

# Preface

Thank you for purchasing the SD320L series AC drive for elevator applications.

The SD320L is a new-generation high-performance vector control AC drive for elevator applications independently developed and manufactured by INVERTER Technology.

It adopts advanced algorithms such as motor vector control and smooth curve calculation based on INVERTER many years' experience in the elevator application industry.

This manual describes the correct use of the e-Drive, including product features, safety information and precautions, installation, parameter setting, commissioning, and maintenance & inspection. Read and understand the manual before using the product, and keep it carefully for reference to future maintenance.

The personnel who involve in system installation, commissioning, and maintenance must receive necessary safety and use training, understand this manual thoroughly, and have related experience before performing operations.

## Notes

- The drawings in the manual are sometimes shown without covers or protective guards. Remember to install the covers or protective guards as specified first, and then perform operations in accordance with the instructions.
- The drawings in the manual are shown for description only and may not match the product you purchased.
- The instructions are subject to change, without notice, due to product upgrade, specification modification as well as efforts to increase the accuracy and convenience of the manual.
- Contact our agents or customer service center if you need a new user manual or have problems during the use.

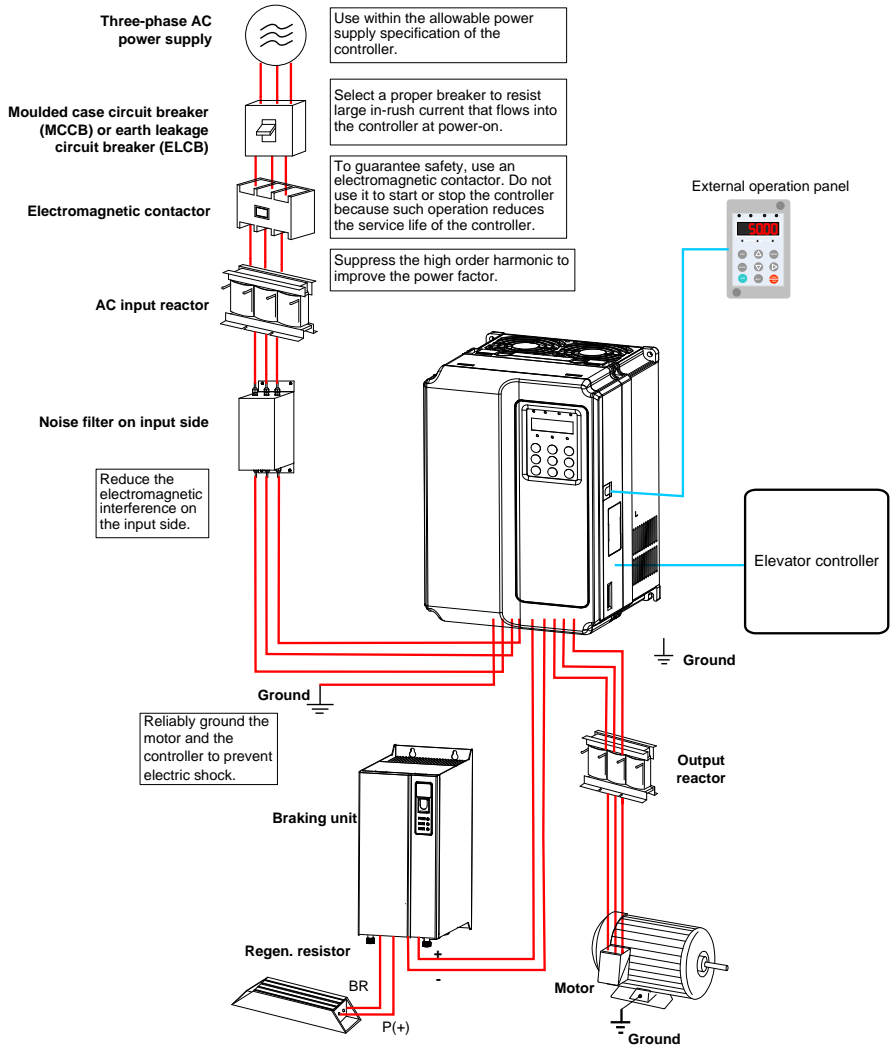
# Introduction

## 1. Product features

The SD320L has the following features:

- Drive both the asynchronous motor and permanent magnetic synchronous motor (PMSM), and provide multiple encoder interfaces.
- Support motor auto-tuning (static auto-tuning and complete auto-tuning).
- Support multiple speed sources, multi-speed and analog setting.
- Guarantee good elevator riding comfort with flexible startup curves, multi-segment S-curve setting, and four groups of acceleration/deceleration time.
- Support emergency evacuation at power failure with the 48 V battery power supply.
- Provide various elevator-related functions, including enable detection, brake contactor control, output contactor control, slow-down judgment, overspeed protection, speed deviation detection, door pre-open, contact stuck detection, motor overheat detection, and startup pre-torque compensation.
- Support connection to the external operation panel through the RJ45 interface, making the operation and commissioning simpler and easier.
- Provide the built-in DC reactor and braking unit, which improves the output power factor and reduces costs of peripheral devices.
- Separate air duct with conformal coating process, professional manufacturing platform, and advanced process make good product quality.
- Have the lightning protection design and the strong anti-interface capability, compliant with the EMC standard.

## 2. Connection to peripheral devices



- Do not install the capacitor or surge suppressor on the output side of the AC drive. Otherwise, it may cause faults to the AC drive or damage to the capacitor and surge suppressor.
- Inputs/Outputs (main circuit) of the AC drive contain harmonics, which may interfere with the communication device connected to the AC drive. Therefore, install an anti-interference filter to minimize the interference.
- For more details on peripheral devices, refer to related selection guidelines.

## Product Checking

Upon unpacking, check:


- Whether the nameplate model and AC drive ratings are consistent with your order. The box contains the AC drive, certificate of conformity, user manual and warranty card.
- Whether the AC drive is damaged during transportation. If you find any omission or damage, contact your supplier or us immediately.

## First-time Use

For users who use this product for the first time, read the manual carefully. If you have any problem concerning the functions or performance, contact the technical support personnel of INVERTER to ensure correct use.

## Approvals

Certification marks on the product nameplate indicate compliance with the corresponding certificates and standards.

Certification	Mark	Directives		Standard
CE		EMC directives	2014/30/EU	EN 12015 EN 12016
		LVD directives	2014/35/EU	EN 61800-5-1
		RoHS directives	2011/65/EU	EN 50581

### Note

- The above EMC directives are complied with only when the EMC electric installation requirements are strictly observed.
- Machines and devices used in combination with this drive must also be CE certified and marked. The integrator who integrates the drive with the CE mark into other devices has the responsibility of ensuring compliance with CE standards and verifying that conditions meet European standards.
- The installer of the drive is responsible for complying with all relevant regulations for wiring, circuit fuse protection, earthing, accident prevention and electromagnetic (EMC regulations). In particular fault discrimination for preventing fire risk and solid earthing practices must be adhered to for electrical safety (also for good EMC practice).
- For more information on certification, consult our distributor or sales representative.

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# Chapter 1 Safety Information and Precautions

## Warnings, Cautions and Notes



A Warning contains information, which is essential for avoiding a safety hazard.



A Caution contains information, which is necessary for avoiding a risk of damage to the product or other machine.






A Note contains information which helps to ensure correct operation.






The notices in this manual you have to observe are aimed at guaranteeing your personal safety, as well as to prevent damage to the AC drive or the parts connected to it. Read this chapter carefully so that you have a thorough understanding and perform all operations by following the notices in this chapter. INVERER will assume no liability or responsibility for any injury or loss caused by improper operation.

### 1.1 Safety Information

Use Stage	Safety Grade	Precautions
Warning	WARNING	<ul style="list-style-type: none"> <li>This AC drive has hazardous voltage and the controlled motor is a dangerous rotating device. Failure to comply with the notices may result in personal injury or damage to the property.</li> <li>Transportation, installation, operation and maintenance of the AC drive can be performed only by qualified personnel after they get familiar with the safety information in this manual. This is the prerequisite of safe and stable running of the equipment.</li> <li>Do not open the front cover or touch the power terminals on the main circuit within 10 minutes after the AC drive is powered off. The capacitor on the DC circuit still has residual voltage even after power-off. Failure to comply will result in electric shock.</li> </ul>
During installation	WARNING	<ul style="list-style-type: none"> <li>Do not install the equipment if you find water seepage, component missing or damage upon unpacking.</li> <li>Do not install the equipment if the packing list does not conform to the product you received.</li> <li>Install the equipment on incombustible objects such as metal, and keep it away from combustible materials. Failure to comply may result in a fire.</li> <li>Do not loosen the fixed screws of the components, especially the screws with red mark.</li> <li>Do not install the AC drive on vibrating parts. Failure to comply may result in damage to the equipment or unexpected accidents.</li> </ul>
	CAUTION	<ul style="list-style-type: none"> <li>Handle the equipment with care during transportation to prevent damage to the equipment.</li> <li>Do not drop wire end or screw into the AC drive. Failure to comply will result in damage to the AC drive.</li> <li>Do not use the equipment with damaged or missing components. Failure to comply will result in personal injury.</li> <li>Do not touch the components with your hands. Failure to comply will result in static electricity damage.</li> <li>Install the AC drive in places free of vibration and direct sunlight.</li> </ul>



Use Stage	Safety Grade	Precautions
At wiring	 <b>WARNING</b>	<ul style="list-style-type: none"> <li>• Wiring must be performed only by qualified personnel under instructions described in this manual. Failure to comply may result in unexpected accidents.</li> <li>• A circuit breaker must be used to isolate the power supply and the AC drive. Failure to comply may result in a fire.</li> <li>• Ensure that the power supply is cut off before wiring. Failure to comply may result in electric shock.</li> <li>• Tie the AC drive to ground properly according to the standard. Failure to comply may result in electric shock.</li> </ul>
	 <b>CAUTION</b>	<ul style="list-style-type: none"> <li>• Never connect the power cables to the output terminals (U, V, W) of the AC drive. Pay attention to the marks of the wiring terminals and ensure correct wiring. Failure to comply will result in damage to the AC drive.</li> <li>• Never connect the braking resistor between the DC bus terminals (+) and (-). Failure to comply may result in a fire.</li> </ul>
During running	 <b>WARNING</b>	<ul style="list-style-type: none"> <li>• Ensure that the cabling satisfies the EMC requirements and the local codes. Use wire sizes recommended in the manual. Failure to comply may result in accidents.</li> <li>• Use the shielded cable for the encoder, and ensure that the shield is reliably grounded at one end.</li> <li>• Use a twisted cable with twisted distance of 20–30 mm as the communication cable, and ensure that the shield is reliably grounded.</li> </ul>
		<ul style="list-style-type: none"> <li>• All peripheral devices must be connected properly according to the circuit wiring instructions provided in this manual. Failure to comply will result in accidents</li> <li>• Cover the AC drive properly before power-on to prevent electric shock.</li> <li>• Do not open the AC drive's cover after power-on. Failure to comply may result in electric shock.</li> <li>• Do not touch the AC drive and peripheral circuits with wet hand. Failure to comply may result in electric shock.</li> <li>• Do not touch any I/O terminal of the AC drive. Failure to comply may result in electric shock.</li> <li>• The AC drive performs safety detection on external strong power circuits automatically at the beginning of power-on. Do not touch the U, V, W terminals of the AC drive or the motor terminals at the moment. Failure to comply may result in electric shock.</li> <li>• Do not touch the fan or the discharging resistor to check the temperature. Failure to comply will result in personal burnt.</li> <li>• Signal detection must be performed only by qualified personnel during operation. Failure to comply will result in personal injury or damage to the AC drive.</li> </ul>
		<ul style="list-style-type: none"> <li>• Do not touch the rotating part of the motor during the motor auto-tuning or running. Failure to comply will result in accidents.</li> <li>• Check that the following requirements are met: <ul style="list-style-type: none"> <li>• The voltage class of the power supply is consistent with the rated voltage class of the AC drive.</li> <li>• The input terminals (R, S, T) and output terminals (U, V, W) are properly connected.</li> </ul> </li> <li>• No short-circuit exists in the peripheral circuit.</li> <li>• The wiring is secured.</li> <li>• Failure to comply will result in damage to the AC drive.</li> </ul>

Use Stage	Safety Grade	Precautions
During running	 <b>CAUTION</b>	<ul style="list-style-type: none"> <li>• For synchronous motor, ensure that motor auto-tuning is performed successfully. Perform trial running before resuming the steel rope so as to make the motor run properly.</li> <li>• Avoid objects falling into the AC drive when it is running. Failure to comply will result in damage to the AC drive.</li> <li>• Do not perform the voltage resistance test on any part of the AC drive because such test has been done in the factory. Failure to comply will result in accidents.</li> <li>• Do not change the default settings of the AC drive. Failure to comply may result in damage to the AC drive.</li> <li>• Do not start/stop the AC drive by turning on or off the contactor. Failure to comply will result in damage to the AC drive.</li> </ul>
During maintenance	 <b>WARNING</b>	<ul style="list-style-type: none"> <li>• Do not repair or maintain the AC drive at power-on. Failure to comply will result in electric shock.</li> <li>• Repair or maintain the AC drive when its voltage is lower than 36 VAC, about 10 minutes after the AC drive is powered off. Otherwise, the residual voltage in the capacitor may result in personal injury.</li> <li>• Do not allow unqualified personnel to repair or maintain the AC drive. Failure to comply will result in personal injury or damage to the AC drive.</li> </ul>
	 <b>CAUTION</b>	<ul style="list-style-type: none"> <li>• Repair or maintenance of the AC drive can be performed only by the warranty center or qualified personnel authorized by INVERTER.</li> <li>• Power supply must be cut off before repair or maintenance of the AC drive.</li> <li>• Set the parameters again after the AC drive is replaced. All the pluggable components must be plugged or removed only after power-off.</li> <li>• Strictly obey the laws and regulations and repair and maintain the escalator equipment periodically. Only timely troubleshooting can ensure the safety of passengers.</li> </ul>
Disposal	 <b>CAUTION</b>	<ul style="list-style-type: none"> <li>• The packaging materials, screws and terminal blocks can be re-used and it is suggested that you keep them well for future use.</li> </ul>
	 <b>WARNING</b>	<ul style="list-style-type: none"> <li>• The electrolytic capacitors on the main circuits and PCB may explode when they are burnt. Poisonous gas is generated when the plastic parts are burnt. Treat them as ordinary industrial waste.</li> </ul>

## 1.2 General Precautions

- Requirement on the residual current device (RCD)

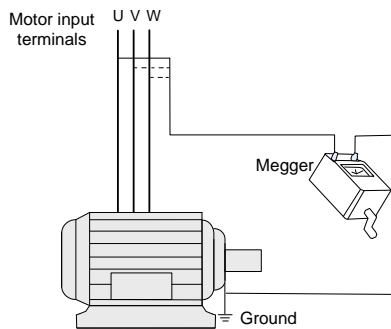
The AC drive generates high leakage current during running, which flows through the protective earthing conductor. Thus install a type-B RCD at primary side of the power supply. When selecting the RCD, you should consider the transient and steady-state leakage current to ground that may be generated at startup and during running of the AC drive. You can select a specialized RCD with the function of suppressing high harmonics or a general-purpose RCD with relatively large residual current.

- High leakage current warning

The AC drive generates high leakage current during running, which flows through the protective earthing conductor. Earth connection must be done before connection of power supply. Earthing shall comply with local regulations and related IEC standards.

- Motor insulation test

Perform the insulation test when the motor is used for the first time, or when it is reused after being stored for a long time, or in a regular check-up, in order to prevent the poor insulation of motor windings from damaging the AC drive. The motor must be disconnected from the AC drive during the insulation test. A 500-V mega-Ohm meter is recommended for the test. Ensure that the insulation resistance is not less than 5 M $\Omega$ .



- Thermal protection of motor

If the rated capacity of the motor selected does not match that of the AC drive, especially when the rated power of the AC drive is greater than that of the motor, adjust the motor protection parameters on the operation panel of the AC drive or install a thermal relay before the motor for protection.

- Running above mains frequency

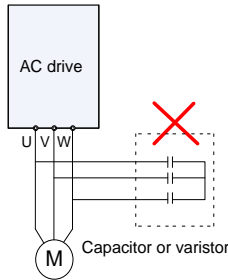
Do not use the AC drive above the mains frequency (default: 50 Hz). If such use is required, consider the strength and lifetime of all mechanical mechanism.

- Motor heat and noise

The output of the AC drive is pulse width modulation (PWM) wave with certain harmonic wave, and therefore, the motor temperature rise, noise, and vibration are slightly greater than those at running with the mains frequency.

- Voltage-sensitive device or capacitor on the output side of the AC drive

The AC drive outputs PWM waves, and therefore, do not install the capacitor for improving power factor or lightning protection voltage-sensitive resistor on the output side of the AC drive. Otherwise, the AC drive may suffer transient overcurrent or even be damaged.

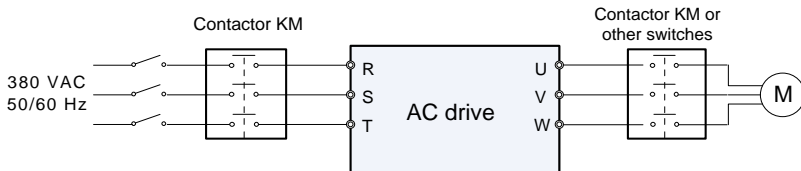


- Contactor on the input and output sides of the AC drive

When a contactor is installed between the input side of the AC drive and the power supply, the AC drive must not be started or stopped by turning on or off the contactor.

If the AC drive has to be operated by the contactor, ensure that the time interval between switching is at least one hour because frequent charge and discharge will shorten the service life of the capacitor inside the AC drive.

When a contactor is installed between the output side of the AC drive and the motor, do not close he contactor when the AC drive is active. Otherwise, modules inside the AC drive may be damaged.



- Use outside the rated voltage

The AC drive must not be used outside the allowable voltage range specified in this manual. Otherwise, components inside the AC drive may be damaged. If required, use a corresponding voltage step-up or step-down device.

- Prohibition of changing three-phase input into two-phase input

Do not change the three-phase input of the AC drive into two-phase input. Otherwise, a fault will result or the servo drive will be damaged.

- Surge suppressor

The AC drive has a built-in voltage dependent resistor (VDR) for suppressing the surge voltage generated when the inductive loads (electromagnetic contactor, electromagnetic relay, solenoid valve, electromagnetic coil and electromagnetic brake) around the AC drive are switched on or off. If the inductive loads generate very high surge voltage, use a surge suppressor for the inductive load or use a surge suppressor together with a diode.

<b>Note</b>	Do not connect the surge suppressor on the output side of the AC drive.
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- Altitude and de-rating

In places where the altitude is above 1000 m and the cooling effect reduces due to thin air, it is necessary to de-rate the AC drive. Contact INVERTER for technical support.

- Special usage

If wiring that is not described in this manual such as common DC bus is applied, contact INVERTER for technical support.

- Disposal

The electrolytic capacitors on the main circuits and PCB may explode when they are burnt. Poisonous gas is generated when the plastic parts are burnt. Treat them as ordinary industrial waste.

- Applicable motor

The standard adaptable motor is four-pole squirrel-cage asynchronous induction motor. For other types of motors, select a proper AC drive according to the rated motor current.

The cooling fan and rotor shaft of a non-variable-frequency motor are coaxial, and the cooling effect of the fan degrades when the motor speed reduces. Therefore, add a more powerful fan or replace the motor with a variable-frequency motor in scenarios where the motor overheats easily.

The standard parameters of the adaptable motor have been configured inside the AC drive. It is still necessary to perform motor auto-tuning or modify the default values based on actual conditions. Otherwise, the running effect and protection performance will be affected.

The AC drive may alarm or even be damaged when short-circuit exists on cables or inside the motor. Therefore, perform the insulation short-circuit test when the motor and cables are newly installed or during routine maintenance. During the test, make sure that the AC drive is completely disconnected from the tested parts.

- Precautions on selecting residual-current circuit breaker (RCCB)

Tripping may be caused if an improper RCCB is selected when the AC drive drives the motor. This is because the output wave of the AC drive has high harmonics and the motor and the cables connecting the AC drive and the motor produce leakage current, which is much larger than the current when the motor runs at the mains frequency.

Thus, it is necessary to determine the proper RCCB sensitivity based on the general leakage current of the cables and the motor. The leakage current is dependent on the motor capacity, cable length, insulation class and wiring method. Generally, the leakage current on the output side of the AC drive is three times of the current when the motor runs at the mains frequency.

## 1.3 Protective Functions

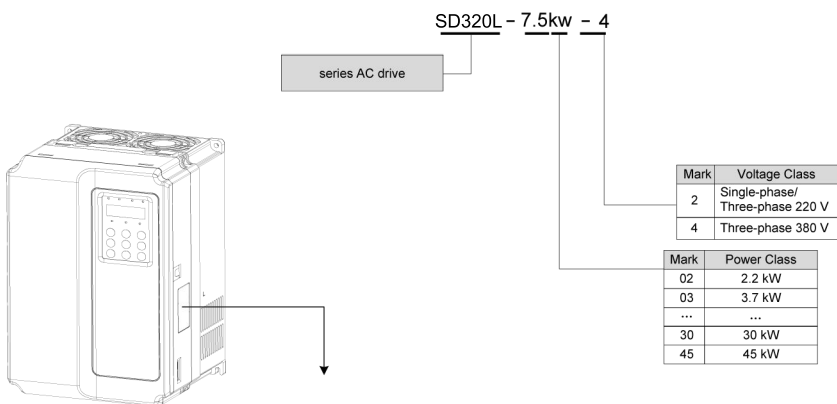
Adopting different protective functions for different levels of faults, the INVERTER provides the escalator running system with full abnormality protection. For detailed solutions to the faults, see [Chapter 8 Maintenance and Troubleshooting](#).

These drive control abnormalities include overcurrent, overvoltage/undervoltage, input/output phase loss, overload and control storage abnormality. Once a fault occurs, the AC drive performs protection immediately, cuts off the output, block the brake and prohibits running.

## Chapter 2 Product Information





### 2.1 Designation Rule and Nameplate


Figure 2-1 Designation rule and nameplate of the INVERTER



**INVERTER**

**MODEL :SD320L-7.5KW-4**  
**INPUT :400VAC,50Hz, 20.5A,3PH+PE**  
**OUTPUT :0-400VAC,18A ,7.5KW,3PH+PE**  
**Freq-Range: 0-400Hz Ver380**  
**Protection class:Ip20**

  
**4007540K048420**

**CE**  
**MADE IN CHINA**

## 2.2 Models

Table 2-1 INVERTER models

INVERTER Model	Input Voltage	Power Capacity (kVA)	Input Current (A)	Output Current (A)	Motor Power (kW)
SD320L-2.2KW-4	Three-phase 380 V, range: 380–440 V	4.0	6.5	5.1	2.2
SD320L-3.7KW-4		5.9	10.5	9.0	3.7
SD320L-5.5KW-4		8.9	14.8	13.0	5.5
SD320L-7.5KW-4		11.0	20.5	18.0	7.5
SD320L-11KW-4		17.0	29.0	27.0	11.0
SD320L-15KW-4		21.0	36.0	33.0	15.0
SD320L-18.5KW-4		24.0	41.0	39.0	18.5
SD320L-22KW-4		30.0	49.5	48.0	22.0
SD320L-30KW-4		40.0	62.0	60.0	30.0
SD320L-37KW-4		57.0	77.0	75.0	37.0
SD320L-45KW-4		69.0	93.0	91.0	45.0

## 2.3 General Technical Specifications

Table 2-2 INVERTER technical specifications

Item		Specifications
Basic specifications	Carrier frequency	2–16 kHz, adjusted automatically based on the load features
	Input frequency resolution	Digital setting: 0.01 Hz Analog setting: maximum frequency x 0.1%
	Input frequency accuracy	Digital setting: maximum frequency x $\pm 0.01\%$ Analog setting: maximum frequency x $\pm 0.01\%$
	Control mode	Sensorless vector control (SVC) Feedback vector control (FVC)
	Startup torque	0.5 Hz: 180% (SVC) 0 Hz: 200% (FVC)
	Speed adjustment range	1:100 (SVC) 1:1000 (FVC)
	Speed stability accuracy	$\pm 0.5\%$ (SVC) $\pm 0.05\%$ (FVC)
	Overload capacity	60s for 150% of the rated current, 1s for 180% of the rated current
	Motor auto-tuning	With-load auto-tuning; no-load auto-tuning
	Acceleration/Deceleration curve	Linear or S-curve acceleration/deceleration 4 groups of acceleration/deceleration time and S curves, make various combinations
	Inspection control	Implemented by multi-speed
	Multi-speed	A maximum of 8 speeds supported
Auto voltage regulation (AVR)	Keep constant output voltage automatically when the mains voltage changes	

Item		Specifications
Operation and display Basic specifications	LED operation panel	It displays the parameters.
	Protection functions	Motor short-circuit detection at power-on, power input/output phase loss protection, overcurrent protection, overvoltage protection, undervoltage protection, overheat protection and overload protection
	Key locking and function selection	Lock the keys partially or completely and define the function range of certain keys so as to prevent malfunction
	Carrier frequency	2–16 kHz, adjusted automatically based on the load features
Individualized functions	Security check of peripheral devices after power-on	Security check of peripheral devices, such as grounding and short circuit, after power-on
	Emergency evacuation at power failure	Easy and convenient emergency evacuation solutions
	Overspeed protection	Built-in elevator overspeed protection functions; multiple protection actions optional
	Speed deviation judgment	Speed deviation judgment function to find positional risks in time
	Forced speed switchover	Forced speed switchover, preventing elevator over travel top/bottom terminal
	Direct travel ride	No-creeping running with the direct travel ride command
	Motor temperature detection	Monitor motor temperature, preventing motor overheat
	Startup compensation	Three startup torque compensation modes: analog, digital, no-load-cell
	QUICK key	User-defined short-cut menu
	Timing control	Timing control function
I/O features	Command source	Operation panel control Terminal control
	Frequency source	4 frequency sources: Digital setting, multi-speed setting, analog voltage 1 setting, analog voltage 2 setting
	Input terminal	10 DI terminals, one for high-speed pulse input (also source PNP or NPN input) 2 AI terminals, one for voltage input, the other for voltage or current input
	Output terminal	3 transistor output terminals 2 relay output terminals 1 AO terminal (0/4–20 mA or 0/2–10 V, used for frequency reference or output frequency output)
Environment	Altitude	Below 1000 m (de-rated 1% for each 100 m higher)
	Ambient temperature	–10°C to 40°C (de-rated if the ambient temperature is above 40°C, maximum temperature: 50°C)
	Humidity	Maximum relative humidity 95%, non-condensing
	Vibration	Less than 5.9 m/s <sup>2</sup> (0.6 g)
	Storage temperature	–20°C to 60°C



## 2.4 Exploded View and Mounting Dimensions

### 2.4.1 Exploded View

Figure 2-2 Exploded view of the INVERTER (2–15 kW, plastic housing)

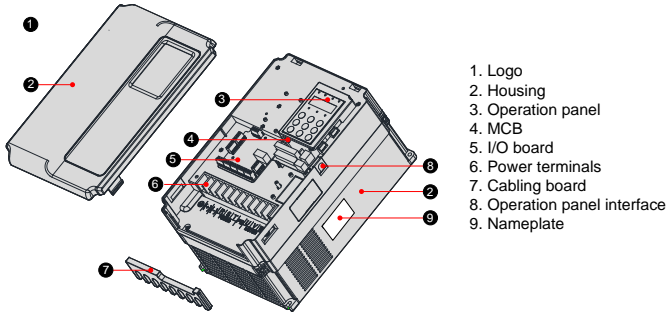
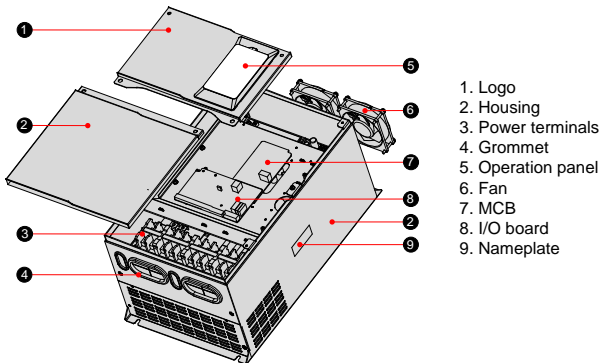


Figure 2-3 Exploded view of the INVERTER (18.5–45 kW, sheet metal housing)



### 2.4.2 Mounting Dimensions

Figure 2-4 Mounting dimension diagram of the INVERTER (2–15 kW, plastic housing)

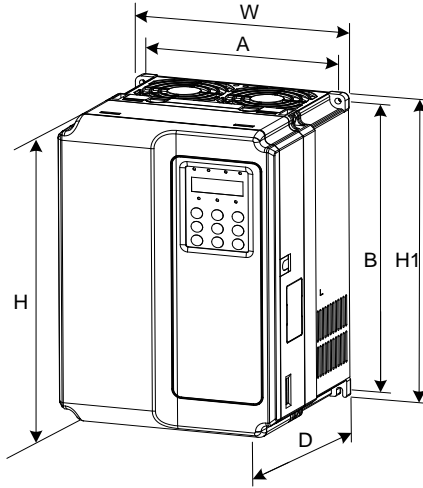
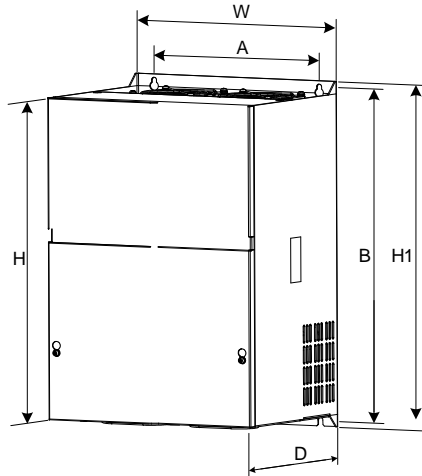


Figure 2-5 Mounting dimension diagram of the INVERTER (18.5–45 kW, sheet metal housing)



AC Drive Model	Mounting Hole (mm)		Physical Dimensions (mm)				Hole Diameter (Φ,mm)	Gross Weight (kg)
	A	B	H	H1	W	D		
SD320L-2.2KW-4	113	172	186	/	125	164	5	1.1
SD320L-3.7KW-4	148	236	248	/	160	183	5	2.5
SD320L-5.5KW-4								
SD320L-7.5KW-4	190	305	322	/	208	192	6	6.5
SD320L-11KW-4								
SD320L-15KW-4								
SD320L-18.5KW-4	235	447	432	463	285	228	8	20
SD320L-22KW-4								
SD320L-30KW-4								
SD320L-37KW-4	260	580	549	600	385	265	10	32
SD320L-45KW-4								

## 2.5 Optional Part

If any optional part in the following table is required, specify it in your order.

Table 2-3 Optional parts of the INVERTER

Name	Model	Function	Remarks
External braking unit	MDBUN	It is provided for the models of 37 kW and above.	For details, see <a href="#">2.3 General Technical Specifications</a> .
PG card	PG-A4	Provides 15 V power supply, adapted to the push-pull and open-collector incremental encoders, several frequency-division options	-
	PG-B	Provides 15 V power supply, adapted to the line driver output incremental and UVW encoders, always 1-frequency-division	-
	PG-C	Provides 15 V power supply, adapted to the SIN/COS encoder, open-collector output, always 1-frequency-division	-
	PG-C2		-
	PG-C3	Provides 15 V power supply, adapted to the SIN/COS encoder, differential output, always 1-frequency-division	-
External LED operation panel	MDKE	It is the external LED display and operation panel.	It provides the RJ45 interface for connecting to the AC drive.
Extension cable	MDCAB	It is a standard 8-core network cable and can be connected to MDKE.	The cable length is 3 m in the standard configuration.

## 2.6 Selection of Braking Components

INVERTER models of 30 kW and below have a built-in braking unit, and you only need to connect an external braking resistor between PR and + terminals. For models above 30 kW, you need to install a braking unit and a braking resistor externally.

Select the braking unit and braking resistor based on the configuration listed in the following table.

Table 2-4 Braking component selection for the INVERTER models

AC Drive Model	Power of Adaptable Motor (kW)	Max. Resistor ( $\Omega$ )	Min. Resistance ( $\Omega$ )	Power of Braking Resistor (W)	Braking Unit
SD320L-2.2KW-4	2.2	290	230	600	
SD320L-3.7KW-4	3.7	170	135	1100	
SD320L-5.5KW-4	5.5	115	90	1600	
SD320L-7.5KW-4	7.5	85	65	2500	
SD320L-11KW-4	11	55	43	3500	
SD320L-15KW-4	15	43	35	4500	
SD320L-18.5KW-4	18.5	34	25	5500	
SD320L-22KW-4	22	24	22	6500	
SD320L-30KW-4	30	20	16	9000	
SD320L-37KW-4	37	16	13	11000	
SD320L-45KW-4	45	14	11	13500	

## Chapter 3 Mechanical and Electrical Installation

Upon unpacking, check:

- Whether the nameplate model and AC drive ratings are consistent with your order. The box contains the AC drive, certificate of conformity, user manual and warranty card.
- Whether the AC drive is damaged during transportation. If you find any omission or damage, contact your supplier or INVERTER immediately.

