Elecnova

Power Quality Products

User Manual

Applied to：
SFR-APF4-150/0.4M

JIANGSU SFERE ELECTRIC CO., LTD.

Safety instructions

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

The device is only used for commercial and industrial users, not as a power source for any life support device.

 Attention
Unauthorized personnel are prohibited from debugging device.

Grounding

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

User maintainable devices

 Warning
Tools are required for all internal maintenance and repair work of the device, and should be performed by personnel who have received relevant training. Devices (including those behind the cover) that require tools to open are not user-maintainable. The device fully meets the safety requirements of device in the operating area. The device and internal capacitor modules have dangerous voltages, but are not accessible to non-maintenance personnel. Since it is only possible to touch a device with

dangerous voltage after opening the cover with a tool, the possibility of contact with dangerous voltage has been minimized. There will be no danger if the device is operated in accordance with the general specifications and following the steps recommended in this manual.

Content

1.Introduction

1.1 Overview

Power quality products include active harmonic filters (AHF) and static var generators (SVG). The product uses an efficient power electronics topology and advanced all-digital control technology to dynamically eliminate harmonic currents and improve power factor.

The device can be widely used in the following industrial fields (steel industry, metallurgy industry, mining industry, new energy industry, automotive industry), municipal field (water treatment industry, telecommunications industry, research institutes), commercial field (hospital, bank, shopping mall , schools, computer rooms, computer centers), rail transportation (electrified railways, subways, ships).

2. Technical specification

2.1 Technical parameters

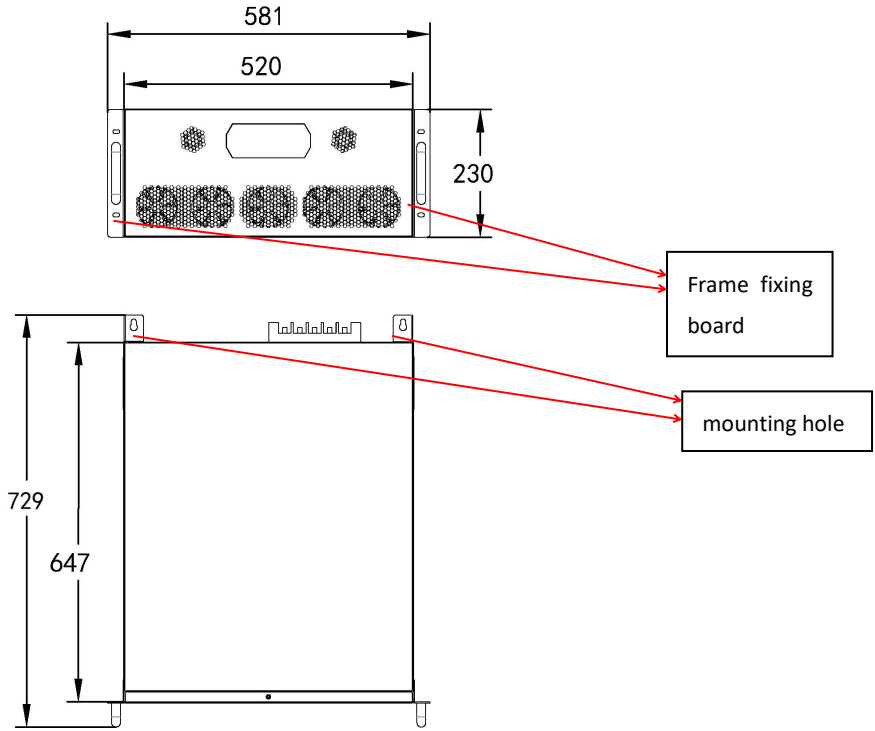
Input	
System voltage	Line voltage 400V
System voltage range	±15%
Frequency	50Hz ±5%
Output and installation	
Capacity specification	150A
Module type	Wall Mounted/Rack Mounted
Incoming way	Upper incoming/Back incoming
Performance	
Harmonics filtering rate	≥90% (Within the range of the ordered capacity, and the load harmonic content is higher than 30% of the ordered capacity)
Harmonics	2^{nd} ~51^{st} harmonics（If you need to control the harmonic order of more

filtering range	than 25 times, you should write in the contract）
Full response time	≤5ms
Instantaneous response time	≤100us
Dynamic current	1.2 times the filter rated capacity output，1min
Protection	
Overload protection	Automatic current limit at 100% rated output
Other protection	Over-voltage protection, under-voltage protection, over-temperature protection, over-current protection
Operation mode	
Stand-alone operation	Support
Parallel operation	Conventionally support 8 sets, special requirements can be customized
Display and operation	
Status display	Power / Operation / Fault LED indication
Module operation	Start/Stop/Restart
HMI (Optional）	Optional 7” (Hole size 215×152mm) 10” (Hole size 261×180mm)
Communication (RS485 interface)	1 loop Modbus-RTU protocol external communication interface, Users can have access to the background system through this interface or HMI port
Environment condition	
IP level	IP20（customized）
Operating environment temperature	-25℃~40℃
Storage/	-25℃~55℃

transport temperature	
Work humidity	Relative humidity 5~95%， no condensation
Altitude	1000m and below(above 1000m, Every additional 100m / 1% derating)
Standard	JB/T 11067-2013 Low-voltage active power filter device

