

BJ-CB212

Automatic Power Factor Controller

User Manual

Version: 1.4

Read me

When you use BJ-CB212 Power factor controller, be sure to carefully read this user manual, and be able to fully understand the implications, the correct guidance of operations in accordance with user manual, which will help you make better use BJ-CB212 Power factor controller, and help to solve the various problems at the scene.

The material in this guide is for information only and is subject to change without notice. Blue Jay Technologies Co., Ltd reserves the right to make changes in the product design without reservation and without notification to its users.

1. Before the meter turning on the power supply, be sure that the power supply within the provisions of the instrument;
2. When installation, the current input terminal must non-open, voltage input terminals must Non-short circuit;
3. Communication terminal (RS232 or RS485) is strictly prohibited to impose high pressure;
4. Be sure the instrument wiring consistent with the internal system settings;
5. When communicating with the PC, instrument communication parameters must be consistent with the PC



- **Please read carefully before using this user manual**
- **Please save this document**

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1. SUMMARIZE

This product is intended for use in an industrial environment.

This equipment is classified as open equipment and must be mounted in an enclosure during operation to provide safety protection.

This manual shows how to install and operate the CB212 power factor controllers. Please read this manual carefully before installation. Keep it for maintenance and operation.

Safety

- 1) Installation, maintenance and operation of the CB212 Controller must be performed by qualified technicians.
- 2) Make sure that the work voltage of the controller is between 415V AC - 20% to 415V AC + 10%, 50Hz \pm 10%.
- 3) Do not open the cover of the controller. User should not try to fix it.
- 4) The CB212 Controller is connected to a current transformer. Do not unplug the current transformer connections before making sure the current transformer is short circuited, or connected to another low impedance load. Failure to do so may cause dangerous high voltages.

Application conditions

- 1) Environment temperature: -25°C to +55°C
- 2) Altitude: less 2000 m
- 3) Humidity: Maximum 90%

2. TECHNICAL PARAMETER

Standard applied: The Electric Industry Standard of the People's Republic of China:
< DL / T 597—1996 >

Basic parameters

Operating voltage : 415V AC (-20% ~ +10%), 50Hz ± 10%

Sampling current: 0—5A, AC

Power consumed: ≤ 10VA

Measuring sensitivity: 100mA

Measuring accuracy: Voltage: 0.5 class;

Current: 0.5 class;

Power factor: 0.5 class;

Power: 1.0 class;

Reactive power: 2.0 class;

Frequency: 0.1 Hz.

Overall Size: 144 X 144 X 110 mm.

Mounting dimensions: 138 X 138 mm.

