

AIM-M10

Insulation monitoring device for medical IT system



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1 General information

1.1 How to use the manual



DECLARATION

This manual is intended for qualified personnel working in electrical engineering and electronics! Acrel is not responsible for personal injury or financial loss resulting from the error of non-professional personnel.



ADVICE

Read the operating manual before mounting, connecting and commissioning the device. Keep the manual within easy reach for future reference.

1.2 Indication of Important Instructions and Information



DANGER

Indicates a high risk of danger that will result in death or serious injury if not avoided.



WARNING

Indicates a medium risk of danger that can lead to death or serious injury if not avoided.



CAUTION

Indicates a low-level risk that can result in minor or moderate injury or damage to property if not avoided.



ADVICE

Indicates important facts that do not result in immediate injuries. They can lead to malfunctions if the device is handled incorrectly.

1.3 Signs and symbols



Disposal



Protect from
moisture



Protect from
dust



Temperature
range



Recycling



RoHS report

1.4 Service and Support

Information and contact details about customer service, repair service or field service for Bender devices are available on the following website: [CONTACT US - Acrel Electric Co., Ltd.](https://www.bender.com)

2 Function

2.1 General

AIM-M10 insulation monitoring device monitors the insulation resistance of medical IT system with AC 115V or AC 230V. In addition, monitors the temperature and load current of the isolating transformer. When fault occurred, AIM-M10 gives alarm, and this alarm signal is provided to remoted alarm device via RS485 bus. In order to meet the requirements of the application, customized parameter setting must be made on the device in order to adapt it to local equipment and operating conditions.

2.2 Device features

- Insulation monitoring for medical IT system.
- Adjustable response value for insulation monitoring.
- Load and temperature monitoring for IT system transformers.
- Adjustable load current response value.
- Temperature monitoring with PT100 thermistors.
- PE connection monitoring.
- Self-monitoring with automatic alarm.
- 10 fault memory alarm messages.
- RS-485 with Modbus RTU protocol for the data exchange with other devices.
- Three-module enclosure, DIN-rail mounting.
- LEDS for On, Insulation, Overload and Overtemp.
- Password protection against unauthorized changing of device parameters.

2.3 Function

Once AIM-M10 is power on, during regular operation, the display shows the present insulation resistance, the load current and the temperature of transformer. If the insulation resistance falls below the response value, the Insulation LED signals an insulation fault. Overload LED lights up if the load current is too high, and the Overtemp LED lights up if the temperature of the monitored IT system transformer is too high. When over-temperature fault occurred, the only relay operates to signal the fault or to open the cooling fan.

In additional, AIM-M10 provides a RS485 communication terminals A, B for the remote alarm indicator or for Centralized monitoring system.

2.3.1 Monitoring the insulation resistance of medical IT system

The measurement range of the insulation resistance is from 1k Ω to 999k Ω . The maximum permissible system leakage capacitance is 5 μ F. The response time for resistance is less than 2s.

The insulation resistance R_F is monitored by means of parameters alarm value. If the insulation resistance below alarm value, Insulation LED is lit, and it will be turned off automatically when the resistance value exceeds the alarm value. According to IEC 60364-7-710, the alarm value of insulation resistance shall not below 50k Ω .

2.3.2 Monitoring the load current of the isolating transformer

AIM-M10 monitors the load current through AKH-0.66P26 current transformer. The measurement range of the load current is from 2.1A to 60A. The alarm value of over load can be set according to the capacity of the transformer, showed as the following table.

Capacity of transformer (VA)	3150	5000	6300	8000	10000
Alarm value of load current (A)	14	22	28	35	45

when the load value exceeds the alarm value, the Over load LED is lit. it will be turned off automatically when the current below the alarm value.

2.3.3 Monitoring the temperature of the isolating transformer

AIM-M10 monitors the temperature of the isolating transformer through 2 PT100 in series which embedded in the transformer. The measurement rang of the temperature is -50 $\cdots$ 200 $^{\circ}$ C. The alarm value of the temperature can be set in the menu. When the measured value exceeds the alarm value, the Overtemp LED is lit. The relay operates. and when the temperature below the alarm value, the LED and relay get back normal state.

