The product models and specifications published in this manual are for reference only, and everything is subject to the actual product and product description.

PRODUCT QUALIFICATION CERTIFICATE

Name: Intelligent Low-voltage Reactive Power Compensation Device Controller

Model: _____

This product meets the standard for crystal inspection and is allowed to leave the factory.

Inspector: Test 8

OPERATION INSTRUCTIONS

Intelligent Low-voltage Reactive Power Compensation Device Controller

V6.0

Note: Thank you for choosing this product. Please read the user manual carefully before installing, using, or maintaining the product.

1. Overview

Intelligent integrated power capacitor compensation device, applied to the integrated reactive power compensation equipment of 0.4kV power grid. It is a novel reactive power compensation device that integrates compensation, communication, and multiple fault protection, abbreviated as intelligent capacitor. By collecting AC current signals through internal CPU chips and equipping them with zero crossing switching devices, the impact on capacitors is reduced, the lifespan of capacitors is improved, and the impact of surge currents on the power grid is alleviated. It has multiple protection functions such as overcurrent, power failure, harmonic, over temperature pressure, and short circuit automatic tripping. Its compensation method is flexible (any combination of co compensation and sub compensation), with small size, low power consumption, and easy installation and maintenance, meeting users' requirements for reactive power compensation, effectively achieving the practical needs of improving power factor, improving power quality, and energy conservation and loss reduction.

2. Model Description

□ □ □ / □ – □ + □

- Capacity of the second group of capacitors
- Capacity of the first group of capacitors
- Rated voltage
- Compensation method
  (S represents three-phase compensation,
  F represents phase separation compensation)
- Product code
- Enterprise code

3. Technical Parameter

1. Altitude: ≤ 2000m;
2. Environmental temperature: -45~+55 ℃;
3. Relative humidity: ≤ 80% (at 25 ℃);
4. Environmental requirements: No harmful gases, no conductive or explosive dust, no severe mechanical vibrations;
5. Rated voltage: 380V ± 20% 50Hz ± 5%;
6. Capacity decay of capacitors: ≤ 1%/year;
7. Power consumption: ≤ 6W;
8. Maximum number of networked capacitors: 32 units.

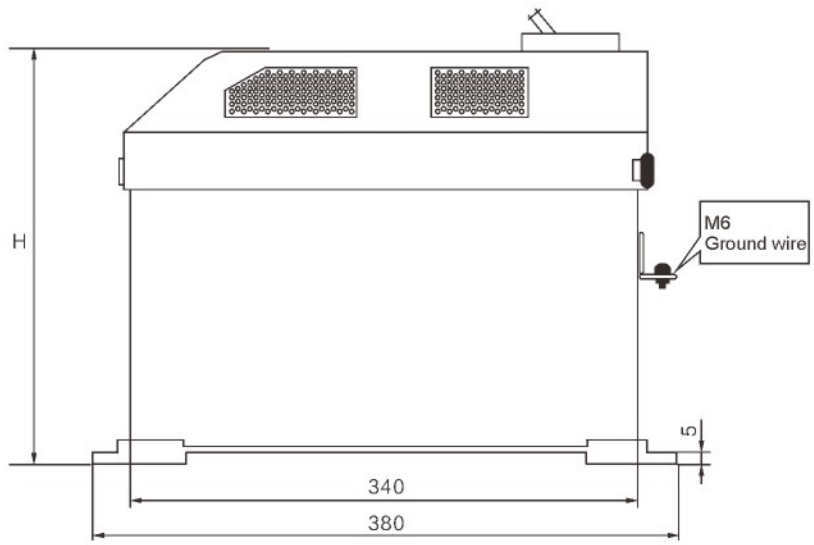
Intelligent Integrated Power Capacitor Compensation Device

