

50A-2U 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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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	Product Name	Product Model	
APF(Rack)	APF 50A	MDF05034RL00	400VAC three-phase four-wire 50A APF-Module (Rack)
APF(Wall-Mounted)	APF 50A	MDF05034WL00	400VAC three-phase four-wire 50A APF- module (Wall-Mounted)

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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	50
Altitude	m	≤1500, 1500m~3000m , Reduce rating by 1% every 100m in this range.
Relative Humidity	%RH	0~95, No condensation
Working Temperature	℃	- 10~45℃ 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%.
APF module Storage and Transportation Temperature	℃	- 20~ + 70
Overvoltage Level		Overvoltage level II

Table 2.1 Environmental Characteristics of 50A APF Module

2.2 Mechanical Characteristics

Project	Unit	Data information
Mechanical	mm	380×424×88 (Rack-Mounted, without packaging materials) ;

Dimensions (W×D×H)		380×425×88 (Wall-Mounted, without packaging materials) ; 527×557×170 (Rack-Mounted or Wall-Mounted , with packaging materials) ;
Weight (Max)	kg	11.5
Color		RAL 7035
Protection level , IEC (60529)		IP20(Front door open or closed,Back door closed)

Table 2.2 Mechanical Characteristics of 50A APF Module

2.3 Electrical Characteristics

Project	Unit	Data information
Rated AC Voltage	Vac	380/400/415 , three-phase five-wire (compatible with three-phase four-wire and three-phase three-wire)
Rated A, B, C, N Currents	A	50
Working Frequency	Hz	50/60
Voltage Range (Rated 380Vac)	%Vac	upper limit: + 15 lower limit: - 20
Frequency Range	Hz	±3
Loss	%	<2
CT Ratio Range		150:5~10000:5

Table 2.3 Electrical Characteristics of 50A APF Module

2.4 Module Appearance And Installation Dimensions

Our company offers rail mounted models for the 50A APF modules produced. Figure 2.1 illustrates the key mechanical characteristics of this model.

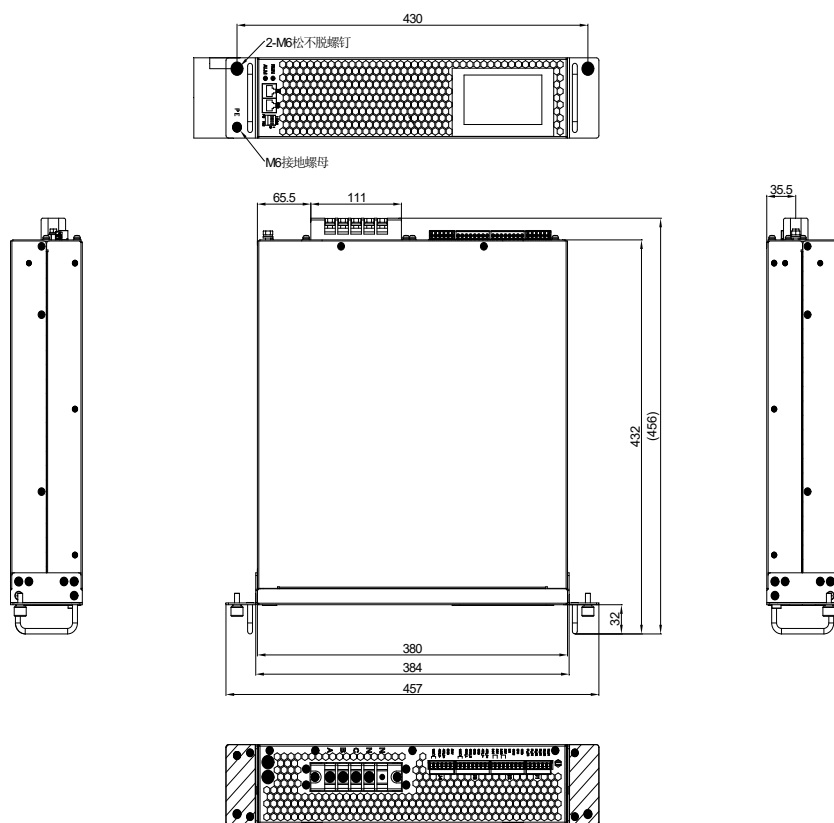


Figure 2.1 Installation Dimension Diagram of Rack-Mounted 50A APF Module (unit: mm)

Figure 2.2 illustrates the key mechanical characteristics of wall mounted model.