2.3.4 Self-test functions

During the normal measuring function, the cyclic test of the continuous PE connection monitoring run in the background.

User controlled test functions interrupt the measuring function of the device. They are triggered by pressing the self-test button.

2.3.5 Continuous PE connection monitoring

The connection of terminals “FE” and “KE” of AIM-M10 to the PE protective conductor are monitored continuously. When the connection is interrupted, and the resistance display “----”.

2.3.6 History memory for fault alarm messages

The history memory saves exclusively the fault messages. 10 fault messages can be saved in the memory. Only the last message be stored in the first item, and the 10th item will be deleted when the last message be stored.

Each fault message includes fault type and time of fault occurrence.

2.3.7 Digital interface

The AIM-M10 uses the serial hardware interface RS-485 with Modbus-RTU protocols. Modbus RTU is an application layer messaging protocol, and it provides master/slave communication between devices that are connected via bus systems and networks. Modbus RTU messages have a 16-bit CRC (cyclic redundant checksum), which guarantees reliability.

2.3.8 Password protection

All parameters setting can only be made after entering the password (0000...9999) correctly. The default password is 0001.

3 Installation, connection and commissioning



Only skilled persons are permitted to carry out the work necessary to install, put into service and run a device or system.



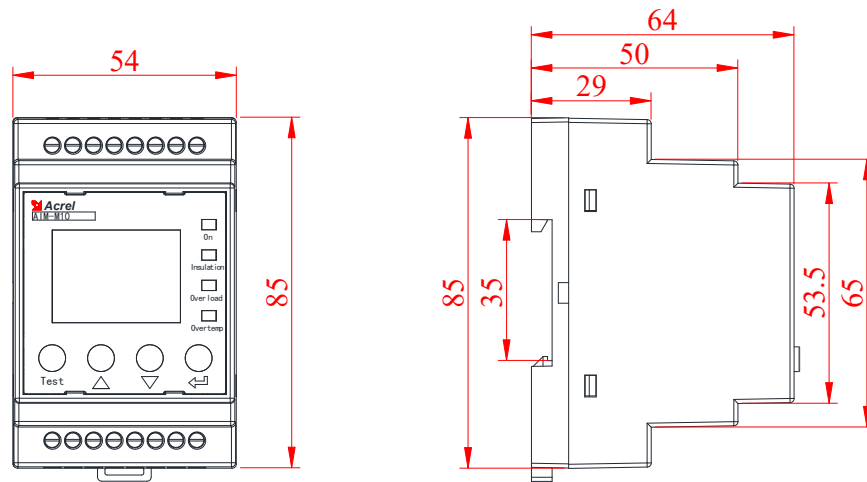
DANGER Risk of fatal injury due to electric shock!

Touching live parts of the system carries the risk of:

- Risk of electrocution due to electric shock
- Damage to the electrical installation
- Destruction of the device

Before installing the device and before working on its connections, make sure that the installation has been de-energized. The rules for working on electrical systems must be observed.

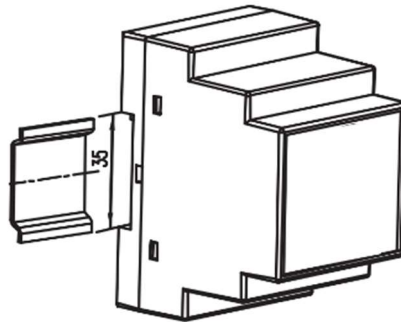
3.1 Dimension diagram and installation



All dimensions in mm.