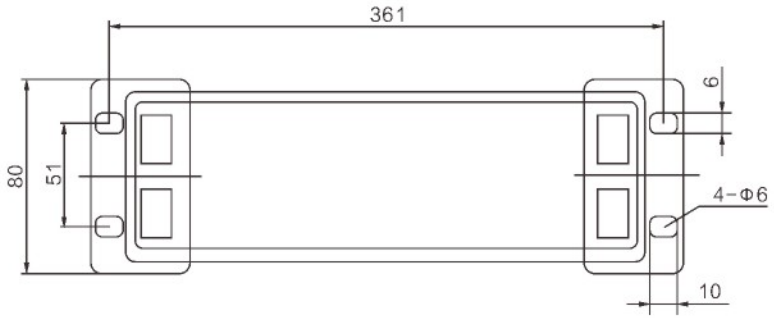
4. Intelligent Capacitor Model Specifications And Installation Dimensions

Intelligent capacitor model specification table

Compensation method	Model specifications	Rated capacity (kVar)	Height H (mm)
Dual compensation (three-phase compensation)	450-30+30	60	335
	450-25+25	50	315
	450-20+20	40	275
	450-20+10	30	275
	450-15+15	30	275
	450-10+10	20	245
	450-5+5	10	245
Single point compensation (phase compensation)	250-30	30	315
	250-25	25	315
	250-20	20	275
	250-15	15	275
	250-10	10	245
	250-5	5	245

1. Installation and external dimensions (Note: The width and depth of smart capacitors with different capacities are the same, only the height is different!)

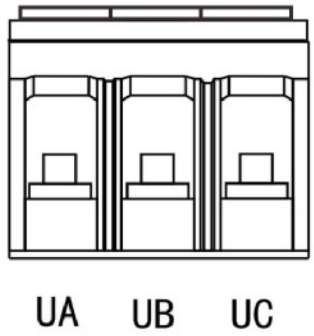




5. Wire Connection

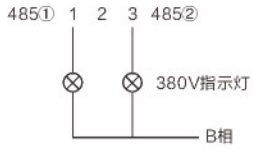
1. Power wiring

The power supply must be wired in the order shown in Ua, Ub, Uc, and grounding. (Note: The shunt capacitor needs to be connected to Un)

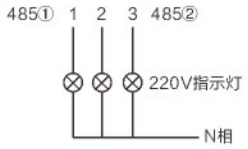


2. Signal wiring

Wiring of indicator lights for shared capacitors



Wiring of auxiliary capacitor indicator light

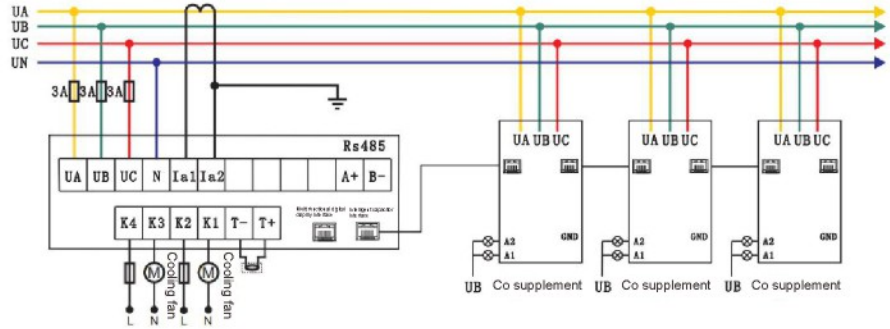


Note:

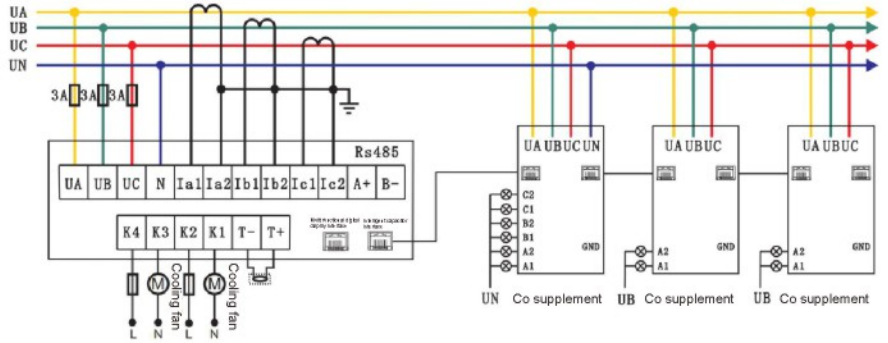
1. The dual compensation capacitor needs to be connected to a 380V indicator light. After connecting a line from 1 and 3 to the 380V indicator light, the other end of the indicator light should be connected to phase B; The other two telephone network ports, 485 ① and 485 ②, are connected to ethernet cables, which are connected in no particular order. (Note: Due to the two sets of capacity inside the dual common capacitor, a single unit needs to be connected to two indicator lights)
2. The auxiliary capacitor needs to be connected to a 220V indicator light, starting from 1, 2, and 3 (note: 1 is phase A; 2 is phase B; After connecting one wire from each of the C phases to the 220V indicator light, the other end of the indicator light is connected to the N phase; The other two telephone network ports, 485 ① and 485 ①, are connected to Ethernet cables, which are connected in no particular order.

6. Schematic Diagram of Capacitor Wiring

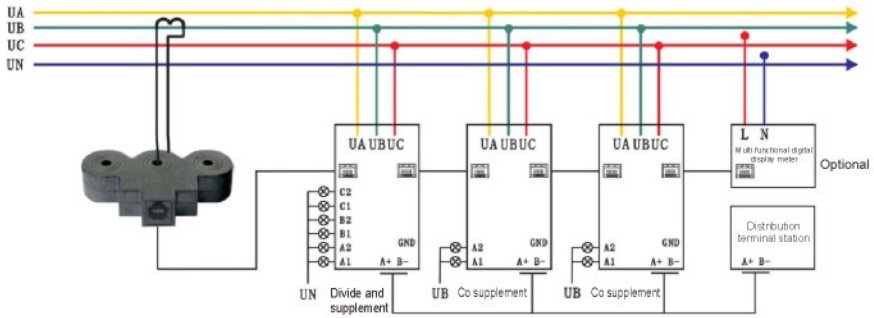
Schematic diagram of wiring for external controller



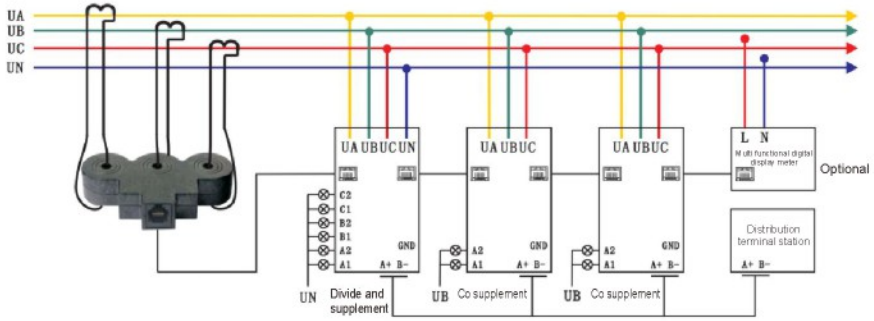
Schematic diagram of compensation wiring for mixed compensation (external controller)



Schematic diagram of wiring for the built-in controller

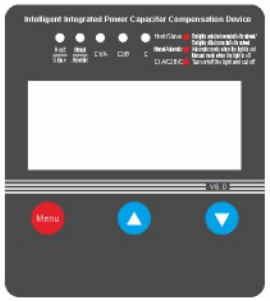


Schematic diagram of compensation wiring for hybrid (built-in controller)



7. Key Points for First-time Use

1. Panel display instructions

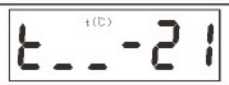


After the capacitor is powered on and enters standby mode, the red light of the host/slave will flash continuously, indicating that the capacitor is not in communication or disconnected from the host. When there is no controller and only our matching small CT transformer is provided, the capacitor will automatically generate a master-slave machine. When the red light of the host/slave is on, it indicates that this is the host; When the red light of the host/slave goes out, it indicates that this is a slave. The slave only retains the interfaces of Id, voltage, and temperature.