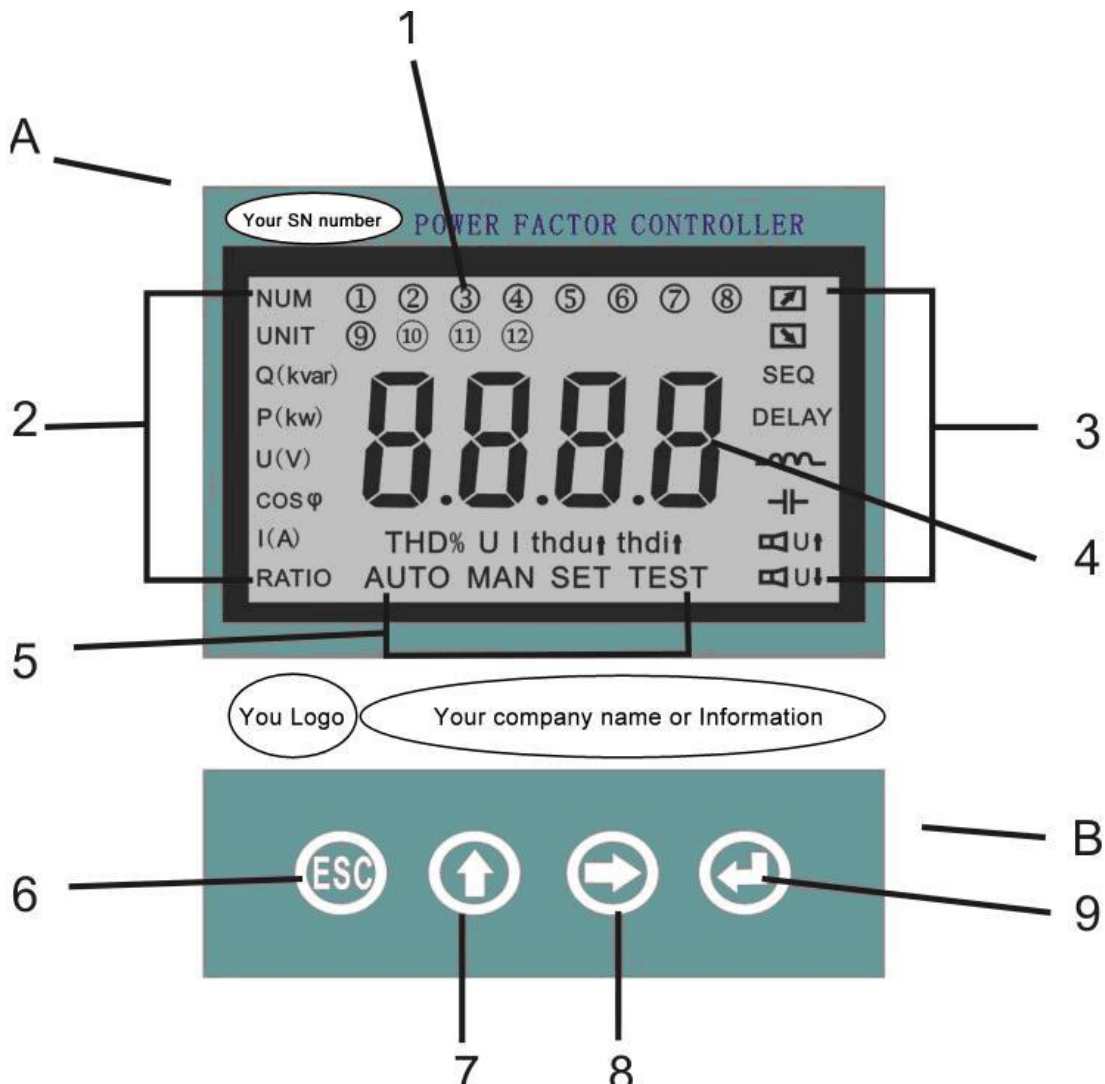
Functions

1. Control object: Reactive power. Stable in all range.
2. Detect phase sequence automatically: Controller will detect the CT polarity internally, as well as the voltage phase Ub and Uc.
3. Multiple output modes available.

3. LCD DISPLAY & KEYPAD

A. LCD Display

- | | |
|--------------------|--------------------------|
| 1. Outputs | 2. Electrical parameters |
| 3. Operating state | 4. Numerical display |
| 5. Main menu | |



* Main menu

AUTO: Automatic operating mode

MAN: Manual operating mode


SET: Setting parameters


TEST: Testing mode


* Electrical parameters


| | | |
|----------|-------|---|
| Q (kvar) | | Reactive power |
| P (kw) | | Power |
| U (V) | | Voltage |
| COS φ | | Power factor |
| I (A) | | Current |
| F ##.# | | Frequency (Hz) |
| THD%U | | Total harmonic voltage distortion ratio |
| THD% I | | Total harmonic current distortion ratio |

* Operating states

: The load is in inductive state.


: The load is in capacitive state.


: Maximum voltage. High voltage alarm setting. All capacitors will be cut off if voltage over this setting.

: Minimum voltage. Low voltage alarm setting. All capacitors will be cut off if voltage below this setting.

thdu↑: Maximum total harmonic voltage distortion. Alarm setting. All capacitors will be cut off if total harmonic voltage distortion over this setting.

thdi↑: Maximum total harmonic current distortion. Alarm setting. All capacitors will be cut off if total harmonic current distortion over this setting.

: The capacitor is going to be turned on.

: The capacitor is going to be turned off.

