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AIM-T500 Insulation Monitoring Device

Installation and Operation Manual V1.6

Acrel Co., Ltd.

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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.
6	2024.09.26	V1.5	Add application, add Russian version
7	2025.01.15	V1.6	Update bottom info.
Notes:			

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AIM-T500 Insulation Monitoring Device

1 Introduction

AIM-T500 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.

2 Functional Characteristic

■ Function of insulation resistance monitoring, warning and alarm for the monitored IT system.

■ Multiple fault indication function, such as relay alarm output and LED alarm output.

■ Advanced field bus communication technology, and it can communicate with the host computer management terminal and monitor the operation status of the IT system in real time.

■ Fault event recording function (SOE). It can record the time and type of failure to provide convenience for operators to analyze the operation status of the system and eliminate faults in time.

■ Applicable for insulation monitoring of AC, DC and AC / DC hybrid IT systems.

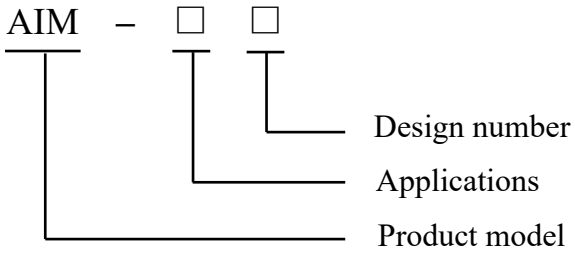
■ Self checking function. realize the fault self-inspection of instrument hardware circuit.

■ Broken line monitoring function. Monitor the connection condition of the PE/KE.

■ The free option of manual reset/automatic reset.

■ Wide range of measurement, Allowable leakage capacitance of the system is large.

3 Model Description



Instructions: AIM for Acrel Insulation monitoring device

T for Industrial

500 for 500 model

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4 Technical Parameters

Item		Parameter
Accessory power supply		AC 85~265V; DC100~300V; 50/60Hz
Power dissipation		< 8W
System voltage		AC 0~690V; DC 0~800V; 40~460Hz
System application		IT system (online), Other system (offline)
Insulation monitoring	Measuring range	1k~10MΩ
	Alarm range	10k~10MΩ
	Resistance accuracy	1~10k,1k; 10k~10M, ±10%
	system leakage capacitance	<500μF
	Response time (Ce=1μF)	<5s
Internal parameters	Measuring voltage	<50V
	Measuring current	<270μA
	Internal DC impedance	≥180kΩ
Relay output		Error, Alarm, Warning
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℃
	Storage temperature	-20~+70℃
	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*

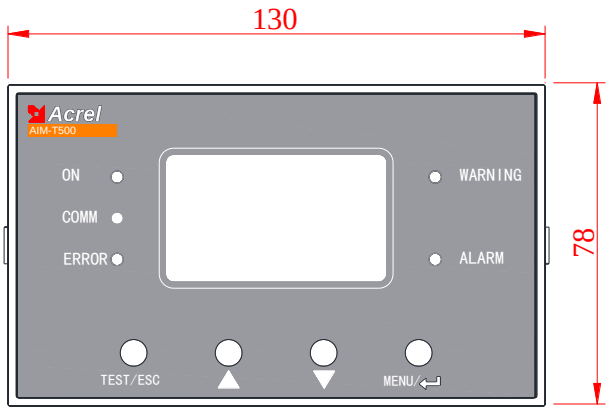
■ IEC 61326-2-4 *Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 2-4: Particular requirements - Test configurations, operational conditions and performance criteria for insulation monitoring devices according to IEC 61557-8 and for equipment for insulation fault location according to IEC 61557-9*

