LCD controller
User manual

（**Version：V2.012**）

Catalogue

1、Function description and installation dimensions

1.1 Function description

The LCD controller is the man-machine operation interface of the hybrid reactive power compensation device (SVG/APF+ordinary power capacitor). It communicates with the SVG/APF module through the RS485 interface, and can set the parameters and view the data of the module and capacitor.

The LCD operation interface can be connected with up to 12 modules and controlled by 16 capacitors.

1.2 Installation dimensions

The controller is installed on the cabinet, and the opening size is 192mm x 138mm. Its overall dimensions are shown in the Fig. below:
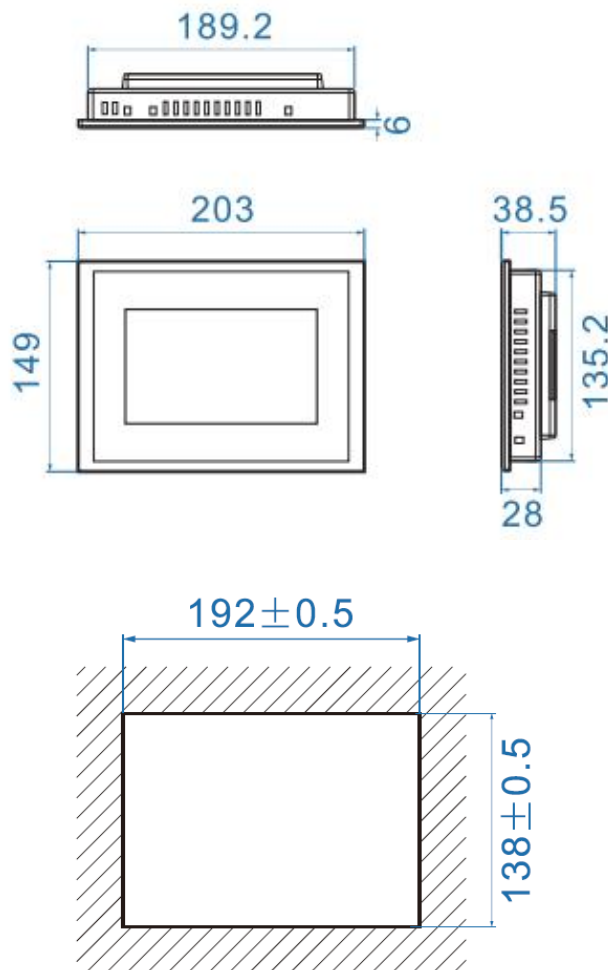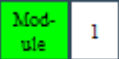
Fig. 1-1 Overall Dimension and Opening Diagram of Controller

2、Power on main interface

After the LCD is powered on, it will enter the boot interface, as shown in Fig. 2-1.

- 【Main Interface】：Mainly displays the voltage, current and other relevant real-time data on the system side, load side and modules.

- 【Module & parameter setting】：This interface can set and view the parameters of all modules and capacitors.

- 【Curve information】：This interface can view the real-time curves of power factor and active and reactive current.

- 【Fault log】：This interface can view the fault information generated during the operation of the equipment.

- Button to start/stop the device.

- "Status indication"：Display the status of the module, including standby, running and fault status.

- ：The address of the module currently communicating with the LCD.

	A Phase	B Phase	C Phase		A Phase	B Phase	C Phase
System Voltage	0V	0V	0V	System Voltage THD	0%	0%	0%
System Current	0A	0A	0A	System Current THD	0%	0%	0%
Load Current	0A	0A	0A	Load Current THD	0%	0%	0%
Module Output Current	0A	0A	0A	Capacitance Comp. Current	0A	0A	0A
System Power Factor	0	0	0	IGBT Temperature	0	0	0
Load Power Factor	0	0	0				

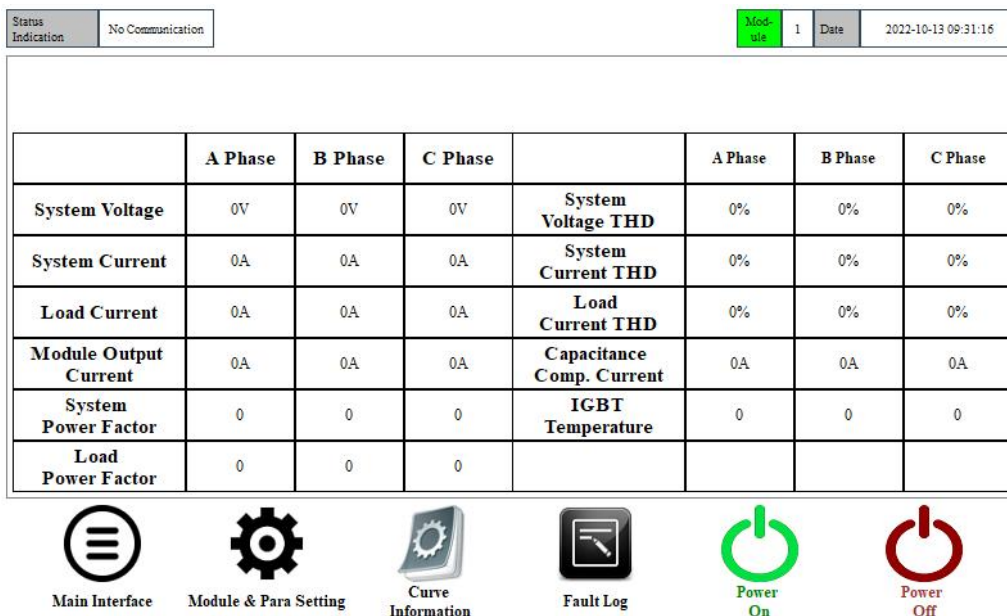Main Interface   Module & Para Setting   Curve Information   Fault Log   Power On   Power Off

Fig. 2-1 Main interface of power on

3、Module and parameter setting

Click 【Module & Parameter Setting】 to enter the interface shown in Fig. 3-1. The interface has four options:

【Module Settings】, 【Developer Options】,【Real Time Data】, and 【Para Setting】.

Fig. 3-1: Module and parameter settings

1、【Module Setting】：Set the number of modules, the number of capacitor control modules, and the communication address;

2、【Developer Options】：It is used by our commissioning personnel；

3、Real-time data and parameter setting

【Module X: Real-time data】：View the real-time data of the corresponding module；

【Module X: para setting】：Set the parameters of the corresponding module.

3.1 Module Settings

When only SVG/APF modules are connected in parallel (without capacitor), the structure diagram of the connection system between the module and the LCD controller is as follows:
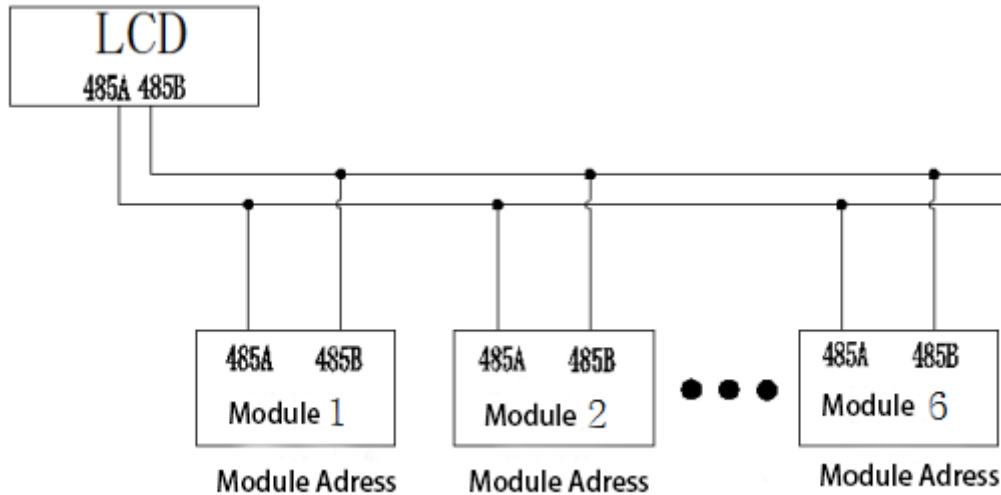
Fig. 3-2: RS485 communication structure

Click【Module Setting】and enter the number of modules in "Number of Modules", as shown in Fig. 3-3.

At most 12 modules can be set on the LCD screen, and the module address increases from 1. After setting, return to

【Module & Parameter Setting】， As shown in Fig. 3-4, the interface will display the real-time data and parameter setting selection of multiple modules.

Fig. 3-3: Module Setup

Fig. 3-4: Multi module real-time data and parameter settings

3.2 Module parameter setting

Click the 【Parameter Setting】 option of the corresponding module to pop up the password input interface shown in Fig. 3-5. After entering the password "1000", click 【Confirm】 to enter the module parameter setting interface, as shown in Fig. 3-6 below. (No operation is carried out within 3 minutes after the password is entered, and the password needs to be entered again)

Fig. 3-5: Password Input Interface
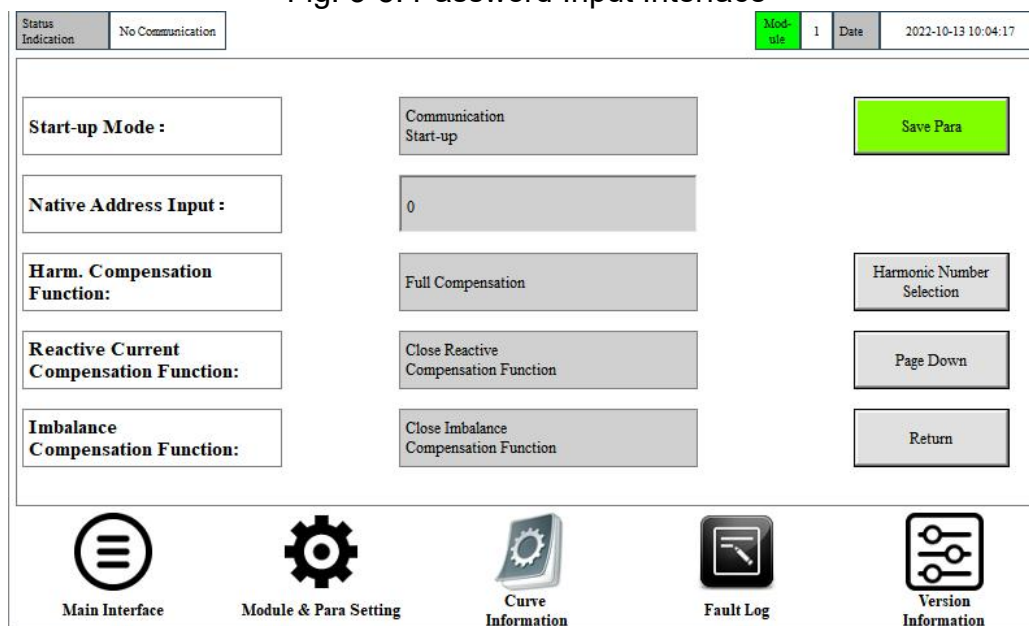
Fig. 3-6: Parameter Setting Interface

