

Product Certificate

Name: Intelligent Residual Current
Protective Circuit Breaker

The product has passed inspection,
complies with standards,
and is approved for release.

Inspector:  _____

Intelligent Residual Current Protective
Circuit Breaker Series

Product User Manual



1. Product Overview

Designed for three-phase four-wire low-voltage grid systems with direct neutral grounding (TT), this product provides protection against ground faults, overcurrent, short circuits, overvoltage, undervoltage, automatic tripping during power loss, and phase loss. It also offers indirect contact protection against electric shock hazards.

Compliance Standards: GB 14046.2, DL/T 20.1, and Residual Current Protector (RCD) Communication Protocol.

- Passed communication standard tests by the Low-Voltage Electrical Appliance Research Institute of China Electric Power Research Institute.
- Authorized by Zhejiang Grid Inspection Company for communication consistency testing.

2. Product Features

2.1 Protection Functions

Automatic residual current tracking, mutation detection, and special waveform analysis. Overvoltage, undervoltage, and phase-loss protection with auto-reclosing upon voltage recovery. Electronic overload, short-time delay, and instantaneous short-circuit protection. Zero-sequence protection and trip-on-stop functionality.

2.2 Display Functions

In the closing state, the automatic Quasi-Residual 电流 and the maximum phase, and the current three-phase voltage parameters, current three-phase current parameters, fixed value electrical action value, the rated limit non-operation time, the current setting parameters, and the real-time clock, wave recording, etc. More than 30 parameters.

In the opening state, the liquid crystal can display the cause of this opening, and query in time

2.3 Setting and query functions:

It can set parameters such as rated residual current, rated limit non-operation time, rated current, short-circuit delay time multiple, short-circuit delay time, short-circuit instantaneous multiple, timing test time, time control, and user password through the keyboard.

It can query parameters such as the number of actions, total number of openings, number of closed openings, and inrush characteristics in real time through the keyboard, as well as wave recording, test records.

2.4. Control functions:

- On-site test trip control can be achieved through the test button.
- Remote scheduled opening, closing, test tripping, and scheduled cancellation control functions are available.
- The synchronous opening and closing functions of the protector can be realized through external tripping and resetting interfaces.

2.5. Self - inspection Function:

It has three functions: remote test trip, timed test trip, and button test trip.

2.6. Monitoring and Recording Function:

Record the daily maximum and time - mark, minimum and time - mark of the residual current, three - phase voltage, and three - phase current within 30 days, with a total of 14 items of records.

Record the parameters and time - marks of the residual current, three - phase voltage, and three - phase current of the latest 10 times of trip events.

Record the latest 10 times of residual current alarm (forced closing) events, protector self - inspection events, and residual current over - limit events, with a total of 3 items of records.

Accumulate 6 items of cumulative parameters such as the total number of protector trips, the number of blocking trips, and the number of residual current trips.

2.7. Auxiliary Function:

RS485 communication function, fully supporting the 《DL/Txxx - xxxx Communication Specification for Residual Current Protectors》 to be soon released by the National Energy Administration, which is currently a submitted draft. It meets the requirements of the 《Technical Specification for Residual Current Operated Protectors》 issued by Zhejiang Province.

Residual current over - limit alarm function.

4 - digit high - brightness digital tube + 8 indicator lights, and 6 buttons realize parameter setting, parameter calibration, program upgrade, data query, test, tripping and other on - site operations.

2.8. Performance and Craftsmanship:

The circuit board is made of highly integrated industrial - grade materials, adopting advanced lightning protection design, and fully meeting the requirements for electromagnetic compatibility in the GB4048.2 - 2008 standard.

The circuit board adopts a compact structural design, suitable for users' requirements for compact space in circuit breakers.

The circuit board has a neat and beautiful process, convenient wiring, and only requires necessary signal input wiring.

It can be directly assembled without secondary debugging. After assembly, only simple voltage current and residual current calibration need to be carried out through buttons.

The product basically includes the functions of high - end products on the current market.

It can be designed and developed according to customers' sample machine structures (or original circuit boards) as per customers' needs.

3、Normal Working Conditions

3.1. Ambient temperature: -5°C to +55°C;

3.2. Relative air humidity: When the average minimum temperature of the wettest month does not exceed 25°C, the monthly average maximum relative humidity of that month does not exceed 90%, and condensation on the product surface due to temperature changes is considered;

3.3. Altitude: Not exceeding 2000 meters;

3.4. Pollution level: Level 3;

3.5. Installation category: Category III;

3.6. The external magnetic field at the installation site does not exceed 5 times the Earth's magnetic field in any direction.

