iAStar-S3
Inverter for Elevator
Instruction Manual

Product Version: V6.02

2010.07

Shanghai STEP Electric Corporation

iAStar-S3 Series elevator-used inverters

Publication state: standard

Product version: V6.02

Preface

The iAStar-S3 Series of elevator-used Inverters is a new type inverter which is researched and developed based on the carry characteristic of elevator. The 32 bit electromotor-used Digital Signal Processing (DSP), Complex Programmable Logic Device (CPLD), Intelligent Power Module (IPM) and the digiral vector controlled frequency-variable speed-adjustable technology are used in the Inverter. It also combines the model characteristic of potential energy. All of them ensure stable, comfortable and efficient running of elevator.

Outline

This instruction manual describes installation, operation, function constants setting, maintenance and trouble-shooting of the iAStar-S3 Inverter. The manual can be the reference for designing the elevator control system by using the iAStar-S3 Inverter. It also can be the reference of installation, commissioning and maintenance of elevator.

Please read the manual carefully before installing and operating the inverter.

Reader

User

Designer of elevator control system

Maintenance engineer

Technical supporter

Innovations

a) The innovative starting compensation technique without load sensors provides an excellently comfortable starting of elevator.

b) The new PWM dead-zone compensation technique can effectively reduce motor noise and wearing.

c) There is no need to run autotuning for asynchronous motor.

d) There is no need to lift the car during self-tuning of the phase angle of elevator with synchronous motor.

Convenient and quick commissioning method of elevator

It is important whether it is convenient for elevator commissioning after wiring. Usually it takes operators much time and effort to set many parameters and perform complicated procedures. This becomes very convenient by using our inverter which is designed especially for elevator. There are only three steps for commissioning:

1 Adjusting running direction

The correct encoder wiring and motor running direction can be easily identified by the operator.

2 Setting parameters

a) Users may use the leave-factory configuration of motor parameters directly identified and/or set by us, or

b) Enter the motor parameters into the inverter according to the motor nameplate.

3 Adjusting feeling

a) The comfortable feeling may be obtained by the leave-factory values of the parameters.

b) This may be further improved through minor adjustments of C parameters of PID.

Note on the content

The content of this manual may have supplements or modifications. Please visit our website for upgrade: www.stepelectric.com.

Safety Information

The following symbols with texts are used in this manual for safety-related contents. Please comply with these regulations as they are very important.

WARNING	Indicates precautions that, if not heeded, could possibly result in loss of life or serious injury.
CAUTION	Indicates precautions that, if not heeded, could possibly result in relatively serious or minor injury, damage to the product, or faulty operation.
IMPORTANT	Indicates important information that should be memorized.

Table of contents

1 Operation Precautions

The user who is familiar with this Inverter may skip directly to Appendix C "Operation guide of elevator control".

This chapter introduces general information about the inverter, including the voltage class, the capacity of available motors, and how to check after transport. In addition, this chapter expands the precautions of installation, layout, operation, maintenance and discarding. It is helpful for safe application of the inverter and longer service life. Please read the chapter carefully.

1.1 Voltage Class and Motor Capacity

The iAStar-S3 Inverter is of 200V and 400V class. The available motor power capacity is from 2.2 to 75 kW.

1.2 Confirmations upon Delivery

CAUTION
◎**Never install an inverter that is damaged or missing components.** Doing so may result in fire and injury.

When unpacking, please confirm carefully that: whether the Inverter is damaged in any way; whether the type and specifications on the nameplate are consistent with the order form. If there is any type inconformity or component missing,please ediately contact the supplier.

1.3 Inverter Specifications

The iAStar-S3 Inverter specifications are shown in Figure 1.1.

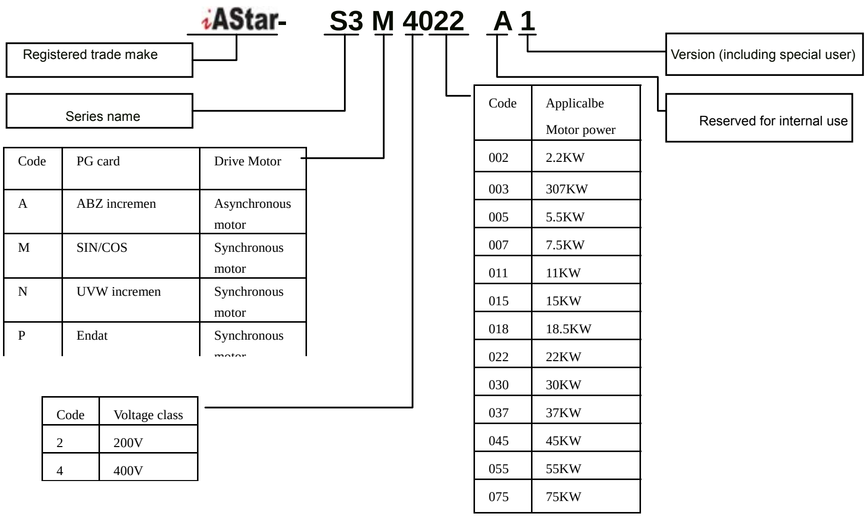


Figure 1.1 Inverter specifications

1.4 Inverter Nameplate Information

The Inverter nameplate is shown in Figure 1.2.

The nameplate includes information such as model number, specifications, lot number and so on.

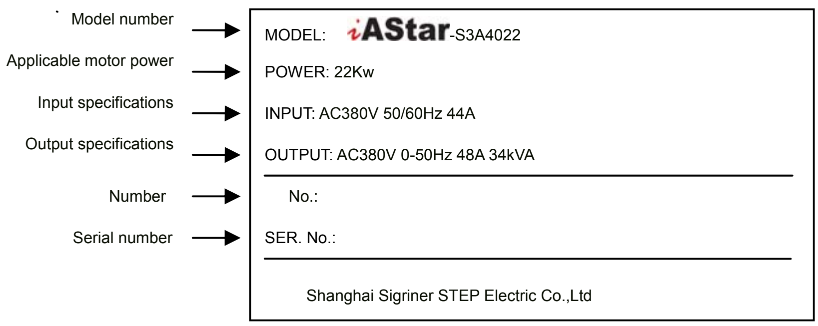


Figure 1.2 Nameplate information

1.5 Safety Precautions

WARNING

◎ **Attach the Inverter to a metal or other noncombustible material.**

Or fire may result.

◎ **Don't attach the Inverter in an environment containing explosive gas.**

Or explosion may result.

◎ **Don't place combustible material nearby.**

Or fire may result.

CAUTION

◎ **Always hold the case when carrying the Inverter.**

Drop of the Inverter may cause injury of people and damage to the Inverter.

◎ **The bearing capacity of the block shall be considered during installation.**

Drop of the Inverter may cause injury of people and damage to the Inverter.

◎ **Install the Inverter away from water splashes.**

Or the Inverter may be damaged.

◎ **Prevent screws, washers or metal sticks from going into the interior of the Inverter.**

Or fire may result and the Inverter may be damaged.

WARNING

◎ **Always turn off the input power supply before wiring.**

Or electric shock may occur.

◎ **Wiring must be performed by an authorized person qualified in electrical work.**

Or electric shock may occur.

◎ **Be sure to ground the protective grounding terminal E.**

Or electric shock may occur.

◎ **Never mix the input terminals and the output terminals of the main circuit.**

Or the Inverter may be damaged and an explosion may result.

◎ **Never connect the terminal ⊕1/⊕2 with ⊖.**

Or fire or explosion may result.

◎ **The cover must be in place before turning on the power supply.**

Or electric shock and explosion may occur.

◎ **Never operate the Inverter with wet hands.**

Or electric shock may occur.

◎ **Check carefully the wiring after connecting the emergency stop circuit.**

Or dangers may occur.

WARNING

◎ **A booster shall be used to slowly bring up the voltage to the Inverter if it has been in storage for more than two years.**

Or electric shock and explosion may occur.

◎ **False operations are not allowed when the Inverter is running.**

Or high-voltage electric shock may occur.

◎ **Never open the cover or touch the terminals shortly after cutoff of the power supply for there is still high voltage in the Inverter.**

Or high-voltage electric shock may occur.

◎ **Only trained and authorized persons qualified in electrical work can perform maintenance.**

Or the Inverter may be damaged or electric shock may occur.

◎ **Maintenance personnel must take off watch, ring and any other metal object before the work. They must be equipped with clothes and tools that conform to relevant insulation requirements during the work.**

Or electric shock and explosion may occur.

1.6 Handling notice

When using the iAStar-S3 Inverter, please pay attention to the following:

1.6.1 Choice of Braking Resistor

The elevator control system is running in four quadrants with potential load and negative torques. Therefore, the choice of braking components shall be considered in order to avoid over-current and overvoltage trip. The iAStar-S3 Inverter has built-in braking unit and only needs an external braking resistor. Table 1.1 shows the braking resistor specifications for 200V Inverters and Table 1.2 for 400V.

Table 1.1 Braking resistors for 200V Inverters

Inverter model iAStar-S3	Applicable motor output	Minimum (Ω)	Maximum (Ω)	Recommended (Ω)	Recommended total power(W)	
					Synchronous	Asynchronous
2002	2.2	13	58	50	1000	1000
2003	3.7	13	39	30	1600	1000

Note: if Inverters of 5.5kW or above in the 200V series are to be used, please contact the D&R center of STEP for the braking resistor specifications.

Table 1.2 Braking resistors for 400V Inverters

Inverter model iAStar-S3	Applicable motor output (kW)	Minimum (Ω)	Maximum (Ω)	Recommended (Ω)	Recommended total power(W)	
					Synchronous	Asynchronous
4002	2.2	56	210	100	1000	1000
4003	3.7	56	144	80	1600	1200
4005	5.5	56	100	70	2000	1600
4007	7.5	56	72	64	3200	2000
4011	11	34	48	40	4000	3200
4015	15	34	41	36	5000	4000
4018	18.5	17	31	24	6400	5000
4022	22	17	27	20	8000	6400
4030	30	11	20	15	10000	8000
4037	37	8	16	12	12000	10000
4045	45	5	10	9	18000	15000
4055	55	5	8	8	22000	18000
4075	75	5	6	6	30000	25000

1.6.2 Absorbing device is prohibited on the output side

Since the output of the Inverter is impulse, trip or damage to devices may occur if capacitors for improving power factor or varistors for lightening protection are installed on the output side. This shall be considered during design. The capacitors and varistors wired to the existing output side of the circuit shall be removed during modernization of old elevators.

Never wire the capacitor on the output side of the Inverter circuit. This is sketched in Figure 1.3.

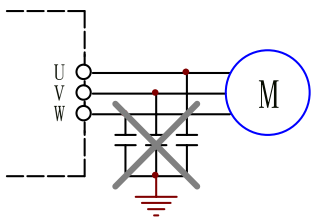


Figure 1.3 Never wire the capacitor on the output side of the Inverter circuit

1.6.3 Operation Voltage of Inverter

The operation voltage of the iAStar-S3 Inverter shall be at its nominal level, i.e., 220V/380V. If the power supply does not provide the appropriate voltage, a transformer must be used.

1.6.4 2-phase power supply is prohibited

3-phase power supply may not be changed to 2-phase, or faults may occur.

1.6.5 User control of output contactor

If the output contactor is not controlled by the iAStar-S3 Inverter but by the user program, it is recommended to pull in the contactor before sending the running command to the Inverter and to pull it off a while after the signal output of the elevator has been stopped in order to ensure correct operation of the contactor without current.

1.6.6 Altitude and derating operation

In areas with an altitude above 1000m, thin air will lower the heat dissipation capacity of the Inverter, and thus the Inverter shall be operated at a derated level. Figure 1.4 shows the relationship between nominal output current and altitude.

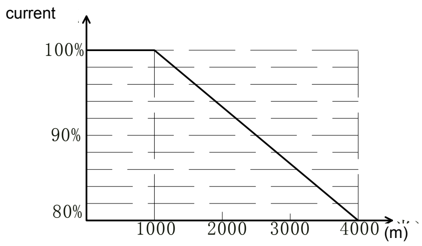


Figure 1.4 Relationship between nominal output current and altitude

1.6.7 Synchronous starpoint connection delay

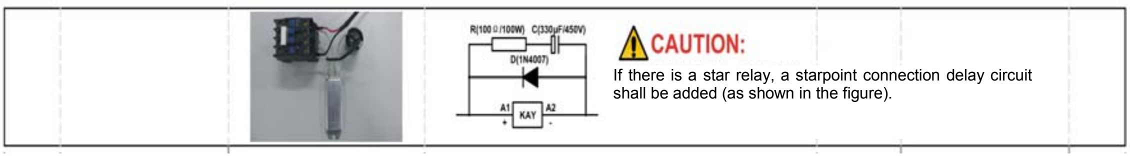


Figure 1.5 Notice on starpoint connection delay circuit

1.7 Discarding Notices

The discarded Inverter shall be disposed as industrial garbage.

1.7.1 Capacitor Disposal

Explosion may occur during burning of the chemical capacitor on the main circuit or PCB. Therefore, burning chemical capacitor is prohibited.

1.7.2 Plastic Parts Disposal

There are many plastic parts on the Inverter, the burning of which will generate poisonous gases. Therefore, burning plastic parts is prohibited.

2 Model and Specification

The following provides the model, specifications and installation dimensions of the iAStar-S3 Inverter.

2.1 Inverter Model Numbers

The iAStar-S3 Inverter model numbers are listed in Table 2.1 for the 200V models and Table 2.2 for the 400V.

Table 2.1 Models of 200V iAStar-S3 Inverters

Model number iAStar-S3-	Rated capacity(kVA)	Rated current output(A)	Applicable motor output(kW)
2002	4.6	12	2.2
2003	6.9	18	3.7

Table 2.2 Models of 400V iAStar-S3 Inverters

Model number iAStar-S3-	Rated capacity(kVA)	Rated current output(A)	Applicable motor output(kW)
4002	4.7	6.2	2.2
4003	6.9	9	3.7
4005	8.5	13	5.5
4007	14	18	7.5
4011	18	27	11
4015	24	34	15
4018	29	41	18.5
4022	34	48	22
4030	50	65	30
4037	61	80	37
4045	74	97	45
4055	98	128	55
4075	130	165	75

2.2 Inverter Technical Index and Specification

The iAStar-S3 Inverter technical indexes and specifications are shown in Table 2.3, Table 2.4 and Table 2.5.

Table 2.3 shows the technical indexes and specifications of 200V inverters; Table 2.4 those of 400 V; and Table 2.5 those that are shared by the two classes.

Table 2.3 Technical indexes and specifications of **200V iAStar-S3** Inverter

Model Number: iAStar-S3		2002	2003
Rated Output	Rated capacity (kVA)	2.2	3.7
		4.6	6.9
	Rated current (A)	12	18
	Maximum voltage output (V)	3-phase, 200/208/220/230/240 (corresponding to voltage input)	
Power Supply	Phase, voltage, frequency	3.7kW and below: 1- or 3-phase, 200/208/220/230/240V 50/60Hz; 5.5kW and above: 3-phase, 200/208/220/230/240V 50/60Hz	
	Allowed fluctuation in voltage	-15%～+10%	
	Allowed fluctuation in frequency	-5%～+5%	
	3-phase unbalance rate	≤2%	
	Instantaneous low voltage bearing	Keep running above AC 150V; Undervoltage protection occurs when the voltage is below AC 150V and lasts for 15 ms.	

Table 2.4 Technical indexes and specifications of **400V iAStar-S3** Inverter

Model Number: iAStar-S3		4002	4003	4005	4007	4011	4015	4018	4022	4030	4037	4045	4055	4075
Maximum Applicable Motor Output (kW)		2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	75
Rated Output	Rated capacity (kVA)	4.7	6.9	8.5	14	18	24	29	34	50	61	74	98	130
	Rated current (A)	6.2	9	13	18	27	34	41	48	65	80	97	128	165
	Maximum voltage output (V)	3-phase, 380/400/415/440/460 (corresponding to voltage input)												
Power Supply	Phase, voltage, frequency	3-phase, 380/400/415/440/460V 50/60Hz												
	Allowed fluctuation in voltage	-15%～+10%												
	Allowed fluctuation in frequency	-5%～+5%												
	3-phase unbalance rate	≤2%												
	Instantaneous low voltage bearing	Keep running above AC 300V; Undervoltage protection occurs when the voltage is below AC 300V and lasts for 15 ms.												

Table 2.5 Shared technical indexes and specifications of **200V** and **400V iAStar-S3** Inverters

Control Characteristics	Control method	Vector control with PG card
	Startup torque	150% 0Hz (vector control with PG card)
	Speed range	1:1000 (vector control with PG card)
	Speed precision	±0.05% (vector control with PG card, 25±10℃)
	Torque limit	Yes (set by parameter)
	Torque precision	±5%
	Frequency control range	0～100Hz
	Frequency precision (temp. fluctuation)	±0.01% (digital instruction)，±0.1% (analog instruction)
	Frequency setting resolution	0.01Hz (digital instruction)，±0.03Hz/60Hz (analog instruction)
	Frequency output resolution (calculation of resolution)	0.001Hz
	Overload ability	Zero speed to 130%, <3Hz when 150%,> 3Hz 185% when
	Braking torque	150% (connecting peripheral braking resistor), built-in braking unit
	Accelerating/decelerating time	0.01～3600s
	Carrier frequency	5～15kHz

Table 2.5 Shared technical indexes and specifications of **200V** and **400V** ***iAStar*-S3** Inverters, Continued

Control Characteristics	Speed setting	Digital setting; analog setting, control system setting through CAN (optional)
	Bus operation under low voltage	At power failure, storage batteries are used to bring the elevator slowly to level immediately
PG Connection	PG power supply	5V, 8V, 15V, 300mA
	PG signal	Open collector, Push-Pull, differential, SIN/COS, Endat absolute type, Endat absolute encoder
	PG dividing frequency output	OA and OB orthogonal, dividing frequency coefficient 1～128
Control Input/Output Signal	Analog voltage input	2-way, -10～+10VDC or 0～+10VDC, precision 0.1%
	Analog current input	1-way, 4～20mA, precision 0.1%
	Analog voltage output	2-way, -10～+10VDC, precision 0.1%
	Photocoupler isolation input	12-way: forward rotation; backward rotation; running signal; exterior fault; fault reset; multi speed (1/2/3); multi-function (1/2/3/4)
	Open collector output	3-way, outputs are optional
	Programmable relay output	1-way, NO contact; contact capacity: resistance, 5A 250VAC or 5A 30VDC
	Programmable relay output	2-way, NO and NC contacts, contact capacity: resistance, 5A 250VAC or 5A 30VDC
	CAN communication terminal	1-way
	RS232 communication terminal	1-way, for operator
Protection Functions	Motor overload protection	Zero speed to 130%, <3Hz when 150%,> 3Hz 185% when
	Inverter overload	Zero speed to 130%, <3Hz when 150%,> 3Hz 185% when
	Over-current	Zero speed to 130%, <3Hz when 150%,> 3Hz 185% when
	Short-circuit protection	Protection of the Inverter when over-current is caused by short circuit of any two phases at the output side
	Fuse protection	Fuse will be broken off to protect the Inverter
	Phase-loss protection	When one phase is lost during running, the circuit will be switched off to protect the Inverter
	Over-voltage threshold	410 V on bus (200V series), 810 V (400V series)
	Under-voltage threshold	190 V on bus (200V series), 380 V (400V series)
	Instantaneous power loss compensation	Protection above 15 ms
	Over-heated of radiation fins	Protection through thermistor
	Speed deviation protection	Protection against speed deviation over 20% of the rated value
	Encoder fault	Wire broken off or phase mistake of PG card

Table 2.5 Shared technical indexes and specifications of 200V and 400V iAStar-S3 Inverters, Continued

Protection Functions	IPM interior protection	IPM over-heated, over-current, short-circuit, under-voltage of control power
	Braking unit protection	Automatic detection of abnormalities and protection
	Over-torque protection	The same as over-current protection
	EEPROM faults	Self-test when powering on
Display	Chinese/English LCD display	Including all sub-menus
Environment	Ambient temp.	-10～+40℃
	Humidity	Below 95%RH (no condensation)
	Storage temp.	-20～+60℃ (for short-term transport)
	Location	Indoor (without corrosive gas and dust)
	Altitude	Below 1000 m
Structure	Protection degree	IP20
	Cooling	Air-blast cooling
Installation method		In cabinet

2.3 Installation Dimension and Weight of Inverter

Installation dimensions and weights of the Inverter are shown in Figure 2.1 and Table 2.6 and Table 2.7.

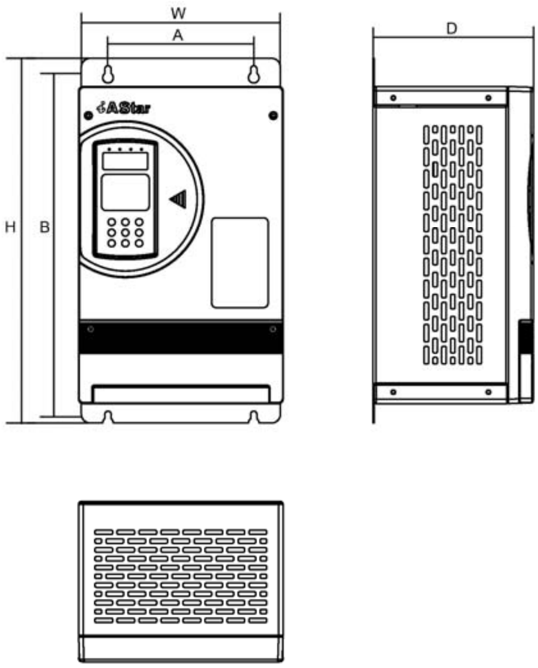


Figure 2.1 Installation dimension and weight of Inverter

Table 2.6 Installation dimensions and weights of **200V iAStar-S3** Inverters

<table>
<tr><th rowspan="2">Model
iAStar-S3-</th><th rowspan="2">A
(mm)</th><th rowspan="2">B
(mm)</th><th rowspan="2">H
(mm)</th><th rowspan="2">W
(mm)</th><th rowspan="2">D
(mm)</th><th rowspan="2">Installation aperture Φ(mm)</th><th colspan="3">Installation</th><th rowspan="2">Fastening torque (Nm)</th><th rowspan="2">Weight (kg)</th></tr>
<tr><th>Bolt</th><th>Nut</th><th>Washer</th></tr>
<tr><td>2002</td><td rowspan="2">165.5</td><td rowspan="2">357</td><td rowspan="2">379</td><td rowspan="2">222</td><td rowspan="2">182</td><td rowspan="2">7.0</td><td rowspan="2">4M6</td><td rowspan="2">4M6</td><td rowspan="2">4Φ6</td><td rowspan="2">3</td><td rowspan="2">9</td></tr>
<tr><td>2003</td></tr>
</table>

Table 2.7 Installation dimensions and weights of **400V iAStar-S3** Inverters

<table>
<tr><th rowspan="2">Model
iAStar-S3-</th><th rowspan="2">A
(mm)</th><th rowspan="2">B
(mm)</th><th rowspan="2">H
(mm)</th><th rowspan="2">W
(mm)</th><th rowspan="2">D
(mm)</th><th rowspan="2">Installation aperture Φ(mm)</th><th colspan="3">Installation</th><th rowspan="2">Fastening torque (Nm)</th><th rowspan="2">Weight (kg)</th></tr>
<tr><th>Bolt</th><th>Nut</th><th>Washer</th></tr>
<tr><td>4002</td><td rowspan="4">165.5</td><td rowspan="4">357</td><td rowspan="4">379</td><td rowspan="4">222</td><td rowspan="4">182</td><td rowspan="9">7.0</td><td rowspan="9">4M6</td><td rowspan="9">4M6</td><td rowspan="9">4Φ6</td><td rowspan="9">3</td><td rowspan="4">9</td></tr>
<tr><td>4003</td></tr>
<tr><td>4005</td></tr>
<tr><td>4007</td></tr>
<tr><td>4011</td><td rowspan="2">165.5</td><td rowspan="2">392</td><td rowspan="2">414</td><td rowspan="2">232</td><td rowspan="2">182</td><td rowspan="2">10</td></tr>
<tr><td>4015</td></tr>
<tr><td>4018</td><td rowspan="2">165.5</td><td rowspan="2">438</td><td rowspan="2">463</td><td rowspan="2">254</td><td rowspan="2">182</td><td rowspan="2">11</td></tr>
<tr><td>4022</td></tr>
<tr><td>4030</td><td>165.5</td><td>511</td><td>533</td><td>305</td><td>240</td><td>23</td></tr>
<tr><td>4037</td><td>200</td><td>512</td><td>530</td><td>330</td><td>290</td><td>10.0</td><td>4M8</td><td>4M8</td><td>4Φ8</td><td>4</td><td>33</td></tr>
<tr><td>4045</td><td>200</td><td>587</td><td>610</td><td>330</td><td>310</td><td>10.0</td><td>4M8</td><td>4M8</td><td>4Φ8</td><td>4</td><td>42</td></tr>
<tr><td>4055</td><td>200</td><td>587</td><td>610</td><td>330</td><td>310</td><td>10.0</td><td>4M8</td><td>4M8</td><td>4Φ8</td><td>4</td><td>42</td></tr>
<tr><td>4075</td><td>260</td><td>707</td><td>730</td><td>430</td><td>330</td><td>10.0</td><td>4M8</td><td>4M8</td><td>4Φ8</td><td>4</td><td>50</td></tr>
</table>

2

Model and Specification

2.4 Digital Operator Dimensions

Digital operator dimensions are shown in Figure 2.2.

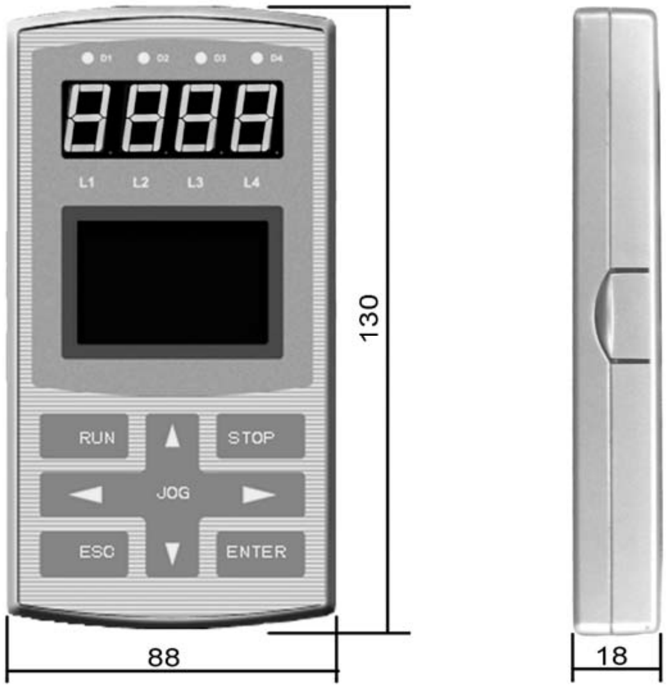


Figure 2.2 Digital operator dimensions

3 Inverter Installation

This chapter describes the installation requirements, precautions, removing and attaching of inverter cover.

3.1 Installation Site

WARNING
◎ **Attach the Inverter to a metal or other non-combustible material.** Or fire may occur. ◎ **Do not install the Inverter near combustible materials.** Or fire may occur. ◎ **Do not install the Inverter in a location with explosive gas.** Or explosion may occur. ◎ **The Equipment Cabinet shall conform to the requirements in EN50178.**

CAUTION
◎ Do not hold the panel or cover when carrying the Inverter. Or the Inverter may fall and be damaged. ◎ The bearing ability of the panel shall be considered when installing. Or the Inverter may fall and be damaged. ◎ Never install the Inverter where there is risk of water splashes. Or the Inverter may be damaged. ◎ Prevent screws, washers or metal sticks from falling into the Inverter. Or the Inverter may be damaged and explosion may occur. ◎ Never install or operate the Inverter when it is damaged or has missing components. Or the Inverter may be damaged. ◎ Do not install the Inverter in direct sunlight. Or the Inverter may be over-heated and an accident may occur.

Install the Inverter under the following conditions:

a) Install the Inverter in a clean location free from oil mist and dust. It may be installed in a totally closed panel that is completely shielded from floating dust.

b) Install the Inverter in a location that may prevent metal powders, oil and water from going into the Inverter.

c) Install the Inverter in a location without wood or other combustible materials.

d) Install the Inverter in a location free from radioactive materials.

e) Install the Inverter in a location free from harmful gases and liquids.

f) Install the Inverter in a location free from excessive vibration.

g) Install the Inverter with low content of salt.

h) Install the Inverter in a location far from direct sunlight.

i) Install the Inverter in a location where the temperature may not increase sharply.

If the Inverter is installed in a closed cabinet, cooling fans or an air conditioner shall be installed to maintain the temperature below 40 ℃.

3.2 Installation Orientation and Space

Install the Inverter in a location with adequate ventilation in order not to reduce the cooling effect. The Inverter is typically installed on a vertical surface. The installation space is shown in Figure 3.1.

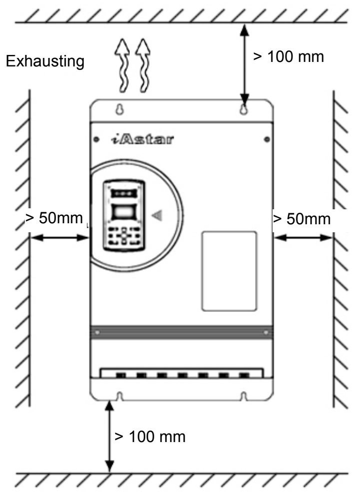


Figure 3.1 Installation space

3.3 Inverter Installation

The installation shall be performed in the following order:

① Check the four mounting holes on the Inverter. Refer to the installation dimensions and weights in Figure 2.1.

Install first the two upper screws. Note to leave several millimeters.

② Put the two hardy holes onto the above-said screws.

③ Install the two lower screws and fasten all the four screws.

Important

The fastener shall be equipped with an anti-vibration mechanism, such as a spring washer.

Make sure all the four screws are fastened.

The installation order is shown in Figure 3.2.

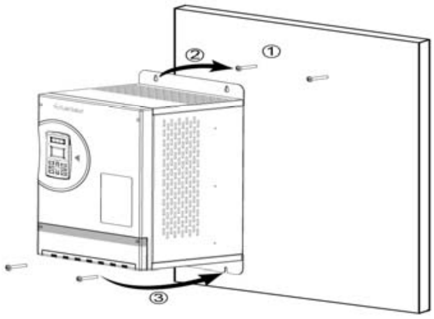


Figure 3.2 Installation order of Inverter

3.4 Removal and Installation of Covers and Components of Inverter

3.4.1 Appearance and Components of Inverter

Appearance and components of the Inverter are shown in Figure 3.3.

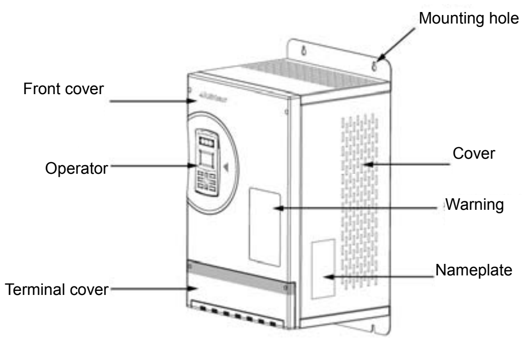


Figure 3.3 Appearance and components of Inverter

3.4.2 Removal and Installation of the Operator

Operator removal

① Push down the locks at both sides of the operator at the same time to release it from the panel and then take it off.

② Pull out the plug from the back of the operator. Note: do not pull the connecting line in order not to damage it.

The removal of the operator is shown in Figure 3.4.

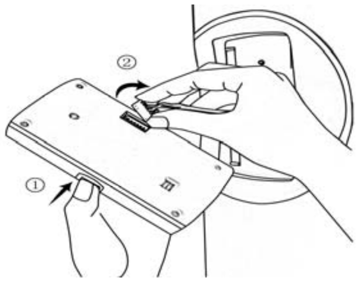


Figure 3.4 Operator removal

Operator installation

Push the plug into the socket on the back of the operator. Then place the lock on one side of the operator into the groove at the side of the panel. Press the operator against the panel till a click is heard, which means that the two side locks are all in the panel.

3.4.3 Opening and Closing of the Terminal Cover

The terminal cover shall be opened during wiring of the main circuit and before removal of the front cover.

Opening the terminal cover

① Loosen the two screws on the terminal cover;

② Pull down the terminal cover.

The opening of the terminal cover is shown in Figure 3.5.

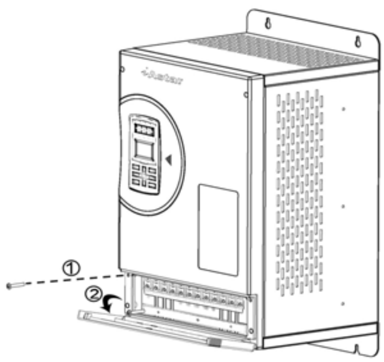


Figure 3.5 Opening the terminal cover

Closing the terminal cover

Close the terminal cover in the reversed sequence of opening. Fasten the two anti-dropping screws on the cover.

3.4.4 Removal and Installation of the Front Cover

The front cover shall be removed during wiring of the control circuit. It may also be removed to facilitate the wiring of the main circuit.

Removal of the front cover

The following steps shall be done:

① Remove the operator. See 3.4.2 Removal and Installation of the Operator.

② Open the terminal cover. See 3.4.3 Opening and Closing of the Terminal Cover.

③ Loosen the two screws on the upper side of the cover and the two screws inside the terminal cover. And now the cover may be removed.

The removal of the front cover is shown in Figure 3.6.

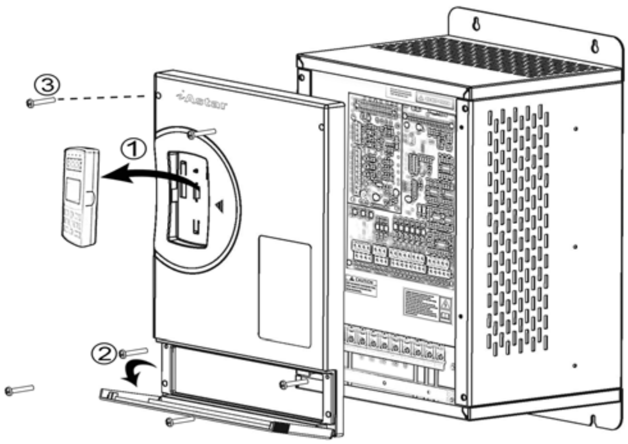


Figure 3.6 Removing the front cover

Installation of the front cover

Install the front cover in the reversed sequence of the removal.

4 Inverter wiring

This chapter describes the wiring of peripheral devices, terminals, main circuit terminal connections, control terminals and PG card terminals.

WARNING

◎ **Always turn off the input power supply before wiring the terminals.**

Or electric shock may occur.

◎ **Wiring shall be performed by an authorized person qualified in electrical work.**

Or electric shock may occur.

◎ **Be sure to ground the earth terminal E.**

Or electric shock may occur.

◎ **Never touch the terminals directly with your hands or allow the output lines to come into contact with the Inverter case.**

Or electric shock may occur.

◎ **Never connect the power supply to Terminal U, V or W.**

Or the Inverter may be damaged.

◎ **Never connect Terminal ⊕1/⊕2 to Terminal ⊖.**

Or explosion may occur.

CAUTION

◎ **Make sure the voltage of the AC circuit power supply is consistent with the rated voltage of the Inverter.**

Or fire and injury may occur.

◎ **Connect the braking resistor correctly according to the diagram.**

Or fire may occur.

◎ **Main circuit terminals and cable or cable terminals must be connected firmly.**

Or the Inverter may be damaged.

4.1 Connections to Peripheral Devices

Connection Diagram

The connection diagram is shown in Figure 4.1.

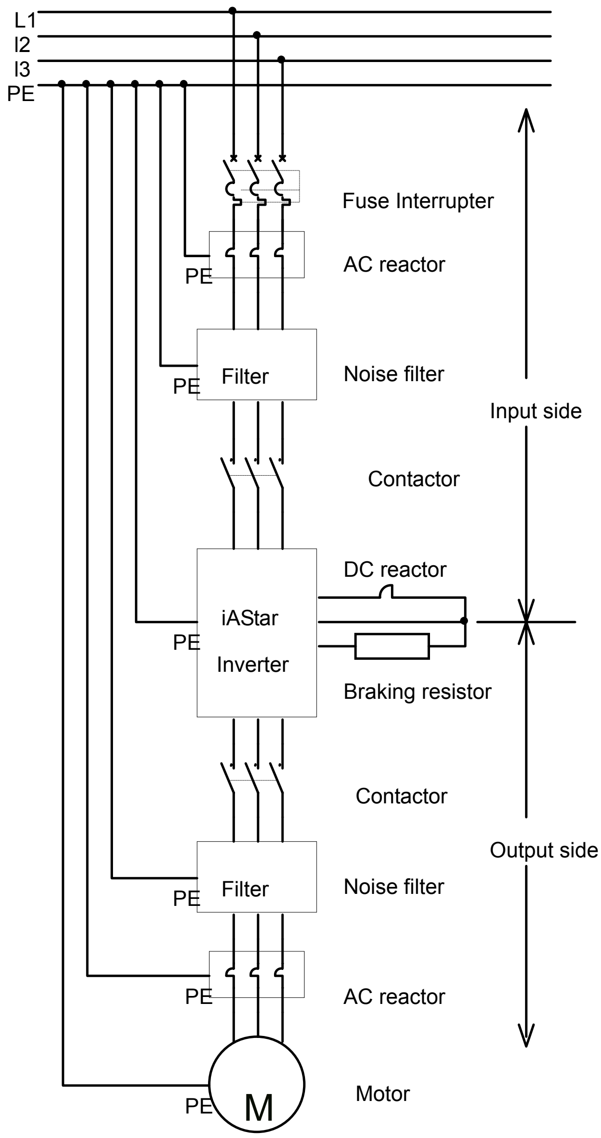


Figure 4.1 Connection diagram

Note: this diagram is based on a 3-phase power supply.

Wiring with peripheral devices

4.1.1.1 Power

WARNING The Inverter may not be operated beyond its rated voltage. Over-voltage may lead to permanent damage to the Inverter.

Specifications of input power

Specifications of input power (main circuit)	
Input voltage	200V, 3.7kW and below: 200/208/220/230/240V AC, single- or 3-phase, -15%～+10%; 5.5kW and above: 200/208/220/230/240V AC 3-phase, -15%～+10%; 400V: 380/400/415/440/460V AC 3-phase, -15%～+10%
Short current (IEC 629)	100kA maximum permissible short current if the incoming cable of the Inverter has a proper fuse.
Frequency	50 ± 5% Hz
Unbalance	Max.: ± 3% of the rated input line voltage
Fundamental power factor (cos phi1)	0.98 (under rated load)
Cable temp.	Min. rated value: 90℃

Input protection

Input protection makes use of breaker, fuse and emergency stop.

Breaker

The Inverter itself does not have a breaker. Therefore, a breaker shall be set between the AC power supply and the Inverter. This breaker shall ensure that:

◎ It conform to relevant safety regulations, including (but not limited to) national and regional electrical regulations.

◎ It shall be locked in the tripped position during installation and maintenance of the Inverter.

The breaker can not be used for emergency stop. This shall be controlled through the operator buttons or commands of I/O terminals.

The breaker shall have a capacity of 1.5 to 2 times of the rated current of the Inverter.

The breaker's time characteristics shall be determined in accordance with the Inverter's over-heating protection (at 150% of the rated output current for 1 min.).

Fuse

The end user shall provide a circuit protection device in accordance with relevant national and regional electrical regulations. The table below lists recommended fuses to provide short protection to the incoming line power of the Inverter.

iAStar-S3-	Input current (A)	Main fuse		
		IEC269 gG (A)	UL T (A)	Bussmann type
2002	13	16	15	CT16
2003	19	20	20	CT20

iAStar-S3-	Input current (A)	Main fuse		
		IEC269 gG (A)	UL T (A)	Bussmann type
4002	7.2	10	10	CT10
4003	10	10	10	CT10
4005	14	16	15	CT16
4007	19	20	20	CT20
4011	28	35	30	FE35
4015	35	35	40	FE40
4018	42	45	50	FE45
4022	49	50	50	FE50
4030	66	71	71	FE71
4037	81	80	80	FE80
4045	98	100	100	FE100
4055	129	160	160	FEE160
4075	166	200	200	FEE200

Emergency stop

The design and installation of the equipment shall have an emergency stop and other necessary safety devices. Control through the operator buttons or commands of I/O terminals may not be sufficient to realize:

◎ Emergency stop of the motor, and

◎ Separation of the Inverter from dangerous voltages.

Input power cable/connection

The input cable may be any of the following:

◎ 4-core cables (3-phase and grounding), with no need of shield.

◎ 4-core insulated conductors in conduit.

Appropriate cable shall be selected according to regional safety regulations, input voltage level and current load on the Inverter. Under any circumstance, the conductor shall be smaller than the maximum dimension of the terminal (see 4.3.3 Conductor Specifications of Main Circuit Wiring). The table below lists the copper cable types under different current loads. Only the cables listed in the upper part are recommended. Aluminum cables are not recommended.

IEC	NEC
Based on: ◎ EN 60204-1 and IEC 60364-5-2/2001 ◎ PVC insulated ◎ 30 °C ambient temp. ◎ 70 °C surface temp. ◎ Symmetrical cables with copper shield ◎ No more than 9 cables aligned in one cable tray.	Baesd on: ◎ For copper cables, see NEC Table 310-16 ◎ 90 °C, insulated ◎ 40 °C ambient temp. ◎ No more than 3 cables in one cable duct, groove, or for current-carrying buried cables. ◎ Copper cables with copper shield

4

Inverter wiring

Max. current load (A)	Copper cable (mm^2)	Max. current load (A)	Copper cable type (AWG/kcmil)
14	3x1.5	22.8	14
20	3x2.5	27.3	12
27	3x4	36.4	10
34	3x6	50.1	8
47	3x10	68.3	6
62	3x16	86.5	4
79	3x25	100	3
98	3x35	118	2
119	3x50	137	1
153	3x70	155	1/0
186	3x95	178	2/0

Grounding of input power cable

The Inverter and the motor shall be grounded in order to ensure personnel safety, correct operation and to reduce radiation.

◎ The conductor diameter shall conform to relevant safety regulations.

◎ According to relevant safety regulations, the shield of power cables shall be connected to PE of the Inverter.

◎ Only when the specifications of the power cable shield conforms to relevant safety regulations, it can be used as the earthing conductor.

◎ If several Inverters are to be connected, do not connect their terminals in series.

4.1.1.2 Output power cable/connection

Motor connection

WARNING	Never connect the incoming power supply to the output Terminal U, V and W of the Inverter. Accidental connection will lead to permanent damage to the driving unit.
CAUTION	Motors with a rated voltage lower than half of the rated voltage of the Inverter may not be connected to the Inverter.
CAUTION	Before withstanding/insulation test of the motor or the motor cable, make sure to disconnect the Inverter and the motor cable. Those tests may not be performed to the Inverter.

Specifications of motor connection

Specifications of output power (motor)	
Output voltage	0 ～ input voltage, symmetrical 3-phase
Current	See 2.2 Inverter Technical Index and Specification
Switching frequency	Set from 4 ～ 15 kHz
Rated temp. of cable	Min. 90 °C
Relationship between motor cable length and switching frequency	See 4.3.6.4 Relationship between Wire Length and Carrier Frequency

Grounding and wiring

Motor cable shielding

Conduit, armored cable or shielded cable shall be used for motor cable shielding.

1) Conduit

① Both ends of the conduit shall be equipped with a bridge with grounding conductor.

② The conduit shall be fixed on the housing.

③ A separate conduit shall be used for the motor cable (and at the same time separate the routing of input power cable and control cable).

④ A separate conduit routing shall be provided for each Inverter.

2) Armored cable

① Both ends of the conduit shall be equipped with a bridge with grounding conductor.

② Use 6-conductor (3 power lines and 3 earthing lines) cables with MC continuous corrugated aluminum armor and symmetrical earthing lines.

③ One cable tray may be shared by the armored motor cable and the input power cable, but not with the control cable.

3) Shielded cable

It is recommended to use cables with symmetrical PE conductors as per CE or C-Tick.

Grounding

Refer to above-said **Grounding of Input Power Cable**.

4.1.1.3 AC Reactor on the Input Side

An optional AC reactor may be used to improve the power factor on the input side and reduce the high harmonic current.

4.1.1.4 Noise Filter on the Input Side

An optional noise filter may be used specifically on the input side to restrain noise transmitted between the power line and the Inverter.

4.1.1.5 Contactor on the Input Side

The Inverter is started and stopped through opening and closing of the contactor on the input side to protect the power supply and prevent spreading of faults.

This contactor may not be used to control the start and stop of motors.

4.1.1.6 Contactor on the Output Side

A contactor is installed on the output side to meet the requirement in the national safety standard GB7588-2003 that there shall be no current across the motor when it stops.

4.1.1.7 Noise Filter on the Output Side

An optional noise filter may be used on the output side to restrain the noise from the output side and leakage current on the cable.

4.1.1.8 AC Reactor on the Output Side

An optional AC reactor may be used on the output side to restrain the radio interference.

The AC reactor on the output side may also prevent over-current of the Inverter caused by the line distribution capacity when the cable linking the Inverter and the motor is long (>20 m).

4.1.1.9 DC Reactor

A DC reactor may be used to improve the power factor.

4.2 Inverter Terminal Wiring

Figure 4.2 shows the interior of the Inverter.