Follow the safety instructions and precautions in Chapter 1 during mechanical and electrical installation of the AC drive.

### 3.1 Mechanical Installation

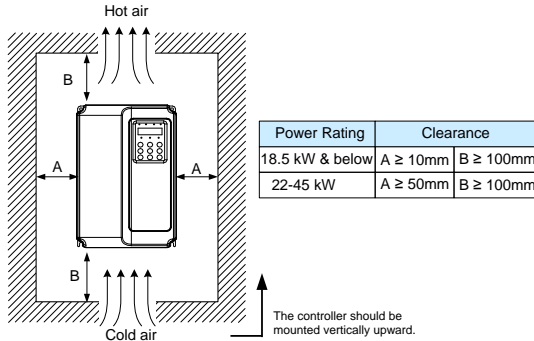
#### 3.1.1 Mounting Environment Requirements

Item	Requirements
Ambient temperature	-10°C to 50°C
Heat dissipation	Install the AC drive on the surface of an incombustible object, and ensure that there is sufficient space around for heat dissipation. Install the AC drive vertically on the support using screws.
Mounting location	Free from direct sunlight, high humidity and condensation
	Free from corrosive, explosive and combustible gas
	Free from oil dirt, dust and metal powder
Vibration	Less than 0.6 g
Protective enclosure	The controllers of plastic housing are whole-unit built-in products operated through remote control and need to be installed in the final system. The final system must have the required fireproof cover, electrical protective cover and mechanical protective cover, and satisfy the regional laws & regulations and related IEC requirements. Earth connection must be done.

### 3.1.2 Mounting Clearance Requirements

The clearance that needs to be reserved varies with the power rating of the INVERTER, as shown in the following figure.

Figure 3-1 Clearance around the INVERTER for mounting



When AC drive power is not larger than 22 kW, the space "A" may not be considered. When the AC drive power is larger than 22 kW, "A" must be larger than 50 mm.

Pay attention to the following points during installation:

Pay attention to the following points during installation:

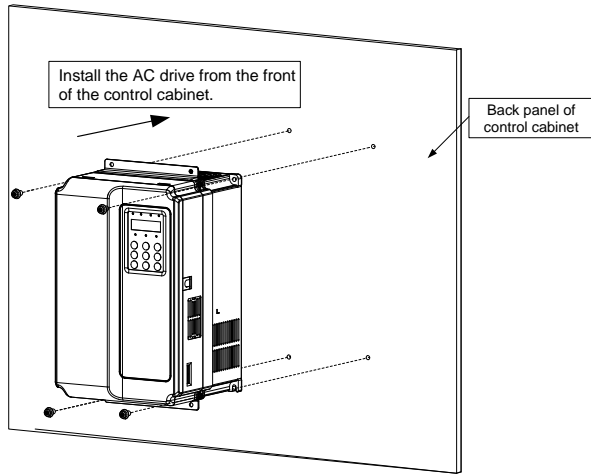
1. Reserve the installation clearances as specified in Figure 3-1 to ensure sufficient space for heat dissipation. Take heat dissipation of other components in the cabinet into consideration.
2. Install the AC drive upright to facilitate heat dissipation.
3. Use the incombustible hanging bracket.
4. In scenarios with heavy metal powder, install the heatsink outside the cabinet, and ensure that the room inside the fully-sealed cabinet is as large as possible.

### 3.1.3 Mechanical Installation Method and Procedure

The INVERTER provides two housings, plastic and sheet metal for different power ratings and voltage classes. The INVERTER can be installed using the backplate mounting or through-hole mounting method based on the application scenario.

### Backplate mounting

Figure 3-2 Backplate mounting of INVERTER (plastic housing)



### Through-hole mounting (plastic housing)

Figure 3-3 External hanging bracket for the INVERTER

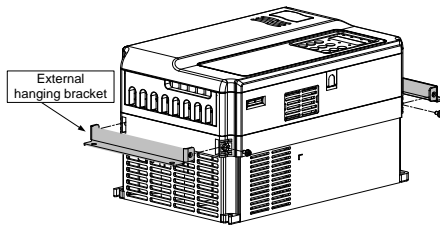


Figure 3-4 Through-hole mounting of the INVERTER (plastic housing)

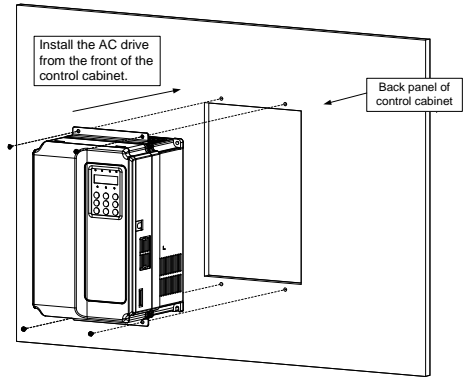
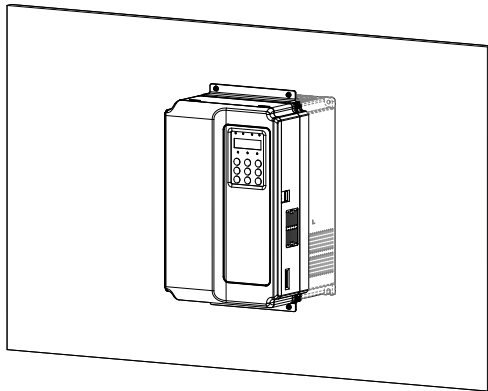


Figure 3-5 Through-hole mounting effect of the INVERTER (plastic housing)





### Backplate mounting installation (sheet metal housing)

Figure 3-6 Backplate mounting installation of INVERTER (sheet metal housing)

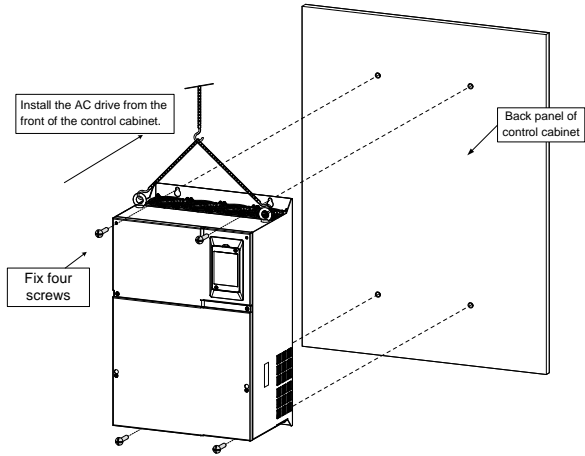
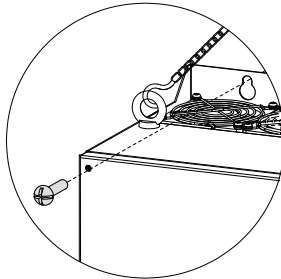


Figure 3-7 Hoisting the INVERTER (sheet metal housing)



### Through-hole mounting (sheet metal housing)

Figure 3-8 External hanging bracket for the INVERTER (sheet metal housing)

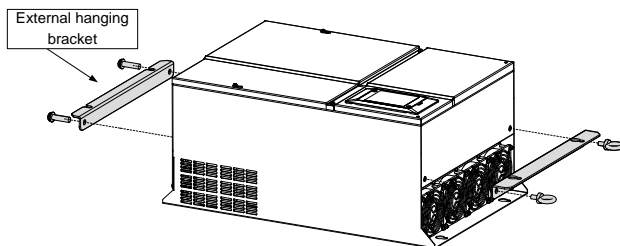


Figure 3-9 Through-hole mounting of the INVERTER (sheet metal housing)

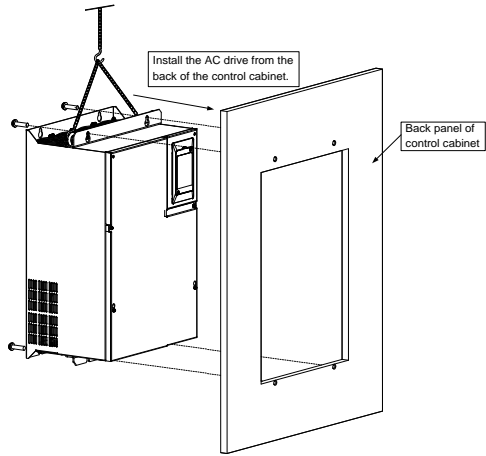
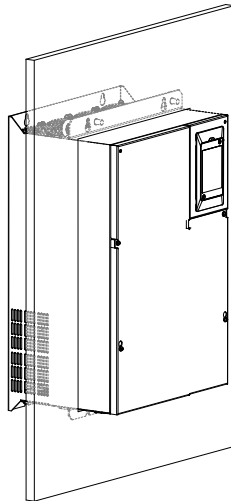


Figure 3-10 Through-hole mounting effect of the INVERTER (sheet metal housing)



### 3.1.4 Removing Front Cover

You need to remove the front cover and before wiring the main circuit and control circuit.

Figure 3-11 Removal of the front cover of the INVERTER (plastic housing)

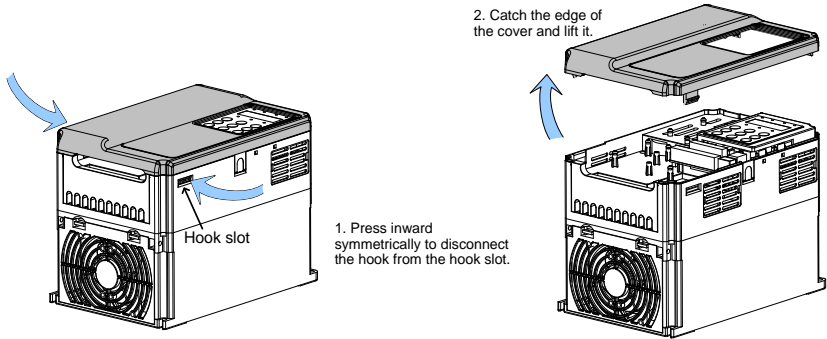
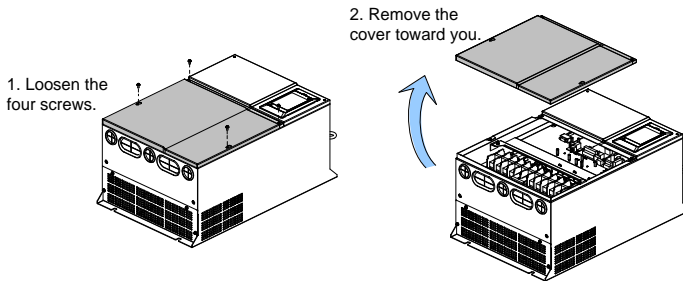


Figure 3-12 Removal of the front cover of the INVERTER (sheet metal housing)



**CAUTION**

Be careful when removing the front cover. Falling off of the cover may cause damage to the AC drive or personal injury.

## 3.2 Electrical Installation

### 3.2.1 Peripheral Electrical Devices

Table 3-1 Selection of peripheral electrical devices

AC Drive Model	MCCB (A)	Contactora (A)	Main Circuit Cable on Input Side (mm <sup>2</sup> )	Main Circuit Cable on Output Side (mm <sup>2</sup> )	Control Circuit Cable (mm <sup>2</sup> )	Grounding Cable (mm <sup>2</sup> )
SD320L-2.2KW-4	16	10	2.5	2.5	0.75	0.75
SD320L-3.7KW-4	25	16	4	4	0.75	1.5
SD320L-5.5KW-4	32	25	6	6	1	2.5
SD320L-7.5KW-4	40	32	6	6	1	4
SD320L-11KW-4	63	40	6	6	1	6
SD320L-15KW-4	63	40	6	6	1	6
SD320L-18.5KW-4	100	63	10	10	1	10
SD320L-22KW-4	100	63	10	10	1	10
SD320L-30KW-4	125	100	16	16	1	16
SD320L-37KW-4	160	100	16	16	1	16
SD320L-45KW-4	200	125	25	25	1	16

Table 3-2 Description of peripheral electrical devices

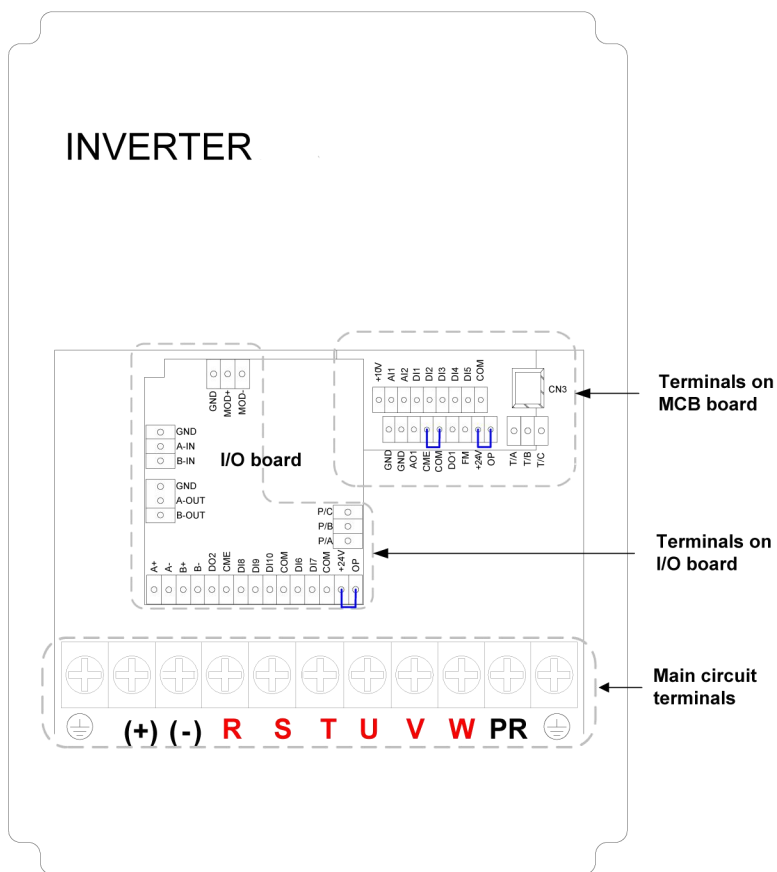
Peripheral Device	Mounting Location	Function Description
MCCB	Power input side	Cut off the power supply of the AC drive and provide short-circuit protection. It is mandatory.
Safety contactor	Between MCCB and the AC drive input side	Apply/Cut off the power supply of the AC drive. Do not start and stop the AC drive frequently by switching the contactor on and off (less than twice per minute) nor use it to directly start the AC drive.
AC input reactor	AC drive input side	Improve the power factor of the input side. Eliminate the higher harmonics on the input side to provide effective protection on the rectifier bridge. Eliminate the input current unbalance due to unbalance between the power phases. It is installed when the DC reactor cannot meet the requirements.
DC input reactor	Built-in as standard configuration for models 7.5 kW to 45 kW	Improve the power factor of the power input side. Eliminate the higher harmonics of the input side effectively and prevent other devices from being damaged due to distortion of the voltage waveform. Eliminate the input current unbalance due to power supply inter-phase unbalance. It features small size and does not cause voltage dip, and is the standard configuration.
AC output reactor	Between the AC drive output side and the motor, close to the AC drive	The output side of the AC drive has much high harmonics, as when the motor is far from the AC drive, there is much distributed capacitance in the circuit. Certain harmonics may cause resonance in the circuit, causing two impacts: Degrade the motor insulation performance and damage the motor in the long run. Generate large leakage current and cause frequent AC drive protection trips. If the distance between the AC drive and the motor is greater than 100 m, install an AC output reactor.

## 3.2.2 Description and Wiring of Main Circuit Terminals




- Ensure that the power supply is cut off before wiring. Failure to comply may result in electric shock.
- Wiring must be performed only by qualified personnel under instructions described in this manual. Failure to comply may result in unexpected accidents.
- Never connect the braking resistor to the DC bus terminals (+), (-).
- The power supply must meet the input power requirements of the AC drive. Otherwise, the AC drive will be damaged.
- The motor to be connected must adapt to the AC drive. Otherwise, it may cause damage to the motor or cause AC drive protection.
- Never connect the power cables to the output terminals (U, V, W) of the AC drive. Failure to comply will result in damage to the AC drive.

Figure 3-13 Terminal arrangement of the INVERTER



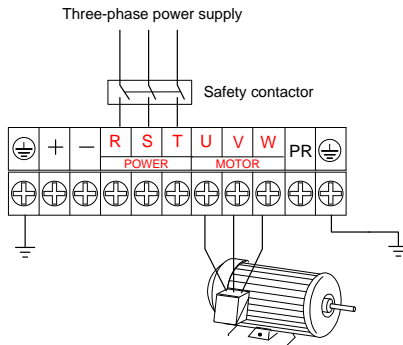
1. Descriptions

Table 3-3 Description of main circuit terminals

Mark	Terminal Name	Function Description
R, S, T	Three-phase power input terminals	Provide three-phase 380 V power supply.
(+), (-)	Positive and negative terminals of DC bus	Connect the external braking unit for models of 37 kW and above.
(+), PR	Terminals for connecting braking resistor	Connect the braking resistor for models of below 37 kW.
U, V, W	AC drive output terminals	Connect the three-phase motor.
	Grounding terminal	Must be grounded.

3. Wiring

Figure 3-15 Main circuit connection diagram



The wiring precautions are as follows:

■ **DC bus terminals (+), (-)**

Terminals (+) and (-) of DC bus have residual voltage after the AC drive is switched off. Before touching the terminals, wait until the CHARGE indicator becomes OFF and ensure that the voltage measured with a multimeter is smaller than 36 V.

When connecting external braking components for the AC drive of 37 kW and above, connect the braking unit to terminals (+) and (-) and the braking resistor to terminals P and PR of the braking unit. Never reverse (+) and (-). Failure to comply may result in damage to the AC drive and even cause a fire.

The cable length between the braking unit and terminals (+) and (-) must not exceed 5 m. The cable length between the braking unit and the braking resistor must not exceed 10 m. Use twisted pair wire or tight pair wires for parallel connection.

Do not connect the braking resistor directly to the DC bus. Otherwise, it may damage the AC drive and even cause fire.

■ **Terminals (+), PR for connecting braking resistor**

For the AC drive of below 37 kW with built-in braking unit, terminals (+), PR are effective.

Connect a braking resistor of the recommended model in [Chapter 2 Product Information](#).

Ensure that the cable length of the braking resistor is shorter than 5 m.

The temperature of the braking resistor increases due to energy release. Protection and heat dissipation measures are required.

■ **AC drive output terminals U, V, W**


The terminals are used to connect the three-phase motor. When the motor rotating direction is reverse to the required direction, exchange any two of the UVW cables.

Do not connect a capacitor or surge absorber to the output side of the AC drive. Otherwise, it may cause frequent AC drive faults or even damage the AC drive.

The output must not be short-circuited or grounded.

Put the UVW cables through the grounded metal pipes and separate these cables from the signal cables or lay them vertical to the signal cables.

If the motor cable is too long, electrical resonance will be generated due to the impact of distributed capacitance. This will damage the motor insulation or generate higher leakage current, causing the AC drive to trip in overcurrent protection. If the motor cable is greater than 100 m long, an AC output reactor must be installed close to the AC drive.

■ **Grounding terminal **

This terminal must be reliably grounded with thick and short main protective earthing (PE) conductor.

The yellow-green multi-strain copper PE conductor above 4 mm<sup>2</sup> is recommended.

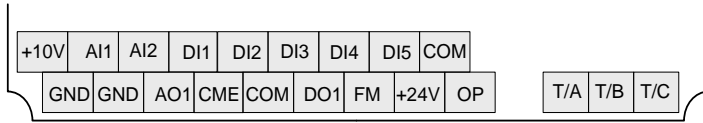
Ensure that the grounding resistance must not be larger than 5 Ω.

The neutral wire must not be the PE conductor.



### 3.2.3 Description and Wiring of MCB Terminals

#### 1. Terminal arrangement



#### 2. Descriptions

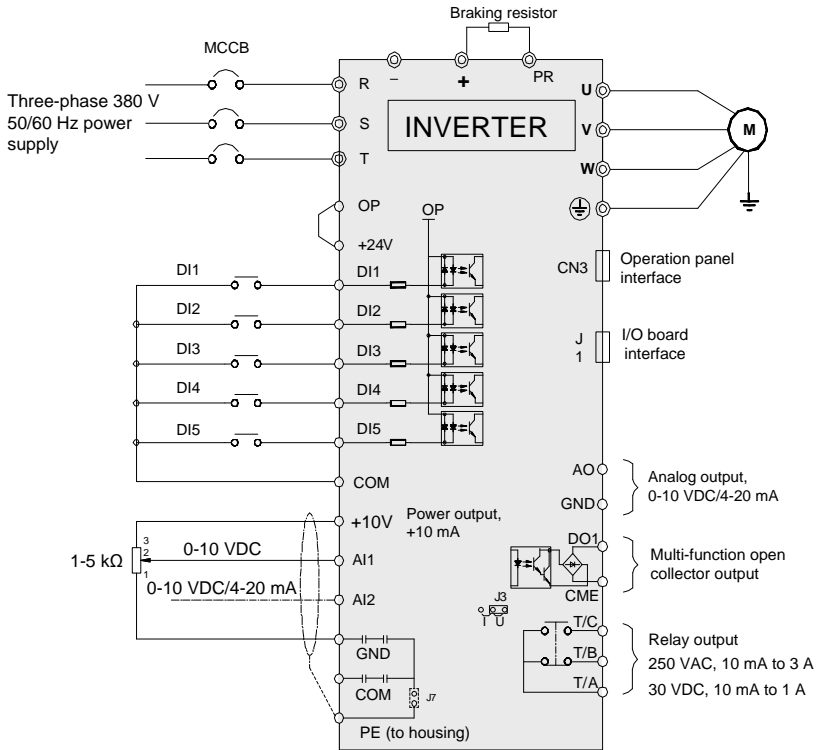
Table 3-4 Description of MCB terminals

Type	Mark	Terminal Name	Function Description
Power supply	+10V-GND	External +10 VDC power supply	Provide +10 V power supply externally. Generally, it provides power supply to the external potentiometer with resistance range of 1–5 k $\Omega$ . Maximum output current: 10 mA
	+24V-COM	External +24 V power supply	Provide +24 V power supply externally. Generally, it provides power supply to DI/DO terminals and external sensor. Maximum output current: 200 mA
	OP	External power supply	It is shorted with +24V by a jumper by default. When DI1 to DI5 need to be driven by external signal, OP needs to be connected to external power supply and be disconnected from +24 V.
Analog input	AI1-GND	AI1	Input voltage range: 0–10 VDC Input impedance: 100 k $\Omega$
	AI2-GND	AI2	1. Input range: 0–10 VDC or 4–20 mA, determined by jumper J3 on the MCB 2. Input impedance: 100 k $\Omega$ for voltage input, 500 $\Omega$ for current input
Digital input	DI1-COM	DI1	1. Optical coupling isolation, compatible with dual polarity input 2. Input impedance: 3.3 k $\Omega$ 3. Voltage range at level input: 9–30 V
	DI2-COM	DI2	
	DI3-COM	DI3	
	DI4-COM	DI4	
	DI5-COM	DI5 (high-speed pulse)	Besides features of DI1–DI4, it can be used for high-speed pulse input.
Analog output	AO1-GND	AO1	Voltage or current output, determined by jumper J4 on MCB Output voltage range: 0–10 V Output current range: 0–20 mA
Digital output	DO1-CME	DO	Optical coupling isolation, dual polarity open collector output Output voltage range: 0–24 V Output current range: 0–50 mA
	FM-COM	Reserved	Note that CME and COM are internally insulated, but they are shorted externally when delivery. In this case, DO1 is driven by +24V by default. If you want to apply external power to DO1, remove the jumper between CME and COM.

Type	Mark	Terminal Name	Function Description
Relay output	T/A-T/B	Normally closed (NC) terminal	Contact driving capacity: 250 VAC, 3 A, $\text{COS}\phi = 0.4$ ; 30 VDC, 1 A
	T/A-T/C	Normally open (NO) terminal	
Auxiliary interface	J1	I/O board interface	28-pin terminal, industrial standard for special card interface
	CN3	Operation panel interface	Connect to the external operation panel.

3. Wiring

Figure 3-16 Wiring of MCB terminals



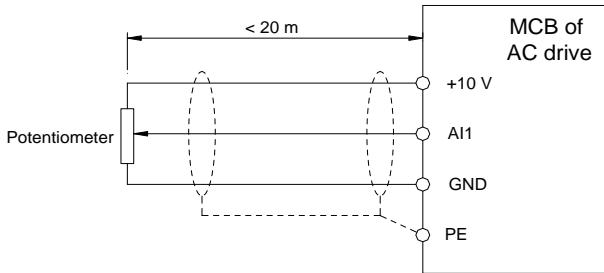
**Note**

⊙ indicates the main circuit terminal, and ○ indicates terminal on the MCB.

## 1) Wiring of AI terminals

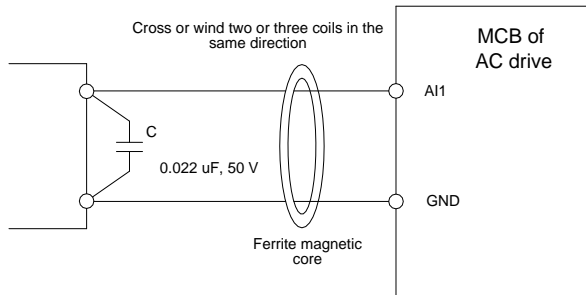
Weak analog voltage signals are easy to suffer external interference, and therefore the shielded cable must be used and the cable length must be less than 20 m, as shown in following figure.

Figure 3-17 Wiring of AI terminals



In applications where the analog signal suffers severe interference, install filter capacitor or ferrite magnetic core at the analog signal source, as shown in the following figure.

Figure 3-18 Install filter capacitor or ferrite magnetic core

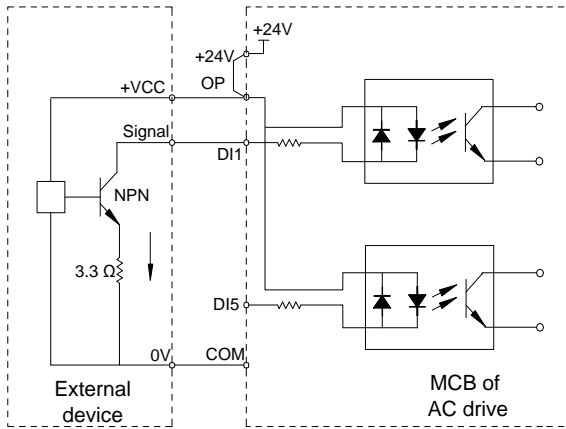


## 2) Wiring of DI terminals

Generally, use the shielded cable not longer than 20 m. When active driving is adopted, necessary filtering measures shall be taken to prevent the interference to the power supply. The contact control mode is recommended.

■ **SINK wiring**

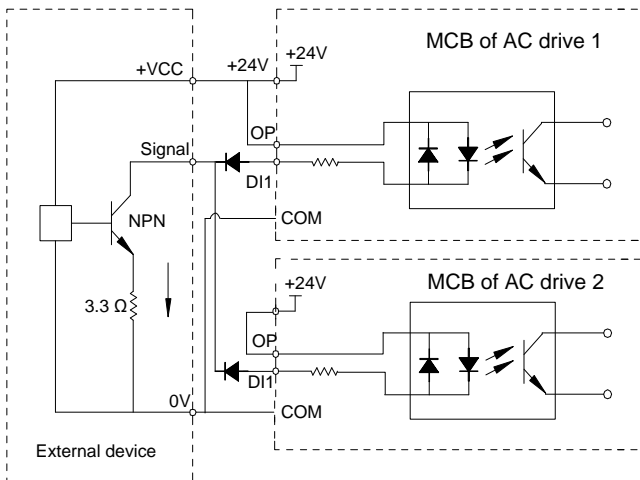
Figure 3-19 Wiring in SINK mode



This is the most commonly used wiring mode. To apply external power supply, remove the jumper between terminals +24V and OP, and connect the positive pole of external power supply to OP, and 0V of external power supply to the corresponding DI through the control contact on the AC drive.

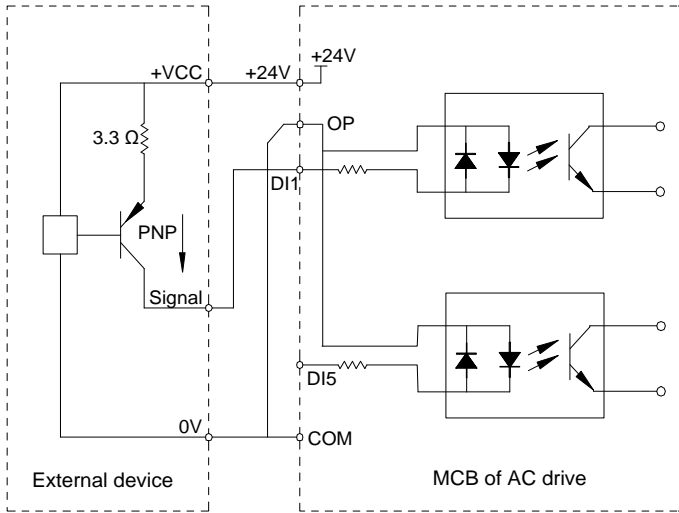
In such wiring mode, the DI terminals of different AC drives must not be connected in parallel. Otherwise, DI mal-function may result. If parallel connection (different AC drives) is required, connect a diode in series at the DI and the diode needs to satisfy the requirement:  $IF > 10 \text{ mA}$ ,  $UF < 1 \text{ V}$ .

Figure 3-20 DI terminals connected in parallel in SINK mode



### ■ SOURCE wiring

Figure 3-21 Wiring in SOURCE mode



In such wiring mode, remove the jumper between +24V and OP, and connect +24V to the common terminal of the external controller and meanwhile connect OP to COM.

To apply external power supply, remove the jumper between terminals +24V and OP, and connect OP to 0V of external power supply, can connect 24V to the corresponding DI through the control contact on the AC drive.

### 3) Wiring of DO terminal

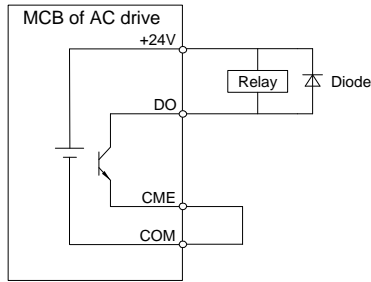
When the DO terminal needs to drive the relay, an absorption diode shall be installed on both sides of the relay coil. The driving capacity is not more than 50 mA. Otherwise, it may cause damage to the 24 VDC power supply.

#### Note

Do not reverse the polarity of the absorption diode during installation, as shown in Figure 3-22. Otherwise, the 24 VDC power supply will be damaged immediately once there is digital output.

CME and COM are internally isolated, but they are shorted by jumper externally at delivery. In this case, DO1 is driven by +24V by default. To apply external power to DO1, remove the jumper between CME and COM.

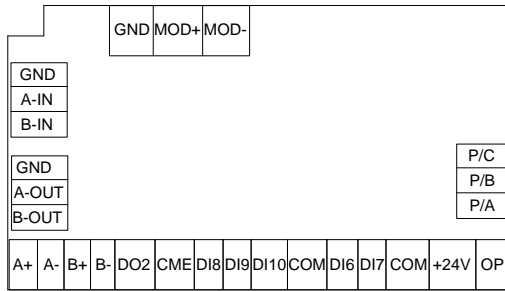
Figure 3-22 DO terminal wiring diagram



### 3.2.4 Description and Wiring of I/O Extension Board Terminals

#### 1. Terminal arrangement

Figure 3-23 Terminal arrangement of I/O extension board



#### 2. Descriptions

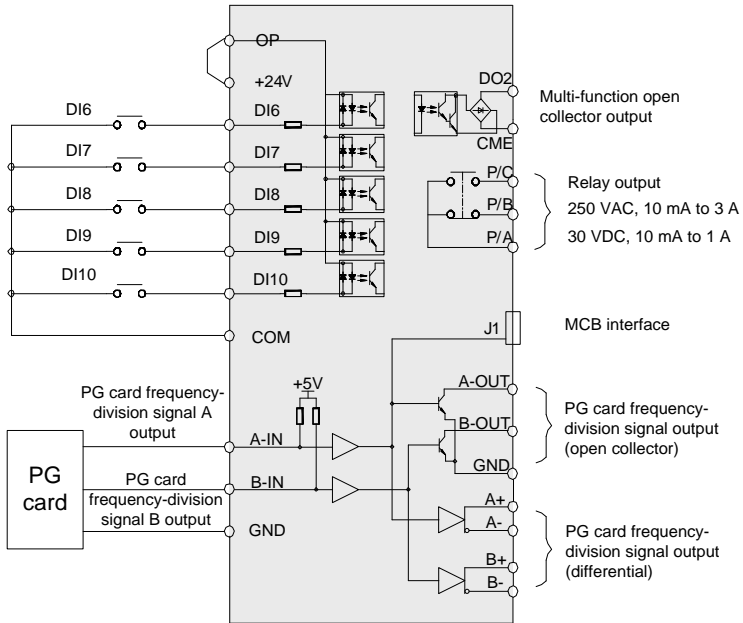
Table 3-5 Description of terminals on I/O extension board

Type	Mark	Terminal Name	Function Description
Power supply	+10V-GND	External +10 VDC power supply	Provide +10 V power supply externally. Generally, it provides power supply to the external potentiometer with resistance range of 1–10 kΩ. Maximum output current: 10 mA
	+24V-COM	External +24 V power supply	Provide +24 V power supply externally. Generally, it provides power supply to DI/DO terminals and external sensor. Maximum output current: 200 mA
	OP	External power supply	It is shorted with +24V by a jumper by default. When DI6 to DI10 need to be driven by external signal, OP needs to be connected to external power supply and be disconnected from +24 V.

