STOCK CODE: 871415

Saving Energy Diligently & Acting Efficiently

EV510-PV SERIES
Vector Frequency Inverter

USER MANUAL V0.0

Nanjing Oulu Electric Corp., Ltd.

Foreword

First of all, thank you for purchasing the EV510-PV series special inverters for photovoltaic water pumping!

The EV510-PV series photovoltaic water pumping dedicated inverter is a special-purpose inverter mainly used to control and regulate the speed and torque of three-phase AC asynchronous motors and three-phase permanent magnet synchronous motors. It supports various PG cards, industrial bus expansion cards, input and output expansion cards and other accessories with powerful functions. An optional LCD keypad is available for comprehensive data display. Meanwhile, it is compatible with our upper computer commissioning tool to facilitate quick commissioning, parameter copying and parameter restoration. It is applicable to photovoltaic water supply scenarios including domestic water supply, urban water supply, farmland irrigation, grassland animal husbandry, forestry irrigation and desertification control.

For the EV510-PV series photovoltaic water pumping inverters, simply connect photovoltaic panels to the inverter, and the photovoltaic water pump will start automatically after power-on with a solar tracking efficiency up to 99%. Equipped with multiple protection functions such as PV overvoltage protection, dry-run protection and water shortage protection, the inverter can effectively extend product service life. An optional 4G module can be configured to realize remote control. Cabinet-mounted solutions with IP54 protection rating are supported. All models enable automatic switching between photovoltaic input and grid input for unattended 24-hour operation.

This manual describes the functional features and operating methods of the EV510-PV series special inverters for photovoltaic water pumping, covering product selection, parameter configuration, operation commissioning, maintenance and inspection. Please read this operation manual carefully before use.

Precautions
◆ The illustrations in this user manual are for illustration only and may differ from the product you ordered.
◆ The company is committed to the continuous improvement of products, product features will continue to upgrade, the information provided is subject to change without notice.
◆ If you have any problems in use, please contact our regional agents or contact our customer service center directly.

When you get the product, please confirm the following items:

Confirm Item	Confirmation method
Verify that the type and model match your order	Please confirm the nameplate on the side of the EV510-PV
Check for any damaged or broken parts	Check the overall appearance and check whether it is damaged during transportation
Whether the fastening parts such as screws are loose	Check with a screwdriver if necessary
Check the manual, warranty card and other accessories	EV510-PV manual and corresponding accessories

Directory

Chapter 1 Safety Information and Precautions

Safety Definition: In this manual, safety precautions are divided into the following two categories:

Danger: situations that may result in serious injury or even death due to the danger caused by not operating as required;

Caution: Danger due to failure to operate as required may result in moderate or minor injuries and equipment damage.

Please read this chapter carefully when installing, debugging and repairing the system, and be sure to operate in accordance with the safety precautions required by this chapter. Any injury and loss caused by illegal operation has nothing to do with the company.

1.1 Safety Matters

Use phase	Security Grade	Precautions
Before Installation	Danger	● Do not install the control system when it is found that water enters, parts are missing or parts are damaged during unpacking! ● When the packing list does not match the physical name, please do not install!
	Attention	● When handling, it should be lifted gently, otherwise there is a risk of damage to the equipment! ● Please do not use the damaged drive or the inverter with missing parts. Danger of injury! ● Do not touch the components of the control system with your hands, otherwise there is a danger of electrostatic damage!
During installation	Danger	● Please install it on metal and other flame retardant objects; Keep away from combustibles. Otherwise, it may cause a fire alarm! ● Do not screw the fixing bolts of equipment elements, especially those marked in red!
	Attention	● Do not let the wire head or screw fall into the driver. Otherwise, the drive will be damaged! ● Please install the drive in a place with less vibration and avoid direct sunlight. ● When more than two inverters are placed in the same cabinet, please pay attention to the installation position to ensure the heat dissipation effect.
During wiring	Danger	● The instructions in this manual must be followed and construction by professional electrical engineering personnel, otherwise unexpected dangers will occur! ● There must be a circuit breaker between the frequency converter and the power supply, otherwise a fire may occur! ● Please confirm that the power supply is in a zero-energy state before wiring, otherwise there is a risk of electric shock! ● According to the standard for the correct specification of the inverter grounding, otherwise there is a risk of electric shock!
	Attention	● Never connect the input power supply to the output terminals (U, V, W) of the frequency converter. Pay attention to the marking of the terminal, do not connect the wrong wire! Otherwise, the drive will be damaged! ● Refer to manual recommendations for wire diameters used. Otherwise, an accident may occur! ● The braking resistor must not be directly connected between the DC bus (+) and (-) terminals. Otherwise, cause a fire! ● The encoder must use shielded wire, and the shielding layer must ensure reliable grounding of single end!
Before Power-on	Danger	● Please confirm whether the voltage level of the input power supply is consistent with the rated voltage level of the inverter. Whether the wiring positions on the power input terminals (R, S, T) and output terminals (U, V, W) are correct; And pay attention to check whether there is a short circuit in the peripheral circuit connected to the driver, and whether the connected lines are tight, otherwise the driver will be damaged! ● Any part of the inverter does not need to carry out voltage test, the product has been tested when leaving the factory. Or cause an accident!

Use phase	Security Grade	Precautions
	Attention	● The frequency converter can only be powered on after the cover plate is covered. Otherwise, it may cause electric shock! ● The wiring of all peripheral accessories must follow the instructions of this manual and be correctly wired according to the circuit connection method provided in this manual. Or cause an accident!
After power-on	Danger	● Do not open the cover after power up. Otherwise there is a risk of electric shock! ● Do not touch the driver and peripheral circuits with wet hands. Otherwise there is a risk of electric shock! ● Do not touch any input/output terminals of the inverter. Otherwise there is a risk of electric shock! ● When powering on, the frequency converter automatically carries out safety detection on the external strong current circuit. At this time, never touch the U, V, W terminal or motor terminal of the driver, otherwise there is a danger of electric shock!
	Attention	● If parameter identification is required, be aware of the risk of injury while the motor is rotating. Otherwise, it may cause an accident! ● Do not arbitrarily change the inverter manufacturer parameters. Otherwise, it may cause damage to the equipment!
During operation	Danger	● Do not touch the cooling fan and discharge resistor to test the temperature. Otherwise, it may cause burns! ● Non-professional technicians should not detect the signal in operation. Failure to do so may cause personal injury or equipment damage!
	Attention	● During the operation of the frequency converter, something should be avoided to fall into the equipment. Otherwise, the equipment will be damaged! ● Do not use the contactor on-off method to control the start and stop of the driver. Otherwise, the equipment will be damaged!
During maintenance	Danger	● Do not carry out repair and maintenance of the inverter without professional training. Otherwise, personal injury or equipment damage may occur! ● Do not electrify the equipment for repair and maintenance. Otherwise there is a risk of electric shock! ● Confirm that the input power of the inverter is powered off for 10 minutes before the drive can be maintained and repaired. Otherwise, the residual charge on the capacitor will cause harm to people! ● All pluggable plug-ins must be plugged in and out in the event of a power failure! ● After replacing the frequency converter, the parameters must be set and checked.

Chapter 2 Product Information

2.1 Naming rules

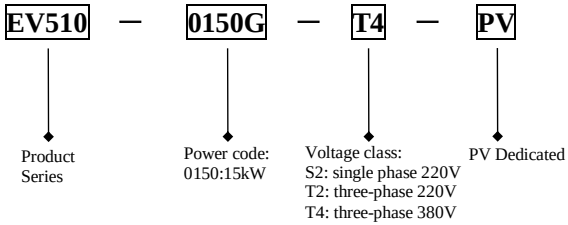


Figure 2-1 Naming Specifications

2.2 Nameplate

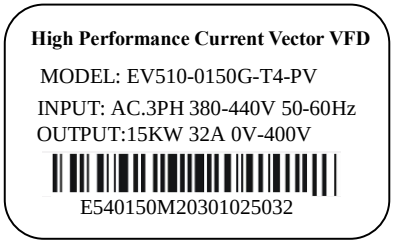


Figure 2-2 Nameplate

2.3 EV510-PV Series Parameters

VFD model	Power supply capacity KVA	Input current A	Output current A	Matching motor kW
Single-phase: 220V,50/60Hz				
EV510-0004G-S2-PV	1.0	5.4	2.3	0.4
EV510-0007G-S2-PV	1.5	8.2	4.0	0.75
EV510-0015G-S2-PV	3.0	14.0	7.0	1.5
EV510-0022G-S2-PV	4.0	23.0	9.6	2.2
Three-phase: 220V,50/60Hz				
EV510-0037G-T2-PV	8.9	14.6	17.0	3.7
EV510-0055G-T2-PV	17.0	26.0	25.0	5.5
EV510-0075G-T2-PV	21.0	35.0	32.0	7.5
Three-phase: 380V,50/60Hz				
EV510-0007G-T4-PV	1.5	3.4	2.1	0.75
EV510-0015G-T4-PV	3.0	5.0	3.8	1.5
EV510-0022G-T4-PV	4.0	5.8	5.1	2.2
EV510-0037G-T4-PV	5.9	10.5	9.0	3.7
EV510-0055G-T4-PV	8.9	14.6	13.0	5.5

VFD model	Power supply capacity KVA	Input current A	Output current A	Matching motor kW
EV510-0075G-T4-PV	11.0	20.5	17.0	7.5
EV510-0110G-T4-PV	17.0	26.0	25.0	11
EV510-0150G-T4-PV	21.0	35.0	32.0	15
EV510-0185G-T4-PV	24.0	38.5	37.0	18.5
EV510-0220G-T4-PV	30.0	46.5	45.0	22
EV510-0300G-T4-PV	40.0	62.0	60.0	30
EV510-0370G-T4-PV	57.0	76.0	75.0	37
EV510-0450G-T4-PV	69.0	92.0	91.0	45
EV510-0550G-T4-PV	85.0	113.0	112.0	55
EV510-0750G-T4-PV	114.0	157.0	150.0	75
EV510-0900G-T4-PV	134.0	180.0	176.0	90
EV510-1100G-T4-PV	160.0	214.0	210.0	110
EV510-1320G-T4-PV	192.0	256.0	253.0	132
EV510-1600G-T4-PV	231.0	307.0	304.0	160
EV510-1850G-T4-PV	240.0	330.0	340.0	185
EV510-2000G-T4-PV	250.0	385.0	377.0	200
EV510-2200G-T4-PV	280.0	430.0	426.0	220
EV510-2500G-T4-PV	355.0	468.0	465.0	250
EV510-2800G-T4-PV	396.0	525.0	520.0	280
EV510-3150G-T4-PV	445.0	590.0	585.0	315
EV510-3500G-T4-PV	500.0	665.0	650.0	350
EV510-4000G-T4-PV	565.0	785.0	725.0	400
EV510-4500G-T4-PV	630.0	800.0	820.0	450
EV510-5000G-T4-PV	700.0	890.0	870.0	500
EV510-5600G-T4-PV	783.0	980.0	950.0	560
EV510-6300G-T4-PV	882.0	1180.0	1100.0	630
EV510-7100G-T4-PV	-	-	1250.0	-
EV510-8000G-T4-PV	-	-	1400.0	-
EV510-9000G-T4-PV	-	-	1580.0	-
EV510-10000G-T4-PV	-	-	1750.0	-
EV510-12000G-T4-PV	-	-	2100.0	-
EV510-14000G-T4-PV	-	-	2320.0	-

2.4 Technical Specifications

Item		Specifications
Basic Functions	Maximum frequency	Vector control: 0~500Hz V/F control: 0~500Hz
	Carrier Frequency	0.8kHz ~ 12kHz can automatically adjust the carrier frequency according to the temperature characteristics
	Input frequency resolution	Digital setting: 0.01Hz analog setting: maximum frequency x 0.025%
	Control mode	Open-loop vector control (SVC) V/F control
	Starting torque	0.5Hz/150%(SVC)
	Speed range	1:100 (SVC)
	Steady speed accuracy	±0.5%(SVC)
	Torque control accuracy	±5%(FVC)
	Overload capacity	150% rated current 60s;180% rated current 3s
	Torque boost	Automatic torque increase; manual torque increase by 0.1~30.0
	V/F curve	Three ways: linear type; multi-point type; N-square type V/F curve (1.2, 1.4, 1.6, 1.8, 2)
	V/F separation	2 ways: full separation, half separation
	Acceleration and deceleration curve	Straight line or S curve acceleration and deceleration mode. Four kinds of acceleration and deceleration time, acceleration and deceleration time range of 0.0~6500.0s
	DC brake	DC braking frequency: 0.00Hz ~ maximum frequency braking time: 0.0s ~ 36.0s Braking action current value: 0.0%~ 100.0%
	Jog control	Inching frequency range: 0.00Hz ~ 50.00Hz. The inching acceleration and deceleration time is from 0.0s to 6500.0s.
	Simple PLC, multi-speed operation	Up to 16-speed operation through built-in PLC or control terminals
	Built-in PID	Convenient for process control closed-loop control system
	Automatic Voltage Adjustment (AVR)	When the grid voltage changes, can automatically keep the output voltage constant
	Overvoltage and overcurrent stall control	Automatic limit of current and voltage during operation to prevent frequent over-current and over-voltage trips
	Fast current limiting function	Reduce the overcurrent fault and protect the normal operation of the frequency converter
	Torque Limitation and Control	"Excavator" feature, automatic torque limit during operation to prevent frequent overcurrent trips in closed-loop vector mode Torque control can be realized
Personalized Functions	Excellent performance	Improving the performance of asynchronous motors with high-performance current vector control technology
	Instant stop	Instantaneous power failure through the load feedback energy compensation voltage reduction, to maintain the inverter in a short period of time to continue to run
	Timing control function	Timing control function: set time range of 0.0Min ~ 6500.0Min
	Multi-motor switching	Two sets of motor parameters, can realize two motor switching control
	Multi-threaded bus support	Supports two fieldbuses: RS-485 and CANlink
	Multi-encoder support	Support differential, open collector, resolver
	Command Source	The operation panel is given, the control terminal is given, and the serial communication port is given, which can be switched in various ways.
	Frequency source	10 kinds of frequency sources: digital given, analog voltage given, analog current given, pulse given, serial The mouth is given. Can be switched in many ways
	Auxiliary frequency source	10 auxiliary frequency sources. Flexible auxiliary frequency fine-tuning, frequency synthesis
I/O ports	Input terminal	Standard: 5 digital input terminals

Item		Specifications
		3 analog voltage input terminals, all supporting 0~10V input; among them, AI3 also supports 0~20mA current input
	Output terminal	Standard: 1 digital output terminal 2 relay output terminals 2 analog output terminals, both supporting 0~20mA current output or voltage output
Display and Keyboard Operation	LED display	Display parameters
	Button locking and function selection	To achieve some or all of the keys to lock, define the scope of action of some of the keys to prevent misoperation
	Protection function	Power-on motor short-circuit detection, output phase loss protection, over-current protection, over-voltage protection, under-voltage protection, over-temperature protection, overload protection, full water & water shortage protection, etc.
Operation Environment	Place of use	Indoor, free from direct sunlight, no dust, corrosive gases, flammable gases, oil mist, water vapor, dripping water or salt, etc
	Altitude	Less than 1000m
	Ambient temperature	-10 ℃ ~ +40 ℃ (ambient temperature is 40 ℃ ~ 50 ℃, please use derating)
	Humidity	Less than 95% RH, no bead condensation
Optional	Dual-screen display LED operation panel	LED display and operation keyboard; universal RJ45 interface

2.5 Product Dimensions

2.5.1 Product installation dimensions

- **Wall mount size**

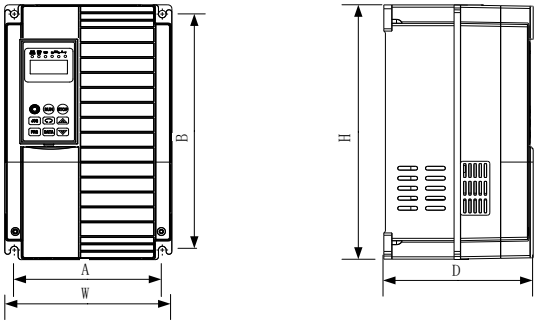


Figure 2-3 Schematic diagram of inverter wall-mounted installation

Models	Installation dimension (mm)		Outline dimension (mm)			Mounting hole diameter	Weight (KG)≈
	A	B	W	H	D		
EV510-0004G-S2-PV	101	171	112	180	118	Φ 4.6	1.3
EV510-0007G-S2-PV							
EV510-0015G-S2-PV							
EV510-0022G-S2-PV							
EV510-0037G-T2-PV	135	245	150	260	153	Φ 6	3.9
EV510-0055G-T2-PV							
EV510-0075G-T2-PV	186	306	210	330.5	188	Φ 9.5	7.5
EV510-0110G-T2-PV							
EV510-0150G-T2-PV	238	396	260	420	196	Φ 8.5	12.5
EV510-0007G-T4-PV	101	171	112	180	118	Φ 4.6	1.3
EV510-0015G-T4-PV							
EV510-0022G-T4-PV							
EV510-0037GP-T4-PV	101	171	112	180	138	Φ 4.6	2.1
EV510-0055G-T4-PV							
EV510-0075G-T4-PV	135	245	150	260	153	Φ 6	3.9
EV510-0110G-T4-PV							
EV510-0150G-T4-PV							
EV510-0185G-T4-PV	186	306	210	330.5	188	Φ 9.5	7.5

