S764

ALP220-EF Earth Fault Overcurrent Relay

Installation and User Manual V1.0

Acrel Electric Co., Ltd.

Disclaimer

The Company reserves the right to modify the product specifications described in this manual without prior notice. Before placing an order, please consult your local distributor to obtain the latest specifications for this product.

Edit Resume

Number of times	Change Time	Change version number	Change Reason
1	2026. 7. 13	V1. 0	New Product User Manual – Initial Revision

Catalogue

1 Summary

The ALP220-EF Earth Fault Overcurrent Relay is designed for low-voltage applications (up to 380 V) where it is necessary to monitor the system's ground current and provide protection when the ground current exceeds the permissible limit. This relay features an LCD display, Modbus-RTU communication capability, system current measurement, three-phase current overcurrent protection, ground current overcurrent protection, residual current measurement, residual current overcurrent protection, fault logging, and event logging functions.

The product complies with the relevant standards:

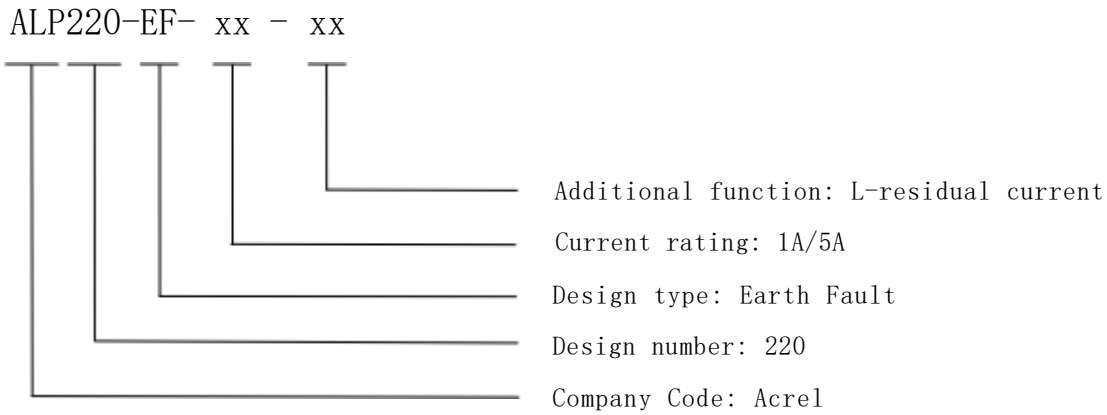
GB/T 14598.27-2025 *"Measuring Relays and Protective Devices —Part 27: Safety Requirementsfor Products "*

GB/T 14598.27-2025 *"Measuring Relays and Protective Devices —Part 26: Electromagnetic Compatibility Requirements "*

GB/T 2423 *"Environmental Testing ofElectrical and Electronic Products —Part 2: Test Methods "*

RoHS Directive 2.0 (2011/65/EU, (EU) 2015/863)

2 Model Specifications



Note: 1. Current rating 1A/5A must be selected based on the primary current transformer specifications xxx/1A or xxx/5A.

2. Residual current protection function requires a separate residual current transformer.

3 Technical Parameter

ALP220-EF Earth Fault Relay; technical specifications are detailed in Table 1:

Table 1: Technical Specifications

Technical parameter	Qualification		
Accessory power supply	Voltage range	AC/DC 85～265V	
	Power dissipation		
Import	Current specifications	ABCN (4-channel): 1A/5A	10%Ie～1000%Ie ±2%
	Residual current specification	30mA-1000mA	±2%
	Frequency	45Hz-65Hz	±0.2Hz
Output	Output method	Dual-channel single-pole double-throw switch	
	Output capacity	Resistive load; AC 250 V 5 A / DC 30 V 5 A	
Installation and Usage Environment	Workplace Scenario	No direct exposure to rain or snow; no corrosive gases; no severe vibration	
	Relative humidity	≤95% RH, no condensation	

	Working temperature	-20℃~+70℃

	Storage temperature	-40℃~+70℃
	Height	≤2000m
	Way to install	Embedded installation: 88×88 (mm)
	Levels of protection	Panel: IP54; Terminals: IP20
Security classification	EMC	Level III

Note: Frequency accuracy measurement error range = Accuracy range; for the accuracy measurement of other parameters, the full-scale error calculation method is applied: Error range = Full scale × Accuracy percentage.

For detailed functional specifications, please refer to Table 2:

Table 2: Functional Configuration

Function		Standard configuration	Optional
Measurement Function	Three-phase alternating current	√	
	Neutral conductor current	√	
	Residual current		√
Defencive function	Inverse-time overcurrent protection	√	
	Inverse Time Grounding	√	
	Three-stage time-delayed overcurrent protection	√	
	Three-stage time-delayed ground fault protection	√	
	Current imbalance	√	
	Leakage current		√
Communication Function	Modbus-RTU	√	
Digital output function	2 Single-pole double-throw switch	√	
Record Function	20 Single fault record	√	
	20 Event Record		
Display Function	Liquid-crystal display	√	
Setpoint Setting Function	Operation Panel Modification	√	
	Communication Amendment		

4 Installation and Wiring

4.1 Outline Overall and Installing Dimensions

The external dimensions ofthe ALP220-EF are shown in the figure below:

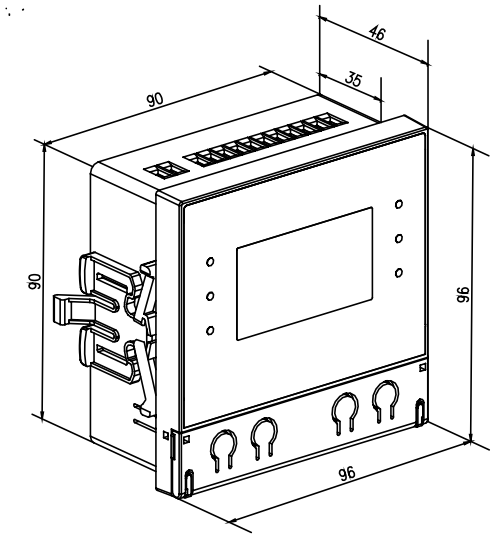


Figure 1: ALP220-EF External Dimensions (Unit: Mm)

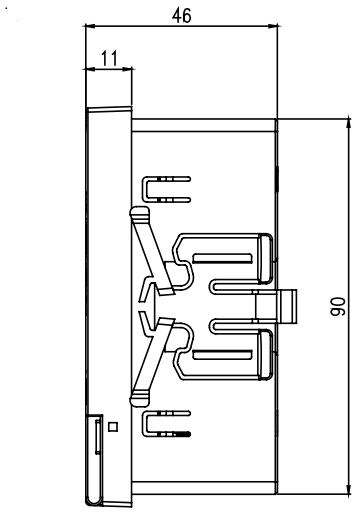


Figure 2: ALP220-EF Side View Dimensions (Unit: Mm)

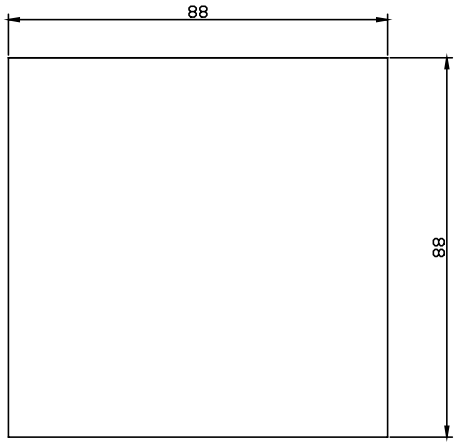


Figure 3: ALP220-EF Installation Opening Dimensions (Unit: Mm)

For Specific Dimensions, Please Refer to Table 3:

Table 3: Dimensional Parameters

Model	Outline dimension(mm)	Housing dimensions (mm)	Opening size (mm)
ALP220-EF	96＊96	90＊90＊46	88 ＊88

5 Operating Guide

5.1 Panel Operation Instructions

The panel is shown in the figure below:

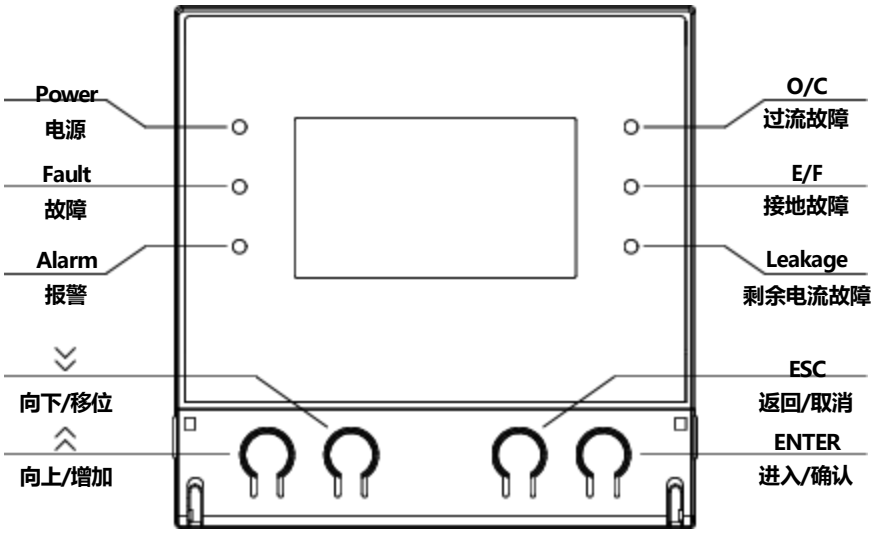


Figure 4: Panel Display Diagram

5.2 Panel Instructions

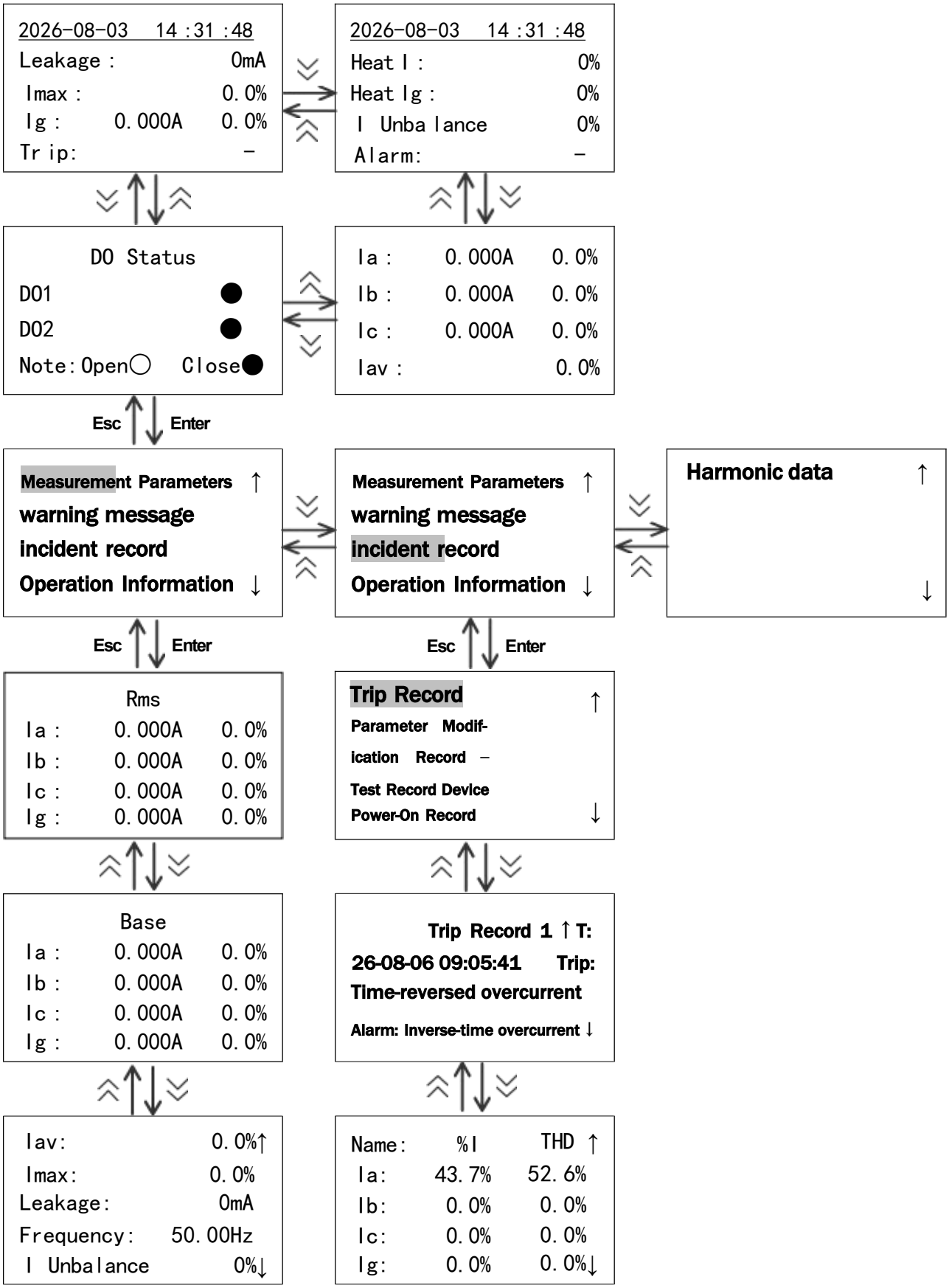
For detailed LED indicator descriptions, please refer to Table 4:

Table 4: LED Indicator Instructions

LED Light Name	Status	Status Description
Power	Off/Always On	Off: No power supply; not in normal operating condition. Always On: Normal operation
Fault	Off/Always On	Off: The measurement circuit is functioning normally. Changliang: Fault detected in the measurement circuit.
Alarm	Off/Always On	Off: The measurement circuit has no alarm. Changliang: Alarm detected in the measurement circuit.
O/C	Off/Always On	Off: The measurement circuit is free of overcurrent faults. Changliang: Overcurrent fault detected in the measurement circuit.
E/F	Off/Always On	Off: The measurement circuit has no ground fault. Changliang: The measurement circuit is experiencing an earth fault.
Leakage	Off/Always On	Off: No residual current fault in the measurement circuit Chang Liang: The measurement circuit is experiencing a residual current fault.

