702

Medical IT System Intelligent Insulation Monitoring Devices

(M300 Five-Piece Set)

Installation and Operation Manual V1.2

Acrel Co., Ltd.

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Modified Records

No.	Time	Versions	Reasons for revision
01	2023.12.20	V1.0	Modified based on 076 Medical... Five-piece set... V2.6, M300 Five-Piece-Set version
02	2024.05.30	V1.1	AID120 discontinued, delete related, add AID200; M300 communication add CAN, supplement related
03	2025.01.15	V1.2	AID150 openings accurate to 0.1, Update bottom info.
Note:			

Contents

Medical IT System Intelligent Insulation Monitoring Devices

1 Introduction

Medical IT systems are mainly used in important medical Class 2 places such as operating rooms, ICU/CCU intensive care units, etc., to provide safe, reliable, and continuous power distribution for important equipment in these places.

The medical insulation monitoring products are the monitoring devices developed by Acrel Co., Ltd. with years of design experience in power instrumentation industry, according to the special requirements of insulation resistance of the power distribution system in medical 2 types of places. It can be used in the isolation power supply system of various operating rooms and intensive care units in medical places to realize the real-time monitoring of system insulation, load and isolation transformer temperature and other operating conditions, and can realize remote monitoring. The product complies with the provisions of enterprise standard Q31/0114000129C013-2016 *IT system insulation monitor*.

Medical IT system intelligent insulation monitoring products (M300 five-piece set) include AITR series medical isolation transformer, AIM-M300 medical intelligent insulation monitor, AKH-0.66P26 current transformer, HDR-60-24 DC power supply and AID series alarm and display meter. The products are shown in Table 1.

Table 1 Medical IT System Insulation Monitoring Products

Model and Name	Picture	Description
AITR series Medical Isolation Transformer		AITR series isolation transformers are specialized in medical IT isolation power supply system, with low core loss, double insulation treatment between windings and electrostatic shielding screen to reduce electromagnetic interference between windings. Pt100 temperature sensor is installed in the wire package for monitoring the transformer temperature. The whole is treated with vacuum dipping paint, which increases the mechanical strength and corrosion resistance. Low temperature rise and low noise.
AIM-M300 Insulation Monitoring Device (IMD)		AIM-M300 insulation monitor adopts advanced microcontroller technology with high integration, compact size, easy installation, integrating intelligence, digitization, and networking, and is suitable for insulation monitoring of isolated power supply systems in operating rooms, intensive care units and other medical 2 types of places.
AKH-0.66P26 Current Transformer		AKH-0.66P26 current transformer is a protection type current transformer used with AIM-M300 insulation monitor, the maximum measurable current is 60A, the ratio is 2000:1, the current transformer is mounted inside the cabinet with screws fixed directly, and the secondary side is led out through the wiring, which is easy to install and use.

HDR-60-24 DC Power Module		HDR-60-24 DC power supply can provide DC 24V power supply for AIM-M300 Medical Intelligent Insulation Monitor, AID150/200 Alarm and Display Device and so on. With high power, stable voltage output and easy installation, the power supply module can meet the power supply requirements of the above devices and is a recommended power supply product.
AID150/200 Alarm and Display Device		AID150/200 alarm and display device adopt LCD liquid crystal display, which can centrally monitor the data of up to 16 sets of AIM-M300 Medical Intelligent Insulation Monitor, with sound and light alarm function for insulation, overload, over temperature, equipment failure and other faults. AID150 uses RS485 and AID200 uses CAN interface.

2 Function Features

2.1 Function Features of AITR series Medical Isolation Transformer

- Core component of a medical IT system for converting TN into IT system (ungrounded system);
- The transformation ratio between the primary and secondary windings is 1:1;
- Double insulation treatment is adopted between the windings, shielding layer is designed;
- The Pt100 temperature sensor is installed in each wire packet to monitor the temperature.

2.2 Function Features of AIM-M300 Insulation Monitor

- Real-time monitoring and fault alarm for the ground insulation resistance of the monitored IT system, transformer load current and transformer winding temperature;
- Real-time monitor and the measured system connecting line breakage fault, current transformer breakage fault, temperature sensor breakage fault and function grounding line breakage fault, and give alarm indication within 2s after the fault occurs;
- Relay alarm output, LED alarm indication and other fault indication functions;
- Communication, which can communicate with the alarm and display device to monitor the operation of the IT system in real time;
- SOE (Sequence of Event) function, recording the time of alarm occurrence and the type of fault, which is convenient for operators to analyze the system operation status and eliminate faults in time.

2.3 Function Features of AID150/200 Alarm and Display Device

- The device can remotely monitor the real-time operation status of up to 16 sets of IT systems, and the main interface shows whether the communication of access system is normal;
- The insulation resistance alarm value, load current alarm value and transformer temperature alarm value of each system insulation monitor can be set remotely and the insulation monitor self-test can be started remotely;
- When insulation failure, overload, high transformer temperature rise or wiring fault occurs in any of the monitored systems, the centralized alarm and display instrument provides corresponding sound and light alarm functions, and the alarm sound can be eliminated manually;

➢ SOE function, convenient for operators to analyze the system operation condition and eliminate the faults in time, and can save the latest 50 records at most.

2.4 Function Features of HDR-60-24 DC Power Supply

➢ It used for the DC 24V power supply for AIM-M300 insulation monitoring device and AID150/200 alarm and display device and other devices;

➢ AC 220V input, DC 24V output, with max output power of 60W.

2.5 Function Features of AKH-0.66P26 Current Transformer

➢ The maximum measurable current is 60A, and the transformation change ratio is 2000:1;

➢ Work with the AIM-M300 insulation monitoring device to measure the load current.

3 Reference Standard

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

■ IEC 61557-8 *Electrical safety of low voltage distribution system below AC 1000V and DC 1500V, Test, measurement or monitoring equipment for protection test section 8: Insulation monitoring device for IT systems*

■ IEC 61557-9 *Electrical safety of low voltage distribution system below AC 1000V and DC 1500V, Test, measurement or monitoring equipment for protection test section 9: insulation fault positioning equipment for IT systems*

■ IEC 61558-1 *Safety of power transformers, power supplies, reactors and similar products section 1: General requirements and tests*

■ IEC 61558-2-15 *Safety of power transformers, power supplies and similar products section 16: Special requirements for isolation transformers for power supply in medical locations*

4 Technical Parameters

4.1 Technical Parameters of AITR series Medical Isolation Transformer

Refer to Table 2.

Table 2 Technical Parameters of AITR series of Medical Isolation Transformer

Item	AITR10000S	AITR8000S	AITR6300S	AITR5000S	AITR3150S
Insulation class	F	F	F	F	F
Protection class	IP00	IP00	IP00	IP00	IP00
Power/voltage/ current					
Rated power	10000VA	8000VA	6300VA	5000VA	3150VA
Rated frequency	50~60Hz	50~60Hz	50~60Hz	50~60Hz	50~60Hz
Rated input voltage	AC230V	AC230V	AC230V	AC230V	AC230V
Rated input current	45.3A	36A	28.5A	22.5	14.2A
Rated output voltage	AC230V/115V	AC230V/115V	AC230V/115V	AC230V/115V	AC230V/115V
Rated output current	43.5A	34.7A	27.4A	21.7	13.7A

Inrush current	<12In	<12In	<12 In	<12 In	<12In
Leakage current	<500μA	<500μA	<500μA	<500μA	<500μA
No load input current	1.359A	1.08A	0.855A	0.675A	0.426A
No load output voltage	234V±3%	234V±3%	234V±3%	234V±3%	234V±3%
Short circuit voltage	<9.2V	<9.2V	<9.2V	<9.2V	<9.2V
General parameters					
Fuse wire	80A	63A	50A	35A	25A
Primary winding resistance	<55mΩ	<64mΩ	<80mΩ	<131 mΩ	<245mΩ
Secondary winding resistance	<45mΩ	<64mΩ	<80mΩ	<116 mΩ	<228mΩ
Iron loss	<80W	<65W	<60W	<50W	<30W
Copper loss	<450W	<345W	<277W	<255W	<175W
Efficiency	>96%	>96%	>96%	>96%	>95%
Maximum ambient temperature	<40℃	<40℃	<40℃	<40℃	<40℃
No-load temperature rise	<80K	<80K	<80K	<80K	<80K
Full load temperature rise	<40dB	<40dB	<40dB	<40dB	<40dB

4.2 Technical Parameters of AIM-M300 Insulation Monitoring Device

Refer to Table 3.

Table 3 Technical Parameters of AIM-M300 Insulation Monitoring Device

AUX Power	Voltage	DC 18~36V	Locate Signal	Locate voltage	--
	Power consumption	≤6W		Locate current	--
Insulation Monitoring	Resistance range	15~999kΩ	Alarm Output	Output mode	2 output relays
	Response value	50~999kΩ		Contact rating	AC 250V/3A DC 30V/3A
	Relative uncertainty	±10%	Communication Protocol	Communication 1	RS485, Modbus-RTU
	Response time	≤3s		Communication 2	CAN, customizable
	Permissible system leakage capacitance	≤5μF	Environment	Operating temperature	-10~+55℃
	Allowed voltage Ufg	≤ DC 280V		Transport temperature	-25~+70℃
	Measuring voltage	≤13V		Storage temperature	-25~+70℃
	Measuring current	≤50μA		Relative humidity	5~95%, No condensation
	Impedance Zi	≥240kΩ		Altitude	<2500m
Current Monitoring	Measuring Value	2.1~60A	Insulation Method		guide
	Measuring accuracy	±5%	Display Method		LCD, LED

	Alarm Value	5~80A	Fault Record	20
Temperature Monitoring	Thermal resistor	two Pt100	IP degree	IP40
	Measuring range	-50~+200℃	Rated voltage / Pollution degree	4KV/III
	Alarm value range	0~+200℃	EMC/EMR	IEC61326-2-4

4.3 Technical Parameters of AID150/200 Alarm and Display Device

Refer to Table 4.

Table 4 Technical Parameters of AID150/200

Item		Technical parameters
Auxiliary power supply	Voltage	DC 24V
	Consumption	< 0.6W
Number of IT systems monitored		16
Insulation resistance alarm setting		10~999kΩ
Load current alarm setting		0~99A
Over-temperature alarm setting		0~200℃
Installation mode		Embedded in wall, rail, panel
Alarm mode		Sound-light alarm
Alarm type		Insulation fault, overload, overheat, equipment fault
Communication mode		RS485, Modbus-RTU; CAN, customized
Display mode		LCD display, 128*64 dot array

4.4 Technical Parameters of HDR-60-24 DC Power Supply

Refer to Table 5.

Table 5 Technical Parameters of HDR-60-24 DC Power Supply

Items		Technical Parameters
AUX Power	Input	AC 100~240V 1.8A
	Output	DC 24V 2.5A
Installation method		35mm guide installation

4.5 Technical Parameters of AKH-0.66P26 Current Transformer

Refer to Table 6.