Host/Slave Light	After power on, the capacitor is in standby mode, and the red light of the host/slave will flash continuously, indicating that the capacitor is not communicating or disconnected from communication; When the capacitor forms its own network, the red light of the host/slave lights up, indicating that this is the host; The red light of the host/slave is off, indicating that this is a slave. After successful communication between the capacitor and the controller, the capacitor must be a slave, and the red light of the host/slave on the capacitor will turn off, which is a normal phenomenon.
Auto/Manual	When in standby mode, the manual/automatic red light is on, indicating that it is currently in automatic mode; Press and hold the menu button for 1 second. When the automatic/manual red light goes out, it indicates that the capacitor has entered manual mode; Press and hold the menu button again for 1 second, and the automatic/manual red light will turn on, indicating that you have returned to automatic mode; The automatic/manual red light flashing indicates that the simulated switching function has been entered.
C1/A light	The C1/A light is on, and if it is a shared intelligent capacitor, it indicates that the first group is put into operation; When adding capacitors, it means that phase A is put into operation.
C2/B lights	The C2/B light is on, and if the smart capacitor is supplemented together, it means that the second group of capacitors is put into operation; When adding capacitors, it indicates the input of phase B.
C lamp	When the C light is on, it indicates that the compensating capacitor C phase is engaged, and when it is off, it is cut off.
Menu	After powering on the capacitor, press and hold the menu button for 1 second to switch between automatic and manual modes; After entering the parameter setting mode, it can be used to switch interfaces.
△	In automatic mode, press and hold the "△" key for 1 second to switch the interface; After entering parameter mode, hold down the "△" key for 1 second to increment the value, and long press to speed up the increment.
▽	In automatic mode, press and hold the "▽" key for 1 second to switch the interface; After entering parameter mode, hold down the "▽" key for 1 second to increase the value, and long press to accelerate the decrease.

2. Display instructions for the master-slave interface

Co complementary host interface:

Content	Explanatory note
	UAC phase voltage (V): 381V Power factor (cos): 0.70
	IB current (A): 250A Reactive power (kvar): 116kvar
	UAB (V) phase voltage: 381V
	UBC phase voltage (V): 381V
	Voltage distortion rate (%): 00.1%
	Current distortion rate (%): 00.1%
	Capacitor temperature (℃): -21℃
	Device ID: 001

Joint compensation type slave interface: (Note: After becoming a slave, the joint compensation type intelligent capacitor only retains the following 4 interfaces)

Content	Explanatory note
	Device ID: 002
	Capacitor temperature (℃): 011 ℃
	UAB phase voltage (V): 381V
	UBC phase voltage (V): 381V

Partition type host interface:

Content	Explanatory note
	A-phase power factor (cos): 1.00
	B-phase power factor (cos): 1.00
	C-phase power factor (cos): 1.00
	A-phase voltage (V): 220V
	B-phase voltage (V): 220V
	C-phase voltage (V): 220V
	UAB (V) phase voltage: 381V
	UBC phase voltage (V): 381V
	UCA phase voltage (V): 381V
	A-phase current (A): 250A
	B-phase current (A): 250A
	C-phase current (A): 250A
	A-phase reactive power (kvar): 38kvar
	B-phase reactive power (kvar): 38kvar

