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# AMC16Z DC Insulation Monitoring Device

Installation and Use Manual V1.2

ACREL CO., Ltd.

# Declaration



Acrel reserves the right to modify the product specifications herein without notification. Please consult the local agent about the latest specifications before placing a purchase order.

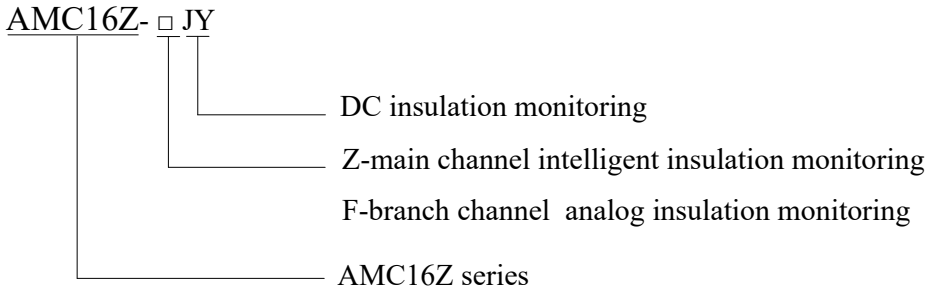
# Content

## 1 Overview

With the continuous expansion of network construction, the daily operation and maintenance management of the communication equipment room faces many difficulties: the number of computer rooms is large and the locations are scattered, which makes it difficult to detect faults and alarm in time; the power consumption of communication computer rooms is very large, and users need to strengthen management and improve the operation efficiency of server racks. In order to ensure the power and environmental safety of the communication room, there must be a suitable insulation monitoring system to achieve all-round green and reliable protection.

AMC16Z DC insulation monitoring device is a device for online real-time monitoring and management of the insulation status of DC system busbars and branches. This product cooperates with the DC leakage current sensor to detect the branch leakage current, and can monitor the A+B dual bus incoming line and the insulation status of up to 192 branch circuits. The products are mainly used in the monitoring and management of the insulation status of various DC power systems.

## 2 Model Specification




| Model | Function description |
|---|---|
| AMC16Z-ZJY | Monitor the busbar voltage, busbar-to-ground voltage, and busbar insulation status of the A+B dual DC incoming circuit. One RS485 interface (A\B) is used to connect to the touch screen or RS485 hub. One RS485 interface (A1\B1) is used to connect AMC16Z-FJY. |
| AMC16Z-FJY | It is selected when externally equipped with an analog leakage current sensor. It is connected to the main module through the RS485 interface for monitoring the insulation state of the shunt. It can be expanded to 8 sets at most. It can be configured as the isolation state of 24 shunts of single-channel DC outlet, and 1-channel RS485 interface (A\B) is used to connect AMC16Z-ZJY. |

## 3 Product Function

The DC insulation monitoring unit has the following functions when detecting busbar insulation:

- Real-time online detection of the insulation condition of the DC system;
- When there is a single-pole grounding fault or a grounding fault occurs at the positive and negative poles at the same time (the grounding resistance is less than the insulation alarm setting value), it can accurately detect and issue an alarm within 10s;
- Display and record the polarity, insulation resistance value and occurrence time of the branch grounding bus;
- It has the function of setting the limit value of the insulation resistance of the DC system;
- When the front end is equipped with other insulation devices, the insulation device system can be configured through the background or touch screen, and the insulation state of the branch circuit can be detected without affecting the front end test system.

## 4 Technical Parameter

### AMC16Z-ZJY

| Technical Parameter | | AMC16Z-ZJY |
|---|---|---|
| Measurement Parameter | | Busbar voltage, busabar insulation resistance |
| Auxiliary power | | DC 24V(DC 22V～DC 26V) |
| Busbar Voltage | Rated | 48VDC,240VDC,336VDC |
| | Measuring range | ±20% |
| | Overload | Instantaneous voltage 2 times / sec |
| Measurement Accuracy | Busbar voltage | 0.5 class |
| | Incoming line to ground insulation resistance | 10kΩ≤Ri≤50kΩ Error ±5% |
| | | 51kΩ≤Ri≤100kΩ Error ±10% |
| | Branch circuit to ground insulation resistance | 10kΩ≤Ri≤50kΩ Error ±5% |
| | | 51kΩ≤Ri≤100kΩ Error ±10% |
| Communication | | RS485/Modbus-RTU |
| Protection level | | IP20 |
| Pollution level | | 2 |
| Safety | Insulation | The insulation resistance between all terminals and the conductive parts of the housing is not less than 100MΩ |
| | Pressure resistance | The busbar voltage and other ports should meet AC2kV 1min, the communication and auxiliary power should meet AC1kV 1min, the leakage current should be less than 2mA, no breakdown or flashover. |
| Electromagnetic Compatibility | Anti-static interference | class 3 |
| | Immunity to fast transient bursts | class 3 |
| | Anti-surge interference | class 3 |
| | Resistant to radio frequency electromagnetic field radiation | class 3 |
| Installation method | | DIN35mm rail or bottom plate installation |
| Environment | Temperature | Work：-15℃～55℃ Storage：-25℃～70℃ |
| | Humidity | Relative humidity ≤93% |
| | Altitude | ≤2500m |

