

15A APF Active Power Filter

User Manual

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Our company provides customers with comprehensive technical support. Users can contact the nearest company office or customer service center, or directly contact the company headquarters.

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Special Declaration

Personal Safety

1. The installation of this product must be carried out by the manufacturer or a professional engineer authorized by the manufacturer's agent. The machine debugging must be carried out by the engineer designated by the manufacturer, otherwise it may cause product failure or endanger personal safety.
2. Before installing and debugging the product, it is essential to carefully read this product manual and safety precautions, otherwise it may cause product failure or endanger personal safety.
3. This product cannot be used as a power supply for any life support module.

Module Safety

1. This product must be placed in a dry, clean, and specified temperature range environment if stored or not used for a long time.
2. This product should be used in an appropriate working environment (see the Environmental Requirements section of this product manual for details).
3. It is prohibited to use this product in the following working environments:
 - High temperature, low temperature, or humid places that beyond the technical specifications of this product
 - Places with vibration and susceptibility to collisions
 - Places close to heat sources or with strong electromagnetic interference

Statement of Responsibility

Our company is not responsible for defects or malfunctions caused by the following reasons:

1. Beyond the specified usage range and working environment of the product, such as allowing the module to work in an environment with conductive dust or condensation;
2. Unauthorized modification or repair, incorrect installation, improper operation, such as not following the instructions in Chapter 3 of this manual for CT wiring;
3. Encountering force majeure
4. Other violations of the provisions of this product manual

This manual may be updated periodically due to product upgrades and other reasons without prior notice.

This manual covers the following products

Product Series	Prouduct Name	Product Model	
APF(Rack)	APF 15A	MDF0154RC00	400VAC three-phase four-wire 15A APF-Module (Rack)

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Chapter 1 Safety Information

1.1 Safety Precaution

Improper use of the following operations can cause dangerous situations and potentially result in personal injury or death !



1. It is strictly prohibited to place combustible materials near the APF module, otherwise there is a risk of fire;
2. It is strictly prohibited to install APF modules in environments containing explosive gases, otherwise there is a risk of explosion;
3. Wiring operations must be carried out by qualified personnel wearing insulation protective equipment, otherwise there is a risk of electric shock;
4. Universal APF wiring operations can only be carried out when the input power is completely power off, otherwise there is a risk of electric shock;
5. After power on, do not touch any other parts of the APF module except for the HMI operation panel;
6. The grounding terminal of the APF module must be reliably grounded, as poor grounding can easily lead to abnormal operation and the risk of electric shock;
7. If maintenance operations are required, they should be carried out after disconnecting the power for 15 minutes, otherwise there is a risk of electric shock;
8. The exposed part of the cable nose in the main circuit wiring must be wrapped with insulation tape



1. When handling, do not use the front panel handle to pull the APF module to avoid personal injury or damage to objects;
2. If screws, gaskets, and metal foreign objects accidentally fall into the interior of the APF module, it must be prohibited from being power on or immediately power off, otherwise there is a risk of fire and damage to the components;
3. If the APF module is damaged or has incomplete components, please do not install or operate it, otherwise there is a risk of fire and personal injury;
4. The main circuit terminal must be firmly connected to the wire nose.

1.2 Precautions For Use

Incorrect Installation

When the APF module is incorrectly installed and applied, if the output transformer is reversed, it will increase the harmonic current and reactive current on the power system, which may endanger the power system and other connected modules.

Input Voltage Value Beyond the Limit

Please use the APF module within its rated voltage range. In special occasions, please use a boosting or lowering device.

Lightning Impulse Protection

The APF module is equipped with a lightning overcurrent protection device, which has a certain self-protection ability for induced lightning. Please ensure that the PE line of the APF module is connected to the ground.

Chapter 2 Product Specification Introduction

2.1 Environmental Characteristics

APF module is a power electronics module with complex control system. **The installation environment may affect its reliability and service life.** The APF module is equipped with a cooling fan to remove the heat generated during operation. Therefore, do not block the ventilation openings during the installation process. **Do not install the APF module in environments with excessive dust, heat, humidity, corrosion, or vibration.**

Project	Unit	Data information
Rated power	A	15
Altitude	m	≤1500, 1500m~3000m , Reduce rating by 1% every 100m in this range.
Relative Humidity	%RH	0~95, No condensation
Working Temperature	℃	- 10~55℃ The ambient temperature is - 10~40℃ ,and the module has no output power reduction; The ambient temperature is 40~45℃ ,and the module output power is reduced to 90%; The ambient temperature is 45~50℃ , and the module output power is reduced to 80%; The ambient temperature is 50~55℃ , and the module output power is reduced to 70%; If the ambient temperature exceeds 55 ℃ , the "ambient temperature over temperature" fault will be reported, and the fault will be recovered when the ambient temperature drops to 50 ℃.
APF module Storage and Transportation Temperature	℃	- 20~ + 70
Overvoltage Level		Overvoltage level II

