

ELR-4MA

AC Earth Leakage Relay

User Manual



Version: 1.13

Revision: 2025.08

Read me

When you use ELR-4MAAC 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-4MAAC 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-4MA Type A Earth Leakage Relay is a compact protection device designed to improve the safety and stability of electrical systems. Complying with IEC 60755 Type A standard, it detects both AC and pulsating DC leakage currents via a leakage current transformer (ZCT). Once the leakage current exceeds the preset limit, the relay promptly issues an alarm, ensuring rapid fault indication.

Featuring adjustable pre-alarm and alarm response thresholds, the ELR-4MA ensures that alarm signals remain active until manually reset, supporting efficient fault identification and resolution. With RS485 Modbus communication allows seamless integration with remote monitoring and control systems. The ELR-4MA is an ideal solution for protecting equipment, reducing operational interruptions, and ensuring personnel safety.

FEATURES

- Isolated auxiliary power supply;
- Standard 35mm din rail mounting;
- Digital display with real-time readings;
- Adjustable trip levels from 5mA to 3A;
- Complies with IEC 60755 Type A standard;
- Pre-alarm and alarm adjustable response;
- Detects AC and pulsating DC leakage current;
- Remote test/reset connections for external activation;
- RS485 Modbus communication;

APPLICATIONS

- Electric vehicle charging stations;
- Medium and low voltage systems;
- Motors and motor control centers;
- Commercial and residential buildings;
- Utilities and power distribution systems;
- Industrial AC distribution systems;
- Industrial control system (PLC, SCADA, DCS);

2.- TECHNICAL PARAMETERS

Relay Parameters

Working power supply

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

I/O capacity

Digital input	2* DI for reset/ test, NC dry contact, Ri<500Ω turns on, Ri>100kΩ turns off
Digital output	2DO; 1* relay NO for safety, 1* relay NC for alarm 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, 0~95%RH, non-condensing, non-corrosive gas

Leakage CT Parameters**Electrical parameters**

Alarm threshold	5mA-3A, adjustable;
Response sensitivity	1mA
Trip time delay	50ms-10sec, adjustable
Operating performance	Type A
Operating frequency	50-400HZ
Rated input	0-1A
Measurement range	10%IN-130%IN
Rated output	0-1V or 0-0.5mA
CT ratio error	$\leq \pm 0.1\%$
Phase angle	$\leq 10^\circ$
Dielectric strength	AC2.5KV 1mA/60S
Insulation resistance	DC500V/1000M Ω

Other parameters

Housing material	ABS flame retardant grade 94V-0
Frame	PBT
Core	Permalloy or nanocrystalline
Internal structure	Environmentally friendly epoxy resin
Fixture method	Screw fastening
Ambient humidity	$\leq 85\%$ humidity
Wiring method	Terminal type/shielded stranded wire 1.5M

Note:

Our leakage protection relay offers two types of CT options to accommodate different conductor shapes and installation requirements, Users can choose according to different needs, Details see [chapter 4.2](#).

3.- Function Introduction

ELR 4MA 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.- 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.

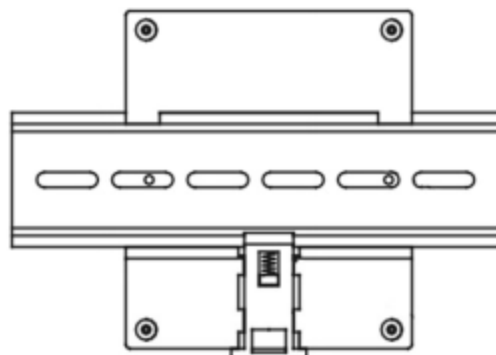
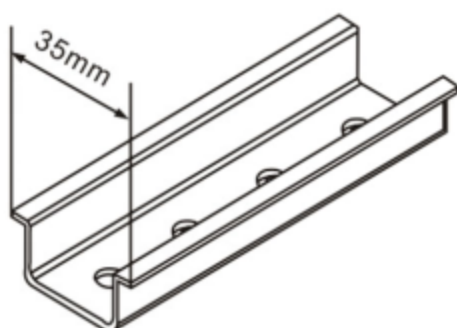
If the instrument is not used as manufacturer's specifications, the protection of the instrument will be damaged.

