hold time	0.5s	Adjust according to the situation of run contactor and brake at motor start and stop
F02.06	Stop zero-speed hold time	0.5s	
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 analogue curve characteristics
F04.01	Line 1 Min. setting	0.0%	
F04.02	Corresponding value of line 1 Min. setting	0.0%	

Ref. Code	Function	Value	Remark
F04.03	Line 1 Max. setting	100.0%	
F04.04	Corresponding value of line 1 Max. setting	100.0%	
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	Running
F12.16	DO2 function	3	Zero-speed running
F12.17	RLY1 function	14	Controller fault
F13.00	AI function	1	Speed setting
F13.04/F13.07	AI bias	0.0%	Adjust according to actual situation
F13.05/F13.08	AI gain	1.00	
F13.06/F13.09	AI filter time	0.05s	

7.4 Power-off Emergency Run Application

During using elevator, if the system power is off, passengers will be shut in car.

HD3N-L provide emergency run mode to resolve this problem.

Connection

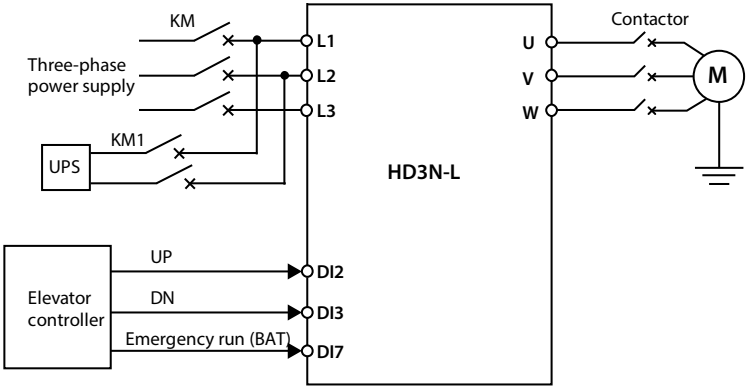


Figure 7-4 Emergency run connection

Running Time Sequence

1.	When mains power fails, the KM opens. Elevator controller outputs emergency run (BAT), and controls KM1 to close.
2.	After some time delay, the elevator controller outputs running command (UP/DN). When HD3N-L receives the command, close the run contactor and open the brake, Acc. at the line rate of F03.08 (emergency Acc. speed) till the speed of F05.09 (emergency run speed).
3.	When the elevator runs near a leveling area, the elevator controller cuts off the emergency run (BAT), HD3N-L begins to Dec. at the line rate of F03.09 (emergency Dec. speed) to stop.
4.	HD3N-L close the brake signal after the speed decelerates to zero. After some time delay, HD3N-L cuts off the run command (UP/DN) and releases the contactor. A complete emergency running process is finished.
Note	
1.	*The emergency voltage should >150VDC to ensure normal running.*
2.	*In emergency running mode, HD3N-L does not detect the Input voltage phase.*

Chapter 8 Troubleshooting and Maintenance

8.1 Troubleshooting

If a fault occurs, the keypad will display the fault alarm status, faulty relay acts, HD3N-L stops output and the motor coasts to stop.

When fault alarm occurs, user should record the fault in detail and take proper action according to the Table 8-1.

If technical help is needed, contact the suppliers or directly call Shenzhen Hpmont Technology Co., Ltd.

Table 8-1 Fault and counter-measures

Fault		Fault reasons	Counter-measures
Lu	DC bus undervoltage	• At the begining of power on and at the end of power off • Input voltage is too low • Improper wiring leads to undervoltage of hardware	• It is normal status of powering on and powering off • Check input power voltage • Check wiring and wire HD3N-L properly
E0001	Controller output Acc. overcurrent	• Improper connection between HD3N-L and motor • Improper motor parameters • The rating of the used HD3N-L is too small • Acc. and Dec. time is too short	• Connect HD3N-L and motor properly • Set correct motor parameters • Select controller with higher rating • Set proper Acc. time and Dec. time
E0002	Controller output Dec. overcurrent		
E0003	Controller output constant speed overcurrent		
E0004	DC bus voltage 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 HD3N-L properly
E0005	DC bus voltage Dec. overvoltage		
E0006	DC bus voltage constant speed overvoltage		
E0009	Heatsink overheat	• Ambient temperature is too high • Poor external ventilation of HD3N-L • Fan fault • Fault occurs to temperature detection circuit	• Use controller with higher power capacity • Improve the ventilation around HD3N-L • Replace the cooling fan • Seek technical support
E0010	Braking unit fault	• Circuit fault of braking unit	• Seek technical support
E0011	CPU fault	• CPU abnormal	• Detect at power on after completely power outage • Seek technical support
E0012	Motor auto-tuning fault	• Motor auto-tuning is timeout	• Check the motor connection • Input correct nameplates parameters • Seek technical support
E0014	Current detection fault	• Current detection circuit is damaged	• Contact the supplier for repairing

Fault		Fault reasons	Counter-measures
E0015	Input voltage phase loss	• For three-phase input HD3N-L, input voltage phase loss fault occurs to power input	• Check the three-phase power input • Seek technical support
E0016	Output voltage phase loss	• Output voltage phase disconnection or loss • Three-phase load of HD3N-L is severely unbalanced	• Check the connection between HD3N-L and motor • Check the quality of motor
E0017	Controller overload	• Acc time is too short • Improper setting of V/f curve or torque boost leads to over current • Mains supply voltage is too low • Motor load is too high	• Adjust Acc time • Adjust V/f curve or torque boost • Check mains supply voltage • Use controller with proper power rating
E0018	Excessive speed deviation	• Brake fault or contactor fault • PG pulse number fault • Improper setting F05.17, F05.18 • Inadequate controller torque • Speed-loop PI parameter setting is incorrect	• Change contactor • Set proper PG P/R • Correct F05.17, F05.18 • Select HD3N-L with biger capacity • Correctly set speed-loop PI parameter
E0019	Motor overload	• Improper setting of V/f curve • Mains supply voltage is too low • Overload protection factor of motor is not set properly • Motor locked-rotor or overload	• Adjust V/f curve • Check the power input • Properly set the overload protection factor of motor • Check the load and mechanical transmission devices
E0020	Motor overheat	• Motor overheat • Motor overheat terminal (DI) connects incorrectly • The setting of motor paramteter is incorrect	• Reduce the load; Increase the Acc/Dec time; Repaire or replace the motor • Detect whether the overheat detection input signal is correct • Set the motor parameter according to the nameplate
E0021	Read/write fault of control board EEPROM	• Memory circuit fault of control board EEPROM	• Contact the supplier for repairing
E0022	Read/write fault of keypad EEPROM	• Memory circuit fault of keypad EEPROM	• Replace the keypad • Contact the supplier for repairing
E0023	Faulty setting of parameters	• The power rating between motor and controller is too different • Improper setting of motor parameters	• Select a controller with suitable power rating • Set correct value of motor parameters
E0024	External equipment fault	• Fault terminal of external equipment operates	• Check external equipment
E0025	Too small running current	• Improper setting of F17.00, F17.01	• Correct the setting of F17.00, F17.01 • Check the connection between HD3N-L and motor • Detect HD3N-L whether output • Detect whether the output contactor work is nomal