Table 1 Environmental Characteristics of APF Module

2.2 Mechanical Characteristics

Project	Unit	Data information
Mechanical Dimensions (W×D×H)	mm	415×345×45(Rack-Mounted, without packaging materials);
The Thickness of The Case	U	1
Weight (Max)	kg	7.5
Color		RAL 7021
Protection level , IEC (60529)		IP20(Front door open or closed,Back door closed)

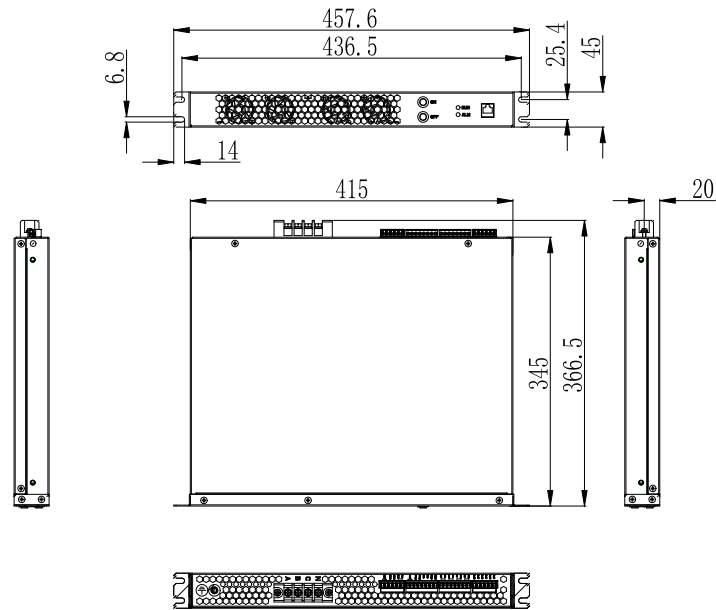
Table 2 Mechanical Characteristics of 15A APF Module

2.3 Electrical Characteristics

Project	Unit	Data information
Rated AC Voltage	Vac	380/400/415 , three-phase four-wire (compatible with three-phase three-wire)
Rated A, B, C, N Currents	A	15
Working Frequency	Hz	50/60
Voltage Range (Rated 380Vac)	%Vac	upper limit: + 15 lower limit: - 20
Frequency Range	Hz	±3
Loss	%	<2.5
CT Ratio Range		150:5~10000:5

Table 3 Electrical Characteristics of 15A APF Module

2.4 Module Appearance and Installation Dimensions



Our company offers rack mounted models for the 15A APF modules produced. Figure 1 illustrates the key mechanical characteristics of this model.

Figure 1 Installation Dimension Diagram of Rack-Mounted 15A APF Module (unit: mm)

Figure 2 illustrates the key mechanical characteristics of wall mounted model.

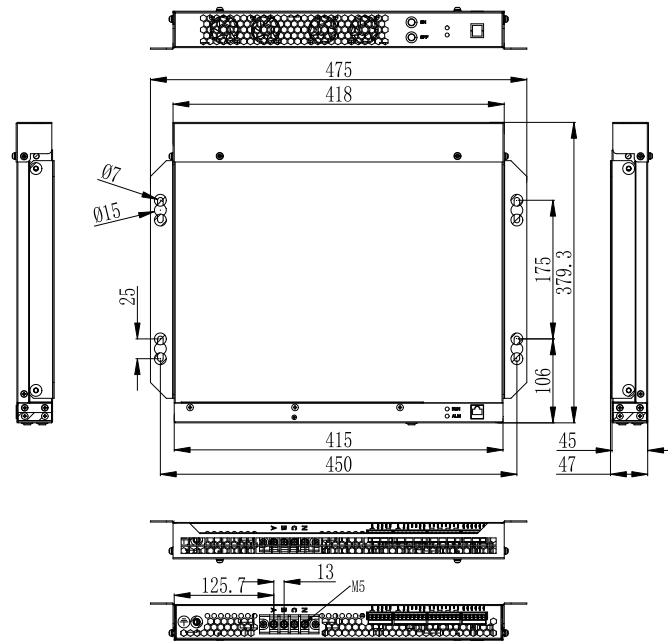


Figure 2 Installation Dimension Diagram of Wall-Mounted 15A APF Module (unit: mm)

2.5 Mechanical Installation

When the APF module is installed on the rail, it is fixed to the cabinet installation column through the hanging ears on the upper and lower sides. The cabinet thickness of the 15A APF module is 1U. In addition, our company can provide a full cabinet model. For specific details, please contact our engineers.