Models	Installation dimension (mm)		Outline dimension (mm)			Mounting hole diameter	Weight (KG)≈
	A	B	W	H	D		
EV510-0220G-T4-PV							
EV510-0300G-T4-PV							
EV510-0370G-T4-PV	238	396	260	420	196	Φ 8.5	12.5
EV510-0450G-T4-PV							
EV510-0550G-T4-PV	272	455	304	470	240	Φ 9	22.9
EV510-0750G-T4-PV	200	614	278	630	310	Φ 9	39
EV510-0900G-T4-PV							
EV510-1100G-T4-PV							
EV510-1320G-T4-PV	300	650	454	670	310	φ9	67
EV510-1600G-T4-PV							
EV510-1850G-T4-PV	400	810	520	835	382	φ13	107
EV510-2000G-T4-PV							
EV510-2200G-T4-PV							
EV510-2500G-T4-PV							
EV510-2800G-T4-PV	460(230 +230 total 3 holes)	895	720	920	382	φ13	155
EV510-3150G-T4-PV							
EV510-3500G-T4-PV							
EV510-4000G-T4-PV							
EV510-4500G-T4-PV							

■ **Floor mounting dimensions**

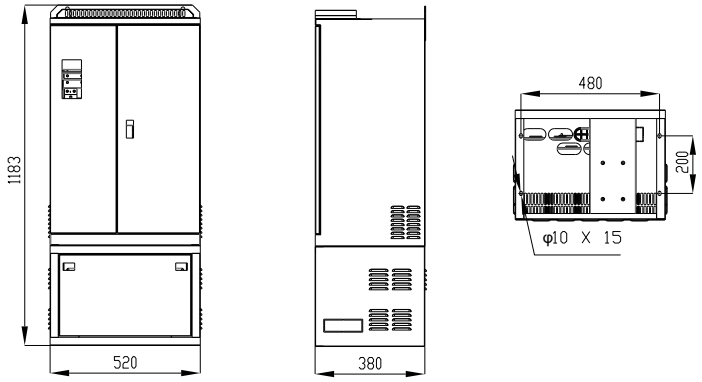


Fig. 2-4 Floor-mounted installation diagram for models 1850G–2500G

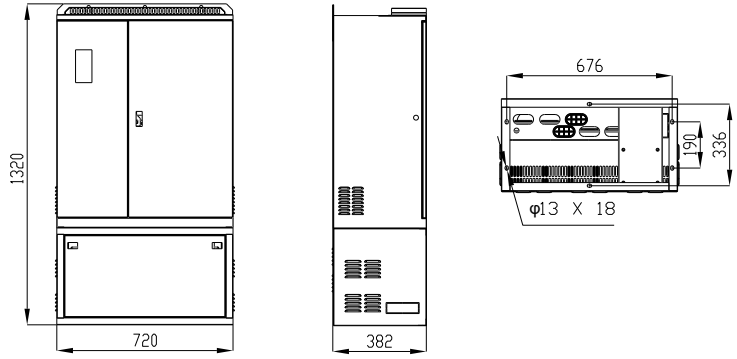


Fig. 2-5 Floor-mounted installation diagram for models 2800G–4500G

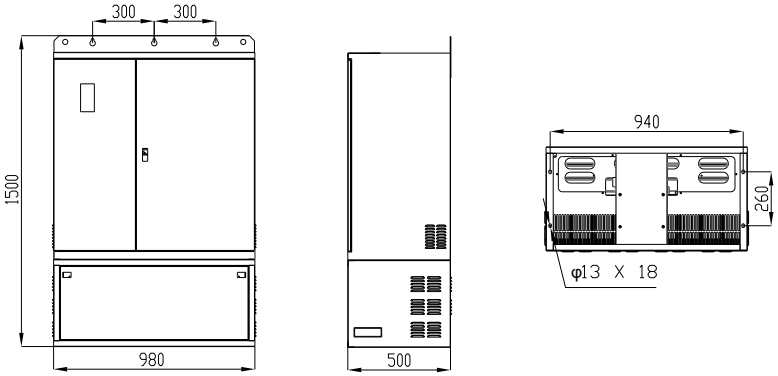


Fig. 2-6 Floor-mounted installation diagram for models 5000G–6300G

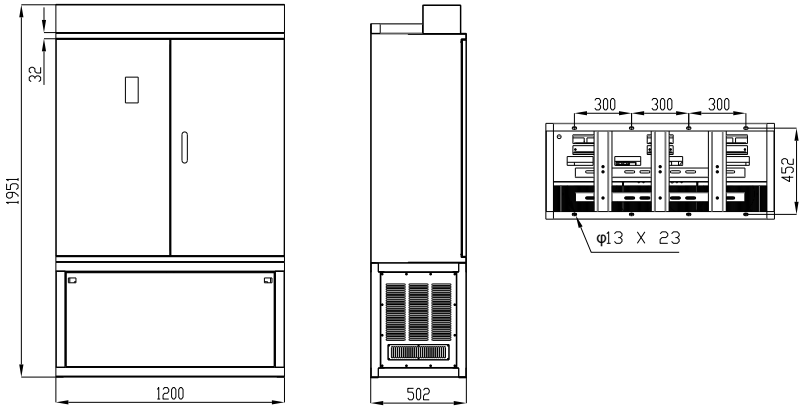


Fig. 2-7 Floor-mounted installation diagram for models 7100G ~ 8000G

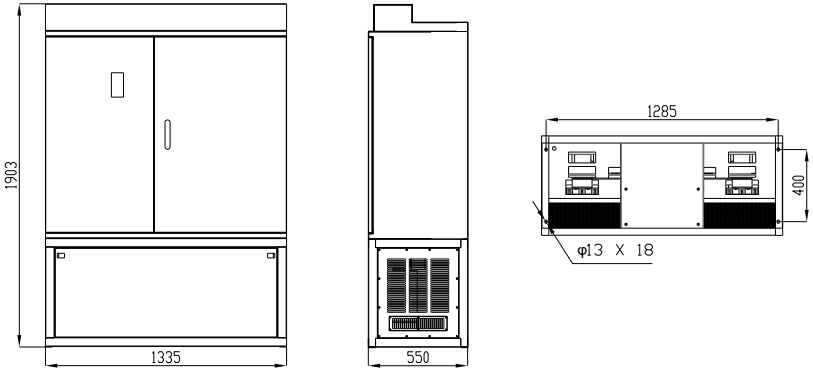


Figure 2-8 Floor-mounted installation diagram for models 9000G ~ 14000G

2.5.2 Outline of operation panel 510A:1 (below 18.5kW)

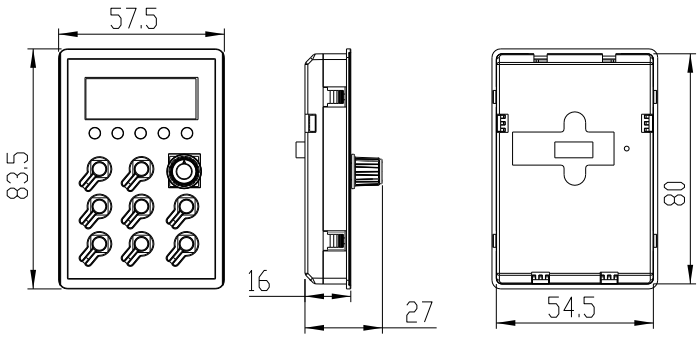


Figure 2-9

2.5.3 Outline of operation panel 510A:2 (18.5kW and above)

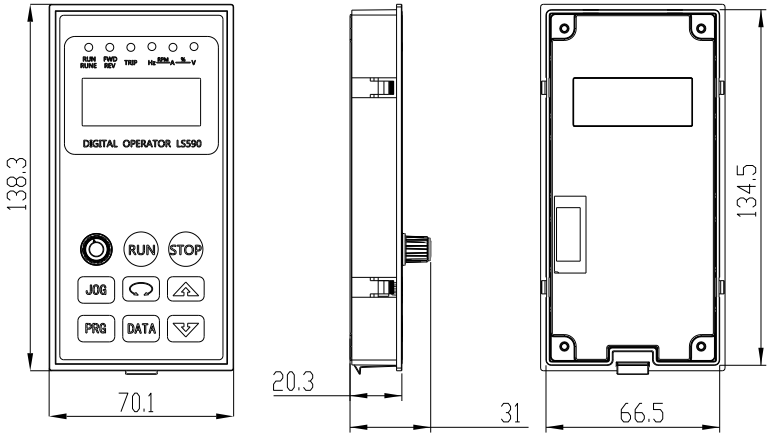


Figure 2-10

2.6 Routine Maintenance and Care of the VFD

2.6.1 Daily maintenance

Due to the influence of environmental temperature, humidity, dust and vibration, it will lead to the aging of the internal components of the inverter, resulting in the potential failure of the inverter or reducing the service life of the inverter. Therefore, it is necessary to implement daily and regular maintenance and maintenance of the inverter.

Daily inspection items:

1) Whether the sound changes abnormally during the operation of the motor

2) Whether the motor produces vibration during operation

3) Whether the installation environment of the frequency converter changes

4) Whether the inverter cooling fan works normally

5) Whether the frequency converter is overheated

Daily cleaning:

1) The frequency converter should always be kept in a clean state

2) Effectively remove the dust on the surface of the inverter to prevent the dust from entering the inverter. Especially metal dust.

3) effectively remove the inverter cooling fan oil

2.6.2 Periodic inspection

Please regularly check the places that are difficult to check during operation. Regular inspection items:

1) Check the air duct and clean it regularly

2) Check whether the screws are loose

3) Check the frequency converter for corrosion

4) Check whether there is arc trace in the terminal

5) Main circuit insulation test

Reminder: When measuring the insulation resistance of the motor with a megohmmeter (please use a DC 500V megohmmeter), disconnect the main circuit line from the frequency converter. Do not use an insulation resistance meter to test the insulation of the control circuit. There is no need to perform a high-voltage test (completed at the factory).

2.6.3 Replacement of vulnerable parts of frequency converter

The wearing parts of the inverter are mainly cooling fans and filtering electrolytic capacitors, and their life is closely related to the environment and maintenance conditions. The general life time is:

Device Name	Lifetime
Fan	2 to 3 years
electrolytic capacitor	4 to 5 years

The user can determine the replacement age according to the running time.

1) Cooling fan

Possible causes of damage: bearing wear, blade aging.

Judgment criteria: whether there are cracks in the fan blades, etc., and whether there is abnormal vibration when the sound is turned on.

2) filter electrolytic capacitor

Possible causes of damage: poor quality of input power supply, high ambient temperature, frequent load jump, electrolyte aging. Discriminant criteria: whether there is liquid leakage, whether the safety valve has been protruding, the determination of electrostatic capacitance, the determination of insulation resistance.

2.6.4 Storage of frequency converter

After the user purchases the inverter, temporary storage and long-term storage must pay attention to the following points:

1) When storing, try to put it into the company's packing box according to the original packaging.

2) Long-term storage will lead to the deterioration of electrolytic capacitors. It must be ensured that the power is turned on once within 2 years, the power-on time is at least 5 hours, and the input voltage must be slowly increased to the rated value with a voltage regulator.

Chapter 3 Mechanical and Electrical Installation

3.1 Mechanical Installation

3.1.1 Installation environment:

1) Ambient temperature: The ambient temperature has a great influence on the life of the inverter, and the operating ambient temperature of the inverter is not allowed to exceed the allowable temperature range (-10 ℃ ~ 40 ℃).

2) Install the inverter on the surface of the flame retardant object and install it on the mounting support vertically with screws. When the inverter is working, it is easy to generate a lot of heat, and there should be enough space around to dissipate heat.

3) Please install it in a place that is not easy to vibrate. The vibration shall not be greater than 0.6G. Pay special attention to keep away from punch press and other equipment.

4) Avoid installing in direct sunlight, damp, and water drops.

5) Avoid being installed in places with corrosive, flammable and explosive gases in the air.

6) Avoid being installed in places with oil, dust and metal dust.

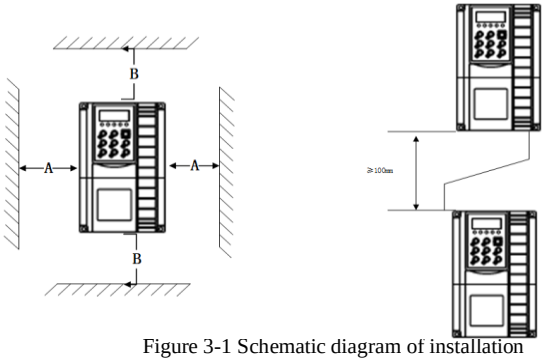


Figure 3-1 Schematic diagram of installation

When installing a single unit: when the inverter power is not more than 22kW, the size may not be considered. When greater than 22kW, A should be greater than 50mm. When installing up and down: Please install the heat insulation deflector shown in the figure when installing up and down the inverter.

Power class	Mounting dimensions	
	B	A
≤ 15kW	≥ 100mm	May not be required
18.5kW ~ 45kW	≥ 200mm	≥ 50mm
≥ 55kW	≥ 300mm	≥ 50mm

3.1.2 Mechanical installation needs to pay attention to the problem of heat dissipation. So please note the following points

1) Please install the inverter vertically to facilitate the upward heat dissipation. But not upside down. If there are more frequency converters in the cabinet, it is best to install side by side. Where upper and lower installation is required, please refer to the schematic diagram in Figure 3-1 to install the heat insulation deflector.

2) The installation space shall be as shown in Figure 3-1 to ensure the heat dissipation space of the inverter. However, please consider the heat dissipation of other devices in the cabinet when arranging.

3) The mounting bracket must be made of flame retardant material.

4) For metal dust applications, it is recommended to use the radiator cabinet outside the installation method. At this time, the space in the fully sealed cabinet should be as large as possible.