Fault		Fault reasons	Counter-measures
E0026	Wrong logic	• Contact the manufacturer	• Contact the manufacturer for repair
E0028	SCI communication timeout	• Connection fault of communication cable • Disconnected or not well connected	• Check the connection
E0029	SCI communication error	• Connection fault of communication cable • Disconnected or not well connected • Communication setting error • Communication data error	• Check the connection • Check the connection • Correctly set the communication format and the baud rate • Send the data according to Modbus protocol
E0036	Contator fault	• Contactor damaged • Feedback contact connection problem	• Change the contactor • Check the connection

Note:

E0022 does not affect normal run of HD3N-L.

8.2 Reset Fault

After the fault is eliminated, reset HD3N-L by any of the following methods:

1. Press ▽ (standard) or **STOP** (optional) to reset.
2. External reset terminal (DI terminal = No. 16 function).
3. Communication fault reset.
4. Switch on HD3N-L after completely power off.

8.3 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 HD3N-L.

- If HD3N-L has been transported for a long distance, check whether the components of HD3N-L are complete and the screws are well tightened.
- Periodically clean the dust inside HD3N-L and check whether the screws are loose.

Danger

- Only a trained and qualified professional person can maintain HD3N-L.
- 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 HD3N-L is powered up or running.
- Checking and maintaining can only be done after AC power of COOL100 is cut off and wait for at least 10 minutes, and the voltage between power terminals (+) and (-) is below 36V.

Warning

- For HD3N-L stored for more than 2 years, please use voltage regulator to increase the input voltage gradually.
- Do not leave metal parts like screws or pads inside the controller.
- Do not make modification on the inside of controller without instruction from the supplier.
- There are IC components inside the controller, which are sensitive to static electricity. Directly touch the components on the PCB board is forbidden.

Daily Maintenance

HD3N-L must be operated in specified environment (refer to section3.2, on page9).

Therefore maintain it according to table below. To prolong the lifetime of HD3N-L, keep good running environment, record the daily run data and detect any abnormal behavior.

Table 8-2 Daily maintenance

Items	Content	Criteria
Running environment	Temperature and humidity	-10 - +40℃, derating at 40 - 50℃ Less than 95%RH, non-condensing
	Dust and water dripping	No conductive dust accumulating, no water dripping
	Gas	No strange smell
HD3N-L	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 HD3N-L every 3 to 6 months according to the actual environment so as to avoid hidden problems and make sure the controller runs well for a long time.

General Inspection:

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

Note:

1. Dielectric strength test of HD3N-L has already been conducted in the factory. Do not do the test again. Otherwise, HD3N-L might be damaged.

2. If insulation test to the motor is necessary, it should be done after input terminals U/V/W of motor have been detached from HD3N-L. Otherwise, HD3N-L will be damaged.

3. For controllers that have been stored for a long time, they must be powered up every 2 years. When supplying AC power to the controller, use a voltage regulator to gradually raise the input voltage to rated input voltage at least 5 hours.

Replacing Damaged Parts

The components that are easily damaged are: Cooling fan and electrolytic capacitors of filters.

Their lifetime depends largely on their application environment and preservation. Users can decide the time when the components should be replaced according to their service time.

Easily damaged	Cooling fan	Electrolytic capacitors
Life	60,000 hours	50,000 hours
Possible cause of damages	Wear of the bearing, aging of the fan vanes	High ambient temperature, aging of electrolyte and large pulse current induced by rapid changing loads
Criteria	After the controller is switched off, check if the abnormal conditions such as crack existing on fan vanes and other parts. When the controller is switched on, check if controller running is normal, and check if there is any abnormal oscillation	Check if frequent over-current or overvoltage failures occur during controller start-up with load. Check if there is any leakage of liquids. Check if the safety valve protrudes. Measure the static capacitance and insulation resistance

Unwanted Controller Recycling

When disposing HD3N-L, pay attention to the following factors:

- The capacitors may explode if they are burnt.
- Plastic will produce toxic gases when burned.
- Disposing method: Dispose unwanted controllers as industrial waste.

Appendix A Parameters

Attributes are changed:

X: It denotes that the setting of this parameter cannot be modified when the controller is in run status.

O: It denotes that the setting of this parameter can be modified when the controller is in run status.

