

AIM-T300 Insulation Monitoring Device

Installation and Operation Manual V1.3

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Modified Records

| No. | Time | Versions | Reasons for revision |
|--------|------------|----------|--|
| 1 | 2018.06.18 | V1.0 | First version |
| 2 | 2019.01.15 | V1.1 | Modify error |
| 3 | 2020.03.28 | V1.2 | Add overview content; Simplified model description; Modify the opening size; Modify wiring terminal; Modify the inaccurate part of the communication address table. |
| 4 | 2020.07.03 | V1.3 | Modify the model description; Modify the typical wiring diagram, modify the terminal, and modify the instrument auxiliary power supply section description. |
| 5 | 2022.02.30 | V1.4 | Modify the format, add modify records; Model description Do not specify the model; Modify technical parameters. |
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| Notes: | | | |

Contents

| | |
|--|----|
| 1 Introduction..... | 1 |
| 2 Functional characteristics..... | 1 |
| 3 Type Introduction..... | 1 |
| 4 Technical parameters..... | 2 |
| 5 Reference standards..... | 2 |
| 6 Installation and connection..... | 2 |
| 6.1 Outline dimension..... | 2 |
| 6.2 Method of installation..... | 3 |
| 6.3 Wiring method..... | 3 |
| 6.4 Matters need attention..... | 4 |
| 7 Program and usage..... | 4 |
| 7.1 Panel description..... | 4 |
| 7.2 LED instructions..... | 4 |
| 7.3 Function description of keys..... | 5 |
| 7.4 Operation instructions of keys..... | 5 |
| 8 Communication Instruction..... | 8 |
| 8.1 Modbus-RTU communication protocol..... | 8 |
| 8.2 Introduction to the function code..... | 8 |
| 8.3 Address table of AIM-T300..... | 9 |
| 9 Typical applications..... | 10 |

AIM-T300 Insulation Monitoring Device

1 Introduction

AIM-T300 insulation monitoring device is designed and developed by Acrel gathering the design experience of electric power meter industry for many years to monitor the insulation condition of low voltage IT distribution system (ungrounded system). The product adopts advanced micro controller technology, with high degree of integration, compact size and easy installation, and it integrates intelligence, digitalization and networking. The device, with many functions such as insulation fault warning, fault alarm, event recording and so on, can be used in the mines, glass factories, electric furnaces and test facilities, metallurgical plants, chemical plants, and exploded dangerous places, computer center, emergency power supply and other places to monitor the insulation status of IT system in real time. When insulation fault occurs, it will alarm and remind the staff to check the fault.

The products conform to the requirements of enterprise standard Q/VDCL-26-2017 *IT System Insulation Monitor*.

2 Functional characteristics

- 2.1 Function of monitoring, fault warning and alarm the ground insulation resistance for IT system;
- 2.2 Multiple fault indication function, such as relay alarm output, LED alarm indication and so on.
- 2.3 Advanced field bus communication technology, communicate with the external alarm and display device or the upper computer management terminal and monitor the operation status of the IT system in real time.
- 2.4 Fault event recording function. It can record the time and type of failure to provide convenience for operators to query and analyze the operation status of the system and eliminate faults in time.
- 2.5 Applicable for insulation monitoring of AC, DC and AC / DC hybrid IT systems.
- 2.6 Self checking function. realize the fault self-inspection of instrument hardware circuit.
- 2.7 Broken line monitoring function. Monitor the connection condition between the L1/L2 and the IT system and the connection condition of the PE/KE function grounding wire.

3 Type Introduction



Instructions: AIM for Acrel Insulation monitoring device;

T for Industrial;

300 for 300 type.

