Intelligent （Self- Powered）passive Protection device

User’s Manual

Preface

Please read this chapter meticulous, before using product.

Safety prevention is suggested before powering on product in this chapter. Customers should pay seriously attention to the content and concepts, otherwise, our company is responsible for none duty of damage caused by error operation.

Before making any operation for device, professional worker should prudently read this manual and familiar with relevant content, operation guideline and warnings.

Several normative defines used in manual are listed as following:

Danger! This tag means neglecting measures of safety and prevention will cause death, fearful human body hurts, and serious damage of equipment.

Caution! This tag means neglecting measures of safety and prevention will cause death, fearful human body hurts, and serious damage of equipment.

Warning! This tag means neglecting measures of safety and prevention will cause, light human body hurts, and damage of equipment. This norm is suit of damage and possible damage for equipment.

Danger! As primary system is running with power, it is should be forbidden opening secondary side loop of CT accessing device, for this opening loop will send extremely dangerous voltage; also, it is should be forbidden short secondary side loop of PT accessing device, for this opening loop will send extremely dangerous short circuit arc;

Caution! As electrical equipment is running with power, making mistake operation could result body hurts and damage of equipment for high voltage carrying by some elements of device.

Only qualified person is allowed to operate device or work near device. Worker should be familiar to attention items referred by manual, workflow and safety norms.

Special attention! General work norms used to high voltage equipment must be complied, or it will result body hurts and equipment damage.

- **Warning!**

Device should resolutely access to ground.

Device should work in ambient conditions met technology parameters ruled without abnormal vibration.

AC voltage or AC current circuits accessed should meet corrective rated parameters responding to device.

As output contacts connected with external loops, power voltage of external circuit should be checked to avoid connected loop over thermal.

Cables connected should be checked meticulously to avoid excess force.

CONTENTS

1. Description of product

1.1Application scope

Intelligent (self -powered) protection device is new developed device,which adopted multiple patents, and its index of technology improved deeply. It is suitable to operate in power substation where no one on duty with severe ambient outside door.

1.2Function features

- Device adopts processor with high-integrated, internal bus wire in chip. Professor deals with signal coming from CT , and controls relay-output via digital logic arithmetic. Device adopts sealed case, maintenance–free design and anti-interference performance, therefore, it is suitable for ring-power-grid cubicle with tightly mounting condition and with very bad operation environment.
- Device adopts extremely low-consumption power technology to ensure reliable function rapidly starting up at any conditions
- Device with design features such as simple structure and convenient installation approach, which is suit for ring-power-grid cubicle with compact installation conditions.
- Self-powered function (power-supply by CT) ,eliminate external burden brought by installing DC panel or USP.
- Protective functions includes three-stage phase to phase over current protection, two stage earth grounding protection, multiple IEC standard inverse curves to be selected,.
- Inrush current blocking function is offered to avoid tripping for error caused by putting on operation transformer with no-load condition.
- Instantaneous protection adopts short-data-window fast algorithm to real rapid tripping short-circuit fault and to avoid override tripping.
- Adopting Chinese word and 64*128 LCD interface, multiple-layer menus display, Chinese and English language exchanging selection, and window design with event-pop up, as well as extremely friendly MHI.
- Flexible and completed protecting functions which could be switched freely via control words in device.
- 1A or 5A rated current could be sampled for design of measurement circuits with automatically dynamic increasing-revenue and extremely width measurement scope.
- Users could customized system frequency to 50Hz or 60Hz. Zero-sequence current obtaining mode could be select as external sampling mode or internal calculation mode.
- Circuit design of increasing acquiring-energy, extremely absorbing peak voltage circuits ensure security and reliability of power supplying loop.
- Inputting Hybrid voltage to power circuit is allowed, ether accessing powered-winding of CT, inputting DC24V ~ DC230V voltage or inputting AC24V ~ AC230V voltage..
- Very width temperature range of working, waterproof design sure that it is possible to run in various extremely ambient conditions.
- Maximum number of History record stored is 100 . Record will not be lost for power off. It is convenient for fault trading.
- Device provides RS-485 communication port and open communication protocol to realize SADAD function.

2. Technology performance index

2.1 Working conditions

2.1.1Ambient temperature：

Working temperature: -30°C ～70°C

Storage temperature: -40°C ～ 85°C

2.1.2Relative humidity： 5% ～ 95%

2.1.3Atmospheric pressure： 70 K Pa ～ 110KPa

2.1.4Altitude height： Not higher than 5000m

2.2 Electical technological parameters

2.2.1Rated data: AC current：1A

Frequency：50Hz/60Hz（mark in your orders）

Power： 24VDC~230VDC

24VAC~230VAC

Self- powered, acquiring power from phase CT,

Integrated CT for sampling and acquiring power in device.

2.2.2Overload capability ： Current circuit: long term running-------10 A

2.2.3Power consumption：Consumption of Power-supply circuit is not larger than 5VA

Consumption of each AC input circuit is not larger than 0.5VA.

Staring up power consumption is no longer than 1VA.

2.2.4Measurement scope：

Phase current: 0.05A ～ 20A （There is an auxiliary power supply situation）

Earth current : 0.05A～ 10A（There is an auxiliary power supply situation）

Starting current: 1A

2.2.5Measurement accuracy：

Phase current : ≤±1% or not larger than 0.02A

External sampling Earth fault current : ≤±1% or not larger than 0.02A

.

2.2.6Protection action time：

Under 2-fold instantaneous setting value, inherent action time of over current protection or earth current protection is not longer than 35ms with difference±1% .

2.2.7 Binary input circuit:

Internal supplying power , bearing current is 2 mA.

2.2.8 Output contact：Output contact can bear continuously AC220V，5A.

2.2.9 Communication port：

At front-panel port—Special communication port for debugging .

At backboard port— RS485communication port for transmission.