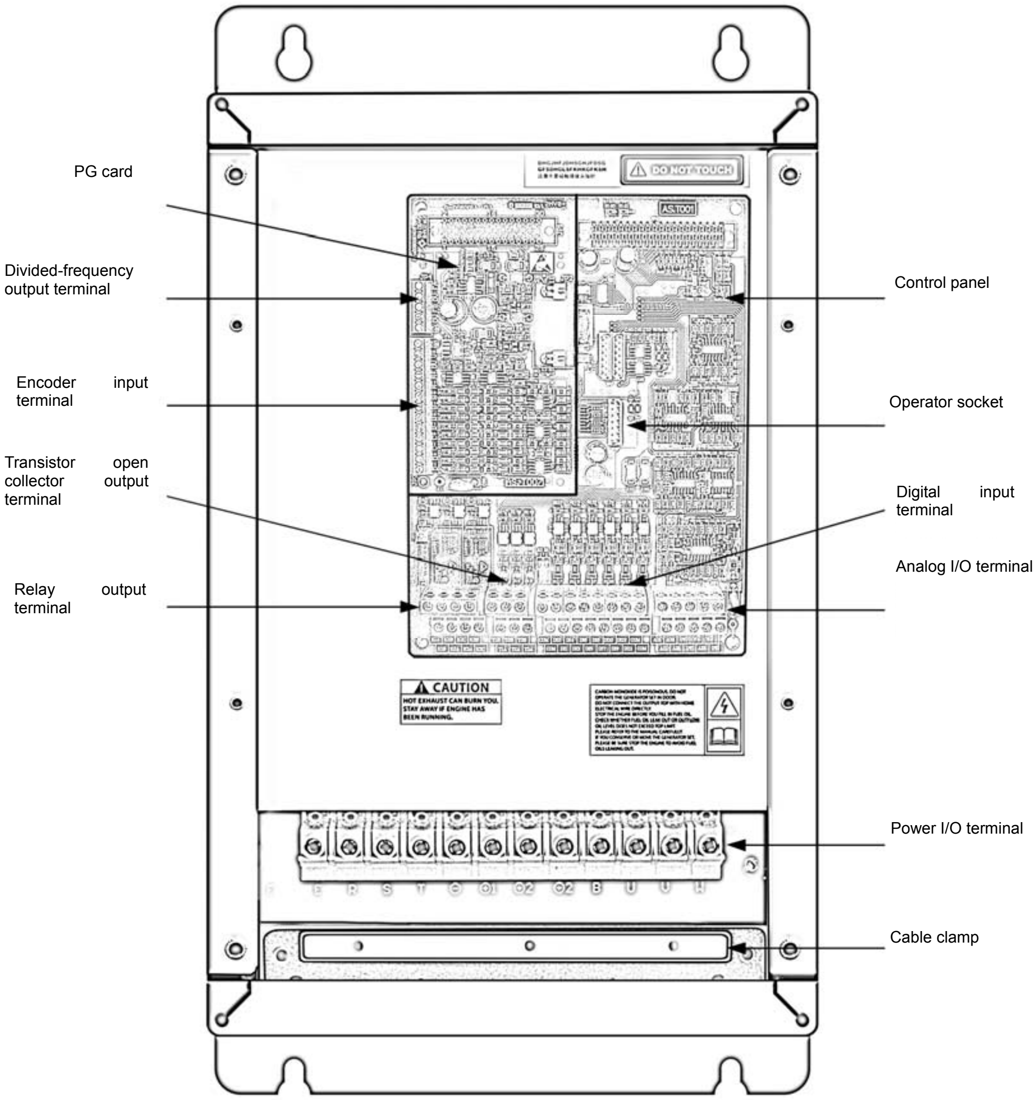


Figure 4.2 Inverter interior

Note: the terminals at all power levels are the same except for the position and alignment of power I/O terminals. The figure above shows the 22kW type.

4.2.1 Connection Diagram

The connection of Inverter terminals is shown in Figure 4.3.

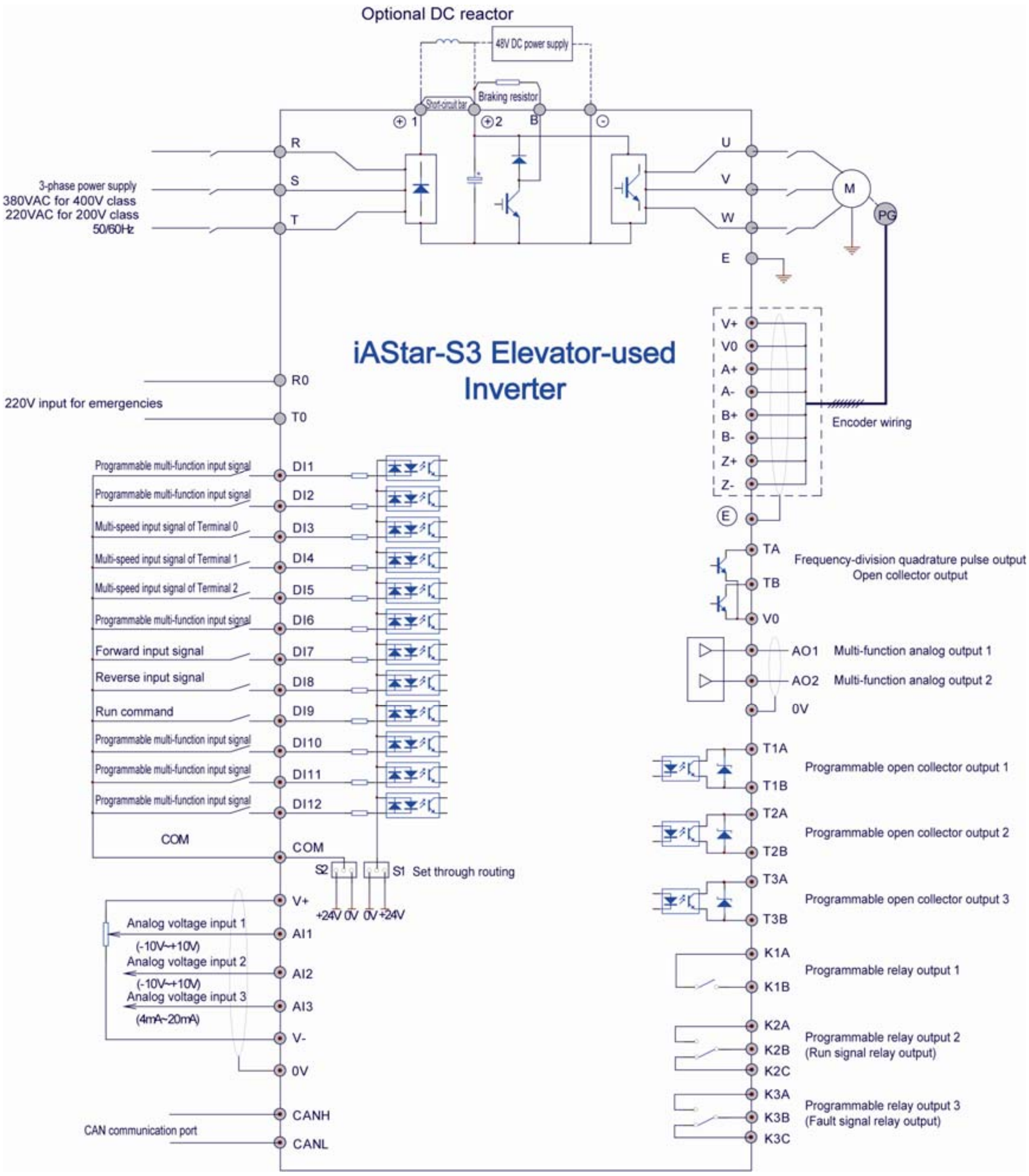


Figure 4.3 Connection diagram

Note 1: the above figure is based on 3-phase power supply, which is 380 – 460V for the 400V class and 200 – 240V for the 200V class.

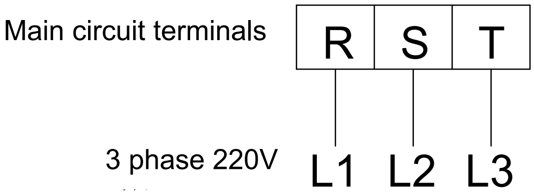
The input power supply for 200V Inverter shall be connected as follows:

3-phase 220V: Phase L1, L2, L3 connected to Terminal R, S, T on the main circuit respectively.

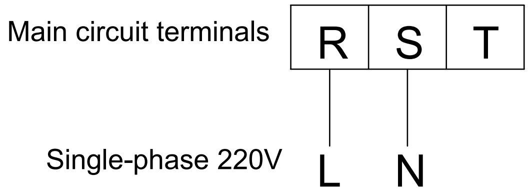
Single-phase 220V: Phase L and Neutral N connected to any two of Terminal R, S, T on the main circuit.

The connection is shown in the diagrams below:

Connection of 3-phase 220V power



Connection of single-phase 220V power



Note 2: the PG card shown in the above figure is of the ABZ increment type for the control of asynchronous motors (AS. T002). If synchronous motor is used, PG card of SIN/CON type (AS. T007), increment UVW (AS. T010), or Endat absolute type (AS. T013) shall be used.

4.2.2 Wiring Precautions

IMPORTANT

a) The connection shall conform to relevant electrical engineering standards.

b) Check the wiring and its reliability after wiring. The following items shall be checked:

Is all wiring correct?

Have any wire clippings or screws been left inside the Inverter?

Is any screw loosened?

Does any bare wire at terminal end contact with other terminals?

c) Although iAStar-S3 is equipped with a braking unit, an external braking resistor is still necessary. The braking resistor shall be installed between Terminal B and Terminal ⊕2, and not anywhere else, or the resistor and the Inverter may be damaged.

d) The DC reactor shall be connected between Terminals ⊕1 and ⊕2, and the short-circuit bar between them shall be removed.

e) When bus low-voltage running is needed, an emergency power of 220V shall be connected between Terminals RO and TO, and a DC 48V shall be put between Terminals ⊕2 and ⊖. These may be saved if no bus low-voltage running is required.

f) It is recommended that the grounding wire PE of the Inverter be connected to a special grounding terminal and the ground resistor shall have its resistance below 10 Ω.

g) The grounding cable shall be as short as possible.

h) When there is need for wiring changes after powering on, the power shall be cut off first. Since it takes some time for the main circuit charge capacitor to discharge, subsequent procedures may be taken only after the charging indicator extinguishes and the DC voltage across the capacitor is measure through a DC voltmeter to be below 24VDC safety level.

i) ○ in the figure stands for terminals of the main circuit, and ⊙ for terminals of the control circuit.

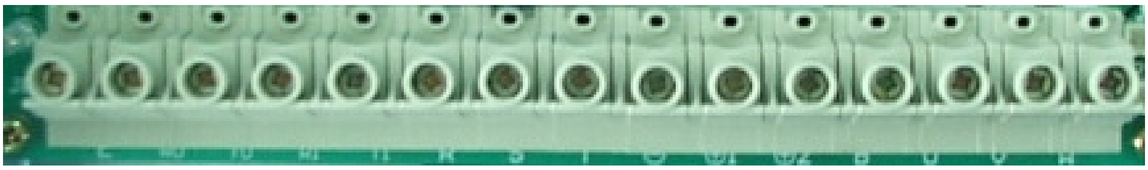
4.3 Wiring Main Circuit Terminals

4.3.1 Main Circuit Terminals

The alignments of main circuit terminals for different Inverter power levels are shown in Figures 4.4 – 4.8.

E	R	S	T	⊖	⊕1	⊕2	⊕2	B	U	V	W

Figure 4.4 Main circuit terminals for 2.2 - 15kW Inverters



E	R0	T0	R1	T1	R	S	T	⊖	⊕1	⊕2	B	U	V	W

Figure 4.5 Main circuit terminals for 18.5kW/22kW Inverters

⊖	⊕1	⊕2

Upper terminals

R	S	T	E	B	⊕2	U	V	W

Lower terminals

Figure 4.6 Main circuit terminals for 30kW Inverters

PE	R	S	T	-	⊕2	B	U	V	W

Figure 4.7 Main circuit terminals for 37kW Inverters

PE	R	S	T	-	⊕2	B	U	V	W

Figure 4.8 Main circuit terminals for 45KW/55KW/75KW Inverters

4.3.2 Symbols and Functions of Main Circuit Terminals

The functions of main circuit terminals are listed in Table 4.1.

Table 4.1 Functions of main circuit terminals

Terminal Symbol	Function
E（or PE）	Ground (PE)
R0, T0	220V emergency power input
R1, T1	380V 2-phase input of pre-charge circuit
R, S, T	AC power for the main circuit, to 3-phase input
⊖	Negative output of DC bus
⊕1	Positive output 1 of DC bus
⊕2	Positive output 2 of DC bus
⊕1, ⊕2	To connect DC reactor
⊕2, B	External braking resistor connection
⊕2, ⊖	48V DC power for bus to run at a low voltage
U, V, W	Inverter output, to 3-phase synchronous/asynchronous machine

Note: except for Inverters of 18.5kW and 22kW, Terminals R0, T0, R1, and T1 are not on the main circuit but on the drive PCB.

4.3.3 Wire Sizes of Main Circuit

600V plastic copper conductors or other insulated conductors for power supply may be used. Cable specifications and tightening torques are listed in Tables 4.2 and 4.3.

Table 4.2 Cable specifications and tightening torques for 200V Inverters

Model: iAStar-S3-	Permissible cable size （mm^2）	Recommended cable size （mm^2）	Tightening torque （N.m）
2002	4～8	4	2.5
2003	4～8	6	2.5

Table 4.3 Cable specifications and tightening torques for 400V Inverters

Model: iAStar-S3-	Permissible cable size （mm^2）	Recommended cable size （mm^2）	Tightening torque （N.m）
4002	3～4	4	2.5
4003	3～4	4	2.5
4005	4～8	6	2.5
4007	4～8	6	2.5
4011	4～8	6	2.5
4015	4～8	6	2.5
4018	8～16	16	4.0
4022	8～16	16	4.0
4030	14～25	25	9
4037	35～100	35	9
4045	35～100	50	9.0
4055	60～100	60	18.0
4075	80～125	80	18.0

IMPORTANT

For 440V Inverters of 22kW and below, the wire of the main circuit may not exceed 16 mm^2. A larger wire may not be able to go through the terminal hole and thus cause difficulties in connection.

The wire sizes are determined at an ambient temperature of 50℃ and a permissible temperature of 75℃.

For 440V Inverters of 30kW and above, the main circuit adopts open terminal connection, for which round crimp terminals shall be used. The selection of round crimp terminals may be found in Table 4.4.

Table 4.4 Round crimp terminals

Cross section （mm^2）	Screw	Terminal
0.5	M3.5	1.25/3.5
	M4	1.25/4
0.75	M3.5	1.25/3.5
	M4	1.25/4
1.25	M3.5	1.25/3.5
	M4	1.25/4
2	M3.5	2/3.5
	M4	2/4
	M5	2/5
	M6	2/6
	M8	2/8
3.5/5.5	M4	5.5/4
	M5	5.5/5
	M6	5.5/6
	M8	5.5/8
8	M5	8/5
	M6	8/6
	M8	8/8
14	M6	14/6
	M8	14/8
22	M6	22/6
	M8	22/8
30/38	M8	38/8
50/60	M8	60/8
	M10	60/10
80	M10	80/10
100		100/10

IMPORTANT

Sufficient attention shall be paid to the voltage drop along the line to determine cable cross section.

Typically, the voltage shall be maintained below 2% of the rated value. If the drop is too heavy, a larger cross section shall be used. The voltage drop may be calculated as follows:

Line-to-line voltage loss (V) = $\sqrt{3}$ * line resistance (Ω)* current (A)

4.3.4 Main Circuit Configurations

The main circuit configurations are shown in Figure 4.9.

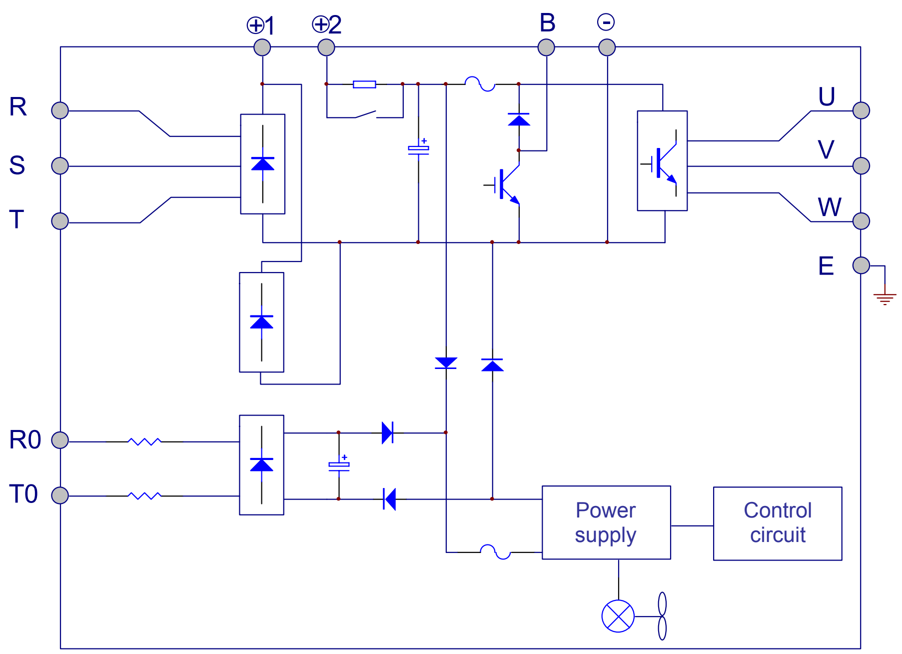


Figure 4.9 Main circuit configurations

4.3.5 Illustration of Main Circuit Wiring

4.3.5.1 Ground Terminal (E)/(PE)

a) It is recommended to connect the ground terminal to a specialized grounding electrode. Reliable connection shall be ensured. The grounding resistance shall be lower than 10 Ω.

b) The grounding conductor may not be shared with welding machines or other power devices.

c) Always use a grounding conductor that complies with the technical standards on the electrical equipment and minimize the length of the wire. Long distances between the grounding conductor and the grounding electrode may lead to leakage current of the Inverter which causes instability in grounding terminal potential.

d) Multi-strand copper lines over 3.5mm^2 shall be used for the grounding wire. It is recommended to use specific green-yellow grounding wires.

e) It is recommended not to loop the grounding wire when more than one Inverter is to be grounded in order to avoid grounding loop.

The method to ground more than one Inverter is shown in Figure 4.10.

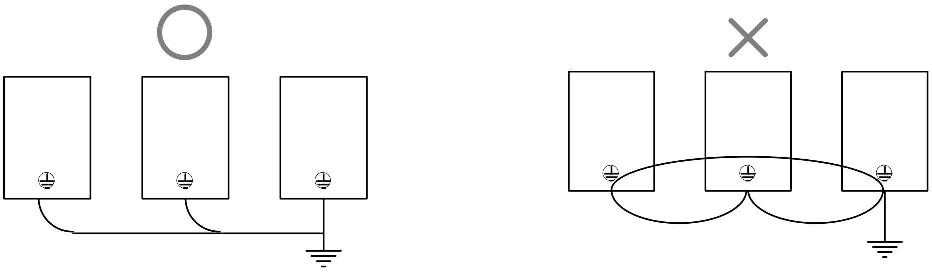


Figure 4.10 Grounding method of more than one Inverter

4.3.5.2 220V Emergency Power Input (R0，T0)

a) At power grid failure, a 220VAC UPS power connected to RO and TO may be used to supply to the control circuit to enable the elevator to run at a low speed leveling at the nearest floor.

b) During normal operation of the elevator, the 220VAC UPS power may also be connected to RO and TO. The connection method is shown in Figure 4.10.

c) Terminals RO and TO of Inverters of 18.5kW and 22kW are set on the main circuit, while those for other Inverters are on the drive PCB.

4.3.5.3 + 48VDC Power Terminals (⊕2，⊖)

a) At power grid failure, storage batteries connected to Terminal**s** ⊕**2** and ⊖ may be used to supply a direct low-voltage power to the Inverter to enable the elevator to run at a low speed leveling at the nearest floor.

b) The connection of UPS and storage battery is shown in Figure 4.11.

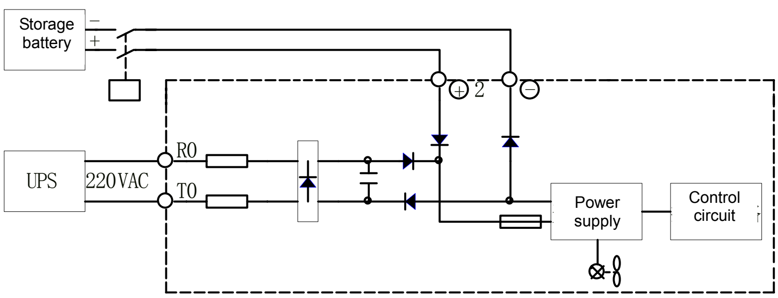


Figure 4.11 Emergency power and storage battery connection

4.3.5.4 Power Supply Input Terminals for the Main Circuit (R, S, T)

a) A 3-phase AC power supply may be connected through a breaker to any one of Terminals R, S, and T on the main circuit. The phase sequence of the input power supply is irrelevant to the sequence of R, S, and T.

b) A noise filter may be installed on the power supply side in order to reduce transmission and radiation interferences of the Inverter caused to the input power supply. The noise filter may reduce the electromagnetic interference both from the power line to the Inverter and vice versa.

CAUTION **Special caution：please use only noise filters specifically for inverters.**

Figure 4.12 shows the correct setting of a noise filter on the power supply side.

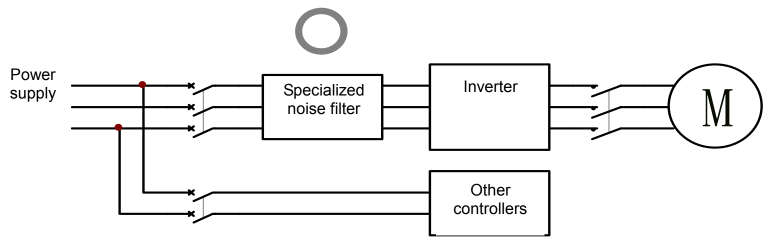


Figure 4.12 Noise filter on the power supply side

Examples of incorrect settings of noise filter on the power supply side are given in Figure 4.13 and Figure 4.14.

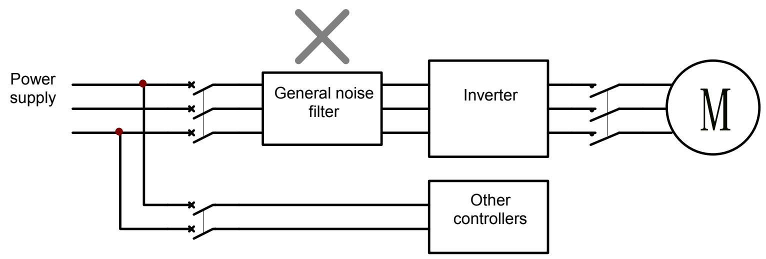


Figure 4.13 Example 1 of incorrect noise filter setting

In Figure 4.13, the general noise filter on the power supply side may not satisfy expected requirements and thus shall be avoided.

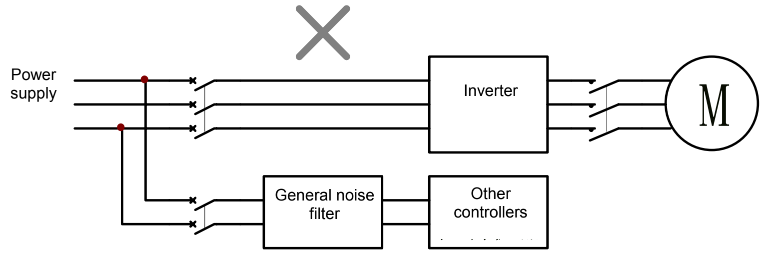


Figure 4.14 Example 2 of incorrect noise filter setting

In Figure 4.14, the noise filter on the receiving side may not satisfy expected requirements and thus shall be avoided.

4.3.5.5 DC Reactor Terminals (⊕1, ⊕2)

a) A DC reactor may be added to improve the power factor. Remove the short-circuit bar between Terminals ⊕1 and ⊕2 pre-wired at the factory when connecting a DC reactor to the Inverter.

b) If no DC reactor is used, please do not remove the short-circuit bar, or the Inverter will not work normally.

The wiring of the short-circuit bar is shown in Figure 4.15.

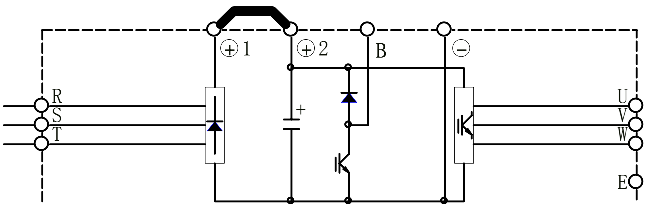


Figure 4.15 Wiring diagram of short-circuit bar

The wiring of the DC reactor is shown in Figure 4.16.

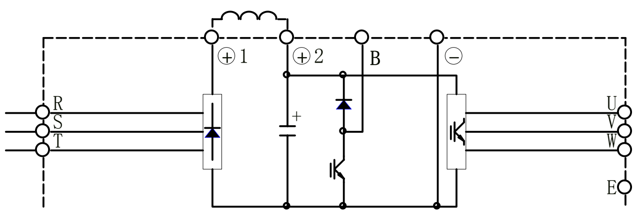


Figure 4.16 Wiring of the DC reactor

4.3.5.6 Connecting the Braking Resistor Terminals (⊕2, B)

a) Since each iAStar-S3 is equipped with a built-in braking unit, an additional braking resistor is required to absorb the energy released during braking. The types of braking resistors are listed in Table 1.1 Braking Resistors for 200V Inverters and Table 1.2 Braking Resistors for 400V Inverters in Chapter One.

b) The braking resistor is put between Terminals ⊕2 and B.
Note: Inverters of 30kW have two ⊕2 terminals, one on the top and the other on the bottom. It is recommended to connect the braking resistor between the ⊕2 terminal on the bottom and Terminal B.

c) Sufficient attention shall be paid to heat dissipation and ventilation in order to maintain good performance of the braking resistor.

d) The wire connecting the braking resistor may not be longer than 5m.
The wiring of additional braking resistor is shown in Figure 4.17.

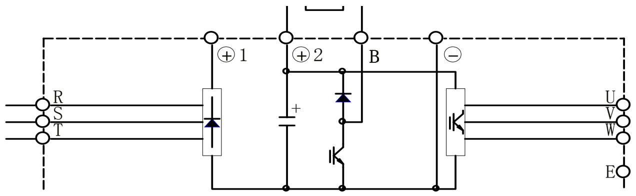


Figure 4.17 Braking resistor wiring

4.3.5.7 Inverter Output Terminals (U, V, W)

a) Connect Inverter output Terminals U, V, and W to motor lead wires U, V and W respectively. Change any two of the output terminals of the Inverter or the motor when the motor is not in the desired rotation direction.

b) Never connect the power supply to the Inverter output Terminals U, V, and W.

c) The output terminals may never be grounded or shorted.

d) Never connect a capacitor and/or an LC/RC noise filter on the Inverter output side, since the Inverter may be thus over-heated or damaged due to its higher harmonics.

Figure 4.18 shows that capacitor shall never be connected on the output side of the Inverter.

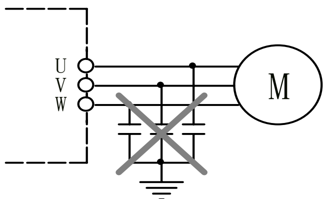


Figure 4.18 Never connect capacitor on the output side of the Inverter

4.4 Countermeasures against Noise

4.4.1 Install a Specialized Noise Filter on the Output Side

A specialized noise filter may be installed on the Inverter output side to restrain the noise from this side. The connection is shown in Figure 4.19.

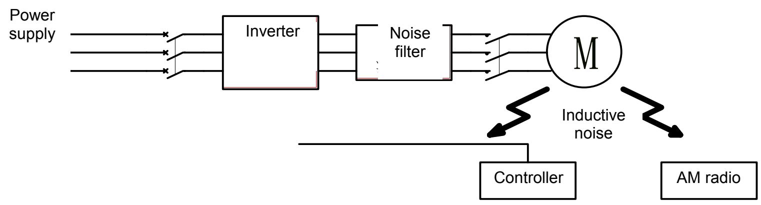


Figure 4.19 Connection of noise filter on the output side of the Inverter

4.4.2 Main Circuit Wiring

The main circuit and the control circuit shall be separately wired in order to improve the resistance to inductive noises from the output side. Cables of the main circuit may be routed through a grounded metal pipe at least 10cm from the signal line. The wiring of the main circuit is shown in Figure 4.20.

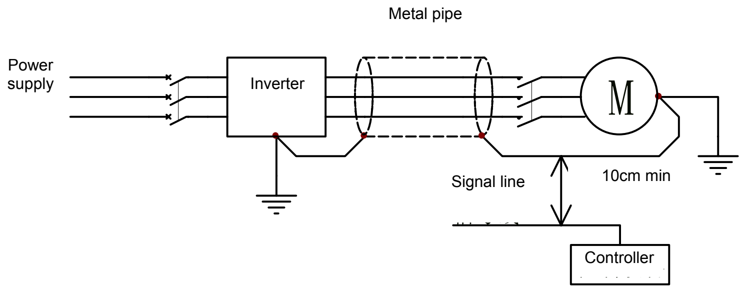


Figure 4.20 Main circuit wiring

4.4.3 Better Countermeasures against Noise

To reduce noises more effectively, a noise filter shall be installed on both the input and the output side of the Inverter and the Inverter shall be enclosed in a steel box, as shown in Figure 4.21.

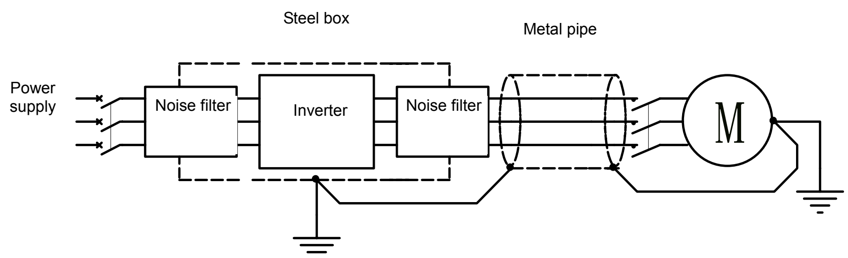


Figure 4.21 Better countermeasures against noise

4

Inverter wiring

4.4.4 Relationship between Cable Length and Carrier Frequency

If the cable linking the Inverter and the motor is too long, the high-frequency leakage current may increase due to distributed capacitance, which may trigger over-current protection of the Inverter output and thus causes negative impacts on surrounding equipment and electrical machines. Therefore, the cable between the Inverter and the motor shall be no longer than 100m. Please adjust carrier frequency E08 and select a noise filter and reactor for the output side according to the following table.

Cable length	50m and shorter	100m and shorter	Over 100m
Carrier frequency	Below 15 kHz	Below 10 kHz	Below 5 kHz

4.5 Wiring the Control Circuit Terminals

4.5.1 Control Circuit Terminals

Terminals of the control circuit are shown in Figure 4.22.

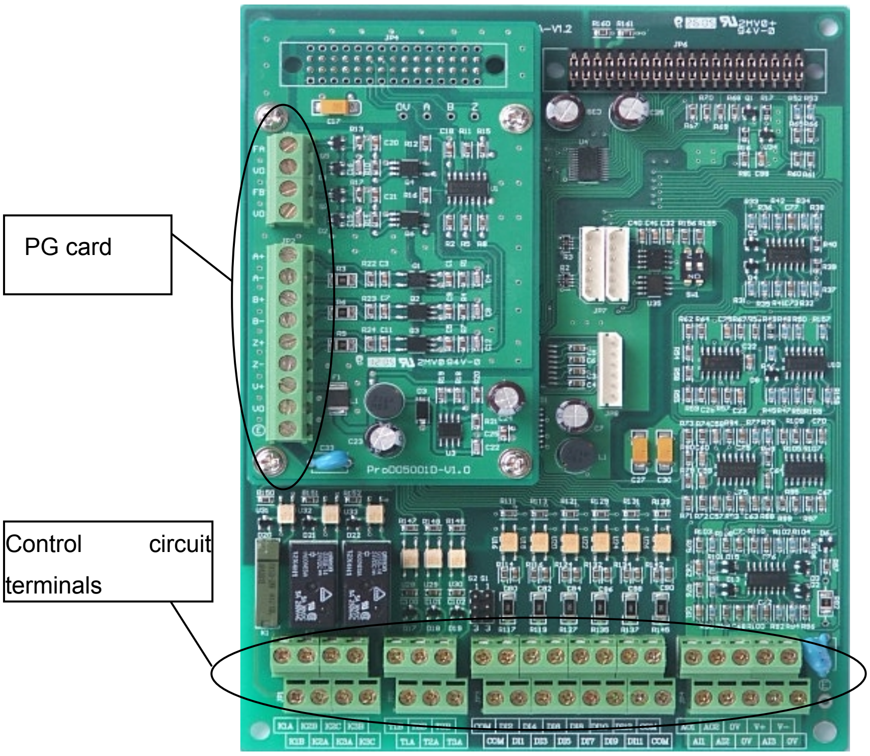


Figure 4.22 Control circuit terminals

Note: the PG card in the above figure is an ABZ increment PG card.

4.5.2 Terminal Symbols of Control Circuit

The terminal symbols of the control circuit are shown in Figure 4.23.

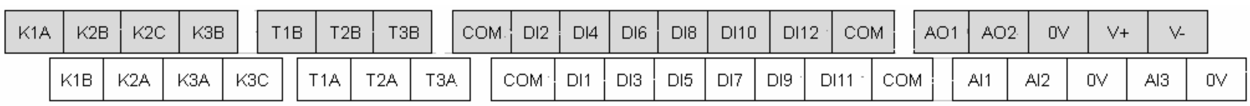


Figure 4.23 Terminal symbols of control circuit

4.5.3 Control Circuit Terminal Functions

The functions of the control circuit terminals are shown in Table 4.5.

Table 4.5 Control circuit terminal functions

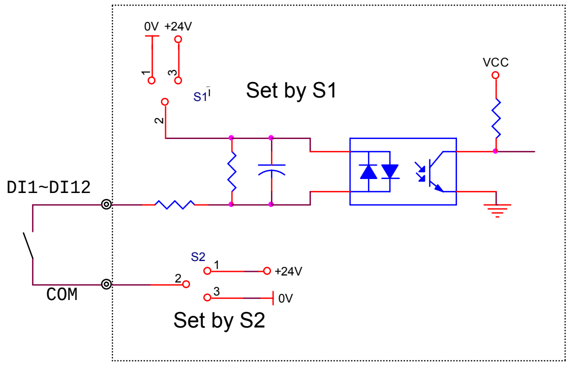
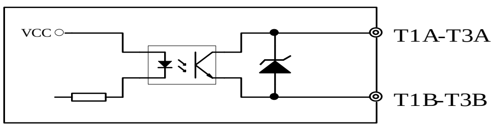
<table>
<tr><th>Name</th><th>Terminal</th><th>Signal</th><th>Configurations</th></tr>
<tr><td rowspan="13">Digital input terminal</td><td>DI1</td><td>Multi-function input 1
(function code: F01)</td><td rowspan="13">Effective when it is closed. The function of each terminal is selected by parameters F01 – F12. See 6.2.6 F (Digital Input) Parameters for function selection.
Circuit configuration of digital input is shown as follows:<table><tr><td>Internal power supply</td><td>+24VDC</td></tr><tr><td>Max. load current</td><td>20mA</td></tr></table></td></tr>
<tr><td>DI2</td><td>Multi-function input 2
(function code: F02)</td></tr>
<tr><td>DI3</td><td>Multi-function input 3
(function code: F03)</td></tr>
<tr><td>DI4</td><td>Multi-function input 4
(function code: F04)</td></tr>
<tr><td>DI5</td><td>Multi-function input 5
(function code: F05)</td></tr>
<tr><td>DI6</td><td>Multi-function input 6
(function code: F06)</td></tr>
<tr><td>DI7</td><td>Multi-function input 7
(function code: F07)</td></tr>
<tr><td>DI8</td><td>Multi-function input 8
(function code: F08)</td></tr>
<tr><td>DI9</td><td>Multi-function input 9
(function code: F09)</td></tr>
<tr><td>DI10</td><td>Multi-function input 10
(function code: F10)</td></tr>
<tr><td>DI11</td><td>Multi-function input 11
(function code: F11)</td></tr>
<tr><td>DI12</td><td>Multi-function input 12
(function code: F12)</td></tr>
<tr><td>COM</td><td>Input common end</td></tr>
<tr><td rowspan="6">Analog input terminal</td><td>AI1</td><td>Multi-function input 1</td><td>External analog voltage input, ranging from 0 to +10V, for the input signal of given analog speed.</td></tr>
<tr><td>AI2</td><td>Multi-function input 2</td><td>External analog voltage input, ranging from -10 to +10V, for the input signal of pre-load.</td></tr>
<tr><td>AI3</td><td>Multi-function input 3</td><td>External analog current input, ranging from 4 – 20mA, for the input signal of given analog speed.</td></tr>
<tr><td>V+</td><td>+15V power output</td><td>+15VDC power supply output terminal for analog input, max. permissible current 20mA</td></tr>
<tr><td>V−</td><td>-15V power output</td><td>-15VDC power supply output terminal for analog input, max. permissible current 20mA</td></tr>
<tr><td>0V</td><td>Reference grounding terminal for analog input</td><td>Reference grounding terminal for analog input</td></tr>
</table>

Table 4.5 Control circuit terminal functions, continued

<table>
<tr><th>Name</th><th>Terminal</th><th>Signal</th><th>Configurations</th></tr>
<tr><td rowspan="3">Relay output terminal</td><td>K1A
K1B</td><td>Programmable relay output
(function code: G01)
NO</td><td>The output functions of the programmable relay may be selected by the function parameters of G01. See 6.2.9 G (Digital Output) Parameters for function selection.
The normally open contact is configured as follows:
<table>
<tr><th>Item</th><th>Specification</th></tr>
<tr><td>Rated capacity</td><td>5A / 250VAC
5A / 30VDC</td></tr>
<tr><td>Min. working current</td><td>100μA</td></tr>
<tr><td>Response time</td><td>Less than 6ms</td></tr>
</table></td></tr>
<tr><td>K2A
K2B
K2C</td><td>Programmable relay output
(function code: G02)
K2A-K2B：NO
K2B-K2C：NC</td><td rowspan="2">The output functions of the programmable relay may be selected by the function parameters of G02 and G03. See 6.2.9 G (Digital Output) Parameters for function selection.
One pair of switching contacts are configured as follows:
<table>
<tr><th>Item</th><th>Specification</th></tr>
<tr><td>Rated capacity</td><td>5A/250VAC 5A/30VDC</td></tr>
<tr><td>Min. working current</td><td>10mA</td></tr>
<tr><td>Response time</td><td>Less than 10ms</td></tr>
</table></td></tr>
<tr><td>K3A
K3B
K3C</td><td>Programmable relay output
(function code: G03)
K3A-K3B：NO
K3B-K3C：NC</td></tr>
<tr><td rowspan="3">Transistor open collector output terminal</td><td>T1A
T1B</td><td>Programmable open collector output 1
(function code: G04)</td><td rowspan="3">The functions of the programmable open collector outputs may be selected by the function parameters of G04 to G06. See 6.2.9 G (Digital Output) Parameters for function selection.


Drive capacity: no more than 30VDC, 50mA</td></tr>
<tr><td>T2A
T2B</td><td>Programmable open collector output 2
(function code: G05)</td></tr>
<tr><td>T3A
T3B</td><td>Programmable open collector output 3
(function code: G06)</td></tr>
<tr><td rowspan="3">Analog output terminal</td><td>AO1</td><td>Programmable analog output 1
(function code: I01)</td><td rowspan="2">The functions of the programmable analog outputs may be selected by the function parameters of I01 and I02. See 6.2.9 I (Analog Output) Parameters for function selection.
These may be used for the inputs of output monitoring and other devices.</td></tr>
<tr><td>AO2</td><td>Programmable analog output 2
(function code: I02)</td></tr>
<tr><td>0V</td><td>Reference grounding terminal for analog outputs</td><td>Reference grounding terminal for analog outputs</td></tr>
<tr><td rowspan="3">CAN communication terminal</td><td>CANH</td><td>CAN communication signal</td><td rowspan="2">For CAN communication signals</td></tr>
<tr><td>CANL</td><td>CAN communication signal</td></tr>
<tr><td>0V</td><td>0V power supply</td><td>0V power output for CAN</td></tr>
</table>

4.5.4 Cable Specifications of Control Circuit Wiring

600V insulated copper cable is used for the control circuit. Cable specifications and tightening torque are listed in Table 4.6.

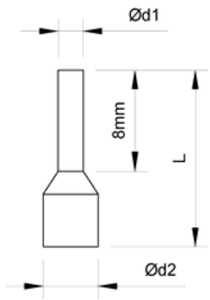
Table 4.6 Cable specifications and tightening torque

Model	Permissible cable, mm^2	Recommended cable, mm^2	Tightening torque (N.m)
iAStar-S3	0.75～1	0.75	1.5

The size of the conductor is determined at an ambient temperature of 50℃ and a permissible temperature of 75℃.

It is recommended that bar-like terminals be used for the control circuit. The specifications of bar-like terminals are listed in Table 4.7.

Table 4.7 Bar-like terminals

Conductor cross section mm^2 (AWG)	d1 (mm)	d2 (mm)	L (mm)	Illustration
0.25（24）	0.8	2	12.5	
0.5（20）	1.1	2.5	14	
0.75（18）	1.3	2.8	14	
1.5（16）	1.8	3.4	14	
2（14）	2.3	4.2	14	

4.5.5 Control Circuit Terminal Wiring

4.5.5.1 Analog Input Terminals

The Inverter is equipped with three analog inputs, of which AI1 and AI2 are used for analog voltage signals and AI3 for analog current signals. The signal range of AI1 is 0 - +10V, that of AI2 is -10V - +10V, and that of AI3 is 4 – 20mA. AI1 is defined as signal input for a given speed; AI2 as signal input for starting pre-load; AI3 as signal input for a given speed. Since AI1 and AI3 are used for the same signal type, they may not receive signals at the same time, or conflict will occur.

The cable connecting the analog signal and the Inverter shall be as short as possible (no longer than 30m), and shielded conductors shall be used. The shield shall be grounded through the 0V terminal on the analog input. Figure 4.24 shows the grounding of the shielded conductor.

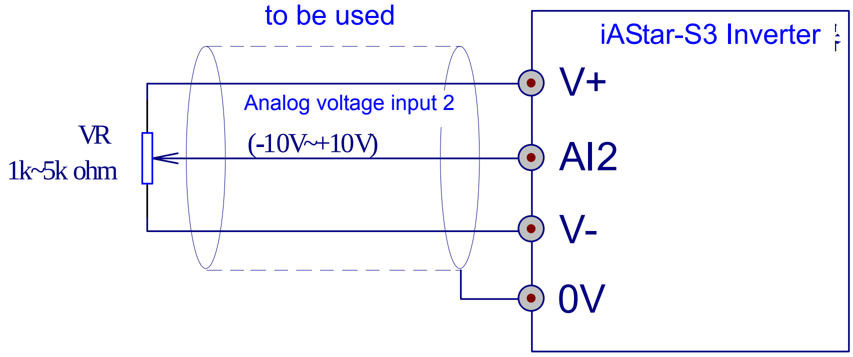


Figure 4.24 Shielded analog input wiring

In Figure 4.24, the analog voltage signal is provided by the Inverter, ranging from -10V to +10V. In most applications, the voltage or current signals for analog inputs are provided by a controller sending analog signals, and most of the voltage signals range from 0 to 10V. It is worthwhile to note that AI1 is only able to accept voltages from 0 to 10V. Figure 4.25 shows its wiring.

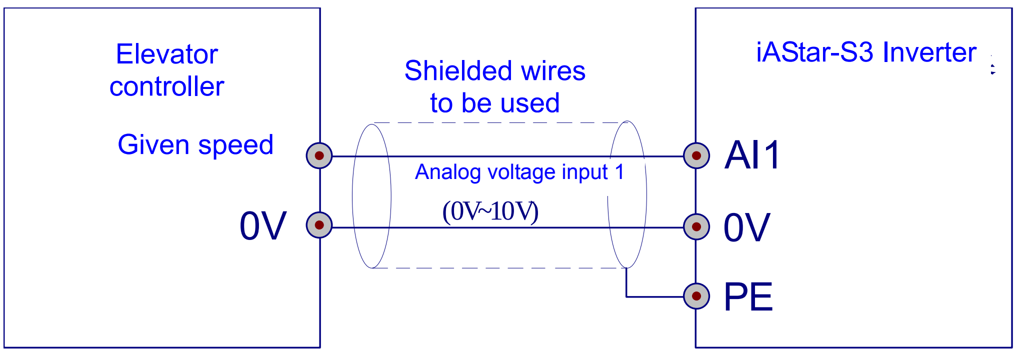


Figure 4.25 AI1 wiring

When analog signal inputs are used, parameters H01 to H12 may be used to set gain, offset, filtering time and other parameters for each input, so as to make full use of the analog ports. See 6.2.8 for more details.

4.5.5.2 Digital Input Terminals

The function codes F01 to F12 may be used to define the input function of each multi-function digital input terminal. The value of F01 to F12 ranges from 0 to 12, each standing for the following function:

0：no function (not used);

1：input of external deceleration signal;

2：NO input of detection points of brake (brake contactor);

102：NC input of detection points of brake (brake contactor);

3：signal input of multi-speed port 0;

4：signal input of multi-speed port 1;

5：signal input of multi-speed port 2;

6：signal input of emergency power supply;

7：forward signal input;

8：reverse signal input;

9：enabling signal input;

10：NO input of base blocking signal;

110：NC input of base blocking signal;

11：NO input of detection points of output (output contactor);

111：NC input of detection points of output (output contactor);

12：fault reset signal input.

See 6.2.6 F (Digital Input) Parameters for more details.

The internal power supply adopted by the digital inputs may be realized through two modes according to the voltage level of COM: one is common emitter input (0V as the common point), and the other is common collector input (+24V as the common point). The two modes may be selected through jumpers S1 and S2.

The positions of S1 and S2 on the control board are shown in Figure 4.26.

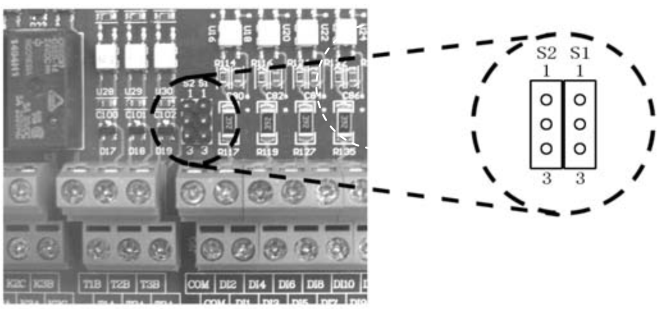


Figure 4.26 Positions of S1 and S2

The functions of S1 and S2 terminals are listed as follows:

Name	Terminal symbol		
	1	2	3
S1	0V	VCOM	+24V
S2	+24V	COM	0V

a) Jumper of Common-emitter Mode (0V as the common point)

When the common emitter mode is used for digital inputs (with 0V as the common point), COM is at a lower voltage level. Both S1 and S2 are set as 2-3. The jumper positions and inputs are shown in Figure 4.27.

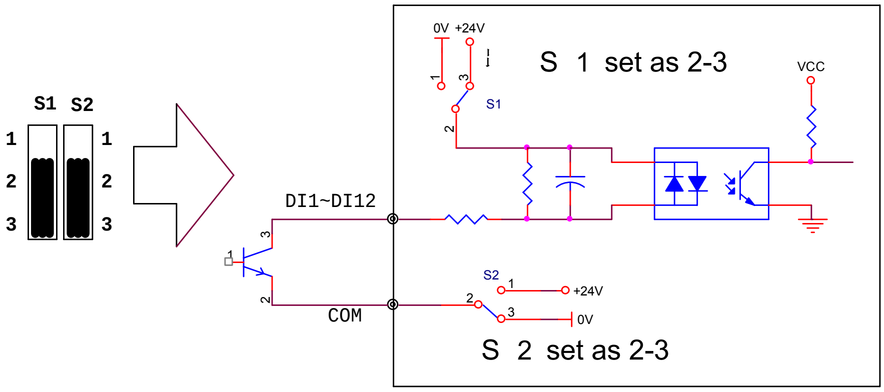


Figure 4.27 I/O circuit configuration of common emitter mode (with 0V as the common point)

b) Jumper of Common-collector Mode (24V as the common point)

When the common collector mode is used for digital inputs (with +24V as the common point), COM is at a higher voltage level. Both S1 and S2 are set as 1-2. The jumper positions and inputs are shown in Figure 4.28.