Table 6 Technical Parameters of AKH-0.66P26 Current Transformer

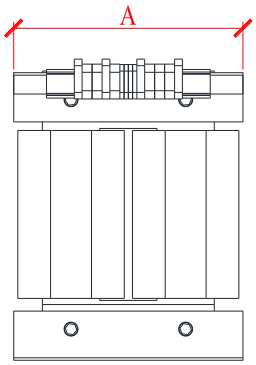
Input current	0.5mA~50A	Frequency range	0.02~10 kHz
Output current	0.025~25 mA	Loading resistance	<200Ω
Temperature coefficient	100 ppm/℃	Transient current (1s)	200A
Phase displacement	10′	Installation	Fixed with 4*10 screws
Operating temperature	-35~+70℃	Secondary wiring	Shielded twisted pair cable $2*0.3mm^2$, 2m, customized
Storage temperature	-40~+75℃		
Secondary resistance range	95~120Ω	Isolation pressure	5000Vac
Accuracy	0.5%	Linearity	0.5%

5 Installation and Wiring

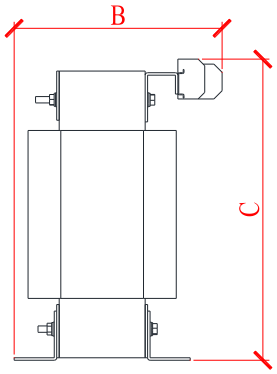
5.1 Shape and Mounting Hole Size

5.1.1 External dimensions of AITR series medical isolation transformer (unit: mm)

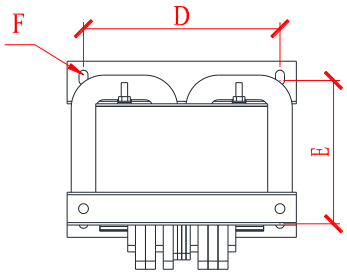
Shape and size of AITR series medical isolation transformer are shown as below and in Table 7.



Front view



Side view



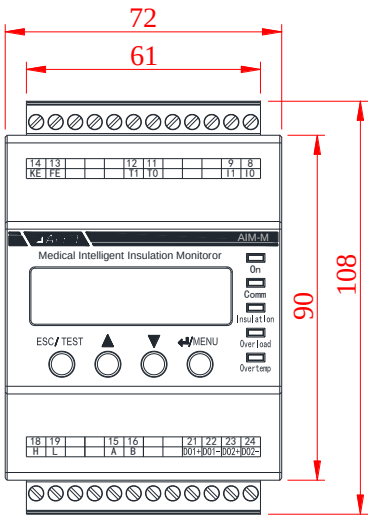
Vertical view

Table 7 External Dimensions of AITR series Medical Isolation Transformer

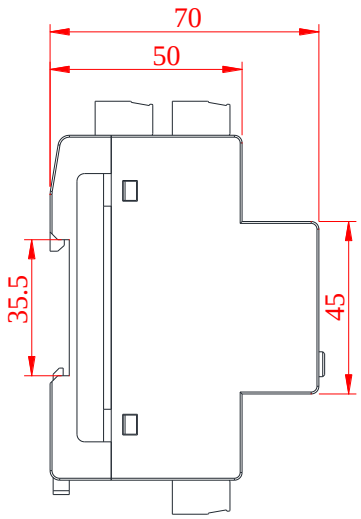
Product Model	Capacity (VA)	Overall dimension (mm)			Mounting dimension (mm)			Weight (kg)
		A	B	C	D	E	F	
AITR10000S	10000	280	236	421	240	190	11*8	86±5
AITR8000S	8000	280	236	421	240	190	11*8	79±5
AITR6300S	6300	280	221	421	240	175	11*8	69±5
AITR5000S	5000	280	211	421	240	175	11*8	62±5
AITR3150S	3150	280	211	421	240	175	11*8	49±5

Note: According to the standard, the maximum capacity of medical single-phase isolation transformer is 10kVA; Dimensions A, B, and C are the length, width, and height of the transformer; dimensions D, E, and F are the installation dimensions of the transformer; F is the mounting hole position. M8*30 screws are recommended to fix the transformer.

5.1.2 External dimensions of AIM-M300 insulation monitoring device (unit: mm)

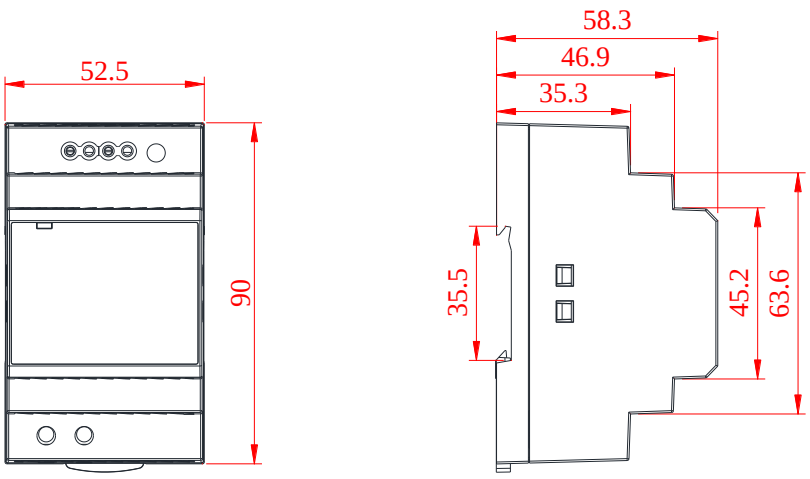


Front view



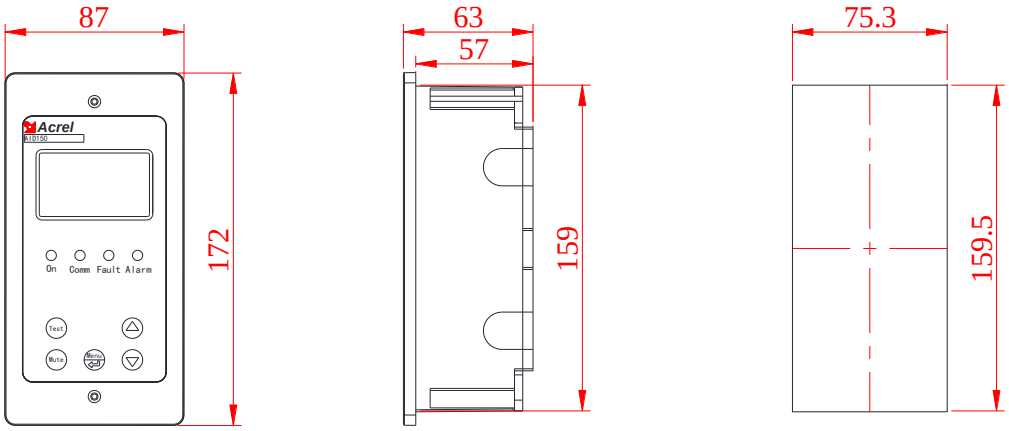
Side view

5.1.3 External dimensions of HDR-60-24 DC power supply (unit: mm)



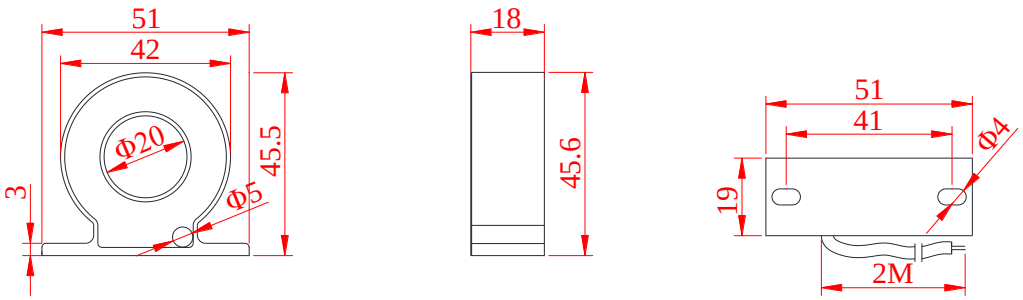
Front view　　Side view

5.1.4 External dimensions of AID150/200 alarm and display device (unit: mm)



Front view　　Side view　　Hole size

5.1.5 External dimensions of AKH-0.66P26 current transformer (unit: mm)



Front view　　Side view　　Bottom view

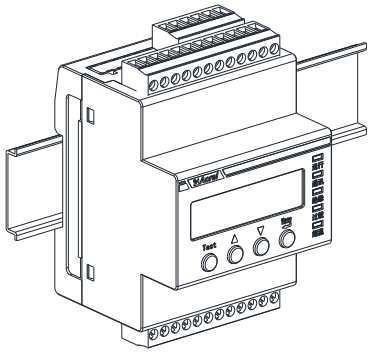
5.2 Installation Method

The M300 five-piece medical IT system insulation monitoring products, with the exception of the AID series of alarms and displays, are best installed centrally in the distribution cabinet (isolated power cabinet), with the isolation transformer mounted on the bottom of the cabinet, secured with matching bolts, and fitted with a cooling fan. Instruments and circuit breakers are mounted on the upper panel. If the isolation transformer is installed separately, it should not be too far away from AIM-M300 insulation monitor.AID150/200 alarms and displays are used in the operating room, they can be installed on the wall next to the intelligence panel in the operating room for medical staff to view; if they are used in ICU/CCU

and other intensive care units, they should be installed in the nurse's station for the nurses on duty to view.AID150 RS485 communication interface and AID200 CI interface are used in the operating room for medical staff to view.AID150 RS485 communication interface and AID200 CI interface are used in the operating room. AID150's RS485 interface and AID200's CAN interface should be connected with AIM-M300 by hand. AID150/200 alarm and display wiring includes two 24V power cables and one 2-core shielded twisted-pair cable, which are all drawn from the isolated power supply cabinet, and attention should be paid to the reserved pipeline during construction.

