AIM-R100 Residual Current Monitoring Products

User Manual V1.5

Acrel Co., Ltd.

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The equipment is professional electrical equipment, any related operation, need to be carried out by special electrical technicians. Acrel is not responsible for personal injury or financial loss resulting from the error of non-professional personnel.

The contents of this description will be updated and amended constantly, and it is inevitable that there will be a slight discrepancy between the physical product and the description in the product function upgrading. Please refer to the physical product purchased and obtain the latest version of the description through www.acrel-electric.com or sales channels.

Modified Records

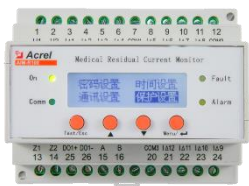| No.	Time	Versions	Reasons for revision
1	2018.11.20	V1.0	Primary version
2	2019.05.15	V1.1	Modified some cable connections and description
3	2019.10.22	V1.2	Update address and contact information
4	2020.12.30	V1.3	Correct errors and add English version
5	2022.09.30	V1.4	Update the Logo, modify some errors, update the standard, modify the communication example, and update the company contact information
6	2025.02.20	V1.5	Updated overview, standard, dimensions and wiring, panels, operation, applications, debug; Deleted function code; Updated bottom
Note:			

Contens

AIM-R100 Residual Current Monitoring Products

1 Introduction

Residual current monitoring products are suitable for medical class 2 and class 1 places and other places that need to monitor the residual current, mainly used for monitoring the residual current of TN-S distribution system mains and branches. When the residual current value exceeds the preset threshold, the system will send an alarm signal to remind the staff to deal with it according to the actual situation, so as to eliminate the potential safety hazards such as electrical fire and electric leakage shock caused by the residual current and provide clean, safe, and continuous power supply for the equipment.

The residual current monitoring products are also the monitoring devices developed by Acrel with rich product design experience and strict reference to the requirements in the standards and specifications. The residual current monitoring products mainly include AIM-R100 residual current monitor, AKH-0.66/L-20 residual current transformer, AID150 alarm and display device and ACLP10-24 DC24V power supply, as shown in Table 1 below.

Table 1 Residual current monitoring products

Model and Name	Picture	Introduction
AIM-R100 Residual Current Monitor (RCM)		AIM-R100 residual current monitor adopts advanced microcontroller technology, with high integration, small size, easy installation, intelligent, digital, and networked, it is the preferred product for multi-loop residual current monitoring in medical class 1, class 2, and other places.
AKH-0.66/L-20 Residual Current Transformer		AKH-0.66/L-20 residual current transformer is used together with AIM-R100 residual current monitor, high accuracy and ratio is 2000:1. The current transformer is installed in the cabinet in the way of screw direct fixation, which is flexible and convenient for installation and use.
AID150 Alarm and Display Device		AID150 alarm and display device adopts LCD display and RS485 bus communication, which can monitor the data of up to 16 sets of AIM-R100 residual current monitors or the insulation monitor devices (IMD) such as AIM-M300, and it can alarm remotely by sound and light.
ACLP10-24 DC Power Supply		ACLP10-24 is DC24V power supply for AID150, which uses a completely isolated linear transformer. It has the characteristics of stable output voltage, small ripple, high voltage withstand grade. It adopts the standard guide to install, and can be installed near the RCM.

2 Functional Characteristics

2.1 Function Characteristics of AIM-R100

➢ With TN-S system residual current real-time monitoring and display function;

➢ Monitoring the residual current transformer wiring short circuit, break line, and the failure alarm;

➢ Relay output, LED alarm indication and various fault indicator function;

➢ Monitoring Advanced field bus communication technology, and alarm and display, communication, can monitoring system operation condition real-time;

➢ SOE function, it can record the time of the alarm and fault types, convenient operating personnel analysis system running status, promptly eliminate malfunction;

➢ Self-checking function, through the function test device of residual current detection function;

➢ Remote reset function, can remote reset residual current monitor, eliminate the alarm message.

2.2 Function Characteristics of AKH-0.66/L-20

➢ Measuring residual current in load with AIM - R100 residual current monitor;

➢ Measurement precision is 0.2 class, ratio is 2000:1.

2.3 Function Characteristics of AID150

➢ Field bus technology, which can be communicated with the residual current monitor;

➢ Device can set the number of monitor and residual current alarm threshold in system remotely;

➢ When residual current exceeded threshold or connection failure, it provides sound and light alarm function, and it can be eliminated;

➢ Up to 16 AIM-R100 residual current monitors or insulation monitors can be monitored, wall installation, apply to the operating room, ICU, or other places of   monitoring.

2.4 Function Characteristics of ACLP10-24

➢ Adopts linear transformer isolation, has strong anti-interference ability, low ripple;

➢ AC 220V input and DC 24V output, the maximum output power is 3W.

3 Reference Standards

■ IEC 60364-7-710 *Building electrical installations section 7-710: Requirements for special installations or locations----medical locations*

■ IEC62020-1 *Electrical accessories - Residual current monitors (RCMs) - Part 1: RCMs for household and similar use*

■ Q31/0114000129C025 *Residual Current Monitoring Device*

4 Technical Parameters

4.1 Technical Parameters of AIM-R100

They are shown in Table 2.

Table 2 Parameters of AIM-R100 residual current monitor

Items		Parameters
Accessory power supply	Voltage	AC 220V±10%
	Power dissipation	≤3VA
Residual current monitoring	Loops	12
	Measure range	0~5000mA
	Setting range	6~1000mA
	Frequency	50±5 Hz

Relay output	output	1 relay output, normally open
	Contact capacity	AC 250V/3A; DC 30V/3A
Communication		RS485; Modbus-RTU
MTBF		≥50000 hour

4.2 Technical Parameters of AKH 0.66P26/L-20

They are shown in Table 3.

Table 3 Technical parameters of the AKH-0.66/L-20 residual current transformer

Items	Parameters
Precision	0.2
Ratio	2000:1
Rated (secondary) current	50mA
Secondary output of transformer	Cable line

4.3 Technical Parameters of AID150

They are shown in Table 4.

Table 4 Technical parameters of AID150 alarm and display device

Items		Parameters
Accessory power supply	Voltage	DC 24V
	Power dissipation	< 0.6W
Residual current display range		--
Self-check function		√
Number of systems		≤16
alarm		Sound and light alarm, sound can be eliminated
SOE		Leakage fault, transformer break, short circuit of transformer, equipment fault
Communication		RS485; Modbus-RTU
Display		128*64 dots LCD

4.4 Technical Parameters of ACLP10-24

They are shown in Table 5.

Table 5 Technical parameters of the ACLP10-24 DC power supply

Items	Parameters
Input Voltage	AC 220V（±10%）
Frequency	50/60Hz
Power	3W
Output Voltage	DC 24V±5%
Voltage change rate	≤30%
Heat	≤20°C

5 Installation and Connection

5.1 Appearance and Installation Size

5.1.1 Appearance and mounting hole size of AIM-R100 (unit: mm)
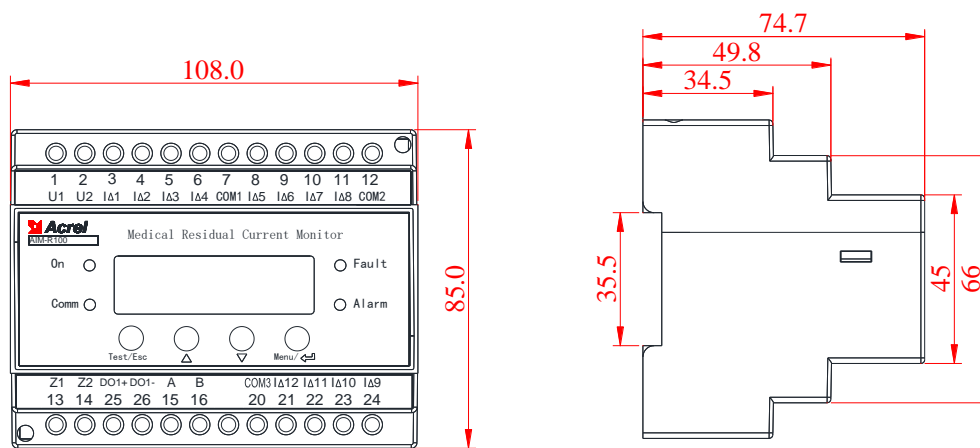
Front view   Side view