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

Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
D00: Status Display Parameter (on pages 24 - 25)						
D00.00	Controller series	3N-L	Actual		*	
D00.01	DSP software version	0.00 - 9.99	Actual		*	
D00.02	DSP non-standard software version	0.00 - 9.99	Actual		*	
D00.03	Keypad Software version	0.00 - 9.99	Actual		*	
D00.04	Elevator running status	*The standard LCD display is hexadecimal number, and the optional LCD display is a 16-bit binary number* Bit0: Controller enable Bit1: Inspection run Bit2: Multi-speed run Bit3: Analogue run Bit8: Brake feedback input Bit9: Contactor feedback input Bit12: Multi-speed terminal 1 Bit13: Multi-speed terminal 2 Bit14: Multi-speed terminal 3 Bit15: Emergency run	Actual		*	
D00.05	Controller rated current	0.1 - 999.9A	Actual			
D00.07	Controller status	*The standard LCD display is hexadecimal number, and the optional LCD display is a 16-bit binary number* Bit0: Controller fault Bit1: Run/stop Bit2: UP Bit3: DN Bit5&Bit4: Acc./Dec./constant Bit6: Zero-speed signal Bit7: Zero-speed running Bit8: Auto-tuning Bit9: Speed reached Bit10: Ready to run Bit11: Brake output Bit12: Contactor output	Actual		*	

A

Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
D01: Drive Status Parameters (on pages 25 - 25)						
D01.00	Control mode	0 - 5	Actual		*	
D01.01	Setting speed	0.000 - 9.999m/s	Actual		*	
D01.02	Setting speed (after Acc. and Dec.)	0.000 - 9.999m/s	Actual		*	
D01.03	Feedback speed	0.000 - 9.999m/s	Actual		*	
D01.04	Setting frequency	0.01 - 100.00Hz	Actual		*	
D01.05	Setting frequency (after Acc. and Dec.)	0.01 - 100.00Hz	Actual		*	
D01.06	Output frequency	0.01 - 100.00Hz	Actual		*	
D01.07	Setting RPM	0 - 60000rpm	Actual		*	
D01.08	Running RPM	0 - 60000rpm	Actual		*	
D01.10	Output voltage	0 - 999V	Actual		*	
D01.11	Output current	0.1 - 999.9A	Actual		*	
D01.14	DC bus voltage	0 - 999V	Actual		*	
D02: Analogue Status Display Parameters (on pages 26 - 26)						
D02.00	AI voltage	0.00 - 10.00V	Actual		*	
D02.01	AI voltage (after calculating)	0.00 - 10.00V	Actual		*	
D02.08	AO output	0.00 - 10.00V	Actual		*	
D03: Running Status Parameters (on pages 26 - 27)						
D03.01	Input terminal status	*The standard LCD display is hexadecimal number, and the optional LCD display is a 16-bit binary number* Bit0 - Bit7: DI1 - DI8	Actual		*	
D03.02	Output terminal status	*The standard LCD display is hexadecimal number, and the optional LCD display is a 16-bit binary number* Bit0 - Bit1: DO1, DO2 Bit2 - Bit3: RLY1, RLY2	Actual		*	
D03.03	Modbus status	0: Normal 1: Communication timeout 2: Incorrect data frame head 3: Incorrect data frame checking 4: Incorrect data frame content	Actual		*	
D03.04	Total time at power-on (h)	0 - 65535h	Actual		*	
D03.05	Total running time (h)	0 - 65535h	Actual		*	
D03.06	Running times	0 - 65535h	Actual		*	
D03.07	Present fault	0 - 65535	Actual		*	

Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
F00: Basic Parameters (on pages 27 - 28)						
F00.00	Motor type	0: Asynchronous motor	0	1	×	
F00.01	Control mode	0: V/f control 1: SVC1 control 2 - 4: Unused 5: SVC5 control 6: SVC6 control	1	1	×	
F00.02	Elevator rated speed	0.100 - 4.000m/s	1.500m/s	0.001m/s	×	
F00.03	Controller Max. output frequency	5.00 - 100.00Hz	50.00Hz	1.00Hz	×	
F00.04	Motor mechanical parameter	10.0 - 6000.0	60.0	0.1	×	
F00.05	Operating mode	0: Keypad control 1: Terminal analogue control 2: Terminal MS control 3 - 5: Unused	0	1	×	
F00.07	Speed setting of keypad	0.000m/s - F00.02	1.500m/s	0.001m/s	○	
F00.08	Run direction	0: The same as run command 1: Opposite to run command	0	1	×	
F01: Protection of Parameters (on pages 28 - 29)						
F01.00	User's password	0 - 65535	0	1	○	
F01.01	Menu mode	0: Full menu mode 1: Checking menu mode	0	1	○	
F01.02	Function parameter initialization	0: No operation 1: Restore to factory settings 2: Download the keypad EEPROM parameter to the current function code settings 3: Clear fault information	0	1	×	
F01.04	Keypad EEPROM parameter initialization	0: No operation 1: Upload the current function code settings to the keypad EEPROM parameter	0	1	○	
F02: Start and Stop Parameters (on pages 29 - 30)						
F02.00	Start delay time	0.000 - 4.999s	0.000s	0.001s	×	
F02.01	Brake open delay time	0.000 - 4.999s	0.500s	0.001s	×	
F02.02	Start zero-speed hold time	0.000 - 4.999s	0.000s	0.001s	×	
F02.03	Start speed	0.000 - 4.000m/s	0.030m/s	0.001m/s	×	
F02.04	Start speed hold time	0.000 - 4.999s	0.300s	0.001s	×	
F02.05	Brake close delay time	0.000 - 1.999s	0.300s	0.001s	×	
F02.06	Stop zero-speed hold time	0.000 - 4.999s	0.300s	0.001s	×	
F02.07	Run contactor close delay time	0.000 - 4.999s	0.000s	0.001s	×	
F02.08	Starting ramp time	0.001 - 2.000s	0.500s	0.001s	×	