3.2 Electrical Installation

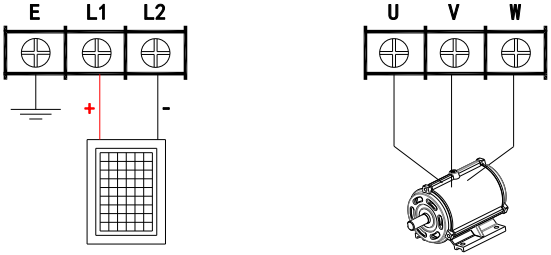
3.2.1 Selection guidance of peripheral electrical components

Model	Molded Case Circuit Breaker(MCCB) A	Recommended Contactor A	Recommended Input Main Circuit Cable mm^2	Recommended Output Main Circuit Cable mm^2	Recommended Control Circuit Cable mm^2
Three-phase 380V					
EV510-0007G-T4-PV	10	10	2.5	2.5	1.0
EV510-0015G-T4-PV	16	10	2.5	2.5	1.0
EV510-0022G-T4-PV	16	10	2.5	2.5	1.0
EV510-0037G-T4-PV	25	16	4.0	4.0	1.0
EV510-0055G-T4-PV	32	25	4.0	4.0	1.0
EV510-0075G-T4-PV	40	32	4.0	4.0	1.0
EV510-0110G-T4-PV	63	40	4.0	4.0	1.0
EV510-0150G-T4-PV	63	40	6.0	6.0	1.0
EV510-0185G-T4-PV	100	63	6	6	1.5
EV510-0220G-T4-PV	100	63	10	10	1.5
EV510-0300G-T4-PV	125	100	16	10	1.5
EV510-0370G-T4-PV	160	100	16	16	1.5
EV510-0450G-T4-PV	200	125	25	25	1.5
EV510-0550G-T4-PV	200	125	35	25	1.5
EV510-0750G-T4-PV	250	160	50	35	1.5
EV510-0900G-T4-PV	250	160	70	35	1.5
EV510-1100G-T4-PV	350	350	120	120	1.5
EV510-1320G-T4-PV	400	400	150	150	1.5
EV510-1600G-T4-PV	500	400	185	185	1.5

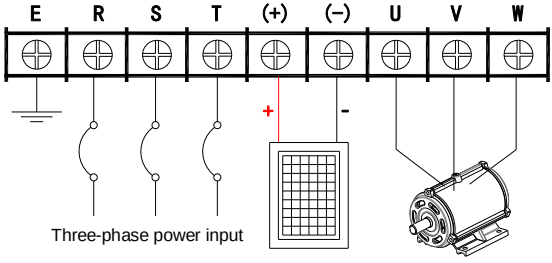
Model	Molded Case Circuit Breaker(MCCB) A	Recommended Contactor A	Recommended Input Main Circuit Cable mm²	Recommended Output Main Circuit Cable mm²	Recommended Control Circuit Cable mm²
EV510-2000G-T4-PV	600	600	150*2	150*2	1.5
EV510-2200G-T4-PV	600	600	150*2	150*2	1.5
EV510-2500G-T4-PV	800	600	185*2	185*2	1.5
EV510-2800G-T4-PV	800	800	185*2	185*2	1.5
EV510-3150G-T4-PV	800	800	150*3	150*3	1.5
EV510-3500G-T4-PV	800	800	150*4	150*4	1.5
EV510-4000G-T4-PV	1000	1000	150*4	150*4	1.5

3.2.2 Main circuit terminal block description

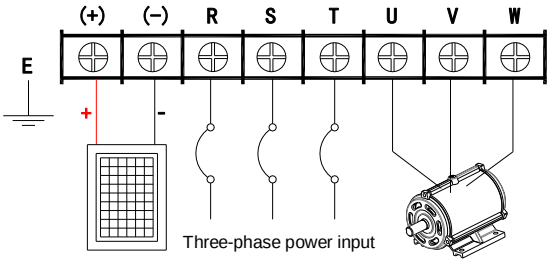
a) Main Circuit Wiring Diagram (0.4kW-2.2kW Single-phase 220V)



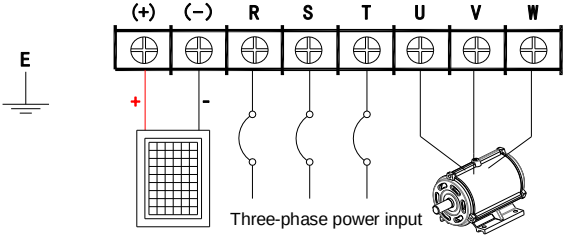
b) Main Circuit Wiring Diagram (0.75kW-18.5kW)



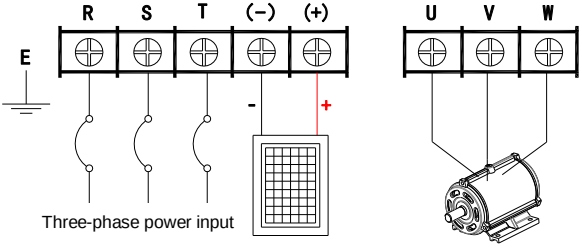
c) Main Circuit Wiring Diagram (22kW-30kW)



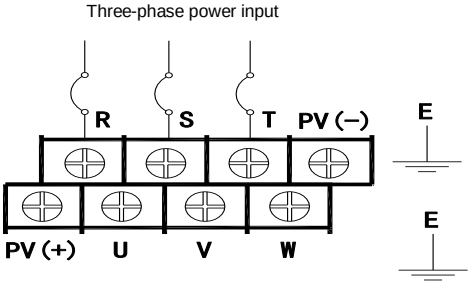
d) Main Circuit Wiring Diagram (37kW-45kW)



e) Main Circuit Wiring Diagram (55kW)

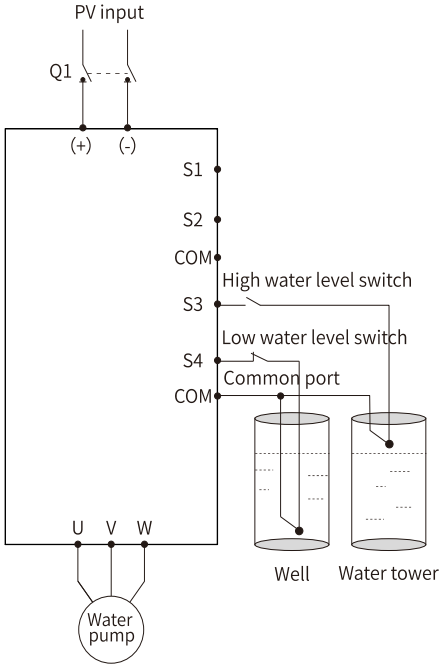


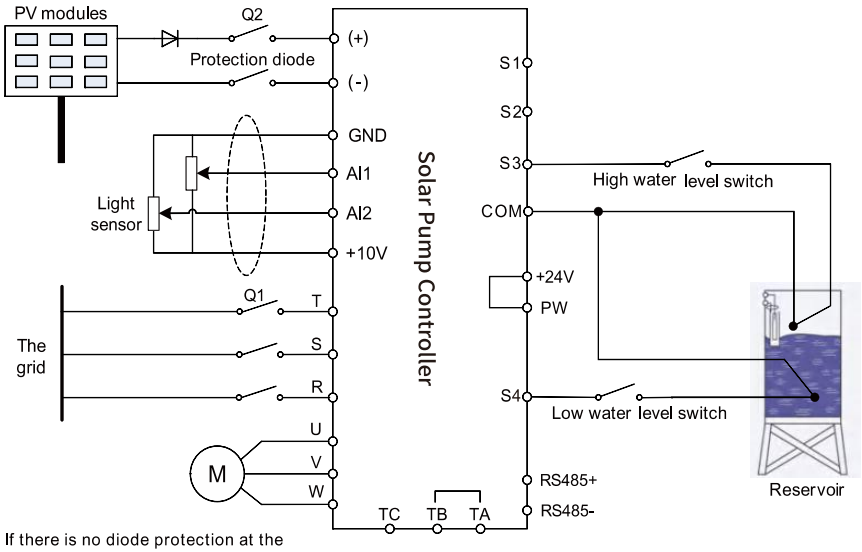
f) Main Circuit Wiring Diagram (75kW-110kW)



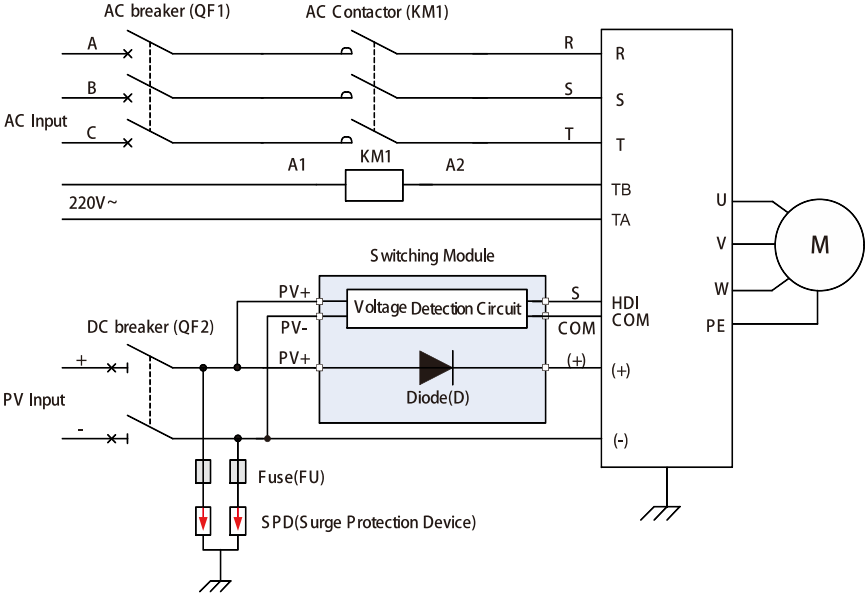
Terminal Symbol		Function Description	
⏚		Protective grounding	Protective grounding terminal. Each machine must be reliably grounded.
Single Phase	L1、L2	PV DC input	PV panel input terminal
	U、V、W	VFD output	Connect to three-phase AC motor
Three Phase	R、S、T	AC input	Connect to grid three-phase AC power
	U、V、W	VFD output	Connect to three-phase AC motor
	（+）（-）	PV DC input	PV panel input terminal

3.3 Standard Wiring Diagram



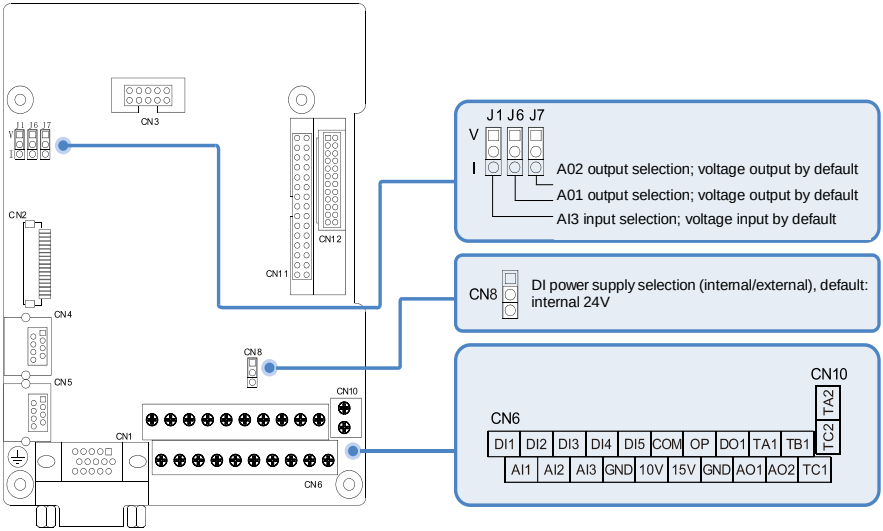


If there is no diode protection at the bus input, Q2 and Q1 can not be switched at the same time. Otherwise damage may occur to the solar panels.



3.4 Control Board Terminals

3.4.1 Control board terminal layout



3.4.2 Description of control board terminals

Category	Terminal Symbol	Terminal Name	Function Description
Power	10V-GND	External 10V Power Supply	Provides 10V power output, max. output current: 10mA. Typically used as the operating power supply for external potentiometers; potentiometer resistance range: 1kΩ ~ 5kΩ.
	15V-GND	External 15V Power Supply	Provides 15V power output, typically used as the power supply for pressure sensors. Max. output current: 10mA.
Analog Input	AI1-GND	Analog Input Terminal 1	1. Input voltage range: DC 0V ~ 10V 2. Input impedance: 22kΩ
	AI2-GND	Analog Input Terminal 2	1. Input voltage range: DC 0V ~ 10V 2. Input impedance: 22kΩ
	AI3-GND	Analog Input Terminal 3	1. Input range: 0VDC ~ 10VDC / 0mA ~ 20mA, selectable via J1 jumper on the control board. 2. Input impedance: 22kΩ for voltage input, 500Ω for current input.
Digital Output	DI1-COM	Digital Output 1	1. Opto-isolated, input frequency < 100Hz. The external or internal power supply drive is selectable via the CN8 jumper on the control board. 2. Input impedance: 1.39kΩ 3. Voltage range for valid level input: 9V ~ 30V
	DI2-COM	Digital Output 2	
	DI3-COM	Digital Output 3	
	DI4-COM	Digital Output 4	
	DI5-COM	Digital Output 5	
	OP	External 24V Power for DI	The DI circuit can be configured to be powered by an external 24V supply via a jumper cap.
Analog Output	AO1-GND	Analog Output 1	Selectable voltage or current output via the J6 jumper on the control board, with a maximum load resistance of less than 500Ω. Output voltage range: 0V～10V Output current range: 0mA～20mA
	AO2-GND	Analog Output 2	Selectable voltage or current output via the J7 jumper on the control board, with a maximum load resistance of less than 500Ω. Output voltage range: 0V～10V

Category	Terminal Symbol	Terminal Name	Function Description
			Output current range: 0mA～20mA
Digital Output	DO1-COM	Digital Output 1	Opto-isolated, bipolar open-collector output. Output voltage range: 0V ~ 24V Output current range: 0mA ~ 50mA Note: Digital output DO1 only supports external power supply drive. When driven by an external power supply, please confirm whether the power supply ground can be connected to COM.
Relay Output	TA1-TB1	Normally Closed Terminal	Contact switching capacity: 250VAC，3A，COSØ=0.4 30VDC，1A
	TA1-TC1	Normally Open Terminal	
	TA2-TC2	Normally Open Terminal	
Jumper	J1	AI3 Input Selection	Voltage or current input is selectable, default is voltage input.
	J6	AO1 Output Selection	Voltage or current output is selectable, default is voltage output.
	J7	AO2 Output Selection	Voltage or current output is selectable; default is voltage output.
	CN8	DI Signal Drive Selection	Selectable internal/external power supply for DI drive, default: internal 24V

Chapter 4 Operation Display and Application Examples

4.1 Operation and Display Interface Introduction

4.1.1 Panel diagram

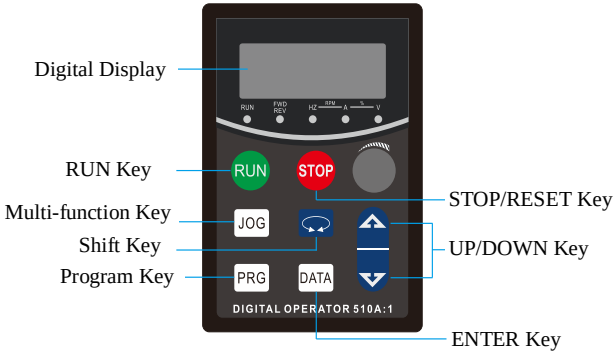


Fig. 4-1 Schematic Diagram of Operation Panel

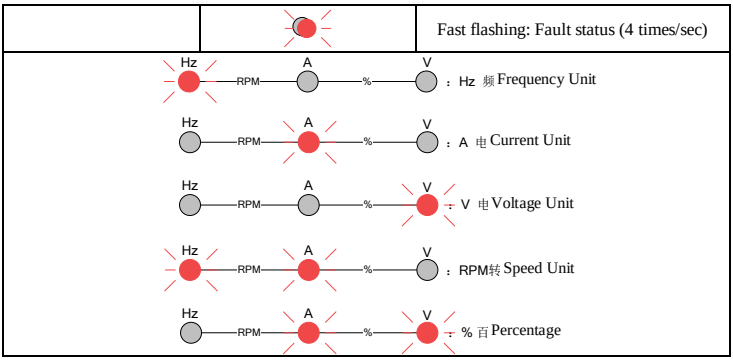
Note: Multi-function key: The function of this key is determined by the function code P7-01.

Stop/reset key: in the running state, pressing this key can be used to stop the operation, which is restricted by the function code P7-02; in the fault alarm state, it can be used to reset the fault, which is not restricted by the function code P7-02.

4.1.2 Indicator light description

It means the light is off, the means the light is on, and the means the light is flashing.

Indicator Status		Status Description
RUN Running indicator		Light On: Running
		Light out: shutdown
F/R Forward/Reverse Indicator		Light out: forward operation
		Light on: reverse operation
L/R Run Command Indicator		Light out: panel controls
		Lights On: Terminal Control
		Flashing: communication control
TUNE Tuning / Torque Control / Fault Indicator		Light out: normal operation
		Light on: torque control mode
		Slow flashing: Tuning status (1 time/sec)



4.2 Function Code View, Modify Method Description

The operation panel of the EV510-PV frequency converter adopts a three-level menu structure for parameter setting and other operations. The three-level menus are respectively: function parameter group (level I menu) → function code (level II menu) → function code setting value (level III menu).

The operation flow is shown in Figure 4-2.

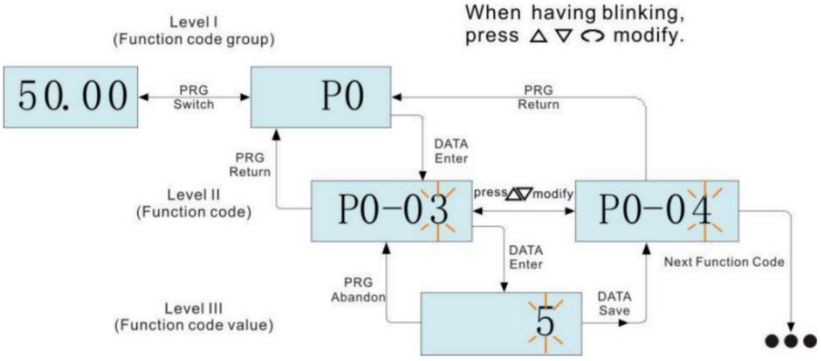


Fig. 4-2 Flow chart of three-level menu operation

Note: In the three-level menu operation, you can press the PRG key or ENTER key to return to the two-level menu. The difference between the two is: ENTER key to save the set parameters and return to the secondary menu, and automatically move to the next function code; and press the PRG key to return to the secondary menu, do not store parameters, and return to the current function code.