2.3 Insulation properties

2.3.1Insulation resistance

No.	Test position	Test requirement	Note
1	Auxiliary power supply circuit grounding	Insulation resistance is greater than 100 meg-ohm.	Measure with 500V opening voltage meg-ohmmeter .
2	AC current grounding		
3	Input Circuit Grounding		
4	Output Circuit Grounding		
5	Between the AC Current Circuit and the Auxiliary Power Supply		

	Circuit		
6	Between the AC Current Circuit and the Output Circuit		

2.3.2Dielectric strength

No.	Test position	Test condition	Test requirement
1	Auxiliary power supply circuit grounding	Under normal test atmospheric conditions, the device undergoes a 1-minute power frequency withstand voltage test. A specific voltage of 2kV (for rated insulation voltage > 63V) or 500V (for rated insulation voltage ≤ 63V) is applied to the test circuit at a frequency of 50Hz. While the voltage is being applied, the other circuits are connected to a common ground potential.	No broken down. No element damaged.
2	AC current grounding		
3	Input Circuit Grounding		
4	Output Circuit Grounding		
5	Between the AC Current Circuit and the Auxiliary Power Supply Circuit		
6	Between the AC Current Circuit and the Output Circuit		
7	Between the Switched Input and the Output Circuit		

2.3.3Inrush voltage

No.	Test position	Test condition	Test requirement
1	Auxiliary power supply circuit grounding	Under normal test atmospheric conditions,device can bear short-time inrush voltage test of 1.2/50us standard lightning wave, with open-circuit testing voltage 5KV, on condition that rated insulation voltage is larger than 63V, or testing voltage 1KV, as rated insulation voltage is not longer than 63V.	No wire broken down. No insulation damaged. No element damaged.
2	AC current grounding		
3	Input Circuit Grounding		
4	Output Circuit Grounding		
5	Between the AC Current Circuit and the Auxiliary Power Supply Circuit		
6	Between the AC Current Circuit and the Output Circuit		

2.3.4Constant damp-heat test

According to the test procedure and the test method in regulation test Cab of norm GB/T 2423.3-2016/IEC 60068-2-78：2012, meeting test conditions including 40℃±2℃ test temperature,93%±3% related humidity, and 10 days test time-delay; In accordance with the clause 2.3.1, within 2h before end of test,it need respectively measure insulation resistance, between every conductive circuit to exposed non-electricity loops, including uncharged metal section and between enclosures without electrical connecting. The test result that insulation resistance are no lower than 10MΩ;and dielectric strength is no lower than 75 percent reference amplitude in

clause 2.3.2 of norm.

2.3.5Alternating damp-heat test

According to the test procedure and the test method in regulation of norm GB/T2423.4-2008/IEC 60068-2-30：2005, meeting test conditions including 40℃±2℃ serious test temperature, 97%related humidity on condition 25℃±3K, 93%related humidity on condition 40℃±2K, and 6 days test time; In accordance with the clause 2.3.1, within 1H or 2h before end of test,it need respectively measure insulation resistance, between every conductive circuit to exposed non-electricity loops, which including uncharged metal section and between enclosures without electrical connecting. The test result are that insulation resistance are no lower than 10MΩ;and withstand dielectric strength test cause no broken and no flash over .and product work reliable with protection connecting impedance no longer than 0.1Ω.

2.4 Anti-electromagnetism interference performance

2.4.1Anti-interference of electrostatic discharging

Pass the 4th grade level electrostatic discharging test in standard norm GB/T 17626.2-2018.

2.4.2Immunity of radiated for radio-frequency electromagnetic field.

Pass the 4rd grade level immunity test of radiation for radio-frequency electromagnetic field in standard norm GB/T 17626.2-2018.

2.4.3Immunity of electrical transient bursts

Pass the 4th grade level immunity test of radiation for electrical transient bursts in standard norm GB/T 17626.4-2018.

2.4.4Immunity of surge striking

Pass the 4th grade level immunity test of surge striking in standard norm GB/T 17626.5-2008.

2.5 Mechinical property

2.5.1vibration

Pass the 1th serious grade level shock-respond test and shock-enduring test in norm GB/T 11287-2000.

2.5.2shock test

Pass the 1th serious grade level shock-respond test and impact-enduring in norm GB/T 11287-2000.

2.5.3bump test

Pass the 1th serious grade level bump test in norm GB/T 14537-1993.

2.6 Protection grade

Meet related technology requirement of Protective grade in norm GB/T 4208-2017/ IEC60529：2013 :Front panel, side panels in accordance with related requirement of IP54. Back panel in accordance with related requirement of IP30.

2.7 Salt spray corrosion capability of device enclosure

Meet standard GB/T10125-2012/ISO 9227：2006 that no corroding point in device for 96h neutral salt spray test cycle.

3. Function configuration

3.1 Inrush current blocking function

Blocking criterion is based on the component ratio of the second harmonic. current value began raise from zero, from now on within 5S, device processor calculate percentage value of second harmonic to fundamental wave. When percentage value excess setting value, action of over current protection will be blocked immediately,and has been judging the harmonic share .Once the share value is lower than setting value, and load current is larger than of over current , tripping immediately. Aiming to avoid mal-judgement of blocking in small current value, if inrush current blocking judgement will exit, as input current secondary value is lower than 0.05A.

Proportion setting value of The second harmonic wave could be set in value menu.

3.2 Three- stage over current protection

Device provides three-stage over current protections including instantaneous, time limited instantaneous and over current. The front two functions have only definite time limited characteristics, but the third one could select four curve characteristics as definite curve, normally inverse curve, very inverse curve and extremely inverse curve. Formulas of the last three curves are shown as following:

(Normal inverse curve)：

$$t = \frac{0.14}{\left[\frac{I}{Id}\right]^{0.02} - 1} \bullet a$$

(very inverse curve)：

$$t = \frac{13.5}{\left[\frac{I}{Id}\right] - 1} \bullet a$$

(extreme inverse curve)：

$$t = \frac{80}{\left[\frac{I}{Id}\right]^{2} - 1} \bullet a$$

wherein： t － tripping time.
a － time multiplier
I － fault current
Id － current setting value

Action characteristics of definite time limited is shown Fig. 3.1; And three inverse curve are shown respectively as Fig.3.2, Fig.3.3, Fig.3.4.