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.

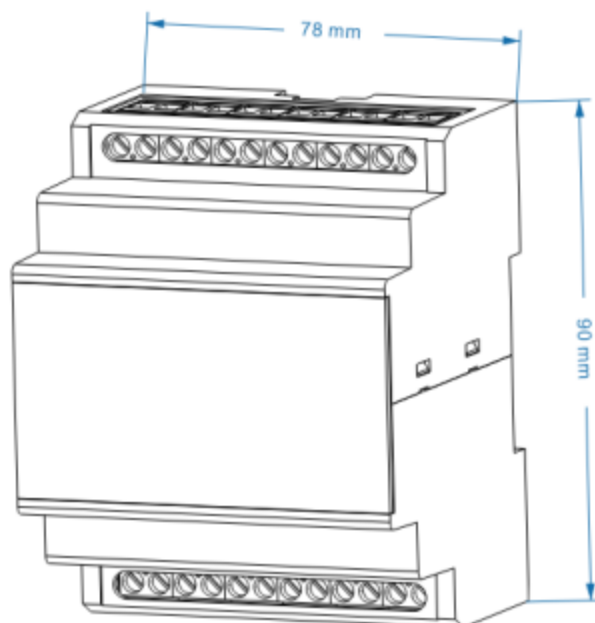
4.1.- Relay mounting and dimensions

Mounting

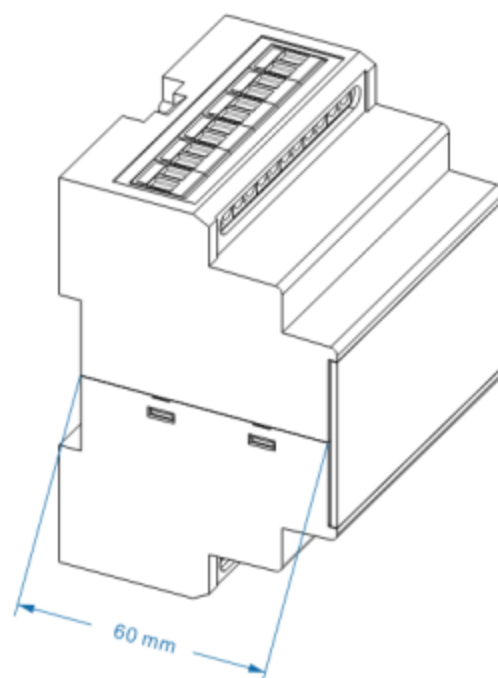
The instrument is to be mounted on 35mm Din-rail. Keep all connections into the cabinet. Please note that with the instrument powered on, the terminals could be dangerous to touch and cover opening actions or elements removal may allow accessing dangerous parts. Therefore, the instrument must not be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