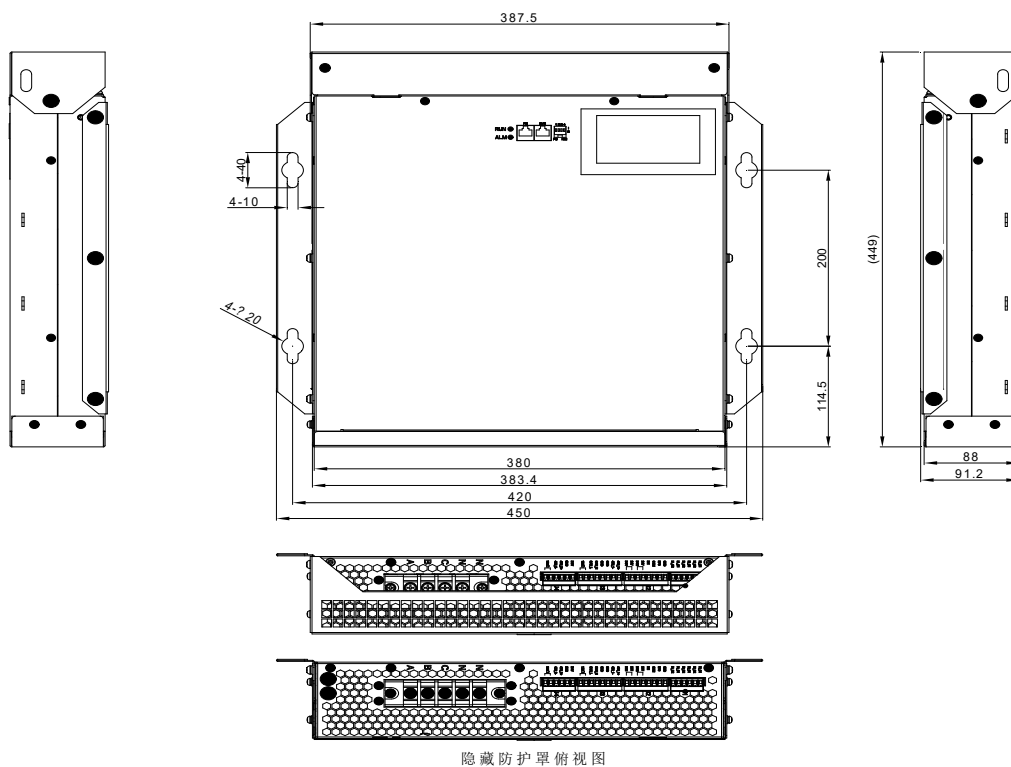


Figure 2.2 Installation Dimension Diagram of Wall-Mounted 50A APF Module (unit: mm)

2.5 Mechanical Installation

When the APF module is installed on the rack, it is fixed to the cabinet mounting column by hanging ears on both sides, as shown in Figure 2.3. The wall mounted models need to be fixed on the hard wall along the left and right sides or hung in the cabinet. The chassis height of the 50A APF module is 2U. In addition, our company can provide full cabinet models. Please contact our engineers for details.

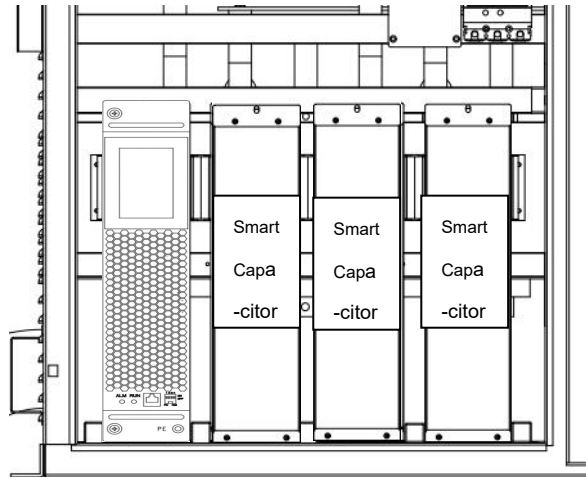


Figure 2.3 Installation Diagram of 50A APF Module Rack

Chapter 3 Electrical Installation

3.1 Power Cable

Terminal Symbol	Terminal Function Description	Current/A	Recommended cross-sectional Area of cable/mm ²	Suggested tightening torque(N•m)
A	A-phase input terminal	50	16	6
B	B-phase input terminal	50	16	6
C	C-phase input terminal	50	16	6
N	Neutral input terminal for three-phase four-wire/three-phase five-wire systems	100	25	6
PE	Safety grounding terminal (chassis)		16	6

Table 3.1 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. When tightening the power cable terminals of the rack mounted APF module, M6 bolts should be used (recommended tightening torque is 6N • m).

3.2 Port Information

3.2.1 Front Panel Port

Figure 3.1 shows the front panel signal ports. Among them, there are two rows of dialing codes located on the upper and lower sides of the dialing hole on the right. The dial code in the upper row is used to set a dedicated ID number for each APF module during parallel power on.

Multiple APF modules are not allowed to use the same ID number, otherwise communication will not be possible. If the user needs to control the SVC capacitor, they can

connect the RJ-45 network port marked with "SVC" to the RJ-45 network port of the SVC capacitor.

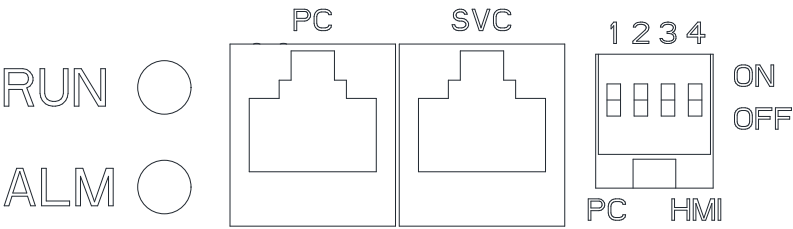


Figure 3.1 Front panel Signal Port

The maximum number of parallel connections allowed by the APF module is 8. Here, the first three dials follow the rule of binary 421 to assign ID numbers to each APF module. Among them, the first dial is the lowest bit, and the third dial is the highest bit.

Module ID	Dialing Combination	Instance
1	000	1 2 3 4 ON OFF
2	001	1 2 3 4 ON OFF
3	010	1 2 3 4 ON OFF
4	011	1 2 3 4 ON OFF
5	100	1 2 3 4 ON OFF
6	101	1 2 3 4 ON OFF
7	110	1 2 3 4 ON OFF
8	111	1 2 3 4 ON OFF

Table 3.2 Corresponding Relationship Between Module ID Number and Dialing Combination

3.2.2 APF Signal Port

The definition of signal ports is shown in Figure 3.2, and the explanations of each signal are shown in the table 3.2.