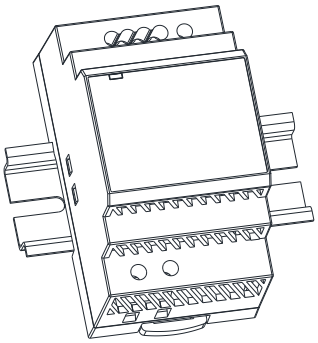
5.2.1 Installation method of AIM-M300 insulation monitoring device

The AIM-M300 insulation monitor is rail mounted as shown in the figure below:



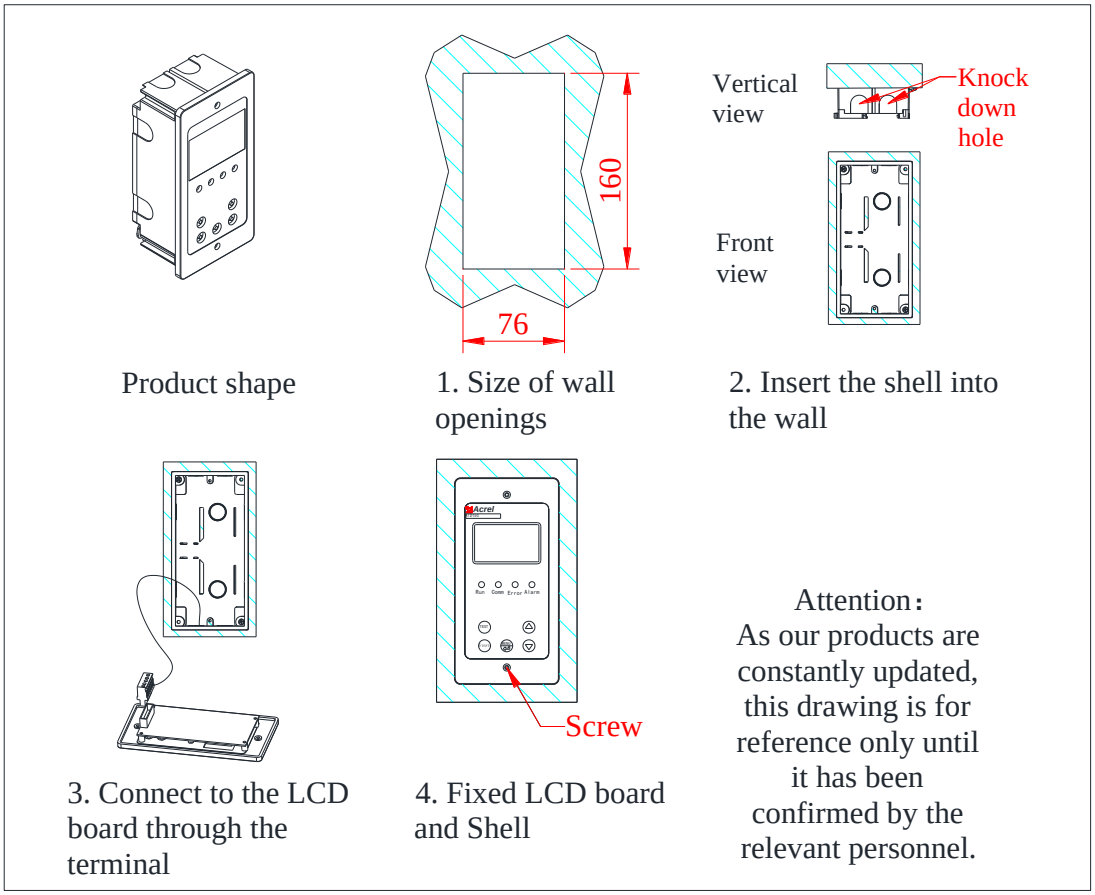
5.2.2 Installation method of HDR-60-24 DC power supply

The HDR-60-24 power supply module is rail-mounted and snap-fastened, and can be mounted side-by-side on the same rail as the AIM-M300 insulation monitor.



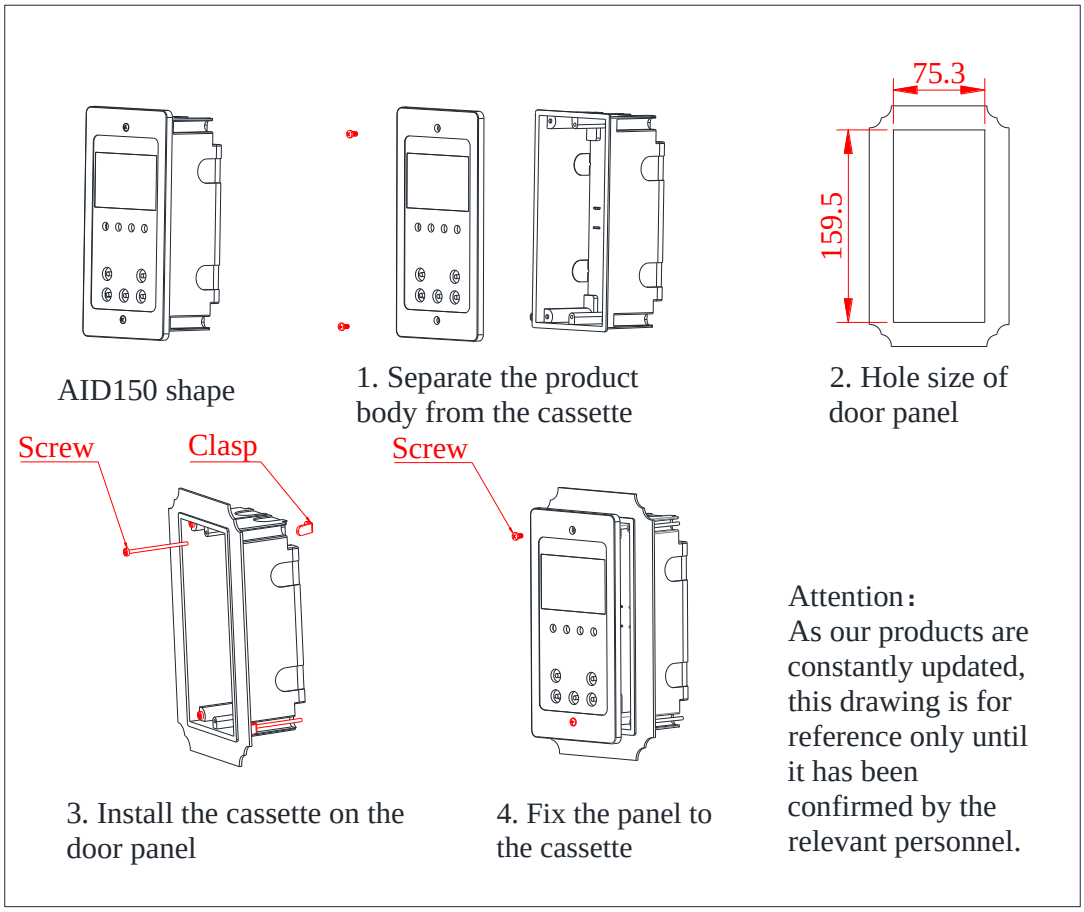
5.2.3 Installation method of AID 150/200 alarm and display device

(1) If the AID150/200 centralized alarm and display device is embedded in the wall, the installation schematic is shown below:



When decorating, first open the opening in a suitable wall position, then introduce the isolated power cabinet wires (two 1.5mm^2 power cables and one 2*1.5mm^2 shielded twisted pair) to receive the terminals, knock out the knockout holes of the shell near the pipeline, then embed the external alarm and display device shell into the wall body for fixing, and then connect the terminals to the corresponding terminals of the front cover wiring board, and then install the panel in the shell, and then fix it by using the supplied Tighten the self-tapping screws to fix it.

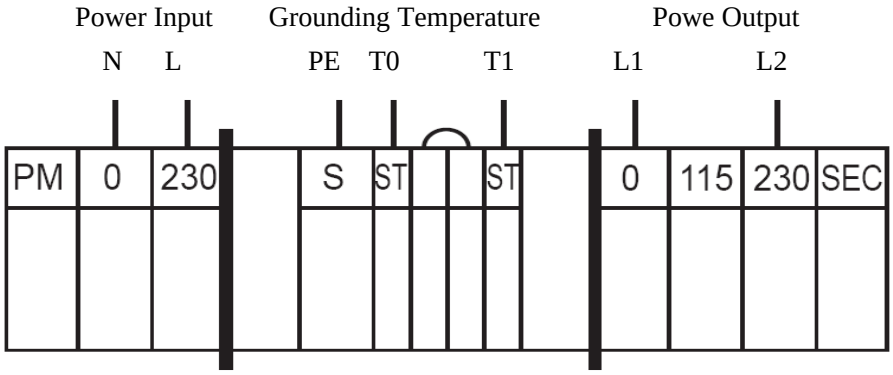
(2) If the AID150/200 is installed by using the cabinet door opening, the installation schematic is shown below:



5.3 Wiring Method

5.3.1 Wiring method of AITR series medical isolation transformer

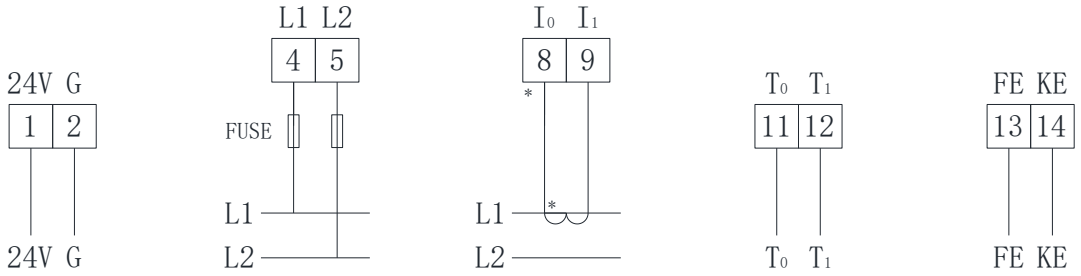
The input terminals at the transformer terminal blocks are labeled with "PM", in which two terminals 0 and 230 are connected to the input 220V single-phase AC. The output terminals are labeled with "SEC", in which the output voltage of two terminals 0 and 230 is AC 220V and is connected to external field load. The "S" terminal is connected to the PE bus bar on the spot or the equipotential terminal line. Two "ST" terminals are temperature sensor interfaces, which are respectively connected to the No.11 and 12 terminals of AIM-M300 insulation monitoring device.



Note: The wirings of input and output terminals of the isolation transformer should select the copper wires matching the line diameter based on the isolation transformer rated input and output current (refer to tables in section 5.4). S terminal wiring can select 2*4mm^2 yellow-green wire. The wiring of two ST terminals can select 2*1.5mm^2 shielded twisted pairs, and the wiring should not be too long.

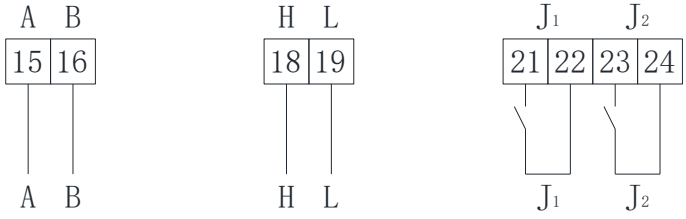
5.3.2 Wiring method of AIM-M300 insulation monitor

Upper row of terminals: 24V, G for auxiliary power supply, L1, L2 and the monitored IT system connection (can be connected to the two outputs of the isolation transformer), I0, I1 for the signal input of the current transformer, T0, T1 for the signal input of the temperature sensor, FE, KE for the function of the grounding line, wiring should be used to connect the two independent wires and the site of the equipotential terminal row.



Power Insulation Current Temperature Grounding

Lower row of terminals: A, B for RS485 communication terminals (used and AID150/200 alarm and display device communication connection), DO1 for over-temperature alarm output (used to control the cooling fan), DO2 for fault alarm relay output.



