RWB-7000L

线路保护测控装置

Line Protection Measurement And Control Device

技术说明书

Technical Specification

目录 catalogue

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订货前，请垂询厂家以获悉本产品的最新规格。

Attention: We reserve the right to modify the product specifications described in this manual without prior notice.

Before ordering, please contact the manufacturer for the latest specifications of this product.

一、概述 Overview

线路保护测控装置是以电流、电压保护及三相重合闸为基本配置的成套线路保护装置。适用于66kV 以下电压等级的非直接接地系统或经电阻接地系统中的方向线路保护及测控，可在开关柜就地安装，也可组屏安装于控制室。

The line protection measurement and control device is a complete set of line protection devices with current, voltage protection and three-phase reclosing as the basic configuration. It is suitable for the direction line protection and measurement and control in the non-direct grounding system or the resistance grounding system of the voltage level below 66kV, which can be installed in the switch cabinet or installed in the control room.

1.1 主要功能配置 Main function configuration

- 三段式低压闭锁相间方向过流
  Three-stage directional over-current protection blocking by compound voltage
- 反时限相间方向过流(一般、非常、极端)
  Phase to phase Current Inverse Definite Minimum Time (IDMT) Limit Component (Standard inverse, Very inverse, Extremely inverse)
- 三段式零序方向过流(可投告警或跳闸)
  Three-stage directional zero sequence protection (independent tripping or alarm)
- 反时限零序方向过流(一般、非常、极端)
  Zero sequence Inverse Definite Minimum Time (IDMT) Limit Component (Standard inverse, Very inverse, Extremely inverse)
- 三相一次重合闸(非同期、检同期和检无压)
  Three-phase reclosing function
- 加速保护 (前加速、后加速保护)
  Over-current acceleration protection and zero sequence acceleration protection (pre-acceleration and post-acceleration)
- 过负荷保护(可投告警或跳闸)
  overload component (independent tripping or alarm)
- 低周解列
  Under-frequency load shedding function
- 过压低压保护
  low voltage and overvoltage protection component
- PT 断线监测
  CT break detection
- CT 断线监测
  CT break detection
- 控制回路断线监测
  Control loop disconnection monitoring
- 测控
  measurement and control

1.2 主要特点 Main feature

☆ 装置采用新一代高性能 32 位 CPU，使产品的稳定性和运算速度得到充分保证。
The device adopts a new generation of high-performance 32-bit CPU, so that the stability and computing speed of the product are fully guaranteed.

☆ 采集模块采用 16 位的 A/D 转换器，各项测量计算指标轻松达到要求。
The acquisition module adopts 16-bit A/D converter, and the measurement and calculation indexes can easily meet the requirements.

☆ 配置大容量的存储模块，可记录多达 32 个录波报告，记录的事件数不少于 1000 条，具有掉电保持功能。
A large-capacity storage module can record up to 32 wave recording reports, recording at least 1000 events, and maintaining power failure.

☆ 高精度的时钟芯片，在装置失电时，仍保证时钟的准确性。
The high precision clock chip ensures the accuracy of the clock when the device loses power.

☆ 配备高速双以太网络通信接口。
Equipped with high-speed dual Ethernet communication interface.

☆ 精心的电气设计，整机无可调节器件，实现了免调试概念设计。
Careful electrical design, the whole machine has no adjustable devices, to realize the concept of debugging.

☆ 高等级、高品质保证的元器件选用。
High-grade, high-quality components selection.

☆ 完善的自诊断功能。
Complete self-diagnosis function.

☆ 防潮、防尘、抗振动的机箱设计。
Case design with moisture, dust and vibration resistance.