5.1.2 Shape and mounting hole size of AKH-0.66/L-20 (unit: mm)
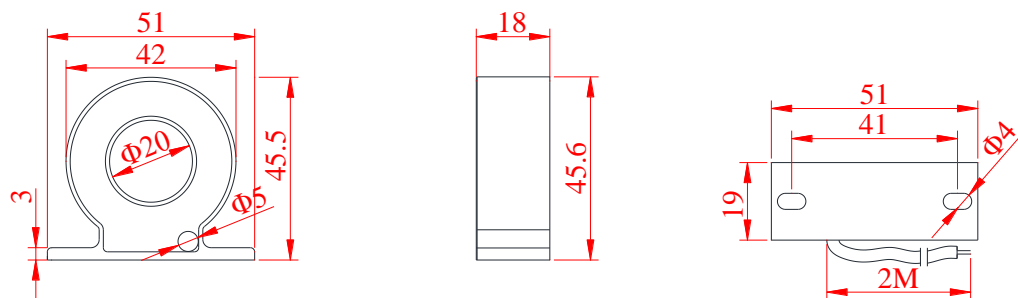
Front view   Side view   Bottom view

5.1.3 Shape and mounting hole size of AID150 (unit: mm)
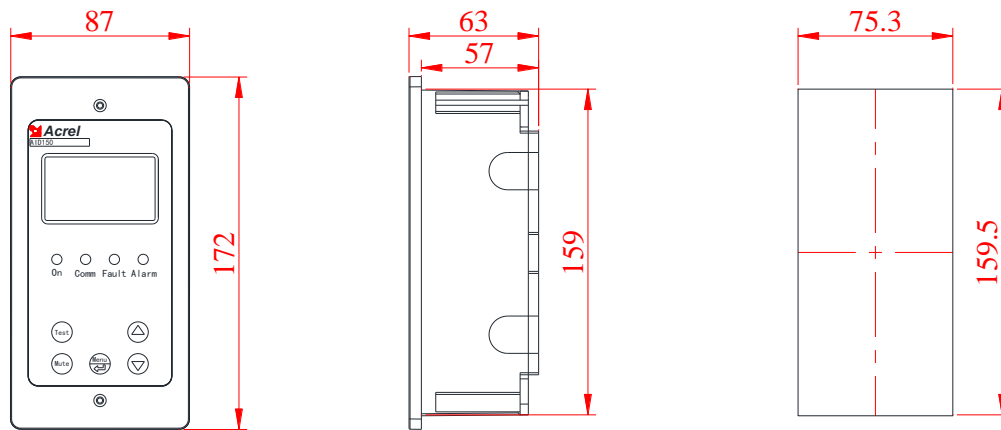
Front view   Side view   Hole size

5.1.4 Shape and mounting hole size of ACLP10-24 (unit: mm)

Front view

Side view
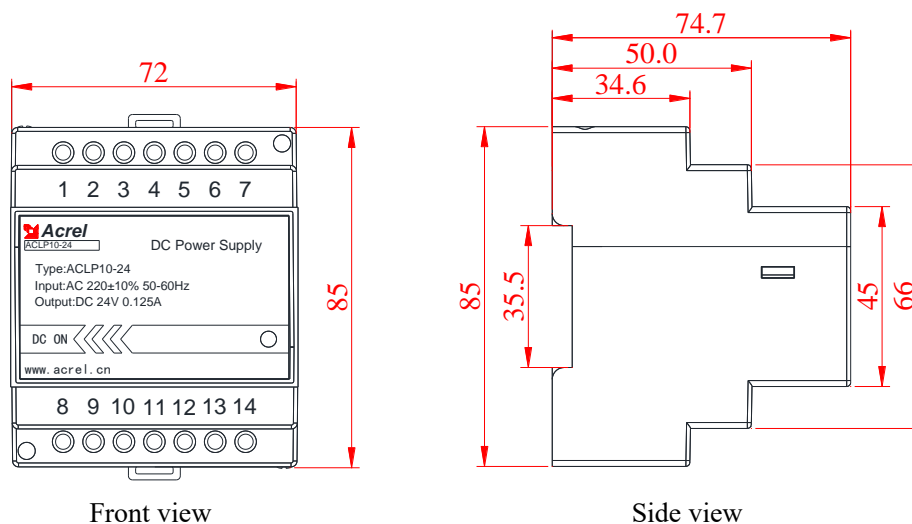
5.2 Method of Installation

In addition to the AID150, the residual current monitoring products are best centrally installed in the distribution cabinet. The AIM-R100 RCM uses 35mm standard guide rail to install, the AKH-0.66/L-20 CT uses screws (attached) directly fixed installation. When the AID150 is used in the operating room, it can be embedded in the wall and installed next to the information panel in the operating room for medical personnel to view; When AID150 is used in other medical places, it is recommended to install in the nurse station. It can also be installed in other locations that are easy to monitor. External wiring of the AID150 includes two DC24V power supply lines and two RS485 communication lines, which are drawn from the distribution cabinet. Pipelines should be reserved during construction. In the monitoring, the RS485 communication between the AIM-R100 and AID150 should be connected had in hand.

5.2.1 Installation method of AIM-R100

The AIM-R100 is installed with guide rail and fixed with buckles, as shown in the figure below:
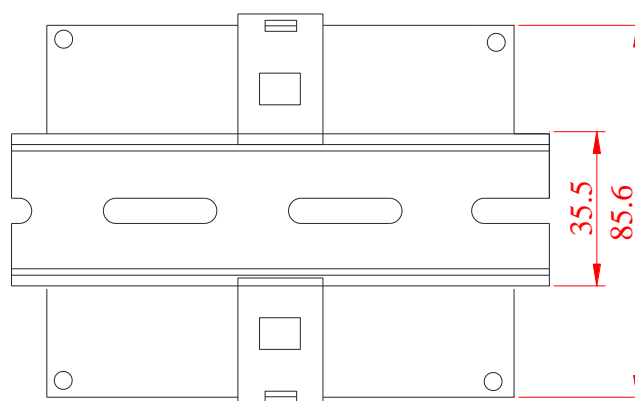
5.2.2 Installation method of AID150

AID150 is suitable for embedded wall installation. installation diagram is shown in figure below.

Product shape	1. Size of wall openings	2. Insert the shell into the wall
3. Connect to the LCD board through the terminal	4. Fixed LCD board and Shell	Attention：As our products are constantly updated, this drawing is for reference only until it has been confirmed by the relevant personnel.
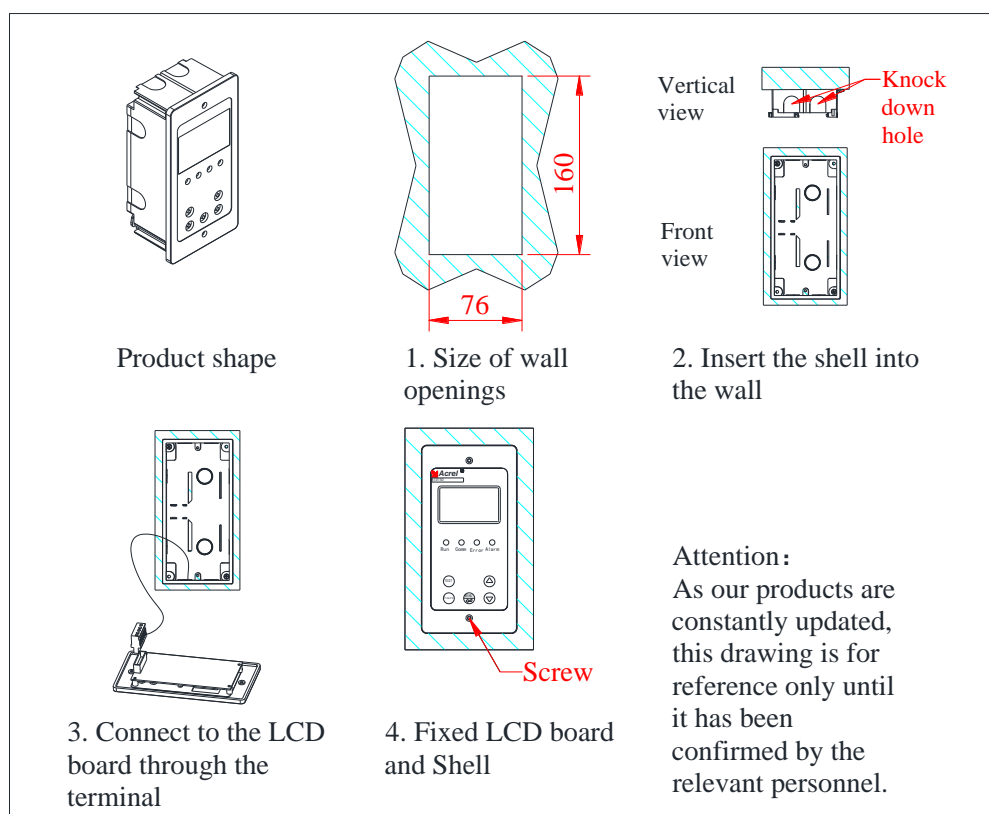
During the decoration, firstly, the AID150 should be embedded in the wall to be fixed and be close to the knockouts of the pipeline, so that the wires (two power cords and two-core shielded twisted pair) can be drawn to the front cover, and then fix the cover on the shell with screws.

