

041



ASJ Series of the Action Relay of After-Current

Installation and Operation Instruction V1.7

Acrel Electric Limited Liability Company

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1 SUMMARY

ASJ Series of action relay of after-current, low-voltage circuit break or low-voltage contactor can be made up for combined after-current production device, which is mainly applied for the TT and TN system distributing circuit with the alternating current 50Hz, the rated voltage 400V or below. ASJ Series of action relay of after-current is applied in the earth fault protection for the electric circuit, so as to prevent the equipment damage and the fire accident of electric equipment caused by the ground fault current, moreover, it also can provide indirect contact protection against the electric shock risk.

The product is qualified in accordance with the requirement of GB/T 22387—2008 *Action Relay of After-Current*

2 Types of Products

Table 1

type	basic function	installing way	picture
ASJ10-LD1C	Measurement of AC-type after-current; Indicator of current off-limit alarm; The setting of rated residual action current (see in the table 2); The setting of non-driving time of limitation (see in the table 2); Two-pair relay output; Possessing the function of on-the-spot and long-distance testing and resetting	rail guiding (TS35mm)	
ASJ10-LD1A	The measurement of A-type after-current; The streamer display of current percentage; The setting of rated residual action current (see in the table 2); The setting of non-driving time of limitation (see in the table 2); Two- pair relay output(both of which can be set) *; Possessing the function of on-the-spot and long-distance testing and resetting		

ASJ10L-LD1A ^{note 2}	<p>Type A residual current measurement;</p> <p>Rated residual action current can be set (see 8.1) ;</p> <p>Limit non-driving time can be set (see 8.1) ;</p> <p>Two sets of relay outputs (settable, see 8.1) ;</p> <p>The fault alarm of transformer can be set (see 8.1) ;</p> <p>Warning value can be set (see 8.1) ;</p> <p>Return value can be set (see 8.1) ;</p> <p>With on-site, remote "test" , "reset" function, 25 event records;</p>		
ASJ20-LD1C	<p>Measurement of AC-type after-current;</p> <p>Indicator of current off-limit alarm;</p> <p>The setting of rated residual action current (see in the table 2);</p> <p>The setting of non-driving time of limitation (see in the table 2);</p> <p>Two- pair relay output;</p> <p>Possessing the function of on-the-spot and long-distance testing and resetting</p>		
ASJ20-LD1A	<p>The measurement of A-type after-current;</p> <p>The streamer display of current percentage;</p> <p>The setting of rated residual action current (see in the table 2);</p> <p>The setting of non-driving time of limitation (see in the table 2);</p> <p>Two- pair relay output(both of which can be set)^{note 1};</p> <p>Possessing the function of on-the-spot and long-distance testing and resetting</p>	Screen structure (48 square)	

Note1: The function of setting for relay means that you can set the initialization and the output of the relay by yourself, which is acted by the dial switch on the panel; the specific setting guide can be found from the table 5.

Note2: OPTIONAL FUNCTION C: RTU Communication RS485, Model ASJ10L-LD1A/C

3 Technical Parameter

Table 2

technical parameter		index	
		Type AC	Type A
input	Rated residual action current $I_{\Delta n}$	0.03、0.1、0.3、0.5(A)	0.03、0.05、0.1、0.3、0.5、1、3、5、10、30(A) ^{note 3}
	Non-driving time of limitation Δt	0.1、0.5(s)	0、0.06、0.1、0.2、0.3、0.5、0.8、1、4、10(s) ^{note 4}
	Rated residual non-action current $I_{\Delta no}$	50% $I_{\Delta n}$	50% $I_{\Delta n}$
	performance characteristics	simple sinusoidal alternating current	simple sinusoidal alternating current and pulsating direct current
	frequency	50Hz \pm 5Hz	50Hz \pm 5Hz
action error		-20% ~ -10% $I_{\Delta n}$	-20% ~ -10% $I_{\Delta n}$
output	output mode	one is the normal closing and the other is for the transformation	one is the normal closing or opening, and the other is for the transformation
	contact capacity	5A 250VAC 5A 30VDC	AL1:8A 250VAC 5A 30VDC AL2:6A 250VAC 5A 30VDC
	reset mode	the on-the-spot one and the long-distance one,	the on-the-spot one, the long-distance one and the automatic one
power supply	voltage range	AC110V、AC220V (permissible error \pm 10%)	AC110V、AC220V、DC85-270V (permissible error \pm 10%)
	power dissipation	\leq 5W	
power frequency withstand voltage		The effective value of alternating current between the power supply, input and output: 2kV/1min	
under the normal operation	temperature	operating temperature: -20 $^{\circ}$ C ~ +55 $^{\circ}$ C storage temperature: -30 $^{\circ}$ C ~ +70 $^{\circ}$ C	
	humidity	\leq 95%RH, with moisture condensation, and corrosive gas place	
	height above sea level	\leq 2000m	
	class of pollution	Grade three	
	installation category	Type III	

Note 3: ASJ10L-LD1A rated residual action current I_N is 10mA-30A continuously adjustable;

Note 4: ASJ10L-LD1A limit non-driving Time N is 0-10S continuously adjustable.