Chapter 3 Electrical Installation

3.1 Power Cable

Terminal Symbol	Terminal Function Description	Current/A	Recommended cross-sectional Area of cable/mm ²
1	A-phase input terminal	15	16
2	B-phase input terminal	15	16
3	C-phase input terminal	15	16
4	Neutral input terminal for three-phase four-wire/three-phase five-wire systems	15	16
5	Safety grounding terminal (chassis)		16

Table 4 APF Module Power Terminal Current and Cable Recommendation



Explanation:

1. Connect the input ground wire to the input ground terminal. (Note: Ground wire connections must comply with local and national regulations.)
2. Connect the AC input cable to the input terminals (A-B-C-N) of the APF module. Pay attention to ensuring the correct phase sequence.
3. When routing the communication input cable, try to avoid the module's air outlet as much as possible to ensure that there are no obstructions within 20cm of the module's air outlet.
4. The connection of the ground wire must use the shortest wiring path.
5. The PE terminal of the rail-mounted type is located below the front panel. Please use the OT16-6 terminal crimping wire and press the OT terminal in with an M6 screw. It is recommended that the tightening torque be 10 N·m.

3.2 Port Information

3.2.1 Front Panel Port

Figure 2 shows the front panel signal ports. NO is the power-on key and OFF is the power-off key. The APF module does not allow parallel operation. The network port is for the large

screen and our company's debugging interface. Figure 3 shows the rear panel ports. Table 5 lists the rear panel signal ports and their functions.

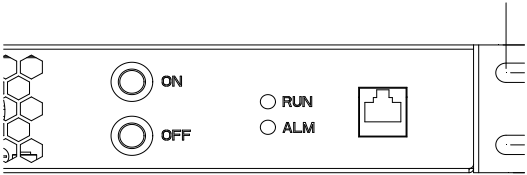


Figure 2 Front Panel Signal Port

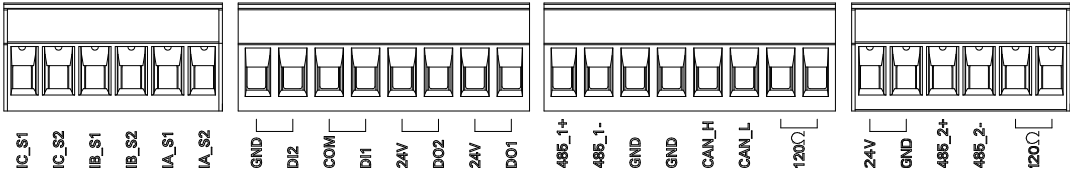


Figure 3 Rear Panel Signal Port

Pin Number	Port Name	Function Annotation
1	A	A Phase
2	B	B Phase
3	C	C Phase
4	N	N Line
5	IC_S2	Connect the S2 terminal of the CT for phase C
6	IC_S1	Connect the S1 terminal of the CT for phase C
7	IB_S2	Connect the S2 terminal of the CT for phase B
8	IB_S1	Connect the S1 terminal of the CT for phase B
9	IA_S2	Connect the S2 terminal of the CT for phase A
10	IA_S1	Connect the S1 terminal of the CT for phase A
11	GND	Power-off dry point
12	DI2	
13	COM	
14	DI1	Power-on dry point
15	24V	
16	DO2	
17	24V	Power supply end of the fault indicator light
18	DO1	

19	485_1+	Digital output common terminal
20	485_1-	
21	GND	
22	GND	
23	CAN_H	
24	CAN_L	
25/26	120 Ω	
27	24V	The power supply end of the monitoring large screen
28	GND	
29	485_2+	Module and monitoring large screen communication interface
30	485_2-	
31/32	120 Ω	485-2 matching resistor

Table 5 Signal Ports and Their Functions on the Rear Panel of the Rack-Mounted 15A APF Module

3.3 Wiring Method For CT

This section elaborates in detail on the problems that users may encounter when connecting CTs in practical application scenarios.

3.3.1 Phase Self-Adjusting

In some application scenarios, users may not be able to confirm the correct phase sequence of the three-phase power lines. At this time, the "phase sequence adaptive" function of the APF module needs to be utilized. The schematic diagram of its principle is shown in Figure 4. If users need to enable the "phase sequence adaptive" function of the module, they should check the "phase sequence adaptive" option to "on" in the parameter setting interface of the monitoring screen, click "Confirm Settings", and then it will take effect.