6 Installation and Connection

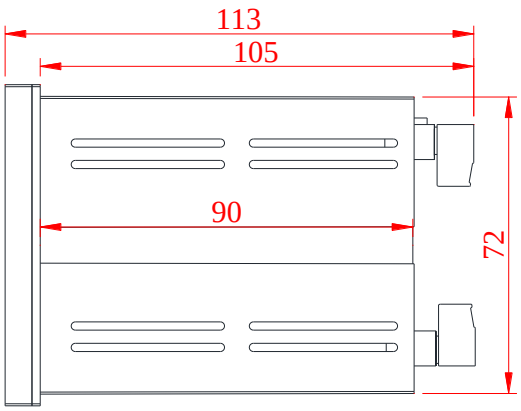
6.1 Shape and Size

AIM-T500 externality and installation size (unit: mm)

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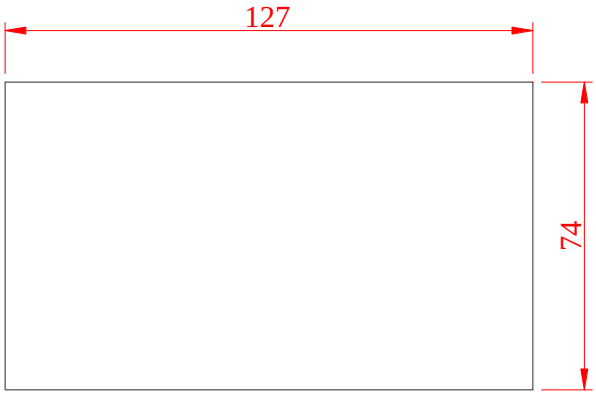
Front view



Side view

6.2 Method of Installation

The AIM-T500 Insulation Monitor is recessed panel mounted with the opening dimensions shown below.



6.3 Wiring Method

Upper terminals: T1, T2 (31, 32) are self-check terminals. They can judge whether the measurement of the resistance of the instrument is accurate. This function must be used without access to the DC system. Short connection with T1 and T2 will display instrument measurement results. F1, F2 (23, 24) are interconnected terminals, when two ungrounded systems are interconnected. The instruments that have access to F1 and F2 will stop working, and it will be monitored separately by another instrument. AK (9) is an extension terminal, used for insulation monitoring of IT systems above AC690/DC800V, see ACPD series manual for details. L1, L2 (4, 5) are connected to the monitored IT system (No three-phase neutral phase IT system can be connected to any 2 phase; When a three-phase IT system with neutral lines is connected, both L1 and L2 are connected to the neutral line; When the single-phase DC system is connected, the L1 is connected to the positive stage and the L2 is connected to the negative pole).

T1	T2	F1	F2	AK
31	32	23	24	9

L2			L1
5			4

Lower terminal: KE, PE (28, 29) are instrument functional grounding lines. They need to be separately connected to the field equipotential grounding terminal. The terminals of U1 and U2 (1, 2) are instrument

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auxiliary power interfaces. A, B (18, 19) terminals are RS485 communication A and B line interface respectively. They are used to communicate with the host computer. DO1+ and DO1- (12, 13), DO2+ and DO2- (14, 15), DO3+ and DO3- (16, 17) are 3 sets of relay outputs. They successively correspond to error alarm, fault alarm, and fault warning.

12	13	14	15	16	17	28	29
DO1+	DO1-	DO2+	DO2-	DO3+	DO3-	PE	KE

18	19		1	2
A	B		U1	U2

6.4 Matters Need Attention

(1) Embedded installation of insulation monitor can be installed in a distribution cabinet.

(2) When wiring is installed, connection should be made in connection with the wiring diagram. It is best to connect the wiring with the needle sleeve connector before inserting the corresponding terminal of the instrument and tighten the screws to avoid improper operation of instruments due to poor contact.