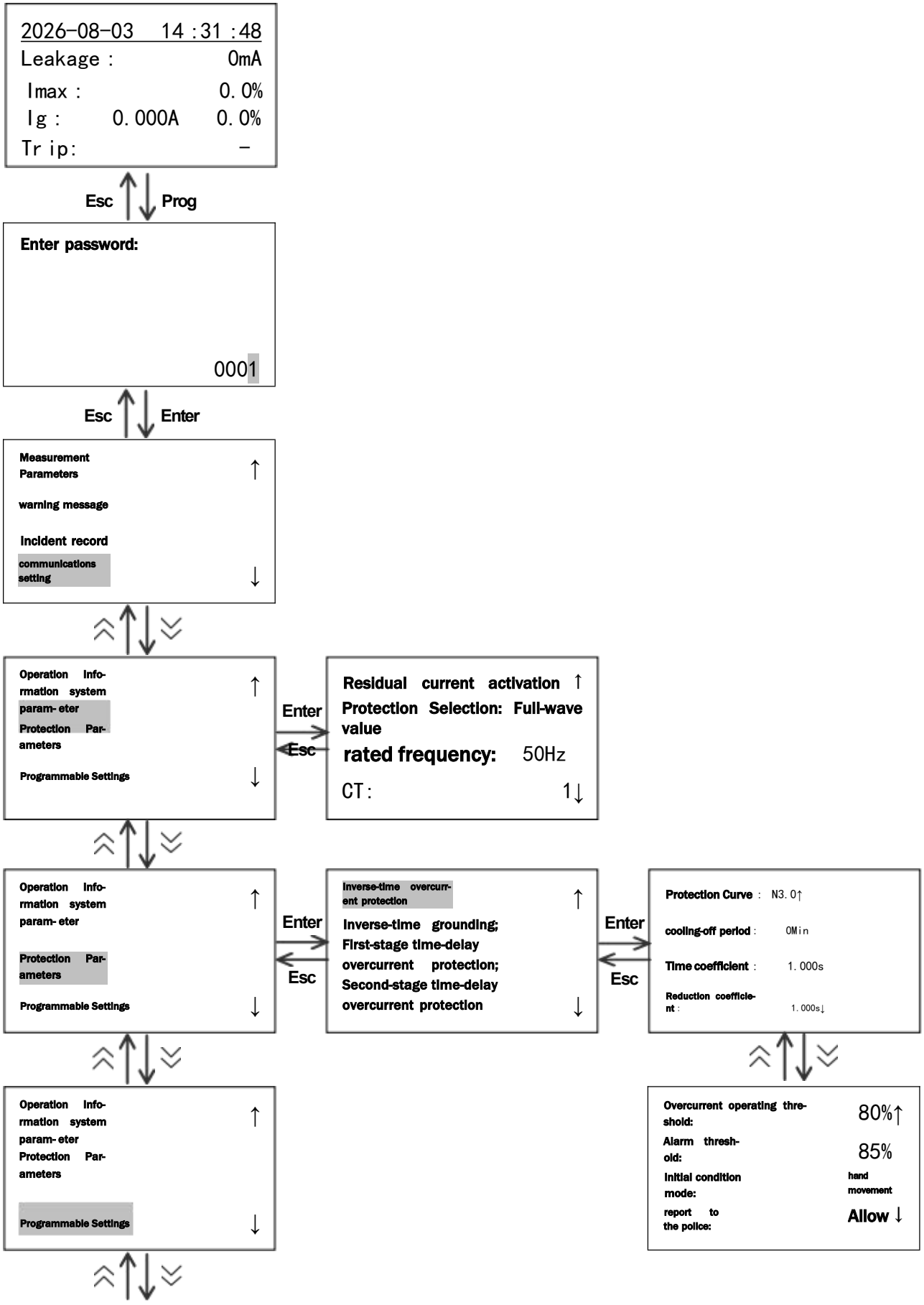
5.3 Operating Interface Instructions

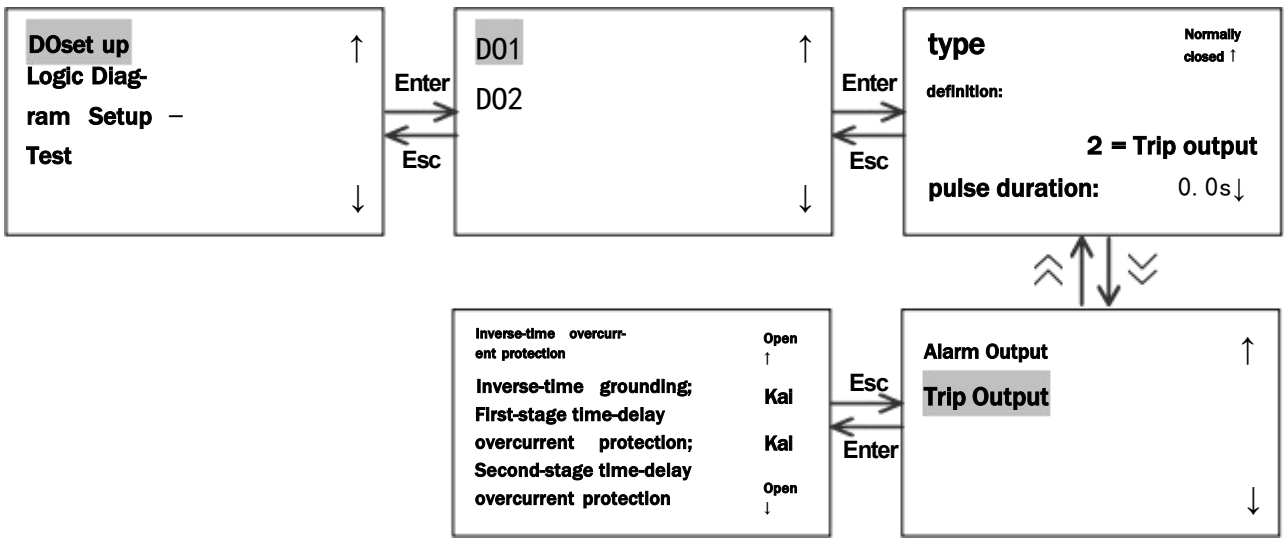
5.3.1 User Interface Display



5.3.2 Configuration Interface Display

After pressing the "Programer" button on the main interface, you can enter a password to access the parameter configuration interface.



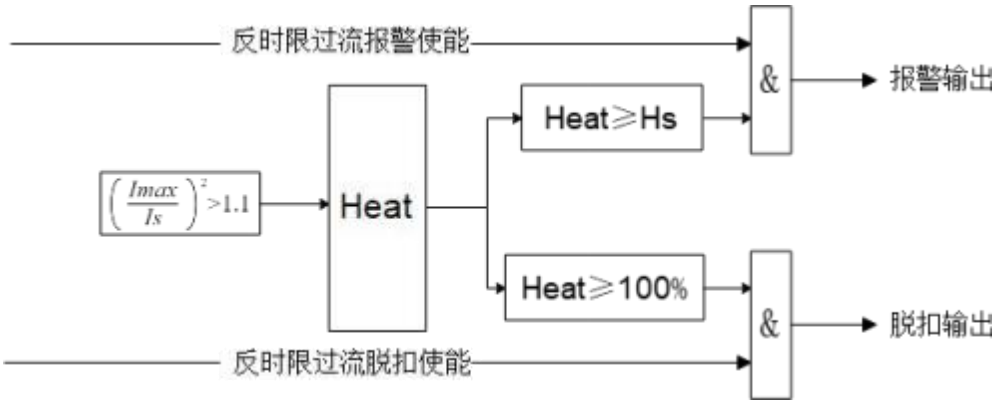


5.4 Protection Logic Explanation

5.4.1 Inverse-Time Overload

When a circuit operates under overload conditions for an extended period, it can lead to cable overheating and reduced insulation, posing a hazard; the protector calculates the cable's thermal capacity based on its pyrexia characteristics, thereby providing protection for both the circuit and the load.

The reverse-time overcurrent protection is triggered when the square of the ratio between the maximum three-phase current (Imax) and the set operating value (Is) exceeds 1.1; at this point, the percentage of line thermal capacity is calculated. When the thermal capacity reaches the set alarm threshold (Hs), an alarm is activated; when the thermal capacity reaches 100%, the protection function is activated.



The inverse-time overcurrent protection system offers a total of five sets of inverse-time characteristic curves for selection; the relay device implements the protection function by monitoring the maximum effective value of the three-phase currents. The calculation formula for the inverse-time overcurrent protection time characteristic complies with the provisions of Formula (1); the protection curve characteristics are shown in Table 5.

$$t = Tp \times \left(\frac{K}{\left(\frac{I}{Is}\right)^{a} - 1} + L\right) \quad \cdots\cdots (1)$$

Where:

T-Trip Time

K-Coefficient (see Table 5)

I – Current Measurement Value

Is – Programmed Threshold Value

-Coefficient (see Table 5)

L – IEC Coefficient (see Table 5)

Tp-1, Time Factor

Inverse-time overcurrent protection operation characteristic:

When the duration of I> Is exceeds t (trip time), the tripping function is activated; after tripping, the reset time characteristic is applied. When the duration of I> Is is less than t (trip time), the reset time characteristic specified herein is applied.

Table 5: Inverse Time Overcurrent Protection Curve Characteristics Table

Characteristic SequenceNumber	Feature Type	Standard	K factor	factor	L factor
N3.0	Standard inverse-time characteristic	IEC	0.14	0.02	0
N1.3	Standard time-reversal function	IEC	0.05	0.02	0.24
U.I.	Very time-reversal-dependent	IEC	13.5	1	0
E.I.	Extreme inverse time constant	IEC	80	2	0
L.t.I	Long-time inverse time constant	IEC	120	1	0

Inverse-time overcurrent protection reset time characteristic:

1) Resetting Behavior:

Alarm Reset Feature:

Return When I <Is.

Trip-Reset Feature:

Before the Inverse-Time Overcurrent Protection Trips:

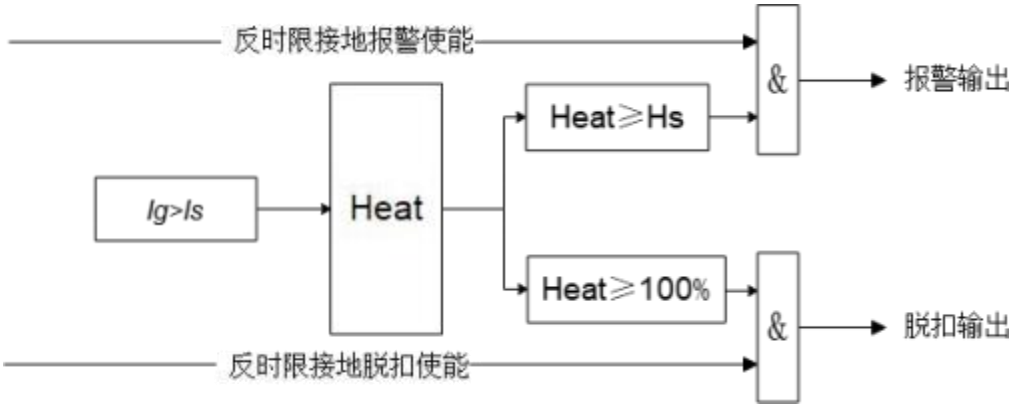
Return When I <Is.

Upon Activation of the Inverse-Time Overcurrent Protection:

Trip Hold: After the Cooling Period Has Elapsed, Reset the Device Using the Reset Button or by Receiving a Reset Command.

5.4.2 Inverse Time Grounding

The triggering condition for the inverse-time zero-sequence overcurrent protection is when the zero-sequence current (Ig) exceeds the preset operating value (Is). The percentage of line thermal capacity is then calculated; when this thermal capacity reaches the preset alarm threshold (Hs), an alarm is generated; when the thermal capacity reaches 100%, the protection function is activated.



The inverse-time grounding protection offers a total of five different inverse-time characteristic clusters for selection; by selecting one of these clusters and monitoring the fundamental ground current, the protection function can be activated. The calculation of the inverse-time grounding protection time characteristic shall comply with the provisions of Formula (2); the time characteristics are shown in Table 6.

$$t = TpE \times \left(\frac{K}{\left(\frac{1\Delta q}{Ise} \right)^{\alpha} - 1} \right) \quad \text{----------（2）}$$

Where:

t-trip time

K-coefficient (see Table 6)

I △ q − Grounded measurement value

Ise − Programmed startup value

-coefficient (see Table 6)

TPE- 1 − Setpoint Time Coefficient

Inverse-time grounding protection operation characteristic:

When the duration of I △ q>Ise is greater than t (trip time), the tripping function is activated; upon tripping, the reset time characteristic is then executed; when the duration of I △ qIse is less than t (trip time), the reset time characteristic specified herein is applied.