RS485 CAN DO1 DO2

Notes:

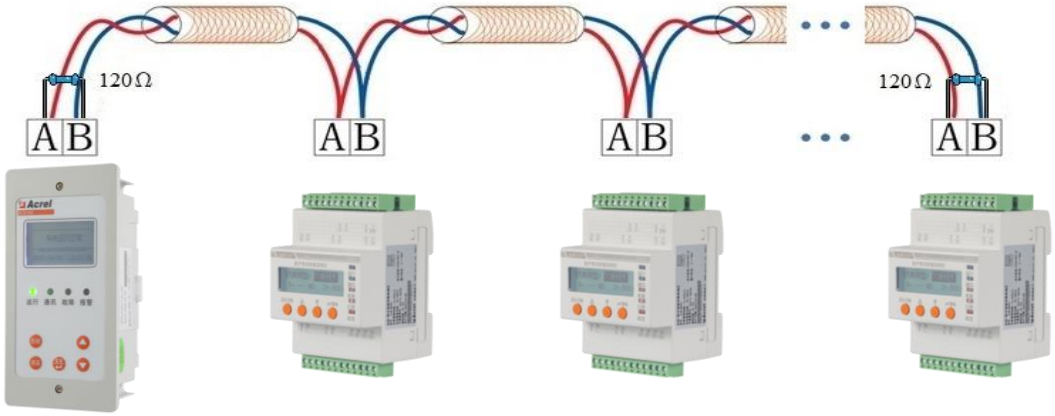
(1) Terminals 1 and 2 of insulation monitor connected to the 24V power supply wiring can be selected 2*1.5mm^2 copper wire, 4, 5 corresponds to the L1 and L2 terminals, you can choose 2*1.5mm^2 multi-stranded copper wire, 13, 14 corresponds to the FE and KE terminals, you can choose 2*4mm^2 yellow and green wire (ground wire). J1, J2 relay output is a dry node, the control of external loads needs J1, J2 relay output is a dry node, when controlling external loads need to add another power supply, such as J1 control AC 220V cooling fan, need to add AC 220V power supply, wiring type according to the load current to determine.

(2) Terminals 8 and 9 correspond to the current transformer signal line, terminals 11 and 12 correspond to the temperature signal line, terminals 15 and 16 correspond to the RS485 communication line.

5.3.3 Wiring methods of AID150/200 Alarm and Display Device

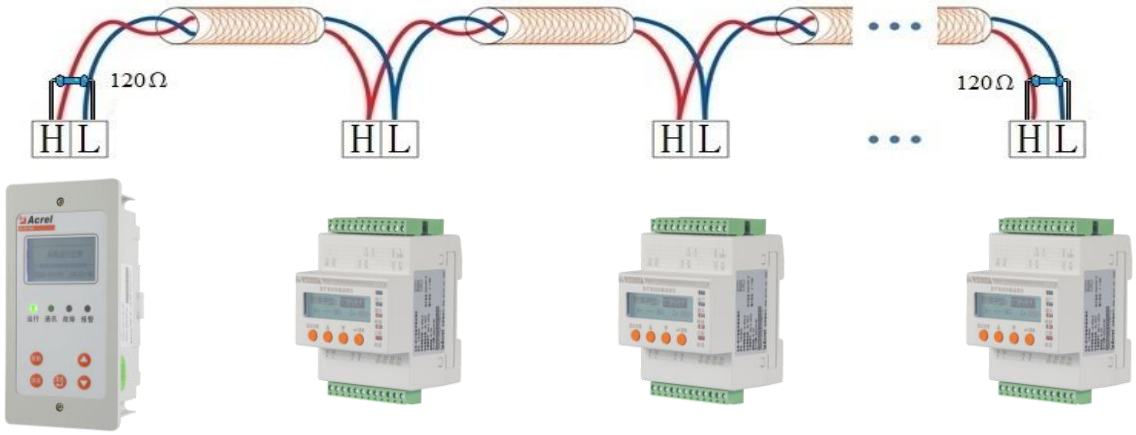
Terminals A and B of AID150 are connected to A and B in the AIM-M300 meter terminals respectively. The power supply terminals are connected to the positive pole and ground of the 24V DC power supply correspondingly, and the wiring diagram is shown below.

When an AID150 is required to access multiple AIM-M300 medical intelligent insulation monitors, all device communication A and B communication terminals should be connected by hand, and if the communication distance is too long or the communication is abnormal, a 120Ω matching resistor should be accessed in parallel at the first and last ends of the communication, as shown in the following figure:



The H and L terminals of AID200 are connected to the H and L in the AIM-M300 meter terminals respectively. The power supply terminals are connected to the positive pole and ground of the 24V DC power supply correspondingly, and the wiring diagram is shown below.

When an AID200 is needed as a local display mounted on the wall or cabinet door in the operating room, the AID200 can be connected to the CAN bus by means of handholding, paying attention to communication abnormalities in the bus at the first end of the tail end of the parallel access to the 120Ω matching resistor. As shown in the figure below:



The 24V power supply of AID150/200 centralized alarm and display device can be connected with

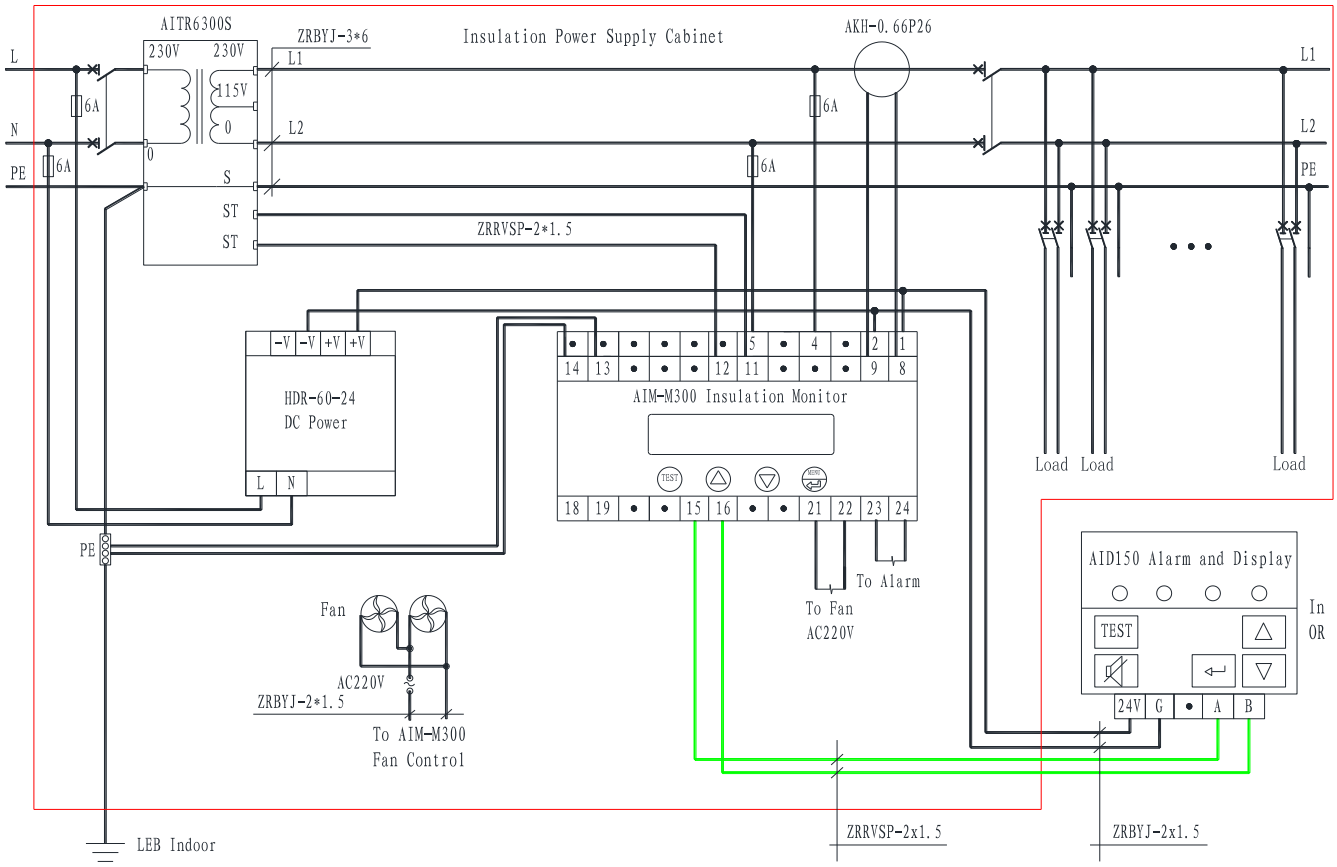
2*1.5mm^2 multi-stranded copper wire; 2*1.5mm^2 shielded twisted-pair wire can be used for external wiring of RS485 communication terminal.

5.3.4 Wiring method of HDR-60-24 DC power supply

Upper row of terminals (output) Lower row of terminals (input)

HDR-60-24 DC power supply lower row of terminals for the power input, access to AC220V L,N, recommended access to the front of the medical single-phase isolation transformer, the upper row of terminals for the power output, to provide two sets of DC 24V outputs, in the power supply, the two -V and +V are connected. The device can provide power supply for AIM-M300 and AID150/200.

5.4 Typical Wiring Diagram



More information:

(1) The connection line diameter of the input and output of the isolation transformer should match the rated current of the isolation transformer, or it can be selected according to the following table:

Isolation Transformer Model	Selected line diameter
AITR3150S	3*4 mm^2
AITR5000S/AITR6300S	3*6 mm^2
AITR8000S/AITR10000S	3*10 mm^2

(2) The auxiliary power supply of AIM-M300 insulation monitor (corresponding terminals: No.1 and

No.2) and AID150/200 alarm and display instrument (corresponding terminals: 24V and G) are all DC 24V, and can be supplied by using HDR-60-24 DC power supply module (24V output terminals: -V and +V). DC power module power input for AC 220V (corresponding terminals: L, N), can be accessed to the front end of the medical single-phase isolation transformer, and series 6A fuse protection.AIM-M300 Insulation Monitor No. 4, 5 terminals for the IT system insulation monitoring, can be accessed to the rear end of the medical single-phase isolation transformer, it is appropriate to series 6A rated fuse protection.AIM-M300 Insulation Monitor 13 AIM-M300 Insulation Monitor No. 13 and No. 14 are grounding terminals, and two independent grounding wires should be used to connect to the equipotential terminal block on site (or the grounding terminal block in the isolated power cabinet).

(3) AIM-M300 insulation monitor 8, 9 terminals for current monitoring, access to AKH-0.66P26 current transformer, the transformer only need to pass through the medical single-phase isolation transformer secondary side of the output of the L1, L2 any one of the two wires, it can not be worn at the same time into the two wires. Current transformer lead wiring into the corresponding terminal, the shield is not grounded.

(4) AIM-M300 insulation monitor 11, 12 terminals for temperature monitoring, access to the temperature sensor, the transformer internal temperature sensor leads to the ST terminal.

(5) AIM-M300 insulation monitor 21, 22 terminals for the over-temperature alarm relay, access to the fan requires external power supply, when multiple transformers are centrally installed in an isolated power supply cabinet, multiple fans should be connected to parallel control by multiple insulation monitors, i.e., each insulation monitor can start and stop all fans. 23, 24 terminals for the fault alarm relay, which can be externally connected to an audible and visual alarm or lead the signal to the intelligence panel. Terminals 23 and 24 are fault alarm relays, which can be connected to sound and light alarms or lead the signal to the intelligence panel.

(6) Terminals 15 and 16 of AIM-M300 insulation monitor are RS485 communication terminals for communication with AID150 18 and 19 are CAN communication terminals for communication with AID200. 16 AIM-M300 can be connected to AID150/200, which can be mounted on the door of the cabinet, the wall of the operation room or the wall of the nurses' station.