二、技术参数 Technical parameter

2.1 环境条件 Environmental condition

正常温度 Normal temperature：-10℃~55℃
极限温度 Limiting temperature：-30℃~70℃
存储温度 Storage temperature：-40℃~85℃

2.2 额定数据 Rated data

装置电源：AC/DC 110/220V 或 DC24V/48V (订货注明)
Device power supply: AC/DC 110/220V or DC24V/48V (specify when order)
状态量电平：外接AC/DC220V或DC110V或DC48V (订货注明)
State quantity level: AC/DC 110/220V or DC24V/48V outside (specify when order)
操作电源：DC220V，AC220V，DC110V，DC48V (订货注明)
Control power supply: DC220V，AC220V，DC110V，DC48V (specify when order)

额定交流数据 Rated AC data：

a) 线电压 Line voltage 100 V
b) 线路抽取电压 Incoming line voltage 100 V or 100/√3 V

c) 交流电流Alternating current 5A或1A (订货注明)
Alternating current 5A or 1A (specify when order)
d) 额定频率 Rated frequency 50Hz

2.3 功率消耗 Power consumption

a) 直流回路 正常工作时：不大于10W
动作时： 不大于15W
DC circuit Normal work: no more than 10W
Action: No more than 15W
b) 交流电压回路 每相不大于0.5VA
AC voltage circuit Not more than 0.5VA per phase
c) 交流电流回路 额定电流为5A时：每相不大于1VA
额定电流为1A时：每相不大于0.5VA
AC current circuit The rated current is 5A:Not more than 1VA per phase
The rated current is 1A:Not more than 0.5VA per phase

2.4 主要技术性能 Main performance technology

2.4.1 采样回路精确工作范围 Precise working range of sampling circuit

电压 voltage：0.005~1.2Un
电流 current：0.08In~20In

2.4.2 各类元件精度 Precision of various components

电流元件 current component： <±3%
电压元件 voltage component： <±3%
检同期角度 Synchronizing angle：<±1°
时间元件： 0s~2s时，误差不超过±35ms；2s以上时，误差不超过±3.0％；
time component: When 0s~2s, the error is not more than ±40ms;
When more than 2s, the error is not more than ±3%;
频率偏差 Frequency deviation：<±0.02Hz
滑差定值 Slip setting value： <±5%

2.4.3 模拟量测量回路精度 Power Frequency Analog Measurement Precision

装设专用测量子模件的测控装置：
The measurement and control device equipped with a special measurement submodule.
电流、电压：0.2 级
AC voltage, AC current： ≤±0.2%；
功率、电度：0.5 级
Active power, reactive power：≤±0.5%；

2.5 过载能力 Overload capacity

交流电流回路 2倍额定电流 连续工作
10倍额定电流 允许工作10s
40倍额定电流 允许工作1s

AC current circuit	2 times the rated current	continuous work
	10 times the rated current	allow to work 10s
	40 times the rated current	allow to work 1s
交流电压回路	1.2倍额定电压	连续工作
AC voltage circuit	1.2 times the rated current	continuous work
电源回路	80%~110%额定电压	连续工作
Power supply circuit	80%~110% rated voltage	continuous work

三、基本操作及使用 Basic operation and use

3.1 面板功能区介绍 Panel Function Area

保护装置面板由三部分组成，1 块彩色点阵液晶、7 个指示灯和 9 个操作按键组成。

The protection device panel is composed of three parts, a color dot matrix LCD, 7 indicators and 9 operating keys.

3.1.1 状态指示灯 Status Indicators

状态指示灯由 7 个指示灯组成，各灯功能如下：

The status indicator consists of seven indicators. Each indicator has the following functions:

序号 No.	指示灯 indicators	功能 function
1	跳闸	线路出现故障保护动作跳闸时点亮
	Trip	The trip indicator light is lit When the fault protection action of the line trips
2	合闸	重合闸等动作时，合闸指示灯点亮
	Reclose	The closing indicator light is lit when reclosing action
3	充电	重合闸正在充电时，充电指示灯闪烁； 重合闸充电完成时，充电指示灯常亮
	Charged	When reclosing is charging, the charging indicator flashes; When reclosing charging is complete, the charging indicator is on.
4	运行	装置正常工作时，运行指示灯闪烁
	Run	When the device is working normally, the running indicator blinks
5	告警	在出现各种预告信号时，告警灯点亮
	Alarm	When various warning signals appear, the alarm indicator lights up
6	跳位	断路器分位时，指示灯常亮
	Open	When the circuit breaker is open, the indicator is steady on
7	合位	断路器合闸时，指示灯常亮
	Closed	When the circuit breaker is closed, the indicator is steady on