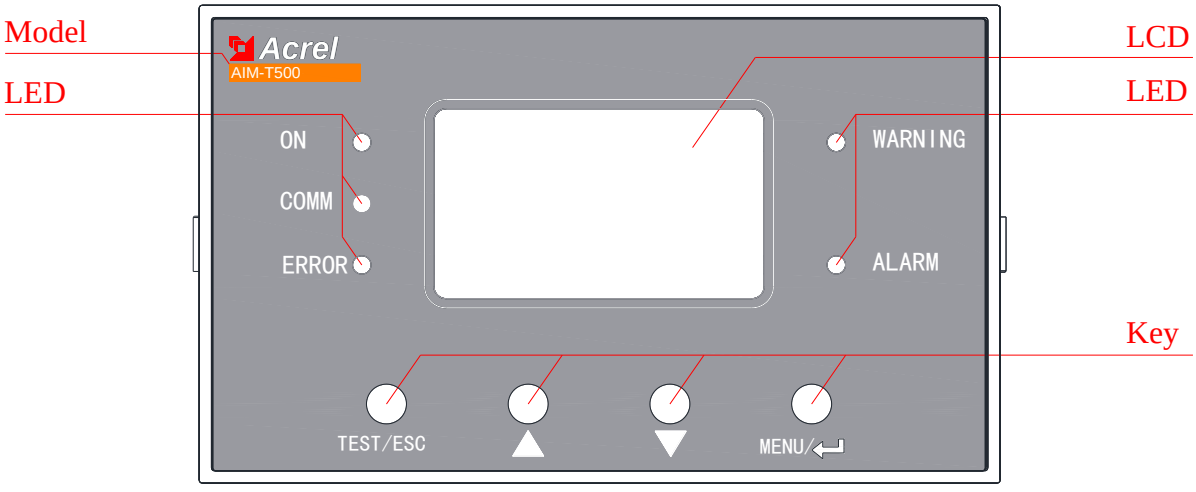
(3) The device provides asynchronous half duplex RS485 communication interface, adopts Modbus-RTU protocol, and all kinds of data information can be transmitted on communication lines. In theory, up to 128 devices can be connected to one line at the same time. Each device can set its address and baud 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 .

(4) 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 Display Panel

Each part of the AIM-T500 panel is shown below.



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7.2 LED Instructions

5 LED indicators are used to indicate the status of the insulation monitor:

LED indicators	Instructions
ON	when the device is working normally, the indicator light flickers, and the scintillation frequency is about once a second
COMM	when the device has communication data to receive or send, the indicator light flickers
ERROR	when the device PE, KE breaks, the indicator light flickers
WARNING	When the insulation resistance of the monitoring is less than the warning value, the warning indicator light flickers
ALARM	when the insulation resistance of the monitoring is less than the alarm value, the alarm indicator light flickers

7.3 Function Description of Keys

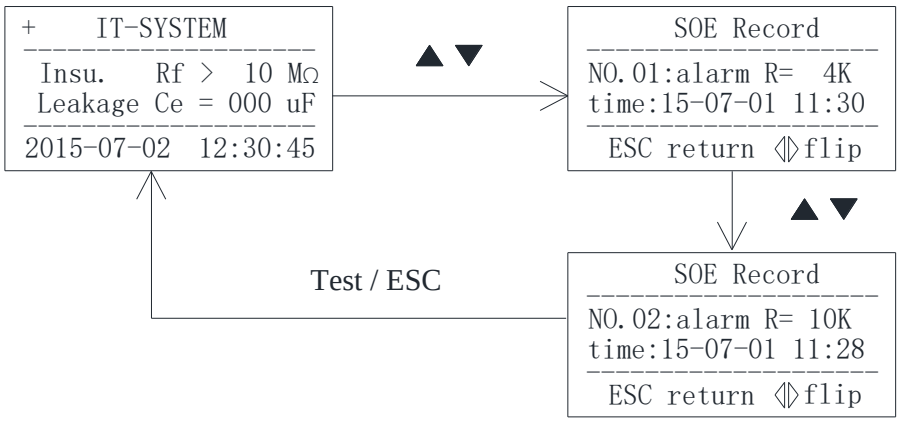
There are four keys in the device. They are "Test / ESC", "▲", "▼", "Menu/↵ ".

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.
▲ ▼	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 Backspace 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 "▲" or "▼" 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 / ESC" button, the monitor will start the

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self-examination program to simulate insulation faults and system errors. The 5 LED lights are on at the same time. The self-check results will be displayed after 2s or so to check whether the alarm and other functions of the instrument is normal.

