

# ELR-4MD

## DC Earth Leakage Relay

### User Manual



**Version: 1.12**

**Revision: 2025.06**

## Read me

**When you use ELR-4MD DC earth leakage relay, be sure to read this user manual carefully, and be able to fully understand the implications, the correct guidance of operations in accordance with user manual, which will help you make better use of ELR-4MD DC earth leakage relay, and help to solve the various problems at the scene.**

1. Before the meter turning on the power supply, be sure that the power supply within the provisions of the instrument;
2. When installation, the current input terminal must non-open, voltage input terminals must Non-short circuit;
3. Communication terminal (RS232/RS485) is strictly prohibited to impose on high voltage;
4. Be sure the instrument wiring consistent with the internal system settings;
5. When communicating with the PC, instrument communication parameters must be consistent with the PC.



- **Please read this user manual carefully**
- **Please save this document**

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## 1.- SUMMARIZE

The ELR-4MD Type A DC Earth Leakage Relay is an advanced protection device designed to enhance the safety and reliability of electrical systems. Complying with IEC 60755 Type A standard, it continuously monitors both AC and pulsating DC leakage current via a DC hall effect current sensor (HCT). When the leakage current exceeds the preset threshold, the relay outputs an alarm signal, ensuring early detection of potential faults.

Equipped with adjustable pre-alarm and alarm response levels, the ELR-4MD ensures that alarm signals remain clearly indicated until received the reset signal, facilitating easy fault diagnosis and troubleshooting. With RS485 Modbus communication interface enables real-time remote monitoring and integration into SCADA systems. ELR-4MD is critical for preventing equipment damage, minimizing downtime, and safeguarding personnel against electrical hazards.

### FEATURES

- Standard 35mm din rail mounting;
- Hall current sensor measurement;
- Digital display with real-time readings;
- Adjustable trip levels (5mA-3A) and time delay;
- Pre-alarm and alarm adjustable response;
- Detects AC and pulsating DC leakage current;
- Remote test/reset connections for external activation;
- RS485 Modbus communication;

### APPLICATIONS

- Medium and low voltage systems;
- Battery energy storage systems;
- Commercial and residential buildings;
- Utilities and power distribution systems;
- Motor control panels and switchboards;
- UPS systems and backup power supplies;
- DC system leakage current measurement;
- Industrial control system (PLC, SCADA, DCS);

## 2.- TECHNICAL PARAMETERS

### Working power supply

|                   |                              |
|-------------------|------------------------------|
| Power supply      | 85-265VAC/DC, optional 48VDC |
| Power consumption | ≤4VA                         |
| Frequency         | 50/60Hz, Accuracy ±0.01Hz    |

### Hall CT

|                       |                         |
|-----------------------|-------------------------|
| Power supply          | ±15Vdc                  |
| Rated current range   | 0-250A, hole size: 60mm |
| Rated output          | ±4V                     |
| Alarm threshold       | 5mA-3A, adjustable;     |
| Response sensitivity  | 1mA                     |
| Frequency range       | 50-400Hz                |
| Trip time delay       | 50ms-10sec, adjustable  |
| Operating performance | Type A                  |

### I/O capacity

|                |                                                                                |
|----------------|--------------------------------------------------------------------------------|
| Digital input  | 2* DI for reset/ test, NC<br>dry contact, Ri<500Ω turns on, Ri>100kΩ turns off |
| Digital output | 2DO; 1* relay NO for safety, 1* relay NC for alarm<br>Load capacity: 5A@250VAC |

### Others

|                     |                                                                         |
|---------------------|-------------------------------------------------------------------------|
| Communication       | RS-485 MODBUS-RTU                                                       |
| Display             | LCD with backlit                                                        |
| Withstand voltage   | 2.5KV 1min                                                              |
| Insulation          | Input, output, power supply to shell >5MΩ                               |
| Storage environment | -40~70°C                                                                |
| Working environment | -25~55°C Altitude ≤2500m,<br>0~95%RH, non-condensing, non-corrosive gas |

### 3.- Function Introduction

ELR 4MD earth leakage relay offers comprehensive monitoring, alarm, and protection features for leakage current detection. Its operation and configuration are simple, intuitive, and highly reliable. The following sections describe its key functions:

#### 3.1.- Leakage Current Measurement

This device samples the AC and pulsating DC leakage current in real time through an external current transformer and continuously monitors the zero-sequence current or differential mode current changes in the system loop.