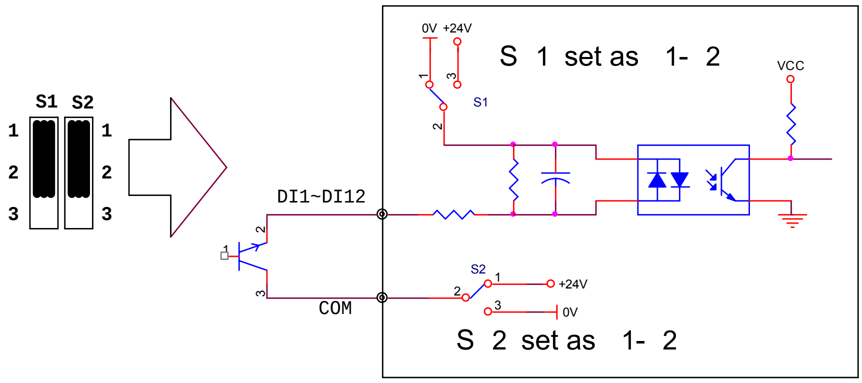


Figure 4.28 I/O circuit configuration of common collector mode (with +24V as the common point)

Note: the bridging for S1 and S2 shall be the same, or none of the input is valid.

4.5.5.3 Digital Output Terminals

Digital output terminals include relay contact terminals and open collector terminals. The parameters of G01 to G06 may be used to set the functions of each digital output terminal. G01 to G06 may be set only as the following values, each standing for a special output function:

0：no action (not used);

001：connect the two ends of the output when the feedback speed > B06 (detected frequency), or stay open;

101：stay open when the feedback speed > B06 (detected frequency), or connect the two ends;

002：run signal, connect the two ends when triggered, or stay open;

102：run signal, stay open when triggered, or connect the two ends;

003：fault signal, connect the two ends at faults, or stay open;

103：fault signal, stay open at faults, or connect the two ends;

004：deceleration signal, connect the two ends during deceleration, or stay open;

104：deceleration signal, stay open during deceleration, or connect the two ends;

005：current detection signal, connect the two ends when there is current during running, or stay open;

105：current detection signal, stay open when there is current during running, or connect the two ends;

006：output contactor control, connect the two ends when triggered, or stay open;

106：output contactor control, stay open when triggered, or connect the two ends;

007：brake contactor control, connect the two ends when triggered, or stay open;

107：brake contactor control, stay open when triggered, or connect the two ends;

008：connect the two ends of the output when the feedback speed < B04 (zero speed ref. 1), stay open when the feedback speed > B05 (zero speed ref. 2), and maintain original state when B04 <＝ feedback speed <＝ B05;

108：stay open when the feedback speed <B04 (zero speed ref. 1), connect the two ends of the output when the feedback speed >B05 (zero speed ref. 2), and maintain original state when the B04 <＝ feedback speed <＝ B05;

009：current detection signal, connect the two ends when there is current, or stay open;

109：current detection signal, stay open when there is current, or connect the two ends;

011: Inverter ready, when initialized without fault;

111: Inverter ready, when initialized with fault

Note: “connect” here means pick-up of NO contact and release of NC contact of relays, and low level of outputs of open collectors. On the same basis, “stay open” means release of NO contact and pick-up of NC contact of relays, and high resistance of open collectors.

See 6.2.7 G (Digital Output) Parameters for more information.

Digital outputs consist of relay contact outputs and open collector outputs. The former is realized through idle contacts, including one NO contact and two pairs of switching contacts.

There are three channels for open collector outputs. The circuit is shown in Figure 4.29.

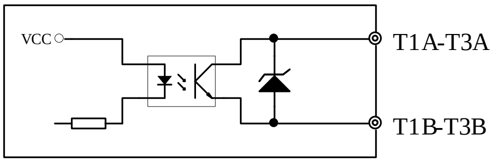


Figure 4.29 Circuit of open collector outputs

Open collector outputs adopt external power supplies. Polarization shall be noticed when the power is connected. The power supply may not exceed +30VDC, 50mA, or the output circuit may be damaged.

If additional inductive load exists, there is no need for a diode.

4.5.5.4 Multi-function Analog Output Terminals

Parameters of I01 and I02 are used to define the functions of multi-function analog output terminals. The value of I01 and I02 ranges from 0 to 13, each standing for a special output function (I01 parameters corresponding to A01 outputs, and I02 corresponding to A02 outputs):

0：given speed

1：given speed after filtering

2：speed feedback

3：output torque

4：compensation torque of zero speed startup

5：zero servo time

6：SIN/COS encoder resolver

7：SIN waveform of SIN/COS encoder

8：current of Phase V

9：current of Phase U

10：reserved

11：analog port 1 (AI1)

12：analog port 2 (AI2)

13：analog port 3 (AI3)

See 6.2.9 I (Analog Output) Parameters for more information.

4.5.5.5 Other precautions for wiring

Keep the control circuit away from the main circuit power line, or interference may cause wrong actions.

4.6 Wiring PG Cards

There are several types of PG cards to adapt to different encoder types, as shown in the following table.

PG card	Applicable motor	Type	Input signal	Remarks
ABZ increment	Asynchronous	AS.T002	Open collector signals, Push-Pull signals	
SIN/COS	Synchronous	AS.T004	SIN/COS differential signals	Replaced by AS.T007.
		AS.T007		
UVW increment		AS.T010	UVW differential signals	
Endat absolute		AS.T013	SIN/COS increment signals	1313 or 413 Encoders from Heidenhain can be used.

4.6.1 ABZ Increment PG Card for Asynchronous Motors

ABZ increment PG card (AS.T002) for asynchronous motors is able to receive two types of encoder output signals, and thus may be equipped with encoders with open collector signals or Push-Pull signals.

4.6.1.1 Terminal Alignment of ABZ Increment PG Card for Asynchronous Motors

The terminal alignment of ABZ increment PG card (AS.T002) for asynchronous motors is shown in Figure 4.30.

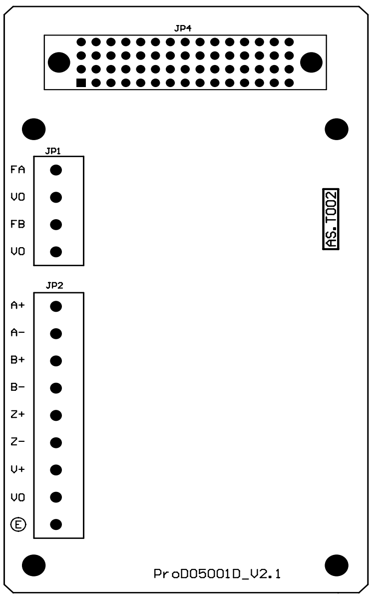


Figure 4.30 Terminal alignment of the PG card for asynchronous motors

4.6.1.2 Terminal Symbols of PG Card for Asynchronous Motors

The symbols of the terminals of ABZ increment PG card for asynchronous motors are shown as follows:

JP1 divided-frequency output terminals:

FA	V0	FB	V0

JP2 input terminals:

A+	A-	B+	B-	Z+	Z-	V+	V0	E

4.6.1.3 Terminal Functions of ABZ Increment PG Card for Asynchronous Motors

The terminal functions of the ABZ increment PG card for asynchronous motors are listed in Table 4.8.

Table 4.8 Terminal functions of the PG card for asynchronous motors

Name	Symbol	Function	Specification
Divided-frequency output	FA, FB	Divided-frequency output	Open collector outputs of crystal triodes: max. voltage 27VDC, max. current 50mA, max. frequency 100kHz. The frequency division coefficient may be set through Function Code E15.
	V0	24V GND	
Encoder input	A+,A-	Phase-A signal of encoder	Open collector/Push-Pull inputs: max. frequency 100 kHz.
	B+,B-	Phase-B signal of encoder	
	Z+,Z-	Phase-Z signal of encoder	
	V+	Anode of encoder power	Voltage 12VDC, max. output current 500mA
	V0	Cathode of encoder power	
	Ⓔ	Shielded ground	Grounding through shielded wires

4.6.1.4 Wiring between Input Terminals of ABZ Increment PG Card for Asynchronous Motors and Encoder Output Signals

The ABZ increment PG card for asynchronous motors may receive two types of encoder output signals, namely, open collector signals and Push-Pull signals.

Wiring with the open collector signals of the encoder is shown in Figure 4.31.

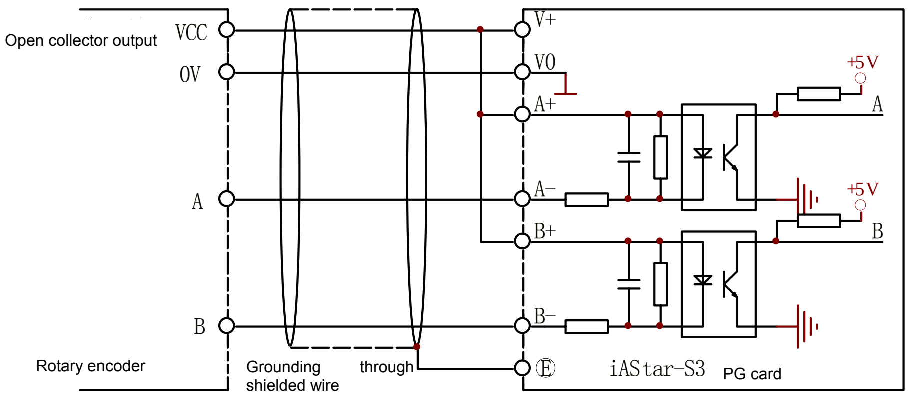


Figure 4.31 Wiring with the open collector signals of the encoder

Wiring with the Push-Pull signals of the encoder is shown in Figure 4.32.

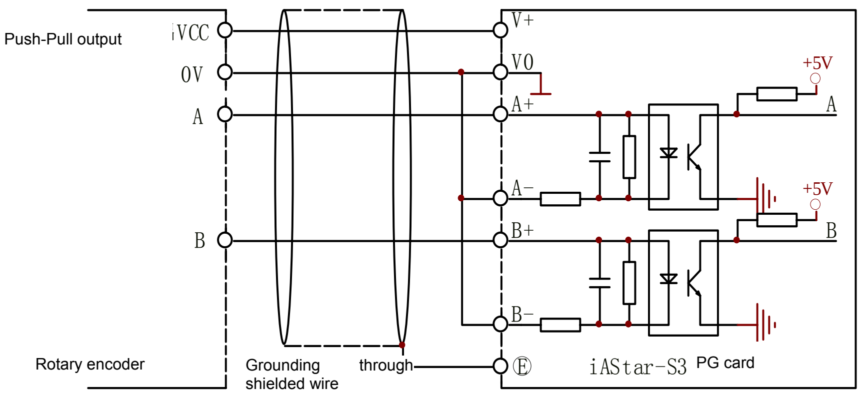


Figure 4.32 Wiring the Push-Pull signals of the encoder

4.6.2 SIN/COS PG Card for Synchronous Motors

The SIN/COS PG card (AS.T007) for synchronous motors may receive SIN/COS differential signals from the encoder, and thus may be equipped with encoders with SIN/COS differential signals.

The SIN/COS PG card for synchronous motors has a DB15 socket, which facilitates the connection of the PG card with the encoder. When the encoder has a DB15 plug on the output side, it only requires placing the DB15 plug into the DB15 socket.

4.6.2.1 Terminal Alignment of SIN/COS PG Card for Synchronous Motors

The terminal alignment of the SIN/COS PG card for synchronous motors is shown in Figure4.33.

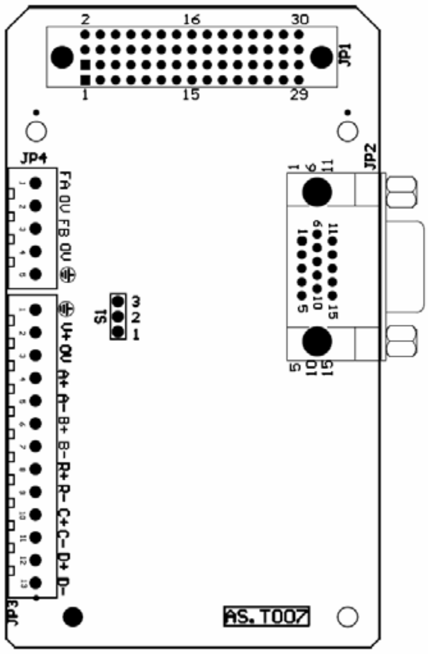


Figure 4.33 Terminal alignment of the SIN/COS PG card (J board) for synchronous motors

4.6.2.2 Terminal Symbols of SIN/COS PG Card for Synchronous Motors

The terminal symbols of the SIN/COS PG card for synchronous motors are shown as follows:

Symbols of JP4 and JP3 terminals

FA	0V	FB	0V	⏚	⏚	V+	0V	A+	A-	B+	B-	R+	R-	C+	C-	D+	D-

Symbols of JP2 terminals (DB15 socket)

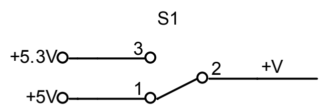
Pin	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Symbol	B-	—	R+	R-	A+	A-	0V	B+	V+	C-	C+	D+	D-	—	—

Note: "—" means unoccupied pin.

4.6.2.3 Terminal Functions of SIN/COS PG Card for Synchronous Motors

The terminal functions of the SIN/COS PG card for synchronous motors are listed in Table 4.9.

Table 4.9 Terminal functions of SIN/COS PG card for synchronous motors

Name	Symbol	Function	Specification
Open collector output	FA	Open collector output	Open collector output of crystal triodes: max. voltage 27VDC, max. current 50mA, max. frequency 100kHz. The frequency division coefficient may be set through Function Code E15.
	FB	Open collector output	
	0V	GND	
	⏚	Shielded ground	
Encoder input	A+,A-	SIN signals of the encoder	Differential signals: max. input frequency 100kHz; SIN/COS encoder shall have 2048 pulses for each turn.
	B+,B-	COS signals of the encoder	
	R+,R-	Z signals of the encoder	
	C+,C-	SIN signals of the	
	D+,D-	COS signals of the	
	⏚	Shielded ground	
	V+	+5V or +5.3V	+5V or +5.3VDC, max. output current 500mA. Select through S1. 
	0V	+5V or +5.3V GND	

Note: + 5.3V power supply may be used to enhance the signals when heavy voltage drop is caused by the long connection line between the encoder and the PG card.

4.6.2.4 Wiring between Input Terminals of SIN/COS PG Card for Synchronous Motors and Encoder Outputs

The SIN/COS PG card for synchronous motors can receive SIN/COS differential signals from encoders.

The wiring with the encoder is shown in Figure 4.34.

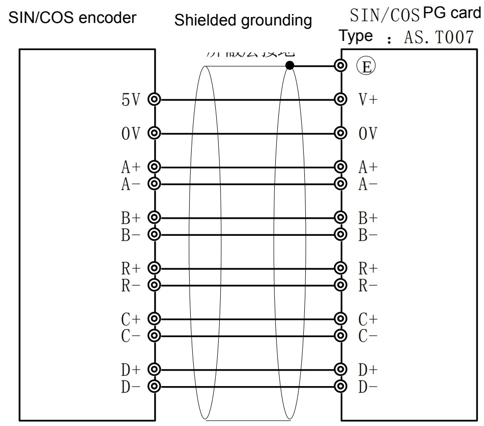


Figure 4.34 Wiring with SIN/COS differential signals of the encoder

4.6.3 UVW Increment PG Card for Synchronous Motors

The UVW increment PG card (AS.T010) can receive UVW differential signals from encoders, and thus may be equipped with an encoder with UVW differential signal outputs.

4.6.3.1 Terminal Functions of UVW Increment PG Card for Synchronous Motors

The alignment of the terminals of UVW increment PG card for synchronous motors is shown in Figure 4.35.

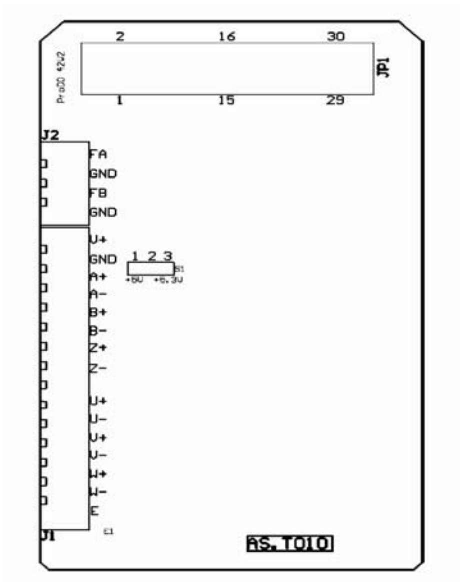


Figure 4.35 Terminal alignment of UVW increment PG card for synchronous motors

4.6.3.2 Terminal Symbols of UVW Increment PG Card for Synchronous Motors

Symbols of J2 terminals of the UVW increment PG card for synchronous motors:

FA	GND	FB	GND

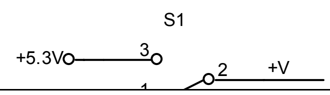
Symbols of J1 terminals of the UVW increment PG card for synchronous motors:

V+	GND	A+	A-	B+	B-	Z+	Z-	U+	U-	V+	V-	W+	W-	E

4.6.3.3 Terminal Functions of UVW Increment PG Card for Synchronous Motors

The terminal functions of the UVW increment PG card for synchronous motors are listed in Table 4.10.

Table 4.10 Terminal functions of the UVW increment PG card for synchronous motors

<table>
<tr><th>Name</th><th>Symbol</th><th>Function</th><th>Specification</th></tr>
<tr><td rowspan="3">Divided-frequency output</td><td>FA</td><td>Phase-A output of divided-frequency open collector</td><td rowspan="2">Open collector output of crystal triodes: max. voltage 27VDC, max. current 50mA, max. frequency 100kHz. The frequency division coefficient may be set through Function Code E15.</td></tr>
<tr><td>FB</td><td>Phase-B output of divided-frequency open collector</td></tr>
<tr><td>GND</td><td>0V</td><td>Common end of Phase A/B signals</td></tr>
<tr><td rowspan="7">Encoder output</td><td>A+,A-</td><td>Phase-A signal of the encoder</td><td rowspan="6">Differential signals: max. input frequency 100kHz;
UVW increment encoder shall have 8196 pulses for each turn.</td></tr>
<tr><td>B+,B-</td><td>Phase-B signal of the encoder</td></tr>
<tr><td>Z+,Z-</td><td>Phase-Z signal of the encoder</td></tr>
<tr><td>U+,U-</td><td>Phase-U signal of the encoder</td></tr>
<tr><td>V+,V-</td><td>Phase-V signal of the encoder</td></tr>
<tr><td>W+,W-</td><td>Phase-W signal of the encoder</td></tr>
<tr><td>E</td><td>Shielded ground</td><td>Shielded ground</td></tr>
<tr><td rowspan="2">Encoder power supply</td><td>V+</td><td>+5V or +5.3V</td><td>+5V or +5.3VDC, max. output current 500mA.
Select through S1
</td></tr>
<tr><td>GND</td><td>+5V or +5.3V GND</td><td></td></tr>
</table>

Note: + 5.3V power supply may be used to reduce voltage drop when the connection line between the encoder and the PG card is long.

4.6.3.4 Wiring between Input Terminals of UVW Increment PG Card and Encoder Output Signals

The UVW increment PG card for synchronous motors can receive UVW differential signals from encoders, with the wiring shown in Figure 4.36.

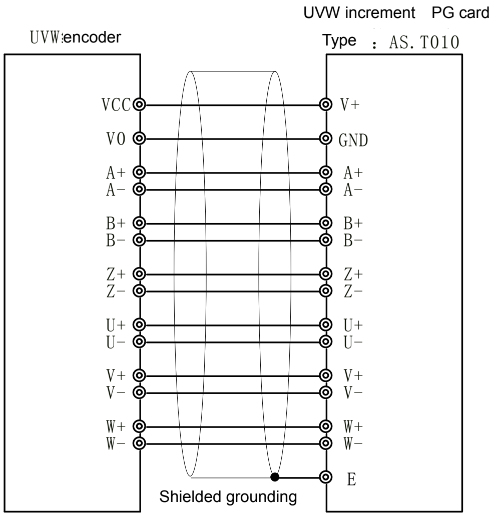


Figure 4.36 Wiring with UVW differential signals from the encoder

4.6.4 Endat Absolute PG Card for Synchronous Motors

The Endat absolute PG card (AS.T013) for synchronous motors can receive Endat output signals from encoders, and thus may be equipped with encoders with Endat output signals, such as 1313 or 413 Encoders from Heidenhain.

The Endat absolute PG card for synchronous motors has a DB15 socket, which facilitates the connection with the encoder. When the encoder has a DB15 plug on the output side, it is only to place the DB15 plug in the DB15 socket without wiring to complete the connection.

4.6.4.1 Terminal Alignment of Endat Absolute PG Card for Synchronous Motors

The terminal alignment of Endat absolute PG card for synchronous motors is shown in Figure 4.37.

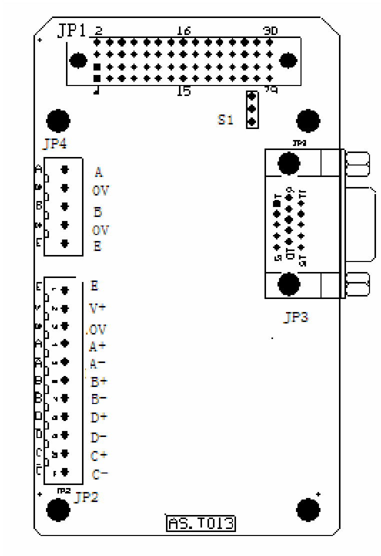


Figure 4.37 Terminal alignment of Endat absolute PG card for synchronous motors

4.6.4.2 Terminal Symbols of Endat Absolute PG Card for Synchronous Motors

The JP2 input terminal symbols of Endat absolute PG card for synchronous motors are shown in the following figure:

E	V+	0V	A+	A-	B+	B-	D+	D-	C+	C-

Figure 4.37 JP2 terminal symbols of Endat absolute PG card for synchronous motors

The JP4 divided-frequency output terminal symbols are shown as follows:

A	0V	B	0V	E

The JP3 (with DB15 socket) input terminal symbols are shown as follows:

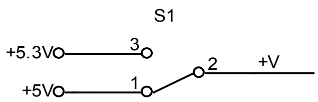
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A+	A-	B+	B-	D+	D-	—	—	—	—	C+	C-	V+	0V	—

Note: “—” means unoccupied pin.

4.6.4.3 Terminal Functions of Endat Absolute PG Card for Synchronous Motors

The terminal functions of the Endat absolute PG card for synchronous motors are listed in Table 4.11.

Figure 4.11 Terminal functions of Endat absolute PG card for synchronous motors

Name	Symbol	Function	Specification
Open collector output	A	Phase-A open collector output	Open collector output of crystal triodes: max. voltage 27VDC, max. current 50mA, max. frequency 100kHz. The frequency division coefficient may be set through Function Code E15.
	B	Phase-B open collector output	
	0V	GND	
	E	Shielded ground	
Encoder input	A+,A-	Phase-A of encoder increment signals	SIN/COS increment signals: max input frequency 100kHz; Endat absolute encoder shall have 2048 pulses (1313 or 413 from Heidenhain).
	B+,B-	Phase-B of encoder increment signals	
	D+,D-	Encoder clock signals	Max. clock frequency 2MHz
	C+,C-	Encoder data signals	
	E	Shielded ground	
	V+	+5V or +5.3\encoder	+5V or +5.3VDC, max. output current 500mA. Select through S1 
	0V	+5V or +5.3V GND	

4.6.4.4 Wiring between Input Terminals of Endat Absolute PG Card for Synchronous Motors and Encoder Output Signals

The Endat absolute PG card can receive differential output signals from **Endat** absolute encoders. The wiring with differential output signals from an Endat absolute encoder is shown in Figure 4.38.

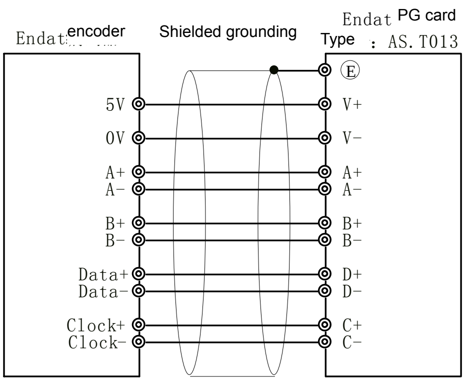


Figure 4.38 Wiring with differential output signals

4

Inverter wiring

4.6.5 PG Card Terminal Wiring Precaution

IMPORTANT

Keep encoder signal wiring away from the main circuit wiring and other power lines. Never lay wires closely in parallel. Shielded wires shall be used for encoder wiring, with the shield connected with the earthing terminal E.

5 Digital Operator

The digital operator is the basic tool of Inverter operation for observing the status and fault codes of the Inverter and setting and viewing the parameters. This chapter describes basic operations of the operator in detail.

5.1 Function of Digital Operator Components

The components of the digital operator and their functions are shown in Figure 5.1.

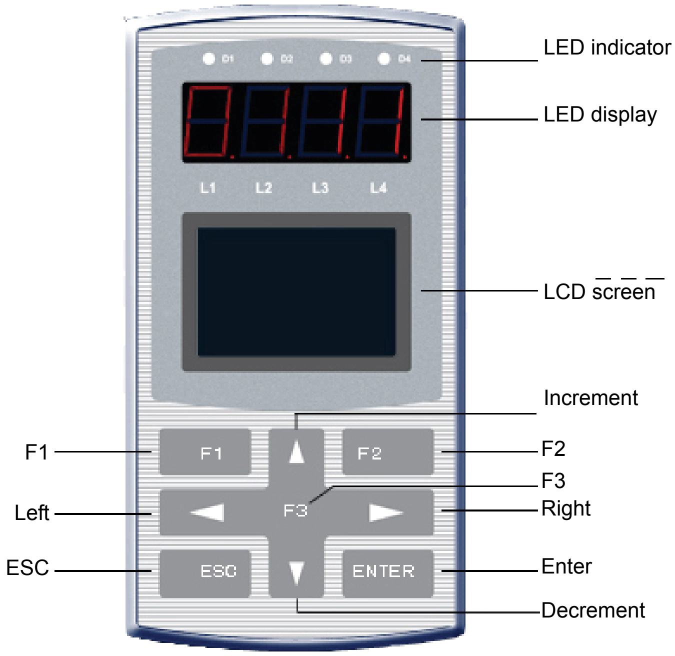


Figure 5.1 Components and their functions of the digital operator

5.1.1 LED Indicator

At the top of the front cover there are four LED indicators showing the four statuses of the elevator, namely “RUN”, “UP”, “DOWN”, and “FAULT”. The functions of these indicators are shown in Table 5.1.

Table 5.1 Elevator status indicated by the four indicators

Elevator Status	D1 (RUN)	D2 (UP)	D3 (DOWN)	D4 (FAULT)
UP	ON	ON	OFF	OFF
DOWN	ON	OFF	ON	OFF
FAULT	OFF	OFF	OFF	ON

D4 (FAULT) has a latching function which will be cancelled only by pressing F3 under RUN mode after the fault has been removed, or by entering a fault reset signal into the input port defined with the fault resetting function. See 8.2.6 F Parameters of Digital Inputs for the definition of fault resetting input port.

5.1.2 LED Digital Tube

Below the LED indicators there are 4 LED digital tubes showing real-time running speed of the elevator.

5.1.3 LCD Display

At the middle of the operator there is an LCD display for setting Inverter parameters, showing elevator running parameters and viewing Inverter fault codes.

5.1.4 Keyboard

The functions of the nine keys at the bottom of the operator are shown in Table 5.2.

Table 5.2 Key functions

Key	Name	Function
>	Right	To select the next function group under【Function Select】mode; To move the cursor to the right bit under 【Parameter Modification】 mode.
<	Left	To select the previous function group under 【Function Select】 mode; To move the cursor to the left bit under 【Parameter Modification】 mode.
∧	Increment	To select the previous function code under 【Function Select】 mode; To increase the value of the selected parameter under 【Parameter Modification】 mode.
∨	Decrement	To select the next function code under 【Function Select】 mode; To decrease the value of the selected parameter under 【Parameter Modification】 mode.
ENTER	Enter	To switch between 【Run】 and 【Function Select】 modes; To confirm parameter modifications under 【Parameter Modification】 mode.
ESC	ESC	To go back to 【RUN】 from 【Function Select】 mode; To go back to【Function Select】from【Parameter Modification】 mode.
F1	F1	To operate password function switch under 【Function Select】 mode.
F2	F2	To adjust LCD brightness under 【Run】 mode.
F3	F3	To reset fault under 【RUN】 mode. To change password under 【Function Select】 mode.。 Initial password: 1234. Permissible password: 0 – 9999.

5.2 Operation

The digital operator provides three operation modes, namely,【RUN】,【Function Select】 and 【Parameter Modification】. The menu may be shown in Chinese or English. The factory setting is Chinese. Choose 0 for the parameter of “Language selection” to switch to English menu.

5.2.1 Power on and Initialization

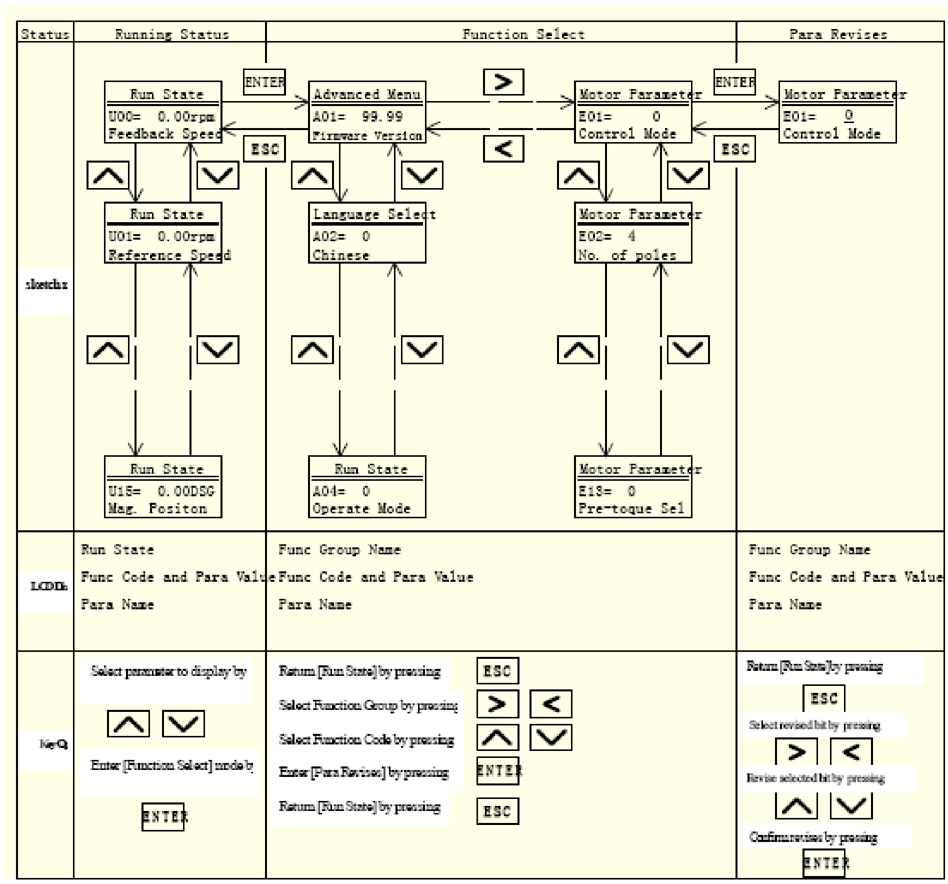
The initialization may take several seconds with an 【Init Menu】 shown on the LCD after power on, as follows:

Note: the software version shown in the 【Init Menu】 is that of the operator.

5.2.2 Operation Mode

Beside the 【Init Menu】 after power on, the digital operator has three operation modes, namely,【RUN】,【Function Select】 and【Parameter Modification】. The operation under these three modes are listed in Table 5.3. .

Table 5.3 Mode switching



5

Digital Operator

5.2.3 【Run State】

The 【Run State】 shows 16 real-time operation parameters of the elevator. These parameters may only be shown but not be changed. The 16 parameters and their function codes are listed in Table 5.4.

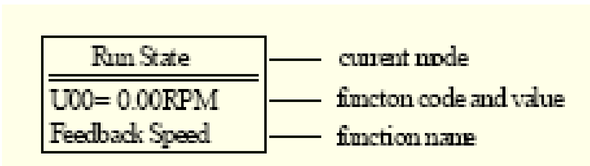
Table 5.4 U parameters of operation status

Function code	Name	Explanation	Range	Unit	Default value	Remarks
U00	反馈速度 Feedback speed	Monitor of motor feedback speed	×	rpm	×	
U01	指令速度 0 Ref. speed 0	Speed setting values instruction 0	×	rpm	×	
U02	指令速度 1 Ref. speed 1	Filtered speed setting values instruction 1	×	rpm	×	
U03	速度偏差 Speed deviation	Deviation of feedback speed from ref. speed values	×	rpm	×	
U04	输出电流 Output current	Monitor of output current	×	A	×	
U05	力矩偏置 Torque offset	Monitor of zero servo output torque	×	%	×	
U06	输出力矩 Output torque	Monitor of the output torque of vector control	×	%	×	
U07	直流母线电压 DC BUS Voltage	Monitor of the DC voltage of the main circuit in the Inverter	×	V	×	
U08	AI1 输入电压 AI1 Voltage	Monitor of the Inverter analog voltage input 1 (AI1)	×	V	×	Refer to Note 3 of 6.2.8 H (Analog Input) Parameters.
U09	AI2 输入电压 AI2 Voltage	Monitor of the Inverter analog voltage input 2 (AI2)	×	V	×	
U10	AI3 输入电流 AI3 Current	Monitor of the Inverter analog voltage input 3 (AI3)	×	A	×	

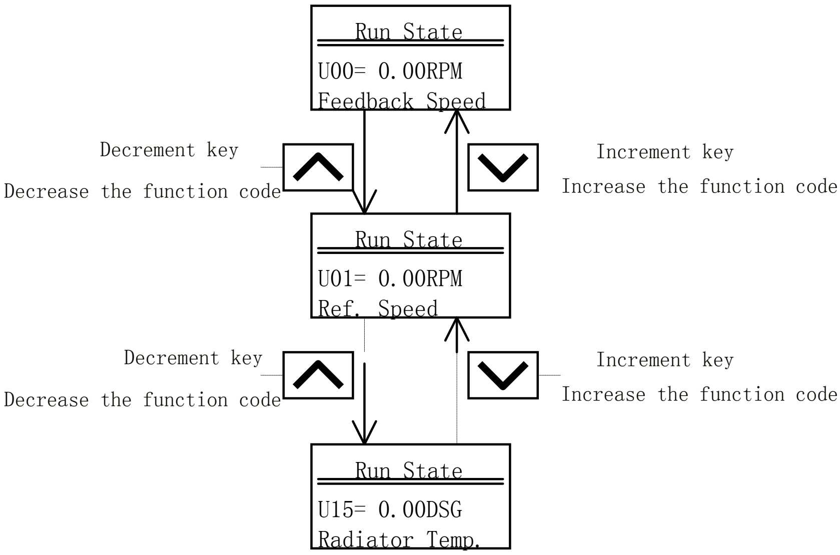
Table 5.5 U parameters of operation status, continued

Function code	Name	Explanation	Range	Unit	Default value	Remarks
U11	输入 DI1-DI12 Input DI1- DI12	Monitor of input status of DI1-DI12, in “XXXXXXXXXXXX”, where “X” = 0, indicating no input, while “X” = 1, indicating input.	×	×	×	Combined with function codes of F parameters.
U12	输出 DO1-DO6 Output DO1-DO6	Monitor of input status of DO1-DO6, in “XXXXXX”, where “X” = 0, indicating no output, while “X” = 1, indicating output.	×	×	×	Combined with function codes of G parameters.
U13	输出电压相位 Output voltage phase	Monitor of output voltage phase (for synchronous motors only)	×	Deg.	×	
U14	输出电流相位 Output current phase	Monitor of output current phase (for synchronous motors only)	×	Deg.	×	
U15	散热器温度 Radiator temp.	Monitor of radiator temperature	×	℃	×	

Under【Run State】mode, the first line of the LCD shows the “Run State”, the second line the function code and its parameter value, and the third line the name of the parameter, as shown in the following figure.



Select the parameter to be displayed through “Increment” or “Decrement” key, as shown in the following figure.



5.2.4 【Function Select】

The 【Function Select】 mode may be used to select a function group and its function codes. There are ten function groups, A – J, each containing function codes of different numbers. See Chapter 8 for a detailed description of function groups and codes.

Under 【Function Select】 mode, the first line of the LCD shows the name of the function group, the second line the function code and its parameter value, and the third line the name of the function code.

Select a function group through Left and Right key.

Select a function code through Increment and Decrement key.

Go back to 【Run State】 mode through ESC key.

Go to 【Parameter Modification】 mode through Enter key.

5.2.5 【Parameter Modification】

The 【Parameter Modification】 mode may be used to modify a selected parameter. The range of parameters can be found in Chapter 8.

Under 【Parameter Modification】 mode, the display of LCD is similar with that under 【Function Select】 mode, except that there is a cursor under the parameter value for modifications.

Change the digit to be modified through Left or Right key.

Change the selected value through Increment or Decrement key.

Confirm the changes through Enter key. If it is not confirmed, the modification will not take effect.

Go back to 【Function Select】 mode through ESC key.

5.2.6 Examples of Parameter Setting

This section describes how to set parameters by an example of changing the encoder specification E09 from 0 to 1024, as shown in the following figure.

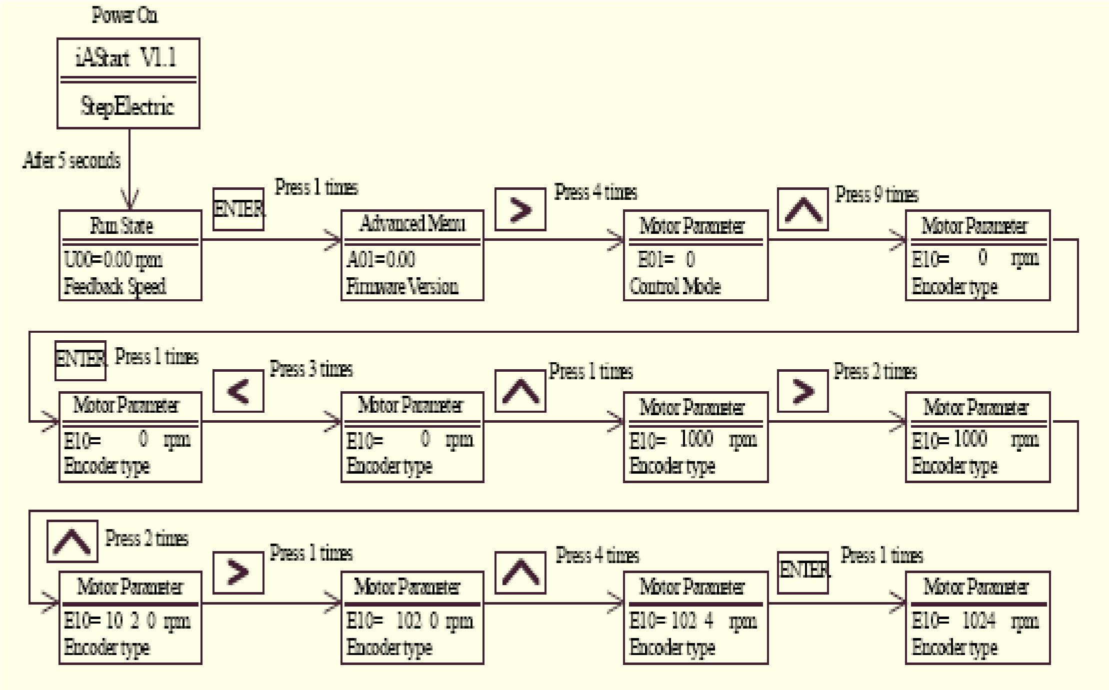


Figure 5.2 Example of parameter setting

5.3 Fault Indication

When a fault occurs to the Inverter, the fault indicator will be lit up, and the U00 and LED digital tubes show the fault code. Fault codes and types are listed in Table 5.6.

Table 5.6 Fault codes and types

Fault Code	Fault Type
1	Power module fault
2	DSP fault
3	Power module radiator overheated
4	Brake unit or brake resistor fault
5	Fuse blown
6	Torque overload
7	Speed deviation
8	Over-voltage
9	Under-voltage
10	Output phase loss
11	Over-current
12	Encoder fault
13	Current detected but not cut off during elevator stopping
14	Reversed speed direction detected during running
15	Speed feedback detected without running command
16	Wrong motor phase
17	Fwd dashing
18	Rev dashing
19	Wrong phase sequence of UVW encoder
20	R+ and R- disconnected, Endat communication fault
21	Reserved
22	KMB detection fault
23	Over voltage input
24	UVW encoder disconnected
25	Fan fault
26	no motor autotuning with UVW encoder
27	Over-current
28	Wrong phase sequence of c and d of 1387 encoder
29	Input phase loss

5.4 Chinese-English Comparison of Parameter Names of the Operator

Table 5.6 Chinese-English comparison of Run State parameter names

	Chinese	English
U00	反馈速度	Feedback Speed
U01	指令速度 0	Ref. Speed 0
U02	指令速度 1	Ref. Speed 1
U03	速度偏差	Speed Deviate
U04	输出电流	Output Current
U05	力矩偏置	Torque Offset
U06	输出力矩	Output Torque
U07	直流母线电压	DC BUS Voltage
U08	Ai1 输入电压	Ai1 Voltage
U09	Ai2 输入电压	Ai2 Voltage
U10	Ai3 输入电流	Ai3 Current
U11	输入 DI1-DI12	Input DI1-DI12
U12	输出 DO1-DO6	Output DO1-DO6
U13	输出电压相位	Voltage Phase
U14	输出电流相位	Current Phase
U15	散热器温度	Radiator Temperature

Table 5.7 Chinese-English comparison of Function Select parameter names

	Chinese			English		
A	高级菜单	A01	固件版本	Advanced Menu	A01	Firmware Version
		A02	语言选择		A02	Language Select
		A03	同步电机自整定		A03	PMSM AutoTuning
		A04	操作模式		A04	Operate Mode
B	系统配置 B 参数	B01	额定功率	B Parameters	B01	Rated Power
		B02	额定输出电流		B02	Rated Current
		B03	零速保持时间		B03	Zero Speed Delay
		B04	零速参考值 1		B04	Zero Speed Ref.1
		B05	零速参考值 2		B05	Zero Speed Ref.2
		B06	频率检出值		B06	SPD Agree Level
		B07	接触器闭合延时		B07	Contact on DLY
		B08	接触器断开延时		B08	Contact off DLY
		B09	反馈速度处理模式		B09	FDBK SPD mode
		B10	系统配置参数		B10	System Parameter
		B11	低速同步电机		B11	Low Speed PMSM
		B12	模拟量限幅		B12	Analog in Limit
		B13	调节器模式		B13	Adjuster Mode
		B14	抱闸确认时间		B14	Brake Time
		B15	张闸延时		B15	Brake Open Dly
		B16	抱闸延时		B16	Brake Close Dly

Table 5.7 Chinese-English comparison of Function Select parameter names, continued

	Chinese			English		
		B17	系统配置参数		B17	System Parameter
C	PI 调整	C01	零速比例 P0	PI Tune	C01	Zero Speed P0
		C02	零速积分 I0		C02	Zero Speed I0
		C03	低速比例 1 P1		C03	Slow Speed P1
		C04	低速积分 1 I1		C04	Slow Speed I1
		C05	低速比例 2 P2		C05	Slow Speed P2
		C06	低速积分 2 I2		C06	Slow Speed I2
		C07	中速比例 P3		C07	Mid Speed P3
		C08	中速积分 I3		C08	Mid Speed I3
		C09	高速比例 P4		C09	High Speed P4
		C10	高速积分 I4		C10	High Speed I4
		C11	速度切换点 F1		C11	Switch Freq. F1
		C12	速度切换点 F2		C12	Switch Freq. F2
		C13	电流环增益		C13	Curr.loop Gain
		C14	零伺服时间		C14	Zero Servo Time
D	速度 D 参数	D01	加速度	D Parameters	D01	Acceleration
		D02	减速度		D02	Deceleration
		D03	蠕动速度		D03	Dwell Speed
		D04	S 曲线（加加速度 1）		D04	Acc Ini Jerk
		D05	S 曲线（加加速度 2）		D05	Acc End Jerk
		D06	S 曲线（减减速度 1）		D06	Dec Ini Jerk
		D07	S 曲线（减减速度 2）		D07	Dec End Jerk
		D08	蠕动时间		D08	Dwell Time
		D09	最高速度		D09	Top Speeed
		D10	曲线方式		D10	Curve Mode 0
		D11	速度参考 0		D11	Speed Ref. 0
		D12	速度参考 1		D12	Speed Ref. 1
		D13	速度参考 2		D13	Speed Ref. 2
		D14	速度参考 3		D14	Speed Ref. 3
		D15	速度参考 4		D15	Speed Ref. 4
		D16	速度参考 5		D16	Speed Ref. 5
		D17	速度参考 6		D17	Speed Ref. 6
		D18	速度参考 7		D18	Speed Ref. 7

Table 5.7 Chinese-English comparison of Function Select parameter names, continued

	Chinese			English		
E	电机参数	E01	控制方式	Motor Parameters	E01	Control Mode
		E02	电机极数		E02	Num.of poles
		E03	电机额定电压		E03	Motor Rated Volt.
		E04	电机额定转速		E04	Motor Rated RPM
		E05	电机额定电流		E05	Motor Rated Cur.
		E06	力矩限制		E06	Tor.Output Lim.
		E07	转差频率		E07	Motor Slip Freq.
		E08	载波频率		E08	Carrier Freq.
		E09	编码器类型		E09	Encoder Type
		E10	编码器规格		E10	Encoder Spec.
		E11	初始相位角		E11	Rotor Mag.Pos
		E12	PG 分频输出		E12	PG Freq. Ratio
		E13	预负载选择		E13	Pre-torque Sel
F	开关量输入	F01	DI1 端口功能	Digital Input	F01	DI1 Input Func.
		F02	DI2 端口功能		F02	DI2 Input Func.
		F03	DI3 端口功能		F03	DI3 Input Func.
		F04	DI4 端口功能		F04	DI4 Input Func.
		F05	DI5 端口功能		F05	DI5 Input Func.
		F06	DI6 端口功能		F06	DI6 Input Func.
		F07	DI7 端口功能		F07	DI7 Input Func.
		F08	DI8 端口功能		F08	DI8 Input Func.
		F09	DI9 端口功能		F09	DI9 Input Func.
		F10	DI10 端口功能		F10	DI10 Input Func.
		F11	DI11 端口功能		F11	DI11 Input Func.
		F12	DI12 端口功能		F12	DI12 Input Func.
G	开关量输出	G01	DO1 端口功能	Digital Output	G01	DO1 Output Func.
		G02	DO2 端口功能		G02	DO2 Output Func.
		G03	DO3 端口功能		G03	DO3 Output Func.
		G04	DO4 端口功能		G04	DO4 Output Func.
		G05	DO5 端口功能		G05	DO5 Output Func.
		G06	DO6 端口功能		G06	DO6 Output Func.