5.5 Considerations

(1) Medical IT system insulation monitoring products, except AID series alarm and display device, should be centrally installed in the isolated power cabinet. If the site space is limited and the isolated power cabinet cannot be used, the isolation transformer can be installed separately, but it should not be too far away from the insulation monitor and the site load.

(2) Installation and wiring should be in strict accordance with the wiring diagram, wiring is best used with a needle sleeve connector crimp, and then inserted into the device corresponding terminals and tighten the screws, to avoid poor contact and lead to the device does not work properly.

(3) The grounding wire of the device and transformer should be reliably connected with the

equipotential terminal row on site. When the isolated power cabinet is used, it should be connected to the grounding terminal row in the isolated power cabinet first, and then uniformly connected to the equipotential terminal row on site.

(4) AIM-M300 insulation monitor current input should use matching AKH-0.66P26 current transformer, wiring is recommended to use pin-type cold compression terminal crimping, and then connected to the insulation monitor terminal, do not connect directly with the bare wire header to ensure a reliable connection, but also to facilitate disassembly. Before removing this wiring, the CT primary circuit must be cut off or the secondary circuit must be shorted.

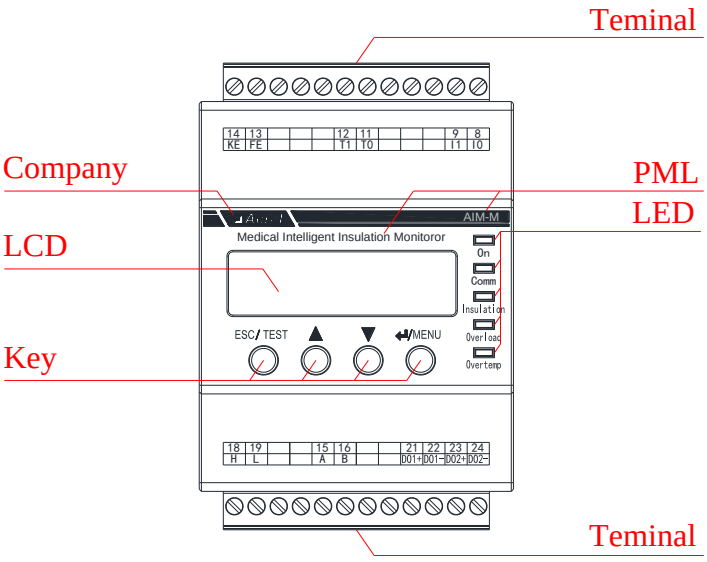
(5) Special reminder:

Any isolation transformer will have an impact current when it starts up, and too large impact current may cause the circuit breaker at primary side of the transformer difficult to disconnect or shut down. Therefore, for medical IT systems composed of medical isolation transformers and insulation monitoring products, in the selection of inlet circuit breaker of the isolation transformer, it is recommended to choose the circuit breakers only with short circuit protection but without overload protection according to IEC standard requirements. If choosing the circuit breaker with overload protection, the circuit breaker should conform to the C and D tripping curves of IEC 60947-2, and the rated current of the circuit breaker should be determined according to the capacity of the isolation transformer as follows: 10kVA-63A, 8kVA-50A, 6.3kVA-40A, 5kVA-40A, 3.15kVA-20A.If the circuit breaker selection is not in accordance with the above requirements, the company shall not be liable for any medical malpractice caused by the closure difficulty of the circuit breaker or the disconnection of the circuit breaker during operation.

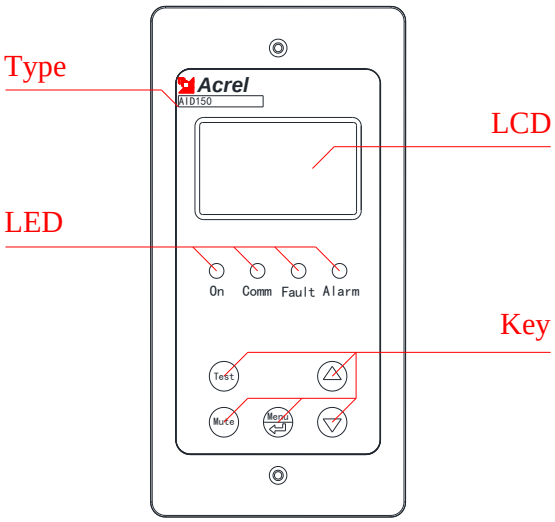
6 Programming and Application

6.1 Panel Description

(1) Panel of AIM-M300 insulation monitor



(2) Panel of AID150/200 alarm and display device



6.2 LED Indicator Instructions

6.2.1 LED indication of AIM-M300 insulation monitor

Indicator	Instructions
On	When the device operation is normal, the indicator light flashes, with the flashing frequency of about one time per second.
Comm	Indicate the status of device communication, when communication, the light flashes.
Insulation	When the insulation resistance exceeds the alarm value, or when the LL/FK is disconnected, the indicator light flashes to alarm.
Overload	When load current exceeds the total load current of transformer, the indicator light flashes.
Overtemp	When testing transformer temperature exceeds the alarm value, or when the temperature sensor wiring is disconnected, the indicator light flashes to alarm.

6.2.2 LED indicator instructions of AID150 Centralized Alarm and Display Device

Indicator status	Instructions
On	When the device is in normal operation, the indicator flashes, and the flickering frequency is about once a second.
Comm	Indicate the status of device communication, when there is data communication, the indicator light flashes.
Fault	When AIM series monitor detect disconnection failure, indicator flashes alarm
Alarm	When AIM-M series monitor exceed threshold alarm, indicator flashing alarm

6.2.3 LED indicator instructions of AID200 Centralized Alarm and Display Device

Indicator status	Instructions
On	When the device is in normal operation, the indicator flashes, and the flickering frequency is about once a second.
Insulation	When the insulation resistance exceeds the alarm value, the indicator light flashes
Overload	When load current exceeds the total load current of transformer, the indicator light flashes.
Overtemp.	When testing transformer temperature exceeds the alarm value, the indicator light flashes .

6.3 Button Function Descriptions

6.3.1 AIM-M300

AIM-M300 insulation monitor has four keys, which are "ESC/TEST" key, "▲" up key, "▼" down key and "↵/MENU" key.

Buttons	Button function
"ESC/TEST" key	In the running state, it is used to start the self-test function of the device; In other states, it is used to return to the function.
"▲" up key, "▼" down key	In non-programming mode, it is used to view fault records, version signals; In programming mode, for increasing or decreasing values, digits or changing the protection action status.
"↵ /MENU" key	In non-programming mode, press this key to enter programming mode; In programming mode, when the confirmation key is used.

6.3.2 Button function descriptions of AID150/200 Centralized Alarm and Display Device

AID150/200 Centralized Alarm and Display Device has five keys, which are "TEST" key, "MUTE" key, "Menu/↵" key, "▲" up key and "▼" down key.

Buttons	Button function
"TEST" key	In non-programmed mode, used to start the meter self-test function; In other states, it is used to return to the function.
"MUTE" key	When an alarm is generated, press this key to silence the alarm sound.
"Menu/↵" key	In non-programming mode, press this key to enter programming mode; In programming mode, use it as a carriage return confirmation key.
"▲" up key, "▼" down key	Non-programmed mode for viewing fault records and switching pages; In programmed mode, for increasing or decreasing the number of digits.

6.4 Button Operation Descriptions

6.4.1 Key operation of AIM-M300 insulation monitor in RUN mode

(1) Enter RUN mode. The default mode entered by power-on is the RUN mode. After the LCD displays the software version number, if no other key operation is performed, the system enters the RUN mode and runs. The main interface displays insulation resistance value, temperature value, current value, load rate and current system time.

(2) View the alarm record. Under the main interface, press "▼" down key to enter "fault record" interface, press "↵ / MENU" key to confirm, then you can check the alarm record by pressing "▲" down key. The first record is the latest record and the tenth record is the earliest record.

(3) View software version information. In the main interface, press "▼" down key twice in succession, you can see the software version information.

(4) Meter self-test. In the main interface, press the "ESC/TEST" key, the insulation monitor will start the self-test program to simulate the overload fault, insulation fault and over-temperature fault, which is used to test whether the device's detection and judgment of the main faults are normal. If the monitor can detect the above three kinds of faults, it indicates that the device functions normally.

6.4.2 Key operation of AIM-M300 insulation monitor in programming mode

(1) Entering programming mode

Under normal operation, press "↵ / MENU" key to enter the password input page of programming mode. Modify the password by "▲" up key or "▼" down key, after inputting the correct password, press

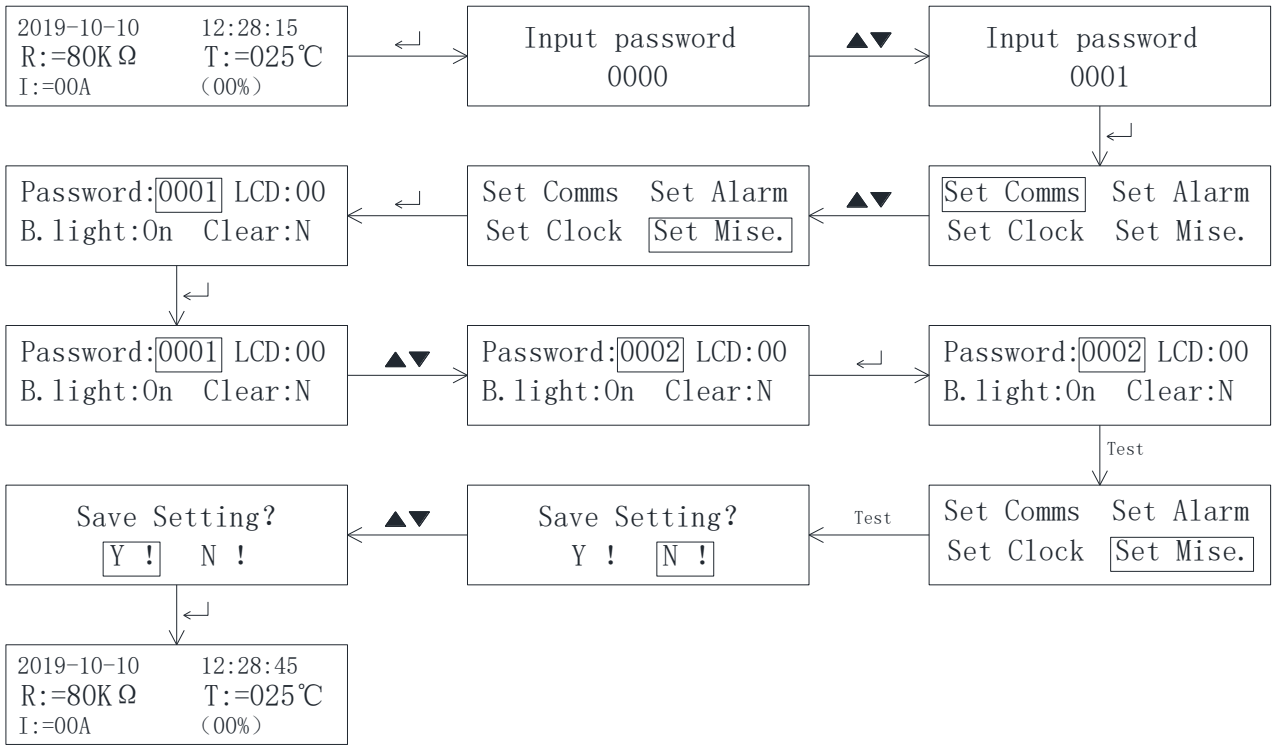
"↵ /MENU" key, then you can enter the programming mode.