7.4.2 Parameter setting

(1) Enter the menu

Under normal operation, enter the password input page by pressing "Menu/↵". Set the size of number by "▲" or "▼", press "Menu/↵" 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 Set" and press "▲" or "▼" to adjust the LCD contrast (long press is supported). You can adjust the LCD backlight time. After the modification is complete, press the "Test / ESC" key to exit. At this time, you can choose whether to save the setting and press "Menu/↵" to confirm and exit.

(3) Security Settings

Enter the menu and select "AlarmSet". Press "▲" or "▼" to adjust the warning and alarm values (long press is supported). Press The "Test / ESC" key to exit. At this time, you can choose whether to save the settings. Press "Menu/↵" to confirm and exit. The default alarm value is 38K and the early warning value is 60K.

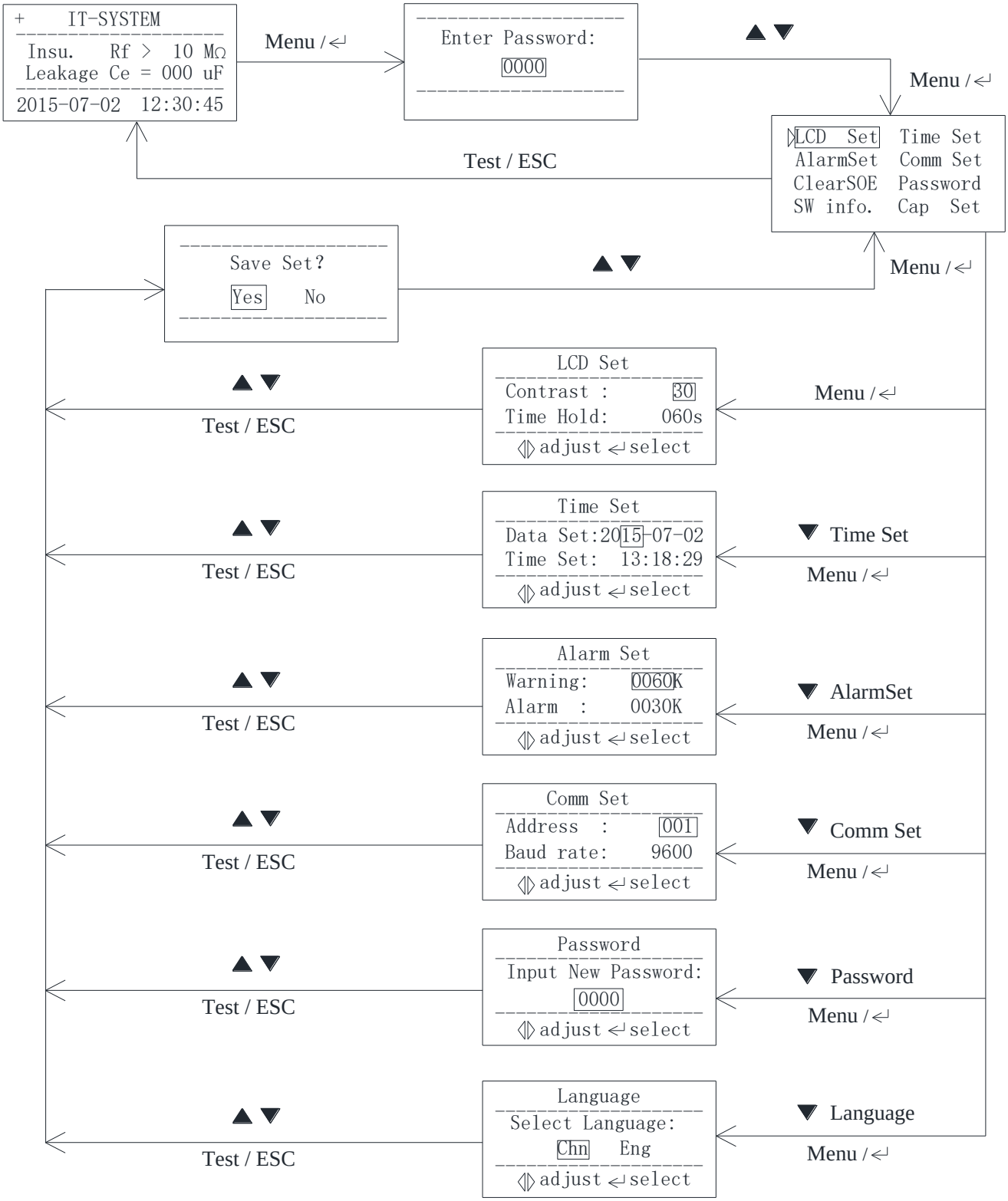
(4) Communication Settings

After entering the menu, select "Comm Set" and press "▲" or "▼" to adjust system communication parameters (hold down is supported). Press "Test / ESC" key to exit. At this time, you can choose whether to save the settings. Press "Menu/↵" 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.

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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 Function Code

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

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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
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

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

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

