ELR-CH16 Multi-Channel Earth Leakage Relay

User Manual

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Read me

When you use ELR-CH16 multi-channel 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-CH16 multi-channel 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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Directory

1.- SUMMARIZE

ELR-CH16 Multi-channel earth leakage relay is designed for measuring leakage current and operating temperature in TT and TN-S systems. It can inject multiple sensor signals, which are able to detect and evaluate fault, leakage and operating currents in earthed power supplies.

When the leakage current in the protected line or the temperature exceeds preset alarm value, ELR-CH16 will generate audible & visual alarm signal, front screen shows details value. RS485 port can transfer data to remote host, and data will be recorded internally for post-event failure analysis.

ELR-CH16 provides max 8 channels of leakage current and 8 channels of temperature signal access. Please confirm your purchase product PN code and refer to related chapter of wiring. Product must be adapted to local equipment and operating conditions by making individual parameter settings, in order to meet the requirements of applicable standards and to attain the protection goals.

FEATURES

- Leakage current alarm setting range 20 ~ 1000mA, minimal adjustment step 1mA;
- The temperature alarm setting range 50.0 ~ 120.0°C, minimal adjustment step is 0.1°C;
- With 2 relay outputs, free to configuration various protection methods;
- Circular record 100 sequence of events, non-volatile memory saves more than 10 years;
- Standard RS485 communication port, MODBUS-RTU protocol;
- Support manual self-test;
- Optional 2-channels passive open input;
- Building in buzzer to provide sound alarm, automatically jump to the alarm interface when protection occurs, key buttons can manual silencing and reset.

APPLICATIONS

- Low-voltage power distribution systems;
- Industrial electrical installations;
- EV charging infrastructure;
- Data centers and critical power systems;
- Commercial and building electrical systems;
- Substations and utility networks;
- Electrical panels and switchgear systems;

2.- TECHNICAL PARAMETERS

Working power supply	
Power supply	AC/DC 90-240V, DC 20-60V (Optional)
Maximum power consumption	6W
Frequency	45/65Hz, Accuracy ±0.01Hz
Leakage CT	
Alarm threshold range	20mA ~ 1000mA; Default 300mA
Accuracy	1%
Primary side current In	1A(rms)
Secondary side current Io	0.5mA (rms)
CT ratio	2000:1
Load resistor RL	≤ 620ohm
Secondary side impedance R	100±20 ohm
Temperature sensor	
Measurement range	0 ~120°C
Accuracy	±2°C
Alarm threshold range	50~120°C; Default 50°C
I/O capacity	
Relay capacity	5A@250Vac/ 30Vdc 2500V optocoupler isolation
Standards	
EMC	IEC 61000-4
Insulation	IEC 60664-1
Rated leakage current	IEC 62020
Others	
Dimension	Installation size: 96mm×96mm×74mm Hole size: (91+0.8mm) × (91+0.8mm)
Communication	RS-485 MODBUS-RTU

Withstand voltage	2.5KV 1min
Insulation	Input, output, power supply to shell >5MΩ
Dielectric strength	IEC / EN 61010-1:2010 2kV AC RMS 1 minute, between input / output / case / power supply
Storage environment	-25°C ~ +70°C, Altitude ≤2500m, 20~95%RH, non-condensing, non-corrosive gas
Working environment	-20°C ~ +60°C, Altitude ≤2500m, 20~95%RH, non-condensing, non-corrosive gas

EMC Test

	Standard	**Test voltage**
Electrostatic discharge immunity test	IEC-61000-4-2 level 4	8kV
Electrical fast transient burst immunity test	IEC61000-4-4 level 3	Input 1kV; Power supply 2kV
Surge (Shock) immunity test	IEC61000-4-5 level 4	common mode test voltage 4kV

Notes:

Blue Jay provides CTZ series transformer work with ELR series, if purchase from other brand, please refer this basic specification.

Blue Jay provides temperature probes in package, but not all sub-mode has temperature detect function, please refer to PN code in order.

3.- 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 damage), the instrument must be immediately powered off. In this case contact a qualified service representative.

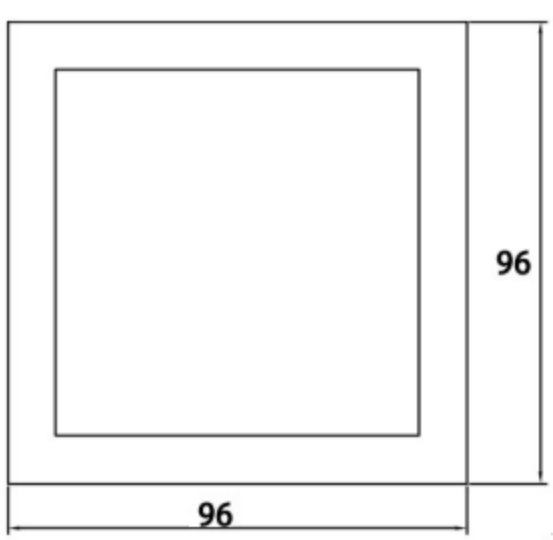
3.1.- Installation

Mounting

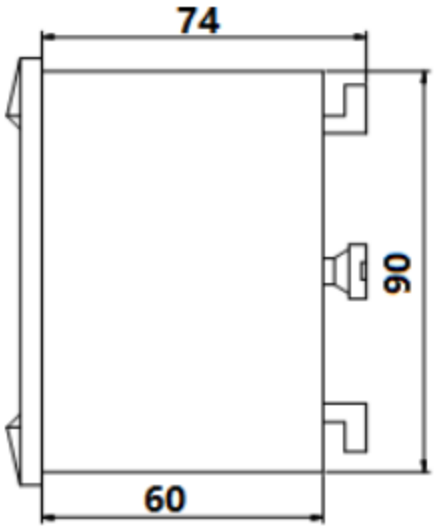
Instrument is to be mounted on panel (cut-out *91+0.8 x 91+0.8 mm*). Keep all connections into the cabinet.