（1）**Startup mode**

Click the input box on the right side of "Startup Mode", and Fig. 3-7 will pop up. The module has four startup modes for selection: communication startup, automatic startup, button startup and automatic startup (load rate).
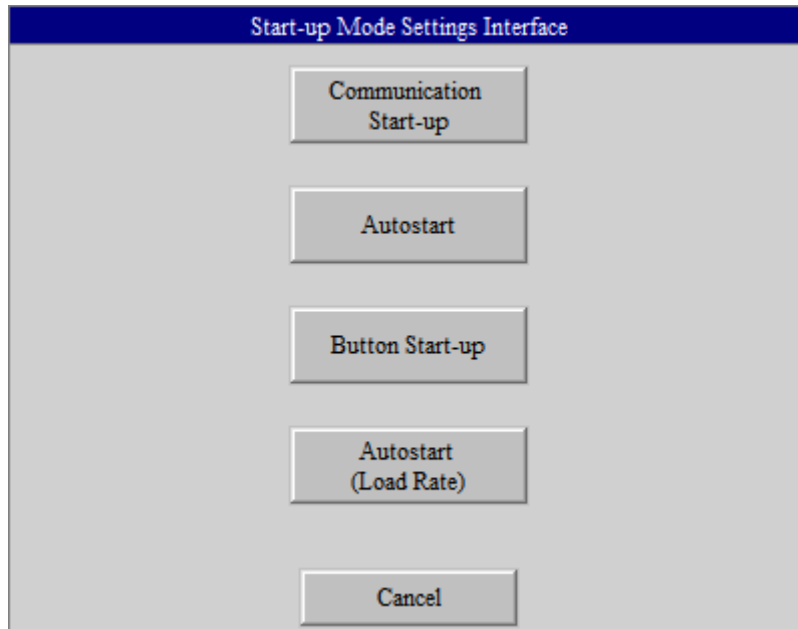
Fig. 3-7 Startup Mode

Startup mode	Explain
Communication start	In this mode, the device cannot be started automatically when powered on, but can be started or shut down through the cabinet button or LCD screen (the function is identical to that of the button).
Autostart	In this mode, after the equipment is powered on, if there is no fault, the equipment will start automatically and can be shut down through the cabinet button or LCD screen.
Button Start-up	In this mode, the device cannot be started automatically when powered on, but can be powered on or off through the cabinet button or LCD screen.
Autostart	In this mode, the capacity and load rate of the transformer

(Load Rate)	need to be set in the special parameter settings. When the transformer load rate reaches the set value, the module starts automatically; When the transformer load rate is less than the setting value, the module stops running.

（2）**Native Adress Inpute**

The factory address of all modules is 1 by default. When the number of modules connected to the LCD is greater than 1, the address of each module needs to be reset. The starting address of the module is 1, increasing in sequence. (Note: the module address of the whole cabinet has been completed during factory debugging)

The module interface is one-to-one corresponding to the module address. For example, the module 1 interface corresponds to the module data with the local address of 1, the module 2 interface corresponds to the module data with the local address of 2, and so on.

Address setting method:

1) Set the module address through the dial switch;

2) Set the module address through the LCD screen;

When the module has no dial switch or the dial is damaged (turn the dial switches to 0), connect one module to the LCD separately, disconnect the RS485 communication of other modules from the LCD (or disconnect the power supply of other modules), enter the LCD **module 1 interface**, change the local address to the target value, and then save the parameters. After the parameters are saved and the LCD is powered off and restarted, it can be displayed on the corresponding module interface.

（**3**）**Harmonic compensation Function**

Harmonic compensation mode has two options: full compensation and compensation by times.

Full compensation: compensate odd harmonics within 2-50 times;

Compensation by times: harmonic compensation is performed according to the specified harmonic compensation times set in "Harmonic Times Selection".

Click the gray key area on the right side of 【**Harmonic compensation Function**】, and the selection interface shown in Fig. 3-8 will pop up. Select according to the site conditions.
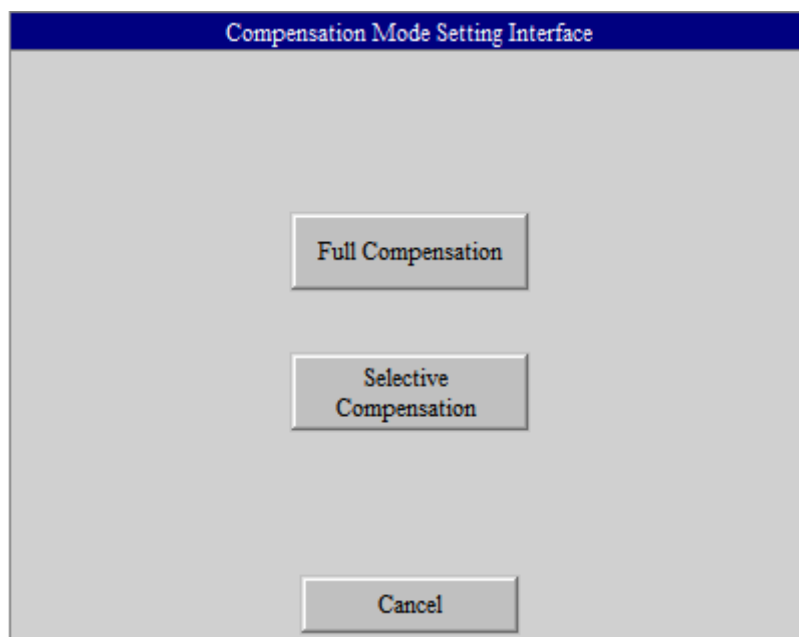
Fig. 3-8 Harmonic Mode Selection

（**4**）**Harmonic number selection**

When the harmonic compensation mode is compensation by times, you need to set 【Harmonic number selection】. The second compensation mode compensates 2-21 odd harmonics by default. Click the 【Harmonic number selection】button to pop up Fig. 3-9, and the harmonic compensation times can be selected as required.
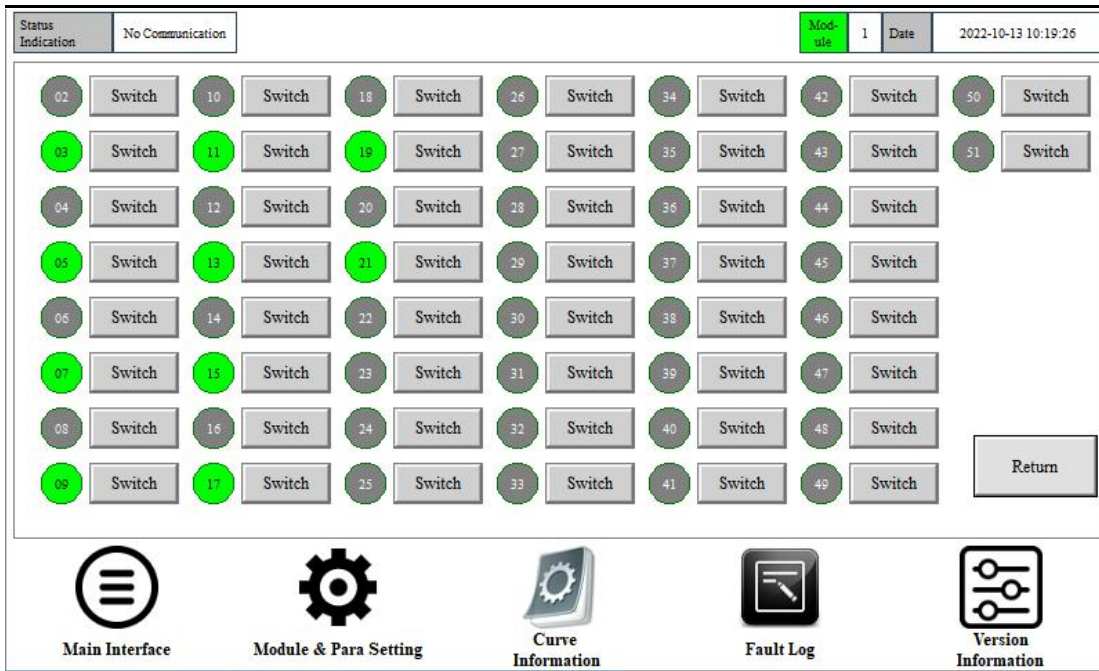
Fig. 3-9 Harmonic Times Selection

（5）**Reactive current compensation function**

Click the gray input box on the right side of 【Reactive current compensation function】, and Fig. 3-10 will pop up to enable and disable the reactive compensation function.
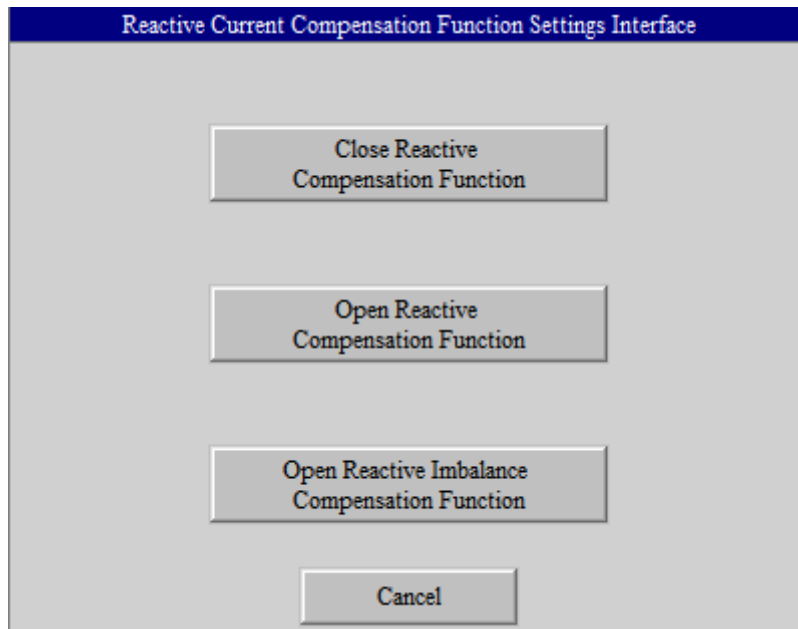
Fig. 3-10 Reactive compensation function