### AMC16Z-FJY

| Technical Parameter | | AMC16Z-FJY |
|---|---|---|
| Measurement Parameter | | Leakage current of 12 branches of A+B |
| Auxiliary power | | DC 12V～DC24V |
| Current outlet circuit | Rated | 5V(DC leakage current sensor, requires external power supply ±12V) |
| | Range | |
| | Overload | Continuous 1.2 times, instantaneous 10 times/sec |
| Measurement | Branch circuit to ground | 10kΩ≤Ri≤50kΩ error ±5% |

| | | |
|---|---|---|
| | | 51kΩ≤Ri≤100kΩ error ±10% |
| Communication | | RS485/Modbus-RTU |
| Protection level | | IP20 |
| Pollution level | | 2 |
| Safety | Insulation | The insulation resistance between all terminals and the conductive parts of the housing is not less than 100MΩ |
| | Pressure resistance | A circuit voltage and current signal//B circuit voltage and current signal//The other ports should meet AC2kV 1min between each other, the leakage current should be less than 2mA, and there is no breakdown or flashover. |
| Electromagnetic Compatibility | Anti-static interference | 3 class |
| | Resistant to radio frequency electromagnetic field radiation | 3 class |
| Installation method | | DIN35mm rail or bottom plate installation |
| Environment | Temperature | Work：-15℃～55℃ Storage：-25℃～70℃ |
| | Humidity | Relative humidity ≤93% |
| | Altitude | ≤2500m |

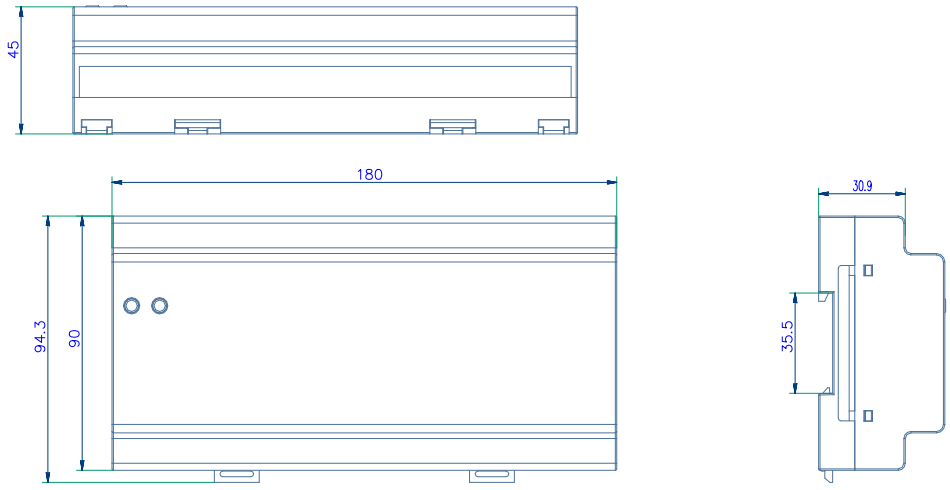
Note: 1. When the bus voltage is DC48V, the measurement range of insulation resistance is 10kΩ to 50kΩ, and the accuracy is ±10%;

2. The input voltage of the branch DC leakage current sensor is 5V, and the default value of the primary side leakage current is 10mA.

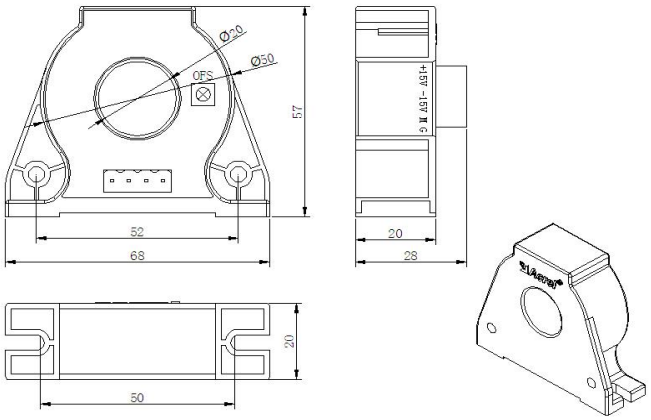
## 5 Installation Guide

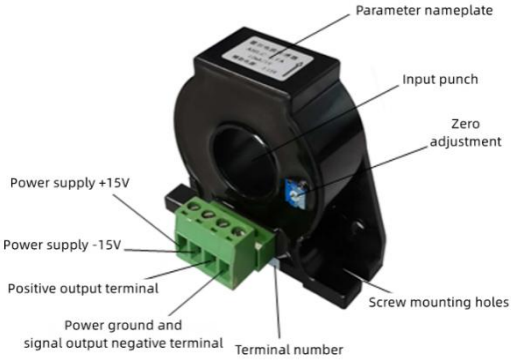
5.1 Shape and installation dimension Unit：mm

