EP Series Intelligent Flexible Inverter Instructions

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Thank you very much for purchasing the STEP EP series intelligent flexible inverter.

To ensure the correct installation and use of the EP series intelligent flexible inverter, please read this instruction manual carefully and use the product only after understanding the safety precautions of the product.

statement

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During the editing and review process, Shanghai Sigriner STEP Electric Co., Ltd. (hereinafter referred to as "STEP") has carefully reviewed the contents of this manual for consistency with the hardware and software described. However, oversights may exist. We will regularly review the contents of this manual and incorporate necessary corrections in future revisions. Suggestions for improvement are welcome.

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Our website: www.stepelectric.com.

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Warranty coverage

Troubleshooting

In principle, the initial fault diagnosis should be performed by the user.

However, upon user's request, STEP or STEP's service network may provide paid services.

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Version Change History

Revision Date	Data Version	Corresponding software version	Information changes
2025-10	V3.0	P95.02=7.05	Update content: 4.1.2.2 Input Protection Fuse and Circuit Breaker Selection Guide 4.2.1 Inverter terminal wiring diagram 4.5.1 Arrangement of control circuit terminals 4.5.1 IO-B board dip switch description 4.5.2 Control circuit terminal number 4.5.3 Control circuit terminal function description 5.1 Run command description 6.2.2.2 Modify the default value of P11 group startup parameter P11.15 6.2.2.5 Modify the description of P14.11 parameter and the attributes of P14.12 and P14.13 parameters in Group P14 V/F 6.2.2.7 Modify the default value of P16.01, the field weakening parameter of Group P16 6.2.2.9 Modify the default values of GVC parameters P17.00 and P17.05 in Group P17 6.2.3.3 Modification of the default value of P22.05 auxiliary parameter in group P22 6.2.8.2 P71 Group Special Functions P71.06, P71.45 Default Value Modification P71.14 Modification Option Description 6.2.10.5 P94 Group Fault Handling P94.05, P94.12, P94.19 Default Value Modification Update full parameter parsing New content: P53 Added PNP wiring function usage requirements P63 fault display adds STO display P68 6.2.2.5 Newly added P14.15-P14.19 to the V/F parameters in Group P14 P69 6.2.2.6 Newly added P15.17-P15.23 to P15.15 SVC parameters P70 6.2.2.7 Newly added P16.04-P16.05 to P16 group magnetic weakening parameters P70 6.2.3.1 P20 group general parameters added P20.27 P81 Added 6.2.5.2 P42 group simple PLC function P87 6.2.8.1 Newly added P70.15-P10.18 for group P70 restrictions and protections P88 6.2.8.2 P71 group special functions added P71.04, P71.17-P71.20, P71.37, P71.38, P71.43 P90 6.2.9.2 P81 Group Modbus Communication Parameters P81.05-P81.24 P91 6.2.9.3 P82 Group (Reserved Parameter Group) P82.06 Full text errata
2025-12	V3.1	P95.02=7.06	New Additions: 6.2.2.2 P11 Group - Added P11.18 Start Delay Time Added output terminal function code 45, motor fan control Added input terminal function code 10, motor fan feedback detection Added alarm #36, motor fan fault Added Appendix F EtherCAT Debugging Guide Errata for the entire text

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Chapter 1 Safety Instructions

This section lists the safety instructions and precautions you should pay attention to when using the intelligent flexible inverter. These instructions are divided into safety-related marking instructions, usage, arrival confirmation, transportation and storage, installation, wiring safety instructions, commissioning / operation, troubleshooting, and product disposal. To ensure personal safety and extend the service life of the equipment and its connected devices, please be sure to read the following safety rules and warnings, as well as all warning signs affixed to the equipment, before installing and commissioning the inverter. Please read this information carefully.

1.1 Safety-related marking instructions

In this instruction manual, the following symbols are used for safety-related content. Statements marked with safety symbols are important and must be followed.

Indicates that incorrect use may cause a dangerous situation that may result in personal injury or even death.

Indicates that incorrect use may result in moderate personal injury and equipment damage.

Indicates the parts that users need to comply with and pay special attention to.

Furthermore, even 

minor incidents may lead to serious accidents depending on the circumstances.

1.2 Safety

1.2.1 Purpose

This series of inverters are used to control the variable speed operation of three-phase motors and cannot be used for single-phase motors or other purposes. Otherwise, it may cause inverter failure or fire.

This series of inverters cannot be simply used in medical devices and other occasions that are directly related to personal safety.

This series of inverters are produced under a strict quality management system. If the failure of the inverter may cause a major accident or loss, it is necessary to set up safety measures such as redundancy or bypass to prevent it.

1.2.2 Arrival Inspection

The delivered goods must be intact and in full compliance with the information on the purchase order. If the goods are found to be damaged or inconsistent with the information on the purchase order, please contact the manufacturer or supplier immediately to resolve the issue.

If the delivered equipment is damaged or missing parts, it must not be installed and put into use, otherwise an accident may occur.

1.2.3 Transportation and storage

Please avoid severe vibration and impact during transportation.

If the device is found to be damaged, notify the transport company immediately.

The transportation and storage of the equipment must meet the specified environmental conditions.

If the device is stored for more than 1 year, the capacitor must be recharged.

1.2.4 Installation

Be careful of fire or electric shock!

Do not install the device in areas with flammable or explosive materials, or areas that are exposed to water or corrosion.

注意

When transporting or installing, please focus on the bottom of the product to prevent the inverter from being hit or damaged.

Do not install the device in an area subject to continuous vibration, shock, or electromagnetic interference.

The inverter should be installed on flame retardant materials such as metal, away from flammable objects and heat sources.

Be careful of fire! Make sure there is no debris (such as wood chips, iron filings, dust, paper, etc.) inside the inverter and on its heat sink.

A certain amount of clearance must be left between inverters and between an inverter and another device or the inner wall of an electrical cabinet . (For specific clearance requirements, see Installation Position and Spacing 3.2.2.)

Do not install the inverter horizontally.

1.2.5 Electrical wiring

危险

Wiring work must be performed by qualified electrical engineers, otherwise there is a risk of electric shock or damage to the inverter.

Before wiring, make sure the power is off, otherwise there may be a risk of electric shock or fire.

The grounding terminal PE must be reliably grounded, otherwise the inverter casing may be electrified.

Do not touch the main circuit terminals, and do not allow the main circuit terminal wiring to come into contact with the casing; otherwise, there is a risk of electric shock.

If the power is turned on with the operation signal connected, the motor will automatically start running. Therefore, please make sure that the operation signal is off before turning the power on. Otherwise, there is a risk of personal injury.

When setting a 3-wire sequential control, please set the parameters of the multi-function input terminal before wiring the control circuit. Otherwise, personal injury may occur due to motor rotation.

1.2.6 Trial run

注意

Do not connect the power input cable to the U / T1 , V /T2, W /T3 motor terminals, nor connect the motor cable to the R/ L1 , S/ L2 , T/ L3 power input terminals.

Power cables and signal cables must be laid in different cable ducts with a minimum spacing of 30 cm between them. Connected cables must not come into contact with rotating mechanical parts.

It is absolutely forbidden to connect capacitors or phase-advanced LC/RC noise filters to the output end of the inverter, otherwise the internal components of the inverter will be damaged.

Please use crimping terminals with insulating sleeves for main circuit terminal wiring.

When selecting the input and output cables of the inverter, please select cables with appropriate cross-sections according to the inverter power.

When the cable length between the inverter and the motor exceeds 100m or when multiple motors are running, it is recommended to use an output reactor to prevent

overcurrent from excessive distributed capacitance, causing inverter failure.

Do not use loads other than three-phase AC motors.

When performing rotary self-learning, please make sure to remove the load. Before the end of the self-learning, the motor will repeatedly run and stop, so please do not touch the motor. Otherwise, there is a risk of personal injury.

Please turn on the power only after confirming that the front cover has been installed. Do not remove the cover when the power is on, otherwise there is a risk of electric shock.

Please prepare an emergency stop switch separately (the stop button is only valid when the function is set).

Please reset the alarm only after confirming that the operating signal has been cut off, otherwise there may be a risk of personal injury.

The motor must be debugged with no load before it can be debugged with load.

Do not touch the inverter heat sink, motor or other high-temperature components while the equipment is still running or for a period of time after a power outage to avoid burns.

Do not start or stop the inverter by repeatedly turning the power on and off; otherwise, the equipment / system may be damaged.

Before operation, please confirm whether the motor and machinery are within the permitted range of use, otherwise the equipment may be damaged.

When used on lifting equipment, please also configure a mechanical brake device.

Do not change the inverter parameters at will. Most of the inverter's factory-set parameters can meet the operating requirements. You only need to set some necessary parameters. Randomly modifying parameters may cause damage to the mechanical equipment.

1.2.7 Maintenance and Inspection

There are high-voltage terminals in the inverter terminals, so please do not touch them at will, otherwise there will be a risk of electric shock.

When the power is on, be sure to install the protective cover. In addition, when removing the protective cover, be sure to disconnect the circuit breaker for wiring, otherwise there is a risk of electric shock.

After cutting off the power supply of the main circuit, wait for at least 10 minutes and confirm that the charging indicator light on the front cover is off before carrying out maintenance and inspection. Otherwise, there will be residual voltage on the capacitor

and there will be a danger of contact.

Except for designated personnel, no one else is allowed to repair, inspect or replace parts. Before operation, please remove any metal jewelry (watches, rings, etc.). When operating, please use insulated tools to avoid the risk of electric shock.

There are CMOS large-scale integrated circuits on the circuit board. Do not touch it with your hands to prevent static electricity from damaging the circuit board.

1.2.8 Scrap disposal

The electrolytic capacitors in the main circuit and on the printed circuit board may explode when burned. Plastic parts may produce toxic gases when burned. Disposal of this equipment must comply with the laws and regulations of the relevant environmental protection authorities regarding the disposal of industrial electronic waste.

1.2.9 Compliance with the Low Voltage Directive

Our products meet the requirements of IEC 61800-5-1:2007+A1:2016 standards and thus comply with the Low Voltage Directive 2014 / 35 / EU.

If the inverter is integrated as a component in the entire electrical system, please ensure that the entire system complies with the requirements of the EC directive.

Also note:

① Make sure the machine is grounded and the grounding terminal is grounded separately.

②The inverter is prohibited from △ grounding and used in IT power systems.

③If installed in a cabinet, make sure the cabinet is grounded.

④ Please use circuit breakers, electromagnetic contactors and other accessories that comply with CE certification. Please choose leakage circuit breakers. Use type B leakage circuit breaker.

The inverter should be used under the conditions of overvoltage category III and pollution degree II. The protection level of the inverter is Class I protection.

1.2.10 Others

Do not place the inverter in an environment with halogen (fluorine, chlorine, bromine, iodine) under any circumstances during transportation or installation. Otherwise, the inverter may be damaged or components may be burned.

1.3 Notes

1.3.1 Motor insulation inspection

Motor insulation inspections should be performed when the motor is used for the first time, after being stored for an extended period, and during regular inspections to prevent damage to the inverter due to insulation failure in the motor windings. During insulation inspections, be sure to disconnect the motor wiring from the inverter. A 500V megohmmeter is recommended. Ensure the measured insulation resistance is no less than 5MΩ.

1.3.2 Thermal protection of motor

If the rated capacity of the selected motor does not match that of the intelligent flexible inverter, especially when the rated power of the inverter is greater than the rated power of the motor, be sure to adjust the motor protection parameter values of the intelligent flexible inverter or install a thermal relay in front of the motor to protect the motor.

1.3.3 About motor heating and noise

Because the inverter output voltage is a PWM wave and contains certain harmonics, the temperature rise, noise and vibration of the motor will increase slightly compared with the industrial frequency operation.

When a conventional motor is driven by a frequency converter and operates at low speed for a long period of time, the motor's heat dissipation becomes poor and the motor temperature rises. If long-term operation at low speed and constant torque is required, a variable frequency motor or forced air cooling must be used.

1.3.4 Input and Output Notes

The output of intelligent flexible inverter is a PWM wave. If capacitors to improve power factor or varistors for lightning protection are installed on the output side, it may cause instantaneous overcurrent or even damage the inverter. Please do not use them.

The schematic diagram of not connecting capacitors to the inverter output side is shown in Figure 1-1.

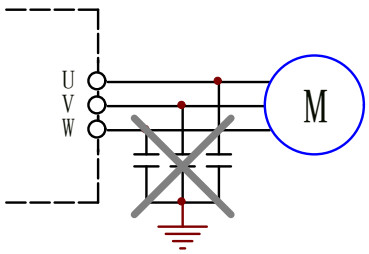


Figure 1-1 Schematic diagram of not connecting capacitors to the inverter output side

If a contactor is installed between the power supply and the inverter input terminal, it is not allowed to use this contactor to control the start and stop of the inverter.

If a switching device such as a contactor is installed between the output terminal and the motor, ensure that the inverter is turned on and off when there is no output. Do not allow the contactor to be closed when the inverter is outputting, otherwise it may easily cause damage to the module.

It is recommended to control the start and stop of the inverter through the terminals. It is strictly prohibited to use contactors or other switching devices on the input side of the inverter to start and stop frequently directly, otherwise it will cause damage to the equipment.

1.3.5 Use outside the rated voltage

If the external voltage is not within the allowable operating voltage range specified in this manual, the intelligent flexible inverter may be damaged. If necessary, use the corresponding step-up or step-down device to transform the voltage.

1.3.6 Lightning surge protection

This series of inverters has a built-in lightning overcurrent protection device, which has a certain degree of self-protection against induced lightning. In areas where lightning is frequent, customers should also install protection at the front end of the inverter.

1.3.7 Leakage Protection

When the inverter is running, high-speed switching will occur, which inevitably generates high-frequency leakage current, sometimes causing the leakage protection circuit to malfunction. When encountering this problem, in addition to appropriately reducing the carrier frequency and shortening the leads, the leakage protector should also be properly installed.

When installing a leakage protector, pay attention to the following points:

- The leakage protector should be installed on the input side of the inverter, and it is more appropriate to place it after the air switch (fuseless circuit breaker).
- The leakage protector should be a model that is insensitive to high-order harmonics or a special leakage protector for inverters. If a common leakage protector is used, it should have a leakage current detection value of at least 200mA and an operating time of at least 0.1s.

1.3.8 Derating

When the ambient temperature of EP6 series is within 50℃, the inverter will not be derated; when it exceeds 50℃, the rated current will be reduced by 1% for every 1℃ increase, and the maximum allowable temperature is 60℃.

In areas with an altitude of less than 1000m, the inverter does not derate. Above 1000m, the rated current is reduced by 1% for every 100m increase in altitude. The maximum allowable altitude is 2000m.

1.3.9 About Motor Adaptation

This inverter is suitable for three-phase AC motors. Please select the inverter according to the motor nameplate.

The default motor parameters built into the inverter are those of an asynchronous motor. However, depending on the actual situation, it is necessary to identify the motor parameters or modify the default values to match the actual values. Otherwise, the operating effect and protection performance will be affected.

A short circuit in the cable or motor can cause the inverter to alarm or even damage it. Therefore, please first perform an insulation short-circuit test on the motor and cable after initial installation. This test should also be performed regularly during routine maintenance. Note that when performing this test, the inverter must be completely disconnected from the tested part.

Chapter 2 Product Overview

The EP series intelligent flexible inverter is a 400V-class (380V to 480V) high-performance vector inverter suitable for three-phase asynchronous motors, permanent magnet synchronous motors, and synchronous reluctance motors with motor capacities ranging from 1.1 to 355kW. With factory default settings, the intelligent flexible inverter provides an ideal solution for many simple motor control applications. By configuring relevant parameters, it can also be used for more advanced motor control operations.

2.1 Nameplate Description

The nameplate is attached to the side of the inverter. It records the inverter model, specifications, batch number, manufacturing code and other information.

Figure 2-1 Inverter nameplate (example)

2.1.1 Product nameplate description

The inverter's nameplate records the inverter's model, specifications, batch number, etc. Nameplate parameter description:

Figure 2-2 Inverter nameplate description

2.1.2 Product Specifications

In the "Inverter Specifications" column on the nameplate, numbers and letters are used to indicate the voltage level and rated current value of the inverter.

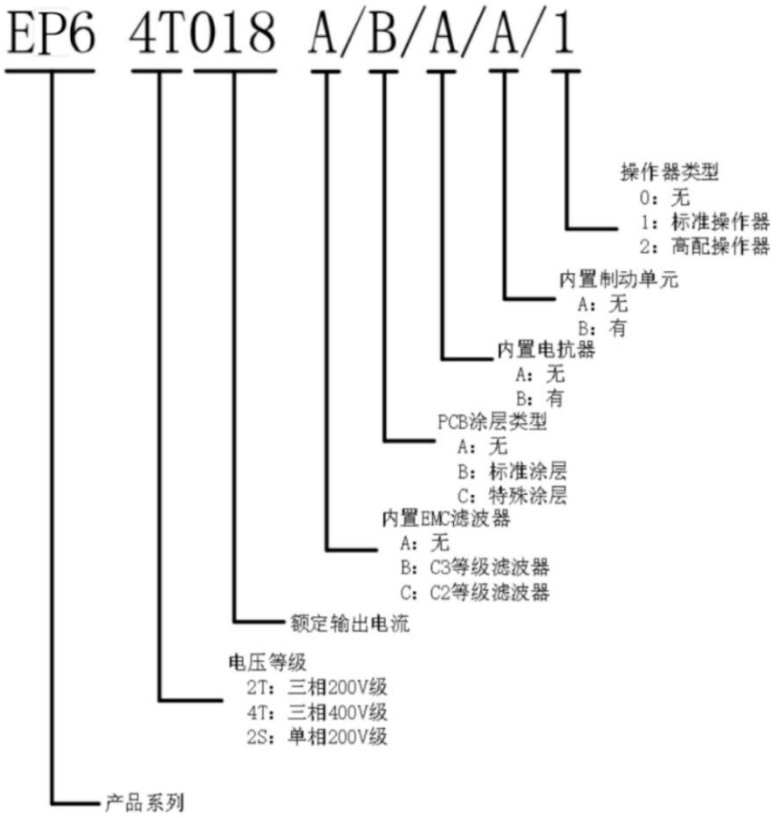


Table 2.1 Inverter specification series

Framework	frequency converter model	EP6 series (heavy load)			
		EP6 rated input current (A)	Rated output Current (A)	Adaptable motor Power (kW)	Overload 150% (1min)
F 0	4T4A1	3.7	3.1	1.1	4.65
	4T5A6	5.0	4.1	1.5	6.15
	4T7A2	6.9	5.6	2.2	8.4
	4T9A4	9	7.2	3	10.8
	4 T012	11.9	9.4	4	14.1
F1	4T018	15.9	14.8	5.5	22.2
	4T023	20.8	18	7.5	27
F2	4T031	29.7	23	11	34.5
	4T039	40.4	31	15	46.5
F3	4T045	50.2	39	18.5	58.5
	4T060	41.4	45	22	67.5
F4	4T075	56.5	60	30	90
F5	4T089	69.6	75	37	112.5
	4T103	85	91	45	136.5
F6	4T140	106	112	55	168
	4T168	139	150	75	225
F7	4T208	168	180	90	270
	4T250	202	216	110	324
F8	4T304	246	260	132	390
	4T377	287	304	160	456
F9	4T414	365	377	200	565.5
	4T477	398	414	220	621
	4T520	452	477	250	715.5
F10	4T605	495	520	280	780
	4T675	584	605	315	907.5

Note: EP6 series ≥ 22kW are equipped with built-in DC reactor as standard .

2.2 Technical indicators and specifications of inverter

Power input	Input voltage	380 - 480V (-15% to +10%), three-phase TN, TT
	Input frequency	50/60Hz (±5%)
	Allowable voltage fluctuation	Voltage imbalance <±3%

Power output	Voltage	0VAC ~input voltage
	Overload level	Heavy load 150%, 1min/10min; light load 110%, 1min/ 10min
	Efficiency (full load)	96%-99%
	Output frequency accuracy	±0.01Hz

Control characteristics	Control method	GVC	SVC	FOC
	Starting torque	150%	150%	150%
	Output frequency	0 ~ 600Hz	0 ~ 600Hz	0 ~ 120Hz
	Carrier frequency	1.5 - 16kHz (derating); carrier frequency can be automatically adjusted according to load characteristics (If the rated carrier frequency is exceeded, derating is required)		
	Frequency setting resolution	Digital input: 0.01Hz Analog input: 1/2048 of the maximum output frequency (11 bits with sign)		
	Run command channel	Operator setting, control terminal setting, communication setting		
	Frequency setting channel	Operator setting, digital/analog setting, communication setting, pulse setting		
	Automatic Voltage Regulation (AVR)	Automatically adjust the duty cycle of PWM signal according to the fluctuation of the bus voltage , thereby reducing the impact of grid voltage fluctuations on output voltage fluctuations		
	Energy consumption braking capacity	EP6 series: HD≤30kW comes standard with built-in brake unit;		

Environmental conditions	Place of use	Install vertically in a well-ventilated electrical cabinet. Horizontal or other installation methods are not allowed. The cooling medium is air. Install in an environment that is not exposed to direct sunlight, dust, corrosive gases, flammable gases, oil mist, steam, or dripping water.
	Ambient temperature	Cabinet installation type: heavy load -10 ℃ ~ +60 ℃ Light load -10 ℃ ~+50 ℃
	Temperature derating	Heavy load＞50 ℃ , the rated output current decreases by 1% for every 1℃ increase in temperature , up to 60 ℃ ; Light load> 40 ℃, the rated output current is reduced by 1% for every 1℃ increase in temperature, up to 50 ℃;
	Altitude	≤ 1000m
	Altitude	> 1000 m, the rated output current is reduced by 1% for

	derating	every 100 m increase, up to 2000 m
	Ambient humidity	5～95%, condensation not allowed
	Vibration (transportation)	2≤f＜9Hz , 3.5mm; 9≤f＜200Hz, 10m/s² ;200≤f＜500Hz, 15 m/s²
	Vibration (installation)	2≤f＜9Hz , 0.3mm; 9≤f＜200Hz, 1m/ s²
	Storage temperature	-40～+70℃
	Protection level	IP20 (F1-F8) IP00 (F9-10)

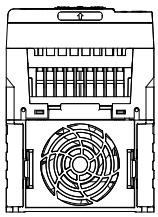
Control Panel	type	Removable
	length	1m (length can be customized, up to 3m)
	connect	RJ45
	LCD text display	14*14 Chinese characters or letters, 8 lines in total, 17 characters per line
	Number of visual LED indicator	2
	Number of buttons	12

other	Cooling method	Forced air cooling
	Installation	In-cabinet wall-mounted installation

2.3 Installation dimensions of the inverter

2.3.1 Product dimensions and installation dimensions

2.3.1.1 Specifications and dimensions



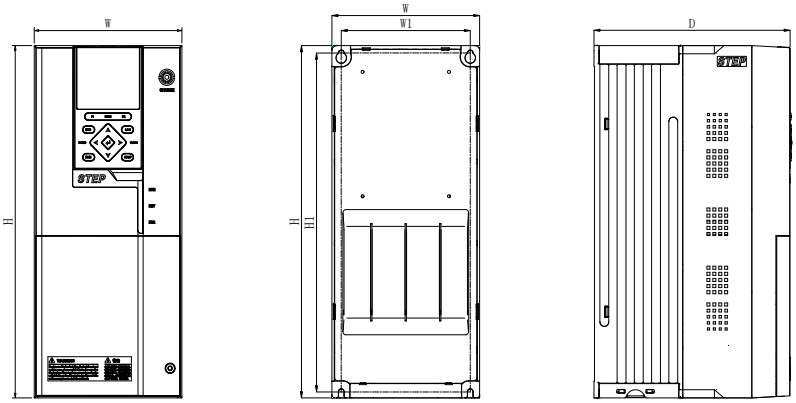


Figure 2-1 Installation dimensions of F0 ~ F3 inverters

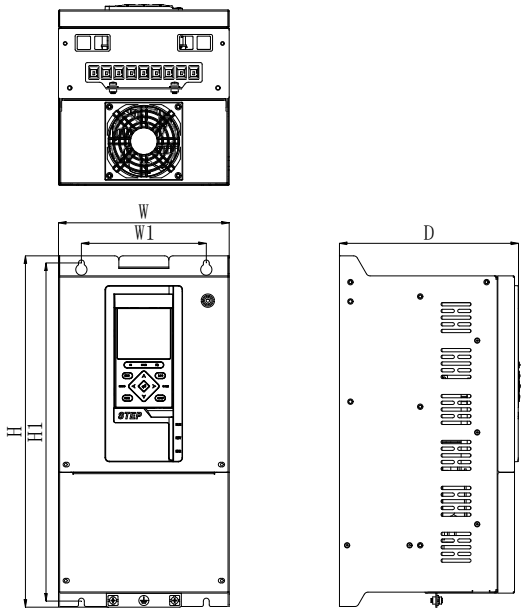


Figure 2-2 Installation dimensions of F4~ F5 inverters

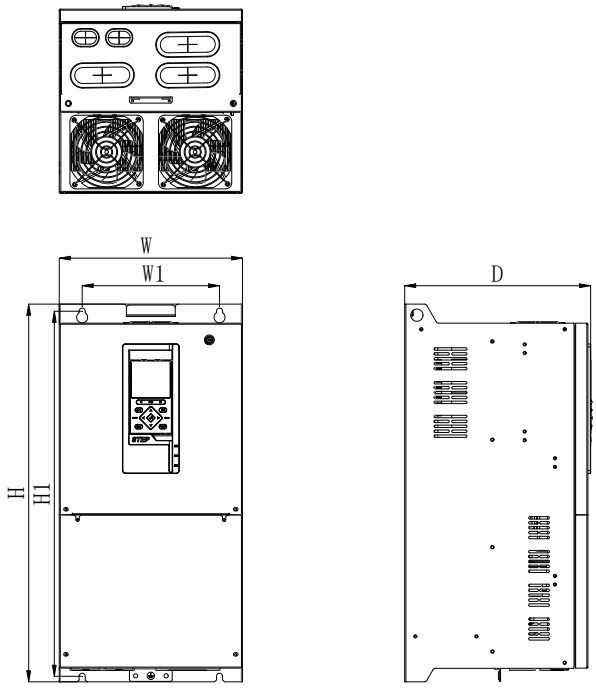


Figure 2-3 F6 ~ F8 inverter installation dimensions

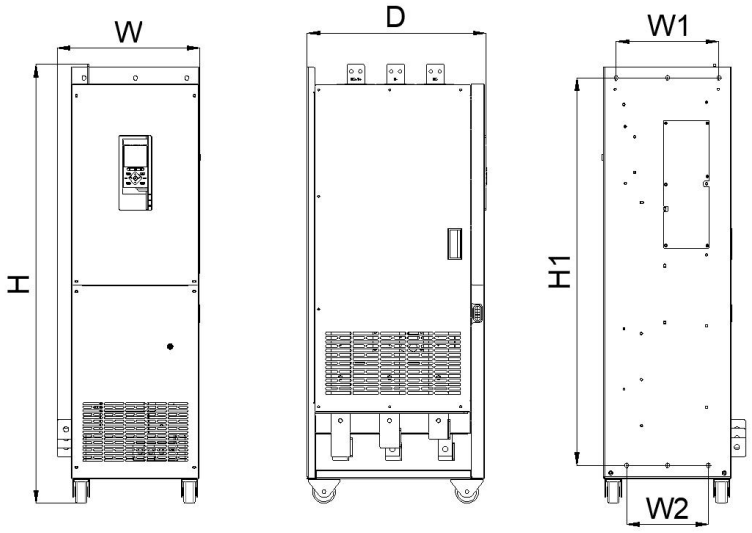


Figure 2-4 F9 inverter installation dimensions

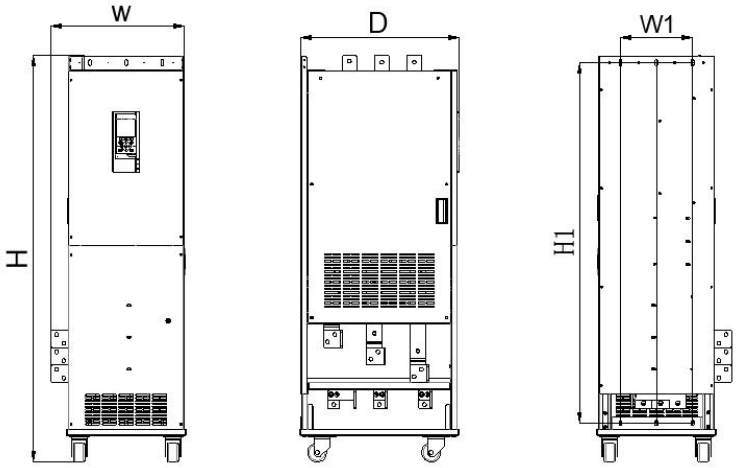


Figure 2-5 F10 inverter installation dimensions

Table 2-1 Dimensions of F0~F10

Specification	Dimensions	Installation spacing	Mounting screws
	H*W*D (mm)	W1 (W2) *H1(mm)	
F0	300*130*200	114*288	4-M5
F1	300*130*200	114*288	4-M5
F2	345*150*200	131*332	4-M5
F3	380*190*200	171*366	4-M6
F4	420* 205*21 5	150*405	4-M6
F5	550*233*25 5	170*533	4-M6
F6	615*300*305	225*595	4-M8
F7	640*335*320	240*617	4-M8

F8	825*400*353	300*796	4-M10
F9	1240*405*510	290 (230) *1095	6-M8
F10	1405*465*550	250*1255	6-M8

Note: F9 -F10 supports both side and bottom wiring. If side wiring is required, the overall width will increase by 60 mm.

2.3.2 Operator size

The dimensions of the inverter operator are shown in Figure 2-6.

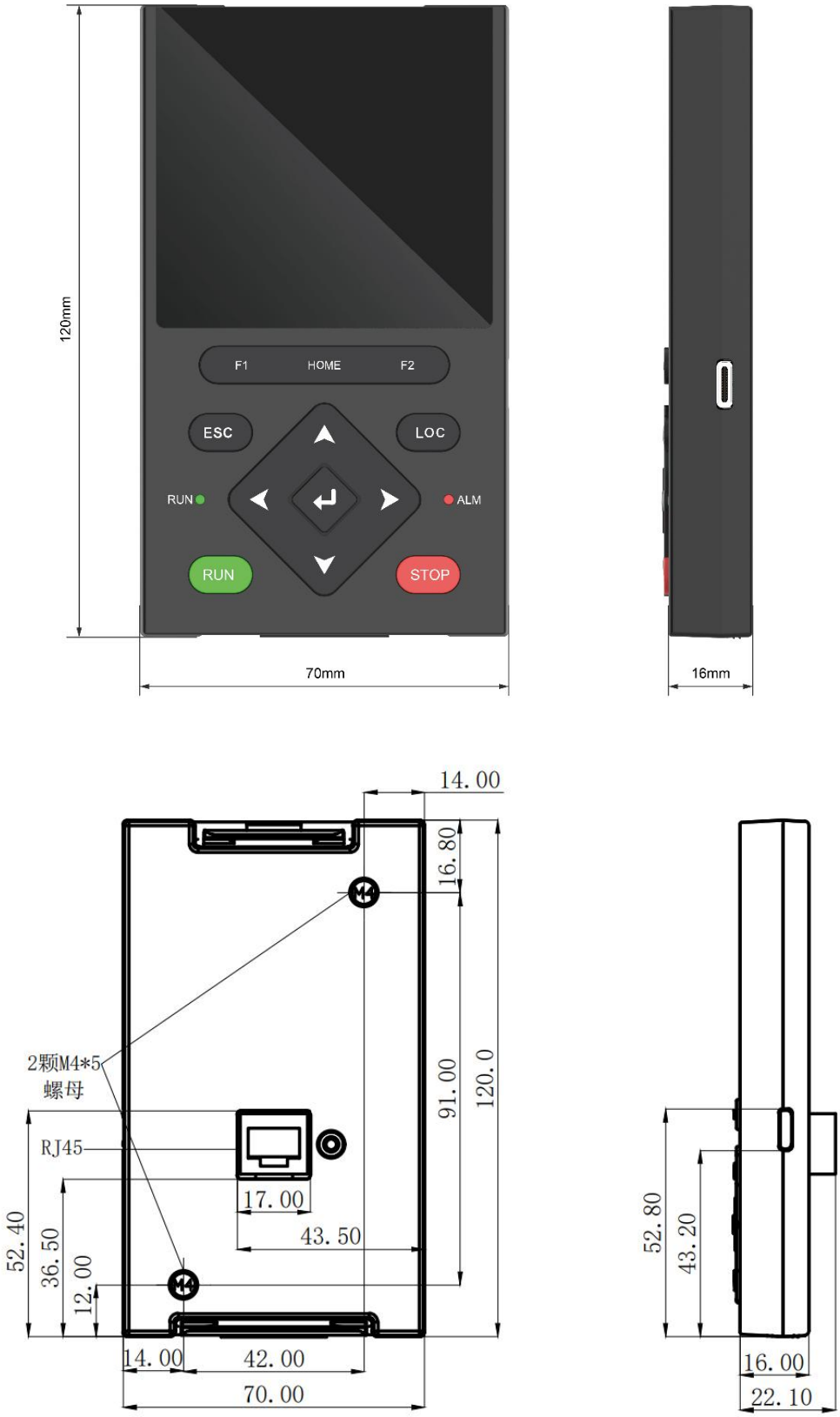


Figure 2-6 Inverter operator dimensions

1）Use the handheld operator alone and install as external panel, and punch holes in the cabinet door to secure it. The dimensions of the cabinet door holes are shown in Figures 2 - 7 below:

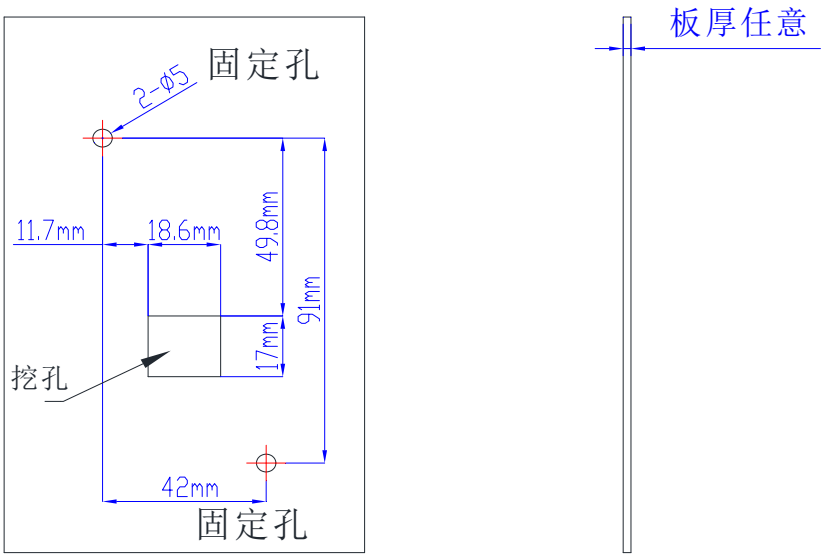


Figure 2-7 Schematic diagram of the dimensions of the cabinet door with the operator's external panel

2）The built-in kit is fixed, and the cabinet door opening dimensions are shown in Figures 2 - 8 below:

Figure 2-8 Cabinet door opening dimensions

2.4 Selection of brake unit and brake resistor

When the motor is braking, negative torque may occur. Therefore, the inverter should be equipped with a brake component, otherwise it will cause overcurrent or overvoltage fault and trip.

When the braking time accounts for 10% of a braking cycle, the configuration of the external braking unit and braking resistor is shown in Table 2-2.

Table 2-2 400V brake unit and brake resistor configuration

Inverter model **EP6**	Inverter power (kW)	Braking unit		Braking resistor (10% utilization)	
		Specification	Quantity (piece)	Equivalent braking Resistor specifications	Quantity (piece)
4T4A1	1.1	EP6≤30kW built-in brake unit		150 W 500Ω	1
4T5A6	1.5			260 W 400 Ω	1
4T7A2	2.2			260 W 250 Ω	1
4T9A4	3			390 W 150 Ω	1
4 T012	4			390W 150Ω	1
4T018	5.5			520W 100Ω	1
4T023	7.5			780W 75Ω	1
4T031	11			1040W 50Ω	1
4T039	15			1560W 40Ω	1
4T045	18.5			4800W 32Ω	1
4T060	22			4800W 27.2Ω	1
4T075	30			6000W 20Ω	1
4T089	37	BKU-4045	1	9600W 16Ω	1

Inverter model EP6	Inverter power (kW)	Braking unit		Braking resistor (10% utilization)	
		Specification	Quantity (piece)	Equivalent braking Resistor specifications	Quantity (piece)
4T103	45	BKU-4045	1	9600W 13.6Ω	1
4T140	55	BKU-4030	2	6000W 20Ω	2
4T168	75	BKU-4045	2	9600W 13.6Ω	2
4T208	90	BKU-4 110	1	18kW 6.7Ω	1
4T250	110	BKU-4 110	1	25k W 5 Ω	1
4T304	132	BKU -4220	1	40k W 3.4 Ω	1
4T377	160	BKU-4220	1	40kW 3.4Ω	1
4 T414	200	BKU-4220	1	48 kW 3Ω	1
4 T477	220	BKU-4220	1	48 kW 3Ω	1
4 T520	250	BKU-4 11 0	2	25 kW 5Ω	2
4 T605	280	BKU-4220	2	40kW 3.4Ω	2
4 T675	315	BKU-4220	2	40kW 3.4Ω	2

When the braking time accounts for 20% of a braking cycle, the configuration of the external braking unit and braking resistor is shown in Table 2-3.

Table 2-3 400V brake unit and brake resistor configuration

Inverter model EP6	Inverter power (kW)	Braking unit		Braking resistor (20% usage)	
		Specification	Quantity (piece)	Equivalent braking Resistor specifications	Quantity (piece)
4T4A1	1.1	EP6≤30kW built-in brake unit		2 60W 470Ω	1
4T5A6	1.5			390 W 340 Ω	1
4T7A2	2.2			520W 230Ω	1
4T9A4	3			780W 140Ω	1
4 T012	4			780W 140Ω	1
4T018	5.5			1040W 90Ω	1
4T023	7.5			1560W 70Ω	1
4T031	11			2000W 47Ω	1
4T039	15			3000W 34Ω	1
4T045	18.5			9600W 28Ω	1
4T060	22			9600W 24Ω	1
4T075	30			12.5kW 17Ω	1
4T089	37	BKU-4045	1	20kW 15Ω	1
4T103	45	BKU-4030	2	10kW 24Ω	2
4T140	55	BKU-4045	2	12.5kW 18Ω	2
4T168	75	BKU-4 110	1	36 kW 6.7 Ω	1
4T208	90	BKU-4045	3	12.5kW 18Ω	3
4T250	110	BKU-4045	3	12.5 kW 1 6 Ω	3
4T304	132	BKU-4220	1	80kW 3.5Ω	1
4T377	160	BKU-4220	1	80kW 3.2Ω	1
4 T414	200	BKU-4110	2	5 0kW 5 Ω	2
4 T477	220	BKU-4110	2	5 0kW 5 Ω	2

Inverter model EP6	Inverter power (kW)	Braking unit		Braking resistor (20% usage)	
		Specification	Quantity (piece)	Equivalent braking Resistor specifications	Quantity (piece)
4 T520	250	BKU-4220	2	60kW 4.7Ω	2
4 T605	280	BKU-4220	2	80kW 3.5Ω	2
4 T675	315	BKU-4220	2	80kW 3.5Ω	2

When the braking time accounts for 40% of a braking cycle, the configuration of the external braking unit and braking resistor is shown in Table 2-4.

Table 2-4 400V brake unit and brake resistor configuration

Inverter model EP6	Inverter power (kW)	Braking unit		Braking resistor (40% utilization)	
		Specification	quantity (piece)	Equivalent braking Resistor specifications	quantity (piece)
4T4A1	1.1	EP6≤30kW built-in brake unit		520W 370Ω	1
4T5A6	1.5			780W 270Ω	1
4T7A2	2.2			1300W 180Ω	1
4T9A4	3			2200W 110Ω	1
4 T012	4			2200W 110Ω	1
4T018	5.5			3300W 75Ω	1
4T023	7.5			4500W 55Ω	1
4T031	11			6600W 37Ω	1
4T039	15			9000W 27Ω	1
4T045	18.5			11kW 22Ω	1
4T060	22			13kW 18Ω	1
4T075	30			2 0kW 13.5 Ω	1
4T089	37	BKU-4030	2	12.5kW 22Ω	2
4T103	45	BKU-4045	2	12.5kW 18Ω	2
4T140	55	BKU-4045	2	20 kW 15 Ω	2
4T168	75	BKU-4 110	1	60 kW 5 Ω	1
4T208	90	BKU-4 110	1	60 kW 5 Ω	1
4T250	110	BKU-4220	1	70kW 3.7Ω	1
4T304	132	BKU-4220	1	70kW 3.7Ω	1
4T377	160	BKU-4220	1	90 kW 3Ω	1
4 T414	200	BKU-4220	2	60kW 5 Ω	2
4 T477	220	BKU-4220	2	70kW 3.7Ω	2
4 T520	250	BKU-4220	2	70kW 3.7Ω	2
4 T605	280	BKU-4220	2	90kW 3 Ω	2
4 T675	315	BKU-4220	2	90kW 3 Ω	2

Chapter 3 Installation of Inverter

3.1 Installation steps

Step 1: Inverter delivery
- Check that the catalog number printed on the label is the same as the one on the purchase order
- Remove the packaging of the intelligent flexible inverter and check whether it is damaged during transportation.

Step 2: Check the line voltage
- Check and confirm that the line voltage is compatible with the voltage and frequency range of the inverter.

Step 3: Install the inverter
- Install the drive according to the instructions in this document
- Install any internal and external options

Step 4: Inverter wiring
- Connect the motor and ensure the voltage is consistent
- Connect the control lines
- Connect speed setting
- Connect the communication cables
- Connect the power cord after ensuring that the power is off.

3.2 Mechanical installation

3.2.1 Product Installation Environment

3.2.1.1 Temperature and humidity

The rated operating temperature for heavy load is -10℃ ～ +50℃ , with a derating of up to 60 ℃ ; the rated operating temperature for light load is -10℃ ～ + 40℃, with a derating of up to 50℃ .

The relative humidity of the air is ≤95%, no condensation.

For installations in harsh environments, it is recommended to enhance the heat dissipation of the inverter.

3.2.1.2 Altitude

When the inverter is installed at an altitude below 1,000m , it can operate at its rated power; if it exceeds 1,000m, the rated current will be reduced by 1% for every 100m increase, with a maximum allowable altitude of 2,000m .

3.2.1.3 Other environmental requirements

- Avoid installing in places that may be subject to severe vibration and impact. The maximum vibration acceleration should not exceed 1g (random vibration).
- Do not install where there are electromagnetic radiation sources.
- Avoid installation in places with oil mist, metal dust and excessive dust.
- Avoid installing in places with harmful gases, liquids, corrosive, flammable and explosive gases.
- Avoid installing in places with high salt content.
- Do not install in direct sunlight.
- Do not install on flammable objects such as wood.

■ During installation, be sure not to allow drilling residue to fall into the inverter.

3.2.2 Installation position and spacing requirements

注意
Depending on the selected installation method, the drive must be mounted vertically on: -In the electrical cabinet The inverter cannot be installed horizontally in the cabinet!

3.2.2.1 Installation position

In order not to reduce the cooling effect of the inverter, the inverter should be installed in a well-ventilated place. The installation direction is generally vertical. As shown in Figure 3-1:

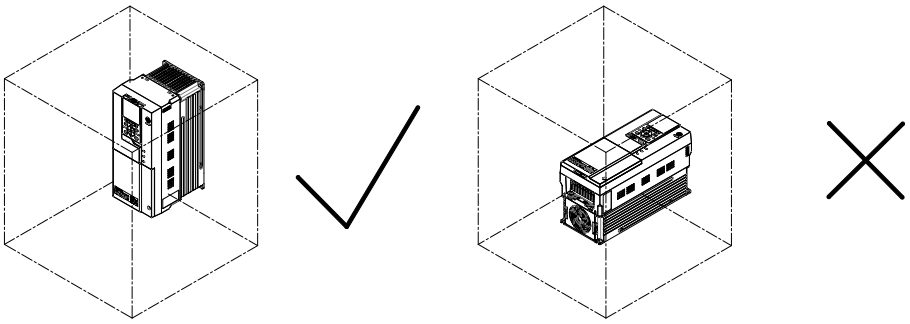


Figure 3-1 Installation orientation

When the user installs the inverter vertically, the angle between the inverter and the horizontal plane can be between 87 ° and 90 °. Details are shown in Figure 3-2 :

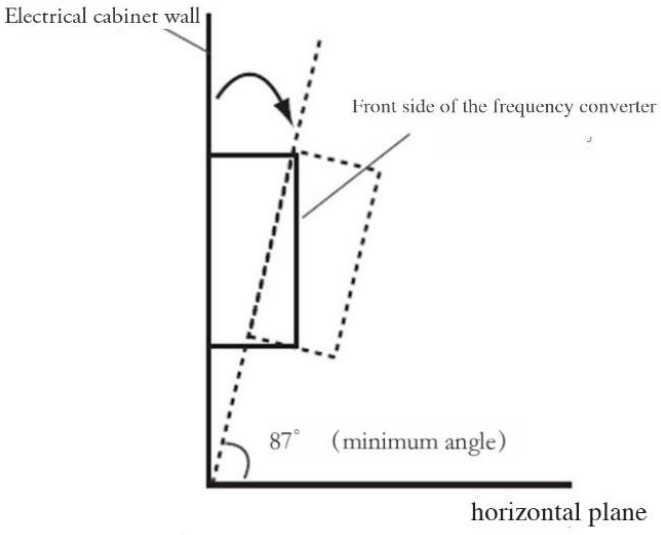


Figure 3-2 Allowable installation angle

3.2.2.2 Installation Space

1、 Non-cabinet installation

The installation space and spacing required for this product vary depending on its power level.

Table 3-1 EP6 light-load power equipment heating power and fan air volume data

Specification	Light load power (kW)	Heating power (W)	Fan air volume (CFM)
F0	1.5	68	57.8
	2.2	81	57.8
	3	109	57.8
	4	138	57.8
	5.5	201	57.8
F1	7.5	240	57.8
	11	355	59.3
F2	15	454	75
	18.5	478	75
F3	22	551	117.4
	30	694	117.4
F4	37	815	234.7
F5	45	1010	234.7
	55	1210	234.7
F6	75	1570	429.1
	90	1810	625.1
F7	110	2140	625.1
	132	2850	625.1
F8	160	3560	896.5
	200	4150	896.5
F9	220	4550	868.7
	250	5060	925.3
	280	5330	925.3
F10	315	5690	1196
	355	6000	1196

① Single machine installation

In order to ensure the space required for inverter cooling, the inverter installation space must be according to Figure 3-3:

Table 3-2 Installation space requirements (single machine)

Power (kW)	Size requirements (unit: mm)		
1.5~18.5	A1≥30	B1≥200	C1≥40
22~132	A1≥50	B1≥200	C1≥40
160~355	A1≥50	B1≥300	C1≥40

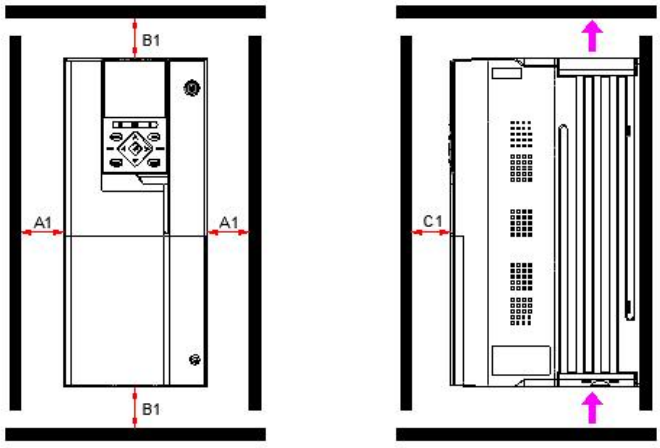


Figure 3-3 Inverter installation space (single unit)

② Multiple machine installation

This product dissipates heat from bottom to top. When multiple devices are working, they are usually installed side by side and the upper parts of the machines must be aligned, especially for devices of different sizes.

Please ensure the space required for installing a single inverter. The installation space requirements are as shown in Figure 3-4.

Table 3-3 Installation space requirements (multiple units installed in parallel)

Power (kW)	Size requirements (unit: mm)		
1.5~18.5	A1≥30	B1≥200	D1≥30
22~132	A1≥50	B1≥200	D1≥50
160~355	A1≥50	B1≥300	D1≥50

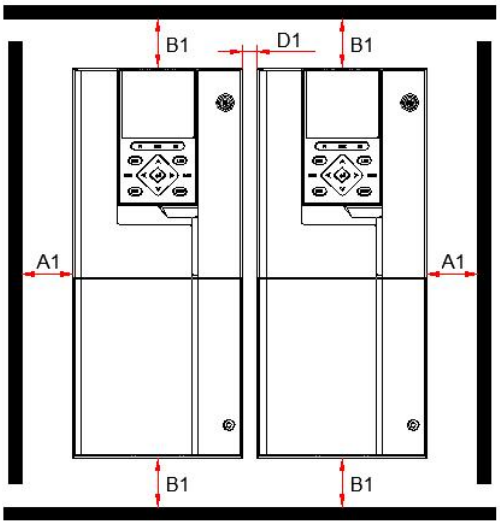


Figure 3-4 Standard installation method for multiple units in parallel

Note: If a C2 filter is installed internally, a 50mm distance must be left between the inverters for heat dissipation.

③ Upper and lower row installation

When this product is installed in a top-down arrangement, the hot air from the lower row of equipment will cause the upper row of equipment to heat up, potentially causing overheating. Therefore, measures such as installing heat-insulating guide plates are required when installing in upper and lower rows, as shown in Figure 3-5.

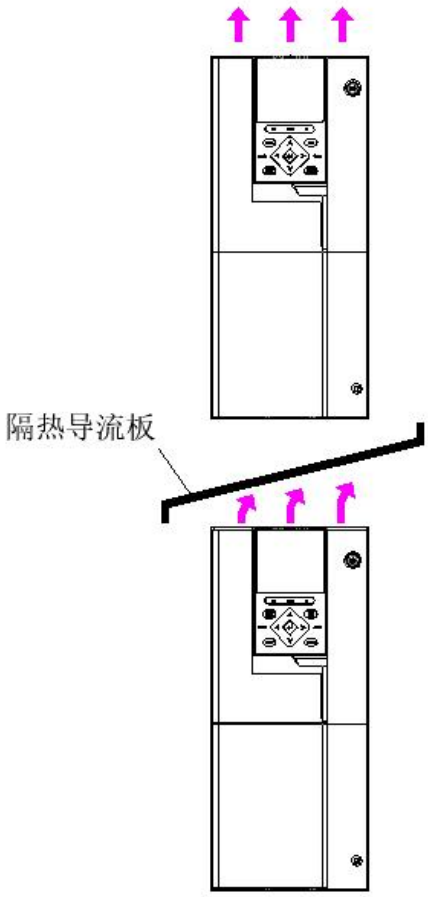


Figure 3-5 Upper and lower row installation requirements

2、 Cabinet installation

When installing this product in a cabinet, the layout inside the cabinet must take into account the required heat dissipation space. Please follow the following installation instructions based on the specific model and installation application.

① Direct exhaust cabinet (no fan on top of cabinet)

If there is no exhaust fan on the top of the cabinet, air baffles must be installed around the inverter air outlet to prevent the inverter's air from flowing back, causing the temperature to rise and eventually causing overheating, as shown in Figure 3-6. The correct layout is shown in Figure 3-7.

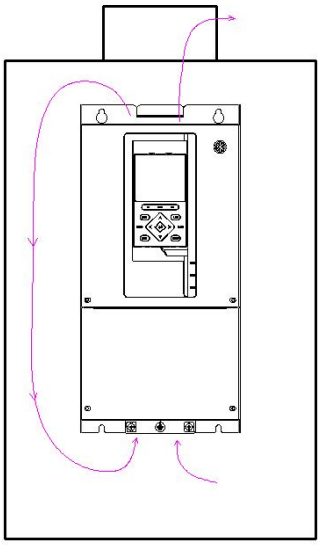


Figure 3-6 No windshield (NG)

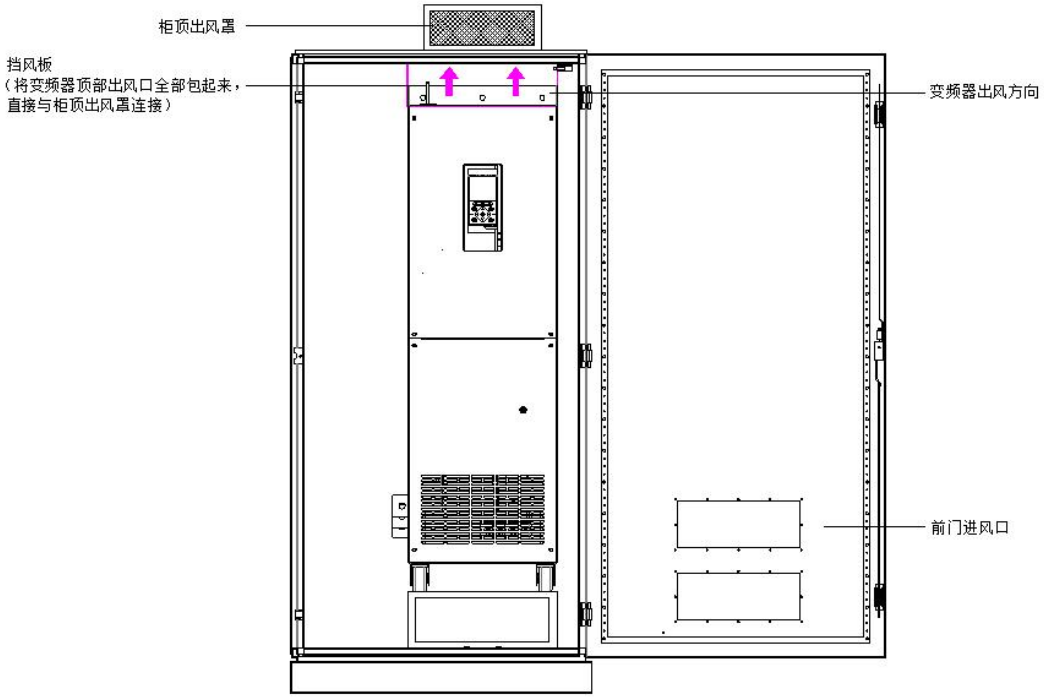


Figure 3-7 Schematic diagram of a direct exhaust fan cabinet

Table 3-4 Direct exhaust cabinet heat dissipation parameters

Power (kW)	Maximum fan air volume (CFM)	Actual effective area of the air inlet of the direct exhaust cabinet (mm2)	Actual effective area of the air outlet of the direct exhaust cabinet (mm2)
1.5~18.5	75	5711	9137
22~30	117.4	8939	14303
37~55	234.7	17871	28593
75	429.1	32673	52276
90~132	625.1	47597	76155
160~200	896.5	68262	109219
220~280	925.3	70455	112727
315~355	1196	91066	145706

illustrate:

1) 1m3/s=2188.8CFM;
2) The above-mentioned “actual effective area” refers to the effective ventilation opening area;
3) The direct exhaust cabinet layout (no fan on the top of the cabinet) is recommended for cabinets without filters at the air outlet. If filters are installed at the cabinet outlet, the air flow resistance will be greatly increased. In this case, it is recommended to install an exhaust fan on the top of the cabinet.

② Top fan exhaust cabinet (with exhaust fan on the top of the cabinet)

If the cabinet has an exhaust fan on top, windshields around the inverter's air outlet are not required. Hot air from the inverter can be exhausted by the cabinet top fan. When selecting a cabinet top fan, ensure that the air volume is ≥ 1.2 times the inverter's fan volume. See the table below for details.

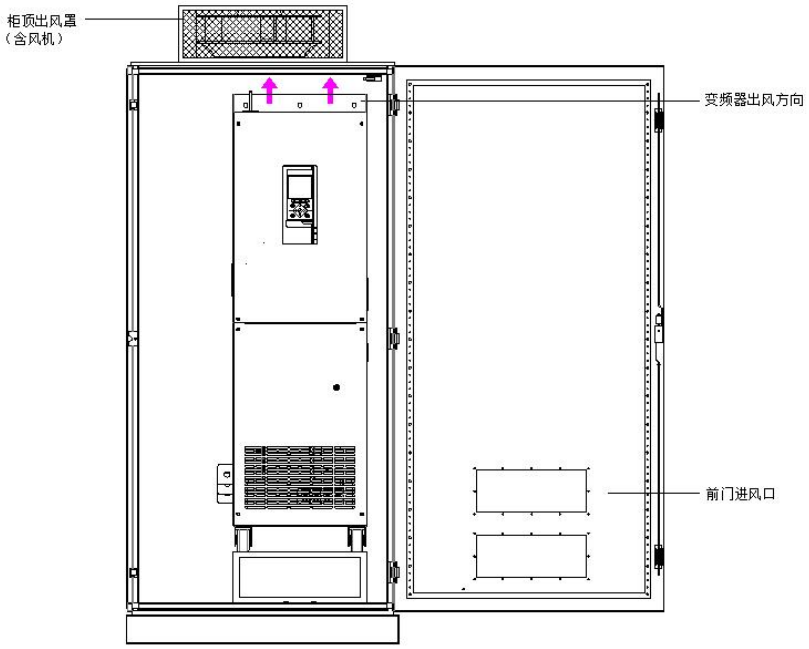


Figure 3-8 Schematic diagram of a cabinet with a top fan (with an exhaust fan on the top)

Table 3-5 Heat dissipation parameters for top fan exhaust cabinets

Power (kW)	Maximum air volume of inverter fan (CFM)	Maximum air flow of the fan on the top of the cabinet (CFM)	Actual effective area of the top fan exhaust cabinet air inlet (mm2)	Actual effective area of the air outlet of the direct exhaust cabinet (mm2)
1.5~18.5	75	90	5711	S=1.2* π /4*N*(D2-Dhub2) Note: N is the number of cabinet top fans; D is the diameter of the cabinet top fan; Dhub is the diameter of the central hub of the cabinet top fan
22~30	117.4	140.88	8939	
37~55	234.7	281.64	17871	
75	429.1	514.92	32673	
90~132	625.1	750.12	47597	
160~200	896.5	1075.8	68262	
220~280	925.3	1110.36	70455	
315~355	1196	1435.2	91066	

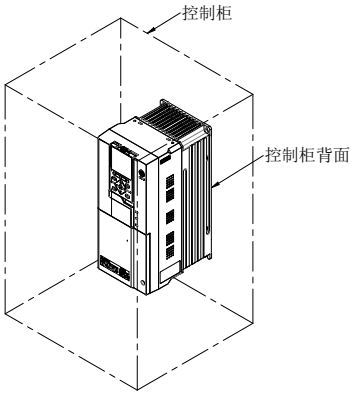
illustrate:

1) 1m3/s=2188.8CFM;
2) The above-mentioned “actual effective area” refers to the effective ventilation opening area;
3) When there are filter cottons at the air inlet and outlet, the fan and ventilation opening area on the top of the cabinet need to be increased. The recommended area of the fan and ventilation opening on the top of the cabinet should be 1.8 to 2 times the value in the table above.

3.2.2.3 Installation

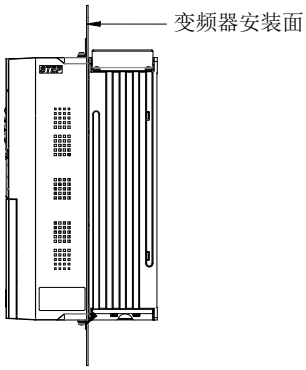
1、 Installation in the cabinet:

控制柜内安装图

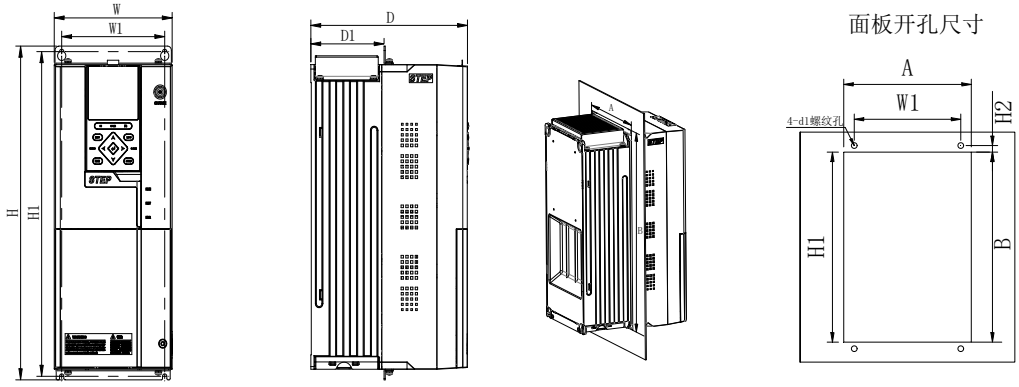


2、 Intermediate installation: The inverter heat sink is partially installed outside the cabinet (if this installation method is required, please contact our technical team)

散热器外置安装图



Dimensions of external radiator products and panel processing diagram for installation:



If you need intermediate installation dimensions, please confirm with our technical team

重要 The fasteners must have anti-vibration parts, such as spring washers; the four screws of the inverter must be tightened.

3.3 Disassembly and installation of operator and cover

3.3.1 Disassembly and Assembly of the Operator

Removal and installation of the operator and wiring cover:

1. Remove the operator:

Press the latch on the operator and pull outward to remove it.

2. Install the operator

When putting the operator back in place, press it in firmly until you hear a click.

3.3.2 Opening and Closing the Wiring Cover

The wiring cover needs to be opened when wiring the main circuit, and the wiring cover also needs to be opened when removing the front panel.

① Loosen the anti-loosening screw at the arrow point

② Pull the cover outward from the bottom to open it

Chapter 4 Inverter Wiring

This chapter describes in detail the connection between the inverter and peripheral devices, an overview of the inverter terminal wiring, the wiring of the main circuit terminals, and the wiring of the control circuit terminals.

◎ **Before wiring, please confirm whether the input power is completely disconnected.**
Otherwise, there is a risk of electric shock

◎ **Please have professional electrical engineers perform the wiring work.**
Otherwise, there is a risk of electric shock.

◎ **The grounding terminal PE must be reliably grounded.**
Otherwise, there is a risk of electric shock.

◎ **Do not touch the terminals directly with your hands, and the output wires of the inverter must not come into contact with the outer cover.**
Otherwise, there is a risk of electric shock.

◎ **Do not connect the power supply to the output terminals U/T1, V/T2, and W/T3.**
Otherwise, there is a risk of damaging the inverter.

◎ **Do not short-circuit terminals B1/DC+ and DC-.**
Otherwise, there is a risk of explosion.

◎ **Please confirm whether the voltage of the AC main circuit power supply is consistent with the rated voltage of the inverter.**
Otherwise, there is a risk of fire or personal injury.

◎ **Please connect the braking resistor correctly according to the wiring diagram.**
Otherwise, there is a risk of fire.

◎ **The main circuit terminals and wires or wire crimping terminals must be firmly connected.**
Otherwise, there is a risk of damaging the inverter.

4.1 Connection between inverter and peripheral equipment

4.1.1 Connection diagram between inverter and peripheral equipment

The connection diagram between the inverter and peripheral devices is shown in Figure 4-1.

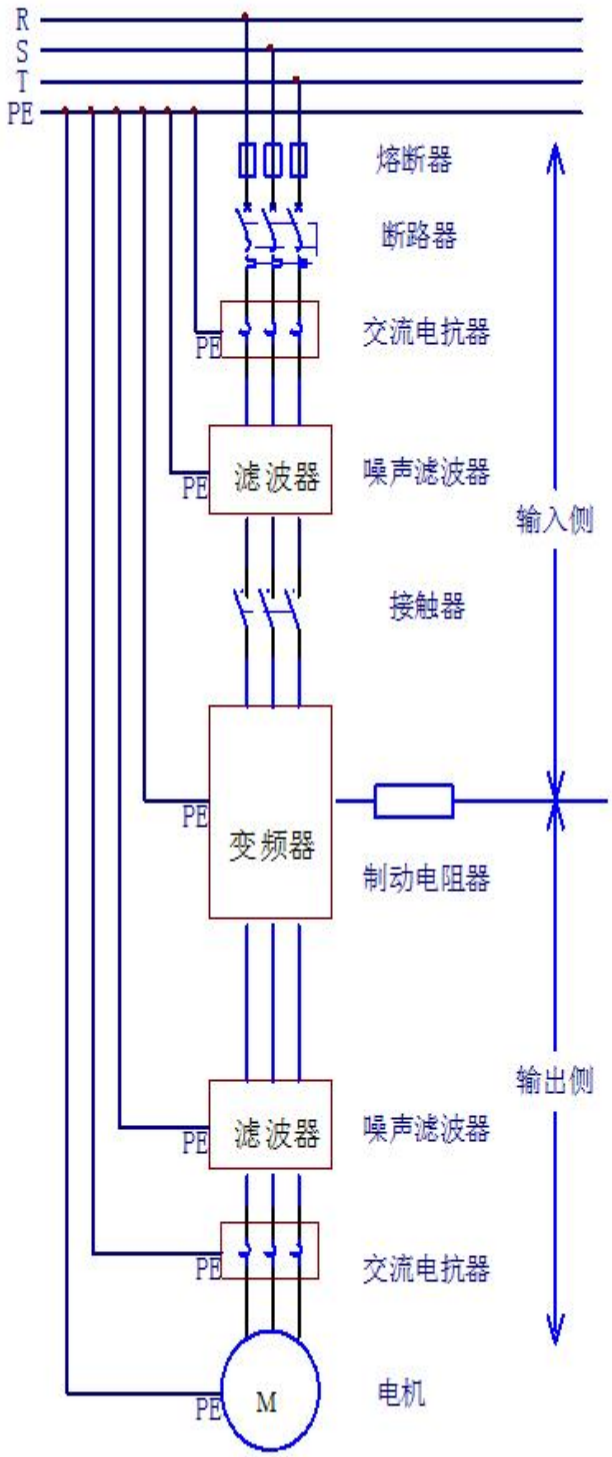


Figure 4-1 Connection diagram of inverter and peripheral equipment

Note: The figure is drawn with three-phase power input as an example.

4.1.2 Connection of peripheral components in the main circuit

4.1.2.1 Input power connection

The inverter cannot be operated outside the rated input voltage range. Overvoltage may cause permanent damage to the inverter.

Table 4-1 Input power technical requirements

Input power (main circuit) connection technical requirements	
Input voltage	Voltage is three-phase 380~480VAC, -15%~+10%
Short-circuit current (IEC60909 standard)	If the incoming cable of the inverter is protected by a suitable fuse, the maximum permissible short-circuit current within 1s is 100kA.
frequency	50 ~ 60 Hz, -5% ~ +5%
Imbalance	Maximum is ±3% of rated input line voltage
Cable temperature	Minimum rating 90 ℃

4.1.2.2 Input Protection

Input protection includes circuit breakers, fuses, and emergency stop devices.

breaker

The inverter itself does not include a circuit breaker. Therefore, a circuit breaker must be installed between the AC input power supply and the inverter. This circuit breaker must ensure:

- The selection must comply with the safety regulations of the actual application, including (but not limited to) national and local electrical regulations.
- During installation and maintenance of the drive, the disconnect device must be capable of being held in the OFF position and locked.
- The circuit breaker is not allowed to control the start and stop of the motor. The motor should be controlled by the operator keys or I/O terminal commands.
- The capacity of the circuit breaker should be 1.5 to 2 times the rated current of the inverter.
- The time characteristics of the circuit breaker should fully consider the time characteristics of the inverter overheat protection (150% of the rated output current, 1 minute).

fuse

The end user must provide a circuit protection device to provide short-circuit protection for the incoming power supply of the inverter, and the selection of the device must be consistent with national and local electrical regulations.