Table 6: Low Time-Limit Grounding Protection Characteristic Parameters Table

Characteristic Sequence Number	Feature Type	Standard	K factor	factor
N3.0	Standard time-reversal function	IEC	0.14	0.02
N1.3	Standard time-reversal function	IEC	0.05	0.02
U.I.	Very time-reversal-dependent	IEC	13.5	1
E.I.	Extreme inverse time constant	IEC	80	2
L.t.I	Long-time inverse time con-stant	IEC	120	1

Resetting behavior:

Alarm Reset Feature:

Return when I △ q <Ise.

Trip-Reset Feature:

Before the inverse-time grounding protection operates:

Return when I △ q <Ise.

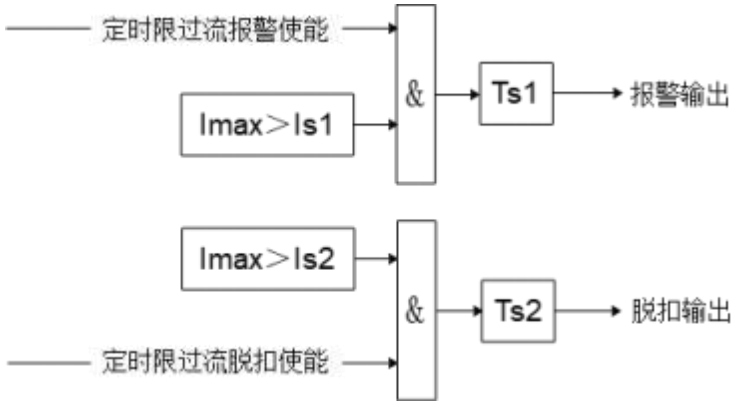
Upon activation of the inverse-time grounding protection:

Trip hold: After the cooling period has elapsed, reset the device using the reset button or by receiving a reset command.

5.4.3 Time-Delay Overcurrent Protection

When the average line current Iav exceeds the set threshold Is, a time-delayed overcurrent protection mechanism is activated; a delay time Ts can be configured, after which the protection action will be triggered.

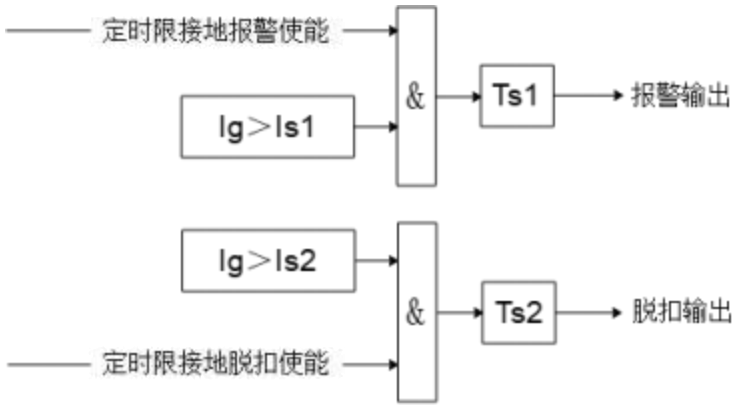
This device features a three-stage time-based overcurrent protection scheme, allowing for the setting of different overcurrent thresholds and tripping times.



5.4.4 Time-Delayed Ground Fault

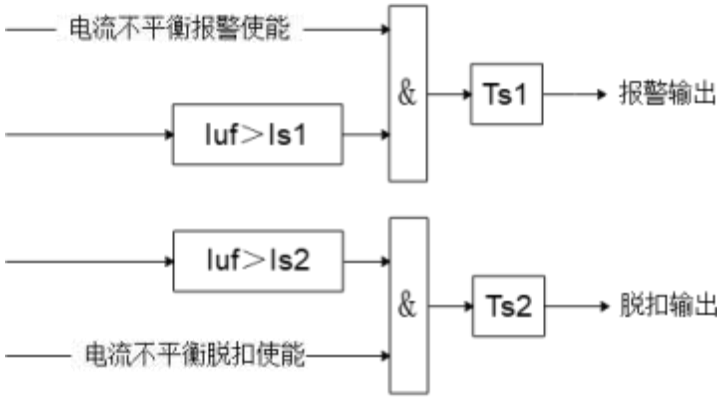
The zero-sequence current is calculated from the three-phase currents; when the zero-sequence current (Ig) exceeds the set threshold (Is), a time-limited overcurrent protection is activated. The delay time (Ts) can be configured, and the protection action will be triggered after this delay period has elapsed.

This device features a three-stage time-determined zero-sequence overcurrent protection scheme, allowing the setting of different overcurrent thresholds and tripping times.



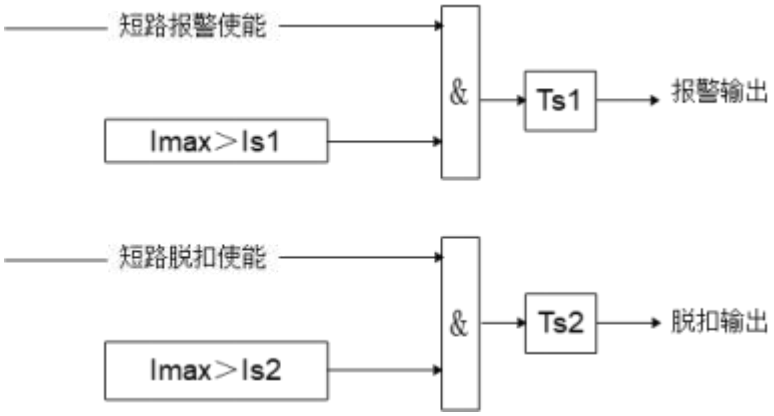
5.4.5 Current Unbalance

The current imbalance degree Iuf is calculated based on the acquired three-phase current data; when the current imbalance exceeds the set threshold Is, an alarm or trip command is issued after the preset protection delay Ts has elapsed.



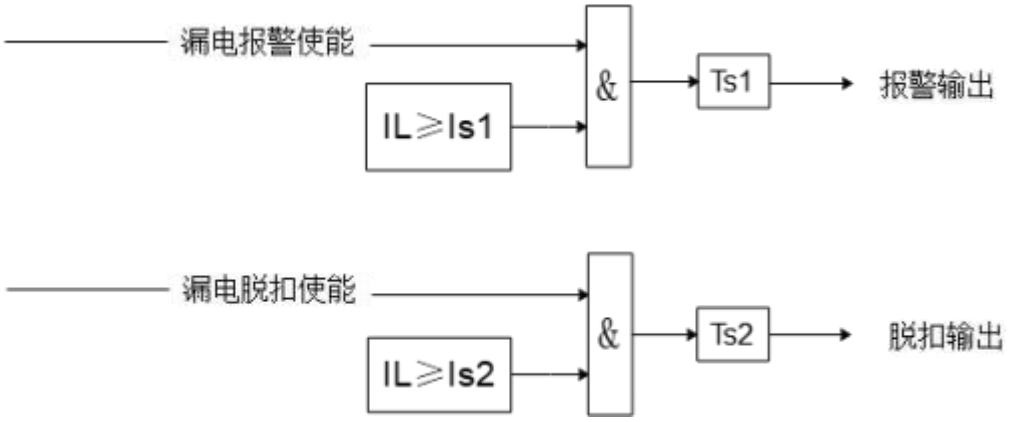
5.4.6 Short Circuit

When the maximum line current Imax exceeds the short-circuit current threshold Is, a trip command is issued after the preset protection delay period has elapsed.



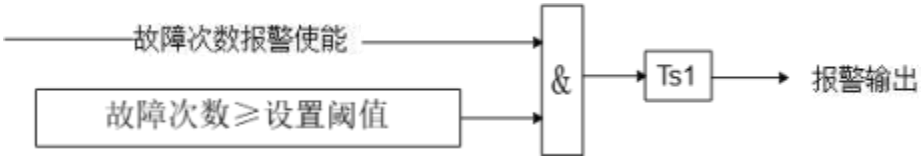
5.4.7 Leakage of Electricity

For residual current protection, a residual current transformer must be installed; this transformer detects the residual current (IL). When the residual current exceeds the set value (Is), a trip command is issued after the preset protection delay period has elapsed.



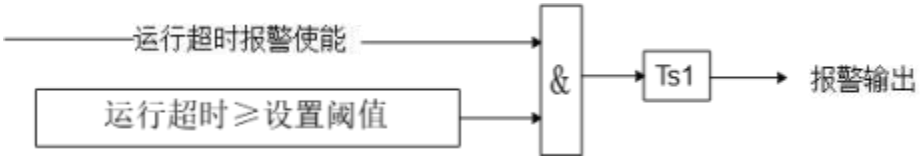
5.4.8 Number of Faults

When the cumulative number of faults triggered by the device exceeds the preset threshold, a trip command is issued after the specified protection delay.