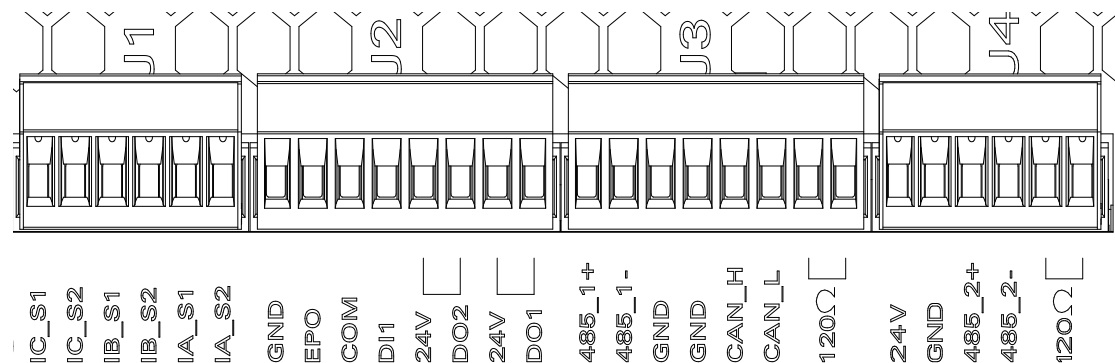


Figure 3.2 Rack-Mounted 50A APF Module Signal Port

Port Number	Pin Number	Channel Name	Functional annotations
J1	1	IC_S1	Connect S1 end of C-phase CT
	2	IC_S2	Connect S2 end of C-phase CT
	3	IB_S1	Connect S1 end of B-phase CT
	4	IB_S2	Connect S2 end of B-phase CT
	5	IA_S1	Connect S1 end of A-phase CT
	6	IA_S2	Connect S2 end of A-phase CT
J2	1	GND	Isolation site, electrically isolated from the mains
	2	EPO	emergency stop buttons
	3	COM	Isolation site, electrically isolated from the mains
	4	DI1	Power on signal input dry contact
	5	24V	Isolated 24V output terminal, electrically isolated from the mains, used to power the large screen and indicator lights
	6	DO2	Fault information
	7	24V	Isolated 24V output terminal, electrically isolated from the mains, used to power the large screen and indicator lights
	8	DO1	Operation information
	1	485_1+	485_1 communication channel,

J3	2	485_1-	used for communication between APF module and SVC capacitor
	3	GND	Isolation site, electrically isolated from the mains
	4	GND	Isolation site, electrically isolated from the mains
	5	CAN_H	CAN communication channel, used for APF module source side parallel communication
	6	CAN_L	
	7	120Ω	CAN communication matching resistor, please short circuit 7 and 8 when needed
	8		
J4	1	24V	Isolated 24V output terminal, electrically isolated from the mains, used to power the large screen and indicator lights
	2	GND	Isolation site, electrically isolated from the mains
	3	485_2+	485_2 communication channel, used for centralized monitoring of modules during parallel power distribution
	4	485_2-	
	5	120Ω	485_2 communication matching resistor, please short circuit 5 and 6 when needed
	6		

Table 3.3 Rack-Mounted 50A APF Module Signal Ports and Their Functions

3.3 The Wiring Method For APF

Figure 3.3 to Figure 3.6 present the wiring schematic diagrams of the APF module. For the power lines and CT lines in the following figures, the connection method is exemplified by the A phase. Here, the solid lines represent power lines, the wide dashed lines represent CT lines, and the thin dashed lines represent signal lines.

The signal ports indicated in the following figure that use the rack-mounted APF are used to illustrate the connection relationship.

3.3.1 APF Standalone Power Distribution

There are two wiring methods for the standalone power distribution of APF. Figure 3.3 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, it can also be connected to the power supply side.

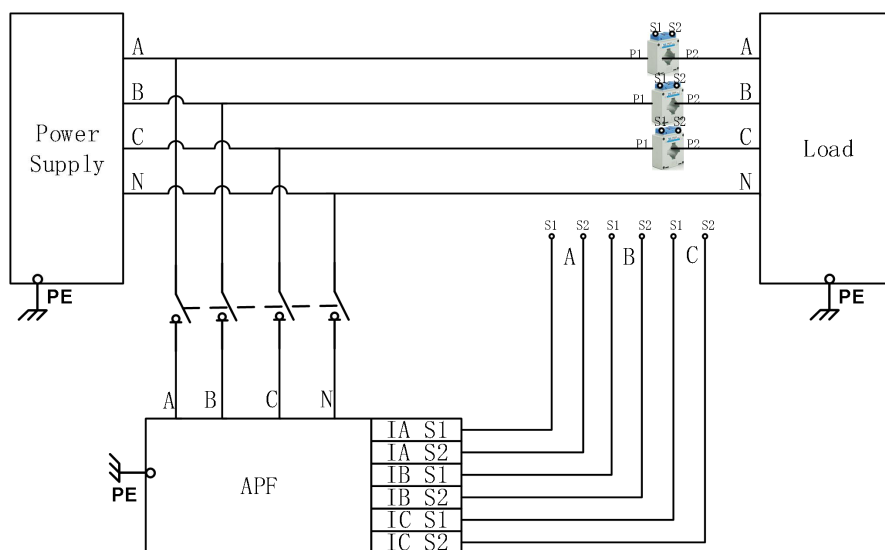


Figure 3.3 Schematic Diagram of APF Standalone Power Distribution (CT connected to the load side)

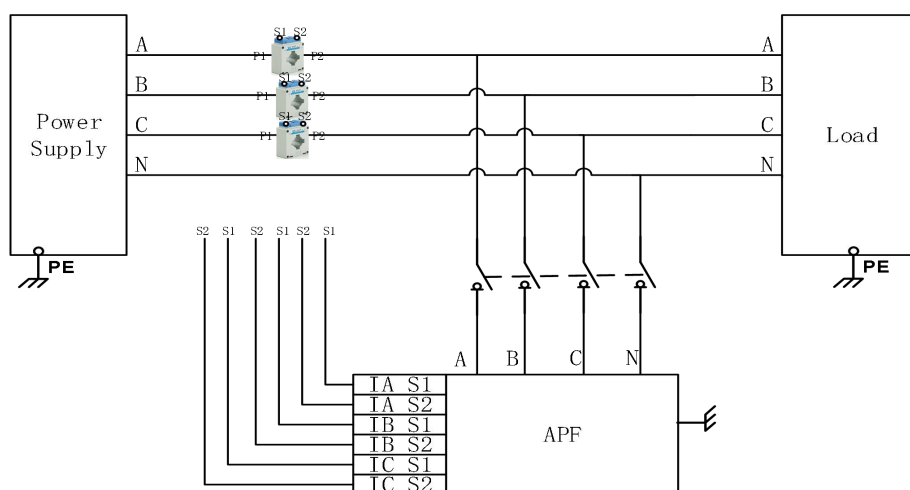


Figure 3.4 Schematic Diagram of APF Standalone Power Distribution (CT connected to the power supply side)

3.3.2 APF Parallel Power Distribution

There are two wiring methods for the parallel-connected power distribution of APF. During parallel-connected power distribution, communication between the APF module and the monitoring large screen is carried out via the 485_2 channel. The upper limit of APF modules connected to the monitoring large screen is 8, and the principle is shown in Figure 3.12. For users using rack mounted APF modules, they can short-circuit the matching resistors of the first and the last APF modules' 485_2 to improve communication quality. Please refer to 3.2.2 for details.

