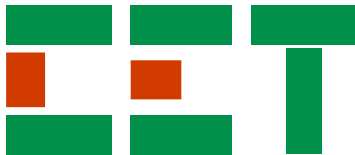


iRelay 50-P
Overcurrent Relay
Installation and Operation Manual



CET Electric Technology Inc

Safety precautions



Danger and warning

This device can only be installed by electrical professionals. The manufacturer will not take any responsibility for the failure caused by non-compliance with the instructions in this manual.

Important tips

Thank you for using our products. To use this device safely, correctly and efficiently, please know the following information:

- 1) This manual describes the installation and simple operation instructions of iRelay 50-P device. For more details, please refer to the User's Manual.**
- 2) To prevent the device from being damaged, it is strictly forbidden to plug in and out the plug-ins of the device and touch the chips and devices on the printed circuit board.**
- 3) Before the device is put into use, the grounding terminal (GND) of the device should be grounded.**
- 4) Please use qualified testing instruments and equipment to test and detect the device.**
- 5) The default password for device setting is: 0001.**

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We have checked relevant contents of this manual. As it is impossible to avoid all errors, we cannot guarantee the complete consistency of the manual with actual device. The data in the manual will be reviewed periodically and necessary amendments will be made in the documents of new version. You are welcomed to bring forward suggestions on amendments. The change of later versions won't be notified.

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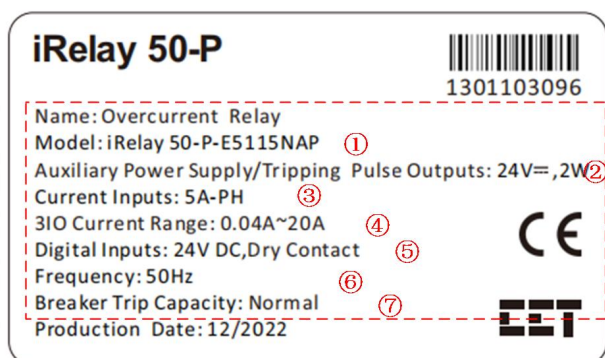
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1. Technical parameter and nameplate description

1.1. Technical parameter

Item	Parameter
Phase current	Optional 5A and 1A
Zero sequence current (IN)	accurate working range: 0.04A~20A
Rated frequency	50Hz/60Hz
Auxiliary power supply (trip pulse output)	24VDC/48VDC
DI	and the internal excitation voltage is 24VDC or 48VDC, which is consistent with the output voltage of tripping pulse.
DO	OUT1: normally opened contact,5A(continuous) OUT2: normally opened contact,Trip energy: > 3Ws,Output voltage: 48VDC
Communication	RS-485 communication port: 1 channel Supported communication protocol: Modbus-RTU
Power consumption	auxiliary voltage supply :< 2W

1.2. Device nameplate description



序号	参数含义
①	Indicating the specific parameter model of the device
②	Indicating the output voltage of auxiliary power supply and tripping pulse of the device
③ ④	Indicating the device introduced CT current
⑤	Indicating device DI loop excitation power supply
⑥	Indicating the power system frequency
⑦	Indicating device tripping ability



Please pay attention to the relevant information on the nameplate before use, to avoid wrong application of working power supply and wrong type selection!

Clock battery

The position of the battery is 3V button cell on the power board of the device. If the external power supply is lost, the battery can power the device clock (date and time). When the device is powered by an external power supply, the battery is only in a very low self-discharge state.

If the correct time and date cannot be restored after the battery of the device is powered off, it is necessary to replace the battery. Power down the device first, disassemble the device, replace the battery, pay attention to the positive pole of the battery facing up, and finally restore the device. Set the date and time through the front panel or communication port.

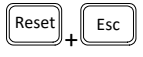
2. Device appearance

2.1. Appearance



2.2. Key description

Total seven keys are set up below the liquid crystal screen on the front panel of iRelay 50-P, and they are

Keys	Instructions
	Shift up of cursor, being setting +1 in editing mode.
	Shift down of cursor, being setting -1 in editing mode.
	Shift left of cursor or page up, “◀” appears at the upper corner of the page of which page-up is available when entering the last layer of menu.
	Shift right of cursor or page down, “▶” appears at the upper corner of the page of which page-up is available when entering the last layer of menu.
	Reset the protection light, alarm light, and configuration Output.
	Confirm the current selection or parameter revision.
	Exit from current operation or parameter revision.
	When iRelay 50-P is power off, if these two keys be pressed at the same time, iRelay 50-P will power on by internal battery.

2.3. Signal indicator Lights

iRelay 50-P has 3 signal indicator lights in total:



Indicator light	Instructions
 Run	Flashing indicates normal work of iRelay 50-P.
 Trip	Red light ON indicates protective action on tripping, and can be turned off by pressing “Reset” key if all protective action on tripping return.
 Alarm	Yellow light ON indicates self-check fault of device or protection action on signals, and can be turned off by pressing “Reset” key if all protective action on signals return.

3. Installation and wiring schematic

3.1. Precautions for installations

(1) Installation environment

The device should be installed in a ventilated, dry and clean place, away from heat source and strong electromagnetic field.

(2) Installation location

Usually installed in switchgear, it can be protected from oil, dirt, dust, corrosive gas or other harmful substances. During installation, attention should be paid to the convenience of maintenance, and there should be enough space to place relevant wires, terminal blocks, short-circuit boards and other necessary equipment.