Table 5.7 Chinese-English comparison of Function Select parameter names, continued

	Chinese			English		
H	模拟量输入	H01	AI1 功能	Analog Input	H01	Ai1 Func
		H02	AI1 模拟量偏置		H02	Ai1 Offset
		H03	AI1 模拟量增益		H03	Ai1 Gain
		H04	AI1 模拟量滤波		H04	Ai1 Filter Time
		H05	预负载补偿方向		H05	Pre-tor.Direc.
		H06	AI2 模拟量偏置		H06	Ai2 Offset
		H07	AI2 模拟量增益		H07	Ai2 Gain
		H08	AI2 模拟量滤波		H08	Ai2 Filter Time
		H09	AI3 功能		H09	Ai3 Func.
		H10	AI3 模拟量偏置		H10	Ai3 Offset
		H11	AI3 模拟量增益		H11	Ai3 Gain
		H12	AI3 模拟量滤波		H12	Ai3 Filter Time
I	模拟量输出	I01	AO1 端口功能	Analog Output	I01	Ao1 Func.
		I02	AO2 端口功能		I02	Ao2 Func.
J	故障记录	J01	故障记录 1	Error Buffer	J01	Error Buffer 1
		J02	故障记录 2		J02	Error Buffer 2
		J03	故障记录 3		J03	Error Buffer 3
		J04	故障记录 4		J04	Error Buffer 4
		J05	故障记录 5		J05	Error Buffer 5
		J06	故障记录 6		J06	Error Buffer 6
		J07	故障记录 7		J07	Error Buffer 7
		J08	故障记录 8		J08	Error Buffer 8
		J09	故障记录 9		J09	Error Buffer 9
		J10	故障记录 10		J10	Error Buffer 10
		J11	故障记录 11		J11	Error Buffer 11
		J12	故障记录 12		J12	Error Buffer 12
		J13	故障记录 13		J13	Error Buffer 13
		J14	故障记录 14		J14	Error Buffer 14
		J15	故障记录 15		J15	Error Buffer 15
		J16	故障记录 16		J16	Error Buffer 16
		J17	故障记录 17		J17	Error Buffer 17
		J18	故障记录 18		J18	Error Buffer 18
		J19	故障记录 19		J19	Error Buffer 19
		J20	故障记录 20		J20	Error Buffer 20

Table 5.7 Chinese-English comparison of Function Select parameter names, continued

	Chinese			English		
K	功能参数	K01~K04	1387 编码器数据 01~04	Function Parameters	K01~K04	Sin/CosEncoder01~04
		K05~K06	UVW 编码器数据 01~02		K05~K06	UVW Encoder D01~02
		K07~K12	UVW 编码器数据 03~08		K07~K12	UVW Encoder D03~08
		K13~K18	UVW 编码器数据 09~14		K13~K18	UVW Encoder D09~14
		K19~K21	UVW 编码器数据 15~17		K19~K21	UVW Encoder D15~17
		K22	风扇检测使能信号		K22	Fan Detec Enable
		K23	速度标定处理		K23	Speed Dev Scale
		K24	电流环增益 2		K24	CurrentLoop Gain
		K25	电流缓降时间		K25	SoftShutdownTime
		K26	输入电压缺相确认		K26	Supply Loss Time
		K27	反馈模式切换		K27	Fbk Cal Mode
		K28	输入缺相电压设置		K28	Supply loss Set
		K29	模拟量丢失斜率		K29	Analog Loss Set
		K30	速度反馈滤波		K30	Fbk Speed Filter
		K31	输出电流异常确认		K31	Surge Cur Times
		K32	数字速度切换模式		K32	Digi Ref Mode
		K33	过调制功能		K33	Overshoot Enable
		K34	保护功能是否有效		K34	Protect Action
		K35	输出缺相故障确认		K35	Output Loss time
		K36	检测制动单元标志		K36	BrakingUnit Flag
		K37	故障自动复位次数		K37	Auto Reset Times
		K39	编码器断线保护阀值 百分比值		K39	PGO Action

6 Function Parameter List

This chapter lists all the function codes and related information for reference.

Although “U running data” are operation data under 【Run State】 mode and do not belong to any function group in 【Function Select】, they are also listed in this chapter for convenience.

6.1 Function Groups

The function codes are divided into several groups.

The function groups are listed in Table 6.1.

Table 6.1 Function groups

Function Group	Group Name	
	Chinese	English
A	高级菜单	Advanced Menu
B	功率参数	B Parameters
C	PI 调节器调整参数	PI Tune
D	速度参数	D Parameters
E	电机参数	Motor Parameters
F	开关量输入	Digital Input
G	开关量输出	Digital Output
H	模拟量输入	Analog Input
I	模拟量输出	Analog Output
J	故障记录	Error Buffer
K	功能参数	Function Parameter
U	运行状态	Run State

6.2 Function List and Explanations

In the following parameter list, “Name” is the function code name, which is shown on the operator. When A02 is set as “1” (in default setting, A02=1), the Chinese name will be displayed; when A02 is set as “0”, the English name will be displayed.

6.2.1 A (Advanced Menu) Parameters (R/W)

The advanced Menu A contains Inverter version, language selection, motor autotuning, and operation mode selection.

Function Code	Name	Content	Range	Unit	Default	Remarks
A01	固件版本 Firmware Version	Inverter version. Set the following value and press Enter: 99.99: to reset all parameters to default value; 99.98: to clear all fault records; 88.88: no checking Inverter fan: 88.89: to check Inverter fan. Press ENTER to return to Inverter version. Refer to Note 1.	0～655.35	×	445.01	This is a read only data and set in the factory according to Inverter features. The version shows (from left to right): Digit 1: voltage level, 4 indicating 400 V and 2 indicating 200 V; Digit 2: hardware number; Digit 3: power level (kW): 0=2.2, 1=3.7, 2=5.5, 3=7.5, 4=11, 5=15, 6=18.5, 7=22, 8=30, 9=37; Digit 4, 5: software version.
A02	语言选择 Language Selection	Select the display language of the operator: 0: English; 1: Chinese.	0 / 1	×	1	The default setting is 1, Chinese display.
A03	同步电机自整定 PMSM AutoTuning	Autotuning for synchronous motors: 0: normal operation; 3: completion of motor autotuning (A03 automatically changed to “3” after each autotuning process); 4: go to autotuning mode; 7: save encoder identification data for SIN/COS encoders; 9: go to SIN/COS encoder identification; 10: encoder identification status (A03 automatically changed to “10” during encoder identification).	0/4/7/9	×	0	Refer to Note 2.
A04	速度给定方式 Operation Mode	Set Inverter operation mode: 0: multi-step speed control; 1: analog voltage input (AI1) control; 2: reserved; 3: analog current input (AI3) control	0 / 1 / 2 / 3	×	1	Refer to Note 3

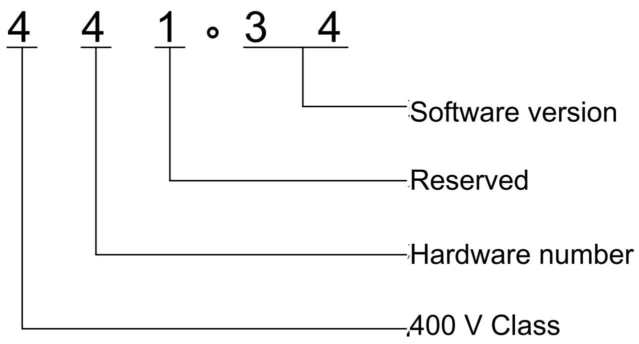
6

Function Parameter List

IMPORTANT

Note 1: A01 firmware version

A01 firmware version shows the hardware and software features of the Inverter, generally set at the factory, and may not be changed. The meaning of the digits is shown as follows:



Besides displaying Inverter version, A01 also has the following setting functions:

a) Reset to default parameters

Set A01 to 99.99 and press ENTER, and all the parameters of the Inverter will be reset to default values, and the operator will display the version.

Be careful before using this setting since all the parameters will be reset.

b) Clear fault records

Set A01 to 99.98 and press ENTER, and all the fault records will be deleted, and the operator will display the version.

The Inverter saves only the last 20 fault records, and those before them will not be saved.

c) Do not check signals of Inverter fan

Set A01 to 88.88 and press ENTER, and the fan signals will not be checked, and the operator will display the version.

This operation is used for earlier trial Inverters and is generally performed by relevant technical personnel.

d) Check signals of Inverter fan

Set A01 to 88.89 and press ENTER, and the fan signals will be checked, and the operator will display the version.

This operation is used to change the setting from “Do not check signals of Inverter fan” to “Check signals of Inverter fan”.

Note 2: A03 motor autotuning

1. For synchronous motors, the Inverter can effectively control the motor only after it obtains the phase angle of the motor magnetic pole to the encoder. Therefore, when either of the following happens, the encoder shall undergo an autotuning process:

a) when a new Inverter is installed;

b) when the encoder or the motor is replaced.

The autotuning procedures are as follows:

① set A03 = 4, and the Inverter goes to autotuning. Manually operate the motor to run at a low speed (in any direction) under a lowest load possible (no load being the best). When A03 automatically changes to 3, stop the motor, and the autotuning ends.

② After the autotuning, set manually A03 = 0, to put the Inverter to the normal operation status with the synchronous motor.

More details may be found in 7.5 Motor Autotuning.

2. For synchronous motors with a SIN/COS encoder, after autotuning of the controlled motor and the encoder, if the Inverter is replaced and another autotuning is not desired, it is necessary to input the phase angle data to the new Inverter and perform SIN/COS encoder identification (which is included in the autotuning process). The identification procedures are as follows:

① Set A03 = 9 and press ENTER, and A03 will automatically change to 10, and the Inverter starts encoder identification;

② Run the motor at a low speed in any direction, and stop the running after the encoder on the motor has revolved two turns;

③ A03 shall be 10 at this time, indicating the identification is finished. Then manually set A03 = 7 to save the identification data. After the saving A03 automatically changes to 0 and the Inverter returns to normal.

Note: all the functions of A03 are specifically used for synchronous motors, and are invalid (actually unnecessary) for asynchronous motors.

IMPORTANT

Note 3: A04 operation mode of the Inverter

1. Three operation modes may be obtained through A04 setting, as shown in the following table:

A04 Setting	Operation Mode	Speed Selection	Direction Setting
0	Digital multi-step	Multi-step port 0～2（corresponding to multi-function input port DI3 – DI5 under default setting）	Upward and downward signals（corresponding to multi-function input port DI7 and DI8 under default setting）
1	Analog voltage input port （AI1）	AI1 analog voltage input（analog voltage input port AI1）	Upward and downward signals（corresponding to multi-function input port DI7 and DI8 under default setting）
2	Reserved	Reserved	Reserved
3	Analog current input port （AI3）	AI3 analog current input（analog current input port AI3）	Upward and downward signals（corresponding to multi-function input port DI7 and DI8 under default setting）

When A04 = 0, the operation speed is given by the code of multi-step port 0 – 2;

When A04 = 1, the operation speed is given by the input voltage (0 - +10V) from the analog voltage input port AI1; when the input voltage is not within 0 - +10V, H02 (AI1 analog offset) and H03 (AI1 analog gain) shall be configured. See 6.2.8 H (Analog Input) Parameters for more information.

When A04 = 3, the operation speed is given by the input current (4 – 20mA) from the analog current input port AI3. When the input current is not within 4 – 20mA, H10 (AI3 analog offset) and H11 (AI3 analog gain) shall be configured. See 6.2.8 H (Analog Input) Parameters for more information.

2. Port Setting

a) Analog voltage input port

Analog voltage signals may only be input through the analog voltage input port AI1.

b) Analog current input port

Analog current signals may only be input through the analog current input port AI3.

c) Multi-step input port

By means of the function codes F01 – F12, multi-step input ports may be selected from the digital input ports DI1 - DI12. Multi-step port 0, 1 and 2 may only be given one port each but may not be given more than one ports. By default, F03 = 3, i.e., DI3 as multi-step port 0; F04 = 4, i.e., DI4 as multi-step port 1; F05 = 5, i.e., DI5 as multi-step port 2. If DI3 - DI5 are not to be used as the multi-step ports, F01 - F12 parameters shall be reset.

d) Upward and downward signal input ports

By means of the function codes of F01 – F12, upward and downward signal input ports may be selected from the digital input ports DI1 - DI12. Upward signals and downward signals may be given only one port each. By default, F07 = 7, i.e., DI7 as the upward signal input port, and F08 = 8, i.e., DI8 as the downward signal input port. If these are not to be used, F01 - F12 parameters shall be reset.

3. The relationship between the analog signal and the speed in analog control mode is shown in Figure 6.1.

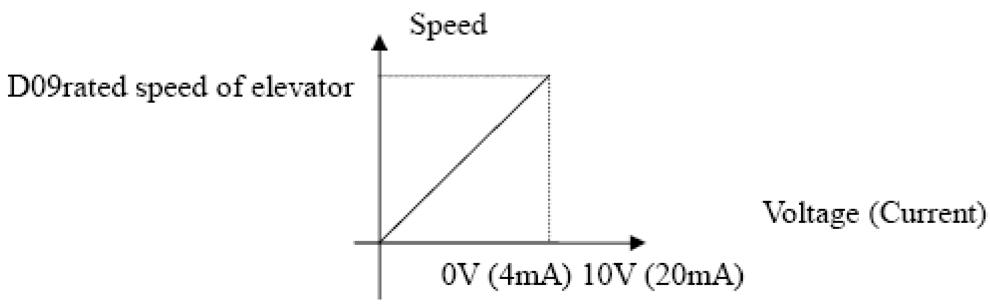


Figure 6.1 Relationship between analog signal and speed

The relationship between analog signals and speed is defined by Figure 6.1 when the following parameters take the default setting:

H02 (AI1 analog offset) = 10.000, H03 (AI1 analog gain) = 1.00, H10 (AI3 analog offset) = 10.000, and H11 (AI3 analog gain).

For analog voltage input ports, when the input voltage is not within 0 - +10V, or H02 (AI1analog offset) or H03 (AI1 analog gain) has been changed, the relationship between the analog input and the speed shall change accordingly. In the same spirit, for analog current input ports, when the input current is not within 4 – 20mA, or H10 (AI3 analog offset) or H11 (AI3 analog gain) has been changed, the relationship between the analog input and the speed shall also change accordingly. Refer to 6.2.8 H (Analog Input) Parameters for more information.

6.2.2 B Parameters (R and R/W)

B parameters are used to define rated power, rated output current and other system features.

Function Code	Name / Operator Display	Content	Range	Unit	Default	Remarks
B01	额定功率 Rated Power	Rated power, in kW. Read only.	2.2～37	kW	Rated power	Read only. Generally set at the factory.
B02	额定输出电流 Rated Current	Rated output current, in A. Read only.	6.2～80	A	Rated current	
B03	零速保持时间 Zero Speed Delay	Delay from stop to output cutoff, in 5ms. =0: no delay, output directly through the enabling main control circuit; > 0: delay time to be set.	0～3000	5ms	0	Refer to Note 1.
B04	零速参考值 1 Zero Speed Ref.1	Threshold of B03 zero speed, in mm/s, also used as the first threshold for G function code = 8 or 108.		mm/s	3	Refer to Figure 6.2 Adjustable Sequence and the explanation on G function code ＝ 8 or 108.
B05	零速参考值 2 Zero Speed Ref.2	Speed in mm/s, used as the second threshold for G function code = 8 or 108.			40	Refer to the explanation on G function code ＝ 8 or 108.
B06	频率检出值 SPD Agree Level	Frequency in mm/s, used as the threshold for G function code = 1 or 101.			200	Refer to the explanation on G function code ＝ 1 or 101.
B07	变频器输出延时 Contact on DLY	Delay from output contact closing to output starting and motor excitation starting when startup, in 5ms.		5ms	1	Refer to Note 2.
B08	接触器断开延时 Contact off DLY	Delay from zero speed to output contact opening when stop, in 5ms.			0	Refer to Note 3.
B09	编码器信号处理模式 FDBK SPD mode	Encoder signal processing mode: =0: special processing of SIN/COS signals; =2: normal mode.	0/2	×	2	Refer to Note 4.
B10	系统数据 System Parameter	For internal use.		×	0	Not to be changed by the user.

Continued

Function Code	Name / Operator Display	Content	Range	Unit	Default	Remarks
B11	同步电机速度选择 Low Speed PMSM	Speed of synchronous motors: ： 0: speed ≥ 100 rpm; 1: speed < 100 rpm.	0/1	×	0	
B12	AI1 模拟量输入限幅 Analog in Limit	Limit to AI1 analog inputs: Corresponding to the analog voltage input at the highest given speed. When the input voltage exceeds this value, the speed remains at its highest level.	0～10000	mV	10000	Refer to Note 5.
B13	调节器模式 Adjusting Mode	Adjusting mode: 0: synchronous motor when the speed ≥ 2m/s; 1: asynchronous motor, or synchronous motor when the speed ＜ 2m/s. 2, 3, 4: noise reduction of synchronous motors.	0/1/2/3/4	×	1	Refer to Note 6.
B14	抱闸确认时间 Brake Time	Delay from the closing of brake contacts to the validation of the braking (or brake contactor) detection signal, in 5ms. This parameter is used for detection of contactor faults, for example, no signal detected during the time span indicating brake (or brake contactor) fault.	0～3000	5ms	0	Refer to Note 7.
B15	张闸延时 Brake Open Dly	Delay from output starting and motor excitation starting to brake contactor closing or brake opening, in 5ms.	0～3000	5ms		Refer to Note 8.
B16	抱闸延时 Brake Close Dly	Delay from zero speed to brake contactor opening or brake closing, in 5ms.	0～3000	5ms		Refer to Note 9.
B17	系统配置参数 System Parameter	For internal use.	×	×	0	Not to be changed by the user.

Note 1: zero speed delay B03

1. B03 = 0: output only through enabling main control circuit when stop;

When B03 is set as 0, during stopping; the Inverter may cut off its power output only according to the enabling signal. That is to say, the Inverter may cut off its power output only when the enabling signal is cut off. Therefore, the whole stopping sequence is controlled by the control system.

2. B03 > 0: B03 is the time delay for the Inverter to cut off the output;

At this time, during the stopping, as long as there is an enabling signal, the Inverter will cut off its power output after B03 delay when the speed reaches zero. The threshold of zero speed is set through B04. Refer to Figure 6.2 Adjustable Sequence for more information on the stopping sequence. It is necessary to note that the enabling signal is a necessary condition for Inverter output and thus the output will be cut off once the enabling signal is cut off under any circumstance.

Note 2: output delay B07

B07 is the delay from the closing of main circuit contactor to the starting of Inverter power output and motor excitation. Refer to Figure 6.2 Adjustable Sequence.

1. If output contactor detection point is not defined (none of F01 to F12 is set to 11), the Inverter will begin power output and the motor will begin excitation after B07 delay when the output contactor is closed.

2. If an output contactor detection point is defined (one of F01 to F12 is set to 11), the Inverter will begin power output and the motor will begin excitation after B07 delay when this port receives a contactor closing signal. Refer to Figure 6.2 Adjustable Sequence.

Note 3: contactor opening delay B08

It is necessary to set this parameter only when the main circuit contactor is under direct control of the Inverter. During stopping, the Inverter will send a signal to cut off the output contactor after B08 delay from zero speed. Refer to Figure 6.2 Adjustable Sequence.

It is worthwhile to mention that the delay setting shall satisfy the requirement that B08 (contactor opening delay) > B03 (zero speed time) > B16 (brake delay).

Note 4: encoder signal processing mode B09

B09 is generally set to 2. B09 is set to 0 under the following circumstances to have special processing method of SIN/COS encoder signals in order to improve motor operation: the encoder shall be of the SIN/COS type, and either of the following happens when all other parameters are set:

1. running at low speed free of load, the motor shows vibration or noise;

2. the motor shows vibration within a certain frequency range.

Note 5: AI1 analog limit B12

When the speed is given through analog voltage inputs, B12 defines the voltage input (in mV) from the corresponding analog input port AI1 at the highest speed. When it is set to "10000", if AI1 input is 10V, the given speed is the highest level; if AI1 input is 1V, the given speed is 1/10 of the highest. When it is set to "9000", if AI1 input is 9V, the given speed is the highest; if AI1 input is 1V, the given speed is 1/9 of the highest. When the input voltage exceeds 9V, the speed remains at the highest level. Generally, this parameter needs no modification. However, slight adjustment may reduce elevator vibration at the highest speed. For example, the maximum analog voltage to set the speed given by the elevator controller is 9.8V, meaning that the speed will be its highest level when the input voltage is 9.8V. If the input voltage at the analog port fluctuates between (9.8 – a) V and (9.8 + a) V at the highest speed due to certain reasons, the actual given speed of the Inverter will fluctuate accordingly. When a reaches a certain level, the elevator will vibrate. In such situations, set B12 to (9.8－a) × 1000 (since the parameter is represented in mV), the given speed will reach its highest level when the input voltage is (9.8 – a) V. Due to the limiting function, when the input voltage fluctuates between (9.8 – a) V and (9.8 + a) V, the speed received by the Inverter will remain at its highest level, thus preventing the above-said vibration.

Note 6: adjusting mode B13

For asynchronous motors, B13 shall be set to 1 and may not be changed. For synchronous motors, when elevator speed >= 2m/s, it shall be set to 0; when the speed < 2m/s, it shall be set to 1. This parameter generally needs no modification. When the motor shows significant noises, however, it may be set to 2, 3 or 4 gradually until the noise is reduced as required. It is worthwhile to mention that a higher value of this parameter may lead to jitter of the motor.

Note 7: brake confirmation time B14

B14 is valid only when the Inverter is to detect the brake (or brake contactor) contact and one of F01 to F12 is set to 2 (i.e., the corresponding port DI is defined as input of brake (or brake contactor) contact detection. In this situation, the time set by B14 is the delay from the closing command of the brake contactor to the confirmation of the validation of brake (or brake contactor) detection signal. This parameter is used to detect brake contactor faults. If the detection signal is still invalid (i.e., the contacts are not yet closed) after B14 delay, Fault 22 (brake or brake contactor fault) signal will be sent.

If none of F01 to F12 is set to 2 (i.e., no DI port is defined as the input of brake (or brake contactor) contact detection), B14 is invalid, and the Inverter will not send the above fault alarm under any circumstance.

Note 8: brake opening delay B15

B15 needs configuration only when the Inverter is to directly control the brake contactor. B15 defines the delay from the starting of Inverter power output and motor excitation to the sending of brake contactor closing command to open the brake when start.

Refer to Figure 6.2 Adjustable Sequence.

Note 9: brake delay B16

B16 needs configuration only when the Inverter is to directly control the brake contactor. B16 defines the delay from zero speed to the sending of brake contactor cutoff command to release the brake when stop. The zero speed takes B04 setting as its threshold, i.e., the speed shall be regarded as zero when it goes below that set by B04.

Refer to Figure 6.2 Adjustable Sequence.

IMPORTANT

Note that the above delays shall meet the following requirement: B08 (contactor opening delay) > B03 (zero speed time) > B16 (brake delay). Or elevator slipping may occur or damages may even be caused to the Inverter.

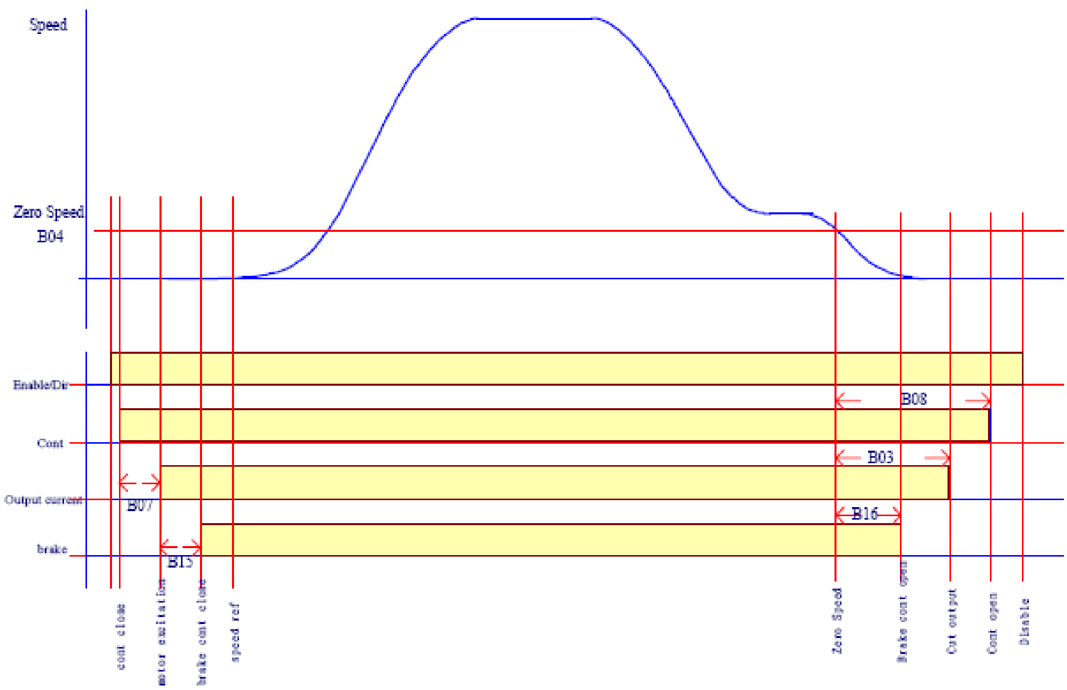


Figure 6.2 Adjustable sequence

6.2.3 C (PI Tune) Parameters (R/W)

C parameters are used to configure PI adjuster.

Function Code	Name	Content	Range	Unit	Default	Remarks
C01	零速比例 P0 Zero Speed P0	Starting compensation proportion: When E13 = 0 (without load device) and C02 (zero speed I0) > 0, effective during C14 (zero servo time) after the enabling signal becomes valid from starting.	0～655.35	×	100.00	Refer to Note 1.
C02	零速积分 I0 Zero Speed I0	Starting compensation integral: Only when C02 > 0, the compensation function takes effect.	0～655.35	×	0.00	Refer to Note 1. Recommended range: 40 ～ 80.
C03	低速比例 1 P1 Slow Speed P1	Proportion at low speeds during acceleration (running frequency ≤ C11 low-speed switching point F1).	0～655.35	×	70.00	Refer to **P1** in Figure 6.7 PI control during elevator operation.
C04	低速积分 1 I1 Slow Speed I1	Integral at low speeds during acceleration (running frequency ≤ C11 low-speed switching point F1).	0～655.35	×	10.00	Refer to **I1** in Figure 6.7 PI control during elevator operation.
C05	低速比例 2 P2 Slow Speed P2	Proportion at low speeds during deceleration (running frequency ≤ C11 low-speed switching point F1).	0～655.35	×	70.00	Refer to **P2** in Figure 6.7 PI control during elevator operation.
C06	低速积分 2 I2 Slow Speed I2	Integral at low speeds during deceleration (running frequency ≤ C11 low-speed switching point F1).	0～655.35	×	10.00	Refer to **I2** in Figure 6.7 PI control during elevator operation.
C07	中速比例 P3 Mid Speed P3	Proportion at medium speeds (running frequency at C11 low-speed switching point F1 < proportion at C12 high-speed switching point F2).	0～655.35	×	120.00	Refer to **P3** in Figure 6.7 PI control during elevator operation.
C08	中速积分 I3 Mid Speed I3 Cur. Loop Gain	Integral at medium speeds (running frequency at C11 low-speed switching point F1 < proportion at C12 high-speed switching point F2).	0～655.35	×	15.00	Refer to **I3** in Figure 6.7 PI control during elevator operation.

Continued

Function Code	Name	Content	Range	Unit	Default	Remarks
C09	高速比例 P4 High Speed P4	Proportion at high speeds (running frequency > high-speed switching point F2).			140.00	Refer to **P3** in Figure 6.7 PI control during elevator operation.
C10	高速积分 I4 High Speed I4	Integral at high speeds (running frequency > high-speed switching point F2).			5.00	Refer to **I3** in Figure 6.7 PI control during elevator operation.
C11	低速切换点 F1 Switch Freq. F1	Frequency switching point from low speeds to medium speeds: used for proportion and integral switching from low to medium speed.	0～15.00	Hz	0.50	Refer to **F1** in Figure 6.7 PI control during elevator operation.
C12	高速切换点 F2 Switch Freq. F2	Frequency switching point from medium speeds to high speeds: used for proportion and integral switching from medium to high speed.	15.00～50.00	Hz	25.00	Refer to **F2** in Figure 6.7 PI control during elevator operation.
C13	电流环增益 Cur. Loop Gain	Current loop gain: Not to be modified for synchronous motors. Automatically set to "1". For asynchronous motors, it may be modified within a specific range to reduce torque pulses in even speed zone.	0～200.00	×	5.00	When E01 = 1 (synchronous), C13 automatically changes to 1.
C14	零伺服时间 Zero Servo Time	Interval from enabling signal validation to the given speed curve.	0～10.000	s	0.800	Refer to Figure 6.3 Zero servo time.

Note 1: starting adjustment

Usually there is excellent comfort even without a load device due to the new technology of load-free sensor starting compensation. This function takes effect when E13 = 0 (without load device). Here, there is generally no need for a pre-load compensation device, only slight adjustments to C01 and C02 may ensure excellent comfort during elevator starting.

C01 and C02 are proportion and integral of starting compensation respectively. These two parameters are effective only during C14 (zero servo time) after the enabling signal takes effect when E13 = 0 (without load device) and C02 (zero speed I0) > 0. C01 corresponds to P (proportion) of the PI adjuster, while C02 to I (integral) of the PI adjuster.

C14 is the zero servo time, used to adjust the delay of the speed curve given by the control system. C14 is 0.8s by default. The sequence of C14 is shown in Figure 6.3.

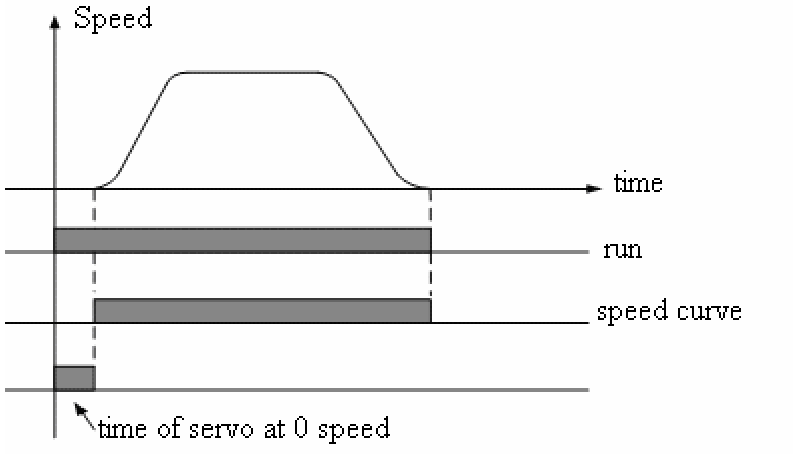


Figure 6.3 Zero servo effective time

Note 2: adjustment parameters C03 - C10 for the PI adjuster

Function codes C03 to C10 correspond to P and I values of the PI adjuster at different stages during operation (see Figure 6.7). Comfort during elevator operation may be increased through adjustments to C03 to C10 at different stages. Function codes C11 and C12 are used for frequency switching between stages (see Figure 6.7).

The structure of PI adjuster for speed loop is shown in Figure 6.4.

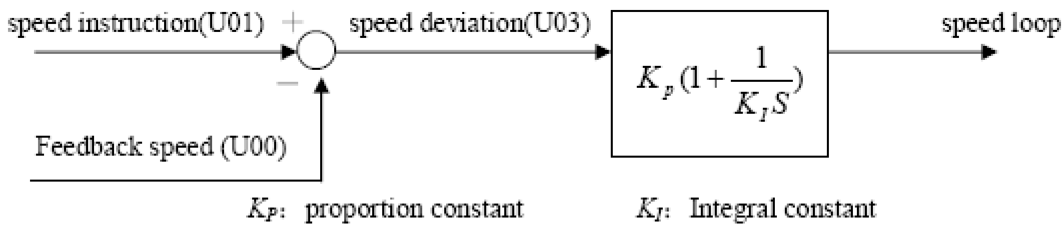


Figure 6.1 Structure of PI adjuster for speed loop

Note 3: Adjustments to P and I constants

a) Increase in P may enhance the dynamic response capability of the system. However, too high P may lead to system vibration. The impact of P on feedback tracing is shown in Figure 6.5.

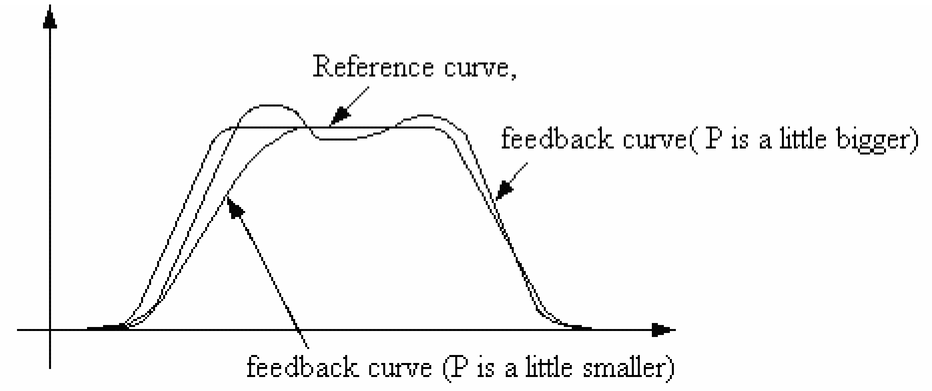


Figure 6.2 P and feedback tracing

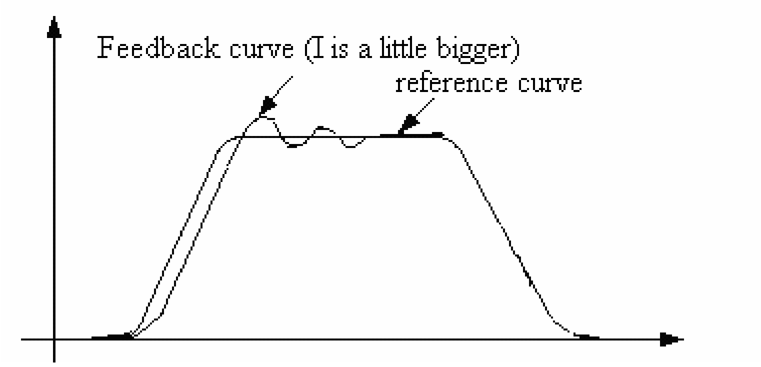


Figure 6.3 I and feedback tracing

b) Increase in I may quicken the dynamic response of the system. When there is over-tuning or too slow system response, I may be increased. However, too high I may also lead to system vibration. Figure 6.6 shows the impact of I on feedback speed.

c) Usually, P is adjusted first. Set P as high as possible as long as there is no system vibration. Then I may be adjusted to obtain quick system response while limit over-tuning.

d) Figure 6.7 shows the PI adjuster divisions along the elevator operation curve.

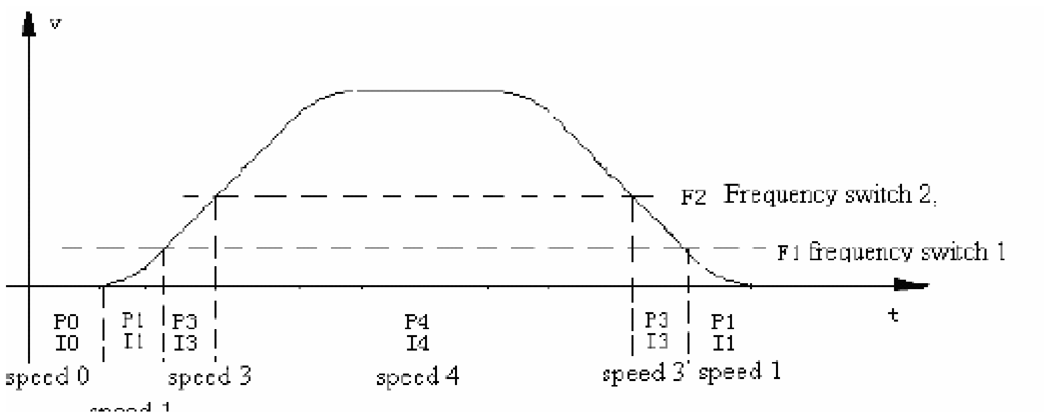


Figure 6.7 PI control during elevator operation

6.2.4 D Parameters (R/W)

D parameters are used to set acceleration/deceleration, acceleration/deceleration rate, and various reference speeds.

Function Code	Name	Content	Range	Unit	Default	Remarks
D01	加速度 Acceleration	Acceleration of S Curve, in m/s².	0.000～0.850	m/s²	0.650	The value may not exceed half of the rated elevator speed (D09). Refer to D01 and D02 in Figure 6.9 S Curve during elevator operation.
D02	减速度 Deceleration	Deceleration of S Curve, in m/s².				
D03	蠕动速度 Dwell Speed	Dwell speed at low speeds, in m/s.	0.000～0.200	m/s	0.012	Refer to D03 in Figure 6.9 S Curve during elevator operation.
D04	S 曲线（加加速度 1） Acc ini jerk	Acceleration ini jerk of S Curve, in m/s².	0.000～0.850	m/s³	0.650	Refer to D04, D05, D06 and D07 in Figure 6.9 S Curve during elevator operation.
D05	S 曲线（加加速度 2） Acc end jerk	Acceleration end jerk of S Curve, in m/s².				
D06	S 曲线（减减速度 1） Dec ini jerk	Deceleration ini jerk of S Curve, in m/s².				
D07	S 曲线（减减速度 2） Dec end jerk	Deceleration end jerk of S Curve, in m/s².				
D08	蠕动时间 Dwell Time	Dwell time at low speeds, in s.	0～10.000	s	0	Refer to D08 in Figure 6.9 S Curve during elevator operation.
D09	最高速度 Top Speed	Rated speed or max. speed, in m/s.	0.000～3.000	m/s	1.750	
D10	曲线方式 Curve Mode	Reserved.	0	×	0	
D11	速度参考 0 Speed Ref.0	Reference speed 0 under multi-step control, in m/s.	0.000～3.000	m/s	0.000	
D12	速度参考 1 Speed Ref.1	Reference speed 1 under multi-step control, in m/s.			0.145	
D13	速度参考 2 Speed Ref. 2	Reference speed 2 under multi-step control, in m/s.			0.030	
D14	速度参考 3 Speed Ref. 3	Reference speed 3 under multi-step control, in m/s.			0.040	
D15	速度参考 4 Speed Ref. 4	Reference speed 4 under multi-step control, in m/s.			0.290	

Continued

Function Code	Name	Content	Range	Unit	Default	Remarks
D16	速度参考 5 Speed Ref. 5	Reference speed 5 under multi-step control, in m/s.	0.000～3.000	m/s	1.000	
D17	速度参考 6 Speed Ref. 6	Reference speed 6 under multi-step control, in m/s.	0.000～3.000	m/s	1.500	
D18	速度参考 7 Speed Ref. 7	Reference speed 7 under multi-step control, in m/s.	0.000～3.000	m/s	1.750	

Note 1: D parameters are used to set up the S curve during elevator operation. Except for D03 (dwell speed) and D08 (dwell time), other D parameters are valid only when the speed is given through digital multi-step control. When the speed is given through analog inputs, other D parameters except D03 and D08 are invalid.

Note 2: the multi-step operation curve is shown in Figure 6.8.

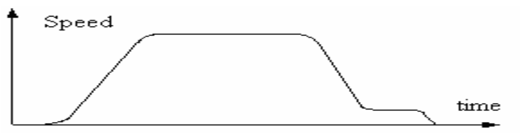


Figure 6.8 Multi-step operation curve

Note 3: D01 - D08 are used to set up the S curve (speed curve) during elevator operation under digital multi-step control. They define acceleration (D01), deceleration (D02), acceleration jerk (D04 and D05) and deceleration jerk (D06 and D07), and thus directly influence the operation efficiency and comfort of the elevator. Dwell speed (D03) and dwell time (D08) mean that: when the speed is given through digital multi-step control, at the starting of the elevator, a dwell speed will be given first, and a normal speed will be given after the dwell time; when the speed is given through analog inputs, at the starting of the elevator, a dwell speed will be given first, and an analog speed will be given when the analog speed exceeds the dwell speed or after the dwell time. Under special circumstances, adjustments to these two parameters may increase elevator comfort. It shall be noted that, under most circumstances, there is no need for a dwell speed, the dwell time (D08) shall be set to 0, and the elevator will start with a normal given speed. The parameters along the elevator operation curve are shown in Figure 6.9.

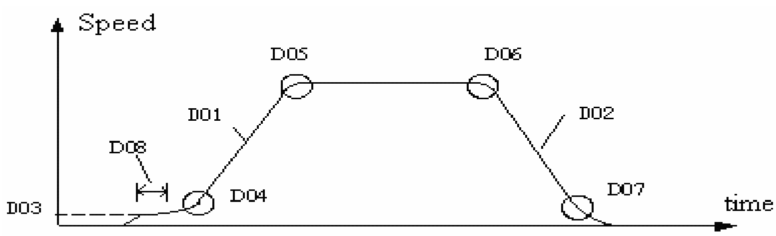


Figure 6.9 S Curve during elevator operation

6

Function Parameter List

IMPORTANT

a) Acceleration D01 and deceleration D02 of S Curve may be adjusted within a specific range. Increase of these values may improve operation efficiency but may also impact comfort, and thus comprehensive considerations shall be given.

b) During acceleration, acceleration ini jerk D04 at the beginning and acceleration end jerk D05 at the end may be adjusted within a specific range. Increase of these values may improve operation efficiency but may also impact the comfort at the two turning corners along the curve, and thus comprehensive considerations shall be given.

c) During deceleration, deceleration ini jerk D04 at the beginning and deceleration end jerk D05 at the end may be adjusted within a specific range. Increase of these values may improve operation efficiency but may also impact the comfort at the two turning corners along the curve, and thus comprehensive considerations shall be given.

Note 4: the impact of the parameters of S Curve on elevator operation curve is shown in Figure 6.10. D01 and D02 determine the slope of the speed curve, the higher of which will result in a steeper slope. D04 to D07 determine the four corners, the higher of which will result in a smaller corner (or a higher curvature).

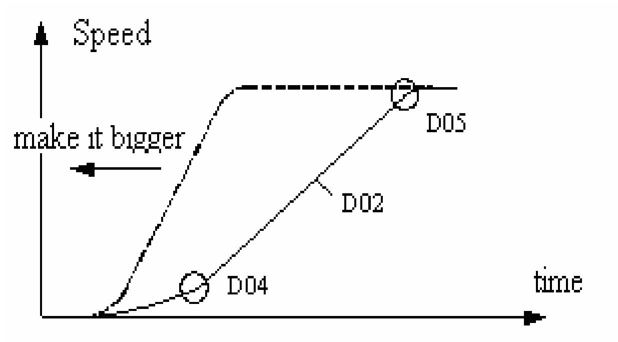


Figure 6.10 Impact of S Curve on elevator operation curve

Note 5: D11 to D18 define reference speed 0 to 7 under multi-step control. The binary codes of the three input ports of digital multi-step ports 0 to 2 may be combined to form eight statuses, corresponding to the eight reference speeds of D11 to D1 stated above. The correspondence is shown in the following table:

Combination Code	DI 2	DI 1	DI 0	Reference Speed
0	0	0	0	Ref. speed 0 (D11)
1	0	0	1	Ref. speed 1 (D12)
2	0	1	0	Ref. speed 2 (D13)
3	0	1	1	Ref. speed 3 (D14)
4	1	0	0	Ref. speed 4 (D15)
5	1	0	1	Ref. speed 5 (D16
6	1	1	0	Ref. speed 6 (D17)
7	1	1	1	Ref. speed 7 (D18)

In this table, Status 0 indicates there is no signal input at the port while Status 1 indicates there is signal input. For example, when Port 0 has a signal input, Port 1 also does, while Port 2 does not, the binary code will be “011” = 3, corresponding to the reference speed 3, with the speed given by D14.

6.2.5 E Parameters (Motor Parameters) (R/W)

E parameters are used to set carrier frequency, motor settings and encoder specifications.

Function Code	Name	Content	Range	Unit	Default	Remarks
E01	控制方式 Control Mode	Inverter control mode: 0: asynchronous motor; 1: synchronous motor.	0/1	×	0	
E02	电机极数 Num. of poles	Set the number of motor poles.	2～32	×	4	Refer to Note 1.
E03	电机额定电压 Motor Rated Volt.	Set rated voltage of the motor, in V.	0～500	V	380	As per the motor nameplate.
E04	电机额定转速 Motor Rated RPM	Set rated speed of the motor, in rpm.	0～9999	rpm	1459	As per the motor nameplate.
E05	电机额定电流 Motor Rated Cur.	Set rated current of the motor, in A.	0～80.00	A	48	As per the motor nameplate.
E06	力矩限制 Tor. Output Lim.	Max. torque limit, percentage to the rated torque.	0～300	%	200	The higher of E06, the bigger the output torque limit.
E07	转差频率 Motor Slip Freq.	Set slip frequency, in Hz: Slip frequency = (synchronous speed － rated speed) × rated frequency ÷ synchronous speed.	0～10.00	Hz	1.40	Refer to Note 2.

Function Code	Name	Content	Range	Unit	Default	Remarks
E08	载波频率 Carrier Freq.	Carrier frequency of Inverter output, in kHz.	4～15	kHz	8.0	Refer to Note 3.
E09	编码器类型 Encoder Type	Set the encoder type: 0: increment, differential, SinCos; 1: CCW increment UVW; 2: CW increment UVW; 8: Endat absolute.	0/1/2/8	×	0	Sin/Cos encoder shall have 2048 pulses; UVW encoders shall have 8192 pulses;； Endat encoder shall have 2048 pulses.
E10	编码器规格 Encoder Spec.	Set the number of pulses per turn of the encoder.	0～9999	×	1024	As per the encoder type.
E11	初始相位角 Rotor Mag. Pos.	Record and display of the initial phase angle of synchronous motors.	0～360	°	0	Resulted from autotuning of synchronous motors.
E12	PG 分频系数 PG Freq. Ratio	PG frequency ratio: Corresponding to 0 to 7powers of 2.	0～7	×	0	As per system requirements and the encoder used.
E13	预负载选择 Pre-torque Sel	Set pre-torque selection mode: 0: no load device; 2: analog signal of load device.	0/2	×	0	Refer to Note 5.

Note 1: E02 is used to set the number of motor poles as per its nameplate.

If the nameplate does not show the number, it may be calculated as follows:

Pole number = 2 (60*f/n).

Where, n is the rated speed, and f is the rated frequency. If f is not indicated on the nameplate,, f = 50 Hz.

The even number most lower than the calculated value may be taken as the pole number.