3. Installation

3.1 Size



Rack Mounted 150A

3.2 Installation requirements

3.2.1 Installation environment

- Good ventilation, keep away from water, heat and flammable and explosive materials.
- Avoid direct sunlight.
- Avoid installation in environments with conductive dust, volatile gases, corrosive substances, and excessive salt.
- If necessary, an indoor exhaust fan should be installed to avoid an increase in room temperature. In a dusty environment, dust protection should be done.

3.2.2 Unpacking

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

During equipment installation, the equipment shall be transported to the installation site and then the outer package shall be removed to check the following items:

1) Open the equipment package and visually inspect the appearance of the equipment. If there is any damage, please inform the carrier immediately.

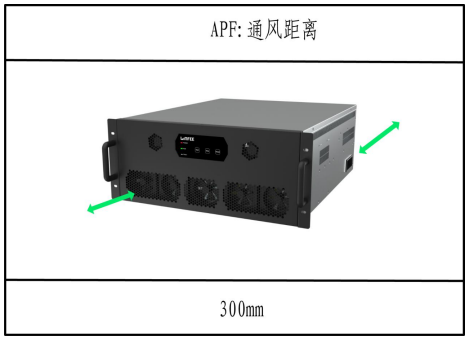
2) Check whether the models of attached accessories are complete and correct according to the list of delivered accessories, and properly keep various spare parts and accessories for subsequent equipment installation, connecting cables and future maintenance.

	When transporting, loading, unloading and handling equipment, appropriate precautions must be taken and appropriate manual and mechanical tools must be used to avoid damage to the equipment. If the equipment does not need to be installed immediately, be sure to store it on a solid and flat ground and follow the storage conditions listed in the technical parameters section. In this case, it is recommended to store the equipment in its original protective packaging.

3.2.3 Installation spacing

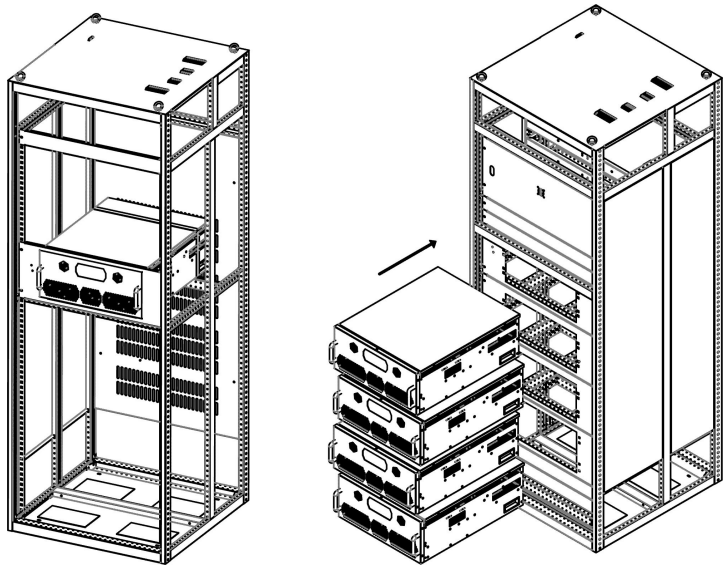
AHF module adopts forced ventilation cooling system, with air inlet on the front plate and air outlet at the rear of the module. After installation, the air flow at the inlet and outlet of the equipment must flow freely. At maximum power, the air velocity is 375 M³／ h。 The AHF module has its own power control system, which can control the fan speed and maximum power according to the internal temperature, so as to ensure that the active filter can maintain the best performance under complex conditions. In order to ensure the

performance of the equipment, we recommend to ensure that the air can flow freely at the front panel of the rack AHF, there are no obstacles at the rear, and a gap of at least 300 mm is left.