Chapter 5 Function Parameter Table

The PP-00 is set to a value other than 0, that is, the parameter protection password is set. In the function parameter mode and the user change parameter mode, the parameter menu must be entered after the password is correctly entered. To cancel the password, set the PP-00 to 0.

The parameter menu in the custom parameter mode is not password protected.

Group P and group A are basic function parameters, and group D is monitoring function parameters. The symbols in the menu are described as follows:

"☆": indicates that the set value of this parameter can be changed when the inverter is in shutdown or running state;

"★": Indicates that the setting value of this parameter cannot be changed when the inverter is in operation;

"●": indicates that the value of this parameter is the actual test record value and cannot be changed;

"*": indicates that the parameter is "manufacturer parameter", which is only set by the manufacturer and is not allowed to be operated by the user.

5.1 Basic Functional Parameters

Function code	Name	Setting range	Factory Value	Change
P0 basic function group				
P0-01	1st Motor Speed Control Mode	0: Speed sensorless vector control (SVC) 1: Vector control with speed sensor (FVC) 2: V/F control	2	★
P0-02	Run command channel	0: operation panel command channel 1: Terminal Command Channel 2: Communication command channel 3: Automatic operation/shutdown of photovoltaic water lifting	3	☆
P0-03	Master Frequency Source A Command Selection	0: digital setting (preset frequency P0-08, UP/DOWN can be modified, power down without memory) 1: digital setting (preset frequency P0-08, UP/DOWN can be modified, power-down memory 2:AI1 3:AI2 4: keyboard potentiometer (AI3) 5: High-speed pulse input setting (S5) 6: Multi-Segment Instruction 7: Simple PLC 8: PID 9: Communication given 10: PV MPPT frequency given	10	★
P0-09	Motor rotation direction	0: Consistent direction 1: in the opposite direction	0	☆
P0-10	Maximum output frequency	50.00Hz ~ 500.00Hz	50.00Hz	★
P0-11	Operating frequency upper limit source selection	0: P0-12 setting 1: AI1 2: AI2 3: keyboard potentiometer (AI3) 4: High speed pulse setting (S5) 5: Communication given	0	★
P0-12	Operating frequency upper limit	Lower limit frequency P0-14 ~ maximum frequency P0-10	50.00Hz	☆
P0-13	Operating frequency upper	0.00Hz ~ maximum frequency P0-10	0.00Hz	☆

Function code	Name	Setting range	Factory Value	Change
	limit offset			
P0-14	Lower limit of operating frequency	0.00Hz ~ upper limit frequency P0-12	0.00Hz	☆
P0-15	carrier frequency setting	0.8kHz to 12.0kHz	Model Determination	☆
P0-16	Carrier frequency adjusted with temperature	0: No 1: Yes	1	☆
P0-17	Acceleration time 1	80.0S	Model Determination	☆
P0-18	Deceleration time 1	1.0S	Model Determination	☆
P0-19	Acceleration and deceleration time unit	0: 1 second 1: 0.1 seconds 2: 0.01 seconds	1	★
P1-00	Motor 1 Type Selection	0: Ordinary asynchronous motor 1: variable frequency asynchronous motor	0	★
P1-01	Motor 1 rated power	0.1kW ~ 1000.0kW	Model Determination	★
P1-02	Rated voltage of motor 1	1V ~ 2000V	Model Determination	★
P1-03	Rated current of motor 1	0.1A ~ 6553.5A	Model Determination	★
P1-04	Rated frequency of motor 1	0.01Hz ~ maximum frequency	Model Determination	★
P1-05	Rated speed of motor 1	1rpm ~ 65535rpm	Model Determination	★
P1-06	Stator resistance of asynchronous motor 1	0.001 Ω ~ 65.535 Ω	self-learning parameters	★
P1-07	Rotor resistance of asynchronous motor 1	0.001 Ω ~ 65.535 Ω	self-learning parameters	★
P1-08	Inductive leakage reactance of asynchronous motor 1	0.01mH ~ 655.35mH	self-learning parameters	★
P1-09	Mutual inductance of asynchronous motor 1	0.1mH ~ 6553.5mH	self-learning parameters	★
P1-10	No-load current of asynchronous motor 1	0.01A ~ P1-03	self-learning parameters	★
		P3 group V/F control parameters		
P3-00	VF Curve Settings	0: Line V/F 1: Multi-point V/F 2: Square V/F 3: 1.2V/F 4: 1.4V/F 6: 1.6V/F 8: 1.8V/F 9: Reservations 10: VF complete separation mode 11: VF semi-separated mode	0	★
P3-01	torque boost	0.0%:(no torque boost) 0.1-30.0%	Model Determination	☆
P3-02	Torque boost cut-off frequency	0.00Hz ~ maximum frequency	50.00Hz	★
P3-03	Multipoint V/F Frequency Point 1	0.00Hz to P3-05 Hz	0.00Hz	★
P3-04	Multi-point V/F voltage point 1	0.0-100.0%	0.0 percent	★
P3-05	Multi-Point V/F Frequency Point 2	P3-03 ~ P3-07	0.00Hz	★
P3-06	Multi-point V/F voltage point 2	0.0-100.0%	0.0 percent	★

Function code	Name	Setting range	Factory Value	Change
P3-07	Multi-Point V/F Frequency Point 3	P3-05 ~ motor rated frequency (P1-04)	0.00Hz	★
P3-08	Multi-Point V/F Voltage Point 3	0.0-100.0%	0.0 percent	★
P3-22	Overvoltage stall action voltage	650V ~ 800.0V	770V	★
P3-23	Overvoltage stall enable	0: invalid 1: Effective	1	★
P3-24	Overvoltage stall suppression frequency gain	0 to 100	30	☆
P3-25	Overvoltage stall suppression voltage gain	0 to 100	30	☆
P3-26	Overvoltage stall maximum rise frequency limit	0 to 50Hz	5Hz	★
Group P4 input terminals				
P4-00	S1 terminal function selection	0: No function 1: Forward rotation operation (FWD) or operation instruction 2: Reverse running (REV) or positive and negative running direction (Note: Set 1 and 2 to be used in conjunction with the P4-11) 3: Three-wire operation control 4: forward rotation jog (FJOG) 5: Reverse jog (RJOG) 6: Terminal UP 7: Terminal DOWN 8: Free Parking 9: fault reset (RESET) 10: Run pause 11: External fault normally open input 12: Multi-segment command terminal 1 13: Multi-segment command terminal 2 14: Multi-segment command terminal 3 15: Multi-segment command terminal 4 16: acceleration and deceleration time selection terminal 1 17: acceleration and deceleration time selection terminal 2 18: Frequency command switching 19: UP/DOWN setting clear (terminal, keyboard) 20: control command switching terminal 1 21: acceleration and deceleration prohibition 22: PID Pause 23: Simple PLC status reset 24: Pause of swing frequency 25: Counter input 26: Counter Reset 27: Length count input 28: Length reset 29: Torque control prohibition 30: High-speed pulse input (only valid for S5) 31: Reserved 32: Immediate DC braking 33: External fault normally closed input 34: Frequency Modification enable 35: PID action direction is reversed 36: External parking terminal 1 37: Control command switching terminal 2 38: PID integration pause	1	★
P4-01	S2 terminal function selection		2	★
P4-02	S3 terminal function selection		53	★
P4-03	S4 terminal function selection		54	★

Function code	Name	Setting range	Factory Value	Change
		39: Frequency source A and preset frequency switching 40: Frequency source B and preset frequency switching 41: motor terminal selection function 42: Reserved 43: PID parameter switching 44: User-defined fault 1 45: User-defined fault 2 46: Speed control/torque control switching 47: Emergency stop 48: External parking terminal 2 49: DC brake deceleration 50: The running time is cleared 51: Two-wire/three-wire switching 52: Reverse frequency prohibited 53: Full water signal 54: Water shortage signal 55-59: Reserved		
P4-10	S1 ~ S7 terminal filtering time	0.000s ~ 1.000s	0.010s	☆
P4-35	S1 delay time	0.0s ~ 3600.0s	0.0s	★
P4-36	S2 delay time	0.0s ~ 3600.0s	0.0s	★
P4-37	S3 Delay Time	0.0s ~ 3600.0s	0.0s	★
P4-38	S1 ~ S5 terminal valid mode selection 1	0: active high 1: active low level Bits: S1 Ten: S2 Hundred bits: S3 Thousands: S4 Ten thousand: S5	00000	★
P4-39	S6, S7 terminal valid mode selection 2	0: active high 1: active low level Bits: S6 Ten: S7 Hundred: Reserved Thousands: Reserved Ten thousand: reserved	00000	★
P5 group output terminal				
P5-00	HDO terminal output mode selection	0: Pulse output (HDP) 1: switch output (HDY)	1	☆
P5-01	HDY output function selection	0: No output 1: inverter in operation 2: fault output (fault shutdown) 3: Frequency level detection FDT1 output 4: Frequency Arrival 5: zero speed operation (no output when shutdown) 6: motor overload pre-alarm 7: inverter overload pre-alarm 8: Set the recorded value to reach 9: Specify the value to reach 10: Length to reach 11: PLC cycle completed 12: Accumulated running time arrives 13: Frequency Limiting 14: Torque Limiting 15: Ready to run	0	☆
P5-02	Relay 1 Output Function Selection (TA-TB-TC)		2	☆
P5-03	Relay 2 output function selection（RA-RC）		0	☆
P5-04	reserve		-	☆
P5-05	reserve		-	☆

Function code	Name	Setting range	Factory Value	Change
		16:AI1>AI2 17: Upper limit frequency reached 18: Lower limit frequency reached (operation related) 19: Undervoltage state output 20: Communication Settings 21: Positioning complete (reserved) 22: Positioning Approaching (Reserved) 23: 2 in zero speed operation (output when shutdown) 24: Accumulated power-on time arrives 25: Frequency level detection FDT2 output 26: Frequency 1 reaches output 27: Frequency 2 reaches output 28: Current 1 reaches output 29: Current 2 reaches output 30: Timed arrival output 31:AI1 input overrun 32: Under load 33: Reverse operation 34: Zero Current State 35: Module temperature reaches 36: Output current overrun 37: lower limit frequency reached (stop also output) 38: alarm output (continue to run) 39: Motor over-temperature pre-alarm 40: this run time to arrive 41: fault output (for free stop fault), and undervoltage does not output		
P5-06	HDP function selection	0: Operating Frequency 1: Set Frequency 2: Output Current 3: Output Torque 4: Output Power 5: Output Voltage 6: High-speed Pulse Input (100.0% corresponds to 100.0kHz) 7: AI1 8: AI2 9: Keypad Potentiometer (AI3) 10: Length 11: Count Value 12: Communication Setting 13: Motor Speed 14: Output Current (100.0% corresponds to 1000.0A) 15: Output Voltage (100.0% corresponds to 1000.0V) 16: Motor Output Torque (Actual value, percentage relative to motor rating)	0	☆
P5-07	AO1 function selection		0	☆
P5-08	AO2 function selection		1	☆
P5-09	HDO output frequency	0.01kHz～100.00kHz	50.00kHz	☆
P5-10	AO1 zero offset coefficient	-100.0%～+100.0%	0.0%	☆
P5-11	AO1 gain	-10.00～+10.00	1.00	☆
P5-12	AO2 zero offset coefficient	-100.0%～+100.0%	0.0%	☆
P5-13	AO2 gain	-10.00～+10.00	1.00	☆
P5-17	HDY output delay	0.0s～3600.0s	0.0s	☆

Function code	Name	Setting range	Factory Value	Change
P5-18	Relay 1 output delay	0.0s～3600.0s	0.0s	☆
P5-19	Relay 2 output delay	0.0s～3600.0s	0.0s	☆
P5-20	DO output delay	0.0s～3600.0s	0.0s	☆
P5-21	DO output delay	0.0s～3600.0s	0.0s	☆
P5-22	Active mode selection	0: Positive logic 1: anti logic Bit: HDO (HDY) Ten: RO1A Hundred places: RO2A Thousands of bits: DO Million: reserved	00000	☆
Group P6 Start/Stop Control				
P6-00	Start mode	0: Direct start 1: Catching a spinning motor 2: Pre-excited start 3: SVC quick start	0	☆
P6-01	Mode of catching a spinning motor	0: From stop frequency 1: From 50 Hz 2: From max. frequency	0	★
P6-02	Speed of catching a spinning motor	20	20	☆
P6-03	Start frequency	0.00Hz～10.00Hz	0.00Hz	☆
P6-04	Start frequency holding time	0.0s～100.0s	0.0s	★
P6-05	DC injection braking 1 level/Pre excitation level	0%～100%	50%	★
P6-06	DC injection braking 1 active time /Pre-excitation active time	0.0s～100.0s	0.0s	★
P6-07	Acceleration/ Deceleration mode	0: Linear acceleration / deceleration 1: S-curve acceleration / deceleration A (static) 2: S curve acceleration / deceleration B (dynamic)	0	★
P6-08	Time proportion of S-curve start segment	0.0%～（100.0%-P6-09）	30.0%	★
P6-09	Time proportion of S-curve end segment	0.0%～（100.0%-P6-08）	30.0%	★
P6-10	Stop mode	0: Decelerate to stop 1: Coast to stop	0	☆
P6-11	DC injection braking 2 start frequency	0.00Hz～max frequency(P0-10)	0.00Hz	☆
P6-12	DC injection braking 2 delay time	0.0s～100.0s	0.0s	☆
P6-13	DC injection braking 2 level	0%～100%	50%	☆
P6-14	DC injection braking 2 active time	0.0s～100.0s	0.0s	☆
P6-15	Braking use ratio	0%～100%	100%	☆
P6-18	Catching a spinning motor current limit	30%~200%	Model dependent	☆
P6-21	Demagnetization time (effective for SVC)	0.00~5.00s	Model dependent	☆

Function code	Name	Setting range	Factory Value	Change
Group P7 Keypad Operation and LED Display				
P7-01	JOG default display check	0: JOG is invalid 1: Operation panel command channel and remote command channel (terminal command channel or communication command channel) switch 2: Forward and reverse switching 3: moving forward 4: reverse jog	0	★
P7-02	STOP/RESET key function	0: The STOP / RES key stop function is valid only during keyboard operation 1: STOP / RES key shutdown is active in any mode of operation	1	☆
P7-03	LED display running parameters 1	0000 ~ FFFF Bit00: Operating frequency 1 (Hz) Bit01: Set frequency (Hz) Bit02: Bus voltage (V) Bit03: Output voltage (V) Bit04: Output current (A) Bit05: Output power (kW) Bit06: Output torque (%) Bit07: S terminal input status Bit08: HDO output status Bit09: AI1 voltage (V) Bit10: AI2 Voltage (V) Bit11: AI3 Voltage (V) Bit12: Count value Bit13: Length value Bit14: Load speed display Bit15: PID setting	1F	☆
P7-04	LED display running parameters 2	0000 ~ FFFF Bit00: PID feedback Bit01: PLC stage Bit02: High-speed pulse input frequency (kHz) Bit03: Operating frequency 2 (Hz) Bit04: Remaining runtime Bit05: AI1 before correction voltage (V) Bit06: AI2 before correction voltage (V) Bit07: AI3 Correction before voltage (V) Bit08: Line speed Bit09: Current power-on time (Hour) Bit10: Current running time (Min) Bit11: High-speed pulse input frequency (Hz) Bit12: Communication setpoint Bit13: Encoder feedback speed (Hz) Bit14: Main frequency A display (Hz) Bit15: Secondary frequency B display (Hz)	0	☆
P7-05	LED display stop parameters	0000 ~ FFFF Bit00: Set frequency (Hz) Bit01: Bus voltage (V) Bit02: S input status Bit03: HDO output status Bit04: AI1 voltage (V) Bit05: AI2 voltage (V) Bit06: AI3 voltage (V) Bit07: Count value Bit08: Length value Bit09: PLC stage Bit10: Load speed Bit11: PID setting Bit12:High-speed pulse input frequency (kHz)	33	☆