(3) Environmental conditions

Operating temperature: $-25^{\circ}\text{C} \sim +70^{\circ}\text{C}$

Storage temperature: $-40^{\circ}\text{C} \sim +85^{\circ}\text{C}$

Atmospheric pressure: 70 kPa $\sim$ 110 kPa

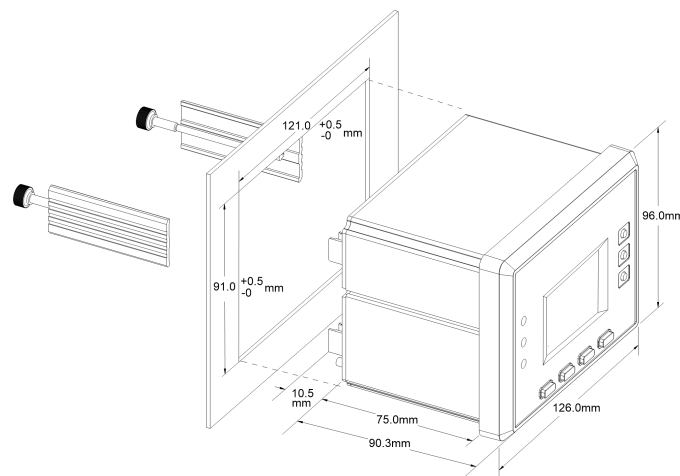
Relative humidity: 5% $\sim$ 95% (no condensation or freezing in the product)

Above sea level: <3000m

(4) Installation diagram

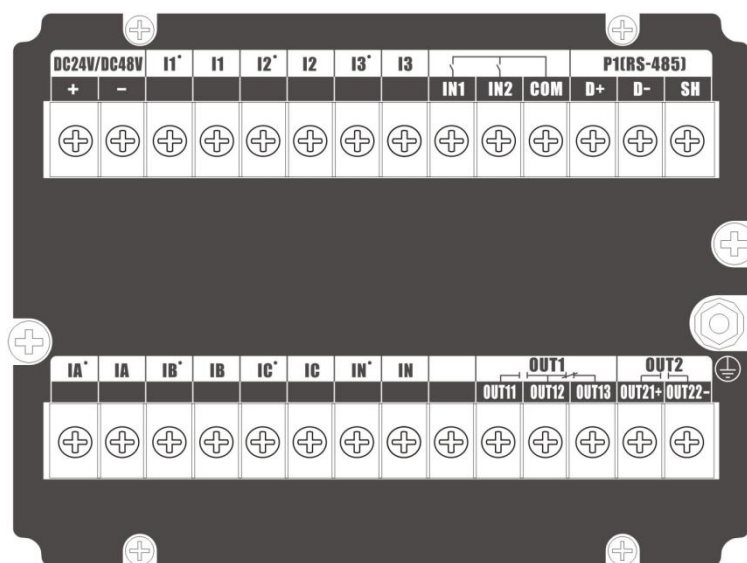
The dimensions of the device are: 96.0mm (height) $\times$ 126.0mm (width) $\times$ 75.0mm (installation depth);

The hole size is: 91.0mm (height) $\times$ 121.0mm (width);