Note 2: E07 is used to set the rated slip frequency of asynchronous motors, which may be calculated as follows:

Slip frequency = (N - n)*f/N

Where, N is the synchronous speed, N = 60*f/P, and P is the number of pole pairs, P = E02/2.

n is the rated speed, and f is the rated frequency.

After autotuning of synchronous motors, commissioning shall be performed to confirm the result. Let the elevator run upward and downward with no load, and observer whether the feedback speed U00 shown on the operator is consistent with the actual speed. If not, increase E07 until they are consistent.

Note 3: E08 is used to set the carrier frequency of PWM output. The higher is the carrier frequency, the smaller is the Inverter noise, but the greater is the consumption. It may be set as required by the user. Noise-free operation may be realized generally when it is set at least at 8 kHz. It is recommended that lower carrier frequency be used as long as the noise is permissible. When the carrier frequency exceeds the default value (8kHz), every 1 kHz of increase will lower the power of the Inverter by 5%.

Note 4: the frequency ratio of the encoder is used to set the output pulse number of the encoder as required by the elevator control system.

Frequency ratio: 0: no division; 1: divided by 2; 2: divided by 4; 3: divided by 8; 4: divided by 16; 5: divided by 32; 6: divided by 64; 7: divided by 128.

Note 5: when there is analog signal of pre-load device, set E13 to 2, or set E13 to 0.

See 7.9.1 Pre-load Compensation Method of Analog Inputs for more information on the method.

6.2.6 F (Digital Input) Parameters (R/W)

Digital input F parameters are used to define the functions of digital input ports.

Function Code	Name	Content	Range	Unit	Default	Remarks
F01	DI1 端口功能 DI1 Input Func.	Functions of digital input ports: 0: no function (the corresponding port invalid); 1: input of external deceleration signals; 2: NO input of brake (or brake contactor) detection signals; 102: NC input of brake (or brake contactor) detection signals; 3: input of multi-step port 0; 4: input of multi-step port 1; 5: input of multi-step port 2; 6: input of triggering signal for emergency power; 7: input of upward signals; 8: input of downward signals; 9: input of running (enabling) signals; 10: NO input of base blocking signals; 110: NC input of base blocking signals; 11: NO input of output contactor detection; 111: NC input of output contactor detection; 12: input of fault reset signals.	0～12/102/110/112	×	0	By default: F03 = 3: DI3 as multi-step port 0; F04 = 4: DI4 as multi-step port 1; F05 = 5: DI5 as multi-step port 2; F07 = 7: DI7 for upward signals; F08 = 8: DI8 for downward signals; F09 = 9: DI9 for running (enabling) signals.
F02	DI2 端口功能 DI2 Input Func.				0	
F03	DI3 端口功能 DI3 Input Func.				3	
F04	DI4 端口功能 DI4 Input Func.				4	
F05	DI5 端口功能 DI5 Input Func.				5	
F06	DI6 端口功能 DI6 Input Func.				0	
F07	DI7 端口功能 DI7 Input Func.				7	
F08	DI8 端口功能 DI8 Input Func.				8	
F09	DI9 端口功能 DI9 Input Func.				9	
F10	DI10 端口功能 DI10 Input Func.				0	
F11	DI11 端口功能 DI11 Input Func.				0	
F12	DI12 端口功能 DI12 Input Func.				0	

Note 1: detailed explanations on the function codes

a) If the function code is set as 1, the corresponding port is used for inputs of external deceleration signals.

When A04 = 1 or 3, B03 (zero speed time) > 0, (i.e., the speed is given through analog signals), and the output contactor and the brake contactor are under the control of the Inverter, an external deceleration signal shall be defined for the Inverter in the deceleration stage when the speed is higher than the zero speed signal. Only when this signal comes into effect, the Inverter will cut off signals from the brake contactor and the output contactor according to the predefined parameters and delays as per the sequence when the elevator reaches zero speed. Refer to descriptions of B03, B04, B05, B08 and B16 in 6.2.2 B Parameters.

b) If the function code is set as 2, the corresponding port is used for inputs of brake (or brake contactor) detection signals.

This function works only when B03 (zero speed time) > 0, for checking the validity of the brake (or brake contactor).

The corresponding input port connects the brake (or brake contactor) contacts. Upon the command to close the contacts, an alarm of Fault 22 (brake or brake contactor detection fault) will be sent if the input detection point does not work after B14 (brake confirmation time). See 6.2.2 B Parameters for more information on B14 (brake confirmation time).

2 is NO input and 102 is NC input.

c) If the function code is set to 3, 4 or 5, the corresponding port is multi-step 0, 1 or 2 respectively.

This function works only when A04 = 0 and the Inverter is under digital multi-step control, for defining multi-step input ports, which may be combined to receive commands concerning elevator operation. Function code 3, 4 or 5 corresponds to only one port.

By default, F03 = 3, DI3 as multi-step port 0; F04 = 4, DI4 as multi-step port 1; F05 = 5, DI5 as multi-step port 2.

d) If the function code is set to 6, the corresponding port is used for input of emergency power triggering signals.

This function code is used to define the input port for triggering the emergency power. A port shall be defined so when there is emergency power.

When the corresponding port receives a signal, the elevator will be put into emergency power operation mode.

e) If the function code is set to 7 or 8, the corresponding port is used for input of upward or downward signals

This function code is used to define the input port for upward or downward signals. These signals are necessary for any operation mode of the Inverter (digital multi-step, analog voltage or analog current). Function code 7 or 8 may only correspond to one port.

By default, F07 = 7, DI7 as the upward signal input port; F08 = 8, DI8 as the downward signal input port.

f) If the function code is set to 9, the corresponding port is used for input of running (enabling) signal.

By default, F09 = 9, DI9 as the input port for running (enabling) signals.

If the running (enabling) signal input has been defined before (none of F01 to F12 is set to 9), the enabling signal may not be used, and the Inverter output signals are controlled separately by the upward or downward signals.

g) If the function code is set to 10, the corresponding port is used for input of base blocking signal.

When the port receives a base blocking signal, the Inverter will immediately cut off the output of the power module.

10 is NO input and 110 is NC input.

h) If the function code is set to 11, the corresponding port is used for input of output contactor detection signals.

This function works only when B03 (zero speed time) > 0. This port receives output contactor detection inputs to confirm the action of the output contactor. At elevator starting, the Inverter begins output and the motor begins excitation after B07 delay when the output contactor action is confirmed by the port. See B07 (contactor closing delay) in 6.2.2 B Parameters for more information.

11 is NO input and 111 is NC input.

i) If the function code is set to 12, the corresponding port is used for input of fault reset signals.

Upon any fault of the Inverter, the defined port receives a fault reset signal, and then the Inverter may be reset (similar with F3 on the operator).

Note 2: by default, the following input ports are defined for special inputs:

a) Input port for Inverter running signals

F07 = 7, DI7 as the upward signal input port;

F08 = 8, DI8 as the downward signal input port;

F09 = 9, DI9 as the running (enabling) signal input port;

b) Input port for multi-step speed giving commands

F03 = 3, DI3 as multi-step port 0;

F04 = 4, DI4 as multi-step port 1;

F05 = 5, DI5 as multi-step port 2.

6.2.7 G (Digital Output) Parameters (R/W)

G parameters are used to define the function of digital output ports.

Function Code	Name	Content	Range	Unit	Default	Remarks
G01	DO1 端口功能 DO1 Output Func.	Functions of the digital output ports: 0: the corresponding port not used; Other values are explained in Note 1 below.	0/1～8/ 101～108	×	0	Function of K1 relay output port
G02	DO2 端口功能 DO2 Output Func.				2	Function of K2 relay output port
G03	DO3 端口功能 DO3 Output Func.				3	Function of K3 relay output port
G04	DO4 端口功能 DO4 Output Func.				0	Function of T1 transistor open collector output port
G05	DO5 端口功能 DO5 Output Func.				0	Function of T2 transistor open collector output port
G06	DO6 端口功能 DO6 Output Func.				0	Function of T3 transistor open collector output port

Note 1: parameters G01 to G06 define the functions of output ports DO1 to DO6. Their range and corresponding function are listed below:

001：connect the two ends of the output when the feedback speed > B06 (detected frequency), or stay open;

101：stay open when the feedback speed > B06 (detected frequency), or connect the two ends;

002：running signal, connect the two ends when triggered, or stay open;

102：running signal, stay open when triggered, or connect the two ends;

003：fault signal, connect the two ends at faults, or stay open;

103：fault signal, stay open at faults, or connect the two ends;

004：deceleration signal, connect the two ends during deceleration, or stay open;

104：deceleration signal, stay open during deceleration, or connect the two ends;

005：current detection signal, connect the two ends when there is current during running, or stay open;

105：current detection signal, stay open when there is current during running, or connect the two ends;

006：output contactor control, connect the two ends when triggered, or stay open;

106：output contactor control, stay open when triggered, or connect the two ends;

007：brake contactor control, connect the two ends when triggered, or stay open;

107：brake contactor control, stay open when triggered, or connect the two ends;

008：connect the two ends of the output when the feedback speed < B04 (zero speed ref. 1), stay open when the feedback speed > B05 (zero speed ref. 2), and maintain original state when B04 <= feedback speed <= B05;

108：stay open when the feedback speed <B04 (zero speed ref. 1), connect the two ends of the output when the feedback speed >B05 (zero speed ref. 2), and maintain original state when the B04 <= feedback speed <= B05;

009：current detection signal, connect the two ends when there is current, or stay open;

109：current detection signal, stay open when there is current, or connect the two ends;

011: Inverter ready, when initialized without fault;

111: Inverter ready, when initialized with fault

Note: “connect” here means pick-up of NO contact and release of NC contact of relays, and low level of outputs of open collectors. On the same basis, “stay open” means release of NO contact and pick-up of NC contact of relays, and high resistance of open collectors.

Note 2: by default, G02 = 2, D02 as the running signal output port; G03 = 3, D03 as the fault signal output port.

Note 3: sequence of running signal

The inverter will send a running signal only after it receives the up/down direction signal and enabling signal. The sequence of the running signal is shown in Figure 6.11.

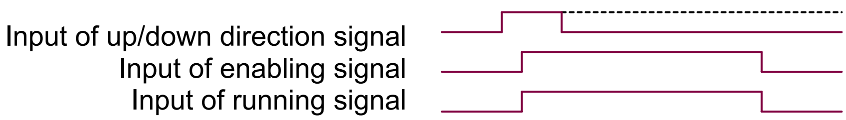


Figure 6.11 Sequence of running signal

Note 4: sequence of fault signal

The Inverter will send a fault signal if any fault occurs. At the same time, the running signal will be cleared. The fault signal will be latched and may be cancelled only through external reset signal, resetting operation from the operator or disconnection of the power supply.

The sequence of fault signal is shown in Figure 6.12.

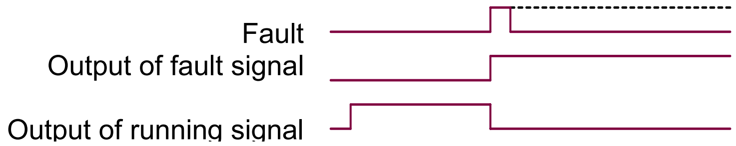


Figure 6.12 Sequence of fault signal

Note 5: if the function code is set to 4 or 104, the corresponding port is used for deceleration signal output.

- With A04 = 1 or 3 and the speed given through analog control, the deceleration signal will act after the external deceleration signal has been triggered.
- With A04 = 0 and the speed given through digital multi-step control, the deceleration signal will act if the new multi-step speed is smaller than the previous one.

Note 6: if the function code is set to 5 or 105, the corresponding port is used for current detection signals.

This port will have signal outputs whenever there is current output from the Inverter.

6.2.8 H (Analog Input) Parameters (R/W)

H parameters are used to define the functions of analog input ports.

Function Code	Name	Content	Range	Unit	Default	Remarks
H01	AI1 功能 AI1 Func.	Function of analog voltage input port AI1: 0: speed given through analog voltage	0	×	0	By system setting, H01 = 0, which may not be changed. Refer to Note 1.
H02	AI1 模拟量偏置 AI1 Offset	Analog offset of analog voltage input port AI1.	0～20.000	×	10.000	Refer to Note 2.
H03	AI1 模拟量增益 AI1 Gain	Analog gain of analog voltage input port AI1.	0～1.00	×	1.00	Refer to Note 3.
H04	AI1 模拟量滤波 AI1 Filter Time	Filter time of the analog input by analog voltage input port AI1, in ms.	5～45	ms	20	To eliminate the impact on the system from fluctuating interferences. However, if the filter time is too long, the sensitivity of system adjustment will be reduced.
H05	预负载补偿方向 Pre-tor. Direc.	Pre-load compensation direction of analog signal of load device for analog voltage input port AI2: 0: positive compensation; 1: negative compensation.	0/1	×	0	When E13 ＝ 2 (analog signal of load device), the pre-load compensation direction shall be set. Refer to Note 5.
H06	AI2 模拟量偏置 AI2 Offset	Analog offset of analog voltage input port AI2.	0～20.000	×	10	AI2 used for -10 - +10V voltage signals. Refer to 7.9.1.
H07	AI2 模拟量增益 AI2 Gain	Analog gain of analog voltage input port AI2.	0～1.00	×	1	Refer to 7.9.1.
H08	AI2 模拟量滤波 AI2 Filter Time	Filter time of the analog input by analog voltage input port AI2, in ms.	5～45	ms	20	To eliminate the impact on the system from fluctuating interferences. However, if the filter time is too long, the sensitivity of system adjustment will be reduced.
H09	AI3 功能 AI3 Func.	Function of analog current input port AI3: 0: speed given through analog current	0	×	0	By system setting, H09 = 0, which may not be changed. Refer to Note 1.
H10	AI3 模拟量偏置 AI3 Offset	Analog offset of analog current input port AI3.	0～20.000	×	10.000	Refer to Note 4.
H11	AI3 模拟量增益 AI3 Gain	Analog gain of analog current input port AI3.	0～1.00	×	1.00	Refer to Note 5.
H12	AI3 模拟量滤波 AI3 FilterTime	Filter time of the analog input by analog current input port AI3, in ms.	5～45	ms	20	To reduce interferences.

Note 1:

- When the speed is given through analog voltage signals (A04 = 1), parameters H01 to H04 are used. By system setting, H01 = 0 and may not be changed.
- When the speed is given through analog current signals (A04 = 3), parameters H09 to H12 are used. By system setting, H09 = 0 and may not be changed.
- When the speed is given through multi-step signals (A04 = 0), AI1 and AI3 are not used. Therefore, H parameters other than H05 to H08 are not valid.

Note 2: setting of H02 (AI1 analog offset)

When AI1 analog inputs are offset (i.e., minimum input is not 0), H02 shall be set as follows:

H02 = actual offset of AI1 analog input (minimum input) + 10.000.

For example: if AI1 analog input voltage ranges from 5 to 10V, H02 = 5 + 10.000 =15.000.

Note 3: H03 defines gain of AI1 analog inputs

- H03 (AI1 analog gain) = 10/(span (range) of AI1 analog input voltage)
  span of analog input voltage = maximum input voltage – minimum input voltage.
  If AI1 analog input voltage ranges from 5 to 10V, the span (range) of AI1 analog input voltage is 5V, and H03 (AI1 analog gain) = 10/5 = 2.
- Formula for U08 (AI1 input voltage):
  U08 (AI1 input voltage) = (input voltage at port AI1 – actual offset of AI1input analog) * H03 (AI1 analog gain).
- Formula for U01 (ref. speed 0):
  Under running conditions, U01 (ref. speed 0) = (U08 (AI1 input voltage) / 10.000) * E04 (rated speed of motor). Where, U08 (monitored AI1 input voltage) ranges from 0 to 10.000V.

Note 4: setting of H10 (AI3 analog offset)

When AI3 analog inputs are offset (i.e., minimum input is not 4mA), H10 shall be set as follows:

H10 = 10.000 + actual offset of AI3 analog input (minimum input) – 4 (mA)） / 1.6.

For example, if AI3 analog input current ranges from 6 to 20mA, H10 = (6 – 4)/ 1.6 + 10.000 =11.250.

Note 5: H11 defines AI3 analog gain

- H11 (AI3 analog gain) = 16/(span (range) of AI2 analog input current).
  span of analog input current = maximum input current – minimum input current.
  If AI3 analog input current ranges from 6 to 20mA, the span (range) of AI3 analog input current is 14mA, and H11 (AI3 analog gain) = 16/14 = 1.14.

Note 6: positive and negative compensation for pre-load:

If viewed from its front, the motor runs clockwise and the elevator goes upward, positive compensation shall be set with heavier load and higher pre-load analog voltage, or negative compensation shall be set with heavier load and lower pre-load analog voltage. On the other hand, if viewed from its front, the motor runs clockwise and the elevator goes downward, negative compensation shall be set with heavier load and higher pre-load analog voltage, or positive compensation shall be set with heavier load and lower pre-load analog voltage.

6.2.9 I (Analog Output) Parameters (R/W)

I parameters are used to define the functions of analog output ports.

Function Code	Name	Content	Range	Unit	Default	Remarks
I01	AO1 端口功能 AO1 Func.	Functions of the analog output ports: 0: speed given 1: speed given after filtering 2: speed feedback 3: output torque 4: compensation torque for zero-speed starting 5: reserved 6: reserved 7: reserved 8: output current of phase-V 9: output current of phase-U 10: reserved 11: signal of analog input port 1(AI1) 12: signal of analog input port 2 (AI2) 13: signal of analog input port 3 (AI3)	0～13	×	0	
I02	A02 端口功能 AO2 Func.					

6.2.10 J (Error Buffer) Parameters (R)

J parameters are used to keep a record of the latest 20 error codes.

Function Code	Name	Content	Range	Unit	Default	Remarks
J01	故障记录 1 Error Buffer1	Recent error buffer 1			0	
J02	故障记录 2 Error Buffer2	Recent error buffer 2			0	
J03	故障记录 3 Error Buffer3	Recent error buffer 3			0	
J04	故障记录 4 Error Buffer4	Recent error buffer 4			0	
J05	故障记录 5 Error Buffer5	Recent error buffer 5			0	
J06	故障记录 6 Error Buffer6	Recent error buffer 6			0	
J07	故障记录 7 Error Buffer7	Recent error buffer 7			0	
J08	故障记录 8 Error Buffer8	Recent error buffer 8			0	
J09	故障记录 9 Error Buffer9	Recent error buffer 9			0	
J10	故障记录 10 Error Buffer10	Recent error buffer 10			0	
J11	故障记录 11 Error Buffer11	Recent error buffer 11			0	
J12	故障记录 12 Error Buffer12	Recent error buffer 12			0	
J13	故障记录 13 Error Buffer13	Recent error buffer 13			0	
J14	故障记录 14 Error Buffer14	Recent error buffer 14			0	
J15	故障记录 15 Error Buffer15	Recent error buffer 15			0	
J16	故障记录 16 Error Buffer16	Recent error buffer 16			0	
J17	故障记录 17 Error Buffer17	Recent error buffer 17			0	
J18	故障记录 18 Error Buffer18	Recent error buffer 18			0	
J19	故障记录 19 Error Buffer19	Recent error buffer 19			0	
J20	故障记录 20 Error Buffer20	Recent error buffer 20			0	

There are totally 29 error codes. The corresponding error types are shown in the following table and their causes and solutions are listed in Table 9.1.

Error Code	Error Type
1	Power module fault
2	DSP fault
3	Power module radiator overheat
4	Brake unit or brake resistor fault
5	Fuse blown
6	Torque overload
7	Speed deviation
8	Over-voltage
9	Under-voltage
10	Output phase loss
11	Over-current
12	Encoder fault
13	Current detected but not cut off during elevator stopping
14	Reversed speed direction detected during running
15	Speed feedback detected without running command
16	Wrong motor phase
17	Fwd dashing
18	Rev dashing
19	Wrong phase sequence of UVW encoder
20	R+ and R- disconnected, Endat communication fault
21	Reserved
22	Brake detection fault
23	Over voltage input
24	UVW encoder disconnected
25	Fan fault
26	No motor autotuning with UVW encoder The fault will be restored after input of autotuning command.
27	Over-current
28	Wrong phase sequence of c and d of 1387 encoder
29	Input phase loss

6.2.11 K (Function) Parameters (R/W)

Function Code	Name	Content	Range	Unit	Default	Remarks
K01~K04	1387 编码器数据 01~04 Sin/CosEncoder01~04	Synchronous 1387 encoder self-learning data	×	×	×	
K05~K06	HUW 同步编码器数据 01~02 UVW Encoder D01~02	Synchronous UVW encoder self-learning data	×	×	×	
K07~K12	HUW 同步编码器数据 03~08 UVW Encoder D03~08	Synchronous UVW encoder self-learning data	×	×	×	
K13-K18	HUW 同步编码器数据 09~14 UVW Encoder D09~14	Synchronous UVW encoder self-learning data	×	×	×	
K19-K21	HUW 同步编码器数据 15~17 UVW Encoder D15~17	Synchronous UVW encoder self-learning data	×	×	×	
K22	风扇检测使能 Fan Detec Enable	Enabling signal for fan checking =0: no checking =1: checking	0/1	×	1	
K23	速度标定处理 Speed Dev Scale	Speed scaling =1: normal =2: half, where there is heavy interference to the field encoder	1/2	×	1	
K24	电流环增益 2 CurrentLoop Gain	Current loop gain 2 A lower gain may reduce the noise during low-speed running of the motor. Do not make it too low, as long as the noise is eliminated. A higher B16 may increase the output torque of low-power inverters (below 5.5kW). Do not make it too high, as long as the torque meets relevant requirement.	45~300	×	100	
K25	电流缓降时间 SoftShutdownTime	Soft shutdown time If necessary, set to 500 ～ 800	0~400	ms	0	
K26	输入电压缺相确认 Supply Loss Time	Confirmation time of supply phase loss (29)	0~200	20ms	10	
K27	反馈模式切换	QEP or Capture switching	0/1	×	0	

Function Parameter List 6

	Fbk Cal Mode	=0: QEP =1: Capture, for synchronous UVW encoders only				
K28	输入缺相电压设置 Supply loss Set	Supply loss setting	50～500	V	90	
K29	模拟量丢失斜率 Analog Loss Set	Analog loss (disconnection) setting	0～100	mm/5ms	10	
K30	速度反馈滤波 Fbk Speed Filter	Feedback speed filter (for EnDat and 1387 encoders) =0: invalid, no filtering =1: valid, filtering of feedback	0/1	×	0	
K31	输出电流异常确认 Surge Cur Times	Occurrences of abnormal current output B11 < 60000: normal protection B11 >= 60000: protection disabled	0～65535	time	5000	
K32	数字速度切换模式 Digi Ref Mode	With the speed given through digital signals, whether the speed may be switched =0: acceleration not allowed during deceleration =1: any switching allowed	0/1	×	1	
K33	过调制功能 Overshoot Enable	Overshoot =0: disabled =1: enabled	0/1	×	0	
K34	保护功能是否有效	Protection bit0 ＝ 0: software over-current (27) enabled bit0 ＝ 1: software over-current (27) disabled bit1＝0: the Inverter will automatically cancel the fault signal when the voltage reaches specific level bit1＝1: the Inverter will not cancel any fault signal of under voltage bit2 ＝ 0: wrong phase	0 ～ 65535	×	0	

		sequence of c and d of 1387 encoder (28) enabled bit2 ＝ 1: wrong phase sequence of c and d of 1387 encoder (28) disabled				
	Protect Action					
K35	输出缺相故障确认 Output Loss time	Confirmation time of output phase loss	0 ～ 20000	ms	5000	
K36	检测制动单元标志 BrakingUnit Flag	Whether to check the braking unit at first power on 0: no checking 1: checking	0 / 1	×	1	
K37	故障自动复位次数 Auto Reset Times	Auto reset times	0～10	time	3	
K39	编码器断线保护阀值 百分比值 PGO Action	When given the speed of the motor rated speed is less than K39, the 12 fault discrimination does not work, only the effective induction motor	0～10	%	2	

6.3 Running Status U

Running status U shows the 16 real-time running statuses of the elevator, which may only be displayed but not changed.

Function Code	Name	Content	Range	Unit	Default	Remarks
U00	反馈速度 Feedback Speed	Monitor feedback speed of the motor, in rpm.	×	rpm	×	
U01	指令速度 0 Ref. Speed 0	Monitor the speed given by motor command, in rpm.	×	rpm	×	
U02	指令速度 1 Ref. Speed 1	Monitor the speed given by motor command after filtering, in rpm.	×	rpm	×	
U03	速度偏差 Speed Deviate	Monitor the difference between feedback speed and the speed given by the command, in rpm.	×	rpm	×	
U04	输出电流 Output Current	Monitor Inverter output current, in A.	×	A	×	
U05	力矩偏置 Torque Offset	Monitor servo output torque, in %.	×	%	×	
U06	输出力矩 Output Torque	Monitor torque output under vector control, in %.	×	%	×	
U07	直流母线电压 DC BUS Voltage	Monitor DC voltage of the Inverter internal main circuit, in V.	×	V	×	
U08	AI1 输入电压 AI1 Voltage	Monitor analog voltage input 1, in V.	×	V	×	
U09	AI2 输入电压 AI2 Voltage	Monitor analog voltage input 2, in V.	×	V	×	
U10	AI3 输入电流 AI3 Current	Monitor analog current input, in mA.	×	mA	×	
U11	输入 DI1- DI12 Input DI1-DI12	Display status of digital input ports DI1 - DI12. U11 displayed in “XXXXXXXXXXXX”, where, “X” = 0, indicating no input; “X” = 1, indicating input.	×	×	×	Combined with F parameters The left most digit corresponds to DI1, The right most to DI12, Others in their order in between.

Continued

Function Code	Name	Content	Range	Unit	Default	Remarks
U12	输出 DO1-DO6 Output DO1-DO6	Display status of output ports DO1 - DO6. U12 displayed in “XXXXXX”, where, “X” = 0, indicating no output; “X” = 1, indicating output.	×	×	×	Combined with G parameters The left most digit corresponds to DO1, The right most to DO6, Others in their order in between.
U13	输出电压相位 Voltage Phase	Phase of output voltage, in Deg.	×	Deg.	×	For synchronous motors only
U14	输出电流相位 Current Phase	Phase of output current, in Deg.	×	Deg.	×	For synchronous motors only
U15	散热器温度 Radiator Temperature	Display radiator temperature.	×	℃	×	

7. Application of Elevator

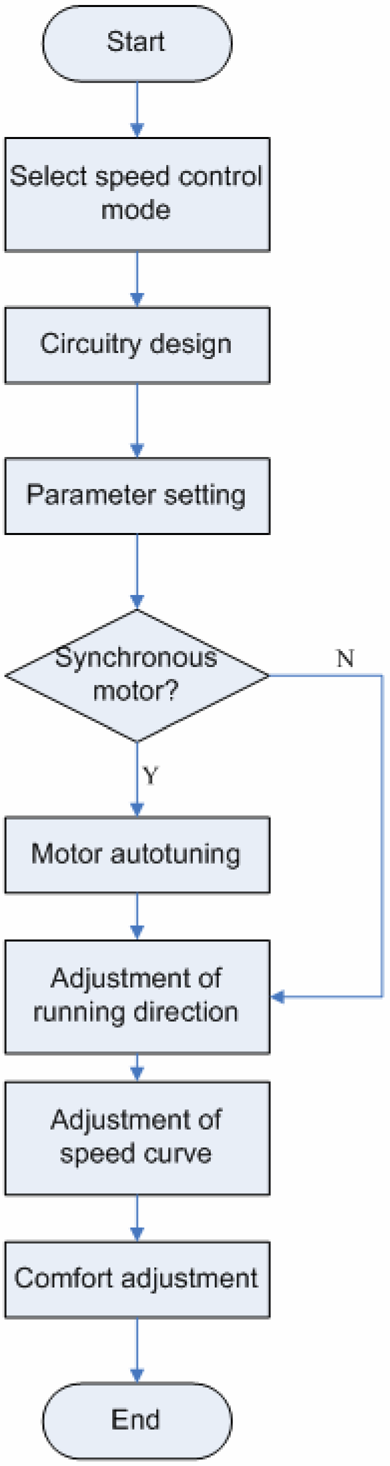
7.1 General

iAStar-S3 Inverter is especially designed for elevator drive. It adopts advanced vector control technology and shows superior speed adjustability. Moreover, due to its specific design, iAStar-S3 Inverter is very simple to commission and operate, with easy adjustment to optimal comfort at each stage of elevator operation.

The internal control of iAStar-S3 is shown in Figure 7.1.

A complete electrical control system of elevators contains a control device and a drive, the former responsible for the starting and stopping sequence control and all automatic operations (certain control systems may even provide a speed command curve), while the latter responsible for speed control of the traction machine, ensuring smooth speed variation during the whole running process to provide excellent comfort. The drive system also calculates the speed command curve, automatically generating a speed curve according to the target speed step given by the control system under multi-step control. In all control modes, the drive system is mainly to control the motor to run strictly to the speed command curve. iAStar-S3 Inverter, a typical elevator drive system, is to be combined with a specific control system for the elevator to form a complete electrical control system. Applicable control systems include SMART COM from STEP and similar elevator control systems.

In the application of iAStar-S3 Inverter to elevator control, a speed control mode (analog or multi-step) shall be first selected according to the controller of the elevator. Then a communication path shall be designed according to the requirements on the communication between the Inverter and the controller. The next step is to set the parameters as required and perform autotuning with synchronous motors. Finally, make adjustments to elevator running direction, speed curve and elevator comfort on site. The whole process is shown as follows:



The following sections in this chapter will describe each step in detail, and the last section will describe the application of the optional functions.

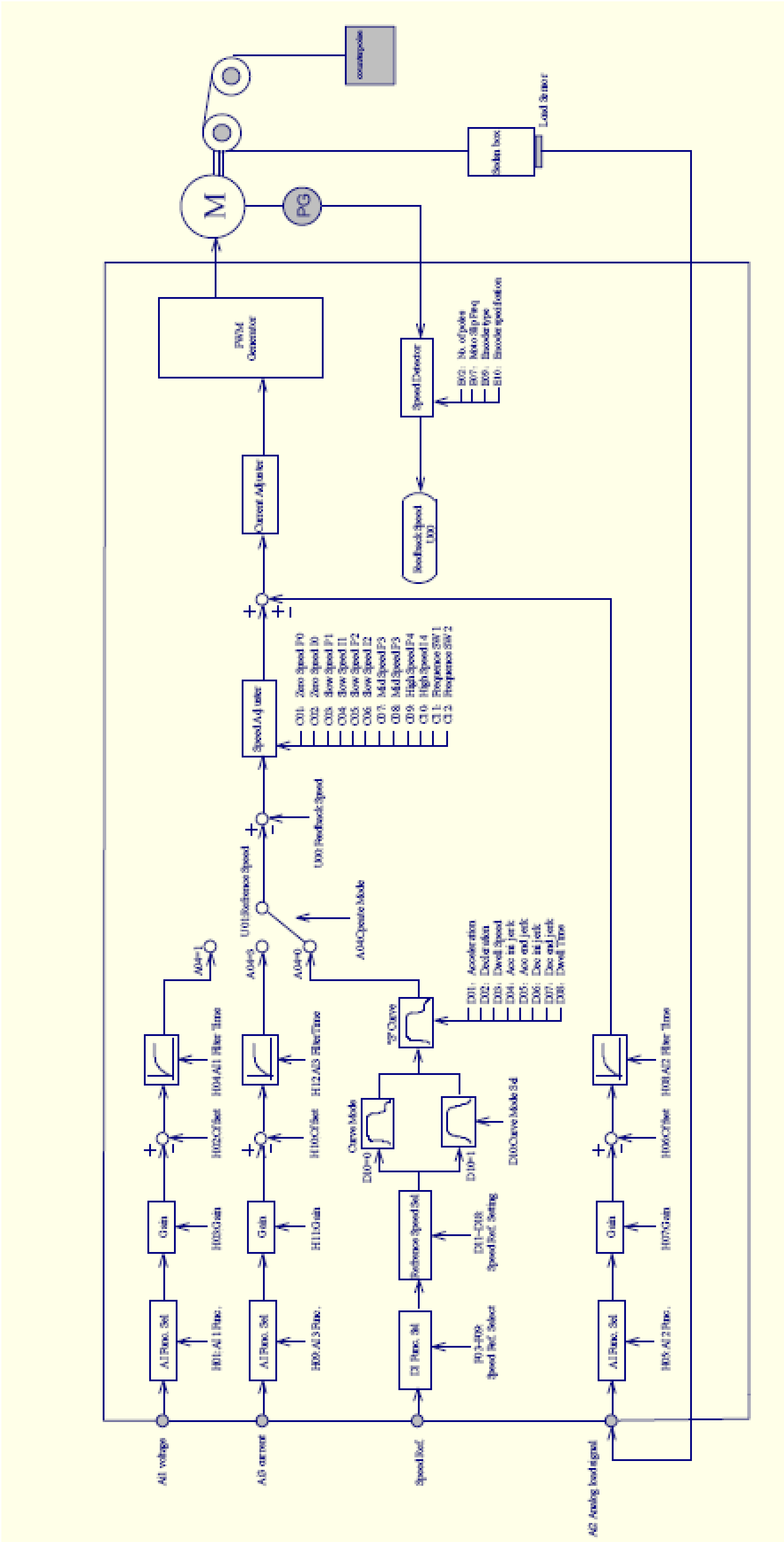


Figure 7.1 Internal control of the Inverter

7.2 Speed Control Mode

iAStar-S3 Inverter may adopt two kinds of speed control: analog control and multi-step control. In analog control mode, the elevator controller generates a speed command curve, and sends the signals to the analog input ports of the Inverter through analog output ports. During elevator operation, the Inverter receives the speed command according to real-time analog signals. In multi-step control mode, the Inverter controller does not need to calculate an accurate speed curve, but to send a speed-step command (target speed command) through a binary signal made of the combination of three digital signals. Upon this speed-step command, the Inverter automatically generates an S curve from the previous command to the new one, and controls the elevator to run strictly as indicated by the S curve. There are two kinds of analog control for iAStar-S3 Inverter: one through analog voltage, and the other through analog current. As to the former, the Inverter provides the speed command from zero speed to maximum speed through 0 – 10V voltage signals input to AI1 port. As to the latter, the Inverter provides the speed command from zero speed to maximum speed through 4 – 20mA current signals input to AI3 port (4mA corresponding to zero speed and 20mA to maximum speed).

Generally, if the elevator controller is able to provide a speed curve and is equipped with analog output ports as required by iAStar-S3 Inverter, it is recommended to use analog control mode. If the controller has no such analog output port or the ability to provide a speed curve, the multi-step control mode shall be used. Compared with analog control, multi-step control is more complicated in the adjustment of speed curve. Moreover, if the controller is able to calculate the speed curve with distance-deceleration principle in the deceleration process, analog control provides not only easy adjustment but also direct landing of the elevator, thus improving operation efficiency.

In multi-step control mode, the Inverter will generate an S curve targeting at the speed-step command and with time as the variable according to the slope of acceleration or deceleration and S corner parameters, whenever it receives a speed-step command. With this method, the deceleration distance at a specific speed is given by the elevator controller. If the actual running of the elevator is consistent with the S curve with no deviation, the elevator may directly land during each operation, i.e., the elevator reaches leveling position when its speed decreases to zero. Thus, the elevator may realize optimal efficiency. In practice, however, since the load and running direction of the elevator change constantly while it is virtually impossible for the Inverter to have seamless match between actual speed and the given speed, the actual deceleration distance varies in operation under different conditions. In order to ensure that the elevator will not run over its leveling position (which may lead to passenger complaint), the longest deceleration distance under all conditions shall be taken during commissioning. When actual deceleration distance under a certain condition is lower than the longest, the elevator will creep a small distance before landing, thus reducing its efficiency. On the other hand, if distance-deceleration technique is used, the speed curve will be adjusted in real-time according to actual running speed under different conditions, thus ensuring direct landing and optimal efficiency.

7.3 Wiring between Elevator Controller and Inverter

There are two kinds of wiring between elevator controller and iAStar-S3 Inverter: One is between elevator controller output signal and the Inverter, including upward and downward commands, enabling signals and speed-giving commands; the other is between Inverter output signal and elevator controller, including running signal (indicating Inverter ready to work), fault signals and encoder pulses processed by PG card. Since there are three speed control modes, each with a slightly different wiring, these are separately described in the following three sections with figures for reference. Different types of PG card also shows different wiring with encoder signals, and the examples in the following figures are different. Refer to 4.5 Wiring of PG Card.

7.3.1 Analog Voltage Control Mode

In analog control mode, control through analog voltage is the most common method. The wiring is shown in Figure 7.2.

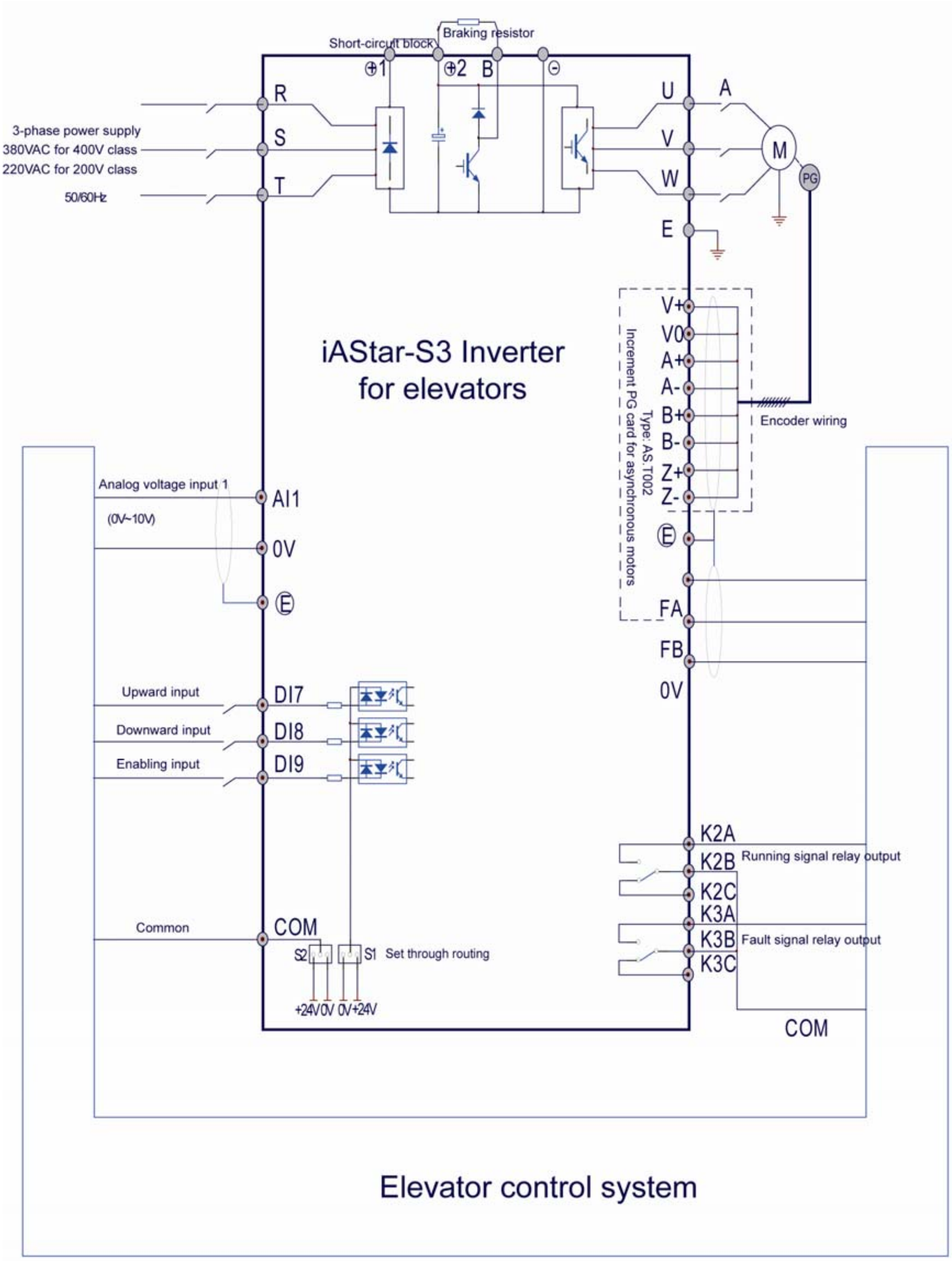


Figure 7.2 Basic circuit diagram of analog voltage control mode

Note: in the diagram, ABZ increment PG card (AS.T002) for asynchronous motors is used. If synchronous motors are to be used, SIN/CON PG card (AS.T007), UVW increment PG card (AS.T010) or Endat absolute PG card (AS.T013) may be chosen instead.

Table 7.1 lists the definitions of the ports in the diagram.

Table 7.1 Definitions of Inverter ports in analog voltage control mode

Port No.	Name	Signal Type
DI7 (by default)	Upward signal	Input
DI8 (by default)	Downward signal	Input
DI9 (by default)	Enabling signal	Input
AI1	Analog voltage input 0～10V	Input
0V	Analog 0V	Input
K2A、K2B、K2C (by default)	Running signal	Output
K3A、K3B、K3C (by default)	Fault signal	Output

- Note: the input ports of upward, downward and enabling signals and the output ports of running and fault signals are defined as listed above by default and normally need no change. If there are special requirements, F parameters may be used to redefine the input ports (see 6.2.6), and G parameters may be used to redefine the output ports (see 6.2.7). Related items in the table above shall be changed after the redefinition.

7.3.2 Analog Current Control Mode

The application of analog current control is less common unless the elevator controller is equipped only with current output ports or analog voltage signals may impact signal quality due to interferences from the surroundings in special circumstances. The wiring is shown in Figure 7.3.

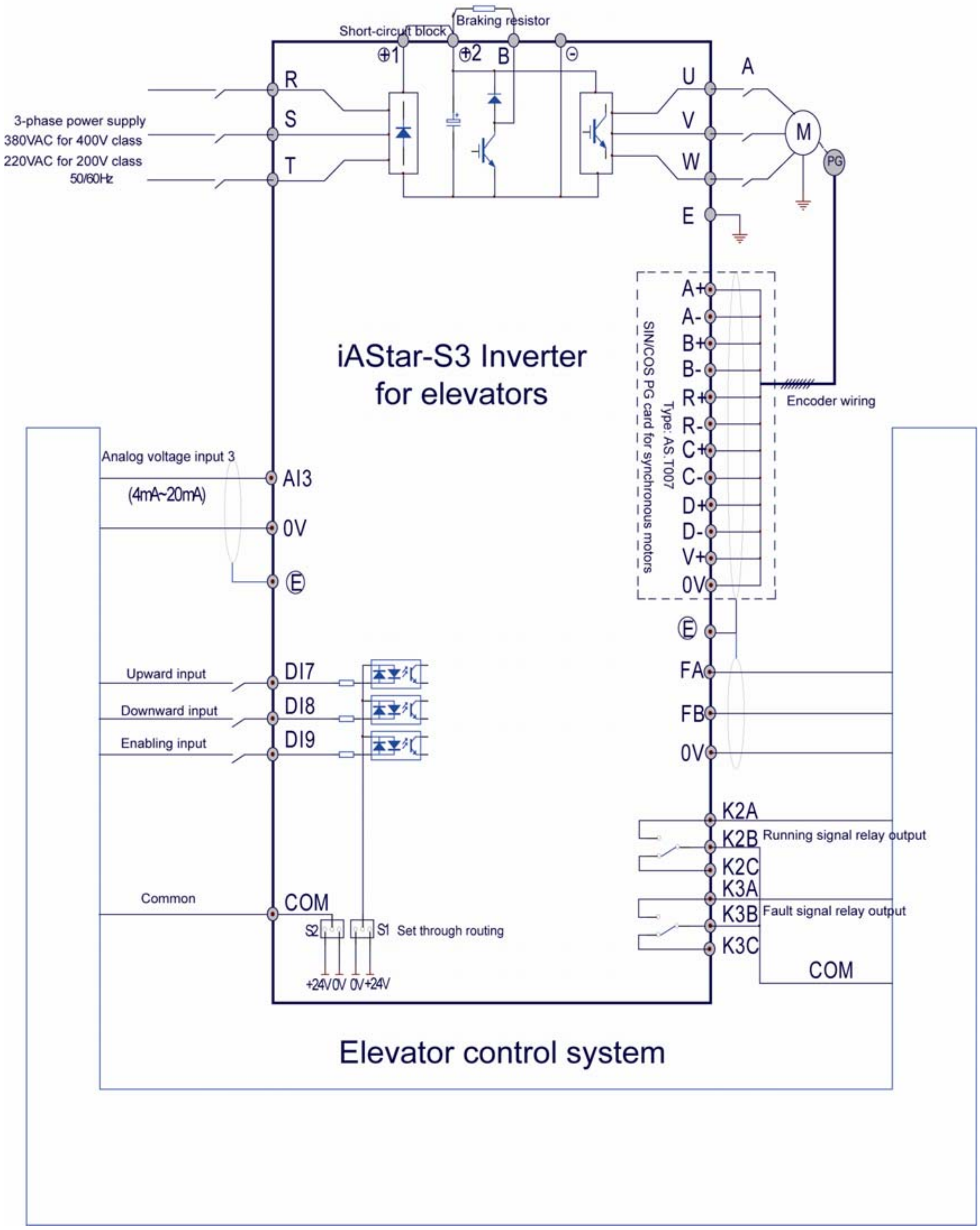


Figure 7.3 Circuit diagram of analog current control mode

Note: in the diagram, SIN/CON PG card (AS.T007) for synchronous motors is used. If synchronous motors are to be used, UVW increment PG card (AS.T010) or Endat absolute PG card (AS.T013) may also be used. If asynchronous motors are to be used, only ABZ increment PG card (AS.T002) shall be used.

Definitions of the ports in the diagram are listed in Table 7.2.

Table 7.2 Definitions of ports in analog current control mode

Port No.	Name	Signal Type
DI7 (by default)	Upward signal	Input
DI8 (by default)	Downward signal	Input
DI9 (by default)	Running signal	Input
AI3	Analog current input 4～20mA	Input
0V	Analog 0V	Input
K2A、K2B、K2C (by default)	Running signal	Output
K3A、K3B、K3C (by default)	Fault signal	Output

Note: the input ports of upward, downward and enabling signals and the output ports of running and fault signals are defined as listed above by default and normally need no change. If there are special requirements, F parameters may be used to redefine the input ports (see 6.2.6), and G parameters may be used to redefine the output ports (see 6.2.7). Related items in the table above shall be changed after the redefinition.

7.3.3 Multi-step Control Mode

The wiring of multi-step control mode is shown in Figure 7.4.

