佰跃电气
BAIYUE ELECTRIC

Baiyue Electric
Digital Relay

FTU-BC300

recloser controller

user's manual

catalogue

1 START UP PREPARATION

1.1 Important step

In order to ensure trouble free operation of the product, please carefully read the following chapters in order to provide you with help and guidance during the whole installation process of the product.

Before you plan to install or use the controller, you must understand all warnings and precautions in this manual to avoid personal injury, equipment damage or shutdown.

1.1.1 Precautions and warnings

Precautions: the operators of BC300 should know that if the equipment is not used under the conditions specified in this manual, it may cause property damage, personal injury or even death, so they must comply with the relevant provisions and instructions in the manual.

Use of symbols

The following icons in this manual indicate safety related conditions or other important information:

 Electrical warning icon: indicates that there is a risk of electric shock.

 Warning icon: indicates that it may cause property damage, personal injury or even death.

 Information icon: remind the reader of relevant facts and conditions.

Early warning and warning may lead to property loss, personal injury or even death, which must be clear;Therefore, all warning and warning instructions must be strictly observed.

 Warning: the terminal of BC300 controller backplane may have dangerous voltage, even within a few seconds after disconnecting the auxiliary power supply.When in use, the grounding position of BC300 recloser controller backplane must be well grounded.

 Warning: the BC300 controller contains electrostatic sensitive devices. When opening the shell, you must wear an anti-static bracelet with good grounding and avoid unnecessary contact with the devices.

 Warning: to prevent electric shock, always disconnect the device from the power outlet before opening the housing.

 Warning: do not place the BC300 controller in an environment with water vapor penetration, violent temperature change, long-term strong vibration, high dust, flammable, explosive or corrosive gas.

 Information: damaged device seals will not have the right to Claim Warranty and will no longer ensure normal operation.

1.2 Unpacking inspection

Open the packaging box of BC300 device and inspect it for actual damage or missing items.

The information provided here does not include all the details of changes in the described equipment, nor does it take into account the conditions that may be encountered during installation, operation and maintenance.

1.3 Safety instructions

The grounding position on the BC300 circuit board must be properly grounded.

Before using the front port to communicate with BC300, make sure that the computer is grounded.

 If you use a laptop, do not connect it to the power supply.The reason is that the power supply or connector cable may not be properly grounded.

The reason for this is: not only to protect personnel, but also to avoid the voltage difference between the serial port of the controller and the computer port.Because the voltage difference may cause permanent damage to the computer or relay.

1.4 Summarize

1.4.1 System introduction

With the increasing capacity and scope of the power system, only setting relay protection devices for each component of the system is far from preventing the serious accident of long-term large-area power outage in the whole power system.Therefore, it is necessary to start from the overall situation of the power system to study what kind of working conditions the system will present, what characteristics will appear when the system loses stability, and how to restore its normal operation as soon as possible after the fault components are cut off by the action of the corresponding relay protection devices.

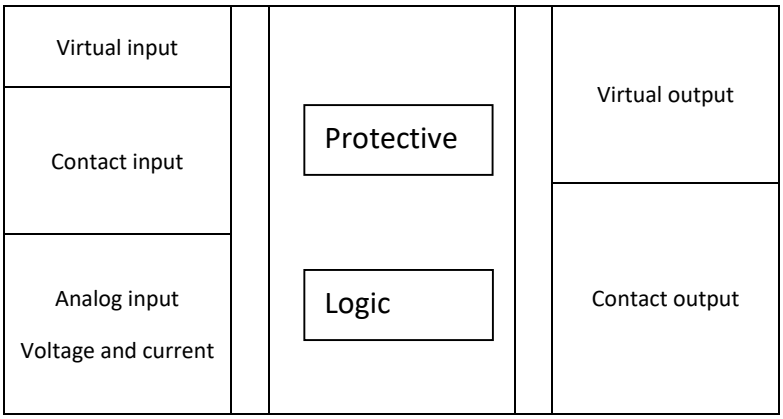
The task of system protection is to limit the scope of influence to the minimum and reduce the load outage time to the minimum when the normal operation of the large power system is damaged.

The protection, control and measurement functions are initially completed by electromechanical components, then by static components, and finally by digital equipment.Digital devices integrate all these functions into one device, which is called intelligent electronic devices (IED).These IEDs must not only complete all functions related to protection and control, but also communicate quickly. They must share information with each other, and send these information to the control and dispatching center. This kind of electronic intelligent equipment can reduce the number of components and wiring by 70% at most.

BC300 is one of the new generation equipment in this category, and can be easily used with distribution automation system.

1.4.2 Hardware composition

BC300 uses a series of interconnected modules to perform protection and control functions.First, it includes a set of AC transformers to detect current and voltage.Once these amplitudes are digitized, they are sent to a digital signal processor (ARM).BC300 is a digital relay whose CPU can control a variety of input / output signals.



Contact input / output: it is a signal used in conjunction with the actual input / output contact in the relay.

Analog input: it is the input signal from current and voltage transformers, which is used to monitor the power system signal.

Logic: logic controller.It is a control module for unit configuration (input / output assignment) and Realization of logic circuit.

Protection elements: relay protection elements, such as over-current, over-voltage, under current, under voltage, low frequency, over-frequency protection, etc.

1.4.3 Communication composition

The processor performs detection, protection, control and communication functions.It communicates with man-machine interface by using special serial port.The serial connection has strong anti electromagnetic interference ability.Therefore, the security of the system is enhanced.

The front of BC300 has a USB port

Communication protocol: IEC60870-5-101, MODBUS protocol. Different protocols can be set for different communication ports and can be operated at the same time.

2 Product description

2.1 Summarize

BC300 recloser controller integrates protection, control, monitoring and recording. It adopts large capacity, resource redundancy design and plug-in structure. It is suitable for the protection, control and monitoring of

power systems of various voltage levels, and can be configured for the protection of various distribution feeders.Users can choose different logic to apply to different objects according to the needs of the site.The protection function also supports different types of power grids, such as neutral ungrounded system, arc suppression coil grounding system and small resistance grounding system.In addition, BC300 can store 4 groups of protection settings, and the group switching function makes it quickly and conveniently adapt to a variety of operation modes.Time synchronization and event reporting can reduce fault diagnosis time and maintenance cost..

BC300 supports RS232 bus network form to meet the communication and network structure requirements of different users, different industrial sites, different network environments and systems of different scales.IEC60870-5-101 protocol can be used to realize the communication with upper layer equipment.