3.2. Terminal diagram

3.2.1. Terminal diagram of rear panel



Terminal diagram of rear panel of iRelay 50-P device

3.2.2. Terminal Diagram Description

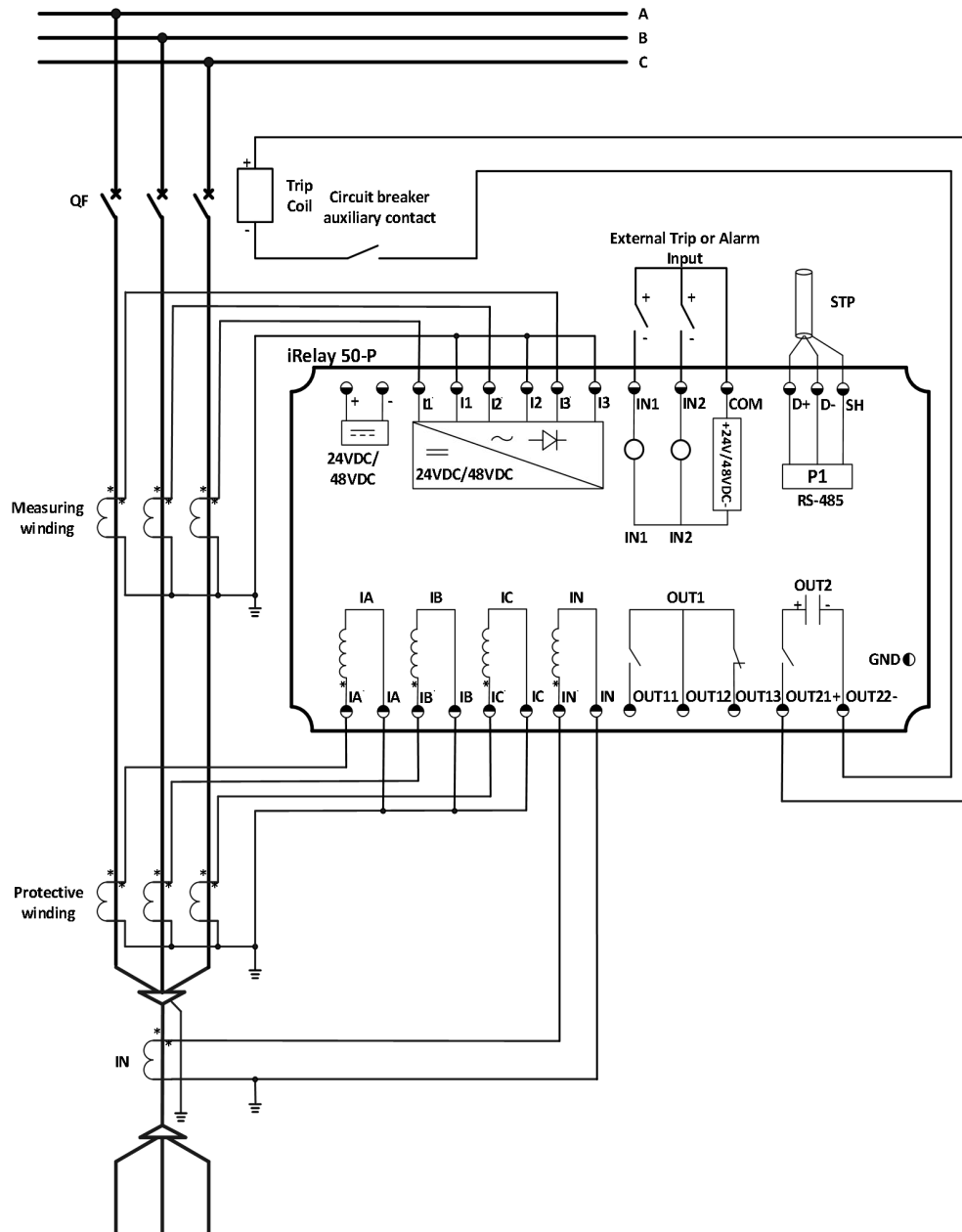
Terminal Identification	Description
DC24V/DC48V+	Auxiliary power supply, 24V DC or 48V DC.
DC24V/DC48V-	
I1*	Connected to the secondary measuring winding of CTs for power supply. I1* and I1, I2* and I2, I3* and I3 connect one phase each, no polarity requirement. Because the finally power provide is the summation power of all three phase, more phases are connected can make less current requirement in each phase. When only one phase is connected, iRelay 50-P can work too, but needs more current in that phase compare with more phase are connected.
I1	
I2*	
I2	
I3*	
I3	
IN1	Inputs of IN1 and IN2, internal excitation
IN2	
COM	DI public end, be connected to negative pole when DI is supplied by DC power.
P1 (D+,D-,SH)	RS-485 interface, signals A, B and shield grounding.
IA*	3-phase relay current input, becoming synonym end with “*”



IA	added.
IB*	
IB	
IC*	
IC	
IN*	Neutral current input, becoming synonym end with "*" added.
IN	
OUT11	Normally dry contact, OUT11 is normally-closed contact while OUT13 is normally-closed contact.
OUT12	
OUT13	
OUT21+	Active impulse output, depends on device selection, the output can be 24V DC or 48V DC, which can be connected to the circuit breaker trip coil to drive the breaker trip.
OUT21-	