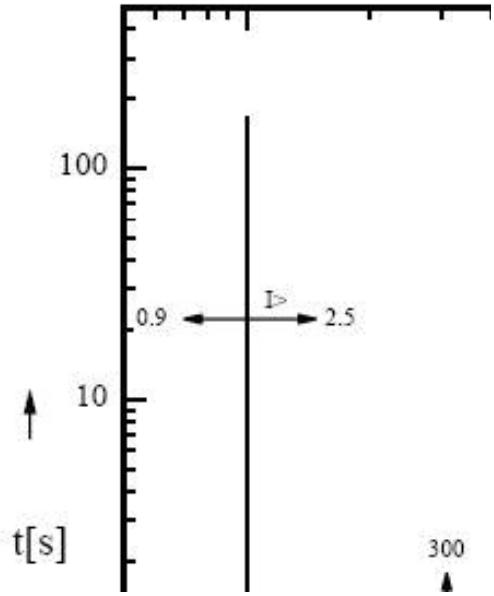


Fig.4.1: Action characteristics of definite curve.

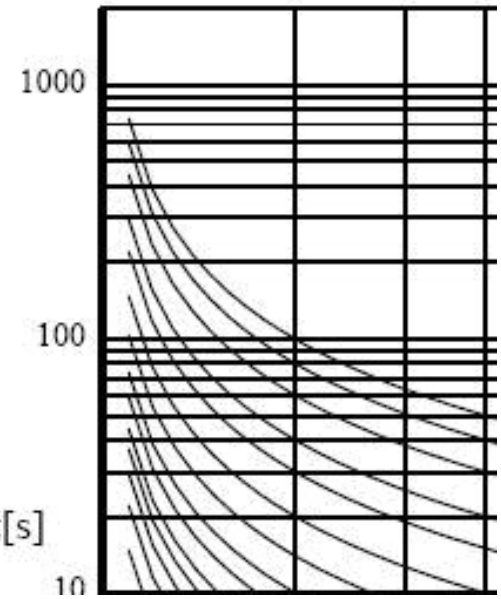


Fig.4.2: Action characteristics of normal inverse curve

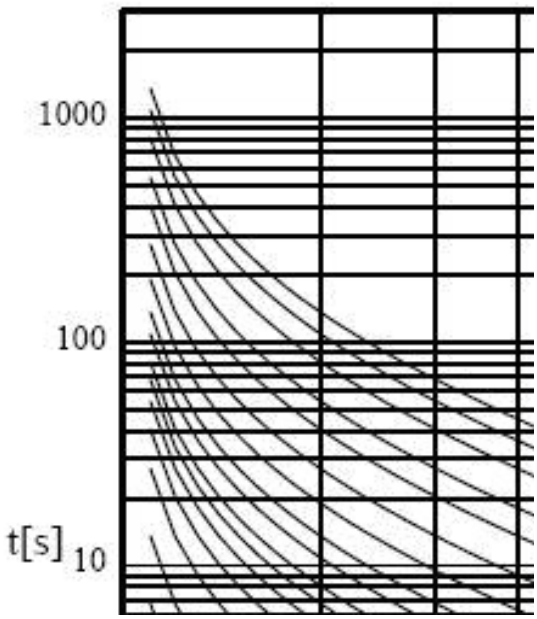


Fig.4.3: Action characteristics of very inverse curve.

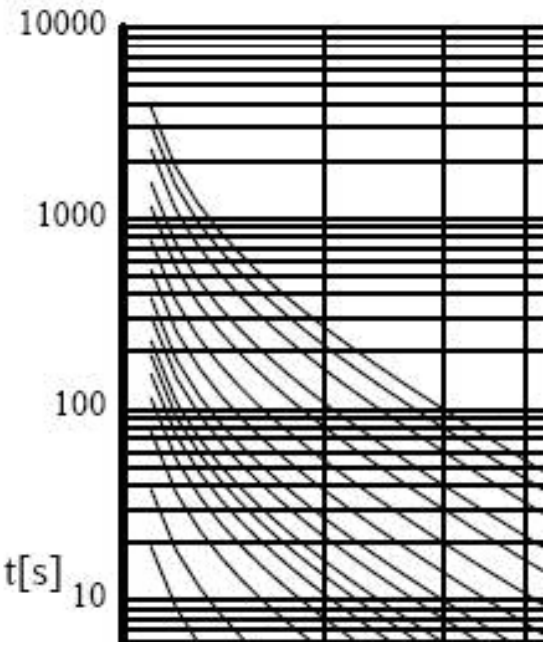


Fig.4.2: Action characteristics of extremely inverse curve

3.3 Two-stage zero-sequence protection

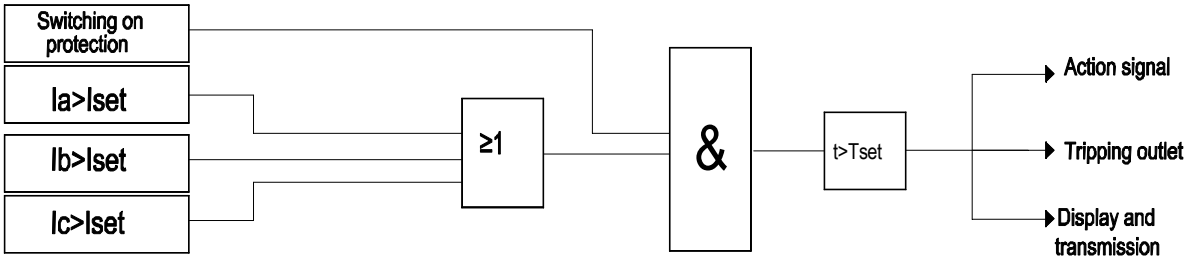
Device provides two-stage zero sequence protection, detecting fault current of earth grounding, its major application is system with neutral point insulation or compensation. The 1st stage protection has definite-time delay action-characteristics, the 2nd stage includes four type curves such as definite curve, normal inverse curve, very inverse curve and extremely inverse curve.

Device gets zero sequence current via two approaches, one is sampling from special-earth CT and the other is internal algorithm, each of two can be selected in earth mode item of system menu.

Due to zero sequence current is very small in non-directly grounding system, it requires high sampling accuracy of device to detecting zero sequence current, so generally, sampling mode of zero sequence current is suggested accessing special zero-sequence CT.

3.4 Overload protection

Device adopts three-phase current,compared to overload current setting value, if phase current value is larger ,relay will trip with time-delay. And relay-output of Overload protection can be configured as either tripping or alarming ,via control word.



Iset： Current setting value of over load protection;

Tset： Time-delay setting value of over load protection;

Action logic block diagram of overload protection

3.5 Seven-binary input loops

Device provides 7 binary input loops. Power voltage can be customized, please mark in your orders. Generally, without special description, binary input adopts internal power supplying mode.