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8.3 Address Table of AIM-T500

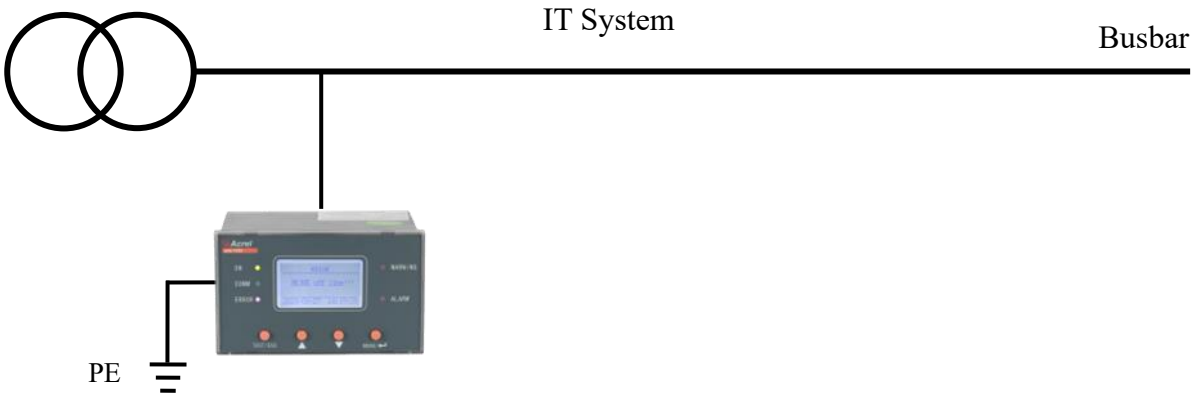
No.	Address	Parameter	R/W	Value range	Data Type
0	0000H	Password	R	0000-9999 (default 0000)	UINT16
1	0001H high	Address	R	1~247 (default 1)	UINT16
	0001H low	Baud rate	R	0~3: 4800, 9600, 19200, 38400 (unit bps) (default 9600)	
2	0002H high	Contrast ratio	R	15-60 (default: 30)	UINT16
	0002H low	Display time	R	15~250 (unit: second) (default 60, 15 light)	
3	0003H high	Year	R/W	0~99; Read +2000	UINT16
	0003H low	Month	R/W	1~12	
4	0004H high	Day	R/W	0~31	UINT16
	0004H low	Warning mark	R	0: none 1: warning 2: warning and alarm	
5	0005H high	Hour	R/W	0~23	UINT16
	0005H low	Minute	R/W	0~59	
6	0006H high	Second	R/W	0~59	UINT16
	0006H low	Data stable	R	0 or 1 (0 invalid, 1 stable)	
7	0007H high	Warning value	R/W	60~4999 (unit: kΩ) (default: 60)	UINT16
	0007H low	Warning value			
8	0008H high	Alarm value	R/W	10~4999 (unit: kΩ) (default: 38)	UINT16
	0008H low	Alarm value			
9	0009H high	Resistance value	R	1~10001 (unit: kΩ)	UINT16
	0009H low	Resistance value			
10	000AH	SN (high 16 bits)	R	Default: 0000000000	UINT16
11	000BH	SN (low 16 bits)			UINT16
12	000CH	Reserved			UINT16
13	000DH	Leakage capacity	R	0~500 (unit: μF)	UINT16
14	000EH high	Symbol of broken line	R	0: none 4:PE/KE broken line	UINT16
	000EH low	Current period		2~200 (unit s)	
15	000FH high	Access system or not	R	0: no access system 1: access system	UINT16
	000FH low	Reserved			
16	0010H high	SOE1 Fault info.	R	The sequence number of incident record	UINT16
	0010H low		R	SOE1 content: 0~2 0: no record 1: warning 2: alarm	