4 Technical parameters

| Item | | Parameter |
|-----------------------------------|----------------------------|--|
| Accessory power supply | | AC 85~265V; DC100~300V; 50/60Hz |
| Power dissipation | | < 6W |
| System voltage | | AC 0~480V; DC 0~480V; 40~460Hz |
| System application | | IT system (online), Other system (offline) |
| Insulation monitoring | Measuring range | 1k~5MΩ |
| | Alarm range | 10k~5MΩ |
| | Resistance accuracy | 1~10k, 1k; 10k~5M, ±10% |
| | system leakage capacitance | <150μF |
| | Response time (Ce=1μF) | <6s |
| Internal parameters | Measuring voltage | <20V |
| | Measuring current | <170μA |
| | Internal DC impedance | ≥120kΩ |
| Relay output | | Warning, Alarm |
| SOE | | 20 records (fault type, fault value, fault time) |
| Alarm type | | LCD, LED indicator |
| Communication | | RS485, Modbus-RTU |
| Impulse voltage / Pollution Level | | 8kV/III |
| EMC/ Radiation | | IEC61326-2-4 |
| Environment | Working temperature | -10 ~+65°C |
| | Storage temperature | -20~+70°C |
| | Relative humidity | <95%, without condensation |
| | Altitude | ≤2500m |

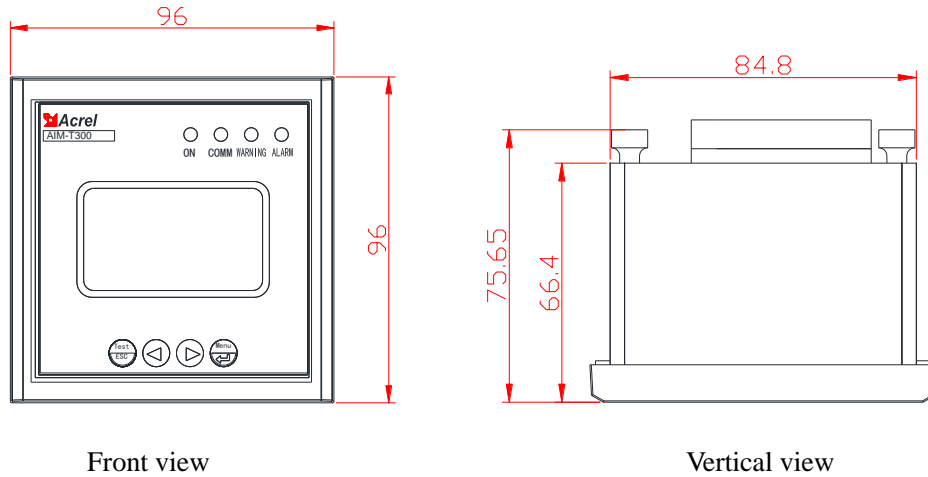
5 Reference standards

- IEC 61557-8 *Electrical safety in low voltage distribution systems up to 1000V a.c. and 1500V d.c. - Equipment for testing, measuring or monitoring of protective measures - Part 8: Insulation monitoring devices for IT systems.*
- IEC 61326-2-4 *Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 2-4: Particular requirements - Test configurations, operational conditions and performance criteria for insulation monitoring devices according to IEC 61557-8 and for equipment for insulation fault location according to IEC 61557-9.*

6 Installation and connection

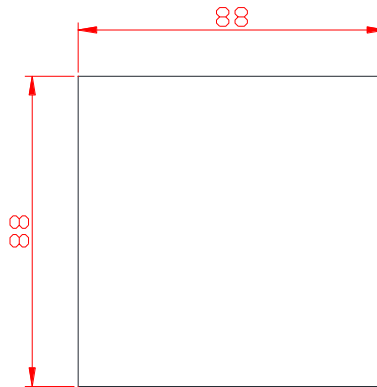
6.1 Outline dimension

AIM-T300 externality and installation size (unit: mm)



The above chart is the front view, rear view and side view of the AIM-T300 insulation monitoring device of the embedded installation in succession.

6.2 Method of installation



The AIM-T300 insulation monitoring device adopts embedded installation, and the above diagram is the hole dimensional drawing of the insulation monitoring device.

