

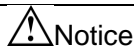
ZBAPF Series Usage Manual

- Please read this manual carefully before powering on the equipment
- Please keep it properly for future reference

Safety instructions

Before installing and using the equipment, please read this manual carefully to better install and use this product. The equipment must be debugged by trained professionals, otherwise it may endanger personal safety and cause equipment failure. The resulting damage to the equipment is not covered by the warranty.

This equipment is only used for commercial and industrial users and cannot be used as a power source for any life support equipment.



Unauthorized personnel are prohibited from debugging the equipment.

Grounded



When connecting the input cable, be sure to ground it reliably. The grounding of the equipment must comply with local electrical codes.

User maintainable device



All equipment internal maintenance and maintenance work requires tools and should be performed by personnel who have received relevant training. Devices that require tools to be opened (including those behind the cover) are not user-maintainable devices.

The equipment fully meets the safety requirements of equipment in the operating area. The equipment and internal capacitor modules have dangerous voltages, but they cannot be accessed by non-maintenance personnel. Since the device with dangerous voltage can only be touched after opening the cover with a tool, the possibility of

contact with dangerous voltage has been reduced to a minimum. If you follow the general specifications and follow the steps recommended in this manual to operate the equipment, there will be no danger.

Content

Chapter 1 Product Introduction.....	3
1.1 Introduction	3
1.2 Technical parameters.....	3
Chapter 2 System Installation.....	5
2.1 Installation preparation	5
2.2 Mechanical installation	5
2.3 Electrical installation	6
Chapter 3 Equipment Commissioning.....	10
3.1 Check before starting.....	10
3.2 Active module debugging	10
3.3 User Management	14
Chapter 4 Maintenance Guide.....	15
4.1 Daily maintenance	15
Chapter 5 Handling of Common Abnormal Problems	16
5.1 Handling of common exceptions	16
Attachment 1: Power unit module port description.....	19
Figure 1-1 Unit module wiring port	19
Attached table 1-1 unit module wiring port description	19

Chapter 1 Product Introduction

1.1 Introduction

The APF collects the current signal in real time through the external system current transformer, the controller separates the harmonic current part, and the IGBT power converter generates the compensation current with the same magnitude and opposite phase as the harmonic in the system, so as to filter the harmonic current of the system.

The APF output compensation current changes dynamically according to the changes in the harmonic content of the system current. In addition, APF has an advanced current limiting function. When the harmonic content of the system to be compensated is greater than the APF capacity, the APF can limit the output to 100% of the rated capacity without overload.

The equipment can be widely used in the following industrial fields (steel industry, metallurgical industry, mining industry, new energy industry, automobile industry), municipal fields (water treatment industry, telecommunications industry, scientific research institutes), commercial fields (hospitals, banks, shopping malls), schools, computer rooms, computer centers), rail transit fields (electrified railways, subways, ships).

1.2 Technical parameters

Table 1-1 Active compensation technical parameters

Enter				
Rated voltage (V)	V1: 400V AC V2: 690V AC 1 (The voltage level is reflected in the contract)			
System voltage range	±20%			
Frequency (Hz)	50/60 +/-5%			
Output and installation method				
Rated current (A)	MH	MV	H	C
	50,60,75,100	100,125,150	50,60,75,100,125,150	100,125,150,200,250,300,375,400,450
Type	Modular		Wall mounting	Cabinet
Inlet method	Back in line	Upcoming	Upcoming	Top incoming line/lower incoming line/cabinet roof through bus (The wiring method of the cabinet shall be specified in the

		contract)
Performance		
Filter rate	≥85% (within the order capacity range, and the load harmonic content is higher than 30% of the order capacity)	
Filter range	2~51th harmonics (if it is necessary to control the harmonics above 25th order, it is indicated in the contract)	
Full response time	≤10ms	
Transient response time	≤100us	
Dynamic current	1.2 times filter rated capacity output, 1min	
Power factor correction	Yes, it can be set (if it needs to be indicated in the contract)	
Unbalance compensation	Yes, it can be set (if it needs to be indicated in the contract)	
Protection		
Overload protection	Automatic current limit at 100% rated output	
Other protection	Over-voltage protection, under-voltage protection, over-temperature protection	
Operation mode		
Stand-alone operation	Can	
Parallel operation	Can	
Display and operation		
UI	7-inch touch screen, 4.3-inch touch screen	
Display state operate	Current, voltage, power, harmonic distortion rate, etc.	
Communication (RS485 interface)	Multiple operation mode options, remote or local Modbus-RTU, with remote monitoring interface and background database, convenient for users to monitor equipment operation parameters on the Internet terminal	
Environmental conditions		
Protection level	IP20 (customizable)	
Operating environment temperature	-10℃~40℃	
Storage/transport temperature	-40℃~60℃	
Working/storage humidity	Relative humidity 20~95%, non-condensing / Relative humidity 10~95%	
Altitude	Below 1000m (the higher altitude needs to be derated for use)	