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17	0011H		Resistance value	R	SOE 1 insulation resistance	UINT16
18	0012H high		Year1	R	SOE 1 time -year	UINT16
	0012H low		Month1	R	SOE 1 time -month	
19	0013H high		Day1	R	SOE 1 time -day	UINT16
	0013H low		Hour1	R	SOE 1 time -hour	
20	0014H high		Minute1	R	SOE 1 time -minute	UINT16
	0014H low		Second1	R	SOE 1 time -second	
21~115	0015H~0073H	The remaining 19 events are recorded in this part of the space, and the rules and formats are the same as the first.				UINT16 *95

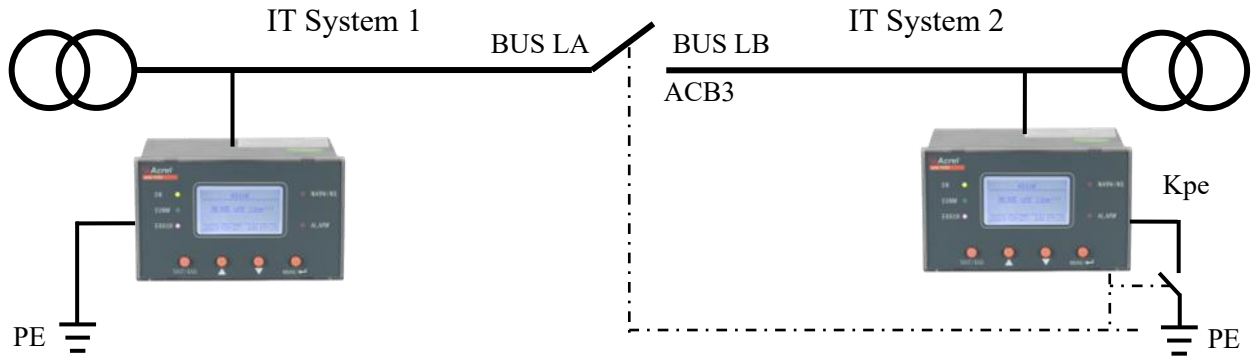
9 Typical Applications

A typical application for a single busbar is shown below.



Instructions: Stand-alone IT systems typically use a single insulation monitor, and the simultaneous operation of multiple insulation monitors can cause signal interference problems.

A typical application of double bus sectionalization is shown below.