（6） **Imbalanced compensation function**

Click the gray input box on the right side of 【Imbalanced compensation function】, and

Fig. 3-11 will pop up to set the opening and closing of the imbalance compensation function.
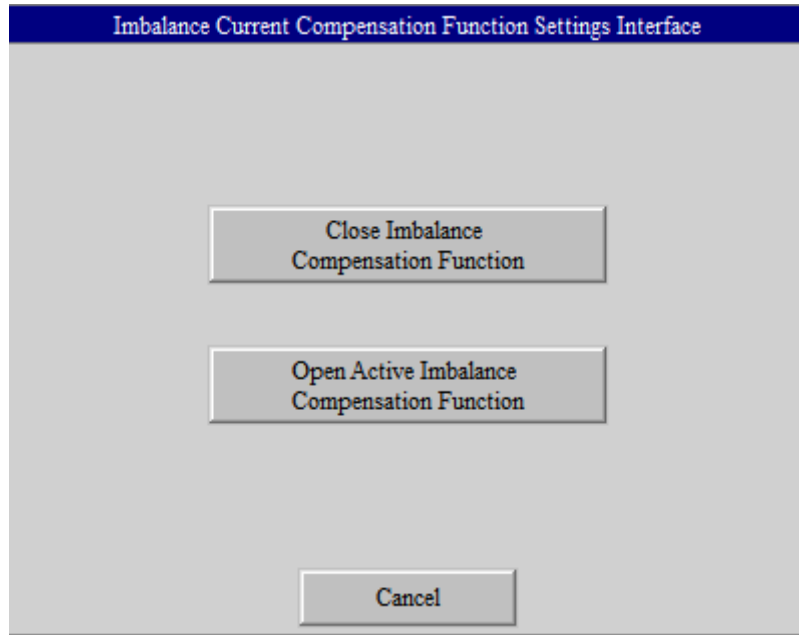
Fig. 3-11 Unbalance compensation function

（7）**Native Mode**

Click the gray input box on the right of 【Native Mode】, and Fig. 3-12 will pop up. Select the working mode of the module according to the use mode of the module.
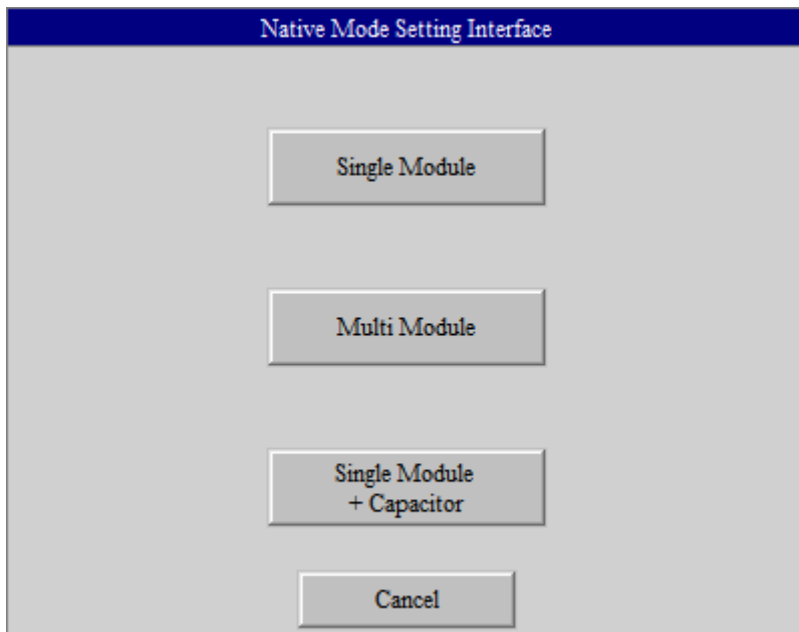
Fig. 3-12 Local Mode

Native Mode	Explain

Single Module	The system is conFig.d with a module, and there is no capacitor under the module
Multi Module	he system is conFig.d with multiple modules or multiple modules plus capacitors
Single Module +Capacitor	The system is conFig.d with multiple modules or multiple modules plus capacitors

（8）External CT position selection

点击【外部 CT 位置选择】右侧灰色输入框，会弹出图 3-13 所示的选择界面，根据现场 CT 的安装位置来选择是负载侧还是电源侧。
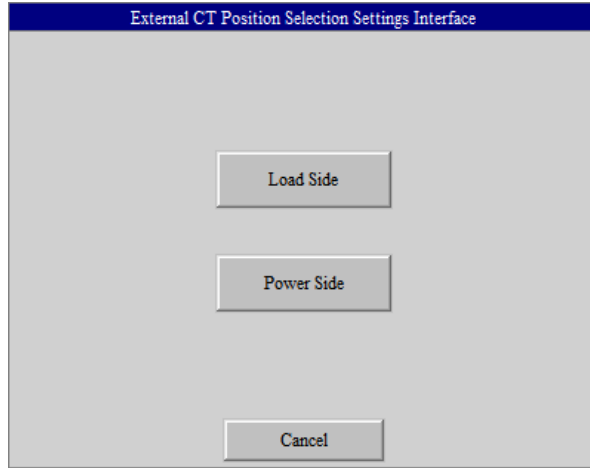
Fig. 3-13 External CT position selection

Load Side	The external CT is installed between the access point of the module busbar and the load.
Power Side	The external CT is installed between the access point of the module busbar and the transformer.

（9）Internal CT position selection

Click the gray input box on the right of 【Internal CT position selection】, and the selection interface shown in Fig. 3-14 will pop up.
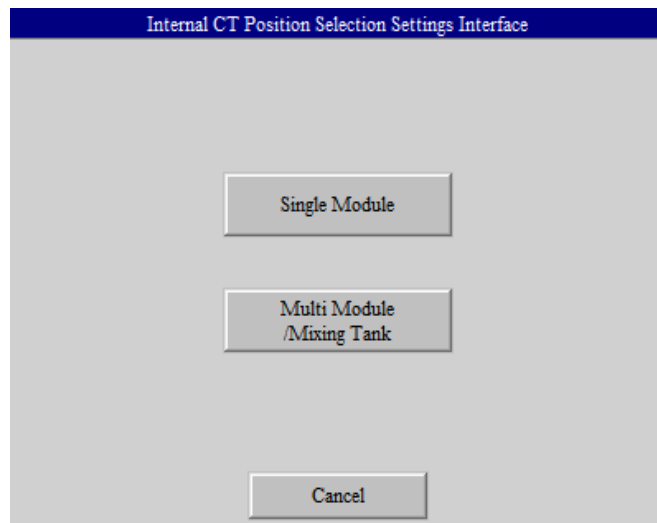
Fig. 3-14 Selection of Internal CT Position

Single Module	The system is only conFig.d with one module, without capacitor
Multi Module/ Mixing Tank	The system is conFig.d with multiple modules, or modules plus capacitors

（10）CT ratio setting

The transformation ratio of external CT and internal CT shall be set according to the transformation ratio of current transformer, number of modules and rated capacity of modules. Modules with different capacities are connected in parallel, which needs to be set according to the rated capacity of the module.

For example, for a compensation cabinet with a capacity of 250A, the external CT transformation ratio of the cabinet is 2000:5, and the internal CT transformation ratio is 800:5. There are the following situations:

- Five 50A modules are conFig.d in the compensation cabinet, so the external CT transformation ratio parameter of each module is set as 400:5, and the internal CT transformation ratio parameter is set as 160:5;

- One 50A module and two 100A modules are conFig.d in the compensation cabinet, so the external CT transformation ratio parameter of the 50A module is set to 400:5, and the internal CT transformation ratio parameter is set to 160:5; The external CT transformation ratio parameter of 100A module is set to 800:5, and the internal CT transformation ratio parameter is set to 320:5;

- One 100A module and one 150A module are conFig.d in the compensation cabinet, so the external CT transformation ratio parameter of 100A module is set as 800:5, and the internal CT transformation ratio parameter is set as 320:5; The external CT transformation ratio parameter of 150A module is set to 1200:5, and the internal CT transformation ratio parameter is set to 480:5.

The CT transformation ratio parameter range is 50:5~20000:5. When setting CT ratio parameters, if it is necessary to set 1200:5, directly enter "1200" and confirm:

（11）Harmonic current/reactive current/unbalance compensation capacity setting

Click the gray input box on the right of 【Compensation Capacity】 to set the compensation capacity of the module corresponding to the mode according to the demand.

Description of module compensation capacity parameter setting:

Re. Com. Cap.	Har.Com.Cap.	Imb.Com.Cap.	Rated capacity
X	Y*1.4	Z	P=X+Y+Z （A:amp.)
Explain	1) The compensation capacity of each function needs to be set according to the actual demand, with A (ampere) as the unit (1kvar=1.5A). 2) Reactive compensation capacity (X), harmonic compensation capacity (Y) and unbalance compensation capacity (Z) of all parallel modules must be consistent. 3) The harmonic compensation capacity shall be set by a factor of 1.4.		

（**12**）**Phase sequence Self-adaptation**

Click the gray input box on the right of【Phase Sequence Adaptation】, and Fig. 3-15 will pop up. You can turn on and off the phase sequence adaptation function, which is turned off by default. When phase sequence error occurs and the module cannot be started, the phase sequence problem can be solved by opening the phase sequence adaptive function, but the CT sampling of each phase must be consistent with the main incoming line.