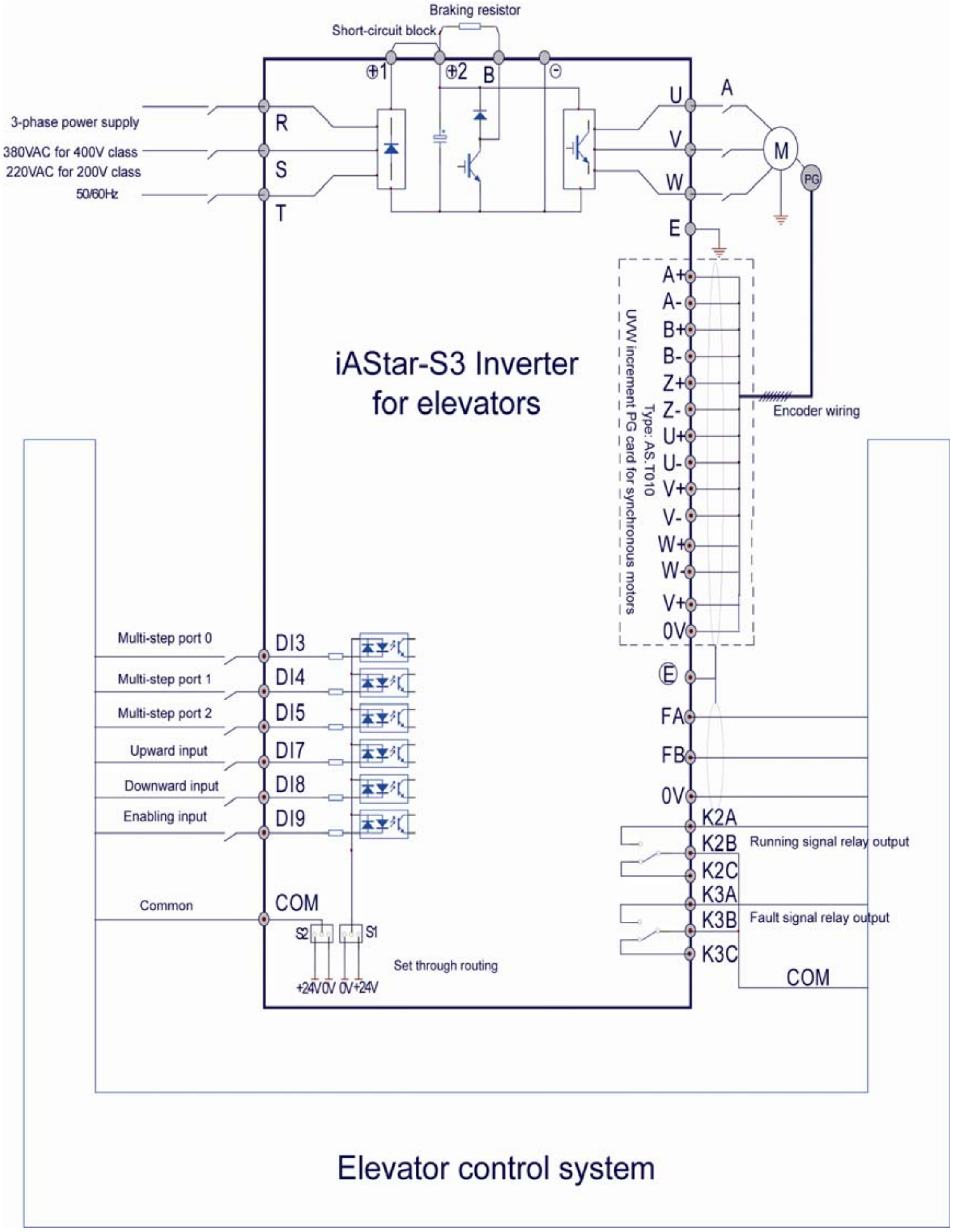


Figure 7.4 Circuit diagram of multi-step control mode

Note: in the diagram, UVW increment PG card (AS.T010) for synchronous motors is used. If synchronous motors are to be used, SIN/CON PG card (AS.T007) or Endat absolute PG card (AS.T013) may also be used. If asynchronous motors are to be used, only ABZ increment PG card (AS.T002) shall be used.

Definitions of the ports in the diagram are listed in Table 7.3.

Table 7.3 Definitions of ports in multi-step control mode

Port No.	Name	Signal Type
DI3 (by default)	Multi-step port 0	Input
DI4 (by default)	Multi-step port 1	Input
DI5 (by default)	Multi-step port 2	Input
DI7 (by default)	Upward signal	Input
DI8 (by default)	Downward signal	Input
DI9 (by default)	Running signal	Input
K2A、K2B、K2C (by default)	Running signal	Output
K3A、K3B、K3C (by default)	Fault signal	Output

Note: the input ports of upward signals, downward signals, enabling signals, multi-step input ports 0 - 2, and the output ports of running and fault signals are defined as listed above by default and normally need no change. If there are special requirements, F parameters may be used to redefine the input ports (see 6.2.6), and G parameters may be used to redefine the output ports (see 6.2.7). Related items in the table above shall be changed after the redefinition.

Eight states result from the combination of different states of the digital multi-step ports, corresponding to the eight reference speeds of D11 to D18, or eight speed-step commands. These are listed in the following table.

Combination Code	Multi-step Port 2	Multi-step Port 1	Multi-step Port 0	Reference Speed
0	0	0	0	Reference speed 0 (function code D11)
1	0	0	1	Reference speed 1 (function code D12)
2	0	1	0	Reference speed 2 (function code D13)
3	0	1	1	Reference speed 3 (function code D14)
4	1	0	0	Reference speed 4 (function code D15)
5	1	0	1	Reference speed 5 (function code D16)
6	1	1	0	Reference speed 6 (function code D17)
7	1	1	1	Reference speed 7 (function code D18)

7.4 Basic Parameter Setting

For each specific project, basic parameters of the Inverter shall be set according to the specifications of the traction machine before application. Since iAStar-S3 Inverter, specifically designed for elevators, meets the practical requirements of elevators from the design stage, most of the factory (default) settings need no change. The parameters that need field modifications or changes are far less than those described here. Therefore, it is very convenient to set the parameters of the Inverter on site. This section will describe the basic parameters that shall be set according to the specifications of the traction machine before application of the elevator. Only after these parameters have been set, may autotuning of the motor be performed and then elevator commissioning and adjustments to running performance. The adjustments will be described in the next sections. It is worthwhile to point out that the parameters other than the following take the default settings.

7.4.1 Parameter Setting for Selection of Speed Control Mode

Only one parameter is used for the selection of speed control mode, namely, A04. A04 may be used to set the control mode as analog voltage, analog current or multi-step, as shown in the following table.

Function Code	Name	Content	Range	Unit	Default	Remarks
A04	速度给定方式 Operation Mode	To set the speed control mode of the Inverter as: 0: digital multi-step mode 1: analog voltage input (AI1) 2: reserved 3: analog current input (AI3)	0 / 1 / 2 / 3	×	1	

7.4.2 Parameter Setting of the Traction Machine

E parameters are concerned with the traction machine and the encoder, and are very important to the Inverter. With any wrong setting, there may be vibration of the elevator, or it may even be unable to work, or damages to the equipment or even accidents may occur. Therefore, each of the following parameters shall be carefully set according to the nameplate. Generally, other E parameters than listed below may use the default settings. E11 will be automatically set during autotuning of the motor, and need no manual setting. If autotuning is not desired with a replaced Inverter, the setting of E11 may be read from the old Inverter and write into the new one.

E01	控制方式 Control Mode	Inverter control mode: 0: asynchronous motor; 1: synchronous motor.	0/1	×	0	
E02	电机极数 Num. of poles	Set the number of motor poles.	2～32	×	4	Refer to Note 1.
E03	电机额定电压 Motor Rated Volt.	Set rated voltage of the motor, in V.	0～500	V	380	As per the motor nameplate.
E04	电机额定转速 Motor Rated RPM	Set rated speed of the motor, in rpm.	0～9999	rpm	1459	As per the motor nameplate.
E05	电机额定电流 Motor Rated Cur.	Set rated current of the motor, in A.	0～80.00	A	48	As per the motor nameplate.
E07	转差频率 Motor Slip Freq.	Set slip frequency, in Hz: Slip frequency = (synchronous speed － rated speed) × rated frequency ÷ synchronous speed.	0～10.00	Hz	1.40	Refer to Note 2.
E09	编码器类型 Encoder Type	Set the encoder type: 0: increment, differential, SinCos; 1: CCW increment UVW; 2: CW increment UVW; 8: Endat absolute.	0/1/2/8	×	0	Sin/Cos encoders shall have 2048 pulses; UVW encoders shall have 8192 pulses; Endat encoders shall have 2048 pulses.
E10	编码器规格 Encoder Spec.	Set the number of pulses per turn of the encoder.	0～9999	×	1024	As per the encoder type.
E13	预负载选择 Pre-torque Sel	Set pre-torque selection mode: 0: no load device; 2: analog signal of load device.	0/2	×	0	Refer to Note 3.

Note 1: E02 is used to set the number of poles of the motor as per its nameplate.

If the nameplate does not show the number, it may be calculated as follows:

Pole number = 2 (60*f/n).

Where, n is the rated speed, and f is the rated frequency. If f is not indicated on the nameplate, f = 50 Hz.

The nearest even number most lower than the calculated value shall be taken as the pole number.

Note 2: E07 is used to set the rated slip frequency of asynchronous motors, which may be calculated as follows:

Slip frequency = (N - n)*f/N

Where, N is the synchronous speed, N = 60*f/P, and P is the number of pole pairs, P = E02/2.

n is the rated speed, and f is the rated frequency.

After autotuning of the synchronous motor, commissioning shall be performed to confirm the result. Let the elevator run upward and downward with no load, and observe whether the feedback speed U00 shown on the operator is consistent with the actual speed. If not, increase E07 until they are consistent.

Note 3: usually there is excellent comfort even without pre-load starting compensation due to the new technology of load-free sensor starting compensation adopted by iAStar-S3 Inverter. This function takes effect when E13 = 0 (without load). However, if the user has special requirements or pre-load compensation with analog signals is required in certain circumstances, E13 shall be set to 2.

See 7.9.1 Pre-load Compensation Method of Analog Inputs for more information on the method.

7.4.3 Setting of Other Parameters

B13 shall also be set according to elevator speed and motor type. If synchronous motors are used as the traction machine, B11 shall also be set to select the motor speed. The settings are listed as follows.

Function Code	Name / Operator Display	Content	Range	Unit	Default	Remarks
B11	同步电机速度选择 Low Speed PMSM	Set the speed of synchronous motors: 0: speed ≥ 100 rpm; 1: speed < 100 rpm.	0/1	×	0	
B13	调节器模式 Adjust Mode	Set adjuster mode: 0: elevator speed ≥ 2 m/s, synchronous motor; 1: asynchronous motor, or synchronous motor with elevator speed < 2 m/s.	0/1/2/3/4	×	1	

7.5 Motor Autotuning

Due to the innovative technology adopted by the Inverter, if asynchronous motors are used, and E parameters are set as the last section, the Inverter is able to automatically identify the internal parameters of the motor and needs no autotuning. That is to say, this section may be skipped if an asynchronous motor is used as the traction machine.

For synchronous motors, since the Inverter needs the accurate phase angle between the motor pole and the encoder to perform correct torque control on the motor, autotuning is necessary after installation of the elevator to obtain automatically information on the motor poles (E11). Only after this may the elevator work normally.

The autotuning with the Inverter is very simple, with no need of lifting of the car on site as normally required by other inverters, but similar with ordinary checking and repairing, as described below:

a) iAStar-S3 Inverter with synchronous traction machines shall be equipped with a synchronous PG card (5V or 5.3 V, with frequency division output).
   If SIN/COS encoders are to be used, a SIN/COS PG card shall be equipped. The number of the PG card is AS.T007. The installation and wiring of SIN/COS PG card can be found in 4.5.2 SIN/COS PG Card for Synchronous Motors. AS.T004 cards are an old type of SIN/COS PG card.
   If UVW encoders are to be used, UVW increment PG card shall be equipped. The number of the PG card is AS.T010. The installation and wiring of UVW increment PG card can be found in 4.5.3 UVW Increment PG Card for Synchronous Motors.
   If Endat absolute encoders are to be used, Endat absolute PG card shall be equipped. The number of the PG card is AS.T013. The installation and wiring of Endat absolute PG card can be found in 4.5.4 Endat Absolute PG Card for Synchronous Motors.

b) Ensure correct phase sequence of the output power line linking the Inverter and the motor.

c) Ensure correct wiring of the encoder and reliable grounding of the shield.

d) Procedures of the autotuning:

   a) Before the autotuning:
      The installation and wiring of the elevator is ready for operation. The elevator shall be put into repair state, with the safety circuit and the locking circuit connected and without any fault. Ensure the balance of the car and the counterweight, i.e., the elevator will not slip with the brake open. The elevator shall be with no load.

   b) Confirm parameter settings:
      Confirm parameter settings through the operator:
      Zero speed integral C02 = 0, current loop gain C13 = 1.00, (both by default);
      Control mode E01 = 1 (for synchronous motors);
      Number of poles E02, rated voltage E03, rated speed E04, rated current E05, encoder type E09 and encoder specification E10 shall be all corrected set as per the configuration.

   c) Autotuning procedures:
      Set A03 to 4 (to send the autotuning command) with the operator.
      In field operation, after setting A03 to 4, hold (until the autotuning ends) the checking button for running upward (or downward). The autotuning begins, with the indicator lit showing Inverter running.
      If SIN/COS encoder or Endat absolute encoder is used, the motor will automatically stop at a certain position, and, about ten seconds after this, it will resume running slowly for about ten seconds. Then it will stop again for about ten seconds, and the Inverter will cut off the output, with the indicator off. A03 can now be seen to automatically change to 3 on the operator, indicating the

end of the autotuning. Release the button and stop elevator repairing running.
If UVW encoder is used, the motor will keep running slowly until the Inverter output is cut off and the indicator is off. A03 automatically changes to 3 on the operator, indicating the end of the autotuning. Release the button and stop elevator repairing running.

d) During autotuning, observe the changes of U13 and U14 on the operator, which shall increase or decrease at the same time. If only U13 changes or the change of U14 is not as much, check whether the brake is open. If one of the two is increasing while the other is decreasing, check the wiring of the encoder. If it is correct, change the phase sequence of the motor.

e) During the repairing operation, the motor runs normally for several turns, and autotuning is performed once for each direction. The pole data shall be taken for both autotuning processes (E11). If the difference between the two values is smaller than 30, the mean value shall be input to E11.
After every autotuning process, A03 shall be set manually to 0 to restore the Inverter to normal. Then the elevator may operate normally.

f) If the autotuning is finished normally but the fault indicator on the operator lights up showing Fault 16, exchange V and W phases of the motor and there is no need for another autotuning.

e) Commissioning to confirm the results after autotuning

7 Let the elevator run upward and downward without load, and observe whether the feedback speeds U00 of the two directions on the operator are consistent. If not, increase E07 until they are consistent.

8 After the counterweight balance test, let the elevator run downward in repair mode. When it reaches a constant speed, observe carefully the output current U04 on the operator. If it does not exceed the rated current, the result shall be regarded as correct; otherwise, the result is not correct and another autotuning is required.

7.6 Running Direction Adjustment

Before the elevator can run at a high speed, check first whether its running direction is correct. The factors impacting its running direction include connection of the upward and downward signals provided by the elevator controller to the Inverter, the connection between the Inverter and the U, V and W phases of the traction machine, and the connection of A and B feedback signals of the encoder (for asynchronous motors). The adjusting procedures are as follows:

- If analog control mode is used, the running speed for repair shall be set on the elevator controller. The speed shall be around .2m/s.
  If multi-step control is used, the running speed for repair shall be set in D parameters (one of D11 to D18), with the converted speed of the elevator around 2m/s.

■ Let the elevator run upward and downward in repair mode, and observe the actual running. The following shows how to make direction adjustment:

(1) Let the elevator run upward in repair mode, adjust its running direction as shown in Figure 7.5:

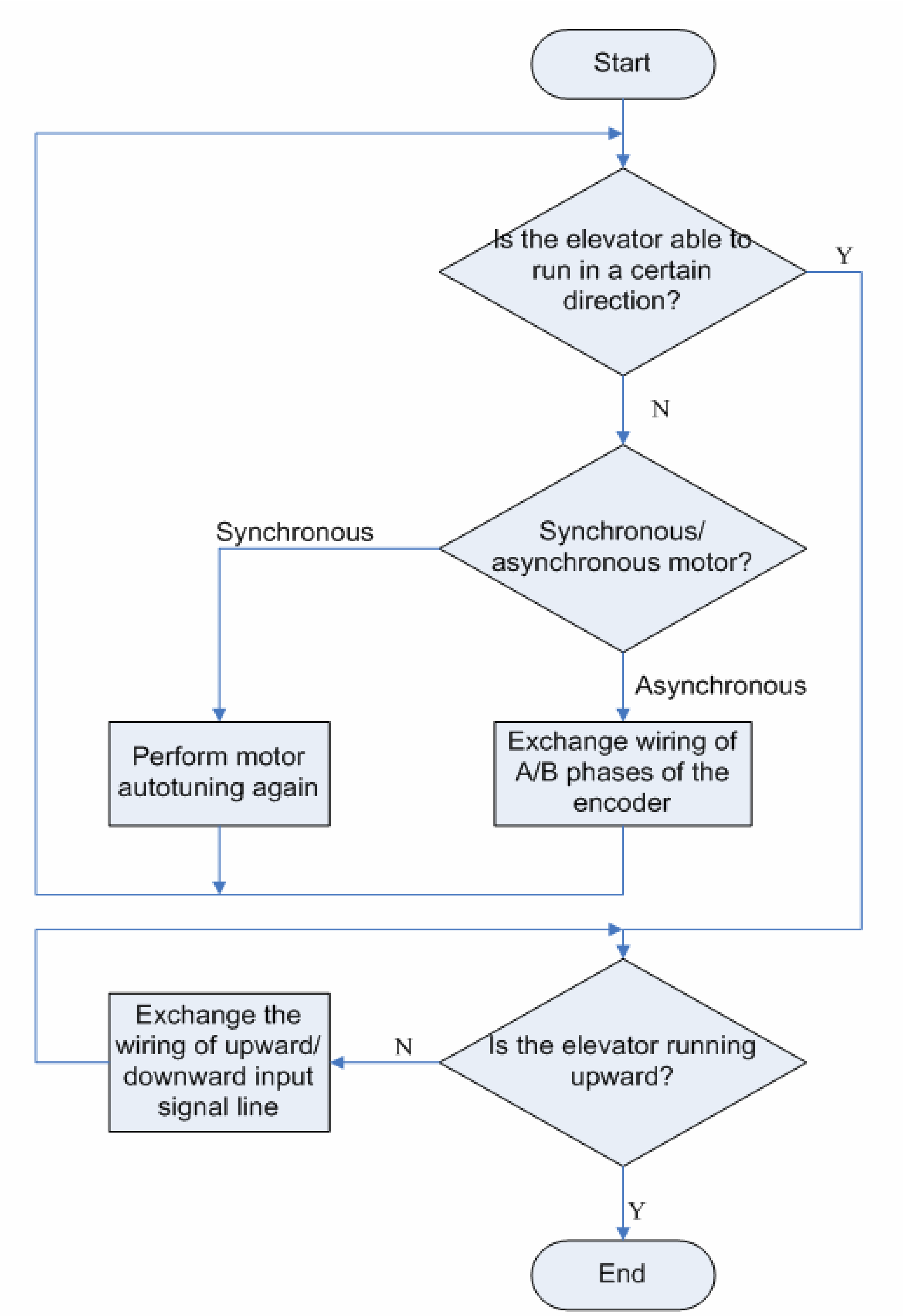


Figure 7.5 Upward running direction adjustment

(2) Let the elevator run downward in repair mode, adjust its running direction as shown in Figure 7.6:

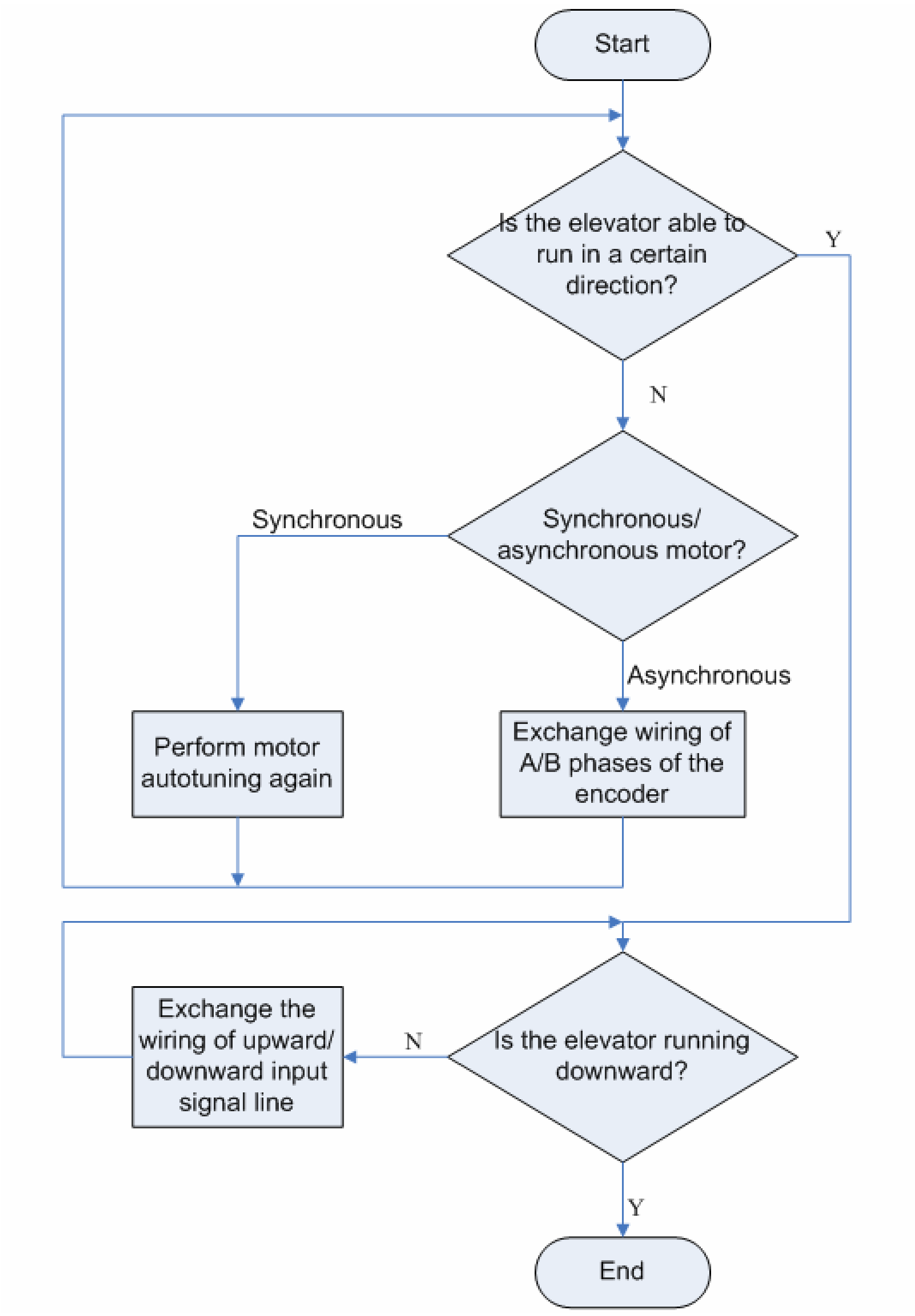


Figure 7.6 Downward running direction adjustment

7.7 Adjustment of Speed Curve

The adjustment of the elevator speed curve directly influences elevator efficiency and comfort. It is thus necessary to make appropriate adjustments during high-speed running of the elevator. The adjusting method differs with different control mode and will be described below separately.

7.7.1 Adjustment in Analog Control Mode

Analog control modes include analog voltage signal input and analog current signal input. The value of A04 for mode selection shall be set as in the table below.

Speed control mode	**A04**
Analog voltage signal input	1
Analog current signal input	3

Except for differences in the setting of A04 as shown above and in the input ports, other adjustments of the speed curve are the same in both analog voltage control mode and analog current control mode.

Since the speed curve is provided by the elevator controller in analog control modes, adjustments of the curve shall also be performed through parameters of the controller. Adjustments include: acceleration, deceleration, and parameters (acceleration jerk or S corner time) of the four corners at starting, slow-speed running, deceleration and stopping. Increase in acceleration (or deceleration) will result in a steeper curve, shorter acceleration (or deceleration) time, and high elevator efficiency, but at the same time lower comfort. Similarly, a shorter corner time may also increase elevator efficiency and reduce comfort. Therefore, efficiency and comfort shall both be considered during adjusting of the speed curve. The principles shall be: first, related national standards shall be considered. For elevator with a speed over 1m/s, the average acceleration and deceleration may not be lower than $0.5m/s^2$. In consideration of the impact from the corner time, the acceleration (deceleration) is generally set at lest at $0.6m/s^2$. Secondly, adjustments shall be made to meet passenger requirements. When passengers care more about efficiency than comfort, make adjustments to improve efficiency. On the other hand, when passengers care more about comfort, adjustment shall be made to improve comfort.

7.7.2 Adjustment in Multi-step Control Mode

In multi-step control mode, A04 shall be set as follows to select the control mode:

Speed control mode	**A04**
Multi-step control mode	0

In multi-step control mode, the elevator controller sends a signal of the given speed to the Inverter through three digital signals, which may be combined to form eight states in binary codes and thus eight speed commands at most. The S curve is calculated by the Inverter and the parameters mentioned in the previous section (acceleration, deceleration and those of the four corners) shall be set on the Inverter. The speed steps shall also be set on the Inverter. The settings are shown in the following table.

Function Code	Name	Content	Range	Unit	Default	Remarks
D01	加速度 Acceleration	Acceleration of S Curve, in m/s^2.	0.000～0.850	m/s^2	0.650	The value may not exceed half of the rated elevator speed (D09). Refer to D01 and D02 in Figure 6.9 S Curve during elevator operation.
D02	减速度 Deceleration	Deceleration of S Curve, in m/s^2.				
D04	S 曲线（加加速度 1） Acc ini jerk	Acceleration ini jerk of S Curve, in m/s^2.	0.000～0.850	m/s^3	0.650	Refer to D04, D05, D06 and D07 in Figure 6.9 S Curve during elevator operation.
D05	S 曲线（加加速度 2） Acc end jerk	Acceleration end jerk of S Curve, in m/s^2.				
D06	S 曲线（减减速度 1） Dec ini jerk	Deceleration ini jerk of S Curve, in m/s^2.				
D07	S 曲线（减减速度 2） Dec end jerk	Deceleration end jerk of S Curve, in m/s^2.				
D09	最高速度 Top Speed	Rated speed or max. speed, in m/s.	0.000～3.000	m/s	1.750	
D11	速度参考 0 Speed Ref.0	Reference speed 0 under multi-step control, in m/s.	0.000～3.000	m/s	0.000	
D12	速度参考 1 Speed Ref.1	Reference speed 1 under multi-step control, in m/s.			0.145	
D13	速度参考 2 Speed Ref. 2	Reference speed 2 under multi-step control, in m/s.			0.030	
D14	速度参考 3 Speed Ref. 3	Reference speed 3 under multi-step control, in m/s.			0.040	
D15	速度参考 4 Speed Ref. 4	Reference speed 4under multi-step control, in m/s.			0.290	
D16	速度参考 5 Speed Ref. 5	Reference speed 5 under multi-step control, in m/s.	0.000～3.000		1.000	
D17	速度参考 6 Speed Ref. 6	Reference speed 6 under multi-step control, in m/s.		m/s	1.500	
D18	速度参考 7 Speed Ref. 7	Reference speed 7 under multi-step control, in m/s.			1.750	

1. Parameter setting of given step speed:

(1) Max. speed D09: the highest running speed of the elevator, in fact the rated speed. This is an important value. When the given speed reaches D19, the Inverter will let the motor run at E04 (rated speed), and all the values specified by D11 to D18 correspond to this parameter.

(2) Reference speed 0 – 7 D11 - D18: eight speed step commands, each for a different running state of the elevator. The elevator runs at the following step speeds normally:

Speed Step	Explanation
Checking speed	The speed for repair running or running to automatically search the leveling position.
Re-leveling speed	The speed for re-leveling at door opening
Half checking speed	During repair running or running to automatically search the leveling position, the speed at a terminal floor (with the action of terminal deceleration switch).
High speed 1 (single-floor speed)	During automatic running at a high speed, the speed with the travel of one floor, also the double- and multi-floor speed when the elevator speed is no more than 1m/s.
High speed 2 (double-floor speed)	During automatic running at a high speed, the speed with the travel of two floors, also the multi-floor speed when the elevator speed is no more than 1.75m/s. This speed is not necessary when the elevator speed is no more than 1m/s.
High speed 3 (multi-floor speed)	During automatic running at a high speed, the speed with the travel of three floors or more, also the rated speed. This speed is not necessary when the elevator speed is no more than 1.75m/s.
Leveling (creeping) speed	The speed during the last stage of the running, also the speed after the elevator enters the door area during the running to automatically search the leveling position.

The way the elevator controller defines the speed codes shall be understood before correct setting of the multi-step parameters. That is to say the statuses of the three digital outputs to give the speed corresponding to the speed steps listed in the table above. The following example of elevator controller illustrates the setting method.

The relationship between the speed code of the elevator controller and the speed step is shown in the following table:

Speed Code	Speed Step
1	Half checking speed
2	Re-leveling speed
3	Leveling (creeping) speed
4	Checking speed
5	High speed 1 (single-floor speed)
6	High speed 2 (double-floor speed)
7	High speed 3 (multi-floor speed)

Suppose the rated speed of the elevator is 2m/s, the parameters may be set as follows:

Parameter	Speed Step	Value
D11 reference speed 0	Zero	0
D12 reference speed 1	Half checking speed	0.120 m/s
D13 reference speed 2	Re-leveling speed	0.030 m/s
D14 reference speed 3	Leveling (creeping) speed	0.050 m/s
D15 reference speed 4	Checking speed	0.250 m/s
D16 reference speed 5	High speed 1 (single-floor speed)	1.000 m/s
D17 reference speed 6	High speed 2 (double-floor speed)	1.600 m/s
D18 reference speed 7	High speed 3 (multi-floor speed)	2.000 m/s

If there is any difference of the definition of the speed codes from the above in practice, the user may take proper measures on the basis of the example above.

2. Adjustments of acceleration (deceleration) and the parameters of S curve corners: D01 and D02 are used for the adjustments of acceleration and deceleration, and D03 to D07 for the adjustments of the four S curve corners. The definitions and the adjusting methods of these parameters are similar with those of the analog control modes. The difference is that these parameters shall be modified on the Inverter in multi-step control mode while they shall be modified on the elevator controller in analog control modes. Moreover, D03 - D07 represent the acceleration (or deceleration) jerk of the four S curve corners respectively. A higher value of the parameters means a shorter acceleration (or deceleration) time, and higher elevator efficiency, but lower comfort. On the other hand, a lower value means longer time, higher efficiency, and better comfort.

Figure 7.7 provides the positions of D01, D02 and D04 - D07 on the speed curve for reference during commissioning.

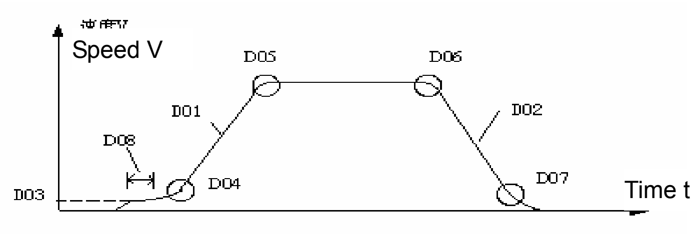


Figure 7.7 Position of the parameters on the speed curve

7.8 Adjustment of Comfort

Elevator comfort is one of the important indexes of elevator performance. There are many factors that play a role in the comfort of elevators, for example, mechanically, installation and adjustment of the guide rail and guide shoe, performance of the traction machine, and so on; electrically, the speed curve, electromagnetic interference to the analog signals (in analog control mode), quality of encoder feedback signals, and drive performance of Inverter. As the user manual, the following discussion is based on the fact that all other factors concerning elevator comfort are already adjusted. This section will describe how to improve Inverter drive performance through adjustments of related parameters in order to obtain excellent comfort.

7.8.1 Adjustment of Starting Comfort

Due to the innovative load-free sensor starting compensation technology, the Inverter may offer excellent starting comfort through parameter adjustments even without a pre-load starting compensation device.

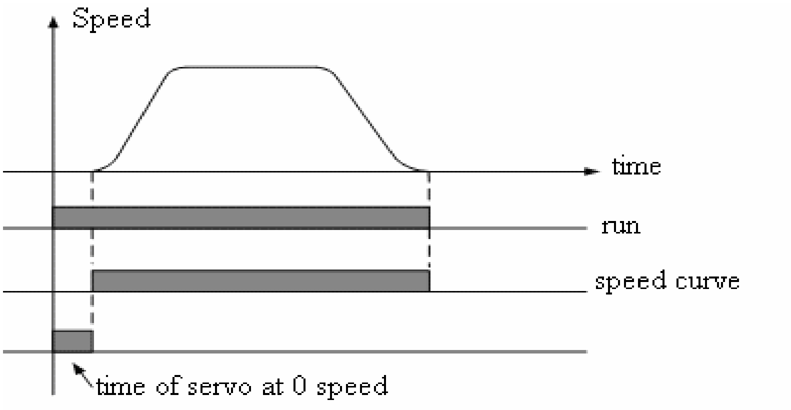
7.8.1.1 Adjustment through Parameters of PI Adjuster

Without pre-load starting compensation (E13 = 0), PI parameters of zero speed may be adjusted to improve elevator comfort. This will not work with a pre-load compensation device (E13 = 2). PI parameters include the following:

Function Code	Name	Content	Range	Unit	Default	Remarks
C01	零速比例 P0 Zero Speed P0	Starting compensation proportion: When E13 = 0 (without load device) and C02 (zero speed I0) > 0, effective during C14 (zero servo time) after the enabling signal becomes valid from starting.	0～655.35	×	100.00	
C02	零速积分 I0 Zero Speed I0 Cur. Loop Gain	Starting compensation integral: Only when C02 > 0, the compensation function takes effect.			0.00	Recommended range: 40 ～ 80.
C14	零伺服时间 Zero Servo Time	Interval from enabling signal validation to the given speed curve.	0～10.000	s	0.800	

In the table, C01 and C02 are the proportion and integral parameters for starting compensation. These two parameters are effective only during C14 (zero servo time) after the enabling signal takes effect when E13 = 0 (without load device) and C02 (zero speed I0) > 0. C01 corresponds to P (proportion) of the PI adjuster, while C02 to I (integral) of the PI adjuster.

C14 is the zero servo time, used to adjust the delay of the speed curve given by the control system. C14 is 0.8s by default. The sequence of C14 is shown in the following figure.



For adjustments, first set C02 to about 40 (when C02 ＝ 0, C01 does not work). When C01 (P) is very small, the elevator will draw back when running downward without load. Increase C01 gradually until drawing-back can not be felt when the elevator runs downward. Too big C01 will cause vertical vibration of the elevator. Therefore, C01 shall be reduced if the elevator shows significant vertical vibration during starting. C02 is the I (integral) of the PI adjuster, the higher of which results in a quicker response. It is generally set between 40 and 60. With C02 too small, C01 will not have enough time to response; with C02 too high, high-frequency vibration will be likely to occur. C14 is the effective time of the PI adjuster (i.e., the zero servo time in the figure above). It is generally set by default (0.8s) and needs no modification.

7.8.1. 2 Adjustment of Sequence

Starting sequence means the order and coordination of closing of the main contactor, sending of the enabling signals (including upward/downward command), brake opening, and sending of the given speed signal during starting of the elevator. Generally, when the elevator starts, the main contactor closes before the Inverter enabling signal is given followed by the commands to open the brake and the given speed. The order and coordination of the commands to open the brake and the given speed play a relatively greater role in the elevator comfort. The ideal situation is that the speed signal be given after the mechanical action of the brake (completely open). However, due to the brake contactor delay and the mechanical delay of the brake, it is not easy to provide the accurate data for the two actions to coordinate in the ideal order. The sequence may be adjusted according to the following principle: if the elevator draws back obviously when starting downward without load, the brake opening time may be delayed (or the speed giving time advanced); if the elevator does not draw back much but dashes significantly when starting upward, the brake opening time may be advanced (or the speed giving time delayed).

7.8.1.3 Adjustment through Dwell Speed

In such special situations as the guide shoe is too tight, a little higher dwell speed will help improve the elevator comfort. The parameters used to adjust dwell speed are listed in the following table:

Function Code	Name	Content	Range	Unit	Default	Remarks
D03	蠕动速度 Dwell Speed	Dwell speed at low speeds, in m/s.	0.000～0.200	m/s	0.012	Refer to D03 in Figure 6.9 S Curve during elevator operation.
D08	蠕动时间 Dwell Time	Dwell time at low speeds, in s.	0～10.000	s	0	Refer to D08 in Figure 6.9 S Curve during elevator operation.

Dwell speed (D03) and dwell time (D08) mean that: when the speed is given through digital multi-step control, at the starting of the elevator, a dwell speed will be given first, and a normal speed will be given after the dwell time; when the speed is given through analog inputs, at the starting of the elevator, a dwell speed will be given first, and an analog speed will be given when the analog speed exceeds the dwell speed or after the dwell time. If there is no need for a dwell speed, the dwell time (D08) shall be set to 0, and the elevator will start with a normal given speed. The position of the dwell speed and the dwell time on the elevator running curve are shown in Figure 7.6.

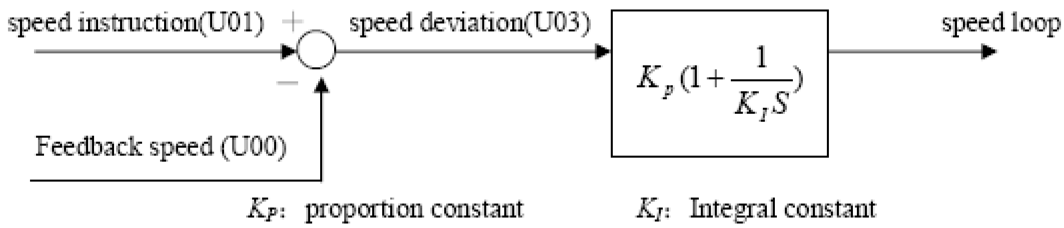
7.8.2 Adjustment of Comfort during Running

By adjustments to the parameters of the PI adjuster during elevator running, the comfort may be improved. The parameters are listed in the following table:

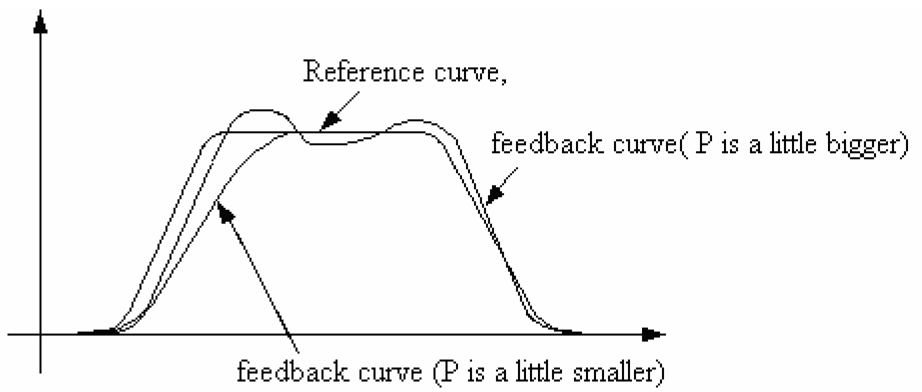
Function Code	Name	Content	Range	Unit	Default	Remarks
C03	低速比例 1 P1 Slow Speed P1	Proportion at low speeds during acceleration (running frequency ≤ C11 low-speed switching point F1).			70.00	Refer to **P1** in Figure 6.7 PI control during elevator operation.
C04	低速积分 1 I1 Slow Speed I1	Integral at low speeds during acceleration (running frequency ≤ C11 low-speed switching point F1).			10.00	Refer to **I1** in Figure 6.7 PI control during elevator operation.
C05	低速比例 2 P2 Slow Speed P2	Proportion at low speeds during deceleration (running frequency ≤ C11 low-speed switching point F1).			70.00	Refer to **P2** in Figure 6.7 PI control during elevator operation.
C06	低速积分 2 I2 Slow Speed I2	Integral at low speeds during deceleration (running frequency ≤ C11 low-speed switching point F1).			10.00	Refer to **I2** in Figure 6.7 PI control during elevator operation.
C07	中速比例 P3 Mid Speed P3	Proportion at medium speeds (running frequency at C11 low-speed switching point F1 < proportion at C12 high-speed switching point F2).			120.00	Refer to **P3** in Figure 6.7 PI control during elevator operation.
C08	中速积分 I3 Mid Speed I3	Integral at medium speeds (running frequency at C11 low-speed switching point F1 < proportion at C12 high-speed switching point F2).			15.00	Refer to **I3** in Figure 6.7 PI control during elevator operation.
C09	高速比例 P4	Proportion at high speeds (running			140.00	Refer to **P3** in Figure
	High Speed P4	frequency > high-speed switching point F2).				6.7 PI control during elevator operation.
C10	高速积分 I4 High Speed I4	Integral at high speeds (running frequency > high-speed switching point F2).			5.00	Refer to **I3** in Figure 6.7 PI control during elevator operation.
C11	低速切换点 F1 Switch Freq. F1	Frequency switching point from low speeds to medium speeds: used for proportion and integral switching from low to medium speed.	0～15.00	Hz	0.50	Refer to **F1** in Figure 6.7 PI control during elevator operation.
C12	高速切换点 F2 Switch Freq. F2	Frequency switching point from medium speeds to high speeds: used for proportion and integral switching from medium to high speed.	15.00～50.00	Hz	25.00	Refer to **F2** in Figure 6.7 PI control during elevator operation.

Function codes C03 to C10 correspond to P and I values of the PI adjuster at different stages during operation (see Figure 7.7). Comfort during elevator operation may be increased through adjustments to C03 to C10 at different stages. Function codes C11 and C12 are used for frequency switching between stages (see Figure 7.8).

The structure of PI adjuster for speed loop is shown in the following figure.

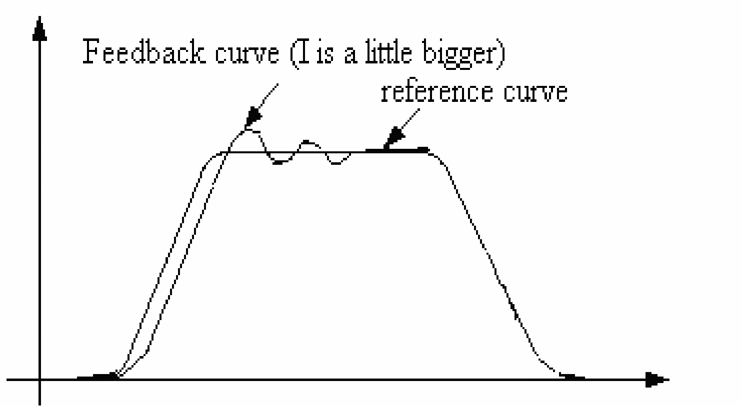


Increase in P may enhance the dynamic response capability of the system. However, too high P may lead to system vibration. The impact of P on feedback tracing is shown in the following figure:



P and feedback tracing

Increase in I may quicken the dynamic response of the system. When there is over-tuning or too slow system response, I may be increased. However, too high I may also lead to system vibration. The following figure shows the impact of I on feedback speed.



I and feedback tracing

Usually, P is adjusted first. Set P as high as possible as long as there is no system vibration. Then I may be adjusted to obtain quick system response while limit over-tuning.

The following Figure 7.8 shows the PI adjuster divisions along the elevator operation curve.

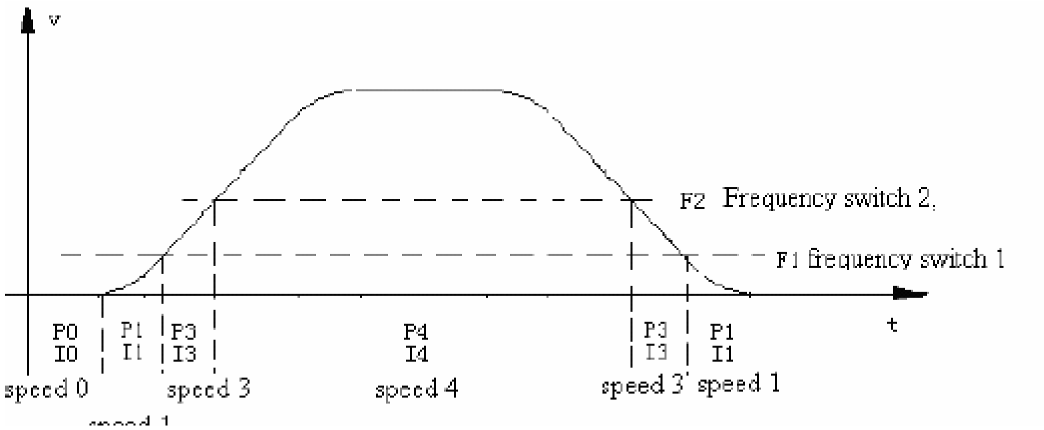


Figure 7.8 PI control during elevator operation

Judging from the figure above, adjustments of the PI adjuster may be performed on three speed divisions, resulting in more convenience in commissioning. If the comfort on the high speed division is not satisfactory, it only needs to adjust the PI parameters in that division and those in the other two divisions have no impact on the comfort. The same is with the other two divisions. Since parameters influencing the comfort in different divisions are different, all three divisions may enjoy optimal comfort after adjustments to corresponding parameters.

7.8.3 Adjustment of Comfort during Stopping

Two factors impact the comfort during elevator stopping: one is the PI value in the low-speed division, which may be adjusted as described above to obtain optimal comfort; the other is the stopping sequence, mainly the order and coordination of speed giving and brake action. The ideal situation is that: when the given speed of the elevator reaches zero, the brake closes. The principle for adjustments is that: if the elevator dashes during stopping, it means the brake closes too early; if the elevator slips during stopping, the brake closes too late.

7.9 Additional Functions

The previous sections in this chapter described adjustments to the Inverter during normal commissioning of the elevator. This section will go on with several additional functions for reference during application.

7.9.1 Pre-load Compensation Method of Analog Inputs

There is excellent comfort even without a pre-load device due to the new technology of load-free sensor starting compensation adopted by iAStar-S3 Inverter. The starting characteristic of this technology is shown in Figure 7.9.

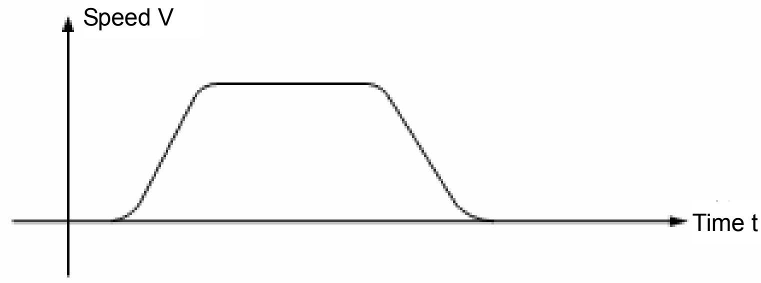


Figure 7.9 Load-free sensor starting compensation

Although iAStar-S3 Inverter generally needs no pre-load device, an analog load device may also be equipped for the acquisition of over-load and full-load signals, or for certain elevators with extremely demanding requirements on comfort. In such situations, the Inverter may also make use of its pre-load starting compensation function. When this technology is applied, the load device is required to send analog DC voltage signals with satisfactory linear characteristics. The wiring between the analog voltage signal of the load device and the AI2 analog input port of the Inverter is shown in Figure 7.10.