2.2 Technical specifications

2.2.1 Sampling accuracy

Protection current: ± 3%

Voltage: ± 2%

Frequency: ± 0.02Hz

2.2.2 Monitoring

Transient event

Capacity: 100 rolling events

Resolution: 1ms

Triggering: digital input state change, protection element triggering, self inspection state change, fixed value modification

Storage: stored in nonvolatile memory

2.2.3 Input

2.2.3.1 Current input

Measuring range: 0 ~ 75A

Power consumption: Rated 5A, no more than 0.5VA per phase

Rated 1A, no more than 0.2VA per phase

Overload capacity: 3 times of rated current, continuous operation 20 times rated current for 2s

2.2.3.2 Contact input

Voltage threshold: 18VDC ~ 36VDC

Impedance: >100k Ω

De buffeting time: 1 ~ 99ms, differential 1ms

2.2.3.2 Voltage input

Measuring range: 5 ~ 270V

2.2.4 Output

Do3-4

Contact type: normally open point

Continuous load: 10A

Breaking capacity: DC, inductive load, l/r=40ms, 220V/0.5A

2.2.5 Control power supply

Rated value: 24VDC

Range: 18-36VDC

Power consumption: less than 10W in normal operation and not more than 15W in operation

2.2.6 Communication

RS232

Speed: 1200-38400bps

Default rate: 9600bps

Protocol: Modbus RTU, IEC60870-5-101

2.2.7 Type test

Medium strength: GB/T145983-2006:2000vac

Insulation resistance: GB/T145983-2006:>100m Ω

Impulse voltage: GB/T145983-2006:5kv

Vibration test: GB/T11287-2000: Level 1

Impact and collision: GB/T14537-1993:level 1

Oscillation wave immunity: GB/T1459813-2008: Class 3, 1MHz, 2.5kv/1kv

Electrostatic discharge: GB/T1459814-1998: level 4, ± 8Kv contact / ± 15kV air

Radiated electromagnetic field: GB/T145989-2002: Level 3, 10v/m

Electrical fast transients: GB/T1459810-2007: class A, ± 4kv/2.5khz and 5KHz

Surge immunity: GB/T 14598.18-2007: Level 3, ± 2kv/ ± 1kV, once /min

RF conducted immunity: GB/T 14598.17-2005:level 3, 10V

Radiated emission limit: GB/T 14598.16-2002: range 30MHz ~ 1000MHz, ranging 3M, step size 50KHz, 1ms, bandwidth 120kHz

Conducted emission limit: GB/T 14598.16-2002: range: 150kHz ~ 30MHz, step size: 5KHz, 20ms, If bandwidth 9KHz

2.2.8 Environment condition

Operating temperature: -20 ℃ ~ +60 ℃

Storage temperature: -40 ℃ ~ +80 ℃

Humidity: 90% no condensation

Type test report can be provided if required by the customer.