Table 4-2 Fuse and Circuit Breaker Selection Guide (Three-Phase 380V~480V) (Bussmann Fuse Recommended)

Inverter model	EP6 inverter power (kW)	Fuse specifications Bussmann		Circuit breaker specifications
		Rated current (A)	model	Rated current (A)
4T4A1	1.1	10	FWP-10B	6
4T5A6	1.5	15	FWP-15B	10
4T7A2	2.2	15	FWP-15B	13
4T9A4	3	20	FWP-20B	16
4T012	4	30	FWP-30B	25
4T018	5.5	40	FWP-40B	32

4T023	7.5	40	FWP-40B	50
4T031	11	60	FWP-60B	63
4T039	15	70	FWH-70B	63
4T045	18.5	100	FWH-100B	80
4T060	22	100	FWH-100B	80
4T075	30	100	FWH-100B	100
4T089	37	125	FWH-125B	160
4T103	45	150	FWH-150B	160
4T140	55	200	FWH-200B	250
4T168	75	250	FWH-250A	250
4T208	90	275	FWH-275A	250
4T250	110	325	FWH-325A	320
4T304	132	400	FWH-400A	450
4T377	160	500	FWH-500A	450
4T414	200	600	FWH-600A	630
4T477	220	600	FWH-600A	630
4T520	250	700	FWH-700A	630
4T605	280	800	FWH-800A	800
4T675	315	1000	170M5016	800

Emergency stop equipment

The overall design and installation of the equipment must include emergency stop devices and other necessary safety equipment. Controlling the motor through the keys of the inverter operator or the I/O terminals or communication commands cannot guarantee:

- the emergency stop of the motor.
- Isolate the inverter from hazardous voltages.

4.1.2.3 Input Power Cable/Connection

The input cable connection can be any of the following:

- Four-core cable (three-phase and ground protection wire) does not require a shielding layer (if there are requirements for conducted interference and radiated interference, shielded wire is required).
- Four insulated conductors are installed in the conduit.

In all cases, the conductor must be smaller than the maximum limit defined by the terminal size. If the motor cable is too long or the cross-sectional area is too large, it should be derated. The inverter cable should use cables with the specified area (see Table 4-11). Since a larger cable cross-sectional area increases the ground capacitance and ground leakage current, using a larger cable cross-sectional area should reduce the output current. Each increase in area reduces the current by approximately 5%. Table 4-11 lists copper-core cable models for different load currents. The recommended models are only suitable for the situations listed at the top of the table. Aluminum-core cables are not recommended.

Table 4-3 Cable corresponding load current

IEC	NEC
based on: EN60204-1 and IEC60364-5-2/2001 standards PVC insulation 30°C ambient temperature 70°C surface temperature Symmetrical cable with copper braid shield No more than 9 cables are placed side by side in the same cable tray	based on: For copper cable, see NEC Table 310-16 90°C cable insulation 40°C ambient temperature There are no more than 3 current-carrying wires in the same trunking, cable trench or buried cable Copper core cable with copper braid shield

To ensure personnel safety, correct operation, and reduce electromagnetic radiation, the inverter and motor must be grounded at the installation location.

- The diameter of the wire must meet the requirements of safety regulations.
- The power cable shield must be connected to the PE terminal of the inverter to comply with safety regulations.
- The shielding layer of the power cable can be used as the grounding wire of the equipment only when the specifications of the shielding layer meet the requirements of safety regulations.
- When installing multiple inverters, do not connect the inverter terminals in series.

4.1.2.4 Output Power Cable / Connection

motor connection technical requirements are shown in Table 4-4 .

Table 4-4 Motor connection technical requirements

Output power (motor) connection technical requirements	
Output voltage	0~Input voltage, symmetrical three-phase voltage
Current	Refer to Chapter 2 "2.2 Technical Specifications and Specifications of Inverter"
Switching frequency	Adjustable: 1.5 ～ 16 kHz
Cable temperature rating	Minimum rating 90°C
Relationship between motor cable length and switching frequency	Refer to Chapter 4, "4.4.5 Relationship between Wiring Length and Carrier Frequency"

Grounding and wiring

Motor Cable Shielding Motor cables require shielding using conduit, armored cable, or shielded cable. Shielded/Armored Cable: High-frequency, low-impedance shielded cable should be used, such as braided copper wire mesh, aluminum wire mesh, or wire mesh.

conduit

- A bridge with a grounding conductor is required at each end of the conduit.
- The conduit is secured to the enclosure.
- Use a separate conduit run for the motor cables (also keep the input power cables and control cables separate) .
- Use a separate conduit run for each drive.

Armored cable

- A bridge with a grounding conductor is required at each end of the conduit.
- Use 6 conductors (3 power wires and 3 ground wires), MC type continuous corrugated aluminum armor cable with symmetrical ground wires.
- Armored motor cables can share a cable tray with input power cables, but not with control cables.

shielded cable

It is recommended that users use cables that meet CE or C-Tick standards and have symmetrically structured PE conductors.

Grounding

Table 4-13 in Section 4.3.4.1 for recommended cross-sectional areas of grounding conductors.

4.2 Inverter terminal wiring

The internal view of the inverter is shown in Figure 4-6.

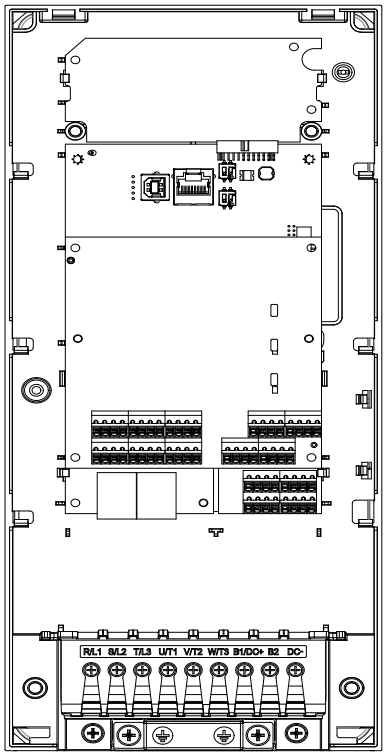


Figure 4-6 Internal view of the inverter

Note: The terminals of the inverters of different power levels are the same, except for the position of the power input/output terminals and the arrangement of the optional motherboard terminals. The figure uses 11kW as an example.

4.2.1 Inverter terminal wiring diagram

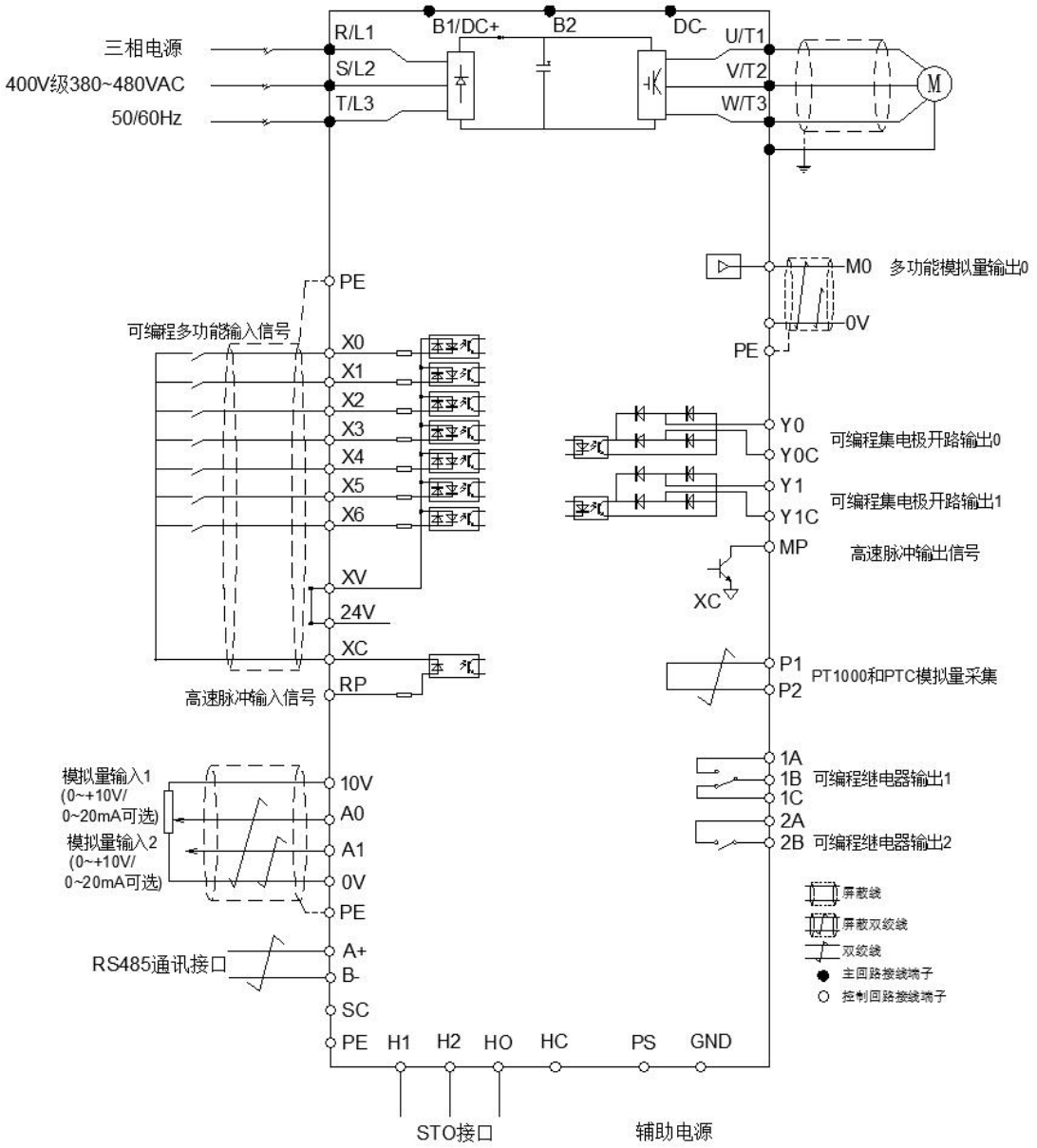


Figure 4-7-1 General I/ O board - A board terminal wiring diagram

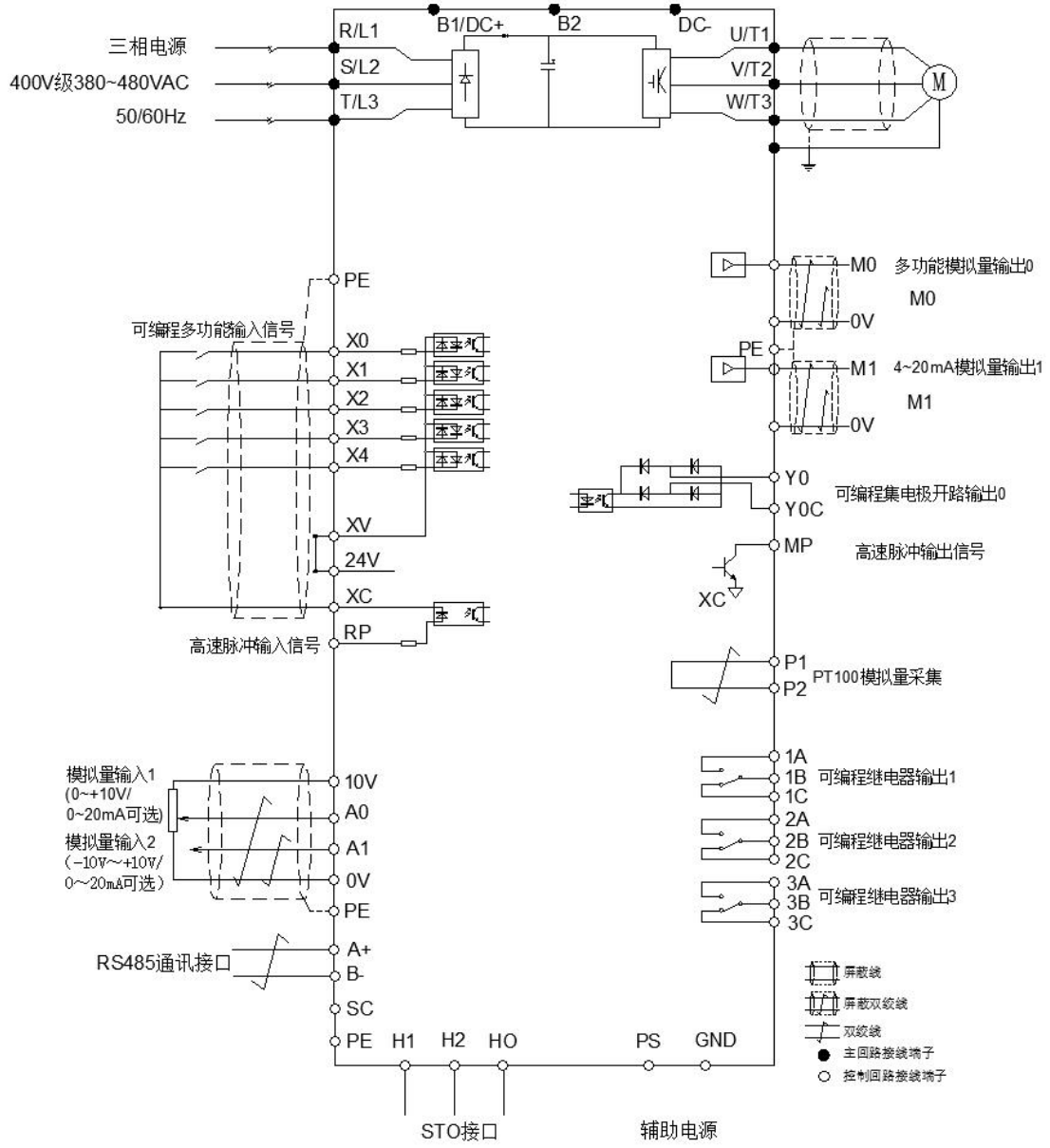


Figure 4-7-1 General I/ O board-B board terminal wiring diagram

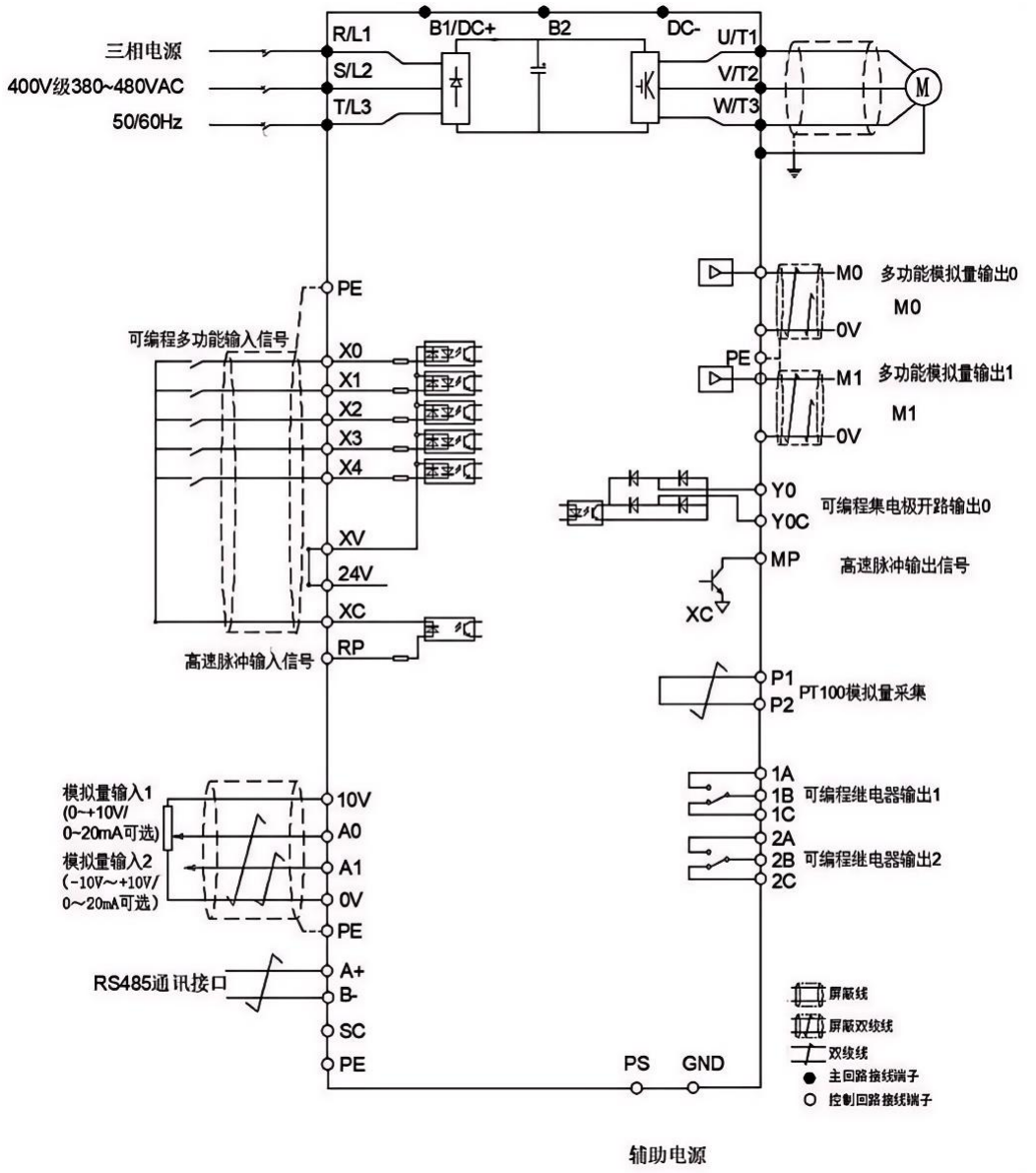


Figure 4-7 - 3 General I/O board-standard board terminal wiring diagram

4.2.2 Precautions for inverter terminal wiring

重要

a) The wiring specifications should comply with electrical standards.
b) After wiring is completed, please be sure to check that the wiring is correct and the connection is reliable. The following wiring checks are required:
   - Is the wiring correct?
   - Check whether there are any wire scraps or screws left in the inverter;
   - Are the screws loose?
   - Check whether the stripped bare wire of the terminal part is in contact with other terminals.
c) Some power levels of the intelligent flexible inverter are equipped with a braking unit, but require an external braking resistor. Install the braking resistor between terminals B1 and B2. Do not connect it to any other terminals, as this will damage the braking resistor and the inverter.
d) Some power levels of the intelligent flexible inverter are equipped with built-in DC reactors.
e) The inverter grounding point PE is best connected to a dedicated grounding electrode , and the grounding impedance should be below 10Ω .
f) Keep the grounding cable as short as possible.
g) After powering on, if you need to change the wiring, you must first turn off the power. Because the inverter's main circuit charging capacitor takes time to discharge, to avoid danger, wait five minutes for the capacitor to discharge. Then, use a DC voltmeter to measure the DC voltage across the charging capacitor. Only proceed to the next step after confirming that the voltage is less than the safe DC voltage of 24V.

4.3 Wiring of main circuit terminals

4.3.1 Main circuit terminal arrangement

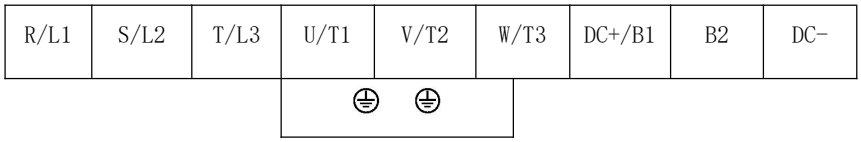


Figure 4-9-1 F0-F6 main circuit wiring terminal diagram

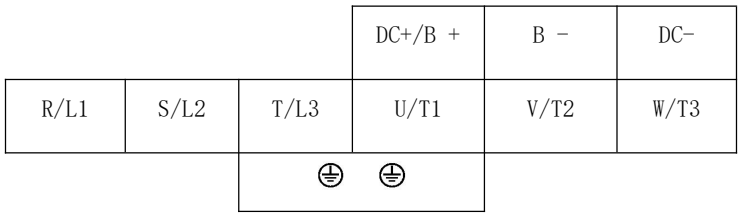


Figure 4-9-2 F7-F10 main circuit wiring terminal diagram

4.3.2 Main circuit terminal numbers and function descriptions

The function description of the main circuit terminals is shown in Table 4-10.

Table 4-10 Functional description of main circuit terminals

Terminal number	Terminal Function Description

R/L1	Main circuit AC power input, connect to three-phase input power
S/L2	
T/L3	
U/T1	Inverter output, connected to the motor
V/T2	
W/T3	
B1	External braking resistor
B2	
B+	External brake unit
B-	
DC+	Common DC bus
DC-	
⏚	Grounding terminal, connected to the protective ground. The grounding resistance cannot be greater than 1Ω at 400V level.

4.3.3 Main circuit wiring conductor specifications

Use 600V copper-core plastic-insulated wire for power supply. See Table 4-11 for wire specifications and tightening torque.

Table 4-11 Wire specifications and tightening torque

Inverter model **Intelligent flexible inverter**	Connectable wire specifications (mm ^{2})	Recommended wire size (mm ^{2})	Tightening torque (Nm)
4T4A1	0.75～1.0	0.75	1.2
4T5A6	1.0～1.5	1.0	1.2
4T7A2	1.0～1.5	1.5	1.2
4T9A4	1.5～2.5	2.5	2.7
4 T012	1.5～2.5	2.5	2.7
4T018	2.5～4	4	2.7
4T023	4-8	6	2.7
4T031	4-8	6	2.7
4T039	8-16	10	2.7
4T045	8-16	16	4.8
4T060	8-16	16	4.8
4T075	25～35	25	4.8
4T089	35～50	35	13
4T103	50～70	50	13
4T140	70～95	70	35
4T168	95	95	35

Inverter model Intelligent flexible inverter	Connectable wire specifications (mm ²)	Recommended wire size (mm ²)	Tightening torque (Nm)
4T208	85～115	95	35
4T250	95～150	120	35
4T304	95～185	150	35
4T377	165～205	185	35
4T414	85～115(x2P)	95x2P	35
4T477	85～115(x2P)	95x2P	35
4T520	125～175(x2P)	150x2P	35
4T605	125～175(x2P)	150x2P	85
4T675	125～175(x2P)	150x2P	85
4T xxx	85～115(x4P)	95x4P	85

重要

The wire specifications are determined based on an ambient temperature of 50℃ and an allowable wire temperature of 75℃

The inverter main circuit uses open-type wiring terminals. Round crimp terminals should be used for open-type wiring terminals. For the selection of round crimp terminals, see Table 4-12:

Table 4-12 Specifications of round crimp terminals

Wire cross-sectional area (mm ²)	Terminal screw specifications	Specifications of round crimp terminals
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

Wire cross-sectional area (mm ²)	Terminal screw specifications	Specifications of round crimp terminals
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
120	M12	12 0/12
185	M12	185 /12
240	M12	240/12
300	M12	300/12
380	M12	380/12

重要

When determining the cross-sectional area of the wire, please fully consider the voltage drop of the wire.

The general selection principle is to keep the voltage within 2% of the rated voltage. When the voltage drop is too large, the cross-sectional area of the wire should be increased. The formula for calculating voltage drop is as follows:

Line voltage drop (V) = $\sqrt{3}$ * wire resistance (Ω) * current (A)

4.3.4 Detailed description of main circuit terminal wiring

4.3.4.1 Power supply

Proposed modification: The inverter must be connected to a protective earth. Due to the high leakage current (over 3.5 mA), a protective earth connection is necessary to comply with IEC 60364-4-41.

4.3.4.2 Grounding terminal (PE)

- It is best to use a dedicated grounding electrode for the grounding terminal , which must be well grounded with a grounding impedance below 10 Ω .
- Do not share the ground wire with welding machines or other power equipment.
- The grounding wire should be as short as possible and in accordance with the specifications of the electrical equipment technical standards. If the grounding wire is too far from the grounding point, the leakage current of the inverter will cause the potential of the grounding terminal to be unstable.
- It is recommended to use a dedicated yellow-green grounding wire. For the cross-sectional area of the grounding wire, see Table 4-13.

Table 4-13 Cross-sectional area of grounding conductor

Cross-sectional area of the conductor during installation S (mm ²)	Minimum cross-sectional area of the corresponding grounding conductor S min (mm ²)
S ≤ 16	S
16 < S ≤ 35	16
35 < S	S/2

- When grounding multiple inverters, it is recommended to avoid loops in the grounding wires. See Figure 4-10 for grounding methods for multiple inverters.

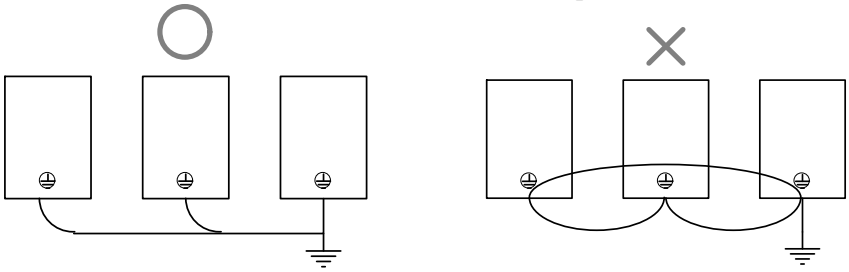


Figure 4-10 Grounding method for multiple inverters

危险

Incorrect wiring:
If the input line voltage is added to (U /T1, V /T2, W /T3), the inverter will be damaged.
Check the power connections before applying power to the drive.
If you are replacing the drive with another one, make sure all wiring to the drive complies with all wiring instructions in this manual.
Failure to follow instructions could result in death or serious injury.

4.3.4. 3 Main circuit power input terminals (R/L1, S/L2, T/L3)

- The three-phase AC power supply is connected to the main circuit terminals R/L1, S/L2, and T/L3 through a circuit breaker. The phase sequence of the input power is independent of the order of the R/L1, S/L2, and T/L3 terminals; any of them can be connected.
- In order to reduce the conducted and radiated interference of the inverter on the input power supply, a three-phase four-wire power cable with a shielding layer can be selected.

注意 Use a special noise filter for the inverter.

4.3.4.4 External Braking Resistor Terminals (B1, B2)

- Some power levels of the intelligent flexible inverter are equipped with a brake unit. To release the energy fed back during motor braking, an external brake resistor must be connected. For brake resistor specifications, see Table 2-2, "400V Class Braking Resistor Configuration Table."
- The braking resistor is installed between terminals B1 and B2.
- In order to ensure the normal operation of the braking resistor, the heat dissipation conditions of the braking resistor must be fully considered to ensure good ventilation.
- The wiring length of the braking resistor cannot exceed 5 m.

For the connection of external braking resistor, see Figure 4-11.

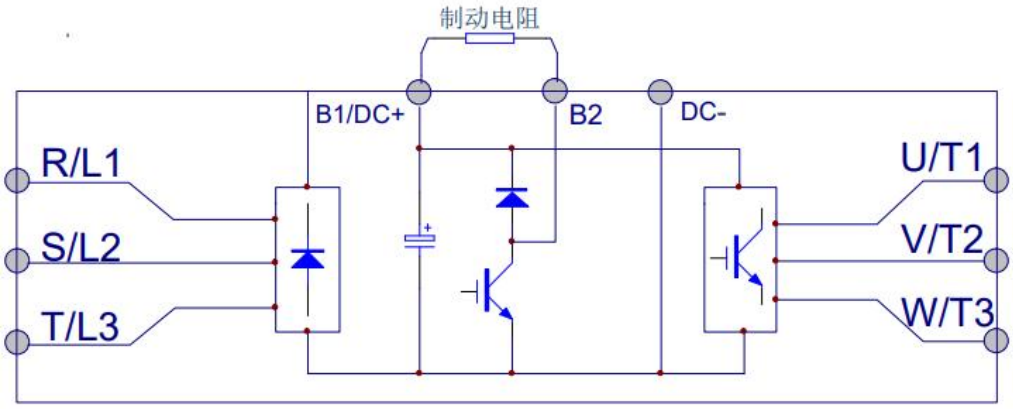


Figure 4-11 Connection diagram of external braking resistor

4.3.4.5 External Braking Unit Terminals (B+, B-)

- When an external braking unit is required, the terminals of the braking unit ⊕ and ⊖correspond to the (B+, B-) terminals of the inverter respectively, and the braking resistor is connected to the BR1 and BR2 terminals of the braking unit.
- The length of the connection between the inverter (B+, B-) terminal and the braking unit ⊕ and ⊖ terminal should be less than 5 m, and the length of the connection between the braking units BR1, BR2 and the braking resistor should be less than 10m.

注意 Do not connect the polarity of B+ and B- in reverse; do not connect the braking resistor directly to the B+ and B- terminals, otherwise the inverter may be damaged or a fire hazard may occur.

4.3.4.6 Energy feedback unit connection (DC+, DC-)

STEP RG series energy regeneration unit feeds power generated by a motor in regenerative braking back into the grid. Using IGBTs for rectifier feedback, the RG series energy regeneration unit reduces harmonic distortion to less than 5% of the fundamental harmonic compared to traditional three-phase phase-parallel bridge rectifiers, minimizing grid pollution. (Not supported by the EH series)

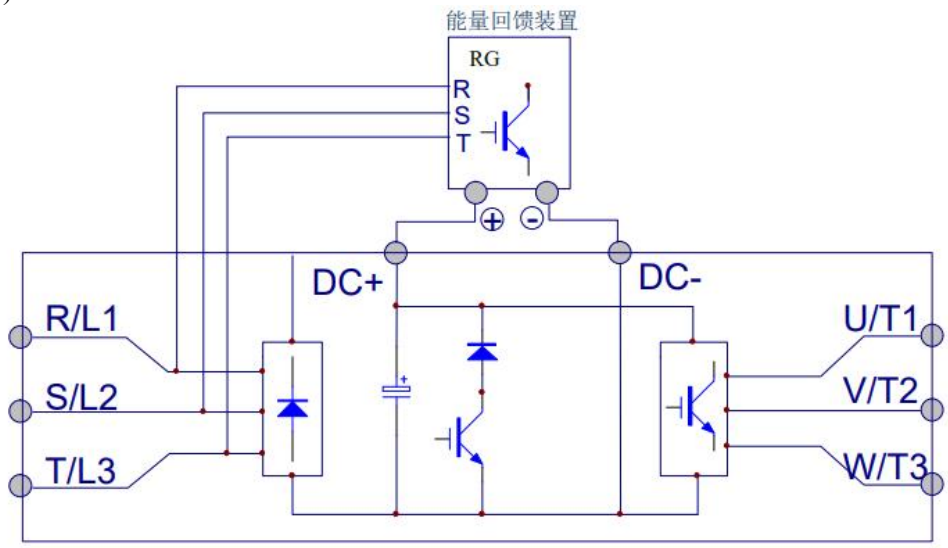


Figure 4-1 2 External energy feedback device

4.3.4.7 Inverter output terminals (U/T1, V/T2, W/T3)

- Connect the inverter output terminals U/T1, V/T2, and W/T3 to the motor terminals U/T1, V/T2, and W/T3. If the motor rotates in the wrong direction, swap the wiring between any two phases of the inverter output terminals or the motor terminals.
- It is strictly forbidden to connect the power input to the inverter's output terminals U/T1, V/T2, and W/T3.
- It is strictly forbidden to ground or short-circuit the output terminals.
- It is strictly forbidden to connect capacitors or surge filters to the inverter output side. Because the inverter output has high-order harmonics, connecting capacitors or surge filters to the output side will cause the inverter to overheat and be damaged.
- It is strictly forbidden to connect capacitors on the output side of the inverter. See Figure 4-13 for a schematic diagram.

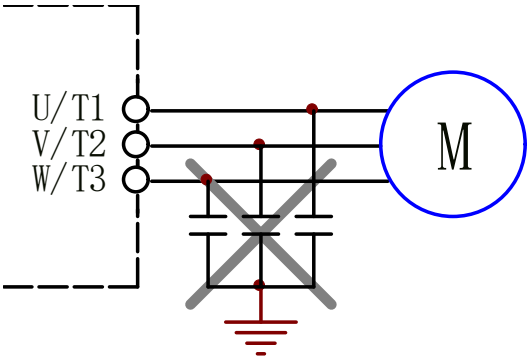


Figure 4-13 Schematic diagram of prohibiting the connection of capacitors on the output side

4.4 Anti-interference measures

4.4.1 Connecting a dedicated noise filter on the output side

To suppress the noise generated on the inverter output side, a dedicated noise filter can be connected to the inverter output side. The wiring of the noise filter on the inverter output side is shown in Figure 4-14.

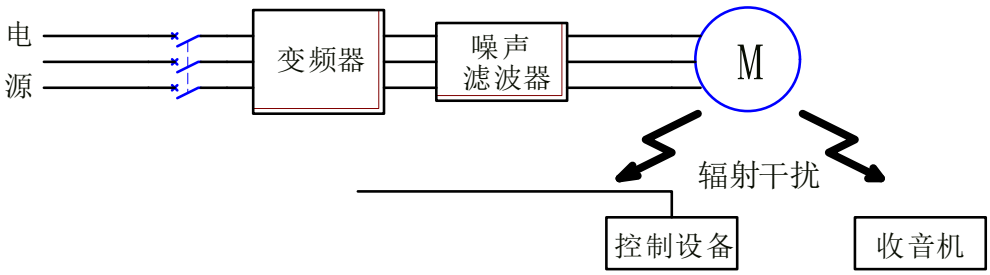


Figure 4-1 4 Wiring of the noise filter on the inverter output side

4.4.2 Connecting a surge suppressor on the output side

When the inverter is connected to an inductive load device (electromagnetic contactor, relay, solenoid valve, etc.), be sure to use a surge suppressor on the coil of the load device, as shown in Figure 4-15:

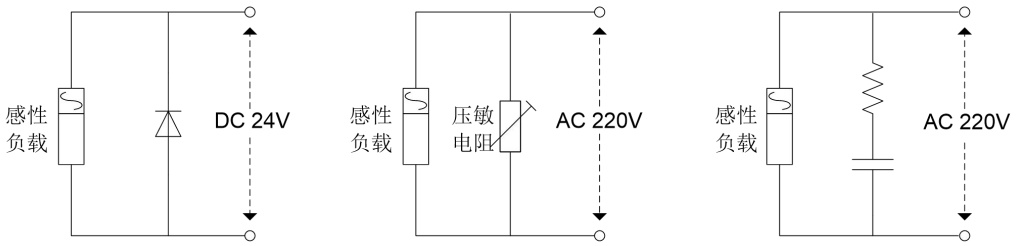


Figure 4-15 Application of inductive load surge suppressor

4.4.3 Layout of main circuit wiring

To suppress radiated interference from the inverter output and enhance anti-interference performance, they should generally be kept as far apart as possible, especially when cables are installed in parallel and over long distances. If signal cables must cross power cables, they should do so perpendicularly. See Figures 4-16 and 4-17 for schematic diagrams of the main circuit wiring layout.

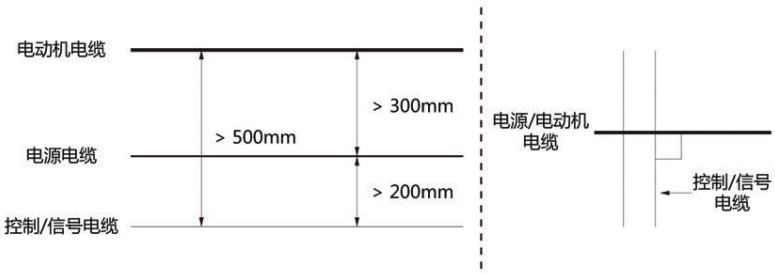


Figure 4-1 6 Main circuit wiring layout 1

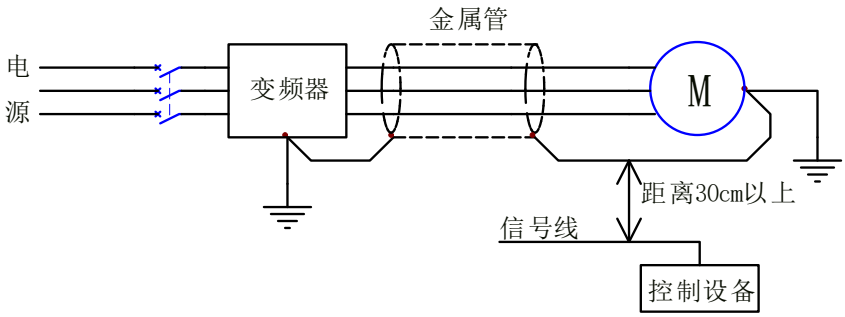


Figure 4-17 Schematic diagram of the main circuit wiring layout 2

Generally, the control cable must be a shielded cable, and the shielded metal mesh must be connected to the metal chassis of the inverter through the cable clamps at both ends, as shown in Figure 4-18.

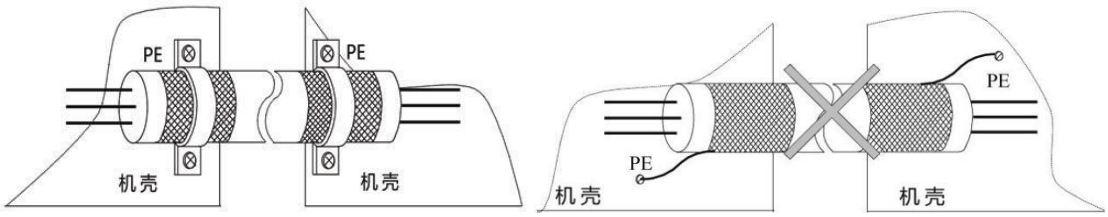


Figure 4-18 Grounding method comparison

4.4.4 More comprehensive anti-interference measures

A more comprehensive anti-interference measure is to install noise filters on both the input and output sides of the inverter and to shield the inverter body in an iron box. See Figure 4-19.

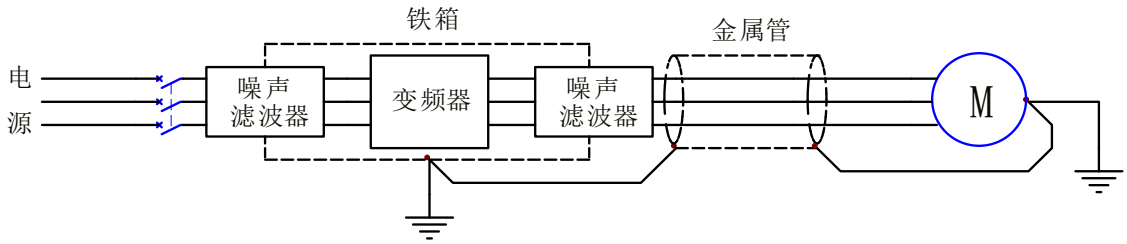


Figure 4-19 More complete anti-interference measures

4.4.5 Relationship between wiring length and carrier frequency

If the wiring between the inverter and the motor is too long, the distributed capacitance of the wires will increase the high-order harmonic leakage current, potentially causing the inverter to output overcurrent protection and adversely affecting surrounding equipment and the motor. Therefore, the wiring length between the inverter and the motor should not exceed 100m. If the wiring length exceeds 100m, reduce the carrier frequency parameter P71.14 and select an output filter and reactor.

4.5 Wiring of control circuit terminals

4.5.1 Arrangement of control circuit terminals

4-21 for a general standard I/ O board:

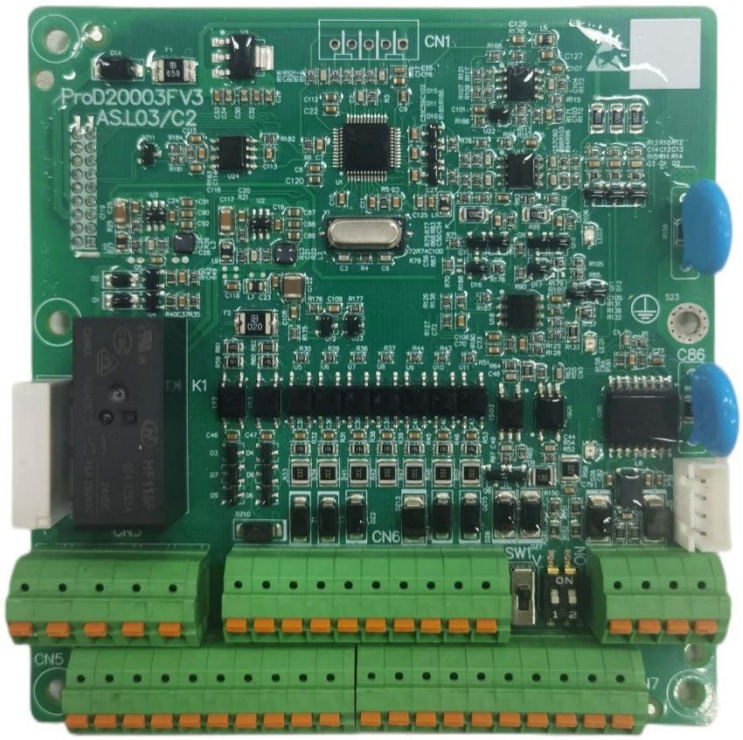


Figure 4-2 1-1 IO-A board control circuit terminal diagram

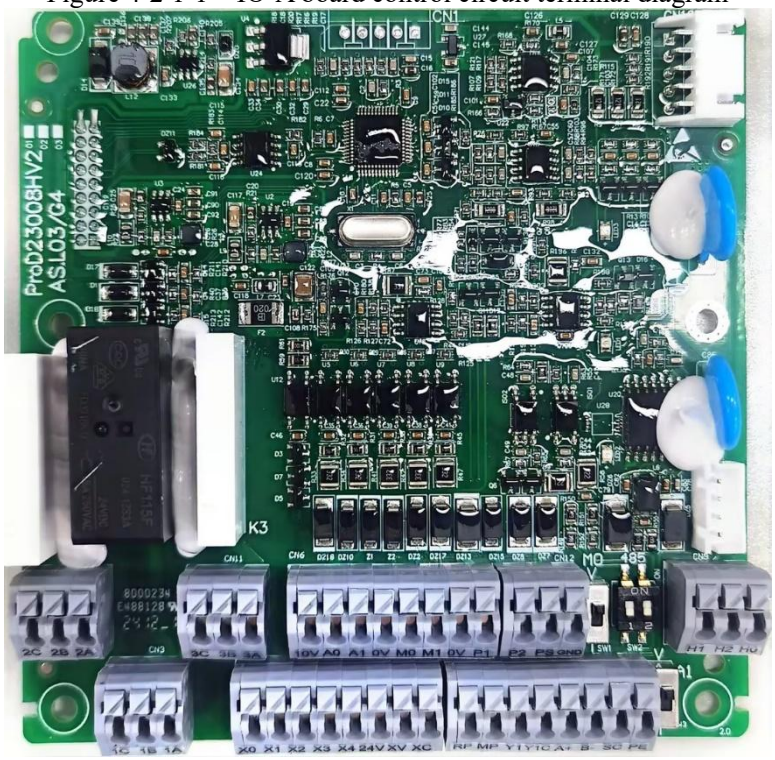


Figure 4-2 1-2 IO-B board control circuit terminal diagram

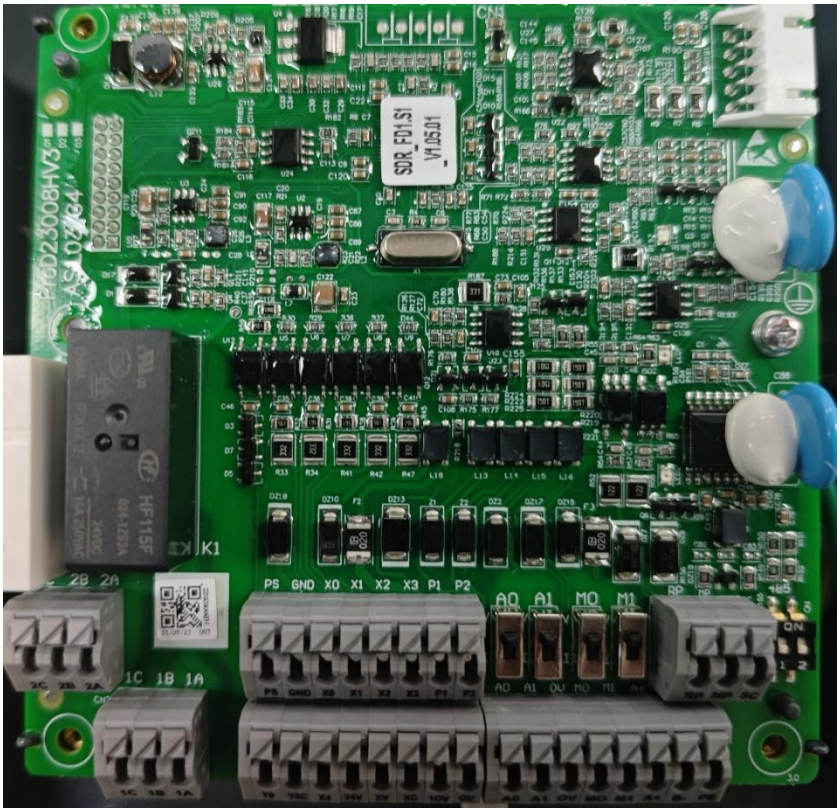


Figure 4-2 1-3 IO board - standard board control circuit terminal diagram

IO- A board: A0/A1 can input analog voltage signals (0V~+10V) or analog current signals (0~20mA). The input mode is modified by the corresponding software parameters of each port. The default is (0~10V) voltage signal.

M0 can output analog voltage signal (0~+10V) or analog current signal (0~20mA). The output mode is determined by the toggle switch SW1 corresponding to the port.

Note: When the switch is set to "V", the corresponding port operates in voltage mode; when the switch is set to "I", the corresponding port operates in current mode. The layout of the output signal type selection toggle switch is shown in Figure 4-22-1.

Figure 4-2 2-1 Output signal type selection toggle switch

IO Board-B: A0/A1 can input analog voltage signals (0V~+10V) or analog current signals (0~20mA). The input mode is modified by the corresponding software parameters of each port. The default is (0~10V) voltage signal.

M0 can output analog voltage signal (0~+10V) or analog current signal (0~20mA). The output mode is determined by the toggle switch SW1 corresponding to the port.

Note: When the switch is set to " V ", the corresponding port operates in voltage mode; when the switch is set to "I", the corresponding port operates in current mode. The layout of the output signal type selection toggle switch is shown in Figure 4-22-2.

Figure 4-22-2 Output signal type selection toggle switch

IO board-standard board:

A0/A1 can input analog voltage signals (-10 V to +10 V) or analog current signals (0 to 20 mA). The input mode is modified by the corresponding software parameters for each port, and the default is a voltage signal (-10 V to 10 V). The layout of the input signal type selection toggle switch is shown in Figure 4-22-3.

Note: DIP switch A1 is for input mode selection. When the switch is turned to the "V" end, the corresponding port is in voltage working mode; when the switch is turned to the "I" end, the corresponding port is in current working mode.

Figure 4-22-3 Input signal type selection toggle switch

M0/M1 can output analog voltage signal (0~+10V) or analog current signal (0~20mA). The output mode is determined by the toggle switch SW1 corresponding to the port.

Note: When the switch is set to " V ", the corresponding port operates in voltage mode; when the switch is set to "I", the corresponding port operates in current mode. The layout of the output signal type selection toggle switch is shown in Figure 4-22-4.

Figure 4-2 2- 4 Output signal type selection toggle switch

4.5.2 Control circuit terminal number

The control circuit terminal numbers are shown in Figure 4-2 3.

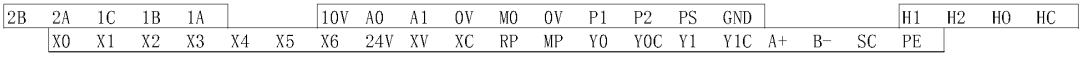


Figure 4-2 3-1 A board control circuit terminal label

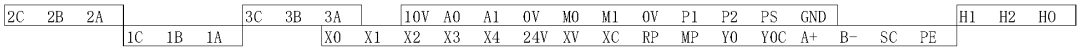


Figure 4-2 3- 2 B board control circuit terminal label

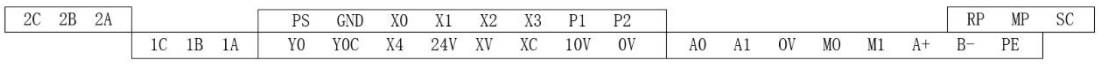


Figure 4-2 3- 3 Standard board control circuit terminal number

4.5.3 Control circuit terminal function description

The function description of the control circuit terminals is shown in Table 4-15.

Table 4-15 Functional description of control circuit terminals

<table>
<tr><th>name</th><th>Terminal number</th><th>signal name</th><th>A-board</th><th>B-board</th><th>Standard board</th><th>Remark</th></tr>
<tr><td rowspan="10">Digital input terminals</td><td>X0</td><td>Multi-function input 0</td><td>●</td><td>●</td><td>●</td><td rowspan="10">Contact input, input signal is valid when the contact is closed. Function is selected by the parameters of function code P30 function group. The specifications of the switch input circuit are as follows:
<table><tr><td>Internal power supply</td><td>+24VDC</td></tr><tr><td>Maximum load current</td><td>100mA</td></tr></table></td></tr>
<tr><td>X1</td><td>Multi-function input 1</td><td>●</td><td>●</td><td>●</td></tr>
<tr><td>X2</td><td>Multi-function input 2</td><td>●</td><td>●</td><td>●</td></tr>
<tr><td>X3</td><td>Multi-function input 3</td><td>●</td><td>●</td><td>●</td></tr>
<tr><td>X4</td><td>Multi-function input 4</td><td>●</td><td>●</td><td>●</td></tr>
<tr><td>X5</td><td>Multi-function input 5</td><td>●</td><td>○</td><td>○</td></tr>
<tr><td>X6</td><td>Multi-function input 6</td><td>●</td><td>○</td><td>○</td></tr>
<tr><td>24V</td><td>Internal +24VDC power output</td><td>●</td><td>●</td><td>●</td></tr>
<tr><td>XV</td><td>Input signal common terminal</td><td>●</td><td>●</td><td>●</td></tr>
<tr><td>XC</td><td>Internal 24V power supply 0V</td><td>●</td><td>●</td><td>●</td></tr>
<tr><td rowspan="3">Analog input terminals</td><td>A0</td><td>Multi-function analog input 0</td><td>●</td><td>●</td><td>●</td><td rowspan="2">In voltage mode, rated input range: 0 V to +10 VDC（±0.1V）, Rin > 10 kΩ
In current mode, rated input range: 0mA to +20mA（±0.2mA）, 1.75Ω > Rin ≥1.20Ω</td></tr>
<tr><td>A1</td><td>Multi-function analog input 1</td><td>●</td><td>●</td><td>●</td></tr>
<tr><td>10V</td><td>+10V power output</td><td>●</td><td>●</td><td>●</td><td>+10VDC power output terminal for analog input, maximum allowable current 20mA</td></tr>
<tr><td>0V</td><td>Analog input signal reference ground</td><td>●</td><td>●</td><td>●</td><td>Analog input signal reference ground</td></tr>
<tr><td rowspan="3">Relay output terminal</td><td>1A
1B
1C</td><td>Relay output 1</td><td>●</td><td>●</td><td>●</td><td>Switching output, where AB is a normally open contact, BC is a normally closed contact, contact capacity:
Resistive: 8A/250VAC or 8A/30VDC,
Inductive: 1.5A/250VAC or 1.5A/30VDC,
Output function can be defined</td></tr>
<tr><td>2A
2B
2 C</td><td>Relay output 2</td><td>●</td><td>●</td><td>●</td><td rowspan="2">A board:
Normally open contact, contact capacity:
Resistive: 4.5A/250VAC or 4.5A/30VDC,
Inductive: 0.4A/250VAC or 0.4A/30VDC,
Output function can be defined
B board/standard board:
Switching output, where AB is a normally open contact, BC is a normally closed contact, contact capacity:
Resistive: 6A/250VAC or 6A/30VDC,
Inductive: 0.4A/250VAC or 0.4A/30VDC,
Output function can be defined</td></tr>
<tr><td>3 A
3 B
3 C</td><td>Relay output 3</td><td>○</td><td>●</td><td>○</td></tr>
<tr><td rowspan="4">Digital output terminal</td><td>Y0</td><td>Digital output 0</td><td>●</td><td>●</td><td>●</td><td rowspan="4">Programmable integrated open output, function can be defined.
Driving capability: no more than DC30V, 30mA</td></tr>
<tr><td>Y0C</td><td>Digital output common terminal</td><td>●</td><td>●</td><td>●</td></tr>
<tr><td>Y1</td><td>Digital output 1</td><td>●</td><td>○</td><td>○</td></tr>
<tr><td>Y1C</td><td>Digital output common terminal</td><td>●</td><td>○</td><td>○</td></tr>
</table>

name	Terminal number	signal name	A-board	B-board	Standard board	Remark
Analog output terminal	M0	Analog output 0	●	●	●	Bandwidth: 30kHz; In voltage mode, rated output range: 0 V~+10VDC (±0.1V), RL≥1kΩ, maximum output current 10 mA rated output range: 0mA~+ 20mA (±0.2mA), 20Ω≤ RL ≤500Ω Output mode is selected by DIP switch SW1 Note: B board M1 only supports current mode
	M1	Analog output 1	○	●	●	
	0V	Analog output signal reference ground	●	●	●	Analog output signal reference ground
High-speed pulse input	RP	Pulse input	●	●	●	Absolute on-state value: DC8V~24V; Absolute off-state value: DC0V~3V Bandwidth: 33KHz
	MP	Pulse output	●	●	●	Switching OC output , maximum allowable voltage DC32V , RL≥ 250Ω , maximum output current 100mA Bandwidth: 33KHz
Overtemperature protection terminal	P1, P2	PTC function connection port	●	●	●	A board: Matching temperature sensor models: PT1000 and PTC PT1000 over-temperature protection point: 120 ℃ B board: Matching temperature sensor model: PT100
24V auxiliary power supply	PS	Auxiliary 24V power input	●	●	●	Connect an external power supply to make the inverter control system work; Power supply range: + 24V (±5%) , required power supply capacity: 700mA
	GND	Auxiliary 24V power ground	●	●	●	
Modbus communication terminal	A+	Modbus communication signal+	●	●	●	Modbus communication signal terminal, maximum baud rate: 115200 bps; DIP switch SW 2 selects the terminal resistance state (not connected by default) ;
	B-	Modbus communication signal-	●	●	●	
	SC	Communication isolation area	●	●	●	Modbus communication isolation ground
	PE	Shield grounding	●	●	●	

Note: ① ● indicates that this terminal exists, ○ indicates that this terminal does not exist.

②IO-A board relay output 2 has only normally open contacts.

③ Use shielded twisted-pair cables for analog signal cables, with the shield layer properly grounded. Keep the cables at least 5 cm away from the power cables. It's best to cross the cables with the power cables, and avoid running them parallel to the power cables. The shield layer can be connected to the inverter housing.

4.5.4 Wire specifications for control circuit wiring

Control circuits should use 600V plastic-insulated copper-core conductors. Wire specifications and tightening torques are shown in Table 4-16.

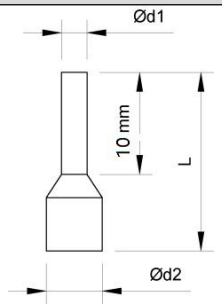
Table 4-16 Wire specifications and tightening torque

Inverter model	Connectable wire specifications mm^2	Recommended wire size mm^2	Tightening torque (Nm)
Full range of intelligent flexible inverters	0.5～1	0.75	1.5

The wire specifications are determined based on an ambient temperature of 50° C and an allowable wire temperature of 75° C.

It is recommended to use rod terminals for control circuit wiring. The specifications of the rod terminals are shown in Table 4-17.

Table 4-17 Specifications of rod terminals

Wire cross-sectional area mm² (AWG)	d1 (mm)	d2 (mm)	L (mm)	Graphic
0.5 (22)	1.3	2.5	16	
0.75 (20)	1.5	2.8	16.4	
1.0 (18)	1.7	3.4	16.4	

4.5.5 Detailed description of control circuit terminal wiring

4.5.5.1 Digital input terminals

Each multi-function switch input terminal can define its input function through the parameter setting of function code group P30. The value set by P30.00~P30.06 is between 0 and 63. Please refer to parameter group P30 for details .

Specific wiring method:

- Use the internal +24V of the inverter and the external controller as a passive contact wiring method

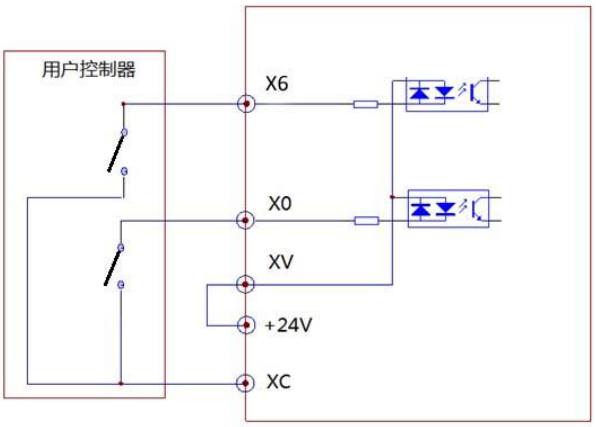


Figure 4-2 4- passive contact wiring method

- Use the internal +24V of the inverter and the external controller as NPN type current sink wiring

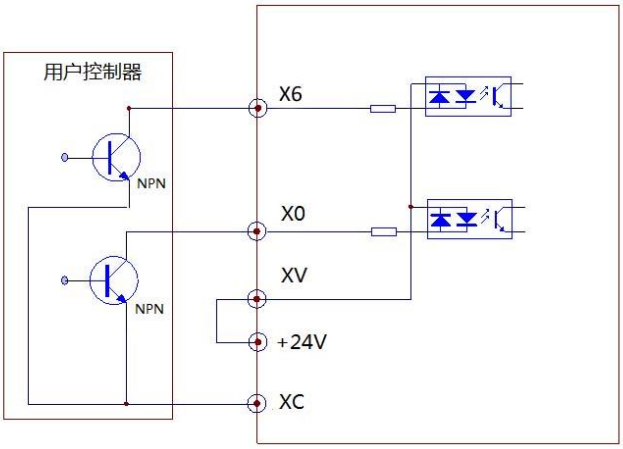


Figure 4-2 5 NPN current sink wiring method

- Use the internal +24V of the inverter and the external controller as a PNP current source wiring method

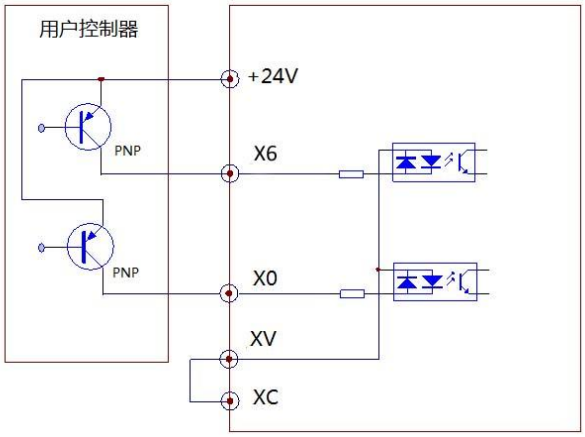


Figure 4-2 6 PNP type current source wiring method

Note: Be sure to remove the short-circuit piece between the +24V and XV terminals, and short-circuit the XC and XV terminals.

- Use external power supply, external controller as NPN type current sink wiring method

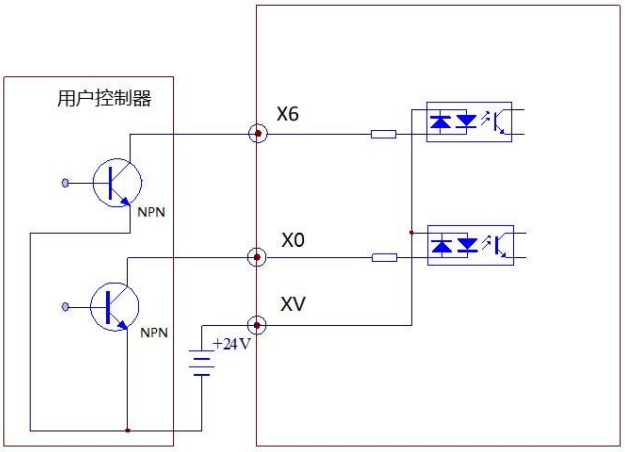


Figure 4-2 7 NPN current sink wiring method

Note : Be sure to remove the short-circuit piece between the +24V and XV terminals

- Use external power supply, external controller uses PNP type current source wiring method

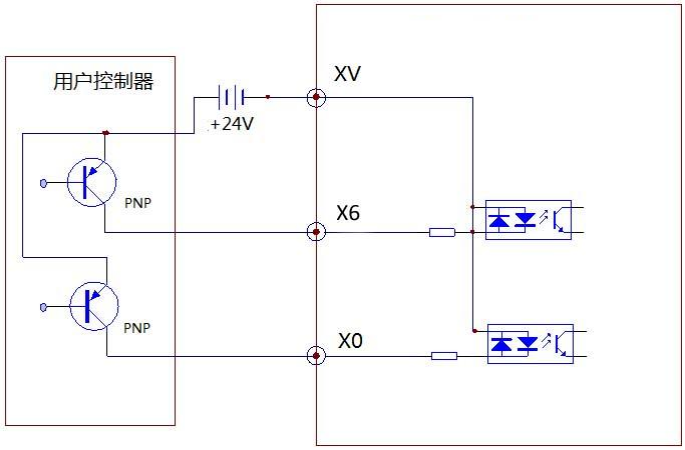
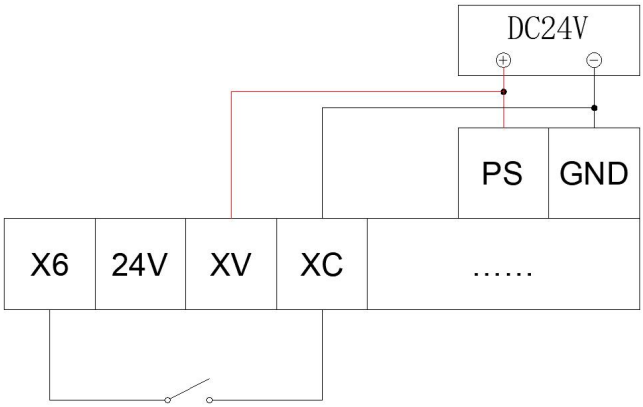


Figure 4-28 PNP type current source wiring method

Note : Be sure to remove the short-circuit piece between the +24V and XV terminals

- Use external power supply (only use external DC24V power supply), the external controller as passive contact wiring mode



Note: When using digital input terminals and the power supply is external DC24V input, the positive and negative poles of the external power supply must be connected to the PS, XV terminals and GND, XC terminals on the IO board respectively before use. Normally open and normally closed are valid.

Note: Be sure to remove the short-circuit piece between the +24V and XV terminals

4.5.5.2 Analog input terminals

This inverter has two analog input ports A0 and A1, and the signal type is optional: voltage/current; the voltage signal range is 0V~+10V, and the current signal range is 0~20mA.

When using analog input signals, you can also use the P32.00~P32.11 parameter settings to select parameters such as gain, offset, and signal filter time for each corresponding input port signal to better utilize the analog input port. For details, please refer to Section 7.6.3 .

When using analog signal connection, the connection line between the analog signal and the inverter should be as short as possible (no more than 30m). Use shielded wire, and the shielding layer of the shielded wire should be grounded.

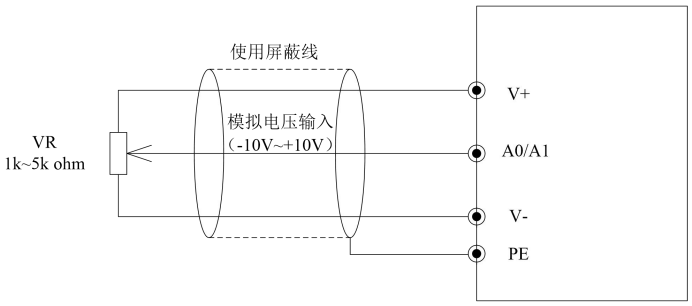


Figure 4-29 Schematic diagram of analog signal shielded line wiring

In Figure 4-29, the analog voltage signal is provided by the inverter, and the voltage range is 0V to +10V. In most practical applications, the analog input voltage signal is provided by the controller that issues the analog signal. Furthermore, if the signal is a voltage, it is usually in the 0-10V range. The wiring diagram is shown in Figure 4-30. If the signal is a current, it is in the 0mA to 20mA range. The wiring diagram is shown in Figure 4-31.

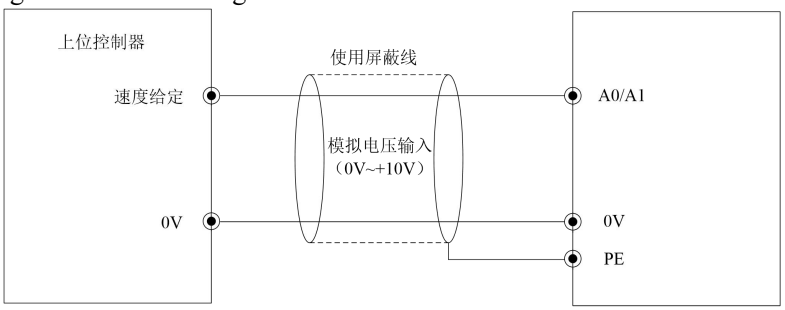


Figure 4-30 Analog voltage signal wiring diagram

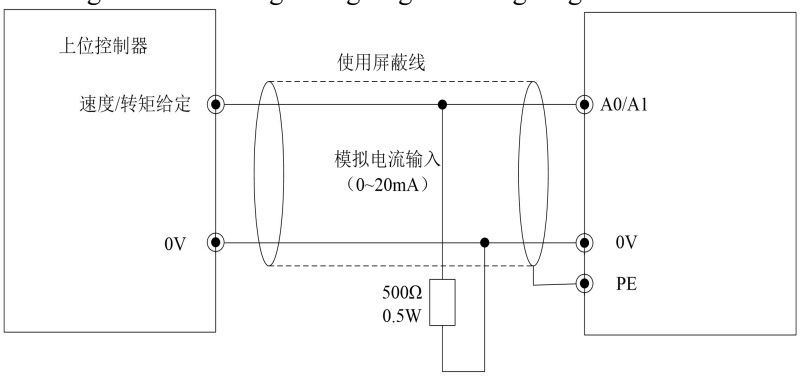


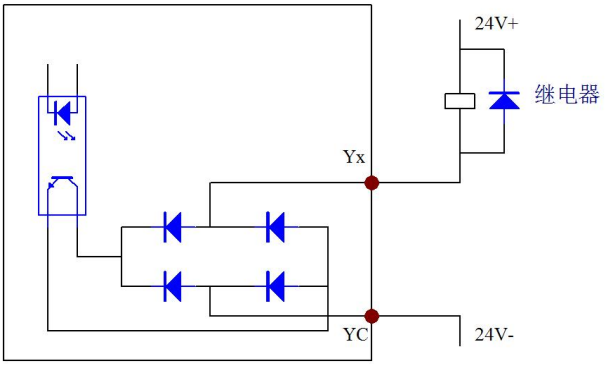
Figure 4-31 Analog current signal wiring diagram

4.5.5.3 Switching output terminals

The switching output terminals consist of two parts: relay contact output terminals and open collector output terminals. The function of each switching output terminal can be defined by setting the parameters in function code group P31. The setting range is 0 to 63, and the values for each are detailed in parameter group P31 .

Note: The open collector output uses an external power supply. Pay attention to the polarity of the power supply when connecting the external power supply. The output power supply specifications are a maximum voltage of +30VDC and a maximum load current of 50mA. Exceeding these specifications may damage the output circuit.