(2) Exit programming mode

In programming mode, press "ESC/TEST" key to enter the exit save confirmation menu, select [Y!] or [N!] by "▲" upper key or "▼" lower key, then press "↵ / MENU" key to enter the programming mode. Press "↵ / MENU" key, then you can exit the programming module and return to the main interface. If [Y!] is selected before exiting, the setting of the parameter is saved when exiting; if [N!] is selected, the setting of the parameter is not saved before exiting.

(3) System password setting

In programming mode, select [Set Misc.] by "▲" up key or "▼" down key, press "↵ / MENU" to enter other settings, and then press "▲" up key or "▼" down key to enter other settings. Press "▲" up key or "▼" down key to highlight the numeric part of the password, and press "↵ / MENU" to confirm the modification, then you can change the password by pressing "▲" up key or "▼" down key. Press "▲" up key or "▼" down key to change the password, and then press "↵ / MENU" again to confirm the change. After that, press "↵ /MENU" again to confirm, and then press "ESC/TEST" to save and exit the programming mode. The operation example is as follows:

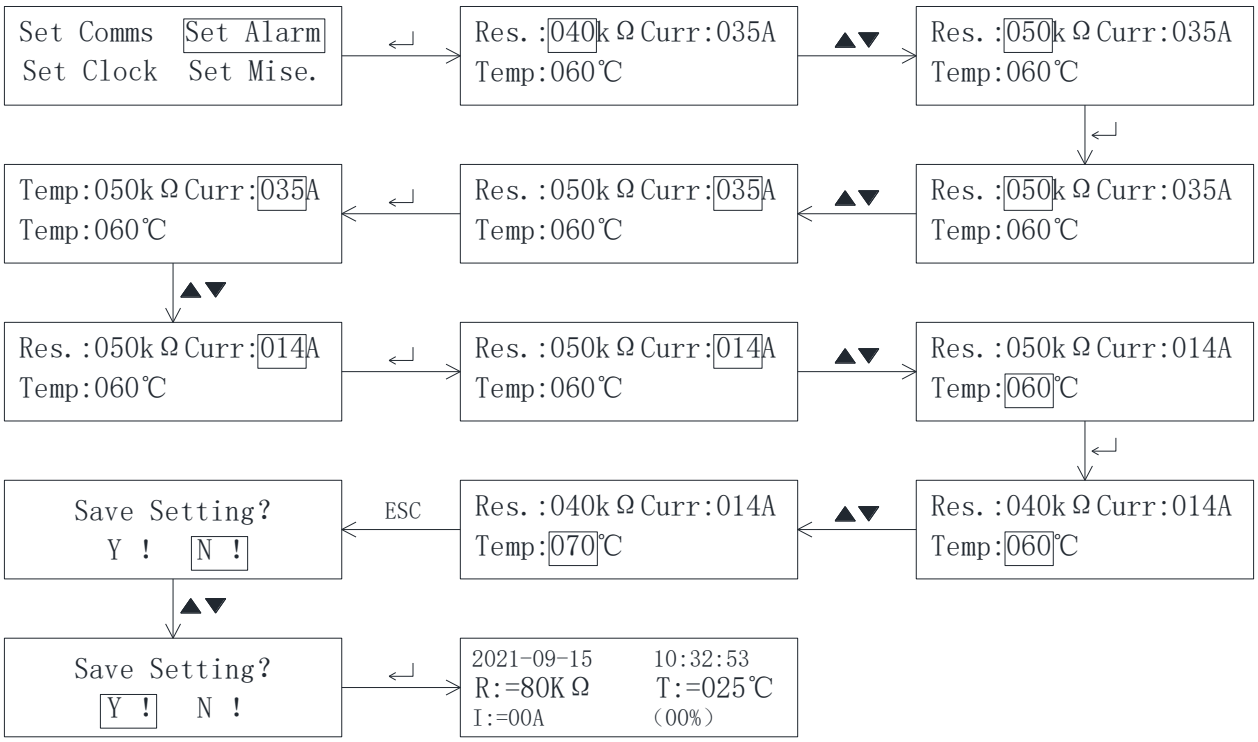


(4) Alarm parameter setting

Alarm parameter is the system insulation alarm value, load current alarm value and transformer temperature alarm value of the size of the settings, and the "Set Mise." setup steps are similar. The following is only on the insulation warning value, current warning value and temperature warning value settings for programming examples.

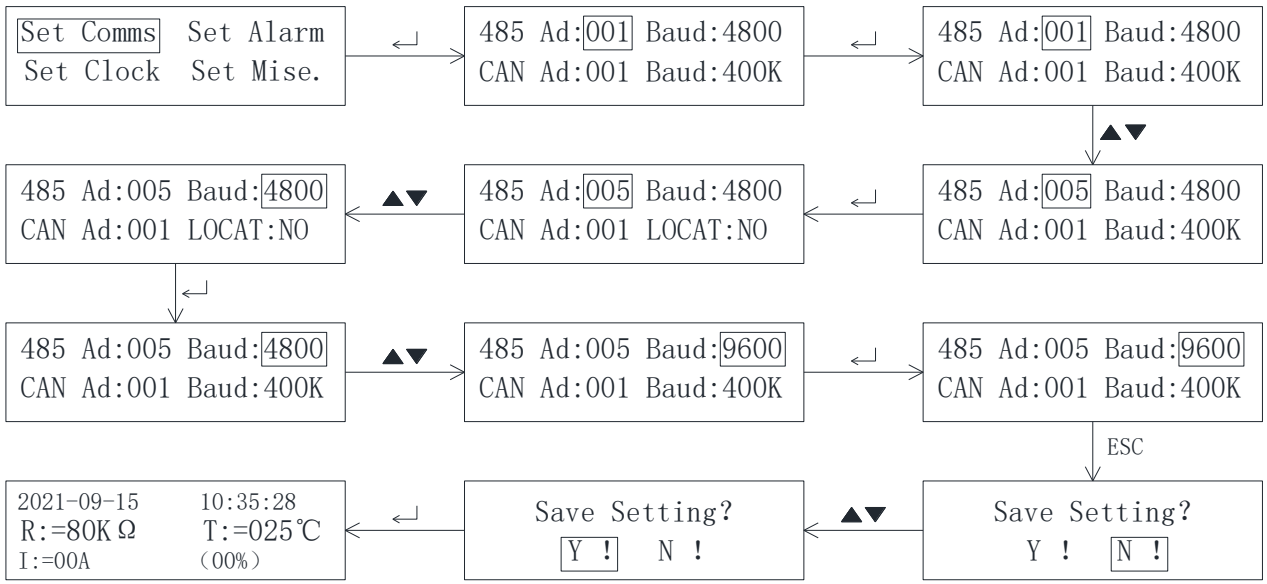
Set the insulation warning value to 50kΩ, the current warning value to 14A and the temperature warning

value to 70℃. The procedure is as follows:



(5) Communication settings

Communication settings include RS485 communication settings and CAN communication settings, RS485 communication settings include setting the communication address and communication baud rate, CAN communication settings can be kept as default. The RS485 communication address is set to 005, and the Baud is set to 9600 bps. the programming example is as follows:



(6) Other parameter settings.

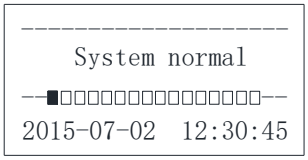
Other parameter settings include contrast settings, backlight time settings and clear fault records, the setting method and the system password setting method is similar, will not repeat here.

Note: AIM-M300 default parameters, RS485 address is 1, baud rate is 9600, insulation failure alarm value is 50kΩ, rated current according to the default transformer capacity, over-temperature is 70℃.

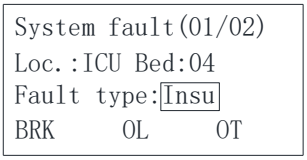
6.4.3 Key Operation of AID150/200 Centralized Alarm and Display Device

(1) Explanation of operation interface

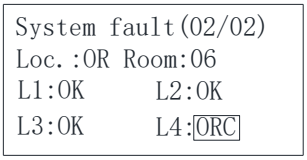
After the system is powered on, if there is no fault alarm, AID150/200 will display the normal operation interface as shown in the following figure, the small box filled in black in the figure indicates that the corresponding address number of the corresponding position serial number of the device is connected to the communication, and the small box not filled in black indicates that there is no device connection, or the communication is not connected. When the insulation monitors or residual current monitor monitors the fault, AID150 displays the corresponding alarm interface and issues the corresponding sound and light alarms. AID200 displays the alarm interface of the insulation monitor.