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



Front view

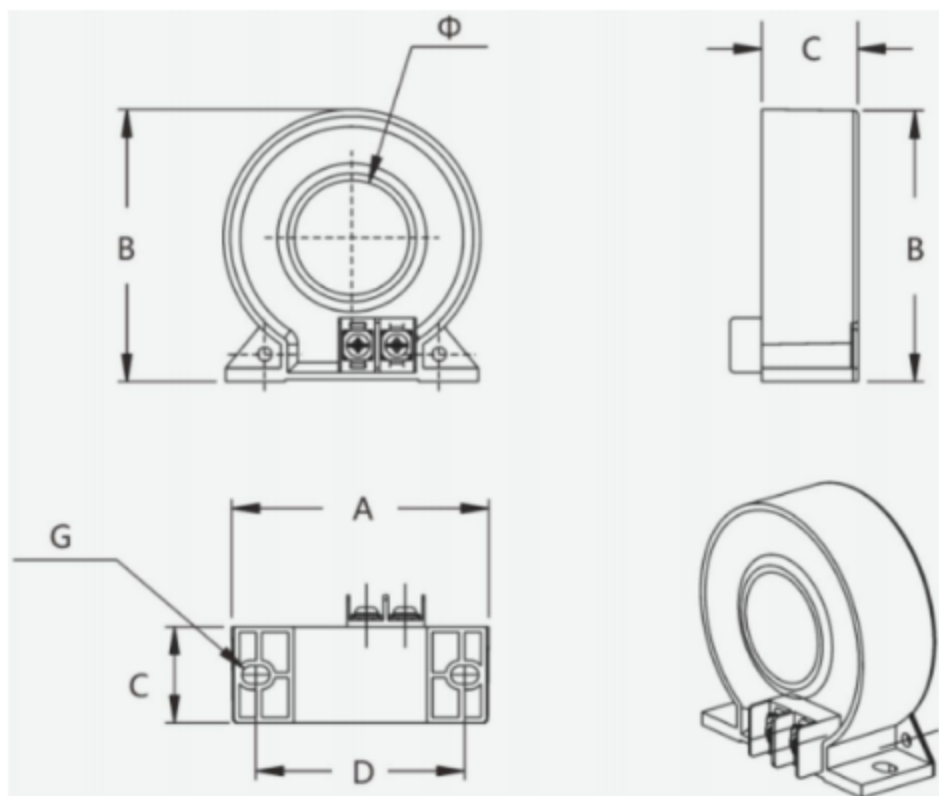


Side view

4.2.- Current transformer dimensions and specifications

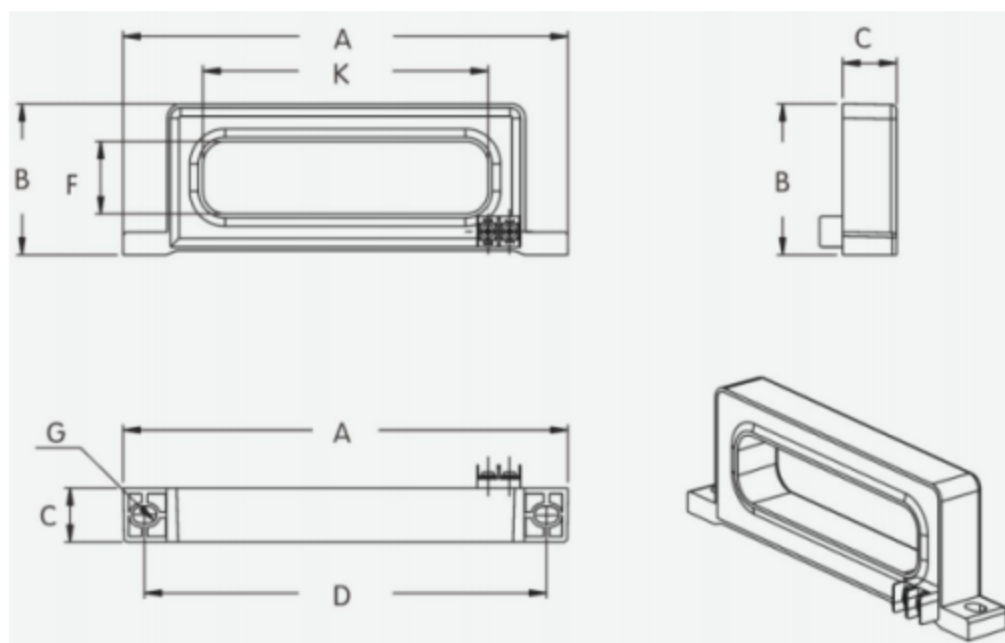
Our leakage protection relay offers two types of CT options to accommodate different conductor shapes and installation requirements; Users can choose according to different needs.

-. Cable-Pass Ring-Type CT Dimension



Model	Rated current range	Input (A)	Output (mA/V)	Accuracy (%)	Dimensions(mm)					
					Ø	A	B	C	D	G
CTZ6-025	0-63A	0~1A	0~1V (0.5mA)	0.5	25mm	56	60	21	48.5	M5
CTZ6-045	0-100A				45mm	79.5	83.5	24	66.5	M5
CTZ6-065	0-250A				65mm	99.5	104	24	86.5	M5
CTZ6-080	0-400A				80mm	113.5	119	26	101.5	M5
CTZ6-100	0-630A				100mm	135.5	141	26	114.5	M6
CTZ6-150	0-800A				150mm	189.5	196	27	171	M6
CTZ6-200	0-1600A				200mm	239.5	246	30	221	M8