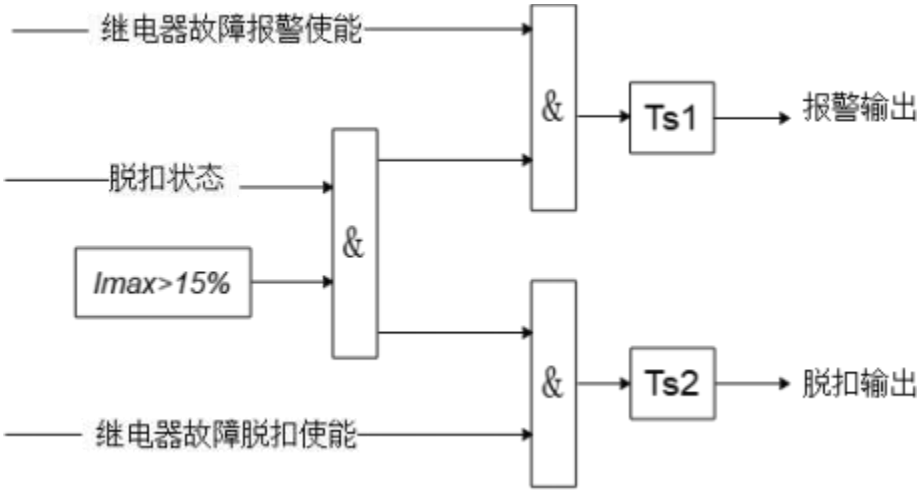
5.4.9 Operation Timeout

When the operating current exceeds the rated current by 15%, the cumulative operating time is initiated; when the operating time exceeds the preset threshold, a trip command is issued after the specified protection delay.



5.4.10 Relay Fault

When a fault is detected and an output is generated, if the maximum current exceeds the rated current by 15%, a trip command shall be issued after the preset protection delay period has elapsed.



6 Communication Guide

6.1 Modbus RTU Communication Protocol Overview

Electrical interface: RS485 (Half-Duplex)

Baud rate: 1200/2400/4800/9600/19200/38400

Address: Composed of one byte (8-bit binary), ranging from 0 to 255; only values from 1 to 247 are used in the system; the remaining values are reserved.

Error detection: CRC

Data Cell	Address code	FC	Data field	CRCverification	type:
Long data	1 1 byte	1 1 byte	Nbyte	2 1 byte	Deg-ree:

Each byte: 1-bit start bit, 8-bit data bits (minimum valid bit sent first), no parity check, 1-bit stop bit; MODBUS function codes supported by ALP220-EF:

01 (0x01) Function Code: Read Coil Status (Relay Output DO; Address 0 corresponds to DO1) 03/04 (0x03,0x04) Function Codes: Read Holding Register

05 (0x05) Function Code: Write coil status (control relay output DO; address 0 corresponds to DO1)

06 (0x06) Function Code: Write to a single register

16 (0x10) Function Code: Write to multiple registers

Note: The Run Control Bit and Output Control Bit should be written using a 16-bit function code.

Communication App

The examples presented in this section should, where possible, follow the format shown in the table below (data is in hexadecimal).

Addr	Fun	Data start		Data		CRC16	
		reg Hi	reg Lo	reg Hi	reg Lo	Lo	Hi
01H	03H	00H	00H	00H	06H	C5H	C8H
Address	FC	Data starting address		Number of data reads		CRC	

6.2 Correspondence Address Form

Table 7: Correspondence Address Table

Classify	Origin Address	Finish Address	Parameter	Read-write Attribute	Span	Type	Give tacit consent to
Protection Parameter (Full-Wave Value)	0		Phase A effective current	R	The higher character comes first; the lower character comes last – xxxx.xxxA	word	
	2		B-phase effective current	R	The higher character comes first; the lower character comes last.	word	
	4		C: Effective Value Current	R	The higher character comes first; the lower character comes last.	word	
	6		N-phase effective current	R	The higher character comes first; the lower character comes last.	word	
	8		Frequency	R	45.00-65.00	word	
	9		Leakage current	R	0-1000mA	word	
	10		Current imbalance degree	R	0-200%	word	
	11		Current-carrying thermal capacity percentage	R	0-100%	word	
	12		Ground thermal capacity percentage	R	0-100%	word	
	13		Phase A effective value current percentage	R	0-100.0%	word	
	14		B-phase effective value current percentage	R	0-100.0%	word	
	15		C Phase Effective Current Percentage	R	0-100.0%	word	
	16		N-phase effective current percentage (Ig)	R	0-100.0%	word	

	17		Average Effective Value Current Percentage	R	0-100.0%	word	
	18		Maximum effective value current percentage	R	0-100.0%	word	
	19	21	Keep			word	
	22		Phase A reference current	R	The higher character comes first; the lower character comes last.	word	
	24		B-phase base current	R	The higher character comes first; the lower character comes last.	word	
	26		C Phase Base Current	R	The higher character comes first; the lower character comes last.	word	
	28		N-phase base current	R	The higher character comes first; the lower character comes last.	word	
	30		Phase A Base Current Percentage	R	0-100.0%	word	
	31		B-phase base-line current percentage	R	0-100.0%	word	
	32		C Phase Base Current Percentage	R	0-100.0%	word	
	33		N-phase base current percentage	R	0-100.0%	word	
	34		Average fundamental current percentage	R	0-100.0%	word	
	35		Maximum fundamental current percentage	R	0-100.0%	word	
	36		Days	R/W	High byte: 00-99 Low byte: 0-12	word	
	37		Time and Date	R/W	High byte: 0-31 Low byte: 0-23	word	
	38		A minute and a second	R/W	High byte: 0-59 Low byte: 0-59	word	
	39	49	Keep				
	50		Trip status	R	Bit0: Inverse-time overcurrent protection; Bit1: Inverse-time grounding; Bit2: Time-limited overcurrent protection; Bit3: Two-stage time-delayed overcurrent protection; Bit4: Three-stage time-delayed overcurrent protection; Bit5: Time-limited ground fault; Bit6: Two-stage time-limited grounding; Bit7: Three-stage time-delayed ground fault protection; Bit8: Current imbalance; Bit9: Leakage of electricity; Bit10: Short circuit; Bit11: Relay fault;	word	
	51		Alarm Status	R	Bit0: Inverse-time overcurrent protection; Bit1: Inverse-time grounding; Bit2: Time-limited overcurrent protection; Bit3: Two-stage time-delayed overcurrent protection; Bit4: Three-stage time-delayed overcurrent protection; Bit5: Time-limited ground fault; Bit6: Two-stage time-limited grounding; Bit7: Three-stage time-delayed ground fault protection; Bit8: Current imbalance; Bit9: Leakage of electricity; Bit10: Short circuit; Bit11: Relay fault; Bit12: Number of faults; Bit13: Performance period	word	
	52		DO state	W/R	Bit0: Relay 1; Bit1: Relay 2 (Communication Control - requires standard DO or communication output DO)	word	

	53		Running state	R	Bit0: Move Bit1: Alarm Bit2: Trip	word	
	54		Logic Diagram State	R	Bit0–2: Logic Diagram 1–3: Output State	word	
	55		Total fault trip count	R		word	
	56	57	Last power-on to trip time	R	0-65535Min	word	
	58	59	Cumulative operating time	R	0-65535H	word	
	60		Current number of power-on events recorded	R	0-60000	word	
	61		Number of power outages recorded so far	R	0-60000	word	
	62		Remaining fault count	R		word	
	63		Remaining runtime	R		word	
	64		Keep				
	65		Latest test record address	R		word	
	66		Latest parameter modification record – Contact address	R		word	
	67		Latest fault record address	R		word	
	68		Latest device power-on communication address	R		word	
	69		Latest device power-off record communication address	R		word	
	70	81	Keep				
	82		Software release			word	
	83		Software Version Number	R		word	
	84	99	Keep	R			
System parameter	100		MODBUS RTUl Address Configuration	R/W	1～247	word	
	101		MODBUS RTUl baud rate configuration	R/W	0～5	word	
	102		MODBUS RTUl Parity Bit	R/W	0～3	word	
	103		Current specifications	R	10-1A; 50-5A	word	
	104		CTl Ratio	R/W		word	
	105		CT2 Ratio (Retained)	R/W		word	
	104		Residual Current Transformer Activation Indicator	R/W		word	
	105		Baseband Switch	R/W	0 – RMS value; 1 – Fundamental frequency	word	
	106		Rated frequency	R/W	45-70	word	
	107		Chinese/English Switch	R/W	0- Chinese; 1-English	word	
	108		Backlighting Time	R/W	0-30s	word	
	109		Contrast ratio	R/W	15-85%	word	
	110		Current shielding value	R/W	1.0%～10.0%	word	
	111		Password	R/W		word	
	112		Keep	R			
	113		Remote Reset	W	0xa5a5		
	114		Factory data reset	W	0xFFFF		
	115		Clear runtime information	W	0xa5b5		
	116		Clear Records	W	0xa5b5		
	117	118	Keep				