AMC16Z-ZJY and AMC16Z-FJY



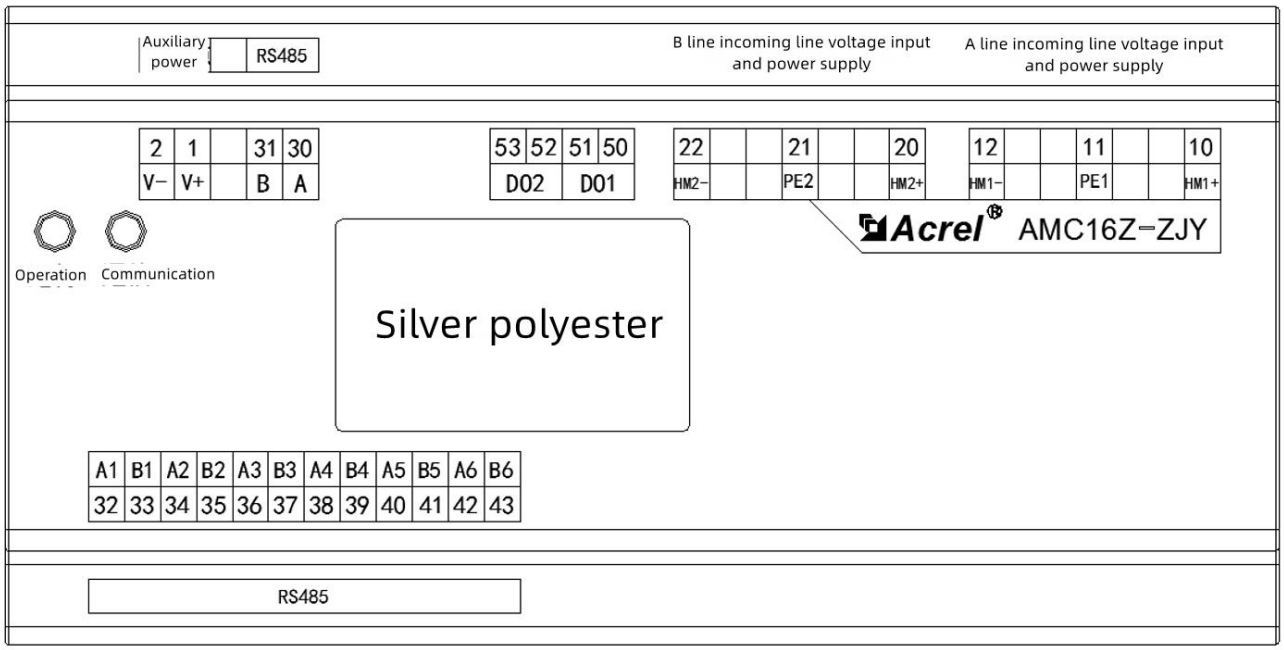
Analog leakage current sensor




5.2 Wiring Terminal

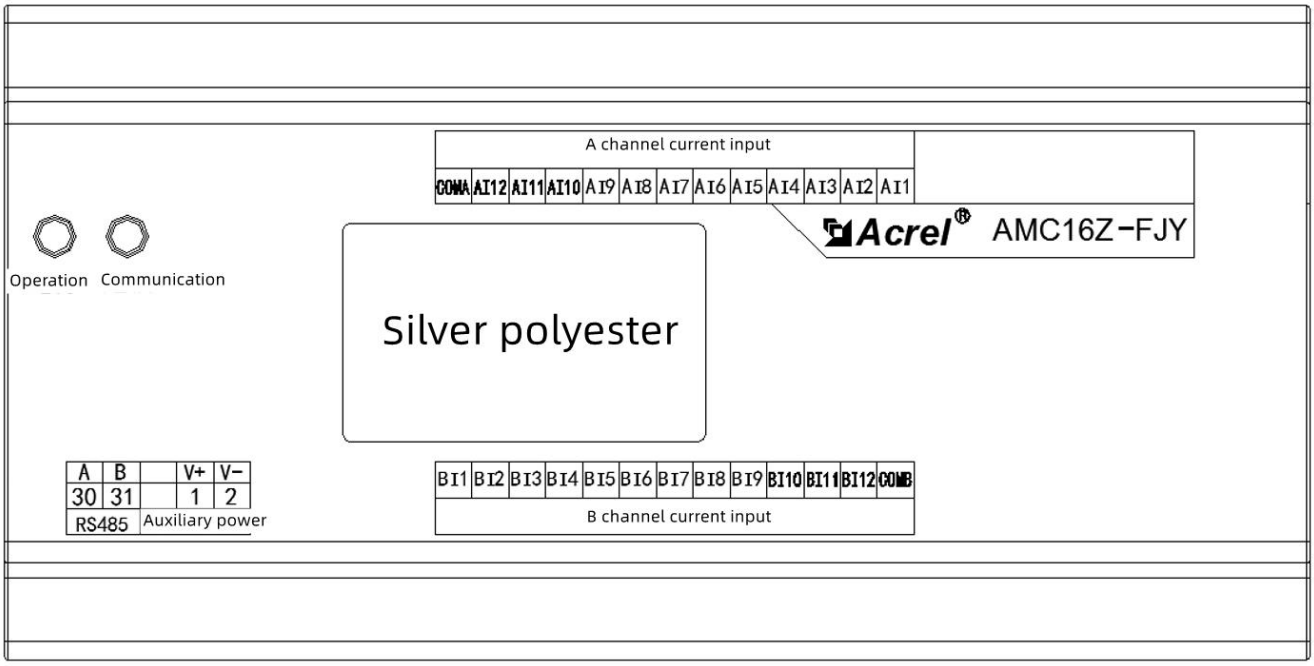
AMC16Z-ZJY：




| Terminal number | Definition | Description | Remark |
|---|---|---|---|
| 1 | V+ | Auxiliary power | DC 24V input |
| 2 | V- | | |
| 10 | HM1+ | A channel busbar voltage input + | A channel incoming line DC voltage input and power supply |
| 11 | PE1 | A channel is connected to the earth | |
| 12 | HM1- | A channel busbar voltage input - | |
| 20 | HM2+ | B channel busbar voltage input + | B channel incoming line DC voltage input and power supply |
| 21 | PE2 | B channel is connected to the earth | |
| 22 | HM2- | B channel busbar voltage input - | |

| | | | |
|---|---|---|---|
| 50 | DO1 | The first channel relay output | Relay output |
| 51 | DO2 | The second channel relay output | |
| 30 | A | RS485 communication | Connect to touch screen or RS485 hub |
| 31 | B | | |
| 32 | A1 | RS485 communication | Connecting the AMC16Z-FJY expansion module |
| 33 | B1 | | |

AMC16Z-FJY：




| Terminal number | Definition | Description | Remark |
|---|---|---|---|
| 1 | V+ | Auxiliary power | DC 12V～DC 24V input |
| 2 | V- | | |
| 30 | A | RS485 communication | Connect to AMC16Z-ZJY |
| 31 | B | | |
| AI1-AI12 | | A channel current input | A channel outgoing line DC current input (12-channel DC leakage current sensor) |
| COMA | | | |
| BI1-BI12 | | B channel current input | B channel outgoing line DC current input (12-channel DC leakage current sensor) |
| COMB | | | |

Analog leakage current sensor:

| Serial number | Mark | Description |
|---|---|---|
| 1 | M | Analog output |
| 2 | G | working power ground |
| 3 | - | Working power DC12V negative |
| 4 | + | Working power DC12V positive |

Note: The branch DC leakage current sensor needs to be purchased separately;

5.3 Precautions

The device should be installed in a dry, clean place away from heat sources and strong electromagnetic fields;
When wiring the device, pay attention to the input polarity of the DC bus voltage and leakage current sensor, otherwise the measurement will be inaccurate;
When wiring the DC leakage current sensor, it is necessary to pass the positive and negative branch busbars through the perforation at the same time;
When there are multiple expansion modules, each branch insulation module needs to use the touch screen to set the communication address;