Function code	Name	Setting range	Factory Value	Change
P7-06	Load speed display coefficient	0.0001～6.5000	1.0000	☆
P7-07	Heat sink temperature of AC Drive IGBT	-20.0℃～120.0℃	-	●
P7-09	Accumulative running time	0h～65535h	-	●
P7-12	Number of decimal places for load speed display	Bit: d0-14 the number of decimal places 0: 0 decimal places 1: 1 decimal place 2: 2 decimal places 3: 3 decimal places Ten: d0-19 / d0-29 the number of decimal places 1: 1 decimal place 2: 2 decimal places	20	☆
P7-13	Accumulative power-on time	0h～65535h	-	●
P7-14	Accumulative power consumption	0kW～65535kwh	-	●
Group P9 Fault and Protection				
P9-00	Motor overload protection	0:Forbid, 1:permit	1	☆
P9-01	Motor overload protection gain	0.20 to 10.00	1.00	☆
P9-02	Motor overload pre-warning coeffcient	50% to 100%	80%	☆
P9-03	Overvoltage protection gain	0~100	30	☆
P9-04	Overvoltage protection voltage	650 to 800 V	770 V	☆
P9-07	Detection of short-circuit to ground upon power-on	Single : power-to-ground short-circuit protection selection 0:invalid 1: valid Tens : Selection of short-to-ground protection before running 0:invalid 1: valid	01	☆
P9-08	Braking unit applied voltage	650 to 800 V	720 V	★
P9-09	Auto reset times	0 to 20	0	☆
P9-10	Selection of HDO action during auto reset	0:No action, 1: Action	0	☆
P9-11	Delay of auto reset	0.1s to 100.0s	1.0s	☆
P9-12	Input phase loss/pre-charge relay protection	Single : Input phase loss protection selection 0:Forbid 1: allow Tens : Contactor pull-in protection selection 0:Forbid 1: allow	01	★
P9-13	Output phase loss protection	Single : Output phase loss protection selection 0:Forbid 1: allow Tens : Input phase loss protection selection 0:Forbid 1: allow	01	☆
P9-14	1st fault type	0: No Fault 1: Reserved 2: Over-current during Acceleration 3: Over-current during Deceleration 4: Over-current during Constant Speed 5: Over-voltage during Acceleration 6: Over-voltage during Deceleration 7: Over-voltage during Constant Speed	-	●
P9-15	2nd fault type		-	●
P9-16	3rd (latest) fault type		-	●

Function code	Name	Setting range	Factory Value	Change
		8: Braking Resistor Overload 9: Under-voltage 10: Inverter Overload 11: Motor Overload 12: Input Phase Loss 13: Output Phase Loss 14: Module Over-temperature 15: External Fault 16: Communication Error 17: Contactor Abnormality 18: Current Detection Abnormality 19: Motor Auto-tuning Error 20: Encoder / PG Card Abnormality 21: Parameter Read/Write Error 22: Inverter Hardware Fault 23: Motor Earth Short Circuit 24: Reserved 25: Reserved 26: Running Time Reached 27: User-defined Fault 1 28: User-defined Fault 2 29: Power-on Time Reached 30: Under-load 31: PID Feedback Loss during Operation 40: Fast Current Limit Timeout 41: Motor Switching during Operation 42: Excessive Speed Deviation 43: Motor Over-speed (Reserved) 45: Motor Over-temperature 51: Initial Position Error 55: Slave Fault in Master-Slave Control		
P9-17	Frequency upon 3rd fault	-	-	●
P9-18	Current upon 3rd fault	-	-	●
P9-19	Bus voltage upon 3rd fault	-	-	●
P9-20	DI state upon 3rd fault	-	-	●
P9-21	DO state upon 3rd fault	-	-	●
P9-22	AC drive state upon 3rd fault	-	-	●
P9-23	Power-on time upon 3rd fault	-	-	●
P9-24	Running time upon 3rd fault	-	-	●
P9-27	Frequency upon 2nd fault	-	-	●
P9-28	Current upon 2nd fault	-	-	●
P9-29	Bus voltage upon 2nd fault	-	-	●
P9-30	DI state upon 2nd fault	-	-	●
P9-31	Input terminal state upon 2nd fault	-	-	●
P9-32	AC drive state upon 2nd fault	-	-	●
P9-33	Power-on time upon 2nd fault	-	-	●
P9-34	Running time upon 2nd fault	-	-	●

Function code	Name	Setting range	Factory Value	Change
P9-37	Frequency upon 1st fault	-	-	●
P9-38	Current upon 1st fault	-	-	●
P9-39	Bus voltage upon 1st fault	-	-	●
P9-40	DI state upon 1st fault	-	-	●
P9-41	DO state upon 1st fault	-	-	●
P9-42	AC drive state upon 1st fault	-	-	●
P9-43	Power-on time upon 1st fault	-	-	●
P9-44	Running time upon 1st fault	-	-	●
P9-47	Fault protection action selection 1	Units: Motor Overload (ERR11) 0: Coast to stop 1: Stop according to stop mode 2: Continue running Tens: Input Phase Loss (ERR12) (Reserved) Hundreds: Output Phase Loss (ERR13) Thousands: External Fault (ERR15) Ten thousands: Communication Error (ERR16)	00000	☆
P9-48	Fault protection action selection 2	Bits: Encoder/PG card exception (ERR20) 0: free parking Ten: function code read/write exception (ERR21) 0: free parking 1: shut down according to the shutdown mode Hundred bits: inverter overload fault action selection (ERR10) 0: Free Stop 1: derating operation Thousands: motor overheating (ERR45) Ten thousand bits: run time arrival (ERR26)	00000	☆
P9-49	Fail-safe action selection 3	Bits: User-defined fault 1(ERR27) 0: free parking 1: shut down according to the shutdown mode 2: Continue to run Ten: User-defined fault 2(ERR28) 0: free parking 1: shut down according to the shutdown mode 2: Continue to run Hundred: Power-on Time Arrived (ERR29) 0: free parking 1: shut down according to the shutdown mode 2: Continue to run Thousands: Underload (ERR30) 0: free parking 1: Slow down and stop 2: Decelerate to 7% of the rated frequency of the motor and continue to run, and automatically return to the set frequency when not under load Ten thousand bits: PID feedback lost at runtime (ERR31) 0: free parking 1: shut down according to the shutdown mode 2: Continue to run	00000	☆
P9-50	Fault protection action	Bit: excessive speed deviation (ERR42)	00000	☆

Function code	Name	Setting range	Factory Value	Change
	selection 4	0: free parking 1: shut down according to the shutdown mode 2: Continue to run Ten: motor speed (ERR43) Hundred: Error in initial position (ERR51)		
P9-54	Continue operation frequency selection in case of fault	0: Run at the current operating frequency 1: Run at set frequency 2: Operation at upper limit frequency 3: the following limit frequency operation 4: Run at abnormal standby frequency	0	☆
P9-55	Abnormal standby frequency	0.0-100.0% (100.0% corresponds to maximum frequency P0-10)	100.0 %	☆
P9-59	Instantaneous stop function selection	0: invalid 1: bus voltage constant control 2: Deceleration and shutdown	0	☆
P9-60	Instantaneous stop non-stop recovery voltage	80% to 100.0%	85.0 %	☆
P9-61	Instantaneous stop non-stop voltage recovery judgment time	0.00s ~ 100.00s	0.50s	☆
P9-62	Instant stop non-stop action voltage	60.0~100.0 (standard bus voltage)	80.0 %	☆
P9-63	Underload Protection Selection	0: invalid 1: Effective	0	☆
P9-64	Underload detection level	0.0-100.0%	10.0 %	☆
P9-65	Underload detection time	0.0~60.0s	1.0s	☆
P9-67	over-speed detection value	0.0 to 50.0% (maximum frequency)	20.0 %	☆
P9-68	Overspeed detection time	0.0s: do not detect 0.1~60.0s	1.0s	☆
P9-69	Detection value of excessive speed deviation	0.0 to 50.0% (maximum frequency)	20.0 %	☆
P9-70	Excessive speed deviation detection time	0.0s: do not detect 0.1~60.0s	5.0s	☆
P9-71	Transient stop gain Kp	0 to 100	40	☆
P9-72	Instant stop non-stop integral coefficient Ki	0 to 100	30	☆
P9-73	Instant stop non-stop action deceleration time	0~300.0s	20.0s	★
Pd group communication parameters				
Pd-00	Universal Baud Rate Settings	Bits: MODBUS 0:300BPS 1:600BPS 2:1200BPS 3:2400BPS 4:4800BPS 5:9600BPS 6:19200BPS 7:38400BPS 8:57600BPS 9:115200BPS Ten: Reserved Hundred: Reserved Thousands: CANlink baud rate 0:20k 1:50K 2:100K 3:125K 4:250K 5:500K 6:1M	5005	☆
Pd-01	MODBUS data format	0: No verification (8-N-2) 1: Even check (8-E-1) 2: odd check (8-O-1) 3: No verification (8-N-1)	3	☆
Pd-02	Local Address	0: broadcast address 1~247	1	☆

Function code	Name	Setting range	Factory Value	Change
Pd-03	MODBUS Response Delay	0ms -20ms	2	☆
Pd-04	Serial communication timeout	0.0: invalid 0.1s ~ 60.0s	0.0	☆
Pd-05	Data Transfer Format Selection	Bits: MODBUS 0: Non-standard MODBUS protocol 1: Standard MODBUS protocol Ten: Profibus-DP 0: PPO1 format 1: PPO2 format 2: PPO3 format 3: PPO5 format	31	☆
Pd-06	Communication Read Current Resolution	0:0.01A (valid when ≤ 55kW) 1:0.1A	0	☆
Pd-08	Expansion card (Profibus, CANopen) Interrupt detection time (reserved)	-	-	-
PP group function code management				
PP-00	User Password	0 to 65535	0	☆
PP-01	Parameter initialization	0: No action 01: Restore factory parameters, excluding motor parameters 02: Clear Record Information 04: Backup User's Current Parameters 501: Restore current user parameters	0	☆
Group A3 dedicated parameter group for photovoltaic water lifting				
A3-00	Photovoltaic system starting voltage	200.0V ~ 800.0V 220V:350.0V 380V:600V	Model Determination	☆
A3-01	Photovoltaic start-up delay time	0~100S	10s	☆
A3-02	Shutdown voltage of photovoltaic system	100.0V ~ 600.0V 220V:350.0V 380V:600.0V	Model Determination	☆
A3-03	Photovoltaic overvoltage	100.0V ~ 800.0V 220V:420.0V 380V:800.0V		☆
A3-04	Photovoltaic overvoltage recovery voltage	100.0V ~ 800.0V 220V:400.0V 380V:780.0V	Model Determination	☆
A3-05	PV proportional gain 1	1 to 5000	1000	☆
A3-06	PV integral gain 1	1 to 1000	200	☆
A3-07	PV proportional gain 2	1 to 5000	1000	☆
A3-08	PV integral gain 2	1 to 1000	200	☆
A3-09	PV control switching voltage point	100.0V ~ 800.0V 220V:300.0V 380V:500.0V	Model Determination	☆
A3-10	Photovoltaic minimum input voltage	100.0V ~ 800.0V 220V:200.0V 380V:450.0V	Model Determination	☆
A3-11	Photovoltaic open circuit voltage	100.0V ~ 800.0V 220V:400.0V 380V:700.0V	Model Determination	☆
A3-12	Water level signal selection	0: Do not detect 1: Terminal function test 2: Analog quantity AI1 3: Analog AI2 4: Analog quantity AI3	0	☆
A3-13	Full water signal value	0.0-100.0%	25.0%	☆
A3-14	Water shortage signal value	0.0-100.0%	90.0%	☆

Function code	Name	Setting range	Factory Value	Change
A3-15	Full water delay	0~1000S	10s	☆
A3-16	Full water fault reset delay	0~1000S	20s	☆
A3-17	Water shortage delay	0~1000S	10s	☆
A3-18	Water shortage fault reset delay	0~1000S	20s	☆
A3-19	Dry pumping operation detection value	1 to 100	0	☆
A3-20	Dry pumping protection delay time	0s～1000s	60s	☆
A3-21	Dry pumping reset delay time	0s～1000s	180s.	☆
A3-22	mppt adjust step time	0.1s ~ 5.0s	20	☆
A3-23	mppt regulated maximum voltage	80.0-100.0%	85.0%	☆
A3-24	mppt step regulated voltage	1.0V ~ 50.0V 220V:3.0V 380V:5.0V	Model Determination	☆
A5 group control optimization parameters				
A5-00	DPWM switching upper limit frequency	5.00Hz ~ Maximum Frequency (P0-10)	8.00Hz	☆
A5-01	PWM modulation mode	0: Asynchronous modulation 1: synchronous modulation	0	☆
A5-02	Deadband Compensation Mode Selection	0: No compensation 1: Compensation Mode 1	1	☆
A5-03	Random PWM Depth	0: Random PWM is invalid 1~10: PWM carrier frequency random depth	0	☆
A5-04	Fast Current Limit enable	0: Not enabled 1: enable	1	☆
A5-05	Maximum output voltage coefficient	100-110%	105%	★
A5-06	Undervoltage point setting	150~420V	350V	☆
A5-08	Dead Time Adjustment	0.0-8.0%	0.0%	★
A5-09	Overpressure point setting	650-820V	Model Determination	★

Chapter 6 Solar Water Pumping Function Description

6.1 Water Level Alarm Detection

Water level alarm detection is a core protection function of the photovoltaic water pumping system to ensure operational safety and prevent water waste and equipment damage. It mainly monitors the water level in water storage tanks and water sources (wells, rivers, etc.) in real time. It is divided into two scenarios: high water level alarm and low water level alarm, adapting to different operational requirements. The system collects water level signals through water level sensors (float type, hydrostatic type, etc.). The water level signal detection method can be set via parameter A3-12 (Water Level Signal Selection), with options including 0 (No Detection), 1 (Terminal Function Detection), and 2–4 (Analog Input AI1–AI3). The default value is 0. The system compares real-time water level data with preset high and low water level thresholds (corresponding to parameters A3-13 Full Water Signal Value and A3-14 Low Water Signal Value) to achieve precise alarming and coordinated control.

When the water source level is detected to be below the preset low water level threshold (A3-14) and the duration reaches the set value of parameter A3-17 (Low Water Delay) (adjustable range 0–1000s, default 10s), the system determines that the water source is insufficient. It immediately triggers a low water level alarm and cuts off the power supply to the water pump to prevent dry running, which could cause impeller wear, motor overheating, and other damage. After the water source replenishes to a safe level, and the set time of parameter A3-18 (Low Water Fault Reset Delay) is met, the alarm is automatically cleared, and the system can resume operation either manually or automatically.

When the water storage tank level is detected to be above the preset high water level threshold (A3-13) and the duration reaches the set value of parameter A3-15 (Full Water Delay), a high water level alarm is triggered, and the pump stops supplying water to prevent overflow and water waste. After the water level returns to the normal range and the set time of parameter A3-16 (Full Water Fault Reset Delay) is met, the alarm is cleared, and the system resumes normal water supply operation.

A3-12	Water Level Signal Selection	0：No detection 1：Terminal function detection 2：Analog AI1 3：Analog AI2 4：Analog AI3	0	☆
A3-13	Full Water Signal Level	0.0%～100.0%	25.0%	☆
A3-14	Water Shortage Signal Level	0.0%～100.0%	90.0%	☆
A3-15	Full Water Delay	0～1000S	10S	☆
A3-16	Full Water Fault Reset Delay	0～1000S	20S	☆
A3-17	Water Shortage Delay	0～1000S	10S	☆
A3-18	Water Shortage Fault Reset Delay	0～1000S	20S	☆

6.2 PV Voltage Fault Detection

PV voltage fault detection mainly monitors the output voltage of the PV module array in real time to identify voltage anomalies on the PV side, ensuring system power generation stability and preventing inverter damage caused by voltage faults. The system collects parameters such as the input voltage, open-circuit voltage (corresponding to parameter A3-11), and operating voltage of the PV array in real time, and compares them with the preset normal voltage range (determined based on PV module specifications, system configuration, and related parameters) to determine whether a voltage fault exists.

PV Under-voltage: When the PV input voltage is detected to be continuously below parameter A3-10 (PV Minimum Input Voltage) for more than 1 second, it is determined as a PV under-voltage fault. Possible causes include shading of PV modules, module aging, poor line contact, insufficient irradiance, etc. The system immediately stops the water pump and triggers a fault alarm, with a message "PV Under-voltage" displayed on the screen.

PV Over-voltage: When the PV open-circuit voltage or operating voltage is detected to be continuously above parameter A3-03 (PV Over-voltage Threshold) for more than 1 second, it is determined as a PV over-voltage fault. Possible causes include excessive irradiance, abnormal number of series-connected modules, line short circuits, etc. This prevents inverter damage caused by voltage faults.

When the PV over-voltage fault is resolved, and the PV voltage drops to or below parameter A3-04 (PV Over-voltage Recovery Voltage) and remains stable for a period of time, the system can automatically reset and resume operation. In addition, the system's PV start and stop voltages must follow the corresponding parameter settings. Parameter A3-00 (PV System Start Voltage) is the core voltage condition for system startup, and parameter A3-02 (PV System Stop Voltage) is the voltage threshold for system shutdown. The system starts when the PV voltage reaches the start voltage and other operating conditions are met, and stops when the voltage drops below the stop voltage.