The collected measurement signal is processed by internal A/D conversion and digital filtering, and the real-time value is synchronously displayed on the LCD screen and can be read remotely through the RS485 Modbus communication interface, realizing local and remote dual monitoring functions.

#### 3.2.- Pre-Alarm and Alarm Threshold

When the measured leakage current exceeds the preset pre-alarm threshold, and after the configured pre-alarm time delay elapses, the LCD screen will indicate "Pre-alarm" status and display the corresponding real-time leakage current value.

If the measured value continues to rise and reaches the preset alarm threshold, following the configured alarm delay time, the internal alarm output relay will be trip output, and the LCD screen will indicate "Alarm" status with the real-time leakage current value.

Device parameters can be configured via the front-panel LCD and function keys or through the RS485 Modbus communication. To ensure system security, access to parameter settings can be password-protected.

#### 3.3.- Automatic and Manual Reset

The alarm relay supports both automatic and manual reset modes, ensuring reliable operation and flexible control.

**Automatic reset:** The alarm relay automatically resets to normal state when the measured leakage current falls below the release value and remains at that value after the configured delay time. This prevents momentary or short leakage current spikes from causing unnecessary system interruptions.

**Manual reset:** When the fault condition is confirmed and eliminated, the relay can be manually reset by short-circuit terminals "C" and "Rst" to restore the control device to normal monitoring status. ([Details see chapter 4.2.](#))

### **3.4.- Manual Self-Test Function**

The device's self-test function is activated by short-circuit terminals "C" and "Test". During the test, the relay simulates an internal fault condition, causing the LCD to sequentially display all status indicators and real-time parameters, while the relay output operates accordingly. This process verifies the correct functionality of the alarm and trip mechanisms, ensuring reliable device performance. ([Details see chapter 4.2.](#))

## 4.- INSTALLATION AND START-UP



The manual you hold in your hand contains information and warnings that the user should respect in order to guarantee a proper operation of all the instrument functions and keep it in safety conditions. The instrument must not be powered on and used until its definitive assembly is on the cabinet's door.

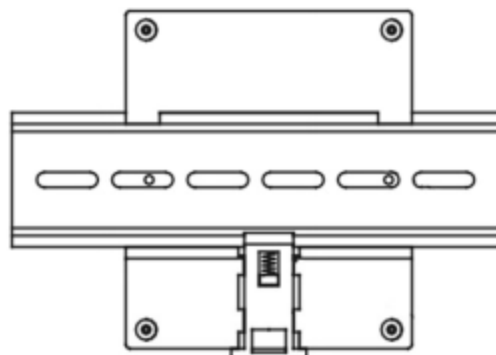
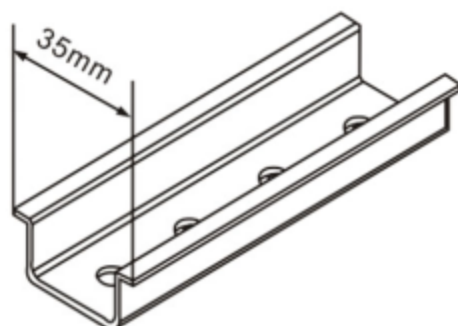
**If the instrument is not used as manufacturer's specifications, the protection of the instrument will be damaged.**

When any protection failure is suspected to exist (for example, it presents external visible damages), the instrument must be immediately powered off. In this case contact a qualified service representative.