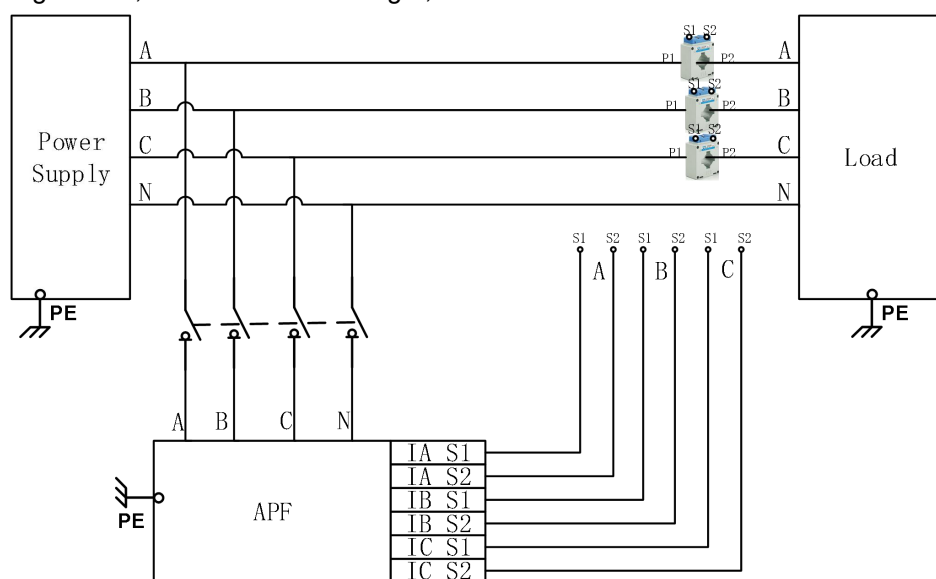


Figure 4 Schematic Diagram of CT Phase Self-Adjusting Wiring Method

After enabling "Phase Sequence Adaptive", even if the specific phase of each phase is unknown, as long as the power line and CT line are connected to the same phase on the module, the module can still work normally.

3.4 Signal Wire Wiring Method

3.4.1 Wiring Method Between APF Module and Monitoring Large Screen

The monitoring large screen is powered by the 24V and GND ports of the APF module.

Warning:

Do not parallel the 24V ports of multiple modules together!

The APF module communicates with the monitoring large screen through the 485_2 channel. For the 485_2 communication channel, please use twisted-pair wiring.

3.4.2 Wiring Method Between APF Module and Indicator Lights

Each APF module provides a set of terminals for connecting the operation indicator lights and fault indicator lights. A separate set of operation and fault indicator lights should be set for each module. **The voltage level of the indicator lights should be 24VDC. When wiring, it is necessary to distinguish the anode and cathode of the indicator lights.** The schematic diagram of the wiring principle is shown in Figures 5 and 6. The terminals are detailed in Table 5.

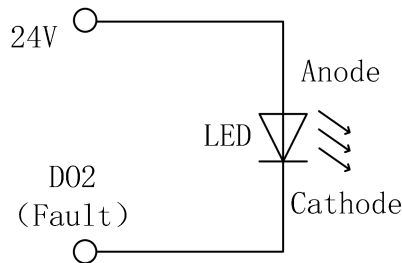


Figure 5 Schematic Diagram of Wiring Method for Running Indicator Light

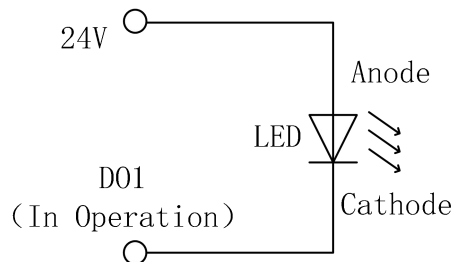


Figure 6 Schematic Diagram of Wiring Method for Fault Indicator

3.5 APF Wiring Method

Figure 7 to Figure 8 present the wiring schematic diagram of the APF module. For the power lines and CT lines in the following figures, the connection method is exemplified by the A phase. **Among them, the solid lines represent the power lines, the wide dashed lines represent the CT lines, and the thin dashed lines represent the signal lines.**

3.5.1 APF Standalone Power Distribution

There are two wiring methods for the single-unit distribution of APF. Figure 7 shows the wiring diagram of APF single-unit distribution when CT is connected to the load side. Our company suggests that users try to connect CT to the load side when wiring. If it is inconvenient to connect CT to the load side, CT can also be connected to the power supply side as shown in Figure 8.

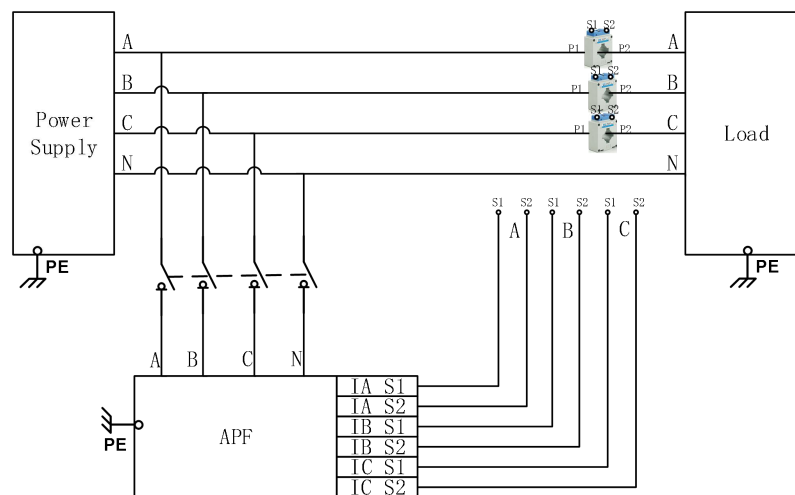


Figure 7 Schematic Diagram of APF Standalone Power Distribution (CT connected to the load side)