Binary input name can be defined by users, with options:

1） Normal binary **(For short: signal 1/2/3/4/5/6/7)**
2） Circuit breaker closed position **(For short: BR On)**
3） Circuit breaker opening position **(For short: BR off)**
4） Spring stored energy signal **(For short: Ener. Full)**
5） Spring less energy signal **(For short: Ener. Less)**
6） External Contact signal trip**(For short: Ext.TRIP)**
7） Heavy gas tripping **(For short: Heavy Gas)**
8） Over temperature tripping **(For short: Over temp)**
9） External contacts trip signal **(For short: LowAirAr)**
10） High-temperature signal **(For short: High temp)**
11） Transformer door opening signal **(For short: TV door)**
12） Low voltage trip **(For short: LowAirRo)**
13） Low voltage blocking **(For short: LowAirLo)**
14） Light gas alarm **(For short: LightGas)**
15） Remote control **(For short:Remote)**
16） Local control **(For short: Local)**
17） Pressure relief valve **(For short: PreRe)**

18） Low-oil-level signal **(For short: LowOil)**

When switch position or full energy signal is defined, corresponding stamp of state signal will be displayed in LCD interface of device.

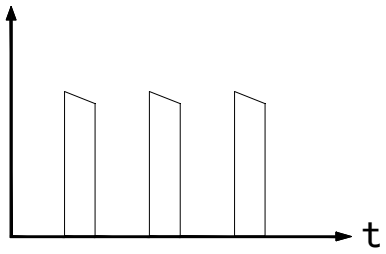
When Binary input is defined as external contact trip, device detected closing input signal continuously in 100ms, then device will output tripping. Generally, it can be used for transformer heavy gas or temperature protection, as well as connecting button to realize manual tripping.

3.6 Three control output

The device has 3 control output circuits. The first loop can choose to normally open or normally closed contact, with three modes: through flow action, grounding action, output signal output; the second loop is fixed for alarm signal output, with three modes: action signal, alarm signal and signal output; the third loop is fixed for pulse disconnection output.

Impulse tripping output

Active impulse tripping output terminal can send short-time impulse energy, this impulse output in Preliminary-set manner to ensure circuit breaker trip successfully.
Impulse output wave is shown on right.



Tripping output impulse width and output manner can be preliminary-set: setting range of output impulse width is 30ms~90ms; impulse output mode can be selected “single time” or “continuous”. If “single” mode is selected, when short-time impulse is detected, device only sends once impulse energy output; if “continuous” is selected, when short-time impulse is detected, device will sends impulse once per second until fault disappear.

3.7 Signal indicting

Green “RUN” indicator ,red “trip” indicator, red “T/R” indicator ,red “GAS” indicator,red “PHASE” indicator, and red “GROUND” indicator are respectively embedded in front panel of device.

After device is powered on, Green “Run” LED flashing indicates device is running normally : but when the “Run” LED ’s state is kept lighting on or off it means that protection get fault;

After device is powered on, Green “T/R” LED flashing indicates communication is normal in device, but when the “T/R” LED’s state is kept lighting off it means no communication.

After device is powered on, red “GAS” LED lighting on means gas alarming, but when the “GAS” LED ’s state is kept lighting off ,it means gas normal.

After device is powered on, red “PHASE” LED lighting on means action of

over current, but when the “PHASE” LED ’s state is kept lighting off ,it means no fault of over-current.

After device is powered on, red “GROUND” LED lighting on means alarming earth ground current, but when the “GROUND” LED ’s state is kept lighting off ,it means no fault of earth ground.

3.8 Event record

Device can record 100 history events each of which contains various types such as action of over current, binary input of position placement, equipment fault and etc. each record includes timestamp of event occupation, various AC input value as even appeared, states of binary input and so on. Event record could not be lost when power is off, because they are storage in chip Flash.

Event is recorded according to time sequence order. Device will automatically cover old record with the latest information as number of record in Flash is more than 100.