Table 1-2 Passive compensation control and protection parameters

Control output	16 outputs
System target power factor	-1~+1
Control method	Manual / Auto
Compensation method	Three-phase total compensation, three-phase separate compensation, mixed compensation
Control power	DC12V, external DC power supply
Switching delay	5-300S, can be set
Protective function	Grid voltage over-voltage, under-voltage, and harmonic protection

Chapter 2 System Installation

2.1 Installation preparation

2.1.1 Installation environment

- Well ventilated, away from water, heat and flammable and explosive materials.
- Avoid direct sunlight.
- Avoid installation in an environment with dust, volatile gases, corrosive substances and excessive salt.

If necessary, an indoor exhaust fan should be installed to prevent the room temperature from increasing. In dusty environments, dust protection should be done.

2.1.2 Installation spacing

The device is forced by an internal fan to provide forced air cooling, and hot air is exhausted through the vents on the upper part of the device. Do not block the vents.

The device should keep a distance of at least 200mm from the wall or adjacent devices to avoid obstructing the ventilation and heat dissipation of the device, causing the internal temperature of the device to rise, and affecting the service life of the device.

2.1.3 Unloading and unpacking

The equipment should be placed in a storage environment that meets the requirements, and the storage time should not exceed 3 months.

When the equipment is installed, the outer packaging should be removed after the equipment is transported to the installation site, and the following items should be checked:

- 1) Unpack the equipment and inspect the appearance of the equipment visually. If there is any damage, please notify the carrier immediately.
- 2) According to the list of delivered accessories, check whether the supplied accessories are complete and correct. At the same time, properly keep all kinds of spare parts and accessories for subsequent installation of equipment, connecting cables and future maintenance.

2.2 Mechanical installation

2.2.1 Equipment-installation diagram

In order to achieve proper air circulation and equipment maintenance, the minimum space spacing required is as follows:

- ◆ The distance between the back of the cabinet and the wall is 100mm
- ◆ The top of the cabinet is at least 200mm away from the ceiling
- ◆ The front of the cabinet is at least 800mm away from the wall or other equipment

 Notice

When installing the equipment, pay attention to personal safety to prevent the equipment from falling down and hurting the human body.

2.3 Electrical installation

2.3.1 Power cable selection

Equipment power input and output power cables mainly include mains AC power input cables and protective earth wires. It is recommended that the input and output cables of the equipment choose BVR or RV type flexible connection cables with rated dielectric strength of AC450V/750V and allowable operating temperature of 70°C.

The current and cable selection of this device are shown in Table 2-1.

Table 2-1 Recommended cable cross-section selection table

Current capacity	ABC three-phase main circuit incoming cable selection	N line selection	PE line selection
50A and below	Copper core is 35 mm ² insulated heat-resistant flexible cable	The N-wire cable is 1.5 times the copper core of the three-phase ABC main circuit cable. (Note: The 3L APF in the specification model has no N line; the 4L APF	The PE cable is 0.67 times the copper core of the three-phase ABC main circuit cable
70A-120A	Copper core is 50 mm ² insulated heat-resistant flexible cable		
120A-160A	Copper core is 70 mm ² insulated heat-resistant flexible cable		
160A-220A	The copper core is 90 (or two 50) mm ² insulated heat-resistant flexible cables		
220A-300A	The copper core is 120 (or two 70) mm ² insulated heat-resistant flexible cables		
300A-400A	The copper core is two 90mm ² insulated heat-resistant flexible cables		

in the specification model has an N line)

2.3.2 CT and cable selection

The use of current transformer is mainly used for SVG to collect load current and calculate the harmonic current, reactive current, negative sequence current and zero sequence current of the load current. Table 2-2 is a guide for the selection of key parameters of transformers used in this series of SVG.