Ventilation distance

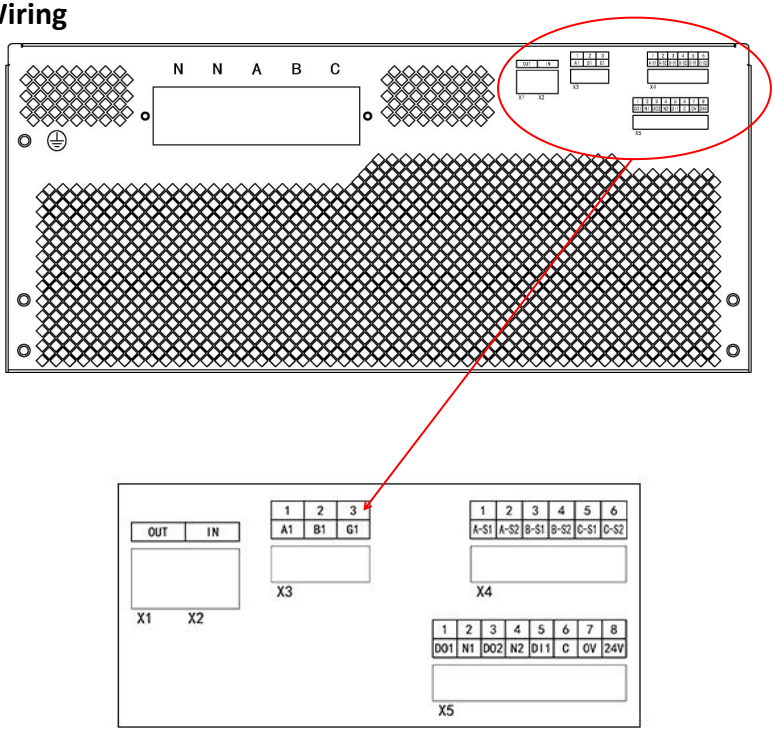
3.2.4 Installation in cabinet



The rack type installation in the cabinet is shown in the figure. Pay attention to the heat

dissipation design in the cabinet

3.3 Wiring



Function interface definition

Port type	Port No.	Function/description
X1	OUT	An output port that communicates with other modules through a network cable
X2	IN	Communicate with HMI touch screen through network cable or online with the previous module
X3 Communication port	A1	Communication output Note: Invalid when the module is SVGM
	B1	
	G1	
X4 CT signal port	A-S1	Input port of phase a current detection S1 (connected with phase a transformer S1)

	A-S2	Phase a current detection S2 input port (connected with phase a transformer S2)
	B-S1	Phase B current detection S1 input port (connected with phase B transformer S1)
	B-S2	Phase B current detection S2 input port (connected with phase B transformer S2)
	C-S1	Phase C current detection S1 input port (connected with phase C transformer S1)
	C-S2	Phase C current detection S2 input port (connected with phase C transformer S2)
X5 Control signal port	DO1	Programmable relay output, default configuration equipment fault relay output
	N1	
	DO2	Programmable relay output. The default configuration is the relay output for equipment startup and operation
	N2	
	DI1	Equipment emergency stop input port (connected with external "normally closed" emergency stop button)
	C	
	0V	Power output negative pole 0V (supplying power to HMI touch screen)
	24V	Power output positive + 24V (supplying power to HMI touch screen)

3.3.1 Power cable selection

Table 3-1 Recommended section of cable cross section

Current capacity	ABC three phase main circuit incoming line selection	N line selection	PE line selection
50A and below	Copper core is 25 mm2 insulated heat-resistant flexible cable	The N-line cable is 1.5 times the copper core of the three-phase ABC main circuit cable.	The PE cable is 0.67 times the copper core of the three-phase ABC main circuit cable
70A-120A	Copper core is 50 mm2 insulated heat-resistant flexible cable		
120A-160A	Copper core is 70 mm2 insulated heat-resistant flexible cable		
160A-220A	Copper core is 90 mm2(or 2 pcs of 50mm2) insulated heat-resistant flexible		

	cable	(Note: 3L AHF in the specification model has no N line; 4L AHF in the specification model has N line)	
220A-300A	Copper core is 120 mm2(or 2 pcs of 70mm2) insulated heat-resistant flexible cable		
300A-400A	Copper core is 2 pcs of 90mm2 insulated heat-resistant flexible cable		

The device power input and output power cables mainly include the main AC power input cable and the protective ground wire. It is recommended that the input and output cables of the device should be BVR or RV type flexible connecting cables with a rated dielectric strength of AC450V / 750V and an operating temperature of 70 ° C. The current and cable selection of this device are shown in Table 3-1.

3.3.2 CT and its cable selection

The use of current transformer is mainly used for AHF to collect load current and calculate the data of harmonic current, reactive current, negative sequence current and zero sequence current of load current. Table 3-2 is the selection guide for the key parameters of transformers used in this series of AHFs.

Table 3-2 Transformer key parameter selection

Parameter	Requirements	Remarks
Primary rated current	In	Recommend: 0.3In≤Actual maximum operating current≤0.6In
Secondary rated current	5A	
Rated voltage	≥0.66kV	
Rated capacity	≥2VA	
Accuracy level	0.5 or 0.2	

Dimension	——	The specific size needs to be selected according to the on-site installation environment

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

Note: if the load current is too small, the compensation and filtering effect may be affected. Please know!