6.3 Wiring method

Upper terminals: the instrument functional grounding wire, KE, PE (28, 29), needs to be connected to the field equipotential grounding terminal respectively. L1, L2 (4, 5) link to the monitored IT system (Three phase IT system is connected to any 2 phase).

| | | | | | |
|----|----|--|----|--|----|
| PE | KE | | L1 | | L2 |
| 28 | 29 | | 4 | | 5 |

Lower terminals: U1, U2 (1, 2) terminals are auxiliary power interface of insulation monitoring device; A, B (18, 19) terminals are A and B line interface for RS485 communication respectively. It is used for communication with upper computer. DO1+ and DO1- (12, 13), DO2+ and DO2- (14, 15) are 2 sets of relay outputs, and they respectively correspond to the two kinds of control outputs: fault warning and fault alarm.

| | | | | | | | | | |
|----------------|----------------|--|----|----|--|------|------|------|------|
| U ₁ | U ₂ | | A | B | | DO1+ | DO1- | DO2+ | DO2- |
| 1 | 2 | | 18 | 19 | | 12 | 13 | 14 | 15 |

6.4 Matters need attention

6.4.1 When wiring is installed, connection should be made in connection with the wiring diagram.

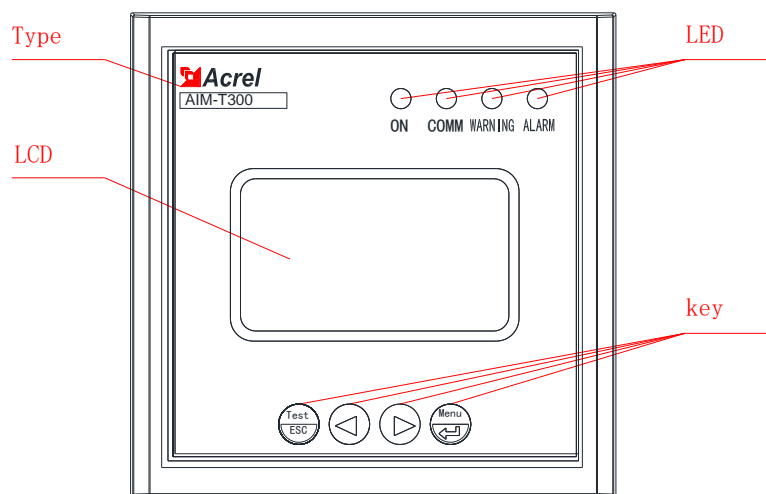
The wiring should be inserted the corresponding terminal of the instrument and tighten the screw after pressing by the needle socket joint to avoid improper operation of instruments due to poor contact.

6.4.2 The device provides asynchronous half duplex RS485 communication interface, adopts Modbus-RTU protocol, and all kinds of data information can be transmitted on communication lines. In theory, up to 128 devices can be connected to one line at the same time. Each device can set its address and baud rate through the menu. It is recommended to use shielded twisted pair when communicating with the upper computer system. The cross section of each core should not be less than 0.5mm^2 , and they connect to A, B respectively. When shielding layer is connected to earth, wiring should be kept away from strong cable or another strong electric field. It is recommended that a matched resistance in parallel should be added between the A and B terminals of the most terminal insulation monitoring device, and the recommended resistance is 120Ω .

6.4.3 The relay output, without power alarm, is a passive output, so an extra power supply is required for the alarm (or caution light).

7 Program and usage

7.1 Panel description



7.2 LED instructions

4 LED indicators are used to indicate the status of the insulation monitoring device:

"ON" : when the device is working normally, the indicator lights flicker, and the scintillation frequency is about once a second.

"COMM" : when the device has communication data to receive or send, the indicator lights flicker.

"WARNING" : When the insulation resistance of the monitoring is less than the warning value, the warning indicator lights flicker.

"ALARM" : when the insulation resistance of the monitoring is less than the alarm value, the alarm

indicator lights flicker.