4、Main Performance Indicators of the Controller

Model	Parameter Description
Rated current of integrity level I_{nn} (A)	Customized according to user requirements
Rated current I_n (A)	0.4 - 1.0 I_{nn} (A), continuously adjustable
Auxiliary power supply voltage U_r (AC V)	400
Applicable pole number	3P/3P+N/4P
Rated residual operating current (mA) $I_{\Delta n}$	The gear value is selectable, and 8 sets of parameter values can be customized according to user requirements
Rated residual non - operating current (mA)	$I_{\Delta no}=50\%I_{\Delta n}$
Rated non-tripping time(s)	The gear value is selectable, and 3 sets of parameter values can be customized according to user requirements
Rated residual short - circuit breaking (making) capacity	$I_{\Delta sm}=I_{cu}(kA)$
Delay reclosing time (s)	20-60
Overvoltage operating value (V)	Default 285 ± 5% (user can calibrate)
Undervoltage operating value (V)	Default 165 ± 5% (user can calibrate)
Phase - failure operating value (V)	Default 120 ± 5% (user can calibrate)
Operating characteristic classification	AC type
Product usage category	Class A

5、Operating Performance of the Release

5.1. Overload Protection Characteristics (Inverse Time Delay Operation)

Rated Operating Current of the Release (A)	Release (Ambient Temperature 40°C)	
	1.05 I_n (Cold State)	1.30 I_n (Hot State)
$I_n \leq 63A$	No operation for $\geq 1h$	Operation in $< 1h$
$I_n > 63A$	No operation for $\geq 2h$	Operation in $< 2h$

Calculation of overload long - delay time: $T1 = (6I_r / I)^2 \times T1$

5.2. Setting Value of Instantaneous Overcurrent Release Current

Rated Current of Integrity Level I_{nn} (A)	Rated Current Multiple	Conventional Time
100	10 $\pm 20\%$	$< 0.2s$
250	10 $I_n \pm 20\%$	$< 0.2s$
400	10 $I_n \pm 20\%$	$< 0.2s$
630	10 $I_n \pm 20\%$	$< 0.2s$
800	10 $I_n \pm 20\%$	$< 0.2s$

6、Operation Instructions

6.1. Button Instructions

The circuit breaker has eight buttons: [Left Shift], [Right Shift],

[Increment], [Decrement], [Confirm], [Reset], [Test], and [Trip].

In addition to the above - mentioned basic functions, the buttons also define shortcut keys and combination keys. The specific descriptions are as follows:

When in the wheel display state (trip state, the display shows the trip cause), press:

【◀】 Enter the trip record query interface.

【▶】 Enter the trip count query interface.

【▲】 Enter the self - inspection record query interface.

【▼】 Enter the function setting interface.

【Confirm】 Enter the password verification. If the password is confirmed successfully, enter the parameter setting interface.

[▲] + [▼] Enter the password verification. If the password is confirmed successfully, enter the data clearing interface. Press 【Confirm】 to clear the data and return to the wheel display interface.

[◀] + [▶] In the tripped state, press [◀] + [▶] simultaneously to display parameters normally.

[Reset] + [▼] Enter the manufacturer's maintenance parameter interface.

Figure 6-1 Button Functions Figure 6-2 Display Interface

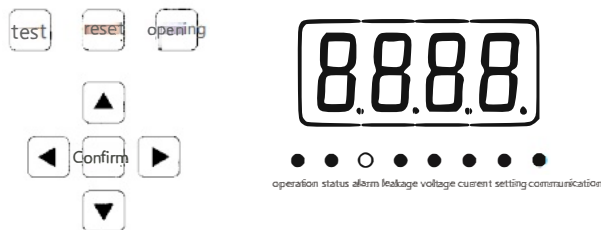


Figure 6-1 Button Functions

Figure 6-2 Display Interface

6.2 Display Instructions

It is displayed with a high-brightness 4-digit LED nixie tube, combined with 8 LED indicators, and the display is intuitive.

The 8 LED indicators are classified as follows:

Operation indicator (green): Indicates the system operation status. The indicator flashes once every 3 seconds, indicating that the protector is operating normally; otherwise, the system is abnormal.