Test pattern	200		Communication Point	R/W	0xa5a5 does not trigger a DO action or trip recording.		
	201		DOl Control	R/W	0xa5a5 − Recovery in l0 seconds		
	212		DO2 Control	R/W			
	213	214	Keep DO3-DO4	R/W			
	215		Inverse-time overcurrent protection	R/W	0xa5a5 Triggers corresponding to trip and trip recording	word	
	216		Inverse Time Grounding	R/W		word	
	217		Time-limited overcurrent protection	R/W		word	
	218		Two-stage time-limited overcurrent protection	R/W		word	
	219		Three-stage time-delayed overcurrent protection	R/W		word	
	220		Time-limited ground fault protection	R/W		word	
	221		Two-stage time-limited grounding	R/W		word	
	222		Three-stage time-delayed ground fault protection	R/W		word	
	223		Current imbalance	R/W		word	
	224		Leakage of electricity	R/W		word	
	225		Low current	R/W		word	
	226		Short	R/W		word	
	227		Contactor fault	R/W		word	
	228		Number of faults	R/W		word	
	229	235	Keep	R/W			
Basic Protection	300		Trip Enable	R/W	Bit0: Inverse-time overcurrent protection; Bit1: Inverse-time grounding; Bit2: Time-limited overcurrent protection; Bit3: Two-stage time-delayed overcurrent protection; Bit4: Three-stage time-delayed overcurrent protection; Bit5: Time-limited ground fault; Bit6: Two-stage time-limited grounding; Bit7: Three-stage time-delayed ground fault protection; Bit8: Current imbalance; Bit9: leakage of electricity; Bit10: short; Bit11: Relay fault; Bit12: Number of faults; Bit15: internal fault	word	
	301		Alarm Enable	R/W	Bit0: Inverse-time overcurrent protection; Bit1: Inverse-time grounding; Bit2: Time-limited overcurrent protection; Bit3: Two-stage time-delayed overcurrent protection; Bit4: Three-stage time-delayed overcurrent protection; Bit5: Time-limited ground fault; Bit6: Two-stage time-limited grounding; Bit7: Three-stage time-delayed ground fault protection; Bit8: Current imbalance; Bit9: leakage of electricity; Bit10: short; Bit11: Relay fault; Bit12: Number of faults; Bit13: performance period; Bit15: internal fault	word	

	302		Inverse-time overcurrent protection curve	R/W	0-N3.0 (0.14) 1-N1.3 (0.05) 2-U.I. (13.5) 3-E.I. (80) 4 -L.t.I (120)	word	N3.0 (0.14)
	303		Inverse-time overcurrent protection cooling time	R/W	0-30min	word	0min
	304		Inverse Time-Dependent Overcurrent Time Coefficient	R/W	0.025s-1.500s	word	1.000s
	305		Inverse-time overcurrent reset time coefficient	R/W	0.025s-3.200s	word	1.000s
	306		Overcurrent startup threshold value	R/W	2%-1000%	word	80%
	307		Inverse-time overcurrent thermal capacity alarm percentage	R/W	10%-100%	word	85%
	308		Inverse-time overcurrent protection reset mode	R/W	0-Manual | 1-Automatic	word	Hand movement
	309		Inverse Time-Dependent Grounding Protection Curve	R/W	0-N3.0 (0.14) 1-N1.3 (0.05) 2-U.I. (13.5) 3-E.I. (80) 4 -L.t.I (120)	word	N3.0 (0.14)
	310		Inverse Time-to-Grounding Time Coefficient	R/W	0.025s-1.500s	word	1.000s
	311		Grounding Start-Up Threshold	R/W	2%-1000%	word	10%
	312		Ground Thermal Capacity Alarm Percentage	R/W	10%-100%	word	20%
	313		Time-limited overcurrent alarm threshold	R/W	2%-1000%	word	70%
	314		Time-limited overcurrent protection threshold	R/W	2%-1000%	word	80%
	315		Time-limited overcurrent alarm delay	R/W	0.01s-100.00s	word	10s
	316		Time-limited overcurrent protection delay	R/W	0.01s-100.00s	word	10s
	317		Time-limited overcurrent protection return coefficient	R/W	2%-15%	word	5%
	318		Two-stage time-limited overcurrent alarm threshold	R/W	2%-1000%	word	250%
	319		Two-stage time-limited overcurrent protection threshold	R/W	2%-1000%	word	300%
	320		Two-stage time-limited overcurrent alarm delay	R/W	0.01s-100.00s	word	1s
	321		Two-stage time-limited overcurrent protection delay	R/W	0.01s-100.00s	word	1s
	322		Two-stage time-limited overcurrent protection return coefficient	R/W	2%-15%	word	5%
	323		Three-stage time-delayed overcurrent alarm threshold	R/W	2%-1000%	word	500%
	324		Three-stage time-delayed overcurrent protection threshold	R/W	2%-1000%	word	600%
	325		Three-stage time-delayed overcurrent alarm delay	R/W	0.01s-100.00s	word	0.05s
	326		Three-stage time-delayed overcurrent protection delay	R/W	0.01s-100.00s	word	0.05s
	327		Three-stage time-delayed overcurrent protection return factor	R/W	2%-15%	word	5%
	328		Time-limited ground fault alarm threshold	R/W	2%-1000%	word	8%
	329		Time-limited ground-trip threshold	R/W	2%-1000%	word	10%
	330		Time-limited ground fault alarm with delay	R/W	0.01s-100.00s	word	1s
	331		Time-delayed ground-fault tripping delay	R/W	0.01s-100.00s	word	1s
	332		Time-limited ground fault protection return coefficient	R/W	2%-15%	word	5%
	333		Two-stage time-delayed ground fault alarm threshold	R/W	2%-1000%	word	150%
	334		Two-stage time-limited grounding trip threshold	R/W	2%-1000%	word	200%
	335		Two-stage time-limited ground fault alarm delay	R/W	0.01s-100.00s	word	0.5s

	336		Two-stage time-limited ground-fault tripping delay	R/W	0.01s-100.00s	word	0.5s
	337		Two-stage time-delayed ground fault protection return coefficient	R/W	2%-15%	word	5%
	338		Three-stage time-delayed ground fault alarm threshold	R/W	2%-1000%	word	350%
	339		Three-stage time-delay ground-fault tripping threshold	R/W	2%-1000%	word	400%
	340		Three-stage time-delayed ground fault alarm	R/W	0.01s-100.00s	word	0.05 s
	341		Three-stage time-delayed ground-fault tripping	R/W	0.01s-100.00s	word	0.05 s
	342		Three-stage time-delayed ground fault protection return coefficient	R/W	2%-15%	word	5%
	343		Current imbalance alarm threshold	R/W	10%-100%	word	20%
	344		Current imbalance trip threshold	R/W	10%-100%	word	30%
	345		Current imbalance alarm delay	R/W	0.01s-100.00s	word	5s
	346		Current imbalance tripping delay	R/W	0.01s-100.00s	word	5s
	347		Current imbalance return coefficient	R/W	2%-15%	word	5%
	348		Earth leakage alarm threshold	R/W	30mA-1000mA	word	80mA
	349		Ground Fault Tripping Threshold	R/W	30mA-1000mA	word	100mA
	350		Earth leakage alarm delay	R/W	0.01s-100.00s	word	5s
	351		Earth leakage tripping with delay	R/W	0.01s-100.00s	word	5s
	352		Grounding Return Factor	R/W	2%-15%	word	5%
	353		Reserve	R/W		word	
	354		Short-circuit alarm threshold	R/W	2%-1000%	word	600%
	355		Short-circuit trip threshold	R/W	2%-1000%	word	800%
	356		Short-circuit alarm delay	R/W	0.01s-100.00s	word	0.01 s
	357		Short-circuit trip delay	R/W	0.01s-100.00s	word	0.01 s
	358		Short-circuit Return Factor	R/W	5%-50%	word	5%
	359		Runtime Alarm Condition	R/W	1-50000H	word	10000H
	360		Fault Occurrence Alarm Condition	R/W	1-50,000 times	word	1000 times
	361		Contactor fault delay		0.01s-10.00s	word	1.0s
	362		Protection Shielding Time	R/W	0.0s-10.0s	word	0.0s
	363	349	Reserve	R/W			
Programmable settings	400		Relay Initial State Setting	R/W	0 – Normally Open; 1 – Normally Closed; Bit0-Bit1 corresponds to DO1-DO2	word	
	401		DO1 Programmable Definition	R/W	0 – Normal DO; 1-Alarm Output; 2 – Trip output; 3 – Device power-on output; 4 – Comm-unication output; 5 – Logic Diagram 1 output; 6 – Logic Diagram 2 output; 7 – Logic Diagram 3 output; 10 – Self-diagnostic output;	word	
	402		DO1 Action Setting (Time)	R/W	0-Level; (3-1000) – Pulse width, unit: 0.1s	word	