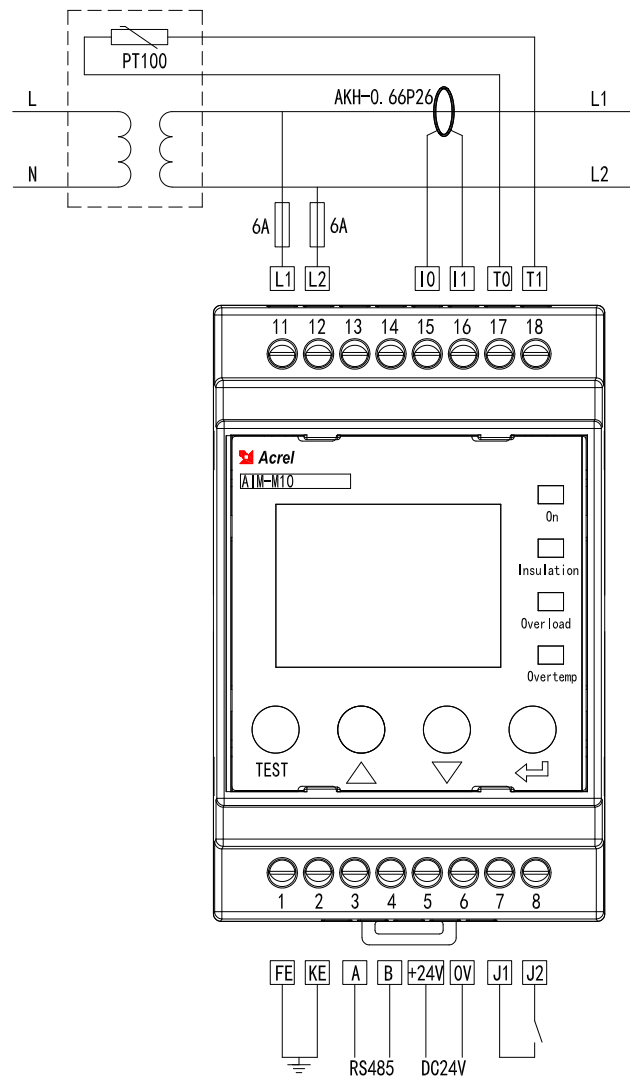
Mounting

DIN rail mounting: Snap the rear mounting clip of the device into place in such that a safe and tight fit is ensured.



3.2 Wiring diagram

Connect the device according the following wiring diagram.



3.3 Connection



CAUTION

Do not touch the terminals of the device after connecting it to the IT system.

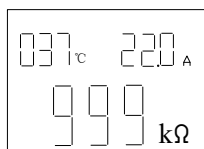
Terminal description:

Terminal Name	Terminal Num.	Connections
FE, KE	1,2	Connect each terminal separately to PE.
A, B	3,4	RS-485 communication interface.
+24V, 0V	5,6	DC 24V power supply output, power supply for AID10/AID150/AID200.
J1, J2	7,8	Alarm relay for overtemperature, connect to cooling fan.
L1, L2	11,12	Connect to L1 and L2 of the IT system via fuse.
I0, I1	15,16	Connect to current transformer AKH-0.66P26.

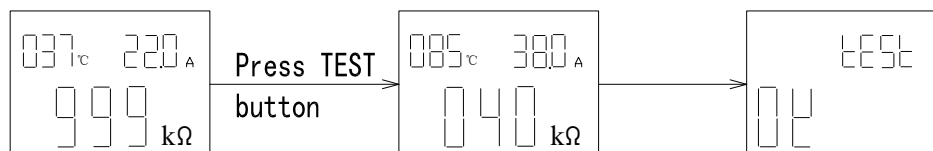
T0, T1	17,18	Connect to ST, ST terminals of isolating transformer.
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3.4 Commissioning

- Prior to commissioning, check connection of AIM-M10 is properly connected to the system to be monitored.
- Connect supply voltage U_s to the AIM-M10. The start routine can take up to 4s, Afterwards, the current measurement values are shown as the standard display.



- Start a manual self-test by pressing the button “Test”. All LEDs are lit and the display will show the following information:



—“test ok”: means the function is normal.