3.1.2 操作键盘 Operating keyboard

键盘由 9 个按键组成，各按键功能如下：

The keyboard consists of 9 keys, and the functions of each key are as follows:

序号 No.	按键 key	主要功能 function
1	＋	用于参数的递加
		Used to append parameters

2	—	用于参数的递减
		Used for decrement of parameters
3	▲	用于向上翻页或上移光标
		Used to turn the page or move the cursor up
4	▼	用于向下翻页或下移光标
		Used to scroll down or move the cursor
5	◀	用于左移光标
		Used to move the cursor left
6	▶	用于右移光标
		Used to move the cursor right
7	确认	用于对参数设定后的保存确认和进入子目录
	ENTER	It is used to confirm the save after parameter setting and enter the subdirectory
8	复归	用于指示灯信号、告警、动作信号的复归
	RESET	Used to restore indicator signals, alarms, and action signals
9	取消	用于对参数设定后的取消和退出子目录
	ESCAPE	It is used to cancel and exit a subdirectory after parameters are set

3.2 装置菜单画面 Device menu screen

主界面 Main interface	一级菜单 menu1	二级菜单 menu2		功能描述 note
		内容	Item	
线路保护 Line Pro	运行工况 Run Sta	1.保护值	Sam Disp	采样显示 sampling display
		2.二次测量	Seco Mea	测量二次值 secondary measurement
		3.一次测量	Prim Mea	测量一次值 primary measurement
		4.电度值	energy	有功电度，无功电度 Active energy, reactive energy
		5.遥信状态	Di Sta	遥信状态 digital input state
	运行设置 Run Set	1.定值显示	Set Disp	定值查看 set display
		2.定值修改	Set Set	定值修改 Set value
		3.压板设置	SFC Set	压板设置 soft linking piece set
	报告管理 Report M	1.顺序事件	Seq Eve	顺序事件 sequent event
		2.动作报告	Trip Eve	事件报告 tripping event
		3.操作报告	Oper Eve	操作事件 operation event
		4.事件清除	Clr Eve	输入密码，清除事件及录波 clear event
	装置设置 Dev Set	1.参数设置	Dev Para	系统设置 SYS SET，内部控制字 1 Internal CW1 等
		2.网络设置	Net Set	网络设置 Ethernet Set
		3.串口设置	Seri Set	串口设置 RS485
		4.时间设置	Time Set	时间设置
		5.密码设置	Pass Set	密码修改 password set
	装置测试	1.开出测试	Do Test	开出传动 Out Act

	Dev Test			开出名称 Out Name， 动作类型(动作/返回) Out Type(Act/Back)
		2.保护上传	Pro Send	保护事件上传 Protection Event Send
		3.告警上传	Ala Send	告警事件上传 Alarm Event Send
		4.开入上传	Di Send	开入上传 Digital Input Send
		5.测量上传	Mea Send	测量上传 Measusrement Send
	出厂设置 Fac Set	1.通道校准	CHN Cal	增益校准 Gain Set，角度校准 Ang Set
		2.电度清零	Ele Clr	输入密码，清除电量。
		3.图形设置	Pic Set	手车工作位置 Hand Work Pos， 接地刀闸位置 Gro Switch Pos
		4.语言设置	Lang Set	中文 cn/英文 en
		5.版本信息	Help	类型 Type，版本 Ver，校验 CRC