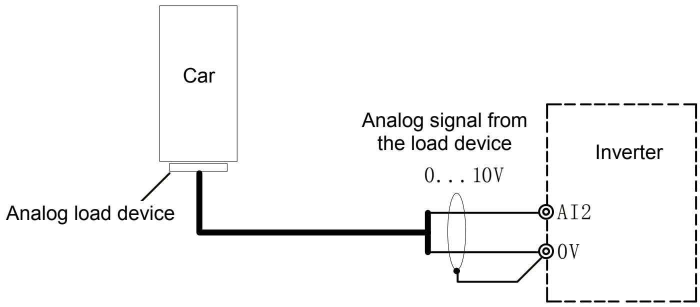


Figure 7.10 Wiring of the analog signals of load device

The following parameters shall be set or modified when the pre-load device starting compensation technology is used.

Parameter Type	Code	Name	Default	Remarks
E (Motor) Parameter	E13	Selection of pre-load	0	Set to 2: analog signal of load device
H (Analog Input) Parameter	H05	Compensation direction of pre-load	0	0: positive; 1: negative.
	H06	AI2 analog offset	0.00	Set during inputs of AI2 analog signal of load device
	H07	AI2 analog gain	1.00	
	H08	AI2 analog filtering time	20	

In the table above, E13 shall be set to 2, and the pre-load compensation work only when it is set to 2.

H05 is used to set the pre-load compensation directions defined as follows:

If viewed from its front, the motor runs clockwise and the elevator goes upward, positive compensation (H05 = 1) shall be set with heavier load and higher pre-load analog voltage, or negative compensation (H05 = 0) shall be set with heavier load and lower pre-load analog voltage. On the other hand, if viewed from its front, the motor runs clockwise and the elevator goes downward, negative compensation (H05 = 0) shall be set with heavier load and higher pre-load analog voltage, or positive compensation (H05 = 1) shall be set with heavier load and lower pre-load analog voltage.

H06 is the offset of AI2 analog inputs:

When the mean value of the maximum and the minimum analog input voltages of AI2 (i.e., the load signal of the pre-load device) is not 0, H07 shall be set. The formula for H06 setting is as follows:

H06 = the mean value of the maximum and the minimum load signals from the pre-load device + 10.000.

For example, if the signal input to AI2 from the pre-load device ranges from -5V to +8V, the mean value is (-5V + 8V)/2 = 1.5V, and H06 = 1.5 + 10.000 =11.500.

Since the pre-load compensation has two directions, if H05 is set as positive compensation, positive compensation will be provided when the analog voltage from AI2 after the offset of H06 is positive, and negative compensation will be provided when the result is negative. Take the above situation for example, if the input voltage is 1V, the result will be -0.5V after the offset of 1.5V, which means 0.5V negative compensation; if the input voltage is 4V, the result will be 2.5V after the offset of 1.5V,, which means 2.5V positive compensation.

In actual commissioning, accurate input voltage range may not be obtained, resulting in inaccurate offset in the calculation described above. Therefore, adjustments are required. The method is as follows: put the elevator under repair mode, ensure the balance between the car and the counterweight (i.e., the car will not slip even with the brake open), set the checking speed to 0, and the elevator may not move at starting. If it moves, H06 offset shall be adjusted until it moves no longer.

H07 is the gain of the analog signals of AI2:

After the pre-load signal is input to AI2 analog port, its size and direction may be determined only after H06 offset and H07 gain. During commissioning, an initial value is given to H07 as follows:

H07 (AI2 analog gain) = 20/(difference (range) of AI2 analog input voltage).

Difference of analog input voltage = max. input voltage – min. input voltage.

For example, if the input voltage of AI2 (or signals from the pre-load compensation device) ranges from -5V to +5V, the difference (range) of AI2 analog input voltage is 10V, and H07 (AI2 analog gain) = 20/10 = 2.

H07 shall be adjusted on site according to actual conditions. If the parameter is set to positive compensation, for example, put the elevator under repair mode, set the checking speed to 0, let the elevator start free of load (with the car side lighter), if the elevator dashes upward, it means the compensation is not high enough. H07 shall be increased gradually until the elevator does not dash. On the other hand, if the elevator dashes downward, the compensation is too high, and H07 shall be lowered until the elevator does not dash.

H08 is the filtering time of AI2 analog input signals. Increases in H08 may improve the resistance of the pre-load signals to electromagnetic interferences, but too high value may also result in slow response. Generally, the default setting is used, that is, H08 = 20ms.

7.9.2 Bus Low-voltage Operation for Emergency Leveling

Upon emergency power-off during operation, the elevator may be stuck in the shaft, with the passengers still in waiting for related personnel to manually move the car to release them. This will result in too much trouble for the passengers. Therefore, in many applications, the elevator shall be equipped with an emergency leveling device. However, since a stand-alone leveling device is very high in cost, an emergency leveling device may be obtained simply through a low-speed running function of the Inverter at low voltage (during power-off, storage batteries are used for power supply, normally with a total of around 48V, or 220V UPS may be used) in addition with some special settings on the elevator controller. In this way, stranded passengers may be released upon emergency power-off, and the cost is relatively low.

For the bus low-voltage operation, a digital input shall be defined to receive the emergency powering signal. F01 may be set to 6, and DI1 will be defined as the input port of emergency power triggering signal. When DI1 is connected, the Inverter enters the bus low-voltage operation mode, i.e., the Inverter will keep running when the bus voltage is as low as 48V. There are two modes, one powered by storage batteries, with the Inverter powered by UPS. The main circuit is shown in Figure 7.11. The storage battery used is of 48V (normally four in serial, each of 12V) and no less than 20Ah.

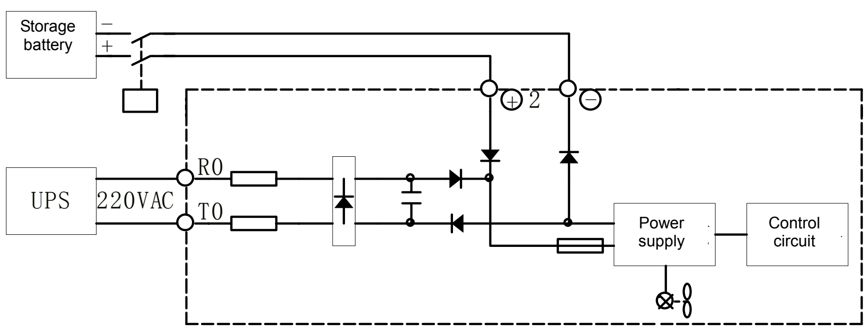


Figure 7.11 Bus circuit powered by UPS and storage battery

The second mode is powered only by UPS, with no storage battery. The main circuit is shown in Figure 7.12.

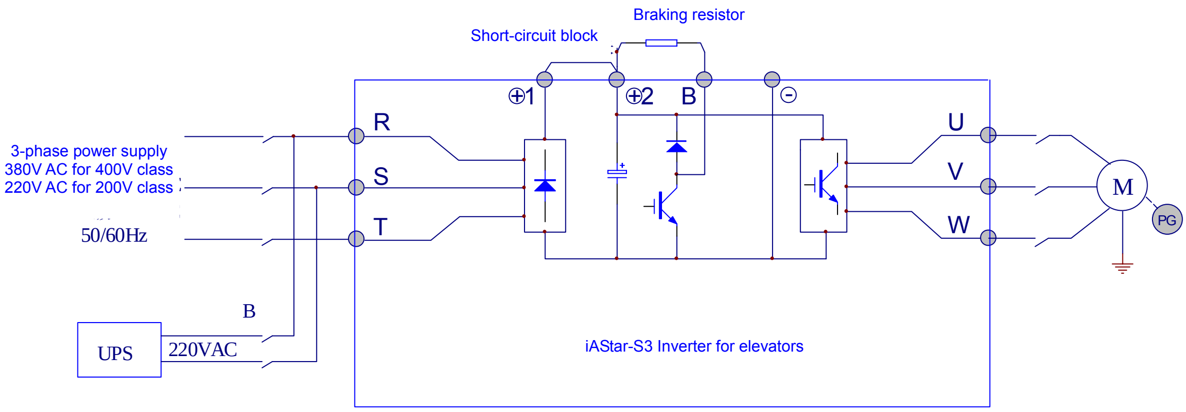


Figure 7.12 Bus circuit powered by UPS

It is worthwhile to note that the contactor B in the figure above may only be closed during emergency power-off, or conflict between different power supplies will result and serious faults may occur.

With the function of bus operation at a low voltage for emergency power-off, when there is emergency power-off, UPS and the storage batteries (if used) will power the Inverter and the elevator controller. The elevator controller detects the emergency power-off through a special contact, and sends a connection signal to DI1 of the Inverter (already set for receiving emergency powering signals), to indicate the emergency leveling status and let the Inverter allow the bus to run at a low voltage. Then the elevator, under the control of the Inverter, runs in a certain direction at a low speed to the most leveling position and stops. After the door opens, the emergency leveling ends.

7.9.3 Wiring of the Main Circuit with one Contactor and Parameter Setting

According to GB-7588 “Safety rules for the construction and installation of electric lifts”, the main circuit shall meet either of the following requirements:

(a) The main circuit is equipped with two independent contactors, each able to cut off the circuit of the traction machine. When the elevator stops, if either of the contactors does not open, the car shall be prevented from moving until the running direction is changed for the next operation.

(b) A contactor is used for cutting off the circuit of the traction machine, a control device is used for blocking the current through static parts, and a monitor device is used for detection of the current blocking when the elevator stops. During normal stopping, if the static parts do not effectively block the current, the monitor device shall have the contactor work to prevent the elevator from running.

If the inverter is not able to provide accurate signal concerning whether the current has been effectively blocked, the elevator control system does not meet the requirement stated in (b) above, and two contactors shall be used in the main circuit. iAStar-S3 Inverter, on the other hand, may provide such signals and output detection results. Therefore, the control system may meet the requirement in (b) if correct design is made in consideration of the elevator controller and iAStar-S3 Inverter. In this way, only one contactor is required for the main circuit, reducing the number of parts used as well as the cost.

To this end, G parameters shall be set first to define a digital output port for the current detection signal. Set G01 to 5, and DO1 (K1 relay) is defined as the port. Figure 7.13 shows an example of the wiring.

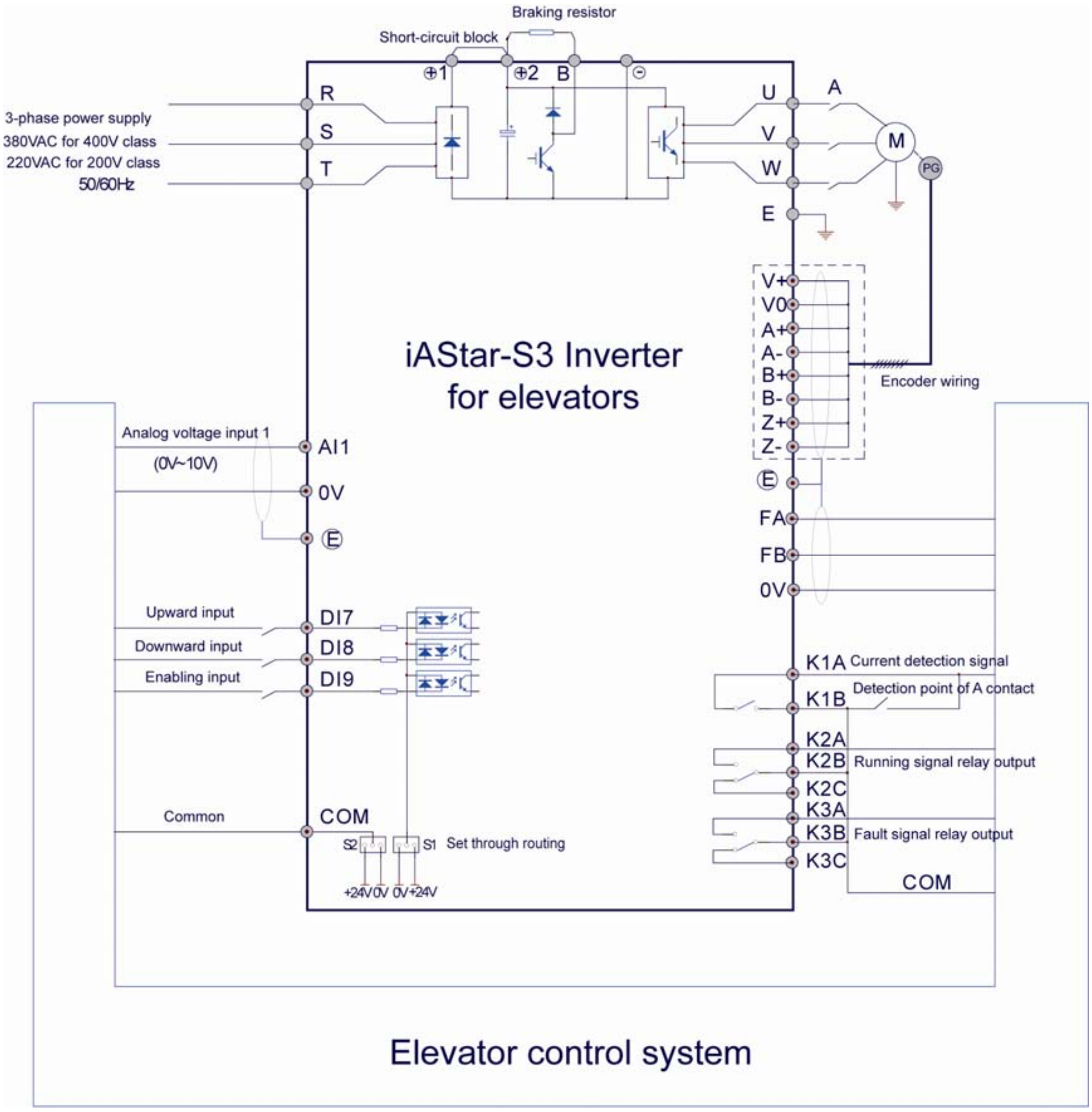


Figure 7.13 Example of the wiring with one contactor

In Figure 7.13, the contacts of K1 relay for Inverter output and the auxiliary contacts of Contactor A of the main circuit are arranged in parallel connected with the elevator controller to monitor the input of the main circuit contact. According to the national standards, the elevator will not run again if the main contact does not release after the elevator stops. Therefore, if the elevator controller detects signal from the input point after the elevator stops, it will prevent the elevator from starting again. When the elevator has stopped, if the Inverter does not block the current, K1 relay will keep being closed, and the input point for the detection will still be connected even if the main contactor is released because the two contacts are connected in parallel, and thus the elevator will not start. Therefore, the circuit meet the requirement of (b) stated above.

8. Fault Inspection

This chapter describes the fault codes, reasons and countermeasures of the Inverter, and provides an analysis to the faults during elevator operation.

WARNING
1） **Maintenance may be performed only 10 minutes after the input power is cut off, when the charging indicator is off or the bus DC voltage is below 24V.** Or electric shock may occur. 1） **Do not change anything about the Inverter by yourself.** Or electric shock or injury may occur. ◎ **Maintenance shall be performed by authorized personnel qualified in electrical engineering. Do not leave any wire end or metal object in the Inverter.** Or fire may occur.

CAUTION
1） **Do not change the wiring or remove connectors when the Inverter is powered.** Or electric shock may occur.

8.1 Protections and Inspections

When a fault occurs to the Inverter, the fault LED on the digital operator will be on, and U00 and the LED digital tubes show the fault code. The user may look up in the fault list for the fault corresponding to the code and perform checking and repair accordingly.

The fault LED has a latching function, and may be cancelled only after the fault is restored and F3 is pressed under U status in 【Run State】.

The Inverter provides 29 fault codes, namely 1 to 29. The fault codes and corresponding faults are shown in Figure 8.1 Fault List.

Table 8.1 Fault List

Fault Code	Content	Reason	Countermeasure
1	**Power module fault** IPM protection triggered by over-current of the Inverter, Inverter output cut off	Instantaneous over-current of the Inverter	Contact the supplier.
		Short of the three phases of output	
		Abnormal power supply of the power module	
		Ambient temp. too high	
2	**DSP controller fault**	Abnormal input voltage of the control board	
3	**Over-heated radiator of the power module** Overheating of the radiator detected by the overheat detector, Inverter output cut off	Ambient temp. too high, fan damaged	Install a cooling device
		Heat source around	Eliminate the heat source
4	**Fault of the brake unit or the braking resistor** Fault in the braking circuit	Fault in the braking circuit or brake parts damaged	
		Disconnection of the external braking resistor, or no braking resistor	Check the wiring of the braking resistor and the resistor itself
5	**Fuse blown**	The fuse of the main circuit is blown	Replace it
6	**Over-torque protection** The output torque reaches 200％ for 10 seconds	Load too high, power of the Inverter too low	Check the load or replace the Inverter with higher capacity
7	**Speed deviation too high**	Load too high	Reduce the load
		Time for acceleration (deceleration) too short	Prolong the time
8	**Over voltage** The voltage on the DC side of the Inverter exceeds the setting (400V class), approx. 810V	Deceleration time too short, regeneration power too high	Prolong the time Add a braking resistor
		The voltage of power supply is too high	Lower the voltage within the specified range
9	**Under voltage** The voltage on the DC side of the Inverter is lower than the setting (400V class), approx. 380V	Phase loss of the input power	Check the input power supply, and reset and restart after the power returns to normal
		Instantaneous power off	
		Fluctuated voltage of the input power	
		Terminal of the input power loosened	Check the input wiring
		Large starting currents in the same power system	Modify the power system to meet related requirements

Table 8.1 Fault list, continued

Fault Code	Content	Reason	Countermeasure
10	**Phase loss of the output** Phase loss on the output side, or very unbalanced phases	Disconnected output wire Output terminal loosened	Check the motor wiring
		Motor power too low, below 1/20 of the max. permissible power of the Inverter	Adjust the capacity of the Inverter or the motor
11	**Motor overload**	Motor current over the preset value by 150％ for 1 minute	
12	**Encoder fault** The inverter is in output frequency state, but there is no PG pulse input.	Disconnected PG Wrong wiring of PG	Check the wiring
		PG card error	Replace the PG card
13	**Current not effectively blocked during elevator stop**	The current is not cut off when the elevator stops	Check or replace the grounding conductor
14	**A signal of reversed speed detected during running**	Different phase sequence between the encoder and the motor	Change the phase sequence of the motor or the encoder
15	**Feedback speed detected with no running command**	The elevator slips when the brake is open	Check the brake
		Interference to the encoder or encoder loosened	Fasten the encoder and remove any interference
16	**Wrong phase sequence of the motor**	If the phase sequence of the encoder is right, that of the motor is wrong	Change the phase sequence
17	Fwd dashing protection	Interference to the encoder or wrong connection	Checking the wiring
18	Rev dashing protection	Interference to the encoder or wrong connection	Checking the wiring
19	Wrong phase sequence of UVW encoder	Problems with the encoder or parameter setting	Check the wiring or change parameter setting
20	R+ and R- disconnection, Endat communication fault	Abnormal encoder wiring	Check the wiring
22	KMB detection fault		Adjust the sequence parameters
21	Reserved		
23	Over voltage input	Over voltage input	Adjust the input voltage
24	UVW encoder disconnected	UVW encoder disconnected	Check the wiring
25	Fan fault		Replace the fan or adjust the parameters
26	No autotuning when UVW encoder is used	Enter autotuning command and the fault will be restored	

Table 8.1 Fault list, continued

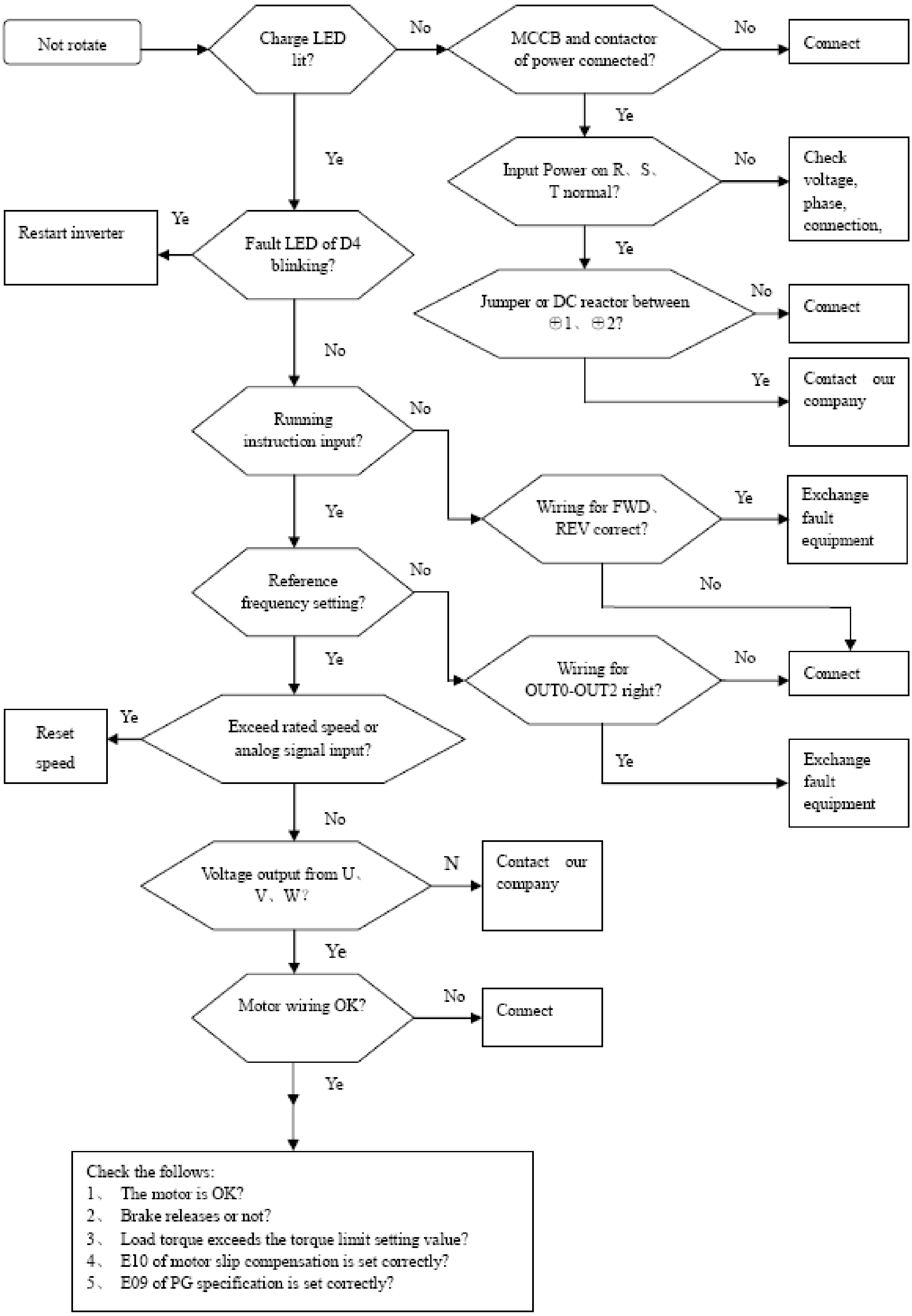
Fault Code	Content	Reason	Countermeasure
27	Over current	Motor stalling	Check the motor or the brake
		Short of the motor coil	Check the motor
		Output short	Check the wiring or the motor
28	Phase C and D wiring fault of 1387 encoder	C and D wiring fault	Check the wiring of Phase C and D
29	Phase loss of input	Phase loss of the input power supply	Check the input power supply or the wiring

8.2 Workflow of Fault Diagnosis

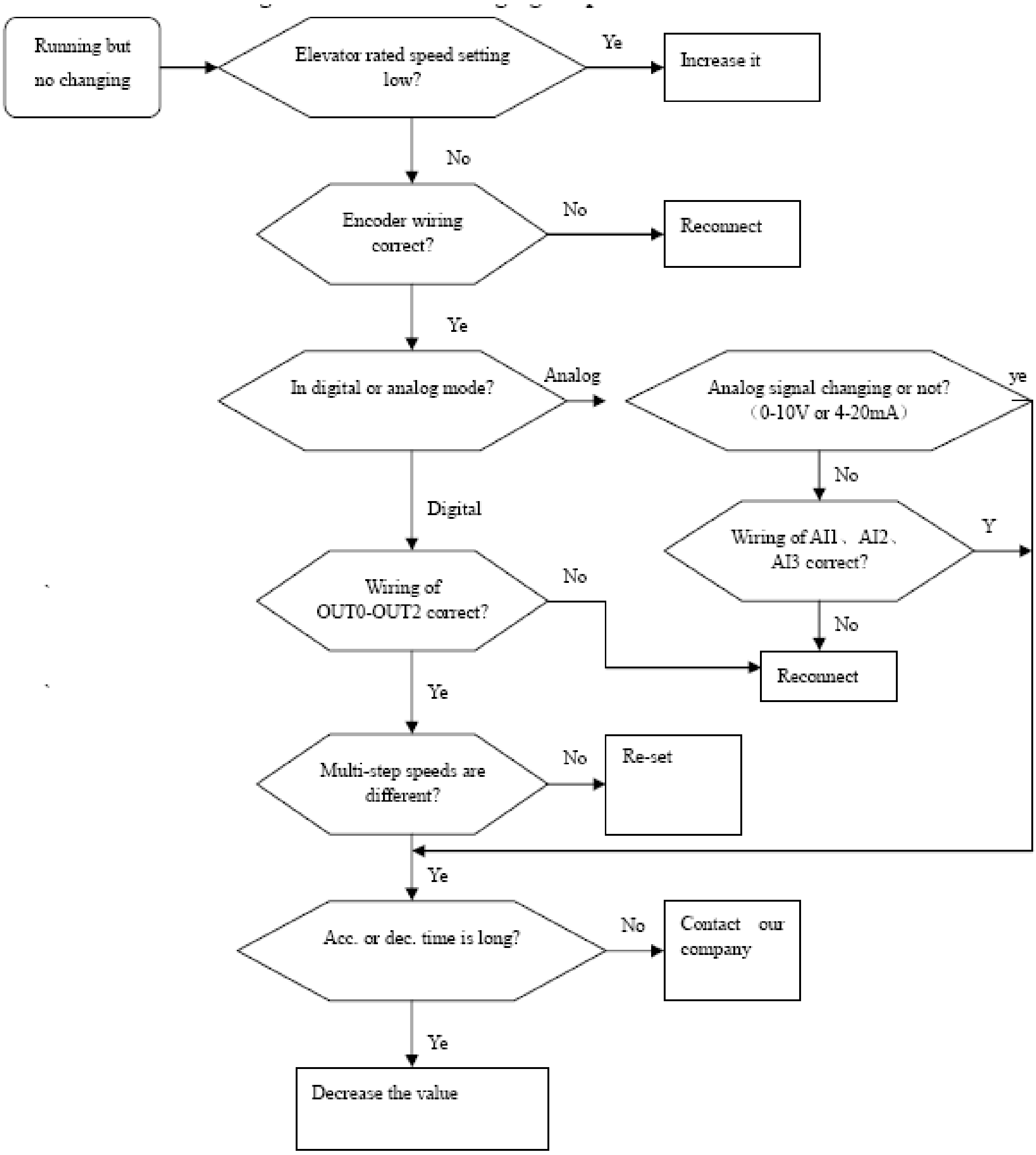
When the system is starting, the Inverter or the motor may not operate as required due to reasons such as wrong parameter setting or wiring. The following diagnosis flow may be used for fault analysis and treatment in such situations.

Abnormal operation of the motor:

◎ The motor does not run when the control terminal receives a running command.


Not rotate
Charge LED lit?
No
MCCB and contactor of power connected?
No
Connect
Ye
Input Power on R、S、T normal?
No
Check voltage, phase, connection,
Ye
Jumper or DC reactor between ⊕1、⊕2?
No
Connect
Ye
Contact our company
Ye
Restart inverter
Ye
Fault LED of D4 blinking?
No
Running instruction input?
No
Wiring for FWD、REV correct?
Ye
Exchange fault equipment
No
Ye
Reference frequency setting?
No
Wiring for OUT0-OUT2 right?
No
Connect
Ye
Exchange fault equipment
Ye
Reset speed
Ye
Exceed rated speed or analog signal input?
No
Voltage output from U、V、W?
N
Contact our company
Ye
Motor wiring OK?
No
Connect
Ye
Check the follows:
1、 The motor is OK?
2、 Brake releases or not?
3、 Load torque exceeds the torque limit setting value?
4、 E10 of motor slip compensation is set correctly?
5、 E09 of PG specification is set correctly?

◎ The motor runs without speed variation.



9. Servicing and Maintenance

This chapter provides the general information on servicing and maintenance.

WARNING
1） **Maintenance shall be performed 10 minutes after the cutoff of the input power supply, with the charging indicator off or the bus DC voltage below 24V.** Or electric shock may occur. 2） **Do not change anything about the Inverter by yourself.** Or electric shock or injury may occur. ◎ **Maintenance shall be performed by authorized personnel qualified in electrical engineering. Do not leave any wire end or metal object in the Inverter.** Or fire may occur.

CAUTION
2） **Do not change the wiring or remove connectors when the Inverter is powered.** Or electric shock may occur.

9.1 Guarantee Period

We will provide maintenance and repair with the following problems of the Inverter:

We will provide maintenance and repair within the guarantee period (dating from the day leaving the factory) for any fault or damage of the Inverter in normal application; a certain amount of charge will be required when the guarantee expires.

A certain amount will also be charged for faults due to the following causes within the guarantee period:

◎ Repair or modification is performed not according to the user manual or without permission by the user.

◎ Applications exceed the specifications.

◎ The Inverter falls after the purchase or is damaged during the transportation.

◎ Damages are caused by earthquake, fire, flood, lightening strike, abnormal power or other natural disasters or related reasons.

9 Servicing and Maintenance

9.2 Product Inquiry

Upon any damage, fault or other problems, please contact our offices or service department with the following information:

Inverter type

Production No.

Purchase date

The inquiry may concern damage status, unknown reasons and faults.

9.3 Daily Inspection

Since the cover of the Inverter may not be removed when it is powered and running, visual inspection shall be performed to see whether it operates normally. The daily inspection may include the following:

◎ Whether the surroundings conform to the specifications;

◎ Whether the performance conforms to the specifications;

◎ Whether there is abnormal noise, vibration or abnormality;

◎ Whether the cooling fan on the Inverter works normally;

◎ Whether there is overheat.

9.4 Periodic Inspection

During periodic inspection, stop the Inverter, cut off the power supply, and remove the cover. It takes some time to discharge the storage capacitor on the main circuit. Therefore, wait for the charging indicator to go out and a multimeter shall be used to check whether the voltage on the DC bus is below the safe level (24VDC). If it is, the inspection may begin.

Immediate contact with the terminals after the power is cut off may lead to an electric shock.

The inspection items are listed in Table 9.1.

Table 9.1 Items of periodic inspection

Item		Details	Method	Criteria
Operation ambient		a) Confirm ambient temperature, humidity, vibration and the existence of dust, corrosive gas, oil fog and water drop. b) Whether there is dangerous object nearby.	1. Visual, thermometer, hygrometer 2. Visual	1）The ambient temperature shall be lower than 40℃, and the humidity and other items shall conform to the specifications. 2）No dangerous object.
LCD display		a) Whether the LCD display is clear, whether the backlight is even. b) Whether there is missing digits on the LCD display	Visual	1） Even backlight 2） Normal display
Connecting parts Terminals and bolts		1）Whether any bolt is loosened 2）Whether any connecting part is loosened	1）Fasten 2）Visual	1）No abnormality 2）Secure installation
Main circuit	Conductor	1） Whether the sheath is broken or has a changed color 2） Whether the copper row is distorted	Visual	No abnormality
	Contactor and relay	1）Whether there is vibration 2）Whether the contact is connected	Listening and visual	1） No 2） A clap of connection
	Capacitor	1）Whether there is leakage, color changing, crack or cover expansion 2）Whether the safety valve is out or expand	Visual	No abnormality
	Heat sink	4. Whether there is dust 5. Whether the air duct is blocked or has foreign objects attached on it	Visual	No abnormality
	Cooling fan	1） Whether there is abnormal noise 2） Whether there is abnormal vibration 3） Whether there is color changing or distortion due to overheat	1） Listening, visual, manually rotate the fan after cutting off the power 2） Visual 3） Visual, smell	1） Stable rotation 2）and 3）No abnormality
Control circuit	Insert-piece	Whether there is dust or foreign object on the double-row insert-piece between the control board and the main circuit.	Visual	No abnormality
	Control board	1） Whether there is color changing or order on the control board 2） Whether there is crack, damage or distortion on the circuit board	1） Visual, smell 2） Visual	No abnormality

Appendix A Electromagnetic Compatibility

In this appendix, the EMC design and installation precautions are described in terms of noise restraint, wiring requirements, grounding, surge absorption of peripheral equipment, leakage current, installation areas, installation precautions, application of power filter, and treatment of radiation.

A.1 Noise Restraint

The inverter will generate noise due to its operation. Its impact on peripheral equipment is determined by noise type, transmission route, design, installation, wiring and grounding of the drive system.

A.1.1 Noise Type

Figure A.1 shows noise types.

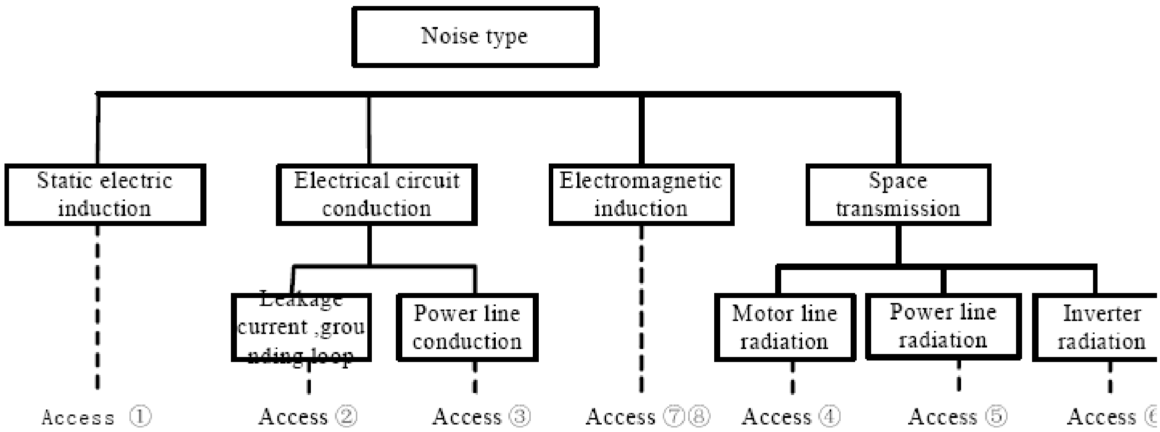


Figure A.1 Noise types

A.1.2 Noise Transmission

Figure A.2 shows noise transmission.

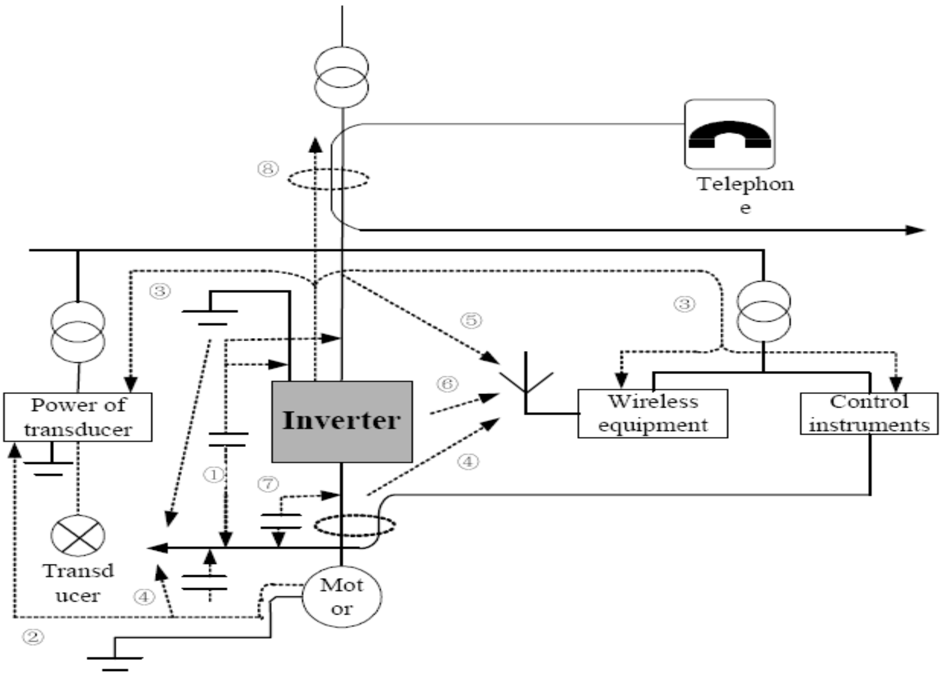


Figure A.2 Noise transmission

A.1.3 Basic Countermeasures for Noise Restraint

The basic measures are listed in Table A.1.

Table 0.1 Basic countermeasures for noise restraint

No.	Cause	Countermeasure
① ⑦ ⑧	Peripheral equipment may take wrong actions due to noises transmitted along the signal line caused by electromagnetic induction and electrostatic induction between parallel or bunched signal lines and power lines.	1. Avoid parallel or bunched signal line and power line; 2. Install sensitive equipment away from the Inverter; 3. Keep sensitive signal lines away from the input and output cables of the Inverter; 4. Shielded conductors shall be used for signal and power lines. It will be even better for them to be put in separate metal tubes (with a distance at least 20cm).
②	Peripheral equipment may take wrong actions due to leakage current of the Inverter grounding when the equipment forms a closed loop with the Inverter wiring.	Not grounding the peripheral equipment will eliminate the leakage current.
③	Peripheral equipment may take wrong actions due to the transmission of noises from the Inverter along the power line when peripherals and the Inverter share the same power supply system.	Install a noise filter on the input side of the Inverter, or separate the peripherals with an insulation transformer/power filter.
④ ⑤ ⑥	Weak peripherals such as control computer, measuring instrument, radio and sensor may take wrong actions when they and their signal lines are installed in the same cabinet with the Inverter with the wiring very close to the Inverter.	1. Keep sensitive peripherals and their signal lines away from the Inverter. Shielded conductors shall be used for signal lines and the shield shall be grounded. Signal cables shall be put in metal tubes and laid away from the Inverter and its input and output cables. Keep the signal line and the input or output cable perpendicular when they have to cross. 2. A radio or linear noise filter (ferrite common-mode choking coil) may be installed on the input and the output side of the Inverter to restrain the noises from the input and output cables of the Inverter. 3. The cable linking the Inverter to the motor shall be equipped with a thick shield and may be put in a duct over 2mm or buried in a cement groove. The cable shall be put in metal tubes and the shield shall be grounded (as for motor cables, 4-core conductors may be used, with one conductor grounded on the Inverter side and another connected to the motor cover).

A.2 Wiring Requirements

A.2.1 Cable laying

To avoid interference coupling, the control signal cable, the power cable and the motor cable shall be laid separately, with enough distances and kept as far as possible, as shown in Figure A.3 (a). When the control signal line has to cross the power line or the motor line, they shall be kept perpendicular, as shown in Figure A.3 (b).

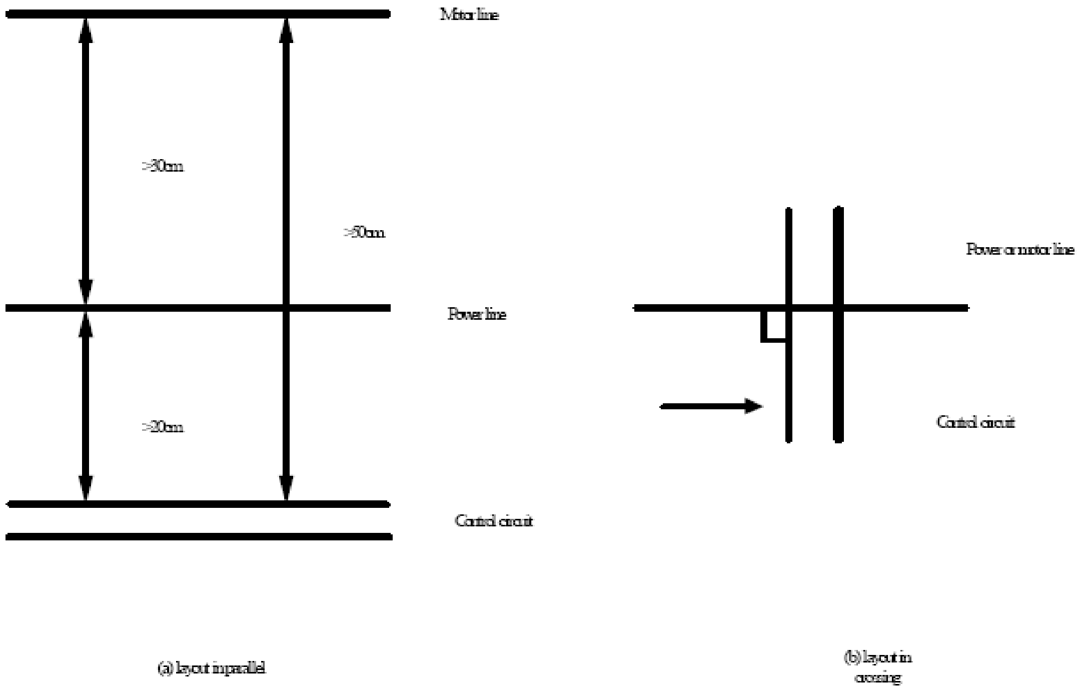


Figure 0.1 Wiring requirements

A.2.2 Cable cross-section area

Since bigger cross-section area means higher capacitance and leakage current to the earth, the motor shall be used at a lower power when its cable has a big cross-section area to lower its output current (5% will be lowered with the reduction of one step pf the cross-section area).

A.2.3 Shielded cable

Armored shielded cables with high frequency and low impedance shall be used, such as braided copper net and aluminum net.

A.2.4 Installation of shielded cable

Shielded conductors are usually used for control cable. The metal shield shall be connected to the metal housing with the cable clamps on both ends in a 360° ring, as shown in Figure A.4. Figure A.5 shown a wrong shielding.

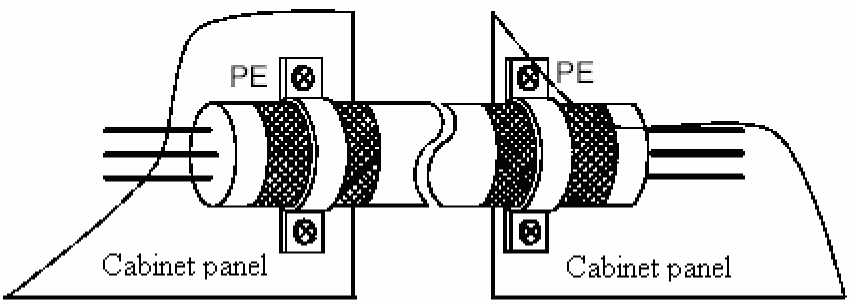


Figure 0.2 Correct wiring to PE

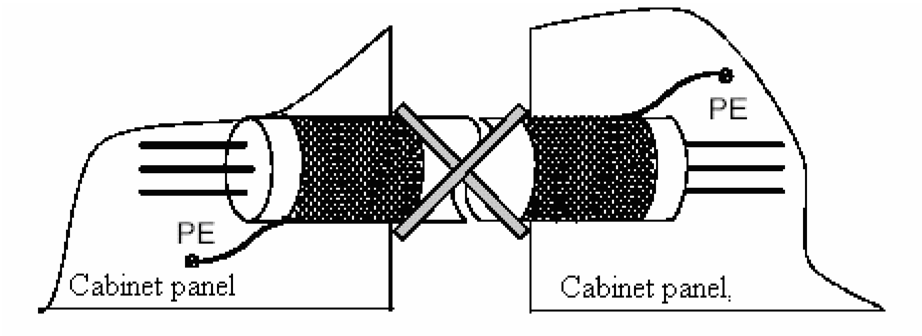


Figure 0.3 Incorrect wiring to PE

A.3 Grounding

A.3.1 Grounding method

Figure A.6 shows the grounding method.

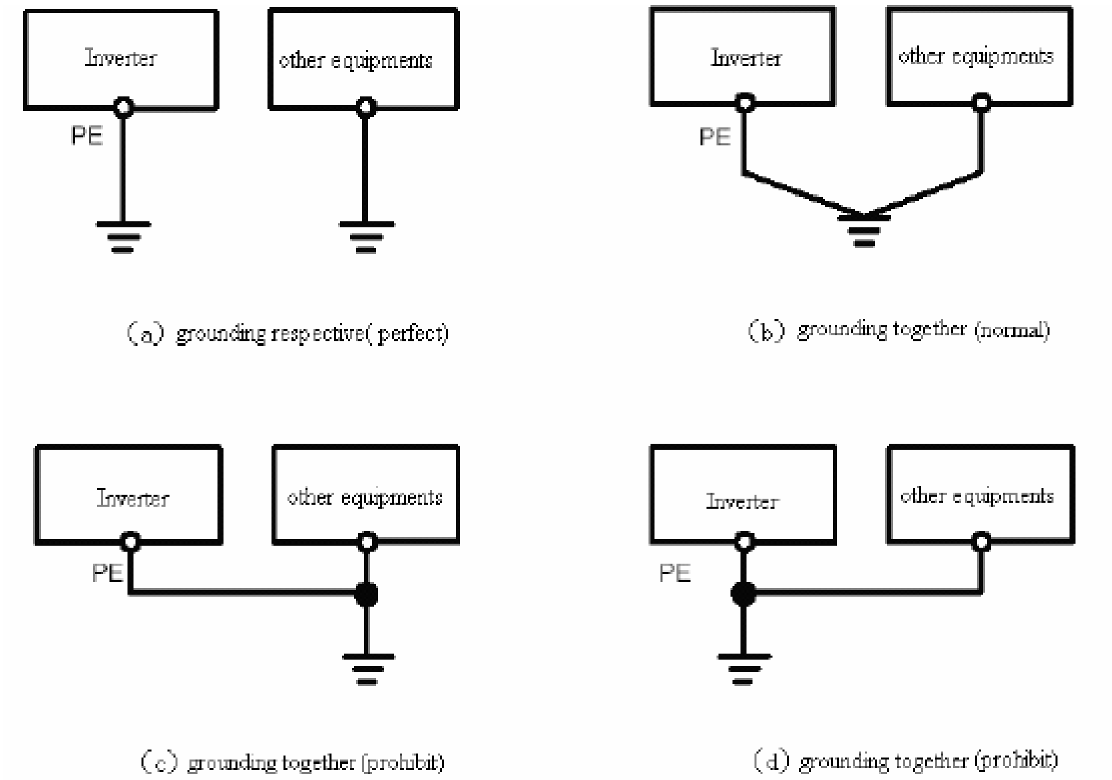


Figure 0.4 Grounding

Among the four grounding methods shown above, (a) is the most preferable and is recommended.