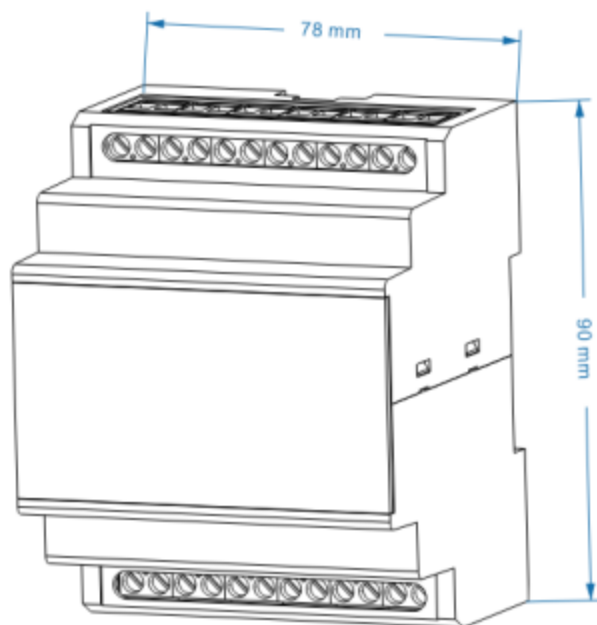
### 4.1.- Installation

#### Mounting

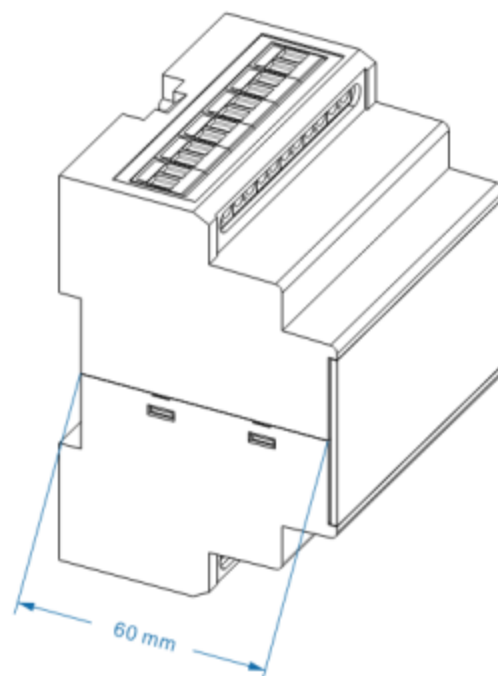
Instrument is to be mounted on 35mm Din-rail. Keep all connections into the cabinet. Please note that with the instrument powered on, the terminals could be dangerous to touch and cover opening actions or elements removal may allow accessing dangerous parts. Therefore, the instrument must not be used until this is completely installed.



**Dimension: 78\*90\*60 mm W\*H\*D**



**Front view**



**Side view**

## 4.2.- Connection Terminal

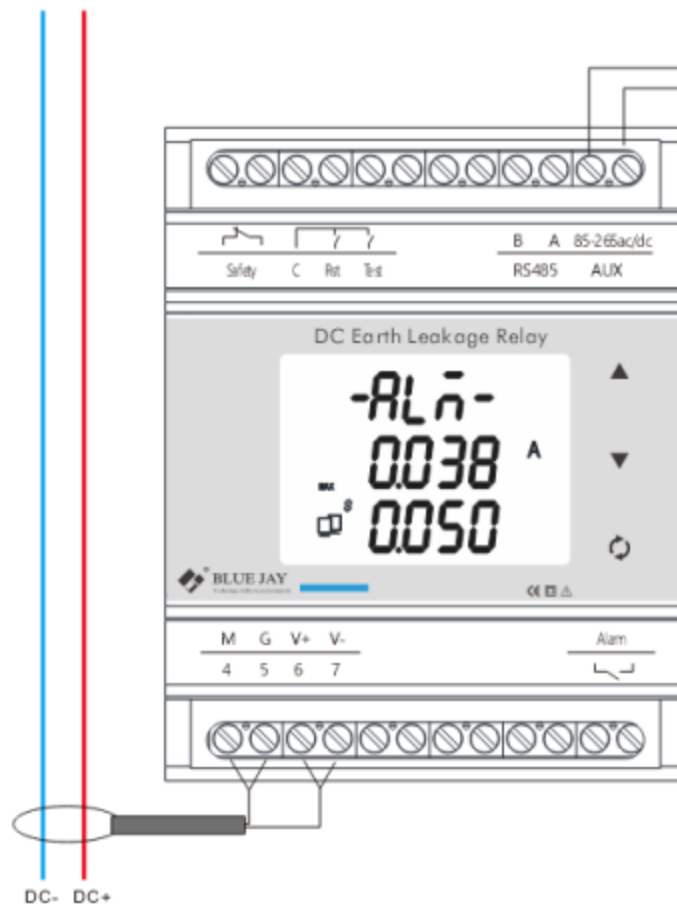


| Marked                 | Notes                          |
|------------------------|--------------------------------|
| <b>Safety</b>          | Device disconnection detection |
| <b>C</b>               | Common terminal                |
| <b>Rst</b>             | Remote reset, NO contact       |
| <b>Test</b>            | Remote test, NO contact        |
| <b>RS485</b>           | RS485 communication A, B       |
| <b>AUX</b>             | Power supply+/- 85-265Vac/dc   |
| <b>M</b>               | Hall CT signal output          |
| <b>G</b>               | Hall CT grounding              |
| <b>V+</b><br><b>V-</b> | Hall CT power supply +/-15Vdc  |
| <b>Alarm</b>           | Alarm output relay             |

### Notes:

- Short-circuit terminal "C" and "Rst" to activate reset function, then short-circuit terminal "C" and "Test" to activate test function.
- The terminal pin definition may change depends on customer order; please refer to the label on the device.