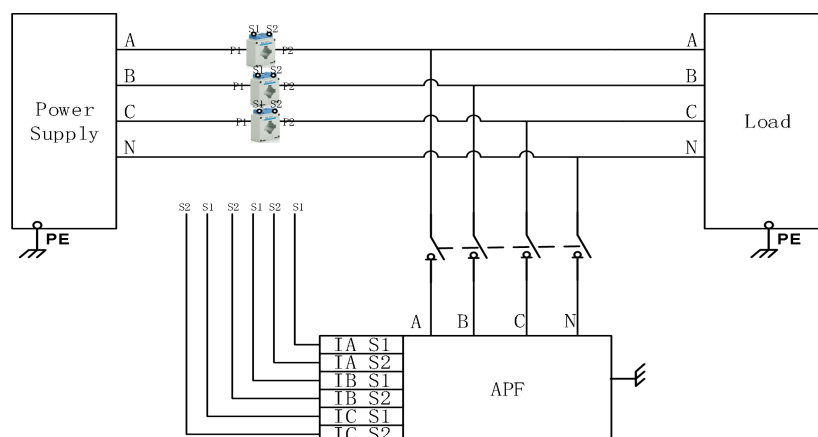


Figure 8 Schematic Diagram of APF Standalone Power Distribution (CT connected to the power supply side)

Chapter 4 Power On Operation Instructions

4.1 APF Module Power On/Off

4.1.1 Startup Steps

This startup step is applicable to turning on the APF module when it is in a fully power-off state.

The operation steps are as follows:

1. Tighten the outer chassis of the APF module and connect the power and signal cables, as described in Chapter 2.

Warning: When performing the startup steps of the APF module, the output terminals of the APF module may already be live. If there is a load connected to the output terminal of the APF module, please confirm with the user whether the power supply to the load is safe. If the load is not ready to receive power, be sure to safely isolate the load from the output terminals of the APF module.

2. Close the isolation switch between the mains electricity and APF module

The front panel displays fault (red) and running (green) indicator lights. If the APF module starts up normally, the green indicator light will light up; If there is a fault in the APF module, the fault indicator light will display red, and the APF module cannot start up normally.

4.1.2 Shutdown Steps

There are two ways to shut down the system. One is to directly disconnect the isolation switch between the APF module and the mains . This is a complete shutdown mode, which means that after shutdown, the system is not live and can be repaired.

Another way is to use the settings on the HMI control panel to shut down. This shutdown mode only shuts down the operation of power components in the system, and the machine is in standby mode.

4.1.3 Manual/Automatic Startup

After APF is power-on, it is necessary to click the power button on the screen to achieve power on compensation. After turning on, the running indicator light will light up.

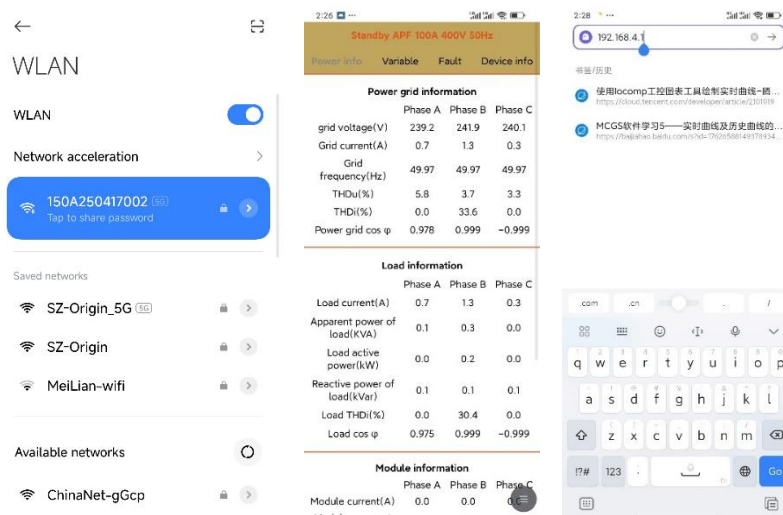
4.2 Instructions for Connecting Monitoring Device With WIFI

4.2.1 Enter Monitoring Page

1. Confirm that the isolating switch between the mains power supply and the APF module has been closed and the module has been powered on normally.
2. Open the WIFI settings of the smart device (such as mobile phone, computer, etc.) that can connect to WIFI, and the WiFi name of the device used (the default name is the capacity of the device+the last nine digits of the S/N code pasted on the label on the chassis), as shown in Figure 9(1), and the hotspot password is a12345678.
3. After connection, a pop-up interface will appear as shown in Figure 9(2). Follow the operations as described in 4.4.2 and 4.4.3. Before exiting, please ensure that the WIFI remains connected.
4. If you want to open the monitoring interface again, please open the browser, enter "192.168.4.1" in the "Search or enter URL" field, as shown in Figure 9(3), and open this URL to see the monitoring interface.



(1)



(1)

(2)

(3)

Figure 9 Operation Diagram for Entering the Interface

4.2.2 Monitoring Operation

1. On the topmost row, you can see the model of the equipment. The second row is the menu of the monitoring interface. Clicking on it will lead you to different pages to monitor the equipment.
2. In the data information, you can monitor the data of the power grid, load and electrical data of the equipment in real time, as shown in Figure 10(1).
3. In the variable settings, you can set the variables that can be set for the equipment. After the variable settings are completed, a green success setting mark will appear at the top of the interface, as shown in Figure 10(2).