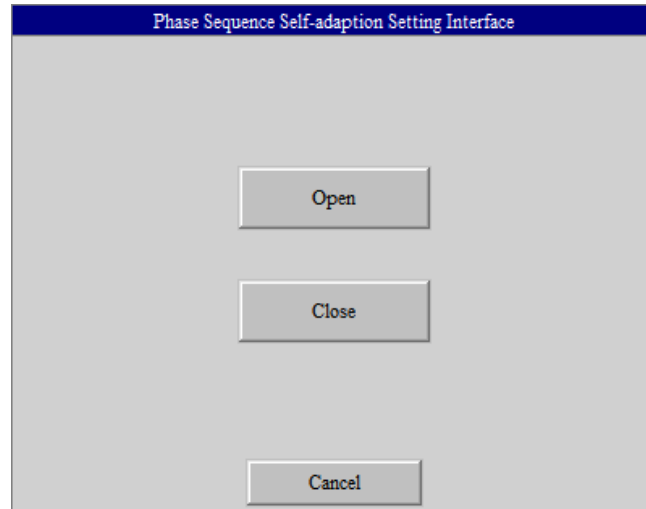Fig. 3-15 Phase sequence adaption

（**13**）**Time setting**

Click the gray input box on the right of 【Time setting】, and the interface shown in Fig. 3-16 will pop up. This interface is used to set the module system time.
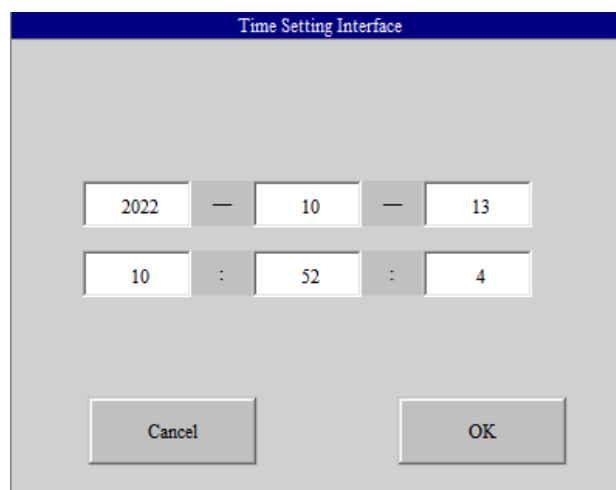

Fig. 3-16 Time Setting

（14）**Special parameter setting**

Special parameter setting mainly include some functions that are not commonly used, including priority mode selection, transformer capacity and load rate settings, target voltage value settings, and timing switch on/off functions.

● Priority mode selection

Click the gray input box after 【Priority Mode Selection】, and Fig. 3-19 will pop up. The interface includes six options: manual capacity allocation, reactive compensation priority, imbalance compensation priority, harmonic compensation priority, and voltage support priority. The module defaults to manual capacity allocation mode.

In the capacity manual distribution mode, the module compensates according to the compensation capacity settings of each function;

In priority mode, it is required to set the compensation capacity of all functions of the module to the rated capacity, and the module will give priority to compensating the specified items. If the equipment has residual capacity after compensation, it will be equally distributed to other items for compensation.
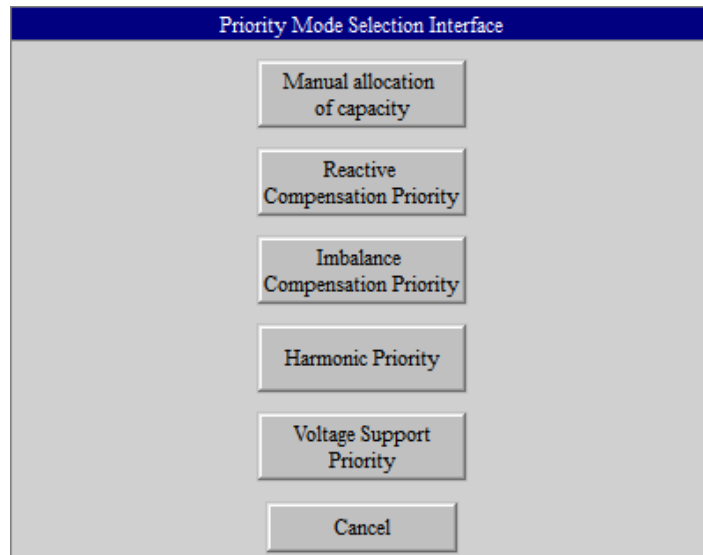

Fig. 3-17 Priority Mode Selection

● Transformer capacity and load rate

When the module startup mode is [self startup (load rate)], [transformer capacity] and [load rate] shall be set. The transformer capacity shall be set according to the actual

transformer capacity on site, and the load rate shall be set according to the actual demand. When the transformer load rate reaches the set value, the module starts to run; When the transformer load rate is lower than the set value, the module stops running.

Target voltage value

When the module is in the 【Voltage Support Priority】 mode, the 【Target Voltage Value】needs to be set.

The target voltage range is 176V~264V. When the system voltage exceeds the upper voltage regulation limit Umax of the device (Umax=target voltage value * 107%), the device can output inductive current to reduce the voltage. When the system voltage is lower than the lower limit of the device's voltage regulation Umin (Umin=target voltage value * 90%), the device can output capacitive current to increase the voltage.

● Timed Power on/off

Click the gray input box on the right side of 【Timed On/Off】, and Fig. 3-18 will pop up. This interface is used to set the timing on/off time of the module and enable/disable the timing function.
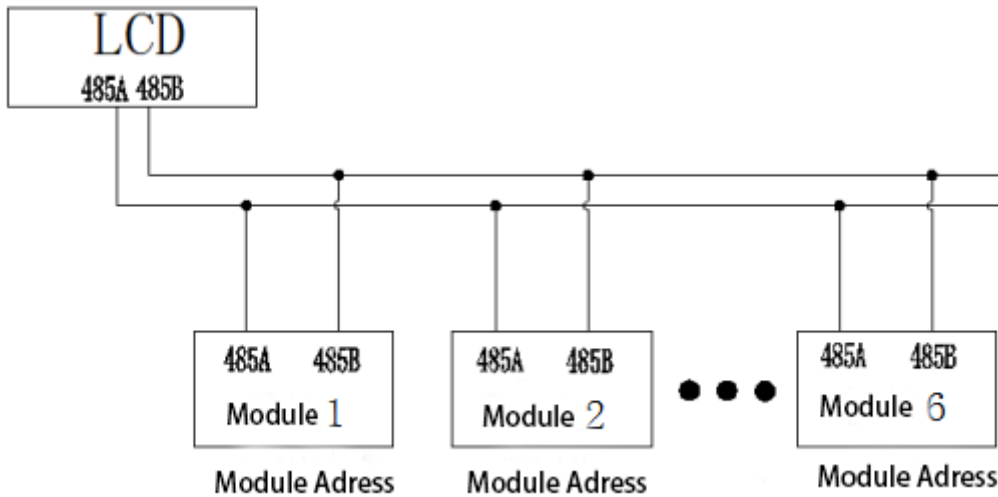

Fig. 3-18 Timing switch

（15）**Save Parameters**

After the module parameters are set, click Save Parameters. At this time, the module will

have a restart process, which can be judged by the operation of the fan.

3.3 Capacitance parameter setting

When the system is conFig.d with modules and capacitors, the RS485 communication structure of the system is shown below.

Built in capacitor control board of the module: it can output 16 channels of thyristor control signals.

When the module controls the capacitor, it is necessary to set the capacitance. Enter 【Module & Parameter Setting Interface】, click 【Module Setting】, and change the parameter of "capacitor control board" of the module that controls capacitor switching to 1, as shown in Fig. 3-19.
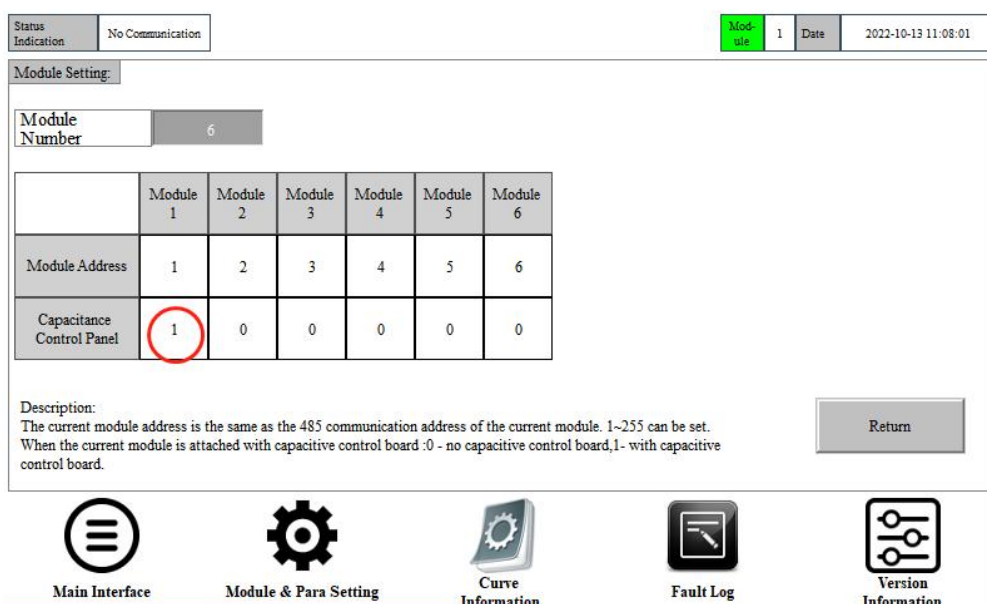