四、保护功能说明 Protection function and Principle

4.1 方向元件 Directional Component

4.1.1 相间方向元件 Phase to phase Directional Component

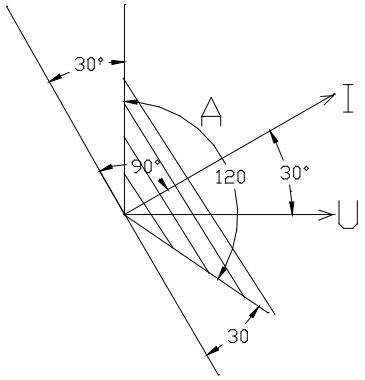
本装置的相间方向元件采用 90°接线方式，按相起动，各相电流元件仅受下表中所示相应方向元件的控制。为消除死区，方向元件带有记忆功能。

本装置 Arg(I/U)=-30°～90°，边缘稍有模糊，误差<±5°。

Use 90° connection mode, and start according to the phase. The direction where the current outflows from the busbar is positive, whose operation range Arg (U/I) = -90° ~ +30°, tolerance<±5°. This is shown in Figure below.

相间方向元件 Phase	电流 I	电压 U
A	IA	UBC
B	IB	UCA
C	IC	UAB

方向元件的对应关系表 Correspondence figure

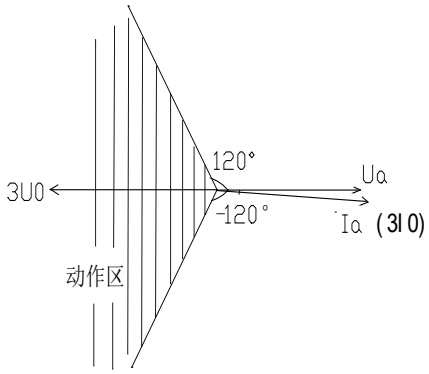


相间方向元件动作区域图 Action area figure

4.1.2 零序方向元件 Zero-sequence Directional Component

本装置的零序方向元件动作区为 Arg(3U0/3I0)=-180°～-120°及 120°～180°，3U0 为自产，外部 3I0 端子接线不需倒向。边缘误差角度<±5°。

The positive direction of the zero-sequence current is from the busbar to line. Zero sequence CT polarity terminal should be connected with the $3I_0$ polarity of the device. If considering it as neutral point low resistance earth mode of primary system, the operation area of the zero sequence directional component should be $\text{Arg}(3U_0/3I_0) = -180°\sim-120°$ and $120°\sim180°$, tolerance<±5°, wherein $3U_0$ is self-made. This is shown in Figure below.



零序方向元件动作区域图 Action area figure

4.2 过电流元件 Overcurrent component

三段过电流保护是指瞬时速断过电流保护、限时速断过电流保护、定时限过电流保护。当任一相电流大于整定值时，经过给定的时限延时后保护跳闸。从故障电流启动到保护动作出口的最短时间不大于 40ms(包括继电器固有动作时间)。为了躲开线路避雷器的放电时间，本装置中 I 段也设置了可以独立整定的延时时间。