### 4.3.- Typical Wiring



**Note:**

This connection drawing is for reference only; the actual connecting terminal please refer to the label on the rear part.

## 5.- SCREEN DISPLAY

### 5.1.- Button description

| Button                                                                            | In Monitor Screen                                  | In Config Sub-menu                                    | In Parameter Setup            |
|-----------------------------------------------------------------------------------|----------------------------------------------------|-------------------------------------------------------|-------------------------------|
|  | Move to previous or next page                      | Move cursor up and down to select function            | Move setting cursor to left   |
|  | <b>Press and hold:</b> Call out password screen    | Move cursor up and down to select function            | Scroll selection number 0 ~ 9 |
|  | <b>Press and hold:</b> Display version information | Confirm the values & Entry or jump to down level menu |                               |

**Note:** In **Config. menu**, if change the setting value, press and hold  for exit menu, device will call out confirm screen ask "SAVE".

Then press and hold  for *exit without saving*;

press and hold  for *save and exit*.

## 5.2.- Overall screen

### Page 1: Real time measurement data



**First row:** present leakage current value

**Second row:** max/min leakage current value

In this screen, press  and  can check the max/min leakage current value between the last time reset action and this time reset action.

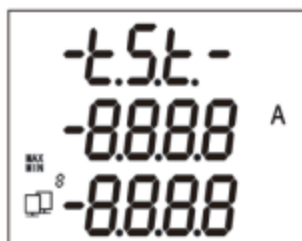
Press  switch to Page 2: Present parameter threshold



**First row:** leakage current alarm threshold

**Second row:** delay time alarm threshold

### Page 3: Device test status



Screen will show all the displayed contents

**Note:** test function is activated by DI signal, and the “safety” and “alarm” output relay will act according to the device status.