3.3. Wiring Schematic

3.3.1. Internal wiring diagram



3.3.2. Typical wiring diagram

Current circuit wiring diagram

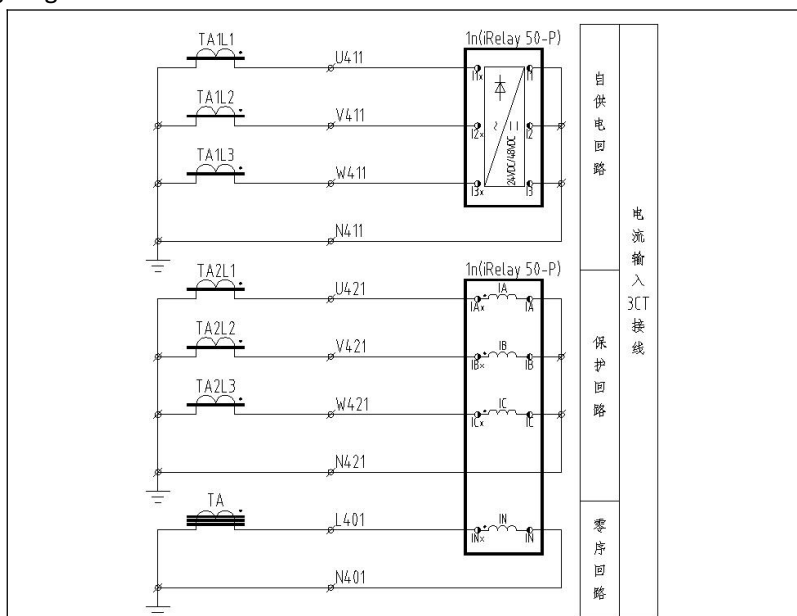


Figure 1 Current transformer 3CT circuit wiring diagram

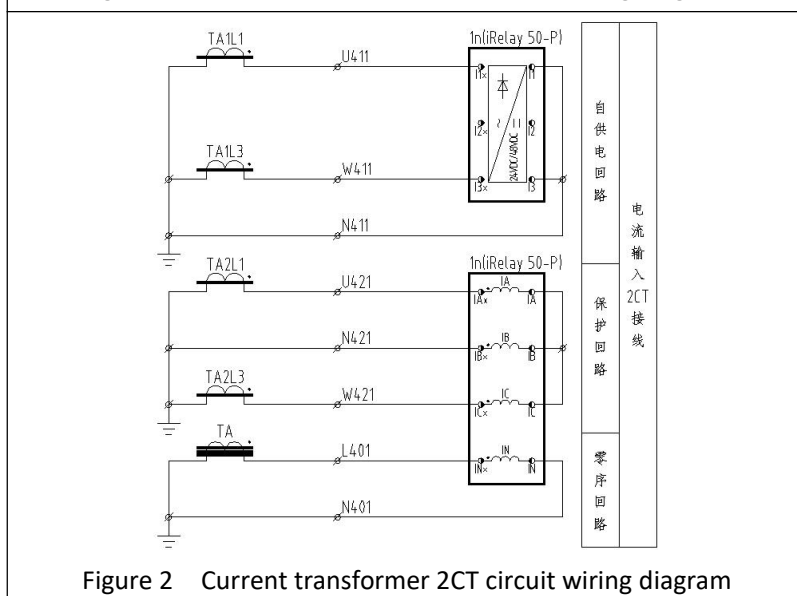
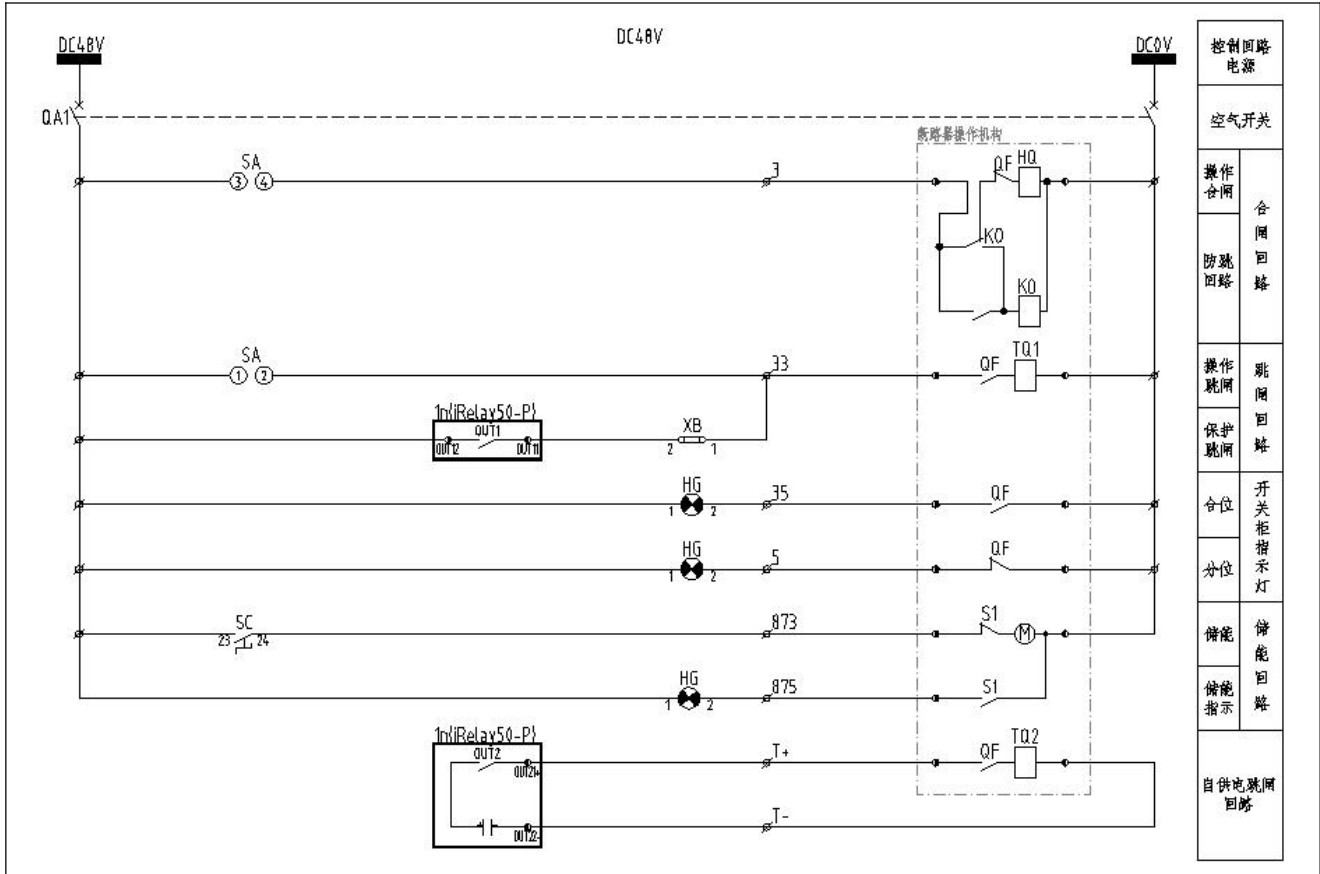


Figure 2 Current transformer 2CT circuit wiring diagram

Notes:

- 1.The current input loop has the above two connection modes. You can select one of them based on the CT configuration on site.
- 2.The CT connected to the self-powered circuit and the CT connected to the protection circuit should come from different windings, otherwise the accuracy of the protection action will be affected.
- 3.If there is only single-phase or two-phase power supply current, just connect the power supply phase, the non-power supply phase can be suspended; Serial connection between different phases is prohibited.