Fig. 3-19 Parameter Setting of Capacitance Control Board

返回【模块及参数设置】界面，点击模块 1 的【实时数据】，进入如图 3-22，可以看到主界面上多了一栏电容工作状态显示，一共 16 路电容投切信号。当电容投入电路的时候，相应的指示灯会变为绿色，电容切除后，指示灯恢复灰色。Return to the 【Module & Parameter Setting Interface】 interface, click the 【Real-time Data】 of module 1, and enter Fig. 3-20. You can see that there is an additional column of capacitor working status display on the main interface, with a total of 16 capacitor switching signals. When the capacitor is put into the circuit, the corresponding indicator light will turn green. After the capacitor is cut off, the indicator light will return to gray.
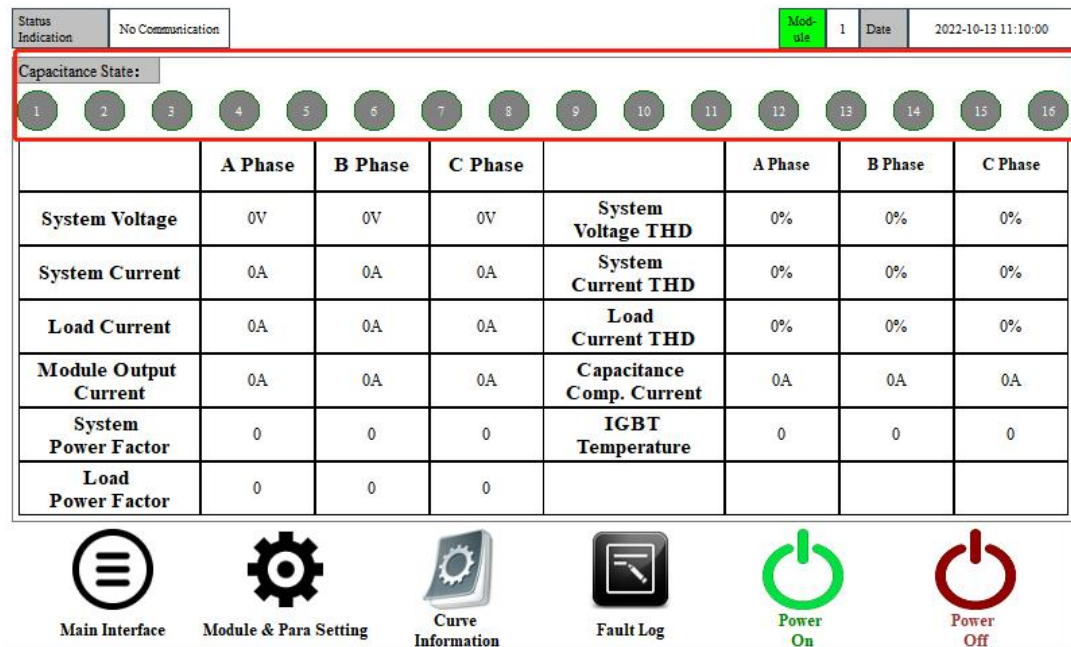

Fig. 3-20 Capacitance indication interface

Enter the 【Module & Parameter Setting Interface】interface again, and you can see that there is an additional 【Capacitance Setting】 option in the interface, as shown in Fig. 3-21.
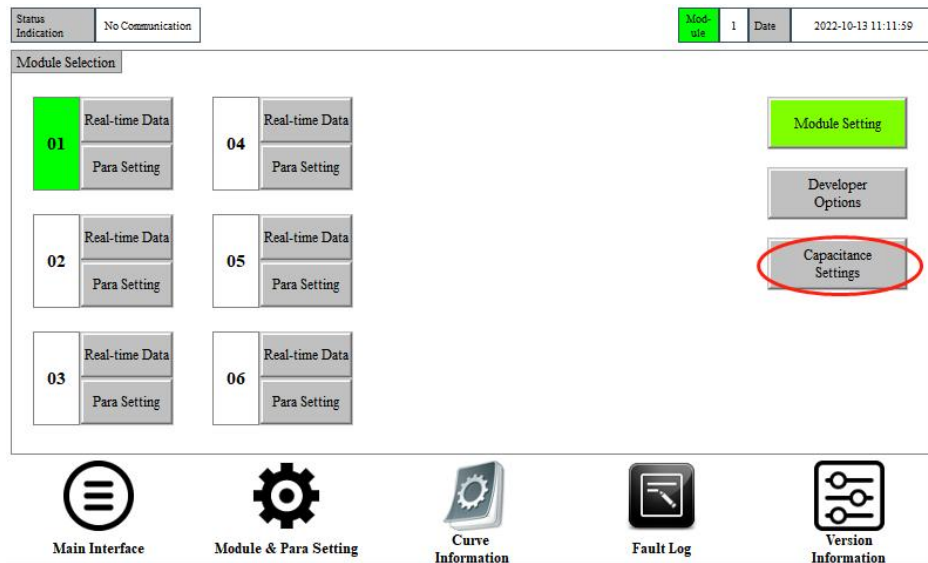
Fig. 3-21 Capacitance Setting

Enter the 【Capacitance Setting】 interface, as shown in Fig. 3-22. This interface can be used to test the switching capacitance and select the switching mode of capacitance.

【Test mode】: used by our commissioning personnel.

【Manual control mode】: manually control capacitor switching, which is not affected by load change.

【Automatic mode】: according to the load reactive power detected by the module, an independent switching strategy is adopted to control the capacitor switching.
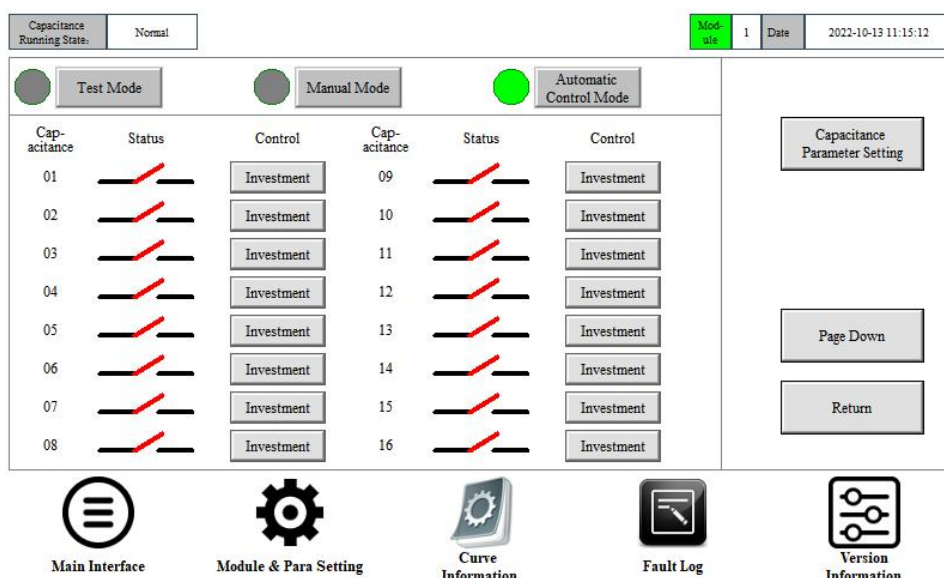

Fig. 3-22 Capacitance setting

Click 【Page down】 to enter the interface shown in Fig. 3-23 below. This interface is used to monitor the total number of capacitor switching corresponding to the module. Click

【Empty The Statistics Record】 to clear all the switching times of 16 channel capacitors.

Fig. 3-23 Number of capacitor switching
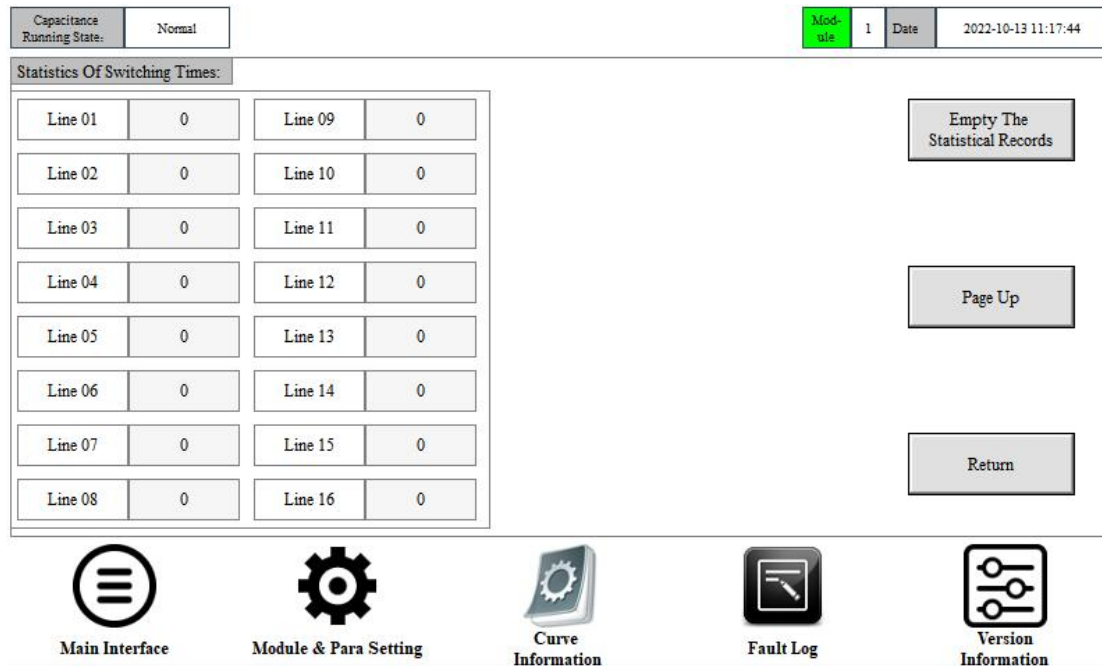
Click 【Capacitance Parameter Setting】in the 【Capacitance Setting】 interface to enter the interface shown in Fig. 3-24. Click the gray area where the parameters need to be set to set the parameters. See Appendix 1 for parameter contents and meanings.
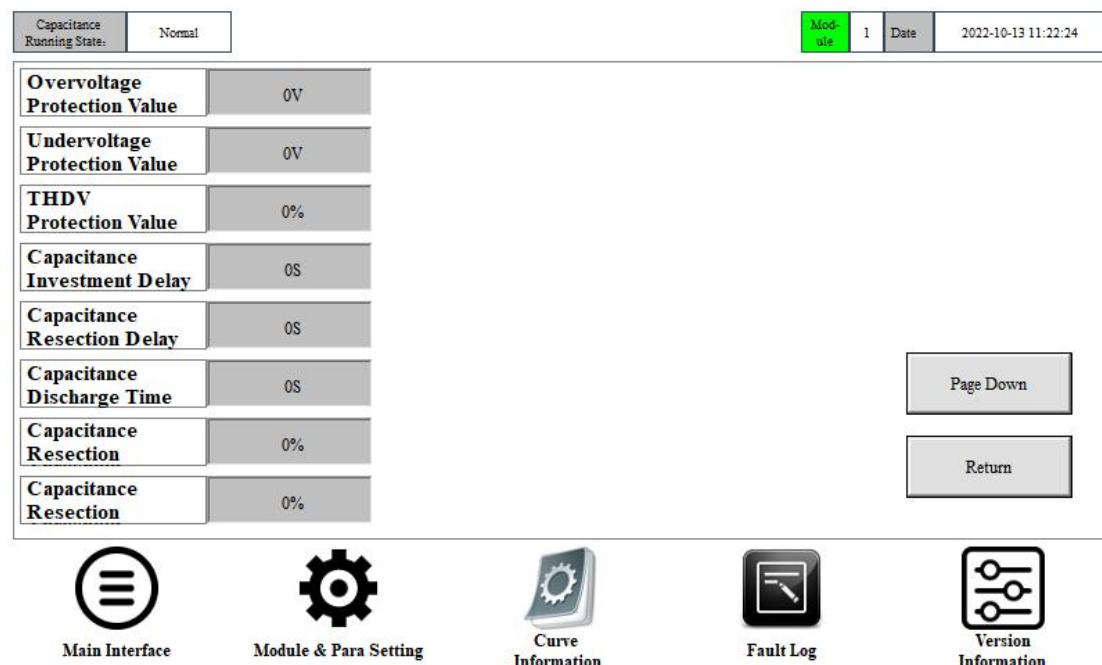
Fig. 3-24 Capacitance parameter setting