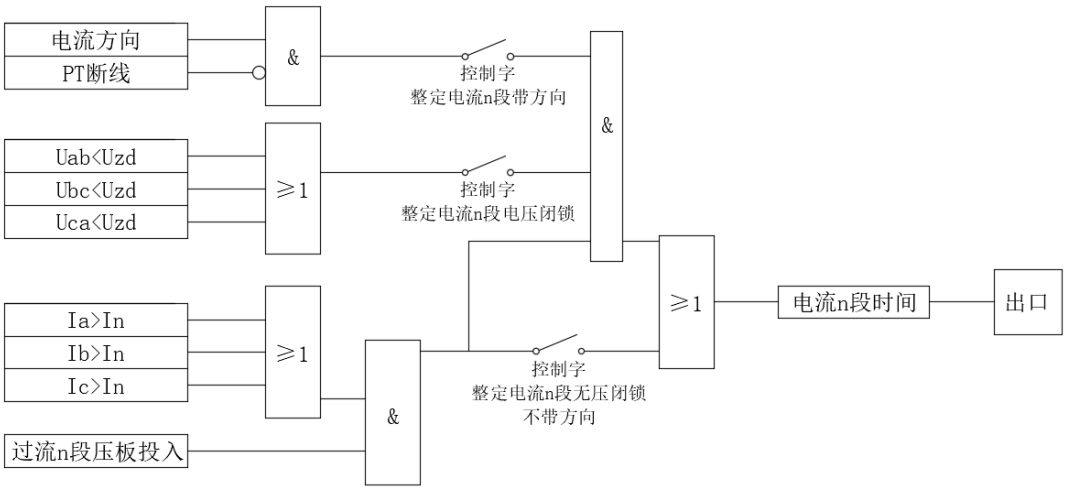
装置在执行三段过流判别时，各段判别逻辑一致，其动作条件如下：

1) I>Idn；Idn 为 n 段电流定值，I 为相电流
2) T>Tdn ；Tdn 为 n 段延时定值
3) 相应于过流相的方向条件及低电压条件满足(若需要)
4) 压板投入。

Three-stage overcurrent protection refers to instantaneous speed overcurrent protection, limited speed overcurrent protection, and fixed time overcurrent protection. When any phase current is greater than the setting value, the protection trip after a given time delay. The minimum time from the fault current start to the protection action outlet is not greater than 40ms(including the natural relay action time). In order to avoid the discharge time of the line arrester, the I section of the device is also set with a delay time that can be adjusted independently.

When the device performs the three-stage overcurrent judgment, the logic of each stage judgment is consistent, and its action conditions are:

1) I>Idn：Idn is the fixed value of the n stage current, and I is any phase current
2) T>Tdn：Tdn sets the value of the n delay
3) The direction conditions corresponding to the overcurrent phase and the low voltage conditions are met (if required)
4) Soft linking piece input；



注：In 为 n 段电流定值，Ia,b,c 为相电流，Uzd 为低电压整定值。

可在控制字 1 里设置 PT 断线相关段或相关元件退出。

PTDX 相关段退出：PT 断线时带方向或电压闭锁的保护段退出运行。

PTDX 相关元件退出：PT 断线时带方向或电压闭锁的保护段仅退出方向及电压。

Note: In is the n stage current setting, Ia,b,c is the phase current, Uzd is the low voltage setting value.

You can set the exit of the relevant segment or the exit of the relevant component in the code 1.

PT break to exit the relevant segment：The protection section with direction or voltage lock exits when the PT breaks;

PT break to exit the relevant component：The protection segment with direction or voltage block exits only the direction and voltage when the PT breaks.

4.3 零序过电流元件 Zero sequence overcurrent component

当线路等发生单相接地时，会产生零序电流，零序电流由专用的零序互感器输入装置(或经三相电流合成)。当零序电流大于整定值时，经过时限延时后保护跳闸或告警。该保护针对中性点不接地系统(经消弧线圈接地)。

When single-phase grounding occurs in the line, zero-sequence current is generated, and the zero-sequence current is generated by a dedicated zero-sequence transformer input device (or synthesized by three-phase current). When the zero sequence current is greater than the setting value, the protection trip or alarm is generated after a time delay. This protection is for neutral ungrounded systems (grounded via arc suppression coils).

零序过电流元件的实现方式基本与过流元件相同，满足以下条件时出口动作(告警或跳闸)：

1) 3I0>I0n ； I0n 为零序 n 段定值
2) T>T0n ；T0n 为零序 n 段延时定值
3) 相应的方向条件满足(若需要)
4) 压板投入。

零序过流可选用 I0 通道或自产。

零序过流可投告警或跳闸，且每段都可以单独整定。

The realization mode of the zero sequence overcurrent component is basically the same as that of the overcurrent component. Output action (alarm or trip) when the following conditions are met:

1) 3I0>I0n ； I0n is set for the zero sequence n stage
2) T>T0n ；T0n is zero sequence n delay setting
3) The corresponding direction condition is met (if required)

4) Soft linking piece input。

Zero sequence overcurrent can be selected I0 channel or three-phase current synthesis.