Control loop wiring diagram:



Notes:

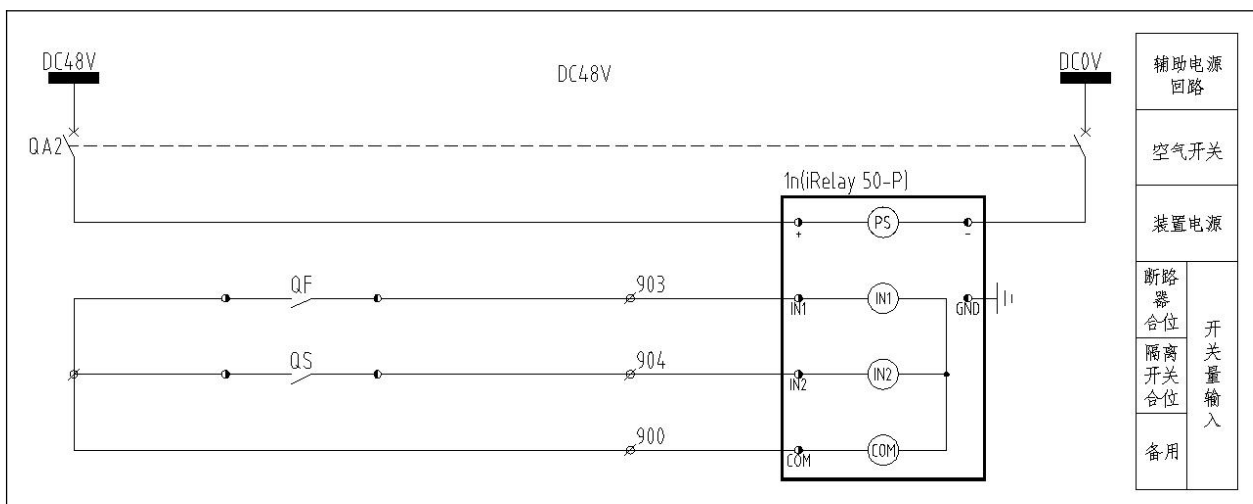
1. OUT1 and OUT2 can be defined as 50P-1、50P-2、50P-3、50P-4、50N-1, Users can define outputs based on the actual protection configuration.
- 2.The power supply of the control loop can be connected to AC220V, DC48V and DC24V according to the rated voltage of the closing coil,The power connection shown in the figure above is only indicative.
- 3.OUT1, OUT2 output protection trip circuit must be connected to the circuit breaker normally open auxiliary contact.
- 4.OUT2 and OUT1 relay types are different. OUT1 (conventional passive dry contact) and OUT2 (active pulse) should be distinguished. Do not connect the power that drives conventional passive dry contact to the active pulse contact.
- 5.The rated voltage of the trip coil connected to OUT2 is the same as the rated voltage of the device, otherwise the trip coil will be damaged.
- 6.When the self-powered circuit is used for power supply, the tripping coil connected to OUT2 must be a low-power coil less than 36W(The internal resistance of this low power coil should not be too small,Suggestion: For 24V power supplies, the coil resistance > 16 Ω;For 48V power supplies, the coil resistance > 64Ω);



otherwise, the tripping coil cannot jump and will be damaged.

7.If the resistance value and power of the tripping coil do not meet the requirements of point 6, the device needs to be connected to the auxiliary power supply, and the auxiliary power supply must be greater than the power requirements of the tripping coil, otherwise the tripping coil can not jump, resulting in damage to the tripping coil.

Wiring diagram of auxiliary power supply and inputs loop:



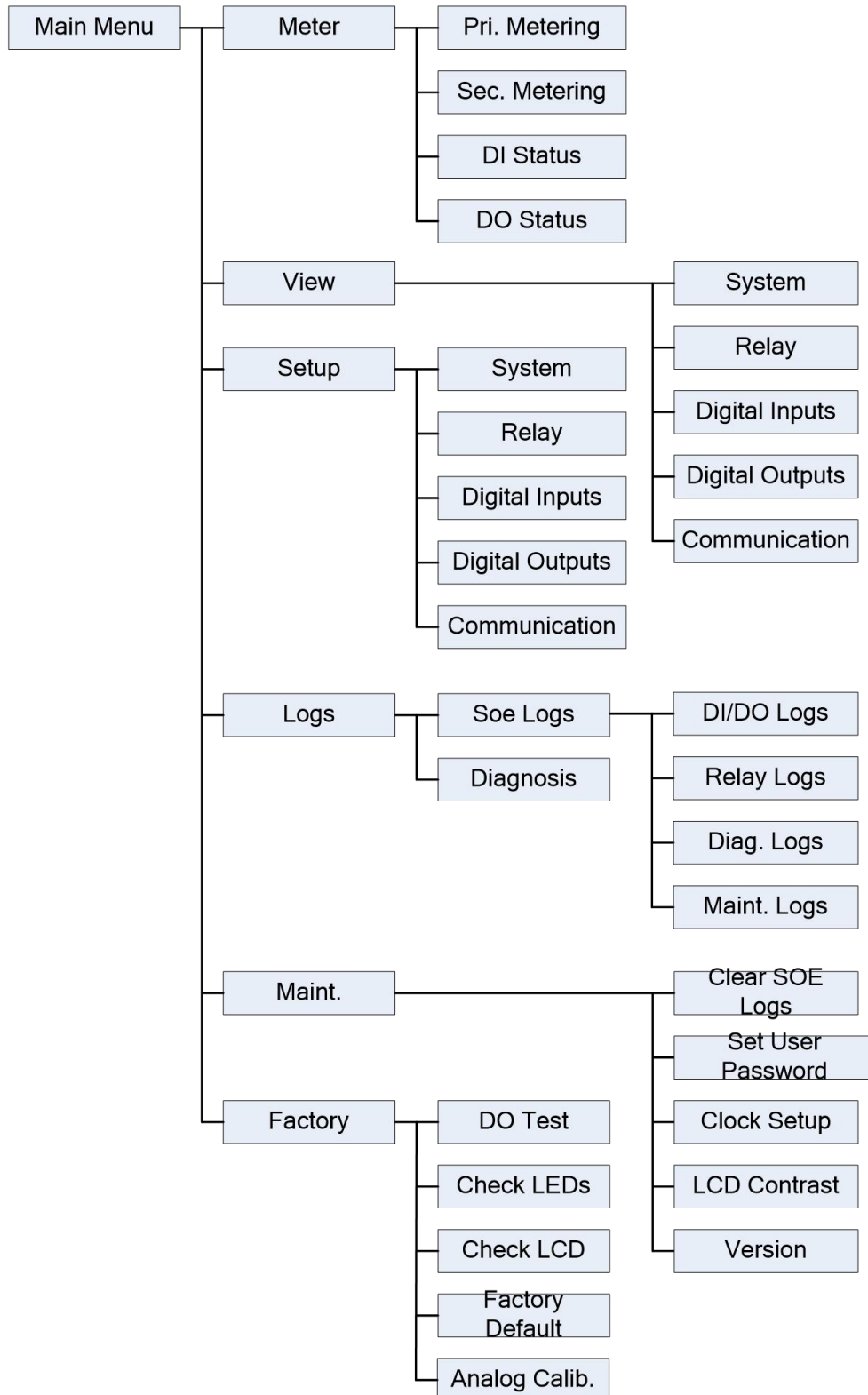
Notes:

- 1.The auxiliary power supply of the device can be connected to DC48V and DC24V voltage according to the specific selection,The power connection shown in the figure above is only indicative.
- 2.There are 2 digital inputs with 24V DC or 48V DC internal excitation.
- 3.digital input only allows access to dry contact.
- 4.If the power supply mode is auxiliary power (24V/48VDC), do not use 220V power. Ensure that the DC supply voltage is consistent with the rated voltage of the device. Otherwise, the power supply part of the device will be damaged and cannot work.
- 5.When there is no auxiliary power supply and the power supply of the self-supply circuit is insufficient, only the value of the device can be checked and set. At this time, the device protection, measurement, communication and control functions are in the exit state, LED and LCD backlight will be extinguished.

4. Settings List

4.1. Menu

Various functions of iRelay 50-P device may be accessed through menu and the menu structure of iRelay 50-P is as shown below:



4.2. Settings List

Parameter Name		Unit	Setting Scope	Default Value
System	CT Ratio		1~9999	100
	IN Ratio		1~9999	100
	Language		Chinese/ English	Chinese
	System Freq.	Hz	50/60	50
	SBO		Off/On	Off
	Start Events		Off/On	Off
	Dropout Events		Off/On	Off
50P-1	50P-1		Off/On	Off
	Pickup	A	0.25~100.00(5A rated) 0.05~20.00(1A rated)	20.00
	Output		OUT1,OUT2	0
50P-2	50P-2		Off/On	Off
	Pickup	A	0.25~100.00(5A rated) 0.05~20.00(1A rated)	20.00
	Delay	s	0.00~99.99	1.00
	Output		OUT1,OUT2	0
50P-3	50P-3		Off/On	Off
	Pickup	A	0.25~100.00(5A rated) 0.05~20.00(1A rated)	20.00
	Delay	s	0.00~99.99	1.00
	Output		OUT1,OUT2	0
50P-4	50P-4		Off/On	Off
	Pickup	A	0.25~100.00(5A rated) 0.05~20.00(1A rated)	20.00
	Delay	s	0.00~600.00	1.00
	Output		OUT1,OUT2	0
	Signal		Alarm/ Trip	Alarm
50N-1	50N-1		Off/On	Off
	Pickup	A	0.02~20.00	6.00
	Delay	s	0.00~99.99	1.00
	Output		OUT1,OUT2	0
	Signal		Alarm/ Trip	Alarm

**Notes:**

1. The above list is an example of the outbound loop protection configuration, If this device is applied to the protection of the incoming circuit, the above list of values can be adjusted according to the actual protection needs of the corresponding protection and setting.
2. 5A rated and 1A rated in current setting of phase protection current indicate the rated value of phase current, Zero sequence current selection table only supports 0.04~20A.
3. When digital output is set to "0.00s", it will be displayed as "Latch".
4. TA ratio: indicates the transformer ratio.
5. This section uses 50P-2 as an example to describe the protection Settings. Other protection Settings are similar:

Parameter Name		Setting Scope	Notes
50P-2	50P-2	Off/On	If you want to invest this protection, select "On". To exit the protection, select "Off". This protection takes effect only when "On" is selected.
	Pickup	0.25~100.00(5A rated) 0.05~20.00(1A rated)	According to the rated current of the secondary side of the current transformer is 5A or 1A, select the value range and set the value.
	Delay	0.00~99.99	The value is set according to the time value in the value list.
	Output	OUT1,OUT2	outputs operate set OUT1 or OUT2.



5. Debugging

5.1. Test notes

1) Self-powered current loop (I1, I2, I3)

A) The I1, I2, and I3 current loops can only be used as the self-powered power supply of the device, and are strictly prohibited to be used for protection and measurement of other functional current inputs.

Usually connected to the special winding of the current transformer (see section 1.4.2 for the technical requirements when ordering, and see Figure 6-1 and 6-2 for the wiring diagram);

B) It is strictly forbidden to connect the windings of the self-powered current input loop (I1, I2, I3) and the protection current input loop (IA, IB, IC) of the device in series.