- Wiring method of multi-function integrated output terminal using external +24V power supply of inverter



Note : If the Y0 or Y1 terminal is damaged when using this wiring method, please make sure that the polarity of the external diode is correct.

4.5.5.4 Multi-function analog output terminal

The multi-function analog output terminal defines its output function through the parameter settings of function codes P33.00 and P33.03. The setting value range is between 0 and 16. Each data represents its corresponding output point. P33.00 parameter corresponds to M0 output point (P33.03 parameter is reserved for M1 output point). It has the following functions:

0: No function
1: Output current
2: Output voltage
3: Torque setting
4: Bus voltage
5: Total output power
6: Output active power
7: Speed (unsigned)
8: Speed setting (signed)
9: Speed feedback (signed)
10: Acceleration rate
11: Radiator temperature
12: Analog A0
13: Analog A1
14: Analog A2 (spare)
15: ModBus analog output 0
16: ModBus analog output 1 (spare)

For detailed description, refer to Chapter 7 “ 7.6.4 Analog Output Parameters”.

4.5.6 Other considerations for wiring

The wiring of the control terminals must be kept away from the power lines of the main circuit, otherwise malfunction may occur due to electromagnetic interference.

Chapter 5 Debugging and Trial Operation

In the following chapters, terms related to the control, operation, and status of the inverter will be mentioned many times. Please read this chapter carefully before using the product so that you can correctly understand and use the functions mentioned in the subsequent chapters.

After confirming that the inverter chassis is installed, you can turn on the input power. After the power is on, do not remove the inverter chassis, otherwise there is a risk of electric shock.

If the inverter has been set with the power-off restart function, please do not get close to mechanical transmission equipment to prevent the inverter from starting the mechanical equipment when power is turned on and causing personal injury.

When an energy-consuming braking resistor is installed, do not touch the braking resistor; otherwise, there is a risk of electric shock and burns.

Before starting the motor and mechanical equipment with the inverter, be sure to confirm the allowable application range of the motor and mechanical equipment, otherwise there is a risk of injury.

Do not check the measurement signal while the inverter is running; otherwise, there is a risk of damaging the equipment.

Do not change the inverter parameter settings at will, otherwise the proper operating effect may not be achieved and there is a risk of damaging the transmission equipment.

Before switching the inverter's operating command channel, be sure to perform switching debugging first; otherwise, there is a risk of equipment damage and personal injury.

5.1 Operation command setting

The operator is the basic tool for operating the inverter. It can be used to observe the inverter's various states and fault codes, as well as to set and view the inverter's various parameters. This chapter describes in detail the basic operation methods of the operator.

5.1.1 Inverter operation command channel

It specifies the physical channel through which the inverter receives operation commands: start, stop, etc. There are three types of operation command channels:

Operator panel: Use RUN, STOP/RESET, LO/RE keys on the operator panel for control;

Control terminals: Use control terminals X0~X6 (digital quantity) and A0~A1 (analog quantity) for control;

Communication port: Use control terminals A+ and B- (Modbus) to start and stop the control via the host computer.

command channel selection can be set through function code P10.02 .

Note: Before command channel switching, be sure to perform switching debugging first, otherwise there is a risk of damage to the equipment and personal injury!

5.1.2 Frequency setting channel of inverter

There are four frequency-given physical channels in normal operation mode , namely:

1. Use the ▲ and ▼ keys on the operator panel to set;

2. Terminal setting;
3. Communication given;
4. Analog voltage and current setting.

5.1.3 Inverter working status

The working status is divided into stop status and running status. Stop status: After the inverter is powered on and initialized, if there is no run command input, or if a stop command is executed during operation, the inverter will enter the stop status.

Running state: After receiving the running command, the inverter enters the running state.

5.1.4 Inverter operation mode

Closed-loop operation: When the closed-loop selection function is valid (P51.00 =1), the inverter will select the closed-loop operation mode, that is, perform PID adjustment according to the given and feedback values (see P51 group function code).

Multi-speed operation: Through the open/close combination of the multi-function terminals ,select multi-speed frequencies 0 to 7 (P 41.00 to P 41.15) for multi-speed operation.

Normal operation: a simple open-loop operation mode.

5.2 Operator User Guide

The operator is the basic tool for operating the inverter. It can be used to observe the inverter's various states and fault codes, as well as to set and view the inverter's various parameters. This chapter describes in detail the basic operation methods of the operator.

Users can use the operator panel to:

- Monitor motor status
- Motor self-tuning
- Control motor operation (motor start / stop, motor speed, forward / reverse, etc.)
- View and respond to faults or alarms
- Setting and modifying parameters
- Switch between local and remote modes

5.2.1 Introduction to the functions of each part of the operator

The names and functions of the various parts of the operator are shown in Figure 5-1.

Figure 5-1 Names and functions of various parts of the operator

5.2.2 LCD Display

The middle of the LCD operator is a liquid crystal display (LCD), which is the main window for setting inverter parameters, displaying motor operating parameters, and viewing inverter fault codes.

5.3 LCD operator operation

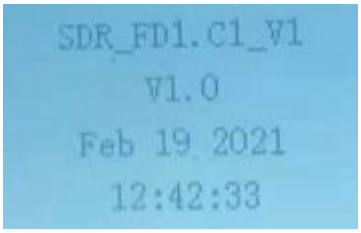
The operator has three states: [Monitoring Status], [Function Selection] and [Parameter Modification]. The operator menu display language is Chinese and English. The factory setting is Chinese. You can switch to English menu display by setting the parameter value of the "Language Selection" item in the advanced menu to 1.

5.3.1 Power-on initialization

When the operator is powered on for the first time, you need to adjust the brightness of the operator's LCD screen using the left and right shift keys. Press the left shift key to dim the brightness, and press the right shift key to brighten the brightness.

After the operator is powered on, it will take a few seconds to initialize. During this process, the LCD screen will display the [Startup Screen].

The boot screen is shown as follows:



Note: After displaying the software version number, the system enters the monitoring state.

5.3.2 Display after power on

The screen will show [monitoring status] 2 seconds after power-on. By default, the interface displays the currently recorded target speed, given speed, feedback speed, and output current.

5.3.3 [Monitoring Status] Detailed Description

After enter monitoring settings, you can choose standard monitoring and waveform monitoring. Standard monitoring can set 8 displays

Table 5.1 Default operating status data comparison table

Name	Content	Setting range	Unit	Factory setting	Remark
Target speed	Displays the target speed command value of the motor	×	Hz	×	
Given speed	Displays the speed command value of the motor	×	Hz	×	
Feedback speed	Display the speed value of the motor feedback	×	Hz	×	
Output current	Display output current	×	A	×	
Output voltage	Display output voltage	×	V	×	
Bus voltage	Displays the DC voltage of the main circuit inside the inverter	×	V	×	
Output power	Display output power	×	kW	×	
Output torque	Display torque output value	×	%	×	
Input X0-X6 status	Displays the status of input terminals X0-X6. The DI display format is "XXXXXXXX", where "X" = 0 means no input; "X" = 1 means input.	×	×	×	
Output K1-K2, Y0, Y1 status	Displays the status of output terminals K1-K2, Y0, and Y1. DO is displayed in the form of "XXXXXX," where "X" = 0 indicates no output; "X" = 1 indicates output.	×	×	×	

5.3.4 [Panel Control] Details

In the "Monitoring Status" interface, press "LOC" to switch between the "Monitoring Status" and "Panel Control" states. In the "Panel Control" state, press "RUN" to control the inverter to enter the Running state, and press "STOP" to control the inverter to enter the Stop state. In the " Panel Control " interface, press the "∧" and "∨" keys to switch the monitoring content, and use ">", "<" or "↵" to set the operating frequency.

5.3.5 Operating status of the operator

The operator has seven operating states. These seven states are [Monitoring Settings], [Debug Wizard], [Parameter Group], [Parameter Handling], [Fault Record], [Auto-tuning], and [System Settings]. In any monitoring state interface, press ENTER to enter the function selection interface.

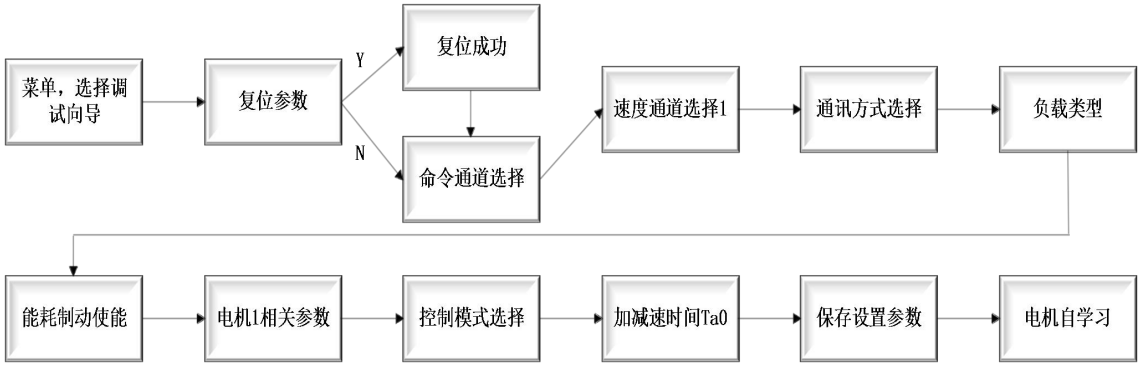
5.3.5.1 [Monitoring Settings] Status Details

[Monitoring Settings] state of the operator is used to modify monitoring data and supports two modes: standard monitoring and waveform monitoring.

In standard monitoring mode, you can customize and modify 8 displayed data; in waveform monitoring mode, the curve of given speed and feedback speed is displayed in real time in the form of waveform.

5.3.5.2 [Debug Wizard] Status Details

The commissioning wizard is a fast parameter setting mode that contains commonly used parameters. By following this parameter guide, you can quickly set the inverter parameters according to the motor nameplate and quickly complete basic commissioning.



5.3.5.3 [Parameter group] Status details

[Parameter Group] state of the operator is used to modify parameters. For the setting range of parameters, please refer to Chapter 6.

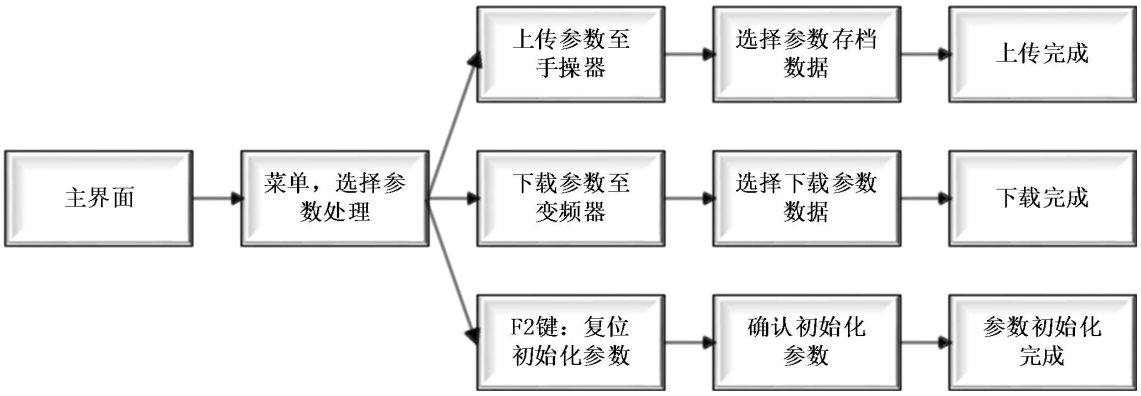
In the [Parameter Group] state, press ∧ or ∨ to select a parameter. Press < to return to the previous menu, and press ∨ or ↵ to enter the parameter setting. After selecting the parameter to be modified, press ↵. A cursor indicating the modification position will appear on the parameter position to be modified. Press < or > to move the cursor to change the modification position. Press ∧ or ∨ to increase or decrease the parameter value. Press

to confirm the modification. If you do not press , the parameter modification will be invalid.

Press ESC to return to the previous menu level.

5.3.5.4 [Parameter Handling] Status details

In the [Parameter Handling] state, you can upload, download, and reset parameters. The operator can store 4 groups of uploaded parameters.



5.3.5.5 [Fault Record] Status Details

In the [Fault Record] mode, you can view the details of the eight most recent faults, including the voltage, current, set speed, feedback speed status, instantaneous values of the three-phase currents U, V, and W, and the time the fault occurred. In the main status screen, pressing ENTER displays ER0=X. Pressing or switches between ER0 and ER7, where ER0 represents the most recent fault number, ER7 represents the most distant fault number, and X represents the fault code associated with the current fault number. The meaning of the fault code is displayed in Chinese below. Pressing again while the fault code is displayed displays the DC bus voltage (U_{dc}) , instantaneous output current (I_{rms}), current frequency given(V_{ref}), feedback frequency (V_{fbk}), instantaneous values of U-phase current (I_u), V-phase current (I_v), and W-phase current (I_w). Pressing ENTER again returns to the fault code display. Pressing ESC returns to the previous menu level.

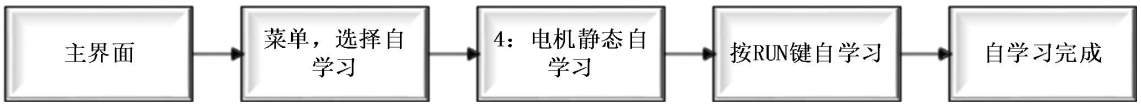
5.3.5.6 [Auto-tuning] Status details

In the [Auto-tuning] state, you can manually auto-tune the motor parameters. Press , and a cursor indicating the modification position will appear on the parameter position to be modified. Press or to select the self-learning item, press to confirm, and press the "RUN " key to start auto-tune. The meanings of auto-tuning selection parameters are as follows:

0: Normal operation mode

4: Motor static self-learning

Press ESC to return to the previous menu level.



5.3.5.7 [Modified parameter] Query Status details

You can view the modified parameters through the panel and modify them directly.

5.3.5.8 [System Settings] Status Details

In the [System Settings] state, you can set the date/time, program upgrade, and waveform acquisition functions. Program upgrade can be upgraded through the operator to upgrade the main control and IO board programs; the waveform acquisition function can be enabled to realize waveform acquisition (acquisition channel is configurable) and automatically store it to the SD card .

Press ESC to return to the previous menu level.

5.4 Fault Display

When the inverter fails, the LCD screen of the operator will display the fault code and fault name. See Table 5.5 for the fault codes and fault names.

Table 5.5 Fault code and fault name table

Fault number	Fault display	Fault number	Fault trace display
1	Module overcurrent protection	2	Rectifier Bridge Overheat
3	Radiator overheating	7	Speed deviation
8	Busbar overvoltage protection	9	Bus undervoltage
10	Output phase loss	12	Encoder failure
13	Low Bus Voltage Fault	17	Speeding in the same direction
18	Reverse speeding	21	abc overcurrent
25	Fan Detection Fault	26	Encoder Not Learned
27	Output overcurrent	29	Abnormal busbar fluctuation
30	Overspeed protection	31	Motor I2T current
32	Grounding protection	34	External fault
35	PT Detection Fault	36	Motor Fan Fault
37	Current sensor failure	3 8	Brake short circuit fault
39	Current sampling abnormality	42	IGBT short circuit fault
43	Communication failure	44	Driver board communication failure
45	I2t instantaneous value overcurrent	46	spare
47	Analog input abnormality	48	Power ID failure
49	STO fault	51	Abnormal output current during operation
54	Grid imbalance fault	55	Grid phase sequence fault

Fault number	Fault display	Fault number	Fault trace display
56	Grid undervoltage fault	57	Grid overvoltage fault
58	ProfiNet Failure	59	Hardware version mismatch

Chapter 6 Function Parameter Table

6.1 Function code parameter table description

Simple table fields	Explanation
Function code number	Indicates the code of the function code, such as P00 .00
Function code name	The name of the function code explains the function of the function code
Factory value	The setting value after the function code is restored to the factory value (see P00.01)
Setting range	The minimum and maximum values that the function code allows to set
unit	V: voltage; A: current; ℃: degree; Ω: ohm; mH: millihenry; rpm: speed; %: percentage; bps: baud rate; Hz, kHz: frequency; ms, s, min, h, kh: time; kW: power; /: no unit, etc.
property	○: This function code can be modified during operation; ×: This function code can only be modified when the machine is stopped; *: This function code is a read-only parameter and cannot be modified
Function code options	Function code parameter setting list
User Settings	For users to record parameters

6.2 Function code parameter table

6.2.1 P0X Group User Parameters

P00 group password parameters						
Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P00.00	Password login	0	0～65535	/	×	0: no password; other: login password;
P00.01	Password Change	0	0～65535	/	×	0: no password; other: password protection;
P01 group customer usage parameters (omitted)						

6.2.2 P1X group control parameters

6.2.2.1 P10 Group Basic Control Parameters

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P10.00	Control mode selection	0	0～6	/	×	0: GVC control (supports synchronous and asynchronous flying start) 1: No PG vector control (SVC) (supports synchronous and asynchronous flying start) 2: With PG torque control 3: With PG vector control (FOC) 4: VFVC control (supports asynchronous flying start) 5: No PG torque control 6: Voltage and current source
P10.01	Operation mode selection	0	0～4	/	×	0: two-wire type 1; 1: Two-wire type 2; 2: Three-wire type 1; 3: three-wire type 2; 4: One wire system (spare)
P10.02	Command channel selection	0	0～6	/	×	0: Panel 1: terminal 2: Communication (Modbus) 3: CAN (spare) 4: DP (spare) 5: PLC 6: SSI
P10.03	Speed channel selection 1	0	0～17	/	×	0: Panel given speed 1: Digital multi-speed setting 3: Analog 0 gives the target speed 4: Analog 0 gives the current speed 5: Analog 1 sets the target speed 6: Analog 1 gives the current speed 8: PID given target speed 11: SSI gives the current speed 12: Communication (Modbus) gives the target speed 15: Up/Down given speed 17: PLC given speed Other channels: spare
P10.04	Torque channel selection	0	0～6	/	×	0: Panel given torque

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
						1: Analog 0 gives target torque
						2: Analog 1 gives target torque
						3: Spare
						4: Spare
						5: ModBus given torque
						6: Spare
P10.05	Compensation torque selection	0	0～6	/	×	0: No compensation torque
						1: Internally set compensation torque
						2: Spare
						3: Spare
						4: Spare
						5: Spare
						6: Spare
P10.06	Speed limit selection	0	0～5	/	×	0: Internal parameter limit 1~ 5: spare
P10.07	Speed channel selection 2	0	0～17	/	×	Same as P10.03

6.2.2.2 P11 Group Startup Parameters

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P11.00	Startup mode selection	0	0～2	/	×	0: Normal startup mode
						1: DC braking and then restart
						2: Speed tracking start
P11.01	Start-up hold frequency	0.00	0.00～50.00	Hz	×	
P11.02	Start frequency holding time	0.0	0.0～3600.0	s	×	
P11.03	Starting DC injection current	30.0	0.0～120.0	%	×	
P11.04	Startup DC injection time	5.0	0.0～100.0	s	×	
P11.05	Excitation time	2.0	0.0 ～10.0	s	×	
P11.06	Zero servo time	0.0	0.0～100.0	s	×	
P11.07	Braking action time	0.20	0.00～100.00	s	×	
P11.08	Tracking delay time	1	0～65000	ms	×	

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P11.10	Tracking voltage Kp	0.20	0.00～100.00	/	×	
P11.11	Tracking voltage Ki	0.50	0.00～100.00	/	×	
P11.12	Tracking voltage Kd	0.00	0.00～100.00	/	×	
P11.13	Tracking Exit Delay	100	0～65000	ms	×	
P11.14	Maximum current during tracking	100.0	0.0～200.0	%	×	
P11.15	Tracking frequency change gain	50	0.0～100.0	%	×	
P11.17	Tracking initial frequency	50.00	0.00～360.00	Hz	×	
P11.18	Startup delay time	0.00	0.00～655.35	s	×	
P11.19	Reverse opening current	20.0	0.0～100.0	%	×	

6.2.2.3 Group P12 parking parameters

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P12.00	Stop mode selection	0	0～4	/	×	0: Inertia stop mode 1: Deceleration stop mode 2: Deceleration + DC braking 3: Deceleration + inertia parking 4: Spare
P12.01	Parking frequency	0.00	0.00～100.00	Hz	×	
P12.02	Stop frequency holding time	0.0	0.0～1000.0	s	×	
P12.03	DC braking starting frequency	2.50	0.00～10.00	Hz	×	
P12.04	Parking DC braking current	50.0	0.0～100.0	%	×	
P12.05	Parking DC braking time	0.5	0.0～10.0	s	×	

6.2.2.4 P13 Group Braking Parameters

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P13.00	Dynamic braking selection	1	0～1	/	×	1: Enable dynamic braking 0: Disable dynamic braking Built-in brake unit, default is 1

P13.01	Brake release voltage	660	340～1160	V	×	The default value is 660, which is calculated based on the grid voltage. Otherwise, it works according to the set value.

6.2.2.5 P14 Group V/F Parameters

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P14.00	V/F curve setting	0	0～5	/	×	0: Standard V/F straight line; 1: 1.2 power curve; 2: 1.5 power curve 3: 2nd power curve 4: User-defined 5: Spare
P14.01	V/F voltage value V0	76	1～460	V	×	
P14.02	V/F frequency value F0	10.00	0.01～300.00	Hz	×	F0<F1
P14.03	V/F voltage value V1	152	1～460	V	×	
P14.04	V/F frequency value F1	20.00	0.01～300.00	Hz	×	F1<F2
P14.05	V/F voltage value V2	228	1～460	V	×	
P14.06	V/F frequency value F2	30.00	0.01～300.00	Hz	×	F2<F3
P14.07	V/F voltage value V3	304	1～460	V	×	
P14.08	V/F frequency value F3	40.00	0.01～300.00	Hz	×	F3<F4
P14.09	V/F voltage value V4	380	1～46	V	×	
P14.10	V/F frequency value F4	50.00	0.01～300.00	Hz	×	
P14.11	ACS voltage given source	0	0~ 5	/	×	0: internal digital given; 1: spare; 2: spare; 3: spare 4: Spare 5: Spare
P14.12	ACS voltage setting	380	0~ 690	V	○	
P14.13	ACS frequency setting	50.0	0 ~3000.0	Hz	○	
P14.14	Special power supply types	0	0 ~ 3	/	×	0: Voltage source 1: Current source 2: Fire pump 3: Fan inspection
P14.15	ACS frequency setting source	0	0 ~5	/	×	
P14.16	Inspection search start frequency	2.00	0.00 ~ 655.35	/	×	
P14.17	Voltage source soft start time	10.0	0.00 ~ 655.35	s	×	

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P14.18	VFVC speed precision adjustment	100.0	0.0 ~6553.5	%	×	
P14.19	VFVC torque boost	5.0	0.0 ~6553.5	%	×	

6.2.2.6 P15 groups of SVC parameters

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P15.00	Initial magnetic pole determination	1	0～2	/	×	0: None 1: DC injection 2: Pulse injection
P15.01	Injected DC size	50	0～150	%	×	
P15.02	Pulse injection amplitude	50	0～100	%	×	
P15.03	Pulse angle compensation	0	0～1	/	×	0: No compensation 1: Compensation 180 degrees
P15.05	Control status word	2	0～1000	/	×	
P15.06	PM current control strategy	0	0～10	/	×	
P15.07	MTPA1 bandwidth	10	0～1000	Hz	×	
P15.08	Imin of MTPA	5	0 ~100	%	×	
P15.09	PM low speed compensation coefficient 1	40	0～200	%	×	
P15.10	Ka	15	0～1000	/	×	
P15.11	Kb	20	0~ 1000	/	×	
P15.12	Kr1	5	0~1000	/	×	
P15.13	Kr2	200	0~2000	/	×	
P15.14	Kr3	20	0~2000	/	×	
P15.15	Kr4	0	0~2000	/	×	
P15.16	Kr5	100	0~2000	/	×	
P15.17	VCIF injection current	10	0.0 ~ 200.0	%	×	
P15.18	VCIF injection current slope	300	1~ 5000	ms	×	
P15.19	VC determination stabilization time	30	1~ 5000	ms	×	
P15.20	Speed observer error threshold	10	0.1 ~100.0	%	×	
P15.21	IF switching frequency	10.0	0~ 100.0	%	×	
P15.22	VC switching frequency	5.0	0~ 100.0	%	×	
P15.23	IF oscillation suppression enable	1	0~ 1000	/	×	

6.2.2.7 P16 groups of field weakening parameters

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P16.01	Field weakening voltage setting	100	0~200	%	×	
P16.02	Field weakening control bandwidth	2.0	0.0～100.0	Hz	×	
P16.03	Magnetic link bandwidth	1.0	0.0～100.0	Hz	×	
P16.0 4	Weak magnetic field KP	0	0~ 655.35	/	×	
P16.0 5	Weak magnetic field KI	0.01	0~ 6.5535	/	×	

6.2.2.9 P17 Group GVC Parameters

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P 17.00	GVC DC injection current	70.00	0.10 ~ 200.00	%	×	
P 17.01	DC injection slope	1.00	0.00 ~655.35	s	×	
P 17.02	External synchronization switching frequency	10	0 ~100	%	×	
P 17.03	Low speed voltage compensation gain	0	0 ~ 20000	%	×	
P 17.04	Voltage compensation upper limit frequency	40	40 ~ 30000	%	×	
P 17.05	Vibration suppression gain	100	0.00 ~655.35	/	×	
P 17.15	Compensation function selection	256	0~ 65535	/	×	

6.2.3 P2X Group Motor Parameters

6.2.3.1 P20 Group General Parameters

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P20.00	Motor 1 Type	0	0~2	/		0: Asynchronous 1: Synchronous 2: Reluctance motor
P20.01	Motor 1 rated power	By inverter power	0 to 655.35	kW	×	Set according to the motor nameplate
P20.02	Motor 1 rated current	By inverter power	0.0～ 1000.0	A	×	Set according to the motor nameplate
P20.03	Motor 1 rated frequency	50.00	0.00～ 500.00	Hz	×	Set according to the motor nameplate
P20.04	Motor 1 rated speed	1460	0～60000	rpm	×	Set according to the motor nameplate

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P20.05	Motor 1 rated voltage	380	0～690	V	×	Set according to the motor nameplate
P20.06	Number of poles of motor 1	4	2～128	/	×	Motor pole pairs = number of poles/2
P20.07	Motor 1 rated slip	1.40	0.10～50.00	Hz	×	Set according to the motor nameplate
P20.08	Motor 1 maximum slip	2.80	0.10～50.00	Hz	×	
P20.09	Motor 1 phase sequence	1	0～1	/	×	0: negative phase sequence; 1: positive phase sequence
P20.10	Motor 1 no-load current	30.00	0.10～100.00	%	×	
P20.12	Motor 1 maximum power	250	50～400	%	×	
P20.14	Motor 2 Type	0	0~1	/		0: Asynchronous 1: Synchronous
P20.15	Motor 2 rated power	By inverter power	0 to 655.35	kW	×	Set according to the motor nameplate
P20.16	Motor 2 rated current	By inverter power	0.0～1000.0	A	×	Set according to the motor nameplate
P20.17	Motor 2 rated frequency	50.00	0.00～500.00	Hz	×	Set according to the motor nameplate
P20.18	Motor 2 rated speed	1460	0～50000	rpm	×	Set according to the motor nameplate
P20.19	Motor 2 rated voltage	380	0～690	V	×	Set according to the motor nameplate
P20.20	Motor 2 poles	4	2～128	/	×	Motor pole pairs = number of poles/2
P20.21	Motor 2 rated slip frequency	1.40	0.10～50.00	Hz	×	Set according to the motor nameplate
P20.22	Maximum slip frequency of motor 2	2.80	0.10～50.00	Hz	×	
P20.23	Motor 2 phase sequence	1	0～1	/	×	0: negative phase sequence; 1: positive phase sequence
P20.24	Motor 2 no-load current coefficient	30.00	0.10～100.00	%	×	
P20.25	Motor 2 maximum power factor	250	50～10000	%	×	

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P20.27	Motor parameter calculation enable	0	0~1	/	×	

Note 1: Different inverter powers correspond to different factory values.

6.2.3.2 P21 Group Advanced Parameters

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P21.00	Motor tuning	0	0~9	/		0: Normal operation mode 1: Encoder static self-learning 2: Spare 3: Spare 4: Motor static self-learning 5: Spare 6: Motor dynamic self-learning 7: Encoder dynamic self-learning 8: Pulse method magnetic pole identification 9: Spare
P21.01	Motor 1 stator resistance	0.100	0.000～65.000	Ω	×	
P21.02	Motor 1 rotor resistance	0.441	0.000～65.000	Ω	×	
P21.03	Motor 1 stator inductance	0.1028	0.0000~6.5000	H	×	
P21.04	Motor 1 rotor inductance	0.1028	0.0000~6.5000	H	×	
P21.05	Motor 1 mutual inductance	0.0991	0.0000~6.5000	H	×	
P21.06	Motor 2 stator resistance	0.100	0.000～65.000	Ω	×	
P21.07	Motor 2 rotor resistance	0.441	0.000～65.000	Ω	×	
P21.08	Motor 2 stator inductance	0.1028	0.0000～6.5000	H	×	
P21.09	Motor 2 rotor inductance	0.1028	0.0000～6.5000	H	×	
P21.10	Motor 2 mutual inductance	0.0991	0.0000～6.5000	H	×	
P 21.11	PM1 stator resistance	0.100	0.000 ~ 65.000	Ω	×	
P 21.12	PM1 motor D-axis inductance	0.0	0~ 6553.5	H	×	
P 21.13	PM1 motor Q-axis inductance	0.0	0 ~ 6553.5	H	×	
P 21.14	PM1 back electromotive force coefficient	340.1	0~ 690.0	V	×	
P21.15	DAL0	0.0	0~ 6553.5	/	×	Internal Use

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P21.16	DAL1	0.0	0~ 6553.5	/	×	Internal Use
P21.17	DAL2	0.0	0~ 6553.5	/	×	Internal Use
P21.18	DAL3	0.0	0~ 6553.5	/	×	Internal Use
P21.19	DAL4	0.0	0~ 6553.5	/	×	Internal Use
P21.20	DAL5	0.0	0~ 6553.5	/	×	Internal Use
P 21.21	Inertia coefficient	0.200	0.000 ~ 65.000	/	×	
P 21.22	Parameter deviation compensation	0.0	0.0 ~ 100.0	/	×	

6.2.3.3 P22 Group Auxiliary Parameters

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P22.01	Encoder 1 type	0	0～3	/	×	0: Incremental ; 1: SinCos; 2: Spare ; 3: Rezav
P22.02	Encoder 1 pulse number	1024	100～ 16000	ppr	×	Encoder pulse number
P22.03	Encoder frequency division coefficient	0	0～7	/	×	Encoder frequency division coefficient
P22.04	Encoder 1 position angle	0.0	0.0～360.0	Spend	*	Encoder position angle
P22.05	Encoder feedback speed filter time	5	0～1000	ms	×	
P22.06	Encoder 1 direction	1	1～1	/	×	
P22.07	SinCos encoder coefficients	11	2 ~ 16	/	×	7-128;9-512;11-2048
P22.08	Rezav encoder 1 pole number	2	2~128	P	×	
P22.09	Encoder 2 type	0	0~3	/	×	0: Incremental ; 1: SinCos; 2: Spare ; 3: Rezav
P22.10	Encoder 2 pulse number	1024	100～ 16000	ppr	×	Encoder pulse number
P22.11	Encoder 2 position angle	0.0	0.0～360.0	rad	*	Encoder position angle
P22.12	Encoder 2 direction	1	1～1	/	×	
P22.13	Rezav encoder 2 poles	2	2~128	P	×	
P22.14	Feedback speed limiting filter	0.00	0.00 ~100.00	%	×	

6.2.3.4 P23 Group Protection Parameters

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P23.00	Motor fan mode	1	0～2	/	×	0: Blocked; 1: Independent fan; 2: No independent fan
P23.01	Motor normal operating threshold	110	70～200	%	×	
P23.02	Motor I^2t current threshold	150	120～300	%	×	

6.2.4 P3X terminal functions

6.2.4.1 P30 Group Digital Input

Version A IO board

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P30.00	X0 terminal input function selection	7	0～199	/	×	
P30.01	X1 terminal input function selection	8	0～199	/	×	
P30.02	X2 terminal input function selection	0	0～199	/	×	
P30.03	X3 terminal input function selection	0	0～199	/	×	
P30.04	X4 terminal input function selection	0	0～199	/	×	
P30.05	X5 terminal input function selection	0	0～199	/	×	
P30.06	X6 terminal input function selection	0	0～199	/	×	
P30.08	Digital input filter times	5	1～200	times	×	

Note: IO-B board and IO-standard board only have X1-X4 terminals, and the parameter function code remains unchanged. For different IO boards, the software automatically displays the corresponding matching parameters.

6.2.4.2 P31 Group Digital Output

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P31.00	Output K1 function definition	2	0～199	/	×	
P31.01	Output K2 function definition	25	0～199	/	×	
P31.02	Output K3 function definition	0	0～199	/	×	

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P31.03	Output Y0 function definition	0	0～199	/	×	
P31.04	Output Y1 function definition	0	0～199	/	×	
P31.06	Output K1 action delay	0.0	0.0～120.0	s	×	
P31.07	Output K1 reset delay	0.0	0.0～120.0	s	×	
P31.08	Output K2 action delay	0.0	0.0～120.0	s	×	
P31.09	Output K2 reset delay	0.0	0.0～120.0	s	×	
P31.10	Output K3 action delay	0.0	0.0～120.0	s	×	
P31.11	Output K3 reset delay	0.0	0.0～120.0	s	×	
P31.12	Output Y0 action delay	0.0	0.0～120.0	s	×	
P31.13	Output Y0 reset delay	0.0	0.0～120.0	s	×	
P31.14	Output Y1 action delay	0.0	0.0～120.0	s	×	
P31.15	Output Y1 reset delay	0.0	0.0～120.0	s	×	
P31.20	Zero current detection width	4.0	0.0～50.0	%	×	
P31.21	Frequency arrival detection width	1.00	0.0～300.00	Hz	×	
P31.22	Detection frequency	1.00	0.0～655.35	Hz	×	
P31.23	Detection frequency width	0.20	0.0～300.00	Hz	×	
P31.24	Single run time reached	2	0.0～65535	h	×	
P31.25	Cumulative running time reached	8	0.0～65535	h	×	
P31.26	Detection frequency 3 upper limit	50.00	0.0 ～ 655.35	Hz	×	
P31.27	Detection frequency 3 upper and lower limits	45.00	0.0 ～ 655.35	Hz	×	
P31.28	Detection frequency 4 upper limit	100.00	0.00 ～ 655.35	Hz	×	
P31.29	Detection frequency 4 lower limit	90.00	0.00 ～ 655.35	Hz	×	

Note: IO-A board does not include P31.02, P31.10, and P31.11; IO-B board/IO-general board does

not include P31.04, P31.14, and P31.15.

6.2.4.3 P32 Group Analog Input

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P32.00	AI0 input type	0	0～3	/	×	0: 0V to 10V 1: Backup 2: 0 ～ 20mA 3: 4～20mA
P32.01	Input AI0 function	0	0～7	/	×	0: No function 1: Target speed signal 2: Current speed signal 3: Torque signal 4: Spare 5: Spare 6: Spare 7: Spare
P32.02	Analog AI0 lower limit	0.00	-100.00～327.67	%	×	
P32.03	Analog AI0 upper limit	100.0	0.0～6553.5	%	×	
P32.04	Input AI0 filter time	10	0～65535	ms	×	
P32.05	Input AI0 limit	10,000	0.000～65.535	V/mA	×	
P32.06	Input AI1 type	0	0～3	/	×	0: 0V to 10V 1: Spare 2: 0～20mA 3: 4~20mA
P32.07	Input AI1 function	0	0～7	/	×	
P32.08	Analog AI1 lower limit	0.00	-100.00～327.67	%	×	
P32.09	Analog AI1 upper limit	100.0	0.0～6553.5	%	×	
P32.10	Input AI1 filter time	10	0～65535	ms	×	
P32.11	Input AI1 limit	10,000	0.000～65.535	V/mA	×	

Note: For the analog input of the standard IO board, the voltage and current mode selection of A0/A1 requires the hardware DIP switch.

6.2.4.4 P33 Group Analog Output Parameters

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P33.00	Output M0 function	1	0～30	/	×	1: Output current 2: Output voltage 3: Torque setting 4: Bus voltage 5: Total output power 6: Output active power 7: Current speed 8: Speed setting

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
						9: Speed feedback 10: Spare 11: Radiator temperature 12: Analog A0 13: Analog A1 14: Spare 15: Modbus analog output 0 16: Modbus analog output 1 17~20: spare 21: IQ(1) debugging 22: IQ(2) debugging 23: IQ(-1) for debugging 24: IQ(-2) for debugging
P33.01	Output M0 lower limit	0	- 100～327.67	%	○	
P33.02	Output M0 upper limit	100.0	0.0～6553.5	%	○	
P33.03	Output M1 function	1	0～30	/	×	
P33.04	Output M1 lower limit	0	- 100～327.67	%	○	
P33.05	Output M1 upper limit	100.0	0.0～6553.5	%	○	
P33.06	Output M0 type	0	0~4	/	×	1: 0～10V 3: 0～20mA 4 : 4～20mA
P33.07	Output M1 type	0	0~4	/	×	3: 0～20mA 4 : 4～20mA

Note: The standard version IO board/B version IO board supports two analog outputs. B board M0 supports voltage and current types, and M1 only supports current type. The standard board M0/M1 supports both voltage and current types.

6.2.5 P4X Group Frequency Control

6.2.5.1 P40 Group Basic Parameters

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P40.00	Panel speed	5.00	0.00～655.35	Hz	×	
P40.01	Fundamental frequency	50.00	0.00～655.35	Hz	×	
P40.02	Acceleration time 0	5.00	0.00~500.00	s	×	Default values for acceleration and deceleration matching different power : 1.5KW-30KW 10S, 37KW-75KW 20S, 90KW-160KW 50S, 185KW-315KW 90S;

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P40.03	Deceleration time 0	5.00	0.00~500.00	s	×	
P40.04	Acceleration time 1	5.00	0.00~500.00	s	×	
P40.05	Deceleration time 1	5.00	0.00~500.00	s	×	
P40.06	Acceleration Time 2	5.00	0.00~500.00	s	×	
P40.07	Deceleration time 2	5.00	0.00~500.00	s	×	
P40.08	Acceleration Time 3	5.00	0.00~500.00	s	×	
P40.09	Deceleration time 3	5.00	0.00~500.00	s	×	
P40.10	Acceleration rounded corner Ts0	0.00	0.00～10.00	s	×	Acceleration starts
P40.11	Acceleration rounded corner Ts1	0.00	0.00～10.00	s	×	Acceleration End
P40.12	Deceleration rounded corner Ts2	0.00	0.00～10.00	s	×	Deceleration starts
P40.13	Deceleration rounded corner Ts3	0.00	0.00～10.00	s	×	Deceleration end
P40.14	Top arc fillet suppression	0	0 ~ 3	/	×	
P 40.15	Turn frequency 1	1 90	0~ 200	%	×	Acceleration/deceleration switching point 1
P 40.16	Turn frequency 2	200	0~ 200	%	×	Acceleration/deceleration switching point 2

6.2.5.2 Group P41 Digital Multi-speed

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P41.00	Digital multi-speed f 0	0.00	0.00～ 655.35	Hz	×	
P41.01	Digital multi-speed f 1	0.00	0. 0 0～ 655.35	Hz	×	
P41.02	Digital multi-speed f 2	10.00	0.00～ 655.35	Hz	×	
P41.03	Digital multi-speed f 3	20.00	0.00～ 655.35	Hz	×	

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P41.04	Digital multi-speed f 4	30.00	0.00～655.35	Hz	×	
P41.05	Digital multi-speed f 5	40.00	0.00～655.35	Hz	×	
P41.06	Digital multi-speed f 6	50.00	0.00～655.35	Hz	×	
P41.07	Digital multi-speed f 7	60.00	0.00～655.35	Hz	×	
P41.08	Digital multi-speed f 8	0.00	0.00～655.35	Hz	×	
P41.09	Digital multi-speed f 9	0.00	0.00～655.35	Hz	×	
P41.10	Digital multi-speed f 10	0.00	0.00～655.35	Hz	×	
P41.11	Digital multi-speed f 11	0.00	0.00～655.35	Hz	×	
P41.12	Digital multi-speed f 12	0.00	0.00～655.35	Hz	×	
P41.13	Digital multi-speed f 13	0.00	0.00～655.35	Hz	×	
P41.14	Digital multi-speed f 14	0.00	0.00～655.35	Hz	×	
P41.15	Digital multi-speed f 15	0.00	0.00～655.35	Hz	×	
P41.16	Jog frequency setting	5.00	0.00～655.35	Hz	×	

6.2.5.2 P42 Group Simple PLC Function

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P4 2 .00	Memory Mode	0	0~ 11	/	×	
P4 2 .01	Loop Mode	0	0~ 2	/	×	
P4 2 .02	Shutdown memory	0	0~ 65535	/	×	
P4 2 .03	Power off memory	0	0~ 65535	/	×	
P4 2 .04	PLC target frequency f0 (Hz)	0	300.00 ~ 300.00	Hz	×	

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P42 .05	PLC target frequency f1 (Hz)	0	300.00 ~ 300.00	Hz	×	
P42 .06	PLC target frequency f2 (Hz)	0	300.00 ~ 300.00	Hz	×	
P42 .07	PLC target frequency f3 (Hz)	0	300.00 ~ 300.00	Hz	×	
P42 .08	PLC target frequency f4 (Hz)	0	300.00 ~ 300.00	Hz	×	
P42 .09	PLC target frequency f5 (Hz)	0	300.00 ~ 300.00	Hz	×	
P42 .10	PLC target frequency f6 (Hz)	0	300.00 ~ 300.00	Hz	×	
P42 .11	PLC target frequency f7 (Hz)	0	300.00 ~ 300.00	Hz	×	
P42 .12	Time unit	0	0~ 1	/	×	
P42 .13	Running time T00	1	0 ~ 6553.5	s	×	
P42 .14	Running time T01	1.5	0 ~ 6553.5	s	×	
P42 .15	Running time T02	2	0 ~ 6553.5	s	×	
P42 .16	Running time T03	2.5	0 ~ 6553.5	s	×	
P42 .17	Running time T04	1	0 ~ 6553.5	s	×	
P42 .18	Running time T05	1.5	0 ~ 6553.5	s	×	
P42 .19	Running time T06	2	0 ~ 6553.5	s	×	
P42.20	Running time T07	2.5	0 ~ 6553.5	s	×	
P42.21	Acceleration/deceleration T00(s)	5.00	0 ~655.35	s	×	
P42.22	Acceleration/deceleration T01(s)	5.00	0 ~655.35	s	×	
P42.23	Acceleration/deceleration T02(s)	5.00	0 ~655.35	s	×	
P42.24	Acceleration/deceleration T03(s)	5.00	0 ~655.35	s	×	
P42.25	Acceleration/deceleration T04(s)	5.00	0 ~655.35	s	×	

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P42.26	Acceleration/deceleration T05(s)	5.00	0~655.35	s	×	
P42.27	Acceleration/deceleration T06(s)	5.00	0~655.35	s	×	
P42.28	Acceleration/deceleration T07(s)	5.00	0~655.35	s	×	

6.2.6 P5X Group Process Control

6.2.6.1 P50 group main and auxiliary reference

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P50.00	Open loop auxiliary setting mode	0	0～5	×	×	
P50.01	Open-loop auxiliary given operation	0	0～6	×	×	

6.2.6.2 P51 Group Process PID

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P51.00	Closed-loop control selection	0	0～1	×	×	
P51.01	Closed-loop main setting mode	0	0～6	×	×	
P51.02	Closed-loop auxiliary setting mode	2	0～6	×	×	
P51.03	Closed-loop auxiliary setting operation	0	0～6	×	×	
P51.04	Closed-loop main feedback method	1	0～6	×	×	
P51.05	Closed-loop auxiliary feedback method	2	0～6	×	×	
P51.06	Closed-loop auxiliary feedback operation	0	0～6	×	×	
P51.07	PID internal given value	0.70	0.00 ～ 10.00	×	×	
P51.09	Proportional gain Kp	0.50	0.00～ 100.00	×	×	
P51.10	Integral gain Ki	0.50	0.00～ 100.00	×	×	

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P51.11	Differential gain Kd	0.00	0.00～ 100.00	×	×	
P51.12	Integral method selection	0	0～1	×	×	
P51.13	Integral action upper limit	1 00.0	0.0～ 6 553.5	%	×	
P51.14	Closed-loop input upper limit	5 0.0	0.0～ 6 553.5	%	×	
P51.15	Closed-loop input lower limit	0.0	0.0～ 6 553.5	%	×	
P51.16	Closed-loop output upper limit	1 00.0	0.0～ 6 553.5	%	×	
P51.17	Sleep selection	0	0～1	×	×	
P51.18	Sleep frequency	3 0.00	0.00～ 6 55.35	H z	×	
P51.19	Sleep delay	1 0.0	0.0～ 6 553.5	s	×	
P51.20	Wake-up error	0.10	0.00～ 6 55.35	×	×	
P51.21	Wake-up delay	1 0.0	0.0～ 6 553.5	s	×	
P51.22	Given acceleration and deceleration time	0.0	0.0～ 6 553.5	s	×	
P51.23	Closed-loop output filter time	0.0 1 0	0.000～ 6 5.535	s	×	
P51.24	Minimum given amount	0.00	0.00～ 10.00	%	×	
P51.25	RefMin-->FdbMin	0.00	0.00～ 10.00	%	×	
P51.26	Maximum given amount	1 0.00	0.00～ 10.00	%	×	
P51.27	RefMax-->FdbMax	1 0.00	0.00～ 10.00	%	×	
P51.28	Preset frequency	2 2.00	0.00～ 6 55.35	H z	×	
P51.29	Preset frequency holding time	0	0 ～ 65535	s	×	
P51.30	Positive and negative characteristics	0	0～1	×	×	

6.2.7 P6X Group Vector Control

6.2.7.1 P60 Group Speed Loop PID

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P60.00	Speed loop-zero speed P	5.00	0.00～655.35	/	×	Zero servo segment
P60.01	Speed loop-zero speed Ti	73	0～65535	ms	×	
P60.03	Speed loop-low speed P	5.00	0.00～655.35	/	×	Low speed section
P60.04	Speed loop-low speed Ti	73	0～65535	ms	×	
P60.06	Speed loop-high speed P	8.00	0.00～655.35	/	×	High-speed section
P60.07	Speed loop-High Speed Ti	73	0～65535	ms	×	
P60.09	Switching frequency f0	10.0	0.00～655.35	%	×	
P60.10	Switching frequency fl	60.0	0.00～655.35	%	×	
P 60.11	Speed loop period	0	0 ~50	/	×	
P 60.12	Torque command filtering	1	0 ~1000	ms	×	
P 60.13	Speed loop hover P	8.00	0.00 ~655.35	/	×	
P 60.14	Speed loop hover Ti	73	0 ~65535	ms	×	

6.2.7.2 P61 Group Current Loop PID

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P61.00	Current loop Kp	0.30	0.00～655.35	/	×	
P61.01	Current loop Ki	0.50	0.00～655.35	/	×	
P61.02	Current loop bandwidth	200.0	0.0～655.35	Hz	×	
P61.03	Current loop selection	4	0～65535	/	×	

6.2.7.3 P62 Group Torque Control

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P62.00	Digital torque setting	0.0	0.0～400.0	%	×	
P62.01	Torque direction	0	0～1	/	×	
P62.02	Torque increase time	1.00	0.01～655.35	s	×	
P62.03	Torque reduction time	1.00	0.01～655.35	s	×	

6.2.7.4 Group P63 Compensation Torque Control

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P63.00	Compensation torque direction	0	0～1	/	×	
P63.01	Compensation gain	100.0	0.0～6553.5	%	×	
P63.03	Pre-torque compensation	0.0	0.0～6344.0	%	×	

6.2.8 P7X Group Enhanced Control

6.2.8.1 P70 Group Restrictions and Protection

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P70.00	Frequency upper limit	50.00	0.0 ～ 655.35	Hz	×	0～maximum frequency
P70.01	Frequency lower limit	0.00	0.0 ～ 655.35	Hz	×	0～Frequency upper limit
P70.02	ID given limit	0.00	0.00 ~ 2.00	%	×	
P70.03	ID limit Gain	0	0~ 10000	/	×	
P70.04	Output torque limit	150	0～250	%	×	
P70.05	Acceleration overcurrent threshold	160	0～200	%	×	
P70.06	Deceleration overvoltage threshold	750	540～800	V	×	
P70.07	Overspeed protection factor	120.00	0.00～ 6 55.35	%	×	
P70.08	Special function selection	6	0～65535	/	×	
P70.09	Maximum frequency	50.00	0 ~655.35	Hz	×	
P70.10	PT signal channel	0	0～3	/	×	0: NC 1: PT1000/PT1002: PTC high resistance 3: PTC low resistance
P70.11	PT protection upper threshold	120.0	0.0 ～ 1000.0	Degree	×	
P70.12	PT protection lower threshold	0.0	0.0 ～ 1000.0	Degree	×	
P70.13	PT protection action delay	3.0	0.0～10.0	s	×	
P70.15	Overexcitation coefficient	0	0~ 150	/	×	
P70.16	Vibration range upper limit	20	/	%	×	Internal parameters
P70.17	Vibration alarm threshold	5.6	/	/	×	Internal parameters
P70.18	Bus voltage low threshold	219	0~ 1000	V	×	
P70.19	Bus undervoltage threshold	380	0～540	V	×	
P70.20	Grid imbalance threshold	20.0	10.0～ 200.0	%	×	
P70.21	PWM detection delay	800	0～65535	ms	×	
P70.23	Current limiting and frequency reduction threshold	1 20	5 0 ~ 200	%	×	Overcurrent frequency reduction function
P70.24	Current Limit KP	0.001	0.000 ~ 65.535	/	×	
P70.25	Current Limit KP	0.0001	0.000 ~ 6.5535	/	×	

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P70.26	Current Limit OutMin	0.005	0.000 ~1.000	%	×	
P70.27	Current limiting recovery threshold	10	0~ 65535	%	×	
P70.28	Grid overvoltage threshold	530	0~ 530	V	×	
P70.29	Over-temperature frequency reduction starting temperature	9 1.0	0.0 ~ 100.0	Degree	×	Over-temperature frequency reduction function
P70.30	Overtemperature frequency reduction recovery temperature	8 0.0	0.0 ~ 100.0	Degree	×	
P70.31	Overtemperature frequency reduction slope	1	0~ 65535	Hz	×	
P70.32	Frequency increase overtemperature threshold	88.00	0.0 ~ 100.0	Degree	×	
P70.33	Overtemperature detection interval	2 0.00	0.00 ~ 655.35	s	×	

6.2.8.2 P71 Group Special Functions

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P71.00	hopping speed f1	0.00	0.00～ 655.35	Hz	×	
P71.01	hopping speed f2	0.00	0.00～ 655.35	Hz	×	
P71.02	hopping speed f3	0.00	0.00～ 655.35	Hz	×	
P71.03	Frequency hopping width	0.00	0.00～ 655.35	Hz	×	
P71.04	Pulse + frequency hold	0	0~ 1	/	×	
P71.05	Reverse prohibition	0	0～1	/	×	0:N 1: Y
P71.06	Forward and reverse interval time	0.1	0.0～6553.5	s	×	
P71.07	PWM modulation mode	2	0～3	/	×	0: 5 stages; 1: 7 stages; 2: <30% rpm 7 stages, >30% 5 stages 3: SPWM mode
P71.14	Carrier frequency	8.000	1.100～ 16.000	KHz	×	EP different power matching default carrier frequency: 7.5 kW and below default to 8K; 11kW - 15 kW default to 6K; 37-90 kW default to 5K (45 kW default to 4K); 110-160

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
						kW default to 4K; 200 kW and above default to 2K
P71.17	Lock load polarity selection	0	0~ 2	/	×	
P71.18	Load speed upper limit	100	0~ 100	%	×	
P71.19	Rising weighing value	65535	0~ 65535	/	×	
P71. 20	Drop weighing value	65535	0~ 65535	/	×	
P71.21	Dead zone compensation selection	2	1～2	/	×	
P71.22	Zero speed threshold	0.20	0.00～10.00	Hz	×	
P71.23	Forward dead zone compensation	90	0～65535	%	×	
P71.24	Dead zone threshold coefficient	0.8	0~ 2.0	%	×	
P71.29	PWM modulation selection	1	0～15	/	×	0: Update underflow 1: Update both overflow and underflow Note: Carrier frequency below 4K can be set to 1
P71.30	Vector control compensation selection	1 32	0~ 65535	/	×	
P 71.31	Inertia compensation coefficient	0.0	0.0 ~ 6553.5	%	×	
P 71.32	Inertia compensation filter time	5	0~ 1000	ms	×	
P 71.33	UPDOWN Compensation	1.00	0.00 ~ 20.00	Hz	×	
P 71.37	Droop control gain	0	0~ 100.0	%	×	
P 71.38	Droop control filtering	0.05	0 ~2.00	s	×	
P 71.40	Input shaping type	0	0~2	./	×	
P71. 41	Oscillation frequency	0.30	0.00~600.00	Hz	×	
P71. 42	Damping coefficient	0.05	0.00~2.00	/	×	
P71. 43	Automatic self-learning mode	0	0~10	/	×	
P 71.45	Output shutdown delay	0.3	0.00~655.35	s	×	

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P71.49	Power outage detection threshold	420	3 80~550	v	×	
P71.50	KEB bus target voltage	480	3 80~550	v	×	
P71.51	KEB proportional Kp	100	0 ~10000	s	×	
P71.52	KEB integral (Ki)	100	0 ~10000	%	×	
P71.53	KEB deceleration upper limit	0.50	0.00 ~100.00	s	×	
P71.54	KEB acceleration upper limit	10.00	0.00 ~100.00	s	×	
P71.55	KEB deceleration initial value	2.00	0.00 ~100.00	s	×	
P71.57	Variable carrier lower limit frequency	2.000	2,000 ~ 8,000	kHz	×	
P 71.58	Fan control method	0	0～4	/	×	
P71.61	Frequency decimal places	2	1~2	/	×	
P71.62	Function switch	1029	0~65535	×	×	Please refer to Chapter 7 for details on the bit description.
P71.63	Phase lock function enabled	0	0～100	/	×	Used for phase-locking of switching between industrial frequency and inverter frequency
P71.64	System bypass angle error	3.60	0.01 ~360.00	Degree	×	
P71.65	System bypass voltage error	5	1 ~100	V	×	
P71.66	Fan control duty cycle	100	0 ~ 65535	%	×	
P 71.70	Deceleration inertia coefficient (%)	100	0~ 200	%	×	

6.2.9 P8X Group Communication Parameters

6.2.9.1 P80 Group Communication Method

Function code	Function code name	Factory value	Setting range	unit	property	Option Description

P80.00	Communication method selection	2	0～4	\	×	0: No communication 1: spare ; 2: Modbus; 3: Spare 4: SSI

6.2.9.2 Group P81 Modbus Communication Parameters

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P81.00	Communication baud rate selection	7	0～7	bps	×	0: 1200 bps 1: 2400 bps 2: 4800 bps 3: 9600 bps 4: 19200 bps 5: 38400 bps 6: 57600 bps 7: 115200 bps
P81.01	Data format	0	0～3	/	×	0: 1-8-1 format, no parity check 1: 1-8-1 format, even parity 2: 1-8-1 format, odd parity 3: 1-8-2 format, no parity check
P81.02	Transmission mode selection	1	0～1	/	×	0: ASC; 1: RTU
P81.04	Local address	1	0～247	/	×	1 to 247, 0 is the broadcast address
P81.05	Communication external address enable	0	0~ 1	/	×	
P81.06	Given frequency external address	0	0 ~65535	/	×	
P81.07	Communication address format selection	1	0~ 1	/	×	0: hexadecimal; 1: decimal
P81.08	Given frequency reference value	0	0~ 40000	/	×	
P81.09	Status word 1 corresponding address	0	0~ 65000	/	×	
P81.10	Status word 1 function selection	0	0~ 31	/	×	
P81. 11	Status word 2 corresponding address	0	0~ 65000	/	×	
P81. 12	Status word 2 function selection	0	0~ 31	/	×	
P81. 13	Status word 3 corresponding address	0	0~ 65000	/	×	
P81. 14	Status word 3 function selection	0	0~ 31	/	×	
P81. 15	Status word 4 corresponding address	0	0~ 65000	/	×	
P81. 16	Status word 4 function selection	0	0~ 31	/	×	
P81. 17	Status word 5 corresponding address	0	0~ 65000	/	×	

P81. 18	Status word 5 function selection	0	0~ 31	/	×	
P81. 19	Status word 6 corresponding address	0	0~ 65000	/	×	
P81. 20	Status word 6 function selection	0	0~ 31	/	×	
P81. 21	Status word 7 corresponding address	0	0~ 65000	/	×	
P81. 22	Status word 7 function selection	0	0~ 31	/	×	
P81. 23	Status word 8 corresponding address	0	0~ 65000	/	×	
P81. 24	Status word 8 function selection	0	0~ 31	/	×	

6.2.9.3 Group P82 (Reserved Parameter Group)

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P82.02	Custom status word group 1	16	0~ 45		×	
P82.03	Custom status word group 2	13	0~ 45	/	×	
P82.04	Custom status word group 3	10	0~ 45	/	×	
P82.05	Custom status word group 4	18	0~ 45	/	×	
P82.0 6	PN communication function enabled	0	0 ~65535	/	×	

6.2.10 P9X Group Monitoring Function

6.2.10.1 P90 Group Reserved Parameters

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P90. 00	Reserved Area	0	0 to 1	/	×	spare

6.2.10.2 P91 Group LCD Display

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P91.00	U01 display data	1	0～ 63	/	×	
P91.01	U02 display data	2	0～ 63	/	×	
P91.02	U03 display data	3	0～ 63	/	×	
P91.03	U04 display data	8	0～ 63	/	×	
P91.04	U05 display data	7	0～ 63	/	×	
P91.05	U06 display data	6	0～ 63	/	×	
P91.06	U07 display data	9	0～ 63	/	×	
P91.07	U08 display data	10	0～ 63	/	×	

6.2.10.3 P92 Group LED Display (Reserved Parameter Group)

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P92.00	Reserved Area	2	0～63	/	×	spare

6.2.10.4 P93 Group Operation Records

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P93.00	Cumulative power-on time	0	0～65535	h	*	
P93.01	Cumulative running time	0	0～65535	h	*	
P93.02	Set total power-on time	0	0 ~30000	Day	*	
P93.03	Remaining power-on time	0	0~ 30000	Day	*	
P93.04	Radiator maximum temperature	0.0	0.0～ 6553.5	Degree	*	
P93.05	Cumulative output power	0.0	0.0～ 6553.5	kWh	*	
P93.06	Inverter output power	6	0～65535	MWh	*	
P93.07	Cumulative fan operating time	3	0～65535	h	*	
P93.08	Record the maximum current	14.3	0～65535	A	*	
P93.0 9	Record maximum power	2.1	0～65535	KW	*	

6.2.10.5 P94 Group Fault Handling

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P94.00	Handling methods for inverter minor faults	1	0～3	/	*	0: When a minor fault occurs, the fault relay will not be output 1: When a minor fault occurs, the fault relay is output
P94.01	Inverter fault automatic reset time	10.0	0.0～6553.5	s	*	Inverter fault automatic reset time
P94.02	Inverter fault automatic reset times	0	0～65535	/	*	Frequency converter fault automatic reset times
P94.03	Radiator overheating time	0.50	0:00~18:00	s	×	
P94.04	Overspeed protection time	1.00	0.00～180.00	s	×	
P94.05	Bus voltage fluctuation threshold	150	30～150	V	×	
P94.07	Encoder disconnection confirmation times	2	0～65535	Times	×	
P94.08	Output phase loss confirmation	2.000	0.000～65.535	s	×	
P94.09	Fault blocking function	0	0~ 65535	/	×	
P94.10	CD phase error line threshold	300	9 ~ 65535	/	×	
P94.11	ABZ protection threshold	20	1～100	%	×	
P94.12	IGBT protection times	20	1～65535	/	×	
P94.13	I^2t protection selection	0	0～3	/	×	Bit0 blocks 27 #fault Bit1 blocks 45 #fault
P94.14	Analog A0 disconnection value	50.0	0.0～100	%	×	
P94.15	Analog A1 disconnection value	50.0	0.0～100	%	×	
P94.16	Analog exception handling	0	0～1	/	×	0: No handling 1: Protection shutdown
P94.17	Speed deviation	0.00	0.00～655.35	/	×	
P94.18	Communication protection	1	0～2	/	×	0: No handling 1: Protection shutdown
P94.19	Communication disconnection protection time	2.000	0.000～65.535	s	×	
P94.20	Ground protection times	20	1～60000	/	×	

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P94.21	Fault action selection 1	0	0~12221	/	×	
P94.22	Fault action selection 2	0	0~22222	/	×	
P94.23	Fault action selection 3	0	0~22122	/	×	
P94.24	Fault action selection 4	0	0~2222	/	×	
P 9 4.25	Continue running frequency selection	0	0 ~4	/	×	0: Run at target frequency; 1: Run at the current frequency; 2: Run at the upper frequency limit; 3: Frequency lower limit operation; 4: Run at multi-speed 15

6.2.10.6 P95 Group Version

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P95.00	Inverter hardware version	580.04		/	*	Inverter hardware version
P95.01	Inverter software version	100.01		/	*	Inverter software version
P95.02	Version number	6.07		/	*	Software version number
P95.03	Driver board software version	2.0			*	Driver board software version

6.2.10.7 Group P96 Inverter Information

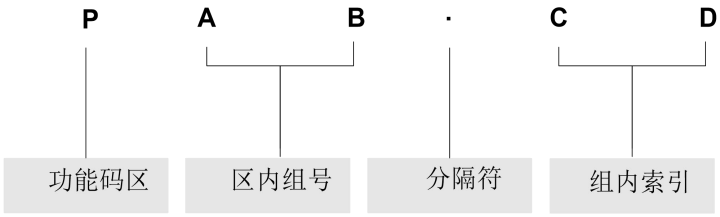
Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P96.00	Inverter rated power	According to power	0.0～999.9	kW	×	
P96.01	Inverter rated current	According to power	0.0～999.9	A	×	
P96.02	Inverter maximum current	According to power	0.0～999.9	A	×	
P96.03	Inverter rated voltage	380	0~690	V	×	0～480
P96.04	Inverter power factor	According to power	0～99		*	
P96.05	Inverter sensor current	According to power	0～9999	A	*	0～9999
P96.06	Inverter module rated current	According to power	0～9999	A	*	0～9999
P96.07	Built-in braking unit current	According to power	0～9999	A	*	0～9999

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P96.08	Three-phase current balance coefficient	1.000	0.900～1.200		*	
P 96.09	Rated current (480V)	According to power	/	A	*	
P 96.10	Light load current (480V)	According to power	/	A	*	
P 96.15	Software upgrade number	6	/	/	*	
P 96.16	Special parameters	90	1 ~65535	/	*	Power ID Lock
P 96.17	Sensor coefficient correction	2	0~ 3	/	*	
P 96.18	Voltage correction coefficient	1 00.0	9 0.0 ~ 110.0	%	*	Bus sampling correction
P 96.19	Current correction coefficient	1 00.0	5 0.0 ~ 200.0	%	*	Current sampling correction
P96.20	Light and heavy load selection	0	0~ 2	/	*	0: Light load (standard) 1: Heavy load (standard) 2: Light load (ES)

Chapter 7 Parameter Detail

7.1 Parameter group classification and format

7.1.1 Parameter group format



7.1.2 Classification of parameter groups

Function code area	Domain	Function code description
P0X function dedicated	P00 Group	Password Parameter Group
P1X Control Parameters	P10 Group	Basic control parameter group
	P11 group	Startup parameter group
	P12 group	Parking parameter group
	P13 group	Braking function parameters
	P14 group	V/F parameter group
	P15 group	SVC parameters
	P16 group	Field weakening parameters
	P17 group	GVC parameters
P2X motor parameters	P20 group	General parameters
	P21 group	Advanced Parameters
	P22 group	Auxiliary parameters
	P23 group	Protection parameters
P3X terminal function	P30 group	Digital input parameter group
	P31 group	Digital output parameter group
	P32 group	Analog input parameter group
	P33 group	Analog output parameter group
P4X Frequency Control	P40 group	Basic parameters
	P41 group	Digital multi-speed
	P42 group	Simple PLC function
P5X Process Control	P50 group	Main and auxiliary given
	P51 group	Process PID
P6X vector control	P60 group	Speed loop PID
	P61 group	Current Loop PID
	P62 group	Torque control
	P63 group	Compensation torque control
P7X Enhanced Control Parameters	P70 group	Restrictions & Protections

Function code area	Domain	Function code description
	P71 group	Special Features
P8X communication parameters	P80 group	Communication methods
	P81 group	Modbus
	P82 group	Reserved parameter group
P9X Display Parameters	P90 group	Reserved parameter group
	P91 group	LCD display
	P93 group	Operation records
	P94 group	Troubleshooting
	P95 group	Version
	P96 group	Inverter information

7.2 P0X Group User Parameter Group

7.2.1 P00 Group Basic Function Parameters

Function code	name	Setting range	Factory settings
P00.00	Password login	0~65535	0

This function is used to prevent irrelevant personnel from querying and modifying parameters, thus protecting the inverter parameters.

00000 : No password protection, all parameters can be queried, and the inverter has no password when it leaves the factory.

Once the user password setting takes effect, when entering the parameter setting state again, all parameters will not be able to be changed through the operation panel unless the correct password is entered. The password in the parameter will always be displayed as 00000.

Note: The factory setting of the intelligent flexible inverter has no user password (P00.00=0), so no password is required to log in when using it for the first time.

Function code	name	Setting range	Factory settings
P00.01	Password Change	0~65535	0

Set password :

Enter a 5-digit password, press ENTER to confirm, and repeat the setting.

Change password :

Press the ENTER key to enter the password verification state, and the display will show 00000. Enter the correct password to enter the parameter editing state, select P00.01 (the P00.00 parameter is displayed as 00000), enter the new password, and press the ENTER key to confirm. Repeat the setting of the same password for P00.01. The new password is set successfully after the display shows "Password set successfully".

Cancel password :

Press the ENTER key to enter the password verification state, and it will display 00000. Enter the correct user password and enter the parameter editing state. Check that P00.01 is 00000, press the ENTER key to confirm, and repeat the setting of P00.01＝00000. The password will be cleared after it displays “Password Clear”.

7.3 P1X Group Control Parameters

7.3.1 P10 Group Basic Control Parameters

Function code	name	Setting range	Factory settings
P10.00	Control mode selection	0~ 6	0

This function is used to set the control operation mode of the inverter.

0: GVC control, suitable for most applications, applicable to synchronous motors, asynchronous motors and reluctance motors. This control method mainly corresponds to the P17 group parameters.

1: No PG vector control, sensorless vector control, suitable for synchronous motors and asynchronous motors.

2: With PG torque control, supporting ABZ encoder, SINCOS encoder and Rezav encoder.

3: With PG vector control, supports ABZ encoder, SINCOS encoder and Rezav encoder.

4: VFVC control, suitable for applications such as flying start and DC braking, and is suitable for synchronous motors and asynchronous motors.

5: No PG torque control, supports synchronous and asynchronous machines.

6: Voltage and current sources are suitable for special applications, such as fire pumps, current sources, voltage sources, etc.

Function code	name	Setting range	Factory settings
P10.01	Operation mode selection	0~ 4	0

P10.01 is used to set the way in which the X0 (forward) and X1 (reverse) terminals control the start and stop of the inverter when the terminal operation command is given.