A3-00	PV System Start Voltage	200.0V～800.0V 220V：350.0V　380V：600V	Model Confirmation	☆
A3-01	PV Start Delay Time	0～100S	10S	☆
A3-02	PV System Stop Voltage	100.0V～600.0V 220V：350.0V　380V：600.0V	Model Confirmation	☆
A3-03	PV Overvoltage Threshold	100.0V～800.0V 220V：420.0V　380V：800.0V	Model Confirmation	☆
A3-04	PV Overvoltage Recovery Voltage	100.0V～800.0V 220V：400.0V　380V：780.0V	Model Confirmation	☆

6.3 Dry Running Detection

Dry running detection is a dedicated protection function of the photovoltaic water pumping system to prevent the pump from operating without water. Its core purpose is to prevent severe faults such as impeller wear, seal damage, and motor overheating caused by the pump running idle when there is no water source or insufficient water supply, thereby extending the service life of the pump. The system uses current detection values combined with corresponding parameter settings to ensure the accuracy of dry running detection and avoid false triggering. Parameter A3-19 (Dry Running Detection Value) is used to set the current threshold reference for dry running detection. When this value is set to 0, dry running detection is disabled. Parameter A3-20 (Dry Running Protection Delay Time) is used to set the delay time for dry running detection to prevent transient water shortages from causing false protection triggers.

A3-19	Dry-running Detection Threshold	0～100.0	0	☆
A3-20	Dry-running Protection Delay Time	0s～1000s	60s	☆
A3-21	Dry-running Reset Delay Time	0s～1000s	180s	☆

6.4 Fault Reset

In PV MPPT mode, except for module faults, all faults can be automatically reset. For minor faults that can self-recover (such as temporary PV over-voltage or under-voltage, transient water level anomalies), when the system detects that the fault condition has been eliminated and the relevant parameters (voltage, water level, current, etc.) remain stable within the normal range for the corresponding reset delay time (e.g., PV over-voltage fault corresponds to the recovery voltage stabilization time in A3-04; water level faults correspond to A3-16 Full Water Reset Delay and A3-18 Low Water Reset Delay), the system will automatically complete the reset without manual intervention. The pump operation and PV power supply logic will automatically resume, making it suitable for unattended scenarios.

P9-11	Fault Auto Reset Waiting Time	0.1s～1000.0s	30.0s	☆

6.5 Operation Judgment

The operation judgment function is the core control logic of the photovoltaic water pumping system. It is used to determine whether the system meets the conditions for normal operation, enabling automatic start/stop of the pump, regulation of operating status, and ensuring safe and efficient system operation. The core judgment criteria include three categories: PV power supply conditions, water level conditions, and equipment status. All judgment logic strictly follows the corresponding parameter settings described above to ensure accurate judgment and stable operation.

The specific judgment logic is as follows:

PV Power Supply Condition Judgment: The system monitors the output voltage and power of the PV array in real time. When the PV voltage reaches the set value of parameter A3-00 (PV System Start Voltage) and remains there for the duration set in parameter A3-01 (PV Start Delay Time), while also not falling below parameter A3-10 (PV Minimum Input Voltage) nor exceeding parameter A3-03 (PV

Over-voltage Threshold), the PV power supply condition is considered satisfied.

Water Level Condition Judgment: The water source level is above parameter A3-14 (Low Water Signal Value), the water storage tank level is below parameter A3-13 (Full Water Signal Value), there are no water level alarms (no triggered full water or low water delays), and the water level signal detection method (A3-12) is set to meet operational requirements. The water level condition is then considered satisfied.

Equipment Status Judgment: The system checks whether the inverter has any faults (e.g., motor overheating, overcurrent fault, overtemperature fault, etc.). If the equipment is fault-free, in standby status, and there is no dry running fault alarm, the equipment status is considered normal.

When all three conditions above are met simultaneously, the system determines that the operating conditions are satisfied, automatically starts the water pump, and enters the normal water supply operation state. If any of the conditions is not met, the system determines that operating conditions are not satisfied and remains in standby mode. If it was already in operation, it immediately stops and triggers the corresponding alarm based on the specific unmet condition (e.g., water level alarm, PV voltage fault alarm, dry running alarm). During operation, the system continuously monitors all conditions and corresponding parameters in real time. If the PV voltage falls below A3-02 (PV System Stop Voltage), water level anomalies occur, or dry running is detected, the system immediately stops and triggers an alarm. After the conditions are restored and the corresponding reset delays are met, operation automatically or manually resumes.

P0-02	Operation Command Channel	0: Operation panel command channel 1: Terminal command channel 2: Communication command channel 3: Automatic start/stop for solar water pumping	0	☆
A3-00	PV System Start Voltage	200.0V～800.0V 220V：350.0V　380V：600V	Model Confirmed	☆
A3-01	PV Start Delay Time	0～100S	10S	☆
A3-02	PV System Stop Voltage	100.0V～600.0V 220V：350.0V　380V：600.0V	Model Confirmed	☆

6.6 PV MPPT Operation Logic

After the system starts, the MPPT controller first scans the voltage and current of the PV array, collecting output power data at different voltages to determine the voltage at the maximum power point (MPP voltage) under the current irradiance conditions. Subsequently, the controller adjusts the inverter's output frequency and duty cycle to stabilize the PV array's output voltage near the MPP voltage, ensuring the PV modules output maximum power. Parameter A3-22 (MPPT Adjustment Step Time) sets the interval for MPPT tracking adjustments to prevent system instability caused by overly frequent adjustments. Parameter A3-23 (MPPT Adjustment Maximum Voltage) sets the upper limit for MPP voltage adjustment to prevent over-voltage faults caused by excessive adjustment voltage. Parameter A3-24 (MPPT Step Adjustment Voltage, adjustable range 1.0V–50.0V, default 3.0V for 220V models, default

5.0V for 380V models) sets the voltage amplitude for each adjustment, ensuring precise and efficient regulation.

When irradiance or ambient temperature changes (e.g., cloud cover, day/night cycles, temperature fluctuations), the maximum power point of the PV array shifts accordingly. The MPPT controller monitors power changes in real time, performs rapid scanning and dynamic adjustments according to the step time set in parameter A3-22, and re-tracks the new maximum power point, ensuring the system always operates within the optimal power generation efficiency range. For example, when irradiance increases, both the MPP voltage and power of the PV array rise. The MPPT controller automatically adjusts the output voltage upward according to the step adjustment voltage set in A3-24 to maintain maximum power output. When irradiance decreases, it automatically lowers the output voltage to avoid power loss.

PV MPPT Adjustment Maximum Voltage = PV Open Circuit Voltage (A3-23) × MPPT Adjustment Maximum Voltage (A3-11)

A3-05	PV Proportional Gain 1	1～5000	1000	☆
A3-06	PV Integral Gain 1	1～1000	200	☆
A3-07	PV Proportional Gain 2	1～5000	1000	☆
A3-08	PV Integral Gain 2	1～1000	200	☆
A3-09	PV Control Switching Voltage Point	100.0V～800.0V 220V：300.0V 380V：500.0V	Model Confirmed	☆
A3-10	PV Minimum Input Voltage	100.0V～800.0V 220V：200.0V 380V：450.0V	Model Confirmed	☆
A3-11	PV Open Circuit Voltage	100.0V～800.0V 220V：400.0V 380V：700.0V	Model Confirmed	☆
A3-22	MPPT Adjust Step Time	0.1s～5.0s	20	☆
A3-23	MPPT Max Adjust Voltage	80.0%～100.0%	85.0%	☆
A3-24	MPPT Step Adjust Voltage	1.0V～50.0V 220V：3.0V 380V：5.0V	Model Confirmed	☆

Chapter 7 Fault Diagnosis and Countermeasures

7.1 Adjustment guide before commissioning of frequency converter

1) Open loop vector control mode (P0-01 = 0)

The control mode is to control the speed and torque of the motor in the application of the motor without encoder speed feedback. In this control mode, the motor parameters need to be self-learned to complete the automatic tuning of the motor parameters.

Problems and failures	treatment countermeasures
Overload or overcurrent fault is reported during motor start-up	■ The motor parameters (P1-01 ~ P1-05) are set according to the motor nameplate; ■ Self-learning (P1-37) of motor parameters is carried out. If conditions permit, it is better to carry out complete self-learning of motor dynamics.
Slow response of torque or speed below 5Hz, motor vibration	■ To improve the response of torque and speed, it is necessary to strengthen the proportional adjustment of the speed ring (P2-00 increase the set value by 10) or reduce the integration time of the speed ring (P2-01 decrease by 0.05); ■ If vibration occurs, you need to weaken the P2-00 and P2-01 the parameter value.
More than 5Hz torque or speed response is slow, motor vibration.	■ To improve the response of torque and speed, it is necessary to strengthen the proportional adjustment of the speed ring (P2-03 increase the set value by 10) or reduce the integration time of the speed ring (P2-04 decrease by 0.05); ■ If vibration occurs, you need to weaken the P2-03 and P2-04 the parameter value.
Low speed accuracy	■ When the load speed deviation of the motor is too large, the vector slip compensation gain (P2-06) shall be increased by 10%.
Large speed fluctuation	■ When the motor speed has abnormal fluctuations, the speed filtering time (P2-07) can be appropriately increased by 0.001s.
The motor is noisy	■ Appropriately increase the carrier frequency value (P0-15) in 1.0KHz (note: increase the carrier frequency motor leakage current will increase).
Insufficient motor torque or output	■ Whether the torque upper limit is limited, increase the torque upper limit (P2-10) in speed mode; increase the torque command in torque mode.

2) Closed loop vector control mode (P0-01 = 1)

This mode is used in applications where the motor has encoder speed feedback. It is necessary to correctly set the number of encoder lines, encoder type and signal direction to complete the automatic tuning of motor parameters.

Problems and failures	treatment countermeasures
Start-up overcurrent or overload fault	■ Set the number of encoder lines, type, encoder direction correctly.
Overload is reported during motor rotation or overcurrent fault	■ The motor parameters (P1-01 ~ P1-05) are set according to the motor nameplate; ■ Self-learning (P1-37) of motor parameters is carried out. If conditions permit, it is better to carry out complete self-learning of motor dynamics.
Slow response of torque or speed below 5Hz, motor vibration	■ To improve the response of torque and speed, it is necessary to strengthen the proportional adjustment of the speed ring (P2-00 increase the set value by 10) or reduce the integration time of the speed ring (P2-01 decrease by 0.05); ■ If vibration occurs, you need to weaken the P2-00 and P2-01 the parameter value.

Problems and failures	treatment countermeasures
More than 5Hz torque or speed response is slow, motor vibration.	■ To improve the response of torque and speed, it is necessary to strengthen the proportional adjustment of the speed ring (P2-03 increase the set value by 10) or reduce the integration time of the speed ring (P2-04 decrease by 0.05); ■ If vibration occurs, you need to weaken the P2-03 and P2-04 the parameter value.
Large speed fluctuation	■ When the motor speed has abnormal fluctuations, the speed filtering time (P2-07) can be appropriately increased by 0.001s.
The motor is noisy	■ Appropriately increase the carrier frequency value (P0-15) in units of 1.0kHz (note: increase the carrier frequency motor leakage current will increase).
Insufficient motor torque or output	■ Whether the torque upper limit is limited, increase the torque upper limit (P2-10) in speed mode; increase the torque command in torque mode.

3) V/F control mode (P0-01 = 2 factory default)

This mode is used in applications where the motor has no encoder speed feedback. It is not sensitive to the motor parameters and only needs to correctly set the rated voltage and rated frequency of the motor.

Problems and failures	treatment countermeasures
Motor oscillation during operation	■ Increase the shock suppression parameter (P3-11) by 10 (maximum adjustment to 100).
Overcurrent for high-power starting	■ Reduce the torque boost (P3-01), adjusted in units of 0.5%.
The motor is noisy	■ Appropriately increase the carrier frequency value (P0-15) in 1.0kHz (note: increase the carrier frequency motor leakage current will increase).
Large current in operation	■ Correctly set the rated voltage (P1-02) and rated frequency (P1-04) of the motor; ■ Reduce the torque boost (P3-01), adjusted in units of 0.5%.
Overvoltage for sudden unloading and overvoltage for deceleration	■ Make sure that the overvoltage stall enable (P3-23) is set to enable. Increase the overvoltage stall gain (P3-24/P3-25, ex-factory 30) by 10 (the maximum is 100); ■ Decrease the overvoltage stall action voltage (P3-22 factory 770V) by 10V (minimum adjustment to 700V).
Sudden overload report overcurrent, accelerated report overcurrent	■ Increase the overcurrent stall gain (P3-20 factory 20) by 10 (maximum adjusted to 100); ■ Reduce the overcurrent stall action current (P3-18 factory 150%) by 10% (minimum adjustment to 50%).

7.2 Fault Alarm and Countermeasures

The following fault types may be encountered during the use of the inverter. Please refer to the following methods for simple fault analysis:

Fault Name	Operating surface Panel Display	Troubleshooting	fault handling countermeasures
Accelerated overcurrent	ERR02	Inverter output circuit is grounded or short-circuited	■ Eliminate peripheral faults and detect whether the motor or interrupt contactor is short-circuited.
		Control mode is FVC or SVC without parameter identification	■ Set the motor parameters according to the motor nameplate and identify the motor parameters.
		Under the condition of rapid acceleration, the acceleration time is set too short.	■ Increase the acceleration time.
		Overcurrent stall suppression setting not appropriate	■ Make sure that the overcurrent stall suppression function (P3-19 = 1) is enabled; ■ The set value of overcurrent stall action current (P3-18) is too large, and it is recommended to be adjusted within 120 to 150; ■ The overcurrent stall suppression gain (P3-20) setting is too small, it is recommended to adjust within 20 to 40.
		Manual torque boost or V/F curve not appropriate	■ Adjust manual lift torque or V/F curve.
		Start the rotating motor	■ Select speed tracking start or wait for the motor to stop and then start.
		by external interference	■ Check the historical fault record. If the current value is far from reaching the overcurrent point value at the time of the fault, find the interference source. If there are no other sources of interference, the driver board or current sensor may be a problem.
deceleration overcurrent	ERR03	Inverter output circuit is grounded or short-circuited	■ Eliminate peripheral faults and detect whether the motor is short-circuited or open-circuited.
		Control mode is FVC or SVC without parameter identification	■ Set the motor parameters according to the motor nameplate and identify the motor parameters.
		Under the condition of rapid deceleration, the deceleration time is set too short.	■ Increase the deceleration time.
		Overcurrent stall suppression setting not appropriate	■ Make sure that the overcurrent stall suppression function (P3-19) is enabled; ■ The set value of overcurrent stall action current (P3-18) is too large, and it is recommended to be adjusted within 120 to 150; ■ The overcurrent stall suppression gain (P3-20) setting is too small, it is recommended to adjust within 20 to 40.
		No additional braking unit and braking resistor	■ Add brake unit and resistor.

Fault Name	Operating surface Panel Display	Troubleshooting	fault handling countermeasures
		by external interference	■ Check the historical fault record. If the current value is far from reaching the overcurrent point value at the time of the fault, find the interference source. If there are no other sources of interference, the driver board or current sensor may be a problem.
Constant speed overcurrent	ERR04	Inverter output circuit is grounded or short-circuited	■ Eliminate peripheral faults and detect whether the motor is short-circuited or open-circuited.
		Control mode is FVC or SVC without parameter identification	■ Set the motor parameters according to the motor nameplate and identify the motor parameters.
		Overcurrent stall suppression setting not appropriate	■ Confirm the overcurrent stall. The inhibition function (P3-19) has been enabled; ■ The set value of overcurrent stall action current (P3-18) is too large, and it is recommended to be adjusted within 120 to 150; ■ The overcurrent stall suppression gain (P3-20) setting is too small, it is recommended to adjust within 20 to 40.
		Frequency converter selection is small	■ In the stable operation state, if the running current has exceeded the rated current of the motor or the rated output current value of the inverter, please select the inverter with higher power level.
		by external interference	■ Check the historical fault record. If the current value is far from reaching the overcurrent point value at the time of the fault, find the interference source. If there are no other sources of interference, the driver board or current sensor may be a problem.
accelerating overvoltage	ERR05	High input voltage	■ The voltage is adjusted to the normal range.
		There is an external force in the acceleration process to drag the motor to run.	■ Cancel the additional power or add a braking resistor.
		Inappropriate overvoltage suppression setting	■ Make sure that the overvoltage suppression function (P3-23) is enabled; ■ Overvoltage suppression action voltage (P3-22) setting value is too large, recommended in 770V ~ 700V adjustment; ■ Overvoltage suppression gain (P3-24) setting is too small, it is recommended to adjust within 30 to 50.
		No additional braking unit and braking resistor	■ Add brake unit and resistor.
		Acceleration time is too short	■ Increase the acceleration time.