Click 【Page down】to enter the interface shown in Fig. 3-25 below. This interface is used

to set the number of capacitor banks and capacity size. When setting the capacity, the sub compensation capacity is set as the single-phase capacity, and the total compensation capacity is set as the total capacity of the capacitance.

Fig. 3-25 Capacitance and Number of Groups

When the module controls the capacitor, the module parameter interface will display the 【Capacitance para Recovery Factory 】 option shown in Fig. 3-26.

Fig. 3-26 Restore factory settings of capacitance control parameters

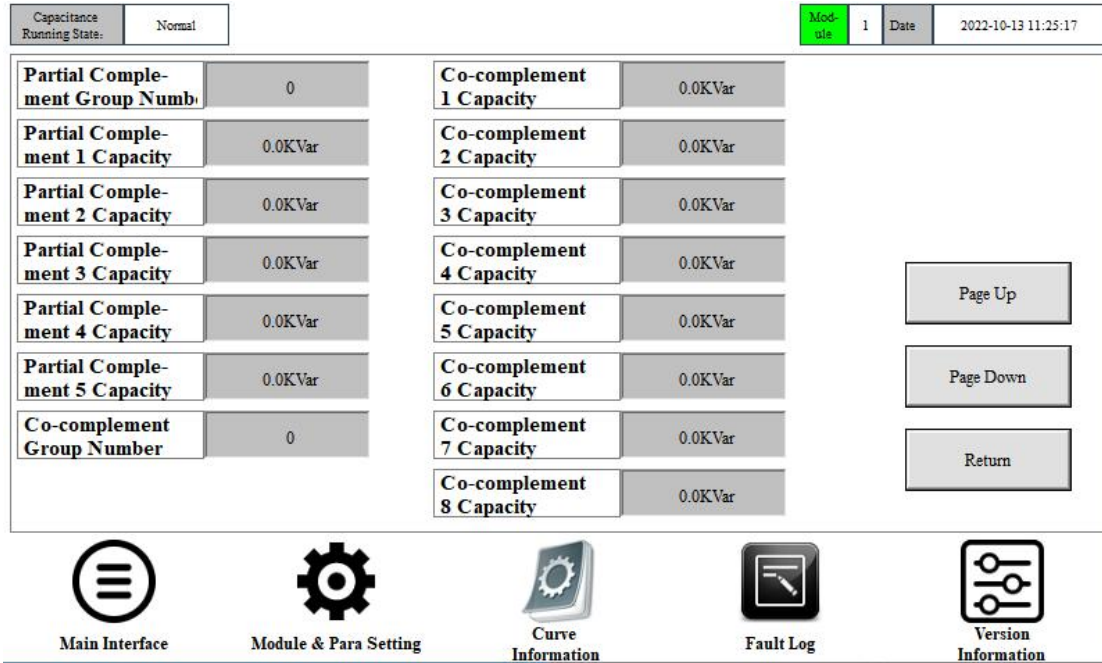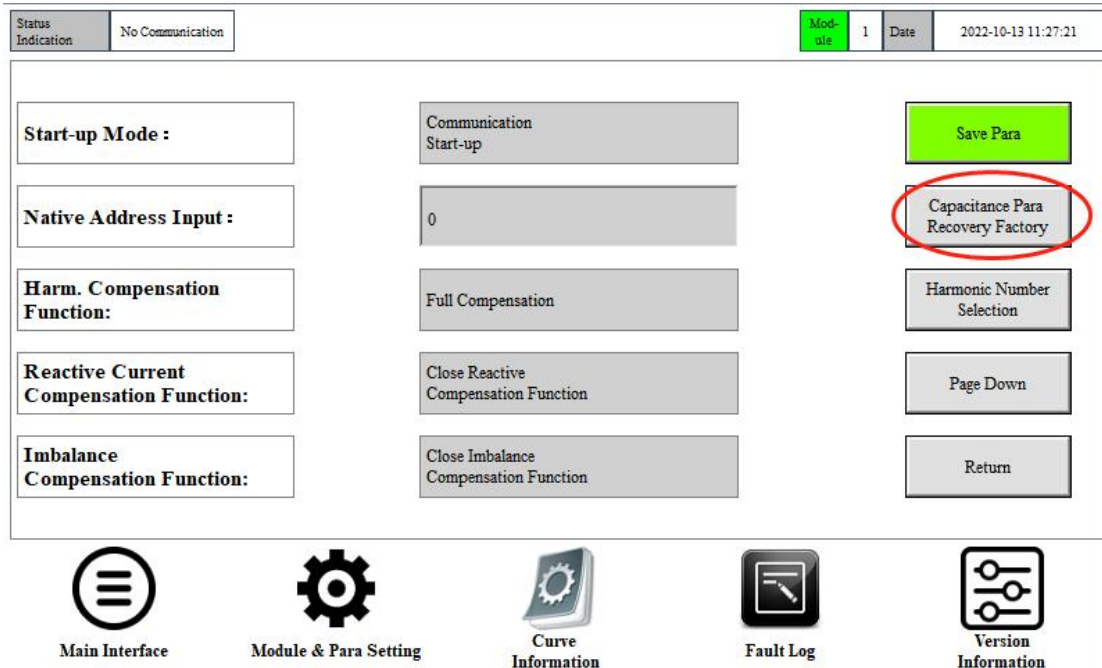Click 【Capacitance Para Recovery Factory】and the interface as shown in Fig. 3-27 will pop up. After entering, you can reset the capacitance parameter to factory setting. (After the capacitor parameters are set, if the capacitor cannot be switched normally, you can try to restore the capacitor control parameters to the factory settings, and then reset the capacitor parameters）
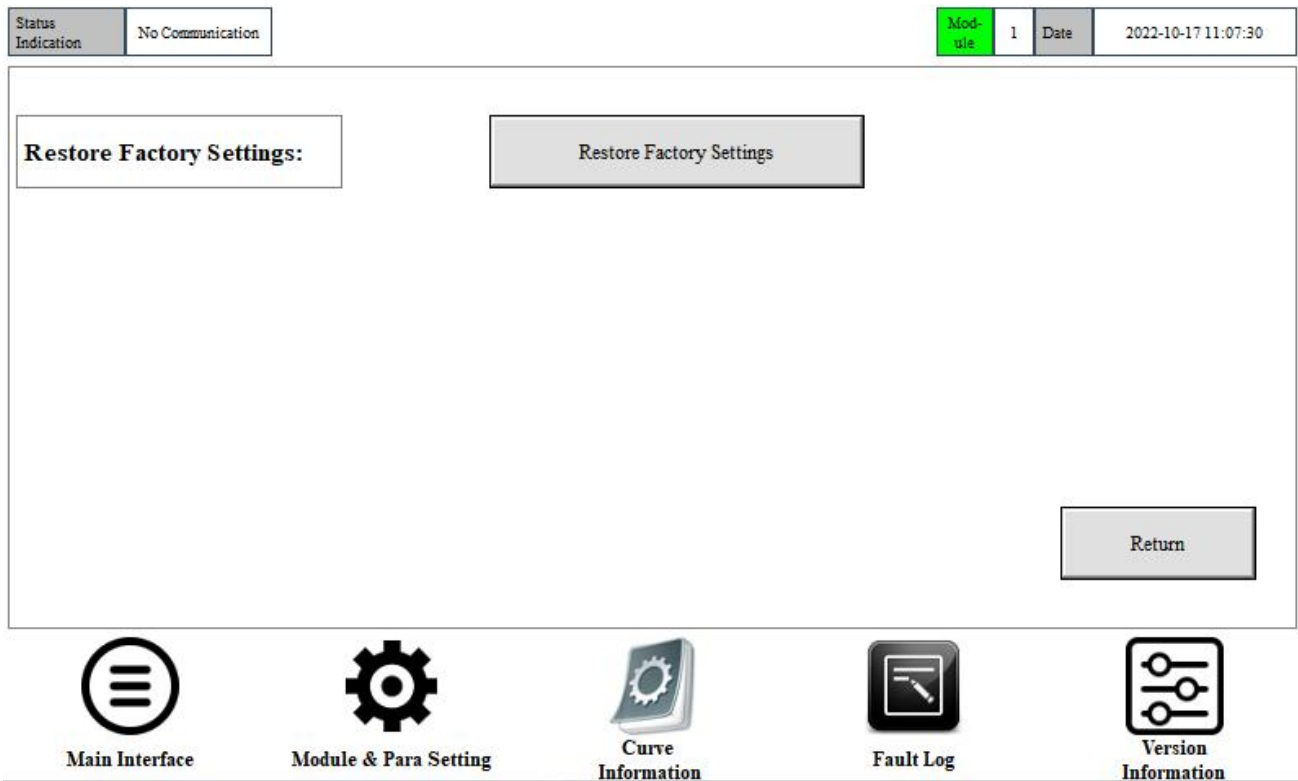
Fig. 3-27 Restore factory settings