Shielded twisted pair should be used for communication cables.

# 6 The detailed MODBUS communication address is shown in the table below

This protocol specifies the physical connection and communication protocol for data exchange between AMC16Z series DC precision power distribution monitoring device and data terminal equipment, and its protocol method is similar to the Modbus_RTU communication protocol.

## 6.1 Brief description of the protocol

The communication protocol used by AMC16Z series devices defines the data sequence definition of address code, function code and check code in detail, which are the necessary contents of specific data exchange. The protocol uses a master-slave acknowledgment connection (half duplex) over a single communication line, which means that signals travel in opposite directions on a single communication line. First, the signal from the host computer is addressed to a unique terminal device (slave), and then the response signal from the terminal device is transmitted to the host in the opposite direction.

This protocol only allows communication between the host (PC, PLC, etc.) and terminal equipment, and does not allow data exchange between independent terminal equipment, so that each terminal equipment will not occupy the communication line when they are initialized, but only respond to Inquiry signal to this unit.

## 6.2 Transfer method

The information transmission is asynchronous and takes bytes as the unit, and the communication information transmitted between the master and the slave is in 11-bit word format. It includes 1 start bit, 8 data bits (the least significant bit is sent first), parity check bit (no check), and 2 stop bits.

### 6.2.1 Data frame format

| address code | function code | data area | CRC verification code |
|---|---|---|---|
| 1 byte | 1 byte | n bytes | 2 bytes |

### 6.2.2 Address field

The address field is at the beginning of the frame, consisting of one byte (8-bit binary code), and the decimal is 0 to 255. In our system, only 1 to 247 is used, and other addresses are reserved. These bits indicate the user-specified address of the end device that will receive data from the host connected to it. The address of each terminal device must be unique, and only the addressed terminal will respond to queries containing this address. When the terminal sends a response back, the slave address data in the response tells the host which terminal is communicating with.