C) It is recommended to connect the two-phase or three-phase self-powered current according to the requirements of the typical wiring diagram (Figure 6-1, Figure 6-2)

D) During debugging, the self-powered current loop of the device can be connected to single-phase, two-phase or three-phase self-powered current. If it is connected to single-phase or two-phase self-powered current, the other non-powered phases can be suspended (see Figure 6-1)

E) Since the three terminals I1, I2, and I3 have been short-circuited inside the device, it is strictly forbidden to connect the three-phase or two-phase I1', I2', and I3' to the current, otherwise the device will be burnt out! Refer to Figure 6-1 for correct wiring and Figure 6-2 for incorrect wiring.

F) If you use the self-powered circuit and auxiliary power supply to provide working power for the device at the same time, please confirm that the input voltage of the auxiliary power supply is DC 24V or 48V.

G) It is strictly forbidden to apply a DC or AC power supply higher than the rated voltage of 48V (the limit value is 57.6V) to the device to prevent the device from being burned!

H) It is strongly recommended to tighten the self-powered current access terminals (I1, I2, I3) and confirm that it is correct before applying the self-powered current. It is strictly forbidden to temporarily lap the terminals of the self-powered current loop and artificially apply the working current intermittently to prevent other abnormal situations such as arcing and burn out the self-powered working power supply of the device.

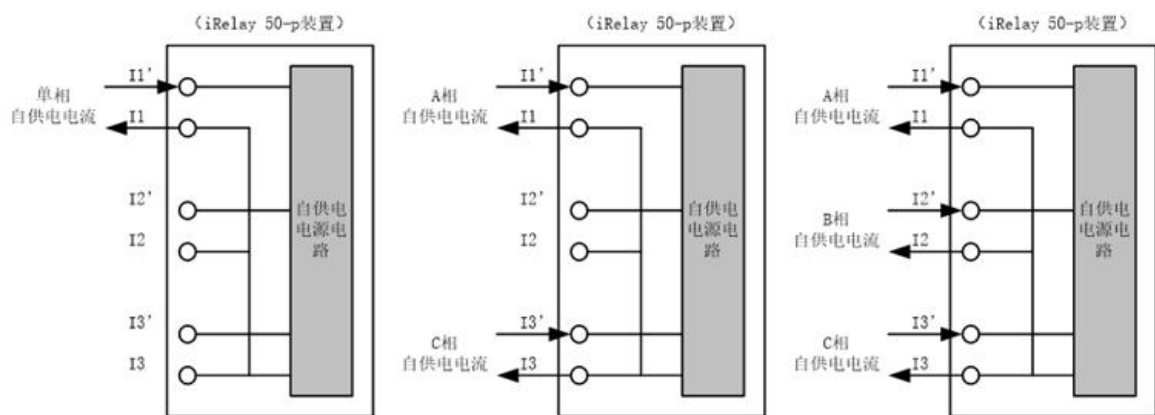


Figure 6-1 Correct wiring method of self-powered power supply

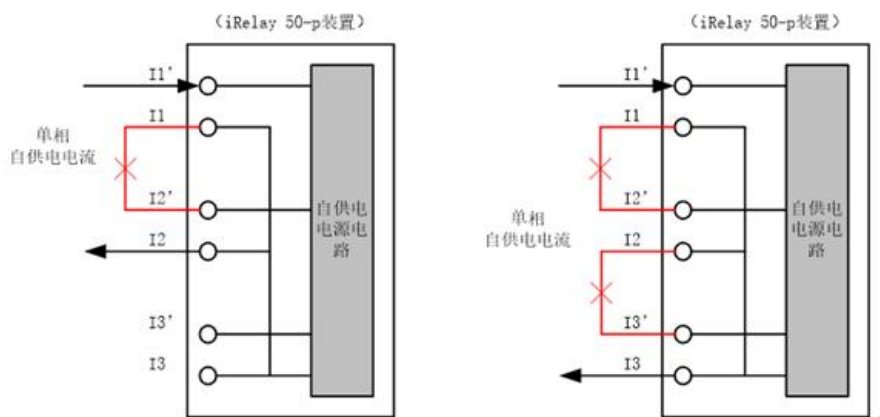


Figure 6-2 Incorrect wiring method of self-powered power supply

2) Trip circuit (OUT2)

A) The relay types of OUT2 and OUT1 are different. It is necessary to distinguish between OUT1 (conventional passive dry contact) and OUT2 (active pulse). It is forbidden to connect the power supply that drives the conventional passive dry contact to the active pulse node.

B) OUT2 active pulse is divided into two voltage types: 24V and 48V. When using the relay protection device to test the OUT2 outlet, it is necessary to confirm whether the relay protection device is compatible with potential contacts.

C) Choose the appropriate voltage and tripping capacity type according to the actual current supply range.

D) The trip circuit must be connected in series with the normally open auxiliary contact of the circuit breaker.



E) When there is no auxiliary power supply and CT self-powered current (the device is powered off), the device's own rechargeable battery can be charged. The rechargeable battery can be fully charged in about 60s, and the auxiliary power supply or CT self-powered charging time is 30min (24VDC selection) or 10min (48VDC selection). After an active pulse trip, the device needs to be recharged. Generally, it can operate reliably when it is charged to 0.6Up (Up: the pulse amplitude after reaching the steady state).