5.2.3 Installation method of ACLP10-24 DC24V

The ACLP10-24 is used to install in the way of guide rail, which is fixed with snap-in type. It can also be installed on the same guide rail side by side with the AIM-R100.

5.3 Wiring Method

5.3.1 Wiring method of AIM-R100

Upper terminals: U1, U2 (1, 2) for AC220V auxiliary power supply, $I\triangle1 \sim I\triangle4$ (3, 4, 5, 6,) access to loop 1~4- residual current transformer end, COM1 (7) access to the other end of the 4 loops residual current transformer, $I\triangle5 \sim I\triangle8$ (8, 9, 10, 11) access to loop 5~8- residual current transformer end, COM2 (12) access to the other end of the 4 loops residual current transformer.

1	2	3	4	5	6	7	8	9	10	11	12
U1	U2	I△1	I△2	I△3	I△4	COM1	I△5	I△6	I△7	I△8	COM2

Power   Loop 1~4 CT input   Loop 1~4 CT input
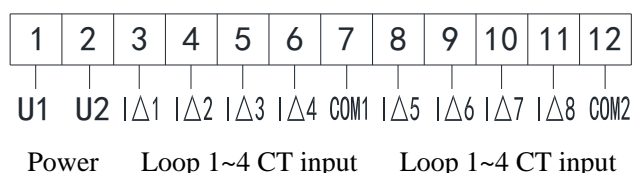
Lower terminals: Z1, Z2 (13, 14) can be externally connected to the self-check reset button, DO1+, DO1- for the alarm relay output, A, B for the RS485 interface communication terminals, $I\triangle9 \sim I\triangle12$ (24, 23, 22, 21) access to one end of the loop 9~12 residual current transformer, COM3 (20) access to the other end of the 4 loops residual current transformer.

13	14	25	26	15	16		20	21	22	23	24
Z1	Z2	DO+	DO-	A	B		COM3	I△12	I△11	I△10	I△9
TEST		DO		RS485			Loop 9~12 CT input				

Added description:

(1) The CT match to RCM comes with lead wires, no need to configure additional cable.

(2) The U1, U2 (1, 2) of RCM wiring is recommended to be connected in series with a 6A fuse.

(3) When the RCM monitoring circuit is not connected to the CT, it is necessary to close the circuit manually. Otherwise, a disconnection fault is displayed.

5.3.2 Wiring method of AID150 alarm and display device

The terminals of the power supply correspond to the positive pole and ground of the DC24V power module respectively. A and B relate to A and B in the lower terminal of AIM-R100.

The wiring diagram is shown in the following figure.

24V	G		A	B
24V	G		A	B
Power			RS485	

The 24V power supply can be connected by multiple copper wires of $2*1.5mm^2$, and the RS485 interface communication terminal can be connected by shielded twisted pair of $2*1.5mm^2$.

5.3.3 Wiring mode of ACLP10-24

1	2	3	4	5	6	7		8	9	10	11	12	13	14
L	N				L	N		24V	G	24V	G		24V	G
Input								Output						
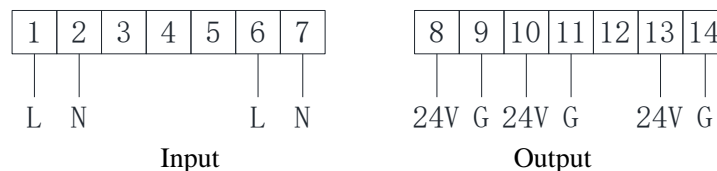
The 1 and 2 terminals of ACLP10-24 are the input terminals of 220V AC power supply. The 6 and 7 terminals are the 220V input extension terminals. Inside the device, 6 is connected to 1, and 7 is connected to 2. Terminals 8 and 9 correspond to 24V and G, terminals 10 and 11 correspond to 24V and G, terminals 13 and 14 correspond to 24V and G. These are three sets of 24V DC power output terminals, which are used to provide 24V DC power for external alarm and display device of AID series. Inside the meter, all V terminals are connected and all G terminals are connected.

5.4 Typical Wiring Method
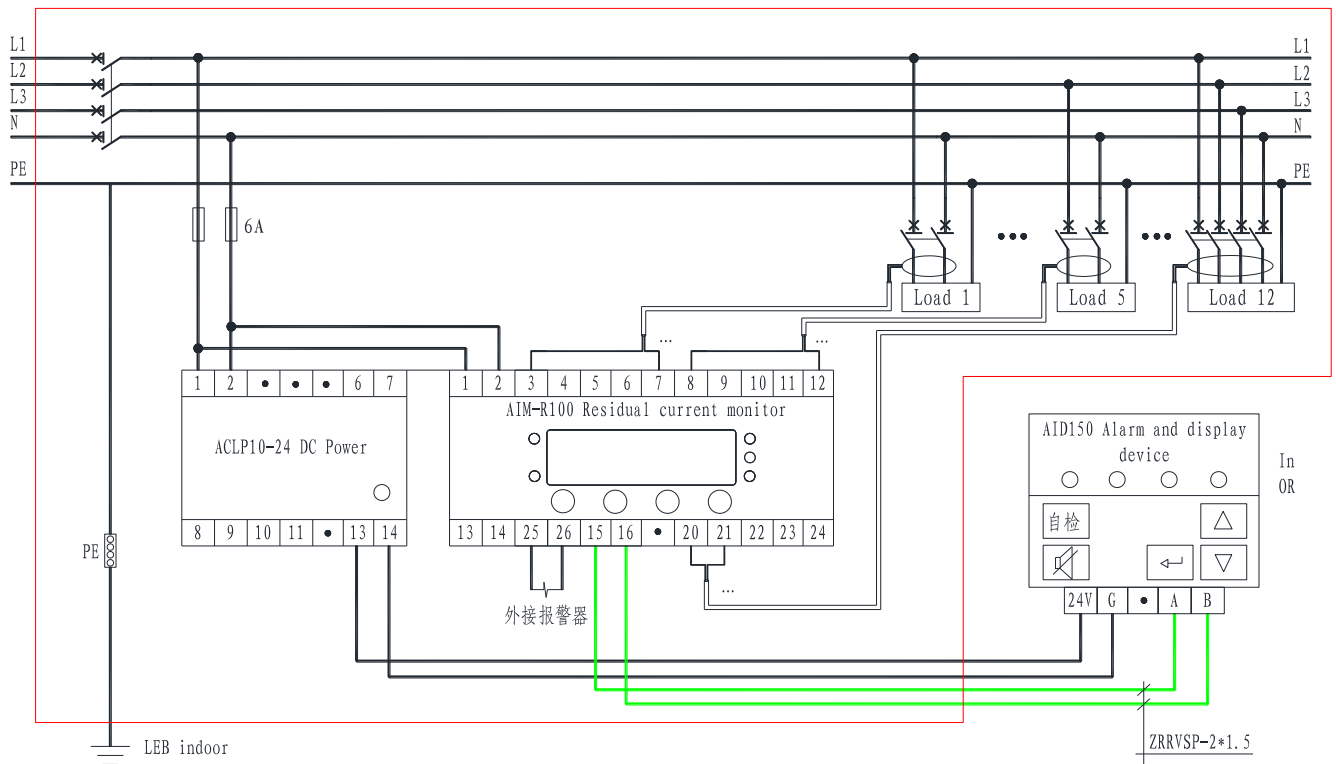
Added description:

(1) Each residual current monitor can be configured with up to 12 AKH-0.66/L-20 residual current transformers, it monitoring 12 circuits of residual current.