Table 2-2 Selection of key parameters of transformer

Parameter	Index requirements	Remark
Rated current once	XXX	0.3 times primary rated current ≤ actual maximum working current ≤ 0.6 times primary rated current
Secondary rated current	5A	
Rated voltage	≥0.66kV	
Rated Capacity	≥2VA	
Level of accuracy	0.5 level or 0.2 level	
size	—	The specific size needs to be selected according to the on-site installation environment

Transformer secondary side (rated current 5A) cables, a total of 3 groups (6). Below 15m: RVVSP 2×2.5 mm²; 15m-30m: RVVSP 2×4 mm²;

2.3.3 Cable connection

Precautions

- To ensure safety, make sure that the power supply equipment (such as transformer) is cut off before connecting all cables;
- To ensure safety, first connect the ground wire;
- Ensure that the phase sequence of the power cable connection is correct;
- Adopt correct power distribution methods (see Figure 2-2) to ensure the safety of equipment and user equipment;

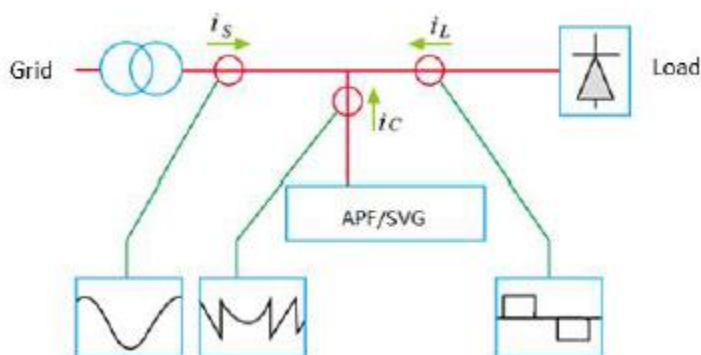
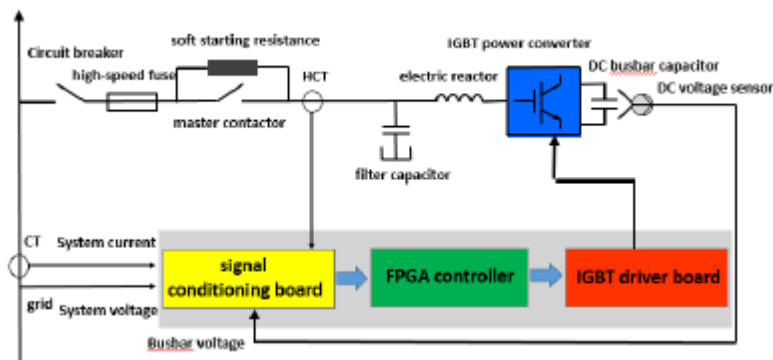


Figure 2-2 Correct power distribution method

The wiring of the main circuit is shown in the figure. The wiring should ensure that the phase sequence of the power grid is consistent with the phase sequence of the device. Otherwise, the device may not start normally. The installation direction of the transformer must be close to the load on the P2 surface as shown in the figure. The S1 and S2 of each transformer must correspond to the corresponding SVG port, and it is strictly forbidden to open the secondary side (if the open circuit may cause the transformer to burn).



For the touch screen connection port signal, please refer to the description in appendix 1, and the installation signal definition can be correctly connected. When multiple power modules are in parallel, the 485A2 of the modules need to be connected in parallel, and the 485B2 must also be connected in parallel.

If you need to control capacitor switching, you need to provide a 12V switching power supply to connect to the corresponding input terminals of the module.