3 Installation of BC300

3.1 Mechanical installation

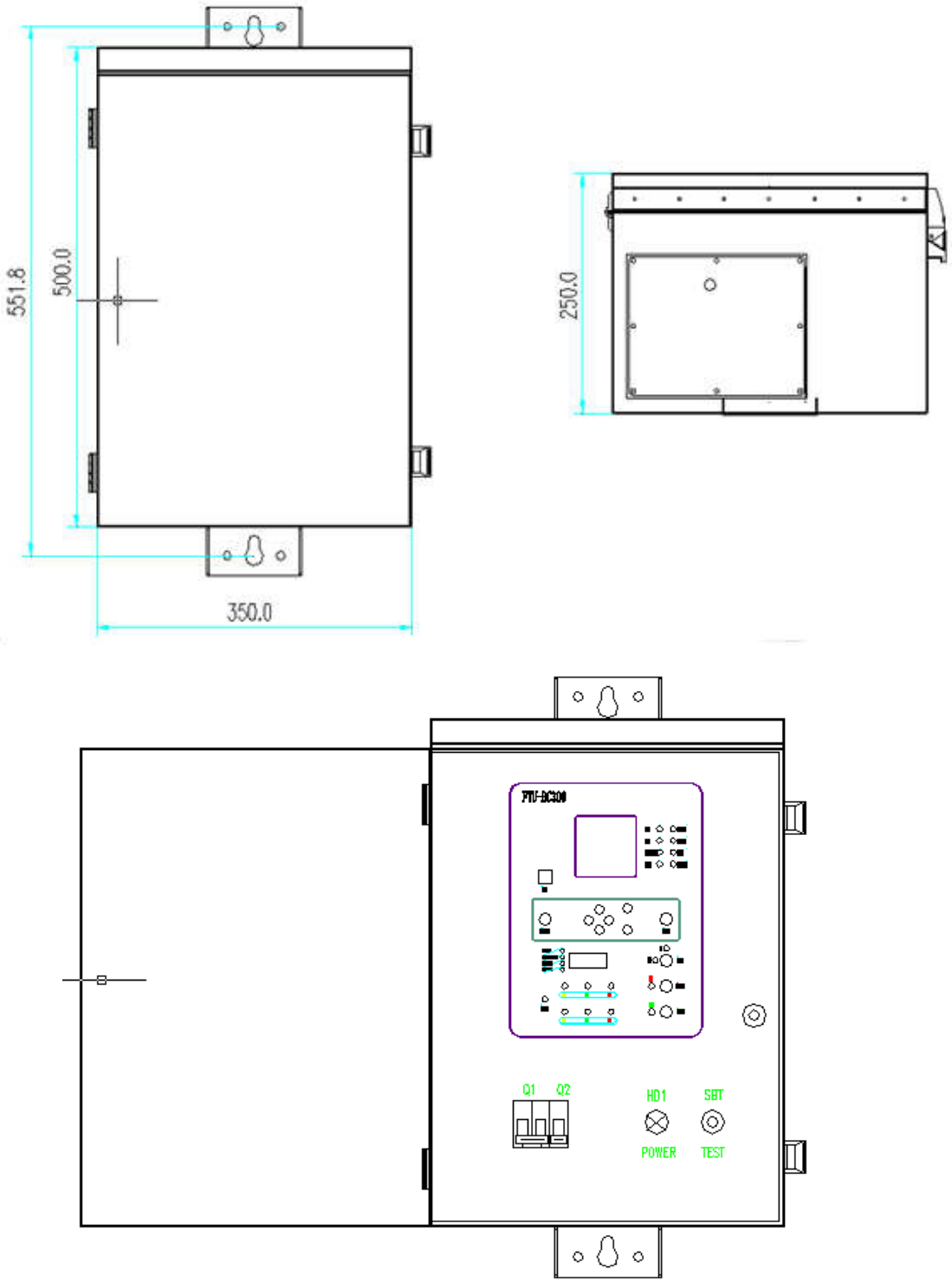


Figure 3.1-1 installation diagram （SIZE:350*500*250）

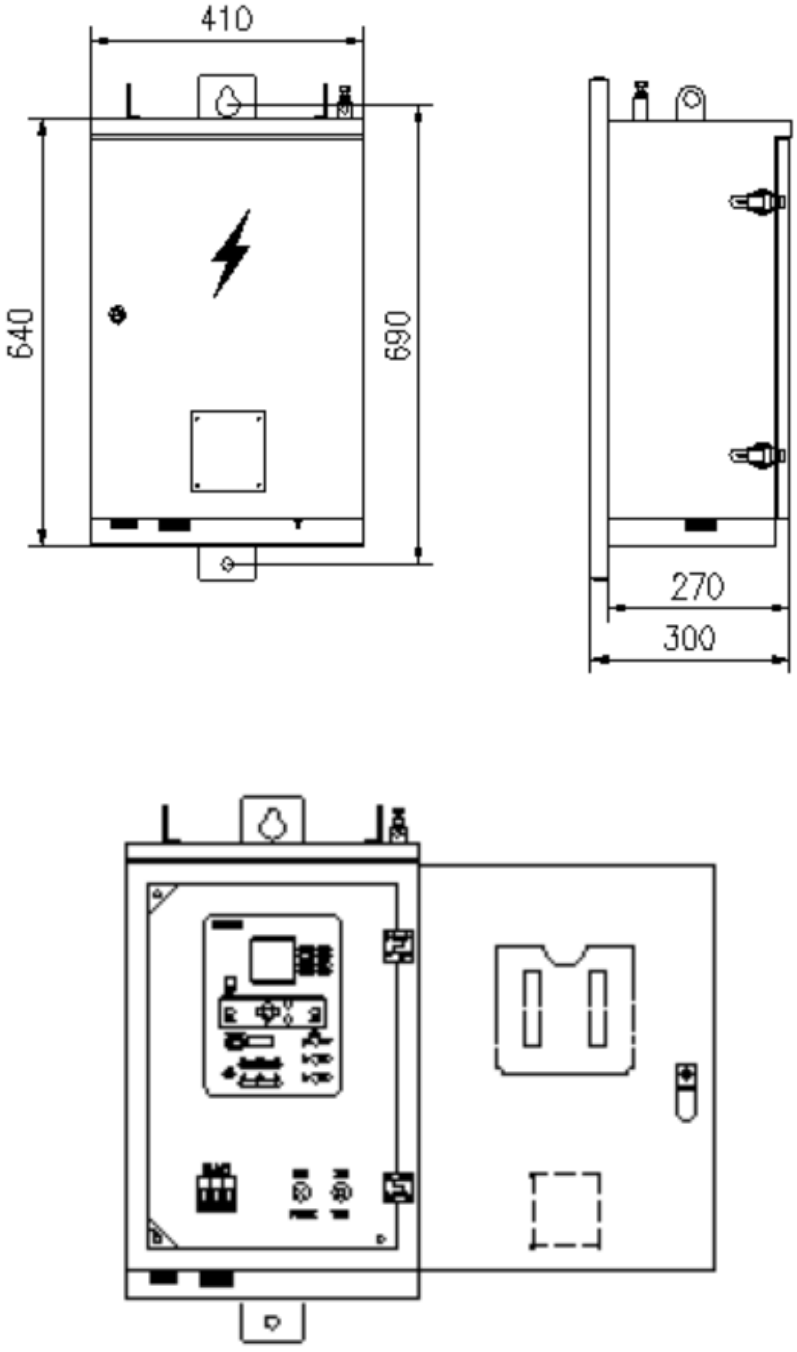


Figure 3.1-2 installation diagram （SIZE:410*640*270）

3.2 Front panel

Figure 3.3 front panel of BC300 device

On the front panel of BC300:

- 11 operation keys
- A USB port,
- 23 LED indicators,
- A 160*160 LCD.

BC300 is set on the panel. The user can set the constant value, parameters and other data of the device through the operation of keys. The device status can be observed through the LCD and LED lights.

3.2.1 LCD display

BC300 adopts liquid crystal display, which can display many information, such as:

- Single line diagram, including real-time positions of switches, disconnectors and grounding switches;
- Real time values of protection current and voltage;
- Equipment version, serial number, self inspection and other information
- Incident reporting (SOE)
- Various equipment parameters
- Various constant value parameters
- time

3.2.2 LED indication

BC300 device has 23 LED indicators, which can be used to indicate the operation status, protection action information, device alarm, communication status, remote and local, switch position, etc.

3.2.3 Key

There are 10 keys on the BC300 panel.

There are 7 main operation keys, and their functions are shown in the following table (table 3.2).

Key	icon	Brief description
Up / down key "Left" / "right" key		Move the cursor up or down or increase or decrease the value
		Move the cursor left and right or switch between main screens
"OK" key		Enter the next menu or follow the prompts on the screen
"Return" and "Cancel" keys		Return to the previous menu or follow the prompts on the screen
"Reset" key		Reset signal indicator Hold attribute relay and signal relay
Key combination		In SOE interface, press simultaneously to clear all event records

Table 3.2 definition of BC300 front panel keys

R/I: remote / local key

Close: closing operation key

Open: opening operation key

3.3 Backplane terminal description

Terminal definition:

Terminal group T4 is analog voltage;Terminal group T3 is analog AC current;

Terminal group T1 is the device power terminal;Terminal group T2\T5 is contact input and output terminal;

3.4 Electrical wiring

3.4.1 AC current and voltage wiring

The double row terminals T3 and T4 of BC300 backplane are AC wiring terminals, and the maximum allowable wire diameter is 6mm²Cable wiring for.

Warning: most of the printed boards in the BC300 chassis are electrostatic sensitive devices. When opening the chassis, you must wear a well grounded anti-static bracelet.

BC300 has 4 current inputs, including 3 protection current inputs and 1 zero sequence AC current input.

■IA, IB and IC are protection current inputs.

■I01 can be connected to zero sequence current, unbalanced current, etc.

3.4.2 Power input wiring

The wiring terminal group T1 of BC300 backplane is the power wiring terminal, AC 220V, which supplies power to the internal switching power supply.

3.4.3 Contact input

The terminal strip T5 of BC300 backplane is an input terminal, and the maximum allowable wire diameter is 1.5mm²Cable wiring for.All inputs of BC300 are active.

BC300 makes time sequence record (SOE) for all input displacement.

3.4.4 Contact output

T2 terminal strip on the back of BC300 has 4 control outputs.

The output mode of BC300 is pulse.The corresponding pulse width (0.01~2.55s) can be set according to different conditions.