4、Curve information

Click 【Curve Information】to enter the interface shown in Fig. 4-1. The interface mainly contains real-time curve information: 【System Power Factor】, 【Load Power Factor】, 【System Active Current】 【System Reactive Current】. Enter the corresponding interface, and the corresponding real-time curve will pop up. The maximum, minimum and average values of A, B and C phases can be seen.
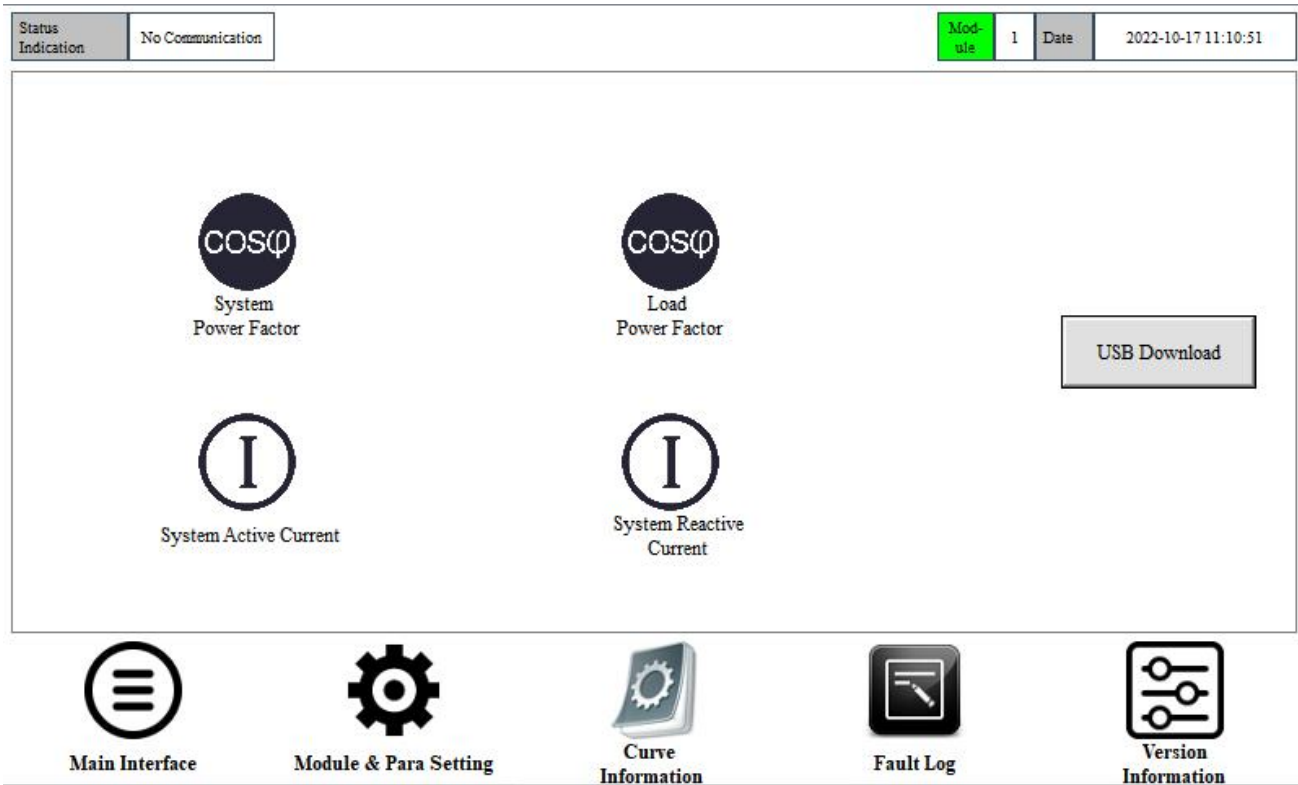
Fig. 4-1 Curve Information

After clicking 【USB Download】, an interface as shown in Fig. 4-2 will pop up about 5 seconds later. At this time, a table file with the suffix of CSV will be automatically generated from the inserted USB flash disk. The maximum, minimum and average values of system power factors A, B and C are downloaded in the file; Maximum, minimum and average values of load power factors A, B and C; Maximum, minimum and average values of system active current A, B and C phases; The maximum, minimum and average values of the system reactive current A, B and C phases, as well as the switching times of each 16 capacitors.
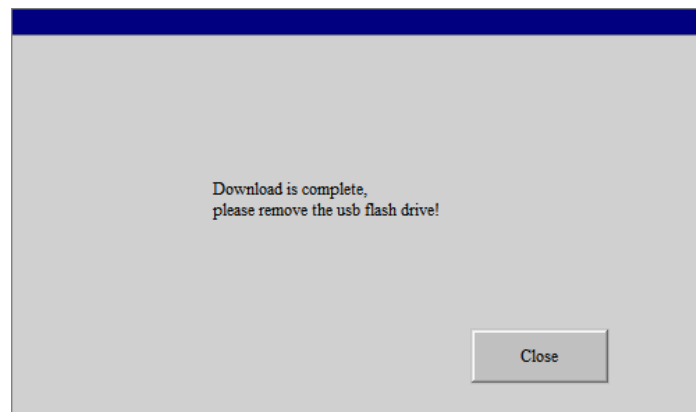
Fig. 4-2 USB Download

Taking the load power factor as an example, click Phase A, Phase B and Phase C respectively in Fig. 4-3 to enter Fig. 4-4, and the data of specific maximum, minimum and average values of corresponding phases in a time period will be displayed.
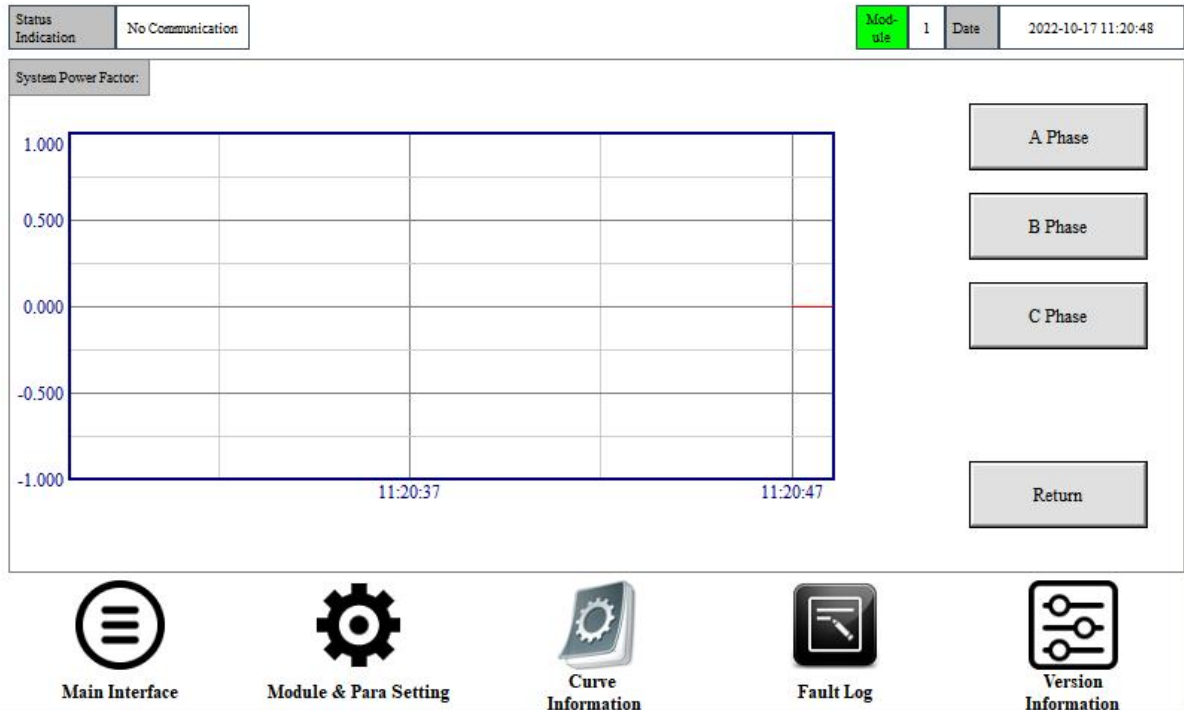
Fig. 4-3 Load power factor
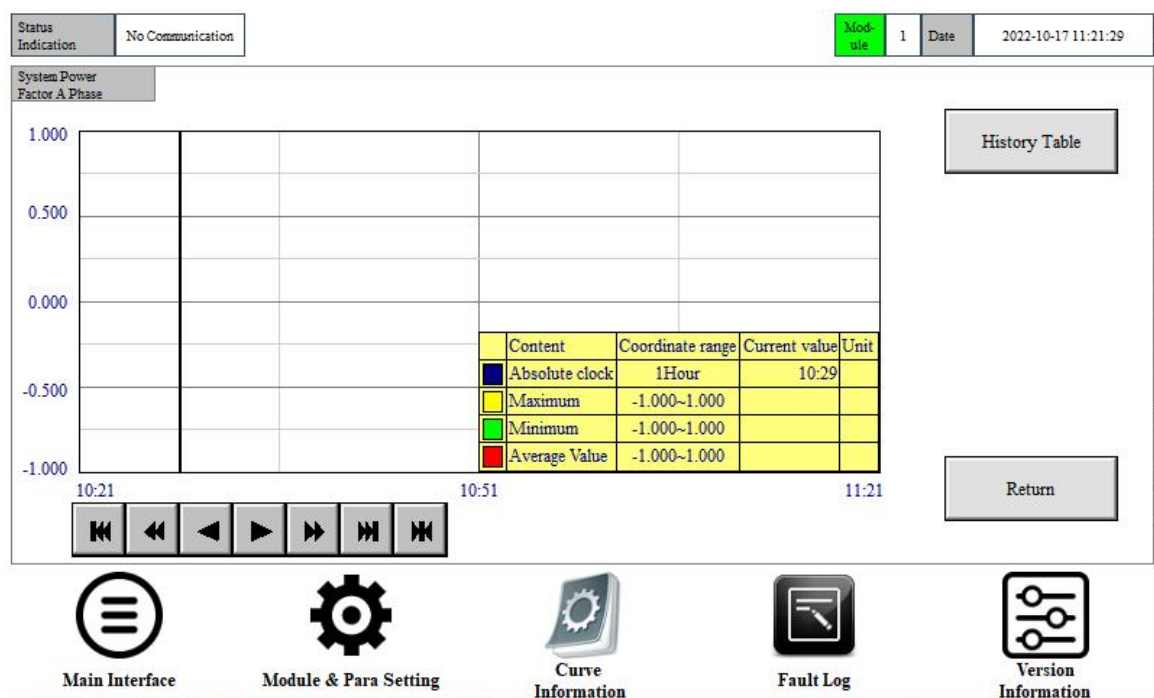
Fig. 4-4 A-phase load power factor

Click 【History Table 】to enter Fig. 4-5 to view the data of the corresponding time node. Click "◀ " and "▶" on the horizontal axis slider above【Setting】to view the corresponding parameter information, and "▲" and "▼" on the vertical axis slider to view more data records in time.