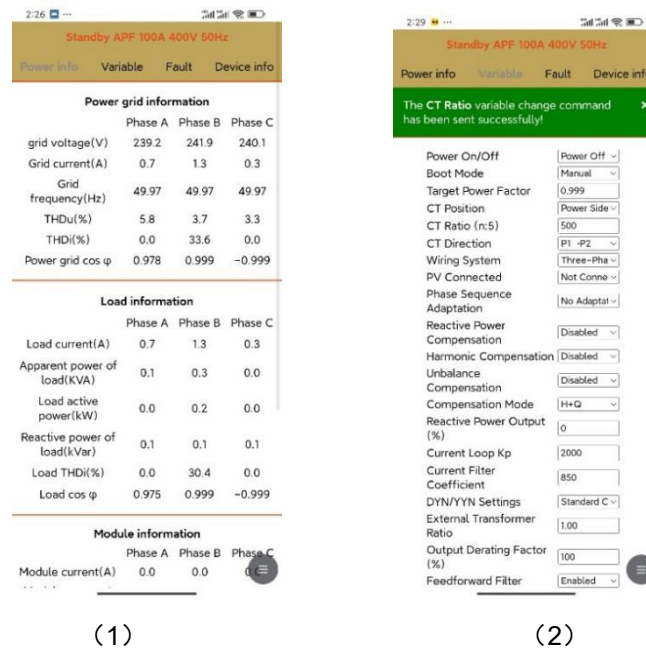


Figure 10 Monitoring Operation

4. As shown in Figure 11(1), when the dropdown box variable is clicked, options will appear and the setting can be completed after clicking; as shown in Figure 11(2), for the numerical variable, after inputting the value, it needs to be confirmed or enter on the keyboard to complete the setting. Multiple variables cannot be set simultaneously.

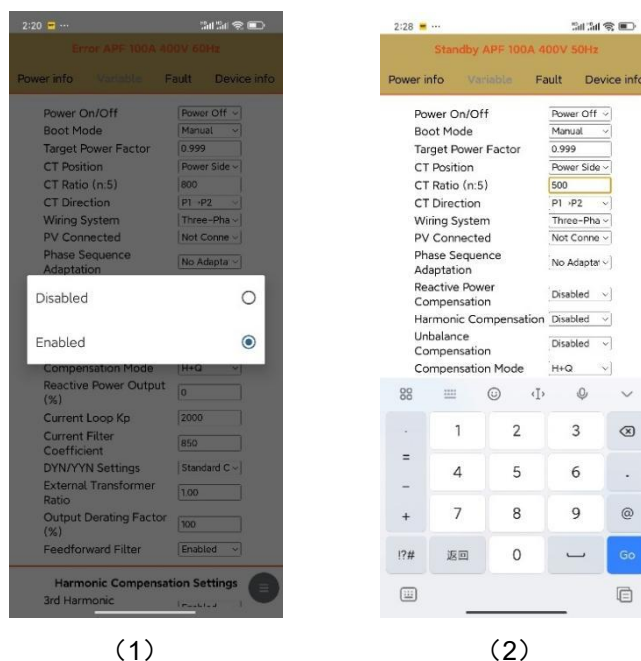


Figure 11 Set Variables

4.2.3 Error Log and Device Information

1. When the equipment malfunctions, a red alarm symbol will appear at the top of the interface, as shown in Figure 12(1). After the user clicks to view the current fault, the alarm symbol will disappear.
2. The current fault will record the current equipment malfunction, as shown in Figure 12(2).

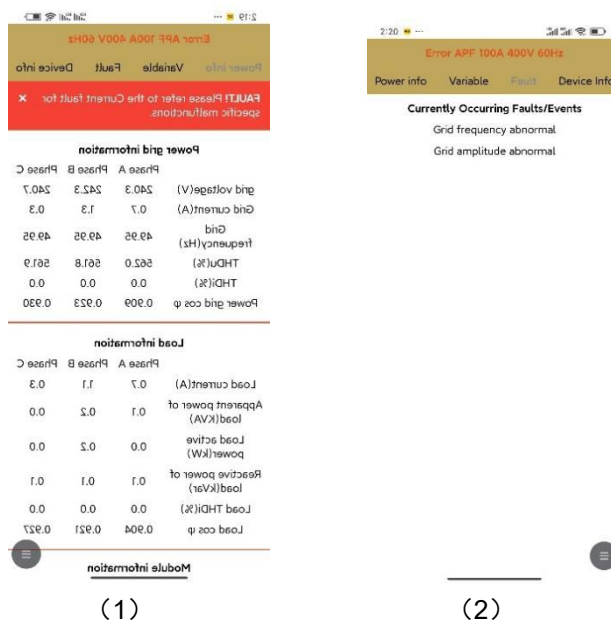


Figure 12 Check the Current Fault

3. In the device information, you can customize the hotspot name. Press Enter to confirm the modification as shown in Figure 13(1). After clicking the Restart WIFI button, the WIFI will be restarted and the name will be changed as shown in Figure 13(2).