0 : **Two-wire 1**

K2 K1	运行命令
0 0	停止
1 0	反转
0 1	正转
1 1	停止

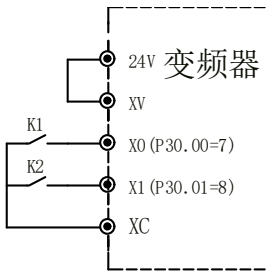


Figure 7-1 Two-wire operation mode 1

1 : **Two-wire 2**

K2 K1	运行命令
0 0	停止
1 0	停止
0 1	正转
1 1	反转

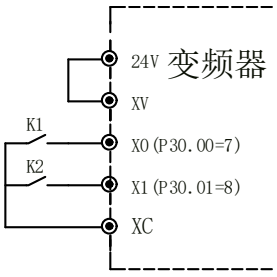


Figure 7-2 Two-wire operation mode 2

2: **Three-wire 1**

Xi (i= 2 ~ 7) terminal is set with the ″9: three-wire operation control″ function.

When K3 is closed, K0 (forward) and K1 (reverse) control are valid; when K3 is open, K0 and K1 control are invalid and the inverter stops.

The rising edge of X0 terminal indicates the forward run command; the rising edge of the X1 terminal indicates the reverse run command.

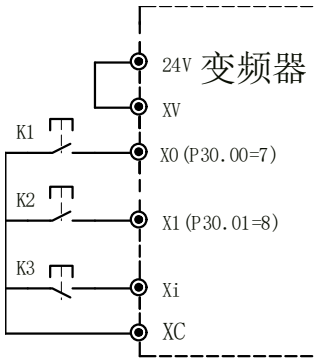
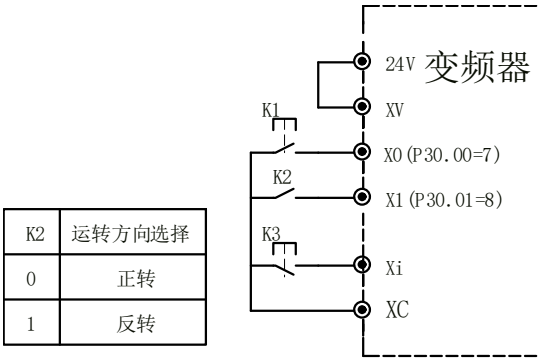


Figure 7-3 Three-wire operation mode 1

3: **Three-wire 2**



K2	运转方向选择
0	正转
1	反转

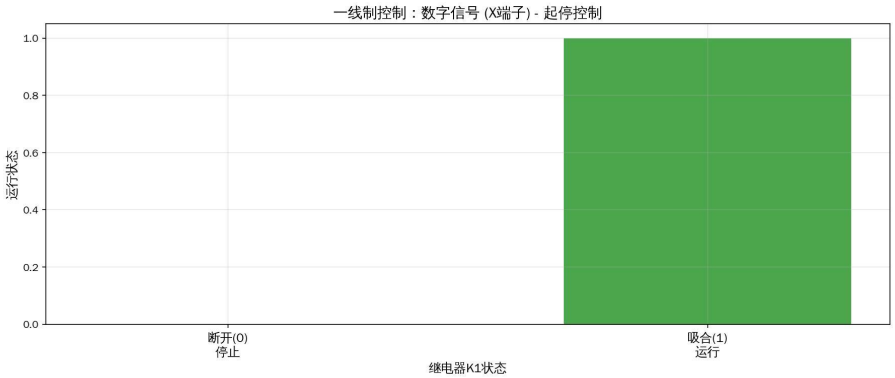
Figure 7-4 Three-wire operation mode 2

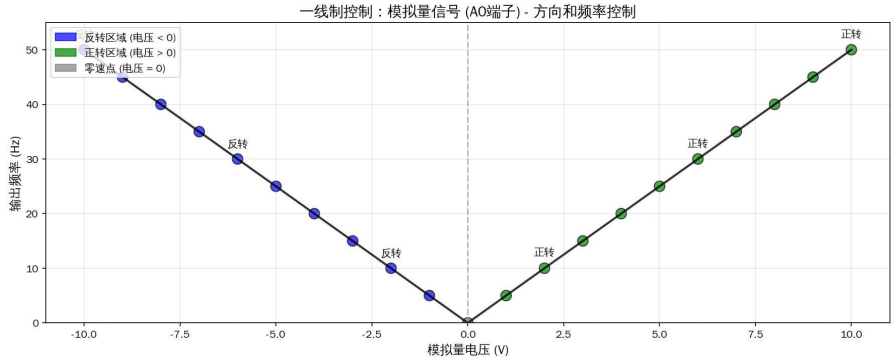
Xi (i= 2 ~ 7) terminal is set with the ″ 9 : three-wire operation control ″ function.

K1 terminal indicates the running command; the disconnection of K2 terminal indicates the forward direction command; the closing of K3 terminal indicates the reverse direction command , and when K3 is disconnected, the inverter stops .

4: **Single-Line Operating Mode**

The single-line operating mode allows the inverter to be controlled for start and stop by a single input terminal. The polarity of the analog input (A0 or A1) determines the running direction, and the magnitude of the analog input determines the operating frequency.





Function code	name	Setting range	Factory settings
P10.02	Command channel selection	0~ 6	0

Three different inverter operation command setting methods can be selected.

0: **Panel gives the run command** The inverter can be operated by pressing the RUN (F1) , STOP (F2), LO/RE and other buttons on the operation panel to run, stop, forward/reverse and other operations.

1: **Terminal given run command** By defining the multi-function terminals X0 ~ X6 , the inverter can be operated in the following ways: run, stop, forward/reverse, etc. Refer to the description of P30.00 ~ P30.06.

2: **Communication given command** The inverter can be operated by Modbus communication, such as running, stopping, forward/reverse, etc. For details, refer to the appendix Modbus communication protocol.

5: This control mode can be selected when the **PLC gives a command** to configure the ProfiNet board.

6: **SSI given command** This control mode can be selected when configuring the IO board of SSI .

Function code	name	Setting range	Factory settings
P10.03	Speed channel selection 1	0~1 7	0

This function is applicable to frequency setting. For the selection of control mode, refer to P1 0.00 group function code.

0: **Panel gives frequency** The frequency setting is set by P40.00. The frequency can also be increased or decreased by the ▲ and ▼ keys during operation. The frequency will be maintained after stopping, but not after power outage.

1: **Digital multi-speed setting target speed** If digital multi-speed terminals 0 to 3 are valid, the frequency is determined by the terminal combination, see P41.00 to P41.15.

3: **A0 analog target speed setting**

4: **A0 analog current speed setting**

5: **A1 analog target speed setting**

6: **A1 analog current speed setting**

The relationship between the given speed and the analog value is shown in the figure.

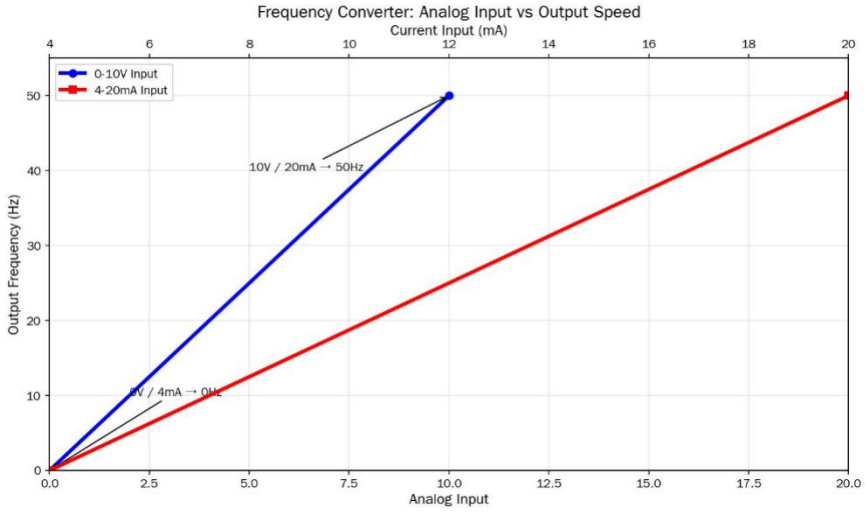


Figure 7-5 Correspondence between analog quantity and frequency

The target speed can be given through the analog input port. At this time, the output frequency is calculated according to the acceleration and deceleration time of group P40. The current speed can also be given. At this time, the acceleration and deceleration time of group P40 is invalid.

8: **PID function gives the target speed** industry application macro occasions

11: **SSI selects SSI board for current speed**

12: **Modbus gives target speed** Standard configuration, see Modbus protocol
15: **Up /Down to target speed** see terminal function
17: **PLC given speed** configuration ProfiNet board

Function code	name	Setting range	Factory settings
P10.06	Speed limit selection	0~ 5	0

Select different channels to limit the speed setting to prevent speed exceeding the limit.
0: **The internal parameter is limited** by the upper and lower frequency limits of P70.00.

Function code	name	Setting range	Factory settings
P10.07	Speed channel selection 2	0~1 7	0

Same as P10.03 speed channel selection 1.

7.3.2 P11 Group Startup Parameters

Function code	name	Setting range	Factory settings
P11.00	Startup mode selection	0~2	0

Depending on the application, different starting methods can be adopted.
0: **Normal startup mode**
It starts running from the starting frequency P11.01 and accelerates to the set frequency after the starting frequency holding time P11.02.

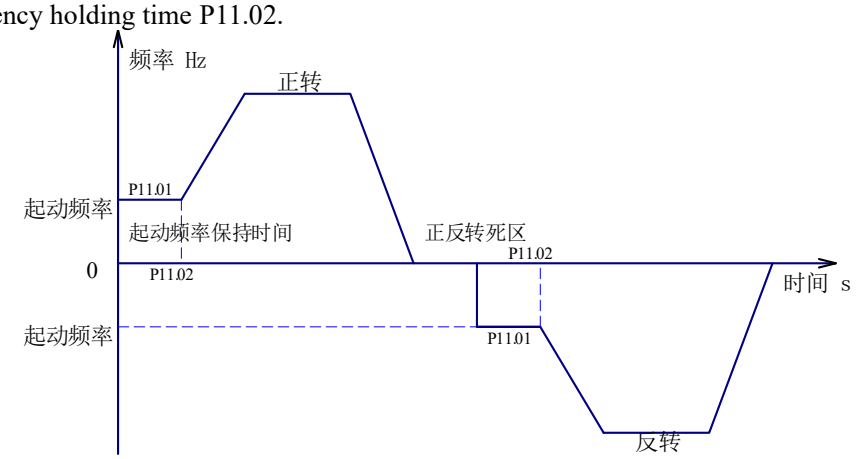


Figure 7-6 Schematic diagram of normal startup mode

1: **DC braking and then restarting**
First, inject DC to excite and brake the motor. The DC injection level and duration are set by P 11.03 and P11.04. After the DC injection time is reached, the motor starts running at the starting frequency P11.01 and accelerates to the set frequency after the starting frequency holding time P11.02 .

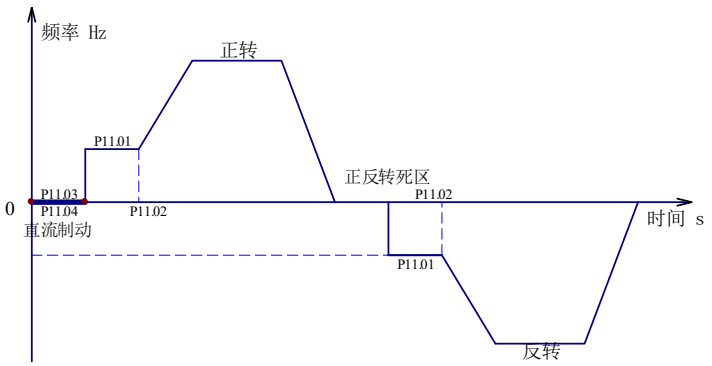


Figure 7-7 Diagram of restarting after D C braking

2: **Speed tracking start**

When a start command is received, the inverter does not initially output power. Instead, it rapidly detects the motor's back electromotive force (EMF) to accurately calculate the motor's current rotational speed (frequency) and rotor position. The inverter then outputs an AC current that is completely synchronized with the current motor speed (matching frequency, phase, and voltage). It then accelerates or decelerates the motor to the target speed at a preset acceleration rate, ensuring a smooth and impact-free start-up process.

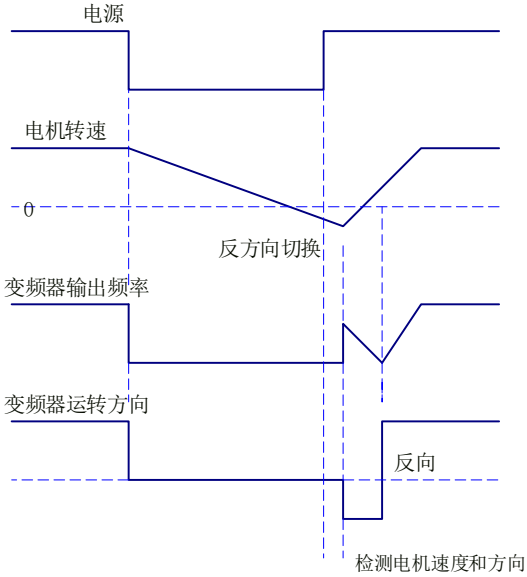


Figure 7-8 Schematic diagram of speed tracking startup mode

Function code	name	Setting range	Factory settings
P11.01	Startup holding frequency (Hz)	0.00~ 5 0.00	0.00
P11.02	Start frequency holding time (s)	0.0~3600.0	0.0

The starting frequency refers to the initial frequency when the inverter starts, as shown in the figure *fs*; *the* starting frequency holding time *ts* refers to the time the inverter keeps running at the starting frequency during the starting process.

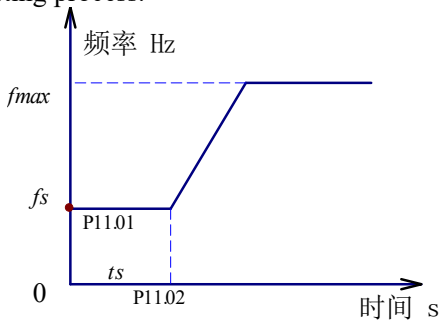


Figure 7-9 Schematic diagram of startup frequency and startup time

Inverter starts running from the starting frequency P11.01, and after the starting frequency holding time P11.02, it accelerates according to the set acceleration time.

Note: For heavy-load starting situations, properly setting the starting frequency holding time will facilitate starting.

Function code	name	Setting range	Factory

			settings
P11.03	Starting DC injection current (%)	0.0~120.0	30.0
P11.04	Startup DC injection time (s)	0.0~ 100.0	5.0

P11.03 and P11.04 are only valid when the starting operation mode is selected as "DC braking and then restart (P11.00 =1)", as shown in the figure below.

The startup DC braking current (P11.03) is set as a percentage of the inverter's rated current. If the set DC braking current is greater than 120 % of the motor's rated current, the injected current will be 120% of the motor's rated current. Heavy load: 0.0 to 120.0 %; light load: 0.0 to 90.0%.

Starting DC braking time (P11.04) is the injection action time. When P11.04=0, there is no DC braking process.

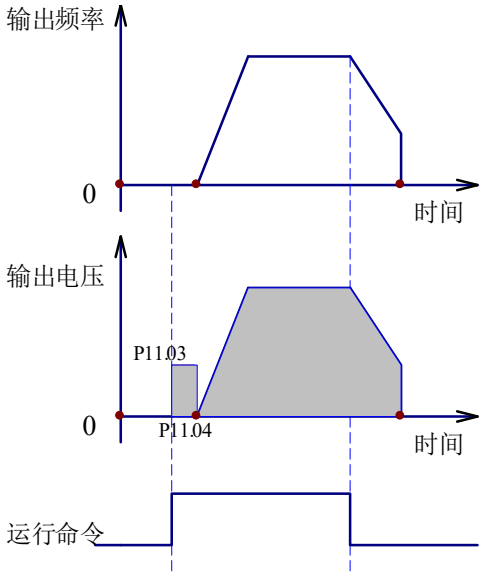


Figure 7-10 Schematic diagram of DC braking

Function code	name	Setting range	Factory settings
P11.05	Excitation time (s)	0.0~ 10.0	2.0

The excitation time is the time required to establish magnetic flux before the motor starts and to achieve the purpose of rapid response when the motor starts. When there is a run command, it first enters the pre-excitation state according to the time set by this function code. After the magnetic flux is established, it enters normal acceleration operation. Setting this function code to 0 means no pre-excitation process.

Note: The motor may rotate during pre-magnetization. In this case, please use mechanical brake.

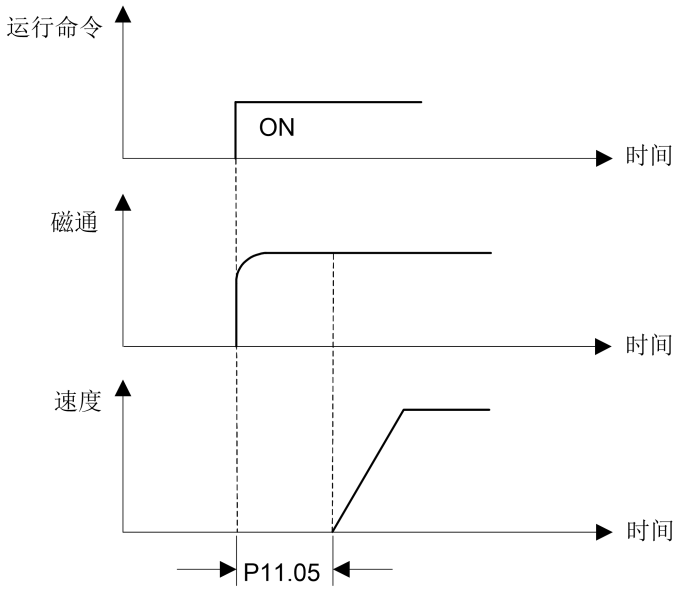


Figure 7-11 Schematic diagram of pre-excitation

Function code	name	Setting range	Factory settings
P11.07	Braking action time (s)	0.00~ 100.00	0.20

Braking action time refers to the time from when the external brake receives the brake control signal to when the mechanical brake actually opens. After the action is completed, it enters the zero servo time, which is the time to maintain zero speed.

Function code	name	Setting range	Factory settings
P11.08	Tracking delay time (ms)	0~65000	1

The tracking delay time is used to wait for the motor to demagnetize. If overcurrent occurs at the beginning of tracking, increase this value.

Function code	name	Setting range	Factory settings
P11.10	Tracking voltage Kp	0.00~100.00	0.20

Kp during the tracking process. If the value is too small, the tracking process will be prolonged. If it is too large, it will cause overcurrent during the tracking process.

Function code	name	Setting range	Factory settings
P11.11	Tracking voltage Ki	0.00~100.00	0.50

Ki during the tracking process. If the value is too small, the tracking process will be prolonged. If it is too large, it will cause overcurrent during the tracking process.

Function code	name	Setting range	Factory settings
P11.12	Tracking voltage Kd	0.00~100.00	0.00

Kd during the tracking process. If the value is too small, the overshoot current will not be suppressed significantly during the tracking process. If it is too large, it will cause overcurrent during

the tracking process.

Function code	name	Setting range	Factory settings
P11.13	Tracking exit delay (ms)	100~65 000	100

To ensure a smooth exit tracking process, appropriately increasing this time will facilitate a smooth exit.

Function code	name	Setting range	Factory settings
P11.14	Maximum current during tracking (%)	0.0~200.0	100.0

The maximum current during tracking is a percentage of the motor's rated current. When the motor is small and the drive is large, ensure that the maximum current during tracking is less than the drive's rated current. If overcurrent occurs during tracking, reduce this value.

Function code	name	Setting range	Factory settings
P11.15	Tracking frequency change gain (%)	0.0~100.0	50

If overvoltage occurs during tracking or P60.09 is greater than 600V , this value should be reduced.

Function code	name	Setting range	Factory settings
P11.17	Tracking initial frequency (Hz)	0.00~ 360.00	50.00

Normally, this value is set to the maximum operating frequency before tracking. If the system's coasting speed drops quickly, this value can be appropriately reduced.

Function code	name	Setting range	Factory settings
P11.18	Startup delay time (s)	0.00~655.35	0

After the inverter receives the run command, it waits for P11.18 (start delay time) before responding to the start command.

Function code	name	Setting range	Factory settings
P11.19	Reverse opening current (%)	0.0~100.0	20.0

Used in the hoisting industry for motor opening control. The motor reverse starting current must be greater than the current value of P11.19 to meet the opening conditions. (Percentage of the inverter's rated output current)

7.3.3 P12 Group Stop Parameters

Function code	name	Setting range	Factory settings
P12.00	Parking mode selection	0~4	0

Different stopping methods can be adopted according to different application scenarios.
0: The inverter blocks output and the motor stops by free inertia;
1: decelerate and stop according to the set deceleration time;
2: According to the set DC braking deceleration stop, when the frequency is lower than the DC

braking start frequency P12.03, the DC braking current P12.04 is injected, and the DC braking time is determined by P12.05;

3: Decelerate to stop at the lower frequency limit, then coast to stop;

4: Spare.

Function code	name	Setting range	Factory settings
P12.01	Stop holding frequency (Hz)	0.00~100.00	0.00
P12.02	Stop frequency holding time (s)	0.0~1000.0	0.0

The inverter starts by decelerating from the normal operating speed to the stop frequency P12.01, and after the stop frequency holding time P12.02, it decelerates to zero according to the set deceleration time, which is conducive to parking stability.

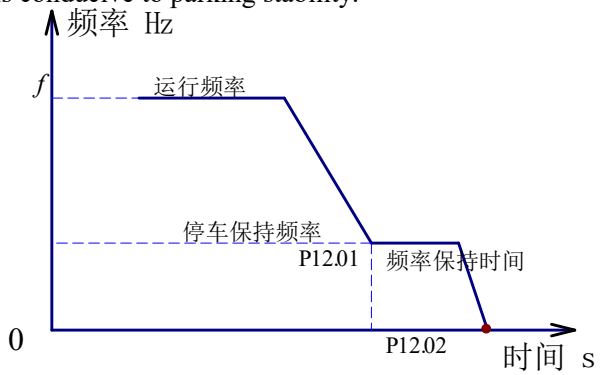


Figure 7-12 Schematic diagram of parking hold frequency

Function code	name	Setting range	Factory settings
P12.03	DC braking starting frequency (Hz)	0.00~10.00	2.50
P12.04	Parking DC braking current (%)	0.0~100.0	50.0
P12.05	Stop DC braking time (s)	0.0~10.0	0.5

P12.03~P12.05 are valid only when the stop mode is selected as "Deceleration + DC braking (P12.00=2)".

Stop DC braking current(P12.04) is set as a percentage of the inverter's rated current. If the set DC braking current is greater than 100 % of the motor's rated current, the injected current is 100% of the motor's rated current. Heavy load: 0.0 to 100.0 %; light load: 0.0 to 90.0%.

Stop DC braking time (P12.05) is the injection action time . When P12.04 =0, there is no DC braking process.

When P12.00=2 (deceleration + DC braking), P12.03 can be set as the braking start frequency for rapid braking.

P12.04 sets the DC braking current amount. This value is a percentage of the inverter's rated current. Variable torque load: 0.0 to 90.0 %.

P12.04 sets the action time of DC braking.

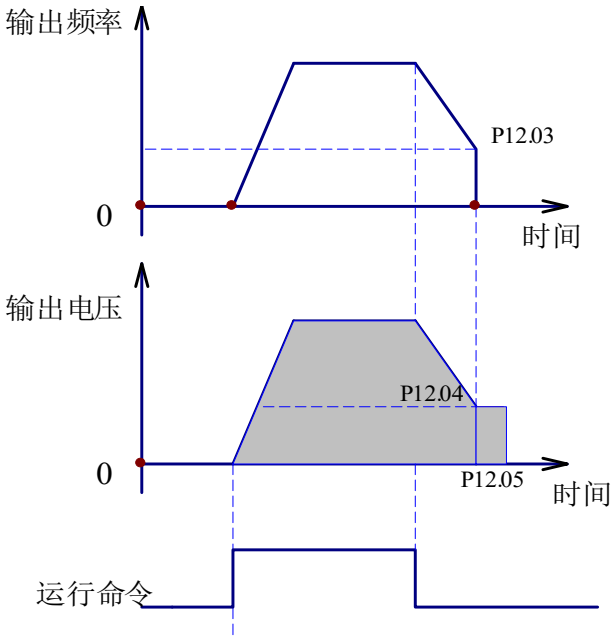


Figure 7-13 Schematic diagram of parking DC braking

7.3.4 P13 Group Braking Function

Function code	name	Setting range	Factory settings
P13.00	Dynamic braking selection	0~1	1
P13.01	Brake release voltage	340 ~ 1160	660

P13.00 Dynamic braking selection reflects whether the inverter uses dynamic braking.

1: Enable the dynamic braking function.

0: The dynamic braking function is not used.

For situations with large moment of inertia and the need for rapid braking and stopping, you can select a matching braking unit and braking resistor, and set the braking parameters to achieve rapid braking and stopping.

By adjusting P13.01, you can select the action voltage of the brake unit. Selecting an appropriate action voltage can achieve rapid energy-consuming braking stop.

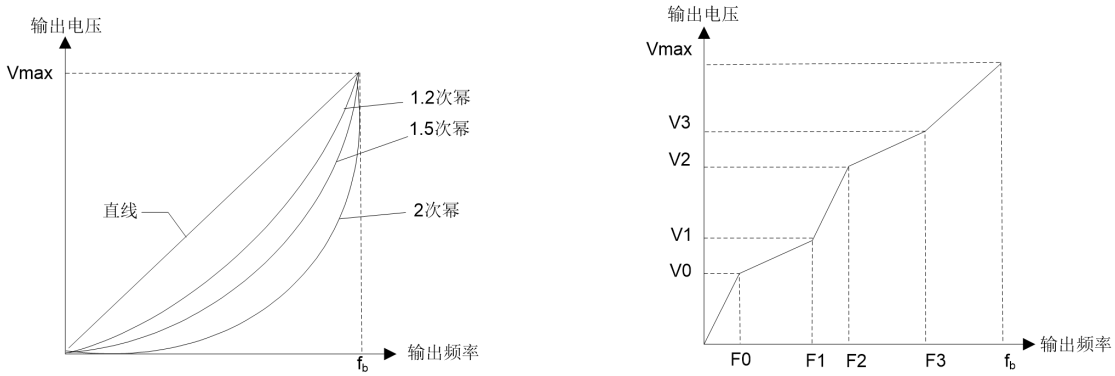
There are two types of brake switch voltages: when the default setting is 660, the turn-on voltage is calculated based on the peak value of the grid voltage; when it is not 660, it is calculated based on the set value.

7.3.5 Group P14 V/F Control Parameters

Function code	name	Setting range	Factory settings
P14.00	V/F curve setting	0~ 5	0
P14.01	V/F voltage value V0(V)	1~460	76
P14.02	V/F frequency value F0 (Hz)	0.01~300.00	10.00
P14.03	V/F voltage value V1(V)	1~460	152
P14.04	V/F frequency value F1 (Hz)	0.01~300.00	20.00
P14.05	V/F voltage value V2(V)	1~460	228

P14.06	V/F frequency value F2 (Hz)	0.01~300.00	30.00
P14.07	V/F voltage value V3 (V)	1~460	304
P14.08	V/F frequency value F3 (Hz)	0.01~300.00	40.00
P14.09	V/F voltage value V4 (V)	1~460	380
P14.10	V/F frequency value F4 (Hz)	0.00~300.00	50.00

Parameter P14.00 determines different V/F curves under voltage vector V/F control operation mode (P10.00=0).



a) V/F curve b) Multi-segment V/F curve

Figure 7-14 VF curve diagram

P 14.00 = 0 is applicable to constant torque load conditions. There is a linear relationship between V and F with a coefficient of 1. See the straight line in the figure for details.

P14.00 = 1~3 is suitable for variable torque loads such as fans and pumps. P14.00 values of 1 to 3 correspond to the 1.2th, 1.5th , and 2nd power curves, respectively (see Figure 7-13 a). The 2nd power curve is suitable for water supply, while the 1.2th and 1.5th power curves are suitable for other liquid loads. Select the appropriate curve based on actual conditions.

P14.00 = 4 user - defined curve, suitable for segmented constant torque load, see Figure 7-13 b.

In Figure 7-13 b): F0<F1<F2<F3< F4 ≤f_b, where $_{fb}$ is the basic operating frequency P 4 0.01

V0≤V1≤V2≤V3 <V4 ≤ Vmax, V0, V1, V2, V3, V4 are the actual output voltages relative to the maximum output voltage and rated frequency (V1= (Vmax/fb) * F1 defaults to Vmax = 380V, f_b = 50Hz) .

Function code	name	Setting range	Factory settings
P14.12	ACS voltage setting	0~ 690	380
P14.13	ACS frequency setting	0.0 ~3000.0	50.0
P14.14	Special power supply types	0 ~ 3	0
P14.15	ACS frequency setting source	0 ~5	0
P14.16	Inspection search start frequency	0.00 ~ 655.35	2.00
P14.17	Voltage source soft start time	0.00 ~ 655.35	10.0 0

When P10.00 is set to 6 for voltage/current source control mode and P14.14 is set to 0 for voltage source mode, V/ F separation mode is implemented. In this case, the inverter's three-phase output is connected to a three-phase LC filter, acting as a three-phase voltage source. P14.12 sets the output voltage amplitude, and P14.13 sets the output voltage frequency.

Setting P14.14 to 1 is current source mode. This mode is constant current control. The current is set by P20.02, and the frequency is set by P14.13. It can be used in power supply scenarios for inductive loads or resistive loads.

Setting P14.14 to 2 is fire pump mode. This mode is mainly used for inspection of fire pumps.

Usually, the motor is an asynchronous motor. During each inspection, the motor runs at no load for a period of time to ensure normal function.

Setting P14.14 to 3 is fan inspection mode. This mode is mainly used for fan inspection. Usually, the motor is a synchronous motor. During each inspection, the motor runs at no load for a period of time to ensure normal function.

When P14.15 is set to 0, it is internal digital given; when it is set to 1, it is analog A0 given; when it is set to 2, it is analog A1 given; when it is set to other, it is reserved.

P14.16 is the inspection search starting frequency, which is valid when P14.14 is set to 3 (fan inspection mode), that is, the initial start search frequency point in fan inspection mode.

P14.17 is the voltage source soft start time, which is valid when P10.00 is set to 6 (voltage-current source control mode) and P14.14 is set to 0. It is the time required for the output voltage to rise from 0V to the rated voltage.

Function code	name	Setting range	Factory settings
P14.18	VFVC speed precision adjustment	0.0 ~6553.5	100.0
P14.19	VFVC torque boost	0.0 ~6553.5	5.0

P14.18 is the VFVC speed accuracy adjustment. When P10.00 = 4 (VFVC mode), speed deviations can be corrected by adjusting this coefficient. Lowering this parameter weakens the inverter's compensation for speed deviations. When the load increases, the motor speed drops more significantly and recovers more slowly, making it unsuitable for applications requiring high speed accuracy. Raising this parameter strengthens the inverter's compensation for speed deviations. If the speed drops due to load, the inverter compensates to make up for the speed difference, but overcompensation can easily lead to overcurrent. If the motor vibrates due to compensation, lower this parameter appropriately to achieve stability.

P14.19 is the VFVC torque boost. When P10.00 = 4 (VFVC mode) and the starting load is heavy (such as conveyor belts, mixers and other constant torque loads), this value can be appropriately increased to increase the starting torque.

7.3.6 P1 5 groups of SVC parameters

Function code	name	Setting range	Factory settings
P15.00	Initial magnetic pole determination	0~2	1

0: No judgment No-load starting capability, which requires a relatively long acceleration time .

1: **DC injection start** Incrementally inject DC current to (P15.01 * motor rated current) to drag the motor poles to the excitation direction.

2: **Pulse voltage injection start** injecting voltage pulses for initial magnetic pole judgment.

Function code	name	Setting range	Factory settings
P15.01	Injected DC size (%)	0~150	50

The unit is based on the motor rated current. Pay attention to this parameter setting when starting the load.

Function code	name	Setting range	Factory settings
P15.02	Pulse injection amplitude (%)	0~100	50

In open-loop vector control PM control mode, this parameter is used when P15.00=2.

Function code	name	Setting range	Factory settings
P15.03	Pulse angle compensation	0~1	0

In open-loop vector control PM control mode, when P15.00 =2, the pulse angle compensation function needs to be enabled for some special motors.

Function code	name	Setting range	Factory settings
P15.05	Control status word	0~1000	2

For control mode selection, the recommended default control word mode is 2.

Function code	name	Setting range	Factory settings
P15.06	PM current control strategy	0~10	0

Default 1: MTPA (maximum torque per unit current) requires motor static self-learning.

Function code	name	Setting range	Factory settings
P15.07	MTPA1 bandwidth (Hz)	0~1000	10

MTPA loop adjustment bandwidth, the default is 10 Hz, generally does not need to be modified.

Function code	name	Setting range	Factory settings
P15.08	I min of MTPA (%)	0~100	5

MTPA minimum control current.

Function code	name	Setting range	Factory settings
P15.09	PM low speed compensation coefficient 1 (%)	0~200	40

Observer bandwidth parameter, used to control the observer convergence speed.

Increasing the bandwidth parameter will speed up the convergence of the observer, but the noise immunity and robustness will be poor, and there will be risks of high noise, oscillation, and parameter sensitivity. Reducing the bandwidth parameter will slow down the convergence of the observer, but the noise immunity and robustness will be better, but there will be risks of response delay and poor dynamic performance.

Function code	name	Setting range	Factory settings
P15.10	Ka	0~1000	15
P15.11	Kb	0~1000	20
P15.12	Kr1	0~1000	5
P15.13	Kr2	0~2000	200
P15.14	Kr3	0~2000	20
P15.15	Kr4	0~2000	0
P15.16	Kr5	0~2000	100

P15.10~P15.16 are speed observer related parameters (internal monitoring parameters for R&D generally do not need to be modified).

Function code	name	Setting range	Factory settings
P15.17	VCIF injection current	0.0 ~ 200.0	1 0
P15.18	VCIF injection current slope	1~ 5000	300
P15.19	VC determination stabilization time	1~ 5000	30
P15.20	Speed observer error threshold	0.1 ~100.0	10.0
P15.21	IF switching frequency	0~ 100.0	10.0
P15.22	VC switching frequency	0~ 100.0	5.0
P15.23	IF oscillation suppression enable	0~ 1000	1

External synchronization: At the initial stage of motor startup, since the motor is in zero speed state and there is no back electromotive force, the observer cannot work and the inverter has no speed feedback. At this time, a voltage with a preset frequency (VF) is input to pull the motor to rotate.

P15.17 is the VCIF injection current. This value indicates the magnitude of the injection current when the SVC external synchronization is started. When this value is greater than 10%, the external synchronization function is enabled; when this value is less than 10%, the external synchronization function is disabled by default.

P15.18 is the VCIF injection current slope. During the SVC mode startup phase, a high current is output to generate sufficient torque to overcome static friction and load inertia. This current is injected into the motor to establish a rotating magnetic field and generate starting torque. When the inverter drives the motor using external synchronization, this is the time required for the injected current to rise from 0 to the target value. The injected current does not reach its maximum value instantaneously, but increases smoothly at the set slope. This rise time is the VCIF injection current slope.

P15.19 is the VC determination stabilization time, which is the time it takes to determine whether the estimated speed is stable during external synchronization. This parameter reflects how long the inverter needs to wait after using external synchronization to drive the motor to observe and confirm that the speed signal estimated by the internal speed observer has reached a stable and reliable state.

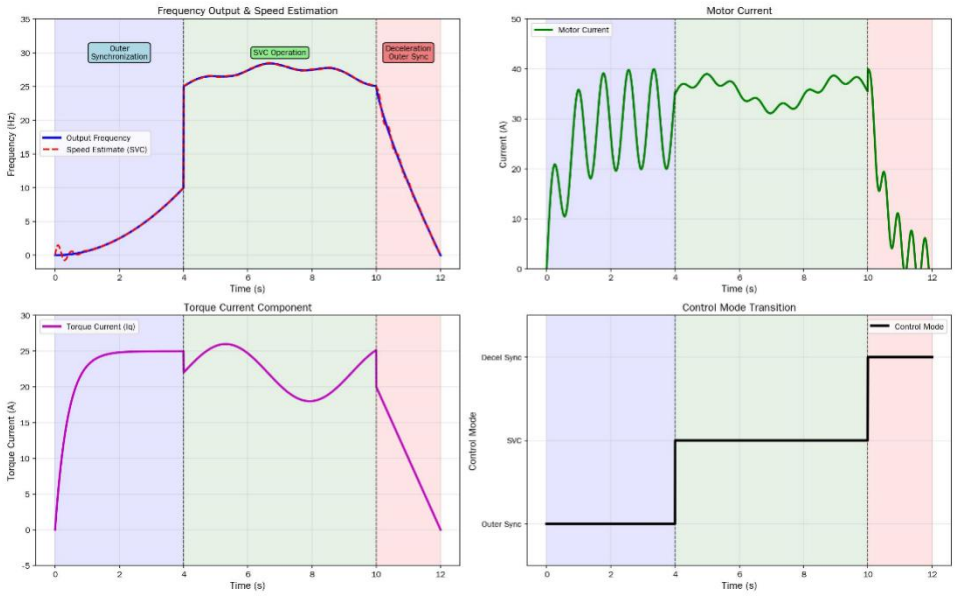
P15.20 is the speed observer error threshold. This threshold determines the completion condition for speed observation during external synchronization. If the speed deviation exceeds this preset threshold during external synchronization, the synchronization process cannot be completed. Increasing this parameter can cause the observer to become inaccurate, leading to protection failure and a series of faults (such as stall and overcurrent). Decreasing this parameter can make the observer more sensitive, prone to false alarms, and result in insufficient system stability. This parameter is generally not modified.

P15.21 is the IF switching frequency, which is the frequency point at which the external synchronization switches to normal mode operation.

P15.22 is the VC switching frequency, the frequency at which normal mode switches to external synchronization mode. When the inverter decelerates a heavy load, the motor may be generating energy. This energy is fed back to the inverter's DC bus, causing the bus voltage to rise sharply. When the bus voltage exceeds P70.06 (deceleration overvoltage threshold), the inverter will alarm for a deceleration overvoltage fault. This parameter is set to ensure precise control at high speeds and safety and stability at low speeds.

P15.23 is the IF oscillation suppression enable. When this value is non- zero, it indicates that the oscillation suppression function is enabled during the external synchronization phase. If the system oscillates, prioritize optimizing the speed loop PID parameters. If the oscillation cannot be eliminated or if further optimizing the speed loop PID results in a significant decrease in system performance, enable this parameter to eliminate the oscillation.

The following figure shows, from left to right, the output frequency, motor current, torque current component, and control mode changes over time.



7.3.7 P16 groups of field weakening parameters

Function code	name	Setting range	Factory settings
P16.01	Field weakening voltage setting	0~200	95

Setpoint of the field weakening control loop;

Function code	name	Setting range	Factory settings
P16.02	Field weakening control bandwidth (Hz)	0.0 ~ 100.0	2.0

If the current fluctuation in the weak magnetic state is large, the control bandwidth can be appropriately reduced, which is suitable for synchronous and asynchronous machines.

Function code	name	Setting range	Factory settings
P16.03	Magnetic loop bandwidth (Hz)	0.0 ~ 100.0	1.0

If the current fluctuation in the weak magnetic state is large, the magnetic loop bandwidth can be appropriately reduced, which is limited to asynchronous machines.

Function code	name	Setting range	Factory settings
P16.04	Weak magnetic field KP	0~ 655.35	0
P16.05	Weak magnetic field KI	0~ 6.5535	0.01

When the inverter drives the motor to a certain speed, the motor back electromotive force will approach the maximum voltage output by the inverter. At this time, if you want to continue to increase the speed, the inverter will apply a direct axis current component (ld) opposite to the excitation current to weaken the internal magnetic field of the motor and achieve a weakening magnetic effect. The inverter calculates the required weakening magnetic current through PID inside:

P16.04 is the field weakening KP, the second field weakening control mode KP in FOC mode. When this parameter is non-zero, this field weakening control mode is enabled.

P16.05 is field weakening KI, the second field weakening control mode KI in FOC mode.

7.3.8 P17 Groups of GVC Parameters

Function code	name	Setting range	Factory settings
P17.00	DC injection current (%)	0.10~200.00	70

The DC injection current level at startup is used as the starting torque. If the current oscillates during startup, the DC injection level can be increased appropriately.

Function code	name	Setting range	Factory settings
P17.01	DC injection slope (s)	0.00~655.35	1.00

The DC injection current rising slope is the speed at which the injection current increases. It represents the time it takes for the current to increase from 0 to the set value. The unit is s, and the default value is 1.0s. This parameter should be less than the excitation time (P11.05) to ensure that the DC injection current or excitation current reaches the set value.

Function code	name	Setting range	Factory settings
P17.02	External synchronization switching frequency (%)	0~100	10

Setting it to 0 means no external synchronization function. Setting it to a non-zero value enables the external synchronization function. The setting value is the external synchronization switching frequency point. When the given frequency is less than or equal to the frequency corresponding to the

switching point, constant current output control is performed. When it is greater than this frequency, GVC control is performed.

For example, for a motor with a rated frequency of 50 Hz, if this parameter is 10%, constant current output control is performed when the operating frequency is 5 Hz or below, and GVC control is performed when the operating frequency is above 5 Hz.

The output current of the external synchronization is set by parameter P17.00. During heavy-load starting, the DC injection current value should be increased. Generally, if the motor vibrates during starting, such as when fault 21# (output contactor detection) is reported, you can try using external synchronization starting.

Function code	name	Setting range	Factory settings
P17.03	Low speed voltage compensation gain (%)	0~20000	0

In low-speed conditions, the output voltage capability is increased to improve the motor's low-speed load capacity. The default value of P17.03 is 0%, which means that low-speed voltage compensation is not performed by default.

Function code	name	Setting range	Factory settings
P17.04	Voltage compensation upper limit frequency (%)	0~30000	40

The voltage compensation frequency upper limit P17.04 is a calibration value, and the default value is 40%. That is, if the rated frequency is 50Hz, the default voltage compensation frequency upper limit is 50Hz × 40% = 20Hz.

When the voltage compensation frequency upper limit P17.04 is exceeded, the output voltage is not compensated. When the voltage compensation frequency upper limit P17.04 is not exceeded, the output voltage is compensated.

Function code	name	Setting range	Factory settings
P17.05	Vibration suppression gain	0.00~655.35	100

The value is generally 1/25 of the rated frequency. For example, if the rated frequency of the motor is 50.00Hz, the value is 2.00. This parameter is used to adjust the current fluctuation suppression function of the GVC control algorithm. The larger the vibration suppression gain, the more obvious the vibration suppression effect, but the dynamic performance will deteriorate.

Function code	name	Setting range	Factory settings
P17.15	Compensation function selection	0~65535	256

Bit 0: The voltage curve is automatically adjusted, and the output voltage is automatically adjusted according to the load.

Bit 1: Low-speed voltage compensation, which can improve low-speed load capacity.

Bit 2: Oscillation suppression, controls motor vibration during light-load operation.

Bit 3: stator resistance compensation, stator resistance voltage compensation, improves low-speed load capacity.

Bit 8: Energy-saving mode. After energy-saving operation is enabled, when the motor is idling, it runs according to the voltage curve corresponding to the back electromotive force, and when fully

loaded, it runs according to the curve corresponding to the rated voltage. This can reduce the current of the motor when it is lightly loaded, thereby improving efficiency and saving energy.

GVC debugging steps:

Step 1: If it is the first time to use, please reset the inverter parameters, the default is GVC (P10.00=0), and then set the motor nameplate parameters to P20 group;

Step 2: When starting with a large load, perform self-learning on the stator resistance; otherwise, directly set the stator resistance to zero.

Step 3: To achieve better control effect, perform motor static auto-tuning. After auto-tuning, relatively accurate stator resistance P21.01 and vibration suppression gain P17.05 can be obtained.

GVC debugging problems and solutions:

Question 1: The starting current has a large impact:

1、 Check whether the stator resistance P21.01 is accurate and whether the stator resistance auto-tuning has been performed.
2、 Adjust the injected DC current P17.00 during startup to make it close to the actual no-load current.
3、 Increase P17.05 vibration suppression gain by 0.5 each time; the default is 2.00.
4、 Increase the low-speed voltage compensation gain P17.03 (reference range 1%-5%).
5、 Enable the constant current output (external synchronization) function and set P17.04 external synchronization frequency switching point.

Question 2: Overcurrent or overvoltage occurs when the load suddenly decreases:

1. Reduce the vibration suppression gain P17.05.

Problem 3: Sudden load increases, motor out of control, and poor dynamic performance:

1. Under low speed conditions, the low speed voltage compensation gain P17.03 can be increased.
2. Reduce the vibration suppression gain P17.05.

7.4 P2X Group Motor Parameters

7.4.1 P20 Group General Parameters

Function code	name	Setting range	Factory settings
P20.00	Motor 1 Type	0~2	0
P20.01	Motor 1 rated power (kW)	0.00~655.35	/
P20.02	Motor 1 rated current (A)	0.0~1000.0	/
P20.03	Motor 1 rated frequency (Hz)	0.00~500.00	/
P20.04	Motor 1 rated speed (rpm)	0~60000	/
P20.05	Motor 1 rated voltage (V)	0~690	/
P20.06	Number of poles of motor 1 (P)	2~128	/
P20.07	Motor 1 rated slip frequency (Hz)	0.1 0 ~50.00	/

P20.00 Motor type: 0: Asynchronous motor 1: Synchronous motor 2: Reluctance motor

P20.01~P20.07 and P20.11 are used to set the parameters of the motor driven by the inverter. Before use, the parameters must be set correctly according to the motor nameplate.

P20.06 is used to set the number of motor poles, which is set according to the nameplate. If there is no motor pole number parameter on the nameplate, it can be calculated according to the following formula:

$$\text{Number of poles} = (120 \times f) \div n$$

Where: n is the rated speed of the motor; f is the rated frequency of the motor.

For the calculated value, an even integer is the "pole number".

Note: The power level of the inverter should match the motor.

P20.07 is used to set the slip frequency.

If there is no slip frequency data on the motor nameplate, the value set for P20.07 can be calculated using the following formula:

Assume the motor rated frequency is f (P20.03), the motor rated speed is n (P20.04), and the number of motor poles is p (P20.06), then:

Slip frequency = f - ((n × p) ÷ 120

Example: Rated frequency is 50Hz, rated speed is 1430rpm, number of motor poles is 4,

Then the setting value of P20.07 = 50 - ((1430×4) ÷ 120) = 2.33Hz.

Function code	name	Setting range	Factory settings
P20.08	Motor 1 maximum slip frequency (Hz)	0.10 ~50.00	2.80
P20.09	Motor 1 phase sequence	0~ 1	1
P20. 10	Motor 1 no-load current coefficient (%)	0.10~100.00	3 0.0 0

P20.08 sets the maximum slip frequency of the motor, which is generally twice the rated slip frequency.

P20.09 sets the direction of motor rotation, 0 means running in negative phase sequence; 1 means running in positive phase sequence.

P20.10 sets the motor no-load current coefficient, which is generally around 30% of the motor rated current.

Function code	name	Setting range	Factory settings
P20.14	Motor 2 Type	0~1	0
P20. 15	Motor 2 rated power (kW)	0.00~655.35	
P20. 16	Motor 2 rated current (A)	0.0~1000.0	
P20. 17	Motor 2 rated frequency (Hz)	0.00~500.00	50
P20. 18	Motor 2 rated speed (rpm)	0~50000	1460
P20. 19	Motor 2 rated voltage (V)	0~690	380
P20. 20	Motor 2 poles (P)	2~128	4
P20. 21	Motor 2 rated slip frequency (Hz)	0.1 0 ~50.00	1.40
P20. 22	Motor 2 maximum slip frequency (Hz)	0.1 0 ~50.00	2.8 0
P20. 23	Motor 2 phase sequence	0~ 1	1
P20. 24	Motor 2 no-load current coefficient (%)	0.10~100.00	3 0.0 0

The parameter descriptions for motor 2 (P20.14~P20.26) are the same as those for motor 1.

Function code	name	Setting range	Factory settings
P20.27	Motor parameter calculation enable	0 ~1	0

P20.27 is the motor parameter calculation enable. This function is a simple offline motor parameter calculation function. When it is set to 1, the relevant motor parameters are automatically calculated according to the motor nameplate parameters. After the calculation is completed, the parameters are automatically cleared.

7.4.2 P21 Group Advanced Parameters

Function code	name	Setting range	Factory settings

P21.01	Motor 1 stator resistance (Ω)	0.000 ~65.000	0.100
P21.02	Motor 1 rotor resistance (Ω)	0.000 ~65.000	0.441
P21.03	Motor 1 stator inductance (H)	0.0000 ~ 6.5000	0.1028
P21.04	Motor 1 rotor inductance (H)	0.0000 ~ 6.5000	0.1028
P21.05	Motor 1 mutual inductance (H)	0.0000 ~ 6.5000	0.0991

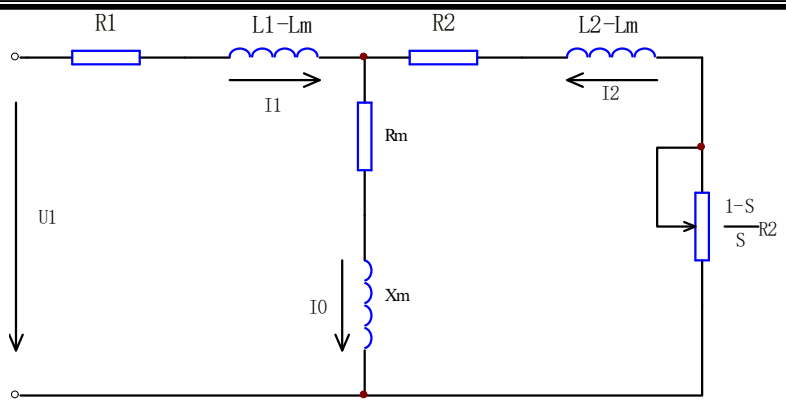


Figure 7-15 Steady-state equivalent circuit diagram of an asynchronous motor

In the figure, R1, R2, L1, L2, Lm, and I0 represent stator resistance, rotor resistance, stator inductance, rotor inductance, mutual inductance, and excitation current, respectively. The excitation current can be calculated from the motor's rated current and power factor or measured through rotating autotuning.

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

Rated torque current = power factor ×motor rated current

No-load excitation current = $\sqrt{1 - Power\ factor^2} \times Motor\ rated\ current \times Motor\ efficiency$, the general motor efficiency is about 85%.

The five parameters P21.01, P21.02, P21.03, P21.04 and P21.05 are only valid for asynchronous motors. They are the internal characteristic parameters of the motor and need to be automatically obtained through the auto-tuning operation of the inverter on the motor.

By performing parameter auto-tuning, the key motor parameters that affect the inverter's operation control are determined. These motor parameters will be automatically saved in the inverter after the parameter auto-tuning process is completed until the next parameter input or parameter auto-tuning is performed again.

The process of parameter auto-tuning is as follows:

① Enter P20.00 ~ P20.11 correctly according to the motor nameplate; correctly set the basic operating frequency P40.01, maximum output frequency P70.02 and maximum output voltage P70.03; set appropriate acceleration and deceleration times P40.02 and P40.03;

② Select the execution mode of parameter auto-tuning.

Function code	name	Setting range	Factory settings
P21 .06	Motor 2 stator resistance (Ω)	0.000 ~65.000	0.100
P21 .07	Motor 2 rotor resistance (Ω)	0.000 ~65.000	0
P21 .08	Motor 2 stator inductance (H)	0.0000 ~ 6.5000	0
P21 .09	Motor 2 rotor inductance (H)	0.0000 ~ 6.5000	0
P21.10	Motor 2 mutual inductance (H)	0.0000 ~ 6.5000	0

The parameter descriptions for motor 2 (P21.06~P21.10) are the same as those for motor 1.

Function code	name	Setting range	Factory settings
P21 .11	PM1 stator resistance (ohm)	0.000 ~65.000	0.100
P21 .12	PM1 motor D-axis inductance	0.000 ~ 6553.5	0
P21 .13	PM1 motor Q- axis inductance	0.000 ~ 6553.5	0
P21 .14	PM1 back electromotive force coefficient (V)	0.0 ~ 690.0	0

P21.11~P21.14 are synchronous motor parameters.

P21.15~P21.20 are the results of dynamic auto-tuning and are only used for display.

Function code	name	Setting range	Factory settings
P21.21	Inertia coefficient	0.000 ~65.000	0.200

Adjust this value appropriately based on the actual system inertia. This allows the inverter to better predict the load inertia, resulting in the most precise control. Setting it too low can lead to system instability and possibly motor oscillation/vibration; setting it too high can result in slow system response and poor rigidity.

Function code	name	Setting range	Factory settings
P21.22	Parameter deviation compensation (V)	0.0 ~ 100.0	0.0

Generally not used.

7.4.3 P22 Group Auxiliary Parameters

Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P22.01	Encoder 1 type	0	0～3	/	×	0: Incremental; 1: SinCos; 2: EnDat (spare) ; 3: Rezav
P22.02	Encoder 1 pulse number	1024	100～16000	ppr	×	Encoder pulse number
P22.03	Encoder frequency division coefficient	0	0～7	/	×	Encoder frequency division coefficient
P22.04	Encoder 1 position angle	0.0	0.0～360.0	degree	*	Encoder position angle
P22.05	Encoder feedback speed filter time constant	5	0～1000	ms	×	
P22.06	Encoder 1 direction	1	1～1	/	×	0: negative phase sequence, 1: positive phase sequence
P22.07	SinCos encoder interpolation coefficient	11	2 ~ 16	/	×	7-128;9-512;11-2048
P22.08	Rezav encoder 1 pole number	2	2~128	P	×	

This group of parameters selects the encoder 1 type, number of pulses per revolution, frequency division coefficient, etc. The position angle is read

during auto-tuning and cannot be set. The filter time must be adjusted within a controllable range. The encoder hardware changes lines according to actual conditions.
P22.01 sets the encoder type, 0: incremental encoder; 1: Sincos encoder; 2: spare; 3: Rezav encoder.
P22.02 sets the encoder pulse number.
P22.03 sets the frequency division coefficient, 0~7 corresponds to 1~128 frequency division.
P22.05 encoder feedback filter time defaults to 0 when P10.00 = 3, and to 10 ms in other control modes.
P22.06 parameter can be modified to select the encoder feedback direction. The default value is 1, and this version does not support modification. If an encoder wiring error is found on-site, causing the feedback direction to be opposite to the actual direction, the inverter output wiring phase sequence can be adjusted.
P22.07 sets the SinCos encoder subdivision coefficient and adjusts it according to the actual situation (usually marked on the encoder nameplate)

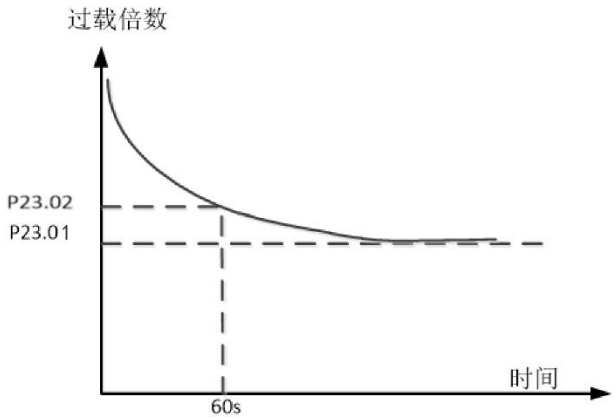
Function code	Function code name	Factory value	Setting range	unit	property	Option Description
P22.09	Encoder 2 type	0	0~3	/	×	0: Incremental ; 1: SinCos; 2: E n Dat (spare) ; 3: Rezav
P22.10	Encoder 2 pulse number	1024	100～16000	ppr	×	Encoder pulse number
P22.11	Encoder 2 position angle	0.0	0.0～360.0	Spend	*	Encoder position angle
P22.12	Encoder 2 direction	1	1～1	/	×	0: negative phase sequence, 1: positive phase sequence
P22.13	Rezav encoder 2 poles	2	2~128	P	×	
P22.14	Feedback speed limiting filter	0.00	0.00 ~100.00	%	×	

This group of parameters selects the encoder 2 type, number of pulses per revolution, frequency division coefficient, etc., the same as the above encoder 1.

7.4.4 P2 3 Group Protection Parameters

Function code	name	Setting range	Factory settings
P23.00	Motor fan mode	0~2	1
P23.01	Motor normal operating threshold (%)	70~200	110
P 23.02	Motor I^2t overcurrent threshold (%)	120~300	150

P23.00 Motor fan mode:
0: Block
1: The motor has an independent fan
2: The motor does not have an independent fan
The motor current is less than P23.01 and can run for a long time;
P23.02 is the 1-minute overcurrent threshold.



7-16 Motor overheat protection curve

7.5 P3X group terminal function

7.5.1 P30 Group Digital Input

Function code	name	Setting range	Factory settings	IO board type
P 30.00	X0 terminal input function selection	0~199	7	Version A IO board
P 30.01	X1 terminal input function selection	0~199	8	
P 30.02	X2 terminal input function selection	0~199	0	
P 30.03	X3 terminal input function selection	0~199	0	
P 30.04	X4 terminal input function selection	0~199	0	
P 30.05	X5 terminal input function selection	0~199	0	
P 30.06	X6 terminal input function selection	0~199	0	
P 30.00	X0 terminal input function selection	0~199	7	B /Standard IO Board
P 30.01	X1 terminal input function selection	0~199	8	
P 30.02	X2 terminal input function selection	0~199	0	
P 30.03	X3 terminal input function selection	0~199	0	
P 30.04	X4 terminal input function selection	0~199	0	

Function input terminal definition table:

Serial number	Function Definition	Serial number	Function Definition
0	No function	1	Acceleration/deceleration selection 0
2	Acceleration/ deceleration selection 1	3	Digital multi-speed selection 0
4	Digital multi-speed selection 1	5	Digital multi-speed selection 2
6	Digital multi-speed selection 3	7	Forward

Serial number	Function Definition	Serial number	Function Definition
8	Reverse	9	Three-wire operation control
10	Motor fan feedback (spare)	11	Switching from inverter frequency to power frequency
12	spare	13	External reset signal
14	External fault signal	15	Magnetic pole tuning signal (spare)
16	Emergency power supply operation (backup)	17	Weighing compensation signal (spare)
18	Base blocking signal	19	Light load switch input (spare)
20	Heavy load switching input (spare)	21	Output contactor detection (spare)
22	Brake contactor detection (spare)	23	Brake switch detection (spare)
24	Motor selection	25	Encoder selection
26	Function parameter 0 (spare)	27	Function parameter 1 (spare)
28	Pulse input 0 (spare)	29	Pulse input 1 (spare)
30	Speed/torque switching (backup)	31	Frequency increase (not maintained)
32	Frequency reduction (not maintained)	33	Emergency stop signal (backup)
34	Forward deceleration input (spare)	35	Reverse deceleration input (spare)
36	Forward stop input (spare)	37	Reverse stop input (spare)
38	Frequency increase (maintain)	39	Frequency reduction (maintain)
40	Jog frequency selection	41	Command switch to panel
42	Command switch to terminal	43	Command switch to the host computer
44	Open loop main and auxiliary reference switching	45	PID main reference is switched to internal
46	PID main reference is switched to analog A0	47	PID auxiliary reference is switched to invalid
48	PID auxiliary reference is switched to analog value A0	49	FJOG instruction
50	RJOG instruction	51	PID main reference is switched to analog value A1
52	PID auxiliary reference is switched to analog value A1	53	Speed channel switching
54	PID Suspension	5 5	Control mode switch 0
56	Control mode switch 1	5 7	Control mode switch 2
58	Motor vibration signal (spare)	5 9	Trickle heating (backup)
60	Reverse de-icing (spare)	61	Speed command switches to panel

0: No function
1: Acceleration/ deceleration selection 0
2: Acceleration/ deceleration selection 1
Please refer to the following table for instructions:

Acceleration/ deceleration	Acceleration/deceleration selection 0	Acceleration and deceleration time selection

OFF	OFF	Acceleration/deceleration time 0 (P40.02, P40.03)
OFF	ON	Acceleration/deceleration time 1 (P40.04, P40.05)
ON	OFF	Acceleration/deceleration time 2 (P40.06, P40.07)
ON	ON	Acceleration/deceleration time 3 (P40.08, P40.09)

3: **Digital multi-speed 0**
4: **Digital multi-speed 1**
5: **Digital multi-speed 2**
6: **Digital multi-speed 3**
For instructions on use, see pages 41.00 to 41.15.
7: **Terminal forward input (FWD)**
8: **Terminal reverse input (REV)**
9: **Three-wire operation control**
is only valid when the terminal operation command is given (P10.02 = 1). For usage, see the instructions for P10.01.
11: **Switching from inverter frequency to power frequency**
When this signal is valid, the drive is switched from variable frequency drive to direct grid drive.
13: **External reset terminal**
external reset terminal signal is valid, and the external signal resets the inverter fault.
14: **External fault terminal**
external fault terminal signal is valid. When the external fault signal is input, the inverter stops running.
17: **Weighing compensation input (spare)**
Command input for user-defined weighing compensation for specific applications.
18: **Base Block**
When this function terminal is valid, the IGBT is quickly turned off from sending PWM waves, and the inverter is prohibited from outputting.
19: **Light load switch input (spare)**
20: **Heavy load switch input (spare)**
Functions 19 and 20 are used in the elevator industry to compare the actual load weight with the counterweight. When the actual load weight is less than the counterweight, it is a light load switch input; when the actual load weight is greater than the counterweight, it is a heavy load switch input.
21: **Output contactor feedback (spare)**
It is usually used in conjunction with output function 11 to control the inverter output contactor so as to confirm the contactor's energizing state before the inverter outputs current and to cut off the inverter output in time when the contactor trips.
22: **Brake contactor feedback (spare)**
It is usually used in conjunction with output function 18 to determine whether the output contactor of the brake is engaged.
23: **Brake limit feedback (spare)**
Generally used in conjunction with output function 18 to determine whether the brake is opened in real time.
31: **Frequency increase (not maintained)**
When this signal is valid, the target frequency continues to increase until it reaches the limit value; if the signal is invalid, the current frequency is maintained, and the shutdown and power-off frequencies are 0.
32: **Frequency decrease (not maintained)**
When this signal is valid, the target frequency continues to decrease until it reaches 0; when the signal is invalid, the current frequency is maintained, and the shutdown and power-off frequencies are 0.
34: **Forward deceleration (spare)**
In the forward running state, when this signal is valid and the target frequency is 0Hz, the inverter decelerates to 0Hz.

35: **Reverse deceleration (spare)**

In the case of reverse operation, when this signal is valid, the target frequency is 0 Hz, and the inverter decelerates to 0 Hz.

36: **Forward stop (spare)**

In the forward running state, when this signal is valid, the inverter stops.

37: **Reverse stop (spare)**

In reverse operation, when this signal is valid, the inverter stops.

38: **Frequency increase (maintain)**

When this signal is valid, the target frequency continues to increase until it reaches the limit value; if the signal is invalid, the current frequency is maintained, and the current frequency is also maintained when the machine is shut down or powered off.

39: **Frequency decrease (maintain)**

When this signal is valid, the target frequency continues to decrease until it reaches 0; if the signal is invalid, the current frequency is maintained, and the current frequency is also maintained when the machine is shut down or powered off.

40: **Jog frequency selection**

In the case of multi-speed operation, when this signal is valid, the target frequency is switched to the jog frequency.

41: **Command to switch to the operation panel**

In the stop state, this signal is valid and the command channel is switched to the panel setting.

42: **Command to switch to terminal**

In the stop state, this signal is valid and the command channel is switched to the terminal setting.

43: **Command to switch to Modbus communication**

In the stop state, this signal is valid and the command channel is switched to the Modbus reference.

44: **Open loop main and auxiliary reference switching**

When this signal is valid, the speed channel source switches to open-loop auxiliary reference, that is, the P10.03 speed channel selection switches to the P50.00 reference mode.

45: **PID main reference is switched to internal**

When this signal is valid, the main given channel of the process closed-loop control switches to the digital internal given channel, otherwise it does not switch.

46: **PID main reference is switched to analog A0**

When this signal is valid, the main given channel of the process closed-loop control switches to A0, otherwise it does not switch.

47: **PID auxiliary reference is switched to invalid**

If this signal is valid, the auxiliary given channel of process closed-loop control is switched to invalid, otherwise it will not be switched.

48: **PID auxiliary reference is switched to analog A0**

If this signal is valid, the auxiliary reference channel of the process closed-loop control switches to A0, otherwise it does not switch.

49: **FJOG command** (jog forward command)

If this signal is valid, the machine will run forward with the jog frequency as the target frequency. If the signal is invalid, the machine will stop.

50: **RJOG command** (jog reverse command)

If this signal is valid, the machine will run in reverse with the jog frequency as the target frequency; if the signal is invalid, the machine will stop.

51: **PID main reference is switched to analog A1**

When this signal is valid, the main given channel of the process closed-loop control switches to A1, otherwise it does not switch.

52: **PID auxiliary reference is switched to analog value A1**

When this signal is valid, the auxiliary reference channel of the process closed-loop control switches to A1, otherwise it does not switch.

5 3 : **Speed channel switching**

Speed setting mode selection	Speed setting method
OFF	P10.03 Speed setting mode 1
ON	P10.07 Speed setting mode 2

5 4 : **PID pause**
When this signal is valid, the process PID function is suspended.
55 : **Control mode switch 0**
56 : **Control mode switch 1**
57 : **Control mode switch 2**

Control mode switch 0	Control mode switch 1	Control mode switch 2	Control mode (P10.00)
1	0	0	Control Mode 0
0	1	0	Control Mode 1
1	1	0	Control Mode 3
1	0	1	Control Mode 6

58: Simple PLC Status Reset
When this signal is active, the external terminal quickly clears the fault or alarm status of the inverter.
59: Status Macro Call
A status macro is a preset group of parameters used to quickly switch the operating mode of the inverter (such as jog operation or multi-speed operation).
60: External Speed (Reserved)
61: Speed command switches to panel
When this signal is valid, the operator panel switches to local state and the target speed can be modified through the operator.

Note: Add 100 to invert the signal, for example: 7: **Terminal forward input (FWD),** the forward signal is valid when it is connected, and the inverter stops when it is disconnected; 107: The forward signal is valid when the signal is disconnected, and the inverter stops when it is connected.

Function code	name	Setting range	Factory settings
P30.08	Digital input filtering times (times)	1~200	5

Anti-interference ability can be improved by appropriately increasing the setting of P 30.08. The longer the terminal filtering times, the longer the delay times of the terminal action.

7.5.2 P31 Group Digital Output

Function code	name	Setting range	Factory settings	IO board type
P31.00	Output K1 function definition	0~199	2	Version A IO board
P31.01	Output K2 function definition	0~199	25	
P31.03	Output Y0 function definition	0~199	0	
P31.04	Output Y1 function definition	0~199	0	
P31.00	Output K1 function definition	0~199	2	Version B IO Board
P31.01	Output K2 function definition	0~199	25	
P31.0 2	Output K3 function definition	0~199	0	
P31.03	Output Y0 function	0~199	0	

	definition			
P 31.00	Output K1 function definition	0~199	2	Standard IO board
P 31.01	Output K2 function definition	0~199	25	
P 31.0 3	Output Y0 function definition	0~199	0	

Y0 ~ Y1 terminal output can be defined as multi-function switch output or as high-speed pulse output (function 19, 20). K1 ~ K3 relay output can also be defined as multi-function output, but cannot be used as pulse output.