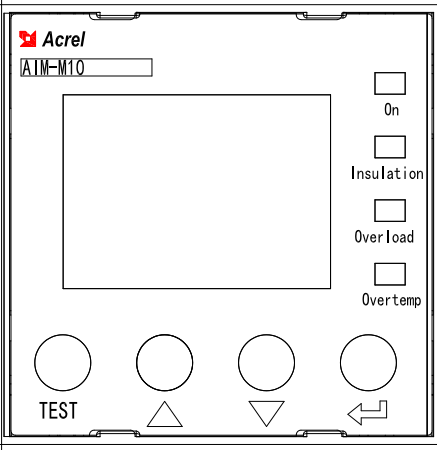
—“test Err”: means the function is abnormal, the device needs to be checked.

- Check if the settings are suitable for the system being monitored.
- Use a suitable resistor to connect between IT system and the earth to simulate insulation fault, to check the function of AIM-M10.

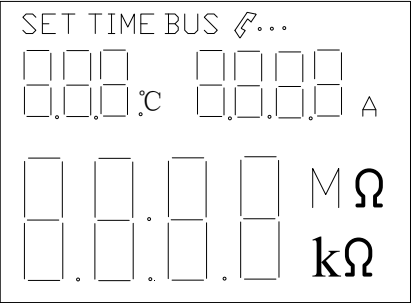
4 Operation

4.1 Operating elements

Device front	Operating elements	Function
	On	Power LED, flash once per second when power on.
	Insulation	Insulation alarm LED. Flash once per second when insulation measured value below response value R_{an} .
	Overload	Overload alarm LED. Flash once per second when current exceeds

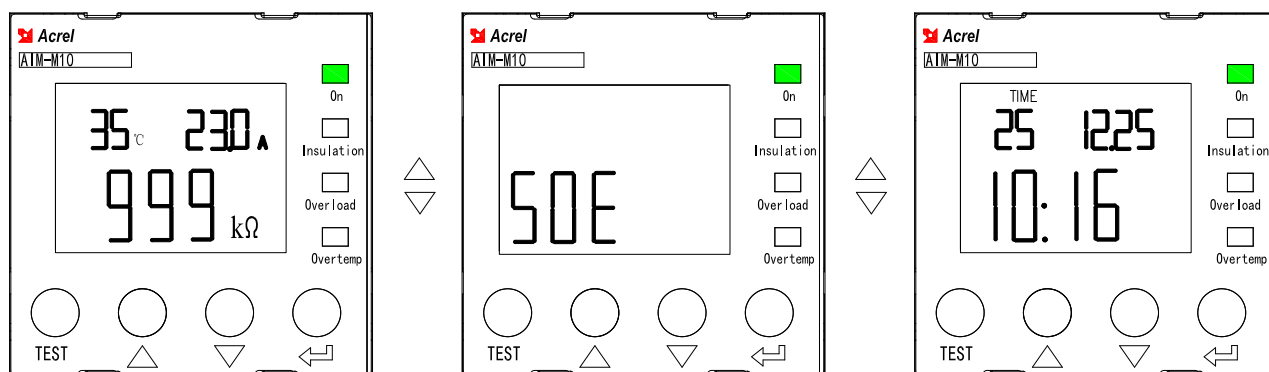
		alarm value.
	Overtemp	Over temperature alarm LED. Flash once per second when the temperature exceeds alarm value.
	Test	Test. To start a self-test. On the operating interface. Return. Exit current menu.
	▲	Up button. Menu item up/increase value
	▼	Down button. Decrease values
	↵	Enter and menu shared button. Menu. To starts menu mode. Enter. Confirm value modification.