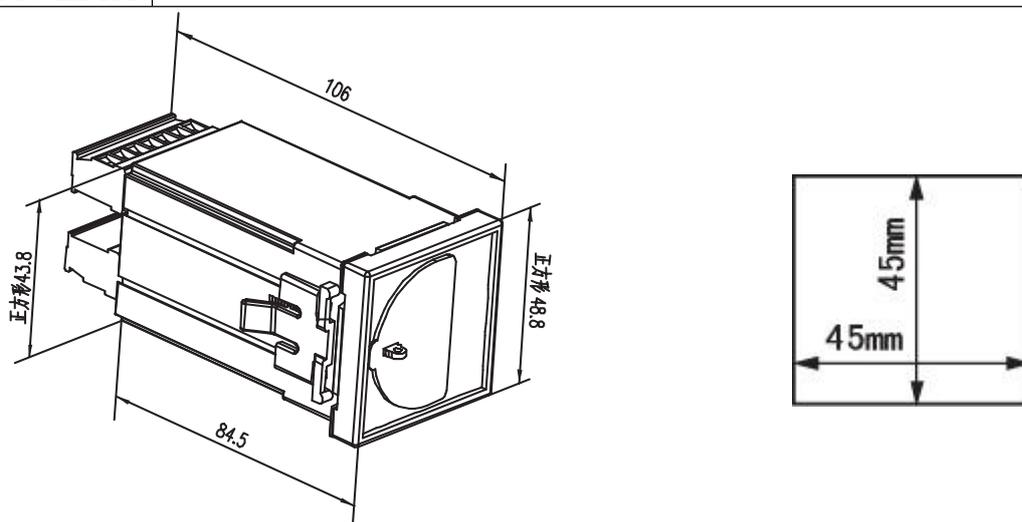
4 Installation Guide

4.1 The Appearance and Hole Size of Installment

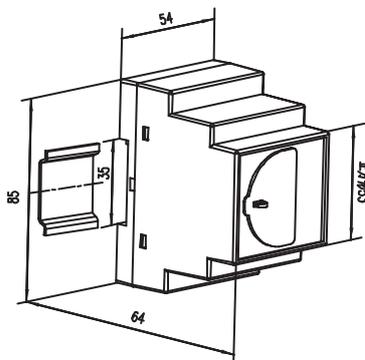
Please refer to the table 3 and the picture 1 and 2

Table 3

instrument type	Panel size (mm)	Shell size (mm)	hole size(mm)
ASJ20-LD1C ASJ20-LD1A	48×48(width by height)	43.8×43.8×100 (width by height by depth)	45×45 (width by height)
ASJ10-LD1C ASJ10-LD1A	85×54×64 (length by width by height)		



Picture 1 ASJ20 he appearance and hole size



Picture 2 ASJ10 appearance and hole size of installment

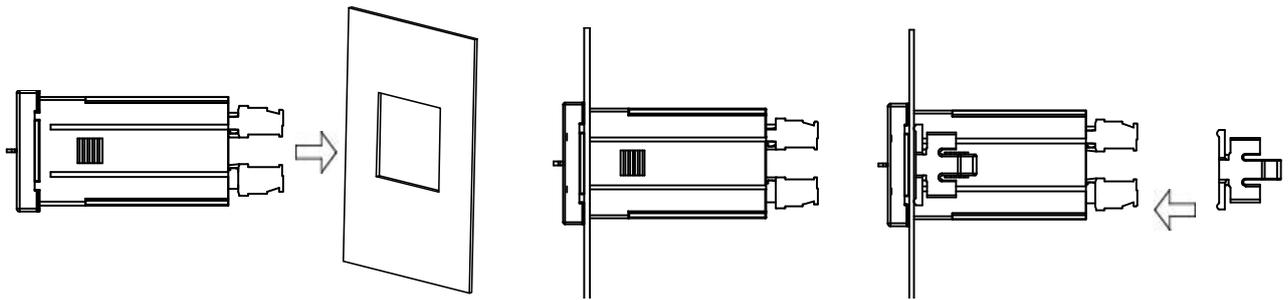
4.2 Installation Instructions

4.2.1 Installation Steps

The installing way of 48 square instrument is the type of screen package, which takes the extrusion and fix of snap joint on the both side. The specific operation is as follows:

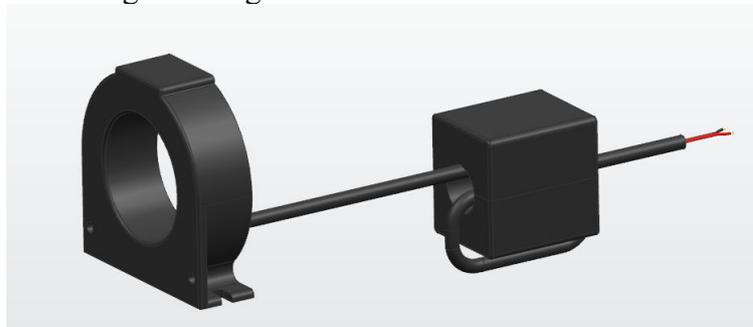
1. Choose a suitable site to open one mounting hole on the switchboard, the size of which shall be the same as that of the installed instrument;
2. Take out of the after-current relay, and take down the fixed snap joint.;
3. Put the instrument and insert it into the hole of switchboard, after that fix and install it with the snap joint.

The operation chart is as follows.



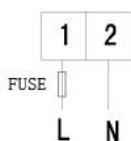
4.2.2 Installation mode of magnetic ring

The secondary side of the transformer is connected to instrument terminals 40 and 41. The installation method of the magnetic ring is shown in the figure below. It is installed near the instrument wiring end and the magnetic ring is threaded for two turns.

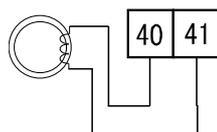


4.3 The Terminal and the Wiring Connection

4.3.1 The Auxiliary Power Supply and the Terminal of Signal Input

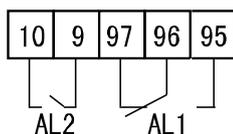


Auxiliary Power Supply

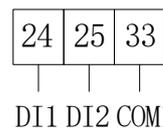


Signal Input

4.3.2 The terminal of relay output

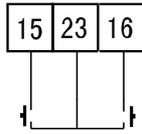


Relay Output Terminal
(no auxiliary power supply applied) AL1:
Alarm relay
AL2: Early Warning relay



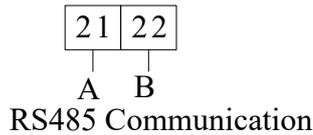
ASJ10L-LD1A
Switch input terminal

4.3.3 The terminal of additional function



The long-distance testing; the long-distance restoration

4.3.4 ASJ10L-LD1A/C Communication terminal



4.4 The announcements

- a) The ground lead is not allowed into the CT.
- b) As for the one-phase power grid, only the phase line and the neutral line need inserting the CT.
- c) ASJ10L-LD1A/C instrument provides asynchronous half-duplex RS485 communication interface, using Modbus-RTU protocol, all kinds of data information can be transmitted on the communication line. Theoretically, up to 128 meters can be connected simultaneously on a single line, and each meter can be configured with its Addr, Baud, or a set of options.

5 The Operating Guide

5.1 The Introduction of AC-type Panel

Table 4

serial number	name	functional specification	
1	power light	the power light will be shined when the working power supply is normal.	
2	restoration button	The system will be restored after pressing the button	
3	alarm light	When the current lives up to the rated residual action current, the alarm light will be open	
4	testing button	Please test whether the indicator light is normal, and the relay can work well.	

5	the setting switch of residual action current	The switch provides four kinds of settings of residual action current	
6	The setting switch of non-driving time of limitation	The switch provides two kinds of settings of non-driving time of limitation	

5.2 The instruction of A-type panel

Table 5

serial number	name	functional specification				
1	power light	The power light will be shined when the working power supply is normal.				
2	restoration button	The system will be restored after pressing the button				
3	alarm light	When the current lives up to the rated residual action current, the alarm light will be open				
4	testing button	Please test whether the indicator light is normal, and the relay can work well.				
5	the setting switch of residual action current	The switch provides ten kinds of settings of residual action current				
6	The setting switch of non-driving time of limitation	The switch provides ten kinds of settings of non-driving time of limitation				
7	Dial-up	the location of dial-up	The left picture is the junction in the normal operation			
		A		B	Relay AL2	Relay AL1
		0		0	1 0	9 9 9
		0		1	0 0	7 6 5
		1		0	early warning	
		1		1	early warning	
		C		0: manual reset ; 1: automatic reset		
D	standby application					

8	indicator light with streamer	The combination of three green LED is applied, which shows the percentage of current, the alarm will be indicated when the LED shines over 50%	
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Note:

1. When the rated residual action current is set for 30mA, the setting of action delay time is invalid, and it will be approved tacitly as the immediate operation.

2. The after-current relay is applied mating with the after-current relay; the main type number of relay includes AKH-0.66L45, AKH-0.66L80, AKH-0.66L100, AKH-0.66L150, AKH-0.66L200, etc.

3. The residual current relay is matched with the residual current transformer of our company. The main types of the residual current transformer are AKH-0.66L45, AKH-0.66L80, AKH-0.66L100, AKH-0.66L150, AKH-0.66L200, etc. .