B. Keypad

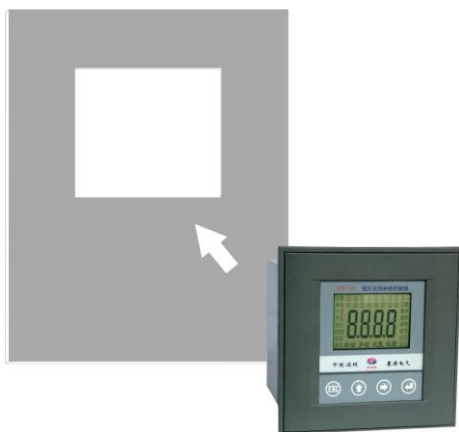
6. ESC key: Press this button to exit current state and return to main menu.

7. ↑ key: In AUTO Mode: press this button, the LCD will display U, I, P, Q, COS φ and Frequency in turn;
In SET Mode; press this button, the number will increase by 1, from 0 to 9.

8. → key: In AUTO Mode, press this button to display the next parameter; In SET Mode, press this button to set the next number

9. ↵ key: In SET Mode, press this button to save the setting in memory and go to the next setting;
In MAN Mode, press this key to switch on the capacitor, press the button again to switch the same capacitor off.

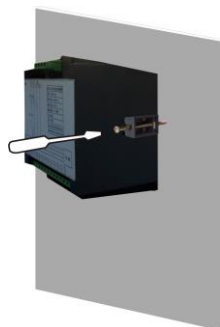
4. INSTALLATION



1. Push the controller slightly into the hole on the panel.



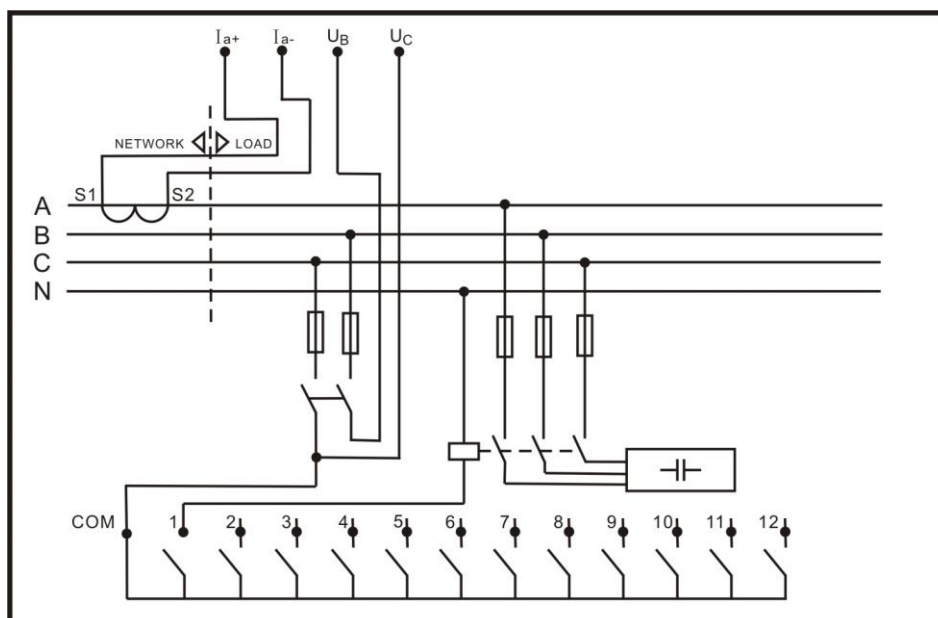
2. Insert the Mounting Brackets in the corresponding holes (both sides) of the controller.