### Page 4: Alarm tripped screen



**First row:** Alarm prompt words

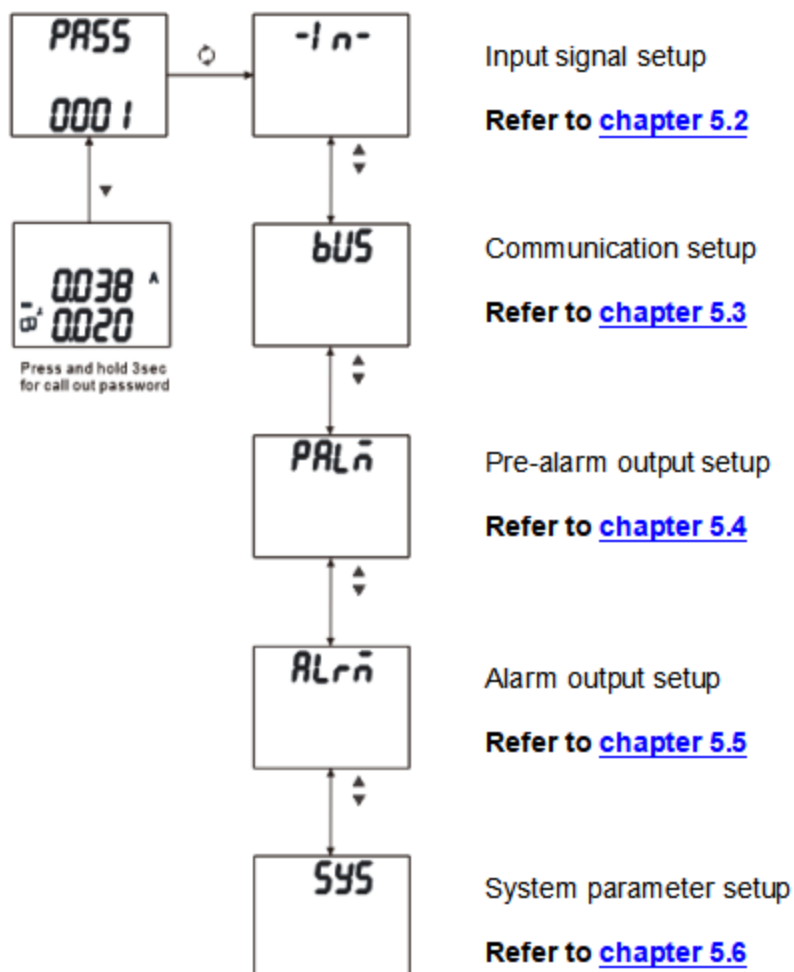
**Second row:** Leakage current value

**Third row:** Maximum leakage current value

## 6.- SETUP PROCEDURE

### 6.1.- Enter setup menu

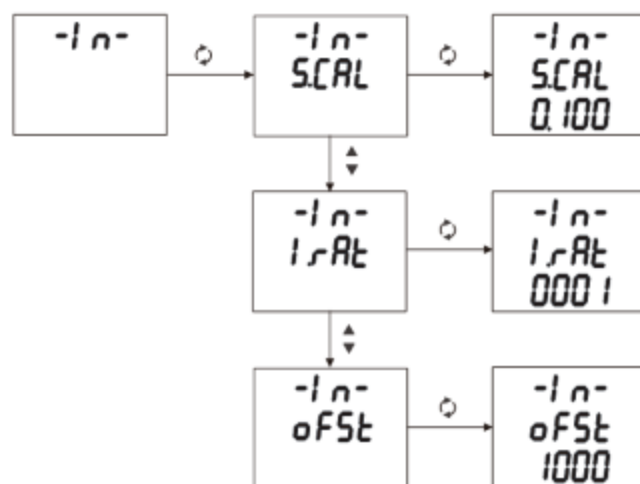
In measuring screen, press and hold the  button, and the prompt of "Password" will appear, and enter the password (default is **0001**), press  button to enter the configuration menu, ELR-4MD provides five configure parameters items: input (-IN-), communication (BUS), pre-alarm (PALM), alarm (ALRM) and system factory commissioning (SYS), Adopt LCD display layered menu structure management.



#### Note:

Parameters also can remote setup via RS485 communication. Details see [chapter 6](#).

## 6.2.- Input signal setup



### Rated leakage value

default: 100, unit: mA

### Alarm ratio

default: 1

### DC offset compensation

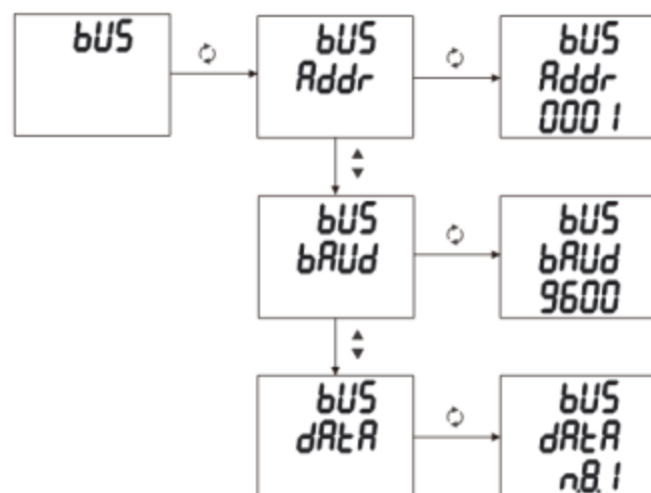
default value: 1000

> 1000 means positive compensation;

< 1000 means negative compensation;