5.3 The Instruction on the Selection

- The device is mainly applied into the system protection, which is the protection of the direct electric shock, indirect electric shock, the fire caused by electric appliance, and the cascade protection.
- The equipment and place below shall be allocated by the protection device: electrical device with mobile type and the hand-held electric tool , the electrical equipment for production, the electric mechanical equipment on the construction, the electrical installation outdoors (see details in GB13955)
- The current value of normal leakage shall be fully considered in terms of the rated residual action current. Generally, the current value shall be more than three times of the maximum value of normal actual measurement, four times of branch line, two and half times of branch line, twice of main line. According to the empirical equation:

one-phase loop: $I\Delta n \geq I_n/2000$ (illumination)

tripphase loop: $I\Delta n \geq I_n/1000$ (power-driving or combination with the power lighting), in which the I_n is the biggest supply current.

- The coordination of current and time shall be between the superior and the subordinate, so as to ensure the selectivity of cascade protection.

$I\Delta n_1$ (superior) $\geq I\Delta n_2$ (subordinate)

t_F (the return time of superior grade) $> t_{Fa}$ (the break time of subordinate ASJ), and the time difference is less than 0.2s.

the general branch line and terminal: 30~100mA \leq 0.1s; the branch line: 300~500mA、0.2~0.8s;
main line: 500~1000mA、 \leq 2s.

- The introduction of system selection is seen in table 6

Table 6

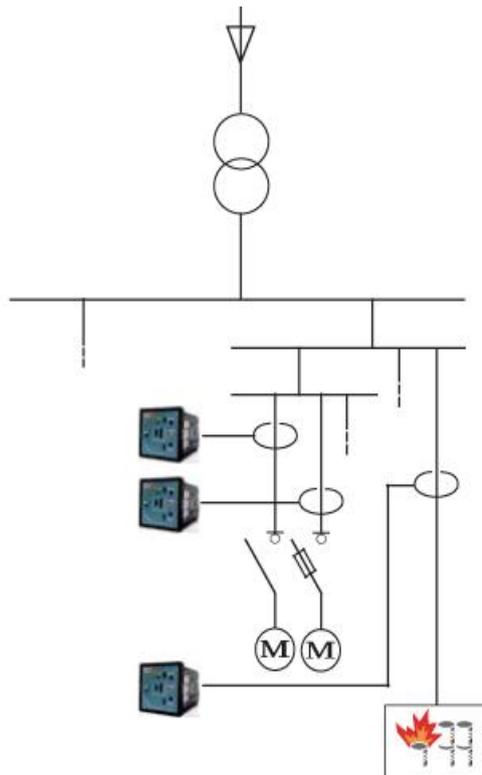
Name of system	system connection	introduction
TT system		<p>The ASJ is recommended. The single-phase earth fault will cause the small amount of current, which is hard to be calculated, consequently, the action current of the switch fails to be reached, and the dangerous voltage will appear on the shell.</p>
System TN-S		<p>ASJ is recommended, which will be fast to cut off the malfunction so as to enhance the safety and reliability, at this time, PE line is not allowed to pierce through the mutual inductor, but the N line have to pierce the mutual inductor, and is not allowed for multiple grounding.</p>
System TN-C		<p>ASJ is not allowed to be applied. The line PE and line N is combined for one, therefore, if line PEN is not grounded multiply with the electrification of shell and the equal current of mutual inductor, the ASJ doesn't move; if line PEN is grounded multiply, and the partial single-phase current will flow into multiple grounding to a certain value, ASJ will move mistakenly.</p>
System TN-C-S		<p>The front of point F is the system TN-C, which is not allowed to put the ASJ into application; the back of point F is the system TN-S, which is allowed to put the ASJ into application, however, the line PE cannot pierce through the mutual inductor.</p>
System IT		<p>ASJ can be applied in accordance with the regulations. According to the connection type, the protection measures of the system similar to TT or TN is applied to prevent the reduction of insulation in the system and make it the secondary backup protection. Firstly, the device of insulation monitoring is applied to forecast a malfunction.</p>

5.4 The Instruction on the Selection of Mutual Inductor

Table 7

type	bore diameter	major loop current	no-load voltage ratio
AKH-0.66L45	45mm	80A	1A:1mA
AKH-0.66L80	80mm	250A	1A:1mA
AKH-0.66L100	100mm	400A	1A:1mA
AKH-0.66L150	150mm	630A	1A:1mA
AKH-0.66L200	200mm	1000A	1A:1mA
AKH-0.66L-260*100II	265*104mm	1000A	1A:1mA

6 Typical Application Case



7 Example of product ordering

E.g.1 :

Type ASJ10-LD1C

auxiliary power supply AC 220V/50Hz

rated current In: 250A

Note:

The after-current relay is applied mating with the after-current relay; the main type number of relay includes AKH-0.66L45, AKH-0.66L80, AKH-0.66L100, AKH-0.66L150, AKH-0.66L200, etc.