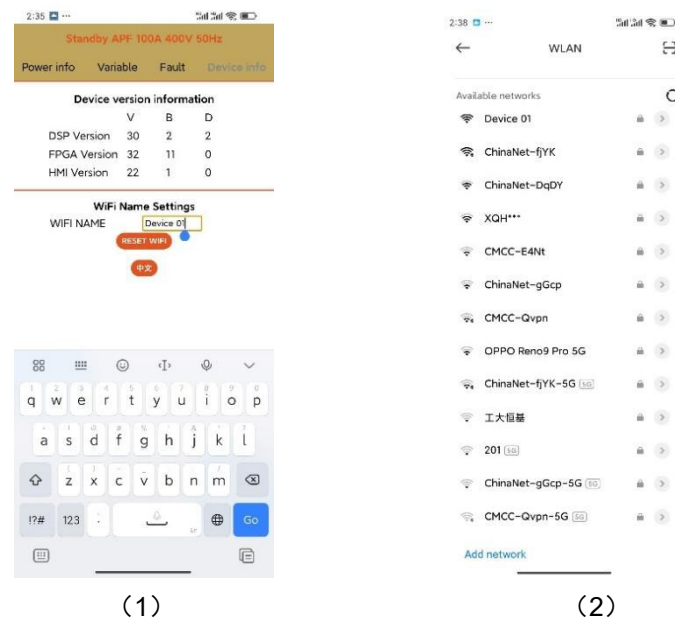


Figure 13 Change the Name of WIFI

4.3 Monitoring Large Screen Display and Settings

After power-on, the small screen lights up and enters the "initial interface". To access the "parameter setting" interface, a password needs to be entered. The initial password is "123456", as shown in Figure 14.

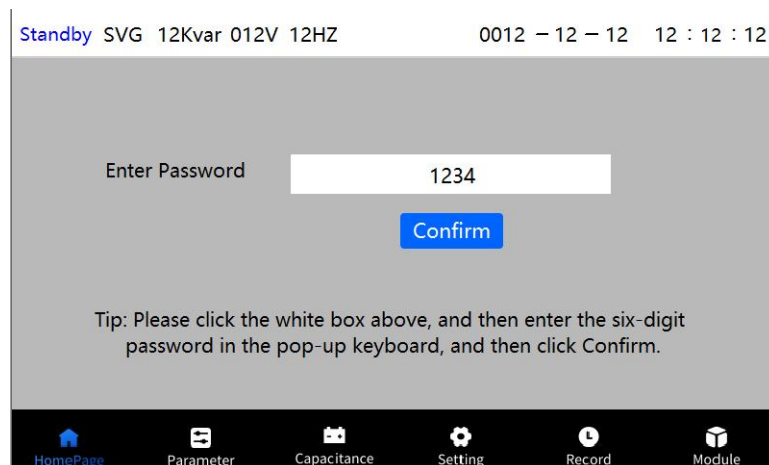


Figure 14 Small Screen Entering Parameter Setting Interface, Entering Password

The parameter setting interface consists of two pages, top and bottom, as shown in Figures 15 to 16. After setting the parameters, you need to click "Confirm Settings" at the bottom of the page to make the settings take effect.