Function settings	meaning	Function settings	meaning
0	No function	1	Power-on self-test is normal
2	Fault output	3	Running
4	Frequency arrival output	5	Frequency consistent output
6	Zero speed signal output	7	Bus voltage is normal
8	The rated current exceeds 5% during operation and exceeds 10% when stopped.	9	Tuning (standby)
10	Frequency detection 1	11	Frequency detection 2
[illegible]	Predictive fault output	13	Auto-tuning request output
[illegible]	Zero servo torque direction	15	Zero current detection output
16	Power generation/motor status	17	Output contactor control
18	Brake contactor control (spare)	19	Pulse output 0 (spare)
20	Pulse output 1 (spare)	21	Radiator overheat alarm
22	Motor overheat alarm	23	Motor selection output
24	Encoder selection output	25	Brake output
26	Cumulative running time	27	Single run time expires
28	Output X1	29	Output X2
30	Undervoltage lockout stop	31	Fan Control
32	Analog input disconnection	33	Motor PTC overheat (spare)
34	Reverse operation	35	Sleeping
36	Alarm output	37	phase lock completed
3 8	Frequency detection 3	3 9	Frequency detection 4
40	Remote control	41	Motor Parameter Set
42	Simple PLC cycle completed	43	Application Macro Call Status
44	System Startup (Backup)		

Function definition table of multi-function switch output:
The settings of the six parameters P31.00 to P31.05 define the functions of the six output ports

K1 to K2 and Y0 to Y1. The setting range of the values and the functions of the corresponding output ports when each value is set are described as follows:

0: **No function**

1 or 101: **Inverter operation is ready (RDY)**

1: The inverter self-test is normal and there is no fault, the corresponding output point is connected, otherwise it is disconnected;

101: The inverter self-test is normal and there is no fault, the corresponding output point is disconnected, otherwise it is connected.

2 or 102: **Inverter fault**

2: When the inverter is in fault shutdown state, the corresponding output point is connected, otherwise it is disconnected;

102: When the inverter is in fault shutdown state, it is disconnected, otherwise it is connected.

3 or 103: **Inverter running signal (RUN)**

3: When the inverter responds to the run command and can operate normally, the corresponding output point is connected, otherwise it is disconnected;

103: When the inverter responds to the run command and can operate normally, the corresponding output point is disconnected, otherwise it is connected.

6 or 106: **The inverter is running at zero speed**

6: When the output frequency of the inverter is 0 during operation, the corresponding output point is connected, otherwise it is disconnected;

106: When the output frequency is 0 during the operation of the inverter, the corresponding output point is disconnected, otherwise it is connected.

7 or 107: **DC bus voltage is not less than 85% of the rated value**

7: When the inverter bus voltage is not lower than 85% of the rated value, the corresponding output point is connected, otherwise it is disconnected;

107: When the inverter bus voltage is not lower than 85% of the rated value, the corresponding output point is disconnected, otherwise it is connected.

8 or 108: **5% of the rated current during operation and 10% of the rated current when stopped**

8: When the inverter exceeds 5% of the rated current during operation and exceeds 10% of the rated current when stopped, the corresponding output point is connected, otherwise it is disconnected;

108: When the inverter exceeds 5% of the rated current during operation and exceeds 10% of the rated current when stopped, the corresponding output point is disconnected, otherwise it is connected.

9 or 109: **Tuning (backup)**

9: When the inverter is in the self-learning state, the corresponding output point is connected, otherwise it is disconnected;

109: When the inverter is in the self-learning state, the corresponding output point is disconnected, otherwise it is connected.

10 or 110: **Frequency detection 1**

When the inverter output frequency reaches or exceeds the value of arbitrary frequency detection (P31.22) plus frequency detection width (P31.23), frequency detection 1 is triggered; after the corresponding output point is activated, when the inverter output frequency falls back to arbitrary frequency detection (P31.22), frequency detection 1 is reset.

10: When frequency detection 1 is activated, the corresponding output point is disconnected;

110: frequency detection 1 is activated, the corresponding output point is connected.

11 or 111: **Frequency detection 2**

When the inverter output frequency reaches or exceeds the value of arbitrary frequency detection (P31.22), frequency detection 2 is triggered; after the corresponding output point is activated, when the inverter output frequency falls back to the value of arbitrary frequency detection (P31.22) minus frequency detection width (P31.23), frequency detection 2 is reset.

11: When frequency detection 2 is activated, the corresponding output point is connected;

111: When frequency detection 2 is activated, the corresponding output point is disconnected.

12 or 112: **Fault prediction**

12: When a fault is predicted, the corresponding output point is connected, otherwise it is disconnected;

112: When a fault is predicted, the corresponding output point is disconnected, otherwise it is connected.

13 or 113: Spare

14 or 114: **Zero servo torque direction judgment** (used for emergency leveling when the motor is powered off, spare)

14: When the inverter is testing heavy load and light counterweight, the corresponding output point is connected, otherwise disconnected;

114: When the inverter is testing a heavy load and a light counterweight, the corresponding output point is disconnected, otherwise it is connected.

15 or 115: **Zero current detection**

15: When the output current of the inverter is greater than the zero current detection threshold (set by P31.20) when it stops, the corresponding output point is connected, otherwise it is disconnected;

115: When the output current of the inverter is greater than the zero current detection threshold (set by P31.20) when it stops, the corresponding output point is disconnected, otherwise it is connected.

16 or 116: **Distinguishing between power generation and electric state**

16:0 - electric; 1 - power generation;

116:0 – power generation; 1 – electric power .

17 or 117: **Output contactor is closed**

17: When output 1, the contactor is closed;

117: When output is 0, the contactor is closed.

It is usually used in conjunction with input function 21 to control the output contactor to close before the inverter outputs current.

21 or 121: **greater than 90 degrees, overheat alarm**

If the radiator temperature is greater than or equal to 90, the corresponding output point is connected, otherwise it is disconnected.

22: **Motor overheat alarm**

Based on the I^2t model, it dynamically evaluates the thermal status of the motor by calculating the heat and heat dissipation of the motor in real time, and issues an early warning before overheating damage actually occurs.

23: **Motor switching output**

Motor selection output, the corresponding output point is disconnected: Motor 1, the corresponding output point is connected: Motor 2.

24: **Encoder switching output**

The encoder selects output, the corresponding output point is disconnected: encoder 1; the corresponding output point is connected: encoder 2.

25: **Brake output**

Brake open, output connected: Brake closed, output disconnected

26: **Accumulated running time reached**

If the inverter's cumulative running time is greater than the time set in P31.25, the output terminal is connected, otherwise it is disconnected

27: **Set continuous running time reached**

If the inverter's single continuous running time is greater than the time set by P31.24, the output terminal is connected, otherwise it is disconnected.

28: **Output X1**

The level state of the input terminal X1 is output through the output terminal.

29: **Output X2**

The level state of the input terminal X2 is output through the output terminal.

30: **Undervoltage lockout stopped**

The system is undervoltage and the output terminal outputs a valid level.

31: **Fan Control**

When the inverter is running or over-temperature, the output terminal is connected, otherwise it is disconnected after a delay of one minute.

32: **Analog input disconnection**

33: **Motor PTC overheat (spare)**

34: **Reverse operation**

Note:

① " connected " above means: for relay outputs, the normally open contacts (1B and 1C, 2B and 2C) are connected, and the normally closed contacts (1B and 1A, 2B and 2A) are disconnected. For open-collector outputs, this means the output is in a low-level state. Similarly, " off " above means: for relay outputs, the normally open contacts (1B and 1C, 2B and 2C) are disconnected, and the normally closed contacts (1B and 1A, 2B and 2A) are connected. For open-collector outputs, this means the output is in a high-impedance state.

② When the factory setting is set, P31.04=3, specifying the Y0 port as the run signal (RUN) output port; P31.05=2, specifying the Y1 port as the inverter fault signal output port.

③ Giving of the running signal (RUN): The inverter will give the running signal (RUN) only when it receives the up/down direction command signal and there is no base block.

④ Fault Signal Timing: When the inverter fails, it outputs a fault signal. Simultaneously, the run signal is cleared. The fault signal is latched and can be cleared by an external reset signal, a reset operation on the operator panel, a power outage, or after an internally set delay time. The fault signal timing is shown in Figure 7-15.

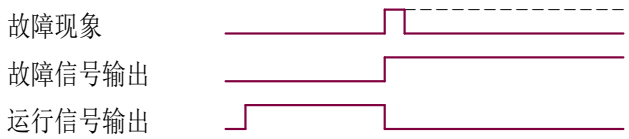


Figure 7-1 7 Fault signal timing

35: Sleeping

Process PID control is in sleep mode.

36: **Alarm output**

The inverter is in alarm state.

37: **Amplitude and phase lock completed**

In the power and frequency conversion function start mode, the switching state can be realized.

38: **Frequency detection 3**

The operating frequency is between P31.26 and P31.27.

39: Frequency detection 4

The operating frequency is between P 31.28 and P31.29.

40: **Remote control state, used in conjunction with terminal input function code 61**

41: **Motor Parameter Set**

Indicates the activation status of the motor parameter set stored in the inverter.

42: **Simple PLC Cycle Complete**

Indicates the status when the built-in simple PLC function of the inverter completes a cycle.

43: **Application Macro Call Status**

Indicates the status when an application macro (preset parameter set) is called.

Function code	name	Setting range	Factory settings	IO board type
P 31.06	Output K1 action delay (s)	0.0 ~ 120.0	0.0	Version A IO board
P 31.07	Output K1 reset delay (s)	0.0 ~ 120.0	0.0	
P 31.08	Output K2 action delay (s)	0.0 ~ 120.0	0.0	
P 31.09	Output K2 reset delay (s)	0.0 ~ 120.0	0.0	
P 31.12	Output Y0 action delay (s)	0.0 ~ 120.0	0.0	
P 31.13	Output Y0 reset delay (s)	0.0 ~ 120.0	0.0	
P 31.14	Output Y1 action delay (s)	0.0 ~ 120.0	0.0	
P 31.15	Output Y1 reset delay (s)	0.0 ~ 120.0	0.0	

P 31.06	Output K1 action delay (s)	0.0 ~ 120.0	0.0	Version B IO Board
P 31.07	Output K1 reset delay (s)	0.0 ~ 120.0	0.0	
P 31.08	Output K2 action delay (s)	0.0 ~ 120.0	0.0	
P 31.09	Output K2 reset delay (s)	0.0 ~ 120.0	0.0	
P 31.08	Output K3 action delay (s)	0.0 ~ 120.0	0.0	
P 31.09	Output K3 reset delay (s)	0.0 ~ 120.0	0.0	
P 31.1 2	Output Y0 action delay (s)	0.0 ~ 120.0	0.0	
P 31.1 3	Output Y0 reset delay (s)	0.0 ~ 120.0	0.0	

P31.06 -P31.13 set the time constants for the action and reset delays of the K1-K3 and Y0-Y1 output signals. These parameters allow you to flexibly set the delay between each output state and its corresponding actual signal. Furthermore, the output state delay can be set separately for both signal triggering and signal reset.

Function code	name	Setting range	Factory settings
P 31.20	Zero current detection width (%)	0.0 ~ 50.0	4.0

This function can be used for load change detection. Set the output terminal function to "15: Zero current detected ". The inverter outputs an indication signal when the output current is less than the zero current detection width P31.20.

When the inverter current is greater than the threshold value during parking, the corresponding output terminal set by function code 15 (or 115) will be activated.

Note : This function parameter is the percentage of the inverter output current relative to the motor rated current.

Function code	name	Setting range	Factory settings
P 31.21	Frequency arrival detection width (Hz)	0.00 ~ 300.00	1.00
P31.22	Detection frequency (Hz)	0.00 ~ 655.35	1.00
P31.23	Detection frequency width (Hz)	0.00 ~ 300.00	0.20

P31.21 This function is used to detect the deviation between the output frequency and the set frequency. Set the output terminal function to " 4: Frequency arrival signal " . When the deviation between the inverter output frequency and the set frequency is within the setting range of this function code, the output indication signal is as shown in the figure, frequency arrival signal FAR.

Yi represents the Y0~Y1 terminals or the relay K1~K2 terminals.

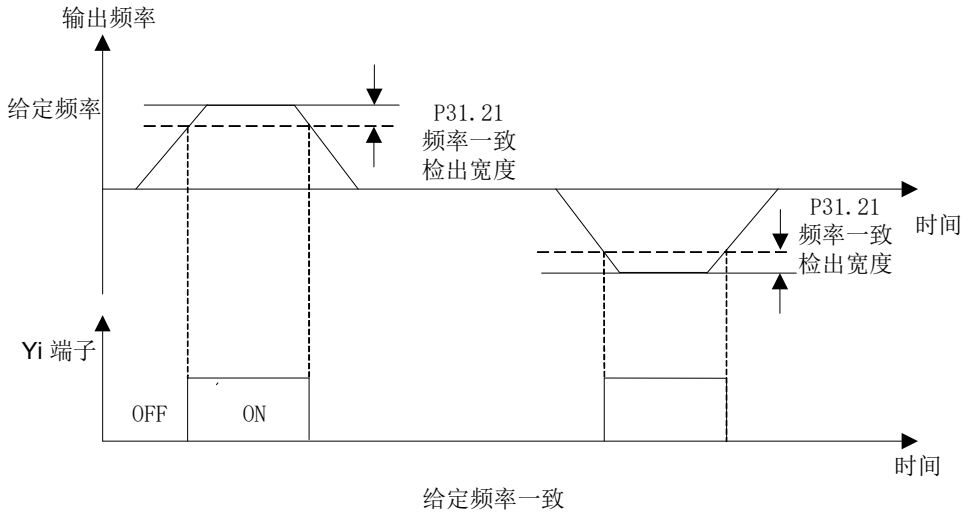


Figure 7-1 8 frequency consistent detection 1

P31.22 and P31.23 are two parameters for arbitrary frequency detection: arbitrary frequency detection width and arbitrary frequency detection width. These two parameters are combined to function in frequency/speed consistency, frequency detection 1, and frequency detection 2. They are primarily used to determine whether the inverter's output frequency is within a specified frequency range. In frequency detection 1, when the inverter's output frequency reaches or exceeds the value of the frequency detection speed (P31.22) plus the frequency detection width (P31.23), frequency detection 1 triggers. After the corresponding output point is activated, frequency detection 1 resets when the inverter's output frequency returns to the frequency detection speed (P31.22). Frequency detection 1 is negative logic; when triggered, the corresponding output state is OFF, and when reset, the corresponding output state is ON.

In frequency detection 2, when the inverter output frequency reaches or exceeds the frequency detection speed (P31.22) value, frequency detection 2 is triggered; after the corresponding output point is activated, when the inverter output frequency drops back to the value of the frequency detection speed (P31.22) minus the frequency detection width (P31.23), frequency detection 2 is reset. Frequency detection 2 is positive logic. When triggered, the corresponding output state is ON, and when reset, the corresponding output state is OFF.

Set the output terminal function to "5: Frequency/speed consistency", as shown below:

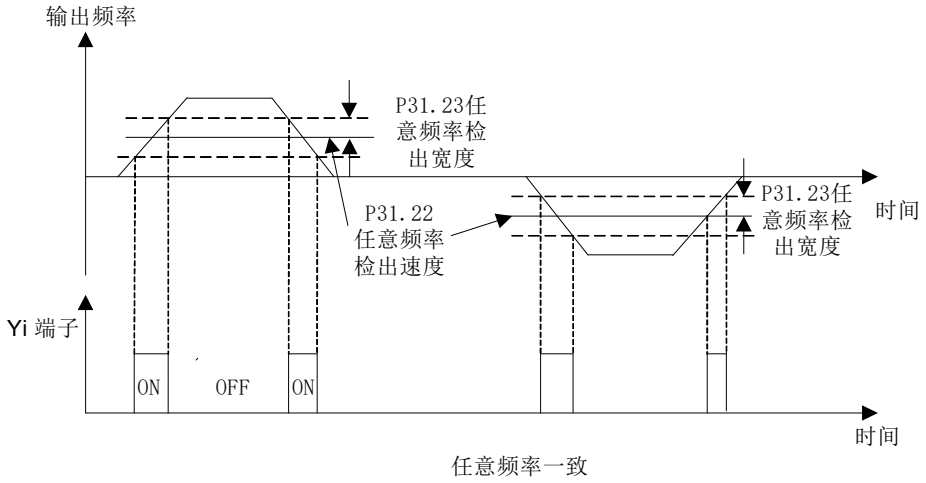


Figure 7-19 frequency consistent detection 2

Set the output terminal function to "10: Speed detection 1", as shown below:

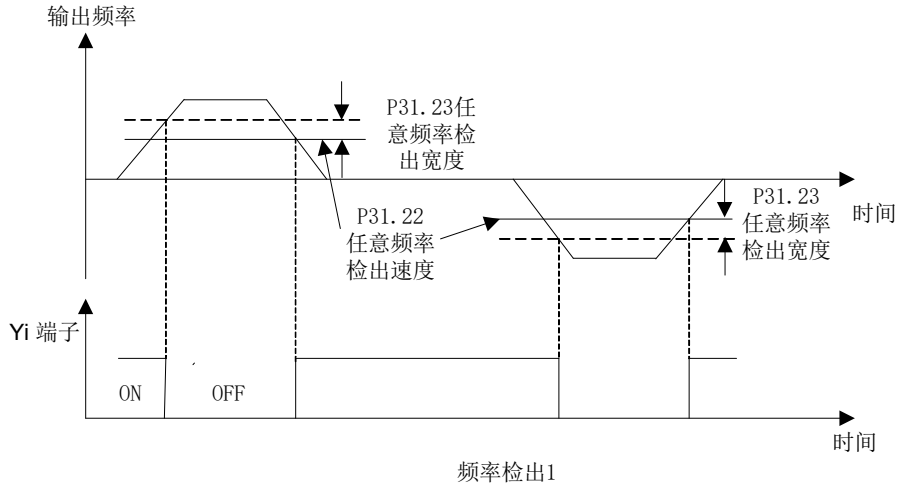


Figure 7-20 Speed detection 1

Set the output terminal function to "11: Speed detection 2", as shown below:

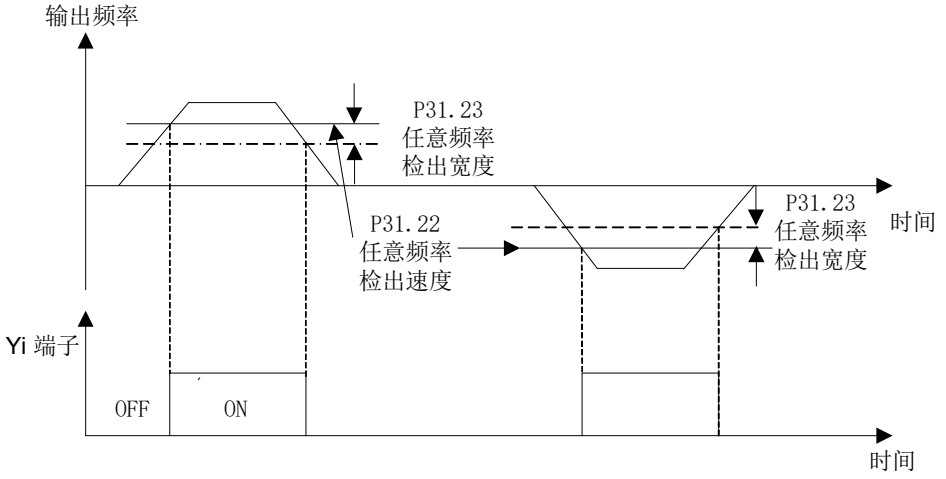


Figure 7-21 Speed detection 2

Function code	name	Setting range	Factory settings
P31.24	Single run time reached (h)	0~ 65535	2

Starting from the inverter running command, the output indication signal is output after the single continuous running time reaches P31.24. The output indication signal can be realized by defining the output terminal function code as "27: Single running time".

Function code	name	Setting range	Factory settings
P 31.25	Cumulative running time reached (h)	0~ 65535	8

After the inverter is powered on, the cumulative running time reaches P31.25, and the output indication signal is output. The output indication signal can be realized by defining the output

terminal function code to "26".

Function code	name	Setting range	Factory settings
P31.26	Detection frequency 3 upper limit	0 ~ 655.35	50.00
P31.27	Detection frequency 3 lower limit	0 ~ 655.35	45.00
P31.28	Detection frequency 4 upper limit	0 ~ 655.35	100.00
P31.29	Detection frequency 4 lower limit	0 ~ 655.35	90.00

When the feedback speed is greater than P31.27 and less than P31.26, then output terminal function detection frequency 3

When the feedback speed is greater than P31.29 and less than P 31.28, then output terminal function detection frequency 4

7.5. 3 P32 groups of analog input

Function code	name	Setting range	Factory settings
P32.00	Input AI0 type	0~ 3	0
P32.06	Input AI1 type	0~ 3	0

Analog input type parameter setting:
0: 0~10V; 2: 0~20mA; 3: 4 mA~20mA
Note :
Version A IO board does not support mode 1: -10V~10V
Standard board/ version B IO board supports mode 1: -10V~10V
Version B IO board needs to be matched through hardware DIP switches .

Function code	name	Setting range	Factory settings
P 32.01	Input AI 0 function	0~7	0
P 32.07	Input AI 1 function	0~7	0

P32.01 and P32.07 set the analog AI input function:
0: **Undefined function**
1: **Target speed signal**
2: **Current speed signal**
3: **Torque signal**
4~7: **spare**

Function code	name	Setting range	Factory settings
P 32.02	Input AI0 lower limit (%)	-100.00 ~ 327.67	0.00
P 32.03	Input AI0 upper limit (%)	0.0 ~ 6553.5	100.0
P32.04	Input AI0 filtering (ms)	0~65535	10
P32.05	Input AI0 limit (V)	0.000~ 65.535	10,000
P 32.08	Input AI1 lower limit (%)	-100.00 ~ 327.67	0.00
P 32.09	Input AI1 upper limit (%)	0.0 ~ 6553.5	100.0
P32.10	Input AI1 filter (ms)	0~65535	10
P32.11	Input AI1 limiter (V)	0.000~ 65.535	10,000

P32.02～P32.05 and P32.08～P32.11 sets the upper limit , lower limit , filter time and amplitude limit of the two analog input ports.

upper/lower limit combination is a scaling factor.

The filter time can improve the anti-interference ability of the terminal input. In field applications, the analog input through the A0 and A1 terminals usually carries certain interference signals, but the longer the terminal filter time, the longer the response delay of the terminal action.

Amplitude limiting only restricts the final processed signal of analog input to a certain range required for control. For current type, the amplitude limit value needs to be changed to 20.000mA.

Actual input = analog input × (input upper limit - input lower limit) + input lower limit

7.5.4 P33 Group Analog Output Parameters

Function code	name	Setting range	Factory settings	IO board type
P 33.00	Output M0 function	0~30	1	Version A IO board
P 33.00	Output M0 function	0~30	1	Version B /Standard IO Board
P 33.0 3	Output M1 function	0~30	1	

Analog DAC monitors digital output 0~1000 represents 0~10.00V

Function definition table of multi-function analog output (some commonly used monitoring data):

Function settings	meaning	Correspondence
0	No definition	
1	Output current	0~ 2 Ie corresponds to 0~10V
2	Output voltage	0~Ue corresponds to 0~10V
3	Torque setting	0~ 2Te corresponds to 0~10V
4	Bus voltage	0~ 1074V corresponds to 0~10V
5	Total output power	0~Pe corresponds to 0~10V
6	Output active power	0~ P e corresponds to 0~10V
7	Current speed (unsigned)	0~maximum frequency corresponds to 0~10V
8	Speed reference (signed)	0~maximum frequency corresponds to 0~10V
9	Speed feedback	0~rated frequency corresponds to 0~10V
1 0	spare	0~50Hz/s corresponds to 0~10V
11	Radiator temperature	0~100 degrees correspond to 0~10V
12	Analog A0	0~10V corresponds to output 0~10V
13	Analog A1	0~10V corresponds to output 0~10V
1 4	spare	0~10V corresponds to output 0~10V
15	ModBus analog output 0	0~10000 corresponds to 0~10V
16	ModBus analog output 1	0~10000 corresponds to 0~10V

Function code	name	Setting range	Factory settings	IO board type

P33.01	Output M0 lower limit (%)	-100.00 ~ 327.67	0.00	Version A IO board
P33.02	Output M0 upper limit (%)	0.0 ~ 6553.5	100.0	
P33.01	Output M0 lower limit (%)	-100.00 ~ 327.67	0.00	B /Standard IO Board
P33.02	Output M0 upper limit (%)	0.0 ~ 6553.5	100.0	
P33.04	Output M1 lower limit (%)	-100.00 ~ 327.67	0.00	
P33.05	Output M1 upper limit (%)	0.0 ~ 6553.5	100.0	

If you need to adjust the analog output defined in the table above, you can use this function to achieve it. The adjusted analog value is the actual output value of the M terminal.

The above parameters are different from other function codes. Adjustment will affect the M output in real time. The output correction method of M0 and M1 is the same.

Actual output = M output × (output M0 upper limit - output M0 lower limit) + output M0 lower limit

Function code	name	Setting range	Factory settings	IO board type
P33.06	Output M0 type	0~ 4	0	Version A IO board
P33.06	Output M0 type	0~ 4	0	Version B/Standard IO Board
P33.07	Output M1 type	3~ 4	0	

Parameters P33.06 and P 33.07 are used to select the analog output type:

M0 channel: 0: No selection; 1: 0~10V; 2: -10V~10V (not supported); 3: 0~20mA; 4: 4~20mA;

M1 channel: 0: No selection; 1: 0~10V (not supported); 2: -10V~10V (not supported); 3: 0~20mA; 4: 4~20mA; (B version IO board does not support voltage type; standard version IO board supports both current type and voltage type)

7.6 P 4X group Speed parameter group

7.6.1 P 40 Group Basic Speed Parameters

Function code	name	Setting range	Factory settings
P 40.00	Panel speed (Hz)	0.00 ~ 655.35	5.0 0

The starting speed is given by the panel and the speed can be changed by pressing the button.

Function code	Name	Setting range	Factory settings
P40.01	Fundamental frequency (Hz)	0.00 ~ 655.35	50.0 0

The basic operating frequency is the minimum frequency corresponding to the maximum output voltage of the inverter. When using a standard AC motor, the rated frequency value of the motor is shown on the motor nameplate.

Function code	name	Setting range	Factory settings
P 40.02	Acceleration time 0 (s)	0.0 0 ~500 .00	5.00

P40.03	Deceleration time 0(s)	0.00 ~500 .00	5.00

This function can set the rate at which the inverter accelerates to a constant speed or decelerates from a constant speed to a stop after starting.

P40.02 Acceleration time 0: The time it takes for the inverter output frequency to rise from zero frequency to the maximum frequency.

P40.03 Deceleration time 0: The time it takes for the inverter output frequency to drop from the maximum frequency to zero frequency.

Function code	name	Setting range	Factory settings
P40.04	Acceleration time 1(s)	0.00 ~500 .00	5.00
P40.05	Deceleration time 1(s)	0.00 ~500 .00	5.00
P40.06	Acceleration time 2(s)	0.00 ~500 .00	5.00
P40.07	Deceleration time 2(s)	0.00 ~500 .00	5.00
P40.08	Acceleration time 3(s)	0.00 ~500 .00	5.00
P40.09	Deceleration time 3(s)	0.00 ~500 .00	5.00

In addition to the previously defined acceleration time 0 (P40.02) and deceleration time 0 (P40.03) , you can also define three groups of acceleration and deceleration times (Acceleration/Deceleration Time 1, Acceleration/Deceleration Time 2, and Acceleration/Deceleration Time 3). By defining the multi-function X terminal (Acceleration/Deceleration Time Selection Functions 1 and 2), different acceleration and deceleration times can be selected based on the terminal status. The meanings of these three groups of acceleration and deceleration times are the same as those of P40.02 and P40.03.

Function code	name	Setting range	Factory settings
P40.10	Acceleration rounded corner 0(s)	0.00 ~ 10.00	0.00
P40.11	Acceleration rounded corner 1(s)	0.00 ~ 10.00	0.00
P 40.12	Deceleration rounded corner 2(s)	0.00 ~ 10.00	0.00
P40.13	Deceleration rounded corner 3(s)	0.00 ~ 10.00	0.00
P40.1 4	Top arc fillet suppression	0~3	0

Acceleration/Deceleration rounded corner: The arc time (P40.10 to P40.13) is added to improve the smoothness of the starting and ending segments during acceleration and deceleration. Arc curve time is suitable for conveyors that transport fragile items or applications that require smooth speed regulation.

P40.10 to P40.13 set the S-curve (speed curve) parameters for motor operation when using a digital multi-speed reference. They specify the acceleration time (P40.02), deceleration time (P40.03), acceleration rounded corner time (P40.10 and P40.11), and deceleration rounded corner time (P40.12 and P40.13). These parameters directly affect the characteristics of the S-curve and are therefore directly related to motor operating efficiency and ride comfort. Figure 7-20 shows the specific position of these parameters in the motor's S-speed curve.

P40.14 parameter is mainly used in elevator applications: P40.14=1, rounded corners are inhibited in acceleration state; P40.14=2, rounded corners are inhibited in deceleration state; P40.14=3, rounded corners are inhibited in both acceleration and deceleration states.

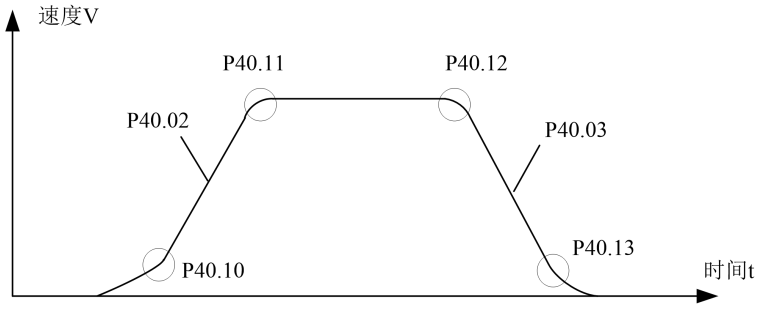


Figure 7-22 Position of the S curve during motor operation

Function code	Name	Setting range	Factory settings
P40.15	Turn frequency 1(%)	0~200	190
P40.16	Turn frequency2 (%)	0~200	200

By setting P40.15 and P40.16, the acceleration and deceleration of P40.04 to P40.09 can be adjusted according to the actual speed.

7.6.2 P41 Group of digital multi-speed parameters

Function code	name	Setting range	Factory settings
P 41.00	Digital multi-speed setting 0 (Hz)	0.00 ~ 655.35	0.00
P 41.01	Digital multi-speed setting 1 (Hz)	0.00 ~ 655.35	0.00
P 41.02	Digital multi-speed setting 2 (Hz)	0.00 ~ 655.35	10.00
P 41.03	Digital multi-speed setting 3 (Hz)	0.00 ~ 655.35	20.00
P 41.04	Digital multi-speed setting 4 (Hz)	0.00 ~ 655.35	30.00
P 41.05	Digital multi-speed setting 5 (Hz)	0.00 ~ 655.35	40.00
P41.06	Digital multi-speed setting 6 (Hz)	0.00 ~ 655.35	50.00
P 41.07	Digital multi-speed setting 7 (Hz)	0.00 ~ 655.35	60.00
P 41.08	Digital multi-speed setting 8 (Hz)	0.00 ~ 655.35	0.00
P 41.09	Digital multi-speed setting 9 (Hz)	0.00 ~ 655.35	0.00
P 41.10	Digital multi-speed setting 10 (Hz)	0.00 ~ 655.35	0.00
P 41.11	Digital multi-speed setting 11 (Hz)	0.00 ~ 655.35	0.00
P 41.12	Digital multi-speed setting 12 (Hz)	0.00 ~ 655.35	0.00
P41.13	Digital multi-speed setting 13 (Hz)	0.00 ~ 655.35	0.00
P 41.14	Digital multi-speed setting 14 (Hz)	0.00 ~ 655.35	0.00
P41.15	Digital multi-speed setting 15 (Hz)	0.00 ~ 655.35	0.00

It can be used as a process open-loop frequency reference. By defining the multi-function X terminal (digital multi-segment 0 to 3), different multi-segment frequency references can be selected according to different terminal states. ON means the terminal is valid, and OFF means the terminal is invalid.

P41.00 to P41.15 define the speed command values for the fifteen speed steps, digital multi-

speed reference 1 to digital multi-speed reference 15. The four binary-coded input points for digital multi-speed references 0 to 3 combine to create 16 states, corresponding to the 15 speed commands specified by P41.00 to P41.15 and speed reference 0 (when the combination code is 0). The correspondence between the multi-speed input port signals and the speed commands is shown in Table 6.2 below.

Table 6.2 Correspondence between multi-speed input terminal combination and given speed

Multi-speed Combination Code	Multi-speed setting 3	Multi-speed setting 2	Multi-speed setting 1	Multi-speed setting 0	Given frequency
0	0	0	0	0	Given speed 0
1	0	0	0	1	Given speed 1
2	0	0	1	0	Given speed 2
3	0	0	1	1	Given speed 3
4	0	1	0	0	Given speed 4
5	0	1	0	1	Given speed 5
6	0	1	1	0	Given speed 6
7	0	1	1	1	Given speed 7
8	1	0	0	0	Given speed 8
9	1	0	0	1	Given speed 9
10	1	0	1	0	Given speed 10
11	1	0	1	1	Given speed 11
12	1	1	0	0	Given speed 12
13	1	1	0	1	Given speed 13
14	1	1	1	0	Given speed 14
15	1	1	1	1	Given speed 15

In the above table, status "0" indicates that the input port has no input signal, and status "1" indicates that the input port has an input signal. The following example further illustrates the above table: If multi-speed setting 0 has an input signal, multi-speed setting 1 has an input signal, multi-speed setting 2 has no input signal, and multi-speed setting 3 has no input signal, then the binary code is "0011" = 3, and the corresponding reference speed is given frequency 3, whose reference speed value is specified by parameter P41.03.

Function code	name	Setting range	Factory settings
P 41.16	Jog frequency setting (Hz)	0.00 ~ 50.00	5.00

The frequency setting value set during jog operation.

7.6. 1 P42 groups of simple PLC functions

Function code	name	Setting range	Factory settings

P42.00	Memory Mode	0~ 11	0
P42.01	Loop Mode	0~ 2	0
P42.02	Shutdown memory	0~ 65535	0
P42.03	Power off memory	0~ 65535	0

P42.00 is the memory mode. When P42.00=0, the memory function is off; when P42.00=1, the power failure memory is on; when P42.00=10, the power failure memory is on.

P42.01 is the cycle mode. When P42.01=0, the machine stops after a single run. When P42.01=1, the final value is retained after the run. When P42.01=2, the cycle continues.

P42.02 is power failure memory, which takes effect when P42.00=1 and displays the frequency position at the power failure memory moment.

P42.03 is power-off memory, which takes effect when P42.00=10 and displays the frequency position at the power-off memory moment.

Function code	name	Setting range	Factory settings	Parameter Description
P42.04	PLC target frequency f0 (Hz)	-300.00~300.00	0	Simple PLC target frequency 0
P42.05	PLC target frequency f1 (Hz)	-300.00~300.00	0	Simple PLC target frequency 1
P42.06	PLC target frequency f2 (Hz)	-300.00~300.00	0	Simple PLC target frequency 2
P42.07	PLC target frequency f3 (Hz)	-300.00~300.00	0	Simple PLC target frequency 3
P42.08	PLC target frequency f4 (Hz)	-300.00~300.00	0	Simple PLC target frequency 4
P42.09	PLC target frequency f5 (Hz)	-300.00~300.00	0	Simple PLC target frequency 5
P42.10	PLC target frequency f6 (Hz)	-300.00~300.00	0	Simple PLC target frequency 6
P42.11	PLC target frequency f7 (Hz)	-300.00~300.00	0	Simple PLC target frequency 7
P42.12	Time unit	0~1	0	0: Unit is seconds 1 : Unit is hours
P42.13	Running time T00	0~6553.5	1	Target frequency 0 running time 0
P42.14	Running time T01	0~6553.5	1.5	Target frequency 1 running time 1
P42.15	Running time T02	0~6553.5	2	Target frequency 2 running time 2
P42.16	Running time T03	0~6553.5	2.5	Target frequency 3 running time 3
P42.17	Running time T04	0~6553.5	1	Target frequency 4 Run time 4
P42.18	Running time T05	0~6553.5	1.5	Target frequency 5 Run time 5
P42.19	Running time T06	0~6553.5	2	Target frequency 6 Run time 6
P42.20	Running time T07	0~6553.5	2.5	Target frequency 7 Run time 7
P42.21	Acceleration/deceleration T00(s)	0~655.35	5.00	Running time stage 0 corresponds to acceleration and deceleration
P42.22	Acceleration/deceleration T01(s)	0~655.35	5.00	Running time 1 stage corresponding to acceleration and deceleration
P42.23	Acceleration/deceleration T02(s)	0~655.35	5.00	Running time 2nd stage corresponding to acceleration and

				deceleration
P42.24	Acceleration/deceleration T03(s)	0~655.35	5.00	Running time 3rd stage correspond to acceleration and deceleration
P42.25	Acceleration/deceleration T04(s)	0~655.35	5.00	Running time 4th stage of corresponding to acceleration and deceleration
P42.26	Acceleration/deceleration T05(s)	0~655.35	5.00	Running time 5th stage corresponding to acceleration and deceleration
P42.27	Acceleration/deceleration T06(s)	0~655.35	5.00	Running time 6th stage of corresponding to acceleration and deceleration
P42.28	Acceleration/deceleration T07(s)	0~655.35	5.00	Running time 7th stage of corresponding to acceleration and deceleration

7. 7 P 5X Group Process Control

7.7.1 Group P50 Main and Auxiliary Reference

Function code	name	Setting range	Factory settings
P 50.00	Open loop auxiliary setting mode	0~5	0

The process open loop auxiliary setting mode P50.00 is selected as follows:
0: None; 1: A0; 2: A1; 5: PID given target speed

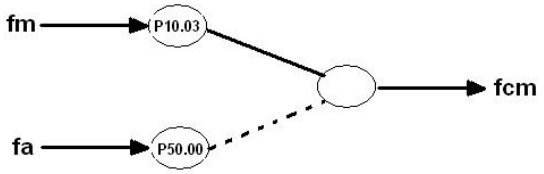


Figure 7-2 Schematic diagram of 3 open-loop auxiliary setting

By default, P10.03 main reference value f_m is used to set f_c. When the digital input 44: open-loop main and auxiliary reference is switched to the auxiliary reference value, the main reference value f_m is switched to the auxiliary reference value f_a.

Function code	name	Setting range	Factory settings
P50.01	Open-loop auxiliary given operation	0~ 6	0

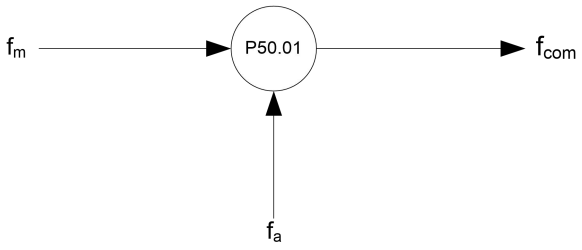


Figure 7-24 Schematic diagram of open-loop main and auxiliary reference synthesis

In the process open-loop control mode, an auxiliary given value f_a is superimposed on the main given value f_m to generate the process open-loop synthetic frequency given $f_{com} = f_m + f_a$.

The main given value f_m and the auxiliary given value f_a can be subjected to operations such as ″addition″, ″subtraction″, ″bias″, ″maximum value″ and ″minimum value″.

The process open loop given main and auxiliary relationship operation P50.01 is defined as follows:

0: **No operation**

1 : **Main setting + auxiliary setting** The auxiliary frequency setting value is superimposed on the main setting and its function is “addition”.

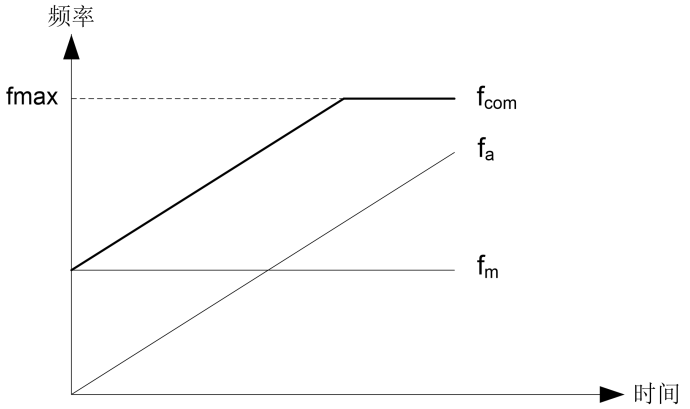


Figure 7-2 5 Open-loop main and auxiliary reference operation 0

Process open-loop composite given f_{com} = main given f_m + auxiliary given f_a

2: **Main setting - auxiliary setting** The auxiliary frequency setting value is superimposed on the main setting and its function is ″subtraction″.

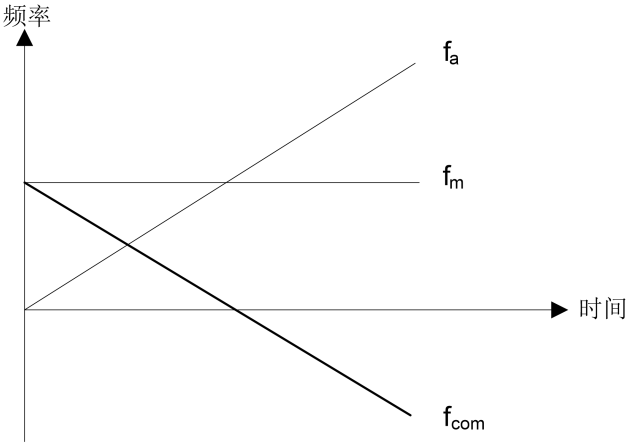


Figure 7-26 Open-loop main and auxiliary reference operation 1

Process open-loop synthetic reference f_{com} = main reference f_m - auxiliary reference f_a

5: **Take the maximum value** Take the maximum value between the main given f_m and the auxiliary given f_a.

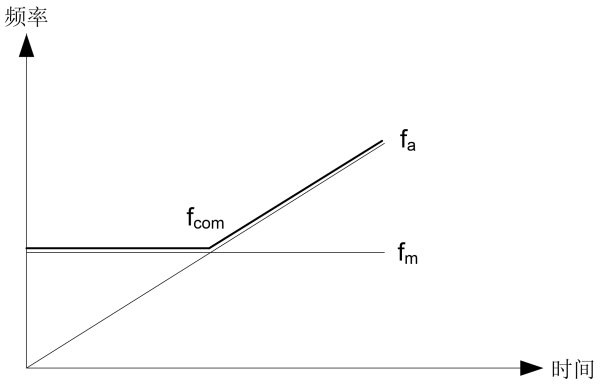


Figure 7-27 Open-loop main and auxiliary reference operation 4

Process open-loop synthetic reference f_{com} = Max {main reference f_m, auxiliary reference f_a}

6 : **Take the minimum value** Take the minimum value of the main given f_m and the auxiliary given f_a.

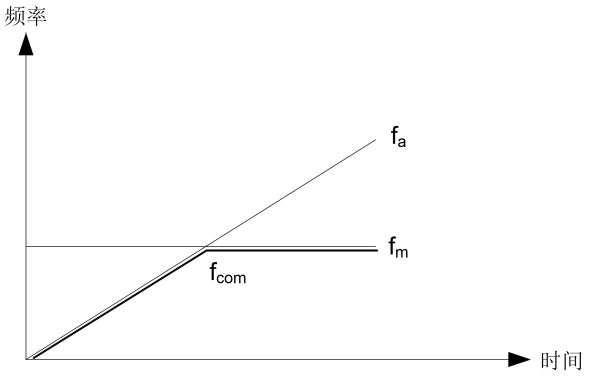


Figure 7-28 Open-loop main and auxiliary reference operation 5

Process open-loop synthetic given f_{com} = Min {main given f_m, auxiliary given f_a}

Note: When the frequency corresponding to the composite quantity fcom exceeds the upper and lower frequency limits, the output frequency is limited to the upper and lower limits.

7.7.2 P51 Group Process PID

PID control is a common method used for process control. It adjusts the inverter's output frequency by performing proportional, integral, and differential operations on the deviation between the controlled variable's feedback signal and the target variable signal, forming a negative feedback system to stabilize the controlled variable at the target value. It is suitable for process control such as flow control, pressure control, and temperature control. The basic control principle block diagram is shown below.

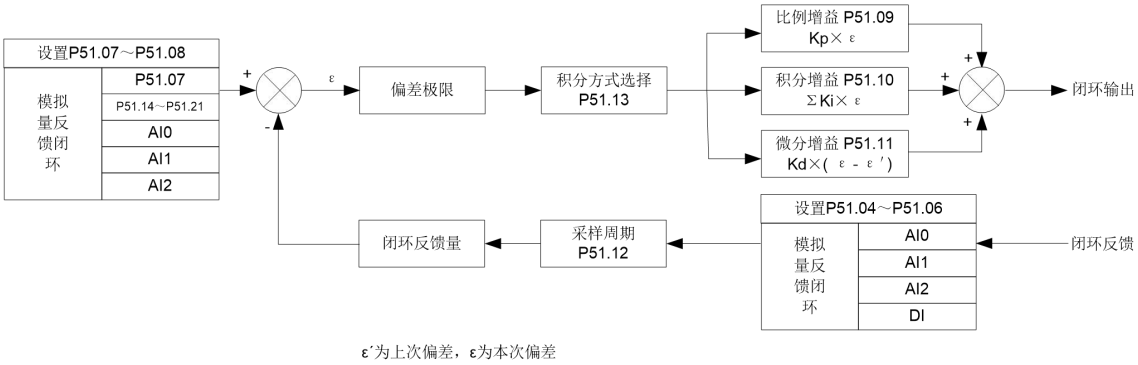


Figure 7-2 9 PID principle block diagram

Function code	name	Setting range	Factory settings
P 51.00	Closed-loop control selection	0~ 1	0

Closed loop operation control selection: 0: invalid; 1: valid

Function code	name	Setting range	Factory settings
P 51.01	Closed-loop main setting mode	0~ 6	0
P51.02	Closed-loop auxiliary setting mode	0~6	2
P51.03	Closed-loop auxiliary setting operation	0~6	0

In a closed-loop system with feedback, if there are main and auxiliary given values, the main given value can be an internal given value, analog value, or communication; the auxiliary given value can be an analog value or an internal given value.

P51.01 closed loop control main reference mode selection is as follows:

0: Digital voltage internal reference (P51.07); 1: A0; 2: A1; 6: Modbus communication reference

P51.02 closed-loop control auxiliary setting mode selection is as follows:

0: None; 1: A0; 2: A1; 6: Modbus communication setting

P51.03 closed-loop control setting main and auxiliary operation selections are as follows:

0: No operation; 1: Main + Auxiliary; 2: Main - Auxiliary; 5: Take the maximum value; 6: Take the minimum value

The main and auxiliary calculation functions of the closed-loop reference are the same as those of the open-loop reference. Please refer to P 50.01 for detailed description.

Note: The closed-loop control analog main reference, auxiliary reference, main feedback, and auxiliary feedback cannot be set to the same channel.

Function code	name	Setting range	Factory settings
P51.04	Closed-loop main feedback method	0~ 6	1
P51.05	Closed-loop auxiliary feedback method	0~6	2
P51.06	Closed-loop auxiliary feedback operation	0~6	0

In a closed-loop system with feedback, the main feedback and auxiliary feedback can be analog or pulse quantities.

The main and auxiliary calculation functions of process closed-loop feedback are the same as those of process closed-loop reference and process open-loop reference. Please refer to P50.01 for detailed description.

P51.04 closed-loop control main feedback mode selection is as follows:

0: None; 1: A0; 2: A1; 6: Modbus communication setting

P51.05 closed-loop control auxiliary feedback mode selection is as follows:

0: None; 1: A0; 2: A1; 6: Modbus communication setting

P51.06 closed-loop control feedback is as follows:

0: No operation; 1: Main + Auxiliary; 2: Main - Auxiliary; 5: Take the maximum value; 6: Take the minimum value

Note: The closed-loop control analog main reference, auxiliary reference, main feedback, and auxiliary feedback cannot be set to the same channel.

Function code	name	Setting range	Factory settings
P 51.07	PID internal given value	0.00 ~ 10.00	0.70

Before determining the process closed-loop setpoint, you should first determine the current control operation mode P51.00=1 (closed-loop control selection is valid).

When the current control operation mode is analog feedback process closed loop, if P50.01 is set to 0, the closed loop reference is determined by P51.07.

Function code	name	Setting range	Factory settings
P51.09	Proportional gain Kp	0.00~10.00	0.50
P51.10	Integral gain Ki	0.00~10.00	0.500
P51.11	Differential gain Kd	0.00~10.00	0.000

A larger Kp value results in a faster response, but too large a value can easily cause oscillation. Kp cannot completely eliminate deviation; Ki can be used to eliminate residual deviation. A larger Ki value results in a faster inverter response to deviation changes, but too large a value can easily cause oscillation. If the system frequently experiences jumpy feedback, Kd is necessary. Kd can quickly respond to changes in the deviation between system feedback and the reference. A larger Kd value results in a faster response, but too large a value can easily cause oscillation.

Function code	name	Setting range	Factory settings
P51.12	Points method selection	0~ 1	0

This function determines the specific operation mode during the process closed-loop regulation.

If the output of the process closed-loop regulation reaches the upper or lower frequency limit (P70.00 or P70.01), there are two action options in the integral link.

0: **When the frequency reaches the upper and lower limits, the integral adjustment stops.** The integral quantity remains unchanged. When the size trend between the given and feedback quantities changes, the integral quantity will quickly follow the change of the trend.

1: **When the frequency reaches the upper and lower limits, continue integral adjustment** The integral value responds to changes in the setpoint and feedback in real time, unless the internal integral limit has been reached. When the trend between the setpoint and feedback changes, it takes longer to offset the impact of continued integration before the integral value can follow the trend.

Function code	name	Setting range	Factory settings
P51. 13	Integral action upper limit (%)	0.0 ~ 6553.5	100.0
P51. 14	Closed loop input upper limit (%)	0.0~ 6553.5	50.0
P51. 15	Closed loop input lower limit (%)	0.0~ 6553.5	0.0
P51. 16	Closed loop output upper limit (%)	0.0~ 6553.5	100.0

P51.14 to P51.16 set the limit value in the process closed-loop control. If the input exceeds the upper limit P51.14, the upper limit value will be adjusted. If it is lower than the lower limit value, no PID adjustment will be performed. Set the limit value in the process closed-loop control.

Function code	name	Setting range	Factory settings
P51. 17	Sleep selection	0~ 1	0
P51. 18	Sleep frequency (Hz)	0.00~ 655.35	30.00
P51. 19	Sleep delay (s)	0.0~6553.5	10.0
P51. 20	Arousal bias	0.00~655.35	0.10
P51. 21	Wake-up delay (s)	0.0~6553.5	10.0

Sleep parameters:

P51.17 Sleep selection: 0: Invalid; 1: Valid

When the sleep selection is valid, you can set P51.18 sleep frequency, P51.19 sleep delay, P51.20 wake-up deviation and P51.21 wake-up delay.

Function code	name	Setting range	Factory settings
P51. 22	Given acceleration and deceleration time	0.0 ~ 6553.5	0.0
P51. 23	Closed-loop output filter time	0.0 0 0~ 65.353	0.01 0

When the closed-loop given suddenly changes, these two parameters can be adjusted to make the given control within a certain response time, making the closed-loop process response more stable in some environments.

Function code	name	Setting range	Factory settings
P51. 24	Minimum given amount (%)	0.00~10.00	0.00
P51. 25	Feedback amount corresponding to the minimum given amount (%)	0.00~10.00	0.00
P51. 26	Maximum given amount (%)	0.00~10.00	10.00
P51. 27	Feedback value corresponding to the maximum given value (%)	0.00~10.00	10.00

P51.24 to P51.27 define the relationship curve between the analog closed-loop reference and the expected feedback. The set value is the percentage of the actual value of the reference and feedback physical quantity relative to the reference value (10V or 20mA).

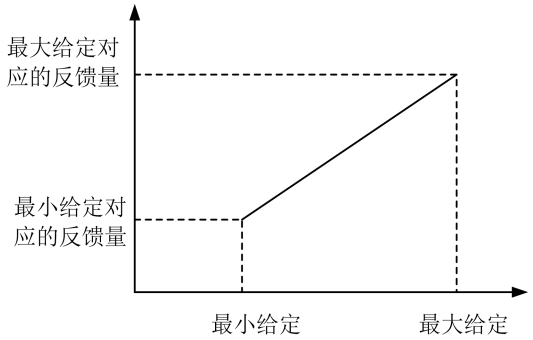


Figure 7-30 Positive feedback regulation

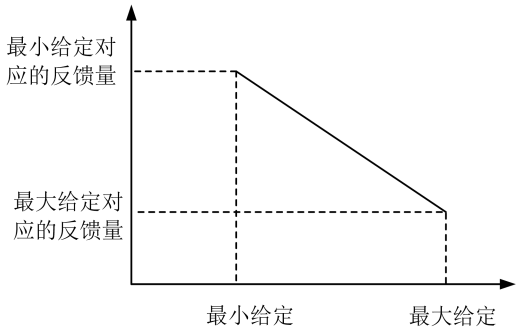


Figure 7-31 Negative feedback regulation

Function code	name	Setting range	Factory settings
P51. 28	Preset frequency (Hz)	0.00~ 655.35	22.00
P51. 29	Preset frequency holding time (s)	0 ~ 65535	0

After the closed-loop operation is started, the frequency first accelerates to the closed-loop preset frequency P51.28 according to the acceleration time, and continues to run at this frequency point for a period of time P51.29 before running according to the closed-loop characteristics. If the closed-loop preset frequency function is not required, set the preset frequency and hold time to 0.

Function code	name	Setting range	Factory settings
P51. 30	Positive and negative characteristics	0~ 1	0

Whether the comparison result between the feedback signal and the set value is inverted, 0: positive characteristic; 1: negative characteristic.

7.8 P6X Group Vector Control

7.8.1 P60 Speed Loop PID

Function code	name	Setting range	Factory settings
P60.00	Speed loop-zero speed P	0.00~655.35	5.00
P60.01	Speed loop-zero speed Ti (ms)	0~65535	73
P60.03	Speed loop-low speed P	0.00~655.35	5.00
P60.04	Speed loop-low speed Ti(ms)	0~65535	73
P60.0 6	Speed ring-high speed P	0.00~655.35	8.00
P60. 07	Speed loop-high speed Ti(ms)	0~65535	73
P60. 09	Switching frequency f0(%)	0.0~6553.5	10.0
P60. 10	Switching frequency f1(%)	0.0~6553.5	60.0

For the PID adjustment of the speed loop, P0 and I0 are used as the zero servo segment adjustment parameters. The other three groups of parameters are divided into three groups by P60.12 (torque command filter) and P60.13 (speed loop hover P). P1 and I1 are used as low-speed segment adjustment parameters, and P3 and I3 are used as high-speed segment adjustment parameters.

The P60 parameter group mainly adjusts the proportional gain and integral time of the speed regulator.

Proportional gain P:

Please adjust according to the size of the mechanical inertia of the motor. For mechanical

devices with large inertia, increase the P gain; for mechanical devices with small inertia, reduce the P gain.

When the P gain is larger than the inertia, the control response can be accelerated, but the motor may oscillate or overshoot. On the contrary, if the P gain is smaller than the inertia, the control response becomes slower and the time for the speed to adjust to a stable value becomes longer.

Integration time I:

When set to 0, the integral is invalid (P is controlled independently). To make the deviation between the speed command and the actual speed in the steady state zero, set the integral time I to a non-zero value. When the I setting value is small, the system responds quickly, but if it is too small, oscillation may occur; when the I setting value is large, the system responds slowly.

PID setting value at high and low speed:

When the motor speed is higher than switching frequency (P60.10), P60.06 and P60.07 take effect, ensuring the system achieves optimal dynamic response without oscillation. When the motor speed is below the switching frequency (P60.09), P60.03 and P60.04 take effect. Generally, to achieve better dynamic response at low speeds, increase the proportional gain (P60.03) and decrease the integral time (P60.04). When the speed is below the switching frequency (P60.10) but above the switching frequency (P60.09), P60.03 to P60.07 take effect.

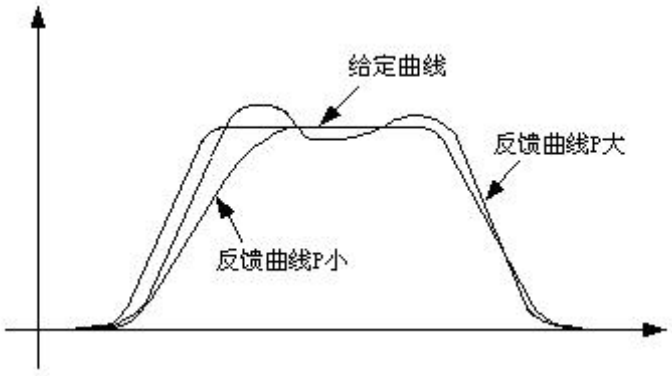


Figure 7-32 Effect of proportional constant P on feedback tracking

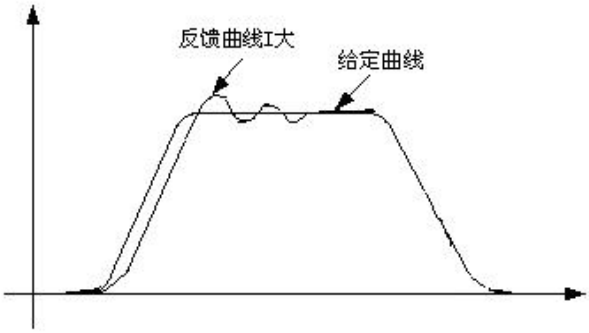


Figure 7-33 Effect of integral constant I on feedback tracking

Function code	name	Setting range	Factory settings
P 60.11	Speed loop period	0~50	0

The default value is 0 and is generally not modified. The larger the value, the slower the speed loop execution cycle.

Function code	name	Setting range	Factory settings
P 60.12	Torque command filtering (ms)	0~1000	1

Torque command filter time, generally not modified.

Function code	name	Setting range	Factory settings

P60.13	Speed loop suspension P	0~655.35	8.00
P60.14	Speed loop suspension Ti	0~65535	73

When configuring the SSI board, after turning on the hover function, the PI parameters at zero speed.

7.8.2 P61 Group Current Loop PID

Function code	name	Setting range	Factory settings
P61.00	Current loop Kp	0.0 0 ~ 655.35	0.30
P61.01	Current loop Ki	0.0 0 ~ 655.35	0.50
P61.02	Current loop bandwidth (Hz)	0.0 0 ~ 655.35	200.0
P61.03	Current loop selection	0~ 65535	4

P61.00 ~P61.01 are mainly used for PID adjustment of the current loop. Generally, no adjustment is performed and the default values are used.

P61.02 is the current loop bandwidth. When the current fluctuation is large, the bandwidth can be reduced accordingly.

P61.03 is the PI parameter selection for the current loop. The default value is 4, and the PI parameters use the self-learning results. If it is set to 0, P61.00 ~P61.01 are used.

Function code	name	Setting range	Factory settings
P62.00	Torque setting (%)	0.0 ~ 400.0	0.0
P62.01	Torque direction	0 ~ 1	0
P62.02	Torque increase time (s)	0.01 ~ 655.35	1.00
P62.03	Torque reduction time (s)	0.01 ~ 655.35	1.00

P62.00~P62.03 are the corresponding parameters in torque control mode. The torque direction can be set by setting P62.01, 0 indicates the positive direction, and 1 indicates the reverse direction. The torque acceleration and deceleration rates can be set by setting P62.02 and P 62.03.

Function code	name	Setting range	Factory settings
P63.00	Compensation torque direction	0 ~ 1	0
P63.01	Compensation torque gain (%)	0 ~ 6553.5	100.0
P63.03	Pre-torque compensation (%)	0.0 ~ 6344.0	0.0

This group of parameters is mainly used in situations where fixed torque compensation is required, such as when large static friction needs to be overcome or constant tension needs to be maintained during low-speed operation.

7.9 P7X Group Enhanced Control

7.9.1 P70 Group Limitations & Protections

Function code	name	Setting range	Factory settings
P70.00	Upper frequency limit (Hz)	0.0 0 ~6 55.35	50.00
P70.01	Frequency lower limit (Hz)	0.0 0 ~6 55.35	0.00

The maximum output frequency f_{max} is the highest frequency that the inverter is allowed to output.

Fundamental frequency F_b refers to the output frequency corresponding to when the inverter output voltage reaches the rated voltage.

The maximum output voltage Vmax refers to the output voltage of the inverter when it is running at the basic operating frequency. When using a standard AC motor, it corresponds to the rated voltage of the motor. Refer to the motor nameplate.

The upper frequency limit f_H and the lower frequency limit f_L are the maximum and minimum operating frequencies of the motor set by the user according to the requirements of the production process.

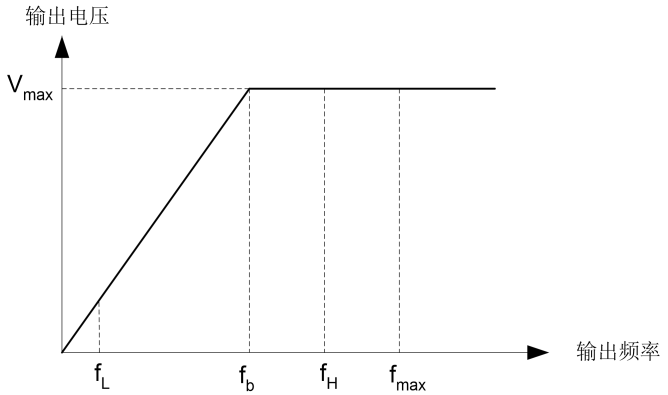


Figure 7-34 Schematic diagram of upper and lower frequency limits

Function code	name	Setting range	Factory settings
P70.02	ID given limit (%)	0.0 0 ~ 2.00	0.00
P70.03	ID limit gain	0~ 10000	0

P70.02 is the D-axis current setting limit value. When this value is exceeded, the system will enter speed reduction control.

P70.03 is the ID limit gain, which determines the speed reduction amplitude.

Function code	name	Setting range	Factory settings
P70.04	Output torque limit (%)	0~250	150
P70.05	Acceleration overcurrent threshold (%)	0~200	160
P70.06	Deceleration overvoltage threshold (V)	540~800	750
P70.07	Overspeed protection factor (%)	0.00~ 655.35	120.00

P70.04 to P70.06 set thresholds for the inverter's overcurrent and overvoltage. Typically, when the set speed or motor load changes dramatically, the inverter's output current may exceed the overcurrent protection point, causing an overcurrent fault. The current limit function allows the inverter to control the instantaneous output to limit the rapidly changing output current to the protection action value, effectively reducing the occurrence of overcurrent faults and ensuring continuous and reliable system operation. When the current exceeds a certain value (P70.04), the inverter enters the current limit state. During constant speed operation, current limiting ensures stable load capacity without generating overcurrent faults. When the load decreases, the inverter automatically exits the current limit state and resumes normal operation. This function is particularly useful in situations where speed or load changes dramatically.

P70.07 sets the overspeed protection value. If the time exceeds the value set in P94.04, fault No. 30 will be reported.

Function code	name	Setting range	Factory settings
P70.08	Special function selection	0~65535	6

Bit0: Overcurrent frequency reduction: This function is enabled when this bit is set to 1. This

function can be set using parameters P70.23 to P70.27.

Bit1: Overtemperature frequency reduction: This function is enabled when this bit is set to 1. This function can be set using parameters P70.29 to P70.33.

Bit2: Over-temperature carrier frequency change function: This function is enabled when this bit is set to 1. When the radiator temperature is higher than 80 degrees, the carrier frequency will decrease by 1 kHz for every 2 degrees increase in temperature (minimum 2kHz).

Bit3: Light load carrier boost function

Bit4: Dwell deceleration overvoltage: Set to 1 to enable. Related parameter P70.06.

Bit5: Dwell acceleration overcurrent

Bit6: Undervoltage fault is not recorded: the function is enabled when this position is 1.

Bit10: Bus voltage compensation (emergency)

Bit11: GVC energy saving mode: When this position is set to 1, the function is enabled and only supports GVC mode.

Bit12: FOC angle compensation block

Bit 13: KEB function: This function is enabled when this bit is set to 1. When power is off, the motor decelerates to generate power, compensating for the bus voltage and extending the triggering time of the undervoltage alarm. Related parameters: P71.50 to P71.56.

Bit14: Start carrier frequency conversion function: Set to 1 to enable. Start carrier frequency conversion.

Function code	name	Setting range	Factory settings
P70.09	Maximum frequency	0 ~655.35	5 0.00

P70.09 is the maximum frequency. When the target frequency is given by analog input, the full scale corresponds to the set value. When setting, please note that the maximum frequency ⩾ upper limit frequency ⩾ rated frequency.

Function code	name	Setting range	Factory settings
P70.10	PT signal channel	0~ 3	0
P70.11	PT protection upper threshold (degrees)	0.0~10 00.0	150.0
P70.12	PT protection lower threshold (degrees)	0.0~10 00.0	0.0
P70.13	PT protection action delay (s)	0.0~10.0	3.0

P70.10 selects the channel of PT signal (0: NC; 1: PT1000/PT100; 2: PTC high resistance; 3: PTC low resistance).

The standard IO board supports PT1000 and the high-resistance and low-resistance protection logic of PTC. Optional IO board that supports PT100 can also support PT100.

Triggering conditions for fault No. 49 (PT detection fault): " PT value > P70.11 " or " PT value < P70.12 " for 5 seconds (P70.13 is not used);

Conditions for clearing fault No. 49 (PT detection fault): 5 seconds after the fault occurs, " P70.12 < PT value P70.11", the fault will be cleared.

Function code	name	Setting range	Factory settings
P70.15	Overexcitation coefficient	0~ 150	0

P70.15 is the overexcitation coefficient. This function implements overvoltage suppression during deceleration in GVC and VFVC modes. 0 indicates disabled. The "overexcitation" function applies an additional voltage compensation at low frequencies to offset the resistance voltage drop, ensuring constant magnetic flux and thus maintaining torque capacity at low speeds.

Function code	name	Setting range	Factory settings
P70.18	Bus Voltage Low Threshold	0~1000	219

The primary function of the low-voltage threshold of a low-voltage inverter is to detect whether the DC bus voltage is too low and to trigger under-voltage protection when the voltage falls below this set value. Its main purpose is to protect the power devices inside the inverter (such as IGBTs) from potential damage caused by insufficient power supply. When the voltage drops below the threshold, the inverter will immediately block the inverter's pulse output and issue an alarm, which is a key and necessary protection mechanism to ensure the safe operation of the equipment.

Function code	name	Setting range	Factory settings
P70.19	Bus undervoltage threshold (V)	0~540	380

The default bus undervoltage threshold for a 400V-class inverter is 380V.

Function code	name	Setting range	Factory settings
P70.20	Grid imbalance threshold (%)	10.0 ~ 200.0	20.0

Grid imbalance faults are determined based on grid voltage sampling, and thresholds can be set based on on-site grid conditions.

Function code	name	Setting range	Factory settings
P70.21	PWM detection delay (ms)	0~ 65535	800

After the inverter is running, if the output current is 0 and after the parameter PWM detection delay, the inverter reports 51# fault (abnormal output current during operation).

Function code	name	Setting range	Factory settings
P70.23	Current limiting and frequency reduction threshold (%)	5 0 ~ 200	1 20
P70.24	Current limiting Kp	0.00~65.535	0.001
P70.25	Current limit Ki	0.000~6.5535	0.0001
P70.26	Current limit OutMin(%)	0.000~1.000	0.005
P70.27	Current limiting recovery threshold (%)	0~ 65535	1 0

P70.23~P70.27 are parameters related to overcurrent frequency reduction. Bit0 of P70.08 (special function enable) needs to be set to enable this function. When the current exceeds P70.23, the frequency reduction function is enabled.