Normal system

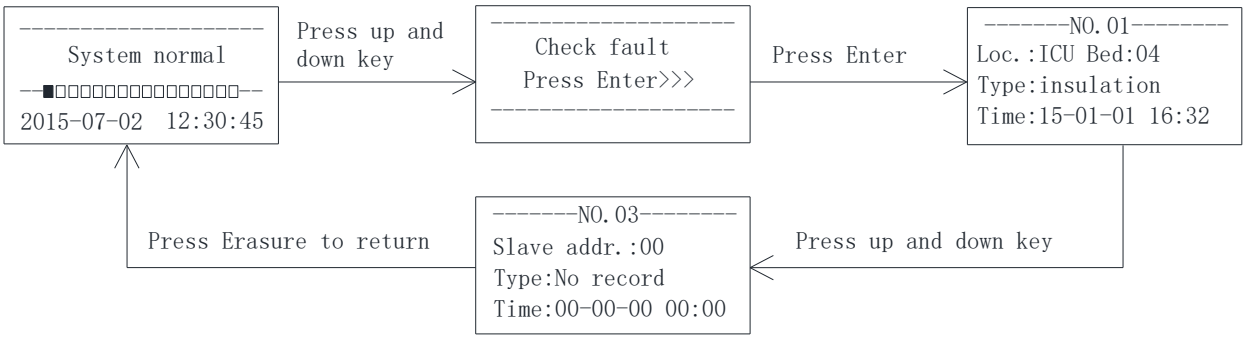


IMD fault indication



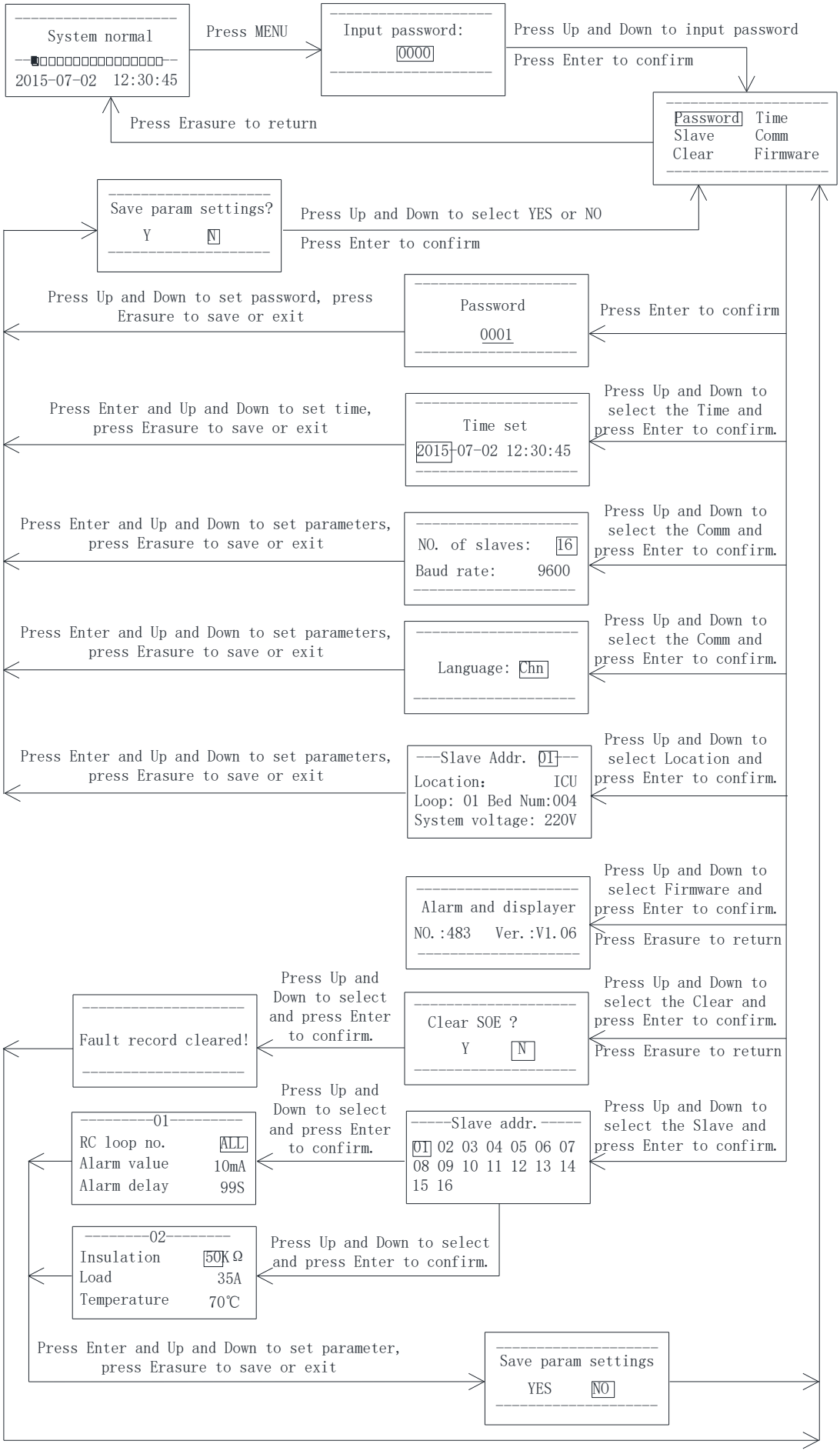
RCM fault indication

(2) Fault record viewing interface operations and descriptions



(3) Programming Interface Operation and Explanation

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


System normal
2015-07-02 12:30:45
Press MENU
Input password:
0000
Press Up and Down to input password
Press Enter to confirm
Password Time
Slave Comm
Clear Firmware
Press Erasure to return
Save param settings?
Y N
Press Up and Down to select YES or NO
Press Enter to confirm
Password
0001
Press Enter to confirm
Press Up and Down to set password, press Erasure to save or exit
Time set
2015-07-02 12:30:45
Press Up and Down to select the Time and press Enter to confirm.
Press Enter and Up and Down to set time, press Erasure to save or exit
NO. of slaves: 16
Baud rate: 9600
Press Up and Down to select the Comm and press Enter to confirm.
Press Enter and Up and Down to set parameters, press Erasure to save or exit
Language: Chn
Press Up and Down to select the Comm and press Enter to confirm.
Press Enter and Up and Down to set parameters, press Erasure to save or exit
---Slave Addr. 01---
Location: ICU
Loop: 01 Bed Num:004
System voltage: 220V
Press Up and Down to select Location and press Enter to confirm.
Alarm and displayer
NO.:483 Ver.:V1.06
Press Up and Down to select Firmware and press Enter to confirm.
Press Erasure to return
Fault record cleared!
Press Up and Down to select and press Enter to confirm.
Clear SOE ?
Y N
Press Up and Down to select the Clear and press Enter to confirm.
Press Erasure to return
---------01---------
RC loop no. ALL
Alarm value 10mA
Alarm delay 99S
Press Up and Down to select and press Enter to confirm.
-----Slave addr.-----
01 02 03 04 05 06 07
08 09 10 11 12 13 14
15 16
Press Up and Down to select the Slave and press Enter to confirm.
--------02--------
Insulation 50KΩ
Load 35A
Temperature 70℃
Press Up and Down to select and press Enter to confirm.
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 communication protocol, which defines the address, function code, data, check code in detail. It is the necessary content to complete the data exchange between the host and slave machine.

7.2 Introduction of Function Code

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 01 slave computer, with the address of the value of 0008H.

The host Computer sends		Send message
Address code		01H
Function code		03H
Start address	High byte	00H
	Low byte	08H
Number of registers	High byte	00H
	Low byte	01H
CRC check code	Low byte	05H
	High byte	C8H

The slave computer returns		Return message
Address code		01H
Function code		03H
Bytes		02H
Register data	High byte	03H
	Low byte	E7H
CRC check code	Low byte	F8H
	High byte	FEH

The reading result returned from the slave is: 0x03E7H, decimal 999, indicating that the insulation resistance value is 999kΩ.

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 shows a preset address of 01 with an installation date and time of 12:00, Friday, December 1, 2009.

The host computer sends		Send message
Address code		01H
Function code		10H
Start address	High byte	00H
	Low byte	04H
Number of	High byte	00H

The slave computer returns		Return message
Address code		01H
Function code		10H
Start address	High byte	00H
	Low byte	04H
Number of	High byte	00H

registers	Low byte	03H
Number of registers		06H
0004H data	High byte	09H
	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

registers	Low byte	03H
CRC check code	Low byte	C1H
	High byte	C9H

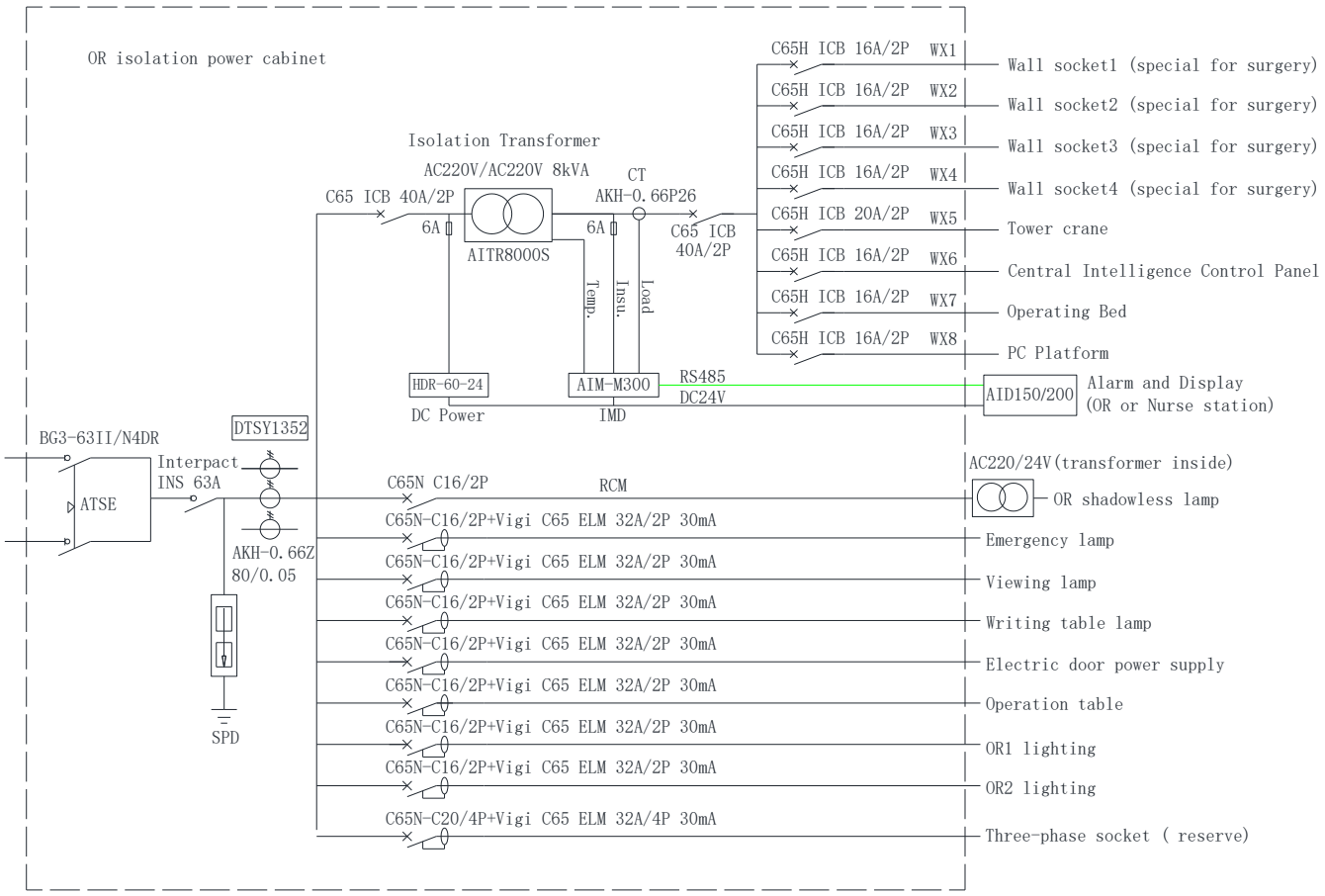
7.3 Parameter Address Table of AIM-M300

No.	Address	Parameter	Read/ Write	Value Range	Data Type
0	0000H	Passwords	R/W	0000~9999 (default 0001)	UINT16
1	0001H high	RS485 address	R/W	1~247 (default 1)	UINT16
	0001H low	RS485 baud	R/W	1~4: 4800, 9600, 19200, 38400 (unit bps) (default 9600)	
2	0002H high	CAN address	R/W	1~110 (default 1)	UINT16
	0002H low	Fault location function	R/W	0: no; 1: yes (default 0)	
3	0003H high	LCD contrast	R/W	00~63 (default 00)	UINT16
	0003H low	Backlight time	R/W	0: bright, 1~99 settable (unit Min) (default 0)	
4	0004H high	Year	R/W	1~99, Add 2000 for year	UINT16
	0004H low	Month	R/W	1~12	
5	0005H high	Day	R/W	1~31	UINT16
	0005H low	Week	R/W	1~7	
6	0006H high	Hour	R/W	0~23	UINT16
	0006H low	Minute	R/W	0~59	
7	0007H high	Second	R/W	0~59	UINT16
	0007H low	Reserved			
8	0008H	Insulation resistance	R/W	10~999 (unit kΩ)	UINT16
9	0009H	Load current	R/W	0~500 (unit 0.1A)	UINT16
10	000AH	Transformer temperature	R/W	-50~200 (unit is℃)	INT16
11	000BH high	Fault loop	R	0~48 (normal is 0)	UINT16