Type	Mark	Terminal Name	Function Description
Digital input	DI6-COM	DI6	1. Optical coupling isolation, compatible with dual polarity input 2. Input impedance: 3.3 kΩ 3. Voltage range at level input: 9–30 V
	DI7-COM	DI7	
	DI8-COM	DI8	
	DI9-COM	DI9	
	DI10-COM	DI10	
Digital output	DO2-CME	DO2	Optical coupling isolation, dual polarity open collector output Output voltage range: 0–24 V Output current range: 0–50 mA  Note that CME and COM are internally insulated, but they are shorted externally when delivery. In this case, DO1 is driven by +24V by default. If you want to apply external power to DO1, remove the jumper between CME and COM.
Relay output	P/A-P/B	Normally closed (NC) terminal	Contact driving capacity: 250 VAC, 3 A, $\text{COS}\phi = 0.4$ ; 30 VDC, 1 A
	P/A-P/C	Normally open (NO) terminal	
PG card input	A-IN-GND	PG card frequency-division signal A input	1) Internally pull up, can be directly connected to frequency-division output terminal of the PG-A4, PG-B, PG-C, or PG-C2 2) Must be connected to the frequency-division output signal of the PG card when the direct travel ride function is used.
	B-IN-GND	PG card frequency-division signal B input	
PG card output	A-OUT-GND	PG card frequency-division signal A output	1) Open collector output 2) When the direct travel ride function is used, the frequency-division output signal of the PG card is sent to terminals A-IN and B-IN, and then output by these terminals to the MCB.
	B-OUT-GND	PG card frequency-division signal B output	
	A+- A-	PG card frequency-division signal A output	1) Differential output 2) When the direct travel ride function is used, the frequency-division output signal of the PG card is sent to terminals A-IN and B-IN, and then output by these terminals to the MCB.
	B+- B-	PG card frequency-division signal B output	
Communication	MOD+	Communication terminal	RS485 communication terminal
	MOD-		

3. Wiring

Figure 3-24 Wiring of terminals on I/O extension board



The frequency-division output signal of the PG needs to be input to terminals A-IN and B-IN on the I/O extension board only when the direct travel ride function is used. The MCB obtains this PG signal from terminals A-OUT and B-OUT (Open collector output) or A+A- and B+B- (Differential output).

3.2.5 PG Card for Elevator Specialized Rotary Encoder

**PG-A4**

It matches the open-collector or push-pull incremental encoder for the asynchronous motor.

1) Specifications

Table 3-6 Specifications of the PG-A4

	Function	Response Speed	Output Impedance	Output Current	Frequency-Division Range
+15V, COM	Power supply to encoder	-	About 300 Ω	300 mA	-
PGA, PGB	Signal input from encoder	0-60 kHz	-	-	-
OUT-A OUT-B	Frequency-division signal output	0-60 kHz	About 30 Ω	100 mA	1-63

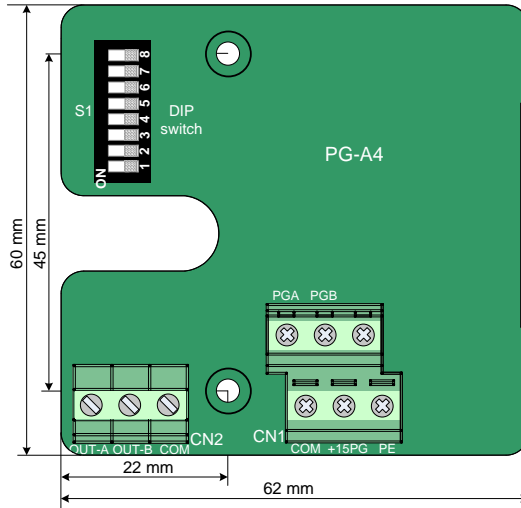


## 2) Descriptions of terminals and DIP switches

The PG-A4 provides 9 terminals, as shown in the following figure.

- +15PG, COM: power supply to encoder
- PGA, PGB: encoder signal input
- OUT-A, OUT-B, COM: frequency-division signal output
- PE: shielded cable wiring (tie it to ground during use as the PG card is not grounded internally)

Figure 3-25 PG-A4 physical appearance and dimensions



#### ■ DIP switch

It is used to set the frequency-division coefficient and filter function of the PG card. There are a total of 8 switches; the first six ones are used to set the frequency-division coefficient and the last two ones are used to set the filter function.

#### ■ Frequency-division coefficient

Each of the six switches indicates a binary bit.

The one marked with "1" indicates the lowest binary bit, and the one marked with "6" indicates the highest binary bit. When a switch is turned to ON, this bit is 1 (active); when this switch is turned to the other side, this bit is 0 (inactive).

The following table shows a setting example.

Table 3-7 DIP switch function setting

Switch for Setting Frequency-Division Coefficient							Switch for Setting Filter Function		
Frequency-division coefficient	6	5	4	3	2	1	7	8	Filter function
No output	0	0	0	0	0	0	0	0	Non-adaptive filter
1 frequency-division	0	0	0	0	0	1			
2 frequency-division	0	0	0	0	1	0	1	0	Adaptive filter (default)
3 frequency-division	0	0	0	0	1	1			
.	.	.	.	.	.	.	0	1	Fixed interlock
.	.	.	.	.	.	.			
.	.	.	.	.	.	.	1	1	Automatic interlock
63 frequency-division	1	1	1	1	1	1			

- **Non-adaptive filter**  
The filter coefficient of the PG card is fixed and very small. It is applied in the no or small interference or high speed applications.
- **Adaptive filter**  
The filter coefficient of the PG card is adjusted automatically. This mode features strong anti-interference capability, especially when the encoder feedback speed is lower than 60 kHz. It is applied in the strong interference applications.  
It is the default mode.
- **Fixed interlock**  
This function reduces edge jitter of the encoder feedback signal on the basis of the self-adaptive filter function.
- **Automatic interlock**  
This function performs switchover between "self-adaptive filter" and "fixed interlock". It is applicable to the conditions of zero speed running and non-zero-speed running, so that the useful signals will not be cleared as edge jitter during zero speed running.

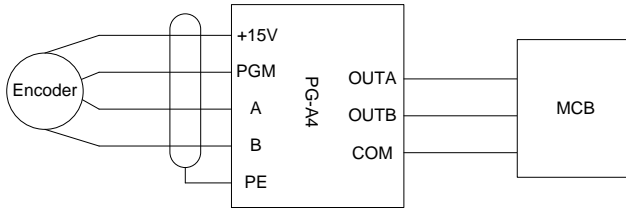
3) Wiring

Follow the precautions during wiring:

- The cable from the PG card to the encoder must be separated from the cables of the control circuit and the power circuit. Parallel cabling in close distance is forbidden.
- The cable from the PG card to the encoder must be a shielded cable. The shield must be connected to the PE on the AC drive side. To minimize interference, only one end is grounded.
- The cable from the PG card to the encoder must run through the duct separately and the metal shell is reliably grounded.

The following figure shows the PG card connection.

Figure 3-26 PG-A4 connection



**PG-B**

It matches the UVW or line-driver incremental encoder for the synchronous motor.

1) Specifications

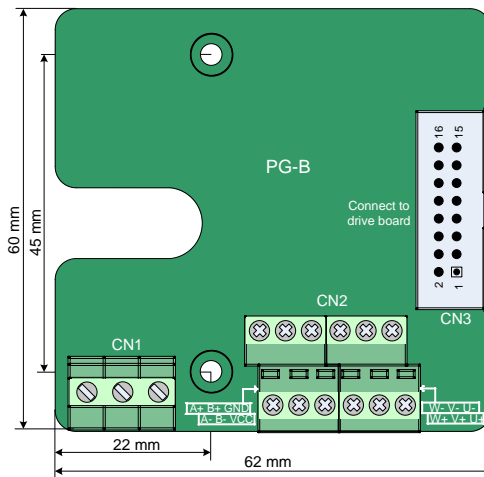
	Function	Response Speed	Output Impedance	Output current	Frequency-Division Range
VCC, GND	Power supply to encoder	-	About 300 Ω	300 mA	-
A+, B+, A-, B-, U+, V+, W+, U-, V-, W-	Signal input from encoder	0–80 kHz	-	-	-
OUT-A, OUT-B, COM	Frequency-division signal output	0–80 kHz	About 30 Ω	100 mA	1

2) Descriptions of terminals

The PG-B provides 15 terminals, as shown in the following figure.

- VCC, GND: power supply to encoder
- A+, B+, A-, B-, U+, V+, W+, U-, V-, W-: encoder signal input
- OUT-A, OUT-B, COM: frequency-division signal output

Figure 3-27 PG-B physical appearance and dimensions



3) Wiring

The cable from the PG card to the encoder must be separated from the cables of the control circuit and the power circuit. Parallel cabling in close distance is forbidden.

The cable from the PG card to the encoder must run through the duct separately and the metal shell is reliably grounded.

**PG-C**

It matches the ERN1387 encoder.

1) Specifications

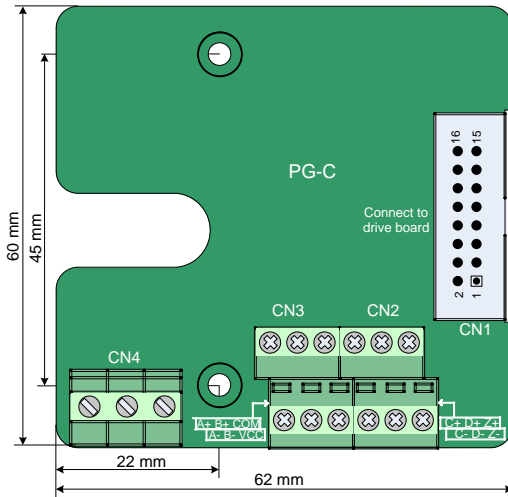
	Function	Response Speed	Output Impedance	Output current	Frequency-Division Range
VCC, GND	Power supply to encoder	-	About 300 Ω	300 mA	-
A+, B+, A-, B-, C+, D+, Z+, C-, D-, Z-	Signal input from encoder	0–80 kHz	-	-	-
OUT-A, OUT-B, COM	Frequency-division signal output	0–80 kHz	About 30 Ω	100 mA	1

2) Descriptions of terminals

The PG-C provides 15 terminals and a 16-pin interface, as shown in the following figure.

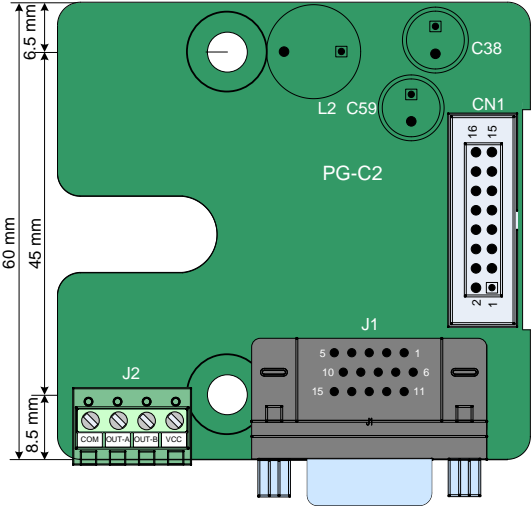
- VCC, GND: power supply to encoder
- A+, A-, B+, B-, C+, C-, D+, D-, Z+, Z-: encoder signal input
- OUT-A, OUT-B, COM: frequency-division signal output
- 16-pin interface: connected to the bottom drive board of the AC drive

Figure 3-28 PG-C physical appearance and dimensions (ERN1387 encoder)



**PG-C2**

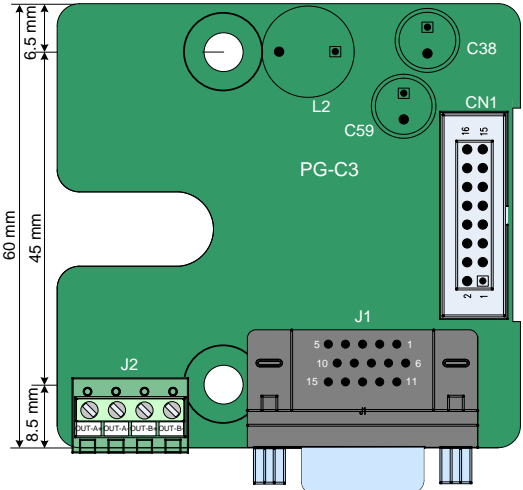
Figure 3-29 PG-C2 physical appearance and dimensions (open collector output)



The PG-C2 provides the type-D 15-pin (DB15) connector as the encoder interface, which is the only difference from the PG-C.

**PG-C3**

Figure 3-30 PG-C3 physical appearance and dimensions (differential output)

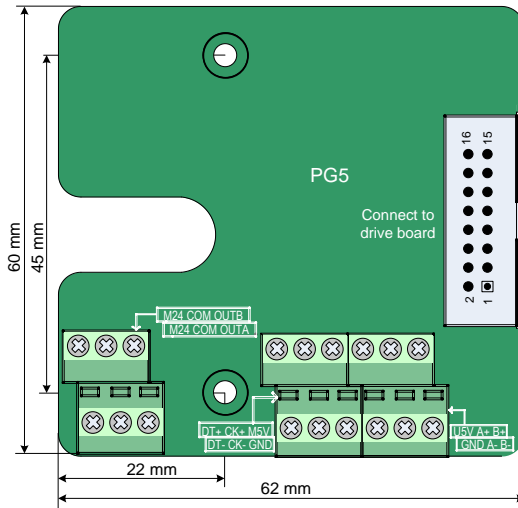


The PG-C3 differs from the PG-C2 only in that it provides differential output.

Both PG-C2 and PG-C3 uses the type-D 15-pin (DB15) connector for connecting the ERN1387 SIN/COS encoder. The following table describes the pin definition.

PG Card Model	DB15 Pin Definition	Applicable Encoder
PG-C2 PG-C3		ERN1387 SIN/COS encoder

**PG5**



The PG5 card provides 18 terminals and a 16-pin port.

The 6-pin terminal block provides frequency-division signal output and connects to the MCB, and the 12-pin terminal block connects to the encoder.

The 16-pin port connects to the drive board of the controller.

Connect the Haidenhain1313/413 encoder and PG card according to the following cable.



Encoder Cable Color	Encoder Signal Name	PG Card Terminal
Green black	Up	M5V
Yellow black	Sensor Up	U5V
Blue black	0V	GND
Red black	Sensor 0V	GND
Green brown	A+	A+
Blue	A-	A-
Grey	B+	B+
Pink	B-	B-
Purple	DATA	DT+
Yellow	DATA\	DT-
Green white	CLOCK	CK+
White	CLOCK\	CK-

## Chapter 4 Operation and Trial Running

### 4.1 Description of Running Modes and States

#### 4.1.1 Command Source

The command source is the channel of RUN commands and speed references. Two command sources are supported:

- Operation panel control  
The RUN commands are given by pressing keys  and  on the operation panel.
- Terminal control  
RUN commands and speed references are given by multi-function input terminals.  
Select one from the two command sources.

#### 4.1.2 Control Mode

Two control modes are supported:


- Sensorless vector control (SVC)
- Feedback vector control (FVC)

#### 4.1.3 Running Mode

- Motor auto-tuning mode  
The INVERTER supports two motor auto-tuning modes: with-load and no-load. For details, see the description of F1-11.
- Common mode  
It refers to the running in operation panel control or analog setting.
- Multi-speed mode  
The speed references are given by state combinations of multi-speed terminals.  
The AC drive can run in only one mode in a period.

#### 4.1.4 System State

The INVERTER has four states, stop, programming, running, and fault and alarm states.

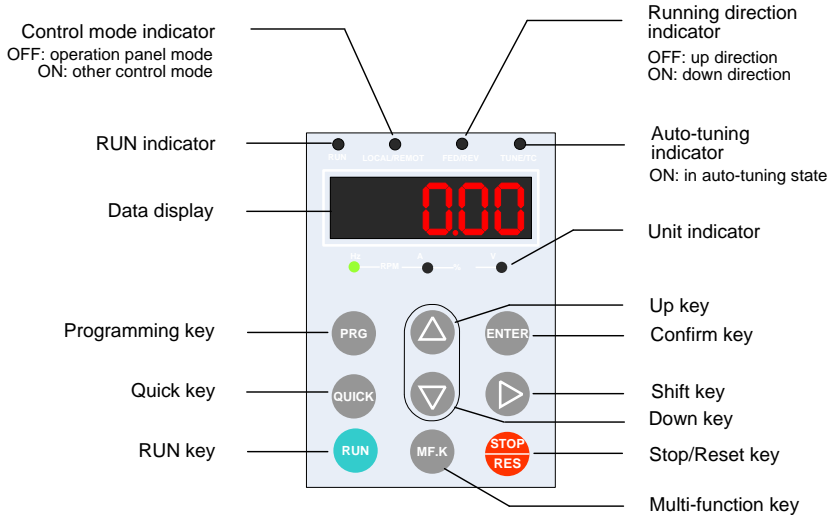
- Stop state  
After power-off and execution of RUN commands, the AC drive is in the stop state. The RUN indicator is OFF, and the operation panel display blinks; the parameters can be viewed circularly by pressing . The AC drive exits this state after receiving the RUN command again.
- Programming state  
The AC drive is in the programming state when you view and set parameters on the operation panel.
- Running state  
The AC drive is in running state (elevator running). The RUN indicator is ON. The operation panel display is not blinking.
- Fault and alarm state  
The AC drive becomes faulty and displays the fault code.



## 4.2 Use of the LED Operation Panel

You can modify the parameters, monitor the working status and start or stop the AC drive by operating the operation panel. The following figure shows the LED operation panel.

Figure 4-1 Diagram of the LED operation panel



### 1. Function indicators

- **RUN**  
ON indicates that the AC drive is in the running state, and OFF indicates that the AC drive is in the stop state.
- **LOCAL/REMOT**  
OFF indicates that the AC drive is in the operation panel running mode, and ON indicates that the AC drive is in terminal control mode.  
**FWD/REV**  
ON indicates down direction of the elevator, and OFF indicates up direction of the escalator.
- **TUNE/TC**  
ON indicates the auto-tuning state.

### 2. Data display

The 5-segment LED display can display the monitoring data such as frequency reference and output frequency, and fault codes.

3. Unit indicators

● means that the indicator is ON, and ○ means that the indicator is OFF.

● Hz—RPM—○ A—%—○ V: unit of frequency

○ Hz—RPM—● A—%—○ V: unit of current










○ Hz—RPM—○ A—%—● V: unit of voltage

● Hz—RPM—● A—%—○ V: RPM: unit of rotational speed

○ Hz—RPM—● A—%—● V: percentage

4. Keys

Table 4-1 Description of keys on the operation panel

Key	Name	Function
	Programming	Enter or exit Level-I menu.
	Confirm	Enter the menu interfaces level by level, and confirm the parameter setting.
	Up	Increase data or function code.
	Down	Decrease data or function code.
	Shift	Select the displayed parameters in turn in the stop or running state, and select the digit to be modified when modifying parameters.
	Run	Start the AC drive in the operation panel running mode.
	Stop/Reset	Stop the AC drive when it is in the running state and perform the reset operation when it is in the fault state.
	Quick	Enter or exit Level-I quick menu.
	Multi-function	Display or hide the fault information in the fault state, which facilitates parameter viewing.

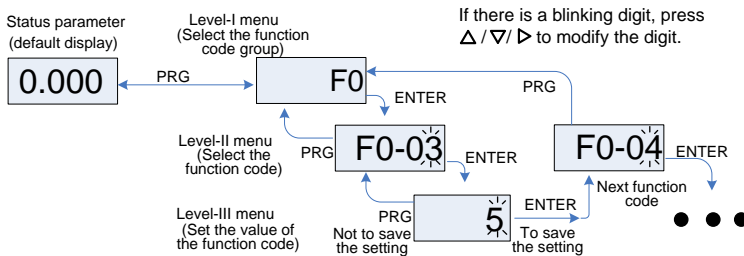
## 4.3 Viewing and Operation

### 4.3.1 Operation Procedure

The LED operation panel adopts three-level menu.

The three-level menu consists of function code group (Level I), function code (Level II), and function code setting value (level III), as shown in the following figure.

Figure 4-2 Operation procedure on the operation panel

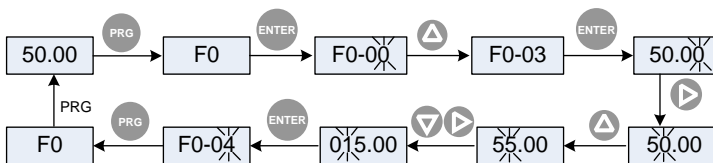


You can return to Level II menu from Level III menu by pressing  $\text{PRG}$  or  $\text{ENTER}$ . The difference between the two is as follows:

- After you press  $\text{ENTER}$ , the system saves the parameter setting first, and then goes back to Level II menu and shifts to the next function code.
- After you press  $\text{PRG}$ , the system does not save the parameter setting, but directly returns to Level II menu and remains at the current function code.

Here is an example of changing the value of F0-03 from 50.00 Hz to 15.00 Hz.

Figure 4-3 Example of changing the parameter value



In Level III menu, if the parameter has no blinking digit, it means that the parameter cannot be modified. This may be because:

- Such a parameter is only readable, such as actually detected parameters and running record parameters.
- Such a parameter cannot be modified in the running state and can only be changed at stop.

### 4.3.2 Viewing Status Parameters


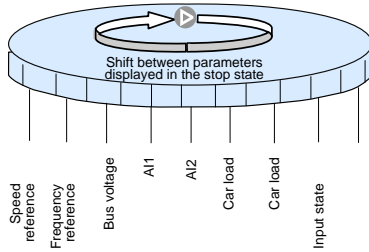
In the stop state, a total of 8 parameters can be displayed circularly by pressing . Select the parameters to be displayed by setting F8-02 (each bit of F8-02 indicates a parameter).

Figure 4-4 Shift between parameters displayed in the stop state




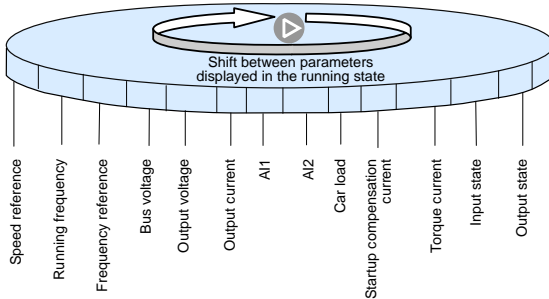
In the running state, a total of 13 parameters can be displayed circularly by pressing . You can select the parameters to be displayed by setting F8-01 (each bit of F8-01 indicates a parameter).

Figure 4-5 Shift between parameters displayed in the running state



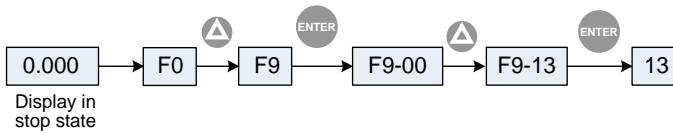
For details, see the description of corresponding parameters in [Chapter 6 Description of Function Codes](#).

### 4.3.3 Reading Fault Information

When a fault occurs on the AC drive, the operation panel displays the fault code. Based on the fault code, you can check the fault causes listed in [Chapter 8 Maintenance and Troubleshooting](#) to rectify the fault quickly.

The INVERTER records the latest 11 faults and the frequency, current, bus voltage, DI/DO terminal state of the latest three faults.

Figure 4-6 Viewing fault code



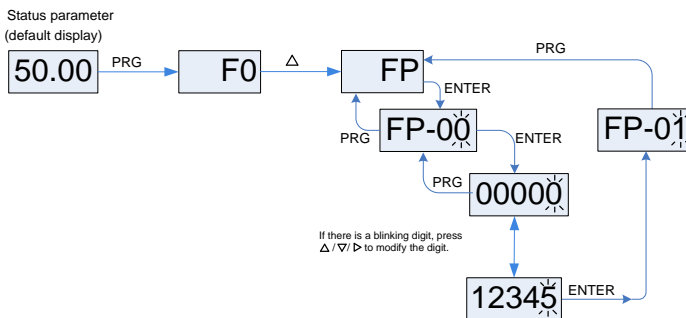
#### 4.3.4 Monitoring DI/DO Terminal State

The DI/DO terminal state needs to be monitored during running. For details, see the descriptions of F8-00 in [Chapter 6 Description of Function Codes](#).

### 4.4 Password Setting

The INVERTER provides the user password protection function.

Figure 4-7 Password setting



When FP-00 is set to a non-zero value, the password function is enabled. The password takes effect after you exit the function code editing state. When you press **PRG** again, "-----" will be displayed, and you must enter the correct user password to enter the menu.

To view factory parameters, you also need to enter the factory password. Do not try to modify factory parameters because incorrect setting will easily cause abnormality or damage to the AC drive.

During password setting, you can change the password and the last input is considered as the set password.

To cancel the password protection function, enter the menu with the correct password and then set FP-00 to 0.

## Chapter 5 Function Code Table

### 5.1 Brief Introduction

- There are a total of 17 function code groups, each of which includes several function codes. The function codes adopt the three-level menu. The function code group number is Level-I menu; the function code number is Level-II menu; the function code setting is Level-III menu.
- The meaning of each column in the function code table is as follows:

Item	Definition
Function code	Indicates the function code number.
Parameter name	Indicates the parameter name of the function code.
Setting range	Indicates the setting range of the parameter.
Min. unit	Indicates the minimum measurement unit of the parameter.
Default	Indicates the default setting of the parameter at factory.
Property	Indicates whether the parameter can be modified (including the modification conditions).

The modification property of the parameters includes three types, described as follows:

"☆☆": The parameter can be modified when the AC drive is in either stop or running state.

"★": The parameter cannot be modified when the AC drive is in the running state.

"●": The parameter is the actually measured value and cannot be modified.

The system automatically restricts the modification property of all parameters to prevent mal-function.

### 5.2 Function Code Groups

On the operation panel, press  and then  or , and you can view the function code groups.

The function code groups are classified as follows:

F0	Basic parameters	F8	Display parameters
F1	Motor parameters	F9	Protection function parameters
F2	Vector control parameters	FA	PG Parameters
F3	Startup/Stop control parameters	Fb	Communication parameters
F4	Input function parameters	FC	Special enhanced parameters
F5	Output function parameters	FU	Monitoring parameters
F6	Speed parameters	FF	Factory parameters
F7	Auxiliary function parameters	FP	User parameters

## 5.3 Function Code Table

Func. Code	Parameter Name	Setting Range	Default	Min. Unit	Property
Group F0: Basic Parameters					
F0-00	Control mode	0: Sensorless vector control (SVC) 1: Feedback vector control (FVC)	1	1	★
F0-01	Command source selection	0: Operation panel control 1: Terminal control	1	1	★
F0-02	Speed reference source	0: Digital setting 1: Multi-speed 2: AI1 3: AI2 4: Reserved 5: Special multi-speed	1	1	★
F0-03	Digital setting frequency	0.00 Hz to maximum frequency	0.00 Hz	0.01 Hz	☆
F0-04	Running direction	0: Direction unchanged 1: Direction reversed	0	1	★
F0-05	Maximum frequency	0.00–90.00	50.00	0.01 Hz	★
F0-06	Carrier frequency	0.5–16.0	Model dependent	0.1 kHz	☆
F0-07	Carrier frequency adjusting mode	0: Fixed PWM 1: Random PWM	0	1	☆
Group F1: Motor Parameters					
F1-00	Encoder type	0: SIN/COS encoder 1: UVW encoder 2: ABZ incremental encoder	0	1	★
F1-01	Rated motor power	0.4–110.0	Model dependent	0.1 kW	★
F1-02	Rated motor voltage	100–500	Model dependent	1 V	★
F1-03	Rated motor current	0.00–655.00	Model dependent	0.01 A	★
F1-04	Rated motor frequency	0.00 to maximum frequency	50.00	0.01 Hz	★
F1-05	Rated motor speed	0–3000	1460	1 RPM	★
F1-06	Reserved	-	-	-	★
F1-07	Synchronous motor power-off angle	0.0–359.9	0.0	0.1°	★
F1-08	Reserved	-	-	-	★
F1-09	Synchronous motor current filter coefficient	0.0–3.0	0.0	0.1	★
F1-10	Encoder verification selection	0–65535	0	1	★

Func. Code	Parameter Name	Setting Range	Default	Min. Unit	Property
F1-11	Motor auto-tuning mode	0: No operation 1: With-load auto-tuning 2: No-load auto-tuning	0	1	★
F1-12	Reserved	-	-	-	★
F1-13	Reserved	-	-	-	★
F1-14	Stator resistance	0.001–65.000	Model dependent	0.001 Ω	☆
F1-15	Asynchronous motor rotor resistance	0.001–65.000	Model dependent	0.001 Ω	☆
F1-16	Asynchronous motor leakage inductance	0.01–650.00	Model dependent	0.01 mH	☆
F1-17	Asynchronous motor mutual inductance	0.1–6500.0	Model dependent	0.1 mH	☆
F1-18	Asynchronous motor magnetizing current	0.01–650.00	Model dependent	0.01 A	☆
F1-19	Synchronous motor shaft D inductance	0.01–650.00	0.01	0.01 mH	★
F1-20	Synchronous motor shaft Q inductance	0.01–650.00	0.01	0.01 mH	★
F1-21	Synchronous motor back EMF	0–65535	0	1 V	★
F1-25	Motor type	0: Asynchronous motor 1: Synchronous motor	1	1	★
Group F2: Vector Control Parameters					
F2-00	Speed loop proportional gain 1	0–100	35	1	☆
F2-01	Speed loop integral time 1	0.01–10.00	0.60	0.01s	☆
F2-02	Switchover frequency 1	0.00 to F2-05	2.00	0.01 Hz	☆
F2-03	Speed loop proportional gain 2	0–100	30	1	☆
F2-04	Speed loop integral time 2	0.01–10.00	0.80	0.01s	☆
F2-05	Switchover frequency 2	F2-02 to maximum frequency	5.00	0.01 Hz	☆
F2-06	Current loop proportional gain	10–500	60	1	☆
F2-07	Current loop integral gain	10–500	30	1	☆
F2-08	Torque upper limit	0.0–200.0%	150.0%	0.1%	☆
F2-09	Torque acceleration time	1–500	1	1 ms	★
F2-10	Torque deceleration time	1–500	350	1 ms	★
F2-11	Speed filter coefficient	1–20	10	1	★
F2-12	Angle-free auto-tuning function selection	0–65535 Bit1: Angle-free auto-tuning function Bit2: Angle-free auto-tuning mode	0	1	★



Func. Code	Parameter Name	Setting Range	Default	Min. Unit	Property
Group F3: Startup/Stop Control Parameter					
F3-00	Startup frequency	0.00–10.00	0.00	0.01 Hz	☆
F3-01	Torque output delay	0.00–10.00	0.20	0.01s	★
F3-02	Brake release delay	0.20–10.00	0.20	0.01s	★
F3-03	Zero-speed delay	0.00–10.00	0.30	0.01s	★
F3-04	Startup time	0.00–10.00	0.00	0.01s	★
F3-05	Startup frequency holding time	0.00–10.00	0.00	0.01s	★
F3-06	Brake apply delay	0.00–10.00	0.20	0.01s	★
F3-07	Stop release delay	0.00–10.00	0.30	0.01s	★
F3-08	RUN contactor open delay	0.00–10.00	0.00	0.01s	★
F3-09	Startup pre-torque selection	0: Pre-torque invalid 1: DI setting 2: AI1 setting 3: AI2 setting 4: Fixed pre-torque 5: No-load-cell compensation	0	1	★
F3-10	Pre-torque offset	0.0–100.0%	48.0%	0.1%	☆
F3-11	Pre-torque gain	0.00–1.50	0.60	0.01	★
F3-12	Pre-torque initial offset	-100.0 to 100.0%	10.0%	0.1%	☆
F3-13	DI load cell signal 1	0.0–100.0%	10.0%	0.1%	★
F3-14	DI load cell signal 2	0.0–100.0%	30.0%	0.1%	★
F3-15	DI load cell signal 3	0.0–100.0%	70.0%	0.1%	★
F3-16	DI load cell signal 4	0.01–00.0%	90.0%	0.1%	★
F3-17	Filter time of load cell analog input	0.00–1.00	0.10	0.01s	☆
F3-18	Load cell analog no-load input	0.00–10.00	0.00	0.01 V	☆
F3-19	Load cell analog full-load input	0.00–10.00	10.00	0.01 V	☆
F3-20	Load for analog load cell auto-tuning	0–100	0	1	☆
F3-21	Analog load cell auto-tuning function	0: Disabled 1: Enabled	0	1	☆
F3-22	Pre-torque direction reversed	0: Enabled 1: Disabled	0	1	☆
F3-24	Slip test function	0: Disabled 1: Enabled	0	1	★