8 ASJ10L-LD1A programming menu description

First Level Menu	Second Level Menu	Level 3 menu	Account for
Addr	1-247	NO	Address setting
bAUd	1200、2400、4800、9600、19200、38400	NO	Communication Baud rate setting
AL	Select the location modification value	Select the location modification value	Rated residual action current setting
AL.Pr	Select the location modification value	Select the location modification value	Setting of alarm action current
rSt.P	Select the location modification value	Select the location modification value	Alarm, early warning action current return value percentage ^{note 2}
Td	Select the location modification value	Select the location modification value	Limit unactuated time setting
Mod	000、001、010、011、100、101、110、111	NO	See The appendix: Mod Menu Description
Brk	on/off	NO	Disconnection alarm setting, on: On, off: off
LCd	0~9999	NO	Backlight setting, 0: backlight is always bright; setting to 1-9999, backlight is extinguished after 1-9999 seconds, in 1 second
Pass	1~9999	NO	Password setting
Time	Year, month, day, hour, minute	Real-time adjustment	Time setting
Clr	yes/no	NO	Yes: clear the event log

Mod Menu description:

Bit2	0	Manual reset
	1	Automatic reset
Bit1	0	Relay AL1 terminals 97,96 are normally closed by default, 96,95 are normally open by default
	1	Relay AL1 terminals 97,96 default constant open, 96,95 default constant closed
Bit0	0	Relay AL2 terminals 10 and 9 are normally open by default
	1	Relay AL2 terminals 10 and 9 are normally closed by default

Note 1: After entering the first level menu, Short Press PROG key to enter the second level menu, between the second level menu with Td/+ Key and Td/-key channel switch, then press

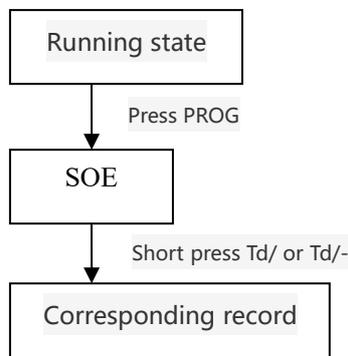
PROG key, then use Td/+ Key and Td/-key to modify the specific value, when you're done, press PROG or RESET to return. When the change is finished, press the RESET key to exit. Before exiting, the save screen will be entered. Press the RESET key again to save. Press Prog to save.

Note 2: When the leakage current is less than 85% of the rated residual operating current, the alarm relay AL1 is reset, and when the leakage current is less than 85% of the rated residual operating current, alarm relay AL2 reset (instrument to be set to auto reset mode).

8.1 ASJ10L-LD1A programming example

The following is a few programming diagrams, users can refer to these examples, the same level of menu items for programming.

(1) viewing SOE records in runtime mode



Each event log consists of two pages, and the event log format is as follows:

n.01	Al
200mA	

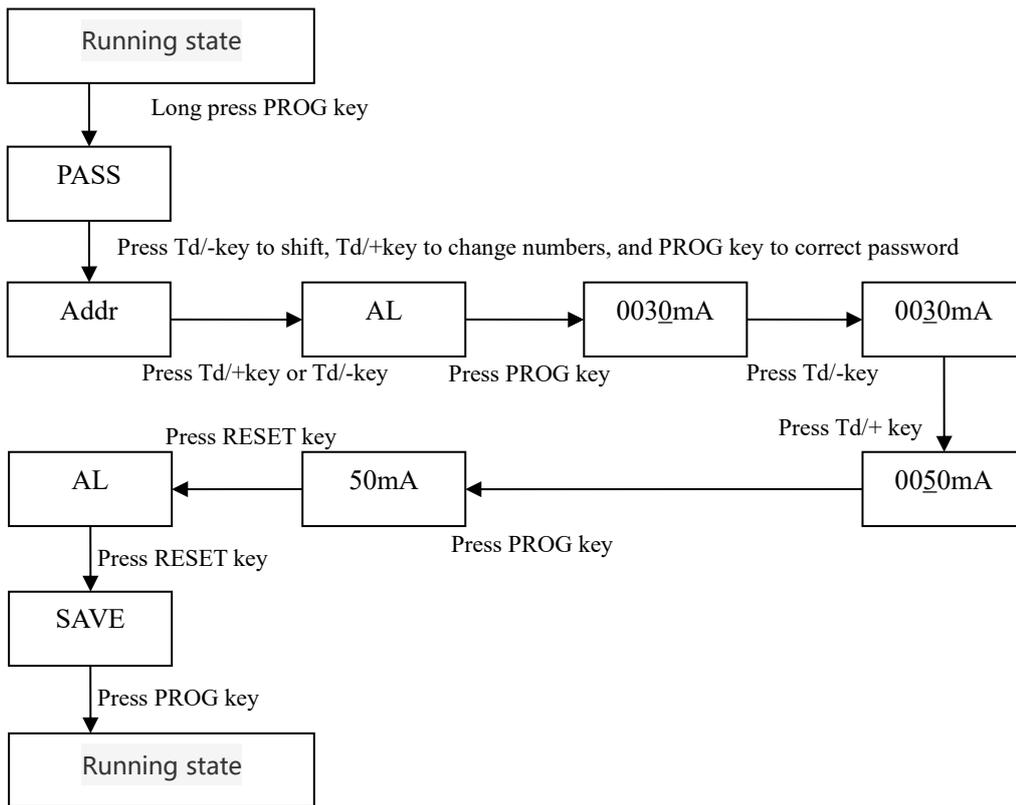
n.01	11.03
12:08	

Where N. 01 is the latest event record, and so on

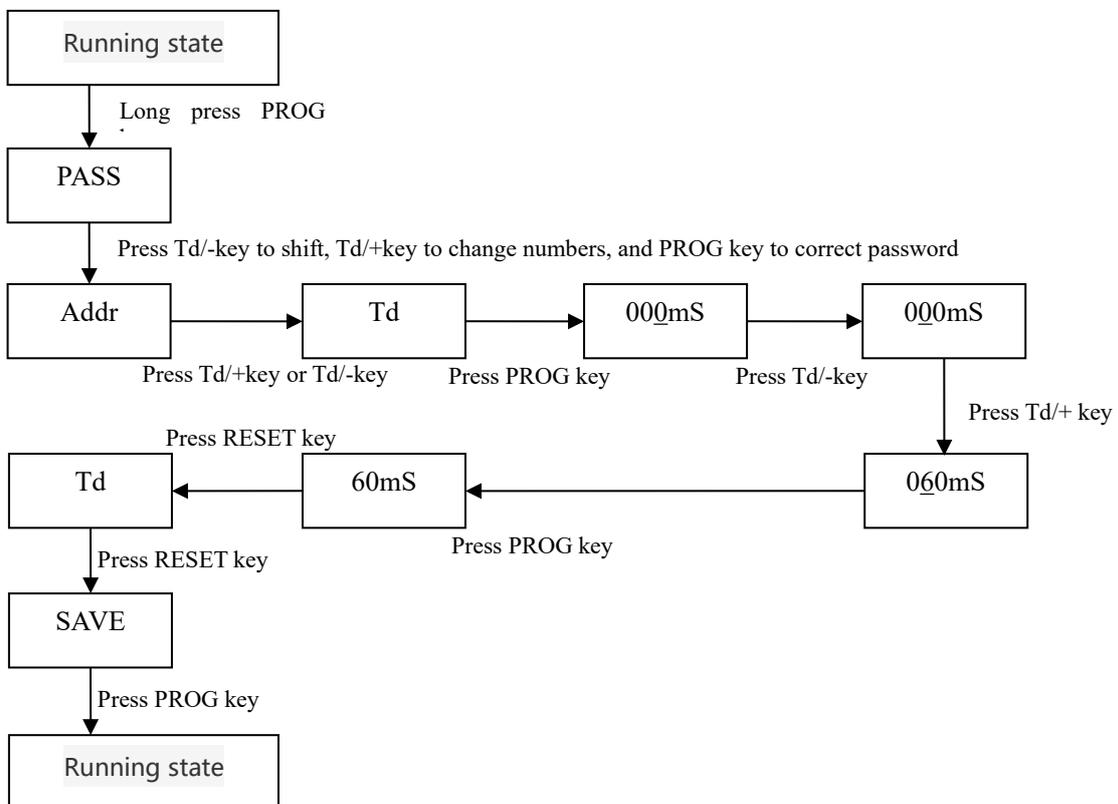
AL indicates that the record is generated by the residual current alarm action, and the AL.PR indicates that it is generated by the predictive alarm action.

The example shows that the first event record is generated by the residual current alarm action, the alarm value is 200 ma, the occurrence time is November 03,12:08.