Content	Explanatory note
9C_038	C-phase reactive power (kvar): 38kvar
FA_00.1	A-phase voltage distortion rate (%): 00.1%
Fb_00.1	B-phase voltage distortion rate (%): 00.1%
FC_00.1	C-phase voltage distortion rate (%): 00.1%
EA_00.1	A-phase current distortion rate (%): 00.1%
Eb_00.1	B-phase current distortion rate (%): 00.1%
Eo_00.1	C-phase current distortion rate (%): 00.1%
t(℃) t__-21	Capacitor temperature (℃): -21℃
Id_001	Device ID: 001

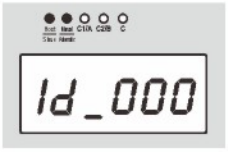
Sub compensation type slave interface: (After becoming a slave, the sub compensation type intelligent capacitor only retains the following 5 interfaces)

Content	Explanatory note
Id_002	Device ID: 002
t(℃) t__011	Capacitor temperature (℃): 011℃
UAb381	UAB phase voltage (V): 381V
UbC381	UBC phase voltage (V): 381V
UAC381	UAC phase voltage (V): 381V

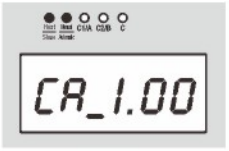
8. Debugging Guide

(Note: When using a matching controller, the factory debugging should mainly follow the debugging guidelines in the controller manual.)

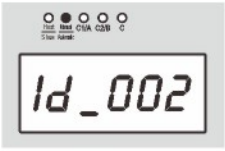
1.1 When the capacitor is powered on at the same time, the LCD screen displays Id-000 and the flashing red lights of the host/slave indicate the networking status.



1.2 The LCD screen displays the A-phase power factor CA-1.00. If the red light of the host/slave stops flashing and the indicator light remains on, it indicates that this device is a host. If the red light of the host/slave stops flashing and the indicator light goes out, it indicates that this device is a slave and the networking is successful.



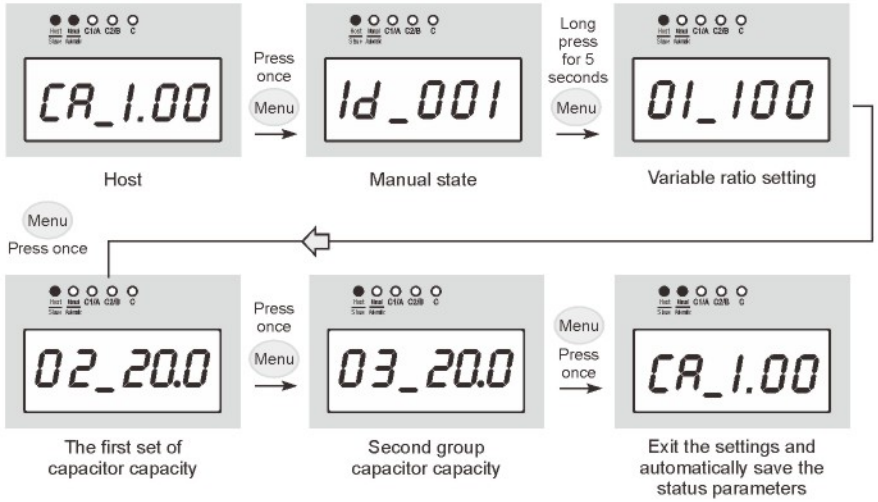
Host



Slave

After the automatic capacitor networking is completed:

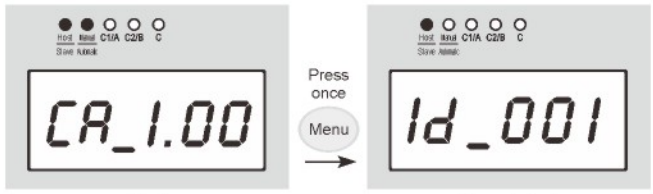
2.1 Find the capacitor with the red light on the host/slave (this is the host), and only set the conversion value for this host. Follow the steps in the following figure to find the ratio setting interface and modify it. (Note: The ratio setting is based on the magnification of the transformer at the main cabinet. If it is 500/5, the ratio value is set to 100.) Press and hold the "△" key to increase the ratio; Long press the "△" key to accelerate the increment, release it to stop! Press and hold the " ▽ " key to decrease, long press the " ▽ " key to accelerate the decrease, release to stop! After modifying the parameters, press the menu key to exit the setting mode in a loop and return to automatic mode. The parameters will be automatically saved.