Func. Code	Parameter Name	Setting Range	Default	Min. Unit	Property
Group F4: Input Function Parameters					
F4-00	Input filter time	0.001–0.200	0.020	0.001s	☆
F4-01	DI1 function selection	0: Invalid	1	1	★
F4-02	DI2 function selection	1: Forward run (FWD) 2: Reverse run (REV)	2	1	★
F4-03	DI3 function selection	3: Multi-speed terminal 1 (K1)	3	1	★
F4-04	DI4 function selection	4: Multi-speed terminal 2 (K2)	4	1	★
F4-05	DI5 function selection	5: Multi-speed terminal 3 (K3) 6: Fault reset	5	1	★
F4-06	DI6 function selection	7: RUN disabled	6	1	★
F4-07	DI7 function selection	8: Inspection signal	7	1	★
F4-08	DI8 function selection	9: Emergency input	0	1	★
F4-09	DI9 function selection	10: RUN contactor feedback signal	0	1	★
F4-10	DI10 function selection	11: Brake contactor feedback signal 12: Load cell terminal 1 13: Load cell terminal 2 14: Load cell terminal 3 15: Load cell terminal 4 16: External fault input 17: Motor overheat signal 18: Up speed judgment 19: Down speed judgment 20: Multi-speed logic selection 1 21: Multi-speed logic selection 2 22: Direct travel ride command The setting range is 0–122. The hundred's digit indicates the NO/NC type (1: NC, 0: NO), and the lowest two digits indicate the selected function (invalid if the number is larger than 22).	0	1	★
F4-11 to F4-12	Reserved	-	-	-	★
F4-13	Multi-speed combination filter time	0.000–0.200	0.020	0.001s	☆

Func. Code	Parameter Name	Setting Range	Default	Min. Unit	Property
Group F5: Output Function Parameters					
F5-00	FM function selection	0: Invalid	15	1	★
F5-01	DO1 function selection	1: AC drive running	3	1	★
F5-02	DO2 function selection	2: Zero-speed running	0	1	★
F5-03	MCB relay function selection	3: Zero-speed signal	4	1	★
F5-04	Extension board relay function selection	4: Fault signal 5: RUN contactor control 6: Brake contactor control 7: Door pre-open signal 8: Bus undervoltage 9: FDT1 output 10: FDT2 output 11: Frequency reached 12: Overspeed output 14: Running time reached 15: Ready for RUN 16: Contact stuck control 17: Re-leveling output 18: Light-load running FDT frequency detection: detects the output frequency of the AC drive and compares it with the frequency reference, and outputs a related signal via the DO	0	1	★
F5-05	Reserved	-	-	-	★
F5-06	Zero-speed output hysteresis time	0.000–2.000	0.000	0.001s	★
F5-07	AO function selection	0: Running frequency 1: Frequency reference 2: Output current 3: Output torque 4: Output voltage 5: AI1 6: AI2	0	1	★
F5-08	AO zero offset coefficient	-100.0 to 100.0%	0.0%	0.1%	☆
F5-09	AO gain	-10.00–10.00	1.00	0.01	☆
Group F6: Speed Parameters					
F6-00	Speed 0	0.00 to maximum frequency	0.00	0.01 Hz	★
F6-01	Speed 1	0.00 to maximum frequency	0.00	0.01 Hz	★
F6-02	Speed 2	0.00 to maximum frequency	0.00	0.01 Hz	★
F6-03	Speed 3	0.00 to maximum frequency	0.00	0.01 Hz	★
F6-04	Speed 4	0.00 to maximum frequency	0.00	0.01 Hz	★
F6-05	Speed 5	0.00 to maximum frequency	0.00	0.01 Hz	★

Func. Code	Parameter Name	Setting Range	Default	Min. Unit	Property
F6-06	Speed 6	0.00 to maximum frequency	0.00	0.01 Hz	★
F6-07	Speed 7	0.00 to maximum frequency	0.00	0.01 Hz	★
F6-08	Running curve of speed 0	1–4	1	1	★
F6-09	Running curve of speed 1	1–4	1	1	★
F6-10	Running curve of speed 2	1–4	1	1	★
F6-11	Running curve of speed 3	1–4	1	1	★
F6-12	Running curve of speed 4	1–4	1	1	★
F6-13	Running curve of speed 5	1–4	1	1	★
F6-14	Running curve of speed 6	1–4	1	1	★
F6-15	Running curve of speed 7	1–4	1	1	★
F6-16	Inspection speed selection	0–7	0	1	★
F6-17	Emergency evacuation operation mode at power failure	0: Function disabled 1: UPS 2: 48 V battery power supply	0	1	★
F6-18	Analog minimum input	0.00–10.00	0.00	0.01 V	☆
F6-19	Corresponding percentage of analog minimum input	0.0–100.0%	0.0%	0.1%	☆
F6-20	Analog maximum input	0.00–10.00	10.00	0.01 V	☆
F6-21	Corresponding percentage of analog maximum input	0.0–100.0%	100.0%	0.1%	☆
F6-22	AI filter time	0.00–1.00s	0.10s	0.01s	☆
F6-23	AC drive function selection 1	0–65535 Bit0: Current cancellation at stop Bit1: No-load-cell compensation during auto-tuning Bit2: Stop waiting Bit4: Maximum frequency upper limit selection Bit5: Analog frequency setting base	48	1	☆
F6-24	Motor overheat voltage threshold	0.00–11.00	0.00	0.01 V	☆
F6-25	AC drive function selection 2	0–65535 Bit0: SPI communication fault detection Bit1: FA-03 and FA-05 modify property Bit2: Err16, Err17 and Err33 reset selection Bit3: No-load-cell compensation during emergency evacuation Bit4: Control mode restriction Bit5: Threshold selection of speed deviation too large	0	1	☆

Func. Code	Parameter Name	Setting Range	Default	Min. Unit	Property
F6-27	Zero-speed signal output delay	0–9999	0	1 ms	☆
F6-28	Upper limit of emergency evacuation speed	0.00 to maximum frequency	8.00	0.01 Hz	★
Group F7: Auxiliary Function Parameters					
F7-00	Acceleration time 1	1.0–100.0s	4.0s	0.1s	☆
F7-01	Deceleration time 1	1.0–100.0s	4.0s	0.1s	☆
F7-02	Time proportion of running curve 1 start segment	10.0–40.0%	40.0%	0.1%	★
F7-03	Time proportion of running curve 1 end segment	10.0–40.0%	40.0%	0.1%	★
F7-04	Acceleration time 2	1.0–100.0s	4.0s	0.1s	☆
F7-05	Deceleration time 2	1.0–100.0s	4.0s	0.1s	☆
F7-06	Time proportion of running curve 2 start segment	10.0–40.0%	40.0%	0.1%	★
F7-07	Time proportion of running curve 2 end segment	10.0–40.0%	40.0%	0.1%	★
F7-08	Acceleration time 3	1.0–100.0s	4.0s	0.1s	☆
F7-09	Deceleration time 3	1.0–100.0s	20.0s	0.1s	☆
F7-10	Time proportion of running curve 3 start segment	10.0–50.0%	40.0%	0.1%	★
F7-11	Time proportion of running curve 3 end segment	10.0–50.0%	40.0%	0.1%	★
F7-12	Acceleration time 4	0.5–100.0s	1.0s	0.1s	☆
F7-13	Deceleration time 4	0.5–100.0s	1.0s	0.1s	☆
F7-14	Time proportion of running curve 4 start segment	10.0–50.0%	40.0%	0.1%	★
F7-15	Time proportion of running curve 4 end segment	10.0–50.0%	40.0%	0.1%	★
F7-16	Slip test acceleration time	0.5–10.0	1.0	0.1s	★
F7-17	Set distance of direct travel ride	0.0–6553.5	0.0	0.1 mm	★
F7-18	Actual distance of direct travel ride	0.0–6553.5	0.0	0.1 mm	●

Func. Code	Parameter Name	Setting Range	Default	Min. Unit	Property
Group F8: Display Parameters					
F8-00	Input/Output terminal state	-	-	-	●
F8-01	Display in running state	1–32767 Bit0: Speed reference Bit1: Running frequency Bit2: Frequency reference Bit3: Bus voltage Bit4: Output voltage Bit5: Output current Bit6: AI1 Bit7: AI2 Bit8: Car load (%) Bit9: Startup compensation current (%) Bit10: Torque current (%) Bit11: Input state Bit12: Output state	32767	1	☆
F8-02	Display in stop state	1–255 Bit0: Speed reference Bit1: Frequency reference Bit2: Bus voltage Bit3: AI1 Bit4: AI2 Bit5: Car load (%) Bit6: Input state Bit7: Output state	255	1	☆
F8-03	Rated elevator speed	0.001–8.000	1.600	0.001 m/s	☆
F8-04	Heatsink temperature	0–100	-	1°C	●
F8-05	MCB software version	0.00–99.99	-	0.01	●
F8-06	Drive board software version	0–65535	-	1	●
F8-07	Set running time	0–65500	0	1 h	☆
F8-08	Accumulative running time (hour)	0–65500	0	1 h	●
F8-09	Accumulative running time (s)	0–3600	0	1s	●
F8-10	High byte of running times	0–9999	0	1	●
F8-11	Low byte or running times	0–9999	0	1	●
F8-12	Short circuit to ground detection at power-on	0: Disabled 1: Enabled	0	1	☆
F8-13	MCB software temporary version	0.00–99.99	-	0.01	●
F8-14	MCB software customer version	0.00–99.99	-	0.01	●

Func. Code	Parameter Name	Setting Range	Default	Min. Unit	Property
F8-17	Year	2000–2100	2014	1	☆
F8-18	Month	0101–1231	0101	0101	☆
F8-19	Hour.minute	00.00–23.59	00.00	00.01	☆
Group F9: Protection Function Parameters					
F9-09	Fault auto reset times	0–3	0	1	☆
F9-11	Fault auto reset delay	0.1–100.0	1.0	0.1s	☆
F9-12	Input phase loss protection	0: Disabled 1: Enabled	1	1	☆
F9-13	Output phase loss protection	0–3 Bit0: Output phase loss detection during running Bit1: Output phase loss detection at startup	1	1	☆
F9-14	1st fault code	0–60	0	1	●
F9-15	1st fault subcode	0–999	0	1	●
F9-16	1st fault month and day	0–1231	0	1	●
F9-17	1st fault hour and minute	00.00–23.59	0	0.01	●
F9-18	2nd fault code	0–60	0	1	●
F9-19	2nd fault subcode	0–999	0	1	●
F9-20	2nd fault month and day	0–1231	0	1	●
F9-21	2nd fault hour and minute	00.00–23.59	0	0.01	●
F9-22	3rd fault code	0–60	0	1	●
F9-23	3rd fault subcode	0–999	0	1	●
F9-24	3rd fault month and day	0–1231	0	1	●
F9-25	3rd fault hour and minute	00.00–23.59	0	0.01	●
F9-26	4th fault code	0–60	0	1	●
F9-27	4th fault subcode	0–999	0	1	●
F9-28	4th fault month and day	0–1231	0	1	●
F9-29	4th fault hour and minute	00.00–23.59	0	0.01	●
F9-30	5th fault code	0–60	0	1	●
F9-31	5th fault subcode	0–999	0	1	●
F9-32	5th fault month and day	0–1231	0	1	●
F9-33	5th fault hour and minute	00.00–23.59	0	0.01	●
F9-34	6th fault code	0–60	0	1	●
F9-35	6th fault subcode	0–999	0	1	●

Func. Code	Parameter Name	Setting Range	Default	Min. Unit	Property
F9-36	6th fault month and day	0-1231	0	1	●
F9-37	6th fault hour and minute	00.00-23.59	0.01	0	●
F9-38	7th fault code	0-60	0	1	●
F9-39	7th fault subcode	0-999	0	1	●
F9-40	7th fault month and day	0-1231	0	1	●
F9-41	7th fault hour and minute	00.00-23.59	0	0.01	●
F9-42	8th fault code	0-60	0	1	●
F9-43	8th fault subcode	0-999	0	1	●
F9-44	8th fault month and day	0-1231	0	1	●
F9-45	8th fault hour and minute	00.00-23.59	0	0.01	●
F9-46	9th fault code	0-60	0	1	●
F9-47	9th fault subcode	0-999	0	1	●
F9-48	9th fault month and day	0-1231	0	1	●
F9-49	9th fault hour and minute	00.00-23.59	0	0.01	●
F9-50	10th fault code	0-60	0	1	●
F9-51	10th fault subcode	0-999	0	1	●
F9-52	10th fault month and day	0-1231	0	1	●
F9-53	10th fault hour and minute	00.00-23.59	0	0.01	●
F9-54	Latest fault code	0-60	0	1	●
F9-55	Latest fault subcode	0-999	0	1	●
F9-56	Latest fault month and day	0-1231	0	1	●
F9-57	Latest fault hour and minute	00.00-23.59	0	0.01	●
F9-58	Logic information of latest fault	0-65535	0	1	●
F9-59	Set frequency upon latest fault	0.00-99.00	0.00	0.01 Hz	●
F9-60	Feedback frequency upon latest fault	0.00-99.00	0.00	0.01 Hz	●
F9-61	Bus voltage upon latest fault	0.0-6500.0	0.0	0.1 V	●
F9-62	Output voltage upon latest fault	0-65000	0	1 V	●
F9-63	Output current upon latest fault	0.00-650.00	0.00	0.01 A	●
F9-64	Torque current upon latest fault	0.00-650.00	0.00	0.01 A	●
F9-65	Output power upon latest fault	0.00-99.99	0.00	0.01 kW	●
F9-66	Input function state 1 upon latest fault	0-65535	0	1	●



Func. Code	Parameter Name	Setting Range	Default	Min. Unit	Property
F9-67	Input function state 2 upon latest fault	0-65535	0	1	●
F9-68	Output function state 1 upon latest fault	0-65535	0	1	●
F9-69	Output function state 2 upon latest fault	0-65535	0	1	●
Group FA: PG Parameters					
FA-00	Encoder PPR	100-9999	1024	1	★
FA-01	Encoder wire-breaking detection time	0.0-10.0	1.0	0.1s	★
FA-03	Encoder magnetic pole angle	0.0-359.9	0.0	0.1°	★
FA-04	Encoder current angle	0.0-359.9	0.0	0.1°	●
FA-05	Wiring mode	0-15	0	1	★
FA-06	PG card frequency-division coefficient ratio (for direct travel ride)	1-65535	1	1	★
Group Fb: Communication Parameters (Reserved)					
Group FC: Special Enhanced Parameters					
FC-00	Action at command abnormal	0: Decelerate to stop 1: Block output immediately	1	1	★
FC-01	Deceleration time at abnormality	0.0-300.0	3.0	0.1s	★
FC-02	Up speed threshold	0.00 Hz to maximum frequency	45.00	0.01 Hz	★
FC-03	Down speed threshold	0.00 Hz to maximum frequency	45.00	0.01 Hz	★
FC-04	Door pre-open judging frequency	0.00 Hz to maximum frequency	5.00	0.01 Hz	★
FC-05	Frequency detection level 1 (FDT frequency 1)	0.00 Hz to maximum frequency	50.00	0.01 Hz	☆
FC-06	Frequency detection level 2 (FDT frequency 2)	0.00 Hz to maximum frequency	50.00	0.01 Hz	☆
FC-07	Frequency detection hysteresis	0.0-100.0%	5.0%	0.1%	☆
FC-08	Frequency reached detection width	0.0-100.0%	0.0%	0.1%	☆
FC-09	Overspeed detection threshold	80-120%	115%	1%	☆
FC-10	Overspeed detection time	0.0-5.0	1.0s	0.1s	☆
FC-11	Action selection at overspeed	0: Decelerate to stop at abnormality 1: Alarm and block output immediately 2: Continue to run	1	1	☆
FC-12	Speed deviation detection threshold	0-50%	30%	1%	☆
FC-13	Speed deviation detection time	0.0-5.0s	1.0s	0.1s	☆

Func. Code	Parameter Name	Setting Range	Default	Min. Unit	Property
FC-14	Action selection at speed deviation too large	0: Decelerate to stop at abnormality 1: Alarm and block output immediately 2: Continue to run	1	1	☆
Group Fd: Special Function Parameters					
Fd-00	Torque boost	0.1%–30.0%	1.0%	0.1%	★
Fd-01	Cut-off frequency of torque boost	0.00 to maximum frequency	50.00	0.01 Hz	★
Fd-02	V/F slip compensation gain	0.0–200.0%	100.0%	0.1%	★
Fd-03	Oscillation suppression gain	0–100	20	1	★
Fd-04	AC drive function selection 3	0–65535	0	1	★
Fd-05	Position lock current coefficient	1.0–50.0%	15.0%	0.1%	★
Fd-06	Position lock speed loop KP	0.05–1.00	0.50	0.01	★
Fd-07	Position lock speed loop TI	0.05–2.00	0.60	0.01	★
Group FU: Monitoring Parameters					
FU-00	Pre-torque current	-200.0 to 200.0%	0.0%	0.1%	●
FU-01	Logic information	0–65535	0	1	●
FU-02	Frequency reference	0.00–99.00	0.00	0.01 Hz	●
FU-03	Feedback frequency	0.00–99.00	0.00	0.01 Hz	●
FU-04	Bus voltage	0.0–6500.0	0.0	0.1 V	●
FU-05	Output voltage	0–65000	0	1 V	●
FU-06	Output current	0.00–650.00	0.00	0.01 A	●
FU-07	Output torque	0.0–200.0%	0.0%	0.1%	●
FU-08	Torque current	0.00–650.00	0.00	0.01 A	●
FU-09	Output power	-99.99 to 99.99	0.00	0.01 kW	●
FU-10	Car load	0.0–100.0%	0.0%	0.1%	●
FU-11	Car speed	0.000–65.000	0.000	0.001 m/s	●
FU-12	Communication interference	0–65535	0	1	●
FU-13	Input function state 1	0–65535	0	1	●
FU-14	Input function state 2	0–65535	0	1	●
FU-15	Output function state 1	0–65535	0	1	●
FU-16	Output function 2	0–65535	0	1	●
FU-17	AI1 voltage	0.00–20.00	0.00	0.01 V	●
FU-18	AI2 voltage	0.00–20.00	0.00	0.01 V	●
FU-19	AO1 voltage	0.00–20.00	0.00	0.01 V	●

Func. Code	Parameter Name	Setting Range	Default	Min. Unit	Property
FU-20	Startup rollback coefficient	0-65535	0	1	●
FU-21	PG card pulses per second	0-65535	0	1	●
Group FP: User Parameters					
FP-00	User password	0-65535	0	1	☆
FP-01	Parameter update	0: No operation 1: Restore default setting 2: Clear fault records	0	1	★
FP-02	User-defined parameter display	0: Invalid 1: Valid	0	1	★

## Chapter 6 Description of Function Codes

### Group F0: Basic Parameters

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F0-00	Control mode	0: Sensorless vector control (SVC) 1: Feedback vector control (FVC)	1	1



It sets the control mode of the system, as described in the following table.

Value	Control Mode	Description	Require Encoder?
0	SVC	It is applicable to: Commissioning and fault judgment at inspection of the asynchronous motor It is not applicable to synchronous motor.	No
1	FVC	It provides high-precision speed control. This mode is used during normal running. Motor auto-tuning is required to obtain correct motor parameters for this mode. Better performance is achieved by adjusting group F2 parameters.	Yes

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F0-01	Command source selection	0: Operation panel control 1: Terminal control	1	1

It sets the channel of control commands including startup and stop.

- 0: Operation panel control (LOCAL/REMOT indicator ON)

The RUN commands are given by pressing keys  and  on the operation panel.  
Change the running direction by modifying F0-04.

- 1: Terminal control (LOCAL/REMOT indicator OFF)

Commands are given by using multi-functional input terminals with functions such as FWD and REV.

Note that when F0-01 = 1, F0-00 is restricted to 1 by default and cannot be modified.

After being changed to 0, F0-01 can be restored to 1 only after power-on again.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F0-02	Speed reference source	1-5	1	1

It sets the input channel of speed references.

0: Digital setting

The initial speed is the value of F0-03.

1: Multi-speed

If multi-speed is used, the relationship between signals and frequencies need to be determined by group F4 and F6 parameters.

2: AI1      3: AI2

The speed reference is given by an analog input (AI) terminal. Two AI terminals are available in the standard configuration: AI1 (0–10 V voltage input) and AI2 (0–10 V voltage input or 4–20 mA current input, determined by jumper J3 on the MCB).

4: Reserved

5: Special multi-speed

It is used in special applications, and generally not used.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F0-03	Digital setting frequency	0.00 Hz to maximum frequency	0.00 Hz	0.01 Hz

It sets the target frequency when the F0-02 (Speed reference source) is 0 (Digital setting).

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F0-04	Running direction	0: Direction unchanged 1: Direction reversed	0	1

The running direction can be reversed by modifying this parameter (without changing the wiring of the motor).

The motor running direction is restored after parameter initialization. Use this function with caution.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F0-05	Maximum frequency	0.00–90.00	50.00	0.01 Hz

It is used to set the maximum output frequency of the AC drive. If it is set to above the mains frequency, the load of the elevator mechanical part must be taken into full consideration.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F0-06	Carrier frequency	0.5–16.0	Model dependent	0.1 kHz

It sets the carrier frequency of the AC drive.

The carrier frequency is closely related to the motor noise during running. When it is generally set above 10 kHz, mute running is achieved. It is recommended to set the carrier frequency to the lowest within the allowable noise.

When the carrier frequency reduces, the following factors increase:

- Harmonics of output current
- Motor power loss
- Motor temperature rise

When the carrier frequency increases:

- Motor power loss and temperature rise declines.
- Power loss, system temperature rise and interference increase.

Adjusting the carrier frequency will exert influences on the aspects listed in the following table.

Table 6-1 Influences of carrier frequency adjustment

Carrier frequency	Low	High
Motor noise	Large	Small
Output current waveform	Bad	Good
Motor temperature rise	High	Low
Controller temperature rise	Low	High
Leakage current	Small	Large
External radiation interference	Small	Large

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F0-07	Carrier frequency adjusting mode	0–1	0	1

- 0: Fixed PWM

The motor noise frequency is fixed.

- 1: Random PWM

The motor noise has wide frequency domain.

## Group F1: Motor Parameters

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F1-00	Encoder type	0: SIN/COS encoder 1: UVW encoder 2: ABZ incremental encoder	0	1

Set F1-00 based on the actual encoder matching the motor, and set the PG card parameters in group FA correctly.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F1-01	Rated motor power	0.4–110.0	Model dependent	0.1 kW
F1-02	Rated motor voltage	100–500	Model dependent	1 V
F1-03	Rated motor current	0.00–655.00	Model dependent	0.01 A
F1-04	Rated motor frequency	0.00 to maximum frequency	50.00	0.01 Hz
F1-05	Rated motor speed	0–3000	1460	1 RPM

Set these parameters according to the motor nameplate.

Ensure that these motor parameters are set correctly. Incorrect setting affects the motor auto-tuning and the vector control effect.

Select the motor adaptable to the AC drive. If there is a great difference between the actual motor power and the standard motor power, the control performance will degrade.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F1-07	Synchronous motor power-off angle	0.0–359.9	0.0	0.1°

It is the angle of the motor magnetic pole at power-off. The AC drive records this value and compares it with the value at next power-on.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F1-09	Synchronous motor current filter coefficient	0.0–3.0	0.0	0.1

It sets the current filter time, which suppress the periodic vertical jitter. Increase the value in ascending order of 0.5 to achieve the optimum effect.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
<b>F1-10</b>	Encoder verification selection	0–65535	0	1

It is the factory parameters. Do not change this value randomly.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
<b>F1-11</b>	Motor auto-tuning mode	0: No operation 1: With-load auto-tuning 2: No-load auto-tuning	0	1

When F1-11 = 1, the asynchronous motor remains static and the synchronous motor rotates during auto-tuning.

Follow the following precautions during auto-tuning:

Ensure that all wiring and installation meet the safety specifications.

Ensure that the motor wiring is correct (UVW cables of the motor respectively connected to UVW cables of the AC drive) for with-load auto-tuning. If the motor wiring is incorrect, the motor may jitter or fail to run after the brake is released; in this case, you need to replace any two of the motor UVW cables.

Reset the current fault and then start auto-tuning, because the system does not enter the auto-tuning state ("TUNE" is not displayed) when there is a fault.

Perform motor auto-tuning again if the phase sequence or encoder of the synchronous motor is replaced.

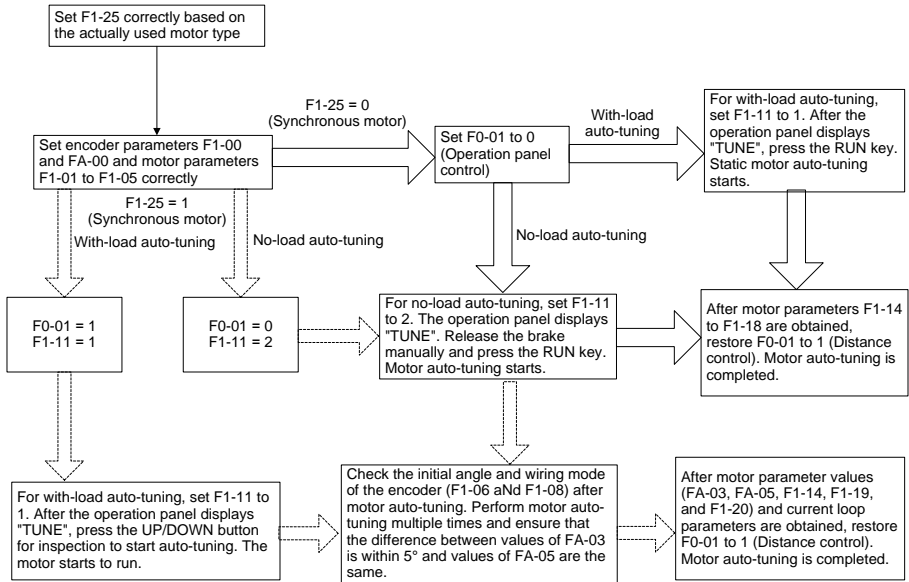
For the synchronous motor, perform three or more times of auto-tuning, compare the obtained values of FA-03 (Encoder magnetic pole angle). The value deviation of FA-03 shall be within  $\pm 5^\circ$ , which indicates that the auto-tuning is successful.

After the auto-tuning is completed, perform trial inspection running. Check whether the current is normal, and whether the actual running direction is the same as the set direction. If the running direction is different from the set direction, change the value of F0-04.

With-load auto-tuning is dangerous (inspection-speed running of many control cabinets is emergency electric running and the shaft safety circuit is shorted). Ensure that there is no person in the shaft in this auto-tuning mode.

The following figure shows the motor auto-tuning process.

Figure 6-1 Motor auto-tuning process



More descriptions of motor auto-tuning are as follows:

- When the INVERTER drives the synchronous motor, an encoder is required to provide feedback signals. You must set the encoder parameters correctly before performing motor auto-tuning.
- During synchronous motor auto-tuning, the motor needs to rotate. The best auto-tuning mode is no-load auto-tuning; if this mode is impossible, then try with-load auto-tuning.
- For synchronous motor, with-load auto-tuning learns stator resistance, shaft-D and shaft-Q inductance, current loop (including position lock) PI parameters, and encoder magnetic pole angle; no-load auto-tuning additionally learns the encoder wiring mode.
- For the asynchronous motor, static auto-tuning learns stator resistance, rotor resistance, and leakage inductance, and automatically calculates the mutual inductance and motor magnetizing current. Complete auto-tuning learns the mutual inductance, motor magnetizing current, and current loop parameters.

For the sake of safety in different control modes, the system handles the output commands to the RUN contactor or brake contactor differently. In some situations, it is necessary to release the RUN contactor or the brake contactor manually.

The following table lists the output state of the running and brake contactors.



Table 6-2 Output state of the RUN and brake contactors

Control mode Output State	No-load Auto-tuning (F1-11 = 2)	With-load Auto-tuning (F1-11 = 1)		Operation Panel Control (F0-01 = 0)	Distance Control (F0-01 = 1)
		Synchronous Motor	Asynchronous Motor		
RUN contactor	Output	Output	Output	Not output	Output
Brake contactor	Not output	Output	Not output	Not output	Output

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F1-14	Stator resistance	0.001–65.000	Model dependent	0.001 Ω
F1-15	Asynchronous motor rotor resistance	0.001–65.000	Model dependent	0.001 Ω
F1-16	Asynchronous motor leakage inductance	0.01–650.00	Model dependent	0.01 mH
F1-17	Asynchronous motor mutual inductance	0.1–6500.0	Model dependent	0.1 mH
F1-18	Asynchronous motor magnetizing current	0.01–650.00	Model dependent	0.01 A
F1-19	Synchronous motor shaft D inductance	0.01–650.00	0.01	0.01 mH
F1-20	Synchronous motor shaft Q inductance	0.01–650.00	0.01	0.01 mH
F1-21	Synchronous motor back EMF	0–65535	0	1 V
F1-25	Motor type	0: Asynchronous motor 1: Synchronous motor	1	1

F1-14 to F1-21 are obtained by means of motor auto-tuning. After the motor auto-tuning is completed successfully, the values of these parameters are updated automatically.

If asynchronous motor auto-tuning cannot be performed onsite, manually enter the values by referring to data of the motor with the same nameplate parameters.

Each time F1-01 (Rated motor power) of the asynchronous motor is modified, F1-14 to F1-18 automatically resume to the default values for the standard motor.

## Group F2: Vector Control Parameters

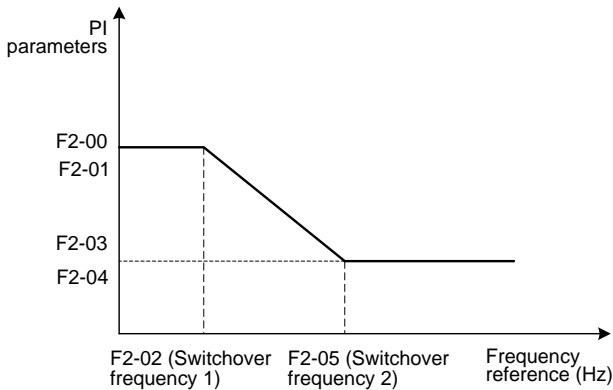
Function Code	Parameter Name	Setting Range	Default	Min. Unit
F2-00	Speed loop proportional gain 1	0–100	35	1
F2-01	Speed loop integral time 1	0.01–10.00	0.60	0.01s
F2-02	Switchover frequency 1	0.00 to F2-05	2.00	0.01 Hz
F2-03	Speed loop proportional gain 2	0–100	30	1
F2-04	Speed loop integral time 2	0.01–10.00	0.80	0.01s
F2-05	Switchover frequency 2	F2-02 to maximum frequency	5.00	0.01 Hz

F2-00 and F2-01 are PI regulation parameters when the running frequency is smaller than the value of F2-02 (Switchover frequency 1).

F2-03 and F2-04 are PI regulation parameters when the running frequency is larger than the value of F2-05 (Switchover frequency 2).

If the running frequency is between F2-02 and F2-05, the speed loop PI parameters are obtained from the weighted average value of the two groups of PI parameters (F2-00, F2-01 and F2-03, F2-04), as shown in the following figure.

Figure 6-2 Relationship between running frequencies and PI parameters



The speed dynamic response characteristics in vector control can be adjusted by setting the proportional gain and integral time of the speed regulator.

To achieve a faster system response, increase the proportional gain and reduce the integral time. Be aware that this may lead to system oscillation.

The recommended adjustment method is as follows:

The default setting meets the requirements of most applications. If the default setting cannot meet the requirements (especially when the motor power is very small), the default speed loop proportional gain may be a little large, and the motor oscillates at startup.

In this case, decrease the proportional gain first to ensure that the system does not oscillate, and then reduce the integral time to ensure that the system has quick response but small overshoot.

If both F2-02 (Switchover frequency 1) and F2-05 (Switchover frequency 2) are 0, only F2-03 and F2-04 are valid.

Note that improper PI parameter setting may cause too large speed overshoot, and overvoltage fault may even occur when the overshoot drops.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F2-06	Current loop proportional gain	10–500	60	1
F2-07	Current loop integral gain	10–500	30	1

These two parameters are current loop regulation parameters in vector control.

The default setting achieves good control performance, and you need not modify them generally.

If they need to be modified, the method is similar to that of PI parameters.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F2-08	Torque upper limit	0.0–200.0%	150.0%	0.1%

It is used to set the torque upper limit of the motor. It is also the pre-torque compensation upper limit during elevator startup.