3. Turn the Screw in the Mounting Bracket and tight it.

5. WIRING DIAGRAM

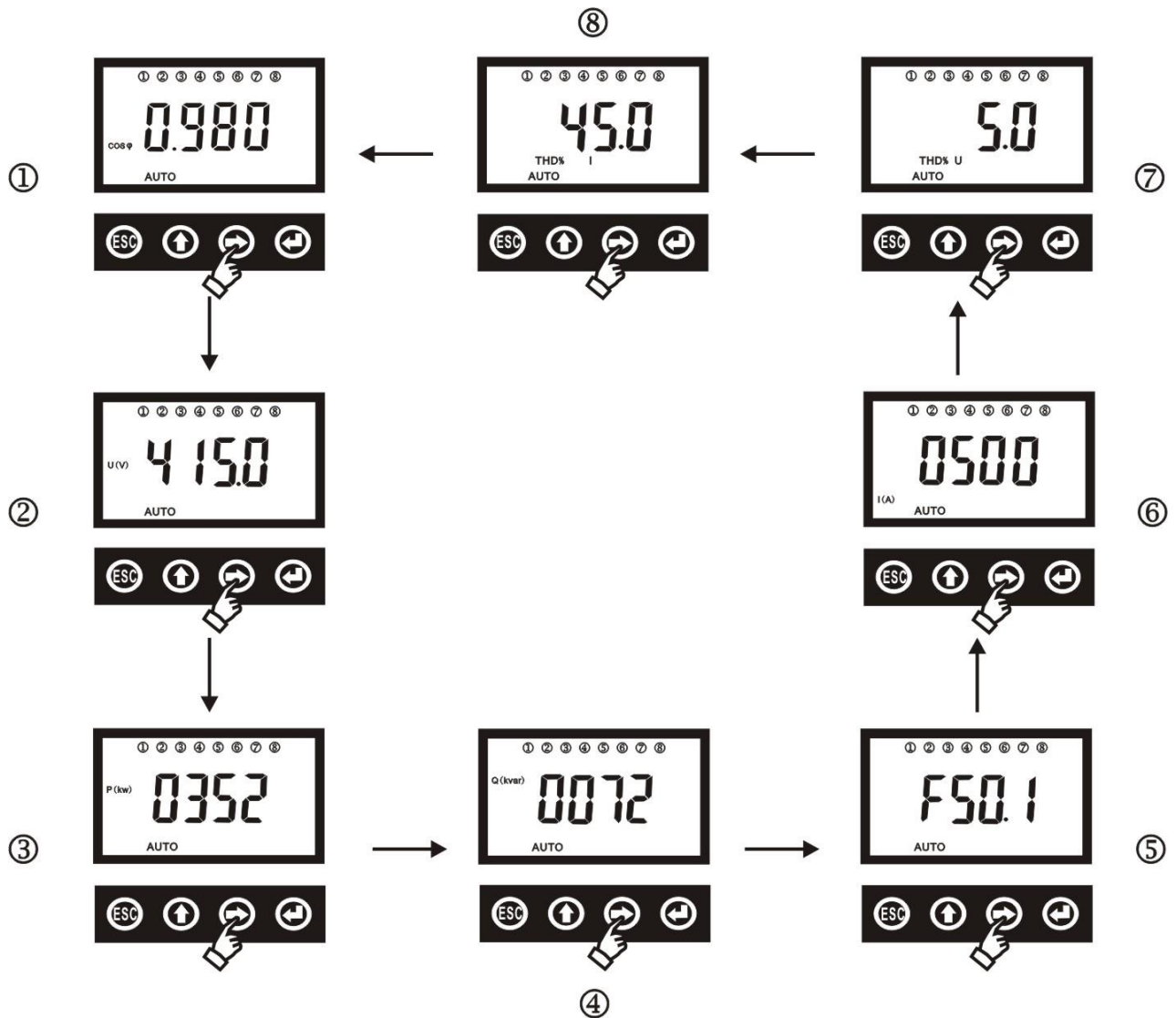
Input voltages are U_B and U_C (415V) . Input current is I_a . (current phase must be different from voltage phases)



6. OPERATING MODE

6.1. AUTO Mode

Turn on power, the controller will enter AUTO mode. Press “↑” button, the display will show all parameters one by one automatically. Press “→” button, the display will show the next parameter.



6.2. MAN mode

Press ESC button in the main menu, the "AUTO" will flash. Press button "→", the "MAN" will flash. Then press button "↵" to enter "MAN" Mode, as the figure shows below.



Manual operation

In this mode, the capacitor can be switched on/off manually. Press button “↵” will switch the capacitor (the flashing number) on, press the button again will switch the same capacitor off. Press button “↑” to go to the next left output (capacitor); press button “→” to go to the next right output (capacitor).