2.2 After completing the above operation, press and hold the "△" key and "▽" key of the host capacitor at the same time to enter the simulation mode. If not needed, the simulation operation can be ignored. (Note: When the host is in simulated debugging mode, the automatic/manual red light of the master-slave capacitor flashes, indicating that it is currently in simulated debugging mode. At this time, when the capacitor is put into operation, only the indicator light on the capacitor interface changes and the capacitor is not actually put into operation. To exit simulation mode, please press and hold both the "△" and "▽" keys on the host again. When the automatic light stops flashing, you will exit simulation mode.)

Manual switching:

3.1 Press and hold the menu button for 1 second. When the following interface appears, it enters manual switching mode. The following figure



3.2 Press and hold the "△" key to activate; Press and hold the "▽" key to cut off. Note: Manual mode is only used to test the intelligent capacitor switching function

(1) Co compensation capacitor: C1 light represents the switching state of the first group of capacitors; The C2 light represents the switching state of the second group of capacitors. When the capacitor is connected, the corresponding LED light will turn on, and when it is disconnected, the corresponding LED light will turn off.

(2) Complementary capacitor: A light represents the switching state of capacitor A; B light represents the switching state of capacitor B; The C light represents the capacitor C in the same phase switching state; When the capacitor is connected, the corresponding LED light will turn on, and when it is disconnected, the corresponding LED light will turn off.

(3) In manual mode, the host can manually control the input of capacitors from the slave.

(4) After all capacitors are switched, press and hold the menu button for 1 second. When the automatic light on the capacitor interface lights up, it will switch back to automatic mode. (Note: When the host switches back from manual to automatic mode, all capacitors that have not been disconnected in manual mode will be automatically disconnected, which is a normal phenomenon.)

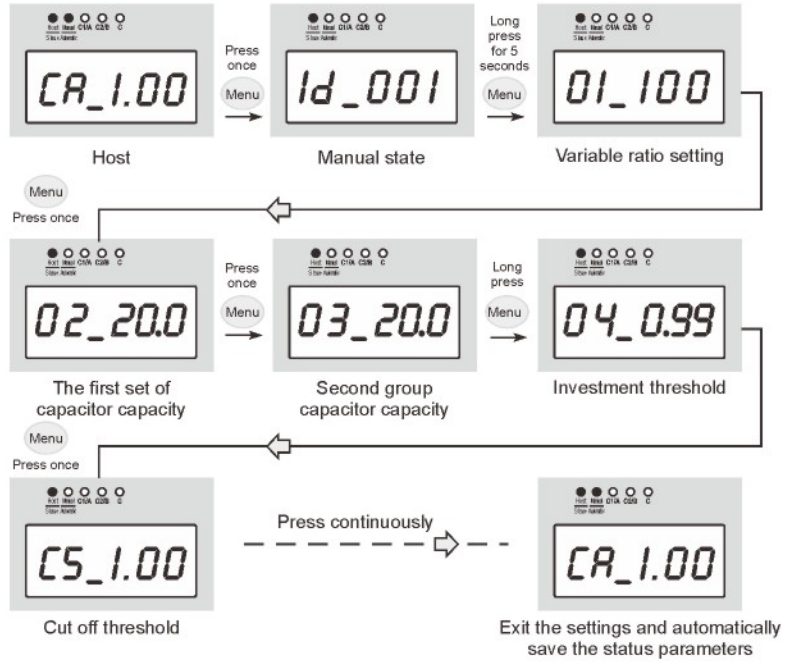
(5) After completing the above operations, you can turn off the power and complete the debugging!