Zero sequence overcurrent can alarm or trip, and each stage can be tuned individually.

4.4 加速保护元件 Acceleration protection components

本装置的加速回路包括手合加速及保护加速两种，加速功能设置了独立的投退压板。

The acceleration circuit of the device includes two kinds: hand acceleration and protection acceleration, and the acceleration function is provided with an independent dropout soft linking piece.

4.4.1 手合加速 Hand acceleration

本装置的手合加速回路不需由外部手动合闸把手的触点来启动，此举主要是考虑到目前许多变电站采用综合自动化系统后，已取消了控制屏，在现场不再安装手动操作把手，或仅安装简易的操作把手。本装置的不对应启动重合闸回路也作了同样的考虑，详见后述。

手合加速回路的启动条件为：

1) 断路器在分闸位置的时间超过 30 秒；

2) 断路器由分闸变为合闸，加速允许时间扩展 3 秒。

3) 任一相电流/零序电流大于加速定值。

4) 延时时间到；

5) 压板投入。

The manual/hand acceleration circuit of the device does not need to be started by the contact of the external manual closing handle, which is mainly considering that the control screen has been canceled after the adoption of integrated automation system in many substations at present, and the manual operation handle is no longer installed on the site, or only a simple operation handle is installed. The same considerations are made for the non-corresponding start reclosing circuit of the device, as described below.

The starting/action conditions of the manual acceleration circuit are:

1) The circuit breaker is in the opening position for more than 30 seconds；

2) The circuit breaker is changed from opening to closing, and the acceleration allowed time is extended by 3 seconds.

3) Any phase current/zero sequence current is greater than the acceleration set value.

4) Delay time reached.

5) Soft linking piece input.

4.4.2 保护加速 Protection acceleration

保护加速分为前加速或重合后加速方式，可由控制字选择其中一种加速方式。

后加速保护适用于保护重合于故障线路时，可加速跳闸，防止故障扩大。后加速保护只在合闸后 3s 内起作用，3s 后加速功能自动退出。若在 3s 内保护已经启动，则后加速保护将一直延续到保护动作或者保护返回后才能自动退出。

本装置设置了独立的过流及零流加速段电流定值及相应的时间定值，与传统保护相比，此种做法使保护配置更趋灵活。本装置的过流加速段还可选择带低电压闭锁，但所有加速段均不考虑方向闭锁。

Protection acceleration can be divided into pre-acceleration or post-coincidence acceleration, and one of the acceleration modes can be selected by the control word.

The rear acceleration protection is suitable for accelerating tripping when the protection coincides with the fault line to prevent the expansion of the fault. The rear acceleration protection only works within 3s after closing, and the acceleration function automatically exits after 3s. If the protection is

enabled within 3s, the post-acceleration protection will continue until the protection action or the protection returns.

The device is equipped with independent current setting and corresponding time setting of the overcurrent and zero current acceleration section, which makes the protection configuration more flexible compared with the traditional protection. The overcurrent acceleration section of the device can also be selected with low voltage lock, but all acceleration sections do not consider the direction lock.

4.5 反时限元件 Inverse time component

反时限保护元件是动作时限与被保护线路中电流大小自然配合的保护元件，通过平移动作曲线，可以非常方便地实现全线的配合。常见的反时限特性解析式大约分为三类，即标准反时限、非常反时限、极端反时限，本装置中反时限特性由整定值中反时限指数整定。各反时限特性公式如下：