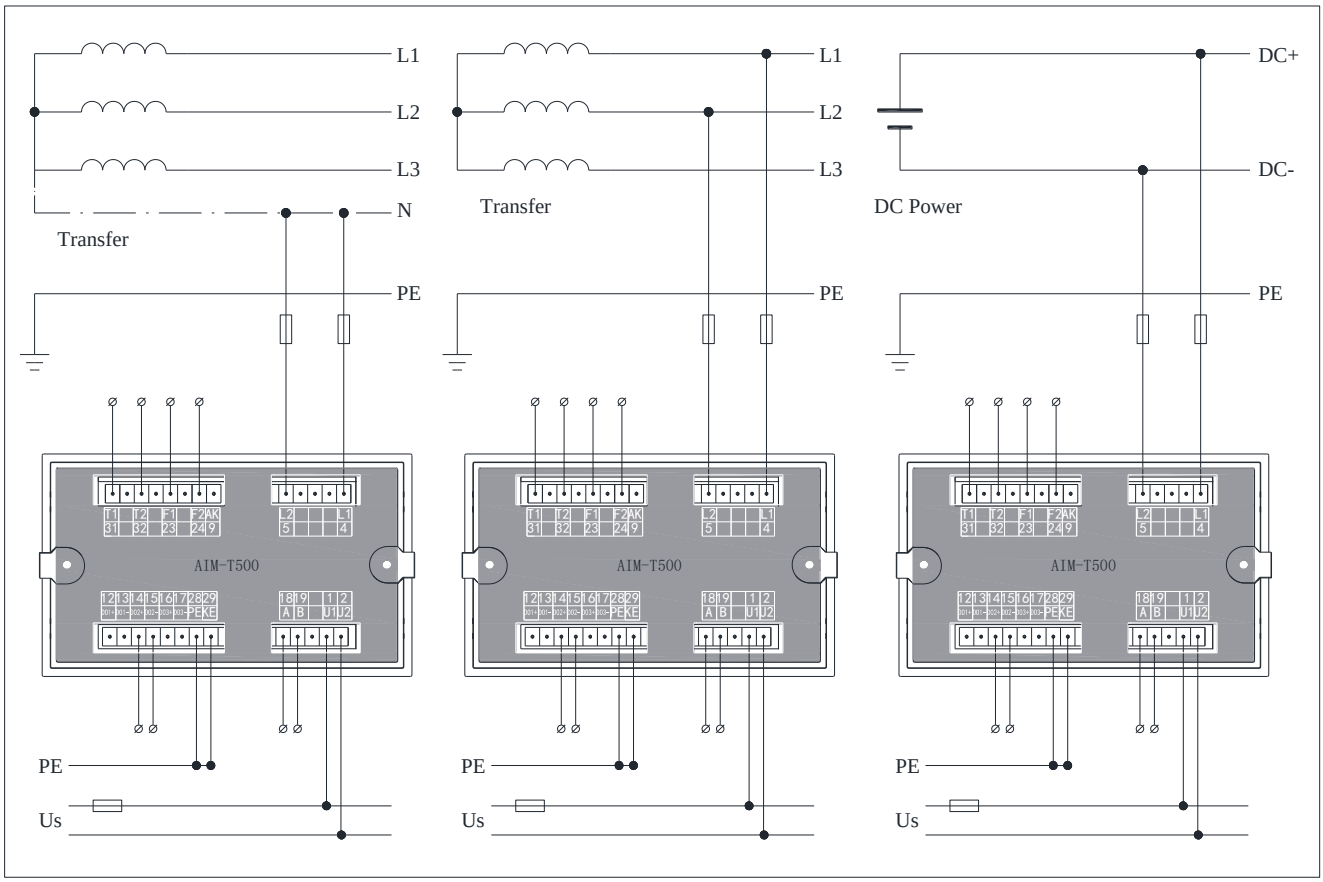


Instructions: When the double busbar is operated in sections, the two insulation monitors are monitored separately. When ACB3 is closed, a transformer with BUS LA and BUS LB runs together, at this time,

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the LA section insulation monitor is used, the LB section insulation monitor Kpe is disconnected, and the F1, F2 terminals are closed, exiting monitoring.

The AIM-T500 typical wiring diagram is shown below.



Instructions:

(1) The two single wires 28 and 29 are each connected to the PE wire.

(2) If there is N in the three-phase ungrounded system, 4 and 5 are connected to N. If there is no N, 4 and 5 are connected to L1 and L2 respectively. If there is no N, 4 and 5 are connected to L1 and L2 respectively, and if it is single phase, 4 and 5 are connected to L1 and L2 respectively.

(3) Us indicates access to AC220V power.

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