Figure 3.5 shows the wiring diagram when APF is connected in parallel for power distribution. Our company suggests that users should try to connect the CT on the load side when wiring. If it is inconvenient to connect on the load side, the CT can also be connected on the power side.

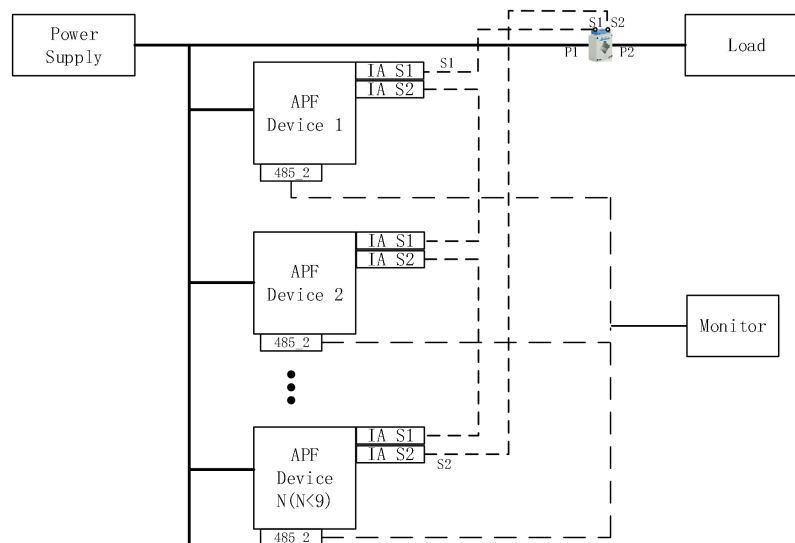


Figure 3.5 Schematic Diagram of APF Parallel Power Distribution (CT connected to the load side)

Figure 3.6 shows the wiring diagram of APF parallel distribution when CT is connected on the power supply side. It should be noted that in this wiring method, CAN_H and CAN_L of the modules are connected in parallel, as well as 485_2+ and 485_2-. Users of rail-mounted APF modules can short the matching resistors of CAN of the first and last APF modules, and short the matching resistors of 485_2 of the first and last APF modules to improve communication quality.

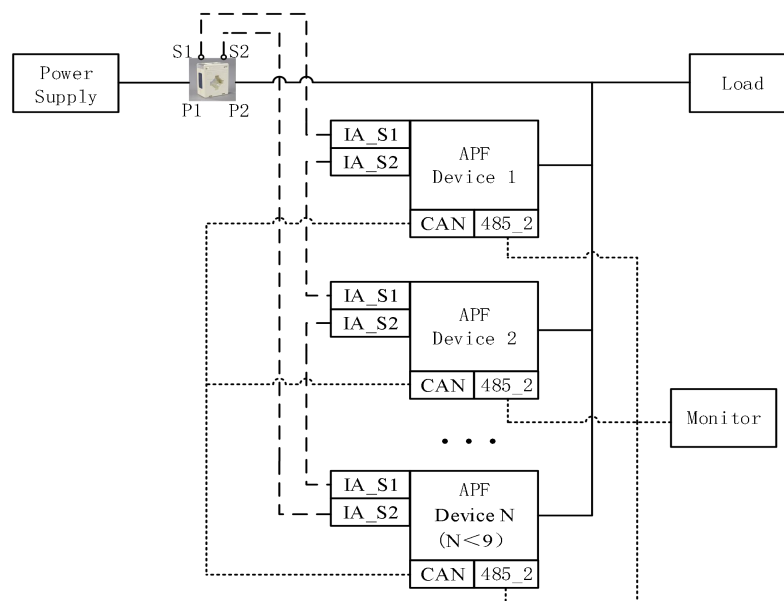


Figure 3.6 Schematic Diagram of APF Parallel Power Distribution (CT connected to the power supply side)

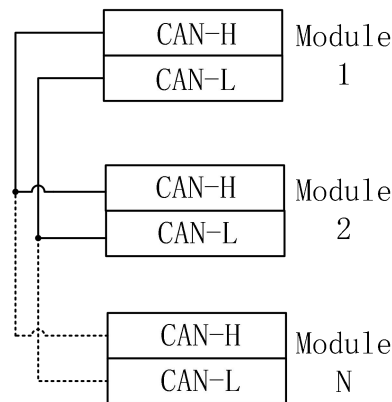


Figure 3.7 CAN_H and CAN_L Are Connected In Parallel

CAN line wiring method: All modules' CAN lines are connected in parallel, and the 120Ω resistors are short-circuited between the first module and the last module.

3.4 The Wiring Method For APFC

Figure 3.8 to Figure 3.11 present the wiring schematic diagram of the APF module and the SVC capacitor forming the APFC module. It should be noted that regardless of which wiring method is adopted, the number of SVC capacitors connected to the grid cannot exceed 16 units. The wiring methods of the power lines and CT lines in the following figures are exemplified by the A phase. Among them, the solid lines represent power lines, the wide dashed lines represent CT lines, and the thin dashed lines represent signal lines.

3.4.1 APFC Standalone Power Distribution

Figure 3.8 shows the wiring diagram of CT when APFC operates in single-machine distribution mode. In this wiring method, please connect CT between the APF and SVC instead of between SVC capacitor and load. If it is inconvenient to connect, CT can also be connected to the power supply side.