9. Hidden Mode

In hidden mode, intelligent capacitors can be modified in terms of multiple protections such as input threshold, cutoff threshold, input delay, cutoff delay, overvoltage protection, temperature protection, harmonic protection, and quadrant settings. The following steps can be followed for operation! (Note: Quadrant settings are designed for photovoltaic systems on the load side. If the existing compensation device does not provide sufficient reactive power for compensation, it can cause an imbalance in the ratio of reactive power to active power, resulting in a decrease in power factor. When capacitors are not controlled by a controller, they can be modified without the need for a four quadrant controller to control them, allowing them to continue operating normally under photovoltaic conditions. Unless necessary, no modifications should be made!)

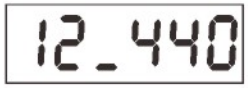
Hidden mode parameter settings:

1.1 Operate as shown in the following figure



Hidden mode interface description:

Content	Explanatory note
	Variable ratio setting: Factory preset: 100, range 001~900. Display magnification example: Transformer ratio 500/5, set to 100. Purpose: To provide measurement and control parameters for the current transformer ratio in the incoming cabinet.
	The first set of capacitor capacity settings: range 01.0kvar~50.0kvar.
	The second set of capacitor capacity settings: range 01.0kvar~50.0kvar.
	Input threshold setting: Factory preset: 0.99, range: 0.10~-0.11. Purpose: The minimum value of power factor compensation for switching capacitors. Input capacitors below this value.
	Cut off threshold setting: Factory preset: 1.00, range 0.11~-0.10 Purpose: To compensate for the maximum power factor of switching capacitors. Cut off the capacitor above this value.
	Switching threshold setting: Factory preset: 01.1, range 00.6~-01.6.
	Power factor lockout setting: Factory preset: 070, range 070-089.
	Input delay setting: Factory preset: 030 seconds, range 001~300 seconds Purpose: Delay time for capacitor input.
	Cut off delay setting: Factory preset: 030 seconds, range 001~300 seconds Purpose: Delay time for capacitor cut off.
	Loop interval setting: Factory preset: 000, range: 000~020.

Content	Explanatory note
	Sub compensation overvoltage protection setting: Factory preset: 245V, range 230~300V. Purpose: When the grid voltage exceeds this set value, the capacitor that has been put into operation will be disconnected.
	Co compensation overvoltage protection setting: Factory preset: 440V, range 410~480V. Purpose: When the grid voltage exceeds this set value, the capacitor that has been put into operation will be disconnected.
	Partial undervoltage protection setting: Factory preset: 170V, range 000-210V. Purpose: When the grid voltage is lower than this set value, the capacitor is cut off.
	Partial undervoltage protection setting: Factory preset: 170V, range: 000-210V. Purpose: When the grid voltage is less than this set value, the capacitor is cut off.
	Common undervoltage protection setting: Factory preset: 310V, range 000-370V. Purpose: When the grid voltage is less than this set value, the capacitor is cut off.
	Overvoltage hysteresis setting: Factory preset: 005V, range 002~012V. Purpose: After overvoltage, the capacitor is cut off. When the grid voltage is less than the overvoltage value hysteresis value, the capacitor is put into operation. After undervoltage, cut off the capacitor. When the grid voltage is greater than the undervoltage value+hysteresis value, the capacitor is put into operation. No capacitors are put into operation within the hysteresis range.
	Voltage harmonic protection setting: Factory preset: 005%, range: 000%~099%. Purpose: When the total harmonic of the power grid voltage is greater than the set value, the capacitor is cut off. Cancel protection when the value is 0.