2.4.ZBAPF installation drawing

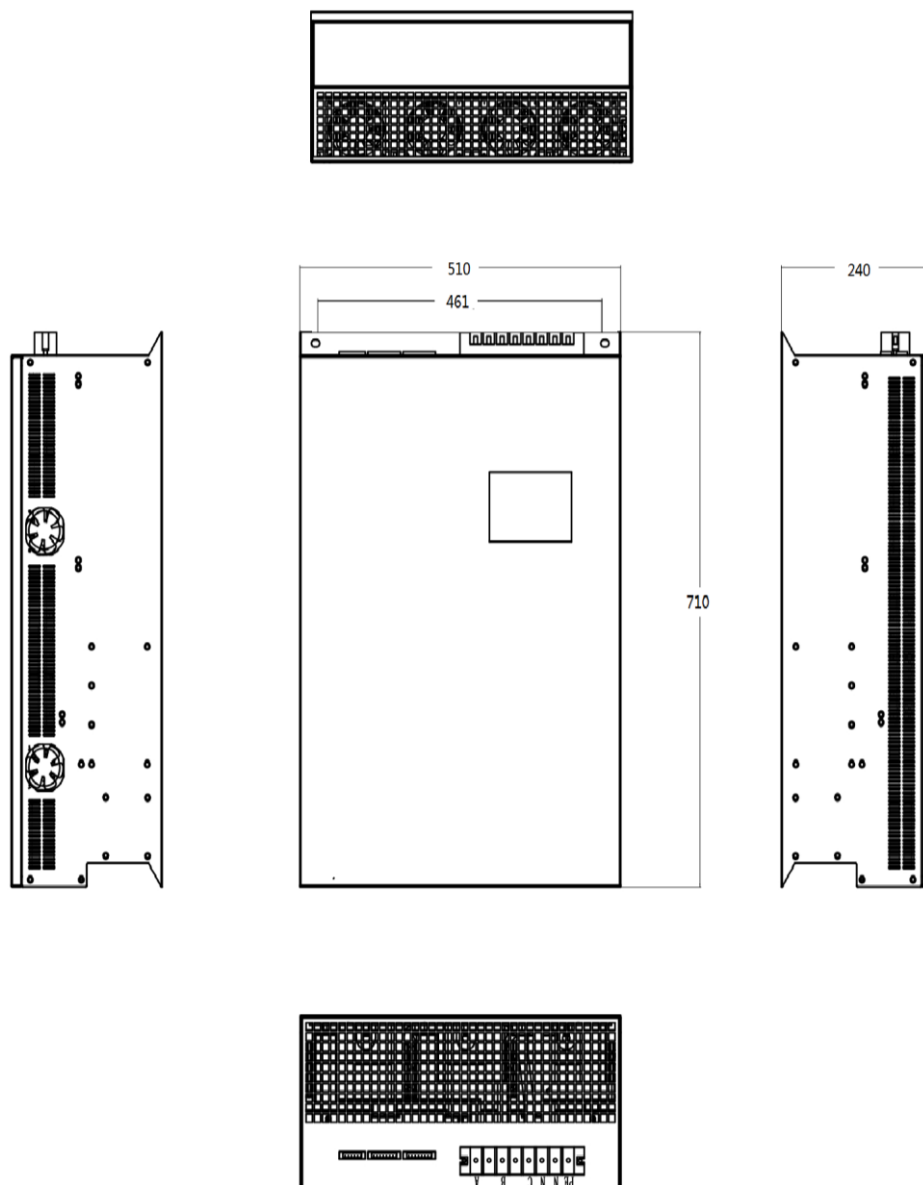
2.4.1 Wall-mounted active filter

Figure 2-1 External dimensions of wall-mounted ZBAPF (30A-50A)

P1



Figure 2-2 Dimensions of wall-mounted ZBAPF (100A)