4. Structure and wiring

4.1Structure and installation

4.1.1 panel layout

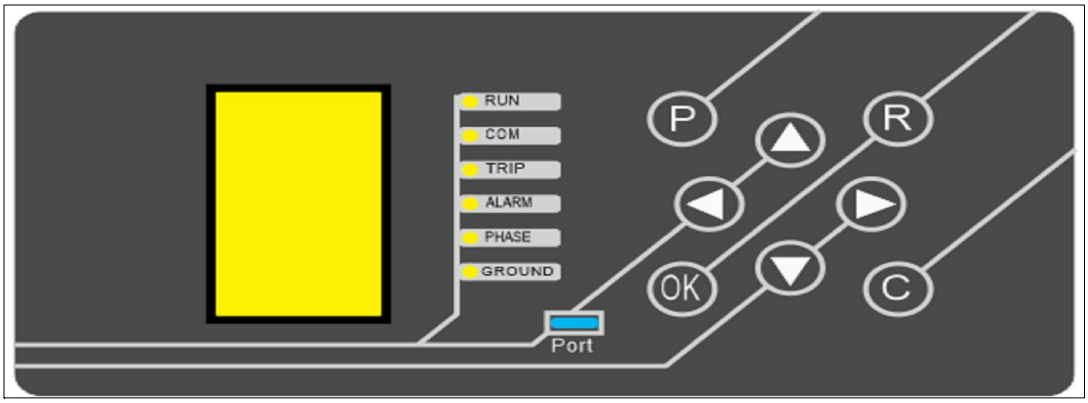


Fig.4.1 front panel schematic diagram

4.1.2 Back terminal outlet method

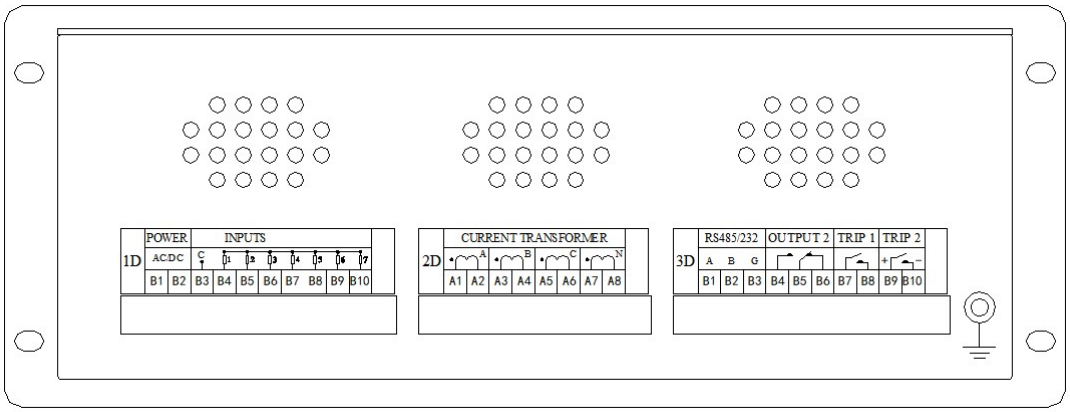


Fig.4.2Back Panel Schematic Diagram

4.1.3 External Dimensions and Installation

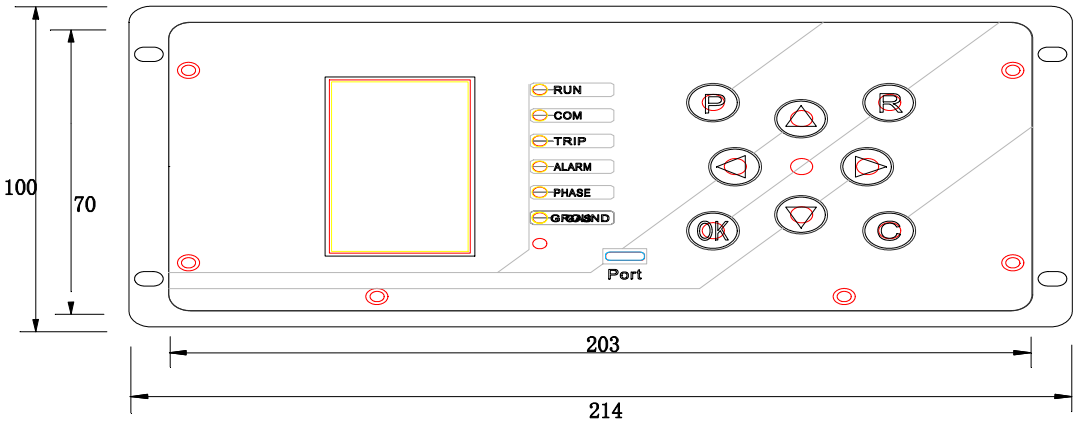


Fig. 4.3 Front-view diagram

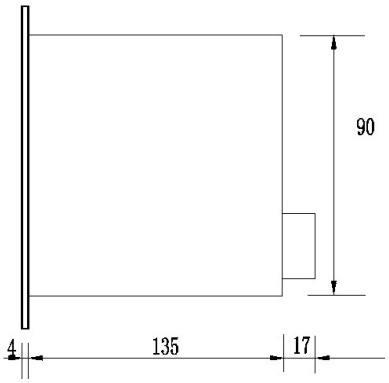


Fig. 4.4 Right-view diagram

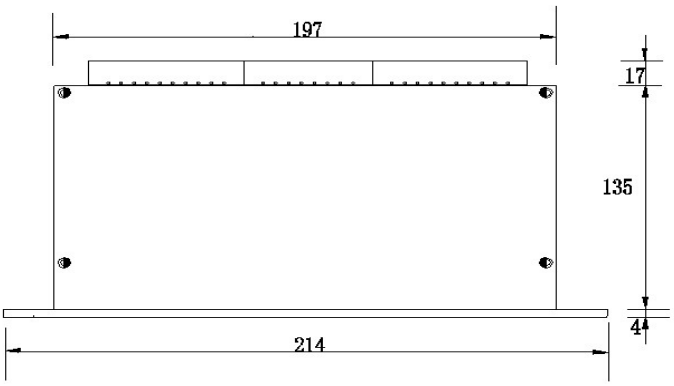


Fig.4.5 Bottom-view diagram

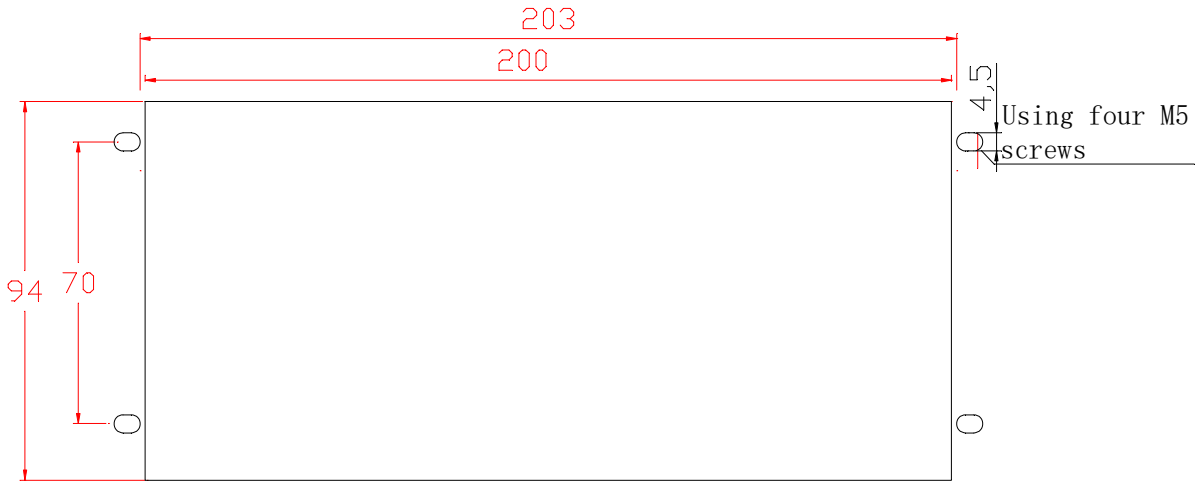


Fig. 4.6 Opening dimension in cabinet door of L-type

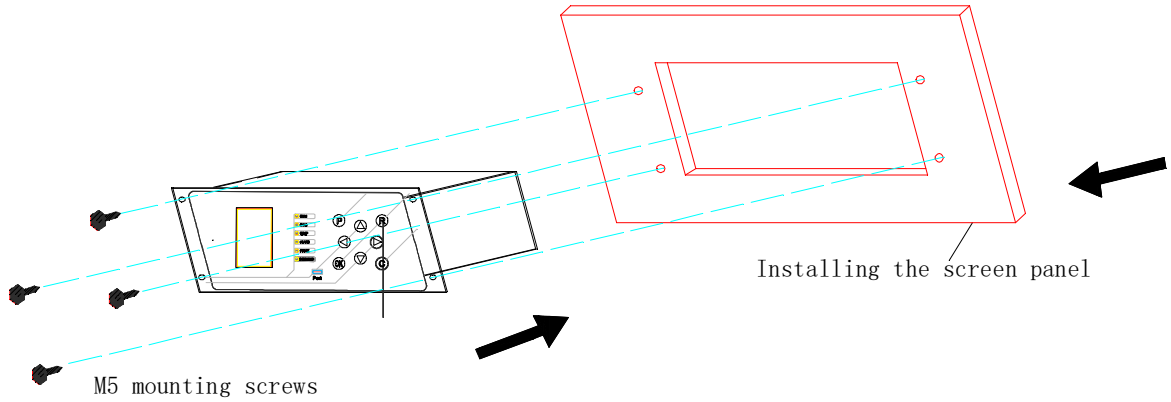


Fig.4.7 Suggestion installation diagram

4.2Wiring

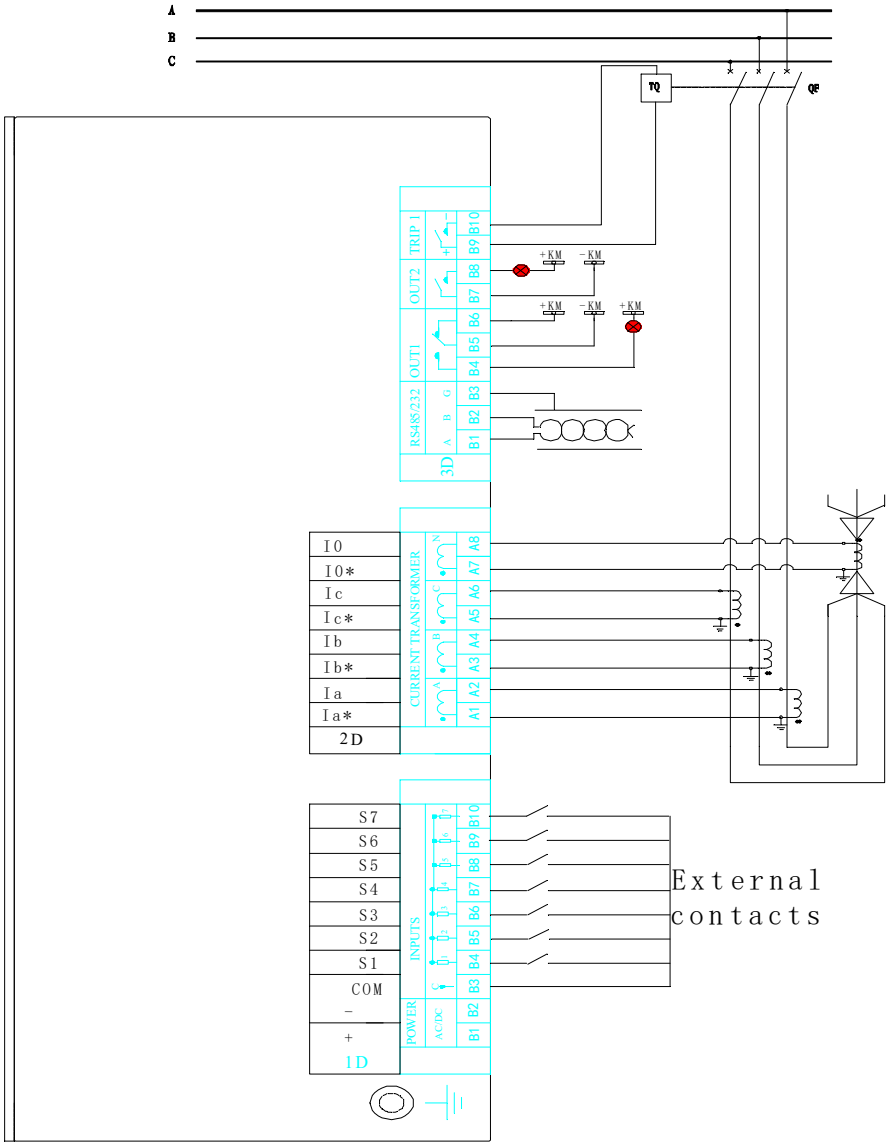


Fig.4.8 Schematic diagram of terminal wiring

Note：1、As shown in diagram above, terminals 2D-A1 - 2D-A6 is shown three-phase current input-mode, besides, two-phase input mode is also allowed.If non-three-phase mode is adopted, none-current-phase terminal should be empty without wiring.

2、As shown in diagram above, terminals 1D-B1 and 1D-B2 are used for inputting auxiliary power, with voltage type 24VDC~230VDC or 24VAC~230VAC

3. When device is used to protect transformer, accessing auxiliary power is necessary, to ensure that tripping of Transformer door open signal is reliable and stable.

5. Description of setting parameters

Three types of parameters should be set in device, one type is system parameters, one type is value parameters, and the last one type is channel parameters. Three type parameters could be respectively set in system, value and calibration menus. Calibration parameters are used to compensate AC channel of hardware, and it will finish setting before shipment, so we just introduce setting parameters of value and system menus below.