Content	Explanatory note
17_040	Current harmonic protection setting: Factory preset: 040%, range: 000%~099%. Purpose: When the total harmonic of the power grid current is greater than the set value, the capacitor is cut off. Cancel protection when the value is 0.
18_001	Slave quantity setting: Factory preset: 001, range 001~050.
19_065	Temperature protection setting: Factory preset: 065 ℃, range 020~080℃. Purpose: When the temperature of the capacitor is higher than the set value, cut off the capacitor and lock the output until the alarm is cleared.
20_006	Temperature hysteresis setting: Factory preset: 006 ℃, range 002~010℃. Purpose: After the over temperature alarm, when the capacitor temperature is less than the over temperature value minus the temperature return difference, the temperature protection is released and the capacitor is put into operation.
21_100	Current sensitivity setting: Factory preset: 100, range 020~100.
22_ on	Manual protection settings: Factory preset: ON, range ON, OFF.
23_002	Quadrant setting: Factory preset: 002, range 002, 004.

Press the up and down keys on the setting screen to modify parameters. After setting the parameters, press the menu as needed to cycle to the automatic screen, and the parameters will be automatically saved.

1.2 Data Clearing:

(1) Clear networking data: Hold down the "▽" key for a long time without releasing it, then power on the capacitor and hold for 3 seconds to clear it.

(2) Clear input cut-off: Press the "△" key without releasing it, then power on the capacitor and hold for 3 seconds to clear.

10. Product Accessories and Instructions

Serial number	Name	Specifications	Purpose	Notes
1	Connecting line	0.3m	Used to connect the network cables between smart capacitors on the same layer in series.	Each smart capacitor will come standard with one.
		0.8m	A network cable used to connect the upper and lower intelligent capacitors in series with each other.	When equipped with a controller or a matching transformer, one will be standard. (Note: This Ethernet cable is packaged together with the controller)
		1.5m	A network cable used to connect smart capacitors with matching transformers without an intelligent controller.	When equipped with a matching transformer, a standard cable will be included (Note: this cable will be placed together with the transformer)
		2.6m	Ethernet cable used for connecting intelligent controllers and intelligent capacitors.	When equipped with a controller, a standard cable will be included (Note: this cable will be packaged together with the controller)
		2.6m markings 485A and 485B	A network cable used to connect smart capacitors or smart controllers to backend terminals.	When users require 485 communication, a configuration will be made. (Note: This network cable will be placed together with the controller/transformer)
2	Secondary current transformer	Co complementary type	When using a co complementary intelligent capacitor as the host, it should be selected	 Co complementary type
		Split supplement (mixed supplement) type	When using a distributed intelligent capacitor as the host, choose	 Split supplement (mixed supplement) type

11. Common Faults and Troubleshooting

Serial number	Abnormal condition	Reason	Solution
1	The capacitor is not connected	Poor communication between products: Poor communication between products and controllers; The distribution current is too small (the load is too light)	Check if the capacitor module is networked and displays the correct address, and if the communication cables are connected properly. It is a normal phenomenon for the load current to be too small and not put into operation.
2	Capacitors can be used, but the compensation effect is not good	If the current of a certain phase is too small, it will affect the operation of the three-phase compensation capacitor.	Add phase separation compensation capacitors in the system.
3	The capacitor can be activated, but the power factor remains unchanged after activation.	Is the installation position of the current transformer correct; Is the phase sequence of the voltage and current lines correct.	The installation position of the distribution current sampling transformer should be such that both the capacitor and the load current flow through the current transformer; The phase sequence of voltage and current lines must be connected correctly.
4	After the capacitor is powered on, the external indicator light of the cabinet will light up	Check if the voltage of the external indicator light and the sampling voltage of the common terminal are correct.	The indicator light for the shared capacitor should be connected to 380V, and the common terminal should be taken as phase B; The auxiliary capacitor indicator light should be connected to 220V, and the common terminal should be set to N phase.
5	Product over temperature protection	After the capacitor in the product is overheated, it will exit operation and resume working after the temperature drops, achieving the purpose of protecting the capacitor.	No need to handle it