Function code	name	Setting range	Factory settings
P70.28	Grid overvoltage threshold	0 ~530	530
P70.29	Over-temperature frequency reduction starting temperature	0.0 ~ 100.0	91.0
P70.30	Overtemperature frequency reduction recovery temperature	0.0 ~ 100.0	80.0
P70.31	Overtemperature frequency reduction slope	0~ 65535	1
P 70.32	Frequency increase overtemperature threshold	0.0 ~ 100.0	88.0
P 70.33	Overtemperature detection interval	0.00 ~ 655.35	20.00

When P70.08's Bit1 is 1, the over-temperature frequency reduction function is enabled;
When the module temperature is higher than P70.32 (frequency increase over-temperature threshold), the speed curve is paused and the frequency increase stops;
When the module temperature is higher than P70.29 (overtemperature frequency reduction start temperature), the frequency will start to be reduced, and it will drop to the lower limit frequency at most. The frequency reduction cycle is P70.33, and the frequency reduction

amount each time is P70.31;
When the module temperature is lower than P70.30, the frequency reduction ends and the normal speed is restored according to a quarter cycle of P70.33 with a step size of P70.31.

7.9.2 Special functions of Group P71

Function code	name	Setting range	Factory settings
P71.00	Frequency hopping speed 1(Hz)	0.00 ~ 655.35	0.00
P71.01	Frequency hopping speed 2(Hz)	0.00 ~ 655.35	0.00
P71.02	Frequency hopping speed 3(Hz)	0.00 ~ 655.35	0.00
P71.03	Frequency hopping width (Hz)	0.00 ~ 655.35	0.00

In order to avoid mechanical resonance points, the inverter jump frequency range can be set. When the inverter set frequency falls within the jump frequency, it will automatically adjust to the jump frequency range for operation. The jump frequency range is from [frequency hopping speed - 0.5 × frequency hopping width, frequency hopping speed + 0.5 × frequency hopping width]. A total of three frequency modulation ranges can be set.

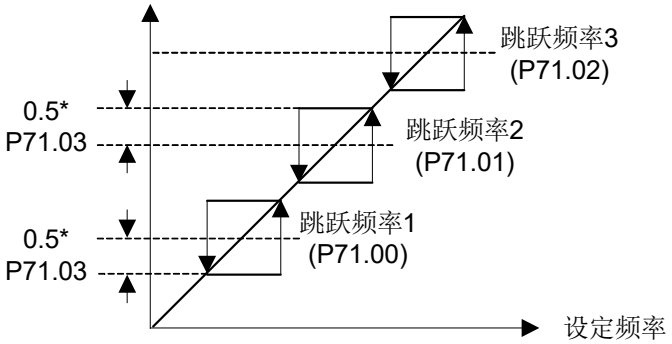


Figure 7-35 Upper and lower limits of jump frequency

Function code	name	Setting range	Factory settings
P71.04	Pulse + level hold	0~ 1	0

P71.04 is a pulse + level hold function. When P71.04 = 0, the function is disabled; when P71.04 = 1, the rising edge + level start function is enabled. For example, during the pulse phase, the inverter receives a brief 24V start command from the controller to the start terminal. The inverter detects the rising edge and begins operation. During the level phase, after the pulse signal, the controller does not cancel the 24V command but instead maintains the output. The inverter will continue to detect the signal and continue operation.

Function code	name	Setting range	Factory settings
P71.05	Reverse prohibition	0~1	0
P71.06	Forward and reverse rotation interval (s)	0.0~6553.5	0.1
P71.07	PWM modulation mode	0~ 3	1

For some production equipment, reverse rotation may cause damage to the equipment. This function can be used to prohibit reverse rotation. P71.05 factory default is to allow reverse rotation. Setting it to 1: prohibit reverse rotation.

When the motor's rotation direction is opposite to that required by the device, you can swap the wiring of any two terminals on the inverter output side to make the forward rotation direction of the device consistent with the forward rotation direction defined by the inverter.

Set P71.06 to realize the waiting time when the inverter speed passes through zero when it rotates from forward to reverse (or from reverse to forward).

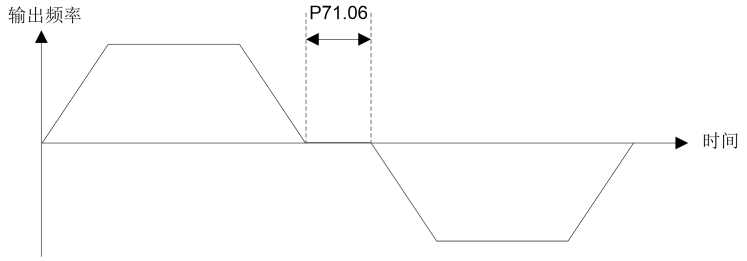


Figure 7-36 Forward and reverse dead zone time

P71.07 function selects PWM modulation mode. 0: 5-segment mode; 1: 7-segment mode; 2: < 30 % rpm 7 segments, > 30 % rpm 5 segments; 3: SPWM mode.

Function code	name	Setting range	Factory settings
P71.14	PWM carrier frequency (kHz)	1.1 ~ 16.000	8.000

Carrier frequency adjustment: When the noise of the variable frequency motor is too loud, the carrier frequency can be increased to make the noise lighter. The random PWM width can adjust the carrier frequency range.

Note: The default carrier frequency is related to the inverter power. The greater the power, the lower the default carrier frequency. If it exceeds the default value, please derate it.

Function code	name	Setting range	Factory settings
P71.17	Lock load polarity selection	0	0~ 2
P71.18	Load speed limit	0~ 100	100
P71.19	Rising weighing value	0~ 65535	0
P71.20	Drop weighing value	0~ 65535	0

P71.17 selects the lock load polarity. This parameter is designed to prevent malicious bypassing of the safety lock through short circuits and deception of the control system. The inverter alternates the polarity of the monitoring signal, making it impossible for a short circuit to simulate a normal signal in both polarities. The setting of this parameter is directly related to the operator's life safety.

When P71.17=0: closed; when P71.17=1: positive polarity limit is turned on; when P71.17=2: negative polarity limit is turned on.

It may be used in the lifting industry. After the function is turned on, it is limited according to P 71.18 (load speed upper limit).

P71.18 is the upper limit of the load speed. The setting of this function limits the upper limit of the speed according to the lock status.

P71.19 is the rising weighing value, which is the record of the self-learning rising weighing value of the lifting equipment.

P71.20 is the descending weighing value, which is the record of the self-learning descending weighing value of the lifting equipment.

Function code	name	Setting range	Factory settings
P71.22	Zero speed threshold (Hz)	0.00~10.00	0.20

P71.22 sets the zero speed threshold, with a default value of 0.2Hz. If the actual operating frequency is lower than the set value, it is considered zero speed.

Function code	name	Setting range	Factory settings
P 71.21	Dead zone compensation selection	0 ~ 2	2
P71.23	Forward dead zone compensation (%)	0~ 65535	90
P 71.24	Dead zone threshold coefficient (%)	0.0~2.0	0.8

P71.21 supports three dead zone compensation methods, and the default compensation method is generally used.

P71.23 compensates for the forward upper and lower bridge arm opening and closing conversion dead zone time, the default value is 90%.

Function code	name	Setting range	Factory settings
P71.29	PWM modulation selection	0~ 15	1

PWM modulation mode:

0: **Underflow update**

1: **Update both overflow and underflow**

Function code	name	Setting range	Factory settings
P71.30	Vector control compensation selection	0~ 65535	132
P71.31	Inertia compensation coefficient (%)	0.0 ~ 6553.5	0
P71.32	Inertia compensation filter time (ms)	0~1000	5

P71.30 ~ P71.32 are used to compensate for the acceleration and deceleration performance of large inertia systems.

Function code	name	Setting range	Factory settings
P71. 33	UPDOWN step size	0.00 ~ 20.00	1.0

UPDOWN terminal function is enabled.

Function code	name	Setting range	Factory settings
P 71.37	Droop control gain	0~ 100.0	0
P 71.3 8	Droop control filtering	0 ~2.00	0.05

P71.37 is the Droop control gain, which affects the droop amplitude of the load frequency.

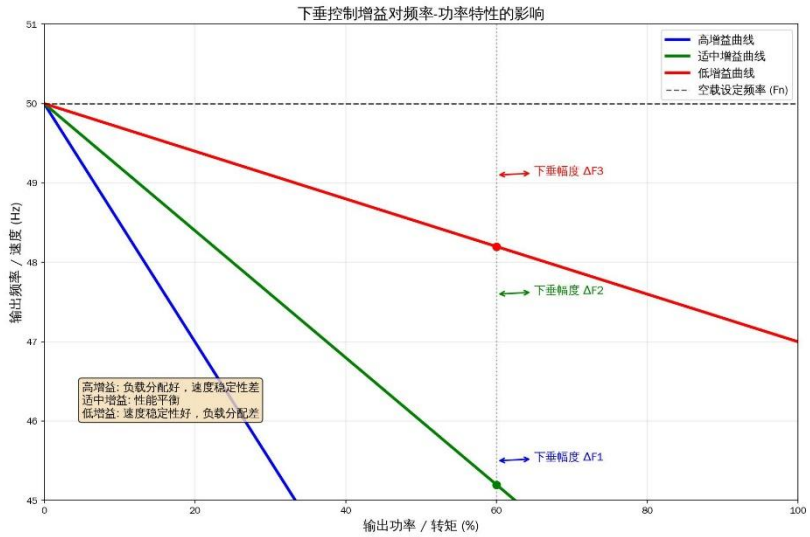


Figure 7-37 Relationship between droop control output power and output frequency

P71.38 is the droop control filter, the droop control filter time, which affects the control dynamic response.

Function code	name	Setting range	Factory settings
P71. 40	Input shaping type	0 ~ 2	0
P71. 41	Oscillation frequency	0.00 ~ 600.00	0.3
P71. 42	Damping coefficient	0.00 ~ 2.00	0.05

P71.40 ~P71.42 are anti-sway control algorithm parameters, which are mainly used in situations where anti-sway is required, such as stackers.

Function code	name	Setting range	Factory settings
P71. 43	Automatic self-learning mode	0 ~10	0

P71.43 is the automatic self-learning mode. In some special occasions (absolutely optimal parameters are required for each startup), if self-learning is required every time power is turned on, the corresponding self-learning mode can be set.

Function code	name	Setting range	Factory settings
P71. 45	Output turn-off delay (s)	0.00 ~ 655.35	0.3

After the brake is applied, the PWM output is closed with a time delay.

Function code	name	Setting range	Factory settings
P71.49	Power failure detection threshold (V)	380~550	4 2 0
P71.50	KEB bus target voltage (V)	380~550	48 0

P71.49 is usually set to 420. If a fault occurs during the KEB process, this value can be appropriately increased by referring to the bus voltage of the inverter.

P71.50 should be greater than P71.49 (power failure detection threshold) and less than the inverter bus voltage during normal power supply. You can refer to the inverter bus voltage to increase this value appropriately.

Function code	name	Setting range	Factory settings
P71.51	KEB ratio Kp (%)	0 ~10000	100
P71.52	KEB integral Ki (%)	0 ~10000	100
P71.53	KEB deceleration upper limit (s)	0.00 ~100.00	0.50
P71.54	KEB acceleration limit (s)	0.00 ~100.00	10.00
P71.55	KEB deceleration initial value (s)	0.00 ~100.00	2.00

Please set the above parameters according to the default factory values and generally do not need to be changed.

Kp in the KEB process. If the value is too small, the KEB time will be too short. If it is too large, it will cause an overvoltage fault on the busbar.

Ki during the KEB process. If the value is too small, the KEB time will be too short, and if it is too large, it will cause an overvoltage fault on the busbar.

Function code	name	Setting range	Factory settings
P71.58	Fan control method	0~4	0

0: The inverter is running and the fan is running; the inverter is stopped and the fan stops after a delay of 1 minute;

1: The inverter is running and the fan is running; the inverter is stopped and the fan stops after a delay of 5 minutes;

2: When the inverter is running, the fan is running; when the inverter is stopped, the fan stops after a delay of 30 minutes;

3: Fan operation condition: if the radiator temperature is >40 degrees, the fan will start; if it is <35 degrees, the fan will stop after a delay of 1 second.

4: After the inverter is powered on, the fan keeps running.

Function code	name	Setting range	Factory settings
P71.61	Frequency decimal places	1 ~ 2	2

This parameter can be used to select the frequency accuracy. For high-speed motors, 1 decimal point can be selected.

Function code	name	Setting range	Factory settings
P71.62	Function switch	0~ 65535	1029

Special function switch, generally used by debuggers

Bit0: Block Emulator

Bit1: RS485 virtual oscilloscope control function of RJ45 port

Bit2: RS485 virtual oscilloscope control function of RJ45 port

Bit3: USB port virtual oscilloscope control function

Bit4: USB port virtual oscilloscope only monitoring function

Bit5: GVC mode displays encoder feedback speed

Bit7: PN card function to enable the application macro parameter selection

Bit8: Output voltage uses reconstruction calculation (otherwise uses sampling calculation)

Bit9: Enable the STO board base blocking function (to avoid malfunction when there is no STO board)

Bit10: Enable the base blocking function of bit1 of word0 in PN function

Bit11: SVC forward pre-torque compensation (with counterweight lifting application)

Bit12: SVC reverse pre-torque compensation (with counterweight lifting application)

Bit13: SVC pre-torque compensation exit mechanism (spare)

Bit14: ZHIYUAN special terminal switching mode function

Function code	name	Setting range	Factory settings
P71.63	Phase lock function enabled	0~ 1	0
P71.64	System bypass angle error (degrees)	0.01~360.00	3.60
P71.65	System bypass voltage error (V)	1 ~100	5

When the power frequency conversion switching function is enabled, P71.63 needs to be set to turn on the function and detect the phase lock state;

P71.64 sets the phase lock completion angle error value;

P71.65 sets the phase lock completion voltage error value.

Function code	name	Setting range	Factory settings
P71.66	Fan control duty cycle (%)	0~ 65535	100

This parameter is mainly applicable to speed-controlled fans with power levels of 22KW and above.

Function code	name	Setting range	Factory settings
P71.70	Deceleration inertia coefficient (%)	0~ 200	100

Relative to P71.31 is used to adjust the inertia compensation size in the deceleration stage.

7.1 0 P 8X Group Communication Control

7.10.1 P80 Group Communication Method

Function code	name	Setting range	Factory settings
P80.00	Communication method selection	0~ 4	2

Select the communication method currently used by the inverter:

0: Undefined function

1: DP (spare)

2: **Modbus**

3: C AN (spare)

4: **SSI**

7.10.2 P81 Group Modbus Communication Parameters

Function code	name	Setting range	Factory settings
P81.00	Communication baud rate selection	0~7	7
P81.01	Data format	0~ 3	0
P81.02	Transmission mode selection	0~1	1

This device supports the internationally accepted Modbus protocol and RTU format. See the appendix for details.

P81.00 determines the communication baud rate, which supports from 1200 to 115200bps.

0: 1200bps

1: 2400bps

2: 4800bps

3: 9600bps

4: 19200bps

5: 38400bps

6: 57600bps

7: 115200bps
P 81.01 sets the communication format and parity check.
0: 1-8-1 format, no parity check.
1: 1-8-1 format, even parity.
2: 1-8-1 format, odd parity.
3: 1-8-2 format, no parity check
P81.02 sets the transmission mode: 0: ASCII; 1: RTU

Function code	name	Setting range	Factory settings
P81.04	Local address	1~247	1
P81.05	Communication external address enable	0~ 1	0
P81.06	Given frequency external address	0 ~65535	0

P81.04 sets the local address, 0 is the broadcast address, available addresses are 1 to 247, and 248 to 255 are reserved.

P81.05 is the communication external address enable. When P81.05=0: closed; when P81.05=1: open the communication address external mapping function.

P81.06 is the external address of the given frequency, that is, the external communication address corresponding to the target frequency.

Function code	name	Setting range	Factory settings
P81.07	Communication address format selection	0~1	1
P81.08	Given frequency reference value	0~ 40000	0

Select the communication address format, 0: hexadecimal; 1: decimal.

P81.08 is the reference value of the given frequency. If the value is less than 1000, the actual given value will be used. If it is greater than 1000, the target frequency is the communication value minus the reference value.

Function code	name	Setting range	Factory settings	Parameter Description
P81.0 9	Status word 1 corresponding address	0~ 65000	0	Valid after P81.05 is turned on
P81. 10	Status word 1 function selection	0~ 31	0	Valid after P81.05 is turned on
P81. 11	Status word 2 corresponding address	0~ 65000	0	Valid after P81.05 is turned on
P81. 12	Status word 2 function selection	0~ 31	0	Valid after P81.05 is turned on
P81. 13	Status word 3 corresponding address	0~ 65000	0	Valid after P81.05 is turned on
P81. 14	Status word 3 function selection	0~ 31	0	Valid after P81.05 is turned on
P81. 15	Status word 4 corresponding address	0~ 65000	0	Valid after P81.05 is turned on
P81. 16	Status word 4 function selection	0~ 31	0	Valid after P81.05 is turned on
P81. 17	Status word 5 corresponding address	0~ 65000	0	Valid after P81.05 is turned on
P81. 18	Status word 5 function selection	0~ 31	0	Valid after P81.05 is turned on
P81. 19	Status word 6 corresponding address	0~ 65000	0	Valid after P81.05 is turned on
P81. 20	Status word 6 function	0~ 31	0	Valid after P81.05

Function code	name	Setting range	Factory settings	Parameter Description
	selection			is turned on
P81. 21	Status word 7 corresponding address	0~ 65000	0	Valid after P81.05 is turned on
P81. 22	Status word 7 function selection	0~ 31	0	Valid after P81.05 is turned on
P81. 23	Status word 8 corresponding address	0~ 65000	0	Valid after P81.05 is turned on
P81. 24	Status word 8 function selection	0~ 31	0	Valid after P81.05 is turned on

7.1 0 .3 P82 Group Profinet

Function code	name	Setting range	Factory settings
P82.02	Custom status word 1	0~ 45	16
P82.03	Custom status word 2	0~ 45	13
P82.04	Custom status word 3	0~ 45	10
P82.05	Custom status word 4	0~ 45	18

P82.02~ P82.05 set custom status:
0: Running state 1
1: Running state 2
2: Detection status
10: Output torque
13: Target frequency setting
14: Current operating frequency
15: Feedback speed (Hz)
16: Feedback speed (rpm)
18: Output voltage effective value
19: Output current effective value
22: Total output power
23: Bus voltage
29: Output terminal status
31: Input terminal status
34: Analog input AI0
35: Analog input AI1
37: Output DA0
38: Output DA1
40: Most recent fault number
43: Radiator temperature

Function code	name	Setting range	Factory settings
P82.0 6	PN communication function enabled	0 ~65535	0

P82.06 is the PN communication function enable. When the ones digit of this parameter is valid, the PN torque limit function is turned on; when the tens digit is valid, the PN gives the target speed.

7.1 1 P 9X group fault and display parameter group

7.1 1 .1 P90 Group (Reserved Parameter Group)

7.1 1 .2 P91 LCD Display

Function code	name	Setting range	Factory settings
P91.00	U01 display data	0~ 63	1
P91.01	U02 display data	0~ 63	2
P91.02	U03 display data	0~ 63	3
P91.03	U04 display data	0~ 63	8
P91.04	U05 display data	0~ 63	7
P91.05	U06 display data	0~ 63	6
P91.06	U07 display data	0~ 63	9
P91.07	U08 display data	0~ 63	10

A total of 8 LCD display parameters are set. The following is the display parameter table.

Function settings	Meaning	Function settings	meaning
0	No definition	1	Target speed (Hz)
2	Given speed (Hz)	3	Feedback speed (Hz)
4	Given speed (rpm)	5	Feedback speed (rpm)
6	Bus voltage (V)	7	Output voltage (V)
8	Output current (A)	9	Output power (kW)
10	Output torque (%)	11	Input terminal status
12	Output terminal status	13	Analog input A0
14	Analog input A1	15	Capacitor discharge reference(s) (for internal use)
16	Capacitor discharge time (s) (for internal use)	17	Target torque (%)
18	Radiator temperature (° C)	19	Cumulative power-on time (h)
20	Cumulative running time (h)	21	Remaining power-on time (days)
22	Inverter operating status	23	Grid imbalance (%)
24	Weighing compensation amount (%)	25	Speed deviation rpm
26	Rectifier bridge temperature (℃)	27	A and B phase count value
28	CD corresponding pulse number	29	B phase counting when Z signal
30	A and B phase are disturbed	31	Number of interferences on Z phase

Function settings	Meaning	Function settings	meaning
32	Encoder sin center point	33	Encoder cos center point
34	Encoder C phase center point	35	Encoder D phase center point
36	Reserve	37	Grid voltage
38	Maximum busbar value during operation (spare)	39	SPI communication exception count
40	Analog output M0	4 1	Analog output M1 (spare)
42	Weighing (%) (internal use)	4 3	IO board type (for internal use)
44	Wave-by-wave current limiting times (for internal use)	4 5	U phase AD sampling value (for internal use)
46	V phase AD sampling value (for internal use)	47	W phase AD sampling value (for internal use)
48	Cia 402 status (internal use)	4 9	Cia 402 jump instruction (internal use)
50	Object dictionary Ai1 (for internal use)	5 1	Object dictionary Ai2 (for internal use)
5 2	Braking status (for internal use)	5 3	Braking voltage (V) (for internal use)
57	PID given value	58	PID feedback value
6 3	Encoder speed (Hz) (for internal use)		

7.11.4 Group P93 Operation Record Parameters

Function code	name	Parameter range	Factory settings
P93.00	Cumulative power-on time (h)	0.000~65.535	0.000
P93.01	Cumulative running time (h)	0.000~65.535	0
P93.02	Set total power-on time (days)	0~30000	0
P93.03	Remaining power-on time (days)	0~30000	0
P93.0 4	Radiator maximum temperature (degrees)	0.000~6553.5	0.0

The inverter can automatically record the following information: the cumulative power-on time of the machine, the cumulative running time of the machine, and the maximum temperature record of the radiator.

Function code	name	Setting range	Factory settings
P93.05	Cumulative output power (kWh)	0.0~ 6553.5	0.0

The inverter starts running after power is applied, and the cumulative power output per unit time is expressed in kWh.

Function code	name	Setting range	Factory settings
P93.06	Inverter output power (MWh)	0~65535	0

The inverter starts running after power-on, and the cumulative power output per unit time is expressed in MWh.

Function code	name	Setting range	Factory settings
P93.07	Cumulative fan operation time (h)	0~65535	0

Inverter fan running time, unit is h.

Function code	name	Setting range	Factory settings
P93 .08	Record the maximum current (A)	/	0
P93 .09	Record the maximum power (kW)	/	0

The inverter records the maximum current in A and the maximum power in kW.

7.11.5 P94 Group Troubleshooting

Function code	name	Setting range	Factory settings
P94.00	Minor fault handling	0~3	1
P94.01	Fault automatic reset time (s)	0.0~ 65535.5	10.0
P94.02	Number of automatic fault resets	0~ 65535	0

P94.00 sets the fault handling method:

0: When a minor fault occurs, the fault relay will not be output;

1: When a minor fault occurs, the fault relay is output;

2: When 52# PTC fault occurs, output fault relay and shut down, and the fault does not reset automatically;

3: Both 1 and 2 are valid.

P94.01 sets the automatic reset time, the default is 10 seconds.

P94.02 sets the number of automatic resets within 30 minutes. By default, automatic reset is not enabled. Automatic reset failure may cause dangerous system operation. Please use with caution.

Function code	name	Setting range	Factory settings
P94.03	Radiator overheating time (s)	0:00~18.00	0.50
P94.04	Overspeed protection time (s)	0.00~180.00	1.00
P94.05	Bus voltage fluctuation threshold (V)	30 ~150	1 50

P94.03 sets the protection time of radiator overheat protection (fault No. 3). When the radiator temperature exceeds 80 degrees, continue for the P94.03 time and then protect.

P94.04 sets the confirmation time of overspeed protection (fault No. 30);

P94.05 sets the bus voltage fluctuation threshold (fault No. 29) for determining voltage drop. When the input voltage fluctuation exceeds the P94.05 value, protection is provided. This value can be increased in areas with unstable power grids.

Function code	name	Setting range	Factory settings
P94.08	Output phase loss confirmation(s)	0.000 ~ 65.535	2. 000
P94.09	Fault masking function	0~ 65535	0
P94.10	CD phase wrong wire threshold	9 ~ 65535	300
P94.11	ABZ protection threshold (%)	1 ~100	20

The input phase loss confirmation time set by P94.08 is only detected during normal operation or encoder dynamic self-learning. When the phase current is continuously greater than the time set by P94.08, protection is provided.

P94.09 fault shielding function, Bit0 is set to 1 to block grid voltage fault, Bit1 is set to 1 to block bus undervoltage fault, Bit2 is set to 1 to block fan fault detection.

P94.10 sets the CD phase error judgment threshold:

① For SinCos encoder, the difference between the AB signal and the CD signal exceeds 94.10 and lasts for 500ms;

② The difference between the Endate absolute position and the AB signal position exceeds 94.10 protection.

P94.11 is the ABZ protection threshold for incremental encoders:

When P10.00=3, the feedback speed is less than 1% and the speed error is large, protection will be activated after 400ms.

Function code	name	Setting range	Factory settings
P94.12	IGBT protection count	1~65535	20

Set the number of times the inverter output current exceeds the IGBT protection current threshold (Fault 21).

Function code	name	Setting range	Factory settings
P94.13	I^2t protection selection	0~3	0

I^2t protection options:

0 : I^2t protection is effective ;

1: The protection fault is only 45# or 46# (I^2t instantaneous value overcurrent or I^2t effective value overcurrent), suitable for frequent start and stop applications;

2: The protection fault is only 21# or 27# (abc overcurrent (three-phase instantaneous value) or output overcurrent (effective value), suitable for continuous overload applications;

3: I^2t not protected.

Function code	name	Setting range	Factory settings
P94.14	Analog A0 disconnection value (%)	0.0~100.0	50.0
P94.15	Analog A1 disconnection value (%)	0.0~100.0	50.0

Analog A0 /A1 input signal disconnection detection value, expressed as a percentage relative to 10V. If the analog A0 /A1 input voltage is less than 10V multiplied by the value of P94.14, the analog input is considered disconnected.

Default value of 0 means that the fault detection is disabled. If a non-zero value is set, speed deviation detection is enabled.

Function code	name	Setting range	Factory settings
P94.16	Analog exception handling	0~ 1	0

If the inverter reports an analog input abnormality fault, parameter P94.16 sets how the inverter operates.

0: **Disable protection**;

1: **Turn on protection**;

Function code	name	Setting range	Factory settings
P94.17	Speed deviation	0.00~ 655.35	0.0 0

Suitable for situations where speed deviation needs to be quickly identified.

Function code	name	Setting range	Factory settings
P94.18	Communication protection	0~1	1
P94.19	Communication disconnection protection time (s)	0.000~65.535	2.000

P94.18 Communication protection: 0: Disable protection; 1: Enable protection.

If normal communication is interrupted for P94.19 time, fault No. 43 (communication fault) will be reported.

Function code	name	Setting range	Factory settings
P94.20	Ground protection times (times)	0~ 60000	20

P94.20 is used to set the number of confirmations for fault No. 32 (ground protection).

Function code	name	Setting range	Factory settings
P94.21	Fault action selection 1	0~ 12221	0
P94.22	Fault action selection 2	0~ 2222	0
P94.23	Fault action selection 3	0~ 22122	0
P94.24	Fault action selection 4	0~ 2222	0

The units, tens, hundreds, thousands, and ten thousand digits of P94.21 represent faults 3, 4, 7, 9, and 10, respectively.

The units, tens, hundreds, thousands, and ten thousand digits of P94.22 represent faults 11, 29, 31, 32, and 34, respectively.

The units, tens, hundreds, thousands, and ten thousand digits of P94.23 represent faults 39, 43, 44, 47, and no function, respectively.

The units, tens, hundreds, and thousand digits of P94.24 represent faults 49, no function, 51, and no function, respectively.

0: Coast to a stop when a fault occurs.

1: Stop in parking mode when a fault occurs. (Press P13.00 (dynamic braking selection) to stop.)

2: Continue running when a fault occurs.

Example:

(1) If you want the No. 3 fault to stop the machine and coast to stop, set P94.21 to 0.

(2) If you want the No. 3 fault to stop the machine according to the setting of P13.00, set P94.21 to 1.

(3) If you want the No. 3 fault to continue running when the fault occurs, set P94.21 to 2.

(4) If you want the No. 4 fault to stop the machine and coast to stop, set P94.21 to 0.

(5) If you want the No. 7 fault to continue running when the fault occurs, set P94.21 to 2.

7.11.6 P95 Group Version

Function code	name	Setting range	Factory settings
P95.00	Inverter hardware version		580.04
P95.01	Inverter software version		100.01

Function code	name	Setting range	Factory settings
P95.02	Version number		6.07
P95.03	Driver board software version		2.0

Group P95 mainly displays the software and hardware version parameters of the inverter, which are generally set directly by the manufacturer.

7.11.7 Group P96 Inverter Information

Function code	name	Setting range	Factory settings
P96.00	Inverter rated power (kW)	0.0~999.9	/
P96.01	Inverter rated current (A)	0.0~999.9	/
P96.02	Inverter light load current (A)	0.0~999.9	/
P96.03	Inverter rated voltage (V)	0~460	/
P96.04	Inverter power factor (%)	0~99	/
P96.05	Current sensor current (A)	0~9999	/
P96.06	IGBT module (A)	0~9999	/
P96.07	Braking IGBT(A)	0~9999	/
P96.08	Three-phase current balance coefficient (%)	0.800 ~ 1.200	1.000
P 96.09	Heavy load current (480V) (A)	According to power	/
P 96.10	Light load current (480V) (A)	According to power	/

Group P96 mainly displays the fixed parameters of the inverter, which are usually set directly by the manufacturer.

P96.00~P96.04 factory initial setting;

P96.05~P96.08 are the parameter settings of the inverter itself, which are determined by the hardware and have read-only properties.

P96.09~P96.10 are the current derating under 480V input voltage conditions.

Function code	name	Setting range	Factory settings
P96.20	Inverter model	0~ 2	0

Setting 0 means light load (standard), 1 means heavy load (standard), and 2 means light load (ES) .

Chapter 8 Troubleshooting

This chapter provides detailed information on inverter faults, including fault codes, content, causes, and countermeasures. It also provides an analysis flow for various fault phenomena during motor commissioning and operation.

◎ Maintenance operations should be performed 10 minutes after disconnecting the input power supply. At this time, the charging indicator light is completely off or the DC bus voltage is below 24VDC.

Otherwise there is a risk of electric shock.

◎ Never modify the inverter by yourself.

Otherwise there is a risk of electric shock or personal injury.

◎ Please have professional electrical engineers perform maintenance operations. It is strictly forbidden to leave wire ends or metal objects inside the inverter.

Otherwise there is a risk of fire.

◎ Do not change the wiring or disconnect the terminals while the power is on.

Otherwise there is a risk of electric shock.

8.1 Protection and inspection functions

The fault causes and countermeasures corresponding to the inverter fault codes are shown in Table 8.1 Fault Table.

Table 8.1 Fault table

Fault Code	Fault display	Possible causes	right policy
1	Module overcurrent protection	DC terminal voltage is too high	Check the grid power supply; check whether the high inertia load has no energy consumption and the rapid stop is caused by braking.
		There is a short circuit on the periphery	Check whether the motor and output wiring are short-circuited or short-circuited to the ground
		Output phase imbalance or phase loss	Check whether the motor and output wiring are loose

Fault Code	Fault display	Possible causes	right policy
		Encoder failure	Check whether the encoder is damaged or the wiring is correct.
		The hardware is in poor contact or damaged	Ask professional technicians to perform maintenance
		The internal connectors of the inverter are loose	Ask professional technicians to perform maintenance
		The power circuit components are overheating due to a problem with the cooling fan or cooling system.	Check the cooling fan. Check for proper cooling fan power and for any obstructions.
		Warning: The inverter operation must be started only after the cause of the fault is cleared to avoid damage to the IGBT.	
2	Rectifier bridge overheating	Environment and cooling system issues	Immediately check whether the inverter cooling fan is operating normally; ensure proper ventilation.
		Long-term overload operation	Check whether the motor and mechanical load are too heavy, and avoid running the inverter in an overloaded state for a long time.
		Power supply and internal faults	Please have a professional technician perform maintenance.
3	Radiator overheating	Ambient temperature is too high	Lower the ambient temperature and enhance ventilation and heat dissipation. Keep the ambient temperature below 40° or check the capacity of the inverter based on this performance
		The cooling fan is damaged or foreign matter has entered the cooling system	Check whether the fan power cord is properly connected, or replace the fan with the same model and remove foreign objects.
		Cooling fan abnormality	Check the cooling fan. Check for proper cooling fan power and for any obstructions.
		Temperature detection circuit failure	Ask professional technicians to perform maintenance
7	Speed deviation	Acceleration time is too short	Extend the acceleration time
		Too much load	Check whether the mechanical transmission mechanism is smooth and whether the load is within the rated capacity of the motor.
		Current limit too low	Appropriately increase the current limit value within the allowable range
		Motor parameter settings are inaccurate	After inputting the rated parameters of the motor, the motor is self-learned.
8	(During acceleration operation) Busbar overvoltage protection	Abnormal input power voltage	Check the input power
		Restart quickly while the motor is rotating at high speed	Restart the motor after it stops
	(During deceleration	The load moment of inertia is too large	Use appropriate dynamic braking components

Fault Code	Fault display	Possible causes	right policy
	operation) Busbar overvoltage protection	Deceleration time is too short	Extend the deceleration time
		The braking resistor is too large or not connected.	Connect a suitable braking resistor
	(Constant speed operation) Busbar overvoltage protection	Input power abnormality	Check the input power
		The load moment of inertia is too large	Use appropriate dynamic braking components
		The braking resistor is too large or not connected.	Connect a suitable braking resistor
9	Bus undervoltage	The power supply voltage is lower than the minimum operating voltage of the device	Check the input power
		A momentary power outage occurs	Check the input power supply, wait until the input voltage is normal, reset and restart
		The input power voltage fluctuates too much	
		The power supply terminal is loose	Check input wiring
		Internal switching power supply abnormality	Ask professional technicians to perform maintenance
		There are loads with large starting current in the same power supply system	Change the power supply system to meet the specified value
10	Output phase loss	The inverter output side wiring is abnormal, missing or broken.	Check the inverter output side wiring according to the operating procedures to eliminate missed connections and broken wires.
		Output terminal is loose	
		The motor power is too small, less than 1/20 of the maximum applicable motor capacity of the inverter	Adjust the inverter capacity or motor capacity
		Output three-phase unbalance	Check whether the motor wiring is intact
			Turn off the power to check whether the characteristics of the inverter output side and DC side terminals are consistent
12	Encoder malfunction	Power/Supply Failure	Use a multimeter to measure the voltage at the encoder's power terminals and ensure it is within the specified range (e.g., 5V ±5%).
		Signal Connection and Circuit Fault	Check whether the shield of the encoder cable is reliably grounded at the inverter end. Whenever possible, lay the signal cables separately from the input/output power cables of the inverter and maintain sufficient distance.
		Encoder Itself Issues	The internal photoelectric sensors, code discs, circuit chips, and other electronic components of the encoder can be damaged due to long-term operation, overheating, or aging, resulting in their

Fault Code	Fault display	Possible causes	right policy
			inability to generate or output correct signals.
13	Bus Low Voltage Fault	Bus voltage is lower than P70.18	Check the bus voltage and adjust the threshold according to the actual working conditions, usually no changes are made.
17	Overspeed in the same direction (within the maximum speed allowed)	Encoder parameter settings are incorrect or interfered with	Check the encoder circuit
		The forward load is too large or the load suddenly changes.	Check external causes of load mutation
18	Reverse speed (within the maximum speed allowed)	Encoder parameter settings are incorrect or interfered with	Check the encoder circuit
		The reverse load is too large or the load suddenly changes	Check external causes of load mutation
21	abc overcurrent (three-phase instantaneous value)	The motor is short-circuited to ground on one side	Check the motor and output line circuit
		Encoder failure	Check whether the encoder is damaged or the wiring is correct.
		Driver board detection circuit error	Replace the driver board
25	Fan Detection Fault	Fan is operating normally	This fault detection can be temporarily disabled if necessary.
		Fan cannot operate	Contact the technician to replace the fan
26	Encoder not trained	Encoder not trained	If open-loop operation is required, please power cycle the device; for closed-loop operation, please re-learn the encoder.
27	Output overcurrent (effective value)	Too much time running in overload state, the greater the load, the shorter the time	Stop running for a while. If it appears again after running, check whether the load is within the allowable range.
		Motor stall	Check the motor or brake
		Motor coil short circuit	Check the motor
		Output short circuit	Check wiring or motor
29	Abnormal busbar fluctuation	Abnormal input voltage	Check the grid voltage
		Input voltage phase loss	

Fault Code	Fault display	Possible causes	right policy
		The input side terminal is loose	Check the input terminal wiring
		Rectifier module damaged	Check whether the rectifier module is damaged
30	Overspeed protection (exceeding the maximum speed protection limit)	Encoder parameter settings are incorrect or interfered with	Check the encoder circuit
		Load mutation	Check external causes of load mutation
		Overspeed protection parameter setting error	Check parameters
31	Motor I^2T overcurrent	Low grid voltage	Check the input power
		Load mutation during operation	Reduce the frequency and amplitude of load mutations
		The motor parameter settings are abnormal.	Correctly set motor parameters
		Encoder parameter settings are incorrect or interfered with	Check the encoder circuit
32	Grounding protection	Wiring error	Refer to the user manual for instructions and correct incorrect wiring
		Motor abnormality	Before replacing the motor, an insulation test to ground is required.
		The ground leakage current on the inverter output side is too large	Ask professional technicians to perform maintenance
34	External fault	There is an external input fault signal	Check the external fault cause
35	PT detection failure	PT detection signal exceeds the set threshold	Check whether the motor temperature is too high or the PT sensor is abnormal.
36	Motor fan malfunction	Motor cooling fan failure	Check whether the wiring of the motor cooling fan is correct and determine whether the motor cooling fan is damaged.
37	Current sensor failure	Driver board hardware failure	Ask professional technicians to perform maintenance
38	Brake short circuit fault	Internal structural defects in the resistor (such as poorly welded resistor wires or cracks in the insulation), environmental humidity or dust leading to insulation degradation, brake unit failure or DC bus overvoltage, as well as incorrect wiring during installation, can all cause short circuits.	This fault generally occurs in inverters below 30kW. 1. Check if the braking resistor is short-circuited. 2. For some programs that have functions but no braking unit, check if the input voltage is too high.
39	The instantaneous current value is too large	Alarm when the instantaneous value of three-phase current is too large when Ia, Ib, and Ic are not running	Ask professional technicians to perform maintenance

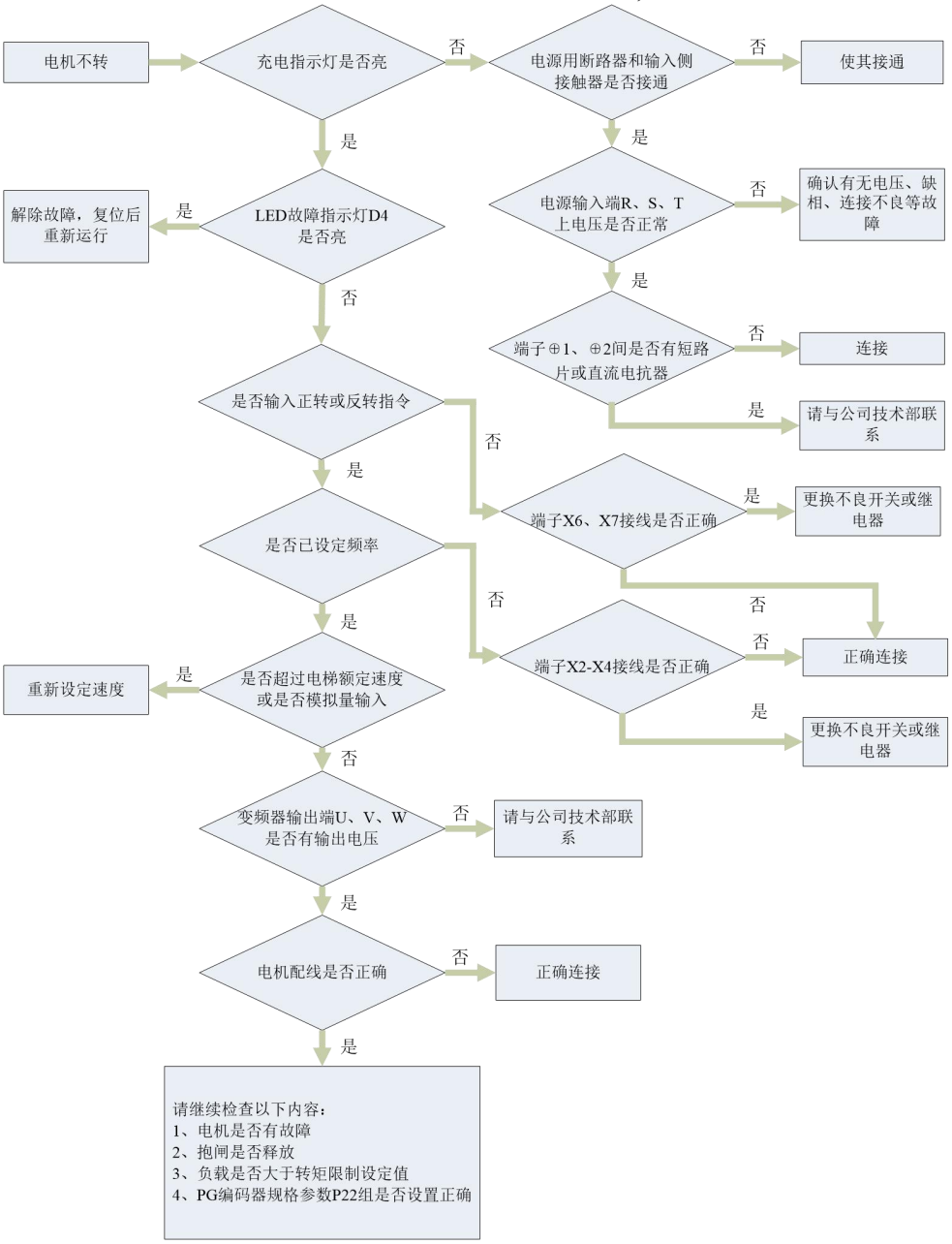
Fault Code	Fault display	Possible causes	right policy
42	Brake IGBT short-circuit protection	braking resistor is short-circuited.	Ask professional technicians to perform maintenance
43	Communication failure	Communication disconnection No communication data was received within a fixed time	Check the communication signal line
44	Driver board communication failure	the main control board and the driver board is abnormal	Check whether the driver board cable is connected properly
45	I^2t instantaneous value overcurrent	IGBT overheating	Ask professional technicians to perform maintenance
47	Analog input abnormality	Analog input signal disconnected Analog input signal abnormality	1. Modify relevant parameters 2. Check the analog input signal
48	Power ID failure	Driver board program abnormality	Check whether the driver board is updating the program normally or whether the driver board chip is working properly
49	Wave- by-wave current limiting fault	Abnormal load Drive control abnormality	Check whether the load or motor control is abnormal
51	Abnormal output current during operation	Improper parameter settings The line from the inverter to the motor is broken Inverter hardware failure	Check parameter P70.21 Check the connection cables Ask professional technicians to perform maintenance
54	Grid imbalance fault	Abnormal grid voltage The driver board sampling circuit is abnormal	The grid voltage imbalance is too large Circuit sampling abnormality
55	Grid phase sequence fault	Input wiring abnormality	Adjust the input wiring sequence
56	Grid undervoltage fault	Grid voltage is lower than 300V	Grid voltage is too low Driver board communication abnormality
57	Grid overvoltage fault	The grid voltage is higher than 540V	Grid voltage is too high Driver board communication abnormality
58	Profinet communication failure	Communication disconnected No communication data received within the fixed time	Check the communication signal line
59	Hardware version mismatch	Hardware version mismatch	Contact the technical team to check the P95 version parameters and match the correct parameters.

8.2 Troubleshooting Process

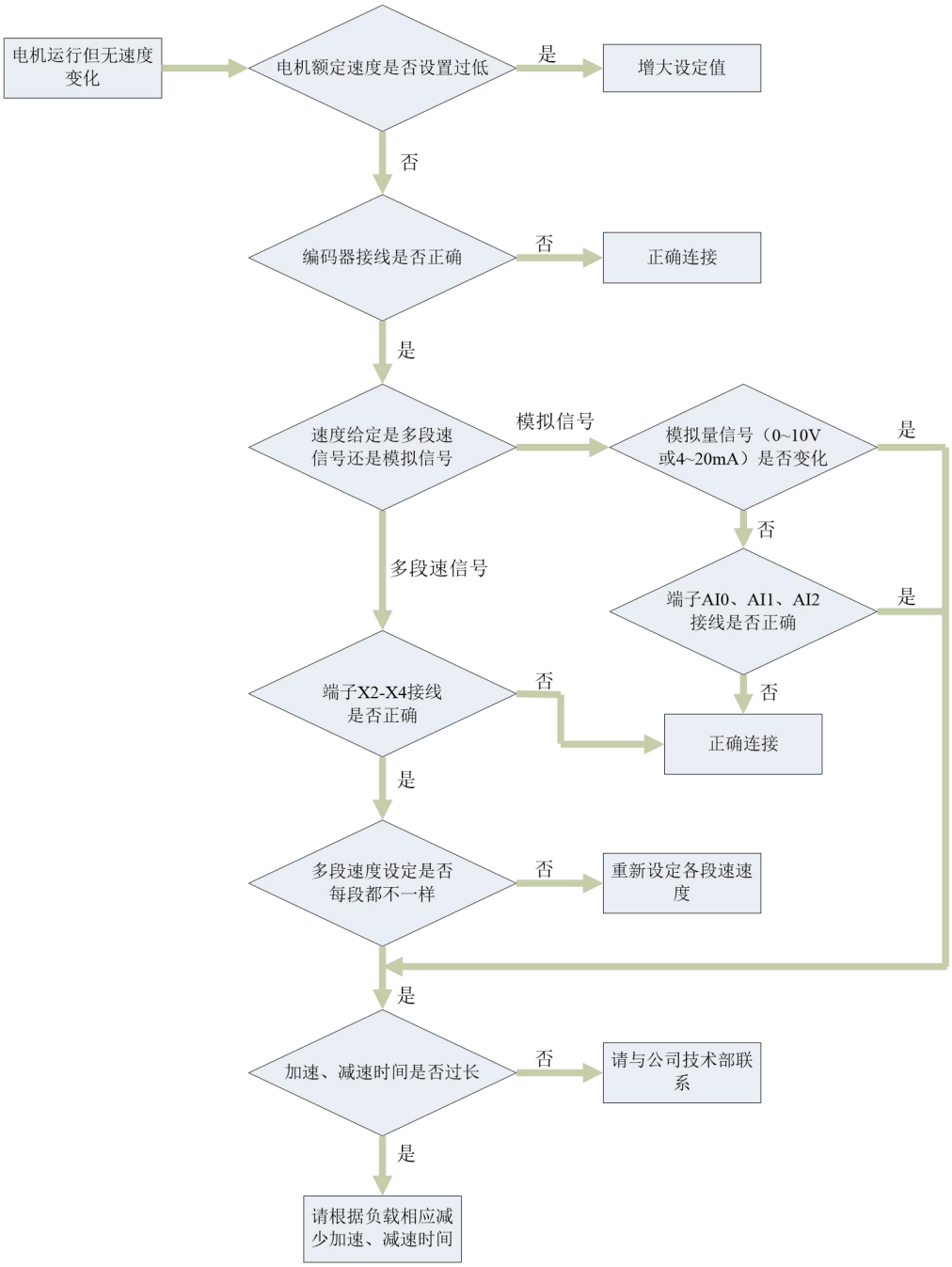
When the system is started, the inverter and motor may not operate according to the settings due to errors in parameter settings and wiring. In this case, please refer to the fault diagnosis process described in this section for analysis and treatment.

【 Abnormal motor operation 】 :

■ When there is a run command on the control terminal, the motor does not rotate:



■ The motor runs but there is no speed change:



Chapter 9 Care and Maintenance

This chapter gives general information on care and maintenance.

◎ Maintenance operations should be performed 10 minutes after disconnecting the input power supply. At this time, the charging indicator light is completely off or the DC bus voltage is below 24VDC.

Otherwise there is a risk of electric shock.

◎ Never modify the inverter by yourself.

Otherwise there is a risk of electric shock or personal injury.

◎ Please have professional electrical engineers perform maintenance operations. It is strictly forbidden to leave wire ends or metal objects inside the inverter.

Otherwise there is a risk of fire.

◎ Do not change or disconnect the wiring terminals while the power is on.

Otherwise there is a risk of electric shock.

9.1 Warranty Period

The company will provide warranty service if the inverter (main body) has the following situations:

Under normal use, if a malfunction or damage occurs, the manufacturer is responsible for the warranty within the warranty period (18 months from the date of shipment); reasonable repair fees will be charged if the warranty period is exceeded.

However, if the failure is caused by the following reasons, a certain fee will be charged even within the warranty period:

1) Problems caused by not using the inverter in accordance with the instruction manual or repairing or modifying the inverter without permission.
2) Problems caused by using the inverter beyond standard specifications.
3) Damage caused by being dropped after purchase or during transportation.
4) Damage caused by earthquake, fire, flood, lightning strike, abnormal voltage or other natural disasters and disaster-related causes.

9.2 Product Inquiry

If you find any damage, malfunction or other problems with the product, please contact our office or after-sales service department regarding the following items.

1. Inverter model

2. Production serial number
3. Purchase date

Issues that require contact include: damage, unclear issues, and malfunctions that have occurred.

9.3 Daily Inspection

The inverter housing should not be removed when it is powered on and running. Visually inspect the inverter from the outside to see if it is operating normally. The following points can be checked daily:

1) Whether the surrounding environment meets standard specifications;
2) Whether the operating performance meets the standard specifications;
3) Are there any unusual noises, vibrations, and anomalies?
4) Whether the cooling fan installed on the inverter is operating normally;
5) Is there any overheating?

9.4 Regular Inspection

During regular inspections, first stop the unit, disconnect the power supply, and remove the outer casing. At this point, the main circuit energy storage capacitors are still charged, and discharging requires time. Therefore, wait until the charging indicator light turns off and use a multimeter to test the DC bus voltage to ensure it is below the safe value (DC 24V or less) before proceeding with the inspection.

There is a risk of electric shock if you touch the terminals immediately after turning off the power.

The regular inspection items are shown in Table 9.1.

Table 9.1 Regular inspection items

Inspection section		Inspection items	Inspection method	Judgment criteria
Operating Environment		1） Check the ambient temperature, humidity, vibration, and the presence of dust, corrosive gases, oil mist, water droplets, etc. 2） Are there any dangerous goods around?	1） Visual inspection, thermometer, hygrometer 2） Visual inspection	1) The ambient temperature is lower than 40 °C. Humidity and other requirements meet the environmental requirements. 2) No dangerous goods
LCD		1） Is the LCD display clear and the backlight even? 2） LCD display is missing characters	Visual inspection	1） Uniform backlight 2） Display normal
Connectors Terminals, bolts		1) Are the bolts loose? 2) Is the connector loose?	1) Tighten 2) Visual inspection	1) No abnormalities 2) Secure installation
Main circuit	wire	1） Whether the protective layer is cracked and discolored 2） Is the shape of the connecting copper bus deformed?	Visual inspection	No abnormalities
	Electromagnetic contactors, relays	1) Is there any vibration sound during operation? 2) Whether the contacts are in contact and attracted	Hearing and visual inspection	1） none 2） There is a sound of contact closing

Inspection section		Inspection items	Inspection method	Judgment criteria
	Energy storage electrolytic capacitors	1) Check for leakage, discoloration, cracks, and shell expansion 2) Is the safety valve out and is the valve body significantly expanded?	Visual inspection	No abnormalities
	heat sink	1） Is dust accumulated? 2） Check whether the fan duct is blocked or has foreign matter attached to it.	Visual inspection	No abnormalities
	cool down fan	1） Is there any abnormal noise? 2） Is there any abnormal vibration? 3） Is the color or deformation caused by overheating?	1） Listen, visually inspect, and manually turn the fan blades after cutting off the power supply. 2） Visual inspection 3） Visual inspection, smell	1） Smooth rotation 2) and 3) No abnormalities
Control circuit	connect plugins	Check whether there is dust or foreign matter on the double-row connecting plug-in between the control board and the main circuit.	Visual inspection	No abnormalities
	Control Panel	1） Check whether the control circuit board has discoloration or odor 2） Check whether the circuit board has cracks, damage or deformation	1） Visual inspection, smell 2） Visual inspection	No abnormalities

Appendix A Inverter EMC Installation Guide

EMC design and installation from the aspects of noise suppression, wiring requirements, grounding, external device surge absorption, leakage current, installation area division and installation precautions, use of power supply filters, and radiated noise treatment for the reference of inverter users.

A.1 Noise Suppression

The working principle of the inverter determines that it will generate a certain amount of noise. The impact of this noise on peripheral equipment is related to factors such as the noise type, noise propagation path, and the design, installation, wiring, and grounding of the transmission system.

A.1.1 Noise Type

The noise type is shown in Figure A-1.

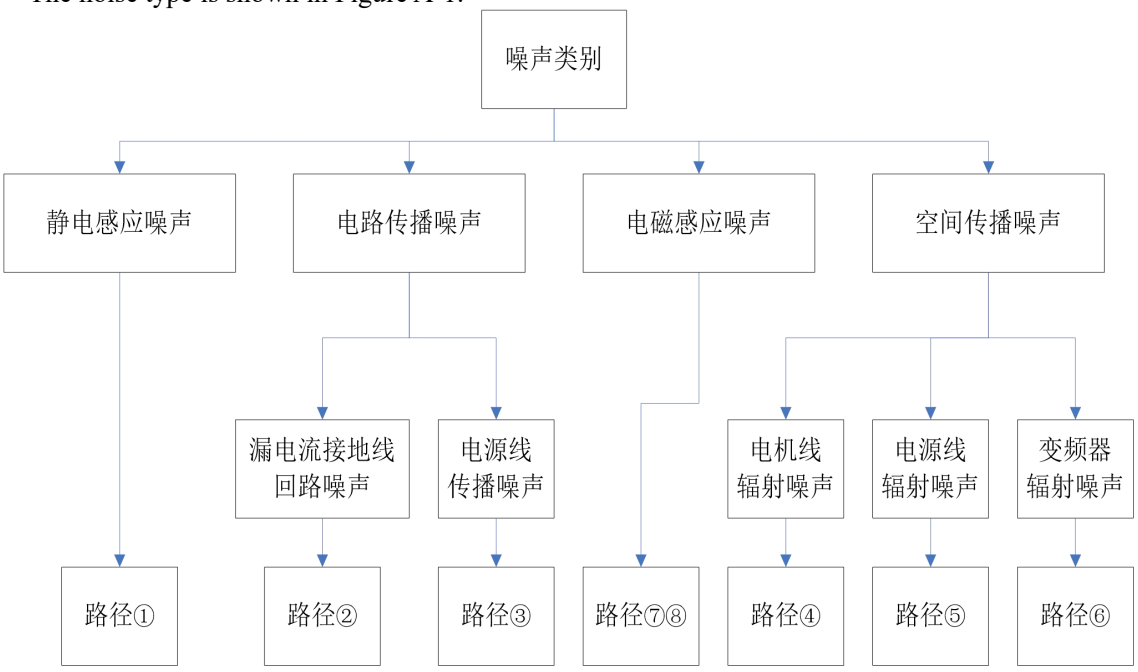


Figure A- 1 Schematic diagram of noise types

A.1.2 Noise propagation pathways

The noise propagation path is shown in Figure A-2.

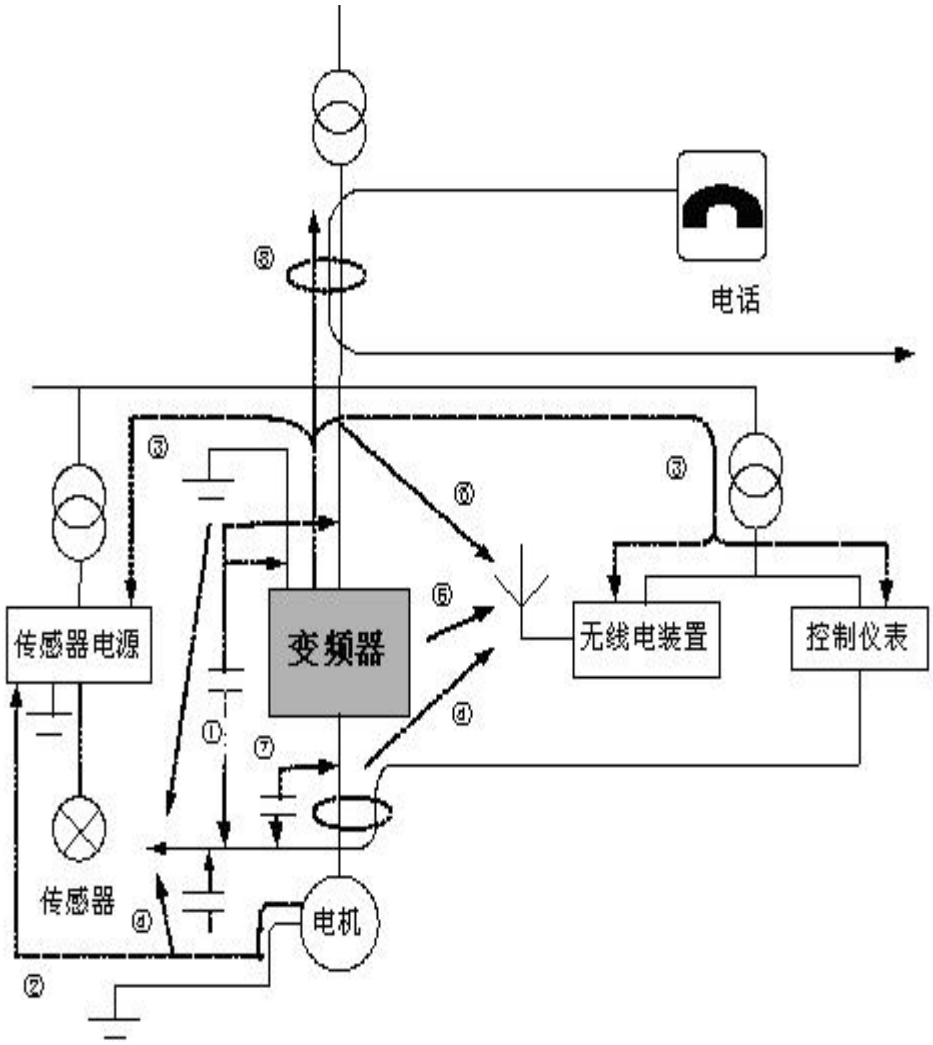


Figure A-2 Schematic diagram of noise propagation

A.1.3 Basic noise suppression strategies

The basic countermeasures for noise suppression are shown in Appendix A.1.

Schedule A.1 Basic measures for noise suppression

serial number	reason	Countermeasures
① ⑦ ⑧	If signal lines are routed in parallel with power lines or bundled with power lines, noise will propagate through the signal lines due to electromagnetic induction and electrostatic induction, causing peripheral devices to malfunction.	1. Avoid running signal lines and power lines in parallel or bundling them into bundles; 2. Keep susceptible peripheral equipment as far away from the inverter as possible; 3. Keep the susceptible signal lines as far away from the input and output cables of the inverter as possible; 4. Use shielded cables for signal and power lines. If they are placed in metal tubes respectively, the effect will be better (the distance between the metal tubes should be at least 20 cm).
②	When peripheral devices form a closed loop through the inverter's wiring, leakage current from the inverter's ground wire may cause the peripheral devices to malfunction.	At this time, if the peripheral equipment is not grounded, the malfunction caused by the leakage current will be eliminated.
③	When peripheral devices and inverters share the same power supply system, the noise generated by the inverter is transmitted along the power line, which may cause other peripheral devices connected to the system to malfunction.	Install a noise filter at the input end of the inverter, or use an isolation transformer/power filter to isolate other peripheral devices from noise.
④ ⑤ ⑥	If peripheral equipment such as control computers, measuring instruments, radio devices, sensors and other weak current equipment and their signal lines are installed in the same control cabinet as the inverter and the wiring is very close to the inverter, malfunctions may occur due to radiation interference.	1. Install vulnerable peripheral devices and their signal cables as far away from the inverter as possible. Use shielded cables for signal cables, and ground the shield. Enclose signal cables in metal conduits and keep them as far away from the inverter and its input and output cables as possible. If signal cables must pass through the inverter's input and output cables, ensure they are orthogonal. 2. Install radio noise filters or linear noise filters (ferrite common mode chokes) on the input and output sides of the inverter to suppress noise radiation from the input and output cables of the inverter; 3. The cable from the inverter to the motor should be placed in a thick shield. This can be placed in a pipe with a thickness of at least 2mm or buried in a cement tank. The cable should be enclosed in a metal pipe and the shield should be grounded. (The motor cable can be a 4-core cable, with one core grounded on the inverter side and the other connected to the motor housing.)

A.2 Wiring requirements

A.2.1 Cable laying requirements

To avoid mutual interference and coupling, the control signal cables should be laid separately from the power cables and motor cables, and ensure that there is sufficient distance between them and they are as far as possible, as shown in Figure A-3 (a) ; when the control signal cable must cross the power cable or motor cable, the two should ensure orthogonal crossing, as shown in Figure A-3 (b) .

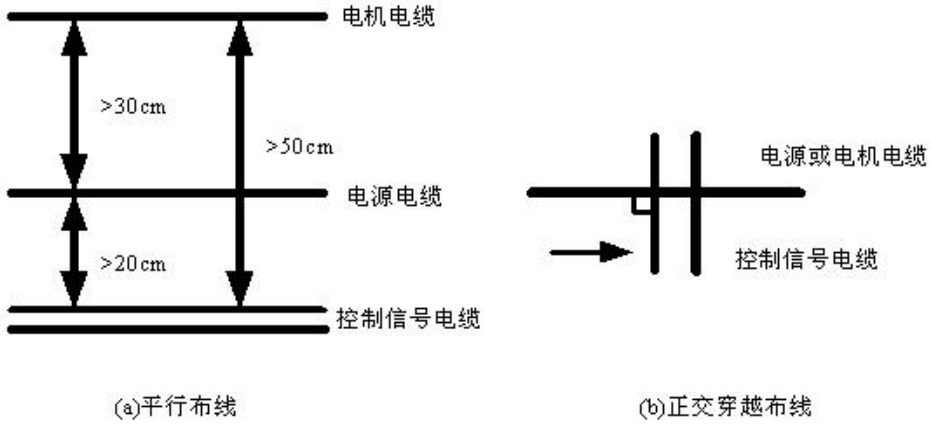


Figure A-3 Wiring Requirements

A.2.2 Cable cross-sectional area requirements

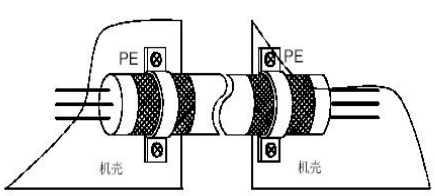
Since the larger the cross-sectional area of the cable, the greater the capacitance to ground and the greater the ground leakage current, if the cross-sectional area of the motor cable is too large, it should be derated to reduce the output current (the current decreases by 5% for every increase in cross-sectional area).

A.2.3 Requirements for shielded cables

High-frequency low-impedance shielded armored cables should be used, such as woven copper wire mesh or aluminum wire mesh.

A.2.4 Requirements for shielded cable installation

Control cables should generally be shielded cables, and the shielded wire mesh must be connected to the metal chassis using a 360 ° loop connection through cable clamps at both ends, as shown in Figure A-4. The shield grounding method in Figure A-5 is incorrect.



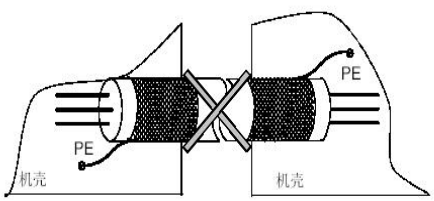


Figure A-4: Correct shield grounding method Figure A-5: Incorrect shield grounding method

A.3 Grounding

A.3.1 Grounding method

For the grounding method of the grounding electrode, please refer to Figure A-6.

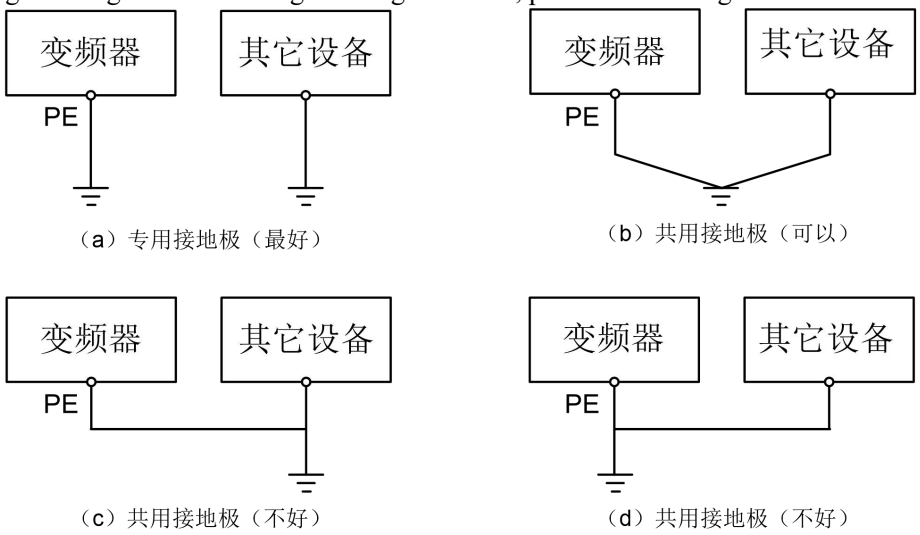


Figure A-6 Schematic diagram of dedicated grounding electrode

Among the four grounding methods in the figure above, (a) is the best grounding method and it is recommended that users use this method whenever possible.

A.3.2 Grounding Connection Precautions

⑴ Grounding cables with standard cross-sections should be used whenever possible to ensure that the grounding impedance is as small as possible; since the high-frequency impedance of flat cables is smaller than that of round conductors, it is better to use flat cables with the same cross-sectional area.

⑵The grounding cable should be as short as possible and the grounding point should be as close to the inverter as possible.

⑶ If a four-core cable is used for the motor line, one of the four-core cables must be grounded on the inverter side, and the other side must be connected to the ground terminal of the motor; if the motor and inverter each have a dedicated grounding electrode, the best grounding effect can be obtained.

⑷ When the grounding terminals of various components in the control system are connected together, the noise source formed by the ground leakage current will affect other peripheral devices in the control system except the inverter; therefore, in the same control system, the grounding of the inverter and weak-current equipment such as computers, sensors or audio equipment should be separated and cannot be connected together.

⑸ To obtain lower high-frequency impedance, the fixing bolts of each device can be used as high-frequency terminals connected to the rear panel of the cabinet. Please be sure to remove the insulating paint at the fixing points during installation.

⑹ The grounding cable should be laid away from the I/O wiring of noise-sensitive equipment, and the grounding wire should be as short as possible.

A.4 Installing a surge absorber

Even if relays, contactors, electromagnetic brakes and other devices that generate a lot of noise are installed outside the inverter chassis, surge suppressors must be installed, as shown in Figure A-7.