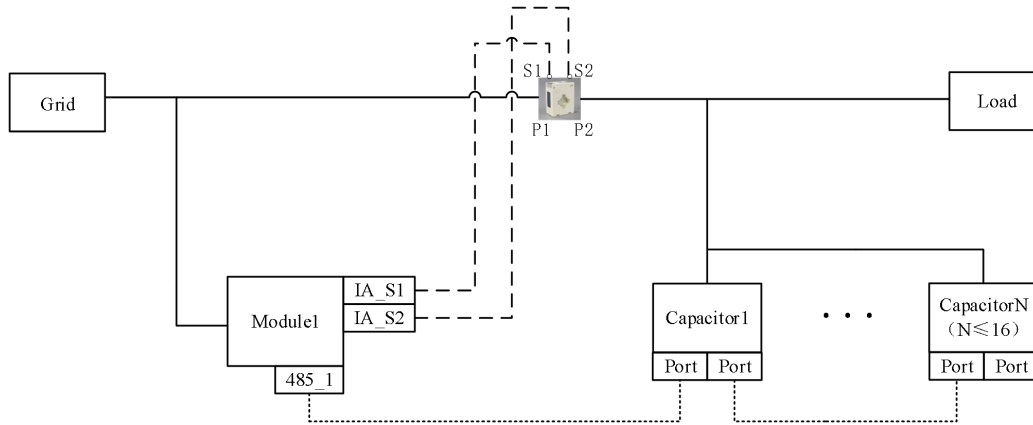


Figure 3.8 Schematic Diagram of APFC Standalone Power Distribution (CT is connected between APF and SVC).

Figure 3.9 shows the wiring diagram of CT when the APFC is operating in single-machine power distribution mode and CT is connected on the power supply side.

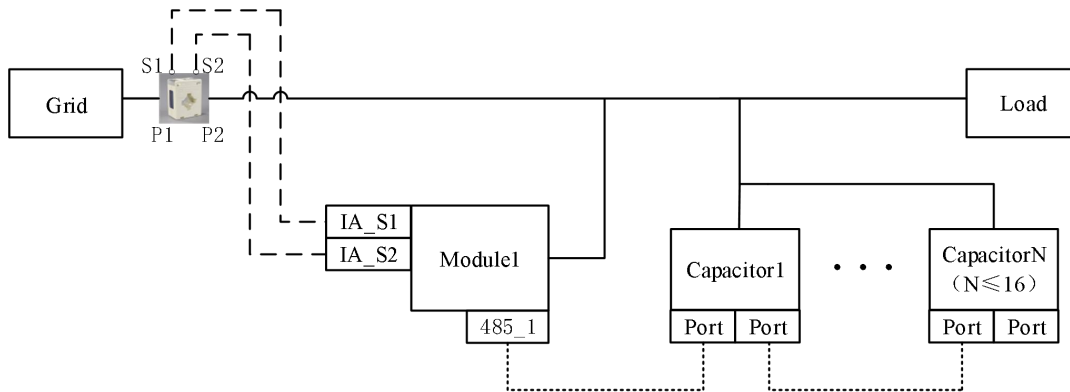


Figure 3.9 Schematic Diagram of APFC Standalone Power Distribution (CT is connected to the power supply side).

3.4.2 APFC Parallel Power Distribution

When operating in parallel with APFC, it is necessary to note that the compensation capacitor should only communicate with the APF module with ID number 1 via the 485_1 channel. Figure 3.10 shows the wiring diagram of CT when operating in parallel with APFC, with CT connected to the load side. In this wiring method, please connect CT between the APF and SVC, and do not connect CT between the SVC capacitor and the load. If it is inconvenient to connect, CT can also be connected to the power supply side. For users with rail-mounted APF modules, the matching resistors of 485_2 for the first and last APF modules can be short-circuited to improve communication quality. Please refer to 3.2.2 for details.

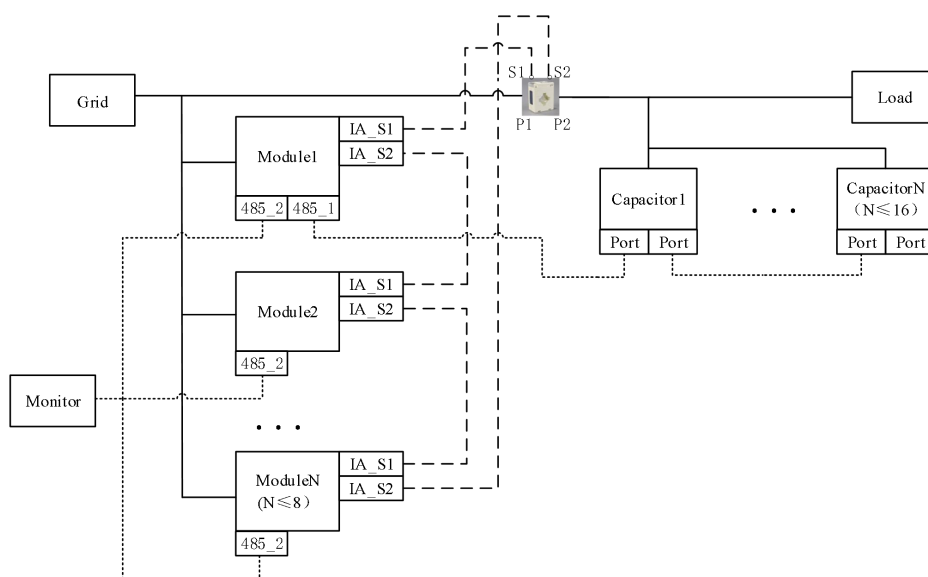


Figure 3.10 Schematic Diagram of APFC Parallel Power Distribution (CT is connected between APF and SVC).

Figure 3.11 shows the wiring diagram of CT when APFC is in parallel distribution mode and connected to the power supply side. Please pay attention to the connection of communication lines. For users using rail-mounted APF modules, they can short-circuit the matching resistors of the first and last APF modules to improve communication quality. For details, please refer to 3.3.2.