Status indicator (red): Indicates the switch position status. It is off in the closed state, always on in the trip lockout state, and flashes in the reclosing state.

Alarm indicator (yellow): Indicates the alarm or alarm status. When off, it means the alarm state is exited and no over-limit alarm occurs; always on indicates an alarm for the residual current state; flashing indicates a leakage over-limit alarm.

Residual current indicator (green): Indicates the residual current value. When the parameter displayed by the 4-digit nixie tube is of the residual current type, the indicator is on.

Voltage indicator (green): Indicates the voltage value. When the parameter displayed by the 4-digit nixie tube is of the voltage type, the indicator is on.

Current Indicator (Green): Indicates the current parameter value. The indicator lights up when the parameter displayed by the 4-digit nixie tube is of the current property.

Setting Indicator (Green): Indicates the setting status. The indicator stays on when entering the parameter setting or function setting status; otherwise it goes out.

Communication Indicator (Green): Indicates the communication status. It is normally in the off state; the indicator flashes when there is communication.

6.3 Operation Display Instructions:

6.3.1 Protector Operation Display. During the operation of the protector, four states may occur: closing operation, residual current alarm operation, test closing, and trip blocking. When the protector is in the wheel display state or the residual current alarm operation state, it is in the power-on operation state. The protector displays the residual current, voltage, and current parameters in the wheel display state, as shown in Figures 6-3, 6-4, and 6-5. The alarm indicator indicates whether the protector is in the residual current alarm state, as shown in Figure 6-7.

When the protector is in the test closing process or the trip blocking state, the protector is in the opening operation state. The protector fixedly displays the current trip information, as shown in Figure 6-8. The status indicator indicates the current switch position state of the protector. The indicator going out means the closing state, flashing means the test closing state, and staying on means the protector trip blocking state.



Figure 6-3 Current rated residual current value

Figure 6-4 Current residual current value and maximum phase

Figure 6-5 Current phase A voltage value



Figure 6-6 Current phase B current value

Figure 6-7 Alarm status indicator light on

Figure 6-8 Display of the cause of this fault trip

6.3.2 Residual Current Over - limit Alarm. When the protector's alarm indicator flashes, it indicates that the current residual current value has exceeded 1.3 times the rated value of the residual current alarm. The alarm display is as shown in Figure 6-7.

6.4 Key Operation Instructions

6.4.1 [Reset]: Restore to the normal system operation state; exit the setting and query functions and return to the wheel - display state (when the circuit breaker is in the tripped state, restore to the stop - display state). When the circuit breaker is in the locked state, press the [Reset] key to start reclosing.

6.4.2 [Test]: That is, the button test trip function. Press the [Test] key, and the circuit breaker should trip. If it does not trip, it indicates that the circuit breaker is abnormal and should be removed and repaired in a timely manner. For specific display instructions, see the self - inspection instructions.

6.4.3 [Trip]: Forced trip function. Press the [Trip] key, and the circuit breaker will trip immediately and be locked until the user presses the [Reset] key to unlock the circuit breaker and re - close.

6.4.4 [◀]: Used as a page - turning key in the information query state, and as a cursor left - move key in the setting and password input states. In the wheel - display or trip stop - display state, press the [◀] key to enter the trip information query state. Press the [▲] and [▼] keys. The latest 5 times of trip information can be queried. Press the [◀] or [▶] key to query the trip cause of the current trip information (for detailed display parameters, see 《Appendix 1. Display Parameter Comparison Table》), the month and day of the trip, and the hour and minute of the trip. As shown in Figures 6-9, 6-10, and 6-11, phase C trips due to overvoltage at 299V, and the trip time mark is 16:45 on June 28.

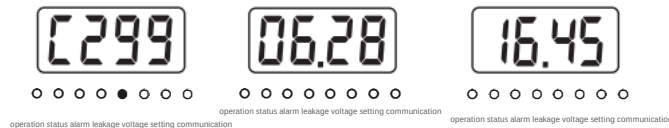


Figure 6-9 Fault Cause Display

Figure 6-10 Fault Occurrence Month and Day

Figure 6-11 Fault Occurrence Hour and Minute

6.4.5 [▶]: Used as a page - turning key in the information query state, and as a cursor right - move key in the parameter setting and password input states. In the wheel - display or trip stop - display state, press this key to enter the trip time count query state. Display the trip time parameters. As shown in Figures 6-12 and 6-13, the total number of trips is 102 times, and the number of locked trips is 53 times.