A

Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
F03: Acc. and Dec. Parameter (on pages 30 - 31)						
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 run Acc. speed	0.020 - 9.999m/s^2	0.200m/s^2	0.001m/s^2	×	
F03.09	Emergency run Dec. speed	0.020 - 9.999m/s^2	0.200m/s^2	0.001m/s^2	×	
F03.10	Motor auto-tuning Acc. speed	0.020 - 9.999m/s^2	0.100m/s^2	0.001m/s^2	×	
F03.11	Motor auto-tuning Dec. speed	0.020 - 9.999m/s^2	0.100m/s^2	0.001m/s^2	×	
F03.12	Stop Dec. jerk	0.020 - 9.999m/s^2	0.350m/s^2	0.001m/s^2	×	
F04: Analogue Curve Parameters (on pages 31 - 31)						
F04.00	Setting curve	0: Line 1 1: Line 2	0	1	×	
F04.01	Line 1 Min. setting	0.0% - F04.03	0.0%	0.1%	○	
F04.02	Corresponding value of line 1 Min. setting	0.0 - 100.0%	0.0%	0.1%	○	
F04.03	Line 1 Max. setting	F04.01 - 100.0%	100.0%	0.1%	○	
F04.04	Corresponding value of line 1 Max. setting	0.0 - 100.0%	100.0%	0.1%	○	
F04.05	Line 2 Min. setting	0.0% - F04.07	0.0%	0.1%	○	
F04.06	Corresponding value of line 2 Min. setting	0.0 - 100.0%	0.0%	0.1%	○	
F04.07	Line 2 Max. setting	F04.05 - 100.0%	100.0%	0.1%	○	
F04.08	Corresponding value of line 2 Max. setting	0.0 - 100.0%	100.0%	0.1%	○	
F05: Speed Parameters (on pages 31 - 32)						
F05.00	Multi-speed 0	0.000m/s - F00.02 (elevator rated speed)	0.000m/s	0.001m/s	○	
F05.01	Multi-speed 1					
F05.02	Multi-speed 2					
F05.03	Multi-speed 3					
F05.04	Multi-speed 4					
F05.05	Multi-speed 5					
F05.06	Multi-speed 6					
F05.07	Multi-speed 7					
F05.08	Inspection run speed	0.000 - 0.630m/s	0.200m/s	0.001m/s	○	
F05.09	Emergency run speed	0.000m/s - F00.02	0.100m/s	0.001m/s	○	
F05.12	FDT1	0.0 - 100.0% (F00.02)	90.0%	0.1%	○	

Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
F05.13	FDT2	0.0 - 100.0% (F00.02)	90.0%	0.1%	○	
F05.14	FDT1 delay level	0.0 - 100.0% (F00.02)	1.0%	0.1%	○	
F05.15	FDT2 delay level	0.0 - 100.0% (F00.02)	1.0%	0.1%	○	
F05.16	Speed within FAR range	0.0 - 20.0% (F00.02)	1.0%	0.1%	○	
F05.17	Over-speed setting	80.0 - 120.0% (F00.02)	115.0%	0.1%	○	
F05.18	Over-speed detection time	0.0 - 2.0s	0.2s	0.1s	○	
F05.19	Detection value of speed deviation	0.0 - 30.0% (F00.02) *0.0: Not detect*	20.0%	0.1%	×	
F05.20	Detection time of speed deviation	0.0 - 2.0s *0.0: Not detect*	1.0s	0.1s	×	
F06: Optimize parameters (on pages 32)						
F06.19	Brake premature close run time	0.000 - 1.999s	0.000s	0.001s	×	
F07: Motor parameters (on pages 33 - 35)						
F07.00	Motor rated power	0.2 - 500.0kW	Depend on HD3N-L	0.1kW	×	
F07.01	Motor rated voltage	0V - controller rated voltage	Depend on HD3N-L	1V	×	
F07.02	Motor rated current	0.0 - 999.9A		0.1A	×	
F07.03	Motor rated frequency	1.00 - 100.00Hz	50.00Hz	0.01Hz	×	
F07.04	Motor rated RPM	1 - 24000rpm	1440rpm	1rpm	×	
F07.05	Motor power facto	0.001 - 1.000	Depend on HD3N-L	0.001	×	
F07.06	Motor parameter auto-tuning	0: No action 1: Static auto-tuning 2: Rotational auto-tuning	0	1	×	
F07.07	Motor stator resistance	0.000 - 65.535Ω	Depend on HD3N-L	0.001Ω	×	
F07.08	Motor rotor resistance	0.000 - 65.535Ω		0.001Ω	×	
F07.09	Motor leakage inductance	0.0 - 6553.5mH		0.1mH	×	
F07.10	Motor mutual inductance	0.0 - 6553.5mH		0.1mH	×	
F07.11	Motor Idling excitation current	0.0 - 999.9A		0.1A	×	
F07.12	Motor core saturation coefficient 1	0.00 - 0.50	0.50	0.01	×	
F07.13	Motor core saturation coefficient 2	0.00 - 0.75	0.75	0.01	×	
F07.14	Motor core saturation coefficient 3	0.00 - 1.20	1.20	0.01	×	
F07.15	Motor torque boost	0.1 - 30.0%	0.1%	0.1%	○	
F07.16	Motor manual torque boost end-point	0.1 - 50.0% (F07.03)	2.0%	0.1%	○	
F07.17	Motor slip compensation gain	0.0 - 300.0%	100.0%	0.1%	○	

A

Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
F07.18	Motor slip compensation filter time	0.1 - 10.0s	0.1s	0.1s	○	
F07.19	Motor slip compensation limitation	0.0 - 250.0%	200.0%	0.1%	×	
F07.20	AVR function	0: No action 1: Enabled all the time 2: Disabled in Dec. process	1	1	○	
F07.21	Motor oscillation-suppression mode	0: Depend on exciting component 1: Depend on torque component	0	1	○	
F07.22	Motor oscillation-suppression coefficient	0 - 200	100	1	○	
F08: Motor Vector Control Speed-loop Parameters (on pages 35 - 36)						
F08.00	Low speed ASR KP	1 - 9999	500	1	○	
F08.01	Low speed ASR KI	0 - 9999	500	1	○	
F08.02	High speed ASR KP	1 - 9999	500	1	○	
F08.03	High speed ASR KI	0 - 9999	500	1	○	
F08.04	ASR PI swithcing frequency 1	0.00 - 50.00Hz	10.00Hz	0.01Hz	○	
F08.05	ASR PI swithcing frequency 2	0.00 - 50.00Hz	15.00Hz	0.01Hz	○	
F08.06	ASR integral limitation	0.0 - 200.0% (F07.02)	180.0%	0.1%	○	
F08.07	ASR differential time	0.000 - 1.000s *0.000: No differential*	0.000s	0.001s	○	
F08.08	ASR output filter time	0.000 - 1.000s *0.000: Filter is unused*	0.008s	0.001s	○	
F08.09	Torque limit	0.0 - 200.0% (F07.02)	180.0%	0.1%	×	
F09: Current-loop Parameters (on pages 36 - 36)						
F09.00	ACR KP	1 - 4000	500	1	×	
F09.01	ACR KI	1 - 4000	500	1	×	
F09.04	ACR execution frequency	2 - 6k	4k	1k	×	
F12: Digital I/O Terminal Parameters (on pages 36 - 40)						
F12.00	Input terminal filter time	0.000 - 1.000s	0.010s	0.001s	×	
F12.01	DI1 function	*Hundred digit = 0, normally open (NO) input; = 1, normally closed (NC) input* 0: Unused 1: Controller enabled (EN) 2: UP 3: DN 4: Multi-speed 1 (MS1) 5: Multi-speed 2 (MS2) 6: Multi-speed 3 (MS3) 7: Inspection input (INS) 8: Emergency run input (BAT)	1	1	×	
F12.02	DI2 function		2	1	×	
F12.03	DI3 function		3	1	×	
F12.04	DI4 function		4	1	×	
F12.05	DI5 function		5	1	×	

Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
F12.06	DI6 function	9: Run contactor feedback input (CSM) 10: Brake feedback input (BSM) 11 - 14: Unused 15: Motor overheat input (OH) 16: Fault reset input (RST) 17 - 33: Unused 34: External fault (EXT)	6	1	×	
F12.07	DI7 function		0	1	×	
F12.08	DI8 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: Running (RUN) 3: Zero-speed running 4: Zero-speed 5: Run contactor output control 6: Brake output control 7: FDT1 8: FDT2 9: Speed within signal (FAR) 10: Up signal output 11: Down signal output 12: Under-voltage 13: Unused 14: Controller fault 15 - 19: Unused	2	1	×	
F12.16	DO2 function		3	1	×	
F12.17	RLY1 function		14	1	×	
F12.18	RLY2 function		0	1	×	
F12.21	Output terminal logic setting	Bit0 - Bit1: DO1 - DO2 logic setting Bit2 - Bit3: RLY1 - RLY2 logic setting 0: Positive logic 1: Negative logic	0	1	○	
F13: Analogue I/O Terminal Parameters (on pages 39 - 40)						
F13.00	AI function	0: Unused 1: Speed setting	0	1	×	
F13.04	AI bias	-100.0 - 100.0%	0.0%	0.1%	○	
F13.05	AI gain	-10.00 - 10.00	1.00	0.01	○	
F13.06	AI filter time	0.01 - 10.00s	0.05s	0.01s	○	

A

Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
F13.16	AO function	0: Unused 1: Running speed (0 - Max. output speed) 2: Setting speed (0 - Max. output speed) 3: Output current (0 - twice rated current of HD3N-L) 4: Output voltage (0 - 1.2 times rated voltage of HD3N-L) 5: Bus voltage (0 - 2.2 times rated voltage of HD3N-L) 6: AI input (0 - 10V)	0		○	
F13.18	AO bias	-100.0 - 100.0%	0.0%	0.1%	○	
F13.19	AO gain	0.0 - 200.0%	100.0%	0.1%	○	
F14: SCI Communication Parameter (on pages 40 - 41)						
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*	0.0s	0.1s	×	
F14.05	Detection time of communication error	0.0 - 1000.0s *0.0: Not detect*	0.0s	0.1s	×	
F15: Display Control Parameter (on pages 41 - 42)						
F15.00	Language selection	0: Chinese 1: English 2 - 9: Unused	0	1	○	
F15.01	Display contrast of the LCD keypad	1 - 10	6	1	○	

Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
F15.02	Set run status parameter 1	0 - 3: Unused 4: Setting speed 5: Setting speed (after Acc. and Dec.) 6: Output frequency 7: Setting RPM 8: Running RPM 9: Unused 10: Output voltage 11: Output current 12 - 13: Unused 14: DC bus voltage 15: AI voltage 16: AI voltage (after calculating) 17 - 22: Unused 23: AO output 24 - 25: Unused 26: Input terminal status 27: Output terminal status 28 - 30: Unused	5	1	○	
F15.03	Set run status parameter 2		6	1	○	
F15.04	Set run status parameter 3		10	1	○	
F15.05	Set run status parameter 4		11	1	○	
F15.06	Set run status parameter 5		0	1	○	
F15.07	Set run status parameter 6		0	1	○	
F15.08	Set stop status parameter 1		4	1	○	
F15.09	Set stop status parameter 2		14	1	○	
F15.10	Set stop status parameter 3		16	1	○	
F15.11	Set stop status parameter 4		26	1	○	
F15.12	Set stop status parameter 5		27	1	○	
F15.13	Set stop status parameter 6		0	1	○	
F16: Function-boost Parameters (on pages 42 - 43)						
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	0ms	1ms	×	
F16.03	Fan control	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	630 - 750V	720V	1V	×	
F16.06	Contactor fault detection 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: Alarm fault after motor stops 1: Alarm fault at once	0	1	○	
F16.12	Delay time of run output signal	0.00 - 1.00s	0.00s	0.01s	×	
F16.13	Emergency run direction auto-determine enable	0: Not enable 1: Determine the running direction according to the current	0	1	×	
F16.14	Running Min. current limit	0 - 100% (F07.11)	20%	1%	×	