Fault Name	Operating surface Panel Display	Troubleshooting	fault handling countermeasures
deceleration overvoltage	ERR06	Inappropriate overvoltage suppression setting	■ Make sure that the overvoltage suppression function (P3-23) is enabled; ■ Overvoltage suppression action voltage (P3-22) setting value is too large, recommended in 770V ~ 700V adjustment; ■ Overvoltage suppression gain (P3-24) setting is too small, it is recommended to adjust within 30 to 50.
		There is an external force in the deceleration process to drag the motor to run.	■ Cancel the additional power or add a braking resistor.
		Deceleration time is too short	■ Increase the deceleration time.
		No additional braking unit and braking resistor	■ Add brake unit and resistor.
constant speed overvoltage	ERR07	Verify that the overvoltage suppression function (P3-23) is enabled	■ Make sure that the overvoltage suppression function (P3-23) is enabled; ■ Overvoltage suppression action voltage (P3-22) setting value is too large, recommended in 770V ~ 700V adjustment; ■ Overvoltage suppression frequency gain (P3-24) setting is too small, it is recommended to adjust within 30 to 50; ■ Overvoltage suppression maximum rise frequency (P3-26) setting is too small, it is recommended to adjust within 5~20Hz.
		There is an external force during operation to drag the motor to run	■ Cancel the additional power or add a braking resistor.
Control power failure	ERR08	Input voltage not within specification	■ The voltage shall be adjusted to the range required by the specification.
Undervoltage fault	ERR09	Instantaneous power failure	■ The instantaneous stop function (P9-59) is enabled to prevent instantaneous power failure and undervoltage fault.
		The voltage at the input end of the frequency converter is not within the range required by the specification.	■ Adjust the voltage to the normal range.
		Busbar voltage not normal	■ Seek technical support.
		Rectifier bridge, buffer resistor, drive board and control board are abnormal	■ Seek technical support.
Inverter overload	ERR10	Whether the load is too large or the motor is locked	■ Reduce the load and check the motor and mechanical condition.
		Frequency converter selection is small	■ Choose a frequency converter with a larger power level.
Motor overload	ERR11	Whether the motor protection parameter P9-01 setting is appropriate	■ Set this parameter correctly.
		Whether the load is too large or the motor is locked	■ Reduce the load and check the motor and mechanical condition.
Input phase loss	ERR12	Three-phase power input abnormal	■ Check and eliminate problems in peripheral circuits.

Fault Name	Operating surface Panel Display	Troubleshooting	fault handling countermeasures
		Driver, lightning protection board, main control board and rectifier bridge are abnormal	■ Seek technical support.
Output phase loss	ERR13	Motor fault	■ Check whether the motor is open.
		The lead wire from the converter to the motor is not normal.	■ Troubleshoot peripheral faults.
		Unbalanced three-phase output of inverter when motor is running	■ Check whether the three-phase winding of the motor is normal and eliminate the fault.
		Driver board, IGBT module abnormal	■ Seek technical support.
Module overheating	ERR14	The ambient temperature is too high	■ Reduce the ambient temperature.
		Air duct blockage	■ Clean the air duct.
		Fan damage	■ Replace the fan.
		Damaged module thermistor	■ Replace the thermistor.
		Inverter module damaged	■ Replace the inverter module.
External device failure	ERR15	The signal of the external fault is input through the multi-function terminal S.	■ Troubleshoot peripheral faults, confirm that the machine is allowed to restart (P8-18) and reset the operation.
Communication failure	ERR16	The upper computer is not working properly	■ Check the upper computer wiring.
		Communication line is not normal	■ Check the communication cable.
		Communication expansion card P0-28 set incorrectly	■ Set the communication expansion card type correctly.
		Communication parameter Pd group setting is incorrect	■ Set the communication parameters correctly.
		After the above tests, you can try to restore the factory settings.	
Contactor fault	ERR17	Abnormal drive board and power supply	■ Replace the driver board or power board.
		Contactor abnormal	■ Replace the contactor.
		Lightning protection plate abnormal	■ Replace the lightning protection plate.
Current detection fault	ERR18	Check current sensor for abnormality	■ Replace the current sensor.
		Abnormal drive board	■ Replace the drive plate.
Motor self-learning fault	ERR19	Motor parameters not set according to nameplate	■ Set the motor parameters correctly according to the nameplate.
		Parameter identification process timeout	■ Check the inverter to motor lead.
		Abnormal encoder	■ Check whether the number of encoder lines is set correctly and P1-27, and check whether the signal lines of the encoder are connected correctly and firmly.
Encoder failure	ERR20	Encoder model mismatch	■ Set the encoder type correctly according to the actual situation.
		Encoder wiring error	■ Detection of PG card power and phase sequence.
		Broken encoder	■ Replace the encoder.

Fault Name	Operating surface Panel Display	Troubleshooting	fault handling countermeasures
		PG card abnormal	■ Replace the PG card.
EEPROM read/write fault	ERR21	EEPROM chip damage	■ Replace the main control board.
Short circuit to ground fault	ERR23	Motor short circuit to ground	■ Replace the cable or motor.
Cumulative Run Time Reach Fault	ERR26	Cumulative running time reaches set value	■ Use the parameter initialization function to clear the record information.
User-defined fault 1	ERR27	Input signal of user-defined fault 1 via multi-function terminal S	■ Reset run.
User-defined fault 2	ERR28	Input signal of user-defined fault 2 via multi-function terminal S	■ Reset run.
Accumulated power-on time reaches fault	ERR29	Accumulated power-on time reaches the set value	■ Use the parameter initialization function to clear the record information.
Underload fault	ERR30	Inverter running current is less than P9-64	■ Confirm whether the load is separated or P9-64, and whether the P9-65 parameter setting conforms to the actual operating conditions.
Runtime PID feedback loss fault	ERR31	PID feedback less than PA-26 setpoint	■ Check the PID feedback signal or set PA-26 to a suitable value.
Wave-by-wave current limiting fault	ERR40	Whether the load is too large or the motor is locked	■ Reduce the load and check the motor and mechanical condition.
		Frequency converter selection is small	■ Choose a frequency converter with a larger power level.
Runtime switching Motor fault	ERR41	Change current motor selection via terminals during converter operation	■ The motor switching operation shall be carried out after the frequency converter is shut down.
Excessive speed deviation fault	ERR42	Incorrect encoder parameter setting	■ Set the encoder parameters correctly.
		No parameter identification	■ Motor parameter identification.
		Excessive speed deviation P9-69 detection parameters and unreasonable P9-70 setting	■ According to the actual situation, set the detection parameters reasonably.
Motor over-speed fault	ERR43	Incorrect encoder parameter setting	■ Set the encoder parameters correctly.
		No parameter identification	■ Motor parameter identification.
		Motor over-speed detection parameter P9-67 and P9-68 setting unreasonable	■ According to the actual situation, set the detection parameters reasonably.
Full water alarm	ERR46	Full water alarm	■ Full water alarm signal trigger, automatic shutdown. When the signal is eliminated, the delay is automatically restored. ■ Check whether the full water signal is triggered by mistake.
Water shortage alarm	ERR47	Water shortage alarm	■ Water shortage signal trigger, automatic shutdown. When the signal is eliminated, the delay is automatically restored

Fault Name	Operating surface Panel Display	Troubleshooting	fault handling countermeasures
Dry pumping alarm	ERR48	Dry pumping alarm	■ When the current for detecting long-term operation is less than the set value, it will automatically stop. After the dry pumping fault reset time, automatic reset.

7.3 Common Faults and Treatment Methods

The following faults may be encountered during the use of the inverter. Please refer to the following methods for simple fault analysis:

Serial Number	Fault phenomenon	Possible causes	Solution
1	No display on power-on	No or too low grid voltage	■ Check input power.
		Switching power supply fault on the converter drive board	■ Check the bus voltage.
		The connection between the control board and the drive board and the keyboard is broken.	■ Reseat the 30-core cable.
		Inverter buffer resistance damage	■ Seek services from manufacturers.
		Control board and keyboard fault	
		Damaged rectifier bridge	
2	Power-on always shows 510-A	Poor connection between driver board and control board	■ Reseat the 30-core cable.
		Related devices on the control board are damaged	■ Seek services from manufacturers.
		The motor or motor line has a short circuit to ground	
		Current sensor fault	
		Grid voltage too low	
3	Power-on display "ERR23" alarm	Motor or output line short to ground	■ Measure the insulation of the motor and output lines with a shaking table.
		Inverter damage	■ Seek services from manufacturers.
4	The power-on inverter shows normal, and "510-A" is displayed after operation and the inverter is shut down immediately.	The fan is damaged or stalling.	■ Replace the fan.
		Peripheral control terminal wiring is short-circuited	■ Troubleshoot external short circuit.
5	Frequent ERR14 (module overheat) fault	Carrier frequency setting too high	■ Reduce the carrier frequency (P0-15).
		The fan is damaged or the air duct is blocked.	■ Replace the fan and clean the air duct.
		Damage to internal components of the converter (thermocouple or others)	■ Seek services from manufacturers.
6	The motor does not rotate after the frequency converter is running	Motor and motor line	■ Reconfirm the correct connection between the frequency converter and the motor.
		Inverter parameter setting error (motor parameter)	■ Restore the factory parameters and reset the use parameter group; ■ Check whether the encoder parameters

Serial Number	Fault phenomenon	Possible causes	Solution
			are set correctly and the rated parameters of the motor are set correctly, such as the rated frequency and rated speed of the motor; ■ Check that the P0-01 (control mode), P0-02 (operation mode) and settings are correct; ■ V/F mode, heavy load start, adjust the P3-01 (torque boost) parameters.
		Poor connection between driver board and control board	■ Do you reseat the connection line and make sure the connection is firm.
		Drive board failure	■ Seek services from manufacturers.
7	S terminal failure	Parameter setting error	■ Check and reset the parameters associated with group P4.
		External signal error	■ Reconnect the external signal line.
		PLC and +24V jumper loose	■ Reconfirm the PLC with the +24V jumper and ensure that Fastening.
		Control board fault	■ Seek services from manufacturers.
8	When closed-loop vector control, the motor speed cannot be increased	Encoder failure	■ Replace the code wheel and reconfirm the wiring.
		Wrong wire connection or poor contact of encoder	■ Replace the PG card.
		PG card fault	■ Seek services from manufacturers.
		Drive board failure	
9	Frequency converter frequently reports overcurrent and overvoltage faults	Motor parameter setting is incorrect	■ Re-set the motor parameters or motor self-learning.
		Acceleration and deceleration time is not appropriate	■ Set the appropriate acceleration and deceleration time.
		load fluctuation	■ Seek services from manufacturers.
10	Power-on (or running) report ERR17	Soft start contactor is not closed	■ Check whether the contactor cable is loose; ■ Check whether the contactor is faulty; ■ Check whether the 24V power supply of the contactor is faulty; ■ Seek services from manufacturers.
11	The motor stops freely or has no braking capacity when decelerating or decelerating to a stop	Encoder disconnection or over-voltage stall protection in effect	■ When there is a speed sensor in vector control mode (P0-01 = 1), please check the encoder wiring; ■ If the braking resistors are configured, select Overvoltage Stall enable as Inactive (set P3-23 = 0) to turn off the overvoltage stall.

Chapter 8 Communication Data Address Definition

The EV510-PV series inverter supports Modbus communication protocol. The upper computer can control, monitor and modify the functional parameters of the inverter through Modbus communication protocol.

EV510-PV communication data can be divided into functional code data and non-functional code data, the latter including running commands, running status, running parameters, alarm information, etc.

8.1 EV510-PV Function Code Data

The function code data is an important setting parameter of the frequency converter. There are P group and A group function parameters EV510-PV. The parameter groups are as follows:

EV510-PV Function code data	Group P (read-write)	P0, P1, P2, P3, P4, P5, P6, P7, P8, P9, PA, PB, PC, PD, PE, PF
	Group A (read-write)	A0, A1, A2, A3, A4, A5, A6, A7, A8, A9, AA, AB, AC, AD, AE, AF

The function code data communication address is defined as follows:

8.1.1 When reading function code data for communication

For P0-PF and A0-AF group function code data, the upper eight bits of the communication address are directly the function group number, and the lower eight bits are directly the serial number of the function code in the function group, for example, as follows:

P0-16 function parameter, its communication address is F010H, where F0H represents P0 group function parameter, 10H represents the hexadecimal data format of serial number 16 in the function group. AC-08 function parameter, its communication address is AC08H, where ACH represents the AC group function parameter, and 08H represents the hexadecimal data format of serial number 8 in the function group.

8.1.2 When writing function code data for communication

For the P0-PF group function code data, its communication address is eight bits higher, according to whether to write EEPROM, divided into 00-0F or P0-PF, the lower eight bits directly for the function code in the function group serial number, for example, as follows:

Write function in parameter P0-16:

When it is not necessary to write into EEPROM, its communication address is 0010H;

When it is necessary to write to EEPROM, its communication address is F010H.

For the A0-AF group function code data, its communication address is eight bits higher, according to whether it needs to be written into EEPROM, it is distinguished as 40-4F or A0-AF, and the lower eight bits are directly the serial number of the function code in the function group, for example, as follows:

Write function parameter AC-08:

When it is not necessary to write into EEPROM, its communication address is 4C08H;

When it is necessary to write to EEPROM, its communication address is AC08H.

8.2 EV510-PV Non-function Code Data

EV510-PV Non-function code data	Status data (readable)	d group monitoring parameters, inverter fault description, inverter running state
	Control parameters (writable)	Control commands, communication settings, digital output terminal control, analog output AO1 control, Analog output AO2 control, high-speed pulse (FMP) output control, parameter initialization

8.2.1 Status Data

The status data is divided into d groups of monitoring parameters, inverter fault description, inverter operation status.

d group parameters monitoring parameters

For the description of group d monitoring data, see the relevant description in Chapter 5 and Chapter 6, and its address is defined as follows:

d0-dF, the high eight bits of the communication address are 70 ~ 7F, and the low eight bits are the serial number of the monitoring parameter in the group, for example, as follows:

d0-11, its mailing address is 700BH

Inverter Fault Description

When the communication reads the inverter fault, the communication address is fixed at 8000H, and the upper computer can obtain the current inverter fault code by reading the address data. The description of the fault code is defined in the P9-14 function code in Chapter 5.

Operation status of frequency converter

When the communication reads the operating status of the inverter, the communication address is set to 3000H, and the upper computer can obtain the current operating status information of the inverter by reading the local data, which is defined as follows:

Communication address of frequency converter running status	Read Status Word Definition
3000h	1: forward operation 2: reverse operation 3: shutdown

8.2.2 Control parameters

The control parameters are divided into control commands, digital output terminal control, analog output AO1 control, analog output AO2 control, and high-speed pulse (FMP) output control.

8.2.3 Control command

When the P0-02 (command source) is selected as 2: communication control, the upper computer can control the start and stop of the inverter through the communication address, and the control command is defined as follows:

Control Command Address	Command Function
2000h	1: forward operation 2: reverse operation 3: forward inching 4: reverse inching 5: free stop 6: deceleration stop 7: fault reset

8.2.4 Communication setting value

The communication setting value is mainly selected by the user EV510-PV the medium frequency source, torque upper limit source, VF separate voltage source, PID given source, PID feedback source, etc. as the given data at the given communication time, and its communication address is 1000H. When the upper computer sets the communication address value, its data range is -10000~10000, corresponding to the given value -100.00%-100.00%.

Digital output terminal control

When the digital output terminal function is selected as 20: communication control, the upper computer can control the digital output terminal of the inverter through the communication address, which is defined as follows:

Digital output terminal control communication address	command content
2001H	BiT0: None BiT1: None BiT2:RELAY1 output control BiT3:RELAY2 output control BiT4:HD0 output control

8.2.5 Analog output AO1, AO2, high-speed pulse output FMP control

When the analog output AO1 and AO2 and the high-speed pulse output FMP output function are selected as 12: communication setting, the upper computer can control the analog output and high-speed pulse output of the frequency converter through the communication address, which is defined as follows

Output control communication address		command content
AO1	2002H	0 ~ 7FFF means 0% ~ 100
AO2	2003H	

8.2.6 Parameter initialization

When it is necessary to initialize the parameters of the frequency converter through the upper computer, this function needs to be used.

If the PP-00 (user password) is not 0, it is first necessary to pass the password verification. After the verification is passed, the upper computer performs the parameter initialization operation after 30 seconds. The communication address for user password verification in communication is 1F00H. If the correct user password is directly written into the address, the password verification can be completed.

The address for parameter initialization for communication is 1F01H, and its data content is defined as follows:

Parameter initialization communication address	Command Function
1F01H	1: Restore factory parameters 2: Clear record information 4: Restore user backup parameters 501: Backup User's Current Parameters

Modbus communication protocol

EV510-PV series inverters provide RS485 communication interface and support Modbus-RTU communication protocols. Users can achieve centralized control through the computer or PLC, through the communication protocol to set the inverter operation command, modify or read the function code parameters, read the inverter working status and fault information.