5.1System parameters

Before putting into operation, please input parameters correctly to ensure normally running of device, system parameters are shown as followings:

No.	Parameters name	Parameters description	Setting scope
1	displaying language **(For short）: Language**	Setting language of interface.	Chinese /English
2	Rated frequency **(For short）: R Freque.**	Setting Rated frequency of AC quantity.	50Hz/60Hz
3	Inherent action time of CB **(For short）: open time**	Setting inherent action time of Circuit Breaker.	0~90ms
4	Impulse width **(For short）: pul. Width**	Setting impulse width of tripping output.	20~90ms
5	Impulse output mode **(For short）:Pul. Style**	Setting impulse mode of tripping output.	Single /continuous **Short for:** 1/N
6	Ratio of phase CT. **(For short）:CT Ratio**	Setting ratio of phase CT in device.	0~9999
7	Zero sequence input mode **(For short）:ZS Input**	Setting inputting mode of zero sequence current.	External sampling/internal calculation
8	Ratio of zero sequence CT. **(For short）:ZS Ratio**	Setting ratio value of zero sequence CT.	0~9999
9	Displaying mode of data. **(For short）:Display**	Setting data displaying mode of interface.	Secondary value/primary value **(For short）:sec. / Pri.**
10	Filtering of binary input **(For short）:**DI filter	Setting time delay for filtering of binary input.	0~60000ms
11	Communication protocol **(For short）:Protocol**	Setting protocol style of RS485 communication.	Modbus
12	Communication address **(For short）:Address**	Setting address of RS485 communication bus.	0~999
13	**Relay output 1**	Setting output manner of relay 1.	Binary input1 /over current action /earth ground action
14	**Relay output 2**	Setting weather switched on output of alarming function.	Action signal/Alarm signal/Signal output/OFF
15	Communication band rate **(For short）:Baud rate**	Setting band rate of RS485 communication bus.	300/600/1200/2400/4800/9600/14400/19200bps

16	Checking mode **(For short）:Checker**	Setting checking mode of RS485 communication.	None/odd/even
17	S1 definition	Setting definition of binary input s1.	Shown in section 4.4 of chapter 4.
18	S2 definition	Setting definition of binary input s2.	
19	S3 definition	Setting definition of binary input s3.	
20	S4 definition	Setting definition of binary input s4.	
21	S5 definition	Setting definition of binary input s5.	
22	S6 definition	Setting definition of binary input s6.	
23	S7 definition	Setting definition of binary input s7.	
24	Displaying contrast of LCD **(For short）:Contrast**	Setting contrast of LCD changed with ambient temperature to get optimal value.	0~9
25	Operation password **(For short）:Password**	Setting password of authorization menus.	0000~9999
26	Backlight color switch **(For short）:BL switch**	Setting whether switching backlight color.	On/off
27	Trip voltage	Setting the pulse trip voltage	17Vdc/22Vdc/24Vdc
28	Equipment date **(For short）:Date**	Setting equipment date in device.	
29	Equipment time **(For short）:Time**	Setting equipment time of system clock..	
30	Software version **(For short）:Firmware**	Setting software version of device.	Referring to displaying version in device.

Note:

1、Both parameters ratio of phase CT and ratio of zero sequence CT are value. For instance: aiming to 500A/5A CT, setting value 100 is achieved via 500 divided by 5.

2、Parameter of data displaying mode is valid only in run menu, data in other menus such as value, event, calibration displays in secondary value manner.

3、Inherent action time is defined time-delay which from coil of Circuit Breaker powered on until its corresponding contacts open, setting value is usually 50ms in default. Real action time of device is equalized that setting value minus inherent action time of Breaker.

5.2Value parameters

Value parameters contain control parameters of functions introduced in chapter 4. Please set correctly.

No.	Value name	Setting instruction	Functions
1	Inrush current blocking On/Off (for short：**Inrush. On/off**）	To set value with two choices “switching on” or “switching off”.	Inrush current blocking function (for short：**Inrush**.)
2	Setting value of surge current blocking (for short：**Inrush. Value**）	To set percentage value with scope: 0~100%.	
3	Switching Return event (for short：Return Event **On/off**）	To set value with two choices “switching on” or “switching off”.	Return event

4	Inter-phase Instantaneous On/Off (for short：**I>. On/off**）	To set value with two choices “switching on” or “switching off”.	Inter-phase instantaneous (for short：**I>.**）
5	Current value of instantaneous (for short：**I>. Current**）	To set current value with scope: 0~50.00A.	
6	Time-delay value of instantaneous (for short：**I>. delay**）	To set time-delay value, with scope: 0~600.00s.	
7	Limited instantaneous On/Off (for short：**I>>. On/off**）	To set value with two choices “switching on” or “switching off”.	Inter-phase limited instantaneous (for short：**I>>.**）
8	Current of limited instantaneous (for short：**I>>. Current**）	To set current value with scope: 0~50.00A.	
9	Time-delay of limited instantaneous (for short：**I>>. Delay**）	To set time-delay value, with scope: 0~600s.	
10	Selecting curve of inter-phase over current (for short：**I>>>. Curve**）	To set curve with five choices “definite” or “Normal inverse” or “Very inverse” or “extremely inverse” or “OFF”.	Phase to phase over current protection (short for：**I>>>.**）
11	Current of over current function (for short：**I>>>. Current**）	To set current value, with scope: 0~50.00A.	
12	Time-delay of inter-phase over current function (for short：**I>>>. Delay**）	To set time-delay value, with scope: 0~600.00s.	
13	Time multiplier of inter-phase over current (for short：**I>>>.Time MUL**）	To set time-multiplier value, with scope: 0.05~20.00	
14	Zero sequence over current 1 ON/OFF (for short：**I0>. On/off**）	To set value with two choices “switching on” or “switching off”.	Zero sequence over-current 1 protection (for short：**I0>>>.**）
15	Current value of zero sequence over current 1 (for short：**I0>. Current**）	To set current value, with scope: 0~20.00A.	
16	Time-delay of zero sequence over current 1 (for short：**I0>. Delay**）	To set time-delay value, with scope: 0~600.00s.	
17	Selecting curve of zero sequence over current 2 (for short：**I0>>. Curve**）	To set curve with five choices “definite” or “Normally inverse” or “Very inverse” or “extremely inverse” or “OFF”.	Zero sequence over current 2 protection (for short：**I0>>>.**）
18	Current value of zero sequence over current 2 (for short：**I0>>. Current**）	To set current value, with scope: 0~20.00A.	
19	Time-delay of zero sequence over current 2 (for short：**I0>>. Delay**）	To set time-delay value, with scope: 0~600.00s.	

20	Time multiplier of zero sequence over current 2 (for short：**I0>>. Time MUL**）	To set time multiple value, with scope: 0.05~20.00	
21	Overload protection On/Off (for short：**Overload On/off**）	To set value with two choices “switching on” or “switching off”.	Overload protection (for short：**Overload**)
22	Out style control of Overload protection (for short:**OutStyle alar/trip**）	To set value with two choices “Alarming” or “Tripping”.	
23	Current of overload protection (for short：**Overload Current**）	To set current value, with scope：0~50.00A	
24	Time-delay of Over Load protection (for short：**Over Load Delay**）	To set time-delay value, with scope: 0~600.00s.	