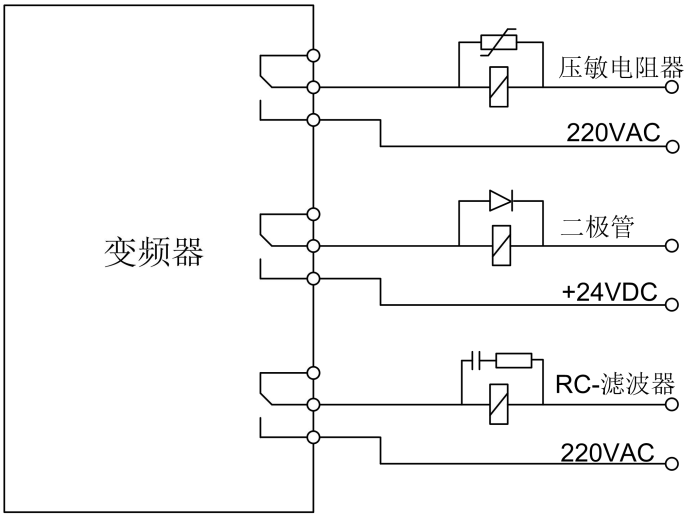


Figure A-7 Requirements for the use of relays, contactors, and electromagnetic brakes

A.5 Leakage Current and Countermeasures

Leakage current flows through the line capacitance and motor capacitance on the input and output sides of the inverter, including ground leakage current and line-to-line leakage current, as shown in Figure A-8. The magnitude of the leakage current depends on the carrier frequency and capacitance.

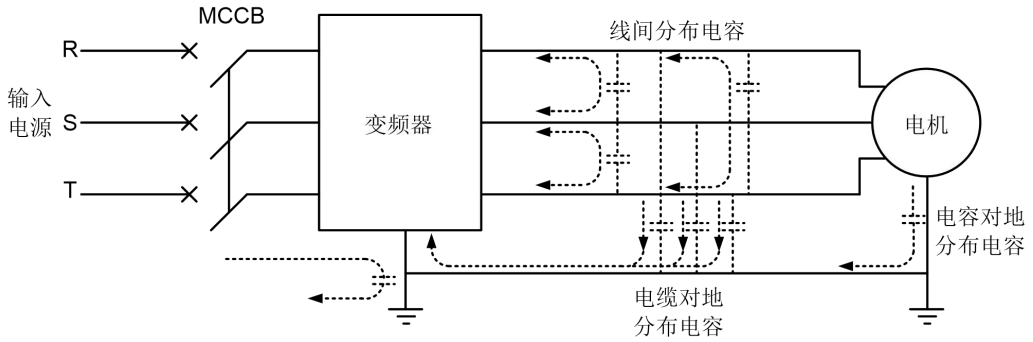


Figure A-8 Leakage current path

A.5.1 Earth leakage current

Ground leakage current not only flows into the inverter but can also flow into other equipment through the ground wire. This can cause leakage circuit breakers, relays, or other equipment to malfunction. The higher the inverter carrier frequency and the longer the motor cable, the greater the leakage current.

Suppression measures: Reduce the carrier frequency; shorten the motor cable as much as possible; use a leakage circuit breaker designed specifically for leakage currents of high harmonics / surges.

A.5.2 Line leakage current

The leakage current flowing through the distributed capacitance between the cables on the inverter output side and its higher harmonics may cause the external thermal relay to malfunction. When the wiring is very long (over 50m), the leakage current increases, which can easily cause the external thermal relay to malfunction.

Suppression measures: Reduce the carrier frequency; install an AC output reactor on the output

side; it is recommended to use a temperature sensor to directly monitor the motor temperature, or use the inverter's own motor overload protection function electronic thermal relay instead of the external thermal relay.

A.6 Suppression of Radiated Emissions of the Inverter

Frequency converters are typically installed in metal control cabinets. Instruments and equipment outside the metal cabinet are minimally affected by the frequency converter's radiated emissions; external connection cables are the primary source of these emissions. Because the frequency converter's power cables, motor cables, control cables, and keyboard cables all need to be routed outside the shielded cabinet, special treatment should be applied at the exit point to prevent the shielding from becoming ineffective.

In Figure A-9, the cables inside the shielded cabinet act as antennas, receiving the noise radiation inside the cabinet, transmitting it outside the shielded cabinet through the cables, and then radiating it into space. In Figure A-10, the cable shield is connected to the shielded chassis ground at the outlet, so that the noise radiation received by the cables inside the cabinet flows directly into the ground through the shielded shell, thereby eliminating the impact on the outside world.

When using the shield grounding method shown in Figure A-10, the cable shield should be connected to the chassis ground as close to the outlet as possible. Otherwise, the cable segment from the grounding point to the outlet will act as an antenna for coupling. The distance between the noise grounding point and the outlet should be at least 15 cm, and the closer the distance, the better.

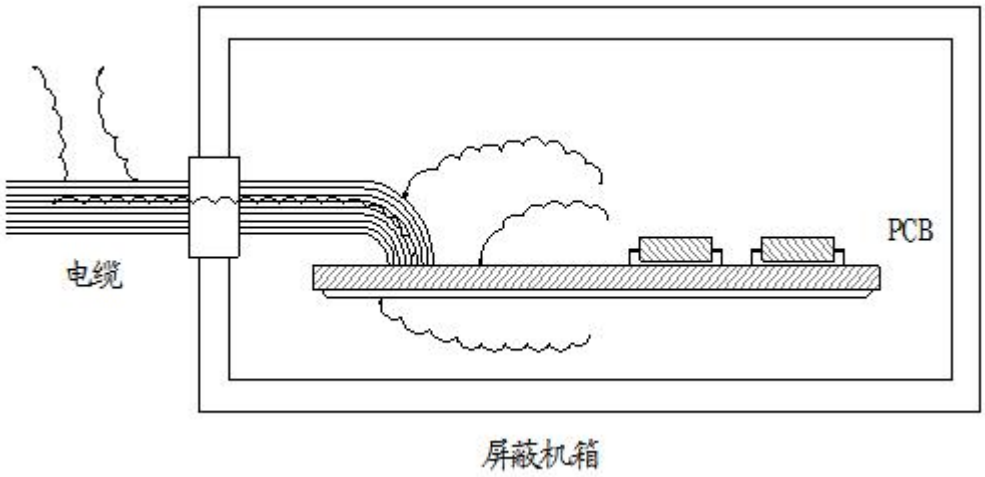


Figure A-9: Radiation caused by cables leading out of the shielded cabinet

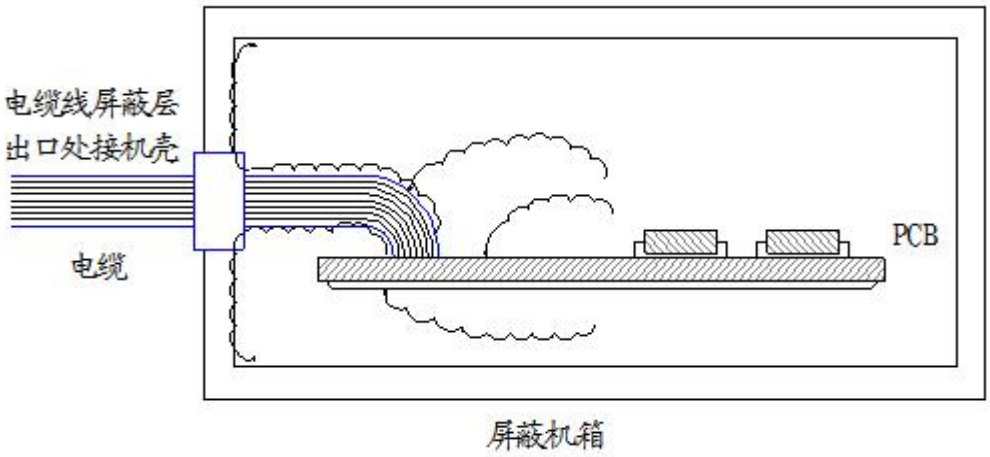


Figure A-10: Suppression of radiation by connecting the cable shield to the shielded chassis ground

A.7 Power Line Filter Usage Guide

Power line filters can be used for devices that can generate strong interference and devices that are sensitive to external interference.

A.7.1 Function of power line filter

（1）The power line filter is a bidirectional low-pass filter that only allows DC and 50Hz power frequency current to pass through, and does not allow higher frequency electromagnetic interference current to pass through. Therefore, it not only suppresses the electromagnetic interference generated by the equipment itself from entering the power line, but also suppresses interference on the power line from entering the equipment.

(2)The power line filter can make the equipment meet the requirements of the electromagnetic compatibility standards of conducted emission and conducted sensitivity, and it can also suppress the radiated interference of the equipment.

A.7.2 Power Line Filter Installation Precautions

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

(2) If the input and output lines of the filter are laid too close to each other, high-frequency interference will bypass the filter and directly couple through the input and output lines of the filter, rendering the power filter ineffective.

(3) The filter housing typically has a dedicated grounding terminal. However, if a single wire is used to connect the filter grounding terminal to the cabinet housing, the high-frequency impedance of the long wire will prevent effective bypass, rendering the filter useless. The correct installation method is to attach the filter housing to a conductive surface on the metal chassis, ensuring the largest possible contact area. During installation, be sure to remove the insulating paint to ensure good electrical contact.

A.8 EMC installation area division for inverters

In a drive system consisting of an inverter and a motor, the inverter and peripheral equipment such as control devices and sensors are typically installed in the same control cabinet. Interference generated by the control cabinet to the outside world can be suppressed at the main contacts. Therefore, a radio noise filter and an AC line reactor should be installed at the incoming line to the control cabinet. To meet EMC requirements, electromagnetic compatibility should also be achieved within the control cabinet.

In a drive system consisting of an inverter and motor, the inverter, brake unit, and contactor are all strong noise sources, which can affect the normal operation of noise-sensitive peripherals such as automation devices, encoders, and sensors. Installing each peripheral device in a different EMC zone based on its electrical characteristics can spatially isolate noise sources and noise receivers, which is the most effective way to reduce interference.

EMC installation area division of the inverter is shown in Figure A-11.

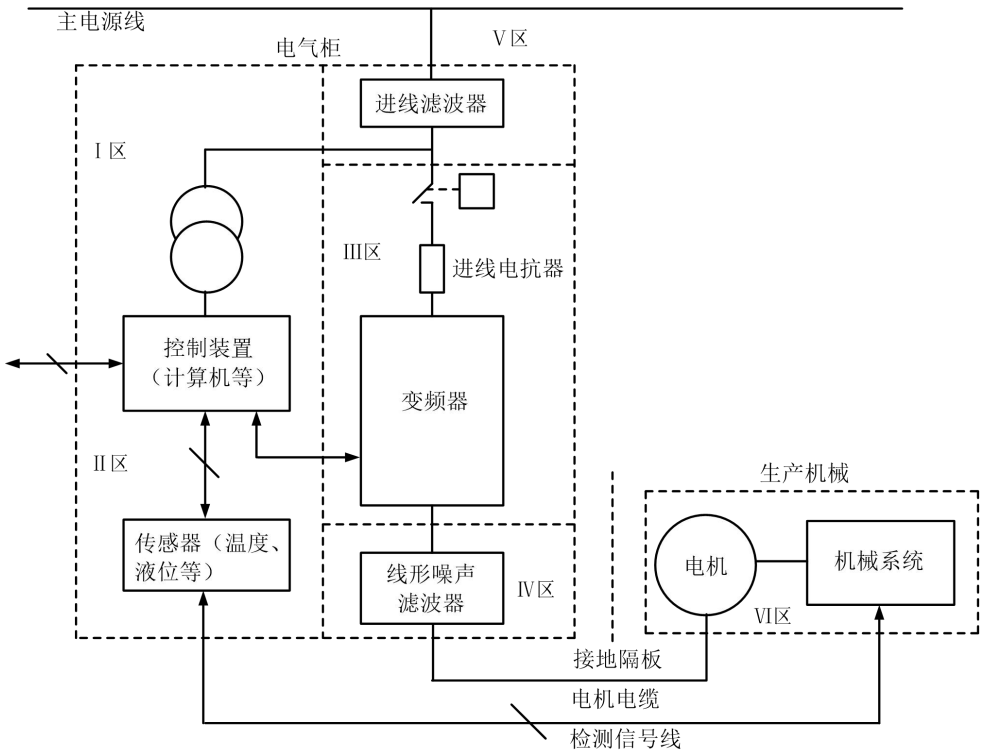


Figure A-11 Schematic diagram of the inverter EMC installation area

The above installation area division is described as follows:

Zone I: Control power transformers, control devices and sensors, etc.

Zone II: Control signals and their cable interfaces are required to have a certain degree of immunity to interference.

Zone III: Main noise sources such as incoming line reactors, inverters, brake units, and contactors.

Area IV: Output noise filter and its wiring part.

Zone V: Power supply (including the radio noise filter wiring part).

Zone VI: Electric motors and their cables.

Each area should be isolated, with a minimum spacing of 20 cm between each area to achieve electromagnetic decoupling; it is best to use grounded partitions to decouple each area, and cables from different areas should be placed in different cable ducts; when filters are required, they should be installed at the interfaces between areas; all bus cables (such as RS485) and signal cables leading out of the cabinet must be shielded.

A.9 Precautions for inverter electrical installation

The electrical installation of the inverter is shown in Figure A- 12 :

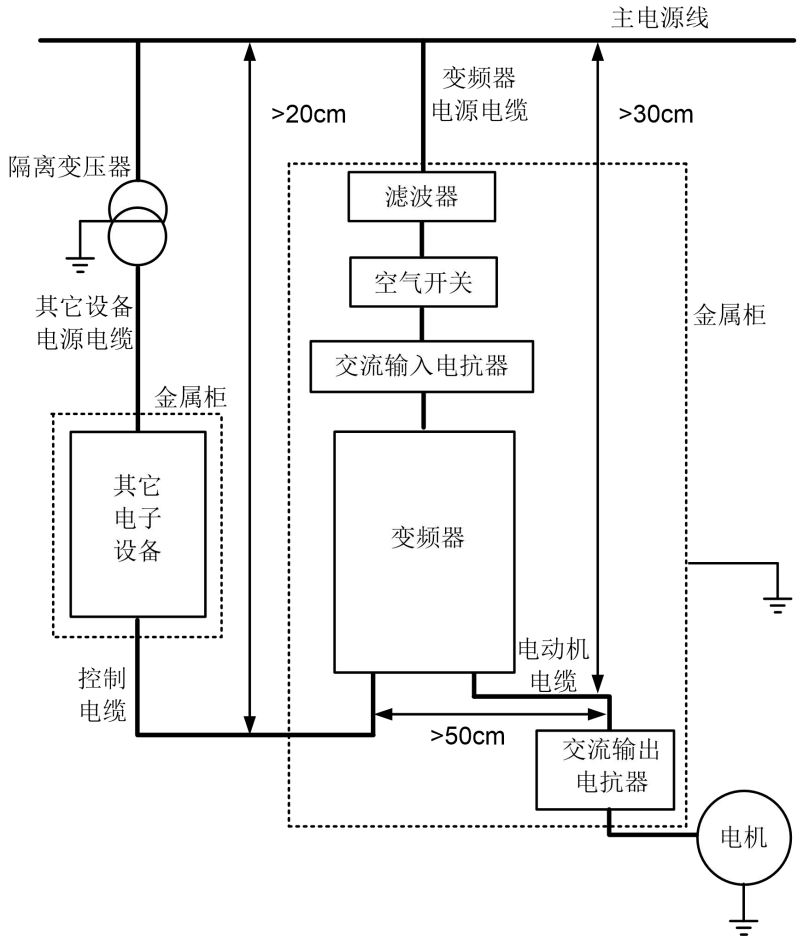


Figure A-12 Schematic diagram of inverter electrical installation

To meet EMC requirements, please note the following during installation:

(1) The inverter should be installed in the cabinet. The inverter base plate and the housings of peripherals such as the input filter should be fixed to the back panel of the control cabinet to ensure good electrical contact with the back panel. The distance between the inverter and the filter should be as short as possible, less than 15cm, which can minimize the high-frequency impedance of the ground wire between the inverter and the input filter and reduce high-frequency noise.

(2) Install a wide grounding bar at the entrance of the control cabinet (no more than 5 cm away from the exit). The shielding layers of all cables entering and leaving the cabinet are fixed to the grounding bar. The connection method uses a 360° loop connection to ensure good electrical contact.

(3) The motor cable must be shielded, preferably with a double shield consisting of a spiral metal tape and a metal mesh. At the inverter end, the motor cable shield must be secured to the cabinet backplane using a metal cable clamp using a 360° loop (see Figure A.4). Two mounting locations should be used: one as close to the inverter as possible, preferably less than 15 cm away; the other to the grounding bar. At the motor end, the motor cable shield should be grounded to the motor metal casing using a 360° loop when passing through the motor terminal box. If this is difficult, the shields can be twisted into a braid, flattened, and connected to the motor ground terminal. The flattened width should be greater than one-fifth the braid length. The motor cable core wire and its PE pigtail lead should be as short as possible, preferably less than 5 cm.

(4) Shielded cables must be used for terminal control cables. The shield must be connected to the grounding bus at the cabinet entrance, using metal cable clamps for a 360° loop connection. At the inverter end, the shield can be secured to the inverter's metal casing using metal cable clamps. If this

is difficult, twist the shields into a wide, short braid, flatten it, and connect it to the inverter's PE terminal. The exposed portion of the cable core and the PE braid lead should be as short as possible , preferably less than 15 cm .

⑸ The keyboard cable cannot pass through the shielded cabinet.

⑹ The size of the holes in the shielding cabinet should be as small as possible, and the maximum length should not exceed 15cm .

A.10 EMC standards met by intelligent flexible inverters

After the intelligent flexible inverter is installed with appropriate input and output filters and AC reactors (see "Optional Accessories" for filter and reactor models) and connected according to the above precautions, the EMC standards that can be met are shown in Appendix A.2.

Appendix A.2 Summary of EMC performance of intelligent flexible inverter

project	Meet the standards	Meet standard level
Conducted disturbance emission	EN12015.1998	$0.15 \le f < 0.50MHz$,$100dB(\mu v/m)$准峰值 $0.50 \le f < 5.0MHz$,$86dB(\mu v/m)$准峰值 $5.0 \le f < 30MHz$,$90 \sim 70dB(\mu v/m)$准峰值
Radiated disturbance emission	EN12015.1998	$30 \le f < 230MHz$,$40dB(\mu v/m)$准峰值 $230 \le f < 1000MHz$,$47dB(\mu v/m)$准峰值
Electrostatic discharge immunity	EN12016.2004	Criterion B (contact discharge 4000V, air discharge 8000V)
Radiated electromagnetic field immunity	EN12016.2004	Level 3 criterion A (3V/m)
Fast transient electrical pulse immunity	EN12016.2004	Level 4 criterion B (high voltage terminal ±2KV/2.5kHz)
Surge immunity	EN12016.2004	Criterion B (±1KV)
Conducted Immunity	EN12016.2004	Criterion A (3V, 0.15～80MHz)

Appendix B Standards that the inverter complies with

European Low Voltage Directive

Intelligent flexible inverter products meet the requirements of EN61800-5-1:2007 standard and thus comply with the Low Voltage Directive (2006/95/EC).

The inverter also complies with the following standards:

EN61800-5-1: 2007: Adjustable speed electrical powerdrive systems –Part 5-1:Safetyrequirements –Electrical, thermal and energy

1. European EMC Directive

When you install the product according to the recommendations in this manual, the intelligent flexible inverter complies with the following EMC standards:

EN12015.1998 Electromagnetic compatibility-Product family standard for lifts, escalators and passenger conveyors-Emission.

EN12016.2004 Electromagnetic compatibility-Product family standard for lifts, escalators and passenger conveyors-Immunity.

EN61800-3:2004: Adjustable speed electric power drive systems Part D 3

ISO9001 quality management system

Shanghai Sigriner STEP Electric Motor Co., Ltd. manages its quality management system in accordance with **ISO9001 standards.**

Appendix C Modbus Communication Protocol

Inverter with Modbus address set to hexadecimal:

Register Modbus address = register address + 0x999A

Register bit Modbus address = register address * 16 + bit number n (n = 0, … , 15)

The Modbus address of the inverter parameter = the parameter number expressed in hexadecimal (for example, the Modbus address of parameter P10.23 is 0x1023)

Inverter with Modbus address set to decimal:

Register Modbus address = register address + 10000

Register bit Modbus address = register address * 16 + bit number n (n = 0, … , 15)

the parameter number expressed in decimal (e.g. the Modbus address of parameter P10.23 is 1023 in hexadecimal)

C.1 Instruction data [Register 3, 6] [Bit 1, 5]

To read the registers in this table, use function code 3; to write the registers in this table, use function code 6.

To read the bits in this table, use function code 1; to write the bits in this table, use function code 5.

Register address	content
0000H	Communication control word bit0 1: Forward 0: Invalid bit1 1: Reverse 0: Invalid bit2 1: Run 0: Stop bit3 Reserved (1: There is an external fault) bit4 1: Reset fault instruction Bit7~5 Reserved (Multi-speed selection # Appendix Z-1) bit8 Reserved (1: Jog frequency valid#) Bit10~9 acceleration/deceleration time selection 0: Curve 1 1: Curve 2 bit11 reserved (1: base blocking#) bit12 1: Select operation and given command 2 0: Select operation and given command 1 bit13 1: Select PID parameter group 2 0: Select PID parameter group 1 Bits 15~14 are not used*

Register address	content
0001H	Modbus target frequency given value communication given value 0~30000: 0.00~300.00Hz
0002H	Reserved (modbus current frequency setting value) IQ10(1.0): Rated frequency
0003H	Reserved (Modbus PID given value) 10000 corresponds to 100% of the given amount
0004H	Reserved (Modbus PID target value validity 1: valid 0: invalid)
0005H	Reserved (AO1 output value) -1024~1024: -5.00~5.00V
0006H	Reserved (AO2 output value) -1024~1024: -5.00~5.00V
0007H	Multi-function port output # bit0 1: DO0 (Relay A) ON 0: OFF bit1 1: DO1 (relay B) ON 0: OFF bit2 1: DO2 ON 0: OFF bit3 1: DO3 ON 0: OFF bit4 1: DO4 (OC) ON 0: OFF bit5 1: DO5 (OC) ON 0: OFF bit6 unused bit7 unused bits 15~8 are not used ***#Terminal output actual value = Modbus set value | internal output value of the function terminal***
0008H	Reserved (Modbus broadcast data validity) bit0 1: Terminal DI0 Modbus broadcast setting is valid 0: Invalid bit1 1: Terminal DI1 Modbus broadcast setting is valid 0: Invalid bit2 1: Terminal DI2 Modbus broadcast setting is valid 0: Invalid bit3 1: Terminal DI3 Modbus broadcast setting is valid 0: Invalid

Register address	content
	bit4 1: Terminal DI4 Modbus broadcast setting is valid 0: Invalid bit5 1: Terminal DI5 Modbus broadcast setting is valid 0: Invalid bit6 1: Terminal DI6 Modbus broadcast setting is valid 0: Invalid bit7 1: Terminal DI7 Modbus broadcast setting is valid 0: Invalid bit8 unused bit9 unused bit10 1: Target frequency broadcast given value is valid 0: Invalid bit11 1: Current frequency broadcast given value is valid 0: Invalid bit12 1: The broadcast given value of the running command (forward, reverse, start and stop command) is valid bits 15~13 are not used
0009H	Reserved (target frequency broadcast given value)
000AH	Reserved (current frequency broadcast given value)
000BH	Reserved (running signal broadcast given value) Bit0 Terminal DI0 Modbus broadcast given value # (the corresponding specific function is set by the parameter) Bit1 Terminal DI1 Modbus broadcast given value # (the corresponding specific function is set by the parameter) Bit2 Terminal DI2 Modbus broadcast given value # (the corresponding specific function is set by the parameter) Bit3 Terminal DI3 Modbus broadcast given value # (the corresponding specific function is set by the parameter) bit4 Terminal DI4 Modbus broadcast given value # (the corresponding specific function is set by the parameter) bit5 Terminal DI5 Modbus broadcast given value # (the corresponding specific function is set by the parameter) bit6 Terminal DI6 Modbus broadcast given value # (the corresponding specific function is set by the parameter)

Register address	content
	bit7 Terminal DI7 Modbus broadcast given value # (the corresponding specific function is set by the parameter) bit8 unused bit9 unused bit10 1: Forward 0: Invalid bit11 1: Reverse 0: Invalid bit12 1: Run 0: Stop bit13 1: There is an external fault bit14 1: Reset fault instruction bit15 unused ***#The adopted value of the function input terminal = (Modbus broadcast value & broadcast given validity) | the actual input value of the function terminal***
000CH~0018H	Reserved (broadcast data)
0019H	Virtual input terminal bit0: virtual terminal X0 bit1: Virtual terminal X1 bit2: Virtual terminal X2 bit3: Virtual terminal X3 bit4: Virtual terminal X4 bit5: Virtual terminal X5 bit6: Virtual terminal X6 bit7: Virtual terminal X7 bits 8~15: Reserved ***#Terminal input actual value = Modbus set value | external terminal input value***
001AH~0068H	Reserved control word (79 spaces) 001AH: Communication given torque -1000~1000 →-100.0%~100.0% motor rated torque 001BH: Speed limit value 0~40000 →0.00~400.00Hz
0069H	**Parameter update request**

Register address	content
	After the slave inverter receives the parameters via Modbus, the parameters are saved in the parameter image area of the inverter. 0x55: Update the actual parameters in RAM with the parameters in the image area 0xAA: Update the actual parameters in RAM with the default factory parameters Zero: No update 【Note】: This unit will be automatically cleared after each update.
006AH~01F9H	reserved(parameters)
01FAH~046FH	630 spaces reserved

C.2 Monitoring data [Register 4] [Bit 2]

To read the registers in this table, use function code 4; to read the bits in this table, use function code 2.

Register address	content
0470H	Inverter status word bit0 1: Operation signal is present 0: No operation signal bit1 1: Running bit2 1: Zero speed bit3 1: Forward rotation 0: Reverse rotation bit4 1: The inverter is powered on normally 0: The inverter is powered on abnormally bit5 1: Base blocked bit6 unused bit7 1: Fault is occurring bit8 Reserved (1: Fault retry) bit9 Reserved (1: parameter setting error) bit10 1: Auto-tuning in progress bit11 1: Request auto-tuning bits 15~12 are not used
0471H	Checkout Status bit0 1: Frequency detection LF, frequency ≤ detection frequency bit1 1: Frequency detection GF, frequency ≥ detection frequency bit2 1: Frequency detection EF, given and feedback frequencies are within the detection

Register address	content
	frequency band bit3 1: Speed reached Bit4 Reserved (1: analog signal given frequency command is lost) bit5 1: Over torque detection bit6 1: Undervoltage detection bit7 1: Bus voltage is greater than 85% of rated voltage bit8 1: Exceeds 5% of rated current during operation and 10% of rated current when stopped bit9 1: Fault prediction bits 15 to 10 are not used
0472H	Reserve (given target frequency)
0473H	Current operating frequency 5000 corresponds to 50.00Hz
0474H	Reserved (PID given value)
0475H	Reserved (PID feedback value)
0476H	Reserved (PID output value)
0477H	Reserved (PID proportional term)
0478H	Reserved (PID integral term)
0479H	Reserved (PID differential term)
047AH	Reserved (communication failure) bit0 1: Communication timeout bit1 1: frame format bit2 1: CRC error bit3 1: Data length error bit4 1: Parity error bit5 1: Overload error bit6 1: Illegal command Bit7 Reserved (operator communication failure) bits 15 to 8 are not used
047BH	Parameter update status bit0 1: Updating 0: Update completed bit1 Reserved (1: data exceeds limit) bit2 Reserved (1: data mismatch) bits 3 to 15 are not used
047CH~0484H	Unused (9 units)
0485H	Inverter output monitoring 1 bit0 1: Everything is normal after power on 0: There is an abnormality after power on

Register address	content
	bit1 1: Fault 0: Normal bit2 1: There is a running signal 0 : There is no running signal bit3 1: Frequency/speed arrival signal bit4 1: Frequency/speed consistent bit5 1: Zero speed bit6 1: DC bus voltage is greater than 85% of the rated voltage bit7 1: Exceeds 5% of rated current during operation and 10% of rated current when stopped bit8 1: Auto-tuning in progress bit9 1: Speed detection 1 bit10 1: Speed detection 2 bit11 1: Fault prediction bit12 1: Self-tuning request
0486H	Reserved (Inverter output monitoring 2)
0487H	Reserved (Inverter output monitoring 3)
0488H	Reserved (Inverter output monitoring 4)
0489H	Pump output monitoring 1 bit0 1: Water pump sleep bit1 1: Motor 1 starts bit2 1: Motor 2 starts bit3 1: Motor 3 starts bit4 1: Motor 4 starts bit5 1: Motor 5 starts bit6 1: Motor 6 starts bit7 reserved (Y8) bit8 reserved (Y9) bit9 reserved (Y10) bit10 reserved (Y11) bit11 reserved (Y12) bit12 reserved (Y13) bit13 reserved (Y14) bit14 reserved (Y15) bit15 Reserved (Y16)
048AH	Pump output monitoring 2 bit0 reserved (Y17) bit1 Reserved (Y18) bit2 Reserved (Y19)

Register address	content
	bit3 Reserved (Y20) bit4 Reserved (Y21) bit5 Reserved (Y22) bit6 reserved (Y23) bit7 reserved (Y24) bit8 reserved (Y25) bit9 reserved (Y26) bit10 reserved (Y27) bit11 reserved (Y28) bit12 reserved (Y29) bit13 reserved (Y30) bit14 reserved (Y31) bit15 reserved (Y32)
048BH	Fault indication 1 bit0 module overcurrent protection Bit 1 ADC fault bit2 Radiator overheating bit3 Braking unit fault bit4 Reserved bit5 Reserved bit6 speed deviation bit7 Bus overvoltage bit8 bus undervoltage bit9 output phase loss bit10 Motor low speed overcurrent bit11 encoder fault bit12 Reserved bit13 Reserved bit14 Reserved bit15 Motor phase sequence error
048CH	Fault indication 2 bit0 Speeding in the same direction bit1 reverse overspeed bit2 reserved bit3 encoder communication failure bit4 abc overcurrent bit5 brake detection fault

Register address	content
	bit6 input overvoltage bit7 reserved bit8 reserved bit9 encoder not self-learning bit10 output overcurrent bit11 SINCOS encoder fault bit12 input phase loss bit13 overspeed protection bit14 motor high speed overcurrent bit15 ground protection
048DH	Fault indication 3 Bit0 capacitor aging bit1 external fault bit2 reserved bit3 reserved bit4 current sensor fault bit5 Braking resistor short circuit bit6 Current instantaneous value is too large bit7 output contactor fault bit8 brake switch fault bit9 IGBT short circuit protection bit10 communication failure bit11 Input power is abnormal bit12 reserved bit13 Reserved bit14 Reserved bit15 Reserved
048EH	Reserved (fault indication 4) Bit 15 to 0 Reserved
048FH	Multi-function terminal input status bit0 1: Multi-function terminal X0 ON 0: OFF bit1 1: Multi-function terminal X1 ON 0: OFF bit2 1: Multi-function terminal X2 ON 0: OFF bit3 1: Multi-function terminal X3 ON 0: OFF bit4 1: Multi-function terminal X4 ON 0: OFF bit5 1: Multi-function terminal X5 ON 0: OFF bit6 1: Multi-function terminal X6 ON 0: OFF

Register address	content
	bit7 1: Multi-function terminal X7 ON 0: OFF bit8 unused bit9 unused bits 15 to 10 are not used
0490H	Multi-function terminal output status bit0 1: K1 ON 0: OFF bit1 1: K2 ON 0: OFF bit2 1: Y0 ON 0: OFF bit3 1: Y1 ON 0: OFF bit4 1: Y3 (K3) ON 0: OFF bit5 1: Y4 (K4) ON 0: OFF bit6 unused bit7 unused bits 15 to 8 are not used
0491H	Feedback speed (Hz) -30000~30000 →-300.00~300.00Hz
0492H	Given speed -30000~30000 →-300.00~300.00Hz
0493H	Given speed filter value
0494H	Output voltage effective value
0495H	Output current effective value
0496H	Output torque -1000~1000 →-100.0%~100.0% inverter rated current
0497H	Inverter efficiency
0498H	Bus voltage
0499H	Analog input AI0/TM motor temperature detection input -10000~10000 → -10.000~10.000V
049AH	Analog input AI1 -10000~10000 →-10.000~10.000V
049BH	Analog input AI2 (reserved)
049CH	System time
049DH	Radiator temperature
049EH	U phase voltage (instantaneous value) (reserved)
049FH	V phase voltage (instantaneous value) (reserved)
0490H	W phase voltage (instantaneous value) (reserved)
04A1H	U phase current (instantaneous value) (reserved)
04A 2H	V phase current (instantaneous value) (reserved)
04A 3H	W phase current (instantaneous value) (reserved)
04A 4H	Output active power
04A 5H	Total output power (reserved)

Register address	content
04A 6H	Reactive power (reserved)
04A 7H	Power factor (retained)
04A 8H	Feedback speed (rpm) -9999~9999 →-999.9~999.9
04A 9H	Pre-torque
04AAH~04B9H	Keep 16 units
04BAH~04D9H	View[0~31]: The specific monitoring content is related to the inverter model. Please refer to the instructions for "Selecting LCD display data content" in the inverter manual. 04BAH: View[0] // undefined 04BBH：View[1] 04BCH：View[2] 04BDH：View[3] 04BEH：View[4] 04BFH：View[5] 04C0H：View[6] 04C1H：View[7] 04C2H：View[8] 04C3H：View[9] 04C4H：View[10] 04C5H：View[11] 04C6H：View[12] 04C7H：View[13] 04C8H：View[14] 04C9H：View[15] 04CAH：View[16] 04CBH：View[17] 04CCH：View[18] 04CDH：View[19] 04CEH：View[20] 04CFH：View[21] 04D0H：View[22] 04D1H：View[23] 04D2H：View[24] 04D3H：View[25] 04D4H：View[26] 04D5H：View[27] 04D6H：View[28] 04D7H：View[29]

Register address	content	
	04D8H：View[30] 04D9H：View[31]	
04DAH~04E5H	Uxx monitoring data (curve data) 04DAH: U01 data value (curve 1) 04DBH: U02 data value (curve 2) 04DCH: U03 data value (curve 3) 04DDH: U04 data value (curve 4) 04DEH: U05 data value (curve 5) 04DFH: U06 data value (curve 6) 04E0H: U07 data value (curve 7) 04E1H: U08 data value (curve 8) 04E2H: Lower byte: U01 identification (curve 1 configuration); high byte: U02 identification (curve 2 configuration) 04E3H: Lower byte: U03 identification (curve 3 configuration); high byte: U04 identification (curve 4 configuration) 04E4H: Lower byte: U05 identification (curve 5 configuration); high byte: U06 identification (curve 6 configuration) 04E5H: Low byte: U07 identification (curve 7 configuration); high byte: U08 identification (curve 8 configuration)	
04E6H~04E9H	Reserve 4 units (for inverter)	
04EAH~05E9H	U-phase current (256-point buffer, for graphic display) [sampled every 10 PWM cycles]	
05EAH~06E9H	V-phase current (256-point buffer, for graphic display)	
06EAH~07E9H	W phase current (256 points buffer, for graphic display)	
07EAH	Output torque (for graphic display)	
07EBH	Given speed (for graphic display)	
07ECH	Feedback speed (for graphic display)	
07EDH	Bus voltage (for graphic display)	
07EEH~09EDH	Reserve 512 spaces (for graphic display)	
0A34H~0A38H	Historical Fault 0 (Earliest occurrence)	Fault Code
		Actual speed at the time of fault occurrence -30000~30000 → -300.00~300.00Hz
		The given speed at the time of fault occurrence -30000~30000 → -300.00~300.00Hz

Register address	content	
		Bus voltage at the time of fault occurrence
		Current at the time of fault occurrence
0A39H~0A3DH	Historical Fault 1	Fault Code
		Actual speed at the time of fault occurrence -30000~30000 → -300.00~300.00Hz
		The given speed at the time of fault occurrence -30000~30000 → -300.00~300.00Hz
		Bus voltage at the time of fault occurrence
		Current at the time of fault occurrence
0A3EH~0A42H	Historical Fault 2	Fault Code
		Actual speed at the time of fault occurrence -30000~30000 → -300.00~300.00Hz
		The given speed at the time of fault occurrence -30000~30000 → -300.00~300.00Hz
		Bus voltage at the time of fault occurrence
		Current at the time of fault occurrence
0A43H~0A47H	Historical Fault 3	Fault Code
		Actual speed at the time of fault occurrence -30000~30000 → -300.00~300.00Hz
		The given speed at the time of fault occurrence -30000~30000 → -300.00~300.00Hz
		Bus voltage at the time of fault occurrence
		Current at the time of fault occurrence
0A48H~0A4CH	Historical Fault 4	Fault Code
		Actual speed at the time of fault occurrence -30000~30000 → -300.00~300.00Hz
		The given speed at the time of fault occurrence -30000~30000 → -300.00~300.00Hz
		Bus voltage at the time of fault occurrence
		Current at the time of fault occurrence
0A4DH~0A51H	Historical Fault 5	Fault Code
		Actual speed at the time of fault occurrence -30000~30000 → -300.00~300.00Hz
		The given speed at the time of fault occurrence -30000~30000 → -300.00~300.00Hz
		Bus voltage at the time of fault occurrence

Register address	content	
		Current at the time of fault occurrence
0A52H~0A56H	Historical Fault 6	Fault Code
		Actual speed at the time of fault occurrence -30000~30000 → -300.00~300.00Hz
		The given speed at the time of fault occurrence -30000~30000 → -300.00~300.00Hz
		Bus voltage at the time of fault occurrence
		Current at the time of fault occurrence
0A57H~0A5BH	Historical Fault 7 (Latest occurrence)	Fault Code
		Actual speed at the time of fault occurrence -30000~30000 → -300.00~300.00Hz
		The given speed at the time of fault occurrence -30000~30000 → -300.00~300.00Hz
		Bus voltage at the time of fault occurrence
		Current at the time of fault occurrence

Appendix D Profinet Communication Debugging Instructions

D.1 Network Settings Introduction

D.1.1 Introduction to STEP inverter PN communication card

* **The model of** the STEP inverter PN communication card is: AS.L03/C9, as shown in the following picture:

D.1.2 Host Settings

* PROFINET The slave station file (.xml) must be configured in the master station. It integrates three types of protocols: 2WORD, 4WORD, and 8WORD. Users can choose any one according to actual needs, and the slave will automatically identify the protocol type.

* Set the name and IP address of each PROFINET slave in the TIA Portal software.

D.1.3 Slave Settings

* **For the PROFINET slave (STEP inverter), set the run command and speed reference to** PROFINET in the P10 group parameters.

D.1.4 Obtaining the GSD File

*** The** GSD file name is GSDML-V2.32-STEP-Profinet Adapter-XX.xml.

Please contact your product manager to obtain the GSD file.

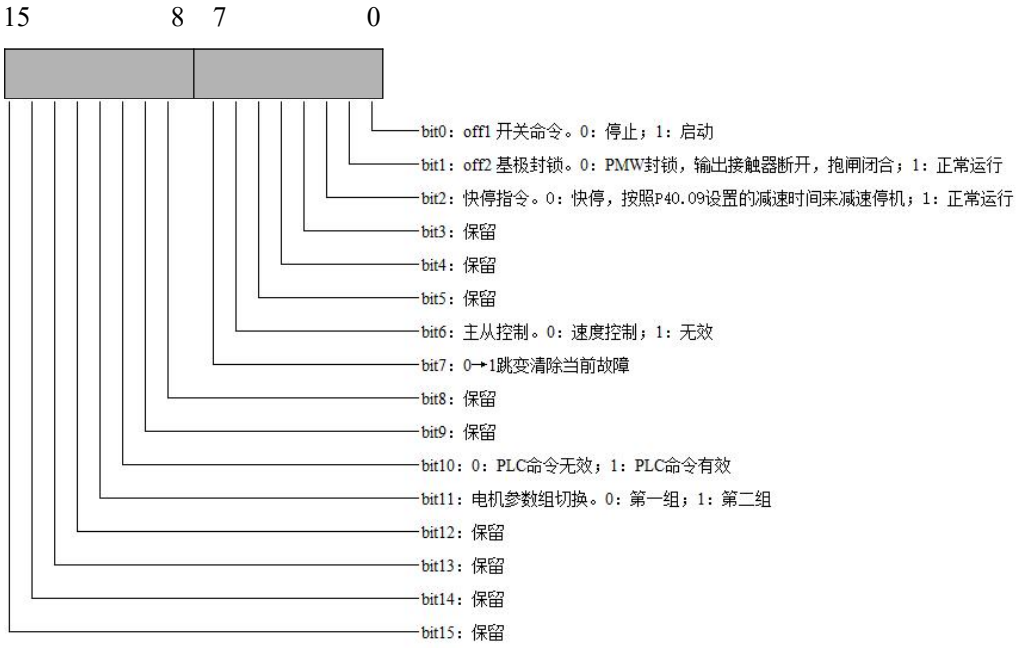
D.2 Contents of the Agreement

PROFINET communication protocol has three types: 2WORD, 4WORD, and 8WORD. The content of this part of the protocol is selected by the user. The user can select the protocol type according to actual needs:

D.2.1 Meaning of 2WORD communication protocol, this type includes 2 control words and 2 status words:

D.2.1.1 Inverter control word

The control word WORD1, each of which is defined as follows:

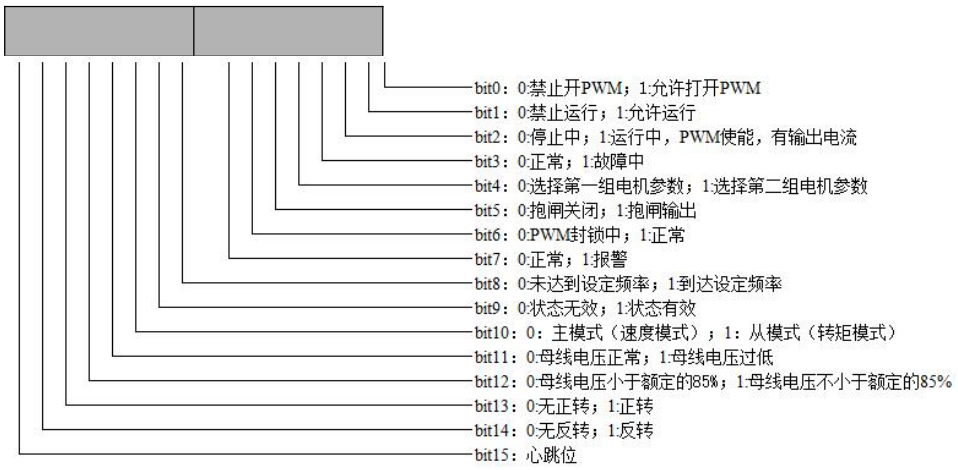


Control word WORD2: used for speed setting, for example: 5000 means forward rotation 50.00 Hz; -5000 means reverse rotation 50.00 Hz

D.2.1.2 Inverter status word

Status word WORD1, each bit is defined as follows:

15 8 7 0



Note: The meaning of the 9th bit (bit9) of the status word WORD1 is:

=0: Indicates that the inverter status received by the PLC from PROFINET is invalid

=1: Indicates that the inverter status received by the PLC from PROFINET is valid

Status word WORD2:

Feedback frequency Hz, for example: 5000 means forward rotation 50.00 Hz; -5000 means reverse rotation 50.00 Hz

In closed-loop control mode: This word is the encoder feedback speed

In V/F control mode: This word is the actual output frequency

D.2.2 Meaning of 4WORD communication protocol, this type includes 4 control words and 4 status words:

D.2.2.1 Inverter control word

The control word WORD1, each of which is defined as follows:

15 8 7 0

Control word WORD2: Speed setting, for example: 5000 means forward rotation 50.00 Hz; -5000 means reverse rotation 50.00 Hz

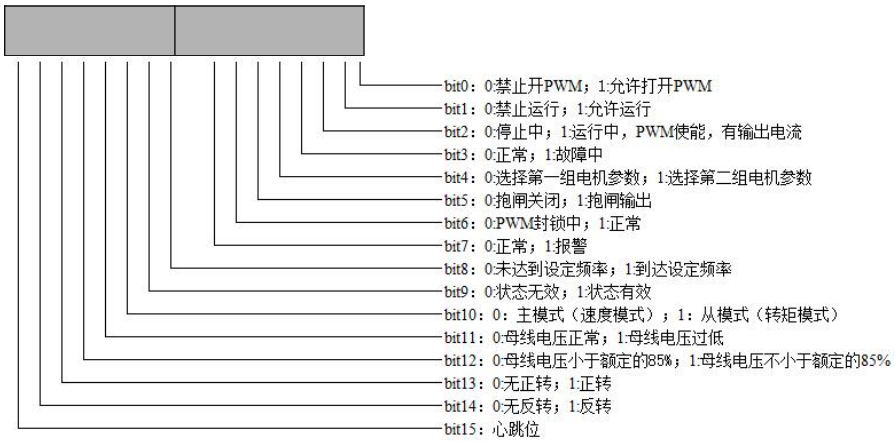
Control word WORD3: Reserved

Control word WORD4: Reserved

D.2.2.2 Inverter status word

Status word WORD1, each bit is defined as follows:

15 8 7 0



Note: The meaning of the 9th bit (bit 9) of the status word WORD1 is:

=0 : Indicates that the inverter status received by the PLC from PROFINET is invalid

=1: Indicates that the inverter status received by the PLC from PROFINET is valid

Status WORD2 : Feedback frequency Hz, for example : 5000 means forward rotation 50.00 Hz; -5000 means reverse rotation 50.00 Hz

In closed-loop control mode: Change the word to encoder feedback speed

In V/F control mode: Change the word to the actual output frequency

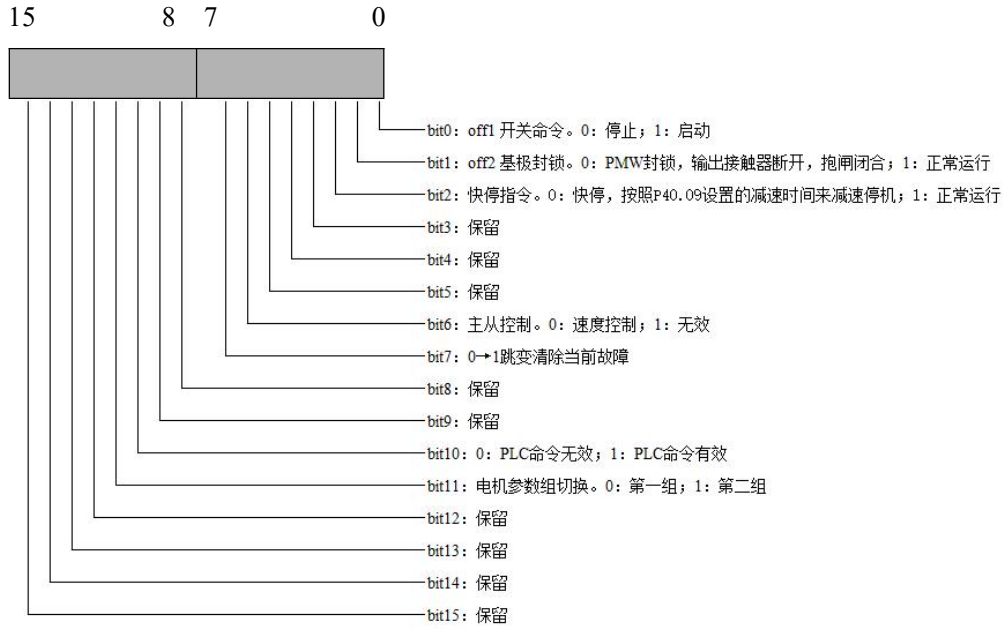
Status WORD3: Output current A For example: 100 means 10.0A

Status WORD4: Output voltage V For example: 380 means 380V

D.2.3 Meaning of 8WORD communication protocol, this type includes 8 control words and 8 status words:

D.2.3.1 Inverter control word

The control word WORD1, each of which is defined as follows:



Control word WORD2: Speed setting, for example: 5000 means forward rotation 50.00 Hz; -5000 means reverse rotation 50.00 Hz

Control word WORD3: Reserved

Control word WORD4: Reserved

Control word WORD5: Reserved

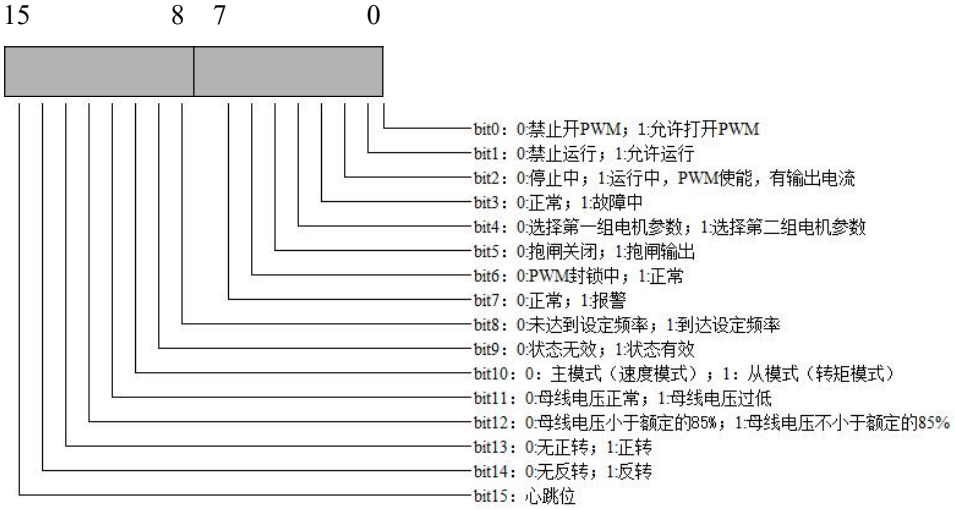
Control word WORD6: PLC forces DO output, the upper 8 bits enable output, and the lower 8 bits are output values

Control word WORD7: acceleration (**.**s), 10000 means 10.00 s, which is the set time to accelerate from 0 to rated frequency;

Control word WORD8: Deceleration (**.**s), 10000 means 10.00 s, which is the set time to decelerate from the rated frequency to 0.

D.2.3.2 Inverter status word

Status word WORD1, each bit is defined as follows:



Note: The meaning of the 9th bit (bit 9) of the status word WORD1 is:

=0: Indicates that the inverter status received by the PLC from PROFINET is invalid

=1 : Indicates that the inverter status received by the PLC from PROFINET is valid

Status word WORD2 : Feedback frequency Hz , for example : 5000 means forward rotation 50.00 Hz; -5000 means reverse rotation 50.00 Hz

In closed-loop control mode: Change the word to encoder feedback speed

In V/F control mode: Change the word to the actual output frequency

Status word WORD3: Output current A For example: 100 means 10.0A

Status word WORD4: output voltage V For example: 380 means 380V

Status word WORD5: Custom status 1, set according to parameter P82.02

Status word WORD6: Custom status 2, set according to parameter P82.03

Status word WORD7: Custom status 3, set according to parameter P82.04

Status word WORD8: Custom status 4, set according to parameter P82.05

Appendix: PROFINET custom status word description

This description is valid for PROFINET 8WORD communication protocol type. The last four words of the status word can be selected through the inverter parameters P82.02, P82.03, P82.04, and P82.05. The definition of each parameter is as follows:

Parameters are set to 0-7 for standby

The parameter is set to 8. The given torque of the inverter is signed. The standard value is the rated torque of the motor. 999 means 99.9% and -1000 means -100.0%.

Set the parameter to 9 for standby

The parameter is set to 10. The current output torque of the inverter is signed. The standard value is the rated torque of the motor. 999 means 99.9% and -1000 means -100.0%.

Set the parameter to 11-12 for standby

The parameter is set to 13, the given target frequency of the inverter is unsigned, and 5000 means 50.00Hz.

The parameter is set to 14. The current operating frequency of the inverter is signed. 5000 means 50.00Hz, and -5000 means -50.00Hz.

The parameter is set to 15. The feedback frequency of the inverter is signed, 5000 means 50.00Hz, -5000 means -50.00Hz

The parameter is set to 16. The feedback speed of the inverter is signed. 1000 means 100.0rpm, -1000 means -100.0rpm.

Parameter is set to 17 for standby

The parameter is set to 18, the output voltage of the inverter is unsigned, and 380 means 380V.

The parameter is set to 19, the output current effective value of the inverter is unsigned, 100 means 10.0A

The parameter is set to 20, the output active power of the inverter is unsigned, and 1000 represents 100.0% of the rated power of the motor.

Set the parameter to 21-22 for standby

The parameter is set to 23, the inverter bus voltage is unsigned, 537 means 537V

Set the parameter to 24-25 for standby

Parameter is set to 29 Inverter output terminal status 1: ON 0: OFF

Set the parameter to 30 for standby

Parameter is set to 31. Inverter input terminal status 1: ON 0: OFF

Set the parameter to 32-33 for standby

Parameter is set to 34 Analog input channel 0 10000 means 10.000V

Parameter is set to 35 Analog input channel 1 10000 means 10.000V

Set the parameter to 36-39 for standby

The parameter is set to 40. The most recent fault number is 0~63.

Set the parameter to 41-42 for standby

The parameter is set to 43 and the radiator temperature is 60 degrees Celsius.

Parameter is set to 44 Encoder count 0~65535

Parameters are set to 45-59 for standby

D.3 Protocol Usage

Through the description of the above types of communication protocols, we have a general understanding of the PROFINET communication of the STEP inverter. The following describes a specific application example of PROFINET communication:

Step 1: Prepare a PLC that supports PN communication, such as Siemens S7-1200;

Step 2: Prepare the GSD file GSDML-V2.32-STEP-Profinet Adapter-XX.xml provided by our company;

Step 3: Prepare a frequency converter with PROFINET function from our company;

Step 4: Power on the inverter and set the following parameters in the inverter parameter group:

P10.02 = 5 PROFINET command given

P10.03 = 17 PROFINET reference speed

P82.02 Custom status word 1 You can select the status word you want to detect through the annotation on the operator.

P82.03 Custom status word 2 You can select the status word you want to detect through the annotation on the operator

P82.04 Custom status word 3 You can select the status word you want to detect through the annotation on the operator.

P82.05 Custom status word 4 You can select the status word you want to detect through the annotation on the operator.

Step 5: Connect the PLC and the inverter with a PROFINET standard cable. (Please complete step 4 before proceeding to step 5)

Step 6: After the PLC imports the GSD file, no matter which type of protocol is selected, the inverter protocol control word WORD1 must be given the following bits through PROFINET communication. This is the operating condition of the inverter:

Word1 (operating conditions)

Bit0 = 1 Run Bit0 = 0 Stop

Bit1 = 1 Normal operation Bit1 = 0 Base blocked

Bit2 = 1 Normal operation Bit2 = 0 Quick stop , decelerate to stop according to the deceleration time set in P40.09

Bit10 = 1 PLC command is valid

Bit7 = 1 Reset fault Bit7 = 0 Normal status

Word2 (speed reference)

-30000 ~ 30000 speed setting

Remark:

If the inverter is AS600 series software and uses master-slave control, you need to set the inverter parameters

Host P10.03 =17 PROFINET given frequency/speed

Slave P10.04 = 7 PROFINET given torque

Set in PLC programming communication

Word1

Bit6 = 0 Main mode speed mode

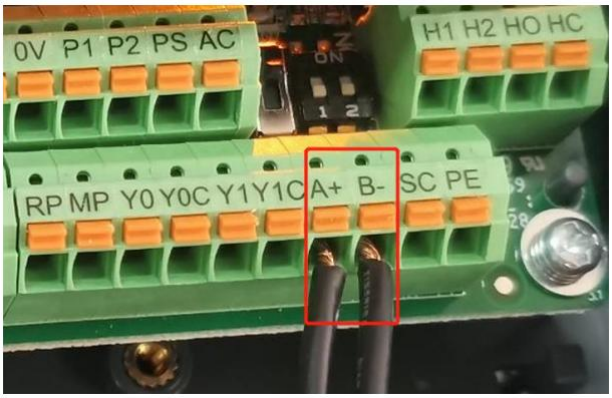
Bit6 = 1 Slave mode torque mode

In main mode Word2	-30000 ~ 30000	Speed setting Word3 invalid
In slave mode Word3	-1000 ~ 1000	Torque setting Word2 is invalid

Appendix E Modbus Communication Debugging Guide

Modbus is a serial communication protocol widely used in the industrial field to implement data exchange between host computers (such as PLCs, HMIs, and PCs) and inverters.

E.1. Wiring



When using a Modbus gateway (or USB to 485 adapter):

T/R+ connects to inverter A+

T/R- to inverter B-

When using a Siemens PLC (such as S7-1200):

PLC TRA connected to inverter B-

PLC TRB connected to inverter A+

E.2. Parameter settings

name	Parameter code	Setting Values	Remark
MODBUS given operation	P10.02	2	The operation command is given by Modbus communication
MODBUS given frequency	P10.03	12	Frequency command is given by Modbus communication
MODBUS communication	P80.00	2	Enable Modbus communication function
Baud rate	P81.00	38400	Must be consistent with the master station
Data format	P81.01	Odd parity	Must be consistent with the master (8 data bits, 1 stop bit is the default)
Transmission Mode	P81.02	RTU	Modbus RTU mode, the most common
Local address	P81.04	1	The station number of the inverter, unique in the network

Communication Format	P81.07	Hexadecimal/ decimal	When the debugging assistant is connected: hexadecimal; When the PLC is connected: decimal;
Communication protection	P94.18	1: On	The inverter takes protective action when communication is interrupted
Communication disconnection protection time	P94.19	2s	If no command is received within this time, a fault will be reported.

Note: The communication between Siemens 1211 PLC and flexible platform inverter only supports baud rate 38400 and odd parity.

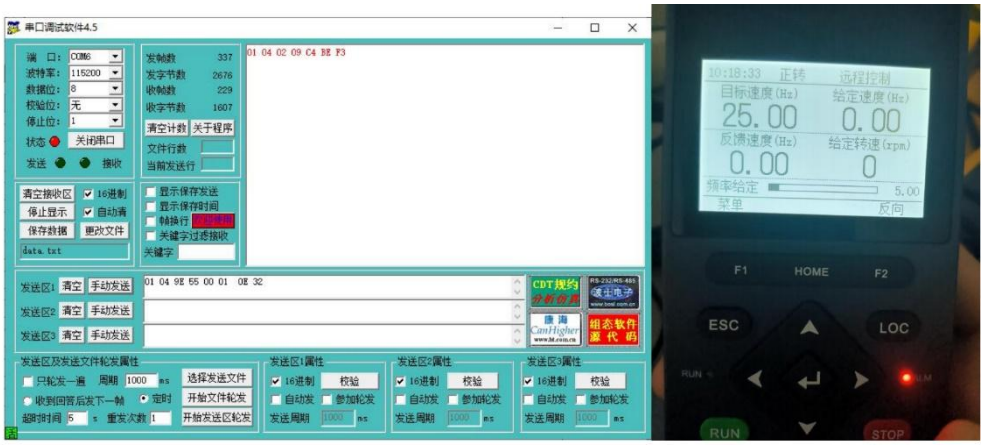
E.3. Read and write monitoring registers

This type of address is used for real-time control and monitoring, such as starting, setting frequency, reading current and voltage, etc.
Address calculation rules: Modbus address = register address + 0x999A
Common function codes: 04 (read), 06 (write single)

Examples of common control instructions (hexadecimal):
Run control (write address 0x999A)
Forward start: 01 06 99 9A 00 05 (Data 00 05 indicates forward)
Reverse start: 01 06 99 9A 00 06
Stop: 01 06 99 9A 00 00

Frequency setting (write address 0x999B)
Given 50.00Hz: 01 06 99 9B 13 88 (data 13 88 = 5000 -> 50.00Hz)
Given 25.00Hz: 01 06 99 9B 09 C4 (data 09 C4 = 2500 -> 25.00Hz)

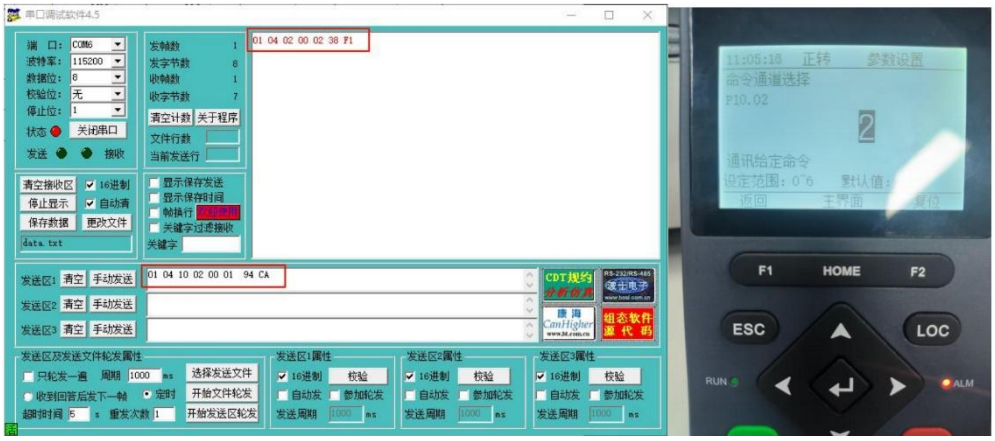
Read status (read from calculated address)
Read current frequency (address 0x4BB): 0x4BB + 0x999A = 0x9E55
Send command: 01 04 9E 55 00 01
Return example (25.00Hz): 01 04 02 09 C4 ..., where 09 C4 is 2500, representing 25.00Hz.



E.4 Read and write function group parameters

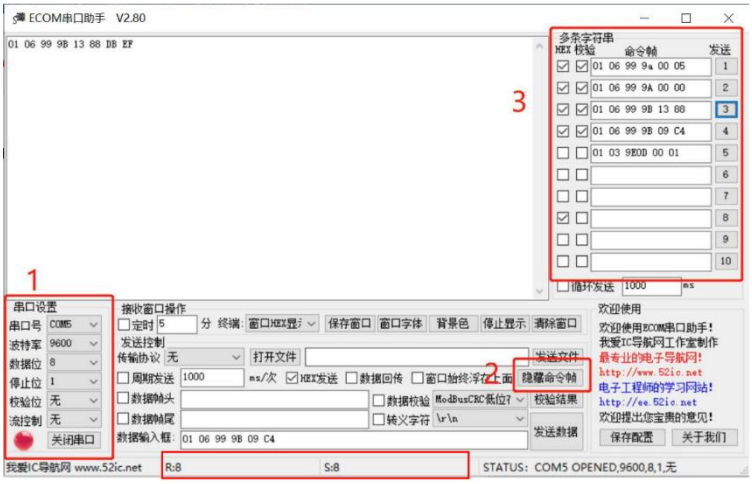
This type of address is used to read and write the internal parameters of the inverter, such as P10.02, P20.04, etc.

Function code: 04 (read), 06 (write)
Address calculation: No conversion is required, just use the parameter number directly.
For example :
Read parameter P10.02: Send 01 04 10 02 00 01. Response 01 04 02 00 02 ..., where 00 02 means the parameter value is 2.



Write parameter P30.01: Send 01 06 30 01 00 0D. Reply 01 06 30 01 00 0D, where 00 0D indicates the parameter value is 13.

E.5 Debugging Tool Usage



Open the serial port debugging assistant, as shown above:

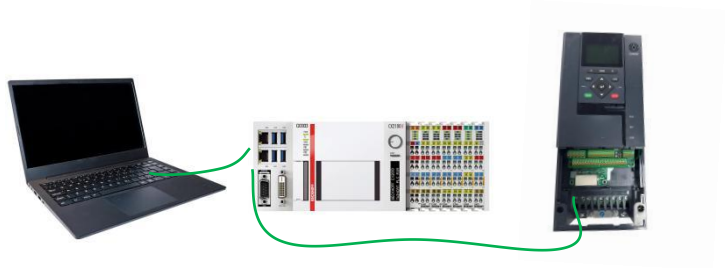
1. Set up the serial port;
2. Click 2 to display the command frame;
3. Control instructions can be sent in the command frame;
4. You can check below whether there is a return value after the data is sent. If there is a return value, it means that the data is sent and received successfully. You can also check below whether there is a return value after the data is sent. Monitor on the handheld operator whether the command is sent successfully.

E.6 Troubleshooting Process

1. Check the wiring: Confirm whether the A+ and B- line sequence is correct.
2. Check parameters: Check each parameter of the inverter (baud rate, parity bit, address, etc.) to see if they match those of the master station.
3. Check the master station configuration: Confirm whether the Modbus address and data length in the PLC program are correct.