J.1 Content of Agreement

The serial communication protocol defines the content and format of information transmitted in serial communication. These include: host polling (or broadcast) format; host encoding method, including: the function code of the required action, transmission data and error checking. The response of the slave also adopts the same structure, including: action confirmation, return data and error check. If the slave makes an error when receiving the information, or cannot complete the action required by the master, it will organize a fault message as a response to the host.

Application mode

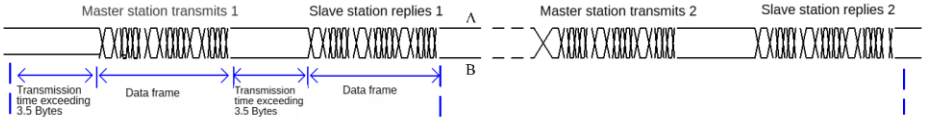
The frequency converter is connected to the "single master and multiple slave" PC/PLC control network with RS485 bus as a communication slave.

bus structure

(1) Single-host multi-slave **topology** system. Each communication device in the network has a unique slave address, one of which is used as a communication host (usually a flat PC upper computer, PLC, HMI, etc.). The host starts communication and reads or writes parameters to the slave. Other devices are communication slave machines and respond to the host's inquiry or communication operation to the machine. Only one device can send data at a time, while the other devices are in the receiving state.

The setting range of the slave address is 1 to 247, and 0 is the broadcast communication address. The slave addresses in the network must be unique.

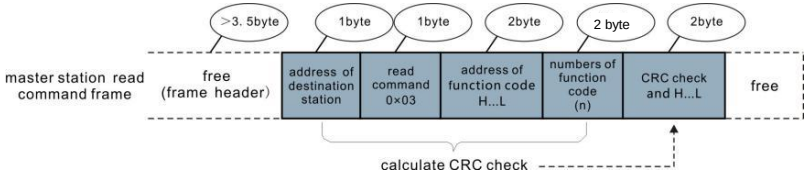
(2) Asynchronous serial **communication transmission mode**, half duplex transmission mode. In the process of serial asynchronous communication, data is sent one frame of data at a time in the form of a message. It is agreed in the MODBdS-RTU protocol that when the idle time of no data on the communication data line is greater than the transmission time of 3.5Byte, it indicates the start of a new communication frame.



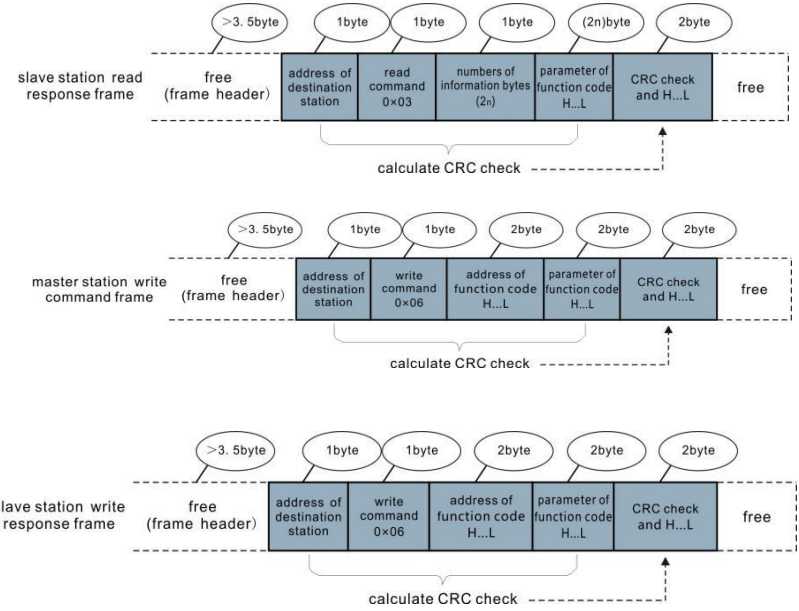
The built-in communication protocol of EV510-PV series inverter is Modbus-RTU slave communication protocol, which can respond to the "query/command" of the host, or make corresponding actions according to the "query/command" of the host, and communicate data response.

The host can refer to a personal computer (PC), industrial control equipment or programmable logic controller (PLC), etc. The host can not only communicate with a slave alone, but also release broadcast information to all lower slave machines. For the individual access "query/command" of the host, the accessed slave returns a response frame rate; for the broadcast information sent by the host, the slave does not need to feedback the response to the host.

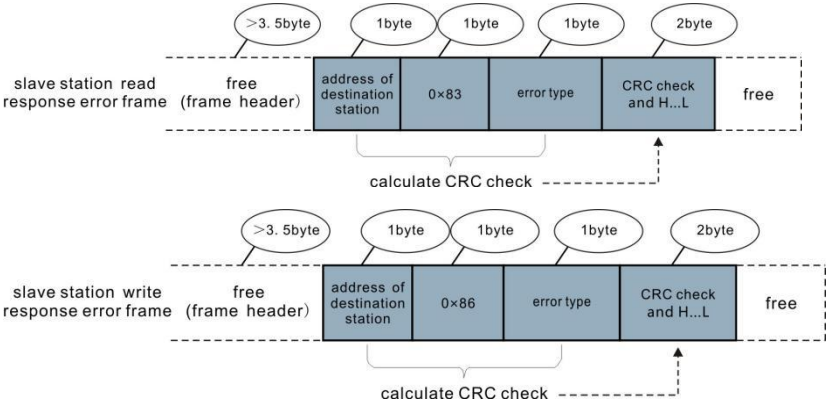
(3) Communication Data Structure The Modbus protocol communication data format of EV510-PV series inverters is as follows. Inverters only support reading or writing Word parameters. The corresponding communication read operation command is Ox03; The write operation command is Ox06, and byte or bit read and write operations are not supported.



In theory, the upper computer can read several consecutive function codes at a time (I. e. n can reach 12 at most), but it should be noted that the last function code of the function code group cannot be crossed, otherwise the reply will be wrong.



If the slave detects a communication frame error, or if the read and write are unsuccessful due to other reasons, it will reply to the error frame.



Data Frame Field Description

Frame header START	Idle with a transfer time greater than 3.5 characters.
Slave Address ADR	Communication address range: 1~247;0 = broadcast address.
Command Code CMD	03: Read slave machine parameters; 06: Write slave machine parameters.
Function code address H	The internal parameter address of the frequency converter is expressed in hexadecimal. It is divided into functional code type and non-functional code type (such as running state parameters, running commands, etc.) parameters, etc., see the address definition for details. When transmitting, the high byte is preceded by the low byte.
Function code address L	
Number of function codes H	The number of function codes read in this frame. If it is 1, it means 1 function code is read. When transmitting, the high byte is preceded by the low byte. This protocol can only rewrite one function code at a time, without this field.
Number of function codes L	
Data H	Reply data, or close-up data, is transmitted with the high byte first and the low byte second.
Data L	
CRCCHK Low	Detection value: CRC16 check value. When transmitting, the low byte comes first and the high byte comes after. The calculation method is detailed in the description of CRC check in this section.
CRCCHK High	
END	3.5 character time.

CMD calibration method

Verification method-CRC verification method:

The CRC(Cyclical Redundancy Check) uses the RTd frame format, and the message includes an error detection field based on the CRC method.

The CRC field detects the contents of the entire message.

The CRC field is two bytes and contains a 16-bit binary value.

It is calculated by the transmission device and added to the message.

The receiving device recalculates the CRC of the received message and compares it with the value in the received CRC field. If the two CRC values are not equal, then there is an error in the transmission.

The CRC is stored in 0xFFFF first, and then a procedure is called to process the consecutive 8-bit bytes in the message with the value in the current register.

Only the 8Bit data in each character is valid for CRC, and the start and stop bits and parity bits are invalid.

In the CRC generation process, each 8-bit character is individually or (XOR) with the contents of the register, and the result is moved in the direction of the least significant bit, and the most significant bit is filled with 0.

The LSB is extracted and detected. If the LSB is 1, the register alone is the exclusive OR of the preset value, and if the LSB is 0, it is not performed. The whole process is repeated 8 times. After the last bit (bit 8) is completed, the next 8-bit byte is independently XOR-ed with the current value of the register.

The value in the final register is the CRC value after all the bytes in the message have been executed.

When a CRC is added to a message, the low byte is added first, then the high byte.

The simple CRC function is as follows:

```
unsigned int crc_chk_value(unsigned char *data_value,unsigned char length)
{
unsigned int crc_value=0xFFFF;
   int I;
while(length--)
{
            crc_value ^ = * data_value ++;
            for( I =0; I <8; I ++)
            {
                  if(crc_value&0x0001)
            {
                        crc_value = (crc_value > > 1 )^ 0xa001;
                  }
                  else
                  {
crc_value = crc_value>>1;
                  }
            }
   }
   return(crc_value);
}
```

Address definitions for communication parameters

Read and write function code parameters (some function codes cannot be changed, only for manufacturers to use or monitor)

Function code parameter address marking rules:

The rule is represented by the function code group number and label number as the parameter address:

High byte: P0 ~ PF (group P), A0 ~ AF (group A), 70 ~ 7F (group d); Low byte: 00 ~ FF

For example, if the range function code is P3-12, the access address of the function code is expressed as 0 × F30C.

Note: PF group: parameters can neither be read nor changed; d group: only read, parameters can not be changed.

Some parameters cannot be changed when the inverter is in operation. Some parameters cannot be changed regardless of the state of the inverter. When changing the function code parameters, pay attention to the range, unit and related instructions of the parameters.

Function code group number	Communication Access Address	Communication modifies the address of the function code in RAM.
P0 ~ PE group	0×F000~0×FEFF	0 × 0000~0 × 0EFF
A0 ~ AC group	0×A000~0×ACFF	0 x 4000~0 x 4CFF
group d0	0 x 7000~0 x 70FF	

Note that because EEPROM is frequently stored, it will reduce the service life of EEPROM, so some function codes do not need to be stored in communication mode, just change the value in RAM.

If it is a P group parameter, to realize this function, it can be realized by changing the high order F of the function code address to 0.

If it is a group A parameter, to realize this function, it can be realized by changing the high bit A of the function code address to 4.

The corresponding function code address is indicated as follows:

High byte: 00 ~ 0F (group P), 40 ~ 4F (group A); Low byte: 00 ~ FF.

For example, the function code P3-12 is not stored in EEPROM, and the address is 030C; The function code A0-05 is not stored in EEPROM, and the address is 4005;

This address indicates that only RAM can be written and cannot be read. When reading, it is an invalid address. For all parameters, the command code 07H can also be used to implement this function.

Shutdown/Operation Parameters Section

Parameter Address	Parameter Description	Parameter Address	Parameter Description
1000	* Communication setting value (decimal) -10000~10000	1010	PID Settings
1001	Operating frequency	1011	PID feedback
1002	Bus voltage	1012	PLC Steps
1003	Output voltage	1013	High-speed pulse input frequency, 0.01kHz
1004	Output current	1014	Feedback speed in 0.1Hz
1005	Output power	1015	Remaining Running Time
1006	Output torque	1016	Voltage before AI1 correction
1007	Running speed	1017	Voltage before AI2 correction
1008	S input flag	1018	Voltage before correction of keyboard potentiometer (AI3)
1009	HDO Output Flag	1019	linear velocity
100A	AI1 voltage	101A	Current power-on time
100B	AI2 voltage	101B	Current Running Time
100c	Keyboard potentiometer voltage (AI3)	101C	High-speed pulse frequency input, unit 1Hz
100D	Count value input	101D	Communication setting value
100E	Length value input	101E	Actual feedback speed
100F	Load speed	101F	Main frequency A display
		1020	Secondary frequency B display

Note: The communication setpoint is a percentage of the relative value, 10000 corresponds to 100.00%, and -10000 corresponds to -100.00%.

For the data of frequency dimension, the percentage is the percentage relative to the maximum frequency (P0-10); for the data of torque dimension, the percentage is P2-10 and A2-48 (the upper limit of torque

is set, corresponding to the first and second motors respectively).

Control command input to converter (write only)

Command Word Address	Command Function
2000	0001: forward operation 0002: reverse operation 0003: forward inching 0004: reverse inching 0005: free stop 0006: deceleration stop 0007: fault reset

Read converter status (read only)

Status Word Address	Status word function
3000	0001: forward operation 0002: reverse operation 0003: shutdown

Parameter lock password verification (if the return is 8888H, the password verification passes)

Password Address	Enter the contents of the password
1F00	*****

Digital output terminal control (write only)

Command Address	command content
2001	BIT2:RELAY1 Output Control BIT3:RELAY2 Output Control BIT4:HDO Output Control

Analog Output AO1 Control (Write Only)

Command Address	command content
2002	0 ~ 7FFF means 0% ~ 100

Analog Output AO2 Control (Write Only)

Command Address	command content
2003	0 ~ 7FFF means 0% ~ 100

High Speed Pulse Output Control (Write Only)

Command Address	command content
2004	0 ~ 7FFF means 0% ~ 100

Inverter Fault Description

Frequency converter fault address	Inverter fault information		
8000	0000: No fault 0001: Reserved 0002: Accelerated overcurrent 0003: deceleration overcurrent 0004: Constant speed over current 0005: acceleration overvoltage 0006: deceleration overvoltage 0007: constant speed overvoltage 0008: buffer resistor	000D: Output phase loss 000E: Module overheating 000F: External fault 0010: abnormal communication 0011: Contactor abnormal 0012: current detection fault 0013: motor self-learning fault 0014: encoder/PG card fault 0015: parameter read/write exception 0016: inverter hardware fault 0017: motor short circuit to ground fault	001B: User-defined fault 1 001C: User-defined fault 2 001D: Power-on Time Arrived 001E: Underload 001F: Runtime PID Feedback Missing 0028: Fast current limit timeout fault 0029: Switching motor fault during operation 002A: excessive speed deviation 002B: Motor overspeed 002D: Motor over-temperature 005A: Encoder line number

Pd group communication parameter description

Pd-00	Baud rate	Factory Value	6005
	Setting range	Bits: Modbus baud rate	
		0:300BPS 1:600BPS 2:1200BPS 3:2400BPS 4:4800BPS	5:9600BPS 6:19200BPS 7:38400BPS 8:57600BPS 9:115200BPS

This parameter is used to set the data transmission rate between the upper computer and the frequency converter. Note that the baud rate set by the upper computer and the frequency converter must be consistent, otherwise, communication cannot be carried out. The greater the baud rate, the faster the communication speed.

Pd-01	Modbus data format	Factory Value	0
	Setting range	0: no check: data format <8-N-2> 1: even check: data format <8-E-1> 2: odd check: data format <8-O-1> 3: no check: data format <8-N-1>	

The data format set by the upper computer and the frequency converter must be consistent, otherwise, the communication cannot be carried out.

Pd-02	Local Address	Factory Value	1
	Setting range	1~247,0 is the broadcast address	

When the local address is set to 0, it is the broadcast address, and the broadcast function of the upper computer is realized.

The local address is unique (except for the broadcast address), which is the basis for point-to-point communication between the upper computer and the inverter.

Pd-03	Modbus response delay	Factory Value	2ms
	Setting range	0 to 20ms	

Response delay: refers to the intermediate time between the end of the inverter data acceptance and the data sent to the upper computer. If the response delay is less than the system processing time, the response delay is subject to the system processing time, if the response delay is longer than the system processing time, the system will wait until the response delay time to send data to the upper computer.

Pd-04	Serial communication timeout	Factory Value	0.0 s
	Setting range	0.0 s (invalid); 0.1~60.0s	

When the function code is set to 0.0 s, the communication timeout parameter is invalid.

When the function code is set to a valid value, if the interval between one communication and the next communication exceeds the communication timeout time, the system will report a communication failure error (ERR16). Usually, it is set to invalid. If the secondary parameter is set in a continuous communication system, the communication condition can be monitored.

Pd-05	Communication protocol selection	Factory Value	30
	Setting range	Bits: MODBUS 0: Non-standard MODBUS protocol 1: Standard MODBUS protocol	
		Ten: Profibus-DP (reserved) 0: PPO1 format 1: PPO2 format 2: PPO3 format 3: PPO5 format	

Pd-05 = 1: Select the standard Modbus protocol.

Pd-05 = 0: When reading the command, the number of bytes returned from the slave is one byte more than that of the standard Modbus protocol. For details, please refer to the "Communication Data Structure" section of this protocol.

Pd-06	Communication Read Current Resolution	Factory Value	0
	Setting range	0:0.01A; 1:0.1A	

The output unit used to determine the current value when the communication reads the output current.

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