7.3 Function description of keys

There are four buttons in the device. They are TEST/ESC, left key, right key, MENU / ↵ respectively.

| key | Key function |
|------------------------|---|
| TEST / ESC | In the non-programming mode, it is used to start the self-checking; In programming mode, it is used to exit. |
| Left key, right key | In the non-programming mode, it is used to read the alarm record; In programming mode, it is used to increase or decrease the figure. |
| MENU/↵ | In non-programming mode, press button to enter programming mode; In programming mode, they are used as return confirmation or selection key. |

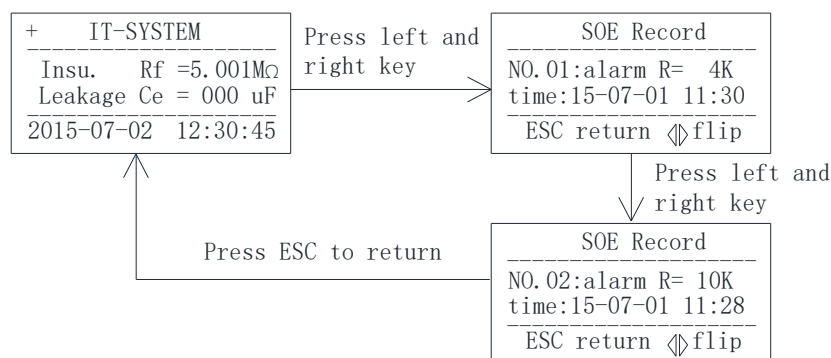
7.4 Operation instructions of keys

7.4.1 Key operation under the main interface

(1) When starting up, enter the main interface by default. If there is no other key operation, the system will go into the main interface and work. The insulation resistance value, the leakage capacitance value and the current system time are showed on the main interface.

(2) Check the alarm record. In the main interface, one can enter the event record query interface by pressing the “left” or “right” to turn the page to successively query the most recent 20 fault records. The first one is the latest record, and the twentieth record is the oldest one.

(3) Self-examination of the instrument. When press the "TEST" button, the monitor will start the self-examination program to simulate insulation faults and system errors. The 4 LED lights are on at the same time, and the relay is closed. The self-check results will be displayed after 2S or so to determine whether the function of the instrument is normal.



7.4.2 Parameter setting

(1) Enter the menu.

Under normal operation, enter the password input page by pressing the "↵" key. Set the size of number by "left" and "right", press "ESC" to enter the menu after inputting the correct password. Otherwise, the password error will be displayed and automatically returned after 1s.

(2) LCD Settings

After entering the menu, select "LCD Settings" and press "Up" and "Down" to adjust the LCD contrast (long press is supported). You can adjust the LCD backlight time. After the modification is complete, press the "Back" key to exit. At this time, you can choose whether to save the setting and press Enter to confirm and exit.

(3) Security Settings

Enter the menu and select "Security Settings". Press "Up" and "Down" to adjust the warning and alarm values (long press is supported). Press The Back key to exit. At this time, you can choose whether to save the settings. Press Enter to confirm and exit. (The default alarm value is 38K and the early warning value is 60K)