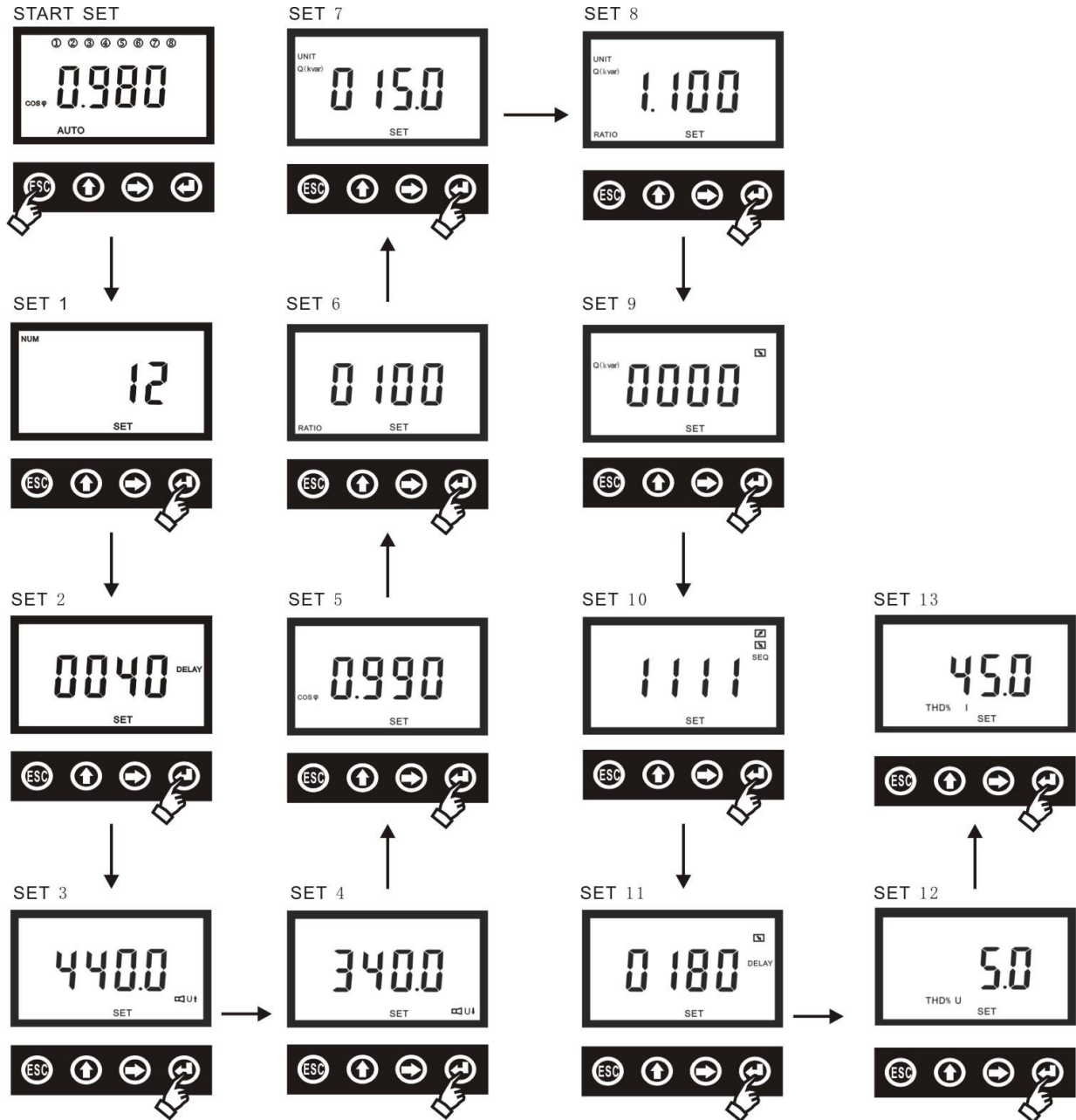
Press button “ESC” will return to the AUTO mode and switch off all capacitors.

In Manual mode, if a capacitor is switched off, the controller will wait a “Waiting Time” before the same capacitor switching on again, to give the capacitor a discharge time.

6.3. SET mode

Press ESC button in “AUTO” mode, then press “→” button twice to choose SET mode, then press “↵” button to enter “SET” Mode.

Press “↑” and “→” button to set the selected (flashing digit) parameter, press “↵” button to save the parameter and go next.



SET 1: Number of outputs: Press button "↑", the number will increase by 1 in the range of 0-9. Press button "→", the cursor will go to the next position. Press button "↓" to save the number of outputs. The maximum outputs are 12.