The value 100% corresponds to the rated output torque of the adaptable motor.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F2-09	Torque acceleration time	1–500	1	1 ms
F2-10	Torque deceleration time	1–500	350	1 ms

These two parameters are used to set the acceleration time and deceleration time of the torque current.

If the motor has abnormal sound when the current is applied at startup, increase the value of F2-09 to eliminate the abnormal sound.

If the motor has abnormal sound when the current is withdrawn at stop, increase the value of F2-10 to eliminate the abnormal sound.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F2-11	Speed filter coefficient	1–20	10	1

It eliminates fluctuation of speed feedback, and need not be modified generally.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F2-12	Angle-free auto-tuning function selection	0–65535	0	1

It sets the angle-free auto-tuning function.

F2-12 Angle-free auto-tuning function selection				
Bit	Function	Description		Default
Bit1	Angle-free auto-tuning function	0: Disabled 1: Enabled		0
Bit2	Angle-free auto-tuning mode	0: Half automatic The angle-free auto-tuning function is enabled only when the inspection signal is active. 1: Full automatic The angle-free auto-tuning function is enabled both when the inspection signal is active and inactive.		0

### Group F3: Startup/Stop Control Parameter

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F3-00	Startup frequency	0.00–10.00	0.00	0.01 Hz

Set the proper startup frequency to increase the torque at elevator startup.

The magnetic flux is set up at motor startup if the startup frequency holding time is set.

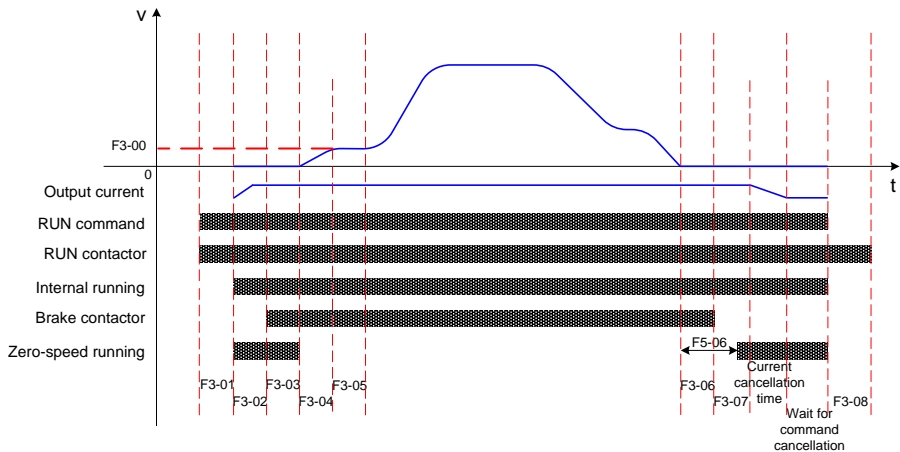
The startup frequency function is valid only when the speed reference source is multi-speed.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F3-01	Torque output delay	0.00–10.00	0.20	0.01s
F3-02	Brake release delay	0.20–10.00	0.20	0.01s
F3-03	Zero-speed delay	0.00–10.00	0.30	0.01s
F3-04	Startup time	0.00–10.00	0.00	0.01s
F3-05	Startup frequency holding time	0.00–10.00	0.00	0.01s
F3-06	Brake apply delay	0.00–10.00	0.20	0.01s
F3-07	Stop release delay	0.00–10.00	0.30	0.01s
F3-08	RUN contactor open delay	0.00–10.00	0.00	0.01s

These parameters are used to improve the riding comfort at elevator startup and stop.

The following figure shows the time sequence (multi-speed as an example).

Figure 6-3 Running time sequence



"Current cancellation time" is dependent on the actual current and torque acceleration/deceleration time (F2-10).

"Wait for command cancellation" can be set to be always waiting or a maximum of 5s waiting time, according to the setting of F6-23.

- When the RUN contactor output is not used, the time segments specified in F3-01 and F3-08 are skipped directly.
- When the brake contactor output and running output are not used, the time segments specified in F3-02 and F3-07 are skipped directly.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F3-09	Startup pre-torque selection	0: Pre-torque invalid 1: DI setting 2: AI1 setting 3: AI2 setting 4: Fixed pre-torque 5: No-load-cell compensation	0	1

The INVERTER provides five pre-torque settings.

- When F3-09 = 1, 2 or 3, a load cell is required additionally.

When pre-torque compensation is used, the system outputs the torque matching the elevator load beforehand to guarantee the riding comfort at the moment when the brake is released.

The output torque is restricted by the torque upper limit (F2-08). When the calculated pre-torque is larger than F2-08, the value of F2-08 is output.

- If no load cell is installed, set F3-09 to 4, and adjust the value of F3-12 so that the AC drive can perform pre-excitation fully before the brake is released, improving the riding comfort. The recommended value of F3-12 is between -15% and +15%.
- If no-load-cell compensation is used, set F3-09 to 5, and adjust Fd-05 to Fd-07 properly on the basis of Fd-05 = 15.0%, Fd-07 = 0.50, and Fd-08 = 0.60.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F3-10	Pre-torque offset	0.0–100.0%	48.0%	0.1%
F3-11	Pre-torque gain	0.00–1.50	0.60	0.01

F3-10 is actually the balance coefficient of the elevator, indicating the percentage of the counterweight to the rated load.

Assume that the no-load weight is G1, counterweight is G2, and rated elevator load is G3:

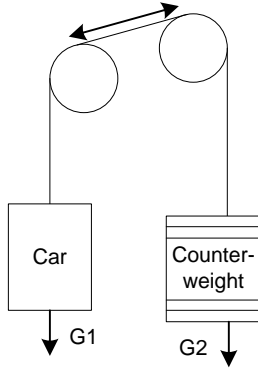
$$F3-10 = (G2-G1)/G3$$

Assume that the load in the car is G4:

$$\text{Motor pre-torque output} = F3-11 \times [G4 - (G3 \times F3-10)]$$

The output pre-torque direction is only related to the car load, but irrelative to the running direction. If the car load is larger than (G3 x F3-10), the output pre-torque direction is up direction; otherwise, it is down direction.

Figure 6-4 Relationship between car load and counterweight



Function Code	Parameter Name	Setting Range	Default	Min. Unit
F3-12	Pre-torque initial offset	-100.0 to 100.0%	10.0%	0.1%

If F3-09 = 4 (Fixed pre-torque), the AC drive outputs the pre-torque current based on the value of F3-12 to perform pre-excitation before the brake is released, improving the riding comfort.

The recommended value of F3-12 is between -15% and +15%.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F3-13	DI load cell signal 1	0.0–100.0%	10.0%	0.1%
F3-14	DI load cell signal 2	0.0–100.0%	30.0%	0.1%
F3-15	DI load cell signal 3	0.0–100.0%	70.0%	0.1%
F3-16	DI load cell signal 4	0.01–00.0%	90.0%	0.1%

When F3-09 = 1, the AC drive detects the car load and controls the pre-torque output current based on these four signals.

F3-13 to F3-16 set the signals of the four load cell DI terminals. The setting is the car load percentage when the signal is active.

For example, if DI load cell signal 1 becomes active when the car load reaches 10%, set F3-13 to 10%; if DI load cell signal 2 becomes active when the car load reaches 30%, set F3-14 to 30%.

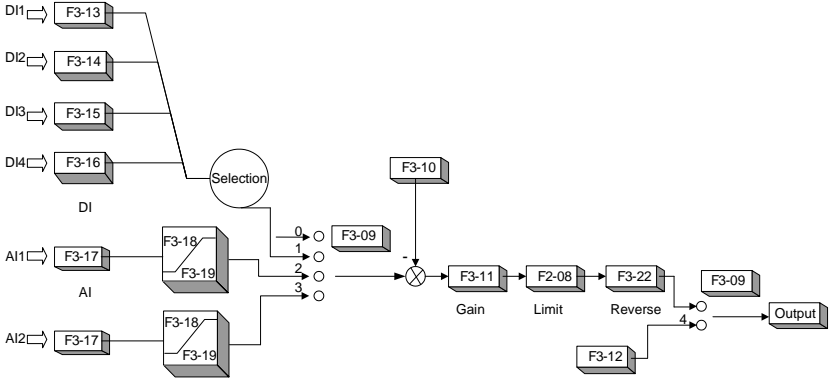
Function Code	Parameter Name	Setting Range	Default	Min. Unit
F3-17	Filter time of load cell analog input	0.00–1.00	0.10	0.01s
F3-18	Load cell analog no-load input	0.00–10.00	0.00	0.01 V
F3-19	Load cell analog full-load input	0.00–10.00	10.00	0.01 V

When F3-09 = 2 or 3, the AC drive detects the car load and controls the pre-torque output current based on AI1 or AI2 signal.

F3-17 is the filter time of the analog signal. Increasing this parameter can improve the anti-interference capability of the load cell signal.

When the analog load cell input is used, the corresponding input voltages at car no-load and full-load must be set to ensure correct pre-torque compensation.

Figure 6-5 Pre-torque compensation principle



Function Code	Parameter Name	Setting Range	Default	Min. Unit
F3-20	Load for analog load cell auto-tuning	0-100	0	1
F3-21	Analog load cell auto-tuning function	0: Disabled 1: Enabled	0	1

When the analog load cell input is used, load-cell auto-tuning is required.

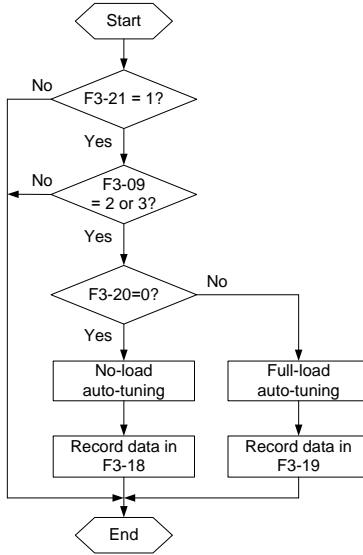
To perform load cell auto-tuning, do as follows:

1. Ensure that F3-21 is set to 1 and F3-09 is set to 2 or 3 to make the system allow load cell auto-tuning.
2. Stop the elevator at any floor, with the car in the no-load state. Set F3-20 to 0 and press **ENTER**.
3. Put N% load in the car. Then set F3-20 to N and press **ENTER**.

For example, if you put 100 kg load in the elevator with rated load of 1000 kg, set F3-20 to 10.

After the load-cell auto-tuning is completed, the corresponding no-load and full-load data will be recorded in F3-18 and F3-19. You can also manually input the data according to the actual situation.

Figure 6-6 Analog load-cell auto-tuning flowchart



<b>Note</b>	<ol style="list-style-type: none"> <li>1. Restore F3-21 to 0 after the auto-tuning is completed.</li> <li>2. No-load auto-tuning must be performed before full-load auto-tuning; otherwise, the obtained data is incorrect.</li> </ol>
-------------	--

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F3-22	Pre-torque direction reversed	0: Enabled 1: Disabled	0	1

The pre-torque direction can be reversed directly with no need of changing the pre-torque value.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F3-24	Slip test function	0: Disabled 1: Enabled	0	1

The slip test can be performed only when the inspection input is set and the inspection signal is active.

The slip test procedure is as follows:

1. In the stop state, set F3-24 to
2. Make the inspection input active.
3. Press the inspection button to start inspection.

In the inspection test mode, the AC drive accelerates according to the acceleration time set in F7-16. If the slip effect is not obvious, decrease the value of F7-16 properly.

After the slip test is completed, restore F3-24 to 0.



## Group F4: Input Function Parameters


Function Code	Parameter Name	Setting Range	Default	Min. Unit
F4-00	Input filter time	0.001–0.200	0.020	0.001s

It is used to sensitivity of DI terminals. If DI terminals are liable to interference and may cause malfunction, increase the value of this parameter to enhance the anti-interference capability. However, increase of DI filter time will reduce the response of DI terminals.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F4-01	DI1 function selection	0–122	1	1
F4-02	DI2 function selection	0–122	2	1
F4-03	DI3 function selection	0–122	3	1
F4-04	DI4 function selection	0–122	4	1
F4-05	DI5 function selection	0–122	5	1
F4-06	DI6 function selection	0–122	6	1
F4-07	DI7 function selection	0–122	7	1
F4-08	DI8 function selection	0–122	0	1
F4-09	DI9 function selection	0–122	0	1
F4-10	DI10 function selection	0–122	0	1

These parameters set the functions of the DI terminals. The functions are described in the following table.

Value	Function	Description																																													
0	Invalid	Even if there is signal input to the terminal, the AC drive has no response. You can allocate this function to terminals that are not used to prevent malfunction.																																													
1	Forward run (FWD)	The DI terminals with the two signals control forward and reverse running of the AC drive to run the elevator in up and down directions.																																													
2	Reverse run (REV)	The DI must be off once after each running; otherwise, the elevator cannot execute next-time running. <table border="1" data-bbox="340 981 893 1109"> <thead> <tr> <th>DI with FWD</th> <th>DI with REV</th> <th>Meaning</th> </tr> </thead> <tbody> <tr> <td>OFF</td> <td>OFF</td> <td>Invalid</td> </tr> <tr> <td>ON</td> <td>OFF</td> <td>Forward</td> </tr> <tr> <td>OFF</td> <td>ON</td> <td>Reverse</td> </tr> <tr> <td>ON</td> <td>ON</td> <td>Invalid</td> </tr> </tbody> </table>	DI with FWD	DI with REV	Meaning	OFF	OFF	Invalid	ON	OFF	Forward	OFF	ON	Reverse	ON	ON	Invalid																														
DI with FWD	DI with REV	Meaning																																													
OFF	OFF	Invalid																																													
ON	OFF	Forward																																													
OFF	ON	Reverse																																													
ON	ON	Invalid																																													
3	Multi-speed terminal 1 (K1)	The 8 speeds are implemented through 8 state combinations of these three terminals.																																													
4	Multi-speed terminal 2 (K2)																																														
5	Multi-speed terminal 3 (K3)	<table border="1" data-bbox="340 1177 893 1422"> <thead> <tr> <th>K3</th> <th>K2</th> <th>K1</th> <th>Frequency Reference</th> <th>Corresponding Parameter</th> </tr> </thead> <tbody> <tr> <td>OFF</td> <td>OFF</td> <td>OFF</td> <td>Speed 0</td> <td>F6-00</td> </tr> <tr> <td>OFF</td> <td>OFF</td> <td>ON</td> <td>Speed 1</td> <td>F6-01</td> </tr> <tr> <td>OFF</td> <td>ON</td> <td>OFF</td> <td>Speed 2</td> <td>F6-02</td> </tr> <tr> <td>OFF</td> <td>ON</td> <td>ON</td> <td>Speed 3</td> <td>F6-03</td> </tr> <tr> <td>ON</td> <td>OFF</td> <td>OFF</td> <td>Speed 4</td> <td>F6-04</td> </tr> <tr> <td>ON</td> <td>OFF</td> <td>ON</td> <td>Speed 5</td> <td>F6-05</td> </tr> <tr> <td>ON</td> <td>ON</td> <td>OFF</td> <td>Speed 6</td> <td>F6-06</td> </tr> <tr> <td>ON</td> <td>ON</td> <td>ON</td> <td>Speed 7</td> <td>F6-07</td> </tr> </tbody> </table>	K3	K2	K1	Frequency Reference	Corresponding Parameter	OFF	OFF	OFF	Speed 0	F6-00	OFF	OFF	ON	Speed 1	F6-01	OFF	ON	OFF	Speed 2	F6-02	OFF	ON	ON	Speed 3	F6-03	ON	OFF	OFF	Speed 4	F6-04	ON	OFF	ON	Speed 5	F6-05	ON	ON	OFF	Speed 6	F6-06	ON	ON	ON	Speed 7	F6-07
K3	K2	K1	Frequency Reference	Corresponding Parameter																																											
OFF	OFF	OFF	Speed 0	F6-00																																											
OFF	OFF	ON	Speed 1	F6-01																																											
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ON	OFF	OFF	Speed 4	F6-04																																											
ON	OFF	ON	Speed 5	F6-05																																											
ON	ON	OFF	Speed 6	F6-06																																											
ON	ON	ON	Speed 7	F6-07																																											

Value	Function	Description
6	Fault reset	Automatic fault reset can be performed via DI terminal with this function. It is the same as the function of  key on the operation panel.
7	RUN disabled	When the terminal with this function becomes ON, the AC drive stops immediately and outputs the brake apply command.
8	Inspection signal	When the inspection signal is active, the AC drive uses the speed selected in F6-16. If the inspection signal is cancelled directly during stop, the AC drive decelerates to 0 based on the speed of F6-16 until the forward or reverse command is cancelled. If the forward or reverse command is cancelled directly during inspection running, the AC drive stops output immediately.
9	Emergency input	After this signal is active, the elevator enters the emergency running state, and the power is supplied by the external 48 V battery or 220 V UPS.
10	RUN contactor feedback signal	If DI terminals are set with the two functions, the AC drive detects these two signals after stop (the output contactor closes). If the two signal are still active for 2.5s, the AC drive will output the stuck signal.
11	Brake contactor feedback signal	
12	Load cell terminal 1	For details, see the descriptions of F3-13 to F3-16.
13	Load cell terminal 2	
14	Load cell terminal 3	
15	Load cell terminal 4	
16	External fault input	When the terminal with this function becomes ON, the AC drive reports a fault and stops running.
17	Motor overheat signal	If the DI set with 17 or 117 (NO/NC input) becomes ON, the AC drive reports the fault and performs motor overheat protection. After the DI becomes OFF, this fault is reset automatically.
18	Up speed judgment	The slow-down function is implemented by using these two functions together with FC-02 and FC-03.
19	Down speed judgment	In the up direction, after the up speed judgment switch (slow-down switch) acts, the AC drive compares the present frequency with FC-02, and immediately decelerates to stop (based on the time set in FC-01) to ensure elevator safety if the present frequency is larger than FC-02. The processing in the down direction is the same. For details, see the description of group FC parameters.
20	Multi-speed logic selection 1	These two signals are used for the multi-speed setting mode (F0-02 = 5) only in special applications.
21	Multi-speed logic selection 2	
22	Direct travel ride command	This signal implements the direct travel ride function. The AC drive executes direct travel ride after this signal is active during deceleration to stop. For details, see <a href="#">7.7 Commissioning of Direct Travel Ride</a> .

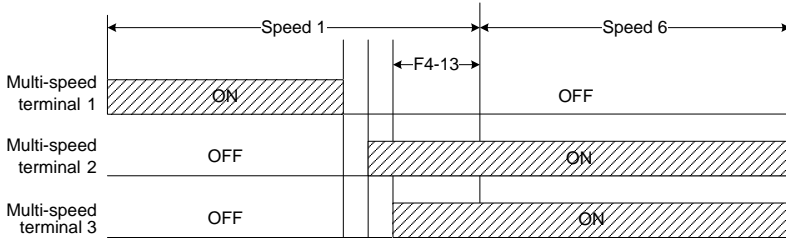
The setting range is 0–122. The hundred's digit indicates the NO/NC type (1: NC, 0: NO), and the lowest two digits indicate the selected function (invalid if the number is larger than 22). For example, "106" indicates that the DI is set with function 06 (Fault reset) and the function is NC type.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F4-13	Multi-speed combination filter time	0.000–0.200	0.020	0.001s

The multi-speed references are given by the external controller. If incorrect speed references exist due to relay delay or discreteness of controller terminals, the elevator running curve may be abnormal.

This parameter is used to filter the references from the multi-speed terminals to avoid incorrect references during multi-speed switchover.

Figure 6-7 Multi-speed switchover diagram



## Group F5: Output Function Parameters

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F5-00	FM function selection	0–18	15	1
F5-01	DO1 function selection	0–18	3	1
F5-02	DO2 function selection	0–18	0	1
F5-03	MCB relay function selection	0–18	4	1
F5-04	Extension board relay function selection	0–18	0	1

These parameters set the functions of the output terminals. The functions are described in the following table.

Value	Function	Description
0	Invalid	The terminal has no function.
1	AC drive running	When the AC drive is running, this signal becomes active.
2	Zero-speed running	When AC drive is in zero-speed running, this signal becomes active.
3	Zero-speed signal	When the AC drive outputs frequency 0 or stops, this signal becomes active.
4	Fault signal	When a fault occurs on the AC drive, this signal becomes active.
5	RUN contactor control	The terminal with this function controls the actions of the RUN contactor.
6	Brake contactor control	The terminal with this function controls the actions of the brake contactor.
7	Door pre-open signal	If the output frequency is smaller than FC-04 during deceleration of the AC drive, this signal becomes active.
8	Bus undervoltage	When the bus voltage is lower than 280 V, this signal becomes active and the power is supplied by the battery.

Value	Function	Description
9	FDT1 output	See the descriptions of group FC parameters.
10	FDT2 output	
11	Frequency reached	
12	Overspeed output	When the AC drive running frequency exceeds FC-09 for more than the time set in FC-10, this signal becomes active.
14	Running time reached	When the accumulative running time of the AC drive exceeds F8-07, this signal becomes ON.
15	Ready for RUN	This signal becomes ON when the AC drive allows running.
16	Contact stuck control	This signal becomes active when the AC drive detects contact stuck.
17	Re-leveling output	When the AC drives allows running, and the running frequency is smaller than FC-05, this signal becomes active.
18	Light-load running	This signal becomes active in light-load running.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F5-06	Zero-speed output hysteresis time	0.000–2.000	0.000	0.001s

It sets the hysteresis time of the output function 2 (Zero-speed running). Refer to Figure 6-3.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F5-07	AO function selection	0–6	0	1

It sets the function of AO1 on the MCB of the AC drive.

The standard output (zero offset 0, gain 1) of AO1 is 0–20 mA (or 0–10 V). The functions that can be set for AO1 are listed in the following table.

Value	Function	Range
0	Running frequency	0 to maximum frequency
1	Frequency reference	0 to maximum frequency
2	Output current	0 to 2 times of rated AC drive current
3	Output torque	0 to 2 times of rated motor current
4	Output voltage	0 to 1.2 times of rated AC drive voltage
5	AI1	0–10 V
6	AI2	0–10 V/0–20 mA

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F5-08	AO zero offset coefficient	-100.0 to 100.0%	0.0%	0.1%
F5-09	AO gain	-10.00–10.00	1.00	0.01

These two parameters can be calculated from the following formula.

$$Y = kX + b$$

In the formula:

- "b" represents the zero offset coefficient.
- "k" represents the gain.
- "X" represents the standard output.
- "Y" represents the actual output.

The AO zero offset coefficient 100% corresponds to 10 V or 20 mA. The standard output 0–10 V (20 mA) corresponds to 0 to the maximum value.

For example, if the AO is used for output of the running frequency, to implement output of 8 V (16 mA) at 0 Hz and output of 3 V (6 mA) at the maximum frequency, the gain is -0.50 and the zero offset coefficient is 80%.

Note that when the direct travel ride function is enabled, the AO output becomes invalid automatically.

## Group F6: Speed Parameters

When multi-speed is used, F6-00 to F6-15 need to be set to determine the running curve.

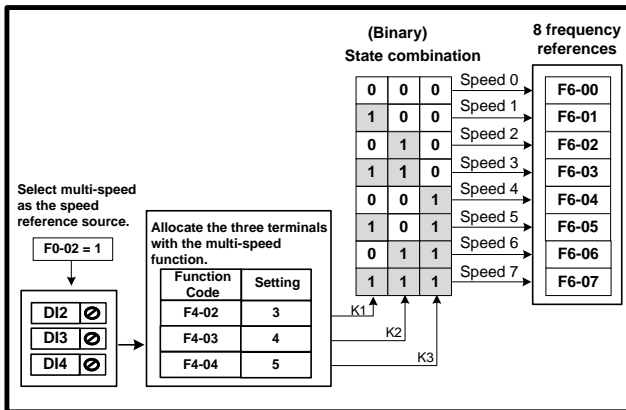
Function Code	Parameter Name	Setting Range	Default	Min. Unit
F6-00	Speed 0	0.00 to maximum frequency	0.00	0.01 Hz
F6-01	Speed 1	0.00 to maximum frequency	0.00	0.01 Hz
F6-02	Speed 2	0.00 to maximum frequency	0.00	0.01 Hz
F6-03	Speed 3	0.00 to maximum frequency	0.00	0.01 Hz
F6-04	Speed 4	0.00 to maximum frequency	0.00	0.01 Hz
F6-05	Speed 5	0.00 to maximum frequency	0.00	0.01 Hz
F6-06	Speed 6	0.00 to maximum frequency	0.00	0.01 Hz
F6-07	Speed 7	0.00 to maximum frequency	0.00	0.01 Hz

The eight speeds are set by state combinations of three DI terminals (multi-speed terminals 1 to 3).

Set F0-02 to 1 (Multi-speed), and set the three DI terminals respectively with functions 3, 4, and 5.

Assume that DI2, DI3, and DI4 are used for multi-speed. The diagram and related parameter setting of the multi-speed function is shown in the following figure.

Figure 6-8 Using multi-speed to control the frequency reference



Function Code	Parameter Name	Setting Range	Default	Min. Unit
F6-08	Running curve of speed 0	1-4	1	1
F6-09	Running curve of speed 1	1-4	1	1
F6-10	Running curve of speed 2	1-4	1	1
F6-11	Running curve of speed 3	1-4	1	1
F6-12	Running curve of speed 4	1-4	1	1
F6-13	Running curve of speed 5	1-4	1	1
F6-14	Running curve of speed 6	1-4	1	1
F6-15	Running curve of speed 7	1-4	1	1

F6-08 to F6-15 select the acceleration/deceleration running curve of each speed, implementing different acceleration/deceleration time running curve in different states.

The values 1-4 indicates running curves 1 to 4, determined by four groups of acceleration/deceleration time provided by the INVERTER ; for details, see the descriptions of group F7 parameters.

Note that the acceleration time and the related running curve of the target speed are used in the acceleration stage; the deceleration time and the related running curve of the target speed are used in the deceleration stage.

For example, assume that:

F6-01 = 0.00 Hz, F6-03 = 8.00 Hz, F6-05 = 48.00 Hz,

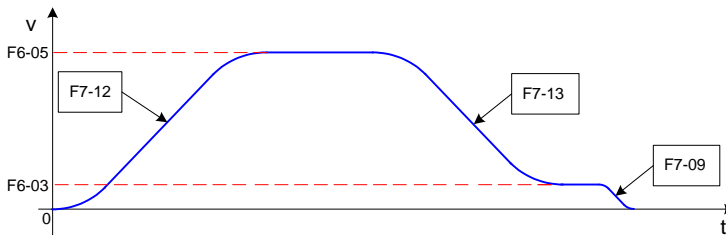
F6-09 = 2, F6-11 = 3, F6-13 = 4

- When the AC drive accelerates from F6-01 to F6-05, the acceleration time is F6-13 (acceleration/ deceleration 4: F7-12).
- When the AC drive decelerates from F6-05 to F6-03, the deceleration time is F6-13 (acceleration/ deceleration 4: F7-13).
- When the AC drive continue to decelerate from F6-03 to F6-01, the deceleration time is F6-11 (acceleration/deceleration 3: F7-09).

This is one running process of the elevator under multi-speed control. The high-speed acceleration/ deceleration time is generally 3-4s. When the AC drive decelerates to zero speed, the deceleration time can be different from the general.

In this example, increasing F7-05 makes speed switchover smoother at stop.

Figure 6-9 Acceleration/Deceleration running curve



Different acceleration/deceleration running curves are obtained based on the eight speed references and four acceleration/deceleration groups.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F6-16	Inspection speed selection	0–7	0	1

It sets the inspection speed from the multi-speed references. The values 0–7 indicates speeds 0–7 set in F6-00 to F6-07.

For details, see [7.3 Inspection Running](#).

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F6-17	Emergency evacuation operation mode at power failure	0–2	0	1

It sets the emergency evacuation operation mode at power failure.

- 0: Function disabled
- 1: UPS
- 2: 48 V battery power supply

For details, see [Chapter 7 Commissioning](#).

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F6-18	Analog minimum input	0.00–10.00	0.00	0.01 V
F6-19	Corresponding percentage of analog minimum input	0.0–100.0%	0.0%	0.1%
F6-20	Analog maximum input	0.00–10.00	10.00	0.01 V
F6-21	Corresponding percentage of analog maximum input	0.0–100.0%	100.0%	0.1%
F6-22	AI filter time	0.00–1.00s	0.10s	0.01s

These parameters specify the speed setting when the speed reference source is analog setting, that is F0-02 = 2 or 3 (AI2 or AI3).

They also define the relationship between the analog input voltage and the corresponding percentage of analog input.

Speed reference = This percentage x Maximum frequency or Rated frequency

When the analog input voltage is larger than the maximum input or smaller than the minimum input, the maximum input or minimum input is used.

If the analog input is current, 1 mA current is equal to 0.5 V voltage.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F6-23	AC drive function selection 1	0–65535	48	1

It is used to select the AC drive functions. Each bit of the function code defines a function, as described in the following table.

F6-23 AC drive function selection 1				
Bit	Function	Description		Default
Bit0	Current cancellation at stop	0: Disabled 1: Enabled		0
Bit1	No-load-cell compensation during auto-tuning	0: Shield 1: Not shield		0

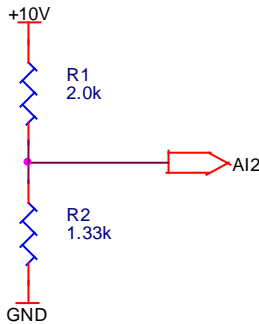
F6-23 AC drive function selection 1				
Bit	Function	Description	Default	
Bit2	Stop waiting	0: Stop if the external command is cancelled or the waiting time exceeds 5s 1: Stop if the external command is cancelled	0	
Bit4	Maximum frequency upper limit selection	0: Maximum frequency (F0-05) being 90.00 Hz 1: Maximum frequency (F0-05) being rated motor frequency	1	
Bit5	Analog frequency setting base	0: Maximum frequency 1: Rated frequency	1	

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F6-24	Motor overheat voltage threshold	0.00–11.00	0.00	0.01 V

This function always uses AI2 for judging motor overheat.

- When F6-24 ≠ 0, motor overheat is not judged by the DI terminal set with such function in group F4 parameters.
- When the voltage input to AI2 remains larger than F6-24 (filter time 0.5s), the AC drive reports fault Err39, indicating motor overheat.
- When the voltage input to AI2 becomes smaller than F6-24 (filter time 2s), the motor overheat fault is reset automatically.

The thermistor R2 resistance is 1.33 kΩ; it is recommended that R1 resistance be 2.0 kΩ and F6-24 be set to 3.9 V. The wiring is shown in the following figure.



Terminals +10V, GND, and AI2 in the preceding figure are respectively connected to terminals o+10V, GND, and AI2 n the MCB of the AC drive.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F6-25	AC drive function selection 2	0–65535	0	1

It is used to select the AC drive functions. Each bit of the function code defines a function, as described in the following table.



F6-25 AC drive function selection 2			
Bit	Function	Description	Default
Bit0	SPI communication fault detection	0: Detect 1: Not detect	0
Bit1	FA-03 and FA-05 modify property	0: Only in operation panel control mode 1: In all modes	0
Bit2	Err16, Err17 and Err33 reset selection	0: Not allow manual reset 1: Allow manual reset	0
Bit3	No-load-cell compensation during emergency evacuation	0: Shield 1: Not shield	0
Bit4	Control mode restriction	0: FVC in terminal control 1: No restriction	0
Bit5	Threshold selection of speed deviation too large	0: Speed deviation exceeds FC-12 and feedback frequency exceeds 1/4 of rated frequency 1: Speed deviation exceeds FC-12	0

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F6-27	Zero-speed signal output delay	0–9999	0	1 ms

If the time from the moment when the output frequency becomes 0 reaches the value of this parameter, the AC drive outputs the zero-speed signal.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F6-28	Upper limit of emergency evacuation speed	0.00 to maximum frequency	8.00	0.01 Hz

When the emergency evacuation speed exceeds the value of this parameter, the AC drive reports fault Err32 and stops running.

#### Group F7: Auxiliary Function Parameters

The INVERTER provides a total of four groups of acceleration/deceleration time, implementing four running curves; each running curve can be set flexibly according to user requirements.