Please note that as the instrument be 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: **Unit: mm**



Front view



Side view

Notes:

Input signal: ELR series using a separate acquisition calculate for each measurement channel, to ensure consistent in use, for different load forms, it's a variety of connection mode. Access wire shall be met: the current 2.5 square mm, voltage of 1.5 square millimeters.

Auxiliary power:

ELR series with universal (AC / DC) power input, if not for a special statement, we provide the 220VAC/DC or 110VAC/DC power interface for standard products. Instruments limit work power supply: AC / DC: 90-240V, please ensure that the auxiliary power can match with ELR series to prevent damage to the product.

Suggest install 1A fuse on the fire line side:

For the areas with poor power quality, suggest installing lightning surge suppressor and rapid burst suppressor to prevent lightning strikes.

3.2.- Connection Terminal and wiring of ELR-CH16IN

Upper connection terminal

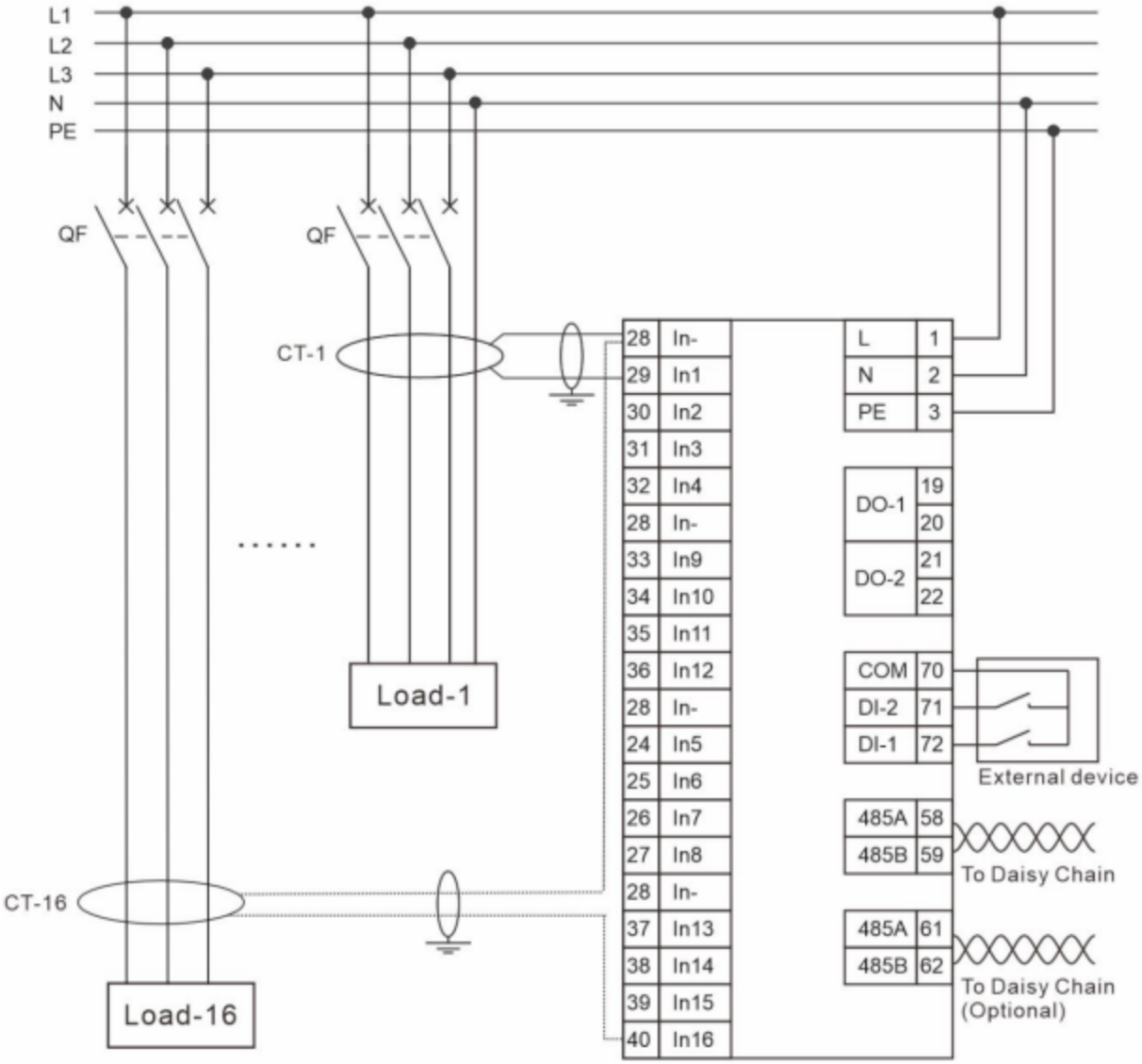
59	58	22	21	20	19		3	2	1
485B1	485A1	DO2-	DO2+	DO1-	DO1+		PE	N	L

Middle connection terminal

62	61		28	33	34	35	36	28	37	38	39	40
485B2	485A2		In-	In9	In10	In11	In12	In-	In13	In14	In15	In16

Lower connection terminal

28	29	30	31	32	28	24	25	26	27	72	71	70
In-	In1	In2	In3	In4	In-	In5	In6	In7	In8	DI1	DI2	COM