A.3.2 Grounding precautions

⑴ Cables with standard cross section area shall be used for grounding, to keep the grounding impedance as low as possible. Since the high-frequency impedance of flat cable is lower than that of round cable, flat cable shall be selected given the same cross-section area.

⑵ The grounding cable shall be as short as possible, with the grounding point as close to the Inverter as possible.

⑶ When 4-core cables are used for the motor, one shall be grounded on the Inverter side and the other on the motor side. When both the Inverter and the motor are equipped with specific grounding poles, optimal grounding may be expected.

⑷ Noises from the leakage current of grounding may impact the inverter and peripherals in the control system when different parts of the system are grounded together. Therefore, the inverter shall be separately grounded from weak equipment such as computer, sensor or audio in the same control system.

⑸ To reduce high-frequency impedance, the fixed bolts may be used as the high-frequency terminal connected with the back panel of the cabinet. The insulation paint on the fixed point shall be removed before installation.

⑹ Grounding cables shall be laid away from the I/O wiring of noise sensitive equipment, and kept as short as possible.

A.4 Surge Absorber installation

Surge absorbers shall be used for apparatus with heavy noises such as relay, contactor and electromagnetic brake even when they are installed outside the Inverter housing, as shown in Figure A.7.

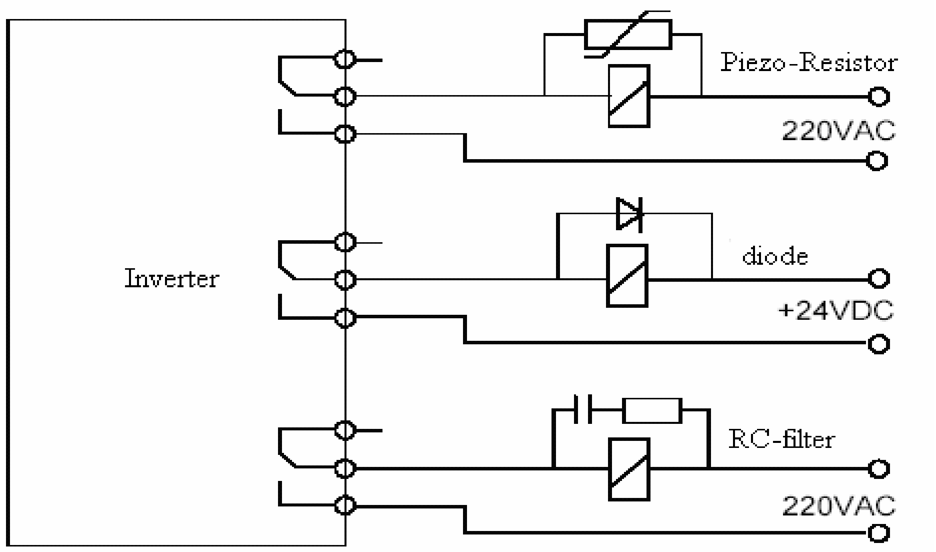


Figure A.7 Application of relay, contactor and electromagnetic brake

A.5 Leakage Current and Countermeasures

Figure A.8 shows that the leakage current will flow through the line capacitor and motor capacitor on the input and output sides of the Inverter, including the leakage current to earth and the leakage current between lines. The leakage current is determined by the carrier frequency and the capacitance.

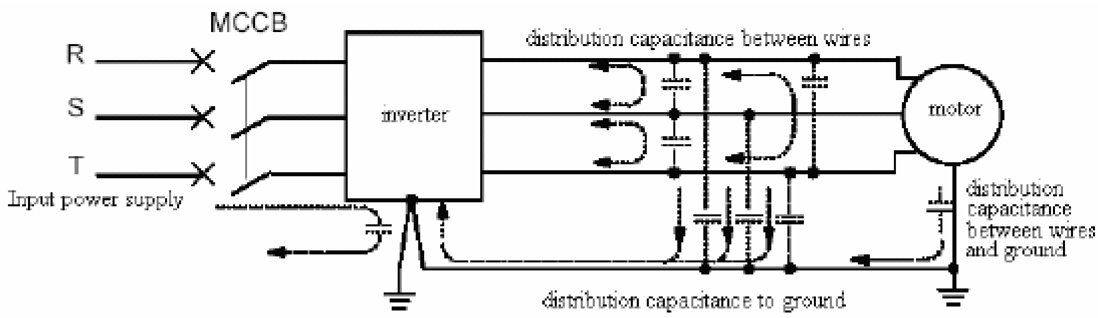


Figure A8 Leakage current path

A.5.1 Leakage current to earth

Leakage current to earth may not only enter the inverter, but also other equipment through the grounding conductor, causing wrong actions of leakage circuit-breaker, relay or other equipment. The leakage current goes higher with higher carrier frequency and longer motor cable.

Countermeasures: lower the carrier frequency; shorten the motor cable as much as possible; use a leakage circuit-breaker specifically designed for high harmonic/surge applications.

A.5.2 Leakage current between lines

External thermal relays may take wrong actions due to the high harmonic of the leakage current cross the distributed capacitors on the output side of the inverter. Especially for inverters with capacity lower than 7.5kW, higher leakage current with a long conductor (above 50 m) may trigger wrong actions of external thermal relays.

Countermeasures: lower the carrier frequency; install an AC reactor on the output side; use a thermal sensor to directly monitor the motor temperature; use the electronic thermal relay for motor over-load protection of the inverter itself instead of an external relay.

A.6 Restraint of Radiation from Inverter

The control cabinet containing the inverter is generally made of metal, thus reducing the radiation from the inverter to the instruments and equipment outside the cabinet. The connecting cable is the major radiation source. Since the cables for inverter power supply, motor, control circuit and keyboard shall be led out of the shielded cabinet, special measures shall be taken at the cable entry, or the shielding may be invalidated.

In Figure A.9, the cables in the shielded cabinet function as antenna receiving the radiation inside the cabinet and sending it to the outer space. In Figure A.10, the shield of the cable is connected to the cover at the exit and grounded, thus sending the radiation in the cabinet directly to the ground and avoiding its going out.

In the shielded grounding shown in Figure A.10, the cable shield shall be grounded as close to the exit as possible, or the length between the exit and the grounding point still works as a coupling antenna. The distance between the grounding point and the exit may not exceed 15cm and shall be as short as possible.

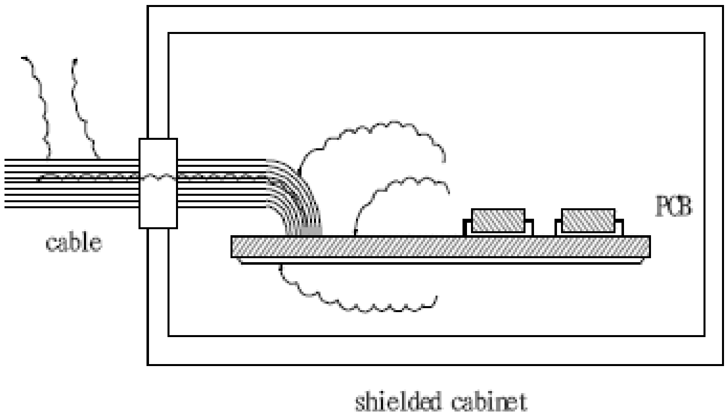


Figure 0.5 Radiation from cables going out the shielded cabinet

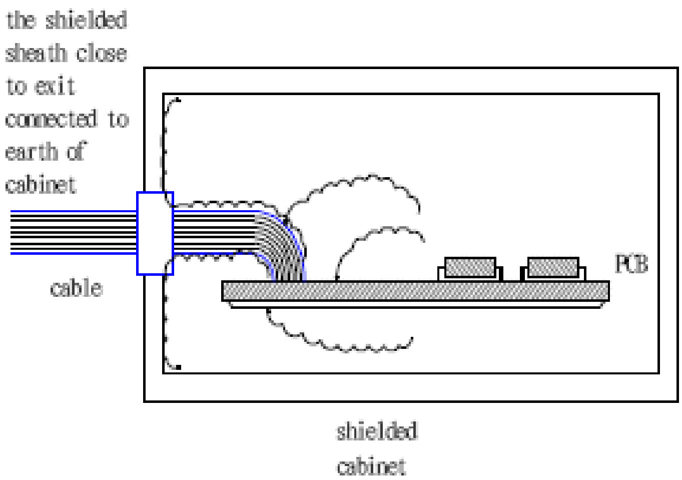


Figure 0.6 Radiation restraint by connecting the cable shield with the housing

A.7 Application of Filter for Power Lines

Filters for power lines may be used for equipment generating strong interferences or sensitive to interferences.

A.7.1 Functions

(1) The filter for power lines is a double-direction lowpass, which only allows direct current and 50Hz industry frequency current to go through, and blocks electromagnetic interferences with high frequencies. Therefore, it may prevent the electromagnetic interferences generated by itself from going into the power line, but also vice versa.

(2) With the filter, the equipment easily meets the EMC requirements on transmission and transmission sensitiveness, and at the same time the radiation of the equipment is restrained.

A.7.2 Installation of Filter for Power Lines

(1) In the cabinet, the filter shall be installed as close to the entry of the power line as possible, and the power input line of the filter shall be as short as possible in the cabinet.

(2) If the input line and the output line of the filter are laid too close to each other, high-frequency interferences will bypass the filter, the input and the output lines will directly couple, and the filter will work no longer.

(3) There is normally a specialized grounding terminal on the filter housing. When the grounding terminal is connected to the housing through a conductor, the filter will not work effectively because of the high impedance of the conductor which reduces the bypassing effect. The correct installation is to put the filter cover on the conductive metal housing surface, with the contacting area as large as possible. The insulation paint shall be removed before the installation to ensure good electrical contacting.

A.8 EMC Installation Areas

In the drive system consisting of an inverter and a motor, the inverter and peripherals such as control devices and sensors are normally installed in the same cabinet. The interference from the cabinet to the outside may be restrained through measures at the main connecting point, and a radio filter and an AC reactor shall be installed at the cable entry of the cabinet. EMC standards shall also be met within the cabinet.

In the drive system consisting of an inverter and a motor, the inverter, the braking unit and the contactor are all strong noise sources impacting normal function of sensitive peripherals such as automatic devices, encoders and sensors. Peripherals may be installed in different EMC areas according to their electrical characteristics, thus separating noise sources and receivers, which is the most effective way of reducing noises. The division of EMC areas for inverter installation is shown in Figure A.11.

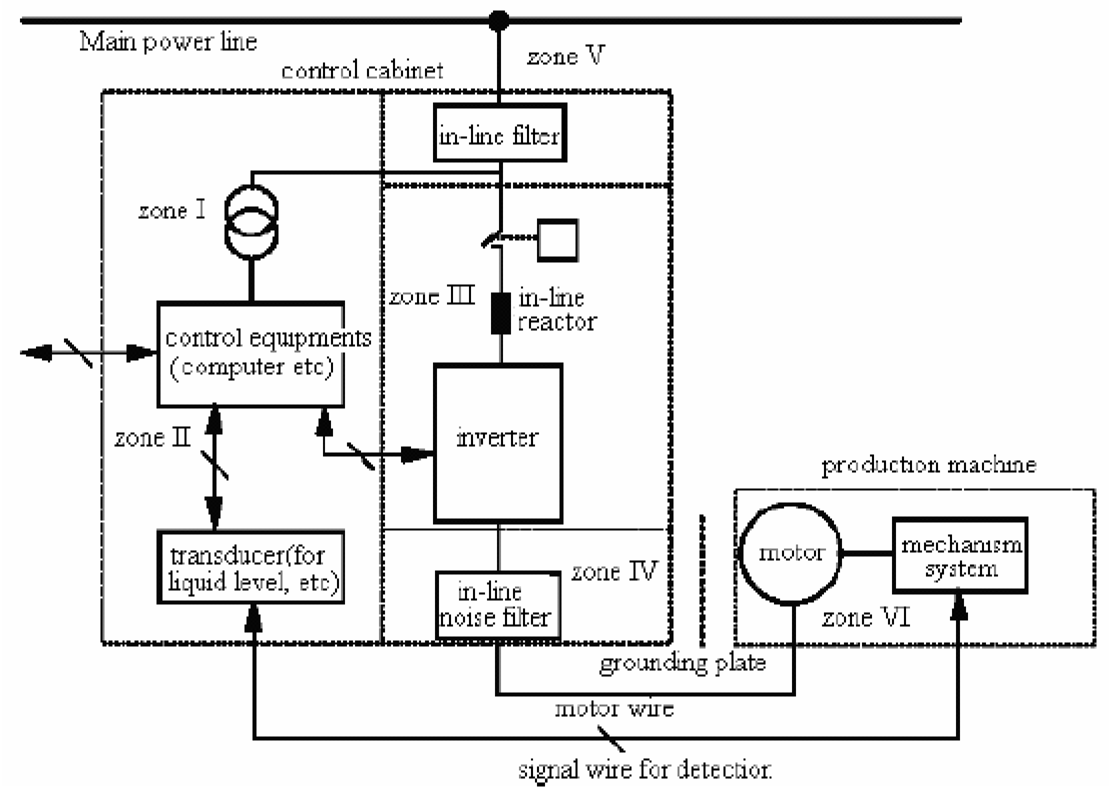


Figure 0.7 EMC installation areas for the inverter

Notes on the installation areas:

Ⅰ: control circuit transformer, control devices, sensors, etc..

Ⅱ: control signals and interfaces, with a certain degree of interference resistance.

Ⅲ: in-line reactor, inverter, braking unit, contactor and other major noise sources.

Ⅳ: output noise filter and its wiring.

Ⅴ: power supply (including the wiring for the radio filter).

Ⅵ: motor and its cables.

Each zone shall be separated from the others, with a distance no less than 20cm, in order to decouple. Grounded spacers may be used for decoupling. Cables from different zones shall be put into different conduits. Filters (if necessary) shall be installed at the interfaces of the zones. All bus cables (such as RS485) and signal cables coming from the cabinet shall be shielded.

A.9 Precautions for Inverter Electric Installation

Figure A.12 shows the electric installation of the inverter:

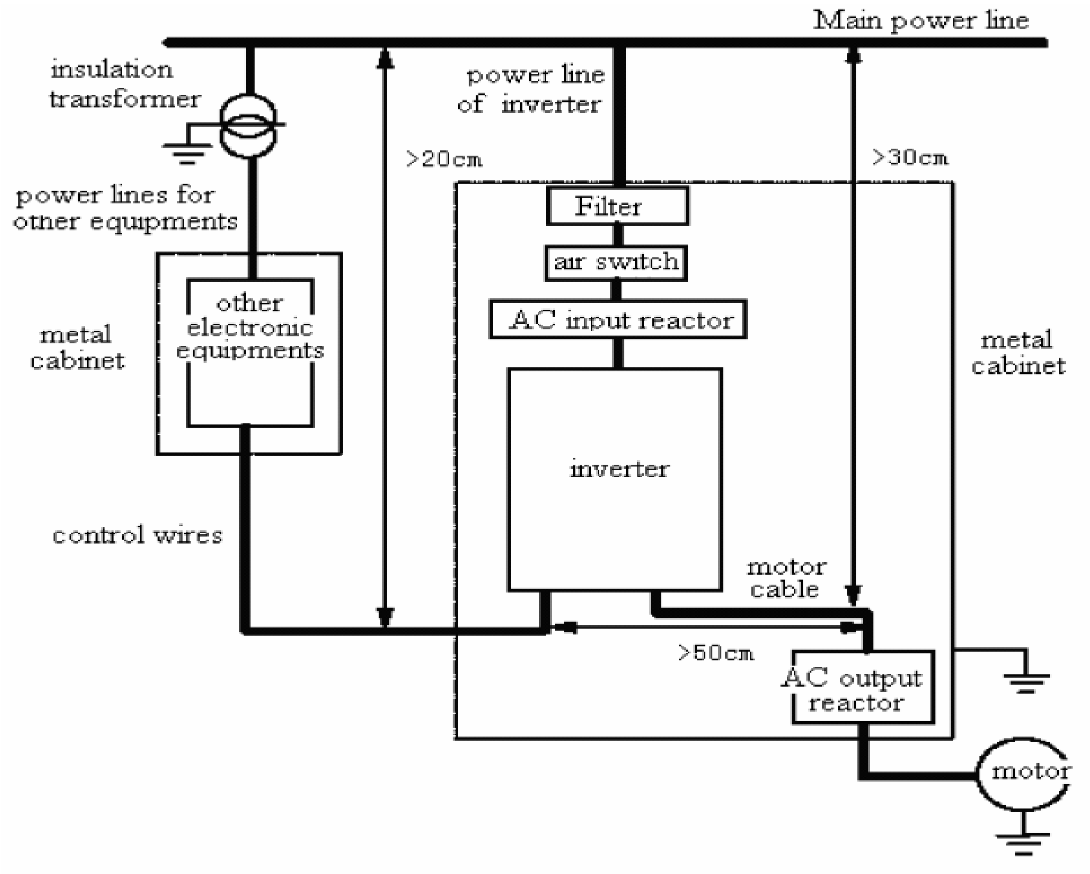


Figure 0.8 Electric Installation of the inverter

To meet EMC requirements, the following shall be noted during the installation:

(1) The inverter shall be installed in a cabinet, with its bottom and the housing of input filters fixed on the back panel of the cabinet, to ensure good electrical contacting. The distance between the inverter and the filter shall be as short as possible, no more than 15cm, thus minimizing the high frequency impedance between the two and reducing high-frequency noises.

(2) Install a wide PE terminal at the inlet of the cabinet (with the distance from the exit no longer than 5cm). The shield of all the incoming and outgoing cables of the cabinet shall be connected to the terminal with a 360° ring to ensure good electrical contacting.

(3) Shielded cables shall be used for the motor, preferably with a double shield of screw metal belt and metal net. The motor cable shield on the inverter side shall be connected to the back panel with the cable clamps in a 360° ring (as shown in Figure A.4). There shall be two fixing positions: one near the inverter (preferably less than 15cm), and the other on

the grounding terminal. The motor cable shield shall be connected to the grounded metal housing of the motor in a 360° ring when the motor end goes cross the terminal box. If it is too difficult, the shields may be braided and then flattened to connect the grounding terminal, with the width larger than 1/5 of the braid length. The bare cable core and the PE braid shall be as short as possible, preferably smaller than 5cm.

⑷ Shielded cables shall be used for terminal control. The shield shall be connected to the grounding terminal at the entry of the cabinet with metal cable clamps in a 360° ring. It may be connected to the metal housing of the inverter though metal cable clamps. If it is too difficult, the shields may be braided and then flattened to connect the grounding terminal, with the width larger than 1/5 of the braid length. The bare cable core and the PE braid shall be as short as possible, preferably smaller than 15cm.

⑸ The keyboard line may not go outside the shielded cabinet.

⑹ Holes on the cabinet shall be as small as possible, no larger than 15cm.

A.10 EMC Standards of iAStar-S3 Inverter

With appropriate input and output filters, AC reactor (types of both may be found in Optional Parts), and wired according to the precautions stated above, the iAStar-S3 Inverter can meet the following EMC requirements listed in Table A.2.

Table 0.2 EMC performance of **iAStar-S3 Inverter**

Item	Standard	Test specification
Conducted radio frequency	EN12015.1998	$0.15 \le f < 0.50 MHz, 100 dB(\mu v / m)$ Subaltern peak value $0.50 \le f < 5.0 MHz, 86 dB(\mu v / m)$ Subaltern peak value $5.0 \le f < 30 MHz, 90 \sim 70 dB(\mu v / m)$ Subaltern peak value
Radio frequency	EN12015.1998	$30 \le f < 230 MHz, 40 dB(\mu v / m)$ Subaltern peak value $230 \le f < 1000 MHz, 47 dB(\mu v / m)$ Subaltern peak value
Electrostatic discharge	EN12016.2004	Criterion B (contact discharge 4000V, air discharge 8000V)
Radio frequency radiated field	EN12016.2004	Level 3, Criterion A (3V/m)
Fast transient bust	EN12016.2004	Level 4, Criterion B (strong voltage ± 2 KV/2.5 kHz)
Surge voltage	EN12016.2004	Criterion B (±1KV)
Conduction noise	EN12016.2004	Criterion A (3V, 0.15～80MHz)

Appendix B Lists of Function Parameters, Running Status and Faults

This appendix is a collection of the function parameter list, running status list and fault list for the convenience of reference and application of the Inverter.

B.1 Function Parameter

Function Code	Name	Content	Range	Unit	Default	Remarks
A	**Advanced Menu**	**Display of the version of the digital operator, language selection, motor autotuning and mode selection (R/W).**				
A01	固件版本 Firmware Version	Inverter version. Set the following value and press Enter: 99.99: to reset all parameters to default value; 99.98: to clear all fault records; 88.88: no checking Inverter fan: 88.89: to check Inverter fan. Press ENTER to return to Inverter version. Refer to Note 1.	0～655.35	×	445.01	
A02	语言选择 Language Select	Select the display language of the operator: 0: English; 1: Chinese.	0 / 1	×	1	
A03	同步电机自整定 PMSM AutoTunning	Autotuning for synchronous motors: 0: normal operation; 3: completion of motor autotuning (A03 automatically changed to "3" after each autotuning process); 4: go to autotuning mode; 7: save encoder identification data for SIN/COS encoders; 9: go to SIN/COS encoder identification; 10: encoder identification status (A03 automatically changed to	0/4/7/9	×	0	

B

Lists of Function Parameters, Running-status and Faults

Function Code	Name	Content	Range	Unit	Default	Remarks
		"10" during encoder identification).				
A04	操作模式 Operate Mode	Set Inverter operation mode: 0: multi-step speed control; 1: analog voltage input (AI1) control; 2: reserved; 3: analog current input (AI3) control	0 / 1 / 3	×	1	
B	**Power Parameters**	**Rated power and rated output current (R, R/W).**				
B01	额定功率 Rated Power	Rated power, in kW. Read only.	2.2～37	kW	22.00	Read only.
B02	额定输出电流 Rated Current	Rated output current, in A. Read only.	6.2～80	A	48.00	
B03	零速保持时间 Zero Speed Delay	Delay from stop to output cutoff, in 5ms. =0: no delay, output directly through the enabling main control circuit; > 0: delay time to be set.		5ms	0	
B04	零速参考值 1 Zero Speed Ref.1	Threshold of B03 zero speed, in mm/s, also used as the first threshold for G function code = 8 or 108.			3	
B05	零速参考值 2 Zero Speed Ref.2	Speed in mm/s, used as the second threshold for G function code = 8 or 108.	0～65535	mm/s	40	
B06	频率检出值 SPD Agree Level	Frequency in mm/s, used as the threshold for G function code = 1 or 101.			200	
B07	接触器闭合延时 Contact on DLY	Delay from output contact closing to output starting and motor excitation starting when startup, in 5ms.		5ms	1	
B08	接触器断开延时 Contact off DLY	Delay from zero speed to output contact opening when stop, in 5ms.			0	
B09	反馈速度处理模式 FDBK SPD	Encoder signal processing mode: =0: special processing of SIN/COS signals;	0/2	×	2	

Function Code	Name	Content	Range	Unit	Default	Remarks
	mode	=2: normal mode.				
B10	系统配置参数 System Parameter	For internal use.		×	0	
B11	低速同步电机 Low Speed PMSM	Speed of synchronous motors: ： 0: speed ≥ 100 rpm; 1: speed < 100 rpm.	0/1	×	0	
B12	模拟量限幅 Analog in Limit	Limit to AI1 analog inputs: Corresponding to the analog voltage input at the highest given speed. When the input voltage exceeds this value, the speed remains at its highest level.	0～10000	×	10000	
B13	调节器模式 Adjust Mode	Adjusting mode: 0: synchronous motor when the speed ≥ 2m/s; 1: asynchronous motor, or synchronous motor when the speed ＜ 2m/s. 2, 3, 4: noise reduction of synchronous motors.	0/1/2/3/4	×	1	
B14	抱闸确认时间 Brake Time	Delay from the closing of brake contacts to the validation of the braking (or brake contactor) detection signal, in 5ms. This parameter is used for detection of contactor faults, for example, no signal detected during the time span indicating brake (or brake contactor) fault.	0～65535	5ms	0	
B15	张闸延时 Brake Open Dly	Delay from output starting and motor excitation starting to brake contactor closing or brake opening, in 5ms.				
B16	抱闸延时 Brake Close Dly	Delay from zero speed to brake contactor opening or brake closing, in 5ms.				
B17	系统配置参数 System Parameter	For internal use.	×	×	0	

Function Code	Name	Content	Range	Unit	Default	Remarks
C	**PI Tune Parameters**	**Parameters of the PI adjuster.**				
C01	零速比例 P0 Zero Speed P0	Starting compensation proportion: When E13 = 0 (without load device) and C02 (zero speed I0) > 0, effective during C14 (zero servo time) after the enabling signal becomes valid from starting.	0～655.35	×	100.00	
C02	零速积分 I0 Zero Speed I0	Starting compensation integral: Only when C02 > 0, the compensation function takes effect.	0～655.35	×	0.00	
C03	低速比例 1 P1 Slow Speed P1	Proportion at low speeds during acceleration (running frequency ≤ C11 low-speed switching point F1).	0～655.35	×	70.00	
C04	低速积分 1 I1 Slow Speed I1	Integral at low speeds during acceleration (running frequency ≤ C11 low-speed switching point F1).	0～655.35	×	10.00	
C05	低速比例 2 P2 Slow Speed P2	Proportion at low speeds during deceleration (running frequency ≤ C11 low-speed switching point F1).	0～655.35	×	70.00	
C06	低速积分 2 I2 Slow Speed I2	Integral at low speeds during deceleration (running frequency ≤ C11 low-speed switching point F1).			10.00	
C07	中速比例 P3 Mid Speed P3	Proportion at medium speeds (running frequency at C11 low-speed switching point F1 < proportion at C12 high-speed switching point F2).			120.00	
C08	中速积分 I3 Mid Speed I3	Integral at medium speeds (running frequency at C11 low-speed switching point F1 < proportion at C12 high-speed switching point F2).			15.00	
C09	高速比例 P4 High Speed P4	Proportion at high speeds (running frequency > high-speed switching point F2).			140.00	
C10	高速积分 I4 High Speed I4	Integral at high speeds (running frequency > high-speed switching point F2).			5.00	
C11	低速切换点 F1	Frequency switching point from low	0～15.00	Hz	0.50	

Function Code	Name	Content	Range	Unit	Default	Remarks
	Switch Freq. F1	speeds to medium speeds: used for proportion and integral switching from low to medium speed.				
C12	高速切换点 F2 Switch Freq. F2	Frequency switching point from medium speeds to high speeds: used for proportion and integral switching from medium to high speed.	15.00～50.00	Hz	25.00	
C13	电流环增益 Cur. Loop Gain	Current loop gain: Not to be modified for synchronous motors. Automatically set to “1”. For asynchronous motors, it may be modified within a specific range to reduce torque pulses in even speed zone.	0～200.00	×	5.00	
C14	零伺服时间 Zero Servo Time	Interval from enabling signal validation to the given speed curve.	0～10.000	s	0.800	
D	**Speed Parameters**	**Acceleration/deceleration, acceleration/deceleration rate, and various reference speeds (R/W)**				
D01	加速度 Acceleration	Acceleration of S Curve, in m/s^2.	0.000～0.850	m/s^2	0.650	
D02	减速度 Deceleration	Deceleration of S Curve, in m/s^2.				
D03	蠕动速度 Dwell Speed	Dwell speed at low speeds, in m/s.	0.000～0.200	m/s	0.012	
D04	S 曲线（加加速度 1） Acc ini jerk	Acceleration ini jerk of S Curve, in m/s^2.	0.000～0.850	m/s^3	0.650	
D05	S 曲线（加加速度 2） Acc end jerk	Acceleration end jerk of S Curve, in m/s^2.				
D06	S 曲线（减减速度 1） Dec ini jerk	Deceleration ini jerk of S Curve, in m/s^2.				
D07	S 曲线（减减速度 2） Dec end jerk	Deceleration end jerk of S Curve, in m/s^2.				
D08	蠕动时间	Dwell time at low speeds, in s.	0～10.000	s	0	

Function Code	Name	Content	Range	Unit	Default	Remarks
	Dwell Time					
D09	最高速度 Top Speeed	Rated speed or max. speed, in m/s.	0.000～3.000	m/s	1.750	
D10	曲线方式 Curve Mode	Reserved.	0	×	0	
D11	速度参考 0 Speed Ref.0	Reference speed 0 under multi-step control, in m/s.	0.000～3.000	m/s	0.000	
D12	速度参考 1 Speed Ref.1	Reference speed 1 under multi-step control, in m/s.			0.145	
D13	速度参考 2 Speed Ref. 2	Reference speed 2 under multi-step control, in m/s.			0.030	
D14	速度参考 3 Speed Ref. 3	Reference speed 3 under multi-step control, in m/s.			0.040	
D15	速度参考 4 Speed Ref. 4	Reference speed 4 under multi-step control, in m/s.			0.290	
D16	速度参考 5 Speed Ref. 5	Reference speed 5 under multi-step control, in m/s.			1.000	
D17	速度参考 6 Speed Ref. 6	Reference speed 6 under multi-step control, in m/s.			1.500	
D18	速度参考 7 Speed Ref. 7	Reference speed 7 under multi-step control, in m/s.			1.750	
E	**Motor Parameters**	**Carrier frequency, motor parameters, and encoder specifications (R/W).**				
E01	控制方式 Control Mode	Inverter control mode: 0: asynchronous motor; 1: synchronous motor.	0/1	×	0	
E02	电机极数 Num. of poles	Set the number of motor poles.	2～32	×	4	
E03	电机额定电压 Motor Rated Volt.	Set rated voltage of the motor, in V.	0～500	V	380	
E04	电机额定转速 Motor Rated RPM	Set rated speed of the motor, in rpm.	0～9999	rpm	1459	
E05	电机额定电流 Motor Rated Cur.	Set rated current of the motor, in A.	0～80.00	A	48	
E06	力矩限制 Tor. Output Lim.	Max. torque limit, percentage to the rated torque.	0～300	%	200	

Function Code	Name	Content	Range	Unit	Default	Remarks
E07	转差频率 Motor Slip Freq.	Set slip frequency, in Hz: Slip frequency = (synchronous speed — rated speed) × rated frequency ÷ synchronous speed.	0～10.00	Hz	1.40	
E08	载波频率 Carrier Freq.	Carrier frequency of Inverter output, in kHz.	4～15	kHz	8.0	
E09	编码器类型 Encoder Type	Set the encoder type: 0: increment, differential, SinCos; 1: CCW increment UVW; 2: CW increment UVW; 8: Endat absolute.	0～10	×	0	
E10	编码器规格 Encoder Spec.	Set the number of pulses per turn of the encoder.	0～9999	×	1024	
E11	初始相位角 Rotor Mag. Pos.	Record and display of the initial phase angle of synchronous motors.	0～360	°	0	
E12	PG 分频系数 PG Freq. Ratio	PG frequency ratio: Corresponding to 0 to 7 powers of 2.	0～7	×	0	
E13	预负载选择 Pre-torque Sel	Set pre-torque selection mode: 0: no load device; 2: analog signal of load device.	0/2	×	0	
F	**Digital Input Parameters**	**Functions of digital input ports (R/W)**				
F01	DI1 端口功能 DI1 Input Func.	Functions of digital input ports: 0: no function (the corresponding port invalid); 1: input of external deceleration signals; 2: NO input of brake (or brake contactor) detection signals; 102: NC input of brake (or brake contactor) detection signals; 3: input of multi-step port 0; 4: input of multi-step port 1; 5: input of multi-step port 2; 6: input of triggering signal for emergency power; 7: input of upward signals; 8: input of downward signals; 9: input of running (enabling)	0～12	×	0	。
F02	DI2 端口功能 DI2 Input Func.				0	
F03	DI3 端口功能 DI3 Input Func.				3	
F04	DI4 端口功能 DI4 Input Func.				4	
F05	DI5 端口功能 DI5 Input Func.				5	
F06	DI6 端口功能 DI6 Input Func.				0	
F07	DI7 端口功能 DI7 Input Func.				7	
F08	DI8 端口功能 DI8 Input Func.				8	

Function Code	Name	Content	Range	Unit	Default	Remarks
F09	DI9 端口功能 DI9 Input Func.	signals; 10: NO input of base blocking signals; 110: NC input of base blocking signals; 11: NO input of output contactor detection; 111: NC input of output contactor detection; 12: input of fault reset signals.			9	
F10	DI10 端口功能 DI10 Input Func.				0	
F11	DI11 端口功能 DI11 Input Func.				0	
F12	DI12 端口功能 DI12 Input Func.				0	
G	**Digital Output Parameters**	**Functions of digital output ports (R/W).**				
G01	DO1 端口功能 DO1 Output Func.	Functions of the digital output ports: 0: the corresponding port not used; Other values are explained in Note 1 below.	0/1～8/ 101～108	×	0	
G02	DO2 端口功能 DO2 Output Func.				2	
G03	DO3 端口功能 DO3 Output Func.				3	
G04	DO4 端口功能 DO4 Output Func.				0	
G05	DO5 端口功能 DO5 Output Func.				0	
G06	DO6 端口功能 DO6 Output Func.				0	
H	**Analog Input Parameters**	**Functions of analog input ports (R/W).**				
H01	AI1 功能 AI1 Func.	Function of analog voltage input port AI1: 0: speed given through analog voltage	0	×	0	
H02	AI1 模拟量偏置	Analog offset of analog voltage	0～20.000	×	10.000	

Function Code	Name	Content	Range	Unit	Default	Remarks
	AI1 Offset	input port AI1.				
H03	AI1 模拟量增益 AI1 Gain	Analog gain of analog voltage input port AI1.	0～1.00	×	1.00	
H04	AI1 模拟量滤波 AI1 Filter Time	Filter time of the analog input by analog voltage input port AI1, in ms.	5～45	ms	20	
H05	预负载补偿方向	Pre-load compensation direction of analog signal of load device for analog voltage input port AI2: 0: positive compensation; 1: negative compensation.	0/1	×	0	
	Pre-tor. Direc.					
H06	AI2 模拟量偏置 AI2 Offset	Analog offset of analog voltage input port AI2.	0～20.000	×	10	
H07	AI2 模拟量增益 AI2 Gain	Analog gain of analog voltage input port AI2.	0～1.00	×	1	
H08	AI2 模拟量滤波 AI2 Filter Time	Filter time of the analog input by analog voltage input port AI2, in ms.	5～45	ms	20	
H09	AI3 功能 AI3 Func.	Function of analog current input port AI3: 0: speed given through analog current	0	×	0	
H10	AI3 模拟量偏置 AI3 Offset	Analog offset of analog current input port AI3.	0～20.000	×	10.000	
H11	AI3 模拟量增益 AI3 Gain	Analog gain of analog current input port AI3.	0～1.00	×	1.00	
H12	AI3 模拟量滤波 AI3 Filter Time	Filter time of the analog input by analog current input port AI3, in ms.	5～45	ms	20	
I	**Analog Output Parameters**	**Functions of analog output ports (R/W).**				
I01	AO1 端口功能 AO1 Func.	Functions of the analog output ports: 0: speed given 1: speed given after filtering 2: speed feedback 3: output torque 4: compensation torque for zero-speed starting 5: reserved	0～13	×	0	
I02	A02 端口功能 AO2 Func.					

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Lists of Function Parameters, Running-status and Faults

Function Code	Name	Content	Range	Unit	Default	Remarks
		6: reserved 7: reserved 8: output current of phase-V 9: output current of phase-U 10: reserved 11: signal of analog input port 1(AI1) 12: signal of analog input port 2 (AI2) 13: signal of analog input port 3 (AI3)				
J	**Error Buffer Parameters**	**To keep a record of the latest 20 error codes (R).**				
J01	故障记录 1 Error Buffer1	Recent error buffer 1			0	
J02	故障记录 2 Error Buffer2	Recent error buffer 2			0	
J03	故障记录 3 Error Buffer3	Recent error buffer 3			0	
J04	故障记录 4 Error Buffer4	Recent error buffer 4			0	
J05	故障记录 5 Error Buffer5	Recent error buffer 5			0	
J06	故障记录 6 Error Buffer6	Recent error buffer 6			0	
J07	故障记录 7 Error Buffer7	Recent error buffer 7			0	
J08	故障记录 8 Error Buffer8	Recent error buffer 8			0	
J09	故障记录 9 Error Buffer9	Recent error buffer 9			0	
J10	故障记录 10 Error Buffer10	Recent error buffer 10			0	
J11	故障记录 11 Error Buffer11	Recent error buffer 11			0	
J12	故障记录 12 Error Buffer12	Recent error buffer 12			0	
J13	故障记录 13 Error Buffer13	Recent error buffer 13			0	
J14	故障记录 14	Recent error buffer 14			0	

Function Code	Name	Content	Range	Unit	Default	Remarks
	Error Buffer14					
J15	故障记录 15 Error Buffer15	Recent error buffer 15			0	
J16	故障记录 16 Error Buffer16	Recent error buffer 16			0	
J17	故障记录 17 Error Buffer17	Recent error buffer 17			0	
J18	故障记录 18 Error Buffer18	Recent error buffer 18			0	
J19	故障记录 19 Error Buffer19	Recent error buffer 19			0	
J20	故障记录 20 Error Buffer20	Recent error buffer 20			0	
K	**Function parameters**	**Function parameters (R/W)**				
K01~K04	1387 编码器数据 01~04 Sin/CosEncoder01~04	Synchronous 1387 encoder self-learning data	×	×	×	
K05~K06	HUW 同步编码器数据 01~02 UVW Encoder D01~02	Synchronous UVW encoder self-learning data	×	×	×	
K07~K12	HUW 同步编码器数据 03~08 UVW Encoder D03~08	Synchronous UVW encoder self-learning data	×	×	×	
K13-K18	HUW 同步编码器数据 09~14 UVW Encoder D09~14	Synchronous UVW encoder self-learning data	×	×	×	
K19-K21	HUW 同步编码器数据 15~17 UVW Encoder D15~17	Synchronous UVW encoder self-learning data	×	×	×	
K22	风扇检测使能 Fan Detec Enable	Enabling signal for fan checking =0: no checking =1: checking	0/1	×	1	

Function Code	Name	Content	Range	Unit	Default	Remarks
K23	速度标定处理 Speed Dev Scale	Speed scaling =1: normal =2: half, where there is heavy interference to the field encoder	1/2	×	1	
K24	电流环增益 2 CurrentLoop Gain	Current loop gain 2 A lower gain may reduce the noise during low-speed running of the motor. Do not make it too low, as long as the noise is eliminated. A higher B16 may increase the output torque of low-power inverters (below 5.5kW). Do not make it too high, as long as the torque meets relevant requirement.	45~300	×	100	
K25	电流缓降时间 SoftShutdownTime	Soft shutdown time If necessary, set to 500 ～ 800	0~400	ms	0	
K26	输入电压缺相确认 Supply Loss Time	Confirmation time of supply phase loss (29)	0~200	20ms	10	
K27	反馈模式切换 Fbk Cal Mode	QEP or Capture switching =0: QEP =1: Capture, for synchronous UVW encoders only	0/1	×	0	
K28	输入缺相电压设置 Supply loss Set	Supply loss setting	50～500	V	90	
K29	模拟量丢失斜率 Analog Loss Set	Analog loss (disconnection) setting	0～100	mm /5ms	10	
K30	速度反馈滤波 Fbk Speed Filter	Feedback speed filter (for EnDat and 1387 encoders) =0: invalid, no filtering =1: valid, filtering of feedback	0/1	×	0	

Function Code	Name	Content	Range	Unit	Default	Remarks
K31	输出电流异常确认 Surge Cur Times	Occurrences of abnormal current output B11 < 60000: normal protection B11 >= 60000: protection disabled	0 ～ 65535	次	5000	
K32	数字速度切换模式 Digi Ref Mode	With the speed given through digital signals, whether the speed may be switched =0: acceleration not allowed during deceleration =1: any switching allowed	0/1	×	1	
K33	过调制功能 Overshoot Enable	Overshoot =0: disabled =1: enabled	0/1	×	0	
K34	保护功能是否有效 Protect Action	Protection bit0 ＝ 0: software over-current (27) enabled bit0 ＝ 1: software over-current (27) disabled bit1＝0: the Inverter will automatically cancel the fault signal when the voltage reaches specific level bit1＝1: the Inverter will not cancel any fault signal of under voltage bit2 ＝ 0: wrong phase sequence of c and d of 1387 encoder (28) enabled bit2 ＝ 1: wrong phase sequence of c and d of 1387 encoder (28) disabled	0 ～ 65535	×	0	
K35	输出缺相故障确认 Output Loss time	Confirmation time of output phase loss	0 ～ 20000	ms	5000	

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Lists of Function Parameters, Running-status and Faults

Function Code	Name	Content	Range	Unit	Default	Remarks
K36	检测制动单元标志 BrakingUnit Flag	Whether to check the braking unit at first power on 0: no checking 1: checking	0 / 1	×	1	
K37	故障自动复位次数 Auto Reset Times	Auto reset times	0～10	次	3	
K39	编码器断线保护阀值百分比值 PGO Action	When given the speed of the motor rated speed is less than K39, the 12 fault discrimination does not work, only the effective induction motor	0～10	%	2	

B.2 Running Status List

Function Code	Name	Content	Range	Unit	Default	Remarks
U00	反馈速度 Feedback Speed	Monitor feedback speed of the motor, in rpm.	×	rpm	×	
U01	指令速度 0 Ref. Speed 0	Monitor the speed given by motor command, in rpm.	×	rpm	×	
U02	指令速度 1 Ref. Speed 1	Monitor the speed given by motor command after filtering, in rpm.	×	rpm	×	
U03	速度偏差 Speed Deviate	Monitor the difference between feedback speed and the speed given by the command, in rpm.	×	rpm	×	
U04	输出电流 Output Current	Monitor Inverter output current, in A.	×	A	×	
U05	力矩偏置 Torque Offset	Monitor servo output torque, in %.	×	%	×	
U06	输出力矩 Output Torque	Monitor torque output under vector control, in %.	×	%	×	
U07	直流母线电压 DC BUS Voltage	Monitor DC voltage of the Inverter internal main circuit, in V.	×	V	×	
U08	AI1 输入电压 Ai1 Voltage	Monitor analog voltage input 1, in V.	×	V	×	

Function Code	Name	Content	Range	Unit	Default	Remarks
U09	AI2 输入电压 Ai2 Voltage	Monitor analog voltage input 2, in V.	×	V	×	
U10	AI3 输入电流 Ai3 Current	Monitor analog current input, in mA.	×	A	×	
U11	输入 DI1- DI12 Input DI1-DI12	Display status of digital input ports DI1 - DI12. U11 displayed in "XXXXXXXXXXXX", where, "X" = 0, indicating no input; "X" = 1, indicating input.	×	×	×	Combined with F parameters
U12	输出 DO1-DO6 Output DO1-DO6	Display status of output ports DO1 - DO6. U12 displayed in "XXXXXX", where, "X" = 0, indicating no output; "X" = 1, indicating output.	×	×	×	Combined with G parameters
U13	输出电压相位 Voltage Phase	Phase of output voltage, in Deg.	×	Deg.	×	
U14	输出电流相位 Current Phase	Phase of output current, in Deg.	×	Deg.	×	
U15	散热器温度 Radiator Temp	Display radiator temperature.	×	℃	×	

Appendix C Conformities of the Inverter

1. European low voltage directives

iAStar-S3 Inverter conforms to low voltage standards in 73/23/EEC and the revised 98/68/EEC. The Inverter also meets the requirements of the following standard:

EN61800-5-1: Adjustable Speed Electrical Power Drive Systems Part 5-1: Safety Requirements - Electrical, Thermal and Energy.

2. European EMC Standards

When installed as specified in this manual, **iAStar** Inverter meet the following EMC requirements:

EN12015.1998 Electromagnetic compatibility-Product family standard for lifts, escalators and passenger conveyors-Emission. (22kW inverters for elevators only）

EN12016.2004 Electromagnetic compatibility-Product family standard for lifts, escalators and passenger conveyors-Immunity. （22kW inverters for elevators only）

EN61800-3: Adjustable Speed Electrical Power Drive Systems Part 3 (5.5/7.5kW, 11/15kW inverter for elevators)

North American Safety Standards

iAStar Inverter has passed UL safety certifications. It conforms to the following standards:

UL508: Industrial Control Equipment

UL508C: Power Conversion Equipment

ISO9001 Quality Control System

STEP manages its quality control system according to requirements in **ISO9001**.

Notice to the Customer

Dear customers,

RoHS, abbreviation of *The Restriction of the use of certain hazardous substances in electrical and electronic equipment*, was put into effect by the European Union on 1st, July, 2006 to specify the content limitations of lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyl (PBB) and polybrominated diphenyl ethers (PBDE) in electrical and electronic equipment newly put into market.

On February 28th 2006, *Electronic Information Products Pollution Control Management Measures*, the Chinese version of RoHS, was issued jointly by Ministry of Information Industry, National Development and Reform Commission, Ministry of Commerce, General Administration of Customs, State Administration for Industry & Commerce, General Administration of Quality Supervision, Inspection and Quarantine, and Ministry of Environmental Protection, which has been put into force mandatorily. On February 1st 2008, *Measures on Prevention and Control of Pollution Caused by Disused Electronic Waste* was put into effect by the Ministry of Environmental Protection, which specifies that the user of electronic and electrical products shall submit or delegate the submission of electronic waste to a listed (including the temporary list) disposing organization with adequate business capacity (including private ones) for dismantling, recycling or disposal.

In terms of the selection and purchasing of electronics, PCB, wire bunches, and structural parts, our products meet the requirements in *Electronic Information Products Pollution Control Management Measures* and RoHS, with strict control over the content of lead, mercury, cadmium, hexavalent chromium, PBB and PBDE. At the same time, lead-free welding technique has been used in the welding of PCBs on the Xinchi Lead-free Welding Line.

Possible toxic or harmful substances in the following parts are listed in the table:

Part	Electronics	PCB	Sheet metal parts	Radiator	Plastics	Conductor
Possible toxic or harmful substances	Lead, mercury, cadmium, hexavalent chromium, PBB and PBDE					

I. Assessment of environmental impact

Our electronics will generate heat during their application, and may emit certain harmful substances, but these do not form serious impact to the surroundings. However, the heavy metals and toxic chemicals after the life end and disposal of the electronics will cause heavy pollution to soil and waters.

II. Service life of electronic products and equipment

Any electronic product or equipment has a certain life cycle, after which it will be damaged and disposed. It will be replaced by more advanced products even its service life has not ended. Our electronics generally have a service life of no more than 20 years.

III. Disposal of electronics

Inappropriate disposal of electronics will cause pollution to the environment. We require that the user establish a recycling system according to relevant national regulations and may not dispose the electronic as general domestic wastes or industrial wastes. Requirements in *Measures on Prevention and Control of Pollution Caused by Disused Electronic Waste* shall be strictly followed in terms of storage, application, and unified disposal by a qualified organization in an environment-friendly way. Persons or organizations without adequate qualifications may not undertake dismantling, application and disposal of electronic wastes.

Electronic wastes may not be disposed with general domestic wastes. Please contact local organizations of disposal or environmental protection for suggestions concerning the treatment of electronic wastes.

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