2.4.2 Rack-mounted active filter

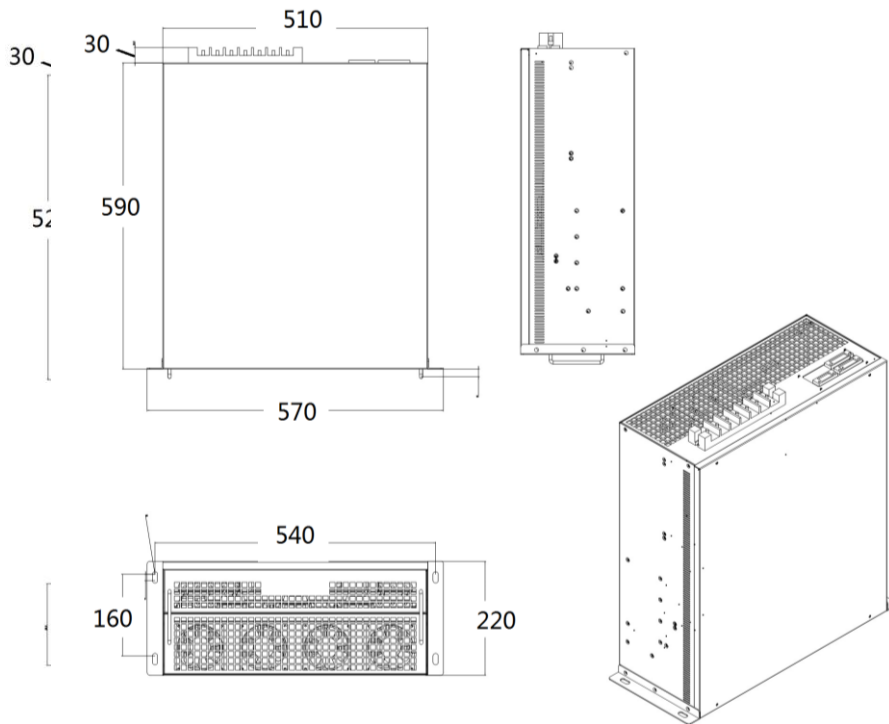


Figure 2-3 Rack ZBAPF Dimensions(30A-50A)

Picture 2-4 Rack ZBAPF Dimensions(100A)

Chapter 3 Equipment Commissioning

3.1 Check before starting

After the equipment is installed, confirm that the electrical connection of the system is correct and then power on.

- 1) Confirm that the equipment shell is reliably connected to the protective ground to prevent the danger of electrification of the shell.
- 2) Check and confirm that the power distribution method of the equipment, the connection of the power cables and the signal cables are correct and there is no short circuit.
- 3) Check and confirm that all input switches are disconnected, and put warning signs on these switches to prevent others from operating the switches.

3.2 Active module debugging

3.2.1 Debugging steps

[First step] Close the device input isolation switch.

The internal control of the device is powered on and enters the self-checking state, which takes about 30s; at the same time, the touch screen lights up when it is turned on.

[Step 2] Touch screen data inspection and parameter setting.

- The start-up display interface of the touch screen is shown in Figure 3-1. The value of "Communication" in the upper right corner of the boot interface displays "0". Click the buttons "curve query", "real-time data", "fault record", "function setting", "parameter setting", "passive setting" to view the data information of the corresponding interface respectively. Function setting, parameter setting and passive setting interface need permission to enter.

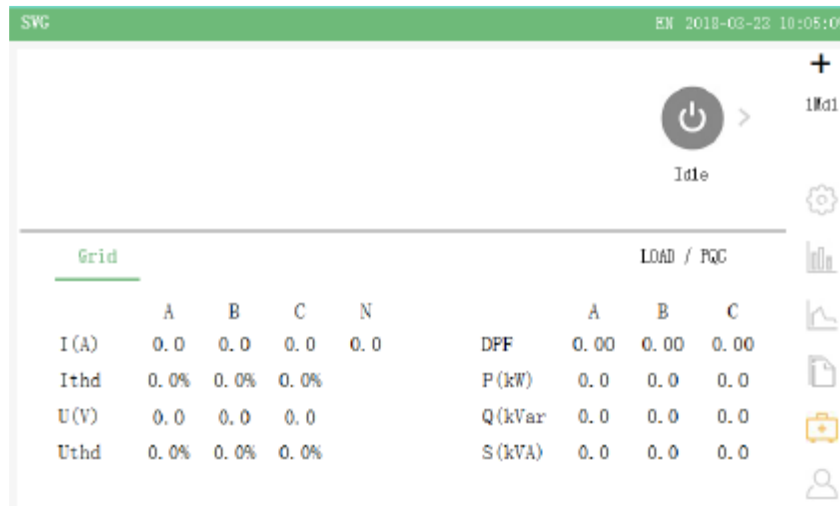


Figure 3-1 Touch screen boot interface

The device operation interface displays current data on the grid side and load side, device output current data, device internal DC bus voltage data, and compensation function status.

Click the "Device Selection" button, and the device selection box will pop up in the upper left corner of the touch screen. You can select the corresponding power module to view its device operating status. The upper part of the touch screen displays the current power module number.

- Click the "Curve Search" button to enter the interface shown in Figure 3-2. The value of "Communication" in the upper right corner of the operation interface displays "0"; under normal circumstances, the interface displays the current ABC three-phase grid voltage effective value and power system phase voltage, and the three-phase grid voltage wave-forms are yellow, green, and red in sequence.