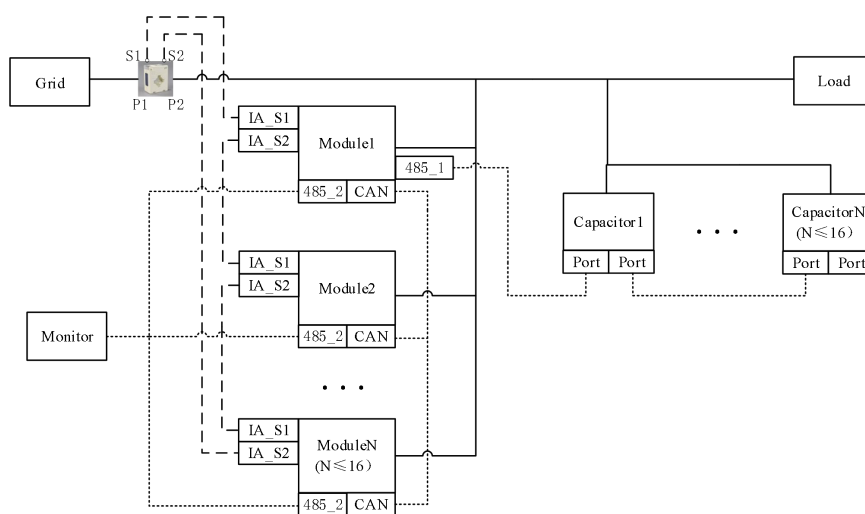


Figure 3.11 Schematic Diagram of APFC Parallel Power Distribution (CT is connected to the power supply side).

3.5 Signal Wire Connection Method

3.5.1 Wiring Method For APF Module And Monitoring Large Screen

The monitoring large screen is powered by the 24V/GND ports of the APF module. When multiple modules are connected in parallel, only the 24V/GND port of one of the modules needs to be used to supply power to the monitoring large screen.

Warning: Please do not connect the 24V outputs of multiple modules in parallel!

The APF module communicates with the monitoring large screen through the 485_2 channel. When multiple APF modules are connected in parallel, the cascading mode of the 485_2 channel ports of the APF modules is parallel. The principle is shown in Figure 3.12. The connection ports are detailed in Table 3.3.

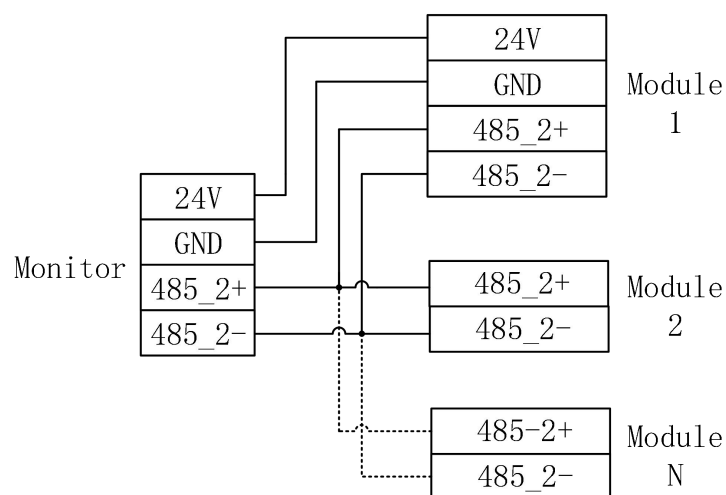


Figure 3.12 Schematic Diagram of Wiring Between the Module and the Monitoring Large Screen

Figure 3.12 is merely for illustration. In fact, when connecting the modules in parallel, any one of the 24V/GND output ports of the modules can be used to supply power to the monitoring large screen. For the 485_2 communication channel, please use twisted-pair wire for connection.

3.5.2 Wiring Method For APF Module And Indicator Light And Emergency Stop Button

Each APF module provides a set of terminals for connecting the operation indicator lights and fault indicator lights. **When multiple APF modules are operated in parallel, do not cascade the indicator lights of multiple APF modules.** If conditions permit, it is recommended to set a separate set of operation and fault indicator lights for each module. **The voltage level of the indicator lights should be 24VDC.** When wiring, **pay attention to distinguish the anode and cathode of the indicator lights.** The schematic diagrams of the wiring principle are shown in Figures 3.13 and 3.14. The terminals of the wiring are detailed in Table 3.3.

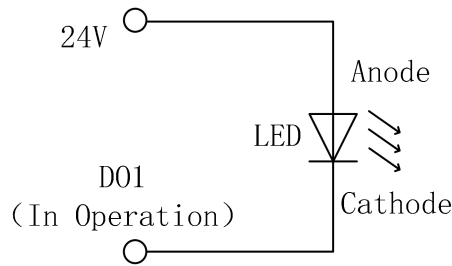


Figure 3.13 Schematic Diagram of Wiring Method for Running Indicator Light

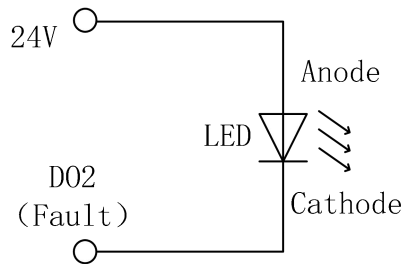


Figure 3.14 Schematic Diagram of Wiring Method for Fault Indicator

Each APF module provides a set of emergency stop button (EPO) terminals. When multiple APF modules are operated in parallel, the EPO dry contacts of each APF module can be cascaded. The cascading method is parallel connection, and the schematic diagram of the principle is shown in Figure 3.15.

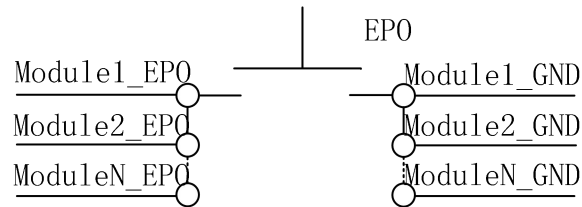


Figure 3.15 Schematic Diagram of Wiring Method For Multi-Module Parallel Emergency Stop Buttons

3.6 Phase Sequence Adaptive And CT Polarity Adaptive

In some application scenarios, users may not be able to confirm the correct phase sequence of the three-phase power lines. At such times, the "phase sequence adaptive" function of the module needs to be utilized. The schematic diagram of its principle is shown in Figure 3.4. 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 as shown in Figure 4.2, and click "Confirm Settings" to take effect.

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 Front Panel of Small 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 4.1.