3.3.3 Cable connections

Notes：

- To ensure safety, make sure that the power supply device (such as a transformer) is powered off before connecting all cables;
- To ensure safety, first connect the ground wire;
- Make sure the phase sequence of power cable connection is correct;
- Adopt the correct power distribution method (see Figure 3-3A and Figure 3-3B) to ensure the safety of AHF and user device; The main circuit wiring mode 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 as shown on the P2 surface. The S1 and S2 of each transformer must correspond to the AHF port with the corresponding label. It is strictly forbidden to open the secondary side.(If the circuit is open, it may cause the transformer to burn).

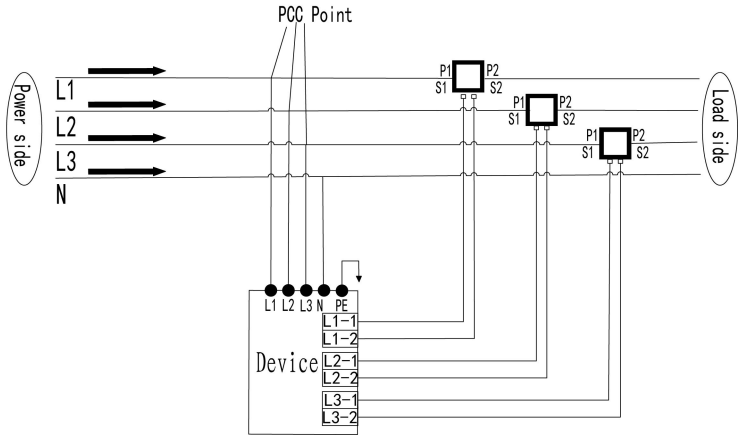


Figure 3-3A

Correct power distribution mode (the transformer is located behind the PCC point).

At this time, the CT configuration shall be "load side"

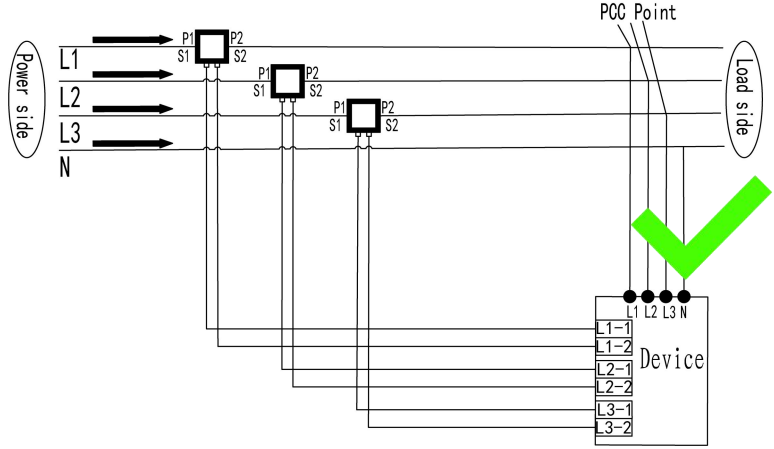
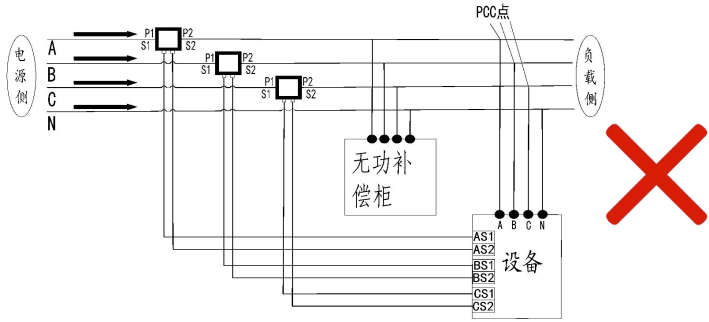


Figure 3-3B

Correct power distribution mode (transformer is located in front of PCC point).

At this time, CT configuration shall be "grid side"

Important: when the module is AHF, if there is a reactive power compensation cabinet on site, the transformer cannot contain the current of the reactive power compensation cabinet, otherwise the module will not operate normally or even be damaged!