A

Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
F16.15	Running Min. detection time	0.0 - 5.0s	0.0s	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	×	
F18: PWM Control Parameter (on pages 43 - 44)						
F17.03	The detection base of lack of input	0 - 100% (controller rated voltage) *0: Not detect*	30%	1%	×	
F17.04	The detection time of lack of input	0.0 - 5.0s *0.0: Not detect*	1.0s	0.1s	×	
F17.05	The detection base of lack of output	0 - 100% (controller rated current) *0: Not detect*	20%	1%	×	
F17.06	The detection time of lack of output	0.0 - 20.0s *0.0: Not detect*	4.0s	0.1s	×	
F17.07	Motor overload protect factor	20.0 - 110.0%	100.0%	0.1%	×	
F17.08	Fault auto reset times	0 - 100 *0: No auto-reset function*	0	1	×	
F17.09	Fault auto reset interval	2.0 - 20.0s/times	5.0s/times	0.1s/times	×	
F17.10	Faulty relay action	Unit: In auto reset process Ten: In undervoltage process 0: Faulty relay doesn't act 1: Faulty relay acts	00	1	○	
F17.11	NO.5 fault type	Lu: DC bus undervoltage E0001: Controller output Acc. overcurrent E0002: Controller output Dec. overcurrent E0003: Controller output constant speed overcurrent E0004: DC bus voltage Acc. overvoltage E0005: DC bus voltage Dec. overvoltage E0006: DC bus voltage constant speed overvoltage E0009: Heatsink overheat E0010: Braking unit fault E0011: CPU fault E0012: Motor auto-tuning fault E0014: Current detection fault E0015: Input voltage phase loss	0	1	*	

Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
F17.11	NO.5 fault type	E0016: Output voltage phase loss E0017: Controller overload E0018: Excessive speed deviation E0019: Motor overload E0020: Motor overheat E0021: Read/write fault of control board EEPROM E0022: Read/write fault of keypad EEPROM E0023: Faulty setting of parameters E0024: External equipment fault E0025: Too small running current E0026: Wrong logic E0028: SCI communication timeout E0029: SCI communication error E0036: Contator fault *E0010, E0014, E0021, E0022, E0024, E0036 can't auto reset*	0	1	*	
F17.12	Setting freqency at NO.5 fault	0.00 - 100.00Hz	0.00Hz	0.01Hz	*	
F17.13	Output frequency 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 - 0xFF	0	1	*	
F17.18	Output terminal status at NO.5 fault	0 - 0xF	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	*	

A

Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
F18: PWM Control Parameter (on pages 44 - 45)						
F18.00	Carrier frequency	1 - 16kHz	8kHz	1kHz	×	
F18.01	Carrier freqency auto adjust selection	0: Reserved 1: Enable	0	1	×	
F18.02	PWM overmodulation enable	0: Disabled 1: Enable	1	1	×	
F18.03	PWM overmodulation mode	0: Two phase/three phase swtich 1: Three phase	0	1	×	
F19: Advanced parameters (on pages 45 - 47)						
F19.09	Frequency and speed switch selection	0: The given way is speed (m/s) 1: The given way is frequency (Hz)	0	1	×	
F19.10	Multi-speed frequency 0	0.00Hz - F00.03	0.00Hz	0.01Hz	×	
F19.11	Multi-speed frequency 1	0.00Hz - F00.03	0.00Hz	0.01Hz	×	
F19.12	Multi-speed frequency 2	0.00Hz - F00.03	0.00Hz	0.01Hz	×	
F19.13	Multi-speed frequency 3	0.00Hz - F00.03	0.00Hz	0.01Hz	×	
F19.14	Multi-speed frequency 4	0.00Hz - F00.03	0.00Hz	0.01Hz	×	
F19.15	Multi-speed frequency 5	0.00Hz - F00.03	0.00Hz	0.01Hz	×	
F19.16	Multi-speed frequency 6	0.00Hz - F00.03	0.00Hz	0.01Hz	×	
F19.17	Multi-speed frequency 7	0.00Hz - F00.03	0.00Hz	0.01Hz	×	
F19.18	Inspection run frequency	0.00 - 21.00Hz	6.66Hz	0.01Hz	×	
F19.19	Emergency run frequency	0.00Hz - F00.03	3.33Hz	0.01Hz	×	
F19.20	Start run frequency	0.00 - 10.00Hz	0.00Hz	0.01Hz	×	
F19.44	SVC5 mode	0: Formal mode 1: Optimization mode	0	1	×	
F19.46	SVC flux cutoff frequency	0.30 - 8.00Hz	0.50Hz	0.01Hz	×	
F19.47	SVC speed estimation filter coefficient	0: 8 1: 16 2: 32	0	1	×	
F19.48	SVC speed observation period	0: 1ms 1: Interrupt	0	1	×	
F19.49	SVC Idling current boost	0: Boost 1: No boost	0	1	×	
F19.50	Low-speed variable carrier enable	0: Disenable 1: Enable	1	1	×	
F19.51	Motor overload protection percentage	150 - 200%	170%	1%	×	
F19.52	Motor overload protection time	0 - 10s *0 - 3s: Disenable*	5s	1s	×	

Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
F19.53	Modify automaticly updated mutual inductance of no-load current	0: Change automatically 1: No change automatically	0	1	×	
F19.55	Enable about the compensation gains of the electric and power generation slip are compensated separately	0: Disenable 1: Enable	0	1	×	
F19.56	Motorized slip compensation gain	200.0 - 20.0%	100.0%	0.1%	×	
F19.57	Power generation slip compensation gain	200.0 - 20.0%	100.0%	0.1%	×	
F19.63	Start DC current when emergency operation	50 - 100%	70%	1%	×	
F19.64	Start DC brake time when emergency run	0.0 - 3.0s	0.0s	0.1s	×	
F19.65	Stop DC current when emergency run	50 - 100%	70%	1%	×	
F19.66	Stop DC brake time when emergency run	0.0 - 3.0s	1.5s	0.1s	×	
F19.67	Current search and torque limit when emergency run	40.0 - 200.0%	100.0%	0.1%	×	
F19.68	Torque boost when emergency run	0.1 - 30.0%	2.0%	0.1%	×	
F19.69	Torque boost cut-off point when emergency run	0.1 - 50.0%	40.0%	0.1%	×	
F19.70	VF output rated voltage percentage when emergency run	60.0 - 100.0%	100.0%	0.1%	×	
F19.88	SVC6 I/F control enable	0: Forbidden 1: Enable	0	1	×	
F19.89	SVC6 I/F control frequency cut-off point	2.00 - 10.00Hz	4.00Hz	0.01Hz	×	
F19.90	Given SVC6 I/F control torque	0 - 200%	100%	1%	×	
F19.96	SVC6 I/F control transition optimization	0: Normal optimization 1: Over optimization	0	1	×	
F19.98	SVC5 startup processing	0: Normal processing 1: Over processing	0	1	×	