(2) Terminal 1, 2 of AIM-R100 RCM and ACLP10-24 power supply are the auxiliary power supply, access to AC220V, it can be connected as shown in the figure, it is appropriate to series 6A fuse.

(3) Terminals 3~12, 20~24 of AIM-R100 access to the CT. When applied in single-phase circuit, AKH-0.66/L-20 should pass through the L and N wires of each output circuit; when applied in three-phase three-line circuit, the CT should pass through the A, B and C wires; when applied in three-phase four-line circuit, the CT should pass through the A, B, C and N wires, and the PE wires are prohibited to pass through. CT connecting wires are connected to the corresponding terminals in sequence, and the circuits not connected to the transformer can be closed manually.

(4) Terminals 13 and 14 of AIM-R100 are connected to the remote reset button, which is used to automatically reset the system to ensure the safety and reliability of the system.

(5) Terminals 15, 16 of AIM-R100 and AID150 are A, B communication terminals can be selected $2*1.5mm^2$ shielded twisted pair, AID150 alarm and display monitor more than one AIM-R100, the communication line should be used in a hand in hand wiring (that is, the last table of the communication line to this table communication terminal, and then lead out from this table terminal, connect to the table communication terminal), the RS485 bus should be connected in parallel between the communication terminals to a matching resistor, the recommended matching resistor should be connected in parallel to the communication terminals, the recommended matching resistor is 120Ω.
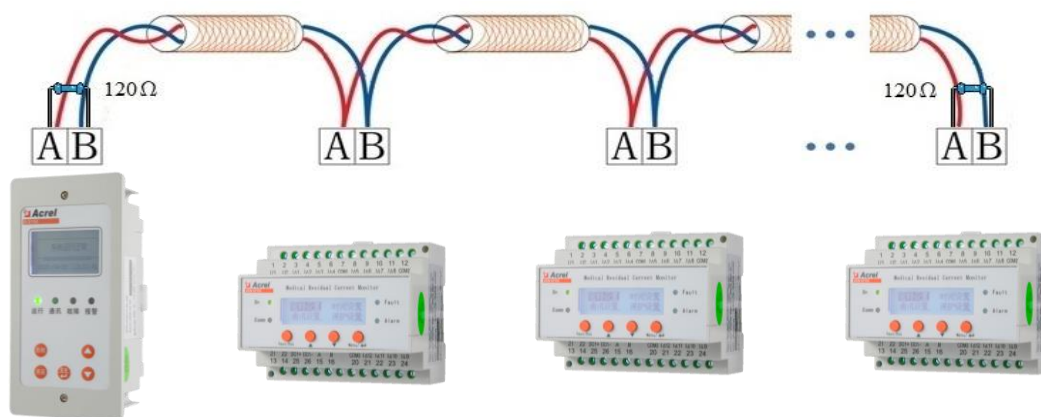
5.5 Matters Needing Attention

(1) The residual current monitoring products except the AID150, others should be centrally installed in the isolated power cabinet or distribution cabinet. it generally selects wall installation.

(2) During installation and wiring, the wiring diagram shall be followed. It is better to press and connect the wiring with the needle-type sleeve joint, then insert the corresponding terminals of the device and tighten the screws to avoid abnormal working of the device due to poor contact.

6 Operation and Usage

6.1 Display Panel

(1) AIM-R100 residual current monitor panel
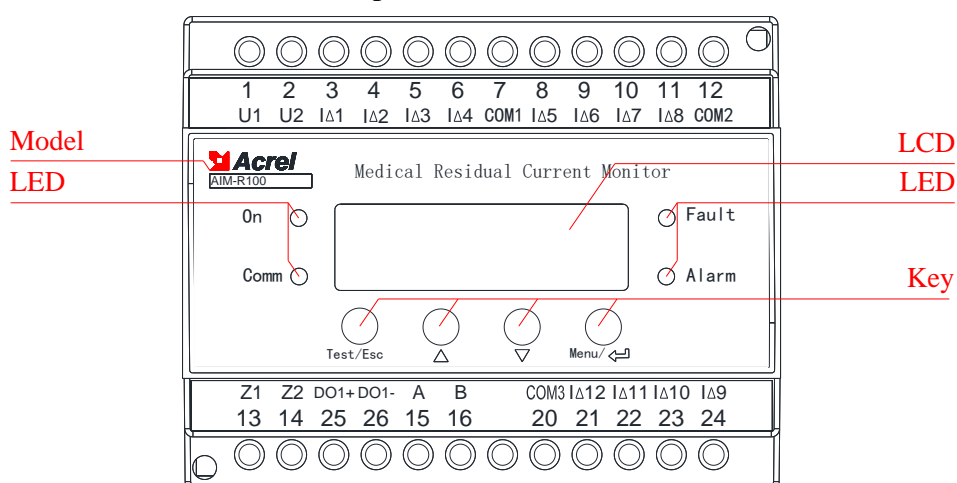
(2) AID150 alarm and display device
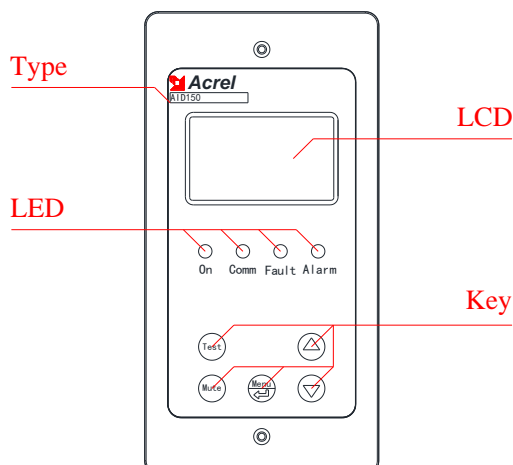
6.2 LED Instructions

6.2.1 AIM-R100 Residual Current Monitor LED instruction

LED states	Instruction
RUN	In normal operation, the light flashes at a frequency of about once a second
COMM	Communication status of the device. the indicator light flashes while communication.
FAULT	The indicator light flashes and alarms while the residual current monitor has fault
ALARM	The indicator light flashes and alarms while the detected circuit has leakage.

6.2.2 AID150 alarm and display device LED instruction

LED states	Instruction
RUN	In normal operation, the light flashes at a frequency of about once a second
COMM	Communication status of the device. the indicator light flashes while communication.
FAULT	The indicator light flashes and alarms while AIM-R100 or AIM-M300 has fault
ALARM	When the value of AIM-R100 exceeds, the indicator light flashes and alarms

6.3 Function Description of Keys

6.3.1 Key function description of AIM-R100 Residual current monitor

AIM-R100 residual current monitor has four keys, "Test/ESC", "▲", "▼", "Menu/↵".

Keys	Function
Test/ESC	In non-programming mode, self-check function; In programming mode, used as a return key.
▲, ▼	In non-programming mode, used to browse SOE; In programming mode, used to increase, decrease, or change the state.
Menu/↵	In non-programming mode, press this key to enter programming mode; In programming mode, when enter ok key is used.

6.3.2 Key function description of AID150 centralize alarm and display device

AID150 has five keys in total, "Test", "Mute", "▲", "▼", and "Menu/↵",

Key	Functions
Test	In non-programming mode, used to start the self-test function of instrument.
Mute	When there is alarm, press this key to eliminate the alarm sound.
▲ ▼	In programming mode, used to increase or decrease the value.
Menu/↵	In non-programming mode, press this key to enter the programming mode; In programming mode, used as the Enter key.