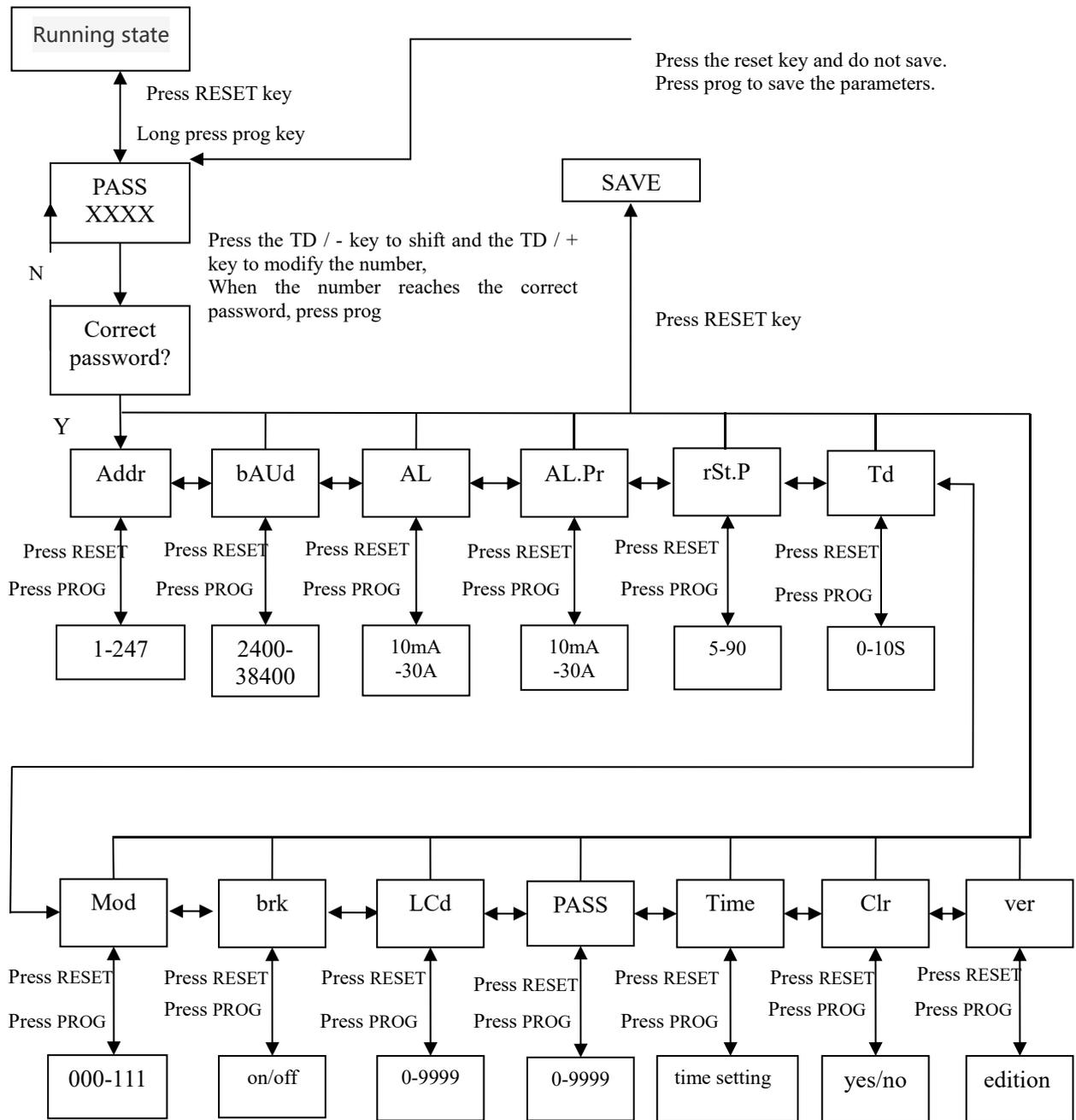
(2) setting the residual current action value to 50mA, which represents the SCINTILLATION position.



Set the limit to 60ms for no-drive time



8.2 ASJ10L-LD1A programming setup flowchart



9 ASJ10L-LD1A/C Communication Guide

9.1 Overview of communication protocols

ASJ10L-LD1A/C residual current relay uses MODBUS-RTU communication protocol, which defines check codes, data sequences, etc. in detail, which are necessary for specific data exchange. The Modbus protocol uses a master-slave reply connection (half duplex) on one communication line, which means that signals are transmitted in opposite directions on a single communication line. First, the host computer's signal is addressed to the only terminal device (slave), then the terminal sends an answer signal in the opposite direction to the host.

The MODBUS protocol only allows communication between the host (PC, PLC, etc.) and terminal devices, and does not allow data exchange between independent terminal devices, so that each terminal device does not occupy the communication line when they are initialized, but only responds to query signals reaching the local computer.

9.1.1 transmission mode

The information is transmitted asynchronously and in bytes. The communication between the host and the slave is in 11-bit word format, which consists of 1 start bit, 8 data bits (lowest valid bit sent first), no-in-place check bit, and one stop bit.

9.1.2 Information frame format

Address code	Function code	Data area	CRC check code
1 byte	1 byte	n byte	2 byte

Address code: the address code is composed of one byte (8-bit binary) at the beginning of the frame. The decimal system is 0-255. Only 1-247 is used in the residual current relay, and other addresses are reserved. These bits indicate the address of the interrupt device specified by the user. The device will receive data from the host connected to it. The address of each terminal device must be unique. Only the addressed terminal will respond to the query containing the address. When the terminal sends back a response, the slave address data in the response tells the host which terminal is communicating with it.