	1	2	3	4	5	6
Use On	Off	Off	Off	Off	Off	Off
I _{ref}	0.00	0.00	0.00	0.00	0.00	0.00
I _{ref}	3I	3I	3I	3I	3I	3I
Mode	PF Mode	PF Mode	PF Mode	PF Mode	PF Mode	PF Mode
Target PF	1.00	1.00	1.00	1.00	1.00	1.00
V _{ref}	0V	0V	0V	0V	0V	0V
CTPos	Grid Side	Grid Side	Grid Side	Grid Side	Grid Side	Grid Side
CTRatio	0.5	0.5	0.5	0.5	0.5	0.5
Var On	Off	Off	Off	Off	Off	Off
Lin On	On	On	On	On	On	On
Harm On	Off	Off	Off	Off	Off	Off
COM	●	●	●	●	●	●
ModErr	●	●	●	●	●	●
	RT-RT2			Bal+		

Figure 3-2 Curve query interface

- Click the "real-time data" button to enter the interface shown in Figure 3-3 (1). The interface displays the grid voltage, grid current, load current, system power and power factor, three-phase IGBT temperature, filter capacitor current, and current imbalance between the grid side and the load side. Click the "harmonic content" button, you can view the grid current harmonic THD and the histogram of each harmonic.

Table 3-1 User parameter settings

Description	Meaning	Scope	Remark
CT ratio	Current sampling transformer transformation ratio	0~100000	Set according to site conditions
CT location	Select the transformer position	1: Grid side 2: Load side	The transformer must be installed on the grid side
Target PF	Expected target value of power factor	0~1	Generally the default is 0.95
DC given	DC voltage inside the device	740~850	Three-phase three: the default is 780 Three-phase four: the default is 750
Over-current threshold	Device instantaneous over-current protection threshold	0~300	Generally the default is 280
Master-slave settings	Unit module is set as master or slave	1 or 2	1: master; 2: slave
Threshold current	When the load current exceeds the threshold current setting value, the equipment runs at no load and does not output compensation current	0~300	Set according to site conditions
Unbal threshold	When the load current exceeds the threshold current setting value, the equipment runs at no load and does not output compensation current	0~100	Set according to site conditions
Self-reset	Fault self-resetting is enabled; after setting it to 1, if the device has a fault, the device will automatically clear the fault and automatically start the output current after a delay of about 5 minutes	0/1	Set according to site conditions
Number of parallel machines	Parallel operation number of unit modules	1~50	Set according to site conditions
Shunt coefficient	The reciprocal of the number of parallel machines	0~1	/
Compensation mode	Set compensation priority; 1 represents unbalanced reactive power priority; 2 represents reactive power priority; 3 represents harmonic priority	1/2/3	Set according to site conditions
Device address	The physical communication address of the unit module	1~8	/
Way selection	Set the number of touch screen channels. After modifying this value, you need to click the Save Settings button	1~8	Set according to site conditions



warn

About 15 minutes after the complete shutdown, the internal electrolytic capacitor voltage of the equipment is completely released, and the equipment shuts down normally. Pay attention to personal safety to prevent accidental electric shock!

3.2.3 Protection reset

When the equipment encounters event protection, it will automatically shut down, prolong the service life of the equipment, and display the current time

protection status in the real-time protection column of the fault record interface. If you restart the device, you need to clear the current event protection status information. The operation steps are as follows:

Click the "reset" button in the fault record interface of the touch screen until the event protection status information on the current page is cleared, that is, there is no protection status information in the real-time protection column.

3.3 User Management

Function settings, parameter settings, and passive settings require permissions. Click the user management button, and the user management dialog box will pop up. Click the login button, and the user login will pop up. Username: user login; password: 8888.

Chapter 4 Maintenance Guide

4.1 Daily maintenance

Except for the cooling fan, the components inside the equipment are stationary. The daily maintenance content is very small. Since the normal operation of the equipment is greatly affected by the environment, it is necessary to ensure that the environmental requirements for the operation of the equipment are met in the daily maintenance. It is recommended that the user keep a record of the following inspections, so that the machine can maintain the best performance and prevent minor problems from turning into major failures.

1. Daily inspection

- 1) Check whether the operation indicator on the panel is always on;
- 2) Check that there is no obvious high temperature at the output of each fan in the cabinet;
- 3) Whether there is abnormal noise or abnormal smell;
- 4) Confirm that the ventilation grid is not blocked;
- 5) Check whether all fans are operating normally, and confirm that there is wind blowing from the machine. The life of the fan will be shortened when used in a high temperature environment.
- 6) Measure and record the three-phase input voltage of the equipment;
- 7) Measure and record the input current of each phase of the equipment. If the measured value is significantly different from the previous one, record the size, type and location of the newly added load, which will help analyze whether a fault will occur.