	403		DO1 Trip Fault Specific Setting 1	R/W	Corresponding trip permit position 1 definition	word	
	404		DO1 alarm fault – Specific Configuration 1	R/W	Corresponding alarm allowable position 1 definition	word	
	405		DO2 Programmable Definition	R/W	0 – Normal DO; 1-Alarm Output; 2 – Trip output; 3 – Device power-on output; 4 – Comm-unication output; 5 – Logic Diagram 1 output; 6 – Logic Diagram 2 output; 7 – Logic Diagram 3 output; 10 – Self-diagnostic output;	word	
	406		DO2 Action Setting (Time)	R/W	0–Level; (3–1000) – Pulse width, unit: 0.1s	word	
	407		DO2 Release Fault – Specific Setting 1	R/W	Corresponding trip permit position 1 definition	word	
	408		DO2 Alarm Fault Specific Configuration 1	R/W	Corresponding alarm allowable position 1 definition	word	
	409	379	Reserve	R/W			
	420		Logic Diagram Input Definition 1	R/W	0 – Off; 1-A; 2-A*B; 3-A+B; 4-A*B*C; 5- (A+B)*C; 6- (A*B)+C; 7-A+B+C; 8-A*B*C*D; 9- (A+B)*C*D; 10- (A*B+C)*D; 11- (A+B+C)*D; 12-A*B*C+D; 13- (A+B)*C+D; 14-A*B+C+D; 15-A+B+C+D; 16-A*B*C*D*E; 17- (A+B)*C*D*E; 18- (A*B+C)*D*E; 19- (A+B+C)*D*E; 20- (A*B*C+D)*E; 21- ((A+B)*C+D)*E; 22- (A*B+C+D)*E; 23- (A+B+C+D)*E; 24-A*B*C*D+E; 25- (A+B)*C*D+E; 26- (A*B+C)*D+E; 27- (A+B+C)*D+E; 28-A*B*C+D+E; 29- (A+B)*C+D+E; 30-A*B+C+D+E; 31-A+B+C+D+E	word	

	421		Input Condition A	R/W	Lower byte: 0 – No input; 1–2 DO1–DO2 10 – Total Alarm Output; 11–24 Alarm Outputs; 11 – Time-Constant Overcurrent; 12 – Time-reversal grounding; 13 – Single-time-duration overcurrent protection; 14 -stage time-delayed overcurrent protection; 15-stage time-delayed overcurrent protection; 16 – Time-limited grounding; 17-stage time-delayed grounding; 18 – Three-stage time-delayed ground fault; 19 – Current imbalance; 20 – Ground leakage; 21 – Short circuit; 22 – Contactor fault; 23 – Number of faults; 24 – Operating time; 40 – Total tripping output; 41–52 – Tripping outputs; 60 – Device power-on output; 61 – Self-diagnosis output; 70 – Communication output 1; 71 – Communication Output 2; 80 – Logic Diagram 1 Output; 81 – Logic Diagram 2 (Output); 82 – Logic Diagram 3 (Output); High byte 0 – Positive Logic; 1 – Inverted Logic	word	
	422		Input Condition B	R/W	Ditto	word	
	423		Input Condition C	R/W	Ditto	word	
	424		Input Condition D	R/W	Ditto	word	
	425		Input Condition E	R/W	Ditto	word	
	426		Enter delay time	R/W	0.0s-100.0s	word	
	427		Enter B delay time	R/W	0.0s-100.0s	word	
	428		Enter C delay time	R/W	0.0s-100.0s	word	
	429		Enter D delay time	R/W	0.0s-100.0s	word	
	430		Enter E for delay time	R/W	0.0s-100.0s	word	

	431		Logic Diagram Input Definition 2	R/W	0 – Off; 1-A; 2-A*B; 3-A+B; 4-A*B*C; 5- (A+B)*C; 6- (A*B)+C; 7-A+B+C; 8-A*B*C*D; 9- (A+B)*C*D; 10- (A*B+C)*D; 11- (A+B+C)*D; 12-A*B*C+D; 13- (A+B)*C+D; 14-A*B+C+D; 15-A+B+C+D; 16-A*B*C*D*E; 17- (A+B)*C*D*E; 18- (A*B+C)*D*E; 19- (A+B+C)*D*E; 20- (A*B*C+D)*E; 21- ((A+B)*C+D)*E; 22- (A*B+C+D)*E; 23- (A+B+C+D)*E; 24-A*B*C*D+E; 25- (A+B)*C*D+E; 26- (A*B+C)*D+E; 27- (A+B+C)*D+E; 28-A*B*C+D+E; 29- (A+B)*C+D+E; 30-A*B+C+D+E; 31-A+B+C+D+E	word	
	432		Input Condition A	R/W	Ditto	word	
	433		Input Condition B	R/W	Ditto	word	
	434		Input Condition C	R/W	Ditto	word	
	435		Input Condition D	R/W	Ditto	word	
	436		Input Condition E	R/W	Ditto	word	
	437		Enter delay time	R/W	0.0s-100.0s	word	
	438		Enter B delay time	R/W	0.0s-100.0s	word	
	439		Enter C delay time	R/W	0.0s-100.0s	word	
	440		Enter D delay time	R/W	0.0s-100.0s	word	
	441		Enter E for delay time	R/W	0.0s-100.0s	word	

	442		Logic Diagram Input Definition 3	R/W	0 – Off; 1-A; 2-A*B; 3-A+B; 4-A*B*C; 5- (A+B)*C; 6- (A*B)+C; 7-A+B+C; 8-A*B*C*D; 9- (A+B)*C*D; 10- (A*B+C)*D; 11- (A+B+C)*D; 12-A*B*C+D; 13- (A+B)*C+D; 14-A*B+C+D; 15-A+B+C+D; 16-A*B*C*D*E; 17- (A+B)*C*D*E; 18- (A*B+C)*D*E; 19- (A+B+C)*D*E; 20- (A*B*C+D)*E; 21- ((A+B)*C+D)*E; 22- (A*B+C+D)*E; 23- (A+B+C+D)*E; 24-A*B*C*D+E; 25- (A+B)*C*D+E; 26- (A*B+C)*D+E; 27- (A+B+C)*D+E; 28-A*B*C+D+E; 29- (A+B)*C+D+E; 30-A*B+C+D+E; 31-A+B+C+D+E	word	
	443		Input Condition A	R/W	Ditto	word	
	444		Input Condition B	R/W	Ditto	word	
	445		Input Condition C	R/W	Ditto	word	
	446		Input Condition D	R/W	Ditto	word	
	447		Input Condition E	R/W	Ditto	word	
	448		Enter delay time	R/W	0.0s-100.0s	word	
	449		Enter B delay time	R/W	0.0s-100.0s	word	
	450		Enter C delay time	R/W	0.0s-100.0s	word	
	451		Enter D delay time	R/W	0.0s-100.0s	word	
	452		Enter E for delay time	R/W	0.0s-100.0s	word	
	453	429	Keep	R/W		Word	
Test Record 1	600		Action 1 – Time (Year-Month)	R		word	
	601		Action 1 – Time (Day/Hour)	R		word	
	602		Action 1 – Time (minutes/seconds)	R		word	
	603		Test Type	R	1-Communication Point; 2-DO Drive; 3-Protective Drive	word	