### 6.2.3 Functional domain

The function field code tells the addressed terminal what function to perform. The following table lists the function codes used by this series of devices, as well as their meanings and functions.

| code | Meaning | Action |
|---|---|---|
| 03 | read data register | Get the current binary value of one or more registers |

| | | |
|---|---|---|
| 16 | Preset multiple registers | Set binary values to a series of multiple registers |

6.2.4 Data field

The data field contains the data required by the terminal to perform a specific function or the data collected when the terminal responds to a query. The contents of these data may be numerical values, reference addresses or setting values. For example, the function field code tells the terminal to read a register, and the data field needs to indicate which register to start from and how many data to read. The embedded address and data vary according to the type and content of the slave.

6.2.5 Error check field

This field allows hosts and terminals to check for errors during transmission. Occasionally, due to electrical noise and other disturbances, a set of data may undergo some changes on the wire as it is transferred from one device to another. Error checking ensures that the host or terminal does not respond to data that has changed during transmission. This improves the security and efficiency of the system, and the 16-bit cyclic redundancy method (CRC16) is used for error checking.

6.2.6 Error detection method

The error check field occupies two bytes and contains a 16-bit binary value. The CRC value is calculated by the transmitting device and then appended to the data frame, the receiving device recalculates the CRC value when receiving the data, and then compares it with the value in the received CRC field, if the two values are not equal, it happens mistake.

During CRC operation, firstly, a 16-bit register is preset to all 1s, and then the 8 bits in each byte in the data frame are continuously operated with the current value of the register. Only the 8 data bits of each byte participate in the generation of the CRC, the start and stop bits and the possible use of parity bits do not affect the CRC. When generating the CRC, the 8 bits of each byte are XORed with the contents of the register, and then the result is shifted to the lower bits, the upper bits are supplemented with "0", and the lowest bit (LSB) is shifted out and detected. If it is 1, the register will perform an XOR operation with a preset fixed value (0A001H). If the lowest bit is 0, no processing will be performed.

The above processing is repeated until the 8 shift operations are performed. When the last bit (the 8th bit) is shifted, the next 8-bit byte is XORed with the current value of the register. Also perform the above-mentioned 8 shift XOR operations. When all the bytes in the data frame are processed, the final value generated is the CRC value.

The process of generating a CRC is:

(1) Preset a 16-bit register as 0FFFFH (all 1s), which is called a CRC register.

The 8 bits of the first byte in the data frame are XORed with the low byte in the CRC register, and the result is stored back in the CRC register.

Shift the CRC register one bit to the right, fill the highest bit with 0, and remove the lowest bit and check.

If the lowest bit is 0: repeat the third step (the next shift); if the lowest bit is 1: XOR the CRC register with a preset fixed value (0A001H).

Repeat steps 3 and 4 until 8 shifts. This completes a full eight bits.

(2) Repeat steps 2 to 5 to process the next eight bits until all bytes are processed.

The final CRC register value is the CRC value.

In addition, there is a method for calculating CRC by using a preset table. Its main feature is that the calculation speed is fast, but the table needs a large storage space. This method will not be repeated here, please refer to the relevant information.

6.3 Introduction to function codes

6.3.1 Function code 02H: read discrete input

This function code reads the continuous state of discrete input from 1 to 2000. The request PDU specifies the starting address, that is, the first input address and input number specified. Inputs are addressed from zero. So addressing inputs 1-16 are 0-15. The discrete input in the response message is divided into one input according to each bit of the data field. Indicated states are 1=ON and 0=OFF. The LSB (least significant bit) of the first data byte includes the input addressed in the query. Other inputs and so on, up to the high-order end of the byte, and in the order from low-order to high-order in subsequent bytes. If the returned input quantity is not a multiple of eight, the remaining bits in the last data byte (up to the high-order end of the byte) will be padded with zeros. The number of bytes field specifies the complete number of bytes of data.

The following example is to read 10 consecutive switch states of DI7~DI16 from slave 01.

| Host send | | Send Message |
|---|---|---|
| Address code | | 01H |
| Function code | | 02H |
| Initial address | High byte | 00H |
| | Low byte | 06H |
| Number of outputs | High byte | 00H |
| | Low byte | 0AH |
| CRC check code | Low byte | 18H |
| | High byte | 0CH |

| Slave return | | Return message |
|---|---|---|
| Address code | | 01H |
| Function code | | 02H |
| Number of bytes | | 02H |
| Input Status 14-7 | | 3FH |
| Input Status 16-15 | | 02H |
| CRC check code | Low byte | 29H |
| | High byte | 89H |

Represents discrete input states 14-7 as hexadecimal byte value 3F, or binary 0011 1111. Input 14 is the MSB of this byte and input 7 is the LSB of this byte.

Represents discrete input states 16-15 as byte value 02 in hexadecimal, or 0000 0010 in binary. Input 15 is the LSB, zero-padding the remaining bits in the last data byte.