3.4.5 Communication wiring

3.4.5.1 RS232/485 wiring

T6 terminal strip on the back of BC300 has RS232/485 communication

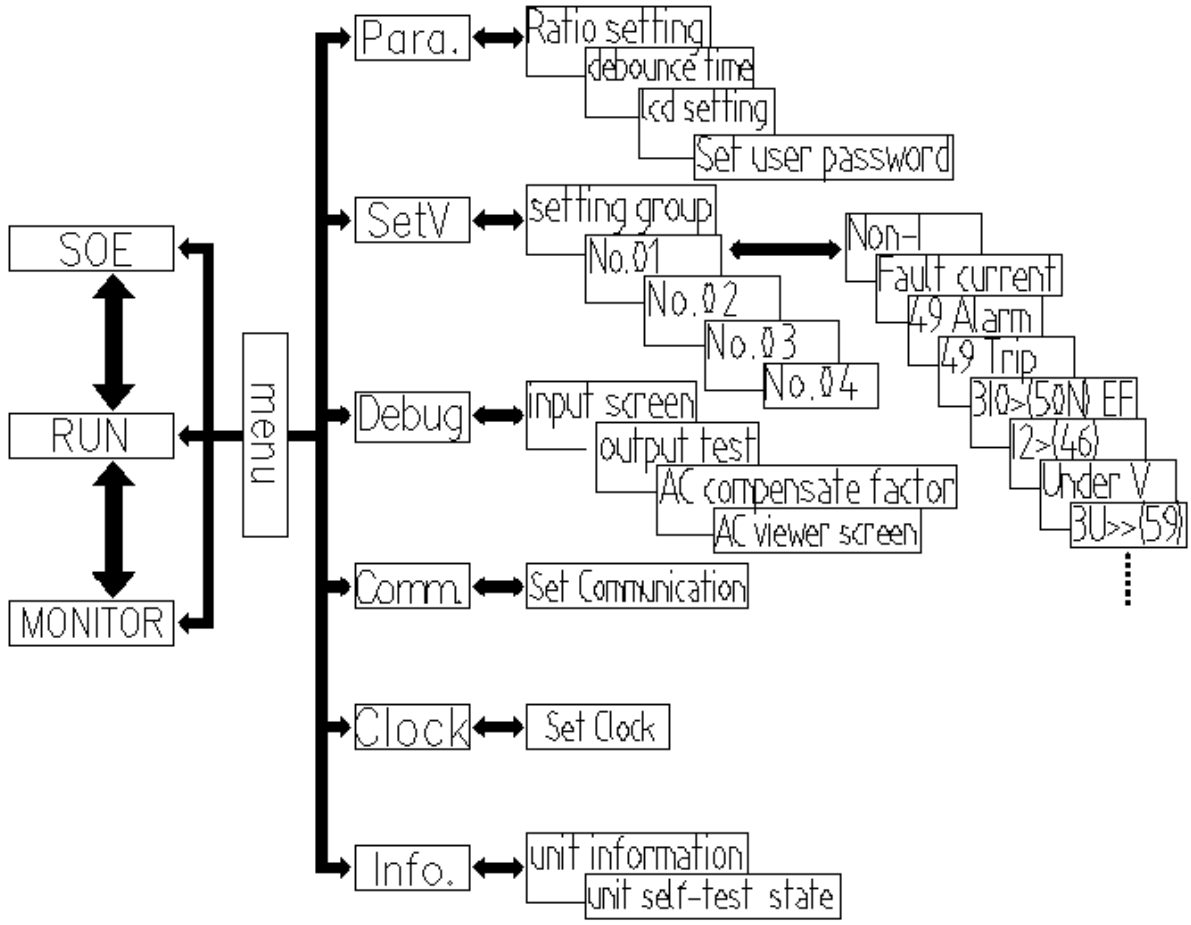
3.4.6 Grounding connection

The BC300 backplane has a ground position marked as.It must be well grounded.

4 Interface operation

4.1 Text menu navigation

BC300 has a text menu, which is a main menu for visualizing setting and changing settings through the human-computer interface.Press the "left" or "right" key in the main interface, and the screen can be switched under the event recording interface, monitoring screen and operation screen.Press "enter" to enter the main interface, select the corresponding submenu to enter the next submenu or perform relevant actions, and press "ESC" to return to the previous menu.To move inside the top-level menu without changing to other lower level menus, press the "left" and "right" keys to move.The following figure is an example of BC300 menu navigation diagram.



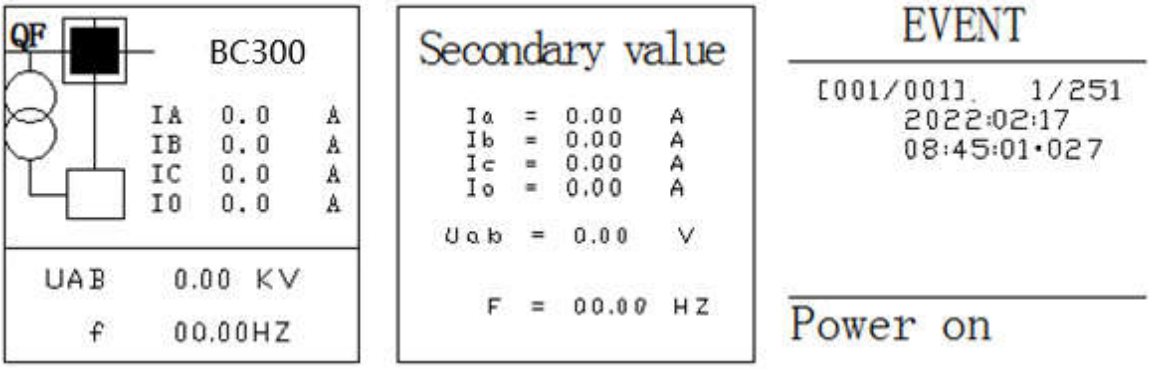
4.2 Power on

When the device is powered on, a blank screen will appear on the LCD;Then all LED lights are turned on at the same time, "run" running light is green, "remote" remote indicator light is green, "local indicator light is green," alarm "standby indicator light is yellow, and other indicator lights (LED1~LED8) are red. The user can observe whether these lights are correct.

When BC300 is started, it also performs self-test on clock, setting value, logic data, power supply voltage, flash memory, internal temperature, etc.After successful startup, the screen will enter the main interface screen, and the protection logic module will be opened immediately;If there is an error in the self-test item, the screen will generate the "self test error" event recording screen, and close the protection logic module.

4.3 Main screen

There are two main screens, namely "operation screen" and "monitoring screen". The "event record" screen and the main screen are at the same level. Each screen can be switched by "left" and "right" keys.



4.4 Manual opening and closing operation

Manual opening and closing operation refers to opening and closing of relay outlet.

The steps are as follows:

Observe the main panel. The remote local position of the device is in the local position. Observe the switch status position. When the switch is in the off position, press the closing button to close the switch, and vice versa.

If the device is under password protection, the manual opening and closing operation cannot be carried out, and the user needs to "log in" to the operating system first.After successful login, press the closing or opening button to switch on and off.

At this time, the device emits a "snap" sound (the internal relay of the device acts), and the screen enters the "event record" screen, generating the corresponding SOE record of closing and opening.At this time, it indicates that the manual opening and closing operation is successful.Without any operation, the screen will automatically switch to the main screen after 60s.

4.5 User login

BC300 uses password protection program. When the user is not logged in, press "enter" key in the main screen to enter the main menu, and select different units to observe each screen, but cannot modify any parameters of the device.If it is necessary to modify the parameters of the device, you must enter the password in the password input pop-up window that appears when modifying the fixed value and press the "enter" key to log in to the user. After successful login, you can modify the corresponding parameters of the device.The "up" and "down" keys modify the number, and the "left" and "right" keys move the cursor

Press "ESC" to exit after the modification. There will be an option to save the modification. Press "enter" to save the modification. Press "ESC" to not save the modification.

Information: after the BC300 password is decrypted, if there is no operation for 60 seconds, the password protection will take effect again.The factory initial password of the device is 000000

4.6 Main menu

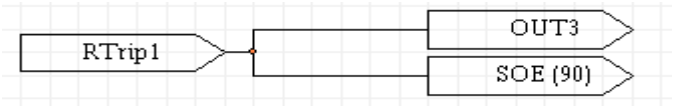
Press "enter" in any main screen to enter the main menu, as shown in Figure 4.3.The main menu screen is mainly composed of 6 submenus.You can move the cursor up, down, left and right to select the submenu, and the selected object will be displayed in reverse.After selecting the submenu, press "enter" to enter the submenu, and press "ESC" to return to the previous menu.After entering the submenu, press the left and right keys to select major items, and press the up and down keys to select minor items to be modified;After selection, press the "enter" key to modify with the up and down keys. After modification, press the "enter" key again to complete the modification

Serial number	Submenu	annotation
1	parameter	Set ct/vt transformation ratio, input filter time, screen setting, password, etc
2	Fixed value	Used to set the current set value group and modify the set value of the device
3	debugging	Including switching value input and output information and analog value coefficient correction
4	communication	Set communication address, rate, protocol, check bit, etc
5	clock	Set device date and time
6	information	Check the device self-test status, local information