Function code: the function code tells the addressed terminal what function to perform. The following table lists the function codes used in this series of instruments. And their significance and function.

function	definition	operation
03H	Read data register	Gets the current binary value of one or more registers

Data area: the data area contains the data required by the terminal to perform specific functions or the data collected when the terminal responds to the query. The contents of the data may be values, reference addresses, or set values. For example, the function code tells the terminal to read a register, and the data area 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 the different contents between the slaves.

CRC check code: the error check (CRC) field takes up two bytes and contains a 16 bit binary value. The CRC value is calculated by the sensing device, and then attached to the data frame. The receiving device recalculates the CRC value when receiving byte data, and then compares it with the value in the received CRC domain. If the two values are not equal, an error occurs.

The process of generating a CRC is as follows:

reset a 16 bit register as 0xFFFF (all 1), which is called CRC register.

The 8-bit of the first byte in the data frame is XOR with the low byte in CRC register, and the result is saved back to CRC register.

Move the CRC register to the right by one bit, fill the highest bit with 0, and move the lowest bit out and detect.

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 (0xa001).

Repeat the third and fourth steps until eight shifts, thus completing a complete octet.

Repeat steps 2 through 5 to process the next octet until all bytes are processed.

The final CRC register value is the CRC value.

In addition, there is a method to calculate CRC by using the 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 materials.

9.1.3 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 a time, but it cannot exceed the defined address range.

The following example is to read the real-time residual current value from ASJ of No.01 slave, address is 0000H.

Host send		Send message
Address code		01H
Function code		03H
Starting address	High byte	00H
	Low byte	00H
Number of registers	High byte	00H
	Low byte	01H
CRC check code	High byte	84H
	Low byte	0AH

Slave return		Return information
Address code		01H
Function code		03H
Number of bytes		02H
Data 1	High byte	00H
	Low byte	00H
CRC check code	High byte	B8H
	Low byte	44H

9.1.4 Function code 06H: Write a single register

The function code 06h allows the user to change the contents of a single register, and the system parameters in the instrument can be written with this function number. The host computer sends one byte data at a time to modify the instrument parameters.

9.2 Communication parameter address table (Word)

address	parameter	Read / write	Numerical range	value type
0000H	Residual current value	R	0-30000mA	word
0001H-0007H	retain			
0008H	Rated residual operating current setting	R/W	10-30000mA	word
0009H	Pre alarm action current value	R/W	10-30000mA	word
000AH-000FH	retain			
0010H	Limit non driving time value	R/W	0-10000ms	word
0011H-0017H	retain			
0018H	postal address	R/W	1-247	word

0019H	Baud rate	R/W	0, 1, 2, 3, 4, 5 correspond to 38.4k, 19.2k, 9600480024001200 respectively	word	
001AH	Disconnection alarm setting	R/W	bit2:bit1:bit0 000: close 001: open	word	
001BH	Alarm status	R	Bit2: Bit1: bit0 000: normal 001: early warning 010: alarm 100: disconnection	word	
001CH	Mode setting	R/W	See the attached table for details	word	
001DH	Protection password	R/W	0000-9999 (default password 0001)	word	
001EH	Di status	R	bit1:bit0 01:ch1 10:ch2	word	
001FH	Backlight delay	R/W	0: the backlight is always on; when it is set to 1-9999, the backlight will turn off after 1-9999 seconds, unit: 1s	word	
0020H-0023H	retain				
0024H	year (H)	R	00-99 means 2000-2099	word	
	month (L)	R	1~12		
0025H	day (H)	R	1~31	word	
	hour (L)	R	0~23		
0026H	min (H)	R	0~59	word	
	seconds (L)	R	0~59		
0021H-002CH	retain				
002DH	First incident record	Record type	R	0 is alarm, 1 is pre alarm	word
002EH		Actual value of alarm	R	0-30000mA	word
002FH		Alarm set point	R	10-30000mA	word
0030H		year (H)	R	Alarm time - year	word
		month (L)	R	Alarm time - month	
0031H		day (H)	R	Alarm time - day	word
		hour (L)	R	Alarm time - hour	
0032H		min (H)	R	Alarm time - min	word
	seconds (L)	R	Alarm time - seconds		
0033H-00C2H	The remaining 24 SOE records	R	The format refers to the first SOE record	word	

note: H: Represents the upper 8 bits; l represents the lower 8 bits;

The parameter of address 001ch indicates the current setting value. See the table below for details.

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0



Significant bit

Bit0	0	Relay al2 terminals 10 and 9 are normally open by default
	1	Relay al2 terminals 10 and 9 are normally closed by default
Bit1	0	The terminals 97 and 96 of relay al1 are normally closed by default and 96 and 95 are normally open by default
	1	The terminals 97 and 96 of relay al1 default to be normally open and 96 and 95 to be normally closed
Bit2	0	Manual reset
	1	Automatic reset

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