-. Busbar-Pass Rectangular CT Dimension



Model	Rated current range	Input (A)	Output (mA/V)	Accuracy (%)	Dimensions(mm)						
					A	B	K	F	C	D	G
F-1025	0-100A	0~1A	0~1V (0.5mA)	0.5	157	53.5	100	25	19	141.5	M6
F-1435	0-250A				203	71.5	140	35	24	188	M6
F-1835	0-400A				246	71.5	180	35	24	230	M6
F-2245	0-630A				280.5	83.5	220	45	24	266	M6
F-2645	0-800A				326	85	260	45	24	310	M6
F-3045	0-1250A				366.5	85	300	45	24	352	M6
F-4545	0-2500A				516.5	85	450	45	24	502	M6

4.3.- Connection Terminal

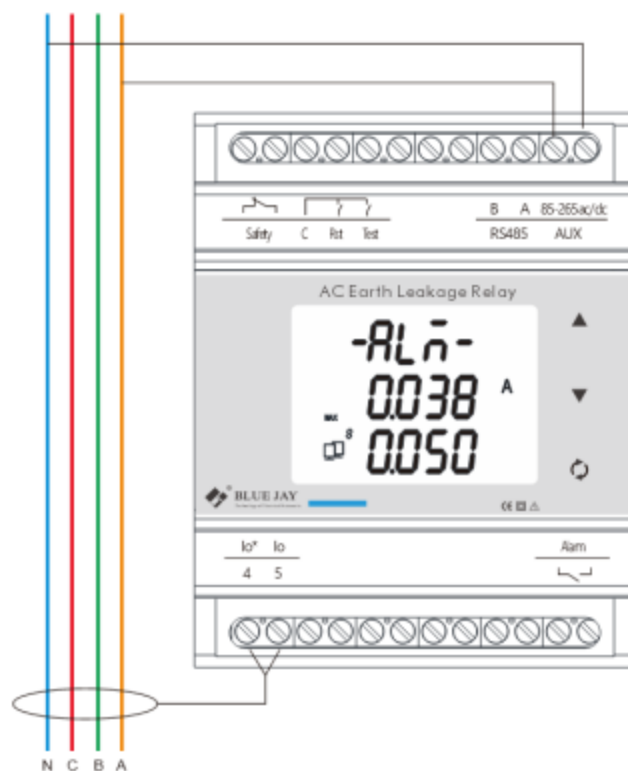


Marked	Notes
Safety	Device disconnection detection
C	Common terminal
Rst	Remote reset, NO contact
Test	Remote test, NO contact
RS485	RS485 communication A,B
AUX	Power supply+/- 85-265Vac/dc
lo* lo	leakage current transformer
Alarm	Alarm output relay

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.

4.4.- 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
	Press and hold: Call out password screen	Move cursor up and down to select function	Scroll selection number 0 ~ 9
	Press and hold: 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