3.3.- Connection Terminal and wiring of ELR-CH8IN8T

Upper connection terminal

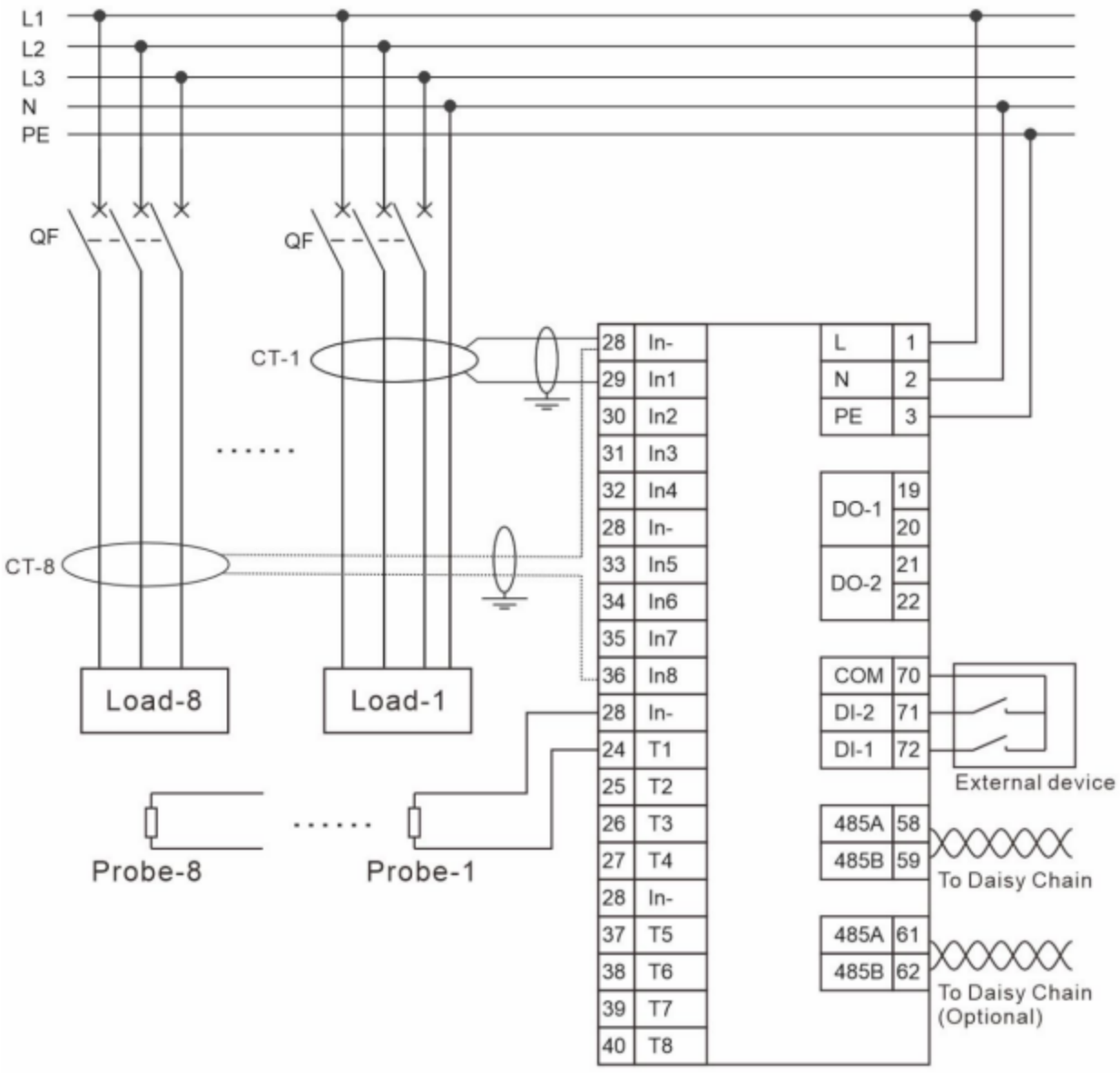
59	58	22	21	20	19		3	2	1
485B1	485A1	DO2-	DO2+	DO1-	DO1+		PE	N	L

Middle connection terminal

62	61		28	33	34	35	36	28	37	38	39	40
485B2	485A2		In-	In5	In6	In7	In8	In-	T5	T6	T7	T8

Lower connection terminal

28	29	30	31	32	28	24	25	26	27	72	71	70
In-	In1	In2	In3	In4	In-	T1	T2	T3	T4	DI1	DI2	COM