The inverse time protection component is a protection component that naturally matches the action time with the current in the protected line, and can be easily matched with the whole line through the translation action curve. The common inverse time characteristic analytical formula can be divided into three types, namely standard inverse time, extraordinary inverse time and extreme inverse time. The inverse time characteristic in the device is adjusted by the inverse time index in the setting value. The inverse time characteristic formula is as follows:

a.一般反时限(整定范围是 0.007～0.14) Standard inverse (setting range is 0.007 ~ 0.14)

$$t = \frac{0.14tp}{(\frac{I}{Ip})^{0.02} - 1}$$

b.非常反时限(整定范围是 0.675～13.5) Very inverse (setting range is 0.675 ~ 13.5)

$$t = \frac{13.5tp}{(\frac{I}{Ip}) - 1}$$

c.极端反时限(整定范围是 4～80) Extremely inverse (setting range is 4 ~ 80)

$$t = \frac{80tp}{(\frac{I}{Ip})^{2} - 1}$$

其中： tp 为时间系数，范围是（0.05~1）

Ip 为电流基准值

I 为故障电流

t 为跳闸时间

注意：整定值部分反时限时间为上面表达式中分子的乘积值，单位是秒。

tp is the inverse time time coefficient, the range is (0.05~1)

Ip is the reference value of the inverse time limit current, that is, the start value of the inverse time limit current protection. When I > Ip, the protection starts

I indicates the fault current

t is the trip time

Note: The setting part of the inverse time limit time is the product value of the molecules in the above

expression, in seconds.

本装置相间电流及零序电流均带有反时限保护功能，且反时限都可设置带或不带方向。

电流反时限的逻辑为：

1) 压板投入；

2) 满足反时限条件；

注：若投入电流反时限，则电流III段保护的定时限自动退出。若投入零序反时限，则零序电流III段保护的定时限自动退出。

The phase-to-phase current and zero sequence current of the device have the function of inverse time limit protection, and the inverse time limit can be set with or without direction.

The action conditions of the inverse time component are:

1) Soft linking piece input.

2) The inverse time condition is satisfied.

Note: If the input current inverts the time limit, the fixed time limit of the current III protection automatically exits. If the zero sequence inverse time limit is put in, the fixed time limit of the zero sequence current section III protection automatically exits.

可在控制字 1 里设置 PT 断线相关段或相关元件退出。

PTDX 相关段退出：PT 断线时带方向或电压闭锁的保护段退出运行。

PTDX 相关元件退出：PT 断线时带方向或电压闭锁的保护段仅退出方向及电压。

You can set the exit of the relevant segment or the exit of the relevant component in the code 1.

PT break to exit the relevant segment：The protection section with direction or voltage lock exits when the PT breaks;

PT break to exit the relevant component：The protection segment with direction or voltage block exits only the direction and voltage when the PT breaks.

4.6 过负荷元件 Overload component

过负荷元件监视三相的电流，其动作条件为：

1) 任一相电流大于过负荷定值；

2) 时间延时到；

3) 压板投入；

过负荷报警压板与跳闸压板，可单独整定。

The overload component monitors the current of the three phases, and its action conditions are:

1) Any phase current is greater than the overload value；

2) Delay time reached；

3) Soft linking piece input；

The soft linking pieces of overload alarm and overload trip can be adjusted separately.

4.7 重合闸 Reclosing component

4.7.1 启动回路 Starting loop

a) 故障电流保护跳闸启动

b) 开关位置不对应启动

其中，b)可在控制字 1 里设置开关偷跳不启动/启动重合。

当充电完成后，检测到 a) 或 b) 且未出现闭锁条件，重合闸经过延时后进行重合动作并放电，整个过程重合闸只动作一次。当重合于永久性故障线路时，可选择后加速保护加速跳开。

a) When the fault current (phase current or zero sequence current) protection trip, start the reclosing function；

b) When the switch position does not correspond, start the reclosing function；

Therein, b) can be set in the code 1 "15.No SGACC Reclose/ SGACC Reclose".

When the charging is completed, a) or b) is detected and there is no locking condition, reclosing after a delay, the reclosing action is carried out and discharged, and the entire process of reclosing only operates once. When it coincides with a permanent fault line, the circuit breaker can be accelerated by the post acceleration protection.