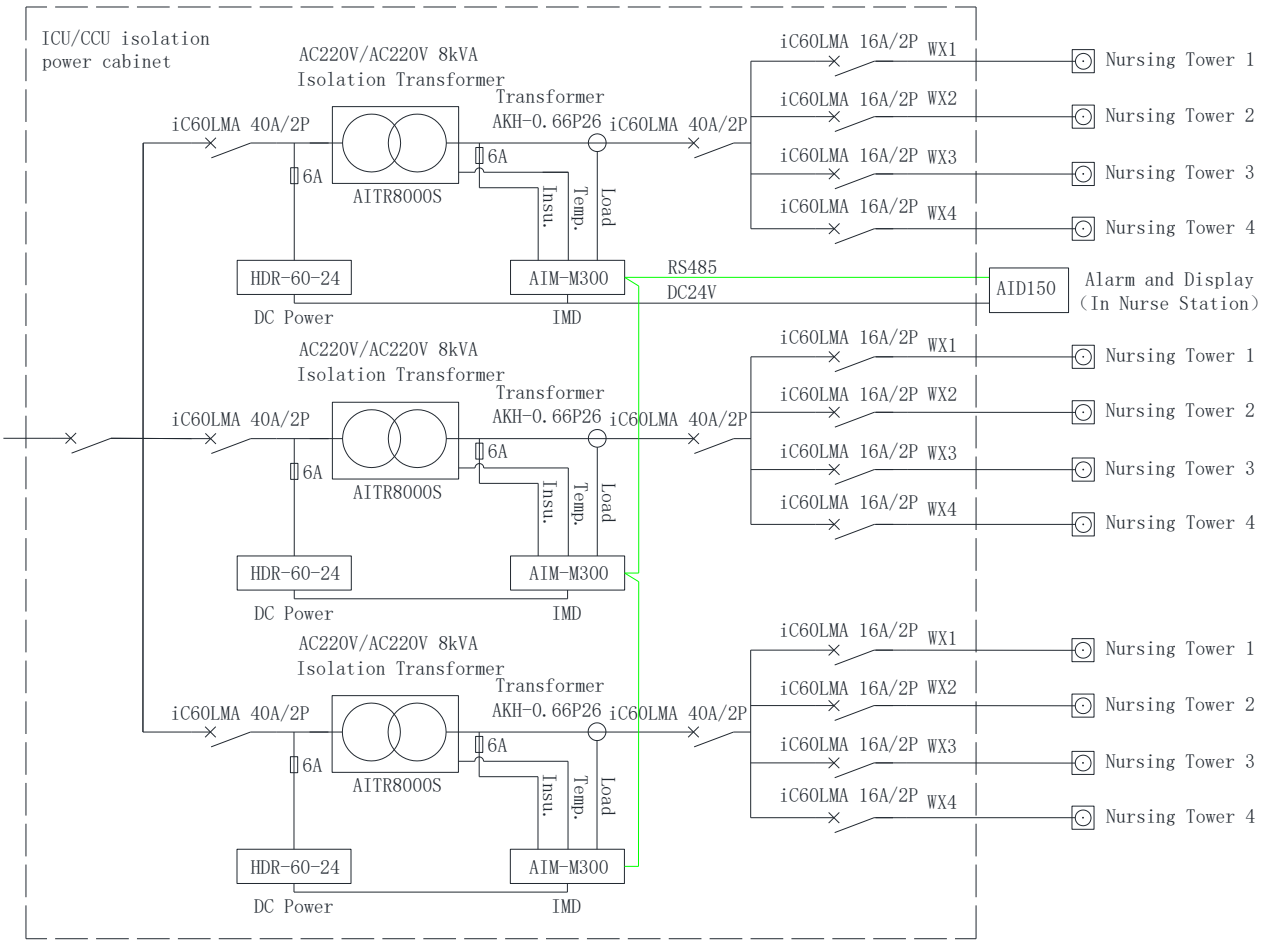
	000BH low	Fault type	R	Bit7: 0 normal; 1 Device fault Bit6: 0 normal; 1 CT disconnection Bit5: 0 normal; 1 Temp sensor disconnection Bit4: 0 normal; 1 FE or KE disconnection fault Bit3: 0 normal; 1 L1 or L2 disconnection fault Bit2: 0 normal; 1 Transformer overheat fault Bit1: 0 normal; 1 Overload fault Bit0: 0 normal; 1 Insulation resistance fault For example, 00 01 is 0000 0000 0000 0001; Indicates insulation fault	
12~15	000CH~ 000FH	Reserved			UINT16 *4
16	0010H	Insulation resistance set value	R	10~999 (unit kΩ) (default 50)	UINT16
17	0011H	Current set value	R	0~50 (unit A) (default 35)	UINT16
18	0012H	Transformer temperature set value	R	0~200 (unit ℃) (default 70)	UINT16
19~22	0013H~ 0016H	Reserved			UINT16 *4
23	0017H high	Reserved			UINT16
	0017H low	SOE control parameters	R	The storage number of next SOE	
24	0018H high	SOE1 Reserved			UINT16
	0018H low	Info.	R	SOE1 type: 0~7 0: No fault record 1: Insulation fault 2: Overload fault 3: Over temperature fault 4: LL disconnection 5: FK disconnection 6: TC disconnection 7: CT disconnection	
25	0019H high	Year	R	SOE1 time - year	UINT16
	0019H low	Month	R	SOE1 time - month	
26	001AH high	Day	R	SOE1 time - day	UINT16
	001AH low	Hour	R	SOE1 time - hour	
27	001BH high	Minute	R	SOE1 time - minute	UINT16
	001BH low	Second	R	SOE1 time - second	
28~ 103	001CH~ 0067H	Store the other 19 SOEs in the same format as the first one			UINT16 *76

8 Typical Applications

Products applications of M300 Five-Piece Set in Operating Room



Products applications of M300 five-piece set in ICU/CCU



9 Power On and Debugging Instructions

9.1 Wiring Check

Every IT system should be wired before powering up, mainly to check for misconnections, omissions, or short connections. The wiring diagram shown in Part 5.4 of this manual can be checked in the following smooth sequence:

(1) Check that each M300 Five-Piece Set forms a separate IT distribution system.

(2) Check whether the L and N power inputs of the HDR-60-24 DC power in each system are connected to the transformer, and whether the -V and +V power outputs are reliably connected to the 24V and G terminals of the AIM-M300 and the AID150/200 alarms and displays respectively.

(3) Check whether terminals 8 (I0) and 9 (I1) of AIM-M300 in each system are reliably connected to the terminals of AKH-0.66P26 and the shield is not grounded.

(4) Check that terminals 11 (T0) and 12 (T1) of the AIM-M300 in each system are reliably connected to the two ST terminals of the isolation transformer.

(5) Check that terminals 4 (L1) and 5 (L2) of the AIM-M300 in each system are reliably connected to the circuit breaker at the output of the isolation transformer.

(6) Check whether terminals 13 (FE) and 14 (KE) of AIM-M300 in each system are connected to the equipotential terminal block with wires respectively, and whether terminal S of the isolation transformer is also connected to the equipotential terminal block reliably.

(7) Check whether terminals 15 (A) and 16 (B) of RS485 communication of AIM-M300 meter in each system are reliably connected with terminals A and B of AID150/200.

(8) If a cooling fan is set up for each isolation transformer, check whether the control of the cooling fan power supply is connected to terminals 21 and 22 of the AIM-M300 in that set.

9.2 Common Problems and Troubleshooting

Ensure that the wiring is correct, power up the system and check whether the devices are abnormal and whether AIM-M300 has fault alarms, for common problems, you can judge the cause and troubleshoot according to the phenomenon of each device and the type of fault:

Equipment name	Fault phenomenon	Possible causes and troubleshooting
AIM-M300 Insulation Monitor	LCD: LL open, insulation indicator lights up	Terminals 4 and 5 of the AIM-M300 Insulation Monitor are not reliably connected to the two wires at the output of the isolation transformer, check the wiring and make sure it is reliably connected.
	LCD: FK open, insulation indicator lights up	Terminals 13 and 14 of the AIM-M300 Insulation Monitor are not reliably connected to the equipotential terminal block, check the wiring and make sure it is reliably connected.
	LCD: CT open, overoad indicator lights up	Terminals 8 and 9 of the AIM-M300 Insulation Monitor are not reliably connected to the two terminals of the current transformer, check the wiring and make sure it is reliably connected.
	LCD: TC open, overtempt. indicator	Terminals 11 and 12 of the AIM-M300 Insulation Monitor are not reliably connected to the two ST terminals of the isolation transformer,

	lights up	check the wiring and make sure it is reliably connected.
	LCD: insulation; insulation indicator lights up	A ground fault on at least one of the two wires of the IT system on the secondary side of the isolation transformer can be removed and returned to normal.
	meter not working	The supply of the AIM-M300 Insulation Monitor is not connected properly, check the wiring of terminals 1 and 2 and make sure.
HDR-60-24 DC Power	power supply not working	Check that the 220V power input wiring is normal and that the voltage between the two terminals is within the allowable input range.
AID150/200 Alarm and Display Device	meter not working	The 24V operating power supply is not connected properly, check if the 24V and G terminal wiring is normal and rewire.
	Comm indicator does not flash	(1) Communication parameters are not set, check the communication parameters (address, baud rate) (2) The communication line with other devices in the system is not connected properly, check the communication line and make sure the matching resistor is connected properly.

Note: If faults occur, interrupt the power to troubleshoot, and adjust the wirings until everything is normal.

9.3 Settings and Debugging

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

(2) Load current setting. After the power distribution system is normally powered on, you need to set the AIM-M300 load current alarm value according to the capacity of the isolation transformer, the correspondence between the alarm current and the capacity of the isolation transformer is as follows: 45A---10kVA, 35A---8kVA, 28A---6.3kVA, 14A---3.15kVA. After setting, you need to exit step by step, and then save the setting parameters. The default current alarm value of the device is 35A, if the matching transformer is 8kVA, the parameter does not need to be set.

(3) Communication address setting. AID150 alarm and display device centralized monitoring of multiple AIM-M300 insulation monitor, you need to set the communication address of AIM-M300 in turn, the address setting should start from 1, up to 16.

(4) System quantity setting. When AID150 is connected to N insulation monitors, it is necessary to set "Number of systems" in AID150 settings to N. When the number of insulation monitors exceeds 16, AID150 should be increased for network monitoring.

(5) Communication view and debugging. After setting the address and the number of systems to view the communication status, AID150 running interface can display access to the communication status of the insulation detector, 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 failure, you need to check the communication bus. If the communication fails, you need to check the connection of the communication bus. If multiple insulation monitors cannot communicate, you can connect matching resistors in parallel at the first end of the communication bus.

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