Error wiring diagram

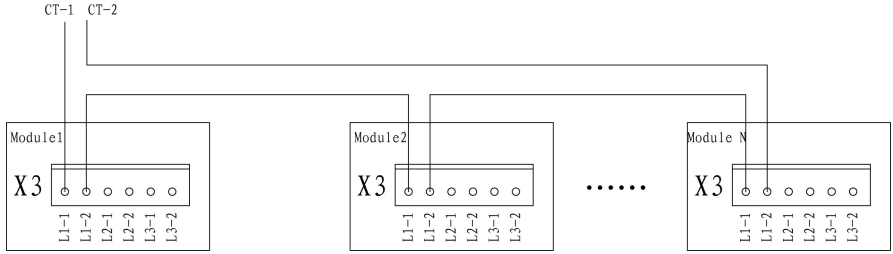


Figure 3-4 CT connection diagram of multiple modules

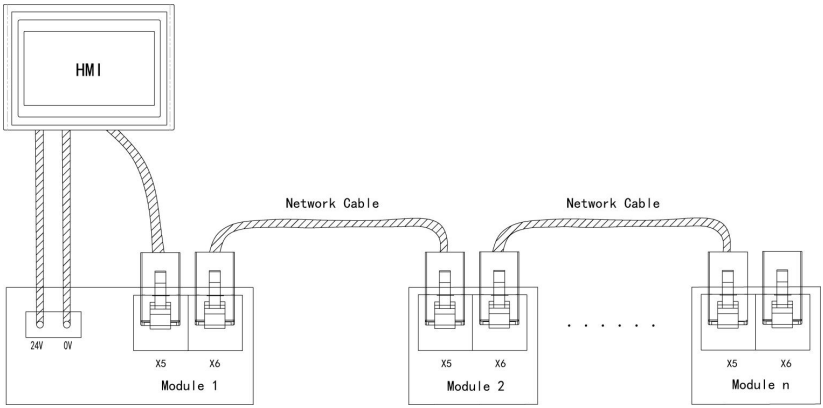
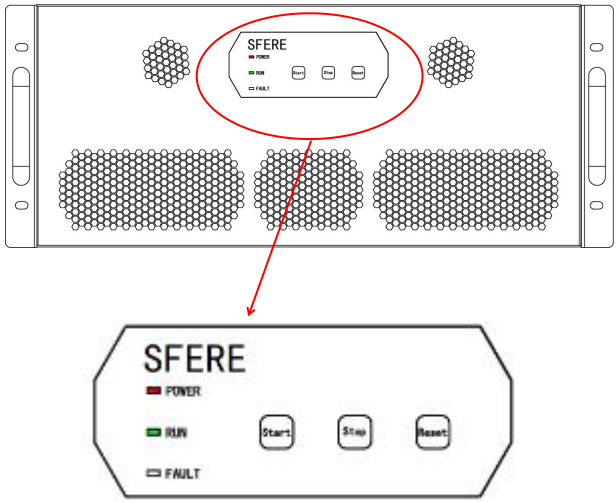


Figure .3-5 schematic diagram of connection of multiple modules and machine communication lines

When multiple modules are combined, CT_ B/CT_ C. refer to CT for signal wiring mode_ A (Fig. 3-4), the current signals are connected in series. The communication interfaces X1 and X2 of the module are connected hand in hand through the network cable (Fig. 3-5), and finally connected with the man-machine interface through the connecting line of DB9 network port.

4. Operation



4.1 Check before running

After the installation of the device, power on after confirming the electrical connection of the system.

1) Confirm that the device shell is reliably connected with the protective ground to prevent the shell from being charged.

2) Check and confirm that the power distribution mode of the device, power cables and signal cables are correctly connected without short circuit.

3) Check and confirm that all input switches are disconnected, and put warning signs on these switches to prevent other faults people operate the switch.

4.2 Testing

(1) Setting parameters: the required parameters are transformation ratio of current transformer, CT position, shunt coefficient and number of parallel units.

Name	Description	Range	Remark
Transformation ratio	Sampling CT ratio	0～20000	Set up according to the site conditions
Shunt coefficient	Reciprocal of number of parallel machines	0～1.000	Ratio of module to total parallel operation capacity
Threshold current	When the load current exceeds the threshold current setting value, the devicce operates without load and does not output compensation current	0～100	Set according to site conditions The default is 0
Unbalance threshold	When the load current exceeds the threshold current setting value, the equipment operates without load and does not output compensation current	0～100	Set according to site conditions The default is 0
Total current limiting	Output maximum current	0～200	**The total current limit shall not exceed the rated current of the module**
Number of parallel machines	Number of parallel operation modules	1～8	
Temperature limit	Temperature limit protection switch	Start/Stop	When on, derate the total current when the internal heat dissipation temperature exceeds the default value

CT position	Select the transformer location	Load or grid	1: Grid side 2: Load side
Postal address	External communication address	1～243	
Baud rate	Baud rate of external communication	2400～38400	Default 9600
Data format	Data format of external communication	N.8.1	
Power factor	Set target power factor	0.9～1	Factory Setting 0.98

(2) In the function option setting, you can select the number of harmonics to be filtered. It is recommended that 3, 5, 7 and 11 be turned on and the rest be turned off.

(3) To start up, click the start slider on the touch screen or long press the "start" button of the module.

(4) Use the power quality analyzer or the multi-function meter with harmonic measurement on the incoming cabinet to observe whether the current harmonic content decreases. If it does not decrease, it increases. It is necessary to detect whether the wiring and position of the current transformer are correct.

Note: please refer to the man-machine interface user manual for detailed operation.

4.3 Stop

【1】Click the touch screen shutdown slider or long press the "Stop" button of the module.

【2】Disconnect the MCCB.

 Warning
About 15 minutes after the complete power off, the electrolytic capacitor voltage inside the device is completely released, and the device is shut down normally. Pay attention to personal safety to prevent electric shock !