3.4.- Connection Terminal and wiring of ELR-CH4IN4T

Upper connection terminal

59	58	22	21	20	19		3	2	1
485B1	485A1	DO2-	DO2+	DO1-	DO1+		PE	N	L

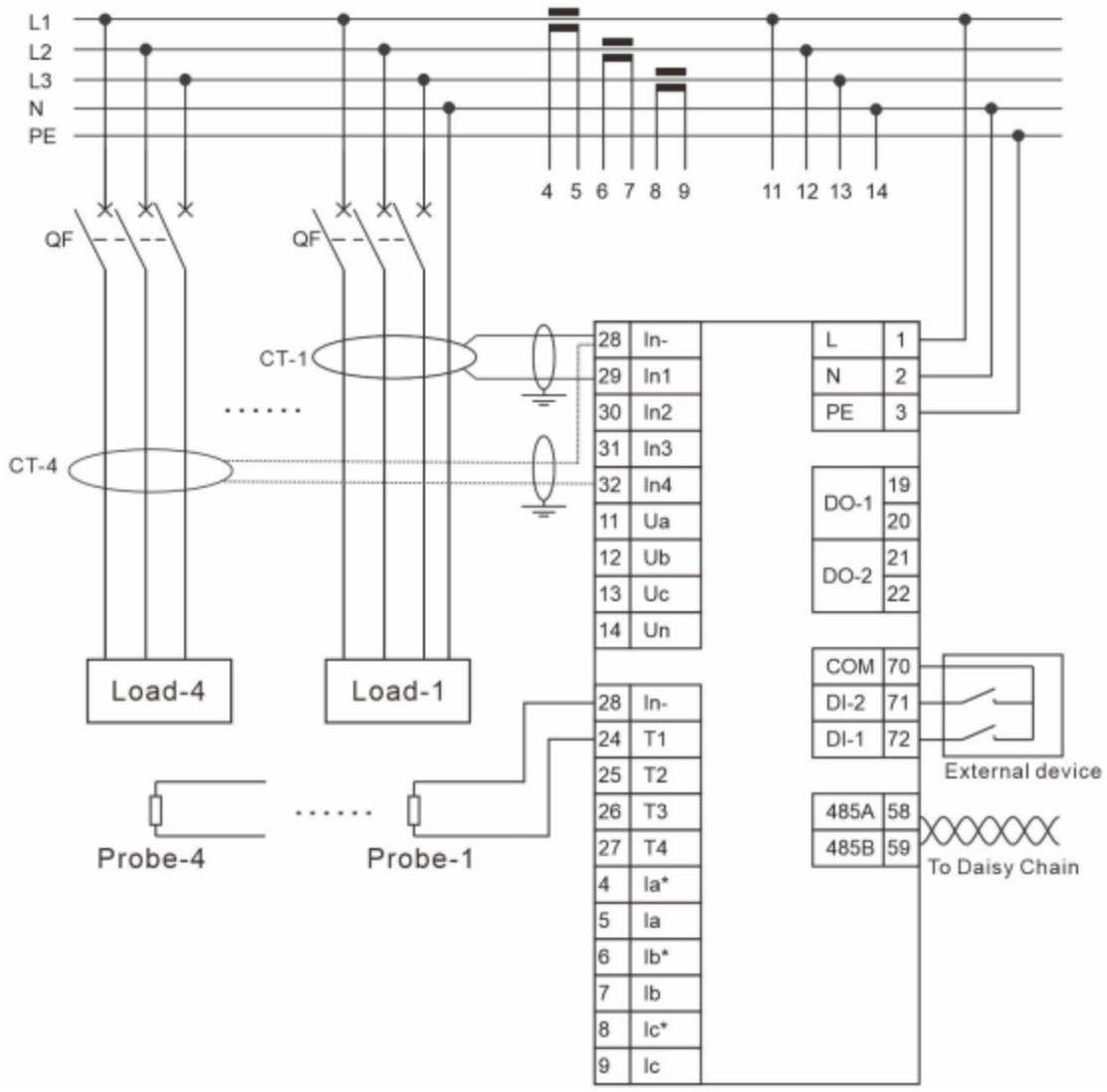
Middle connection terminal

14	13	12	11	9	8	7	6	5	4
UN	UC	UB	UA	IC	IC*	IB	IB*	IA	IA*

Lower connection terminal

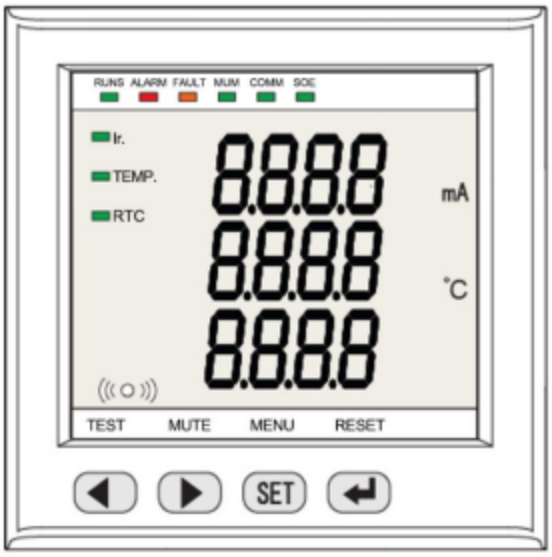
28	29	30	31	32	28	24	25	26	27	72	71	70
In-	In1	In2	In3	In4	In-	T1	T2	T3	T4	DI1	DI2	COM

Notes: The voltage/current measurement function is optional, please refer to the PN code of purchase products.



4.- SCREEN DISPLAY

4.1.- Full Symbol in Display Screen



RUNS	System regular status, no alarm or fault
ALARM	There have alarm trigged
FAULT	There has failure trigged
MUM	Buzzer stopped
COMM	Device in TX/RX
SOE	Screen show event record
Io	Leakage current
TEMP.	Temperature value
RTC	Real Time Clock

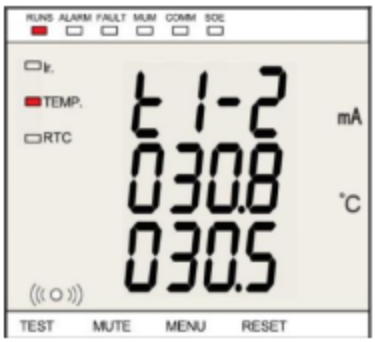
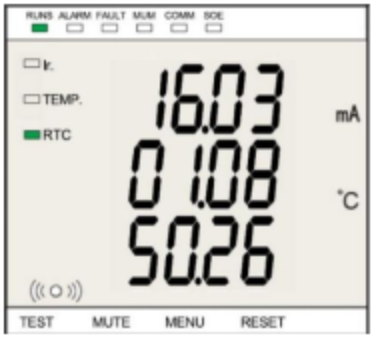
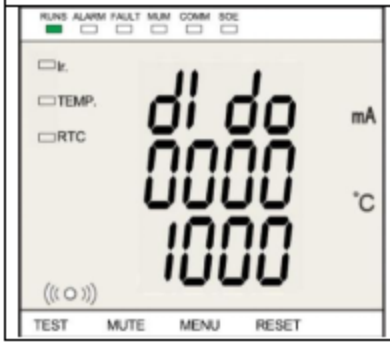
4.2.- Operation Button Description