4.2 Display elements

	SET	Parameter setting
	TIME	Time and date displaying or setting
	BUS	Communication setting
	🔧...	Communication state
	°C A MΩ kΩ	Measurement units
	7-segment display	Display of the values

4.3 Display in standard mode

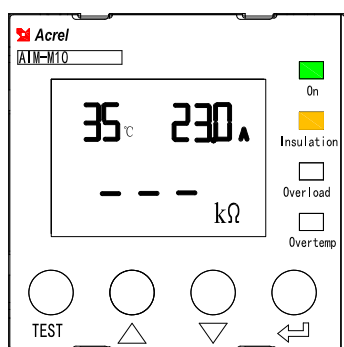
If there is no alarm pending, the On LED is flashed and the currently measured values are shown on the display. Pressing up/down arrow to switch between measured value displaying, fault record query and time.



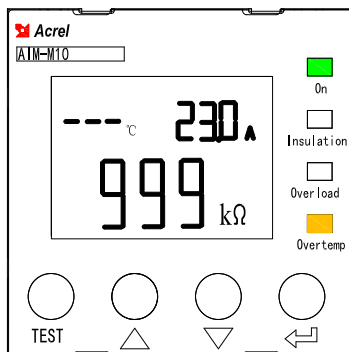
If no one button is pressed in one minute, the display will return to measured value display.

4.4 Alarm indication

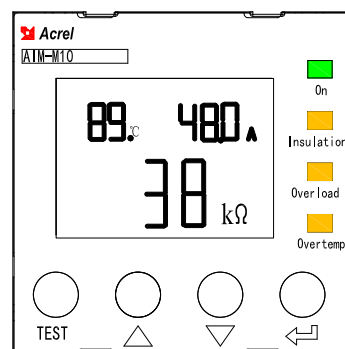
Display examples:



Alarm for FK disconnection.



Alarm for temperature sensor disconnection.

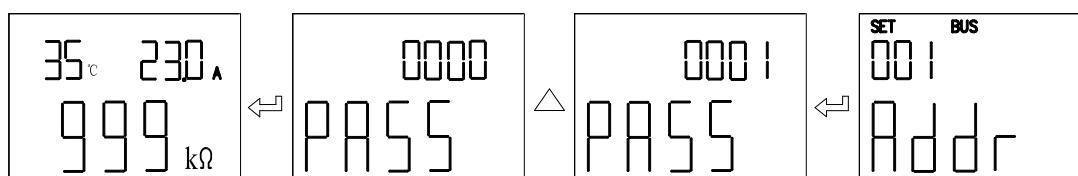


Alarm for insulation fault, overload, and overtemperature.

5 Parameter setting

5.1 Enter the setting interface

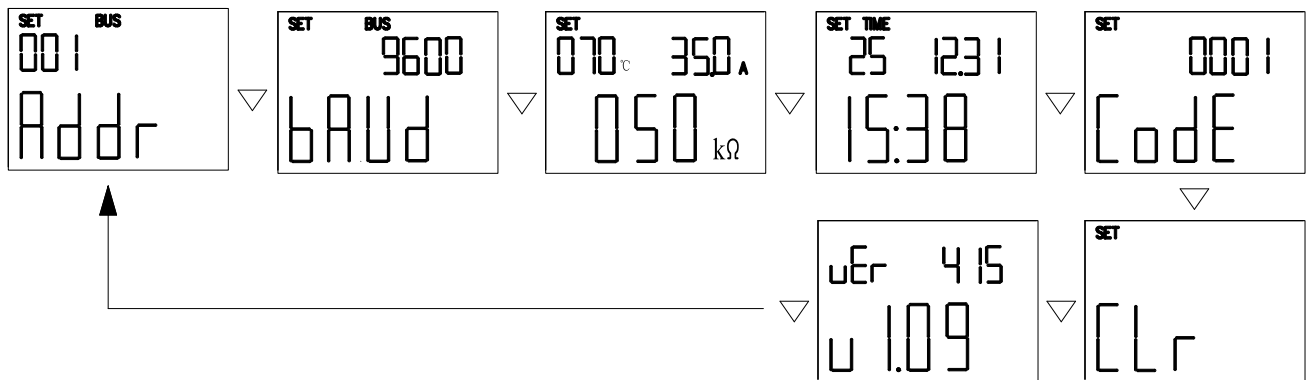
On measured value display, press enter button to enter password input interface, then press up arrow button to input the correct password and press enter button to enter the setting interface. The default password is 001.