SET 2: Delay time (Second): The controller continues to monitor the state for a period of time, to confirm that the circuit always requires to add (switch on) a capacitor for this period of time. Usually, the delay time is set to 30~40s

SET 3: Maximum voltage (V): If voltage is higher than this setting, the controller will switch off one capacitor every 0.5 seconds. Only after the voltage lower than the setting by 6V, will the capacitor be allowed to switch on again.

SET 4: Minimum voltage (V): If voltage is lower than this setting, the controller will switch off one capacitor every 0.5 seconds. The capacitor is allowed to switch on again as soon as the voltage above the setting.

SET 5: Target COSφ: Target power factor. Usually set to 0.980 ~ 0.99.

SET 6: CT ratio: The current transformer ratio setting. If the current transformer (CT) is 500 / 5, the setting should be 100 (not 500).

SET 7: Capacitor capacity (kvar): The capacity of a single capacitor. If the controller is set to 1-2-2-2 or other code output mode, it is the capacity of the first capacitor (the smallest one).

SET 8: Capacitor coefficient: The capacitor capacity × capacitor coefficient = Switch on limit. When the Q power ≥ Switch on limit, the controller will add (switch on) a capacitor into the circuit. Usually, it sets to 1.100 ~1.200

SET 9: Switch off limit: Usually set to 000.0

SET 10: Switching sequence: Following switching sequences are available:

| | | |
|------------------------|------------|---|
| Circulation switching: | 1111 | 1 |
| Coded switching: | 1122 | 2 |
| | 1222 | 2 |
| | 1244 | 4 |

SET 11: Waiting time (second): To allow the capacitor a time to discharge. Usually, the delay time is set to 120 ~ 180 seconds.

SET 12: thdu↑: Maximum total harmonic voltage distortion. Alarm setting. All capacitors will be cut off if total harmonic voltage distortion over this setting.

SET 13: thdi↑: Maximum total harmonic current distortion. Alarm setting. All capacitors will be cut off if total harmonic voltage distortion over this setting.

If you choose the RS485 port

SET 12: UNIT SEQ: Set the slave device address, user can free to set 1~32

SET 13: Baud ratio: User can free to set 2400/4800/9600/14400/19200/28800/38400

Thdu↑ and thdi↑ following the **SET 13**

When parameter setup is completed, press ESC button back to “AUTO” mode.

6.4. TEST mode

Press ESC button in “AUTO” mode, then press button “→” three times, the LCD will show “TEST”. Then press button “↵” to enter “TEST” Mode. Shown as below:



In this mode, the controller switches capacitors on and off one by one in cycle, alternatively for 5 seconds. Each capacitor will follow the rule of Waiting Time (i.e. 180 seconds) before switching on again.

7. RS485 COMMUNICATION PORTOCOL

MODBUS © protocol

The composition of the RS-485 cabling must be carried out with a meshed screen cable (minimum 3 wire), diameter of not less than 0.5mm², with a maximum distance of 1,200 m between the CB212 and the master unit. This Bus may connect a maximum of 32 CB212

Note:

1. For communication with the master unit, customers can choose the RS-232 to RS-485 converter to use
2. Not all the CB212 with RS485 port, please check your ordered product to confirm if the meter have remote communication function
3. Communication Baud ratio standard 4800/9600 adaptive

Due to product modifications or custom requirements, the interface pin place may be change. For details, please refer to product label on the rear board

Modbus RTU Frame Format:

| | | |
|-------------------------|---------------|--|
| Address code | 1 BYTE | <i>Slave device address 1-247</i> |
| Function code | 1 BYTE | <i>Indicates the function codes like read coils / inputs</i> |
| Data code | 4 BYTE | <i>Starting address, high byte Starting address, low byte Number of registers, high byte Number of registers, low byte</i> |
| Error Check code | 2 BYTE | <i>Cyclical Redundancy Check (CRC)</i> |

Example

Host to Slave

| Addr | Fun | Data Address (high) | Data Address (low) | Data Number (high) | Data number (low) | CRC16 (low) | CRC16 (high) |
|------|-----|---------------------|--------------------|--------------------|-------------------|-------------|--------------|
| 01H | 03H | 00H | 00H | 00H | 08H | 44H | 0CH |