Button	Measurement Interface	Alarm/Fault Interface	Configuration Interface
◀	**Click**: Switch to the previous page **Long press 3S**: Self-test	**Click**: Switch to next "Alarm" info page **Long press 3S**: Self-test	Move cursor or Modify number
▶	**Click**: Switch to the next page **Long press 3S**: ON/OFF buzzer	**Click**: Switch to next "Fault" info page **Long press 3S**: ON/OFF buzzer	Move cursor or Modify number
SET	**Click**: Enter configuration menu	**Click**: Enter configuration menu	Exit or Return to upper menu level
↵	**Click**: Refresh sensor to measurement	**Click**[1]: Refresh sensor to clear alarm status	Confirm or Enter next menu level

Notes[1]:

If there have fault event, after fault be resolution, device will automatic reset "FAULT" status, "ALARM" status must manually press button to reset.

4.3.- Measurement Interface

<table>
<tr><th>Screen</th><th colspan="2">Description</th></tr>
<tr><td rowspan="4"> 
</td><td>Line-1</td><td>“I” for leakage current
“1-2” for mean this page for channel-1 and channel-2</td></tr>
<tr><td>Line-2</td><td>Channel-1 current, screen show 100mA</td></tr>
<tr><td>Line-3</td><td>Channel-2 current, screen show 200mA</td></tr>
<tr><td colspan="2">Press button ▶ can switch to show page 2-8 (Ir3-Ir16)</td></tr>
<tr><td rowspan="4"> 
</td><td>Line-1</td><td>“t” for temperature
“1-2” for mean this page for channel-1 and channel-2</td></tr>
<tr><td>Line-2</td><td>Channel-1 temperature, screen show 30.8°C</td></tr>
<tr><td>Line-3</td><td>Channel-2 temperature, screen show 30.5°C</td></tr>
<tr><td colspan="2">Press button ▶ can switch to show page 2-4 (t3-t8)</td></tr>
<tr><td rowspan="4"> 
</td><td>Line-1</td><td>“Year”. “Month”</td></tr>
<tr><td>Line-2</td><td>“Date”. “Hour”</td></tr>
<tr><td>Line-3</td><td>“Minute”. “Second”</td></tr>
<tr><td colspan="2">Demo RTC is 2016-03-01 08:50:26</td></tr>
<tr><td rowspan="4"> 
</td><td>Line-1</td><td>This page show DI and DO status</td></tr>
<tr><td>Line-2</td><td>DI status, LED tube show “DI-1, DI-2, / , /”</td></tr>
<tr><td>Line-3</td><td>DO status, LED tube show “DO-1, DO-2, / , /”</td></tr>
<tr><td colspan="2">Notes: 0 for opened, 1 for closed</td></tr>
</table>

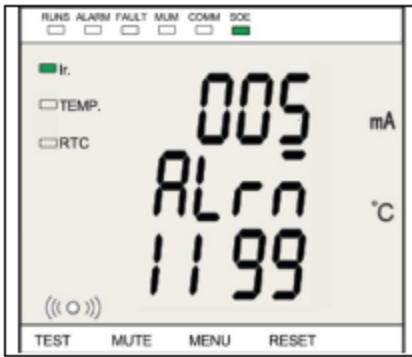
4.4.- Alarm/Fault Interface

Screen	Description	
	Line-1	Show this screen is alarm info, "**ALARM**" light will ON
	Line-2	"**Ir**" mean leakage current alarm info "**1H**" mean channel-1 over upper limit
	Line-3	Alarm trip value is 300mA
	Press and hold ◀ 3set can Self-test, device will check whether have other channels in alarm status. "**MUM**" light ON mean buzzer in silence, press and hold ▶ can switch ON/OFF the buzzer sound.	
	Line-1	Show this screen is probe open loop fault, "**FAULT**" light will ON
	Line-2	"**t1**" mean problem is in channel-1 temperature
	Line-3	No info in this line
	Press and hold ◀ 3set can Self-test, device will check whether have other channels in fault status. "**MUM**" light ON mean buzzer in silence, press and hold ▶ can switch ON/OFF the buzzer sound.	

Notes:

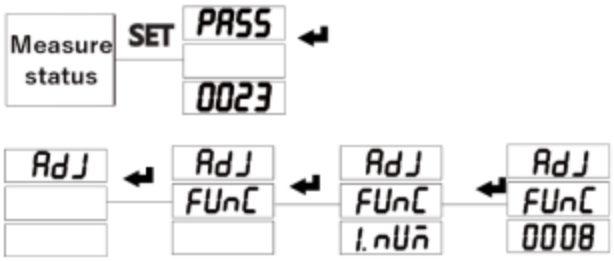
1. If any channel trigs the alarm, will automatically switch to alarm/fault interface;
2. If "**ALARM**" / "**FAULT**" light ON, mean troubles are not resolved, please do "Self-test" and "Reset" to troubleshooting and until indicator OFF.

4.5.- Event record

	Line-1	Event number
	Line-2	Event type
	Line-3	Event value **Notes**: Event channel and Event value will automatic switch to display one by one.

5.- SETUP PROCEDURE

ELR-CH16 supports leakage current monitoring for max 16 channels. Before measurement, Users can freely configure the number of active channels (≤16) according to requirements via the menu settings described below.