5. Maintenance

The components inside the device are stationary except for the cooling fan rotating. Routine maintenance content is very small, because the normal operation of the device is greatly affected by the environment, so in daily maintenance, care must be taken to ensure that the environmental requirements for device operation are met. It is recommended that the user record the following inspection contents, so that the machine can maintain the best performance and prevent small problems from turning into major failures.

1.Daily inspection

1) Check whether the panel running indicator is 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 and 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 out from the machine. The life of the fan will be shortened under high temperature environment;

6) Measure and record the three-phase input voltage of the device;

7) Measure and record the current of each phase of the device input. If the measured value is significantly different from the previous one, record the size, type and location of the newly added load, which is helpful to help analyze whether a failure will occur.

2. Monthly inspection

1) First check according to the content of daily inspection;

2) Shut down according to the shutdown procedure, wait 10 minutes, and then check when the DC side capacitor voltage drops to a safe voltage;

3) Check the aging, wear and over temperature traces of power cables and signal

cables, 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 remove the dust from the cooling air duct to keep the air duct clear.

3. Other checks

1)Input / output cable insulation jacket and connection end inspection: periodic inspection is recommended. At this time, the device needs to be completely powered off, and the inspection period is preferably not more than 1 year;

2) Lightning protection inspection: The lightning protection indicator needs to be opened before the front door can be observed, so it is recommended to follow the monthly inspection method. However, daily inspections are required in heavy and wet seasons, especially after lightning strikes occur near the device, in order to discover problems in real time and timely maintenance.

6.Handling of common abnormal problems

When the device stops during operation, the abnormal information will be saved in the event record, and the user can analyze and deal with it according to the saved fault information.

Table 6.1 Problems and treatment of field installation wiring debugging

Serial number	Problem Description	Cause Analysis	Approach
1	The active power of the touch screen view interface is negative	The current direction of the L1 transformer, or its secondary signal line is reversed, or the three-phase current and the three-phase voltage are not in	Check if the current direction of L1 transformer is from P1 to P2? S1 is connected to terminal block L1-1, S2 is connected to terminal block L1-2? Check the sequence of three-phase voltage and current in one-to-one correspondence?

		one-to-one correspondence;	
2	Start-up emergency stop protection	The emergency stop button is pressed, or the module DI1 port and port C are not short-circuited;	If the emergency stop button is pressed, release the emergency stop button; if there is no emergency stop button, and port DI1 and port C are not short-circuited, short-circuit with a wire.
3	The fan does not rotate after the device is started	Fan failure：abnormal 24V power supply; missing 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;
4	The power factor is low	Insufficient reactive power compensation capacity; Device wiring error;	Check whether the wiring of main cable and transformer signal line is wrong; Measure and compare the power factor during equipment operation and shutdown to determine whether the reactive power compensation capacity is insufficient;
1) In the case of load current, the secondary side of the transformer cannot be opened, otherwise the transformer may be damaged, so the secondary side needs to be shorted with a shorting piece.			

7. Accessory List

1. Dimensions	581mm(Width)×230mm(Height)×729mm(Depth)		
2. Weight	51kg		
3. Accessories			
No.	Name	Specification	Quantity
1	Rack mount		2
2	Terminal	8P	1(already installed on the product)
3	Terminal	6P	1(already installed on the product)
4	Terminal	3P	1(already installed on the product)
5	Bridge piece	EBL2-5	1(already installed on the product)
6	Cross recessed pan head screws	M4×8	6
7	Testing record		1
8	Instruction	User Manual for Power Quality Products	1

Appendix: Communication Address Table

Address		R/W type	Data type	Data format	Name	Description
Hex.	Decimal					
0x0	0	R/W	long	D*1	Run_ST	Protection mark
0x2	2	R	long	D*1	Filter Flag	Harmonic enable flag (display 0 means off, display 1 means on)
0x4	4	R	long	D*1	PH_En_Flag	Imbalance enable flag (display 0 means off, display 1 means on)
0x6	6	R	long	D*1	Q_En_Flag	Reactive enable flag (display 0 means off, display 1 means on)
0x8	8	R	long	D*1	Auto_Reset Flag	Self-reset enable flag (display 0 means off, display 1 means on)
0xA	10	R	long	D*1	On_Off Flag	Start flag (display 0 means off, display 1 means on)
0xC	12	R	long	D*0.01	DC+	DC bus upper side voltage xxxx.xxV
0xE	14	R	long	D*0.01	DC-	DC bus lower voltage xxxx.xxV
0x10	16	R	long	D*0.01	DC	DC bus total voltage xxxx.xxV
0x12	18	R	long	D*0.01	Ia_Out	Device L1 output current value xxx.xxA
0x14	20	R	long	D*0.01	Ib_Out	Device L2 output current value xxx.xxA
0x16	22	R	long	D*0.01	Ic_Out	Device L3 output current value xxx.xxA
0x18	24	R	long	D*0.01	In_Out	Device LN output current value xxx.xxA
0x1A	26	R	long	D*0.01	Uan	Phase L1 grid side voltage xxx.xxV
0x1C	28	R	long	D*0.01	Ubn	Phase L2 grid side voltage xxx.xxV
0x1E	30	R	long	D*0.01	Ucn	Phase L3 grid side voltage xxx.xxV
0x20	32	R	long	D*0.01	Ia	Phase L1 grid side current xxx.xxA
0x22	34	R	long	D*0.01	Ib	Phase L2 grid side current xxx.xxA
0x24	36	R	long	D*0.01	Ic	Phase L3 grid side current xxx.xxA
0x26	38	R	long	D*0.01	In	Phase LN grid side current xxx.xxA