Ref. Code	Function	Setting Range	Default	Unit	Attribute	Setting
F20: Function-boost Parameters 2 (on pages 47 - 47						
F20.00	Start DC brake current	50 - 150%	100%	1%	×	
F20.01	Duration of start DC brake current	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 open time	0 - 9s	0s	1s	×	
F20.04	Ground detection before running	0: Detection 1: No detection	0	1	×	
F20.05	Brake open frequency	0.00 - 10.00Hz	0.00Hz	0.01Hz	×	
F20.06	Brake open current	0 - 150%	0%	1%	×	
F20.07	Restore customized parameters	0 - 9	0	1	×	
F20.13	Emergency run torque limit	70.0 - 200.0%	0.0%	0.1%	×	
F20.14	Emergency run undervoltage point setting	160 - 220V	190V	1V	×	
F20.15	Emergency run parameter	Unit: Unused Ten: Emergency run torque limited (F20.19) 0: F20.19 no functional 1: F20.19 functional Hundred: Emergency run mode determine 0: F00.01 1: V/f control	110	1	×	
F20.17	Search speed of light load current method when emergecy run	0.020 - 0.200m/s	0.150m/s	0.001m/s	×	
F20.18	Search time of light-load current method when emergency run	0.300 - 3.000s	0.500s	0.001s	×	
F20.19	Emergency run torque limited	70.0 - 200.0%	100.0%	0.1%	×	

Appendix B Communication Protocol

1. Introduction

HD3N-L 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 parameters, read the status parameters and write the control command etc.

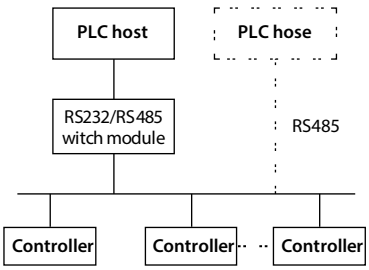
The controller is in slave mode when it is communicating.

Communication Terminal

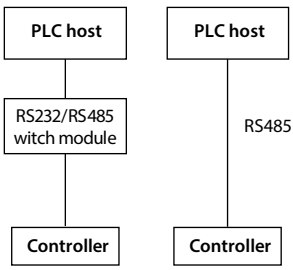
For the communication terminals, see section 4.5, page 16. The transmitting mode is shown in the table below.

Port	Asynchronous, half duplex
Format	1-8-2 (11 start bit, 8 data bits, 2 stop bits), no check, RTU
Baut Rate	9600bps
Relative Setting	F14: SCI Communication Parameter

Network Mode



Single host, multi sub-machine



Single host, single sub-machine

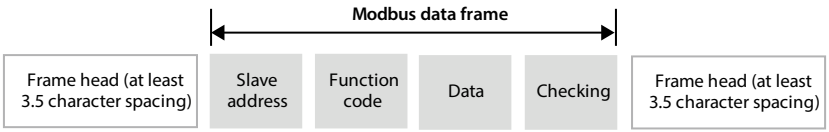
B

Protocol Format

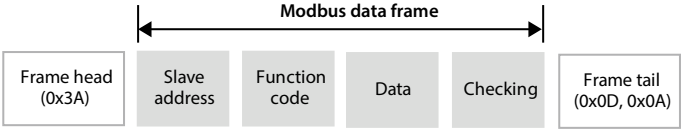
Modbus protocol supports both RTU and ASCII mode, the corresponding frame format is as follows:

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

RTU model



ASCII model



RTU model:

- 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, referred to the page 84.

For example: To read the slave internal register F00.04 = 50.00Hz of No.1 address:

Command Frame	**Address**	**Parameter**	**Register Address**		**Read Char No.**		**Checksum**	
	0x01	0x03	0x00	0x04	0x00	0x01	0xC5	0xCB
Response Frame	**Address**	**Parameter**	**Response Byte**		**Content of Register**		**Checksum**	
	0x01	0x03	0x02		0x5	0xDC	0xB8	0x5A

ASCII model:

- 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 40 (0x0FA0) to the internal register F00.04 of slave 1.

LRC checking = the complement code of (0x01 + 0x41 + 0x00 + 0x04 + 0x00 + 0x28) = 0x92

	Frame Head	**Address**		**Code**		**Register Address**				**Written Content**				**LRC Checking**		**Frame Tail**	
Character	:	0	1	4	1	0	0	0	4	0	0	2	8	00	92	CR	LF
ASCII	3A	30	31	34	31	30	30	30	34	30	30	32	38	39	32	0D	0A

2. Scaling of Drive Transmitting Values

Except the parameters of the remarks, all other function parameters can define the scaling relationship of the function parameters via referring the manual's Min. unit.

3. Protocol Function

Supported Function

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

To Read Function and Status Parameters

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	

Command Frame	Address	Code	Read Byte No.	Register Content	CRC/LRC Checking
Data frame bytes	1	1	1	2 * no. of registers	2/1
Value or range	1 - 247	0x03	2 * no. of registers		

To Rewrite Single Function or Control Parameter

Function code 0x06 (not save at power off) or 0x41 (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	

Command 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 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.

The register address is mapped to the function and control parameters of controller, etc, the controller will start to save from low address to high address of the register when it continuously saves many register parameters.

The saving will return from the firstly failed address if the saving process isn't completely successful.

Fault and Exception Code

If the operation command fails, the response is fault code, and is the function code + 0x80.

Below is the instruction for the exception codes.

Exception Code	Instructions
0x01	Illegal function parameters.
0x02	Illegal register address.
0x03	Data fault. Data is exceeded the upper/lower limit.
0x04	Slave operation fails (including fault caused by data invalid).
0x16	Unsupported operation (unsupported to read the attributes, factory default and upper/lower limit for the control parameter and status parameter).
0x17	The register number of command frame is fault.
0x18	Incorrect information frame, including incorrect information length and incorrect checking.
0x20	Parameters cannot be modified.
0x21	Parameters are unchangeable when the controller is in running status.
0x22	Parameters are protected by password.