2. Monthly inspection

- 1) First, check according to the content of daily inspection;
- 2) Shut down according to the shutdown procedure, wait for 10 minutes, and check when the DC side capacitor voltage drops to a safe voltage value;
- 3) Check the power cables and signal cables for signs of aging, wear and over-temperature, and check whether the power cables and signal cables are firmly connected;

4) Use a vacuum cleaner to remove surface impurities, and use low-pressure air to blow away the dust in the heat dissipation air duct to keep the air duct unobstructed;

3. Other checks

1) Insulation jacket and connection end inspection of input/output cables: It is recommended to make regular inspections. At this time, the equipment needs to be completely powered off. The inspection period should preferably not exceed 1 year;

2) Lightning protection inspection: The lightning protection indicator light needs to be opened before the front door can be observed, so monthly inspection is recommended. However, during the thunderous and humid seasons, daily inspections are required, especially after lightning strikes near the equipment, so as to find problems in real time and maintain them in time.

Chapter 5 Handling of Common Abnormal Problems

5.1 Handling of common exceptions

When the device is operating abnormally, the abnormal information will be saved in the historical alarm record of the touch screen or on the IoT intelligent cloud platform, and the user can analyze and handle the abnormality according to the saved abnormal information.

Table 5.1 Partial exception protection of touch screen or IoT display

Serial number	Description of anomaly	Cause Analysis	Approach	instruction
1	Grid voltage over-voltage protection	The grid voltage exceeds the over-voltage threshold	Measure the three-phase voltage to ensure that it is within the rated range; check whether the three-phase main incoming wire is off.	Grid voltage over-voltage threshold is 270V
2	Grid voltage under-voltage protection	The grid voltage is lower than the under-voltage threshold, and the main circuit breaker is not closed		Grid voltage under-voltage threshold is 170V
3	DC bus voltage over-voltage protection	The DC side capacitor voltage exceeds the overvoltage threshold	Check whether the connection of the DC voltage detection interface on the interface board is normal; whether there is a large fluctuation in the grid voltage.	The DC bus voltage over-voltage threshold is 880V
4	DC bus voltage under-voltage protection	The DC side capacitor voltage is lower than the		The DC bus voltage under-voltage threshold

			under-voltage threshold		is 500V
5	Contact protection		The relay is disconnected abnormally	Check whether the relay wiring is loose; if the protection still exists, please contact after-sales technical support.	This protection only appears when the device is working normally
6	Emergency stop protection	stop	Emergency stop signal feedback open circuit	Check whether the emergency stop button is pressed; check whether the emergency stop input port is open.	
7	Output current protection	current	The output instantaneous current exceeds the protection threshold	After reset, restart the device	
8	Temperature protection		Radiator overheated	Check whether the ambient temperature is too high; whether the fan is normal; whether the air path is unobstructed; whether there is dust accumulation at the air inlet; whether the temperature sensor wiring is loose.	

Remarks: The equipment has the function of self-recovery after shutdown caused by non-device's own problems. In addition to the emergency stop protection, when these protections appear, after a delay of 5 minutes, the equipment automatically clears the protection status and restarts operation. But the output current protection, DC bus voltage over-voltage protection, after accumulating more than 3 times, the equipment will not restart.

Table 5.2 On-site installation, wiring and debugging problems and their solutions

Serial number	Problem Description	Cause Analysis	Approach
1	Touch screen three-phase voltage sequence display yellow, red, green	The main power input three-phase voltage phase sequence is wrong	Main circuit power input phase B and phase C are adjusted relative to each other 1)
2	The active of the screen interface negative	power touch view is	A mutual sensor direction, or its secondary side signal line is reversed, or the phase sequence of the three-phase current is wrong, or the phase sequence of the three-phase voltage is wrong
3	Emergency protection	stop	The emergency stop button is pressed, or the box port S3 and IGND are not short-circuited
4	The overcurrent protection is activated at the first boot	stop	If the emergency stop button is pressed, release the emergency stop button; if there is no emergency stop button, and the S3 and IGND ports are not short-circuited, just use a wire to short-circuit it.
5	The fan does not turn after the device is started	Three-phase voltage phase sequence error	Correct the three-phase main input power supply. If the fault still exists, please contact after-sales technical support.
6	Low power factor	Fan failure; abnormal 24V power supply; lack of fan control signal	Check whether the fan cable is disconnected; check whether the fan is damaged (such as fan motor failure); check whether the 24V power supply is normal;
		Insufficient reactive power compensation capacity; wrong wiring of equipment	Check whether the wiring of the main cable and the signal line of the transformer is wrong; measure and compare the power factor of the equipment during operation and shutdown to determine whether the reactive power compensation capacity is insufficient;