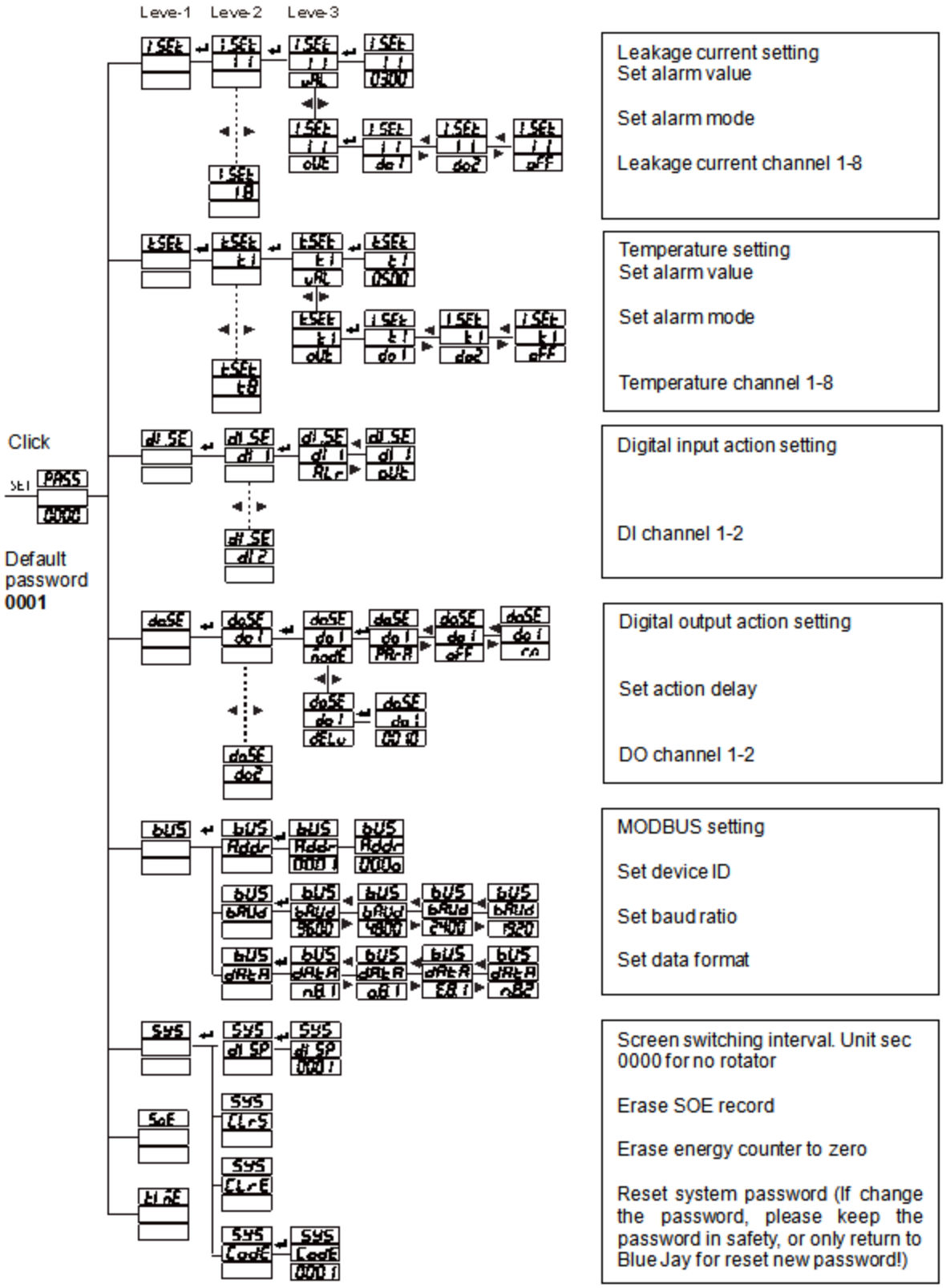


Step 1: In any measurement screen, press ↵ and enter password **0023** to access setting.

Step 2: In **[Adjust]** menu, press ↵ to enter sub menu **[Function- I.number]**. Press ◀ / ▶ to select number of active channels.

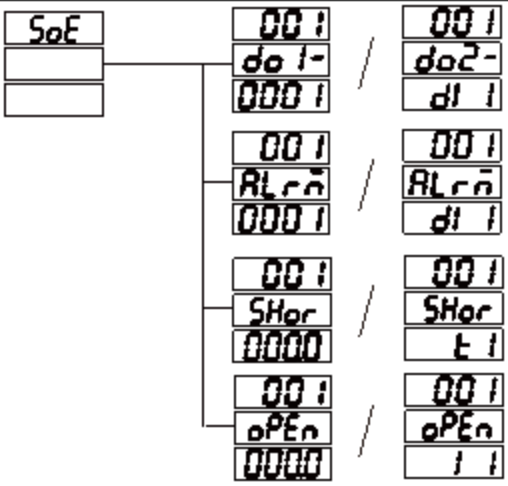
Step 3: After setting, return to previous menu and save the settings.