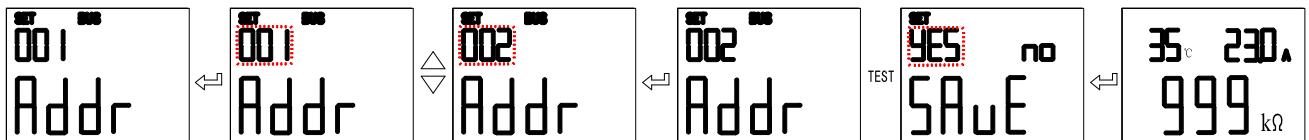
5.2 Settings menu overview

The settings menu include: address setting, baud rate setting, alarm values of overtemperature, over current, and insulation fault setting, time setting, password setting, software information, and record

cleaning. Shown as below.

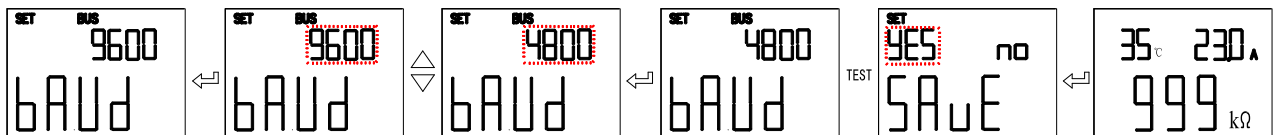


5.3 Setting the RS485 address



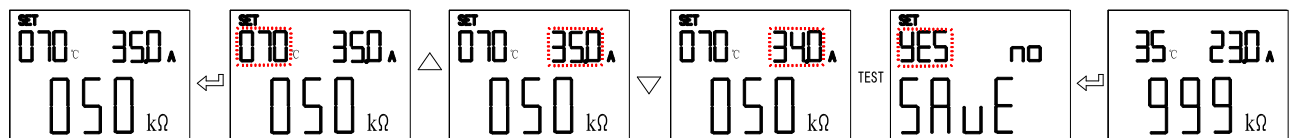
Note: here 001 means the display is flashing.

5.4 Setting the RS485 baud rate



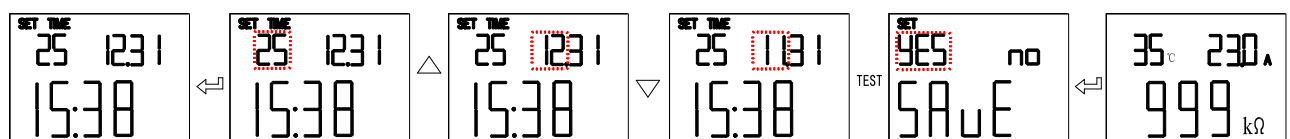
5.5 Setting the response value

Here up arrow used to select parameter, down arrow used to set values.

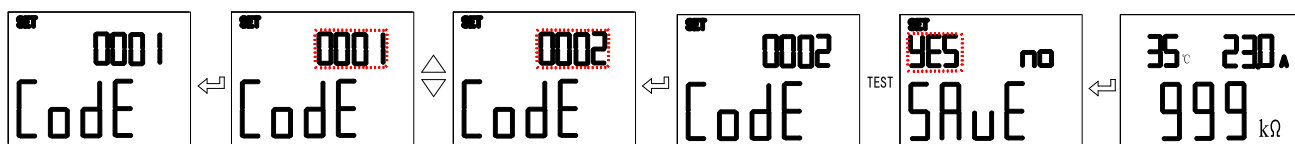


5.6 Setting the time and date

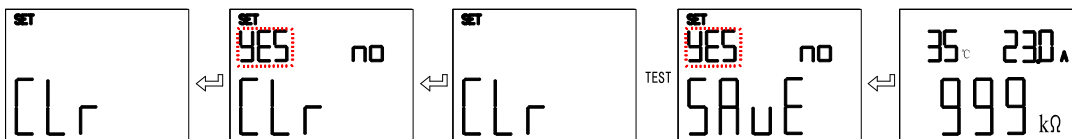
Here up arrow used to select parameter, down arrow used to set values.