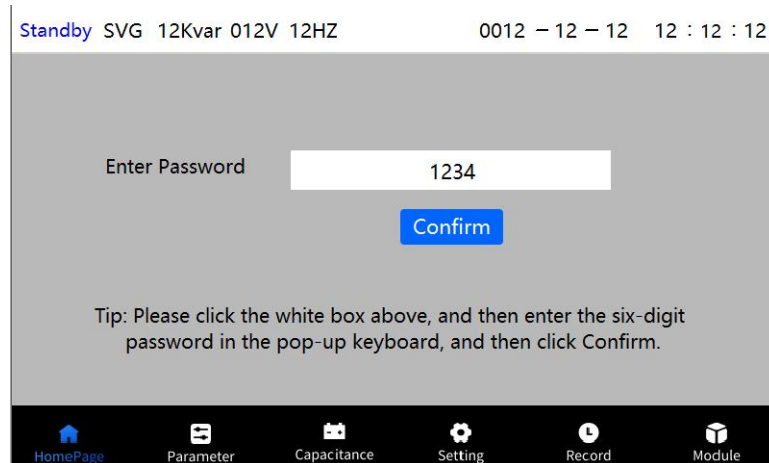


Figure 4.1 Small Screen Entering Parameter Setting Interface, Entering Password

The parameter setting interface consists of two pages, top and bottom, as shown in Figures 4.2 to 4.3. After setting the parameters, you need to click "Confirm Settings" at the bottom of the page to make the settings take effect.

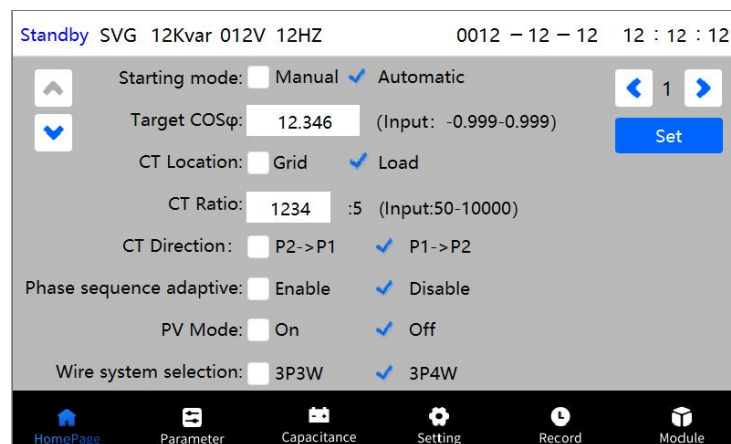


Figure 4.2 The First Page of The Screen Parameters Setting Interface For Small Screens

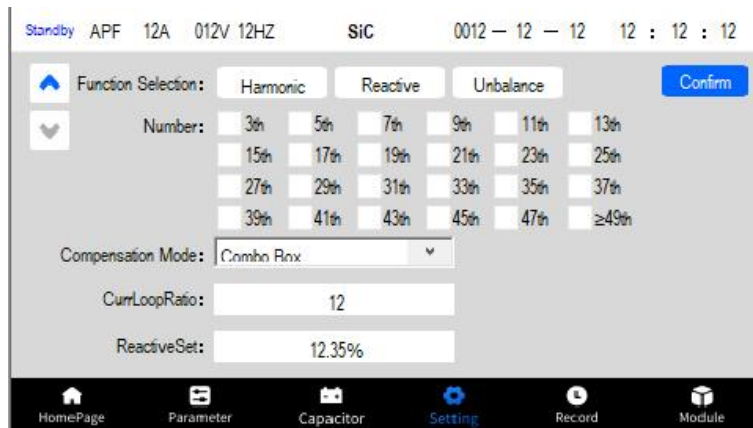


Figure 4.3 The Second Page of The Screen Parameters Setting Interface for Small Screens

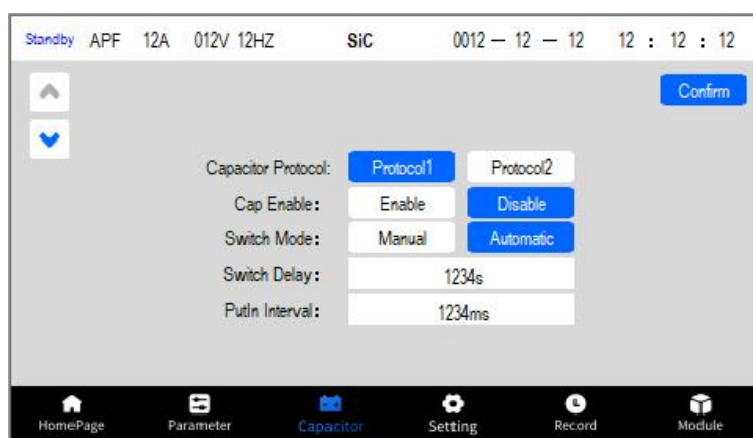


Figure 4.4 SVC Capacitor Information Interface

If the user purchases a product for APFC modules, the small screen will also display additional capacitance information, as shown in Figure 4.4. After setting the capacitor switching method, users need to click "Confirm Settings" at the bottom of the page to take effect. In order to protect the SVC capacitor, the settings made by the user will not take effect during the capacitor switching delay time.

4.3 Centralized Monitoring Of Large Screen Display And Settings

The monitoring screen will light up after power on and enter the initial interface. The information in the upper left corner will display the total capacity of the APF modules integrated into the grid. The monitoring screen supports up to 8 APF modules in parallel. In the "Module Information" interface, you can view the specific information of each APF module.

To enter the parameter setting interface, you need to enter a password, as shown in Figure 4.5. The initial password is "123456".