After completing channel setting, User also need to access the standard configuration menu (password 0001) and configure other parameters, details are as follows:

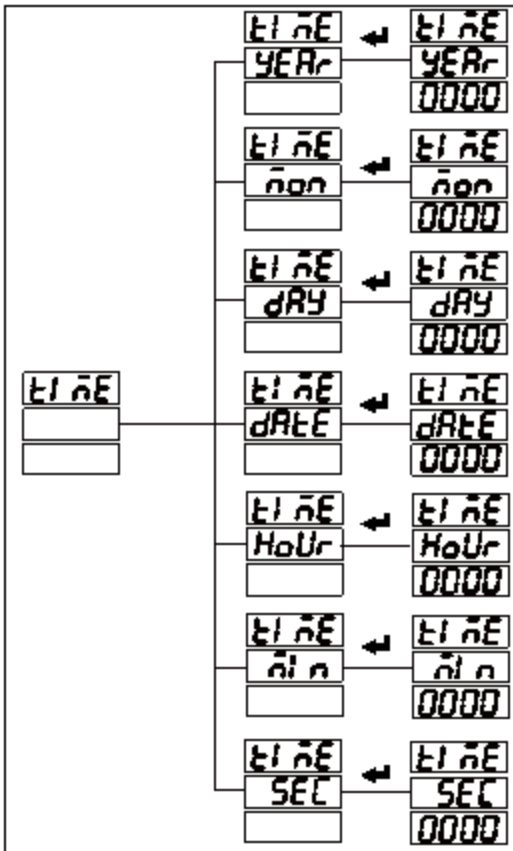


SOE records are folded under configuration interface, in this sub-screen user can review all the 100 log event records.

Notes: This menu page is read only.

	DO event, screen show DO-1 trigged or DO2 trigged by DI1 closed.
	Alarm event, screen show Alarm triggered by DI1 closed.
	Short circuit, 000.0 is meaningless, t1 means channel-1 temperature 1 probe shorted loop.
	Open circuit, 000.0 is meaningless, I1 means channel-1 leakage current CT opened loop.

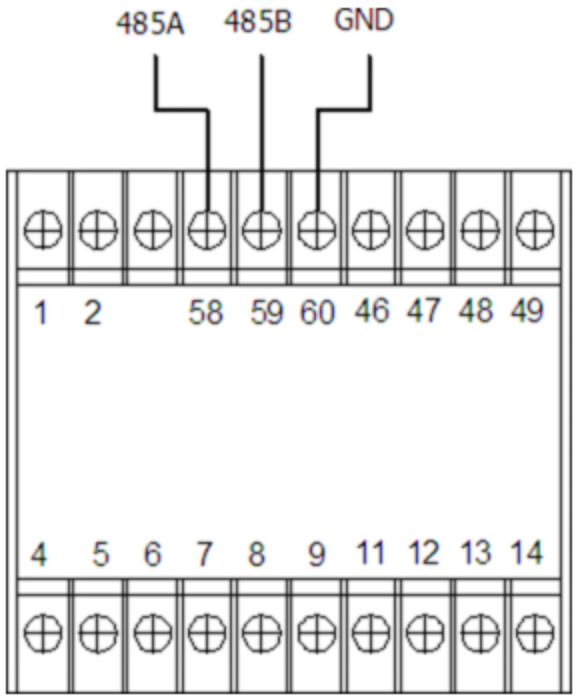
RTC configuration:

	Set Year
	Set Month
	Set Day
	Set Date
	Set Hour
	Set Minute
	Set Second

6.- COMMUNICATION INTERFACE

6.1.- 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 0.5mm2, with a maximum distance of 1,200 m between the ELR-CH16… and the master unit. This Bus may connect a maximum of 32pcs.



Notes:

-. For communication with the master unit, users 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.

-. Full range of ELR series RS485 PIN number is 58,59,60

-. Due to product modifications or special requirements, the interface pin place may be changed. For details, please refer to product label on the rear side

6.2.- MODBUS © Protocol

Modbus RTU Frame Format:

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

MODBUS FUNCTIONS:

Code	Meaning	Description
FUNCTION 01	Read Coil status	Only valid when equipped DO port
FUNCTION 02	Read Input status	Only valid when equipped DI port
FUNCTION 03	Reading of n Words	This function permits to read all the electrical parameters of the ELR…series.
FUNCTION 05	Force Single coil	When DO in remote control mode can work
FUNCTION 06	Preset Single register	**Disable in default** If need this code valid, please contact Blue Jay Sales Team before your order!

Note: Float data follow **IEEE754**, float low bit first, high bit next. (**CD AB**)

6.3.- Register Map

6.3.1.- Measurement data, read only, function 03 to read.

Address	Item.	Description
0x00	Channel -1 leakage current (rms)	Real value = [Read value] / 10mA Example: Polling data 235, Real value = 23.5mA
0x01	Channel -2 leakage current (rms)	
0x02	Channel -3 leakage current (rms)	
0x03	Channel -4 leakage current (rms)	
0x04	Channel -1 leakage current status	0: Normal status 1: Alarm trig 2: Sensor in short circuit 3: Sensor disconnection
0x05	Channel -2 leakage current status	
0x06	Channel -3 leakage current status	
0x07	Channel -4 leakage current status	
0x08	Channel -5 leakage current (rms)	Real value = [Read value] / 10mA Example: Polling data 235, Real value = 23.5mA
0x09	Channel -6 leakage current (rms)	
0x0A	Channel -7 leakage current (rms)	
0x0B	Channel -8 leakage current (rms)	
0x0C	Channel -5 leakage current status	0: Normal status 1: Alarm trig 2: Sensor in short circuit 3: Sensor disconnection
0x0D	Channel -6 leakage current status	
0x0E	Channel -7 leakage current status	
0x0F	Channel -8 leakage current status	
0x10	Channel -1 temperature detect	Real value = [Read value] / 10°C Example: Polling data 173, Real value = 17.3mA
0x11	Channel -2 temperature detect	
0x12	Channel -3 temperature detect	
0x13	Channel -4 temperature detect	
0x14	Channel -1 temperature sensor status	0: Normal status 1: Alarm trig 2: Sensor in short circuit 3: Sensor disconnection
0x15	Channel -2 temperature sensor status	
0x16	Channel -3 temperature sensor status	
0x17	Channel -4 temperature sensor status	
0x18	Channel -5 temperature detect	Real value = [Read value] / 10°C Example: Polling data 173, Real value = 17.3mA
0x19	Channel -6 temperature detect	
0x1A	Channel -7 temperature detect	
0x1B	Channel -8 temperature detect	
0x1C	Channel -5 temperature sensor status	0: Normal status 1: Alarm trig 2: Sensor in short circuit 3: Sensor disconnection
0x1D	Channel -6 temperature sensor status	
0x1E	Channel -7 temperature sensor status	
0x1F	Channel -8 temperature sensor status	

6.3.2.- Device status, read only, function 03 to read.