6.3.2 Function code 03H: read register

This function allows the user to obtain the data and system parameters collected and recorded by the device. There is no limit to the number of data requested by the host at one time, but it cannot exceed the defined address range.

The following example is to read 3 basic data collected from slave 01 (each address in the data frame occupies 2 bytes) Uab, Ubc, Uca. The address of Uab is 03H, the address of Ubc is 04H, and the address of Uca is 05H.

| Host send | | Send Message |
|---|---|---|
| Address code | | 01H |
| Function code | | 03H |
| Initial address | High byte | 00H |
| | Low byte | 03H |
| Number of registers | High byte | 00H |
| | Low byte | 03H |
| CRC check code | Low byte | F5H |
| | High byte | CBH |

| Slave return | | Return message |
|---|---|---|
| Address code | | 01H |
| Function code | | 03H |
| Number of bytes | | 06H |
| Register data | High byte | 0EH |
| | Low byte | EEH |
| Register data | High byte | 0EH |
| | Low byte | E8H |
| Register data | High byte | 0EH |
| | Low byte | E9H |
| CRC check code | Low byte | 8FH |
| | High byte | 7EH |

6.3.3 Function code 10H: write multiple registers

Function code 10H allows users to change the contents of multiple registers, and the system parameters and switch output status of the instrument can be written in with this function number. The host can write up to 16 (32 bytes) of data at a time.

The following example is that the meter with the preset address of 01 simultaneously outputs the digital DO. The address of the switch output status indication register is 0045H, and the first bit corresponds to DO.

| Host send | | Send Message |
|---|---|---|
| Address code | | 01H |
| Function code | | 10H |
| Initial address | High byte | 00H |
| | Low byte | 45H |
| Number of registers | High byte | 00H |
| | Low byte | 01H |
| Number of bytes | | 02H |
| 0045H Data to be written | High byte | 00H |
| | Low byte | 01H |
| CRC check code | Low byte | 69H |
| | High byte | 05H |

| Slave return | | Return message |
|---|---|---|
| Address code | | 01H |
| Function code | | 10H |
| Initial address | High byte | 00H |
| | Low byte | 45H |
| Number of registers | High byte | 00H |
| | Low byte | 01H |
| CRC check code | Low byte | 10H |
| | High byte | 1CH |

6.4 Communication address

| Serial number | Variable | Address | Read/ Write | Word Length | Unit | Data Type | Remark |
|---|---|---|---|---|---|---|---|
| 1 | Address | 00H | R/W | 1 | NONE | Uint16 | 1～247 |
| 2 | Baud rate | 01H | R/W | 1 | NONE | Uint16 | 0:115200<br>1:2400<br>2:4800<br>3:9600<br>4:19200<br>5:38400<br>6:57600 |
| 3 | Check Digit | 02H | R/W | 1 | NONE | Uint16 | 0: no parity<br>2: odd parity<br>3: Even parity |
| 4 | Reserve | 03H | R/W | 1 | NONE | Uint16 | Reserved |
| 5 | Rated voltage | 04H | R/W | 1 | V | Uint16 | 48V,240V,336V |
| 6 | Reserve | 05H | R/W | 1 | NONE | Uint16 | Reserved |
| 7 | Busbar voltage ratio | 06H | R/W | 1 | NONE | Uint16 | Reserved |
| 8 | Leakage current transformation ratio | 07H | R/W | 1 | NONE | Uint16 | Reserved |
| 9 | Reserve | 08H～0DH | R/W | 1 | NONE | Uint16 | Reserved |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 10 | Main circuit insulation resistance low alarm | 0EH | R/W | 1 | kΩ | Uint16 | |
| 11 | Branch circuit insulation resistance low alarm | 0FH | R/W | 1 | kΩ | Uint16 | |
| 12 | Busbar voltage high point alarm | 10H | R/W | 1 | V | Uint16 | |
| 13 | Busbar voltage low point alarm | 11H | R/W | 1 | V | Uint16 | |
| 14 | Current zero calibration | 12H | R/W | 1 | NONE | Uint16 | The high bit is: 0x86 (representing A channel 1-96)<br>The high bit is: 0x87 (representing B channel 1-96)<br>The high bit is: 0x88 (indicates that 1-192 is not divided into AB road)<br>The low bits are: 0x01-0xC0<br>0xff: all calibration |
| 15 | Number of branches | 13H | R/W | 1 | NONE | Uint16 | 1～8 |
| 16 | Tributary access mode | 14H | R/W | 1 | NONE | Uint16 | 0x00: one in and one out<br>0x01: one in and two out<br>0x02: Two in and one out<br>0x03: Two in and two out |
| 17 | Busbar insulation measurement enable | 15H | R/W | 1 | NONE | Uint16 | 0x01: on (pre-stage without insulation measurement)<br>0x00: off (pre-stage has insulation measurement) |
| 18 | Branch address | 16H | R/W | 1 | NONE | Uint16 | Reserved |
| 19 | Branch baud rate | 17H | R/W | 1 | NONE | Uint16 | Reserved |
| 20 | Host sending times | 18H～19H | R | 2 | NONE | Uint32 | |
| 21 | Slave returing times | 1AH～1BH | R | 2 | NONE | Uint32 | |
| 22 | Year, Month | 1CH | R/W | 1 | NONE | Uint16 | |
| 23 | Day, Week | 1DH | R/W | 1 | NONE | Uint16 | |
| 24 | Hour, Reserved | 1EH | R/W | 1 | NONE | Uint16 | |
| 25 | Minute, Second | 1FH | R/W | 1 | NONE | Uint16 | |
| 26 | Alarm delay | 20H | R/W | 1 | 0.1s | Uint16 | |
| 27 | Bus voltage alarm hysteresis | 21H | R/W | 1 | V | Uint16 | |
| 28 | Busbar insulation resistance alarm hysteresis | 22H | R/W | 1 | kΩ | Uint16 | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 29 | Branch insulation resistance alarm hysteresis | 23H | R/W | 1 | kΩ | Uint16 | |
| 30 | A channel busbar voltage alarm enable | 24H | R/W | 1 | NONE | Uint16 | 0x00：Ban 0x01：Allowed |
| 31 | B channel busbar voltage alarm enable | 25H | R/W | 1 | NONE | Uint16 | 0x00：Ban 0x01：Allowed |
| 32 | A channel busbar insulation resistance alarm enable | 26H | R/W | 1 | NONE | Uint16 | 0x00：Ban 0x01：Allowed |
| 33 | B channel busbar insulation resistance alarm enable | 27H | R/W | 1 | NONE | Uint16 | 0x00：Ban 0x01: Allowed |
| 34 | Branch insulation resistance alarm enable | 28H | R/W | 1 | NONE | Uint16 | 0x00：Open 0x01：Close |
| 35 | DO1 | 29H | R/W | 1 | NONE | Uint16 | 0x00：Open 0x01：Close |
| 36 | DO2 | 2AH | R/W | 1 | NONE | Uint16 | 0x00：Open 0x01：Close |
| 37 | Reserved | 2BH-2DH | R/W | 3 | NONE | Uint16 | Reserved |
| 38 | Event logging clear | 2EH | R/W | 1 | NONE | Uint16 | 0x8866 |