Slave to Host

| Addr | Fun | Byte count | Data1 low | Data1 high | Data2 low | Data2 high | Data3 low | Data3 high | Data4 low | Data4 high |
|-----------|------------|------------|------------|------------|------------|------------|------------|------------|-----------|------------|
| 01H | 03H | 10H | AAH | 02H | 72H | 0FH | 83H | 02H | F4H | 01H |
| Data5 low | Data5 high | Data6 low | Data6 high | Data7 low | Data7 high | Data8 low | Data8 high | CRC16 high | CRC16 low | |
| 2AH | 01H | 40H | 01H | 00H | 00H | 00H | 00H | 1BH | 19H | |

Register address table

| Address | Parameter | Data Range | Word mode | property |
|---------|--|------------|-----------|----------|
| 0000H | Power factor (Resolution 0.001) | 0~0.999 | Word | R |
| 0002H | Phase to phase Voltage Vbc (Resolution 0.1) | 0~999.9 | Word | R |
| 0004H | Current Va (Resolution 0.1) | 0~999.9 | Word | R |
| 0006H | Frequency (Resolution 0.1) | 0~999.9 | Word | R |
| 0008H | Active power (Resolution 0.1) unit: KW | 0~999.9 | Word | R |
| 000AH | Reactive power (Resolution 0.1) unit: KVar | 0~999.9 | Word | R |
| 000CH | Capacitor switching status | 0~9999 | Word | R |
| 000EH | Fault status | 0~9999 | Word | R |

Example of three decimal (power factor): 02AAH = 682 (decimal) **real value** 0.682

Example of one decimal (frequency): 01F4H = 500 (decimal) **real value** 50.0

Tel: +0086-023-67628702

Email:tech@cqbluejay.com

www.cqbluejay.com

Add: 1802, Building 2, No.88, Jianxin East Road, Chongqing, 400020, China

Note:

For capacitor switching status

Each bit represents one step switch state: **1 for switch closed, 0 for switch open**

Example:

| | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 | D9 | D10 | D11 |
|-------------|----|----|----|----|----|----|----|----|----|----|-----|-----|
| data | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 |

Mean step 1, 3, 7, 9, 10 switch **closed** (capacitor connect to the grid)

Step 2, 4, 5, 6, 8, 11, 12 switch **open** (do not connect in grid)

For Fault status:

| | D0 | D1 |
|---------------|----|----|
| Normal | 0 | 0 |
| Over voltage | 1 | 0 |
| Under voltage | 0 | 1 |

8. TROUBLESHOOTING

1. After power turned on, the controller shows capacitive state, Capacitor is not switched on .

A. The wiring is not correct. Please check the voltage and current phases sequence (refer to wiring diagram).

B. If other capacity compensation devise is running on the load side, it may make the load real capacitive circuit.

2. After a capacitor switched on, the Power Factor remain unchanged.

The current transformer may not in the right position. The current go through capacitors should also go through the CT. (refer to wiring diagram).

3. After capacitor switched on, Power Factor decrease.

A. The wiring is not correct. Please check the voltage and current phases sequence (refer to wiring diagram).

B. Turn off all power to the capacitor cabinet, then turn on power again (reset the system).

4. The controller can not follow the change of the load fast enough.

The load changes too fast, such as welding machine, derrick and crane etc. Use dynamic power factor control system in these cases.

5. After capacitor switched on, the current go through capacitors raises too high.

The circuit may have high harmonic current and/or harmonic voltage.

1. Add an inductor in each capacitor, it protects the harmonic current go through the capacitor, but can not eliminate the harmonic current of network.

2. Install harmonic current filter. If harmonic current is too big, installing a harmonic current filter is an effective way to limit the harmonic current.

9.- TECHNICAL SERVICE

For any inquiry about the instrument performance or whether any failure happens, contact to Blue Jay's technical service.

Blue Jay - After-sales service

*Building 13, 2-8, Jialing third village Pioneer Park,
Jiangbei District , 400020 Chongqing*

Tel - + 0086 023 86850812

Fax - + 0086 023 67636974

E-mail : tech@cqbluejay.com