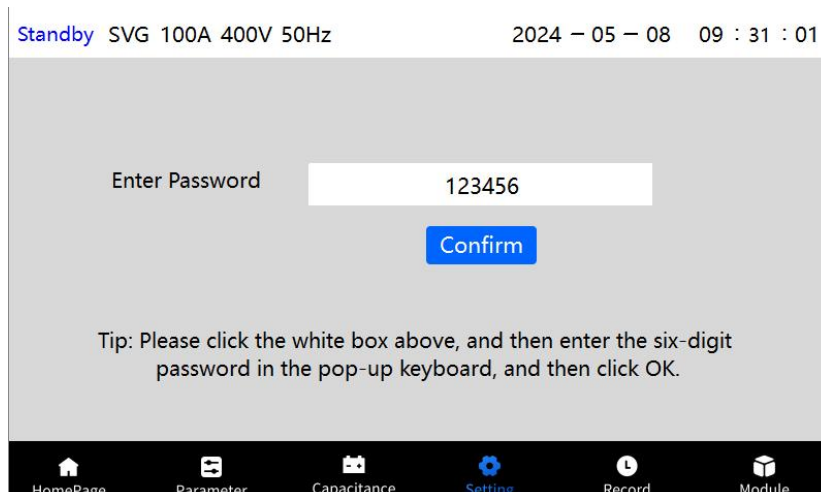


Figure 4.5 Parameter Setting Input Password

The parameter setting interface consists of two pages, as shown in Figures 4.6 to 4.7. Click the left and right arrows in the upper right corner to select and view the parameter settings of one of the APF modules. **It is not allowed for two APF modules to share the same ID number.** For details on setting the APF module ID number, please refer to section 3.2.1.

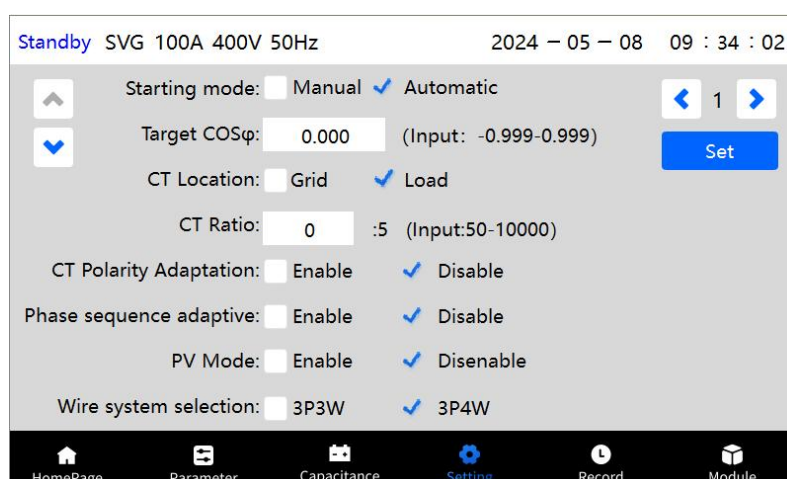


Figure 4.6 First Page of Parameter Setting Interface



Figure 4.7 Second Page of Parameter Setting Interface

After completing the settings, you need to click "Confirm Settings" on the right side to take effect.

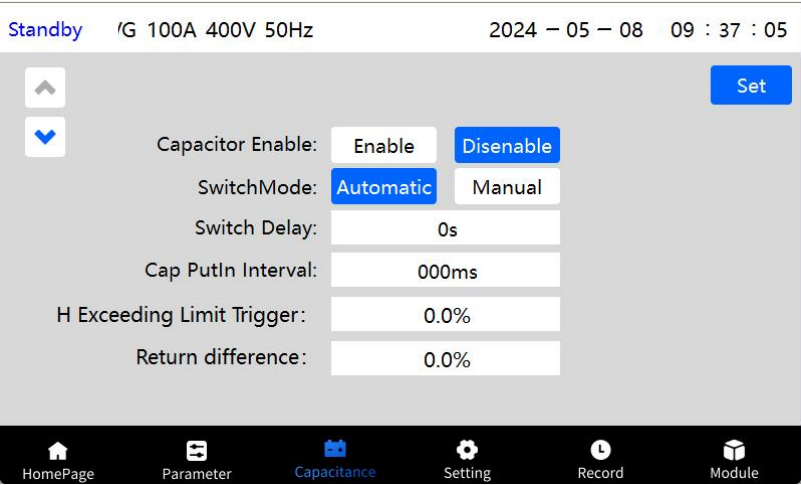


Figure 4.8 The First Page of The Capacitor Information Interface

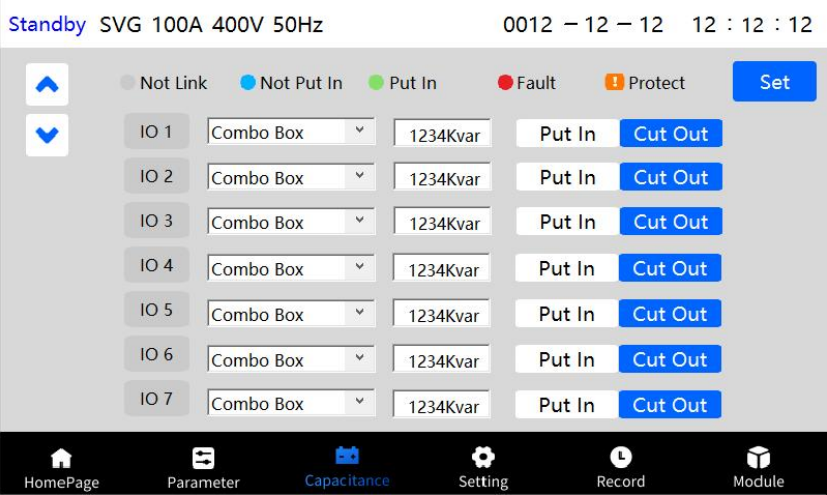


Figure 4.9 The Second Page of The Capacitor Information Interface

If the user purchases the product for APFC modules, the small screen will also display additional capacitance information, as shown in Figure 4.8 and Figure 4.9. After setting the capacitor switching method, users need to click "Confirm Settings" on the right side of the page to take effect. In order to protect the SVC capacitor, the settings made by the user will not take effect during the capacitor switching delay time.

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 5.1

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 5.1 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	After the fault is resolved, it will automatically recover

	frequency beyond the range of 60Hz $\pm$ 3Hz	
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 $^{\circ}$ C	After the temperature drops to 80 $^{\circ}$ 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 $^{\circ}$ C	Automatically recover when the ambient temperature drops to 50 $^{\circ}$ C or below

Table 5.2 Fault Information Table