Electrical parameter data area (0x30H start, 03H command)

| Serial number | Description | Word address | Read/ Write | Word Length | Unit | Data Type | Remark |
|---|---|---|---|---|---|---|---|
| 1 | 1-segment busbar height value | 30H～31H | R | 2 | V | float | |
| 2 | 1-segment busbar low ground value | 32H～33H | R | 2 | V | float | |
| 3 | 1-segment busbar voltage value | 34H～35H | R | 2 | V | float | |
| 4 | 1-segment busbar positive-to-ground resistance | 36H～37H | R | 2 | V | float | |
| 5 | 1-segment busbar negative-to-ground resistance | 38H～39H | R | 2 | V | float | |
| 6 | 2-segment busbar height value | 3AH～3BH | R | 2 | V | float | |
| 7 | 2-segment busbar low ground value | 3CH～3DH | R | 2 | V | float | |
| 8 | 2-segment busbar voltage value | 3EH～3FH | R | 2 | V | float | |
| 9 | 2-segment busbar positive-to-ground resistance | 40H～41H | R | 2 | V | float | |
| 10 | 2-segment busbar negative-to-ground resistance | 42H～43H | R | 2 | V | float | |
| 11 | A channel busbar branch positive-to-ground Insulation resistance 1～192 | 44H～103H | R | 1 | KΩ | Uint16 | One decimal |
| 12 | A channel busbar branch negative-to-ground Insulation resistance 1～192 | 104H～1C3H | R | 1 | KΩ | Uint16 | One decimal |
| 13 | B channel busbar branch positive-to-ground | 1C4H～223H | R | 1 | KΩ | Uint16 | One |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Insulation resistance 1～96 | | | | | | decimal |
| 14 | B channel busbar branch negative-to-ground Insulation resistance 1～96 | 224H～283H | R | 1 | KΩ | Uint16 | One decimal |

Remote signaling (01H, 02H)

| Serial number | Description | Bit address | Read/ Write | Remark |
|---|---|---|---|---|
| 1 | Busbar A positive-to-ground insulation resistance alarm | 0 | R | 0 is invalid,1 is valid |
| 2 | Busbar B positive-to-ground insulation resistance alarm | 1 | R | |
| 3 | Busbar A negative-to-ground insulation resistance alarm | 2 | R | |
| 4 | Busbar B negative-to-ground insulation resistance alarm | 3 | R | |
| 5 | Busbar A high voltage alarm | 4 | R | |
| 6 | Busbar B high voltage alarm | 5 | R | |
| 7 | Busbar A low voltage alarm | 6 | R | |
| 8 | Busbar B low voltage alarm | 7 | R | |
| 9 | A channel busbar branch positive-to-ground Insulation resistance (1-192) | 8-199 | R | |
| 10 | A channel busbar branch negative-to-ground Insulation resistance (1-192) | 200-391 | R | |
| 11 | B channel busbar branch positive-to-ground Insulation resistance (1-96) | 392-487 | R | |
| 12 | B channel busbar branch negative-to-ground Insulation resistance (1-96) | 488-583 | R | |