Figure 6-12 Total Number of Trips

Figure 6-13 Number of Locked Trips

6.4.6 [▲]: Used for page turning when querying parameters, and for digital increment in the setting and password input states. In the wheel display or trip stop - display state, press the [▲] key to enter the self - inspection record query state. Press the [▲] and [▼] keys. The latest 5 self - inspection records can be queried. Press the [◀] and [▶] keys to query the self - inspection result of this self - inspection record, the month and day of the self - inspection, and the hour and minute of the self - inspection. DonE means the self - inspection passes, and FAIL means the self - inspection fails. As shown in Figures 6 - 14, 6 - 15, and 6 - 16, the current self - inspection is successful, and the time is 16:45 on June 28.



Figure 6-14 Self - inspection Successful

Figure 6-15 Self - inspection Occurrence Date (Month and Day)

Figure 6-16 Self - inspection Occurrence Time (Hour and Minute)

6.4.7 [▼]: Used for page turning when querying parameters, and for digital decrement in the setting and password input states. In the wheel display or trip stop - display state, press the [▼] key to enter the password verification state, as shown in Figure 7-5. After successful password verification, entry into function item setting is allowed. 13 functions can be set: leakage alarm (L.300), automatic tracking (Auto), 突变保护 (-tbn) (Sudden Change Protection (-tbn)), 特波保护 (-lbo) (Special Wave Protection (-lbo)), 重合闸 (rESu) (Reclosing (rESu)), overvoltage (u.285), undervoltage (n.165), phase failure e (p.120), complete loss of voltage (ULSt), overload (r.250), short - circuit short delay (-r2 -), 缺零 (-qL -) (Loss of Zero (-qL -)), external trip (E - Fd). Press the [▲] and [▼] keys to switch function items, press the [◀] key to enable the function, and press the [▶] key to disable the function item. The parameter flashing display indicates that the function is in the disabled state, and the parameter always - on display indicates that the function is in the enabled state. Figure 6-17 shows the leakage alarm function setting, and the current residual current action value is 300mA. Figure 6-18 shows the automatic tracking function on setting, and Figure 6-19 shows that the overvoltage value is 285V. For specific parameters, refer to 《Appendix 1 Display Parameter Comparison Table》.



Figure 6-17 Leakage Current Alarm Function



Figure 6-18 Automatic Tracking Protection Function



Figure 6-19 Overvoltage Protection Function

6.4.8 [Confirm]: Used as a confirmation function in the parameter setting and password input states. In the wheel display or trip stop - display state, press the [Confirm] key to enter the password verification state. After successful password verification, entry into parameter setting is allowed. Press the [◀] and [▶] keys to move the cursor, and press the [▲] and [▼] keys to change parameter values. Press the [Confirm] key to save and enter the next setting item (if an illegal parameter is entered, it will stay in this setting state). Press the [Reset] key to abandon the setting and exit the setting state. The following can be set: rated residual operating current action value (L.300), rated non - operating time (t.300), residual current sudden change protection value (E.50), rated current (r.400), overload long - delay time (d.012), short - circuit delay multiple (r2.06), short - delay time (S.200), instantaneous multiple (r3.08), overvoltage setting value (u.285), undervoltage setting value (n.165), phase - failure setting value (p.120), timed test trip time (25.00), current year and month (14.04), current day and hour (18.20), current minutes and seconds (25.32), last 4 digits of communication address (0000.), communication baud rate (2400), user password (9009), a total of 18 parameters. As shown in Figures 6-20, 6-21, 6-22, 6-23, 6-24, 6-25. For specific parameters, refer to 《Appendix 1 Display Parameter Comparison Table》. Current day and hour (18.20), current minutes and seconds (25.32), last 4 digits of communication address (0000.), communication baud rate (2400), user password (9009), a total of 18 parameters. As shown in Figures 6-20, 6-21, 6-22, 6-23, 6-24, 6-25. For specific parameters, refer to 《Appendix 1 Display Parameter Comparison Table》.