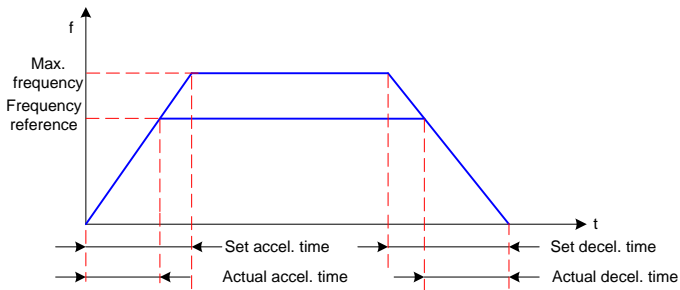
Function Code	Parameter Name	Setting Range	Default	Min. Unit
F7-00	Acceleration time 1	1.0–100.0s	4.0s	0.1s
F7-01	Deceleration time 1	1.0–100.0s	4.0s	0.1s
F7-02	Time proportion of running curve 1 start segment	10.0–40.0%	40.0%	0.1%
F7-03	Time proportion of running curve 1 end segment	10.0–40.0%	40.0%	0.1%
F7-04	Acceleration time 2	1.0–100.0s	4.0s	0.1s
F7-05	Deceleration time 2	1.0–100.0s	4.0s	0.1s
F7-06	Time proportion of running curve 2 start segment	10.0–40.0%	40.0%	0.1%
F7-07	Time proportion of running curve 2 end segment	10.0–40.0%	40.0%	0.1%
F7-08	Acceleration time 3	1.0–100.0s	4.0s	0.1s
F7-09	Deceleration time 3	1.0–100.0s	20.0s	0.1s

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F7-10	Time proportion of running curve 3 start segment	10.0–50.0%	40.0%	0.1%
F7-11	Time proportion of running curve 3 end segment	10.0–50.0%	40.0%	0.1%
F7-12	Acceleration time 4	0.5–100.0s	1.0s	0.1s
F7-13	Deceleration time 4	0.5–100.0s	1.0s	0.1s
F7-14	Time proportion of running curve 4 start segment	10.0–50.0%	40.0%	0.1%
F7-15	Time proportion of running curve 4 end segment	10.0–50.0%	40.0%	0.1%

Acceleration time indicates the time required by the AC drive to accelerate from 0 Hz to the maximum frequency (F0-05).

Deceleration time indicates the time required by the AC drive to decelerate from the maximum frequency (F0-05) to 0 Hz.

Figure 6-10 Acceleration/Deceleration time



When frequency reference = maximum frequency, actual acceleration/deceleration time = set acceleration/ deceleration time.

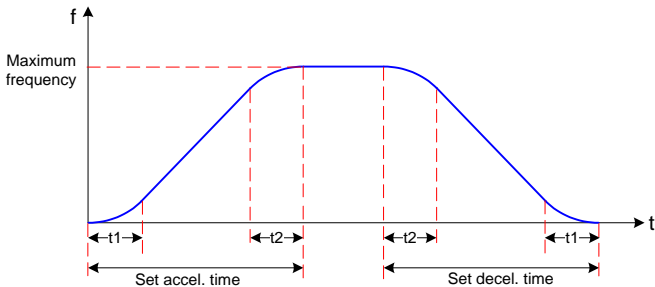
When frequency reference < maximum frequency, actual acceleration/deceleration time = set acceleration/ deceleration time x (set frequency/maximum frequency).

The INVERTER provides four different running curves (S curve), in which acceleration and deceleration are symmetric.

The following figure takes the acceleration segment of running curve 1 as an example.

- t1 is the time set in F7-02, during which the frequency change slop increases gradually;
- t2 is the time set in F7-02, during which changes to 0;
- between t1 and t2, the frequency change slop keeps the same.

Figure 6-11 Running curve acceleration/deceleration diagram



In multi-speed mode, the INVERTER ensures smooth speed switchover and improves the riding comfort through the multi-speed selection and the S-curve setting.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F7-16	Slip test acceleration time	0.5–10.0	1.0	0.1s

It set the acceleration rate in the slip text. For details, see Figure 6-10.

If the slip effect is not satisfactory, decrease the value slightly.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F7-17	Set distance of direct travel ride	0.0–6553.5	0.0	0.1 mm

It sets the running distance of direct travel ride.

For details, see [7.7 Commissioning of Direct Travel Ride](#).

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F7-18	Actual distance of direct travel ride	0.0–6553.5	0.0	0.1 mm

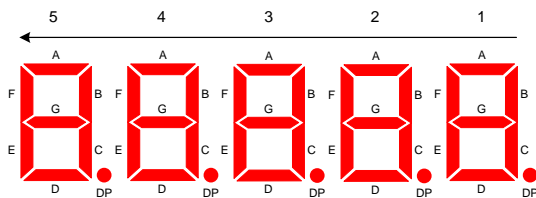
It monitors the actual running distance of direct travel ride.

For details, see [7.7 Commissioning of Direct Travel Ride](#).

## Group F8: Display Parameters

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F8-00	Input/Output terminal state	-	-	-

It displays the system input and output states. The LEDs are numbered 5 to 1 from left to right. If a segment is ON, it indicates that the signal is active; if a segment is OFF, it indicates that the signal is inactive.



	1 and 2	3	4	5
A	Reserved	DI1 input	DI9 input	FM output
B		DI2 input	DI10 input	DO1 output
C		DI3 input	-	DO2 output
D		DI4 input	-	Relay 1 output
E		DI5 input	-	Relay 2 output
F		DI6 input	-	
G		DI7 input	-	
DP		DI8 input	-	

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F8-01	Display in running state	1–32767	32767	1

It sets the running parameters displayed on the operation panel when the elevator is in the running state.

F8-01 includes 16 binary bits, each defining a parameter (the last three bits are reserved). A total of 13 parameters can be displayed during running.

The 13 binary bits correspond to the running parameters listed in the following table.

Bit	Parameter Name	Default	Bit	Parameter Name	Default
Bit0	Speed reference	1	Bit7	AI2	1
Bit1	Running frequency	1	Bit8	Car load	1
Bit2	Frequency reference	1	Bit9	Startup compensation current	1
Bit3	Bus voltage	1	Bit10	Torque current	1
Bit4	Output voltage	1	Bit11	Input state	1
Bit5	Output current	1	Bit12	Output state	1
Bit6	AI1	1	Bit13 to Bit15	Reserved	1

The setting method is as follows:

If a bit is set to 1, the parameter indicated by this bit is displayed; if this bit is set to 0, the parameter is not displayed.

Convert the sum of binary values of all 16 bits to decimal, and then set the decimal on the operation panel.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F8-02	Display in stop state	1–255	255	1

It sets the parameters displayed on the operation panel when the elevator is in the stop state.

F8-02 includes 8 binary bits, each defining a parameters. A total of 8 parameters can be can be displayed at stop.

The 8 binary bits correspond to the parameters listed in the following table.

Bit	Parameter Name	Default	Bit	Parameter Name	Default
Bit0	Speed reference	1	Bit4	AI2	1
Bit1	Frequency reference	1	Bit5	Car load	1
Bit2	Bus voltage	1	Bit6	Input state	1
Bit3	AI1	1	Bit7	Output state	1

The method of setting F8-02 is similar to that of F8-01.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F8-03	Rated elevator speed	0.001–8.000	1.600	0.001 m/s

It sets the car speed when the motor runs at the rated frequency.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F8-04	Heatsink temperature	0–100	-	1°C

It displays the heatsink temperature related to the IGBT of the inverter module.

The IGBT over-temperature protection threshold varies with the AC drive model, and the AC drive performs internal processing automatically to avoid the over-temperature fault.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F8-05	MCB software version	0.00–99.99	-	0.01

It displays the MCB software version.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F8-06	Drive board software version	0–65535	-	1

It displays the drive board software version.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F8-07	Set running time	0–65500	0	1 h

It presets the AC drive running time.

When F8-08 (Accumulative running time) reaches the value of this parameter, the AC drive outputs the running time reached signal via DO and stops running.

If it is set to 0, this function is invalid.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F8-08	Accumulative running time (hour)	0–65500	0	1 h
F8-09	Accumulative running time (s)	0–3600	0	1s

During AC drive running, F8-09 is accumulated by 1 per second.

After F8-09 reaches 3600, it is cleared to 0 and F8-08 is accumulated by 1.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F8-10	High byte of running times	0–9999	0	1
F8-11	Low byte of running times	0–9999	0	1

These parameters are used to view the actual accumulative running times of the elevator.

Running times of the elevator = F8-10 x 10000 + F8-11.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F8-12	Short circuit to ground detection at power-on	0: Disabled 1: Enabled	0	1

If this function is enabled, the AC drive detects whether the motor is short circuited to ground at power-on.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F8-13	MCB software temporary version	0.00–99.99	-	0.01

A non-zero value indicates the software version used for test or customized functions.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F8-14	MCB software customer version	0.00–99.99	-	0.01

It displays the MCB software version specially used for the customer.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F8-17	Year	2000–2100	2014	1
F8-18	Month	0101–1231	0101	0101
F8-19	Hour.minute	00.00–23.59	00.00	00.01

These parameters are used to set the AC drive time.

## Group F9: Protection Function Parameters

Function Code	Parameter Name	Setting Range	Default	Min. Unit
<b>F9-09</b>	Fault auto reset times	0–3	0	1

It sets the fault auto reset times allowed within one hour. If this value is reached, the AC drive reports a fault and enters the standby state, and needs to be repaired.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F9-11	Fault auto reset delay	0.1–100.0	1.0	0.1s

It sets the waiting time from the moment when the fault is alarmed to the moment when it is finally auto reset.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
<b>F9-12</b>	Input phase loss protection	0: Disabled 1: Enabled	1	1

It sets whether to perform phase loss protection on the input side.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F9-13	Output phase loss protection	0–3	1	1

It sets the output phase loss protection function, as described in the following table.

F9-13 Output phase loss protection			
Bit	Function	Description	Default
Bit0	Output phase loss detection during running	0: No 1: Yes	1
Bit1	Output phase loss detection at startup	0: No 1: Yes	1

Function Code	Parameter Name	Setting Range	Default	Min. Unit
F9-14	1st fault code	0–60	0	1
F9-15	1st fault subcode	0–999	0	1
F9-16	1st fault month and day	0–1231	0	1
F9-17	1st fault hour and minute	00.00–23.59	0	0.01
F9-18	2nd fault code	0–60	0	1
F9-19	2nd fault subcode	0–999	0	1
F9-20	2nd fault month and day	0–1231	0	1
F9-21	2nd fault hour and minute	00.00–23.59	0	0.01

Function Code	Parameter Name	Setting Range	Default	Min. Unit
...	...	...	...	...
F9-50	10th fault code	0–60	0	1
F9-51	10th fault subcode	0–999	0	1
F9-52	10th fault month and day	0–1231	0	1
F9-53	10th fault hour and minute	00.00–23.59	0	0.01
F9-54	Latest fault code	0–60	0	1
F9-55	Latest fault subcode	0–999	0	1
F9-56	Latest fault month and day	0–1231	0	1
F9-57	Latest fault hour and minute	00.00–23.59	0	0.01
F9-58	Logic information of latest fault	0–65535	0	1
F9-59	Set frequency upon latest fault	0.00–99.00	0.00	0.01 Hz
F9-60	Feedback frequency upon latest fault	0.00–99.00	0.00	0.01 Hz
F9-61	Bus voltage upon latest fault	0.0–6500.0	0.0	0.1 V
F9-62	Output voltage upon latest fault	0–65000	0	1 V
F9-63	Output current upon latest fault	0.00–650.00	0.00	0.01 A
F9-64	Torque current upon latest fault	0.00–650.00	0.00	0.01 A
F9-65	Output power upon latest fault	0.00–99.99	0.00	0.01 kW
F9-66	Input function state 1 upon latest fault	0–65535	0	1
F9-67	Input function state 2 upon latest fault	0–65535	0	1
F9-68	Output function state 1 upon latest fault	0–65535	0	1
F9-69	Output function state 2 upon latest fault	0–65535	0	1

These parameters record the fault code, subcode, fault time of the last 11 faults, and detailed information about the latest fault.

#### Group FA: PG Parameters

The INVERTER supports vector control on the asynchronous motor and PMSM. A PG card matching the encoder is required to implement vector control.

Set the encoder and PG card parameters correctly based on their actual models.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
FA-00	Encoder PPR	100–9999	1024	1

It sets the pulses per revolution of the encoder which is mandatory in the elevator application.

Set this parameter correctly; otherwise, overcurrent may occur during running.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
FA-01	Encoder wire-breaking detection time	0.0–10.0	1.0	0.1s

If the encoder signal is lost during running, motor control cannot be performed correctly.

The INVERTER keeps detecting the pulse signals from the encoder. If it detects that the pulse signal abnormal time exceeds FA-01, it reports the encoder fault and stops running.

When this parameter is set to 0, this function is disabled.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
FA-03	Encoder magnetic pole angle	0.0–359.9	0.0	0.1°

It sets the encoder initial angle. This value is automatically obtained through motor auto-tuning; if the value is known already, you can also set this parameter manually.

This parameter is necessary to control on the PMSM. Based on the encoder initial angle, the AC drive judges the rotor position of the PMSM and implements high-accuracy control. Control on the asynchronous motor does not require this parameter.

By default, this parameter can be modified only when F0-01 = 0.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
FA-04	Encoder current angle	0.0–359.9	0.0	0.1°

It records the motor rotor position from the encoder, which is critical to high-accuracy control on the PMSM.

This parameter is retentive at power-off, and is related only to the PMSM.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
FA-05	Wiring mode	0–15	0	1

It sets the motor wiring mode. It is valid only to PMSM.

This is the factory parameter, and you need not modify it.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
FA-06	PG card frequency-division coefficient ratio	1–65535	1	1

When the direct travel ride function is used, the AC drive obtains encoder pulse signals from the frequency-division output terminal of the PG card. FA-06 must be the same as the PG card frequency-division coefficient.

for details, see the descriptions of the PG card in [3.2.5 PG Card for Elevator Specialized Rotary Encoder](#).

## Group Fb: Communication Parameters

Reserved.

## Group FC: Special Enhanced Parameters

Function Code	Parameter Name	Setting Range	Default	Min. Unit
FC-00	Action at command abnormal	0–1	1	1

- 0: Decelerate to stop

The AC drive decelerates to stop according to the normal control logic, ensuring smooth deceleration and elevator speed change.

- 1: Block output immediately

The AC drive applies the brake and stops output of the RUN contactor immediately.

"Command abnormal" means that the RUN command becomes invalid suddenly.



FWD	REV	Meaning
OFF	OFF	Invalid
ON	OFF	Forward RUN
OFF	ON	Reverse RUN
ON	ON	Invalid

Function Code	Parameter Name	Setting Range	Default	Min. Unit
<b>FC-01</b>	Deceleration time at abnormality	0.0–300.0	3.0	0.1s

It sets the time of deceleration from the maximum frequency to 0 Hz at abnormality.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
FC-02	Up speed threshold	0.00 Hz to maximum frequency	45.00	0.01 Hz
FC-03	Down speed threshold	0.00 Hz to maximum frequency	45.00	0.01 Hz

The INVERTER implements slow-down based on these two parameters.

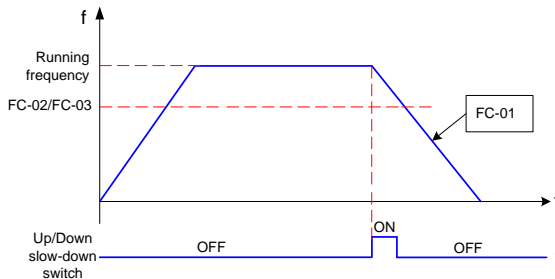
When the up/down speed judgment signal (slow-down switch signal) is active, the AC drive detects whether the running frequency exceeds FC-02/FC-03. If yes, the AC drive decelerates to stop according to the time set in FC-01.

Note that the AC drive instructs up direction running of the elevator after receiving the forward RUN command and down direction running of the elevator after receiving the reverse RUN command.

The up speed judgment signal is invalid in the down direction, and vice versa.

The following figure shows the slow-down principle.

Figure 6-12 Slow-down principle



Function Code	Parameter Name	Setting Range	Default	Min. Unit
FC-04	Door pre-open judging frequency	0.00 Hz to maximum frequency	5.00	0.01 Hz

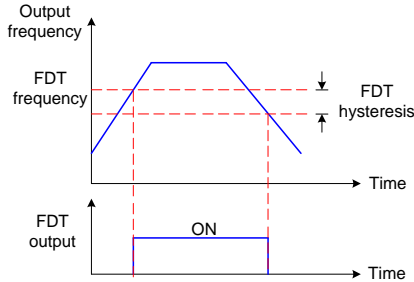
When the elevator decelerates to stop, if the output frequency is smaller than FC-04, the AC drive outputs the door pre-open signal via DO, and this signal remains active before stop.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
FC-05	Frequency detection level 1 (FDT frequency 1)	0.00 Hz to maximum frequency	50.00	0.01 Hz
FC-06	Frequency detection level 2 (FDT frequency 2)	0.00 Hz to maximum frequency	50.00	0.01 Hz
FC-07	Frequency detection hysteresis	0.0–100.0%	5.0%	0.1%

As shown in the following figure, FC-05 to FC-07 are FDT related parameters.

$$\text{FDT hysteresis} = \text{FDT frequency} \times \text{FC-07}$$

Figure 6-13 FDT signal output principle

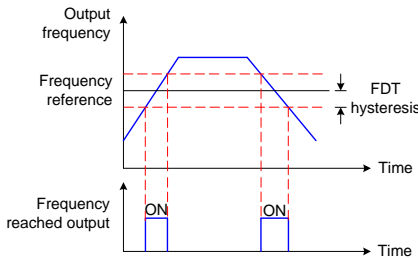


Function Code	Parameter Name	Setting Range	Default	Min. Unit
FC-08	Frequency reached detection width	0.0–100.0%	0.0%	0.1%

This function sets the detection width of whether the output frequency reaches the frequency reference.

$$\text{Detection frequency amplitude} = \text{Maximum frequency} \times \text{FC-08}$$

Figure 6-14 Frequency reached detection width



Function Code	Parameter Name	Setting Range	Default	Min. Unit
FC-09	Overspeed detection threshold	80–120%	115%	1%
FC-10	Overspeed detection time	0.0–5.0	1.0s	0.1s

The AC drive detects whether overspeed occurs by comparing the running frequency with FC-09. If the running frequency remains larger than FC-09 for more than the time set in FC-10, the AC drive considers that overspeed occurs.

FC-09 is a percentage relative to the maximum frequency; 100% corresponds to the maximum frequency. After detecting that overspeed occurs, the AC drive decelerates to stop according to the time set in FC-01.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
FC-11	Action selection at overspeed	0–2	1	1

0: Decelerate to stop at abnormality (according to the time set in FC-01)

1: Alarm and block output immediately

2: Continue to run

Function Code	Parameter Name	Setting Range	Default	Min. Unit
FC-12	Speed deviation detection threshold	0–50%	30%	1%
FC-13	Speed deviation detection time	0.0–5.0s	1.0s	0.1s

If the AC drive detects that the deviation between the running frequency and the frequency reference is larger than FC-12 and the time lasts for FC-13, it considers that the speed deviation is too large.

FC-12 is a percentage relative to the maximum frequency.

After detecting speed deviation too large, the AC drive performs processing according to FC-14.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
FC-14	Action selection at speed deviation too large	0–2	1	1

0: Decelerate to stop at abnormality (according to the time set in FC-01)

1: Alarm and block output immediately

2: Continue to run

Group Fd: Special Function Parameters

Function Code	Parameter Name	Setting Range	Default	Min. Unit
Fd-00	Torque boost	0.1%–30.0%	1.0%	0.1%
Fd-01	Cut-off frequency of torque boost	0.00 to maximum frequency	50.00	0.01 Hz

Fd-00 compensates for insufficient torque production by boosting output voltage of the AC drive. A very large setting will result in motor overheat and AC drive overcurrent.

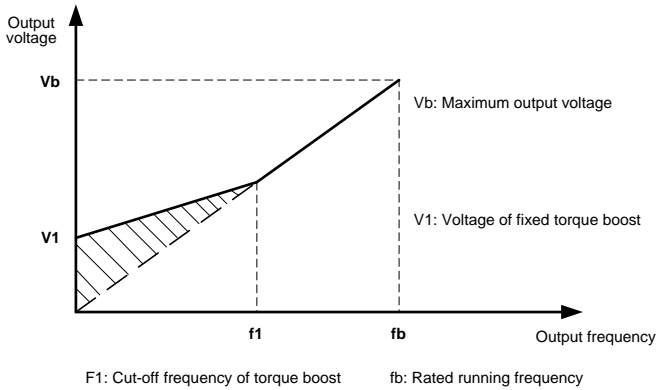
Generally, Fd-00 does not exceed 10%.

- Increase this parameter when a heavy load is applied but the startup torque of the motor is insufficient.
- Decrease this parameter when a light load is applied.

If it is set to 0.0%, fixed torque boost is enabled.

Fd-01 sets the cutoff frequency under which torque boost is valid. If the frequency reference exceeds the value set in Fd-01, torque boost becomes invalid.

Figure 6-15 Customized torque boost



Function Code	Parameter Name	Setting Range	Default	Min. Unit
Fd-02	V/F slip compensation gain	0.0–200.0%	100.0%	0.1%
Fd-03	Oscillation suppression gain	0–100	20	1

Fd-02 indicates compensation for the motor speed slip changed with the load.

- When the rated load is applied, use the default setting 100%, and the motor speed is close to the speed reference.
- When the load is lower than the rated load, decrease this parameter to smaller than 100%.
- When the load is higher than the rated load, increase this parameter to higher than 100%.
- Fd-03 sets the oscillation suppression gain.
- Set this parameter to a value as small as possible in the prerequisite of efficient oscillation suppression to avoid influence on V/F control.
- Set this parameter to 0 if the motor has no oscillation.
- Increase the value properly only when the motor has obvious oscillation. The larger the value is, the better the oscillation suppression result will be.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
Fd-04	AC drive function selection 3	0–65535	0	1

It is used to select the AC drive functions. Each bit of the function code defines a function, as described in the following table.

Fd-04 AC drive function selection 3			
Bit	Function	Description	Default
Bit0	Asynchronous motor current loop parameter setting	0: Using fixed values 1: Set by F2-06 and F2-07	0

Function Code	Parameter Name	Setting Range	Default	Min. Unit
Fd-05	Position lock current coefficient	1.0–50.0%	15.0%	0.1%
Fd-06	Position lock speed loop KP	0.05–1.00	0.50	0.01
Fd-07	Position lock speed loop TI	0.05–2.00	0.60	0.01

These parameters are used to adjust elevator startup in the case of no-load-cell.

For details, see [7.6 No-Load-Cell Commissioning](#).

## Group FU: Monitoring Parameters

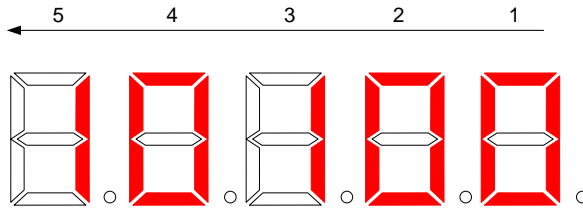
Function Code	Parameter Name	Setting Range	Default	Min. Unit
FU-00	Pre-torque current	-200.0 to 200.0%	0.0%	0.1%

It displays the percentage of the pre-torque current (positive or negative, indicating motoring or power generation)

Function Code	Parameter Name	Setting Range	Default	Min. Unit
FU-01	Logic information	0–65535	0	1

It displays the elevator and door state.

Figure 6-16 Elevator state display



5		4		3		2		1	
Allow running by terminal		Direction command		Multi-speed setting		Running state			
0	No	0	No command	0	Speed 0	00	Standby state		
1	Yes	1	Up direction	1	Speed 1	01	RUN contactor control		
		2	Down direction	2	Speed 2	02	Brake release control		
				3	Speed 3	03	Start zero-speed running		
				4	Speed 4	04	Normal curve running		
				5	Speed 5	05	Emergency running		
				6	Speed 6	06	Startup frequency processing		
				7	Speed 7	07	RUN contactor open		
						08	Direct travel ride control		
						09	Decelerate to stop		
						10	Stop zero speed holding		
						11	Brake apply control		
						12	Stop		
						13	Slip test running		
						14	Decelerate to stop at abnormality		

Function Code	Parameter Name	Setting Range	Default	Min. Unit
FU-02	Frequency reference	0.00–99.00	0.00	0.01 Hz
FU-03	Feedback frequency	0.00–99.00	0.00	0.01 Hz
FU-04	Bus voltage	0.0–6500.0	0.0	0.1 V
FU-05	Output voltage	0–65000	0	1 V
FU-06	Output current	0.00–650.00	0.00	0.01 A
FU-07	Output torque	0.0–200.0%	0.0%	0.1%
FU-08	Torque current	0.00–650.00	0.00	0.01 A
FU-09	Output power	-99.99 to 99.99	0.00	0.01 kW

These parameters display the current system performance state. FU-09 can be positive or negative.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
FU-10	Car load	0.0–100.0%	0.0%	0.1%

It displays the car load measured by the load cell when the load cell pre-torque function is used.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
FU-11	Car speed	0.000–65.000	0.000	0.001 m/s

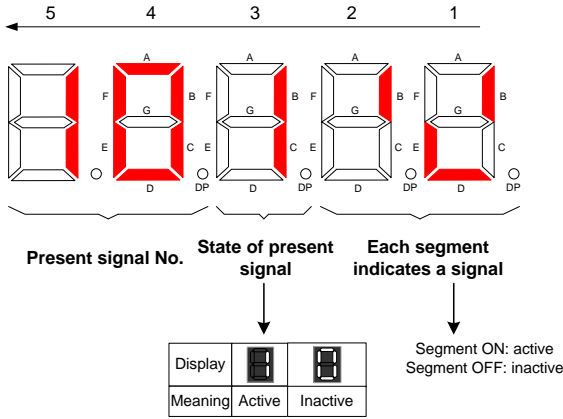
It displays the car running speed. The displayed value is correctly only when F8-03 is set correctly.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
FU-12	Communication interference	0–65535	0	1

It displays the communication quality between the MCB and the drive board. The display is 0–9; the larger the value is, the more serious communication interference is, and the poorer the communication quality is.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
FU-13	Input function state 1	0–65535	0	1
FU-14	Input function state 2	0–65535	0	1
FU-15	Output function state 1	0–65535	0	1
FU-16	Output function 2	0–65535	0	1

Figure 6-17 Example of input/output function state



The example in the preceding figure shows that signal 10 is active and also signals 2, 4, and 5 are also active.

FU-13 Input function state 1				
No.	Signal	No.	Signal	LED Segment
0	Reserved	8	Inspection signal	
1	Forward run	9	Emergency input	
2	Reverse run	10	RUN contactor feedback signal	
3	Multi-speed terminal 1	11	Brake contactor feedback signal	
4	Multi-speed terminal 2	12	Load cell terminal 1	
5	Multi-speed terminal 3	13	Load cell terminal 2	
6	Fault reset	14	Load cell terminal 3	
7	RUN disabled	15	Load cell terminal 4	
FU-14 Input function state 2				
No.	Signal	No.	Signal	LED Segment
16	External fault input	24	Reserved	
17	Motor overheat signal	25	Reserved	
18	Up speed judgment	26	Reserved	
19	Down speed judgment	27	Reserved	
20	Multi-speed logic selection 1	28	Reserved	
21	Multi-speed logic selection 2	29	Reserved	
22	Direct travel ride command	30	Reserved	
23	Reserved	31	Reserved	

FU-15 Output function state 1				
No.	Signal	No.	Signal	LED Segment
0	Reserved	8	Bus undervoltage	
1	AC drive running	9	FDT1 output	
2	Zero-speed running	10	FDT2 output	
3	Zero-speed signal	11	Frequency reached	
4	Fault signal	12	Overspeed output	
5	RUN contactor control	13	Reserved	
6	Brake contactor control	14	Running time reached	
7	Door pre-open signal	15	Ready for RUN	

FU-16 Output function state 2				
No.	Signal	No.	Signal	LED Segment
16	Contact stuck control	24	Reserved	
17	Re-leveling output	25	Reserved	
18	Light-load running	26	Reserved	
19	Reserved	27	Reserved	
20	Reserved	28	Reserved	
21	Reserved	29	Reserved	
22	Reserved	30	Reserved	
23	Reserved	31	Reserved	

Function Code	Parameter Name	Setting Range	Default	Min. Unit
FU-17	A11 voltage	0.00–20.00	0.00	0.01 V
FU-18	A12 voltage	0.00–20.00	0.00	0.01 V

These two parameter respectively display A11 voltage and A12 voltage.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
FU-19	AO1 voltage	0.00–20.00	0.00	0.01 V

It displays AO1 voltage.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
FU-20	Startup rollback coefficient	0–65535	0	1

It is used to observe car rollback at startup when the no load cell function is used (F3-09 = 5).

For details, see [7.6 No-Load-Cell Commissioning](#).

Function Code	Parameter Name	Setting Range	Default	Min. Unit
FU-21	PG card pulses per second	0–65535	0	1

When direct travel ride is used, the PG card frequency-division signals are output to the corresponding terminal on the I/O extension card and then to the MCB of the AC drive.

This parameter is used to view whether PG card pulses are normal.



## Group FF: Factory Parameters

Reserved.

## Group FP: User Parameters

Function Code	Parameter Name	Setting Range	Default	Min. Unit
FP-00	User password	0-65535	0	1

FP-00 is used to set the user password.

If it is set to any non-zero number, the password protection function is enabled. After a password has been set and taken effect, you must enter the correct password in order to enter the menu. If the entered password is incorrect, you cannot view or modify parameters.

If FP-00 is set to 00000, the previously set user password is cleared, and the password protection function is disabled.

Remember the password that you set. If the password is set incorrectly or forgotten, contact us technical support to replace the control board.

Function Code	Parameter Name	Setting Range	Default	Min. Unit
FP-01	Parameter update	0: No operation 1: Restore default setting 2: Clear fault records	0	1
FP-02	User-defined parameter display	0: Invalid 1: Valid	0	1

FP-02 is used to set whether to display the parameters that are modified.

When it is set to 1, the parameters that are different from the default setting are displayed.

# Chapter 7 Commissioning

This chapter describes the AC drive operating modes and general commissioning methods.

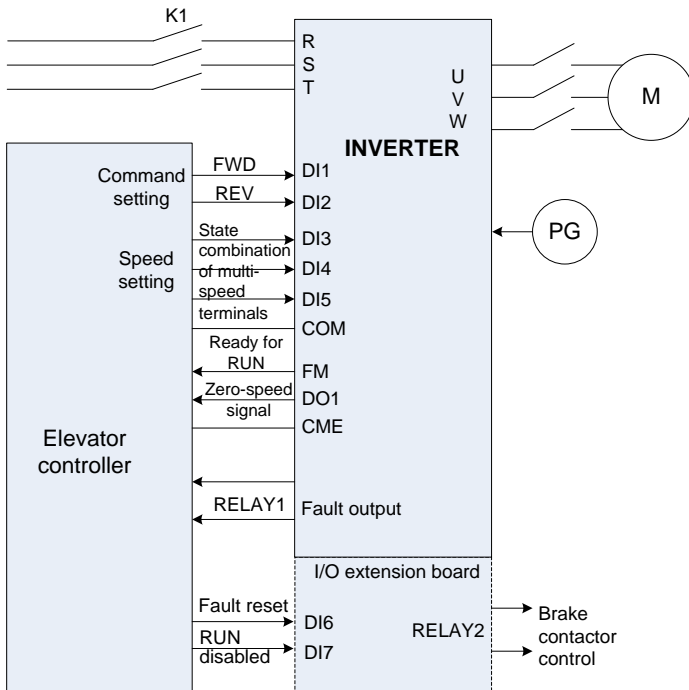
## 7.1 Multi-Speed as Speed Reference Source

As a common mode for the elevator application, multi-speed used as the speed reference source features strong anti-interference capability, good adaptability, and feasibility.

Different from the traditional multi-speed mode that has the same acceleration/deceleration running curve for different speeds, the multi-speed mode especially designed for the INVERTER provides a different acceleration/deceleration running curve for each speed, making commissioning easier.

### 7.1.1 System Wiring

Figure 7-1 System wiring of multi-speed as speed reference source



**Note**

The input and output terminals except RELAY2 have default setting at delivery. Change the setting only when required.

It is recommended that RELAY2 be used as the brake control output and connected to the brake control circuit of the system.

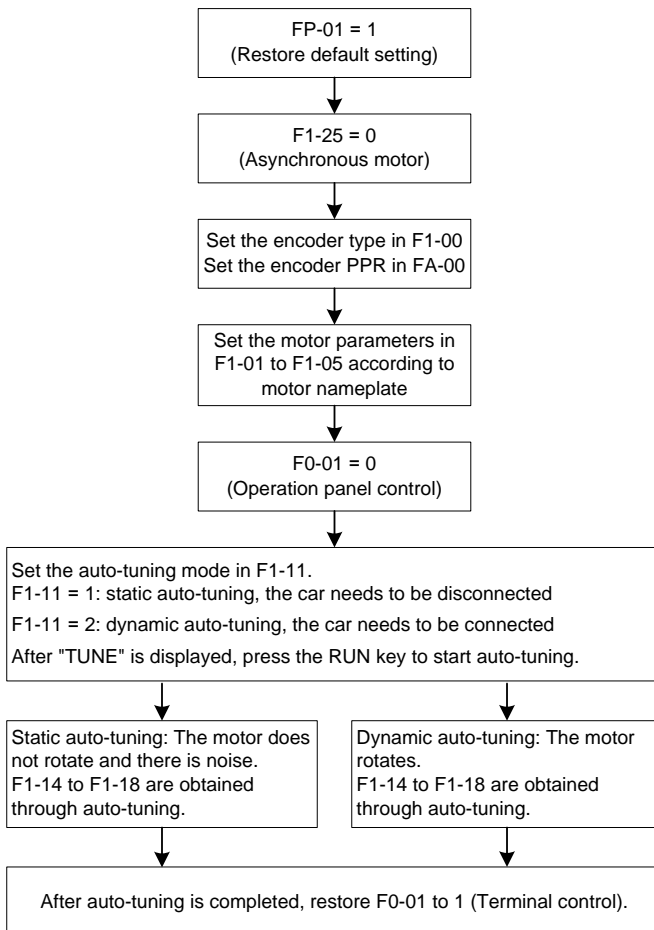
### 7.1.2 Parameter Setting

This section describes the parameter setting in the commissioning procedure that is divided into three parts: motor auto-tuning, inspection running, and normal speed running.