Event logging read send data frame

| | |
|---|---|
| Read the latest event logging | 01 03 10 00 00 0C 41 0F |
| Repeat the last read operation | 01 03 10 0C 00 0C 81 0C |
| Read the previous event logging | 01 03 10 18 00 0C C1 08 |

Return dataframe

| | |
|---|---|
| Return frame | 01 03 18 12 01 01 08 05 11 00 03 02 00 00 1c 01 13 03 72 01 20 00 C0 43 70 1e b8 30 cc |

Description:

01: Slave address

03: Function code

18: Hexadecimal, decimal is 24, indicating that there are 24 bytes of data behind

30 cc: Cyclic Redundancy Check Code

The meaning of 24 bytes of data is in turn

| Meaning | Return value | decimal | Unit | Remark |
|---|---|---|---|---|
| Year (Alarm time) | 12 | 18 | | |
| Month (Alarm time) | 01 | 1 | | |
| Day (Alarm time) | 01 | 1 | | |
| Hour (Alarm time) | 08 | 8 | | |
| Minutes (Alarm time) | 05 | 5 | | |
| Second (Alarm time) | 11 | 17 | | |
| Alarm type | 0003 | 3 | | 1: High voltage alarm<br>2: Low voltage alarm<br>3: Positive to ground insulation alarm<br>4: Negative to ground insulation alarm |
| Alarm loop | 02 | 2 | | 1: A channel busbar |

| | | | | |
|---|---|---|---|---|
| | | | | 2: B channel busbar<br>3: A channel branch<br>4: B channel branch |
| Circuit number | 00 | 0 | | When the busbar alarms, the circuit number is 0;<br>When the branch alarms, it indicates the specific branch number |
| Insulation alarm setpoint | 001C | 28 | KΩ | Uint16_t |
| Positive resistance to ground when alarming | 0113 | 275 | KΩ | Uint16_t（with one decimal） |
| Negative resistance to ground during alarm | 0372 | 882 | KΩ | Uint16_t（with one decimal） |
| Busbar voltage high alarm | 0120 | 288 | V | Uint16_t |
| Busbar voltage low alarm | 00C0 | 192 | V | Uint16_t |
| Busbar voltage value | 43 70 1e b8 | 240.12 | V | Float |

7 Common fault diagnosis and troubleshooting methods

7.1 Inaccurate device measurements

* Check whether the wiring of voltage and branch leakage current is correct；

* Check whether the rated leakage current value of the branch leakage current sensor is consistent with the internal setting of the device；

7.2 Unable to read branch insulation data

* Check whether the communication address of the branch expansion module is set；

7.3 Communication is abnormal

* Check whether the communication cable is connected properly；

* Check whether A and B terminals of the communication are interleaved；

* Check whether the address of the device is set correctly, and whether the communication baud rate is set correctly；

* When the multi-device communication is not normal, first try to see whether the single-device communication is normal.；

7.4 Insulation abnormality alarm of branch circuit under normal working condition of the system

* Check whether the wiring of the leakage current sensor is correct, and whether there is only one wire perforated

* Check whether the leakage current sensor has zero drift (the zero point of the leakage current sensor is inconsistent, the difference is large, and it needs to be adjusted)

Modification record：

| Date | Old version | New version | Modification content |
|---|---|---|---|
| 2019.10.15 | | V1.0 | Writing for the first time |
| 2020.04.11 | V1.0 | V1.1 | 1. Delete the content of the intelligent leakage current sensor in the model specifications, technical parameters and installation guide;<br>2. Modify the mailing address table. |
| 2021.01.22 | V1.1 | V1.2 | In technical parameters and terminals, the auxiliary power supply of AMC16Z-ZJY is changed from DC12V to DC24V; the auxiliary power supply of AMC16Z-FJY is changed from DC12V to DC 12V～24V. |

Headquarters: Acrel Co., LTD.

Address: No.253 Yulv Road Jiading District, Shanghai，China

TEL.: 0086-21-69158338　0086-21-69156052　0086-21-59156392　0086-21-69156971

Fax: 0086-21-69158303

Web-site: www.acrel-electric.com

mail: ACREL008@vip.163.com

Postcode: 201801

Manufacturer: Jiangsu Acrel Electrical Manufacturing Co., LTD.

Address: No.5 Dongmeng Road,Dongmeng industrial Park, Nanzha Street,Jiangyin City,Jiangsu Province,China

TEL：0086-510-86179966

Fax：0086-510-86179975

Web-site: www.jsacrel.com

Postcode: 214405

E-mail: sales@email.acrel.cn