Address	Item.	Description
0x20	Digital Input	Bit 0 for DI-1 Bit 1 for DI-2 0: Opened 1: Closed
0x21	DI-1 channel status	0: Normal status 1: Alarm trig Note: In configuration screen if disable alarm function, this register is invalid.
0x22	DI-2 channel status	
0x30	Digital Output	Bit 0 for relay DO-1 Bit 1 for relay DO-2 0: Opened 1: Closed
0x40	Year	RTC information
0x41	Month	
0x42	Date	
0x43	Hour	
0x44	Minute	
0x45	Second	
0x46	Week	

6.3.3.- Meter status data, read and write, function 03 read/ function 06 to write.

Address	Item.	Description
0x100	CH -1 leakage current alarm threshold	Range 20~1000 (For 20~1000mA)
0x101	CH -2 leakage current alarm threshold	
0x102	CH -3 leakage current alarm threshold	
0x103	CH -4 leakage current alarm threshold	
0x104	CH -1 leakage current alarm action	0: No action 1: DO-1 trig 2: DO-2 trig
0x105	CH -2 leakage current alarm action	
0x106	CH -3 leakage current alarm action	
0x107	CH -4 leakage current alarm action	
0x108	CH -5 leakage current alarm threshold	Range 20~1000 (For 20~1000mA)
0x109	CH -6 leakage current alarm threshold	
0x10A	CH -7 leakage current alarm threshold	
0x10B	CH -8 leakage current alarm threshold	
0x10C	CH -5 leakage current alarm action	0: No action 1: DO-1 trig 2: DO-2 trig
0x10D	CH -6 leakage current alarm action	
0x10E	CH -7 leakage current alarm action	

0x10F	CH -8 leakage current alarm action	
0x110	CH -1 temperature alarm threshold	Range 500 ~ 1200 (For 50.0°C ~ 120.0°C)
0x111	CH -2 temperature alarm threshold	
0x112	CH -3 temperature alarm threshold	
0x113	CH -4 temperature alarm threshold	
0x114	CH -1 temperature alarm action	0: No action 1: DO-1 trig 2: DO-2 trig
0x115	CH -2 temperature alarm action	
0x116	CH -3 temperature alarm action	
0x117	CH -4 temperature alarm action	
0x118	CH -5 temperature alarm threshold	Range 500 ~ 1200 (For 50.0°C ~ 120.0°C)
0x119	CH -6 temperature alarm threshold	
0x11A	CH -7 temperature alarm threshold	
0x11B	CH -8 temperature alarm threshold	
0x11C	CH -5 temperature alarm action	0: No action 1: DO-1 trig 2: DO-2 trig
0x11D	CH -6 temperature alarm action	
0x11E	CH -7 temperature alarm action	
0x11F	CH -8 temperature alarm action	
0x120	DI-1 alarm enable	When DI loop closed, alarm or not: 0: No action 1: Alarm trig
0x121	DI-2 alarm enable	
0x123	DI-1 alarm action	0: No action 1: DO-1 trig 2: DO-2 trig
0x124	DI-2 alarm action	
0x130	DO-1 action method	0: Comm port 1: Local buzzer 2: No action
0x131	DO2 action method	
0x132	DO-1 trig delay timer	Range 0 ~ 9999 (For 0 ~ 999.9sec)
0x133	DO-2 trig delay timer	

6.3.4- Sequence of event, function 03 to read.

Address	Contents	Description
0x200-0x204	SOE_001	SOE_001 is latest record Details see Notes
0x205-0x209	SOE_002	
0x20A-0x20E	SOE_003	
0x20F-0x213	SOE_004	
0x214-0x218	SOE_005	
0x219-0x21D	SOE_006	
…	…	
0x3D9-0x3DD	SOE_100	

Notes: Each event is represented by 10 bytes.

BYTE 0	Event type: 01: Alarm,	02: Sensor short circuit, 03: sensor disconnection,	04: DO1 action event, 05: DO2 action event
BYTE 1	Event channel: 01: CH-1 leakage current 02: CH-2 leakage current 03: CH-3 leakage current 04: CH-4 leakage current 05: CH-1 temperature 06: CH-2 temperature	07: CH-3 temperature 08: CH-4 temperature 09: DI-1 10: DI-2 11: Reserved 12: Comm port 13: CH-5 leakage current	14: CH-6 leakage current 15: CH-7 leakage current 16: CH-8 leakage current 17: CH-5 temperature 18: CH-6 temperature 19: CH-7 temperature 20: CH-8 temperature
BYTE 2-3	Failure value		
BYTE 4-9	Failure event timestamp		
BYTE 4	Year		
BYTE 5	Month		
BYTE 6	Date		
BYTE 7	Hour		
BYTE 8	Minute		
BYTE 9	Second		

Notes:

-. Not all the data above can be read by RS485, the reading address will be unsuccessful.

-. The data can be read out depends on your multi-channel monitor model, please refer to the corresponding product manual before building your software.

-. Some software has different definitions of the start bit of register address, there will be offset, please add 1 for the right address. To get more info, please contact technical support **tech@cqbluejay.com**

7.- SAFETY CONSIDERATIONS

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

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. This instrument is factory-shipped at proper operation conditions.

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

8.- MAINTENANCE

The ELR-CH16 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 repair 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