6.4 Key Operation Instructions

6.4.1 AIM-R100 residual current monitor key operation in programming mode

(1) Enter the programming mode

In normal operation, press the "Menu/↵" key to enter the programming mode password entry page. After entering the correct password, press "Menu/↵" to enter. The default password is 0001.

(2) Quit the programming mode

In programming mode, press "Test/ESC" to directly return to the operation interface.

(3) System Password Setting

Select the option [Set Pwd] in programming mode and press "Menu/↵". Change the system password

by "▲" or "▼", and press "Test/ESC" to exit after the change is completed. Press "Menu/↵" to save the change to "Yes" and exit. Operation examples are as follows:

```
 2015-07-02  12:30:45          Press Menu              Input Password
L1:   30mA  L2:Break       ───────────────►               0000
L3:    6mA  L4:Close
```
Press Up and Down to input password
Press Enter to confirm

```
    Set Password        Press Enter to confirm      ┌───────┐
        0001            ◄───────────────────────    │Set Pwd│   Set Time
                                                     └───────┘
                                                     Set Comm  SetAlarm
```
Press Up and Down to set password,
press Esc to save or exit

```
                           Press Up and Down to     ┌───────┐
   Save Settings?          select the option and    │Set Pwd│   Set Time
   Yes   ┌──┐              press Enter to confirm    └───────┘
         │No│           ──────────────────────────► Set Comm  SetAlarm
         └──┘
```
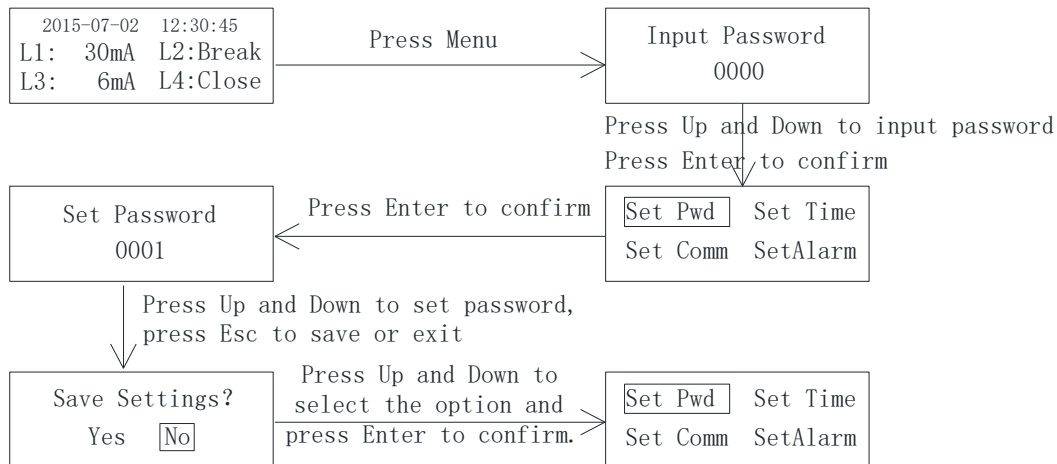
(4) Time setting

Select the option [Set Time] in programming mode and press "Menu/↵". Change the system time by "▲" or "▼", and press "Test/ESC" to exit after the change is completed. Press "Menu/↵" to save the change to "Yes" and exit. Operation examples are as follows:

```
                         Press Up and Down to
Set Pwd   ┌────────┐        select the option            Set Time
          │Set Time│                              ┌────┐
Set Comm  └────────┘     Press Enter to confirm   │2015│-07-02 12:30:45
          SetAlarm     ──────────────────────────►└────┘
```
Press Up and Down to set value,
press Esc to save or exit

```
                         Press Up and Down to
Set Pwd   ┌────────┐       select the option          Save Settings?
          │Set Time│                                  Yes    ┌──┐
Set Comm  └────────┘     Press Enter to confirm              │No│
          SetAlarm     ◄──────────────────────────           └──┘
```
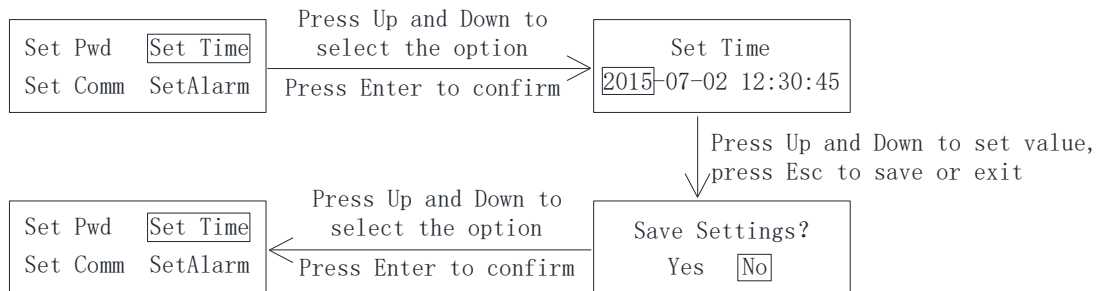
(5) Communication Settings

[Set Comm] is to set for communication. It belongs to the menu of the same level as [Set Pwd], and the entry steps are the same. Press "Test/ESC" to exit when the setup is complete. Press "Menu/↵" to save the change to "Yes" and exit. Operation examples are as follows:

```
                         Press Up and Down to
Set Pwd    Set Time        select the option            Set Comm
┌────────┐                                                   ┌──┐
│Set Comm│ SetAlarm     Press Enter to confirm       Addr:  │01│  Baud:9600
└────────┘             ──────────────────────────►          └──┘
```
Press Up and Down to set value,
press Esc to save or exit

```
                         Press Up and Down to
Set Pwd    Set Time       select the option          Save Settings?
┌────────┐                                           Yes    ┌──┐
│Set Comm│ SetAlarm     Press Enter to confirm              │No│
└────────┘             ◄──────────────────────────          └──┘
```
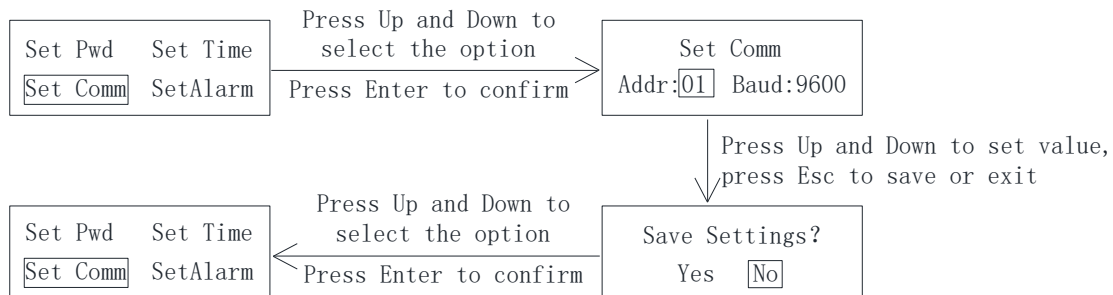
Note: When setting communications, set addresses in an order of 1 to 16 (the addresses cannot be repeated), and set the baud rate to 9600. One AID150 can be connected to a maximum of 16 AIM-R100. When only one AIM-R100 is connected to the AID150, use the default value.

(6) Protection Settings

[SetAlarm] is the RCM threshold setting. Select [SetAlarm] in the programming mode to set the CT loop number, loop alarm value and trip time. Press "Test/ESC" to exit when the setup is complete.