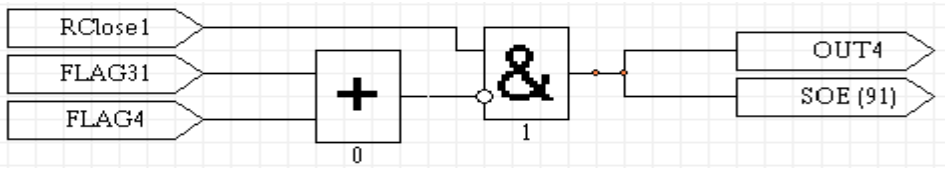
Table 4.3 main menu details

5 Protection and control functions

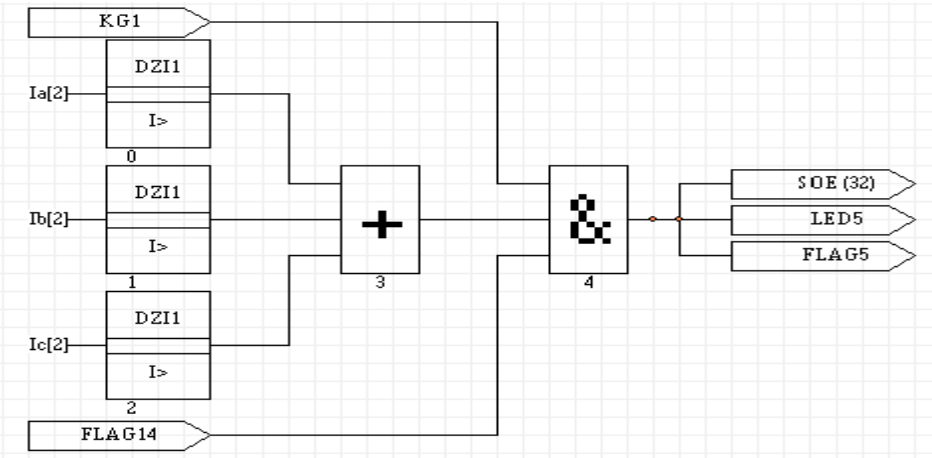
5.1 Remote Trip



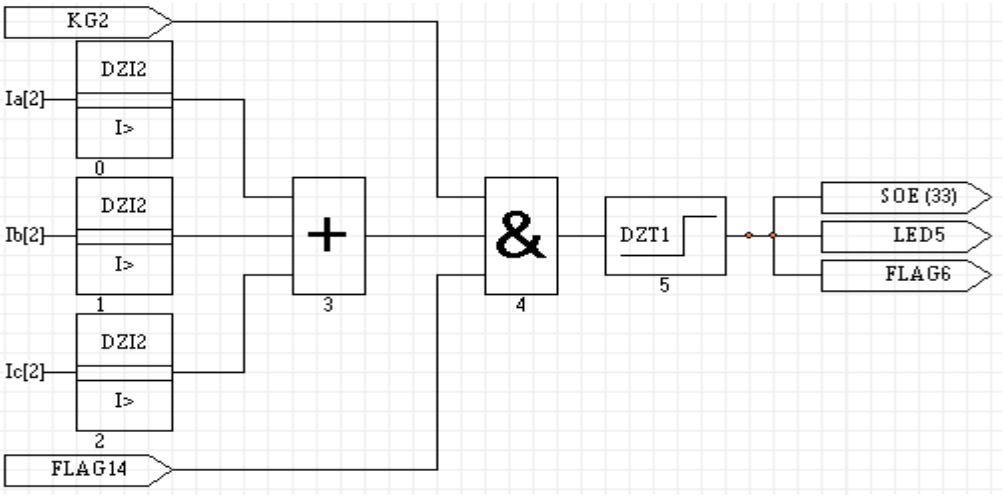
5.2 Remote control closing



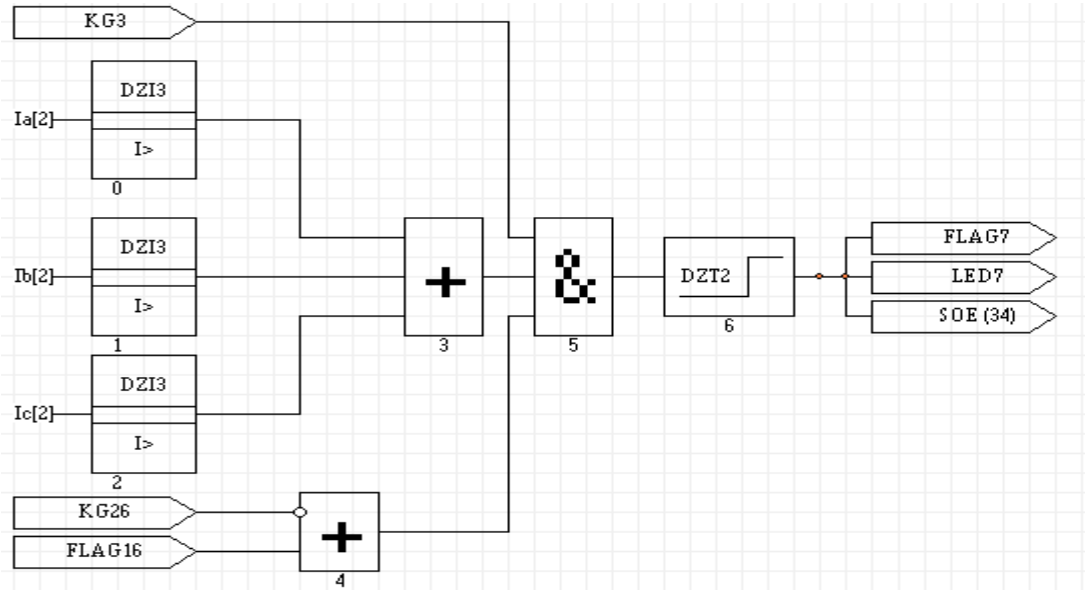
5.3 Instantaneous quick break



5.4 Delay quick break



5.5 Definite time overcurrent



5.6 Inverse-time overcurrent

The inverse time element reflects the time / current curves of four international standards, namely, general inverse time, strong inverse time, super inverse time and long inverse time.The inverse time element is composed of current input, set current value, characteristic curve setting value, inverse time multiple and binary output.

The time and current relationship according to iec-255 and bs-142 can be expressed as follows:

$$t_{(s)} = \frac{K.\beta}{\left(\frac{I}{Ie}\right)^{\alpha} - 1}$$

Where, t (s): action time

K: Inverse time constant

I: Current input

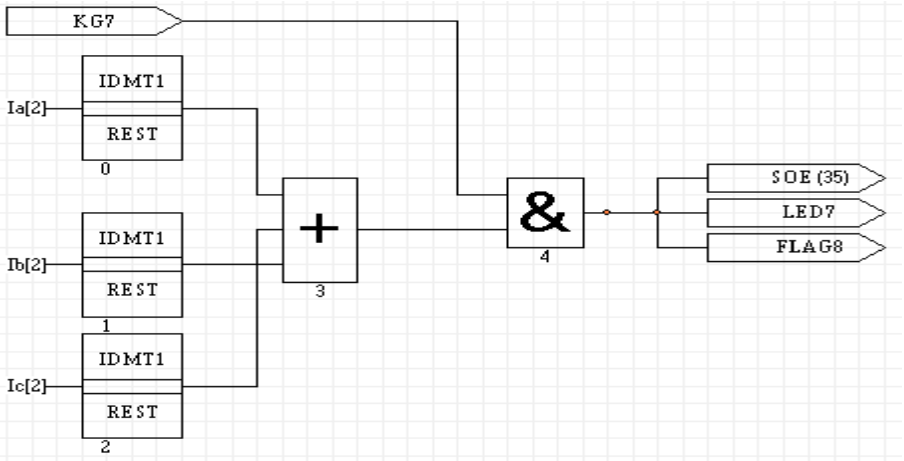
Ie: inverse time limit rated current

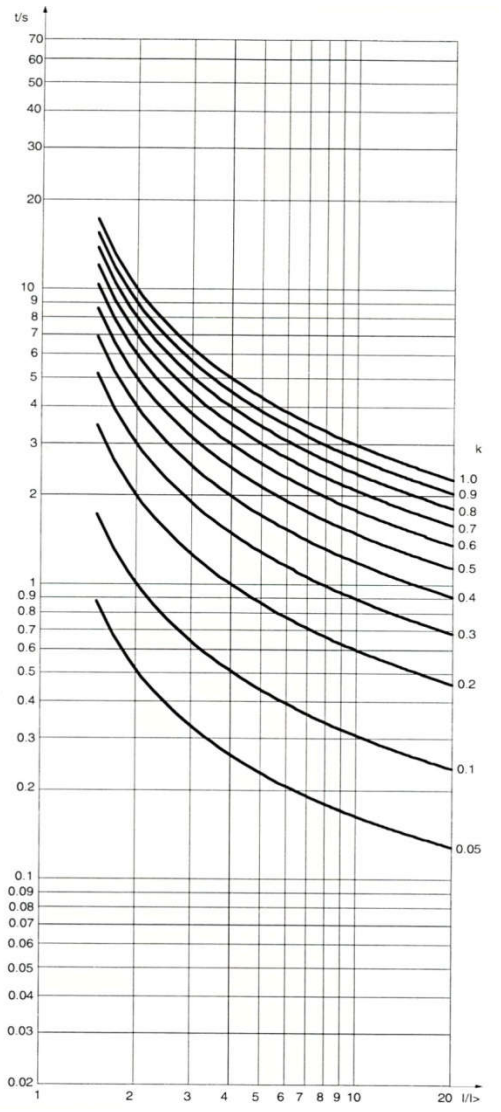
constant α 、 β The value determination curve is as follows:

Curve	Time / current curve group	α	β
IEC curve a	General inverse time limit	0.02	0.14
IEC curve B	Strong inverse time limit	1.0	13.5
IEC curve C	Super inverse time limit	2.0	80.0
IEC long inverse	Long inverse time limit	1.0	120.0

inverse time limit parameter values

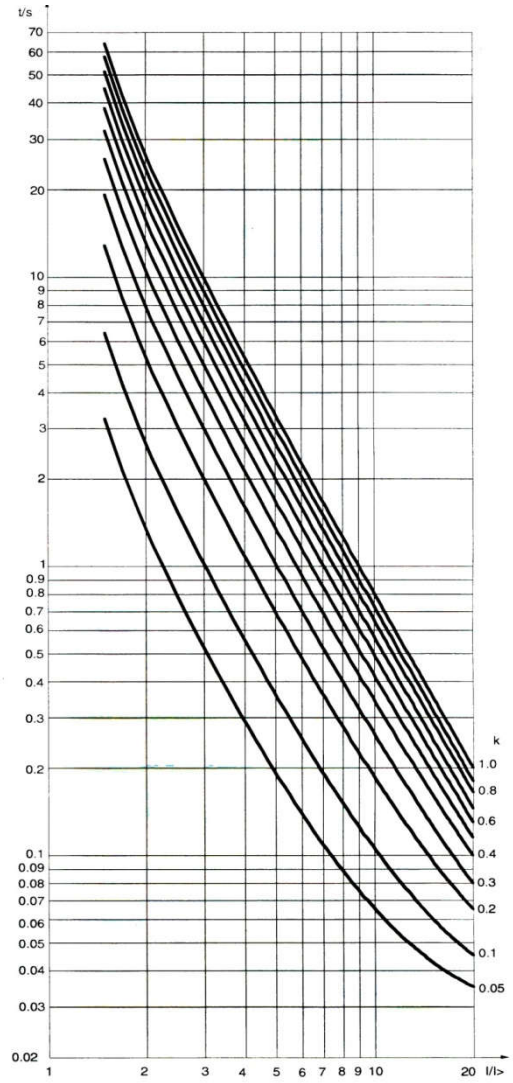
Standard bs-142.1966 limits the normal current range to 2~20 times the set value. In addition, when the component is a general inverse time limit, strong inverse time limit or super inverse time limit, it must be started when the current exceeds 1.3 times the set value;When the element is a long inverse time limit, it will start when the current exceeds 1.1 times the set value.The protection logic diagram is as follows:





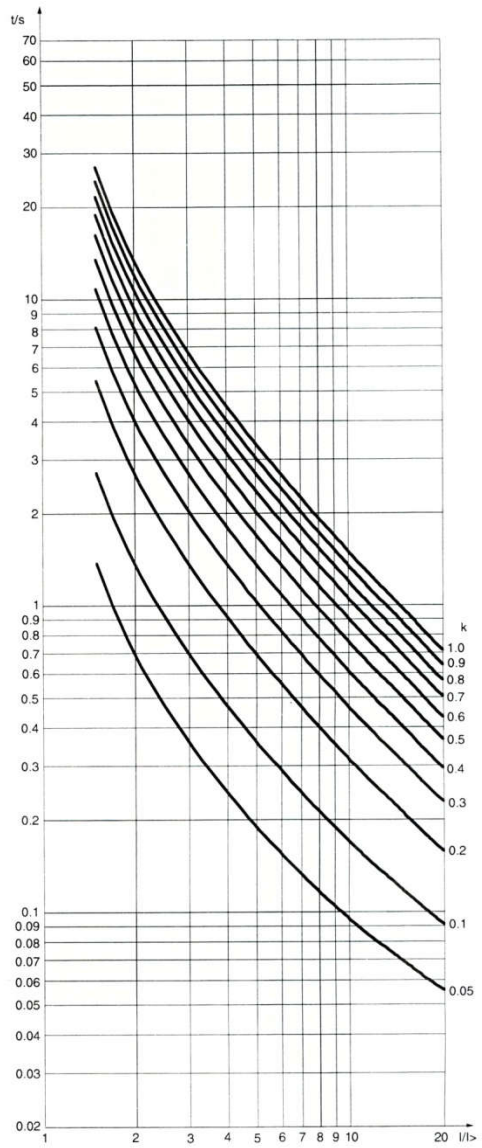
General inverse time curve

α =zero point zero two β =zero point one four



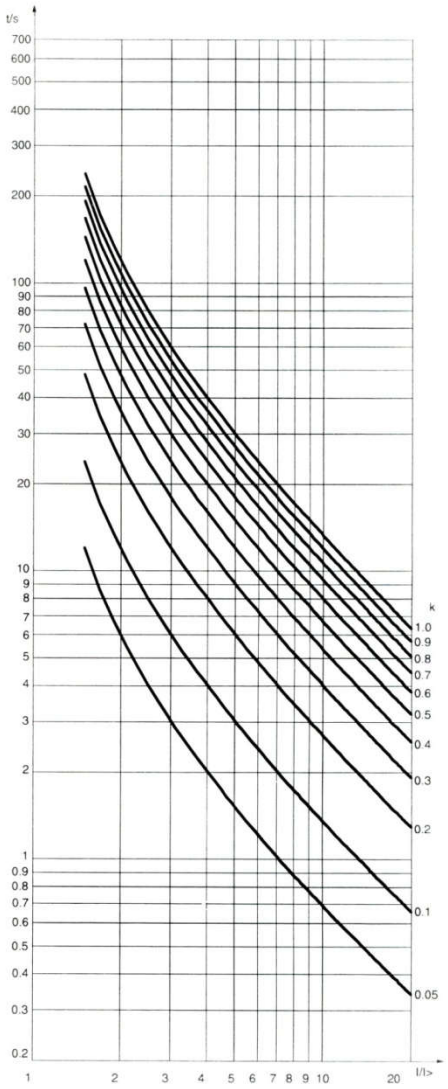
Strong inverse time curve

α =two β =eighty



Super inverse time curve

α =one β =thirteen point five

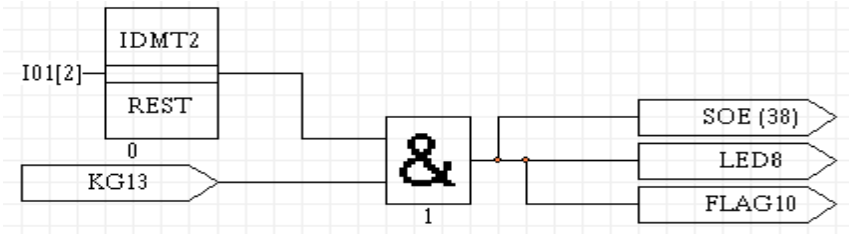


Long inverse time curve

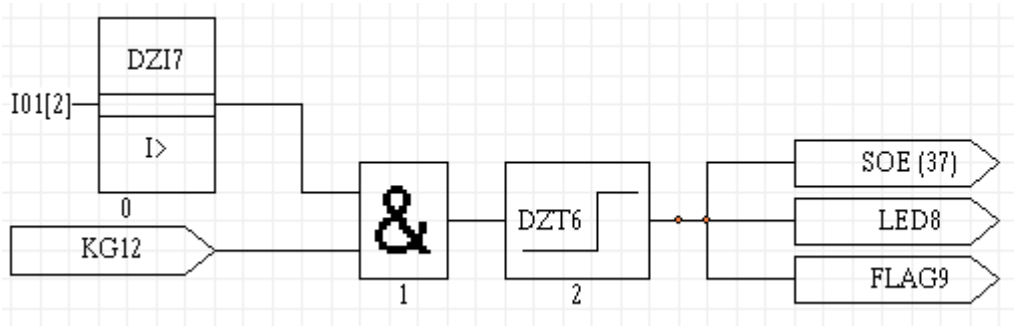
α =one β =one hundred and twenty

5.7 Zero sequence inverse time overcurrent

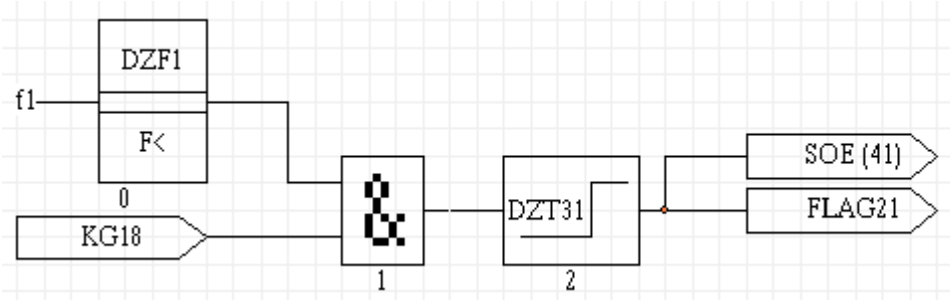
The principle of zero sequence inverse time overcurrent protection is the same as that of inverse time overcurrent protection. When the calculated in current is greater than the set value, a signal will be sent through the inverse time element. The protection logic is as follows:



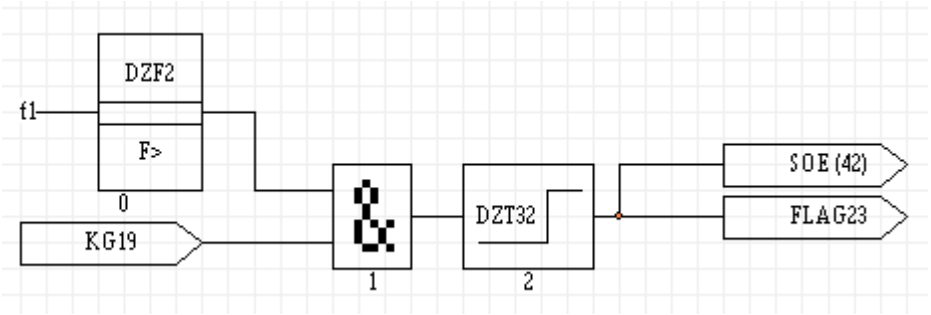
5.8 Zero sequence definite time overcurrent



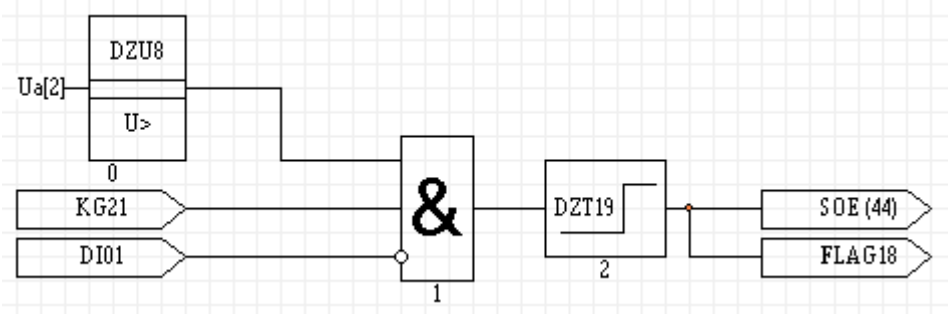
5.9 Low frequency protection



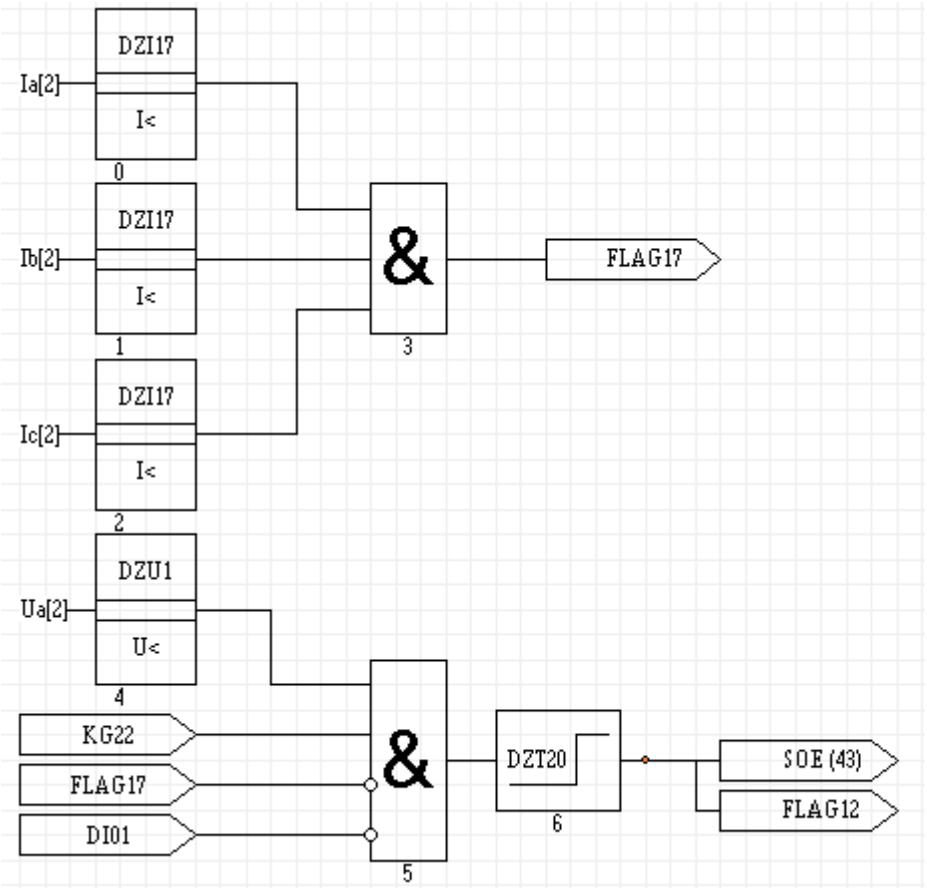
5.10 High frequency protection



5.11 Overvoltage protection



5.12 Undervoltage protection



6 Commissioning inspection

6.1 Visual inspection

Confirm that BC300 is free from any damage during transportation and that all screws are properly tightened.