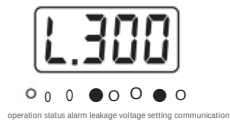


Figure 6-20 Setting of Rated Residual Current



Figure 6-21 Setting of Rated Non - operating Time



Figure 6-22 Setting of Sudden Change Protection Value



Figure 6-23 Rated Current Setting

Figure 6-24 Short - Circuit Delay Setting

Figure 6-25 Communication Baud Rate Setting

6.4.9 [▲] + [✓]: Press the two buttons simultaneously to enter the key verification state. After the key verification is successful, you are allowed to enter the data clearing interface, as shown in Figure 6-26. At this time, press the [Confirm] button. Then all the recorded parameters of the stored data will be cleared, and it will return to the normal cycle display state.

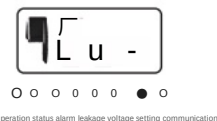


Figure 6-26 Data Clearance

6.4.10 [◀] + [▶]: Press the two buttons simultaneously to enter the current parameter information cycle display state.

6.5 Production Operation Instructions (Omitted in User Manual)

6.5.1 [Reset] + [▼]: Press the two buttons simultaneously to enter the key verification state (PUK: 9009). After the key verification is successful, you are allowed to enter the factory setting interface. Combined with [◀], [▶], and [Confirm] buttons, functions such as parameter zero calibration, residual current calibration, three-phase voltage calibration, three-phase current calibration, factory setting restoration, and program upgrade can be achieved, as shown in Figures 6-27, 6-28, 6-29, 6-30, and 6-31 below.

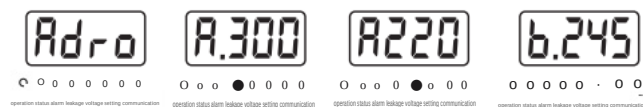
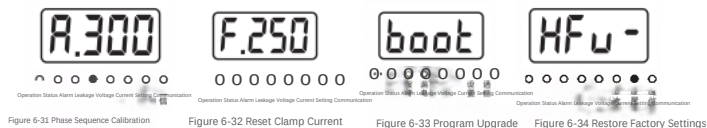


Figure 6-27 Parameter Calibration Requirement

Room 6 - 28 Residual Current Calibration

Figure 6 - 29 Three - Phase Voltage Calibration

Figure 6 - 30 Current Calibration



Parameter Calibration: After entering the factory setting interface, use **[▲] + [□]** to switch to the display as shown in Figure 6-27 above. Press the **[▶]** key. Within 5 seconds, the residual current zero offset and current zero offset calibration will be automatically completed.

Residual Current Calibration: After entering the factory setting interface, use **[▲] + [□]** to switch to the display as shown in Figure 6-28 above. After confirming that the residual current applied to the residual current transformer reaches the rated residual current action setting value (e.g., 300mA), press the **[▶]** key. Within 5 seconds, the residual current calibration will be automatically completed.

Three - Phase Voltage Calibration: Follow the above operations to switch to the display as shown in Figure 6-29 above. At this time, the phase A voltage is displayed. The **[▲] + [□]** keys can be used to switch and query the phase A, B, and C voltages. After confirming that the applied three - phase voltages are all 220V, and as long as the voltage indicator light is on, press the **[▶]** key. Within 10 seconds, the three - phase voltage calibration will be automatically completed.

Three - Phase Current Calibration: The calibration process for three - phase current is the same as that for three - phase voltage. Switch to the display as shown in Figure 6-30 above. The **[▲] + [□]** keys can be used to switch and query the phase A, B, and C currents. After confirming that the applied current value is the set rated current value (e.g., 400A), press the **[▶]** key. Within 10 seconds, the three - phase current calibration will be completed.

Phase Sequence Calibration: If an incorrect phase sequence is found, after entering the factory setting interface, use **[▲] + [□]** to switch to the display as shown in Figure 6-31 above. Press the **[▶]** key. Within 5 seconds, the phase sequence correction will be automatically completed.

Shell Frame Current Modification: After entering the factory setting interface, use **[▲] + [□]** to switch to the display as shown in Figure 6-32 above. Use the **[□]** or **[▶]** keys to adjust the shell frame current value.

Restore Factory Settings: After entering the factory setting interface, use **[▲] + [□]** to switch to the display as shown in Figure 6-33. Press the **[Confirm]** key. At this time, all parameters will be restored to the default setting state before leaving the factory. (Note: This function is not enabled yet)

Program Upgrade: Use **[□] + [□]**, **[□]**, and **[□]** keys to switch to the display as shown in Figure 6-34. Press the **[Confirm]** key. The program will automatically restart and enter the program upgrade state. The specified device can be used to upgrade the protector program through the serial port.