#### Motor Auto-tuning

##### 1) Asynchronous motor auto-tuning

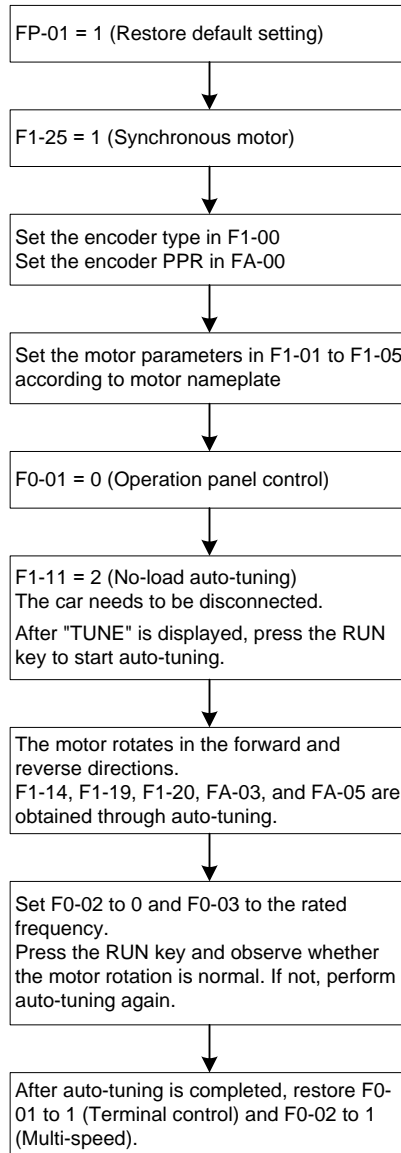
Figure 7-2 Asynchronous motor auto-tuning flowchart



Note that if F0-00 = 0 (SVC) or 2 (V/F control), the encoder type and PPR need not be set. However, the FVC mode is recommended for the elevator application.

## 2) Synchronous motor no-load auto-tuning

Figure 7-3 Synchronous motor no-load auto-tuning flowchart



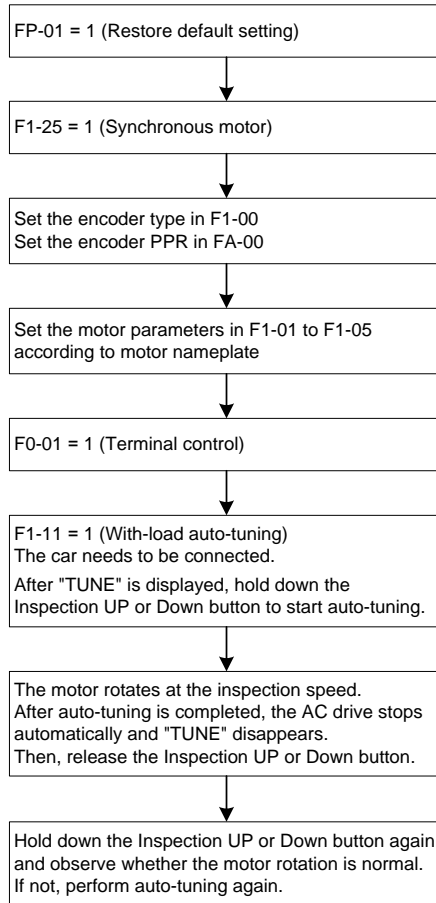
It is recommended that several times of auto-tuning be performed; after ensuring that the value deviation of FA-03 is within 5° and FA-05 remains the same in several times of auto-tuning, then perform trial running.

### 3) Synchronous motor with-load auto-tuning

#### A. Auto-tuning flowchart

The INVERTER provides an encoder angle identification method with the car connected (the user need not remove the steel rope).

Figure 7-4 Synchronous motor with-load auto-tuning flowchart



#### B. Precautions

- The AC drive spends 2s to store obtained data after auto-tuning is completed, and does not respond to any input command at this moment.
- This auto-tuning mode can be used only by professional personnel to prevent danger.
- The no-load-cell pre-torque compensation function is disabled (F6-23 Bit1 = 0) to prevent abnormality.
- If auto-tuning fails to be performed, exchange any two of UVW cables of the AC drive, and perform auto-tuning again.

## Inspection Running

Before the elevator enters the inspection running stage, perform the following setting:

- Inspection speed selection (F6-16)
- Speeds for multi-speed running (F6-00 to F6-07)
- Acceleration/deceleration running curves (F6-08 to F6-15)
- Specific acceleration/deceleration time (F7-00 to F7-15)

Example:

- If speed 2 is used as the inspection speed, set F6-16 to 2.
- Then, set the frequency reference corresponding to speed 2 in F6-02. The AC drive outputs this frequency during inspection running.
- Set the running curve of speed 2 in F6-10. The default value is curve 1.
- If the acceleration/deceleration time of curve 1 need to be modified, set F7-00 to F7-03.

Note that if the terminal functions are different from the default setting, check and set group F4 and F5 parameters correctly before inspection running.

## Normal Speed Running

Before the elevator enters the normal speed trial running, perform the following operations:

- Check that the encoder wiring and cable connection between the AC drive and the motor are correct.
- Set all involved speeds.
- Select the running curves corresponding to the speeds. It is recommended that curve 1 is used for the normal speed running; if several speeds are used, use curve 1 for the lowest speed).
- Set the acceleration/deceleration time and start and end segments of all curves to guarantee good riding comfort.
- Adjust group F2 and F3 parameters to improve the riding comfort during running and startup.

## Setting Example

Assume that the speed reference combinations of the AC drive are as follows:

- Inspection: speed 2, frequency reference 10 Hz, running curve 4
- Creeping: speed 3, frequency reference 3 Hz, running curve 3
- Normal speed: speed 7, frequency reference 48 Hz, running curve 1

The parameter setting is as follows.

Stage	Function Code	Parameter Name	Value	Remarks
Inspection	F6-16	Inspection speed selection	2	
	F6-02	Speed 2	10	
	F6-10	Running curve of speed 2	4	Running curve 4 is defined by F7-12 to F7-15.
Creeping	F6-03	Speed 3	3	
	F6-11	Running curve of speed 3	3	Running curve 3 is defined by F7-08 to F7-11.
Normal speed	F6-07	Speed 7	48	
	F6-15	Running curve of speed 7	1	Running curve 1 is defined by F7-00 to F7-03.

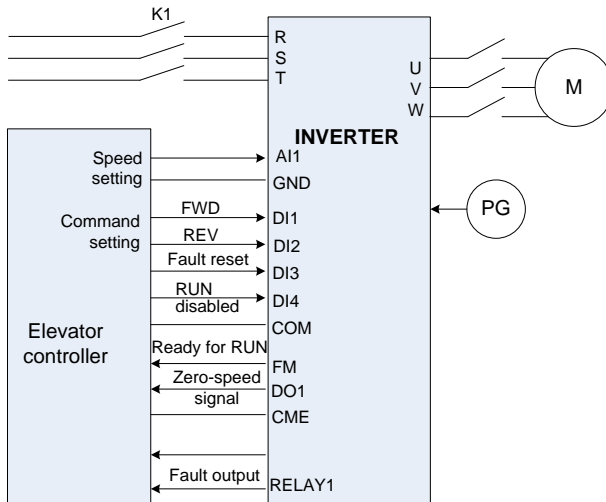
Note that this example lists only the speed-related parameters. Other parameters to be set during multi-speed commissioning are not described here.

## 7.2 AI as Speed Reference Source

Using AI as the speed reference source is also a common mode, in which the speed reference and RUN command are set through AI terminals.

### 7.2.1 System Wiring

Figure 7-5 System wiring of AI as speed reference source



### 7.2.2 Parameter Setting

When AI is used as the speed reference source, the AC drive executes commands sent by the elevator controller. The AI signal is assumed as 0–10 V input.

The motor auto-tuning method is the same as that for multi-speed mode.

The following table lists the parameter setting.

Type	Function Code	Parameter Name	Value
Analog function parameters	F0-02	Speed reference source	2
	F6-19	Corresponding percentage of analog minimum input	0
	F6-21	Corresponding percentage of analog maximum input	100
	F6-18	Analog minimum input	0
	F6-20	Analog maximum input	10
	F6-22	AI filter time	0.1
Motor encoder parameters	Groups F1 and FA	Obtained through motor auto-tuning. See asynchronous motor auto-tuning descriptions in <a href="#">7.1 Multi-Speed as Speed Reference Source</a> .	
Vector control speed loop parameters	Group F2	Adjusted based on the actual running characteristics.	

Type	Function Code	Parameter Name	Value
Input terminal parameters (group F4)	F4-03	DI3 function selection	7
	F4-04	DI4 function selection	6

### 7.3 Inspection Running

The inspection running mode can be implemented through multi-speed control based on the elevator inspection running characteristics.

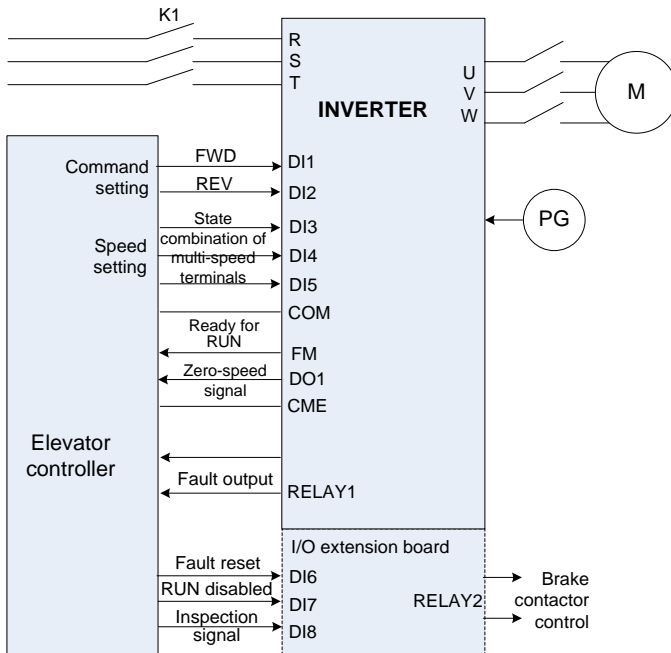
Enable the AC drive to enter the inspection mode in the following ways:

- Make the inspection signal of the input terminal active.  
After this signal becomes active, if F6-16 is a non-zero value, the AC drive runs at the speed selected by F6-16.
- Set F6-16 (Inspection speed selection) to a non-zero value, and make the selected speed equal to F6-16.  
For example, if F6-16 is set to 1 and state combinations of multi-speed DI terminals correspond to speed 1, the AC drive enters the inspection running state.

The slip test and angle-free auto-tuning functions can be used only in the inspection running mode. Enable the AC drive to the inspection running mode before the system starts up.

#### 7.3.1 System Wiring

Figure 7-6 System wiring of inspection running





### 7.3.2 Parameter Setting and Running Curve

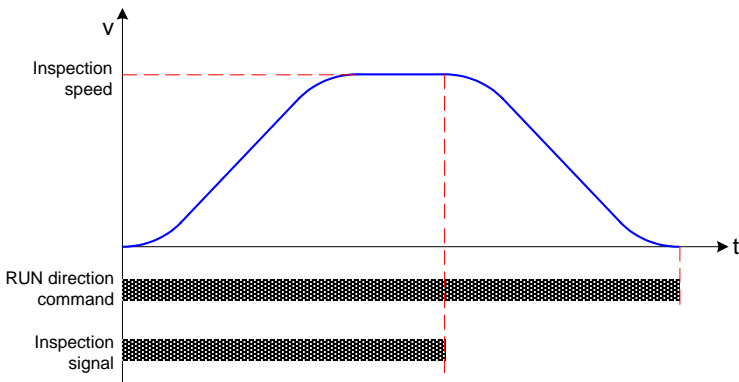
The running sequence of the inspection running mode is different from those of the normal speed running mode in the aspect of stop process.

For example, if  $F6-16 = 2$ , when there is forward (reverse) RUN command and the inspection signal of the input terminal is active, the INVERTER runs at the frequency of speed 2, and the acceleration time is determined according to the running curve corresponding to speed 2.

In the stop process, if the inspection signal is canceled first, the AC drive decelerates to 0 according to the deceleration time for speed 3 until the forward (reverse) RUN command is cancelled, as shown in the following figure.

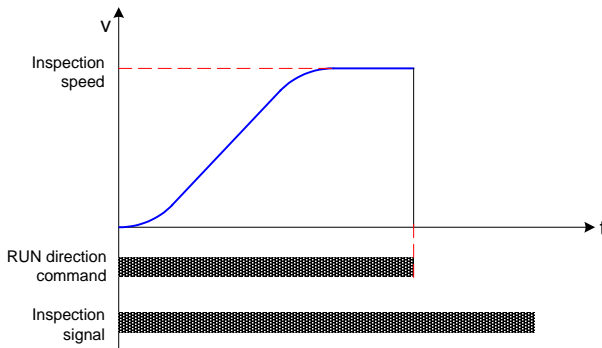
The deceleration time can be short to a small value (for example, 1s) to achieve quick stop.

Figure 7-7 Stop process time sequence of inspection signal



If the forward (reverse) RUN command is cancelled directly during inspection running, the AC drive stops output immediately, as shown in the following figure.

Figure 7-8 Stop process time sequence at RUN command cancellation



Assume that for speed 2, inspection frequency 10 Hz, and running curve 4 are used for inspection running. The following tables lists the parameters to be set.

Function Code	Parameter Name	Value	Default	Remarks
F6-02	Speed 2	10.00 Hz	0.00 Hz	The rated motor frequency is 50.00 Hz.
F6-10	Running curve of speed 2	4	1	-
F6-16	Inspection speed selection	2	0	Speed 2 is selected
F7-12	Acceleration time 4	2.0s	20.0s	
F7-13	Deceleration time 4	1.0s	20.0s	Set it to the minimum value to ensure that the speed is reduced to a very small value before the brake is applied.

### 7.4 Emergency Evacuation at Power Failure

Passengers may be trapped in the car if power failure suddenly happens during use of the elevator.

The INVERTER provides two standby power supply modes to prevent this problem

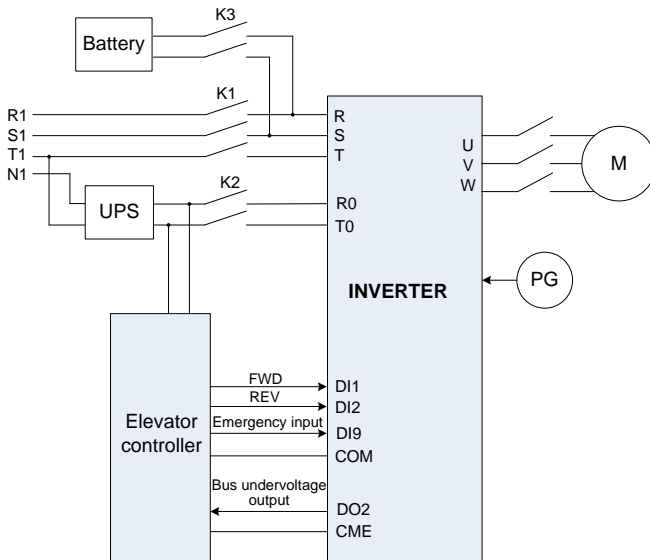
- 48 V battery power supply  
The power of the AC drive main circuit is supplied by the 48 V battery, and other working power is supplied by the UPS (or inverter power).
- UPS  
The main circuit and working power of the AC drive are supplied by the UPS higher than 220 V.

The following parts describes the two parts respectively.

#### 7.4.1 48 V Battery

##### 1. Wiring of 48 V battery power supply

Figure 7-9 48 V battery power supply for emergency evacuation



Note that this mode is used, the AC drive need to be modified with adding the UPS power interfaces R0 and T0.

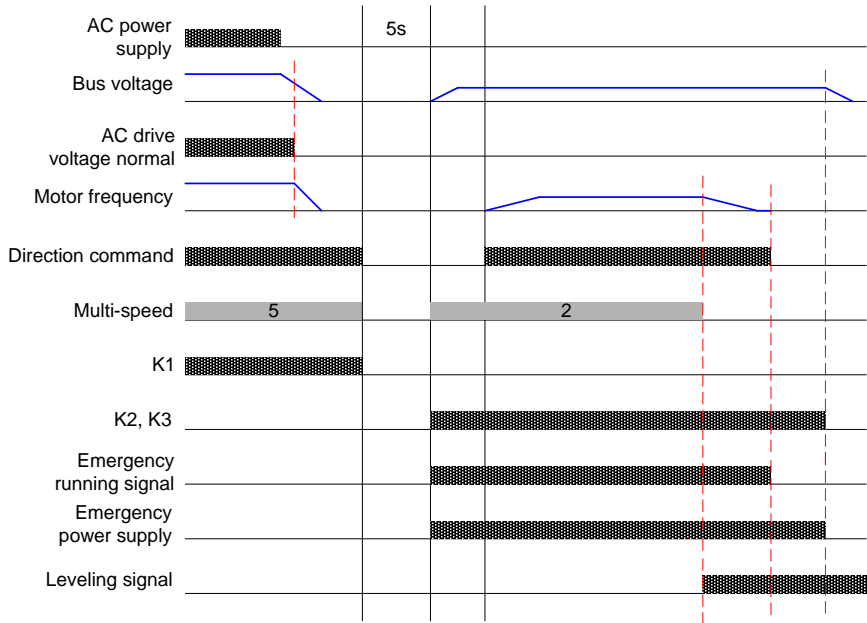
## 2. Running time sequence

Perform wiring according to the preceding figure, use DO2 for bus undervoltage output, and use speed 2 as the emergency evacuation speed. The following table lists the parameters to be set.

Function Code	Parameter Name	Value	Default	Remarks
F4-09	DI9 function selection	9	0	Emergency input
F5-02	DO2 function selection	8	0	Bus undervoltage
F6-02	Speed 2	2.00 Hz	0.00 Hz	The rated motor frequency is 50.00 Hz.
F6-10	Running curve of speed 2	3	1	
F6-17	Emergency evacuation operation mode at power failure	2	0	48 V battery power supply
F7-08	Acceleration time 3	30.0s	4.0s	Increasing the acceleration time can prevent too large impact current.

The following takes the up direction as an example to shown the time sequence.

Figure 7-10 Time sequence of emergency evacuation



The AC drive receives the emergency running signal from the elevator controller through the DI terminal. Based on this signal, the AC drive determines to enter the emergency evacuation state.

Contacts K1, K2, and K3 are controlled by the elevator controller.

3. Precautions

1) Set the running frequency and acceleration/deceleration time properly based on the elevator conditions. It is recommended that the acceleration/deceleration time be larger than 10s.

Set the running frequency according to the following formula:

$$\text{Running frequency} < (48 \text{ V} - 5 \text{ V}) \times \text{Rated motor frequency} / (1.414 \times \text{Rated motor voltage})$$

2. The battery supplies 48 V power to the main circuit, and the auxiliary power such as UPS supplies the working power.

3. It is recommended that the steady output current of the battery be larger than the magnetizing current of the motor.

4. The AC drive determines whether it is emergency running according to the signal input to the related DI terminal.

The running speed is given through multi-speed setting, and the acceleration/deceleration time selected for this speed is used, but it is linear rather than S curve.

5. The AC drive does not detect the DC bus voltage. Before the brake is released, ensure that 48 V voltage has been input to the main circuit.

6. The AC drive monitors the speed during running of the battery as the power supply. If the speed exceeds F6-28 (Upper limit of emergency evacuation speed), the AC drive reports fault Err32 and performs protection.

7. The direction of drive load is not allowed during emergency running. The external controller must select the running direction of balanced load or braking load.

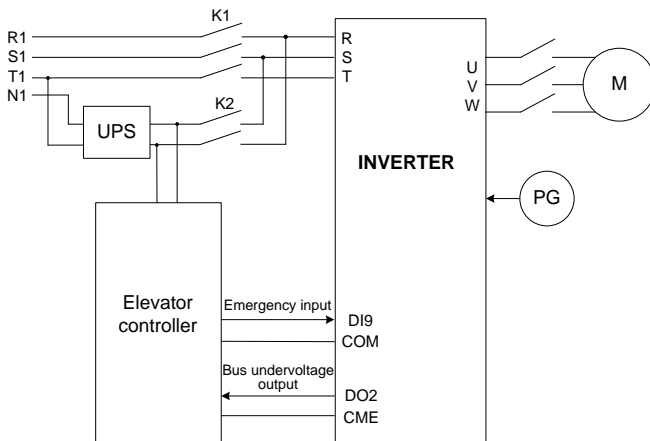
The INVERTER provides the "Light-load running" signal, and determines whether to output this signal according to the load conditions. The external controller determines the emergency running direction based on this signal.

8. The contactor to the AC drive main circuit and the contactor to the UPS must not be closed at the same time; otherwise, the UPS and battery will be damaged.

7.4.2 UPS

1. Wiring of UPS power supply

Figure 7-11 UPS power supply for emergency evacuation



## 2. Running time sequence

When UPS is used for power supply at emergency evacuation in multi-speed control, the following wiring need to added:

- Wiring to the terminals respectively with "Emergency input" and "Bus undervoltage output" signals
- Wiring between the UPS and the AC drive in stop state

Assume that speed 2 is used as the emergency evacuation speed. The following table lists the parameters to be set.

Function Code	Parameter Name	Value	Default	Remarks
F4-09	DI9 function selection	9	0	Emergency input
F5-02	DO2 function selection	8	0	Bus undervoltage
F6-02	Speed 2	2.00 Hz	0.00 Hz	The rated motor frequency is 50.00 Hz.
F6-10	Running curve of speed 2	3	1	
F6-17	Emergency evacuation operation mode at power failure	1	0	UPS
F7-08	Acceleration time 3	30.0s	4.0s	Increasing the acceleration time can prevent too large impact current.

The running time sequence of UPS is the same as that of 48 V battery power supply.

The AC drive receives the UPS emergency running signal from the elevator controller through the DI terminal. Based on this signal, the AC drive determines to enter the emergency evacuation state.

Contactors K1, K2, and K3 are controlled by the elevator controller.

## 7.5 Analog Load Cell Commissioning

This section describes the analog load cell commissioning method on the prerequisite that FWD and REV commands respectively indicate up direction and down direction of the elevator.

### 7.5.1 Parameter Setting

Assume that AI1 is used for the pre-torque input. Set the following parameters:

- F3-09 = 2
- F3-10 = elevator balance coefficient

In the case of car no-load, view the AI1 sampling value (FU-17) on the operation panel and enter this value in F3-18.

In the case of car full-load, enter the AI1 sampling value (FU-17) in F3-19.

F3-18 and F3-19 can also be obtained through load cell auto-tuning.

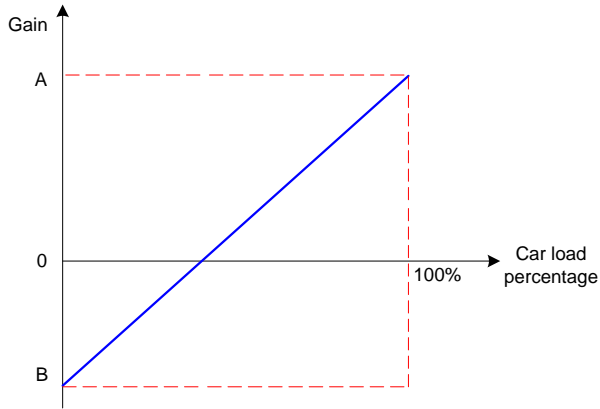
Set F3-11 properly; generally, the value 0.6 is used.

### 7.5.2 Commissioning When Balance Coefficient Incorrect

In certain sites, no-load compensation is correct, but the compensation effect becomes poor when the car load increases; this is caused by incorrect elevator balance coefficient.

If the balance coefficient is unknown, calculate the balance coefficient (F3-10) and gain (F3-11) according to the no-load and full-load compensation test.

Figure 7-12 Compensation curve



The commissioning procedure is as follows:

1. Set F3-10 to 50%.
2. Perform car no-load auto-tuning. Run the elevator in the up and down directions.
3. Adjust F3-11 to ensure that there is no rollback or over torque compensation at the instantaneous moment of brake release both in the up and down directions. Record F3-11 = B.
4. Put full load in the car and perform car full-load auto-tuning. Run the elevator in the up and down directions.
5. Adjust F3-11. When the compensation is proper, record F3-11 = A.

According to the preceding figure, the oblique line is the correct compensation curve of the elevator. The cross point between this line and the horizontal axis is the balance compensation point, that is, balance coefficient. Calculate the balance coefficient according to the following formula:

$$F3-10 = 100 \times B / (A + B)$$

$$F3-11 = (A+B)/2$$

For example, if B = 0.7, and A = 0.4, then F3-10 = 36.4%, and F3-11 = 0.55.

## 7.5.3 Commissioning When Running Direction Incorrect

If the FWD command instructs down direction, and the REV command instructs up direction, which is opposite to the prerequisite, compensation causes bad consequence on the system.

In this case, record the sampling values F3-18 and F3-19 at car no-load and full-load and the coefficient efficient F3-10.

Assume that  $F3-18 = X$ ,  $F3-19 = Y$ ,  $F3-10 = Z$ .

Then, set  $F3-19 = X$ ,  $F3-18 = Y$ ,  $F3-10 = 100 - Z$ .

## 7.6 No-Load-Cell Commissioning

### 7.6.1 Parameter Setting

Function Code	Parameter Name	Value
F1-00	Encoder type	0
F3-09	Startup pre-torque selection	5
F3-02	Brake release delay	> 0.5s

### 7.6.2 Commissioning Description

Increase Fd-05 (Position lock current coefficient) gradually to a value that ensures that rollback is as small as possible and the motor does not jitter after the brake is released. View FU-20 during commissioning to check rollback.

If the motor has obvious oscillation when Fd-07 (Position lock speed loop TI) is smaller than 1.00, increase Fd-05.

The default setting of Fd-06 (Position lock speed loop KP) is proper. Do not change it to a very large value because this may result in motor oscillation.

## 7.7 Commissioning of Direct Travel Ride

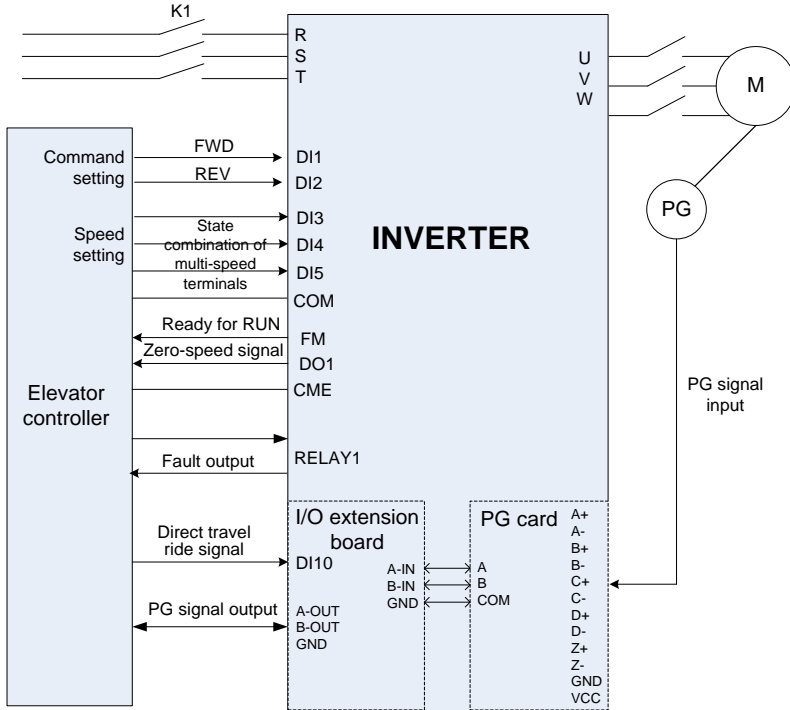
The INVERTER provides the direct travel ride function, which eliminates creeping of the elevator at arrival and improves the running efficiency. This function requires that:

- The elevator controller outputs a direct travel ride signal to the AC drive.
- This signal is sent when the car arrives at the position with a fixed distance to the leveling position, and keeps active until the AC drive stops.

### 7.7.1 Wiring

The following figure is a wiring example, in which the elevator uses the SIN/COS encoder and I/O extension card for open collector output.

Figure 7-13 Wiring of direct travel ride function



- The PG card pulse input terminal on the I/O extension board of the AC drive receives the frequency-division output signal from the PG card.  
This terminal can be connected only to the PG card with open collector output. Select the correct PG card model according to the descriptions of PG card in [Chapter 3 Mechanical and Electrical Installation](#).
- The elevator controller obtains the PG card frequency-division signal from the PG card pulse output terminal on the I/O extension board of the AC drive.

There are two output terminals; one is open collector output, and the other is differential output. Select the correct terminal according to the input type of the controller.



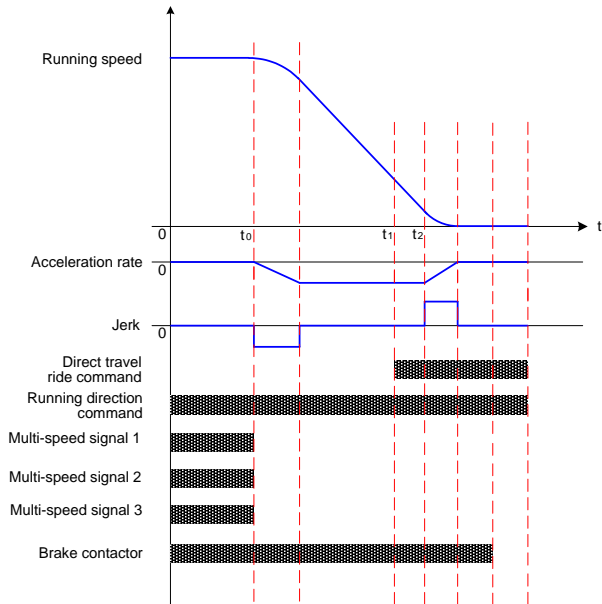
## 7.7.2 Parameter Setting

Besides the motor parameters and encoder parameters, the parameters listed in the following table are also need to set correctly (with Figure 7-13 as an example).

Function Code	Parameter Name	Value	Default	Remarks
F4-10	DI10 function selection	22	0	Direct travel ride command (NO)
F7-17	Set distance of direct travel ride	100.0 mm	0.0 mm	Distance from the car to the leveling position when the direct travel ride command is active (set based on actual conditions)
F8-03	Rated elevator speed	1.600 m/s	1.600 m/s	-
FA-06	PG card frequency-division coefficient ratio	1	1	Set according to the PG card frequency-division ratio

## 7.7.3 Time Sequence

Figure 7-14 Time sequence of direct travel ride



- At the speed switchover point, the elevator controller cancels all the multi-speed signals, making the target speed of the AC drive be 0.
- When the car runs to the position with a specified distance to the leveling zone, the elevator controller issues the direct travel ride command.
- When the AC drive reaches zero speed, the brake is applied.
- After the brake is applied completely, the direction command and direct travel ride command are cancelled. The direct travel ride command can also be cancelled before next-time deceleration.

### 7.7.4 Commissioning Description

After setting the parameters and performing all wiring, register a call and perform trial running.

After the car arrives, view the value of F7-18, and perform the following operations:

1. F7-18 = 0

The AC drive does not use the direct travel ride function at stop. There are two reasons:

1) The AC drive does not receive the direct travel ride command.

To solve the problem, check wiring of the direct travel ride command signal and function selection of the corresponding DI terminal of the AC drive.

If the direct travel ride command is active, the corresponding LED segment in FU-14 is ON.

2) The end time segment of AC drive deceleration is too long.

That is, the time from t2 to zero-speed in Figure 7-14 is too long.

In this case, even if the AC drive receives the direct travel ride command, it cannot execute the command because it has entered the deceleration stage and the stop distance cannot be adjusted.

To solve the problem, reduce the end time segment of AC drive deceleration.

For example, if speed 4 is used for the normal speed running, and F6-12 (Running curve of speed 4) is set to 1, then decrease the value of F7-02 (Time proportion of running curve 1 start segment).

2. F7-18 ≠ 0

The AC drive uses the direct travel ride function. Adjust F7-17 based on the actual leveling conditions:

- Increase F7-17 at under-leveling.
- Decrease F7-17 at over-leveling.

When F7-17 is increased or decreased to a certain value, F7-18 will not change along with F7-17. It indicates that F7-17 reaches the upper limit or lower limit.