0x28	40	R	long	D*0.01	Pa_Sys	Phase L1 grid side active power xxx.xxkw
0x2A	42	R	long	D*0.01	Pb_Sys	Phase L2 grid side active power xxx.xxkw
0x2C	44	R	long	D*0.01	Pc_Sys	Phase L3 grid side active power xxx.xxkw
0x2E	46	R	long	D*0.01	P_Sys	Grid side active power xxx.xxkw
0x30	48	R	long	D*0.01	Qa_Sys	Phase L1 grid side reactive power
0x32	50	R	long	D*0.01	Qb_Sys	Phase L2 grid side reactive power
0x34	52	R	long	D*0.01	Qc_Sys	Phase L3 grid side reactive power
0x36	54	R	long	D*0.01	Q_Sys	Grid side reactive power
0x38	56	R	long	D*0.01	Sa_Sys	Phase L1 grid side apparent power
0x3A	58	R	long	D*0.01	Sb_Sys	Phase L2 grid side apparent power
0x3C	60	R	long	D*0.01	Sc_Sys	Phase L3 grid side apparent power
0x3E	62	R	long	D*0.01	S_Sys	Grid side apparent power
0x40	64	R	long	D*0.001	Pfa_Sys	Phase L1 grid side power factor
0x42	66	R	long	D*0.001	Pfb_Sys	Phase L2 grid side power factor
0x44	68	R	long	D*0.001	Pfc_Sys	Phase L3 grid side power factor
0x46	70	R	long	D*0.001	Pf	Grid side power factor xxx.x
0x48	72	R	long	D*0.01	Thd_Sys	Grid side current harmonics distortion rate xxx.xx%
0x4A	74	R	long	D*0.01	SysUnbalance	Grid side current imbalance rate
0x4C	76	R	long	D*0.01	Ia_Load	Load side current L1
0x4E	78	R	long	D*0.01	Ib_Load	Load side current L2
0x50	80	R	long	D*0.01	Ic_Load	Load side current L3
0x52	82	R	long	D*0.01	In_Load	Load side current LN
0x54	84	R	long	D*0.01	LoadUnbaln	Load side current imbalance rate
0x56	86	R	long	D*0.01	Ia_LCL	Phase L1 capacitor filter current xxx.xx
0x58	88	R	long	D*0.01	Ib_LCL	Phase L2 capacitor filter current xxx.xx

0x5A	90	R	long	D*0.01	Ic_LCL	Phase L3 capacitor filter current xxx.xx
0x5C	92	R	long	D*0.01	In_LCL	Phase LN capacitor filter current xxx.xx
0x5E	94	R	long	D*0.1	Tem_A1	IGBT L1 phase temperature *0.1
0x60	96	R	long	D*0.1	Tem_B1	IGBT L2 phase temperature*0.1
0x62	98	R	long	D*0.1	Tem_C1	IGBT L3 phase temperature*0.1
0x64	100	R	long	D*0.1	Tem_A2	IGBT L1 phase temperature *0.1
0x66	102	R	long	D*0.1	Tem_B2	IGBT L2 phase temperature*0.1
0x68	104	R	long	D*0.1	Tem_C2	IGBT L3 phase temperature*0.1
0x6A	106	R	long	D*0.01	THI02	2nd harmonic current calculation percentage XXX.XX%
0x6C	108	R	long	D*0.01	THI03	3rd harmonic current calculation percentage
0x6E	110	R	long	D*0.01	THI04	4th harmonic current calculation percentage
0x70	112	R	long	D*0.01	THI05	5th harmonic current calculation percentage
0x72	114	R	long	D*0.01	THI06	6th harmonic current calculation percentage
0x74	116	R	long	D*0.01	THI07	7th harmonic current calculation percentage
0x76	118	R	long	D*0.01	THI08	8th harmonic current calculation percentage
0x78	120	R	long	D*0.01	THI09	9th harmonic current calculation percentage
0x7A	122	R	long	D*0.01	THI10	10th harmonic current calculation percentage
0x7C	124	R	long	D*0.01	THI11	11th harmonic current calculation percentage
0x7E	126	R	long	D*0.01	THI12	12th harmonic current calculation