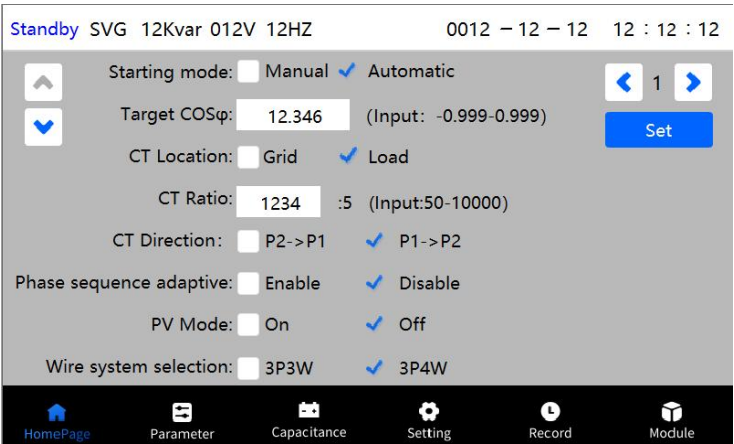


Figure 15 The First Page of The Screen Parameters Setting Interface

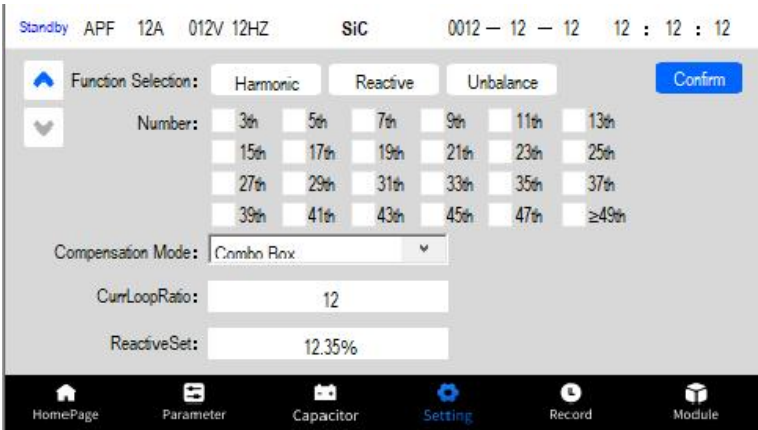


Figure 16 The Second Page of The Screen Parameters Setting Interface

Chapter 5 Daily Maintenance and Upkeep

5.1 Safety Precautions

1. The APF module operates with strong electricity. For safety, maintenance personnel should not touch any live terminals of the module during operation, and ensure that the grounding terminal of the module is reliably grounded.
2. Due to the large amount of capacitors in the APF module busbar, maintenance and repair work must be carried out after 15 minutes of power off, and only after the discharge of the capacitors is completed.

5.2 Daily Inspection

Please do not open the APF module while it is running or power on. Users should visually inspect the APF module for any abnormalities from the outside, and usually perform the following checks:

- ① Whether the display screen data meets the requirements;
- ② Is the display screen showing a malfunction;
- ③ Is there any abnormal sound, vibration, or odor;
- ④ There are no signs of overheating or abnormal phenomena such as discoloration.

Following safety precautions, the module undergoes regular inspections after being disconnected from the power grid. The periodic inspection items are shown in Table 6

Category	Check Item	Remarks
Environment	Temperature, humidity, presence of metal dust or corrosive gases	
Electrical connections	Is there any damage to the cables and terminals	
	Reliably Connected check :Is the main circuit wiring, grounding wire, CT wiring, communication wiring, etc reliably connected.	
Module heat dissipation	Is there any blockage at the air duct	

Table 6 Regular Inspection Items Table

5.3 Fault Information

Users can see the fault information of the APF module in the "Current Record" and "History" columns. **The meaning of "fault information"** is that the current problems faced by the APF module will affect the normal function of the APF module. The APF module will automatically shut down or cannot be power on. Until the content of the fault information is resolved, the user cannot manually turn on the APF.

Display information content	Specific situation	Recovery conditions
Fan abnormality	At least one fan has malfunctioned	After the fault is resolved, it will automatically recover
Bus voltage undervoltage	After successful soft start, the voltage of the power bus is lower than 80% of the rated voltage of the bus	After the fault is resolved over 1 minutes, it will automatically recover
Overload timeout	Current overload	After the fault is resolved over 5 minutes, it will automatically recover (This fault needs to be manually cleared if reported three times within 30 minutes)
Abnormal grid voltage	Including one or more of the following situations: ① The grid voltage over $220V \pm 15\%$; ② Input voltage power failure; ③ Phase lock failure	After the fault is resolved, it will automatically recover
Soft start failed	During the soft start process, the positive and negative bus voltages cannot reach 1.1 times the effective value of the C-phase grid voltage	After the fault is resolved, it will automatically recover (This fault needs to be manually cleared if reported three times within 30 minutes)
Abnormal input voltage frequency	For 50Hz machines, the grid frequency beyond the range of $50Hz \pm 3Hz$; For 60Hz machines, the grid frequency beyond the range of $60Hz \pm 3Hz$	After the fault is resolved, it will automatically recover

Input voltage phase sequence reverse	Input voltage phase sequence reversed	After the fault is resolved, it will automatically recover
Bus voltage overvoltage	If the DC bus voltage is too high, the relay will be disconnected and the IGBT will be blocked	After the fault is resolved over 5 minutes, it will automatically recover
Auxiliary power supply failure	Internal auxiliary power board of APF module loses power	After the fault is resolved, it will automatically recover
Input missing zero line	N-line open circuit	After the fault is resolved, it will automatically recover
Relay open circuit fault or fuse broken	Relay or fuse open circuit; Or the relay cannot be properly engaged	After the fault is resolved, it will automatically recover
Relay short circuit fault	The relay cannot be disconnected normally	After the fault is resolved, it will automatically recover (This fault needs to be manually cleared if reported three times within 30 minutes)
IGBT over temperature	IGBT temperature reaches 90 °C	After the temperature drops to 80 °C, it will automatically recover. But if the fan is abnormal at this time, it cannot be recovered
Emergency shutdown	Forcefully shut down the APF module through an external relay	Manual Clearing
Abnormal output current	The actual output current differs from the bridge arm output current by 20% of the rated current	After the fault is resolved, it will automatically recover
ambient temperature too high	The ambient temperature over 55 °C	Automatically recover when the ambient temperature drops to 50 °C or below

Table 7 Fault Information Table