This is because that the deceleration distance can be adjusted only within a certain range when the direct travel ride command is received.

- If F7-17 reaches the upper limit, increase the deceleration time.

For example, if speed 4 is used for the normal speed running, and F6-12 (Running curve of speed 4) is set to 1, then increase the value of F7-01 (Deceleration time 1). This increases the deceleration distance. The speed switchover point needs to be adjusted accordingly.

- If F7-17 reaches the lower limit, reduce the end time segment of AC drive deceleration.

For example, if speed 4 is used for the normal speed running, and F6-12 (Running curve of speed 4) is set to 1, then decrease the value of F7-02 (Time proportion of running curve 1 start segment).

Note that a very small value of F7-02 may affect the riding comfort.

3. The deviation between the leveling error at light-load running and that at heavy-load running is very large.

For example, the leveling error at heavy-load running is within 2 mm, but that at light-load running is larger than 5 mm.

To solve the problem, decrease the speed loop integral time set in F2-01 and F2-04 to improve the speed loop control accuracy and reduce the deviation.

## 7.7.5 Calculating Speed Switchover Point

The deceleration distance can be adjusted only within a certain range when the direct travel ride command is received. Therefore, the speed switchover point ( $t_0$  in Figure 7-14) at which the system starts to decelerate must be accurate.

The distance from  $t_0$  to AC drive stop is calculated according to the following formula:

$$L = V \times t_{dec} \times \left( \frac{2 + K_f - K_s}{4} \right) + \frac{V}{12} \times \frac{K_s^2 - K_f^2}{2 - K_s - K_f}$$

$$t_{dec} = \frac{V \times T_{dec}}{V_{max}}$$

In the formula,

- $V$  is the car speed before speed switchover (m/s).
- $V_{max}$  is the car speed (m/s) at the maximum frequency output by the AC drive (F0-05).
- $T_{dec}$  is the set deceleration time (s).
- $K_s$  is the time proportion of the running curve start segment (%).
- $K_f$  is the time proportion of the running curve end segment (%).

Example:

- Speed 4 is used for normal speed running, F6-04 (Speed 4) = rated frequency, and maximum frequency = rated frequency
- F6-12 (Running curve of speed 4) = 1
- F7-01 (Deceleration time 1) = 4s
- F7-02 (Time proportion of running curve 1 start segment) = 20.0%
- F7-03 (Time proportion of running curve 1 end segment) = 20.0%
- F8-03 (Rated elevator speed) = 1 m/s

The calculation result base on these parameters is:

$$V_{max} = 1 \text{ m/s}, V = 1 \text{ m/s}$$

$$T_{dec} = 4 \text{ s}, K_s = 0.2, K_f = 0.2$$

Then,  $L$  is calculated as 2 m.

The elevator controller performs speed switchover and starts to decelerate at the position 2 m away from the leveling position.

## Chapter 8 Maintenance and Troubleshooting

### 8.1 Maintenance

#### 8.1.1 Routine Maintenance

The influence of the ambient temperature, humidity, dust and vibration will cause the aging of the components inside the AC drive, which may cause potential faults or reduce the service life of the AC drive. Therefore, it is necessary to carry out routine and periodic maintenance.



**WARNING**

There is still voltage on the filter capacitor after power-off. Wait until the CHARGE indicator goes off and test with a multimeter that the residual voltage is lower than 36 V and then perform repair or maintenance.

Routine maintenance involves checking:

- Whether abnormal noise exists during motor running
- Whether the motor vibrates excessively
- Whether the installation environment of the AC drive changes
- Whether the cooling fan works properly
- Whether the AC drive overheats

Routine cleaning involves:

- Keep the AC drive clean all the time.
- Remove the dust, especially metal powder on the surface of the AC drive, to prevent the dust from entering the AC drive.
- Clear the oil stain on the cooling fan of the AC drive.

#### 8.1.2 Periodic Inspection

Perform periodic inspection on the items that are difficult to check during running. Periodic inspection involves:

- Check and clean the air filter periodically.
- Check whether the screws become loose.
- Check whether the AC drive is corroded.
- Check whether the wiring terminals have arc signs.
- Carry out the main circuit insulation test.



**CAUTION**

Before measuring the insulating resistance with megameter (500 VDC megameter recommended), disconnect the main circuit from the AC drive. Do not use the insulating resistance meter to test the insulation of the control circuit. The high voltage test need not be performed again because it has been completed before delivery.

### 8.1.3 Replacement

The cooling fan and filter electrolytic capacitor of the AC drive may need to be replaced after reaching their service life. Their service life is related to the operating environment and maintenance.

The service life of the two components is listed in the following table.

Table 8-1 Service life of cooling fan and filter electrolytic capacitor

Component	Service Life	Possible Damage Cause	Judging Criteria
Fan	2 to 3 years	Bearing worn Blade aging	Check whether there is crack on the blade. Check whether there is abnormal vibration noise upon startup.
Electrolytic capacitor	4 to 5 years	Input power supply in poor quality High ambient temperature Frequent load jumping Electrolytic aging	Check whether there is liquid leakage. Check whether the safety valve has projected. Measure the static capacitance. Measure the insulating resistance.

### 8.1.4 Storage of the AC Drive

For storage of the AC drive, pay attention to the following two aspects:

1. Pack the AC drive with the original packing box provided by INVERTER
2. Long-term storage degrades the electrolytic capacitor. Thus, the AC drive must be energized once every 2 years, each time lasting at least 5 hours. The input voltage must be increased slowly to the rated value with the regulator.

## 8.2 Troubleshooting

### 8.2.1 Faults and Troubleshooting

The INVERTER has almost 50 pieces of alarm information and protective functions. If a fault occurs, AC drive stops output, enables the contact of the fault relay to act, and displays the fault code on the operation panel.

Before seeking for help, find the possible causes and rectify the fault according to the instructions in this chapter. If the fault persists, contact your agent or our company.

Note that faults Err33, Err16, Err17 can be reset only after power-on again.

Fault Code	Name	Possible Causes	Solution
Err02	Overcurrent during acceleration	<ul style="list-style-type: none"> <li>● The main circuit output is grounded or short circuited.</li> <li>● Motor auto-tuning is performed improperly.</li> <li>● The load is too heavy.</li> <li>● The encoder signal is incorrect.</li> <li>● The UPS feedback signal is abnormal.</li> </ul>	<ul style="list-style-type: none"> <li>● Check the contactors:               <ol style="list-style-type: none"> <li>a. Check whether the RUN contactor at the AC drive output side is normal.</li> <li>b. Check whether the shorting PMSM stator contactor causes short circuit at the AC drive output side.</li> </ol> </li> <li>● Check motor cables:               <ol style="list-style-type: none"> <li>a. Check whether the motor cables have damaged jacket, possibly short circuited to ground, or connected insecurely.</li> <li>b. Check insulation of motor power terminals, and check whether the motor winding is short circuited or grounded.</li> </ol> </li> <li>● Check whether there is mechanical stuck.</li> <li>● Check motor parameters:               <ol style="list-style-type: none"> <li>a. Check whether motor parameters comply with the nameplate.</li> <li>b. Perform motor auto-tuning again.</li> </ol> </li> <li>● Check whether the balance coefficient is correct.</li> <li>● Check the encoder:               <ol style="list-style-type: none"> <li>a. Check whether encoder pulses per revolution (PPR) is set correctly.</li> <li>b. Check whether the encoder signal is interfered with, whether the encoder cable runs through the duct independently, whether the cable is too long, and whether the shield is grounded at one end.</li> <li>c. Check whether the encoder is installed reliably, whether the rotating shaft is connected to the motor shaft reliably by observing whether the encoder is stable during normal-speed running.</li> <li>d. Check whether the encoder wirings are correct. For asynchronous motor, perform SVC and compare the current to judge whether the encoder works properly.</li> </ol> </li> <li>● Check whether UPS feedback is active in non-UPS running state (Err02).</li> <li>● Check whether the acceleration or deceleration rate is too large (Err02, Err03).</li> </ul>
Err03	Overcurrent during deceleration	<ul style="list-style-type: none"> <li>● The main circuit output is grounded or short circuited.</li> <li>● Motor auto-tuning is performed improperly.</li> <li>● The deceleration rate is too short.</li> <li>● The encoder signal is incorrect.</li> </ul>	
Err04	Overcurrent at constant speed	<ul style="list-style-type: none"> <li>● The main circuit output is grounded or short circuited.</li> <li>● Motor auto-tuning is performed properly.</li> <li>● The load is too heavy.</li> <li>● The encoder is seriously interfered with.</li> </ul>	

Fault Code	Name	Possible Causes	Solution
Err05	Overvoltage during acceleration	<ul style="list-style-type: none"> <li>The input voltage is too high.</li> <li>The regeneration power of the motor is too high.</li> <li>The braking resistance is too large, or the braking unit fails.</li> <li>The acceleration rate is too short.</li> </ul>	<ul style="list-style-type: none"> <li>Observe whether the bus voltage is normal and whether it rises too quickly during running.</li> <li>a. Check whether the cable connecting the braking resistor is damaged, whether the copper wire touches the ground, and whether the connection is reliable.</li> <li>b. Check whether the resistance is proper based on the recommendation in <a href="#">Chapter 3 Mechanical and Electrical Installation</a> and select a proper braking resistor.</li> <li>Check for the balance coefficient.</li> </ul>
Err06	Overvoltage during deceleration	<ul style="list-style-type: none"> <li>The input voltage is too high.</li> <li>The braking resistance is too large, or the braking unit fails.</li> <li>The deceleration rate is too short.</li> </ul>	
Err07	Overvoltage at constant speed	<ul style="list-style-type: none"> <li>The input voltage is too high.</li> <li>The braking resistance is too large, or the braking unit fails.</li> </ul>	
Err08	Control power fault	<ul style="list-style-type: none"> <li>The input voltage is too high.</li> <li>The drive control board is faulty.</li> </ul>	<ul style="list-style-type: none"> <li>Adjust the input voltage.</li> <li>Contact us or our agent directly.</li> </ul>
Err09	Undervoltage	<ul style="list-style-type: none"> <li>Instantaneous power failure occurs on the input power supply.</li> <li>The input voltage is too low.</li> <li>The drive control board fails.</li> </ul>	<ul style="list-style-type: none"> <li>Check whether the external power fails during running.</li> <li>Check whether wiring of all power input cables is secure.</li> <li>Contact us or our agent directly.</li> </ul>
Err10	AC drive overload	<ul style="list-style-type: none"> <li>The brake circuit is abnormal.</li> <li>The load is too heavy.</li> <li>The encoder feedback signal is abnormal.</li> <li>Motor parameters are incorrect.</li> <li>Motor cables are abnormal.</li> </ul>	<ul style="list-style-type: none"> <li>Check the brake circuit and power supply.</li> <li>Reduce the load.</li> <li>Check whether the encoder feedback signal and setting are correct, and whether the encoder initial angle of the PMSM is correct.</li> <li>Check the setting of the motor parameters and perform motor auto-tuning again.</li> <li>Check the motor cables (see the instructions for Err02).</li> </ul>
Err12	Power supply phase loss	<ul style="list-style-type: none"> <li>The power input phases are not symmetric.</li> <li>The drive control board fails.</li> </ul>	<ul style="list-style-type: none"> <li>Check whether the three phases of power supply are balanced and whether the power voltage is normal. If not, adjust the power supply.</li> <li>Contact us or our agent directly.</li> </ul>
Err13	Power output phase loss	<ul style="list-style-type: none"> <li>The output wiring of the main circuit is loose.</li> <li>The motor is damaged.</li> </ul>	<ul style="list-style-type: none"> <li>Check whether the motor wiring is secure.</li> <li>Check whether the RUN contactor on the output side is normal.</li> <li>Eliminate the motor fault.</li> </ul>
Err14	Heatsink overheat	<ul style="list-style-type: none"> <li>The ambient temperature is too high.</li> <li>The fan is damaged.</li> <li>The air filter is clogged.</li> </ul>	<ul style="list-style-type: none"> <li>Lower the ambient temperature.</li> <li>Clear the air filter.</li> <li>Replace the damaged fan.</li> <li>Check whether the installation clearance of the AC drive satisfies the requirement.</li> </ul>

Fault Code	Name	Possible Causes	Solution
Err15	External fault or output abnormal	<ul style="list-style-type: none"> <li>● The elevator controller is faulty.</li> <li>● The braking output side is short circuited.</li> <li>● The UVW output side is abnormal.</li> </ul>	<ul style="list-style-type: none"> <li>● Eliminate problems of the elevator controller.</li> <li>● Check that wiring of the braking resistor and braking unit is correct, without short circuit.</li> <li>● Check whether the main contactor works properly.</li> <li>● Contact us or our agent directly.</li> </ul>
Err16	Current control fault	<ul style="list-style-type: none"> <li>● The magnetizing current deviation is too large.</li> <li>● The torque current deviation is too large.</li> <li>● The torque time limit is exceeded.</li> </ul>	<ul style="list-style-type: none"> <li>● Check the circuit of the encoder.</li> <li>● Check whether the output circuit breaker is off.</li> <li>● Check whether the setting of current loop parameters is too small.</li> <li>● Check whether the encoder initial angle is incorrect. If it is incorrect, perform angle auto-tuning.</li> <li>● Check whether the load is too heavy.</li> </ul>
Err17	Encoder reference signal abnormal.	<ul style="list-style-type: none"> <li>● The deviation between the current position and the absolute position is too large at arrival of Z signal.</li> <li>● The deviation between the absolute position angle and the accumulation angle is too large.</li> </ul>	<p>Check:</p> <ul style="list-style-type: none"> <li>● Whether the encoder is normal</li> <li>● Whether the encoder wiring is correct and reliable</li> <li>● Whether the PG card wiring is correct</li> <li>● Whether the grounding of the control cabinet and motor is reliable</li> </ul>
Err18	Current detection fault	The drive control board fails.	Contact us or our agent directly.
Err19	Motor auto-tuning fault	<ul style="list-style-type: none"> <li>● The motor cannot rotate properly.</li> <li>● Motor auto-tuning times out.</li> <li>● The encoder of the PMSM is abnormal.</li> </ul>	<ul style="list-style-type: none"> <li>● Enter the motor parameters correctly.</li> <li>● Check the motor wiring and whether phase loss occurs on the contactor on the output side.</li> <li>● Check that encoder wiring is correct and encoder PPR is set correctly.</li> <li>● Check whether the brake is released during no-load auto-tuning.</li> <li>● Check whether the Inspection Up/Down button is released before the synchronous motor with-load auto-tuning is completed.</li> </ul>



Fault Code	Name	Possible Causes	Solution
Err20	Speed feedback incorrect	<p>Subcode 1: AB signals are lost during motor auto-tuning.</p> <p>Subcode 3: The motor cable phase sequence is incorrect.</p> <p>Subcode 4: Z signal cannot be detected during motor auto-tuning.</p> <p>Subcode 5: The cables of the SIN/COS encoder break.</p> <p>Subcode 7: The cables of the UVW encoder break.</p> <p>Subcode 8: The angle deviation is too large.</p> <p>Subcode 9: Overspeed occurs or the speed deviation is too large.</p> <p>Subcode 10, 11: The AB or CD signals of the SIN/COS encoder are interfered with.</p> <p>Subcode 12: The speed detected is 0 at torque limit.</p> <p>Subcode 13: The encoder AB signals are lost during running.</p> <p>Subcodes 14: Z signal is lost during running.</p> <p>Subcode 19: The AB analog signal cables break during low-speed running.</p> <p>Subcode 55: CD signals are incorrect during motor auto-tuning or Z signal is seriously interfered with.</p>	<p>Subcodes 1, 4, 5, 7, 8, 10, 11, 13, 14, 19: Check all signal wiring of the encoder.</p> <p>Subcode 3: Exchange any two phases of the motor UVW cables.</p> <p>Subcode 9: Set F1-00, F1-12, and F1-25 for the PMSM correctly.</p> <p>Subcode 12: Check whether there is mechanical stuck and whether the brake is released during running.</p> <p>Subcode 55: Check the grounding and eliminate interference problems.</p>
Err21	Parameter setting error	The maximum frequency is smaller than the rated frequency.	Set the maximum frequency correctly.
Err23	Short circuited to ground	The output is short circuited to ground.	<ul style="list-style-type: none"> <li>● Check whether the motor or contactor on the output side is short circuited to ground.</li> <li>● Contact us or our agent directly.</li> </ul>
Err24	RTC clock fault	Subcode 101: The RTC clock information of the MCB is abnormal.	<p>Subcode 101:</p> <ul style="list-style-type: none"> <li>● Replace the clock battery.</li> <li>● Replace the MCB.</li> </ul>
Err25	Storage data abnormal	Subcodes 101, 102: The storage data of the MCB is abnormal.	<p>Subcodes 101, 102: Contact us or our agent directly.</p>
Err32	Emergency running overspeed	The speed during running with battery power supply exceeds F6-28.	<ul style="list-style-type: none"> <li>● Check whether the battery voltage is normal.</li> <li>● Check whether cable connection between the battery and the AC drive becomes loose.</li> <li>● Check whether F6-28 is set too small.</li> </ul>

Fault Code	Name	Possible Causes	Solution
Err33	Overspeed fault	The running speed remains larger than FC-09 for more than the time in FC-10.	Check: <ul style="list-style-type: none"> <li>• Whether the motor power is proper</li> <li>• Whether the elevator load is too heavy</li> <li>• Whether the encoder signals are correct</li> <li>• Whether FC-09 and FC-10 are set too small</li> </ul>
Err34	Speed deviation too large	The deviation between the AC drive feedback frequency and the frequency reference remains larger than FC-12 for more than the time in FC-13.	Check: <ul style="list-style-type: none"> <li>• Whether the motor power is proper</li> <li>• Whether the elevator load is too heavy</li> <li>• Whether the encoder signals are correct</li> <li>• Whether FC-12 and FC-13 are set too small</li> </ul>
Err36	Contactor fault	<ul style="list-style-type: none"> <li>• The contactor feedback signal is active before startup.</li> <li>• There is no feedback signal after the contactor is closed.</li> </ul>	Check: <ul style="list-style-type: none"> <li>• Whether the contactor contact and feedback contact are normal</li> <li>• Whether the functions of AC drive input terminal are set correctly</li> <li>• Whether the control circuit power of the contactor is normal</li> </ul>
Err37	Brake feedback abnormal	The brake output and feedback signals are inconsistent for more than 2s.	<ul style="list-style-type: none"> <li>• Check whether the brake coil and feedback contact are normal.</li> <li>• Check the signal feature (NO, NC) of the feedback contact.</li> <li>• Check whether the control circuit power of the brake coil is normal.</li> </ul>
Err38	Contact stuck	The feedback signal of the brake or RUN contactor remains active for more than 2.5s at stop.	<ul style="list-style-type: none"> <li>• Check wiring.</li> <li>• Check whether the brake and RUN contactors are normal.</li> </ul>
Err39	Motor overheat	The motor overheat signal is active.	<ul style="list-style-type: none"> <li>• Check whether the motor is damaged and the motor is used correctly.</li> <li>• Improve the heat dissipation conditions of the motor.</li> </ul>
Err40	Elevator running conditions not met	The set elevator running time is reached.	The elevator is used for a very long time and needs to be maintained.
Err55	DSP communication protection	The wiring between the drive control board and the MCB is abnormal.	Check wiring between the drive control board and the MCB.

## 8.2.2 Symptoms and Diagnostics

The following symptoms may occur during use of the AC drive. When these symptoms occur, perform simple analysis according to the following table.

No.	Symptom	Solutions
1	There is no display at power-on.	<ul style="list-style-type: none"> <li>● Check with a multimeter whether the AC drive power supply is consistent with the rated AC drive voltage.</li> <li>● If not, eliminate the power supply problems.</li> <li>● Check whether the three-phase rectifier bridge is normal. If it is damaged, contact us or our agent for technical support.</li> <li>● Check whether the CHARGE indicator is ON.</li> <li>● If this indicator is OFF, the fault may occur on the rectifier bridge or snubber. If this indicator is ON, the fault may be caused by the switch-mode power supply. Contact us or our agent for technical support.</li> </ul>
2	The power circuit breaker trips after power-on.	<ul style="list-style-type: none"> <li>● Check whether the power supply is grounded or short circuited. If yes, eliminate the problems.</li> <li>● Check whether the rectifier bridge is damaged. If yes, contact us or our agent for technical support.</li> </ul>
3	The motor does not rotate after the AC drive runs.	<ul style="list-style-type: none"> <li>● Check whether there is balanced three-phase output from the UVW cables.</li> <li>● If yes, the cause is motor cabling problem, motor damage, or locked-rotor due to mechanical reasons. Eliminate the problems.</li> <li>● If there is output but the three-phase output is unbalanced, the cause is damage of the AC drive board or output module. Contact us or our agent for technical support.</li> <li>● If there is no output voltage, the cause may be damage of the AC drive board or output module. Contact us or our agent for technical support.</li> </ul>
4	The AC drive display is normal after power-on, but the power circuit breaker trips during running.	<ul style="list-style-type: none"> <li>● Check whether inter-phase short-circuit occurs in the output module. If yes, contact us or our agent for technical support.</li> <li>● Check whether motor lead wire is short circuited or grounded. If yes, eliminate the problems. If yes, eliminate the problems.</li> <li>● If trip occurs only sometimes and the distance between the motor and the AC drive is far, install an AC output reactor.</li> </ul>

## Appendix A: Standards Compliance

### A.1 CE Certification

#### A.1.1 CE Mark



CE mark indicates compliance with European safety and environmental regulations. It is required for engaging in business and commerce in Europe.

European standards include the Machinery Directive for machine manufacturers, the Low Voltage Directive for electronics manufacturers, and EMC guidelines for controlling noise.

This drive is marked with CE mark based on the following EMC guidelines and the Low Voltage Directive.

2014/35/EU: Low Voltage Directive

2014/30/EU: Electromagnetic compatibility

Machines and devices used in combination with this drive must also be CE certified and marked. The integrator who integrates the drive with the CE mark in into other devices has the responsibility of ensuring compliance with CE standards and verifying that conditions meet European standards.

#### A.1.2 CE Low Voltage Directive Compliance

This drive has been tested according to IEC 61800-5-1: 2007, and it complies with the Low Voltage Directive completely.

To enable machines and devices integrating this drive to comply with the Low Voltage Directive, be sure to meet the following conditions:

##### Mounting Location

Mount the AC drive in places with pollution not higher than severity 2 and overvoltage category 3 in accordance with IEC60664.

##### Installing Fuse on the Input Side

To prevent accidents caused by short circuit, install fuse on the input side and the fuse must comply with the UL standard.

##### Preventing Entry of Foreign Objects

The drive units must be installed in a fireproof cabinet with doors that provide effective electrical and mechanical protection. The installation must conform to local and regional laws and regulations, and to relevant IEC requirements.

##### Grounding


If using an AC drive of the 400 V class, tie the neutral point of the drive power supply to ground.

### A.1.3 EMC Guidelines Compliance

Electromagnetic compatibility (EMC) describes the ability of electronic and electrical devices or systems to work properly in the electromagnetic environment and not to generate electromagnetic interference that influences other local devices or systems.

In other words, EMC includes two aspects: The electromagnetic interference generated by a device or system must be restricted within a certain limit; the device or system must have sufficient immunity to the electromagnetic interference in the environment.

The drive satisfies the European EMC directive 2004/108/EC and the standard EN 61800-3: 2004 +A1: 2012 Category C2. The AC drives are applied to both the first environment and the second environment.

	<p>When applied in the first environment, the AC drive may generate radio interference. Besides the CE compliance described in this chapter, take measures to avoid the radio interference if required.</p>
---	---

The integrator of the system installed with the AC drive is responsible for compliance of the system with the European EMC directive and standard EN 61800-3: 2004 +A1: 2012 Category C2, C3 or C4 according to the system application environment.

### A.1.4 Definition of Terms

#### First environment

Environment that includes domestic premises, it also includes establishments directly connected without intermediate transformers to a low-voltage power supply network which supplies buildings used for domestic purposes.

#### Second environment

Environment that includes all establishments other than those directly connected to a low-voltage power supply network which supplies buildings used for domestic purposes

#### Category C1 AC drive

Power Drive System (PDS) of rated voltage less than 1 000 V, intended for use in the first environment

#### Category C2 AC drive

PDS of rated voltage less than 1 000 V, which is neither a plug in device nor a movable device and, when used in the first environment, is intended to be installed and commissioned only by a professional person.

#### Category C3 AC drive

PDS of rated voltage less than 1 000 V, intended for use in the second environment and not intended for use in the first environment

#### Category C4 AC drive

PDS of rated voltage equal to or above 1 000 V, or rated current equal to or above 400 A, or intended for use in complex systems in the second environment

## A.1.5 Selection of EMC Devices

### **EMC Input Filter on Power Input Side**

An EMC filter installed between the AC drive and the power supply can not only restrict the interference of electromagnetic noise in the surrounding environment on the AC drive, but also prevents the interference from the AC drive on the surrounding equipment.

The INVERTER AC drive satisfies the requirements of category C2 only with an EMC filter installed on the power input side. The installation precautions are as follows:

- Strictly comply with the ratings when using the EMC filter. The EMC filter is category I electric apparatus, and therefore, the metal housing ground of the filter should be in good contact with the metal ground of the installation cabinet on a large area, and requires good conductive continuity. Otherwise, it will result in electric shock or poor EMC effect.
- The grounds of the EMC filter and the PE conductor of the AC drive must be tied to the same common ground. Otherwise, the EMC effect will be affected seriously.
- The EMC filter should be installed as closely as possible to the power input side of the AC drive.

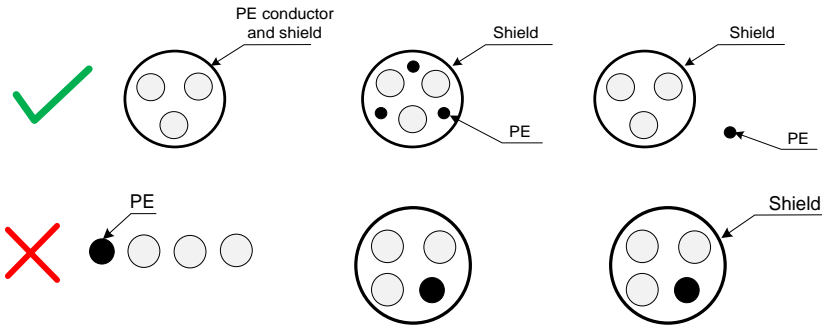
## A.1.6 Shielded Cable

### Requirements for Shielded Cable

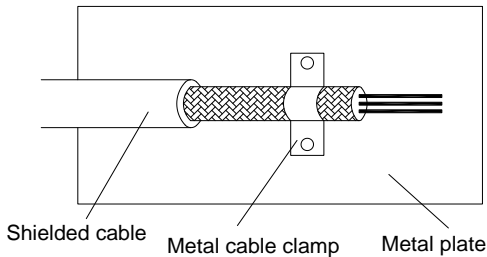
The shielded cable must be used to satisfy the EMC requirements of CE marking. Shielded cables are classified into three-conductor cable and four-conductor cable. If conductivity of the cable shield is not sufficient, add an independent PE cable, or use a four-conductor cable, of which one phase conductor is PE cable.

The three-conductor cable and four-conductor cable are shown in the following figure.

To suppress emission and conduction of the radio frequency interference effectively, the shield of the shielded cable is cooper braid. The braided density of the cooper braid should be greater than 90% to enhance the shielding efficiency and conductivity, as shown in the following figure.

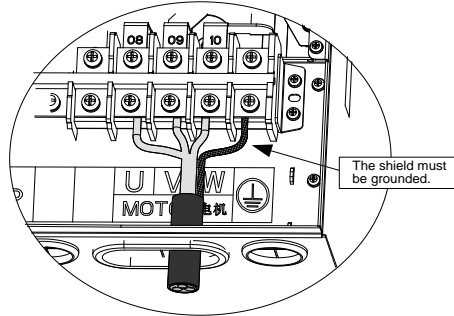


It is recommended that all control cables be shielded. The grounding area of the shielded cable should be as large as possible. A suggested method is to fix the shield on the metal plate using the metal cable clamp as shown in the following figure.



The following figure shows the grounding method of the shielded cable.

Figure A-1 Grounding of the shielded cable



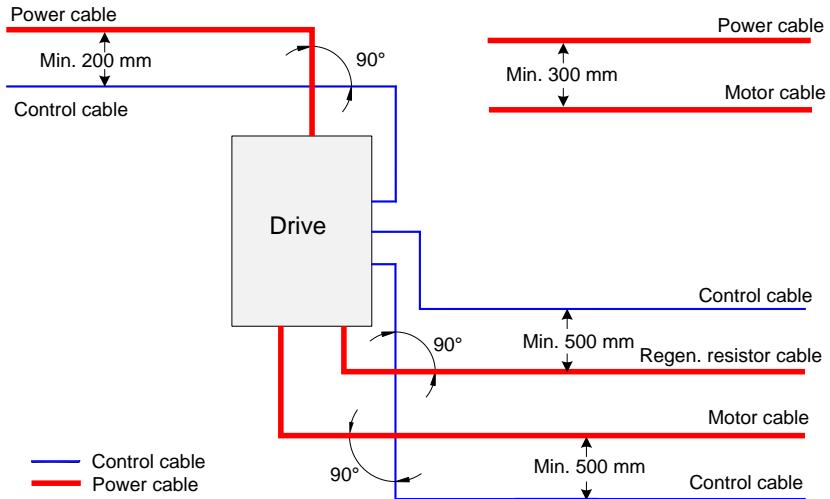
### Cabling Requirements

- The motor cable and PE shielded conducting wire (twisted shielded) should be as short as possible to reduce electromagnetic radiation and external stray current and capacitive current of the cable. If the motor cable is over 100 meters long, an output filter or reactor is required.
- It is recommended that all control cables use shielded cables.
- The motor cables must be far away from other cables. The several drives can be laid in parallel.
- It is recommended that the motor cables, power input cables and control cables be laid in different ducts. To avoid electromagnetic interference caused by rapid change of the output voltage of the drive, the motor cables and other cables must not be laid side by side for a long distance.
- If the control cable must run across the power cable, make sure they are arranged at an angle of close to 90°. Other cables must not run across the drive.
- The power input and output cables of the drive and weak-current signal cables (such as control cable) should be laid vertically (if possible) rather than in parallel.
- The cable ducts must be in good connection and well grounded. Aluminium ducts can be used to improve electric potential.
- The filter, drive and motor should be connected to the system (machinery or appliance) properly, with spraying protection at the installation part and conductive metal in full contact.

The following figure shows the recommended cabling diagram.



Figure A-2 Recommended cabling diagram



### A.1.7 Solutions to Current Leakage

The drive outputs high-speed pulse voltage, producing high-frequency leakage current during running of the drive.

The drive generates DC leakage current in protective conductor. In this case, a time-delay B-type residual current device (RCD) must be used. If multiple drives are used, an RCD must be provided for each drive.

The factors that influence the leakage current are as follows:

- Drive capacity
- Carrier frequency
- Type and length of motor cable
- EMI filter
- When the leakage current causes the RCD to act, you should:
  - Increase the sensitivity current of the RCD.
  - Replace it with a time-delay B-type RCD with high-frequency suppression function.
  - Reduce the carrier frequency.
  - Shorten the length of the output cables.
  - Install a current leakage suppression device.

Use Chint Electric and Schneider brands.

## A.1.8 Solutions to EMC Interference

The drive generates very strong interference. Although EMC measures are taken, the interference may still exist due to improper cabling or grounding during use. When the AC drive interferes with other devices, adopt the following solutions.

Interference Type	Solution
ELCB tripping	<ul style="list-style-type: none"> <li>● Connect the motor housing to the PE of the AC drive.</li> <li>● Connect the PE of the AC drive to the PE of the mains power supply.</li> <li>● Add a safety capacitor to the power input cable.</li> <li>● Add magnetic rings to the input drive cable.</li> </ul>
AC drive interference during running	<ul style="list-style-type: none"> <li>● Connect the motor housing to the PE of the AC drive.</li> <li>● Connect the PE of the AC drive to the PE of the mains voltage.</li> <li>● Add a safety capacitor to the power input cable and wind the cable with magnetic rings.</li> <li>● Add a safety capacitor to the interfered signal port or wind the signal cable with magnetic rings.</li> <li>● Connect the equipment to the common ground.</li> </ul>
Communication interference	<ul style="list-style-type: none"> <li>● Connect the motor housing to the PE of the AC drive.</li> <li>● Connect the PE of the AC drive to the PE of the mains voltage.</li> <li>● Add a safety capacitor to the power input cable and wind the cable with magnetic rings.</li> <li>● Add a matching resistor between the communication cable source and the load side.</li> <li>● Add a common grounding cable besides the communication cable.</li> <li>● Use a shielded cable as the communication cable and connect the cable shield to the common grounding point.</li> </ul>
I/O interference	<ul style="list-style-type: none"> <li>● Enlarge the capacitance at the low-speed DI. A maximum of 0.11 uF capacitance is suggested.</li> <li>● Enlarge the capacitance at the AI. A maximum of 0.22 uF is suggested.</li> </ul>

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