Press "Menu/↵" to save the change to "Yes" and exit. Operation examples are as follows:

```
┌─────────────────────┐   Press Up and Down to   ┌─────────────────────┐
│ Set Pwd   Set Time  │       select the option   │ Loop          [All] │
│ Set Comm  [SetAlarm]│ ─────────────────────────→│ Alarm Value   10mA  │
└─────────────────────┘   Press Enter to confirm  └─────────────────────┘
                                                              │
                                                   Press Up and Down to set value,
                                                   press Esc to save or exit
                                                              │
┌─────────────────────┐   Press Up and Down to   ┌─────────────────────┐
│ Set Pwd   Set Time  │       select the option   │ Save Settings?      │
│ Set Comm  [SetAlarm]│ ←─────────────────────────│ Yes    [No]         │
└─────────────────────┘   Press Enter to confirm  └─────────────────────┘
```
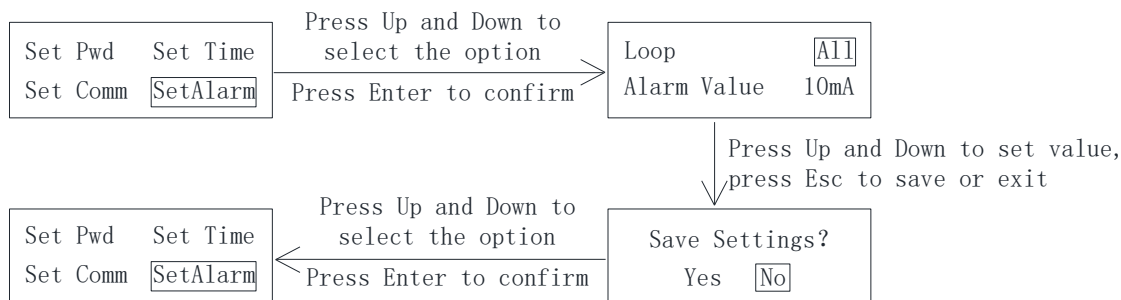
(7) Empty the record and version information

[Clr SOE] is for clearing fault records and re-records at the current time.

[Sw Info.] is used to display information about the meter model and software version. The operation is relatively simple, as follows:

```
┌─────────────────────┐   Press Up and Down to   ┌─────────────────────┐
│ [Clr SOE]  Sw Info. │       select the option   │    Clear SOE?       │
│ Set Loop   Language │ ─────────────────────────→│    Yes    [No]      │
└─────────────────────┘   Press Enter to confirm  └─────────────────────┘

┌─────────────────────┐   Press Up and Down to   ┌─────────────────────┐
│ Clr SOE   [Sw Info.]│       select the option   │   SN:2015121203     │
│ Set Loop   Language │ ─────────────────────────→│ Software:484 V1.06  │
└─────────────────────┘   Press Enter to confirm  └─────────────────────┘
```
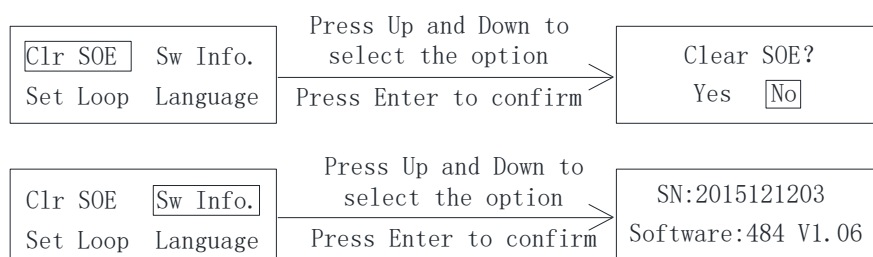
(8) Enable and close some unused circuits

[Set Loop], AIM-R100 can be connected to 12 AKH-0.66/L-20 CT at most, it can close off the unused part of the circuit that is not connected to the transformer. The operation is as follows:

```
┌─────────────────────┐   Press Up and Down to   ┌─────────────────────┐
│ Clr SOE    Sw Info. │       select the option   │ L1: [Open] L2: Close│
│ [Set Loop] Language │ ─────────────────────────→│ L3: Close L4: Close │
└─────────────────────┘   Press Enter to confirm  └─────────────────────┘
                                                              │
                                                   Press Up,Down and Enter to set
                                                   value, press Esc to save or exit
                                                              │
┌─────────────────────┐   Press Up and Down to   ┌─────────────────────┐
│ Clr SOE    Sw Info. │       select the option   │  Save Settings?     │
│ [Set Loop] Language │ ←─────────────────────────│  Yes    [No]        │
└─────────────────────┘   Press Enter to confirm  └─────────────────────┘
```
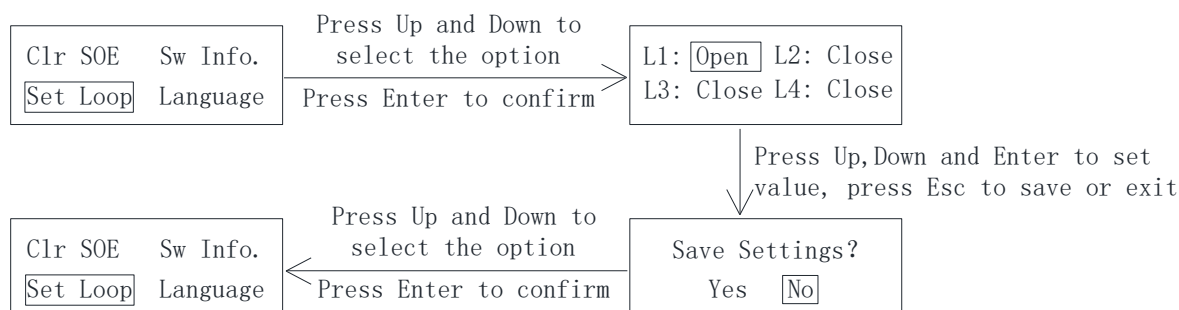
(9) Self-check operation

Press the "Test/ESC" key in the normal operation state, the meter will be self-check. After completed, it will automatically jump to the normal operation state. Operation examples are as follows:

```
┌─────────────────────┐                          ┌─────────────────────┐
│ 2015-07-02 12:30:45 │        Press Test         │                     │
│ L1:  30mA  L2:Break │ ─────────────────────────→│                     │
│ L3:   6mA  L4:Close │                           │                     │
└─────────────────────┘                          └─────────────────────┘
                                                              │
                                                   All indicators
                                                   light up
                                                              │
┌─────────────────────┐   Indicator lights       ┌─────────────────────┐
│ 2015-07-02 12:30:45 │   return to normal        │                     │
│ L1:  30mA  L2:Break │ ←─────────────────────────│ Self-check is done! │
│ L3:   6mA  L4:Close │                           │                     │
└─────────────────────┘                          └─────────────────────┘
```
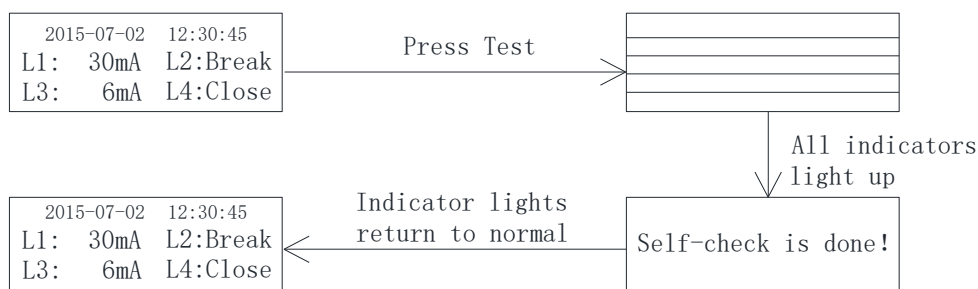
(10) Fault event record query

Press "▼" key for many times in normal operation to reach the interface of [Fault Record], and Press