Compensation unit is 0.1% of rated value

## 6.3.- Communication setup



### Modbus address <sup>(1)</sup> \*

default 0001

### Comm. port baud ratio <sup>(2)</sup> \*

default 9600 <sup>(2)</sup> \*

### Comm. port data format

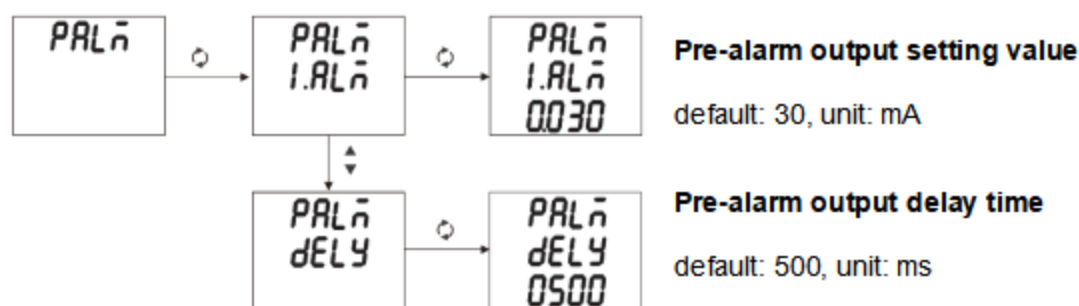
default n.8.1, can select o.8.1/ e.8.1 / n.8.2

### Notes:

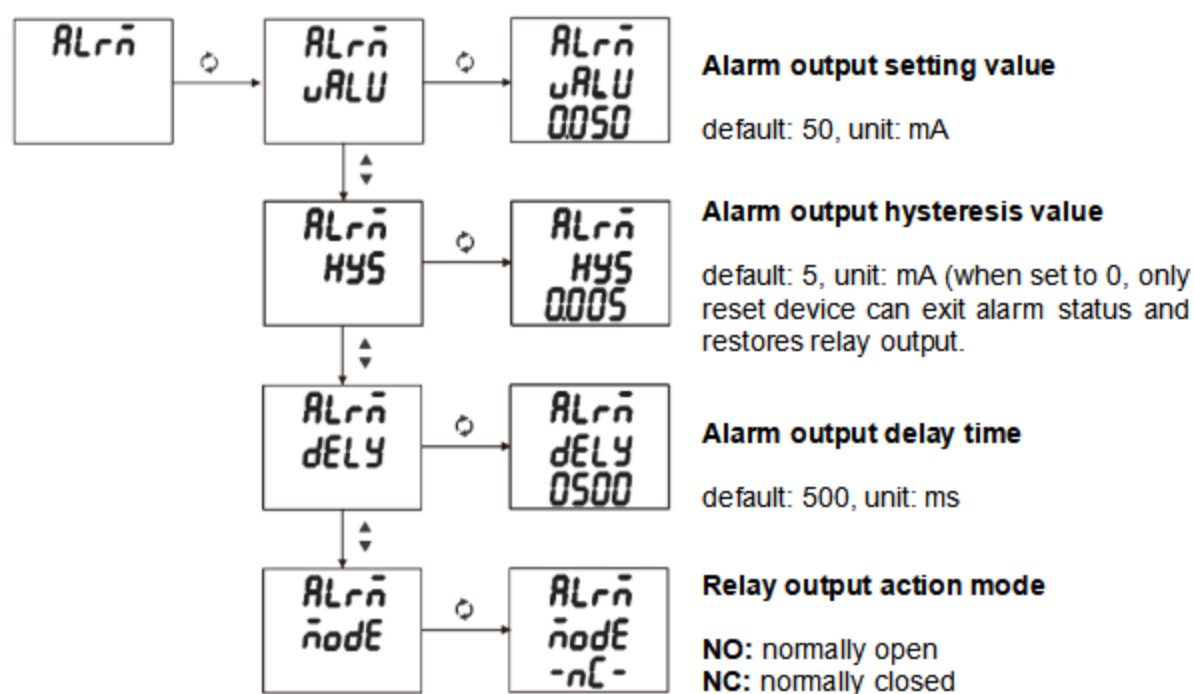
(1) Modbus address setup range 1-247.

(2) Baud ratio can select 1200 / 2400 / 4800/ 9600 / 19200, and regular meter equipped with communication port max baud ratio is 19200bps. If need higher speed, please contact Blue Jay sales team.