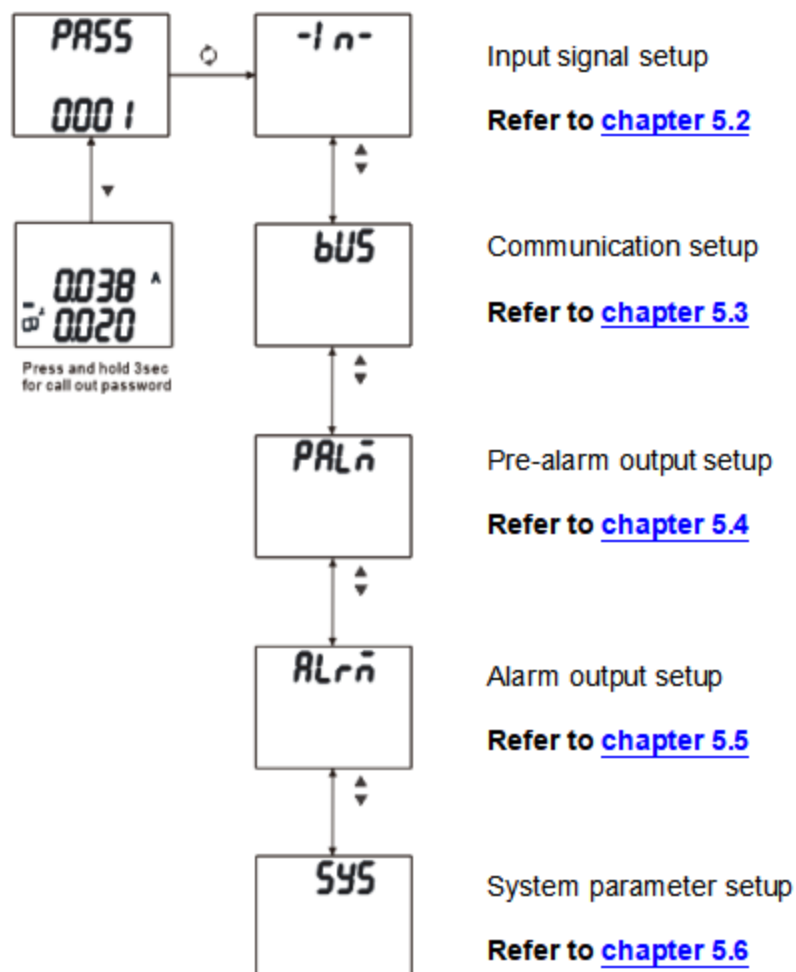
Second row: Leakage current value

Third row: Maximum leakage current value

6.- SETUP PROCEDURE

6.1.- Enter setup menu

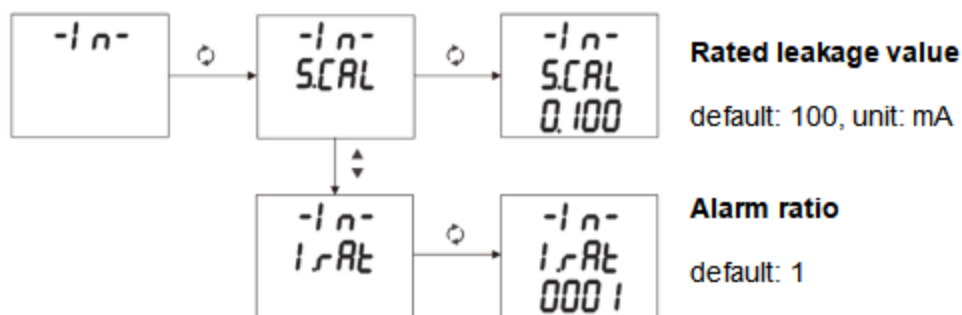
In measuring screen, press and hold the  button, and the prompt of "Password" will appear, and enter the password (default is **0001**), press  button to enter the configuration menu, ELR-4MA provides five configure parameters items: input (-IN-), communication (BUS), pre-alarm (PALM), alarm (ALRM) and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



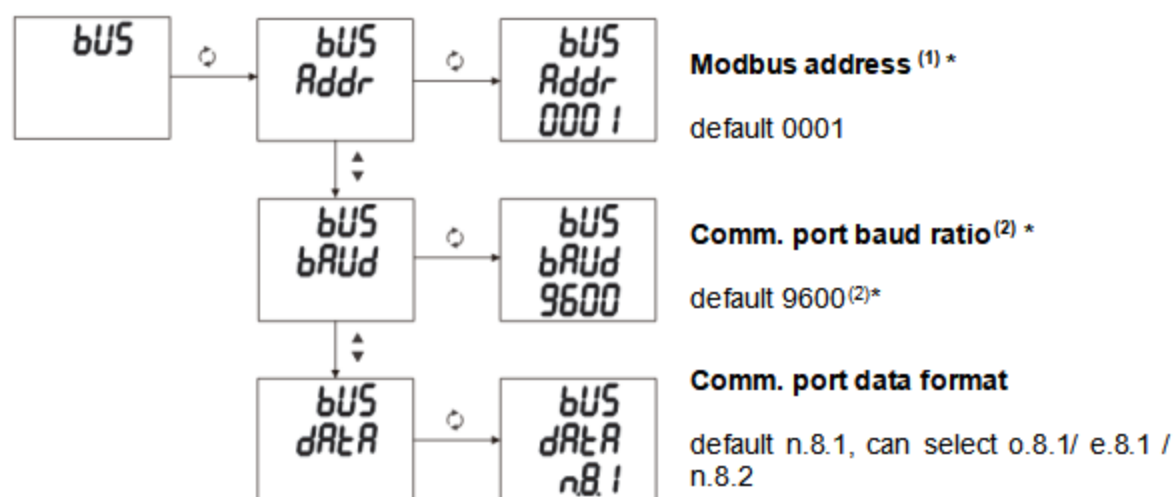
Note:

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

6.2.- Input signal setup



6.3.- Communication setup

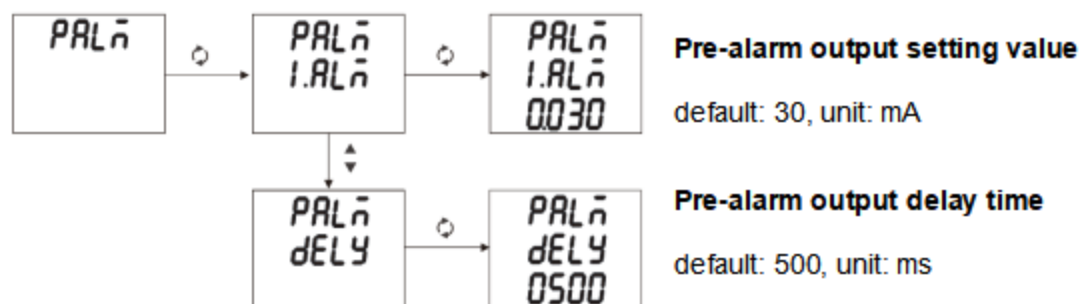


Notes:

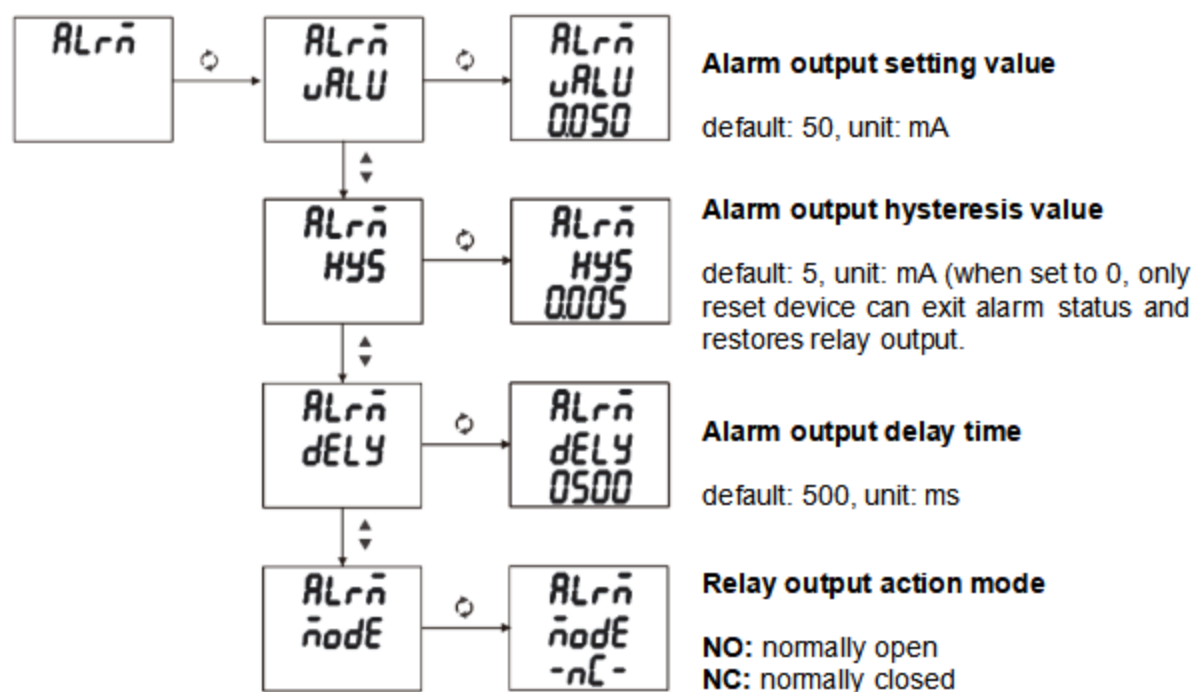
(1) Modbus address setup range 1-247.