5.7 Setting the password



5.8 Clear the fault records



5.9 Parameter setting and description

Parameters	FAC	Range
Password	0001	0000...9999
Address	1	1...247
Baud rate	9600	4800,9600,19.20(19200)
Alarm value of insulation	50	50...999 (unit: kΩ)
Alarm value of current	35	5...50 (unit: A)
Alarm value of temperature	70	0...200 (unit: °C)

FAC: Factoring settings

6 Data access via RS-485 interface

6.1 Modbus RTU protocol

A Modbus RTU message consists of address, function code, data, CRC. The address is ID of slave device to connect with. Function code is operation command, which define the read or write operation. Data is the content to exchange between the devices. And CRC is 16-bit check code, which is used to guarantee the communication reliability.

6.2 Introduction of function code

1) 03H or 04H: read the registers

This function allows the master device to acquire data from the slave via RS485 bus. There is no limit to the amount of data obtained, but it cannot exceed the defined address range.

The following example shows how to read the insulation measured value from the register 0008H of device with address 01.

Master read		Send message
Address of slave		01H
Function code		03H
Start address of register	High byte	00H
	Low byte	08H
Amount of register	High byte	00H
	Low byte	01H
CRC check code	Low byte	05H
	High byte	C8H

Slave return		Return message
Address of slave		01H
Function code		03H
Amount of byte		02H
Register data	High byte	00H
	Low byte	50H
CRC check code	Low byte	B8H
	High byte	78H

2) 06H or 10H: write the registers

This function allows the master device to write data to slave. Function code 06H allows to write one unit16 at a time. Function code 10H allows to write multiple uint16 at a time to slave device.

The following example shows how to write date (e.g. 2009-11-1,12:00) from the register 0004H of device with address 01.

Master writes		Send message
Address of slave		01H
Function code		10H
Start address of register	High byte	00H
	Low byte	04H
Amount of register	High byte	00H
	Low byte	03H
Amount of byte		06H
Data of 0004H	High byte	09H
	Low byte	0CH
Data of 0005H	High byte	01H
	Low byte	05H
Data of 0006H	High byte	0CH
	Low byte	00H
CRC check code	Low byte	A3H
	High byte	30H

Slave return		Return message
Address of slave		01H
Function code		10H
Start address of register	High byte	00H
	Low byte	04H
Amount of register	High byte	00H
	Low byte	03H
CRC check code	Low byte	C1H
	High byte	C9H

6.3 Modbus parameter registers

No.	Address	Parameter	R/W	Value Range	Data Type
1	0000H	Password	R/W	0001...9999 (Default 0001)	word
2	0001H high byte	Address	R/W	1...247 (Default:1)	word
	0001H low byte	Baud rate	R/W	1...3: 4800, 9600, 19200 (unit bps) (Default: 2)	
3	0002H	Reserve			word
4	0003H	Reserve			word
5	0004H high byte	Year	R/W	1...99	word
	0004H low byte	Month	R/W	1...12	
6	0005H high byte	Day	R/W	1...31	word
	0005H low byte	Week	R/W	1...7	
7	0006H high byte	Hour	R/W	0...23	word
	0006H low byte	Minute	R/W	0...59	
8	0007H high byte	Second	R/W	0...59	word
	0007H low byte	Reserve			
9	0008H	Insulation resistance	R/W	10...999 (Unit : kΩ)	word
10	0009H	Load current	R/W	0...500 (Unit: 0.1A)	word
11	000AH	Transformer temperature	R/W	-50...200 (Unit :°C)	word
12	000BH high byte	Reserve			word