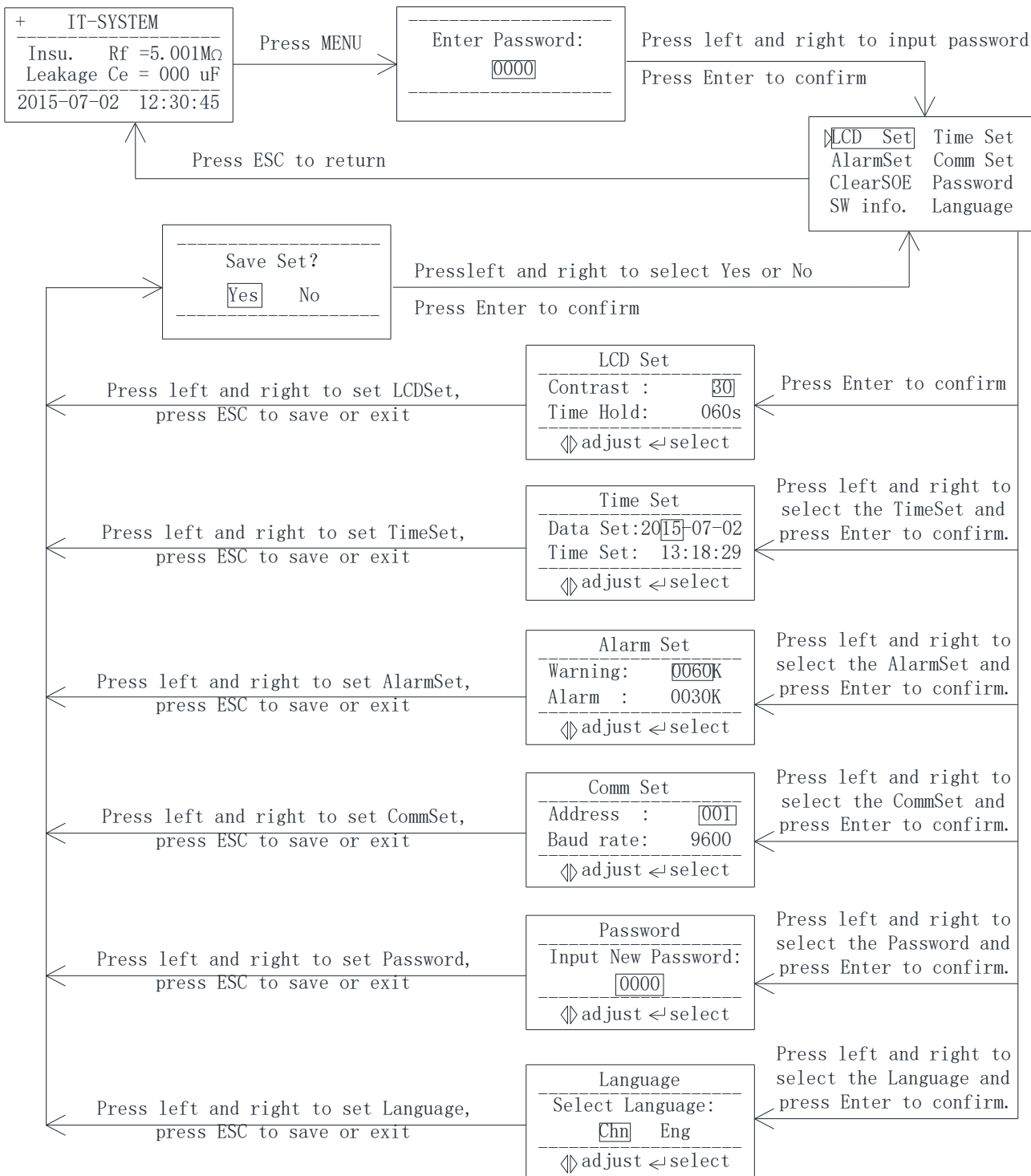
(4) Communication Settings

After entering the menu, select Communication Settings and press Up or Down to adjust system communication parameters (hold down is supported). Press The Back key to exit. At this time, you can choose whether to save the settings. Press Enter to confirm and exit. (The default communication address is 1 and baud rate is 9600).

(5) Setting of other information

The insulation monitor also provides the functions of Clearing Records, Password Setting, Software Information, and Capacitor Setting. The settings of these parameters are similar to those described in the preceding steps.

The specific interface display and operation steps are as follows:



8 Communication Instruction

8.1 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.