Fig. 4-5 Historical Data

5、Fault Log

【Fault Log】to enter as shown in Fig. 5-1. In the fault record interface, you can view the faults occurred when the equipment is running, including the detailed time, fault code, fault name and key system parameters of the fault. Click the "◀" and "▶" on the horizontal axis slider above the [Setting] to view the corresponding parameter information. The "▲" and "▼" on the vertical axis slider can view more event records.

Fig. 5-1 Fault Log

6、Version information

Click 【Version Information】 to enter the interface as shown in Fig. 6-1. This interface can view the module version number, hardware version number and the version number of the touch screen itself.

Fig. 6-1 Version Information

7、Description of typical application parameter settings

7.1 Mode selection and CT setting

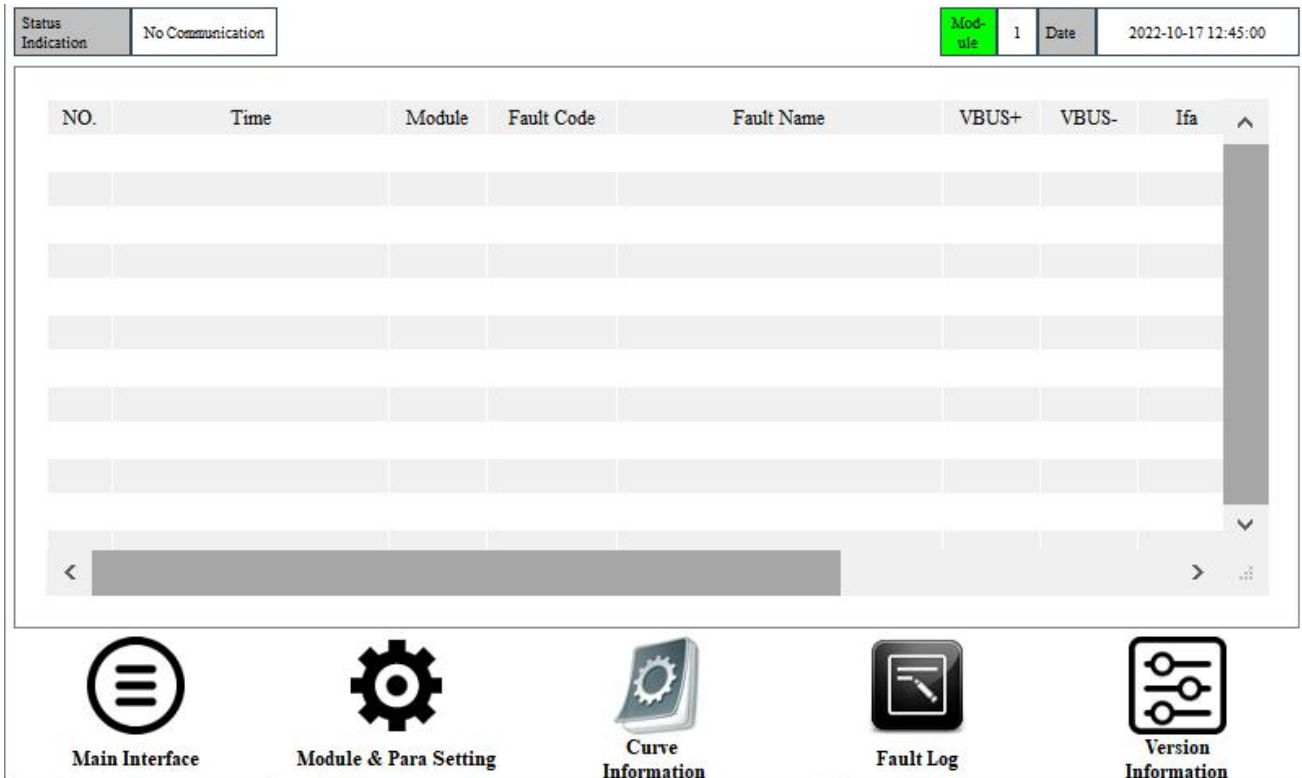### （1）Related parameter settings for single module application

Application scenario	Native mode	External CT Position selection	Internal CT Position selection	External CT Ratio Setting	Internal CT Ratio Setting
CT connected to load side	Single module	Load side	Single module	Actual ratio	Actual ratio
CT connected to power side	Single module	Power side			

Note: If it is a single module application, internal CT is not necessary

（2）Relevant parameter settings for parallel application of multiple modules

Application scenario	Native mode	External CT Position selection	Internal CT Position selection	External CT Ratio Setting	Internal CT Ratio Setting
CT connected to load side	Multi module	Load side	Multi module	Actual ratio/Number of modules	Actual ratio/Number of modules
CT connected to power side	Multi module	Power side			

Note: If the rated capacity of the module is different, the CT transformation ratio must be set according to the rated capacity of the module.

（3）Relevant parameter settings for hybrid compensation application of single module and capacitor

Application scenario	Native mode	External CT Position selection	Internal CT Position selection	External CT Ratio Setting	Internal CT Ratio Setting
CT connected to load side	Single module+ capacitor	Load side	Multi module/mixing cabinet	Actual ratio	Actual ratio
CT connected to power side	Single module+ capacitor	Power side			

7.2 Module compensation capacity setting

Reactive compensation capacity	Harmonic compensation capacity	Imbalance compensation capacity	Module rated capacity
X	Y*1.4	Z	P=X+Y+Z （A：ampere）
Explain	1) The compensation capacity of each function needs to be set according to the actual demand, with A (ampere) as the unit (1kvar=1.5A). 2) Reactive compensation capacity (X), harmonic compensation capacity (Y) and unbalance compensation capacity (Z) of all parallel modules must be consistent. 3) The harmonic compensation capacity shall be set by a factor of 1.4.		

For example, if a 75A APF module is used alone to compensate 25A reactive power and 50A harmonic, then the reactive compensation capacity=25A, harmonic compensation capacity=70A (50A * 1.4), and Imbalance compensation capacity=0A.

。 **Note: After setting parameters, click 【Save Parameters】, the module will have a restart process, and the fan will restart.**

Appendix1 ：

Module parameter setting		
Parameter name	Parameter setting	Remarks
Startup mode	Communication start □　　　DI Start □ Auto start □　　　Auto starting (load rate)□	
Local address input	___1	
Harmonic compensation mode	Full compensation □ Selective Compensation ☑	Selective Compensation
Harmonic number selection	_2～21_	
Reactive compensation function	Close the reactive power compensation function □ Open reactive compensation function □ Open reactive imbalance compensation function □	
Imbalance compensation function	Close Imbalance compensation function　　□ Open Active Imbalance Compensation Function □	
Native Mode	Single module □ Multi module □ Single module+Capacitor □	
External CT ratio setting	Load side □　　　Power side □	
Internal CT ratio Selection	Single module □　　　Multi module/ Mixing tank□	
External CT ratio setting	____：5	
External CT ratio setting	____：5	
Harmonic current compensation capacity	_____A	
Reactive current compensation capacity	_____A	
Imbalance compensation capacity	_____A	
Phase Sequence Self-adaption	Open ☑　　　Close □	
Priority Mode Selection	Manual allocation　　☑ Reactive Compensation Priority　　□ Imbalance Compensation Priority □ Harmonic Priority　　□	Manual allocation

	Voltage Support Priority □	
Transformer Capacity（kVA）	_____ kVA	
Load Rate		
Target Voltage Value	_____ V	
Timing power on/off		

Appendix2 ：

Capacitance control parameter setting			
Parameter name	Defaul t	设置范围	备注
Overvoltage protection value	264	230~300V	The controller will cut off all capacitors when the voltage is higher than this value
Undervoltage Protection value	176	0~220V	The controller will cut off all capacitors when the voltage is lower than this value
THDV Protection Value	35%	0~100%	Voltage THD higher than this value will cut off all capacitors
Capacitance Investment Delay	40	1~1200S	After the input conditions are met, the corresponding capacitor shall be put into operation after the time delay.
Capacitance Resection Delay	40	1~1200S	When the removal conditions are met, the corresponding capacitor shall be removed after the time delay.
Capacitance Discharge Delay	60	1~1200S	After the capacitor is cut off, the discharge time begins, during which the capacitor cannot be put into operation.
Capacitance Investment threshold	130%	110%~200 %	The current reactive power demand<the capacity of the current bank of capacitors * (capacitor cut-off threshold), when this condition is met, the capacitors will be cut off
Capacitance Investment threshold	90%	40%~95%	The current reactive power demand<the capacity of the current bank of capacitors * (capacitor cut-off threshold - 1), when this condition is met, the capacitors will be cut off
Capacitance capacity	0	0~99kvar	Single phase compensation capacity or total compensation capacity