5.2. Check before power on

- A) Check whether the model and parameters of the device are consistent with the order. If the self-powered circuit (I1, I2, I3) is used for power supply, it needs to be connected to the transformer measurement winding. The power supply circuit is forbidden to be connected in series with the protection winding to avoid affecting the protection accuracy; When using DC auxiliary power supply, be sure to check whether the rated voltage of the power supply matches (the auxiliary power supply voltage is 24V or 48V DC, and it is prohibited to use city power or 220V DC power supply, otherwise the device will be damaged);
- B) Confirm that the device is reliably grounded.
- C) Check whether the appearance of the device is in good condition, whether the terminals, buttons, and LCD display are in good condition.
- D) Check whether the actual wiring of the device is consistent with the design drawings of the tested protective screen group screen, the main wiring of the primary equipment protected by the tested protective screen and the description of the relevant secondary equipment drawings.

5.3. Power-on check

- A) After power-on, if the software of the device starts to run normally, the indicator light of the device "running" flashes at this time, you can simply judge whether each CPU board and program are normal;
- B) Whether the LCD is displayed normally;
- C) Check the parameter settings of the device. If the factory default settings of the device do not meet the on-site requirements, refer to the device instructions for corresponding settings.

5.4. Analog check

Input the rated current value (1A or 5A, please check the current selection of the device nameplate) to the protection current circuit (IA, IB, IC, IN), and check whether the primary and secondary measurement values

displayed by the device are within the error range.

5.5. Debugging before being put into Operation

1) Protection function debugging

Set the fixed value of the protection current, start the protection, configure the OUT1 outlet, and use the relay protection meter to increase the amount to test whether the protection is reliable and return.

Measurement

When testing the protection function, the test methods of using OUT1 and OUT2 are different. The OUT1 output is a dry contact output, which can be directly connected to the relay tester's input circuit; OUT2 is an active pulse output. Connect OUT2 to the relay input module of the relay tester, and it must be connected at both ends of the OUT2 outlet. Connect a resistor (note that the resistance power should be greater than U^2/R , such as 48V configuration prototype, the resistance value is 1K ohm, then the power should be greater than 2.4W)

2) Trip function debugging

Set the fixed value of the protection current, start the protection, configure the OUT2 outlet, test whether the circuit breaker trips correctly after the protection action; conduct a trip test

Please confirm the following two points before inspection;

A) The trip circuit must be connected in series with the normally open auxiliary contact of the circuit breaker. If it is not connected in series, it is forbidden to carry out the tripping test, so as to avoid the contact of the device from sticking and burning out the circuit breaker trip coil

B) Identify the type of OUT2 (whether the voltage type is 24V or 48V) and the resistance value of the field trip coil (the internal resistance of the low-power coil should not be too small, it is recommended that the resistance of the 24V coil is greater than 16 ohms, and the resistance of the 48V coil greater than 64 ohms). If the resistance value parameter of the trip coil is not within the recommended range, please stop the trip test first, otherwise the OUT2 contact of the device may be damaged or the trip coil may be burned. After the relevant parameters are fed back to the device R&D department of CET company, the CET device R&D department Confirm whether iRelay 50-P can meet the circuit breaker tripping requirements

3) DI debugging

DI debugging is conducted under the "Measurements->DI Status" menu. Short circuit IN1 and COM, the display status of IN1 will change from "OFF" to "ON", open the short circuit, the display status of IN1 will



change from “ON” to “OFF”.

4) DO debugging

DO debugging may be conducted in “DO Test” of “Factory”. Select the output to be debugged, and press “Enter” key to test whether the output operate correctly.

5) Relay action test

Conduct debugging according to concrete project setting.

6) Communication function debugging

It is conducted under “Setup->Communication” menu to confirm the continuous number of each protection device inside the substation, and that there is no repeated address number. Connect iRelay 50-P with communication management machine, and connect it to the monitoring system. Conduct related operations at the monitoring system, like reading the metering value and protection setting, revising and downloading settings, remote resetting, protection time check, DI/DO call, reading protection action event information, etc., and check whether the protection device can normally respond to and correctly execute commands; meanwhile, observe whether the communication between the protection device and upper-position computer is normal by monitoring the communication management machine and background messages.

5.6. Common problems and solutions

1) When the device is powered on, the running light is not on, and the protection device cannot work?

Answer: Please check whether the power supply wiring and voltage are correct (when the auxiliary power supply is connected), whether the self-powered current wiring is correct, and whether the self-powered current input is sufficient. **Pay attention to the auxiliary power supply of 24VDC or 48VDC, and do not add other power supplies such as 220VAC/DC by mistake.**

2)The sampling value of the device is incorrect?

Answer: Check whether TA wiring is correct and whether its transformation ratio is set correctly.

3)What are the specific requirements of iRelay 50-P self-powered device, circuit breaker and CT?

Answer: iRelay 50-P self-powered device has corresponding requirements for circuit breaker and CT. Please refer to Parameter Requirements of iRelay 50-P Self-powered Protection Device for Current Transformer (CT) and Matching Trip Parameters of iRelay 50-P Self-powered Protection Device and Circuit Breaker.

4)RS-485 can't communicate?



Answer: Check whether the communication attribute settings (communication address, baud rate, etc.) are correct; Check whether the communication link and equipment are normal; Communication test software is used to assist the discrimination.

5)The switch input status is abnormal?

Answer: Check whether the input contacts are connected correctly.

6)If the project only has phase current transformers A and C, does the phase current circuit B of the device need to be connected?

Answer: The CT winding used to obtain power supply does not need to be connected to the self-powered device by synthetic B-phase.

The CT winding used for protection needs to be connected to the self-powered device in phase B, see 2TA wiring example in P9.

If the cause of the problem can't be determined, please call our after-sales service hotline at **400-9916-218**.