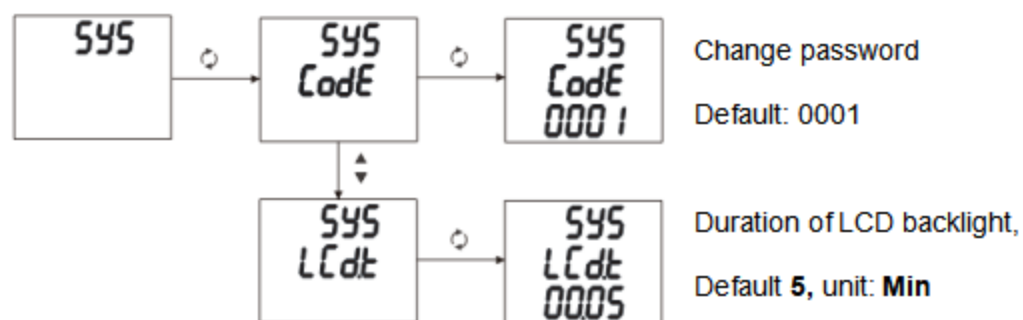
## 6.4.- Pre-alarm output relay setup



## 6.5.- Alarm output relay setup



## 6.6.- System setup



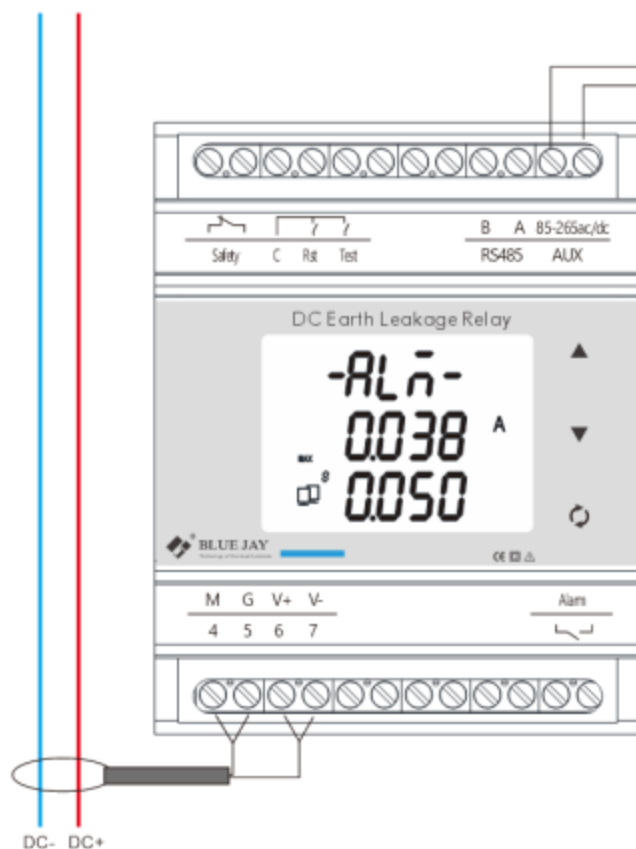
### Note:

- . If change the password, please keep the password safety, or only return to Blue Jay to reset new password!

## 7.- COMMUNICATION INTERFACE

### 7.1.- Connection for RS485 BUS

The composition of the RS-485 cabling must be carried out with a meshed screen cable (minimum 3 wire), diameter of not less than 0.5mm<sup>2</sup>, with a maximum distance of 1,200 m between the ELR-4MD... and the master unit. This Bus may connect a maximum of 32pcs.



#### Notes:

- For communication with the master unit, user can choose RS-485 to RS-232 converter or RS485 to USB adapter to use.
- For expand the number of devices in the communication network, a signal repeater can be used.
- Due to product modifications or special requirements, the interface pin place may be change. For details, please refer to product label on the rear side.

## 7.2.- MODBUS © Protocol

### Modbus RTU Frame Format:

|                         |               |                                                                                                                                        |
|-------------------------|---------------|----------------------------------------------------------------------------------------------------------------------------------------|
| <b>Address code</b>     | <b>1 BYTE</b> | <i>Slave device address <b>1-247</b></i>                                                                                               |
| <b>Function code</b>    | <b>1 BYTE</b> | <i>Indicates the function codes like read coils / inputs</i>                                                                           |
| <b>Data code</b>        | <b>4 BYTE</b> | <i>Starting address, high byte<br/>Starting address, low byte<br/>Number of registers, high byte<br/>Number of registers, low byte</i> |
| <b>Error Check code</b> | <b>2 BYTE</b> | <i>Cyclical Redundancy Check<br/>( <b>CRC</b> )</i>                                                                                    |

### MODBUS FUNCTIONS:

| <b>Code</b>        | <b>Meaning</b>         | <b>Description</b>                                                                                         |
|--------------------|------------------------|------------------------------------------------------------------------------------------------------------|
| <b>FUNCTION 03</b> | Reading of n Words     | <i>This function permits to read all the electrical parameters</i><br><br><b><i>Disable in default</i></b> |
| <b>FUNCTION 06</b> | Preset Single register | <i>If need valid this code, please contact Blue Jay Sales Team before your order!</i>                      |