						percentage
0x80	128	R	long	D*0.01	THI13	13th harmonic current calculation percentage
0x82	130	R	long	D*0.01	THI14	14th harmonic current calculation percentage
0x84	132	R	long	D*0.01	THI15	15th harmonic current calculation percentage
0x86	134	R	long	D*0.01	THI16	16th harmonic current calculation percentage
0x88	136	R	long	D*0.01	THI17	17th harmonic current calculation percentage
0x8A	138	R	long	D*0.01	THI18	18th harmonic current calculation percentage
0x8C	140	R	long	D*0.01	THI19	19th harmonic current calculation percentage
0x8E	142	R	long	D*0.01	THI20	20th harmonic current calculation percentage
0x90	144	R	long	D*0.01	THI21	21st harmonic current calculation percentage
0x92	146	R	long	D*0.01	THI22	22nd harmonic current calculation percentage
0x94	148	R	long	D*0.01	THI23	23rd harmonic current calculation percentage
0x96	150	R	long	D*0.01	THI24	24th harmonic current calculation percentage
0x98	152	R	long	D*0.01	THI25	25th harmonic current calculation percentage
0x9A	154	R	long	D*0.01	THI02_Load	2nd harmonic current calculation percentage XXX.XX%
0x9C	156	R	long	D*0.01	THI03_Load	3rd harmonic current calculation

						percentage
0x9E	158	R	long	D*0.01	THI04_Load	4th harmonic current calculation percentage
0xA0	160	R	long	D*0.01	THI05_Load	5th harmonic current calculation percentage
0xA2	162	R	long	D*0.01	THI06_Load	6th harmonic current calculation percentage
0xA4	164	R	long	D*0.01	THI07_Load	7th harmonic current calculation percentage
0xA6	166	R	long	D*0.01	THI08_Load	8th harmonic current calculation percentage
0xA8	168	R	long	D*0.01	THI09_Load	9th harmonic current calculation percentage
0xAA	170	R	long	D*0.01	THI10_Load	10th harmonic current calculation percentage
0xAC	172	R	long	D*0.01	THI11_Load	11th harmonic current calculation percentage
0xAE	174	R	long	D*0.01	THI12_Load	12th harmonic current calculation percentage
0xB0	176	R	long	D*0.01	THI13_Load	13th harmonic current calculation percentage
0xB2	178	R	long	D*0.01	THI14_Load	14th harmonic current calculation percentage
0xB4	180	R	long	D*0.01	THI15_Load	15th harmonic current calculation percentage
0xB6	182	R	long	D*0.01	THI16_Load	16th harmonic current calculation percentage
0xB8	184	R	long	D*0.01	THI17_Load	17th harmonic current calculation percentage
0xBA	186	R	long	D*0.01	THI18_Load	18th harmonic current calculation

						percentage
0xBC	188	R	long	D*0.01	THI19_Load	19th harmonic current calculation percentage
0xBE	190	R	long	D*0.01	THI20_Load	20th harmonic current calculation percentage
0xC0	192	R	long	D*0.01	THI21_Load	21st harmonic current calculation percentage
0xC2	194	R	long	D*0.01	THI22_Load	22nd harmonic current calculation percentage
0xC4	196	R	long	D*0.01	THI23_Load	23rd harmonic current calculation percentage
0xC6	198	R	long	D*0.01	THI24_Load	24th harmonic current calculation percentage
0xC8	200	R	long	D*0.01	THI25_Load	25th harmonic current calculation percentage
0xCA	202	R	long	D*0.01	IA1_OUT	L1-1 phase output current value xxx.xxxa
0xCC	204	R	long	D*0.01	IB1_OUT	L2-1 phase output current value xxx.xxxa
0xCE	206	R	long	D*0.01	IC1_OUT	L3-1 phase output current value xxx.xxxa
0xD0	208	R	long	D*0.01	IA2_OUT	L1-2 phase output current value xxx.xxxa
0xD2	210	R	long	D*0.01	IB2_OUT	L2-2 phase output current value xxx.xxxa
0xD4	212	R	long	D*0.01	IC2_OUT	L3-2phase output current value xxx.xxxa
0xD5	213	R	int	D*0.1	Temp_In	Internal temperature
0xD6	214	R	int	D*0.1	Temp_Fan	Outside temperature

Protection mark

The 0th	DC bus over-voltage protection	The 7th	DC bus under-voltage protection
The 1st	AC grid over-voltage protection	The 8th	LCL topology C branch overload protection
The 2nd	AC grid under-voltage protection	The 9th	Grid voltage Ud off-limit protection

The 3rd	Contactor abnormal protection	The 10th	Grid voltage sum off-limit protection
The 4th	Module IGBT over-temperature protection	The 11th	AC grid voltage phase loss protection
The 5th	Module output over-current protection	The 12th	Null
The 6th	Module emergency stop protection		