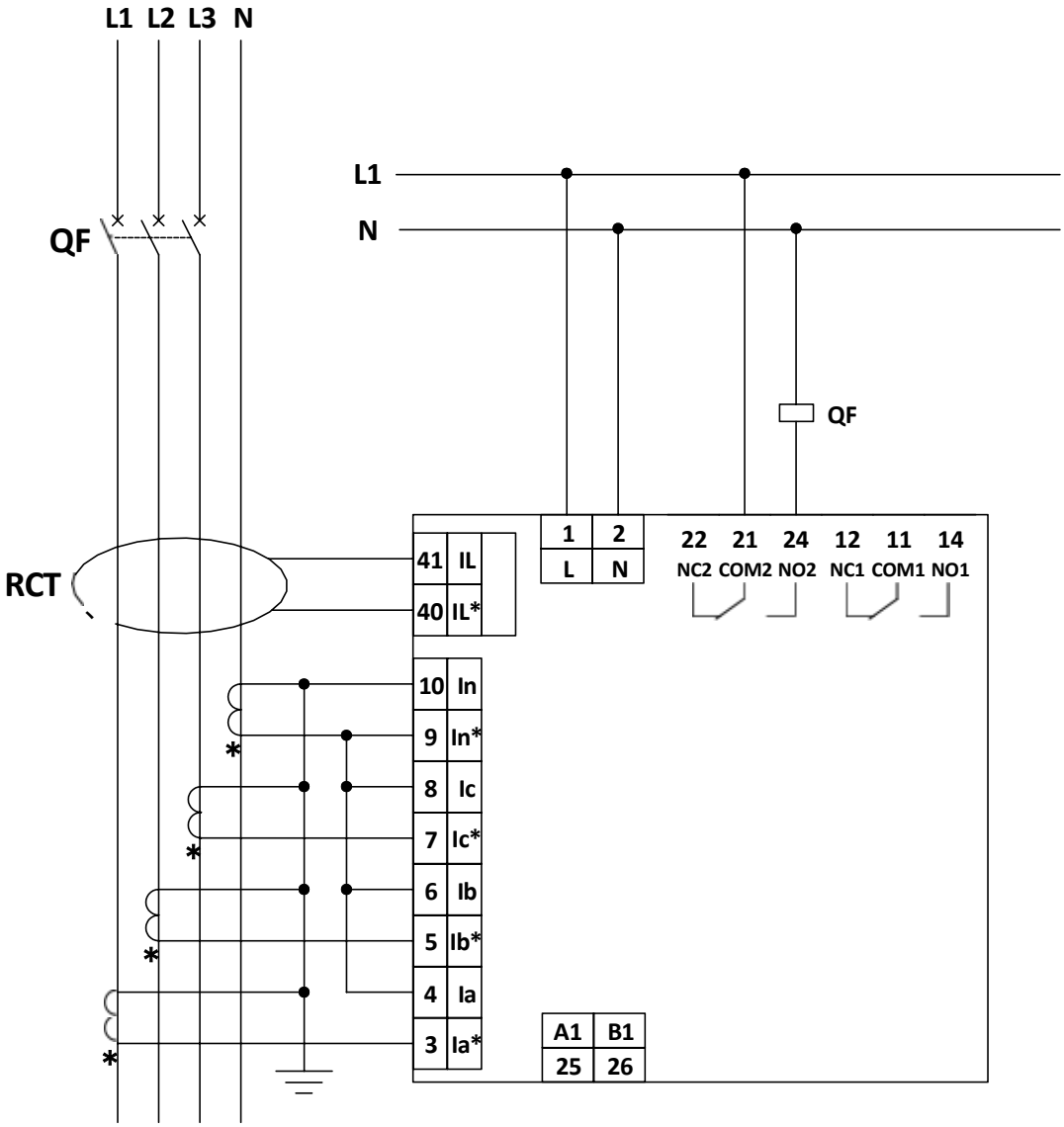
	604		Transmission object	R	1-DO1; 2-DO2; 3–4 (DO3–DO4); 5– Inverse time overcurrent protection; 6 – Inverse-time grounding protection; 7 – Single-stage time-delayed overcurrent protection; 8 – Two-stage time-delayed overcurrent protection; 9 – Three-stage time-delayed overcurrent protection; 10– Single-stage time-delayed grounding protection; 11-Step Time-Domain Ground Fault Protection; 12– Three-stage time- delayed ground fault protec- tion; 13 – Current imbalance; 14 – Ground leakage; 15 – Short circuit; 16 – Contactor fa-ult; 17 – Numberof faults; 18 - Operation timeout	word	
	605		DOcurrent state	R	bit0-DO1; bit1-DO2	bit	
	606	607	Keep	R		word	
Test Record 2 ~ Test record 19	608		Ditto	R		word	
	~			R		word	
		759		R		word	
Reserve	760	639					
Parameter Modification Record	800		Last modified – Date (Year/Month)	R		word	
	801		Modification Time – Day/Time	R		word	
	802		Last modified – minutes and seconds	R		word	
	803		Primary mailing address	R		word	
	804		Postal address length	R		word	
	805		Setup Method	R	0=lcd, 1=rs485-1	word	
Parameter Modification Record 2-20	806		Ditto	R		word	
	~			R		word	
		919		R		word	
Reserve	920	999					
Device Power-On Record 1	1000		Device Power-On Time – Date (Year/Month)	R		word	
	1001		Device Power-On Time – Day/Hour	R		word	
	1002		Device power-on time – minutes/seconds	R		word	
	1003		This Article – Power-On Index	R	Record the number of times the device has been powered on.	word	
Device Power-On Record – 2–8	1004	1031				word	
Reserve	1032	1079					
Device Power Off Record 1	1080		Device power-off duration – Year/Month	R		word	
	1081		Device Power Off Duration – Days/Hours	R		word	
	1082		Device power-off duration – minutes/seconds	R		word	
	1083		This section – Power Outage Index	R	Record how many times the power has been cut off this time.	word	
Device Power Off Record 2-8	1084	1111				word	

Reserve	1112	1159					

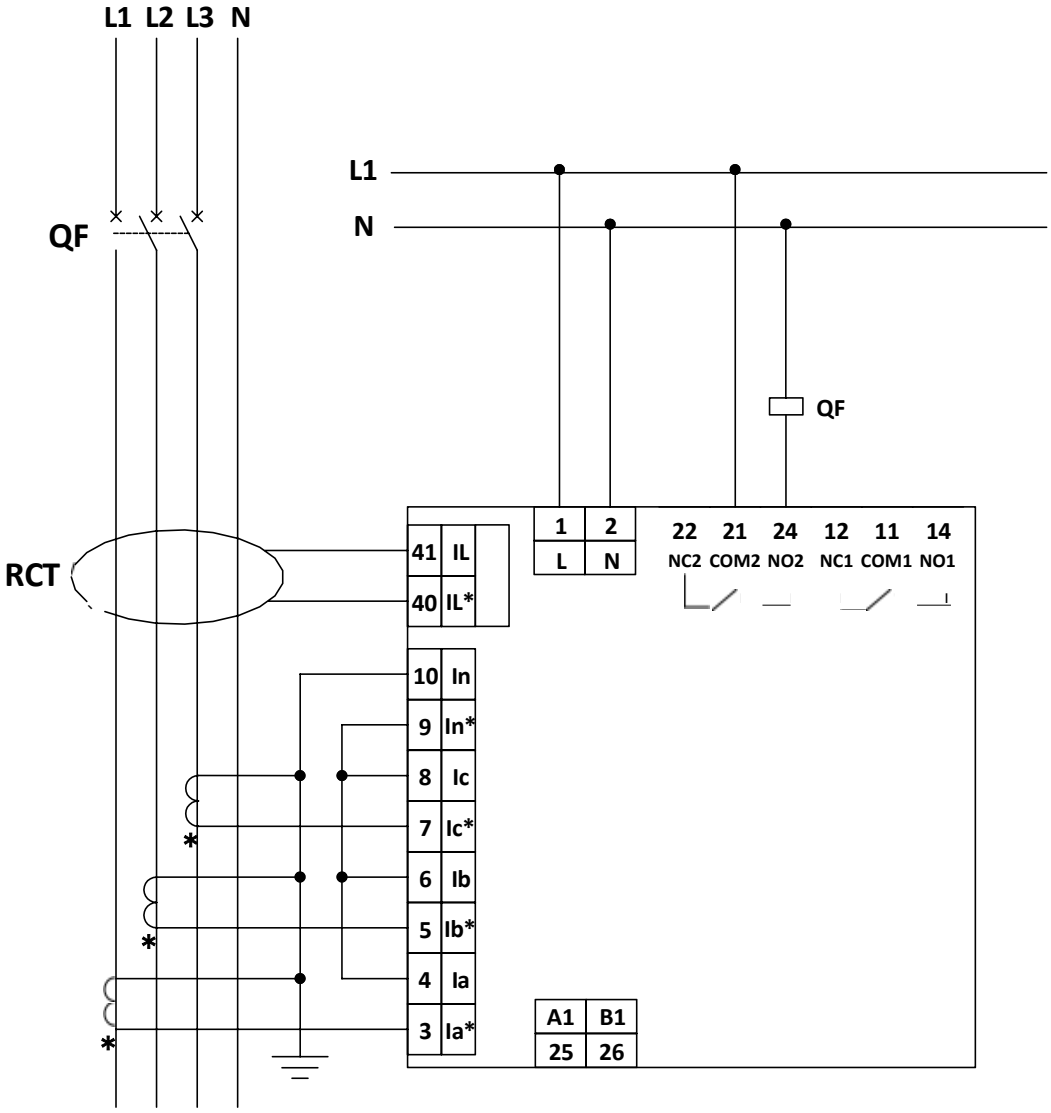
Custom communication address	2500		Custom Address 1 – Corresponding Value	R	Corresponding mailing address	word	
	2501		Custom Address 2 Corresponding Value	R		word	
	~		~	R		word	
	2698		Custom Address 199 – Corresponding Value	R		word	
	2800		Custom Address 1 – Corresponding Address Settings	R/W		word	
	~		~	R/W		word	
	2998		Custom Address 199 – Corresponding Address Settings	R/W		word	
Reserve	2999	2999					
Fault Record 1	3000		Action 1 – Time (Year-Month)	R		word	
	3001		Action 1 – Time (Day/Hour)	R		word	
	3002		Action 1 – Time (minutes/seconds)	R		word	
	3003		Fault Trip Status 1	R		word	
	3004		Fault Alarm Status 1	R		word	
	3005		Aphase current	R		word	
	3006		Bphase current	R		word	
	3007		Cphase current	R		word	
	3008		Nphase current	R		word	
	3009		Phase A current total harmonic content	R		word	
	3010		B-phase current total harmonic content	R		word	
	3011		C Phase Current Total Harmonic Content	R		word	
	3012		N-phase current total harmonic content	R		word	
	3013		Frequency	R		word	
	3014		Leakage current	R		word	
	3015		DO state	R		word	
	3016		Test Trigger Flag	R	0 – Measurement Trigger; 2 – Protection Drive Trigger	word	
	3017		Baseband Switch	R		word	
	3018	3029	Keep	R			
Fault Record 2 ~ Failure logging 20	3030		Ditto	R		word	
	~			R		word	
		3599		R		word	
Reserve							

7 Typical Wiring Method

7.1 Three-Phase Four-Wire Connection



7.2 Three-Phase Three-Wire Connection



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