"Menu/Enter" key to enter. Up to 10 fault records can be recorded, arranged from new to old. Press "Test/ESC" key to exit when the view is complete.

```
┌─────────────────────────┐                    ┌─────────────────────────┐
│  2015-07-02  12:30:45   │   Press Down key   │  2015-07-02  12:30:45   │
│ L1:   30mA  L2:Break    │ ─────────────────> │ L5: Close L6: Close     │
│ L3:    6mA  L4:Close    │                    │ L7: Close L8: Close     │
└─────────────────────────┘                    └─────────────────────────┘
                                                         │ Press Down key
                                                         ▼
┌─────────────────────────┐                    ┌─────────────────────────┐
│     Fault Record        │   Press Down key   │  2015-07-02  12:30:45   │
│  Press Enter key>>>     │ <───────────────── │ L9: Close L10:Close     │
└─────────────────────────┘                    │ L11:Close L12:Close     │
         │ Press Enter                         └─────────────────────────┘
         ▼
┌─────────────────────────┐                    ┌─────────────────────────┐
│ 1、Loop:1(31mA)         │ Press Up/Down to view │ 2015-07-02  12:30:45  │
│ Alarm value:30mA        │ ───────────────────> │ L1:   30mA  L2:Break  │
│ 2015-07-02  12:30:45    │ Press Esc to exit    │ L3:    6mA  L4:Close  │
└─────────────────────────┘                    └─────────────────────────┘
```

6.4.2 AID150 alarm and display device

(1) Description of the Operating Interface

After the system is powered on, if there is no fault alarm, AID150 shows the normal operation interface as shown in the following figure. The black boxes in the figure indicate that the corresponding address serial number is connected to the device communication, and the black boxes indicate that there is no device connection, or that the communication is not connected. When the insulation monitors or residual current monitor detects the fault, AID150 displays the corresponding alarm interface and sends out the corresponding sound and light alarm.

```
┌─────────────────────────┐   ┌─────────────────────────┐   ┌─────────────────────────┐
│ ─────────────────────   │   │ System fault(01/02)     │   │ System fault(02/02)     │
│    System normal        │   │ Loc.:ICU Bed:04         │   │ Loc.:OR Room:06         │
│ --■□□□□□□□□□□□□□□--      │   │ Fault type:│Insu│       │   │ L1:OK       L2:OK       │
│ 2015-07-02  12:30:45    │   │ BRK     OL      OT      │   │ L3:OK       L4:│ORC│    │
└─────────────────────────┘   └─────────────────────────┘   └─────────────────────────┘
     Normal System         Fault Indication (AIM-M300)   Fault Indication (AIM-R100)
```

(2) Fault record viewing interface operations and descriptions

```
┌─────────────────────────┐  Press up and  ┌─────────────────────────┐              ┌─────────────────────────┐
│ ─────────────────────   │  down key       │ ─────────────────────   │ Press Enter  │ -------NO.01-------      │
│    System normal        │ ──────────────> │   Check fault           │ ───────────> │ Loc.:ICU Bed:04         │
│ --■□□□□□□□□□□□□□□--      │                 │  Press Enter>>>         │              │ Type:insulation         │
│ 2015-07-02  12:30:45    │                 │ ─────────────────────   │              │ Time:15-01-01 16:32     │
└─────────────────────────┘                 └─────────────────────────┘              └─────────────────────────┘
         ▲                                                                                      │
         │                          ┌─────────────────────────┐                                │
         │  Press Erasure to return │ -------NO.03-------      │  Press up and down key         │
         └───────────────────────── │ Slave addr.:00          │ <──────────────────────────────┘
                                     │ Type:No record          │
                                     │ Time:00-00-00 00:00     │
                                     └─────────────────────────┘
```

(3) Programming Interface Operation and Explanation

The operation method and process are shown in the following flow chart.

```
 _____                        _____
   System normal       Press MENU            Input password:        Press Up and Down to input password
 --■□□□□□□□□□□□□□□--  ───────────►          0000                   Press Enter to confirm
  2015-07-02  12:30:45                      _____
 _____

              Press Erasure to return                                         _____
         ◄──────────────────────────────────────────────────                  Password   Time
                                                                               Slave      Comm
                                                                               Clear      Firmware
   _____                                                        _____
    Save param settings?     Press Up and Down to select YES or NO
      Y        N             Press Enter to confirm
   _____

   Press Up and Down to set password, press        _____
          Erasure to save or exit                    Password          Press Enter to confirm
  ◄──────────────────────────────────────            0001            ◄──────────────────────
                                                    _____

                                                                              Press Up and Down to
   Press Enter and Up and Down to set time,        _____        select the Time and
         press Erasure to save or exit               Time set               press Enter to confirm.
  ◄──────────────────────────────────────          2015-07-02 12:30:45    ◄──────────────────────
                                                    _____

                                                                              Press Up and Down to
   Press Enter and Up and Down to set parameters,  _____        select the Comm and
         press Erasure to save or exit                                      press Enter to confirm.
  ◄──────────────────────────────────────          NO. of slaves:    16   ◄──────────────────────
                                                    Baud rate:    9600
                                                    _____

                                                                              Press Up and Down to
   Press Enter and Up and Down to set parameters,  _____        select the Comm and
         press Erasure to save or exit                                      press Enter to confirm.
  ◄──────────────────────────────────────          Language:  Chn        ◄──────────────────────
                                                    _____

                                                                              Press Up and Down to
   Press Enter and Up and Down to set parameters,  ---Slave Addr. 01--        select Location and
         press Erasure to save or exit             Location:        ICU     press Enter to confirm.
  ◄──────────────────────────────────────          Loop: 01 Bed Num:004   ◄──────────────────────
                                                    System voltage: 220V

                                                                              Press Up and Down to
                                                   _____        select Firmware and
                                                    Alarm and displayer      press Enter to confirm.
                                                    NO.:483   Ver.:V1.06     Press Erasure to return
                                                   _____

                            Press Up and                                      Press Up and Down to
   _____      Down to select        _____         select the Clear and
    Fault record cleared!   and press Enter        Clear SOE ?               press Enter to confirm.
                            to confirm.              Y        N              Press Erasure to return
   _____    ◄──────────────        _____

                            Press Up and
   ----------01----------    Down to select       -----Slave addr.-----       Press Up and Down to
   RC loop no.      ALL     and press Enter        01 02 03 04 05 06 07        select the Slave and
   Alarm value     10mA     to confirm.            08 09 10 11 12 13 14      press Enter to confirm.
   Alarm delay      99S   ◄──────────────         15 16                    ◄──────────────────────

   ----------02----------   Press Up and Down to select
   Insulation    50KΩ       and press Enter to confirm.
   Load            35A      ◄──────────────
   Temperature     70℃

   Press Enter and Up and Down to set parameter,  _____
          press Erasure to save or exit            Save param settings
  ◄──────────────────────────────────────           YES        NO
                                                   _____
```

7 Communication Protocol

7.1 Modbus-RTU Communication Protocol

Meter RS485 interface adopts Modbus-RTU protocol, which defines the address, function code, data, check code in detail. It is necessary content to complete the data exchange between the host and slave.

7.2 Function Code Introduction

7.2.1 Function code 03H or 04H: Read the registers

This function allows the user to acquire the data collected and recorded by equipment and the system parameters. The number of data requested by hosts has no limit, but cannot exceed the range.

The following example shows how to read a measured insulation resistance value from No.01 slave computer, with the address of the value of 0008H.

The host computer sends		Send message		The slave computer returns		Return message
Address code		01H		Address code		01H
Function code		03H		Function code		03H
Start address	High byte	00H		Bytes		02H
	Low byte	08H		Register data	High byte	00H
Number of registers	High byte	00H			Low byte	50H
	Low byte	01H		CRC check code	Low byte	B8H
CRC check code	Low byte	05H			High byte	78H
	High byte	C8H				

7.2.2 Function code 10H: Write the registers

The function code 10H allows the user to change the contents of multiple registers, which can write the time and date in this meter. The host can write up to 16 (32 bytes) data at a time.

The following example presets the time of the slave at address 01 to Friday, 01/12/09, 12:00 PM.