6. Operation of machine human interface (MHI)

Operation mode of MHI is realized via three approaches. One is using MHI which contains indicators, light-tough board of button and large LCD screen; the other one is adopting debugging assistance software in background to realize interaction operation. We only introduce MHI operation here.

There are seven light–touch keys contain "**C**" key, "**OK**" key, "▲"key, "▼"key, "◄"key, "►"key , "**P**"key and "**R**"key.

"**OK**" key is used to entering sub-menu or confirm key.

"▲"key is used to move cursor one bit up or plus one for modifying parameter.

"▼"key is used to move cursor one bit down or minus one for modifying parameter.

"◄"bey is used to move cursor one bit towards left.

"►"key is used to move cursor one bit towards right.

"**P**"key is used to start power source of backup to set or check parameters.

"**R**"key is used to return signal of event in device.

"**C**" key for return, from the submenu to the main menu.

When Line feeder no powering on, pressing "P" button , device powered by high energy lithium battery self-carried, will start up and enter debugging status, users can make operation of checking, setting and etc. If it takes 20 seconds without pressing round button for the second time, device will auto cut off battery power.

LCD screen adopts manner of hierarchical displaying, main function menus includes Monitor, System, Value, Event, Calibration and Output. Let us introduce different menu respectively.

6.1Monitor menu

As device is powered on, LCD screen entering monitor menu automatically. Real time AC quantity and binary input state are displayed at the top six rows of screen. If position signal of breakers or stored-energy signal is defined in item of binary input in system menu, then corresponding icon will be shown at the first row of HMI; if switching on re-closure function, icon of re-closure charging state will be displayed as charging battery at the first row.

As shown in fig.6.1, displaying data in screen will be renewed once per second. This menu includes two screens to display data, data of one screen rolls out automatically per ten seconds, as well as exchanging data between two screens via "▲"key and "▼"key.

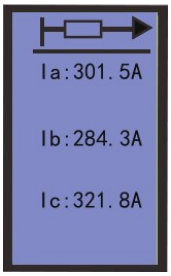


Fig.6.1 Monitor menu

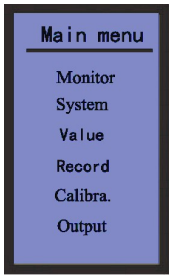


Fig.6.2 Main menu

6.2Mian menu

In monitor menu, pressing "**OK**" key can enter main menu shown in Fig.6.2.

Main menu includes six items as monitor, System, value, event, calibration, output menu. Selecting menu in demand by shifting "▲"key and "▼"key, and cursor's background color is black, then pressing "**OK**" key to enter sub-menu pointed by cursor.

6.3System menu

Fig.6.3 Browsing/modification menu Fig.6.4 input password Fig.6.5 system menu

Entering system menu from main menu, firstly, LCD will display choice: "browse"and "modify". If "browse" is chosen, system data is shown directly, customer only browse parameters here; if "modify" is selected, setting parameters can be operated, firstly, inputting password correctly, then entering modifying state of system menu.

In "browse" or "modify" selection interface, firstly, shifting selection by "▲"key and "▼"key, secondly, confirming selection via pressing "**OK**" key. In interface of input password, firstly, entering modification state "**OK**" key and choosing bit to modify by "◄"key or "►"key, then, writing bit of value in demand by "▲"key and "▼"key, finally, confirming password via pressing "**OK**" button. If you write error bit when input password, device will pop up "error" message, and then return main menu automatically

At modification state of system men, firstly, selecting parameter modifying in demand by "▲"key and "▼"key, then entering modification state via "**OK**" button, and choosing bit by "◄"key or "►"key to input, finally writing bit of value via "▲"key and "▼"key. After inputting value, cursor could be remove to selection state of parameters via "◄"key or "►"key , then chose next parameters in demand, finally, confirming all modification operation by pressing "**OK**" button to save parameters and "**R"** button to exit system menu.

6.4Value menu

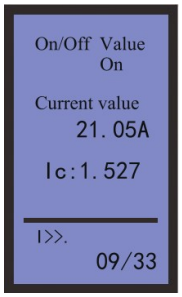


Fig.6.6 Value menu

Fig.6.7 Event menu

Both operation process of value and system menus are same: firstly choosing "browse" or "modify", then input password, finally entering display state fixed value.

Protection type of observing fixed value is displayed currently on top row.

Order number /total number of fixed value observed on bottom row state.

All voltage and current setting value are described by secondary value.

6.5Event menu

Entering event record menu shown as fig,6.7.

Device record and display the latest 100 event record. Each even record contains time stamper with millisecond accuracy and The maximum number of event record is 100. Each record carries timestamp with accuracy of millisecond and two screen data to display, event type and occur time will be displayed in the first screen; AC quantities of event will be displayed in the second screen,

Checking each data via "▲"key and "▼"key and Checking different screen data of each record via "◄"key or "►"key .

All voltage and current value in even menu are described by secondary value.

6.6Calibration menu

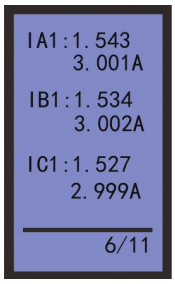


Fig.6.8 Calibration menu

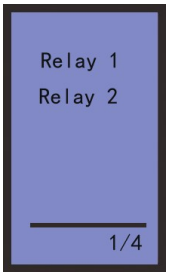


Fig.6.9 Output menu

In order to eliminate each AC input channel difference caused by inconsistency hardware, device set calibration menu, to adjust channel balance using software. Operation process of calibration is same with system.

Various correctly calibration parameters have been input before delivering products from plant. Do not enter this menu randomly, to avoid making error modification operation, unless device sent fault signal or be doubt inaccuracy of channel measurement. If you entered calibration menu by mistake, please press "**R"**

key directly to return main menu.

Note: **Aiming to avoid error action, when modifying parameters in device, device will exit all protection functions automatically while HMI entering on modifying state of any kind of parameters. So after finishing modification, device should return to main menu or monitor menu to ensure switching on protection functions timely.**

7. Manual version

Version		Software version	Date	Modification
Old	New			
	1.00	V1.0001	2024-12-25	The initial version.