	000BH low byte	Fault type		R	Bit0: 0 normal; 1 Insulation fault Bit1: 0 normal; 1 Overload Bit2: 0 normal; 1 Transformer overheat Bit3: Reserve Bit4: 0 normal; 1 PE or KE disconnection Bit5: 0 normal; 1 Temperature sensor disconnection Bit6: Reserve Bit7: Reserve	
13... 16	000CH...000FH	Reserve				
17	0010H	Insulation resistance alarm value		R/W	10...999 (Unit kΩ) (default 50)	word
18	0011H	Load current alarm value		R/W	5... (Unit A) (default 35)	word
19	0012H	Transformer temperature alarm value		R/W	0...200 (Unit °C) (default 70)	word
20... 24	0013H...0017H	Reserve				
25	0018H high	Fault record 1	Reserve			word
	0018H low		STA1	R	SOE1 type: 0...6 0: No fault record 1: Insulation fault 2: Overload fault 3: Over temperature fault 4: LL disconnection 5: PK disconnection 6: TC disconnection	
26	0019H high		Year1	R	SOE1 time - year	word

	0019H low		Moth1	R	SOE1 time - month	
27	001AH high		Day1	R	SOE1 time - day	word
	001AH low		Hour1	R	SOE1 time - hour	
28	001BH high		Minute1	R	SOE1 time - minute	word
	001BH low		Second1	R	SOE1 time - second	
29... 64	001CH...003FH	Other 9 fault records in the same format as the first one				

7 Technical data

7.1 Technical data AIM-M10

() * =factory settings

Supply voltage

Supply voltage U_s	AC220V $\pm$ 10%
Frequency	50/60Hz
Power consumption	$\leq$ 5 W

Response values

Response value	50...999k Ω
Relative uncertainty	$\pm$ 10%
Response time	$\leq$ 2s
Permissible system leakage capacitance	Max. 5 μ F

Measuring circuit

Measuring voltage	<12V
Measuring current	$\leq$ 42 μ A
Internal DC resistance	$\geq$ k Ω

Load current monitoring

Response value	5...50A
Relative uncertainty	$\pm$ 5%
Nominal frequency	50/60Hz
Setting values of over current alarm	

Capacity of transformer	3.15kVA/5kVA/6.3kVA/8kVA/10kVA
I _{alarm}	14A/ 22A/28A/35A/45A(35A)*
Temperature monitoring	
Temperature sensor	2*PT100 in series
Response value	0°C...200°C(70°C)*
Relative uncertainty	±2°C
Display, memory	
Display	LCD display, not illuminated
Number of fault records	10
Password	0000...9999(0001)*
Interface	
Interface / protocol	RS485/Modbus-RTU
Baud rate	4800,9600,19200bps(9600bps)*
Cable length(9600bps)	≤1200m
Cable: twisted pairs	Min. J(St)Y 2x0.75
Terminating resistor	120Ω (0.25W), external, can be connected
Device address	1...247 (1)*
Switching elements	
Switching elements	1 n/o contact
Electrical endurance under rated operating condition	20,000,000 cycles
Contact data	
Rated operational voltage	AC 250V, DC 30V
Rate operational current	AC 250V,3A, DC 30V,5A
Environment	
Operating temperature	-10°C ... +55°C
Storage temperature	-20°C ... +70°C
Humidity	≤95%RH, no condensation and corrosive gas
Altitude	≤2000m
other	
Operating mode	Continuous operation

Degree of protection internal components	IP30
Degree of protection terminals	IP20
Pollution degree	III
Installation	DIN rail mounting
weight	244.3g

7.2 Standards and certifications

AIM-M10 insulation monitoring device was developed in compliance with the following standards:

- IEC 61557-8: 2014
- EN 61000-3-3:2021
- EN IEC 61000-3-2:2019/A1:2021
- IEC 61326-2-4:2020
- IEC 61000-4-8:2009
- CISPR11(Edition 6.2)



8 Change log

Date	Document version	Valid from software	State/Changes
01/2026	V1.00		First edition.

9 Contact us

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