## 7.3.- Register Map

### 7.3.1.- Basic power data -Primary Side; Function 03 to Read

| Register | Data              | Byte mode |   | Instruction                                        |
|----------|-------------------|-----------|---|----------------------------------------------------|
| 00       | Io                | int       | 1 | Present real-time DC leakage value, unit: mA       |
| 01       | Io <sub>max</sub> | int       | 1 | Historical maximum leakage value, unit: mA         |
| 02       | Io <sub>min</sub> | int       | 1 | Historical minimum leakage value, unit: mA         |
| 10       | Pre-alarm status  | int       | 1 | <b>0</b> : no alarm; <b>1</b> : enter alarm status |
| 11       | DI                | int       | 1 | <b>Bit0</b> : reset; <b>Bit1</b> : test            |
| 12       | DO                | int       | 1 | <b>Bit0</b> : safety; <b>Bit1</b> : alarm          |

### 7.3.2.-Configuration menu (Function 03 to Read & Function 06 to Write)

| Register | Data                           | Byte mode |   | Instruction                                                                                                                                                           |
|----------|--------------------------------|-----------|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 20       | Password                       | int       | 1 | Default: 1                                                                                                                                                            |
| 21       | Backlight time                 | int       | 1 | Default: 5 minutes                                                                                                                                                    |
| 22       | Communication address          | int       | 1 | Input range: 1-247                                                                                                                                                    |
| 23       | Communication baud rate        | int       | 1 | <b>0</b> :1200; <b>1</b> :2400; <b>2</b> :4800; <b>3</b> :9600; <b>4</b> :19200.                                                                                      |
| 24       | Communication data format      | int       | 1 | <b>0</b> : n.8.1; <b>1</b> : o.8.1; <b>2</b> : e.8.1; <b>3</b> : n.8.2                                                                                                |
| 30       | Rated leakage value            | int       | 1 | Default: 100, unit: mA                                                                                                                                                |
| 31       | DC offset compensation         | int       | 1 | Default value: 1000, means no compensation;<br>> 1000 means positive compensation;<br>< 1000 means negative compensation;<br>Compensation unit is 0.1% of rated value |
| 32       | Pre-alarm output setting value | int       | 1 | Default: 30, unit: mA                                                                                                                                                 |
| 33       | Pre-alarm output delay time    | int       | 1 | Default: 500, unit: ms                                                                                                                                                |
| 34       | Alarm ratio                    | int       | 1 | Default: 1                                                                                                                                                            |
| 35       | Alarm output setting value     | int       | 1 | Default: 50, unit: mA                                                                                                                                                 |
| 36       | Alarm output hysteresis value  | int       | 1 | Default: 5, unit: mA<br>(when set to 0, only reset device can exit alarm status and restores relay output.)                                                           |
| 37       | Alarm output delay time        | int       | 1 | Default: 500, unit: ms                                                                                                                                                |
| 38       | Relay action mode              | int       | 1 | <b>0</b> : normally open, <b>1</b> : normally closed                                                                                                                  |

## 8.- SAFETY CONSIDERATIONS



All installation specification described at the previous chapters named:  
**INSTALLATION AND STARTUP, INSTALLATION MODES and SPECIFICATIONS.**

Please note that with the instrument powered on, the terminals could be dangerous to touching and cover opening actions or elements removal may allow accessing dangerous parts. This instrument is factory-shipped at proper operation condition.

- ◆ The device must have a professional installation and maintenance
- ◆ Any operation of the device, you must cut off the input signal and power;

## 9.- MAINTENANCE

The ELR-4MD does not require any special maintenance. No adjustment, maintenance or repairing action should be done when the instrument is open and powered on, should those actions are essential, high-qualified operators must perform them.

Before any adjustment, replacement, maintenance or repairing operation is carried out, the instrument must be disconnected from any power supply source.

When any protection failure is suspected to exist, the instrument must be immediately put out of service. The instrument's design allows a quick replacement in case of any failure.

For any inquiry about the instrument performance or any failure,  
contact to Blue Jay's technical service.

*Blue Jay - After-sales service*

E-mail: [tech@cqbluejay.com](mailto:tech@cqbluejay.com)