7、Description of External Terminals

Terminals 3 and 4 of the external wiring: Terminal 3 and 4 are for tripping, and Terminal 4 and 5 are for reset function. Short - circuiting Terminal 3 and 4 will cause the circuit breaker to trip and lock. Disconnecting Terminal 3 and 4 will make the circuit breaker automatically reclose. Terminals 1 and 2 are RS485 communication interfaces. The remaining Terminals 5, 6, and 7 are currently empty. The external terminals are shown in Figure 7 - 19.

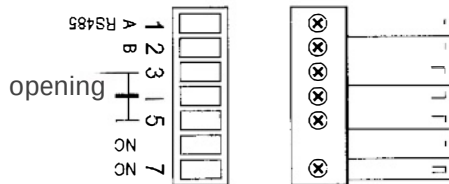


图 7-1

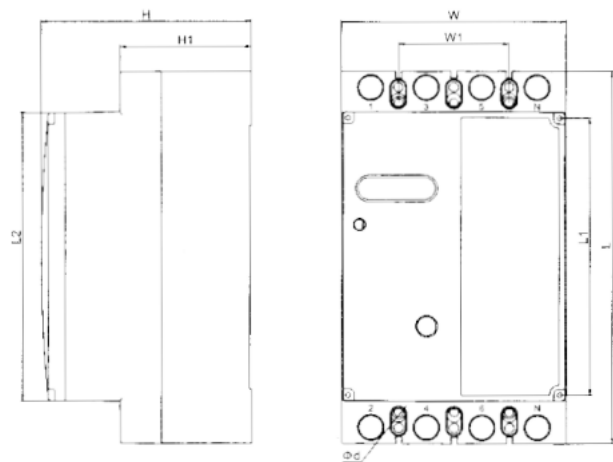
8、Installation and First - time Use

8.1 The circuit breaker should be installed vertically and fixed with screws through the installation holes.

8.2 The user selects a suitable conductor according to the load and connects the conductor to the circuit breaker (a copper connector must be equipped). The upper terminal (N, L) of the circuit breaker is the power incoming terminal of the main circuit, and the lower terminal is the outgoing terminal. The power neutral wire (zero wire) must be connected to the "N" terminal.

8.3 After installation, confirm that the molded case switch is in the ON state, and then power on the circuit breaker. If the red indicator light is flashing and the nixie tube displays "-dd-", it indicates that the circuit breaker is in the opening state. At this time, the circuit breaker will automatically close. After 20 - 60 seconds of normal closing, the red indicator light goes out, indicating that the closing is successful, and the nixie tube starts to cycle - display the current parameters. If the red indicator light is always on, it indicates that the protector has tripped and locked. Press the [Reset] key to make the protector enter the automatic reclosing state.

8.4 Panel Functions, Outline and Installation Dimensions



Specification	Outline Dimensions					Installation Dimensions		Installation Screw Size
	L	W	H	H1	L1	W1	L2	
125A New Model	150	120	123	64	108	60	119	4.5
250A New Model	165	141	132	86	90	71	116	5
125A	222	123	135	82	157	58	170	4.5
250A	240	143	139	88	166	70	178	5
400A/630A	336	198	181	99	242	96	253	6
800A	355	240	190.5	103	285	117	268	6

9. Notes:

9.1 After the leakage circuit breaker is put into normal operation, conduct a test trip once a month and keep a good record. 9.2 Do not use the method of short - circuiting the phase wire to the neutral wire to test the trip, so as to avoid causing short - circuit current and burning the device. A resistor of about 1K Ω (determined according to regulations) should be connected in series in it.

9.3 It cannot provide protection against the electric shock hazard caused by simultaneous contact with two wires of the protected circuit.

9.4 Do not open the circuit breaker without permission; otherwise, you will be responsible for the consequences.

9.5 According to the "Rural Installation and Operation Regulations for Residual Current Operated Protectors" (DL/T736 - 2000) of the state and the industry, in case of an emergency where disconnecting the power supply will cause an accident or major life and economic losses, the residual current protector can be temporarily withdrawn from operation after being approved by the technical management department of the power supply enterprise, and the protection period can be set to the residual current alarm mode. After entering the alarm state (the alarm indicator light is always on), the protector loses the residual current protection function. After the emergency state is lifted, the protector must be put back into operation and cannot be used for a long time without a valid reason.