8.2 Introduction to the function code

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

This function allows to acquire the data by equipment and the system parameters. The number of data requested by hosts has no limit, but cannot exceed the defined address 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 |
|-------------------------|-----------|--------------|
| 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 | 00H |
| | Low byte | 50H |
| CRC check code | Low byte | B8H |
| | High byte | 78H |

8.2.2 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 registers | High byte | 00H |
| | Low byte | 03H |
| Number of registers | | 06H |
| 0004H data | High byte | 09H |
| | Low byte | 0CH |

| The slave computer returns | | Return message |
|----------------------------|-----------|----------------|
| Address code | | 01H |
| Function code | | 10H |
| Start address | High byte | 00H |
| | Low byte | 04H |
| Number of registers | High byte | 00H |
| | Low byte | 03H |
| CRC check code | Low byte | C1H |
| | High byte | C9H |

| | | |
|----------------|-----------|-----|
| 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 |

Note: The above data is for reference only, see address table for register definition

8.3 Address table of AIM-T300

| No. | Address | Parameter | Read/write | Value range | Data Type |
|-----|------------|-----------------------|------------|--|-----------|
| 1 | 0000H | Passwords | R | 0000-9999 (default 0000) | word |
| 2 | 0001H high | Address | R | 1~247 (default 1) | word |
| | 0001H low | Baud rate | R | 0~3: 4800, 9600, 19200, 38400 (unit bps) (default 9600) | |
| 3 | 0002H high | Contrast ratio | R | 15-60 (default: 30) | word |
| | 0002H low | Display time | R | 15~250 (unit second) (default 60, 15 light) | |
| 4 | 0003H high | Year | R/W | 0~99 | word |
| | 0003H low | Month | R/W | 1~12 | |
| 5 | 0004H high | Day | R/W | 0~31 | word |
| | 0004H low | Warning mark | R | 0: none 1: warning 2: early warning and alarm | |
| 6 | 0005H high | Hour | R/W | 0~23 | word |
| | 0005H low | Minute | R/W | 0~59 | |
| 7 | 0006H high | Second | R/W | 0~59 | word |
| | 0006H low | Data stable | R | 0 or 1 (0 invalid, 1 stable) | |
| 8 | 0007H high | Warning value | R/W | 60~4999 (unit: k Ω) (default: 60) | word |
| | 0007H low | Warning value | | | |
| 9 | 0008H high | Alarm value | R/W | 10~4999 (unit: k Ω) (default: 38) | word |
| | 0008H low | Alarm value | | | |
| 10 | 0009H high | Resistance value | R | 1~5001 (unit: k Ω) | word |
| | 0009H low | Resistance value | | | |
| 11 | 000AH | SN (high 16 bits) | R | Default: 0000000000 | word |
| 12 | 000BH | SN (low 16 bits) | | | word |
| 13 | 000CH | Reserve | | | word |
| 14 | 000DH | Leakage capacity | R | 0~150 (unit: μ F) | word |
| 15 | 000EH high | Symbol of broken line | R | 0: none 1: L1 broken 2: L2 broken 4:PE/KE broken line | word |
| | 000EH low | Current period | | 2~200 (unit s) | |
| 16 | 000FH high | Whether access system | R | 0: no access system 1: access system | word |

| | | | | | | |
|-------|-----------------|--|------------------|---|--|------|
| | 000FH low | Reserve | | | | |
| 17 | 0010H high | | STA1 | R | The sequence number of incident record | word |
| | 0010H low | | | R | Incident1 content: 0~2 0: a fault free record 1: early warning 2: alarm | |
| 18 | 0011H | Fault Record 1 | resistance value | R | incident 1 insulation resistance | word |
| 19 | 0012H high | | Year1 | R | incident 1 time -year | word |
| | 0012H low | | Month1 | R | incident 1 time -month | |
| 20 | 0013H high | | Day1 | R | incident 1 time -day | word |
| | 0013H low | | Hour1 | R | incident 1 time -hour | |
| 21 | 0014H high | | Minute1 | R | incident 1 time -minute | word |
| | 0014H low | | Second1 | R | incident 1 time -second | |
| 22~16 | 0015H-0073 H | The remaining 19 events are recorded in this part of the space, and the rules and formats are the same as the first. | | | | |

9 Typical applications

Typical connection diagram