Appendix F EtherCAT Communication Debugging Instructions

F.1 Hardware Connection



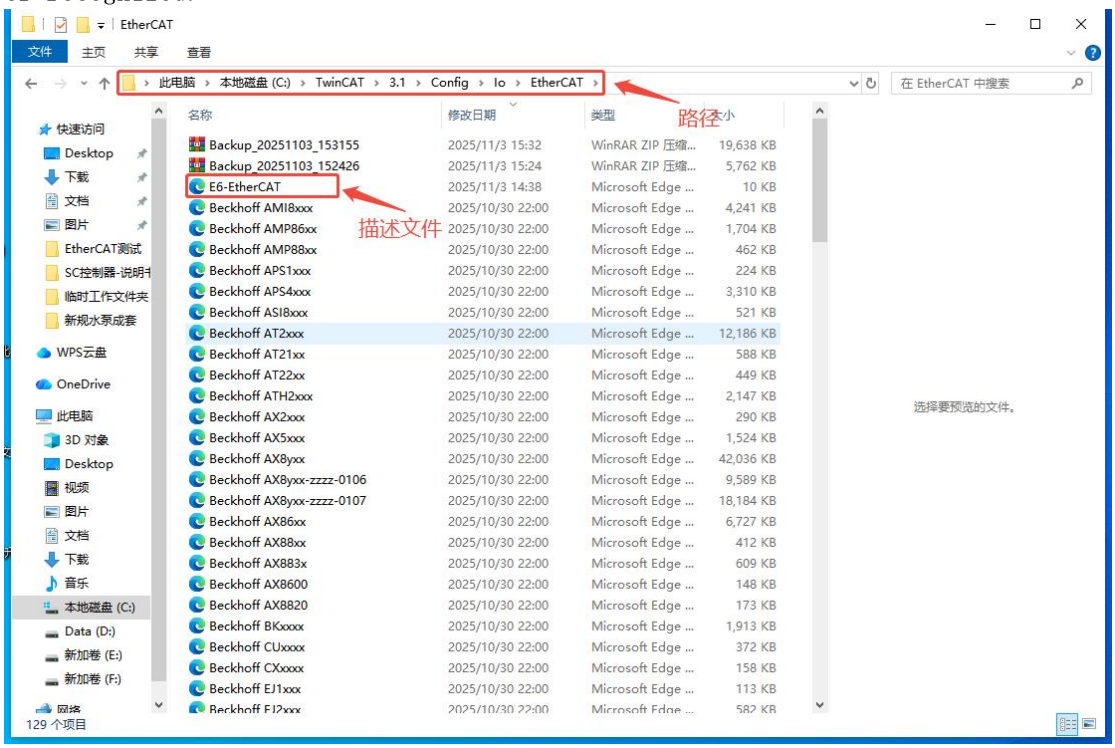
硬件连接方式

F.2 Inverter Parameter Settings

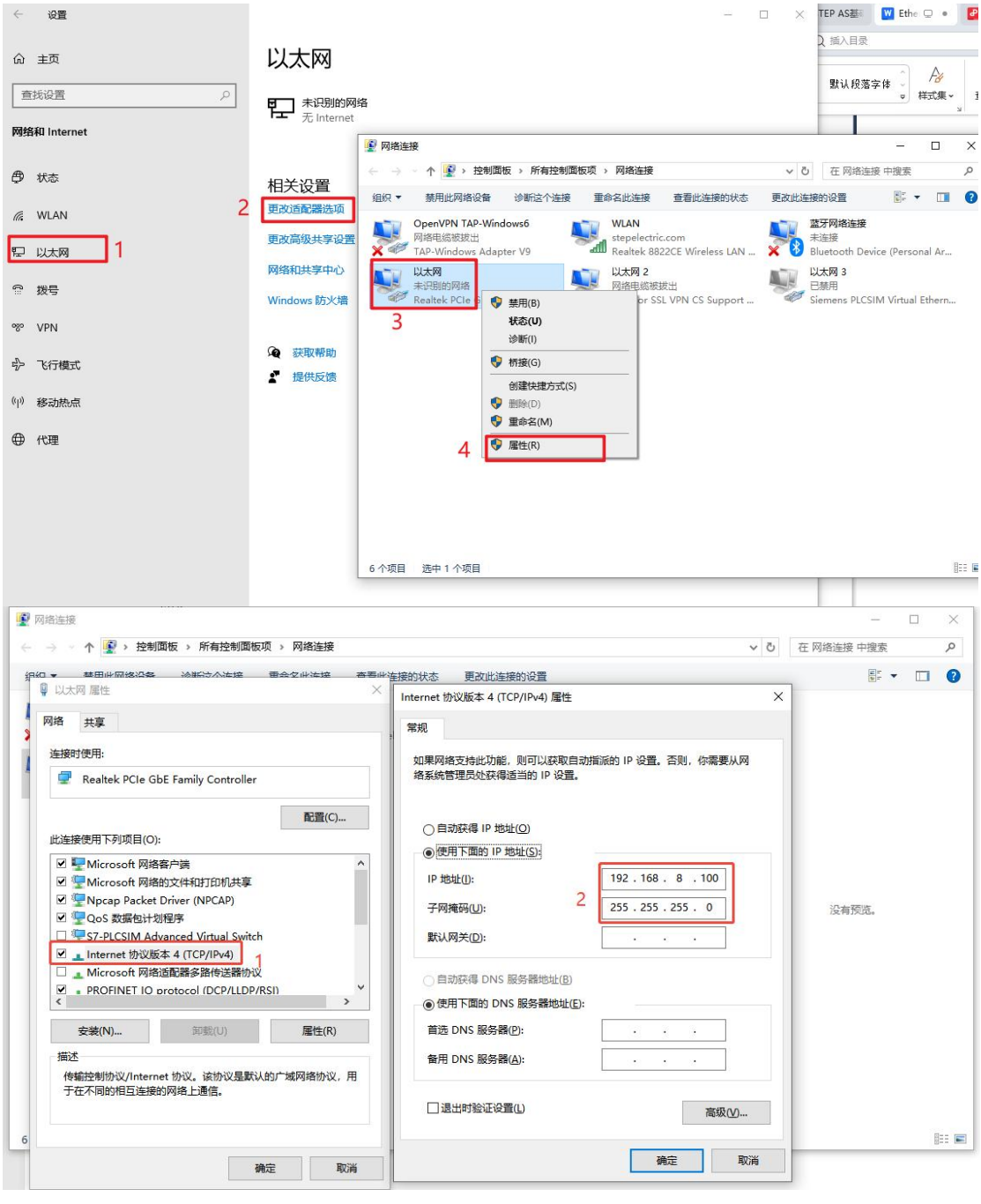
P10.02=4（EtherCAT command）
P10.03=10（EtherCAT commanded speed）

F.3 Establish communication connection

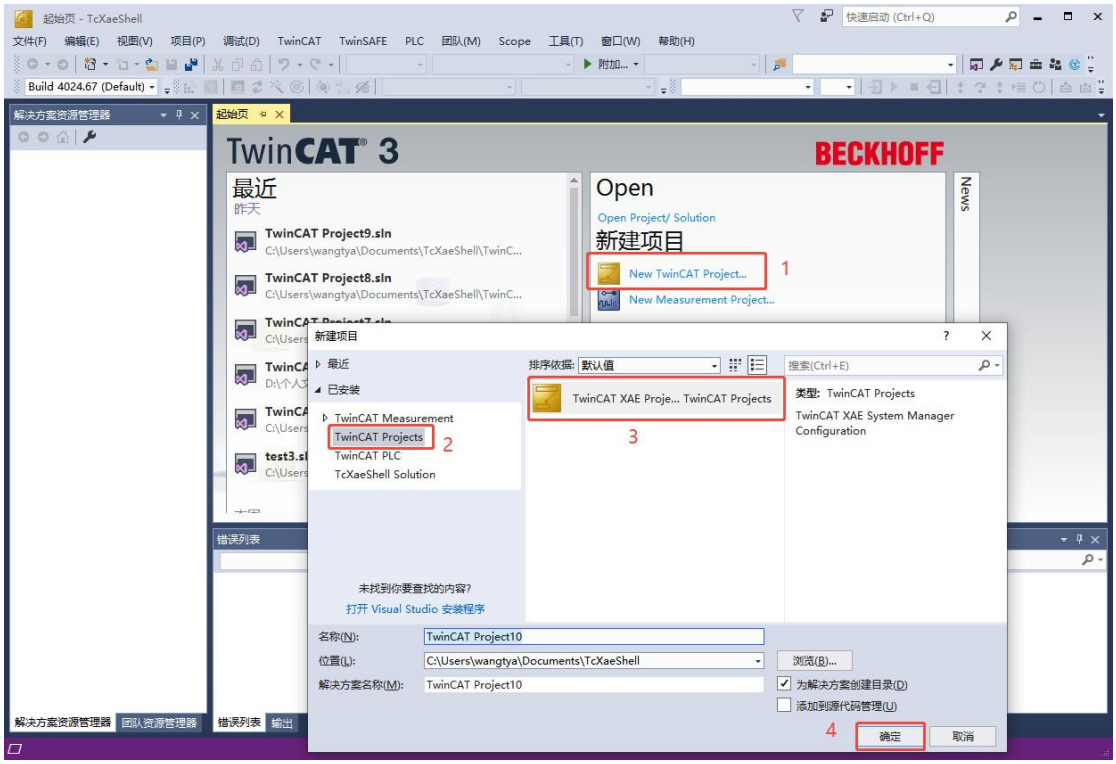
1. Open the TwinCAT installation directory (C:TwinCAT3.1ConfigIoEtherCAT) and copy the XML file to the directory to complete the addition. After installing the Beckhoff TwinCAT software on the PC, you need to import the device description XML file for the EtherCAT slave devices; otherwise, the slave devices cannot be scanned or recognized.



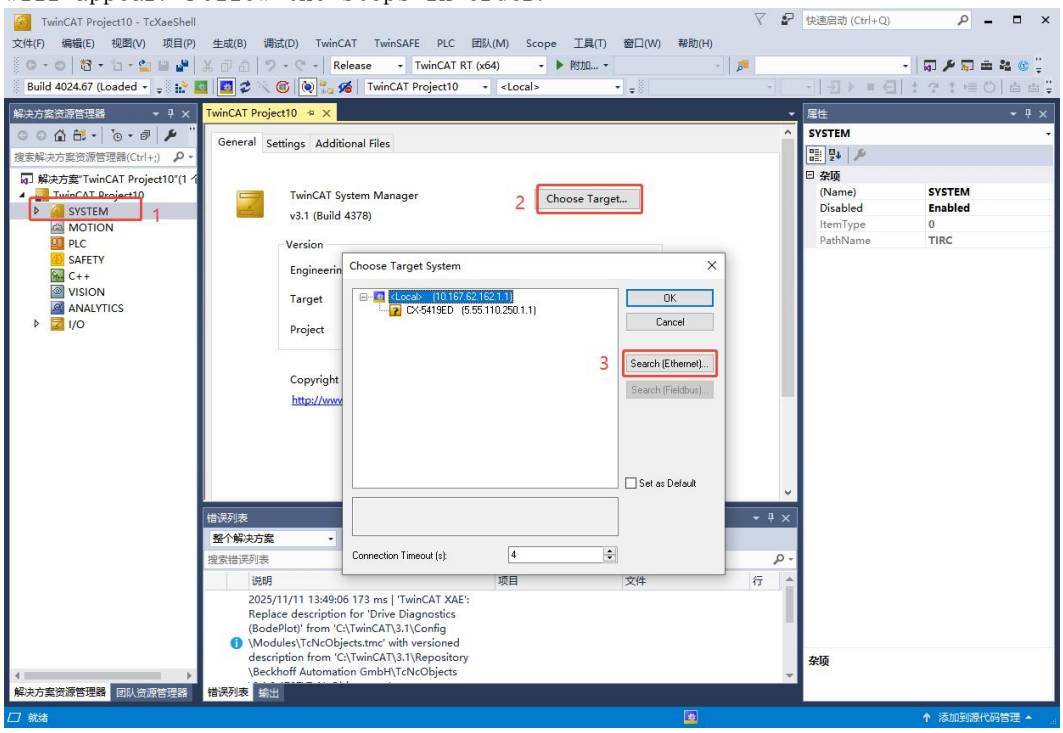
2. Configure the computer's IP address and the Beckhoff PLC port to be on the same network segment. (The PLC port IP used for this test is 192.168.8.91)

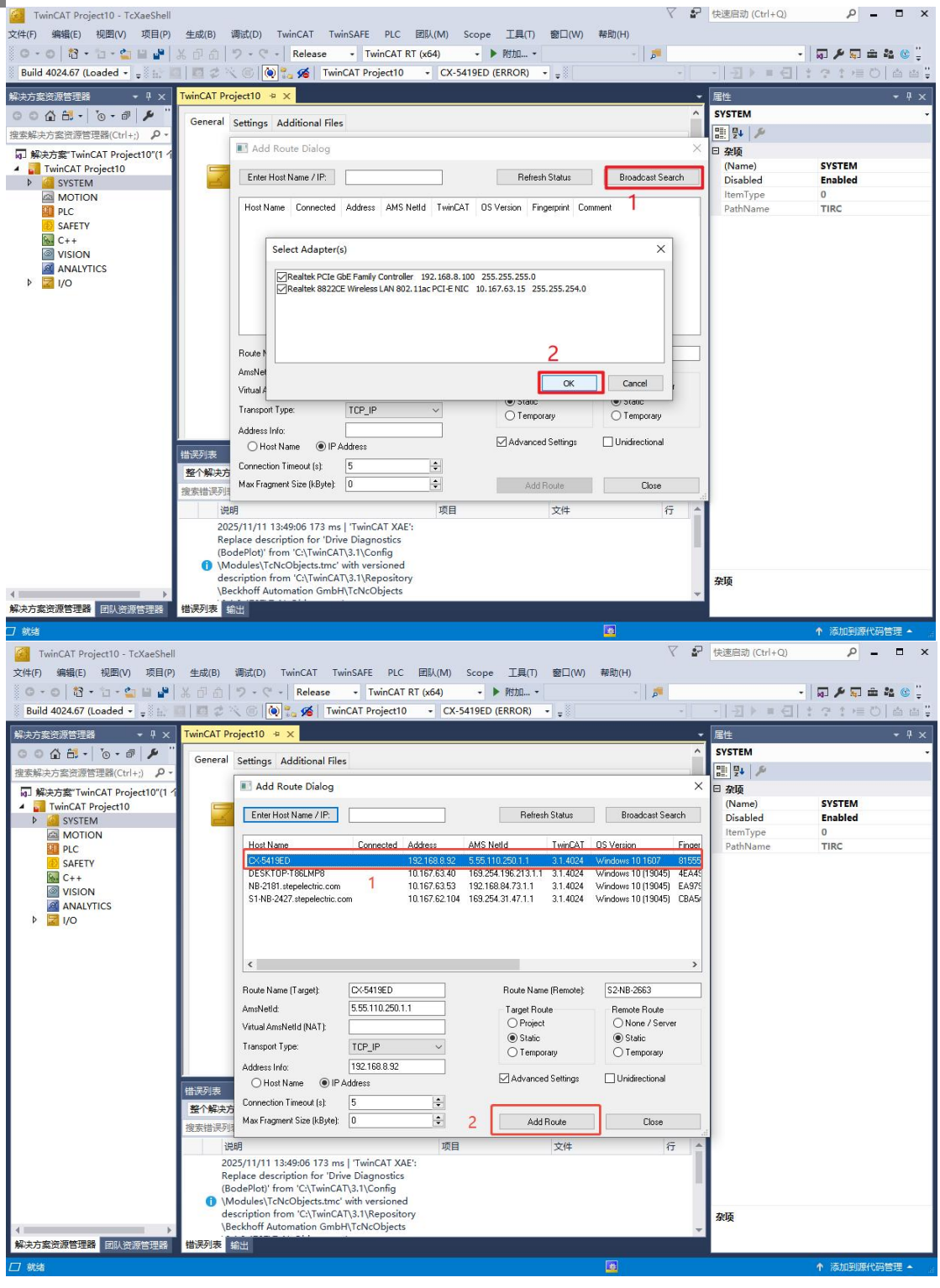


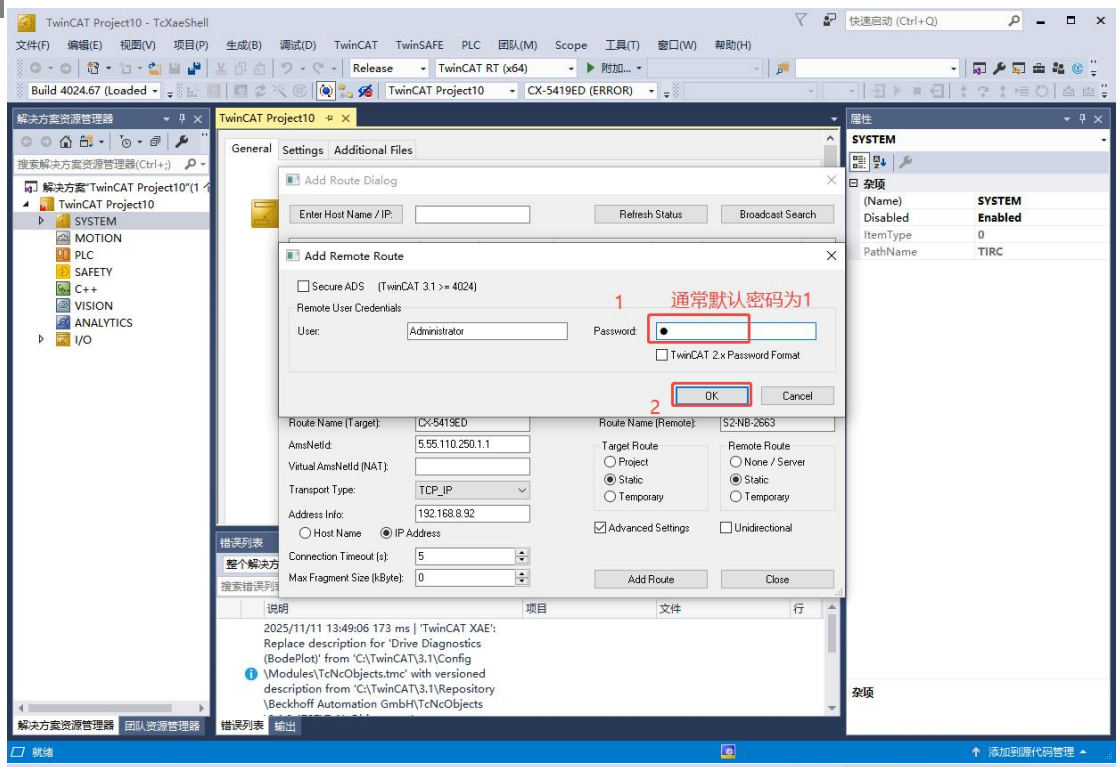
3. Open TwinCAT XAE (TcXaeShell) and create a new project, as shown in the figure below.

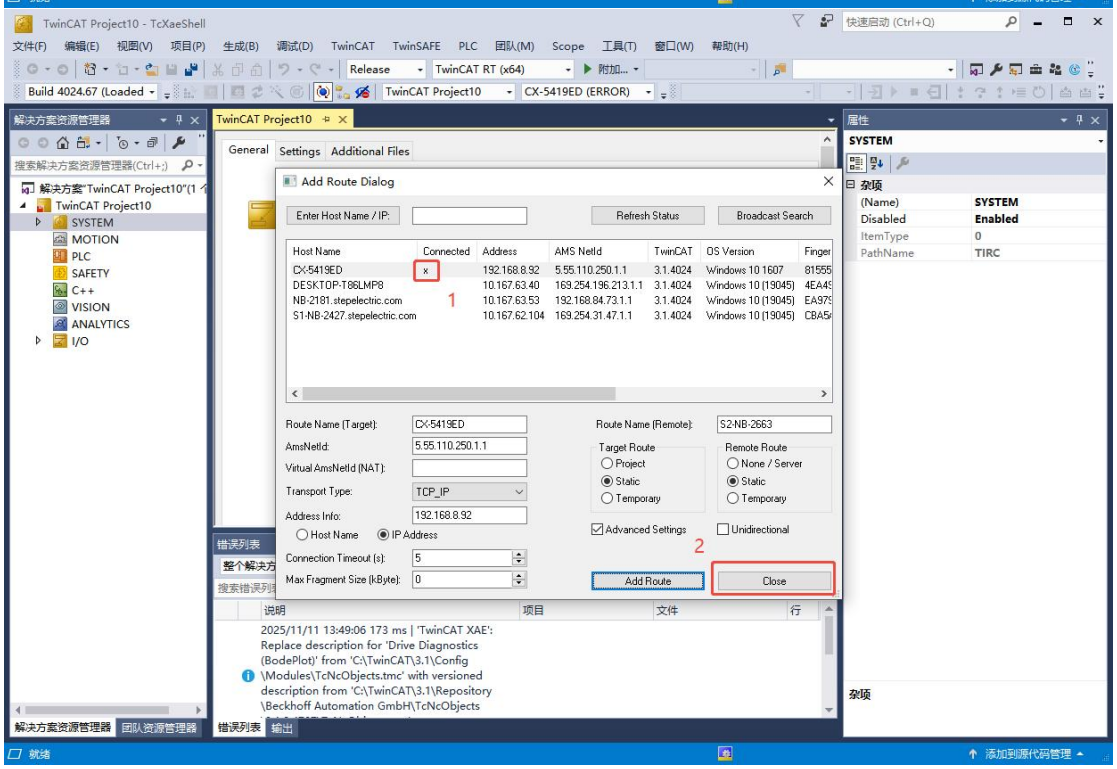


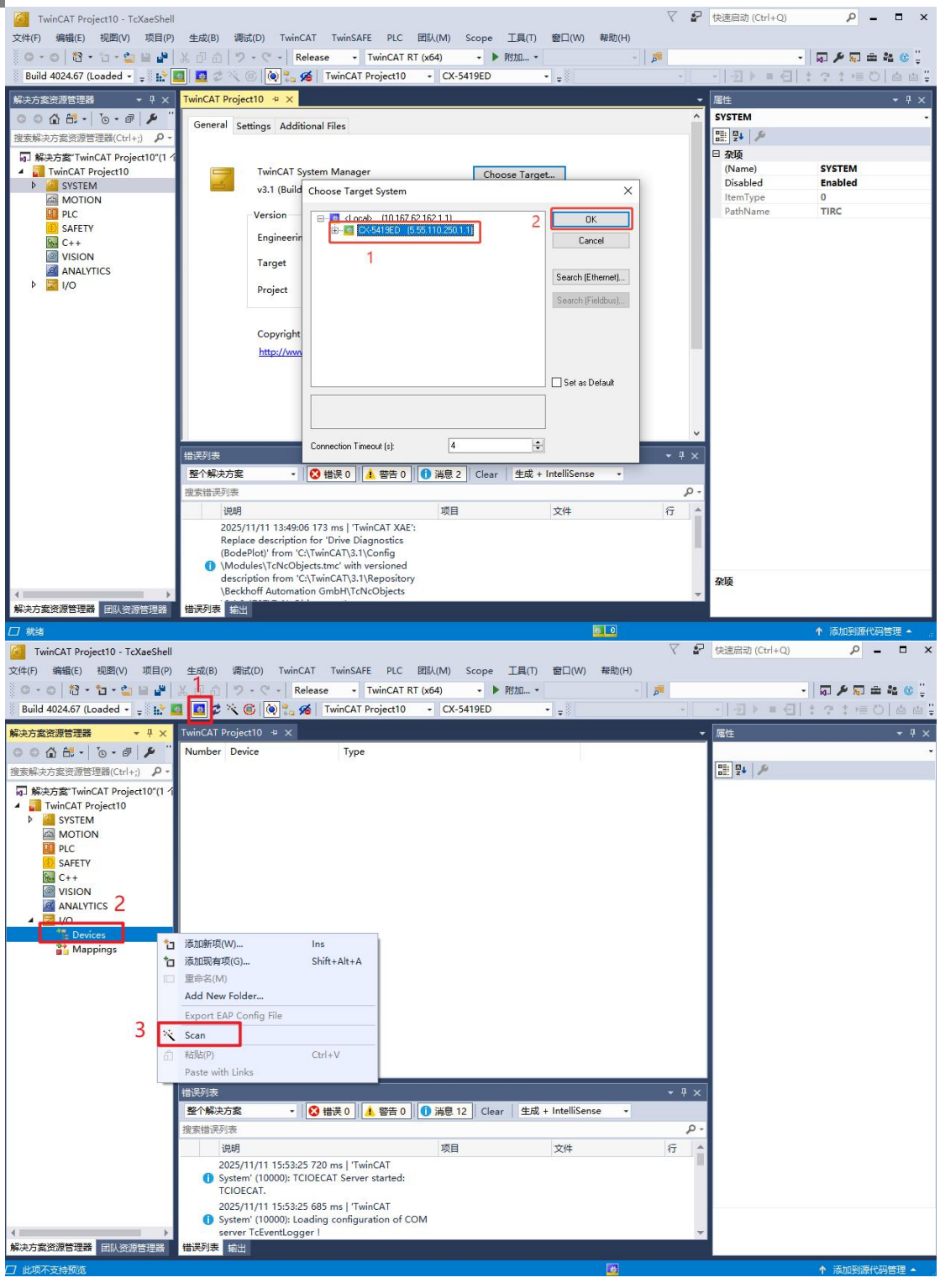
4. After entering the project, double-click 'SYSTEM'. In the right-hand window, click 'Choose Target System', and a window will pop up. If the PLC has been added before, it will be displayed in the window and can be selected directly. If it is being added for the first time, you need to click 'Search', and a popup window will appear. Follow the steps in order.

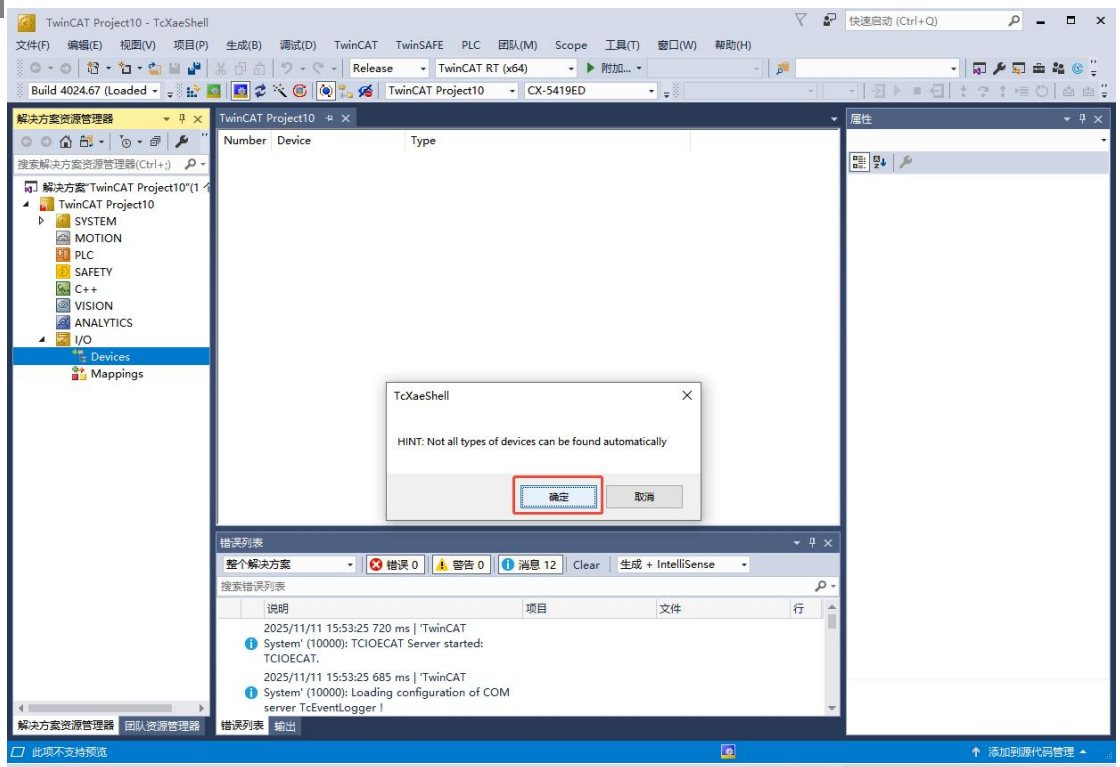


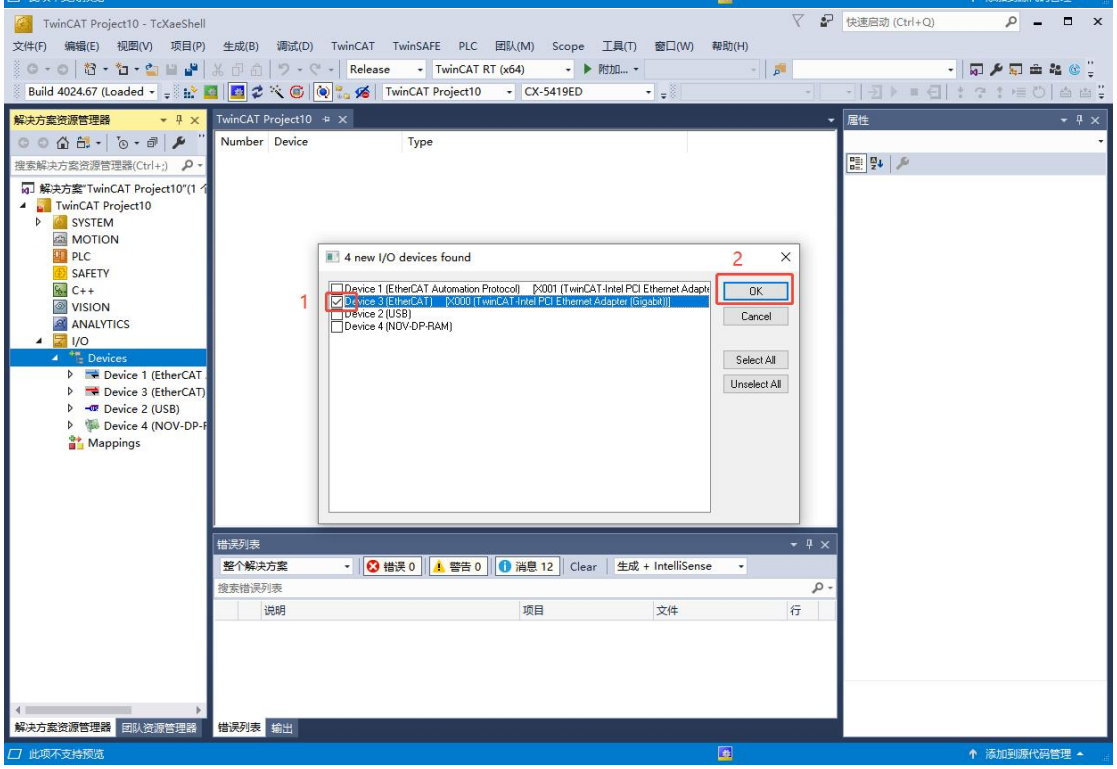

TwinCAT Project10 - TcXaeShell
Add Route Dialog
Enter Host Name / IP:
Refresh Status
Broadcast Search
1
Select Adapter(s)
Realtek PCIe GbE Family Controller 192.168.8.100 255.255.255.0
Realtek 8822CE Wireless LAN 802.11ac PCI-E NIC 10.167.63.15 255.255.254.0
2
OK
Cancel
Transport Type: TCP_IP
Address Info:
Host Name
IP Address
Connection Timeout (s): 5
Max Fragment Size (kByte): 0
Add Route
Close
CX-5419ED 192.168.8.92 5.55.110.250.1.1 3.1.4024 Windows 10 1607
DESKTOP-T86LMP8 10.167.63.40 169.254.196.213.1.1 3.1.4024 Windows 10 (19045)
NB-2181.stepelectric.com 10.167.63.53 192.168.84.73.1.1 3.1.4024 Windows 10 (19045)
S1-NB-2427.stepelectric.com 10.167.62.104 169.254.31.47.1.1 3.1.4024 Windows 10 (19045)
Route Name (Target): CX-5419ED
AmsNetId: 5.55.110.250.1.1
Route Name (Remote): S2-NB-2663
Target Route
Remote Route
Project
None / Server
Static
Temporary
Advanced Settings
Unidirectional

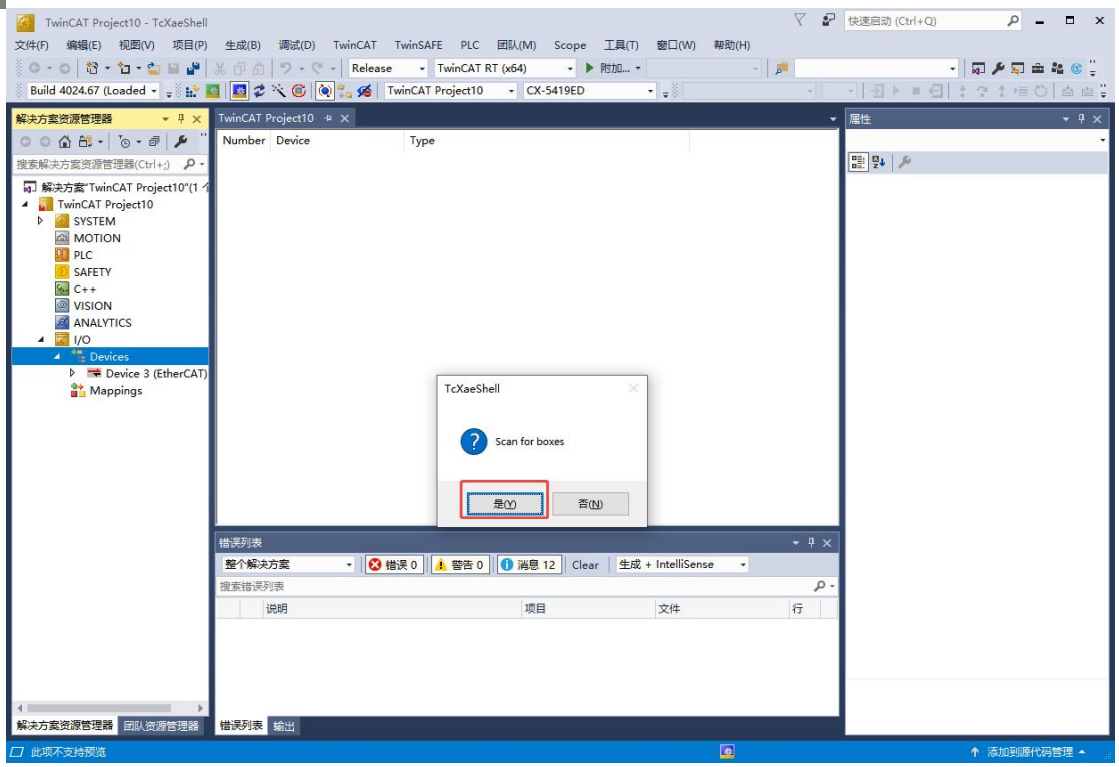

TwinCAT Project10 - TcXaeShell
Add Route Dialog
Enter Host Name / IP:
Refresh Status
Broadcast Search
Add Remote Route
Secure ADS (TwinCAT 3.1 >= 4024)
Remote User Credentials
User:
Administrator
Password:
1
通常默认密码为1
TwinCAT 2.x Password Format
OK
Cancel
2
Route Name (Target):
CX-5419ED
Route Name (Remote):
S2-NB-2663
AmsNetId:
5.55.110.250.1.1
Virtual AmsNetId (NAT):
Transport Type:
TCP_IP
Address Info:
192.168.8.92
Host Name
IP Address
Target Route
Project
Static
Temporary
Remote Route
None / Server
Static
Temporary
Advanced Settings
Unidirectional
Connection Timeout (s):
5
Max Fragment Size (kByte):
0
Add Route
Close


TwinCAT Project10 - TcXaeShell
Add Route Dialog
Enter Host Name / IP:
Refresh Status
Broadcast Search
Host Name
Connected
Address
AMS NetId
TwinCAT
OS Version
CX-5419ED
192.168.8.92
5.55.110.250.1.1
3.1.4024
Windows 10 1607
DESKTOP-T86LMP8
10.167.63.40
169.254.196.213.1.1
Windows 10 (19045)
NB-2181.stepelectric.com
10.167.63.53
192.168.84.73.1.1
S1-NB-2427.stepelectric.com
10.167.62.104
169.254.31.47.1.1
1
2
Route Name (Target):
Route Name (Remote):
AmsNetId:
Virtual AmsNetId (NAT):
Transport Type:
Address Info:
Target Route
Remote Route
Advanced Settings
Unidirectional
Connection Timeout (s):
Max Fragment Size (kByte):
Add Route
Close

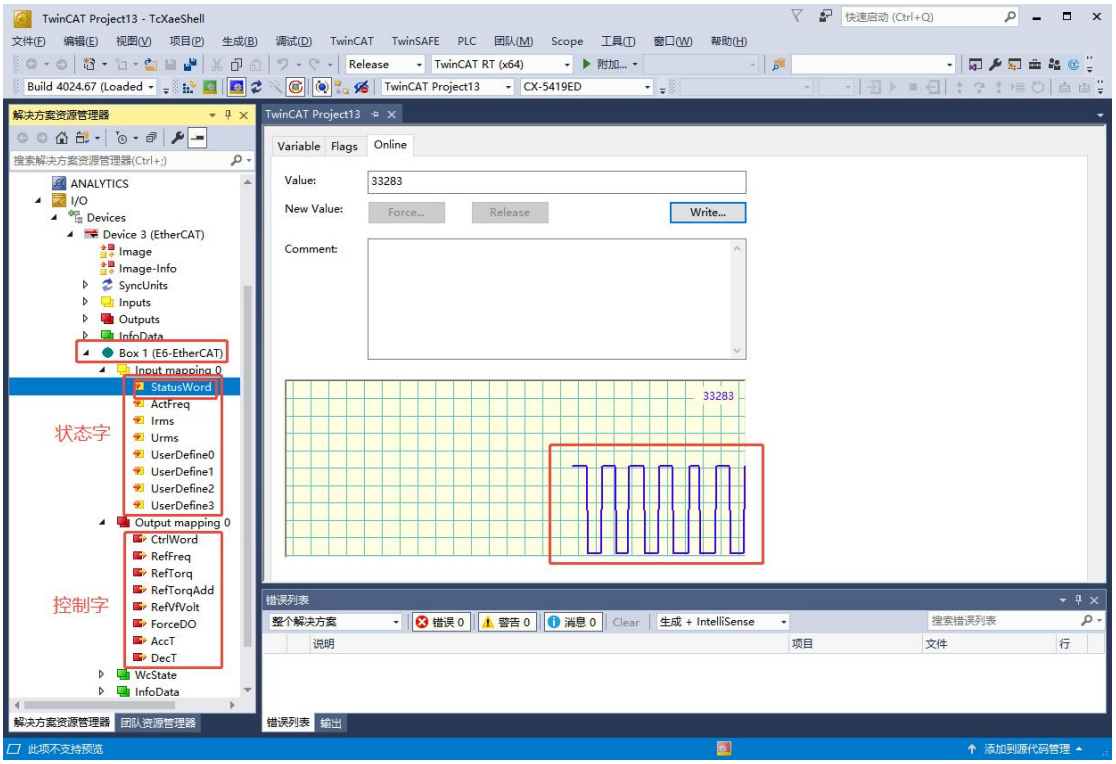

TwinCAT Project10 - TcXaeShell
Choose Target System
OK
Cancel
Search (Ethernet)...
Search (Fieldbus)...
Set as Default
Connection Timeout (s):
1
2
Devices
Mappings
Add New Folder...
Export EAP Config File
Scan
3


TwinCAT Project10 - TcXaeShell
TcXaeShell
HINT: Not all types of devices can be found automatically
确定
取消

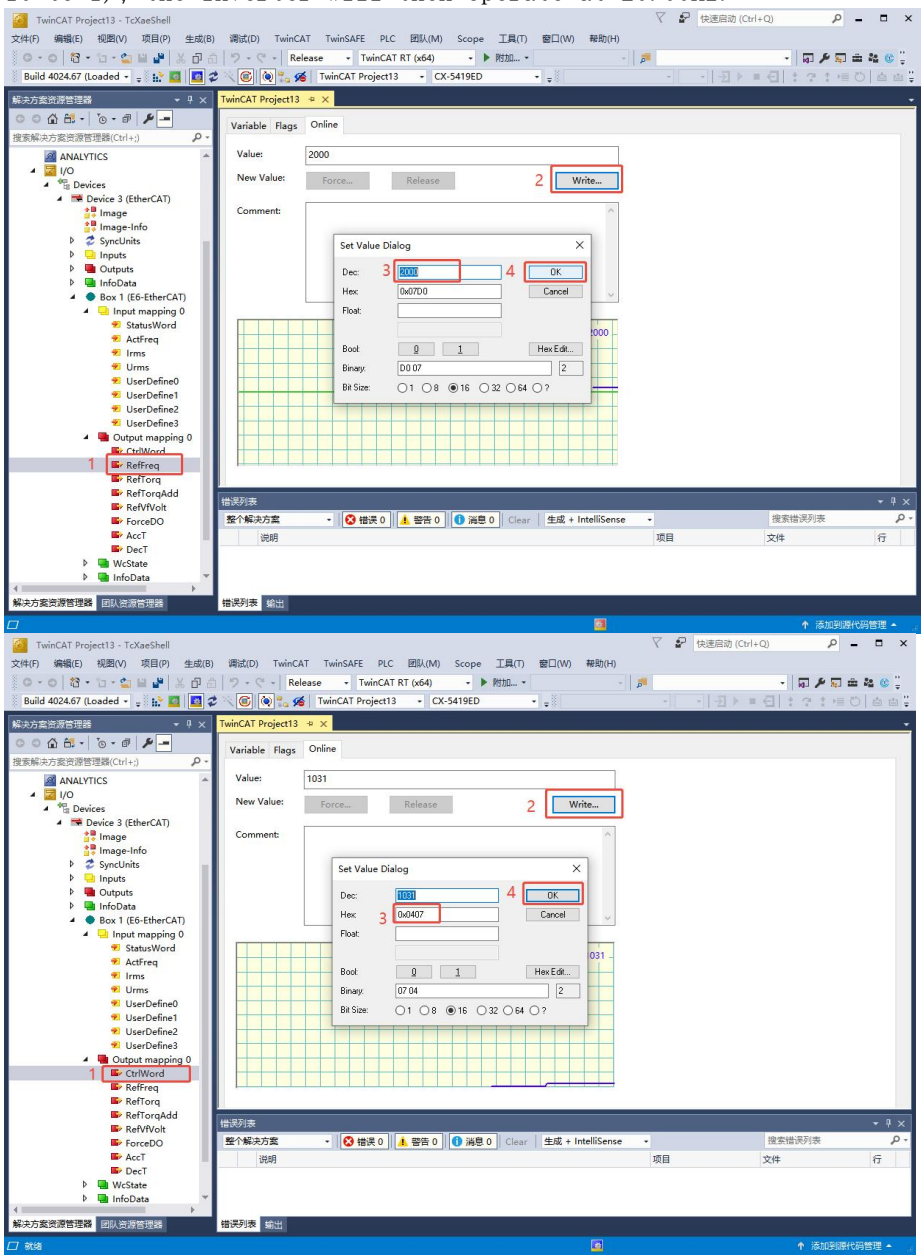

TwinCAT Project10 - TcXaeShell
4 new I/O devices found
Device 1 (EtherCAT Automation Protocol)
Device 3 (EtherCAT)
Device 2 (USB)
Device 4 (NOV-DP-RAM)
OK
Cancel
Select All
Unselect All



5. After the scan is complete, you can see that "box1 (E6-EtherCAT)" is the inverter module. Expanding it, Input corresponds to the inverter status word, and Output corresponds to the inverter control word. By clicking on the status word, you can see the heartbeat waveform in the right window, indicating that the communication is connected. You can then read the inverter status and write instructions, frequency, etc., to the inverter via EtherCAT. For specific communication details, see the communication protocol.



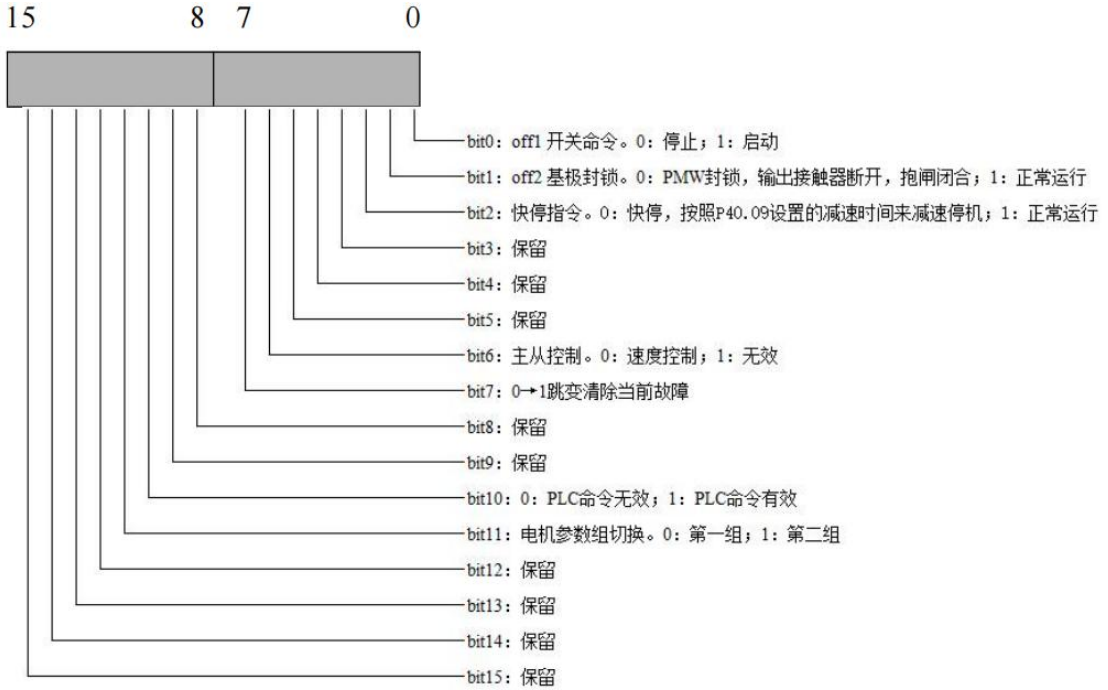
6. For example, to control the inverter to operate at 20.00Hz: first write 2000 in Word1 (representing 20.00Hz), then write 0x406 in Word0 (setting bits 0, 1, 2, and 10 to 1); the inverter will then operate at 20.00Hz.



F.4 Communication protocol

1. Control character

Control word WORD1, with each of its bits defined as follows:



Control Word WORD2: Speed command, for example: 5000 indicates forward rotation 50.00 Hz; -5000 indicates reverse rotation 50.00 Hz.

Control Word WORD3: Spare

Control Word WORD4: Spare

Control Word WORD5: Spare

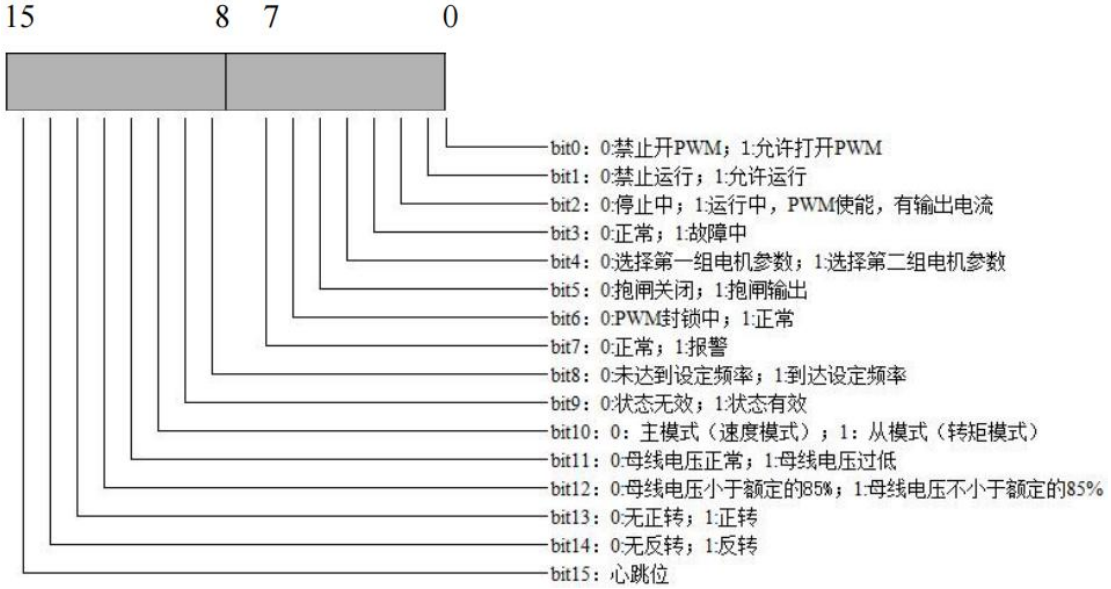
Control Word WORD6: PLC forced DO output, high 8 bits enable output, low 8 bits are output values.

Control Word WORD7: Acceleration (**.**s), 10000 represents 10.00s, this set time is for accelerating from 0 to rated frequency.

Control Word WORD8: Deceleration (**.**s), 10000 represents 10.00s, this set time is for decelerating from rated frequency to 0.

2.Status word

Status word WORD1, with each bit defined as follows:



Note: The 9th bit of status word WORD1 (i.e., bit9) meaning:

=0: indicates that the inverter status received by the PLC from EtherCAT is

invalid
=1: indicates that the inverter status received by the PLC from EtherCAT is valid
Status word WORD2: feedback frequency in Hz, for example: 5000 means forward rotation 50.00 Hz; -5000 means reverse rotation 50.00 Hz
In closed-loop control mode: this word represents encoder feedback speed
In V/F control mode: this word represents the actual output frequency
Status word WORD3: output current in A, for example: 100 means 10.0A
Status word WORD4: output voltage in V, for example: 380 means 380V
Status word WORD5: custom status 1, set according to parameter P82.02
Status word WORD6: custom status 2, set according to parameter P82.03
Status word WORD7: custom status 3, set according to parameter P82.04
Status word WORD8: custom status 4, set according to parameter P82.05

Appendix: Explanation of EtherCAT Custom Status Words

This description mainly refers to the last four bytes of the EtherCAT status word, which can be selected through the inverter parameters P82.02, P82.03, P82.04, and P82.05. The definitions for each selectable parameter are as follows:
Parameter set to 0-7: Reserved
Parameter set to 8: Inverter's target torque, signed, standard value is the rated motor torque, 999 means 99.9%, -1000 means -100.0%
Parameter set to 9: Reserved
Parameter set to 10: Inverter's current output torque, signed, standard value is the rated motor torque, 999 means 99.9%, -1000 means -100.0%
Parameter set to 11-12: Reserved
Parameter set to 13: Inverter's target frequency, unsigned, 5000 means 50.00Hz
Parameter set to 14: Inverter's current operating frequency, signed, 5000 means 50.00Hz, -5000 means -50.00Hz
Parameter set to 15: Inverter's feedback frequency, signed, 5000 means 50.00Hz, -5000 means -50.00Hz
Parameter set to 16: Inverter's feedback speed, signed, 1000 means 100.0rpm, -1000 means -100.0rpm
Parameter set to 17: Reserved
Parameter set to 18: Inverter's output voltage RMS, unsigned, 380 means 380V
Parameter set to 19: Inverter's output current RMS, unsigned, 100 means 10.0A
Parameter set to 20: Inverter's output active power, unsigned, 1000 means 100.0% of motor rated power
Parameter set to 21-22: Reserved
Parameter set to 23: Inverter's bus voltage, unsigned, 537 means 537V
Parameter set to 24-25: Reserved
Parameter set to 29: Inverter output terminal status, 1: ON, 0: OFF
Parameter set to 30: Reserved
Parameter set to 31: Inverter input terminal status, 1: ON, 0: OFF
Parameter set to 32-33: Reserved
Parameter set to 34: Analog input channel 0, 10000 means 10.000V
Parameter set to 35: Analog input channel 1, 10000 means 10.000V
Parameter set to 36-39: Reserved
Parameter set to 40: Most recent fault code, 0~63
Parameter set to 41-42: Reserved
Parameter set to 43: Heatsink temperature, 60 means 60° C
Parameter set to 44: Encoder count, 0~65535
Parameter set to 45-59: Reserved

3.Protocol Usage

Given frequency conditions:
First, the following two positions must be set before the frequency can be written to the inverter:
Bit2 = 1
Bit10 = 1
Write the target frequency to Word2 (speed command), for example 3000 (30Hz).

Operating conditions:
Bit0 = 1
Bit1 = 1
Bit2 = 1
Bit10 = 1

Appendix G Optional Expansion Cards

G. 1 Torque off STO expansion card

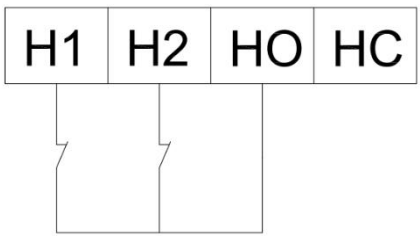
Torque off STO expansion card Board model: AS.L17/P

Functional description of the STO terminal on board A

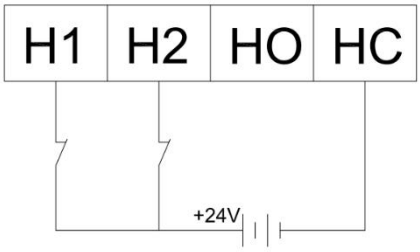
name	Terminal number	signal name	Remark
STO terminal	H1	STO1 channel terminal	When using internal 24V wiring, when activating the STO1 channel, H1 and HO are connected. When using external power supply, when activating STO1 channel, H1 is connected to external power supply 24V+, and HC terminal is connected to external power supply -.
	H2	STO2 channel terminal	When using internal 24V wiring, when activating the STO2 channel, H2 and HO are connected. When using external power supply, when activating STO2 channel, H2 is connected to external power supply 24V+, and HC terminal is connected to external power supply -.
	HO	STO24V+	STO internal 24V power supply +
	HC	STO external 24V-terminal	When using external power supply, HC is connected to external power supply 24V-

Note: It is forbidden to plug or unplug the high-voltage card while it is powered on. The low-voltage card can only be plugged or unplugged after the operator is powered off for at least 10 seconds.

When board A uses internal 24V wiring , the wiring diagram is as follows:



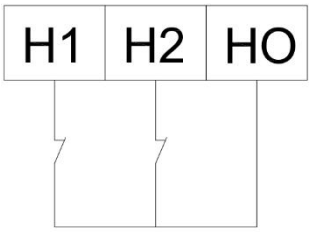
When board A uses external 24V wiring , the wiring diagram is as follows:



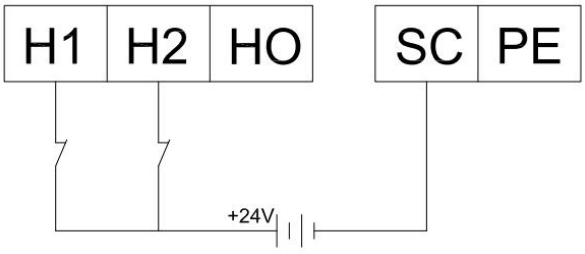
Functional description of the STO terminal on the B board

name	Terminal number	signal name	Remark
STO terminal	H1	STO1 channel terminal	When using internal 24V wiring, when activating the STO1 channel, H1 and HO are connected. When using external power supply, when activating STO1 channel, H1 is connected to external power supply 24V+, and SC terminal is connected to external power supply -.
	H2	STO2 channel terminal	When using internal 24V wiring, when activating the STO2 channel, H2 and HO are connected. When using external power supply, when activating STO2 channel, H2 is connected to external power supply 24V+, and SC terminal is connected to external power supply -.
	HO	STO24V+	STO internal 24V power supply +

B board uses internal 24V wiring, the wiring diagram is as follows:



B board uses external 24V wiring, the wiring diagram is as follows:



STO function is enabled

Function code	name	Setting range	Factory settings
P71.62	Function switch	0~ 65535	1029

Special function switch, generally used by debuggers

Bit1: RS485 virtual oscilloscope control function of RJ45 port;

Bit2: The RS485 virtual oscilloscope of the RJ45 port only has monitoring function;

Bit3: USB port virtual oscilloscope control function;

Bit 4: USB port virtual oscilloscope only has monitoring function;

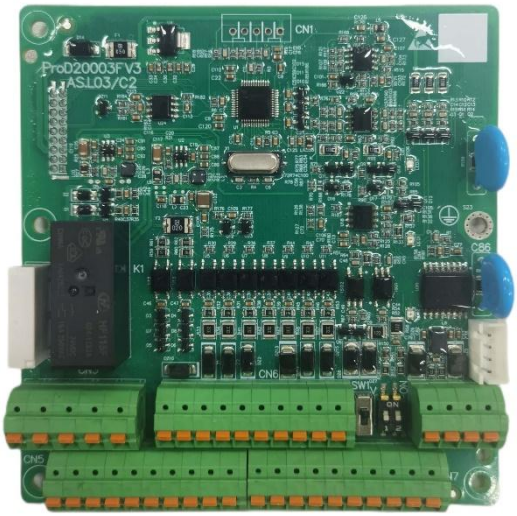
Bit 9: Enable the STO board base blocking function (to avoid malfunction when there is no STO board). For example, when Bit 9 is set to 1, the STO board base blocking function is enabled. When it is set to 0, it is disabled. Add 2 to the power of 9 to the factory parameter 1029, that is, 1541 to enable this function.

G. 2 Profinet communication board

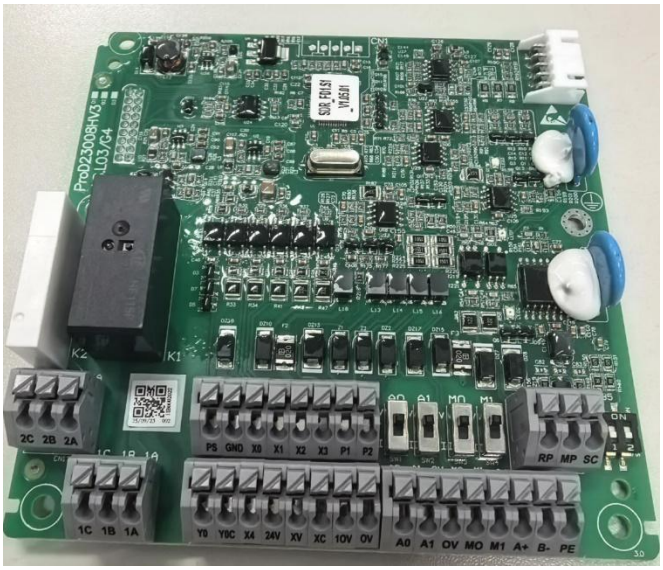
Profinet communication card Board model: AS.L03/C9

Note: It is forbidden to plug or unplug the high-voltage card while it is powered on. The low-voltage card can only be plugged or unplugged after the operator is powered off for at least 10 seconds.

G.3 IO interface board



Universal Standard IO Board - A Board

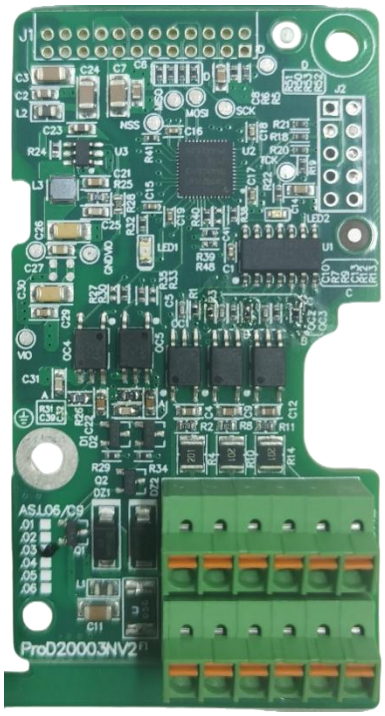


Universal Standard IO Board-B

IO board for intelligent flexible inverter	
Optional categories	Board model
Universal Standard IO Board - A Board	AS.L03/C2
Universal IO Board - B Board	AS.L03/ G4
With SSI programmable IO board - with isolated 485	AS.L03/D4.01
With SSI programmable IO board - with isolated CAN	AS.L03/D4.02

Note: It is forbidden to plug or unplug the high-voltage card while it is powered on. The low-voltage card can only be plugged or unplugged after the operator is powered off for at least 10 seconds.

G.4 Encoder PG card



Encoder PG card

PG card optional for intelligent flexible inverter	
Optional categories	Board model
5V incremental PG card	AS.L06/C9.01
12V incremental PG card	AS.L06/C9.02
5V incremental frequency division PG card	AS.L06/C9.03
12V incremental frequency division PG card	AS.L06/C9.04
12V incremental PG card	AS.L06/C9.05
12V incremental frequency division PG card	AS.L06/C9.06
ENDAT type PG card 5V; frequency division	AS.L06/D1.01
ENDAT type PG card 5V	AS.L06/D1.02
Resolver PG card	AS.L06/D2.01
SINCOS frequency division PG card 5V	AS.L06/C5.01
SINCOS type PG card 5V	AS.L06/C5.02
12V SinCosine Divider PG Card	AS.L06/C5.03
12V SinCos PG card	AS.L06/C5.04

Note: It is forbidden to plug or unplug the high-voltage card while it is powered on. The low-voltage card can only be plugged or unplugged after the operator is powered off for at least 10 seconds.

Incremental PG Card Specifications

Specifications: Support 5V/ 12V power input, supports open collector/push-pull/differential, supports 5V/12V divided output

Input and output electrical indicators

Parameter indicators			
name	Terminal number	Terminal Function Description	Remark
Frequency division signal output	FA	Frequency division signal output A phase	Transistor collector open output, maximum output frequency 100 kHz (supports 1, 2, 4, 8, 16, 32, 128 Total 7 Segment frequency division);
	0V	Frequency division signal output 0V	
	Facebook	Frequency division signal output B phase	
	0V	Frequency division signal output 0V	
Encoder input	A+	encoder A Phase signal+	Open collector/push-pull/differential, maximum input frequency 100kHz
	A-	encoder A Phase signal-	
	B+	encoder B Phase signal+	
	B-	encoder B Phase signal-	
	Z+	encoder Z Phase signal+	

	Z-	encoder Z Phase signal-	
	V+	Encoder power positive	Voltage 5V / 12VDC ±5%
	V-	Negative pole of encoder power supply	-
	PE	Shield grounding	Shield wire grounding terminal

Wiring Instructions:

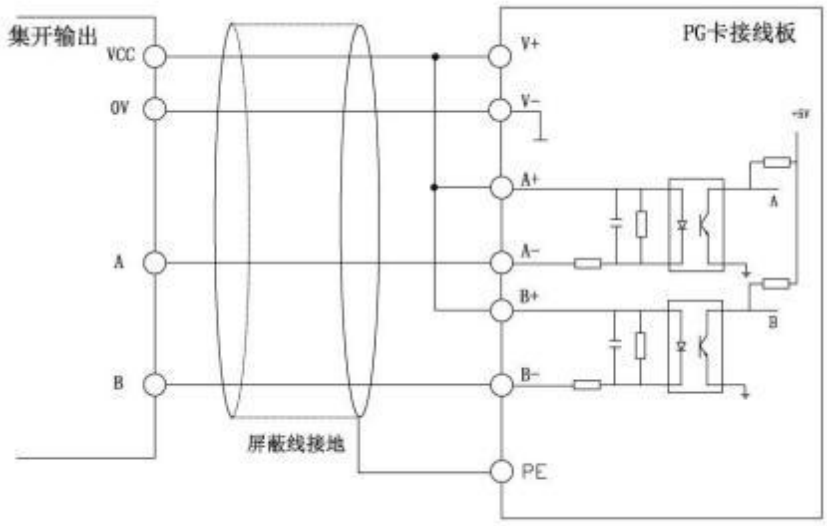


Figure E-1 Wiring with encoder open collector signal

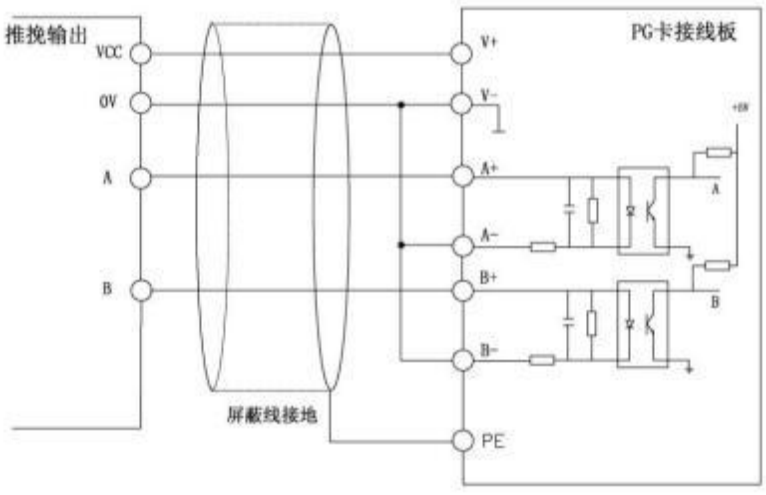


Figure E - 2 Wiring with encoder push-pull signal

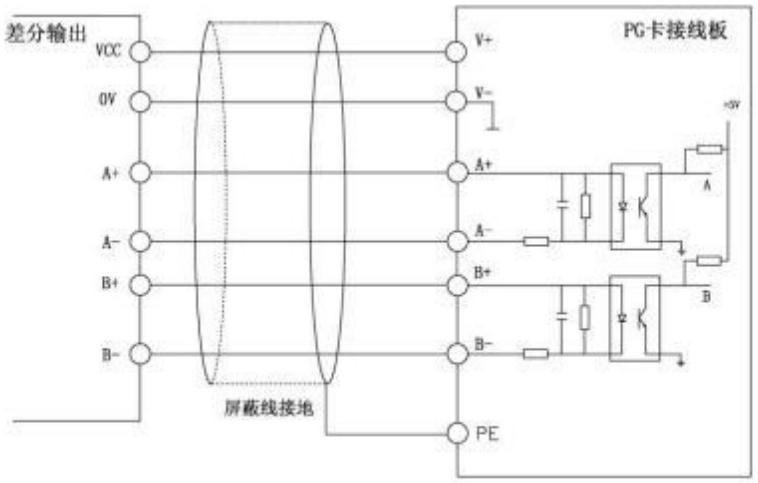


Figure E- 3 Wiring with encoder differential signal

Customer Complaint

Customer Name:	
Telephone:	fax:
Complaint category: ☐ Sales ☐ Promotion ☐ Service ☐ Quality ☐ Business ☐ Product ☐ Other	
Content of complaint:	
Complainant (Signature): Complaint unit (official seal): Date: Year Month Day	

Product warranty card

Customer Name:	
Telephone:	fax:
Warranty Products:	
Warranty content:	
Warrantor (signature): Warranty unit (official seal): Date: Year Month Day	

Warranty Discussion

1. The warranty period of this product is eighteen months (subject to the barcode information on the body). During the warranty period, if the product malfunctions or is damaged under normal use in accordance with the instruction manual, our company will be responsible for free repair.
2. During the warranty period, if the product is damaged due to the following reasons, a certain repair fee will be charged:

A. Damage to the machine caused by improper use or unauthorized repair or modification;

B. Damage to the machine caused by fire, flood, voltage abnormality, other natural disasters and secondary disasters ;

C. Hardware damage caused by dropping or transportation after purchase;

D. Damage to the machine caused by failure to operate in accordance with the user manual provided by our company;

E. Failure or damage caused by obstacles other than the machine (such as external equipment factors);

3. If the product fails or is damaged, please fill in all the details in the "Product Warranty Card" correctly and in detail.
4. The collection of maintenance fees shall be based on the latest revision of the "Maintenance Price List" of our company.
5. This warranty card will not be reissued under normal circumstances. Please be sure to keep this card and show it to the maintenance personnel during warranty service.
6. If you have any questions during the service process, please contact our agent or our company in time.
7. The right of interpretation of this Agreement belongs to Shanghai Sigriner STEP Motor Co., Ltd.

Shanghai Sigriner STEP Motor Co., Ltd.

(Customer Service Center) Service Hotline: 400-821-0325

Address: No. 1560 Siyi Road, Jiading District, Shanghai

Zip Code: 201801

Tel : 021-69926000

Fax: 0 21 - 69926000

Website: http://www.stepelectric. com

Customer Notice

Dear Customer,

RoHS stands for the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment. The European Union implemented the RoHS directive on July 1, 2006. It stipulates that the use of six hazardous substances—lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBBs), and polybrominated diphenyl ethers (PBDEs)—is restricted in newly marketed electrical and electronic equipment.

On February 28, 2006, seven Chinese ministries and commissions, including the Ministry of Information Industry, the National Development and Reform Commission, the Ministry of Commerce, the General Administration of Customs, the State Administration for Industry and Commerce, the General Administration of Quality Supervision, Inspection and Quarantine, and the State Environmental Protection Administration, jointly promulgated the "Measures for the Control of Pollution Caused by Electronic Information Products," which became China's version of the RoHS Directive and became mandatory. On February 1, 2008, the State Environmental Protection Administration of the People's Republic of China issued the " Measures for the Control of Environmental Pollution Caused by Electronic Waste, " which came into effect. These measures explicitly stipulate that users of electronic and electrical products must provide or entrust electronic waste to dismantling, utilization, or disposal units (including individual businesses) listed on a list (including the provisional list) with appropriate business scope for dismantling, utilization, or disposal .

Our company strictly controls six hazardous substances , including lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBBBs), and polybrominated diphenyl ethers (PBDEs), in the selection and procurement of electronic components, PCB boards, wiring harness materials, and structural parts . During the production process, PCB components are soldered on the Xinchi lead-free soldering production line using lead-free soldering processes.

The following components may contain toxic and hazardous elements:

Component Type	electronic components	Electronic printed circuit boards (PCBs)	sheet metal	heat sink	Plastic parts	wire
Possible toxic and harmful elements	Six hazardous substances including lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls and polybrominated diphenyl ethers					

一、Environmental impact analysis:

Our company's electronic products will generate some heat during use, which may cause trace amounts of certain harmful substances to be emitted, but this will not cause serious impact on the surrounding environment. Once the electronic products reach the end of their life cycle and are discarded, the heavy metals and toxic and hazardous chemicals in them will cause serious pollution to soil and water resources.

二、Life cycle of electronic products and equipment:

Any electronic product and equipment has a service life and will be damaged and scrapped. Even if it can still be used, it will be eliminated by the upgrading of electronic products. The life cycle of our company's electronic products and equipment generally does not exceed 20 years.

三、Disposal methods for scrapped electronic products:

When electronic products are scrapped, improper handling can pollute the environment. Our company requires customers to establish recycling systems in accordance with relevant national regulations. They must not be discarded as general household waste or industrial solid waste. Instead, they must strictly adhere to the "Measures for the Prevention and Control of Environmental Pollution by Electronic Waste" issued by the State Environmental Protection Administration. They must be stored and utilized in an environmentally sound manner or collected and recycled by qualified disposal agencies. Unqualified individuals and organizations are prohibited from dismantling, utilizing, or disposing of electronic waste.

Do not dispose of electronic waste with normal household waste. Call your local waste disposal agency or environmental agency for advice on how to dispose of electronic waste.

Shanghai Sigriner STEP Motor Co., Ltd.