(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.

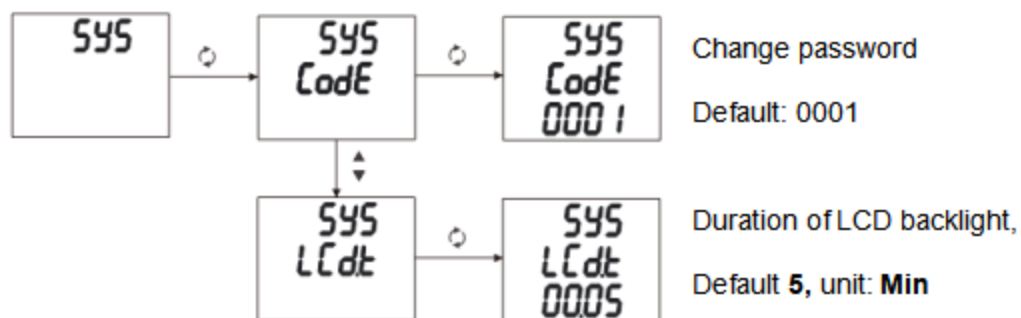
6.4.- Pre-alarm output relay setup



6.5.- Alarm output relay setup



6.6.- System setup



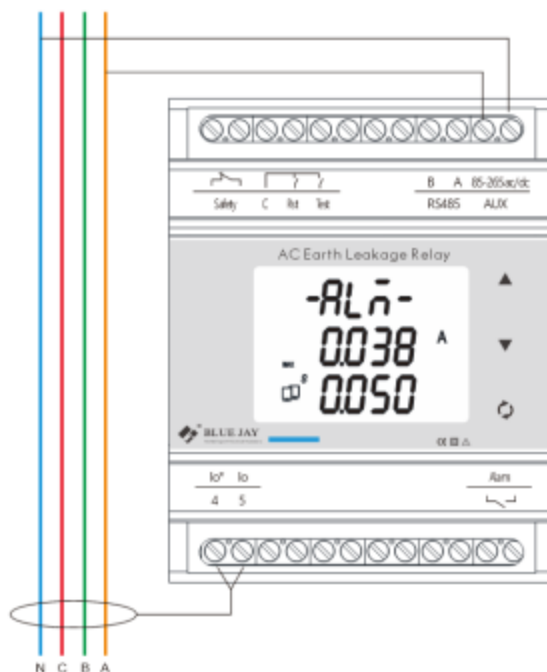
Note:

- 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^2 , with a maximum distance of 1,200 m between the ELR-4MA... and the master unit. This Bus may connect a maximum of 32 pcs.



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:

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

MODBUS FUNCTIONS:

Code	Meaning	Description
FUNCTION 03	Reading of n Words	<i>This function permits to read all the electrical parameters</i> <i>Disable in default</i>
FUNCTION 06	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 leakage value, unit: mA
01	Io _{max}	int	1	Historical maximum leakage value, unit: mA
02	Io _{min}	int	1	Historical minimum leakage value, unit: mA
10	Pre-alarm status	int	1	0 : no alarm; 1 : enter alarm status
11	DI	int	1	Bit0 : reset; Bit1 : test
12	DO	int	1	Bit0 : safety; Bit1 : 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	0 :1200; 1 :2400; 2 :4800; 3 :9600; 4 :19200.
24	Communication data format	int	1	0 : n.8.1; 1 : o.8.1; 2 : e.8.1; 3 : n.8.2
30	Rated leakage value	int	1	Default: 100, unit: mA
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 (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	0 : normally open, 1 : 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-4MA 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