The host computer sends		Send message		The slave computer returns		Return message
Address code		01H		Address code		01H
Function code		10H		Function code		10H
Start address	High byte	00H		Start address	High byte	00H
	Low byte	04H			Low byte	04H
Number of registers	High byte	00H		Number of registers	High byte	00H
	Low byte	03H			Low byte	03H
Number of registers		06H		CRC check code	Low byte	C1H
0004H data	High byte	09H			High byte	C9H
	Low byte	0CH				

0005H data	High byte	01H
	Low byte	05H
0006H data	High byte	0CH
	Low byte	00H
CRC check code	Low byte	A3H
	High byte	30H

7.3 AIM-R100 Address Table

No.	Address	Parameter	Read/ Write	Value Range	Data Type
0	0000H	Password	R/W	0001~9999 (default 0001)	UINT16
1	0001H	RS485 address	R/W	1~16 (default 1)	UINT16
		RS485 baud rate	R/W	1~3: 4800, 9600, 19200 (unit bps) (default 2)	
2	0002H	Reserved			UINT16
3	0003H	Reserved			UINT16
4	0004H	Year	R/W	1~99, decimal value +2000	UINT16
		Month	R/W	1~12	
5	0005H	Day	R/W	1~31	UINT16
		Week	R/W	1~7	
6	0006H	Hour	R/W	0~23	UINT16
		Minute	R/W	0~59	
7	0007H	Second	R/W	0~59	UINT16
		Reserved			
8	0008H	Trip time	R/W	0~60 (unit second)	UINT16
9~10	0009H~000AH	Reserved			UINT16*2
11	000BH	Meter model and Fault flag	R	bit15~bit12: 0 for IMD; 1 for RCM bit11~bit8: Reserved bit7~bit6: Loop 1 state (00 Normal: 01 Short circuit: 10 Break line: 11 Over current; Same below) bit5~bit4: Loop 2 state bit3~bit2: Loop 3 state bit1~bit0: Loop 4 state 0x80C0 means 1000 0000 1100 0000, Loop 1 overcurrent	UINT16

12	000CH	Fault flag		R	bit15~bit14: Loop 5 state bit13~bit12: Loop 6 state bit11~bit10: Loop 7 state bit9~bit8: Loop 8 state bit7~bit6: Loop 9 state bit5~bit4: Loop 10 state bit3~bit2: Loop 11 state bit1~bit0: Loop 12 state 0xC000 means 1100 0000 0000 0000, loop 5 overcurrent	UINT16
13	000DH	S O E 1	Fault loop	R	1~12	UINT16
14	000EH		Fault value	R	10~5000 (0xE5E5 for short circuit, 0xFAFA for broken circuit)	UINT16
15	000FH		Fault value set	R	10~1000 (unit mA) (default 10mA)	UINT16
16	0010H		Year	R	SOE1- year	UINT16
			Month	R	SOE1- month	
17	0011H		Day	R	SOE1- day	UINT16
			Hour	R	SOE1- hour	
18	0012H		Minute	R	SOE1- minute	UINT16
			Second	R	SOE1- second	
19~72	0013H~0048H	SOE2~10		R	Format like SOE1	UINT16*54
73	0049H	Reserved				UINT16
74~85	004AH~0055H	Loop 1~12 value		R	0~5000 (unit mA)	UINT16*12
86~97	0056H~0061H	Loop 1~12 fault value		R	6~1000 (unit mA)	UINT16*12

8 Typical Applications

The application of medical residual current monitoring products in the operating room power distribution system is shown in the figure below:

C65H ICB 16A/2P WX1 — Wall socket1 (special for surgery)
C65H ICB 16A/2P WX2 — Wall socket2 (special for surgery)
C65H ICB 16A/2P WX3 — Wall socket3 (special for surgery)
C65H ICB 16A/2P WX4 — Wall socket4 (special for surgery)
C65H ICB 20A/2P WX5 — Tower crane
C65H ICB 16A/2P WX6 — Central Intelligence Control Panel
C65H ICB 16A/2P WX7 — Operating Bed
C65H ICB 16A/2P WX8 — PC Platform

Isolation Transformer
AC220V/AC220V 8kVA
CT
AKH-0.66P26
C65 ICB 40A/2P
6A   6A
AITR8000SS
C65 ICB 40A/2P
Temp. Insu. Load

HDR-60-24   AIM-M300   RS485 DC24V   AID150 — Alarm and Display (In operating room)
DC Power   IMD

AIM-R100
RCM

BG3-63II/N4DR
Interpact INS 63A
DTSY1352
ATSE

AKH-0.66Z 80/0.05
SPD

C65N C16/2P   WL1   AC220/24V(transformer inside) — OR shadowless lamp
C65N-C16/2P+Vigi C65 ELM 32A/2P 30mA   WL2 — Emergency lamp
C65N-C16/2P+Vigi C65 ELM 32A/2P 30mA   WL3 — Viewing lamp
C65N-C16/2P+Vigi C65 ELM 32A/2P 30mA   WL4 — Writing table lamp
C65N-C16/2P+Vigi C65 ELM 32A/2P 30mA   WL5 — Electric door power supply
C65N-C16/2P+Vigi C65 ELM 32A/2P 30mA   WL6 — Operation table
C65N-C16/2P+Vigi C65 ELM 32A/2P 30mA   WL7 — OR1 lighting
C65N-C16/2P+Vigi C65 ELM 32A/2P 30mA   WL8 — OR2 lighting
C65N-C20/4P+Vigi C65 ELM 32A/4P 30mA   WL9 — Three-phase socket (reserve)

9 Power On and Debugging Instructions

9.1 Wiring Check

Each set of residual current monitoring products should be connected before power on, mainly to check whether there is wrong connection, missing connection, or short circuit. According to the wiring diagram shown in part 5.4 of this manual, the inspection can be carried out in the following order:

(1) Check each set of residual current monitoring system, including AIM-R100, AKH0.66/l-20, AID150, and ACLP10-24.

(2) Check input terminals 1 and 2 of ACLP10-24 in each set of residual current products are connected to AC220V power supply. Whether the 24V and G of the output end are reliably connected with the 24 V and G terminals of the AID150, and the positive and negative poles are correct.

(3) Check the corresponding wiring of each CT in the system is connected with I△n at one end and " COM " terminal at the other end (without positive and negative). Check the wiring of CT.

9.2 Common Faults and Eliminations

Make sure the wirings are correct and power on the system. Then check whether each meter is abnormal, and whether there is a fault alarm in AIM-R100. For common problems, the causes can be determined and the faults can be eliminated according to the phenomenon of each device and the fault types. See the table below:

Model	Fault	Possible causes and troubleshooting
AIM-R100 Residual Current Monitor	LCD display: disconnection fault, fault indicator light on	The outgoing line of residual current transformer is not reliably connected to the signal input terminal of AIM-R100. Check the wiring and ensure the reliable connection.
	LCD display: short-circuit fault, fault indicator light lights on	If the outgoing line of residual current transformer is short circuited, check the wiring and ensure its reliable connection.
	The meter doesn't work	The 220V power supply of AIM-R100 is not connected well. Check the wiring of terminals 1 and 2 and ensure its reliable connection.
ACLP10-24 Power Supply	Power on indicator is not lit.	Check whether the wirings of 220V power input are normal and whether the voltage between the two terminals is within the allowable input range.
AID150 Alarm and Display Device	The meter doesn't work	The 24V power supply is not connected well. Check the wirings of 24V and G terminals and rewire.
	Communication fault	(1) The address setting of AIM-R100 is repeated, or BAUD is not set to the default 9600. (2) If the communication line with AIM-R100 in the system is not well connected, check the communication line and confirm whether the matching resistance is connected properly.

9.3 Settings and Debugging

(1) Medical IT products need to enter a password when entering the menu settings, and the initial password for medical IT products is 0001.

(2) After the system is normally powered on, the default alarm current threshold is 10mA, if you need to adjust, please refer to chapter 6.4 to change the parameter operation.

(3) Communication address setting: When AID150 alarm and display device centrally monitors multiple AIM-R100 residual current monitors, you need to set the RS485 communication address of AIM-R100 in turn, and the address setting should start from 1, and the maximum should not exceed 16.

(4) System quantity setting. When AID150 connects N residual current monitors, you need to set "Number of systems" in AID150 settings to N. When the residual current monitor exceeds 16, you should increase AID150 for network monitoring.

(5) Communication view and debugging. After setting the address and system number to check the communication status, AID150 operation interface can display the communication status of the access residual current monitor, if it shows "□", it means that the corresponding address communication failure, if it shows "■", it means that the corresponding address communication success. If the communication fails, you need to check whether the connection of the communication bus is reliable. If several residual current monitors are unable to communicate, you can connect matching resistors in parallel at the end of the first end of the communication bus.