4. Address Mapping

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

Function Code Address Mapping

The group numbers of function parameters are mapped as higher bytes of register address, the relationships are shown as below table.

The intergroup indexes are mapped as lower bytes, and the index of 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	0x10	F16
0x01	F01	0x08	F08	0x11	F17
0x02	F02	0x09	F09	0x12	F18
0x03	F03	0x0c	F12	0x13	F19
0x04	F04	0x0d	F13	0x14	F20
0x05	F05	0x0e	F14		
0x06	F06	0x0f	F15		

Control Parameter (0x32) Address Mapping

The group number (0x32) of control parameter is mapped to the high byte of the register address, and the intergroup indexes are shown as below table.

Address	Function	Save at Power Failure or Not
0x3200	Control command word	No
0x3201	Master setting	No

Control Command Word (0x3200)

The control command word (0x3200) are defined in the table below.

Note:

The controller command must be valid when the SCI speed is given (F00.05 = 4).

Control (Bit)	Meaning		Description
Bit0	1	Run command is valid	Associated with the controller enable bit for one run. So the controller close the run contactor, open the brake and starts running. It should be invalid after stopping.
	0	Run command is invalid	The controller stops outputting and issues a signal to release the brake.
Bit1	1	DN	Elevator running direction, equivalent to terminal UP or DN effective.
	0	UP	
Bit2	1	No emergency stop	The controller can run normally.
	0	Emergency stop	The controller requires the elevator controller to emergency stop.

B

Control (Bit)	Meaning		Description
Bit3	1	SCI control is valid	After the terminal EN is valid, the controller can run normally.
	0	SCI control is invalid	The controller stops outputting and issues a signal to release the brake.
Bit4	1	There is a new running speed	The running speed should be changed, and the new running speed is determined by the main setting.
	0	No new running speed	Continue to run at the currently set speed.
Bit5	0	Unused	
Bit6	1	Reset is valid	Reset the fault of the controller.
	0	Reset is invalid	
Bit7	1	Unused	
	0	This frame is mainly set as speed command	The main setting of this frame is speed command.
Bit8 - Bit11	0	Unused	
Bit12	1	Inspection run is valid	Inspection run mode, equivalent to terminal INS is valid.
	0	Inspection run is invalid	
Bit13	1	Emergency run is valid	Emergency run mode, equivalent to terminal BAT is valid.
	0	Emergency run is invalid	
Bit14 - Bit15	0	Unused	

Master Setting (0x3201)

The master settings (0x3201) are defined in the table below.

Control (Bit7)	Operation Setting Data Value	Description
0	0	Speed corresponds to F05.00
	1	Speed corresponds to F05.01
	2	Speed corresponds to F05.02
	3	Speed corresponds to F05.03
	4	Speed corresponds to F05.04
	5	Speed corresponds to F05.05
	6	Speed corresponds to F05.06
	7	Speed corresponds to F05.07
1	0	Unused

Status Parameter (0x33) Address Mapping

The group number (0x32) of status parameters are mapped to the high byte of the register address, and intergroup indexes are shown as below table.

Address	Function	Address	Function
0x3300	Controller series	0x330E	Setting RPM
0x3301	DSP software version	0x330F	Running RPM
0x3302	DSP non-standard software version	0x3311	Output voltage
0x3303	Keypad Software version	0x3312	Output current
0x3304	Elevator running status	0x3315	DC bus voltage
0x3305	Controller rated current	0x3318	AI voltage
0x3306	Controller status	0x3319	AI voltage (after calculating)
0x3307	Control mode	0x3320	AO output
0x3308	Setting speed	0x3323	Input terminal status
0x3309	Setting speed (after Acc. and Dec.)	0x3324	Output terminal status
0x330A	Feedback speed	0x3325	Modbus status
0x330B	Setting frequency	0x3326	Total time at power-on (h)
0x330C	Setting frequency (after Acc. and Dec.)	0x3327	Total running time (h)
0x330D	Output frequency	0x3328	Running times
		0x3329	Present fault

5. Special Instruction

1. For data frames in ASCII format, if the frame length is even, discard the frame.

2. Controller parameters that can be read but cannot be modified by the host computer: group F07, group F14.

3. Multiple DI terminal functions with the same setting will cause dysfunction. Users should avoid this case when modifying the DI terminal function via Modbus protocol.

6. CRC Checking

The code to calculate the CRC online is as follows:

```
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++)
        {
lf(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

When using Modbus communication control controller, please make sure the hardware connection is correct.

In addition, please preset the communication data format, baud rate and communication address.

1. Slave 2 up run at MS2

Command	Add.	Code	Register Address		Register Number		Content Bytes No.	Register Content				Checksum	
	0x02	0x43	0x32	0x00	0x00	0x02	0x04	0x00	0x1D	0x00	0x02	0x53	0x03
Response	Add.	Code	Register Address		Operate Register Number							Checksum	
	0x02	0x43	0x32	0x00	0x00			0x02				0xCB	0x4F

2. Slave 2 down run at MS2

Command	Add.	Code	Register Address		Register Number		Content Bytes No.	Register Content				Checksum	
	0x02	0x43	0x32	0x00	0x00	0x02	0x04	0x00	0x1F	0x00	0x02	0xF2	0xC3
Response	Add.	Code	Register Address		Operate Register Number							Checksum	
	0x02	0x43	0x32	0x00	0x00			0x02				0xCB	0x4F

3. Slave 2 emergency stop command

Command/ Response	Add.	Code	Register Address		Register Content		Checksum	
	0x02	0x41	0x32	0x00	0x00	0x0B	0x72	0x89

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

4. Slave 2 inspection up run command

Command/ Response	Add.	Code	Register Address		Register Content		Checksum	
	0x02	0x41	0x32	0x00	0x10	0x0D	0xFF	0x4B

5. Slave 2 fault reset

Command/ Response	Add.	Code	Register Address		Register Content		Checksum	
	0x02	0x41	0x32	0x00	0x00	0x40	0x32	0xBE

6. Slave 2 emergency up run command

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

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