1) If the voltage phase sequence is found to be yellow, red and green during on-site debugging, not only need to reverse the main power input B and C phases, but also the secondary side signal lines of the transformer B and C phases need to be reversed, that is, B-S1 Swap with C-S1, and B-S2 with C-S2. When there is a load current, the secondary side of the transformer cannot be opened, otherwise the transformer may be damaged, so it is necessary to short the secondary side with a shorting link.

Attachment 1: Power unit module port description

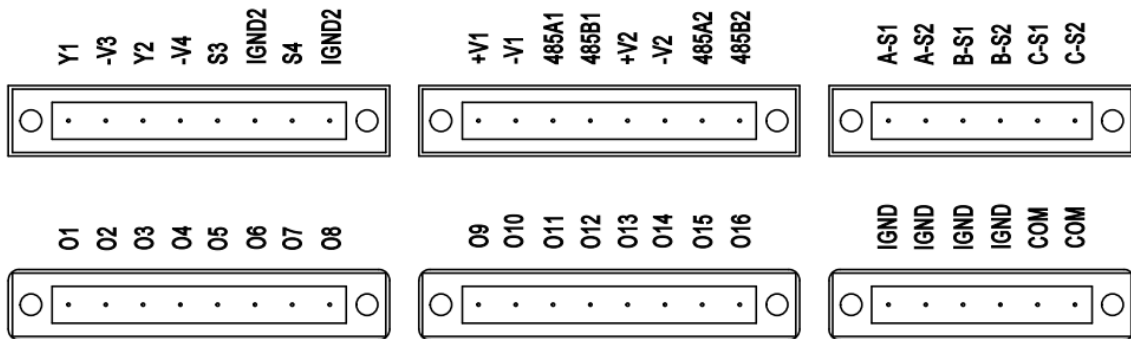


Figure 1-1 Unit module wiring port

Attached table 1-1 unit module wiring port description

Port type	The port number	Function Description
Transformer signal port	A-S1	A phase load current detection S1 input port (connected to A mutual sensor S1)
	A-S2	A phase load current detection S2 input port (connected to A mutual sensor S2)
	B-S1	B-phase load current detection S1 input port (connected to B mutual inductor S1)
	B-S2	B-phase load current detection S2 input port (connected to B mutual sensor S2)
	C-S1	C-phase load current detection S1 input port (connected to C mutual sensor S1)
	C-S2	C-phase load current detection S2 input port (connected to C mutual sensor S2)
Control signal port	+V1	IOT power output anode (connected to IOT power anode)
	-V1	IoT power output negative pole (connected to the negative pole of the IoT power supply)
	485A1	IOT 485 communication A1 output port (connected to IOT 485 serial port A1)
	485B1	IOT 485 communication B1 output port (connected to IOT 485 serial port B1)
	+V2	24V DC power output positive (connected to touch screen power input +)
	-V2	24V DC power output negative pole (connected to the touch screen power input-connection)
	485A2	485 communication A1 output port (with touch screen serial port RS485+)

485B2	485 communication B1 output port (with touch screen serial port RS485-)
Y1	STUR fault output 1 port (connected to external fault indicator)
-V3	STUR fault output 2 port (connected with external fault indicator)
Y3	invalid
-V4	invalid
S3	STUR emergency stop 1 output port (connected to the external "normally closed" emergency stop button)
IGND2	STUR emergency stop 2 output port (connected to the external "normally closed" emergency stop button)
S4	STUR start/stop signal 1 input port (connected to external "normally open" start/stop button)
IGND2	STUR start/stop signal 2 input port (connected to external "normally open" start/stop button)
O1 to O16	1 to 16 passive capacitor control input and removal control ports
COM	External switching power supply input +12V
IGND	External switch power input common terminal (ground)

STRONG POWER ELECTRIC CO., LTD.

Add.: Zhongbao Electric Smart Grid Industrial Park, No. 999

Wuyang East Road, High-tech Zone, Xinxiang City

Tel.: +86-373-5763010

Fax: +86-373-5068807

E-mail: info@zgxbdq.com

Website: <http://www.zgxbdq.com>