6.2 General considerations for power network

All equipment using AC current will be affected by frequency.The relay has been calibrated in the factory using a network with a minimum harmonic component of 50 or 60Hz.When testing relays, a power supply network whose waveform does not contain harmonics must be used.Ammeters and timers for testing relay action values and action times must be calibrated, and their accuracy is higher than that of relays.The power supply used for the test must be stable. The main thing is that the value of the power supply should be close to the action threshold.

It is important to point out that the accuracy of the test depends on the power grid and instruments used.It is very useful to check whether the relay operates normally by using improper power network and instruments for function test.Therefore, an approximate method can be used to verify the action characteristics of the relay.

6.3 Post

6.3.1LED detection

After the device is powered on, the LED can automatically light up, and the color is correct (green, red and yellow). After the self-test, if the device works normally, the operation indicator (run) works with the pulse attribute.

6.3.2 Liquid crystal

After power on, the LCD will light up to check whether there are blind spots and whether the displayed data, images and text are complete.

6.3.3 Device self test

When the device is powered on, it also performs self-test on clock, setting value, logic data, power supply voltage, flash memory, internal temperature, etc.If all self inspection items are correct, the device opens the function module to enter the main interface.If the device has a self-test error, the device will report a self-test error event record.

6.4 Key detection

After the device is powered on, each key can be operated flexibly and reliably, and can make correct response.

6.5 Screen display and switching detection

6.5.1 Screen display

The contents and menu names of each picture shall correspond to each other without typos, and each parameter and its description shall correspond without spelling errors.Icons, single line diagrams, etc. shall be correctly displayed.

6.5.2 Screen switching

Each picture can be switched through the up, down, left and right keys, the next menu can be entered through the "enter" key, and the previous menu can be returned through the "ESC" key;Each parameter in the same screen can be selected by up and down keys;

6.6 Parameter setting and saving detection

Modify the parameters according to BC300 parameter modification steps, and the data will take effect after saving.The saved data shall still exist after power failure;The constant value group can be switched. After switching, the four groups of constant values can exist and be saved independently, but only the currently input constant value group can work.

6.7 Clock detection

After the device is powered on, the time can be manually set on the panel by pressing the key;The running time of the clock shall be correct, and the modified time can be saved after power failure.

6.8 SOE detection

The change of input state, the modification of setting value, the generation of protection action, panel reset and other operations shall generate corresponding SOE, and shall have correct time scale, SOE code and SOE name. The code and name shall correspond, and the SOE with protection fault shall also have corresponding fault action value;The first SOE record is always the latest, and the last one is overwritten after 100 records.

6.9 Measurement and detection

6.9.1 Voltage measurement

The device applies the voltages shown in the following table for measurement.

Allowable measurement error: ≤± 0.5%

Voltage	Test point			Allowable error
U1	0 V	50 V	100 V	≤± 0.5%
U2	0 V	50 V	100 V	

6.9.2 Current measurement

The device applies each current shown in the following table for measurement.

Allowable measurement error: ≤± 0.5%

Current	Phase angle	Test point			Allowable error
IA	0°	0 a	1 A	5 A	≤± 0.5%
IB	120°	0 a	1 A	5 A	
IC	240°	0 a	1 A	5 A	
I0	0°	0 a	10 A	20 A	

6.9.3 Frequency

Apply the voltage as shown in the table below to the device, and test each frequency as shown below.

Allowable measurement error: ≤± 0.01Hz

Voltage		
100V		
Test point		
49 Hz	50 Hz	51 Hz
Allowable error: ≤± 0.01Hz		

6.10 Contact input and output detection

6.10.1 Contact input test

When the signal is connected to the switching value input port, each input shall have a state change from 0 to 1 and generate corresponding SOE. Removing the signal will generate a state change from 1 to 0 and generate corresponding SOE.

Di channel	Channel initial state	Channel status	SOE records
1~ 7	1	From '1' to '0'	have
	0	From '0' to '1'	have

6.10.2 Output test

After successful login, the user enters the "debugging" menu, selects the corresponding output channel, and connects the small lamp or Multimeter in the output circuit. Press the "enter" key for operation test. The channel status changes from 0 to 1. The small lamp lights up or the multimeter beeps. Press the "enter" key again. The channel status changes from 1 to 0. The small lamp goes out or the multimeter stops beeping.

Do channel	Channel initial state	Channel status	SOE records
1~4	0	From '0' to '1'	have
	1	From '1' to '0'	have

7 Common problems and Solutions

If there is a problem with the equipment, we strongly recommend that you follow the following recommendations before sending the equipment back to the factory.Although they can not solve all the problems, at least they will enable you to identify the problems as soon as possible so that they can be repaired as soon as possible.

classification	problem	Possible causes	Handling suggestions
protect	Relay does not trip	This function is disabled uncommitted Conditional locking	Check whether the self-test information is correct Put the corresponding protection control word on Check whether the locking conditions are met
commonly	After the BC300 is powered on, the panel indicator is not lit	Insufficient supply voltage Wiring error	Check the supply voltage Check auxiliary power terminal number
commonly	After power is supplied to BC300, the display clock differs greatly from the actual value	Time operation setting error Button battery failure in the device	Reset time Replace with a new 3V button battery
communication	RS232 port of BC300 panel cannot communicate	PC communication parameter setting error Wiring polarity error BC300 or main station not grounded Inconsistent communication parameters or protocols	Check PC communication parameter settings Exchange wiring Ensure that both are reliably grounded Check communication parameters and communication protocol settings

8 Equipment maintenance

When the BC300 device is used under the conditions specified in the "technical data" section and this manual, the equipment is maintenance free within the specified time.The electronic circuit of BC300 device does not have any parts subject to abnormal physical or electrical wear.

If the environmental conditions are different from those specified in the "technical data" (such as temperature and humidity), or the atmosphere around the device contains chemically active gas or dust, the equipment shall be visually inspected in combination with the secondary test. The following points shall be noted in the visual inspection:

- Mechanical damage traces of equipment chassis and terminals,
- Dust on the equipment panel or chassis,
- Corrosion traces of terminal blocks, chassis or interior of equipment,

If the protection terminal does not operate correctly, or the action value is obviously different from the protection terminal characteristics of the protected equipment, the protection terminal needs maintenance.Please contact our company or the relevant agent for more information about inspection, overhaul or recalibration of the protection terminal.If you want to return the BC300 device to our company for maintenance because it cannot work normally, please contact our company first.During transportation back to the unit for maintenance, it must be packed carefully to prevent further damage to the equipment.