4.7.2 闭锁条件 Blocking condition

断路器合位时重合充电时间为 15 秒；充电过程中重合绿灯发闪光，充电满后发常绿光，不再闪烁。本系列的装置设置的重合闸“放电”条件有：

a) 控制回路断线后，重合闸延时 10 秒自动“放电”

b) 弹簧未储能端子高电位，重合闸延时 2 秒自动“放电”

c) 闭锁重合闸端子高电位，重合闸立即“放电”

When the circuit breaker is in position, the reclosing charging time is 15 seconds. During the charging process, the green light will flash, and the green light will glow after full charging, and it will no longer flash. The reclosing "discharge" conditions of this series of devices are:

a) After the control loop is broken, reclosing delay 10 seconds automatic "discharge"；

b) No energy storage terminal high potential, reclosing delay 2 seconds automatic "discharge"；

c) Lock reclosing terminal high potential, reclosing immediately "discharge".

4.7.3 重合闸判别方式 Reclosing discrimination method

三相一次重合闸判别方式可分为：非同期方式、检同期方式、检无压方式、检同期及无压方式。

Three-phase reclossing method can be divided into: non-synchronous method, detecting synchronous method, detecting non-voltage method, detecting synchronous method and non-voltage method.

序号 No.	判别方式 method	备注 note
1	非同期方式	不检
	non-synchronous method	without judgement
2	检同期方式	线路抽取电压 Ux 与同期电压相别之间的检同期定值(角度)
	detecting synchronous method	The difference (synchronizing angle) between the incoming-line voltage Ux and the contemporaneous voltage
3	检无压方式	线路抽取电压 Ux 无压
	detecting non-voltage method	the incoming-line voltage Ux is no-voltage
4	检同期及无压方式	见本表格序号 2#和 3#
	detecting synchronous method and non-voltage method	See this figure 2# and 3#

4.8 低周解列元件 Low-frequency trip component

利用这一元件，可以实现分散式的频率控制，当系统频率低于整定频率时，此元件就能自动判定是否切除负荷。

低周解列，即低频减载，低周减载。低频减载功能逻辑中设有一个滑差闭锁元件以区分故障情况、电机反充电和真正的有功缺额。

考虑低频减载功能只在稳态时作用，故取 AB 相间电压进行计算，试验时仍需加三相平衡电压。当此电压(UAB)低于闭锁频率计算电压时，低频减载元件将自动退出。

With this component, distributed frequency control can be realized. When the system frequency is lower than the setting frequency, this component can automatically determine whether to cut the load.

Low cycle decompression, that is, low frequency load shedding, low cycle load shedding. A slip blocking element is included in the low-frequency load shedding function logic to distinguish fault conditions, motor backcharging, and true active power gaps.

Considering that the low-frequency load shedding function only works in steady state, the AB phase voltage is used for calculation, and the three-phase balance voltage is still needed to be added during the test. When this voltage (UAB) is lower than the calculated voltage of the lockout frequency, the low-frequency load shedding component will automatically exit.

综上所述，低频减载元件的判据为：

1) 三相正序平衡电压，且 Uab>Ubs；

2) df/dt < F/T；

3) 频率由正常到不正常的变化(频率小于低频定值，且大于 45Hz)；

4) T>TF；

5) 本线路有载，负荷电流>0.1In；

6) 压板投入。

注：Ubs 为低周闭锁电压定值，F/T 为低周闭锁滑差定值。In 为装置二次额定电流。

In summary, the criteria for low-frequency load shedding component are:

1) Three-phase positive sequence equilibrium voltage, and Uab>Ubs；

2) df/dt < F/T；

3) Change in frequency from normal to abnormal (frequency less than the low frequency fixed value and greater than 45Hz)；

4) T>TF；

5) This line is loaded, the load current is >0.1In；

6) Soft linking piece input.

Note：Ubs is the low frequency locking voltage setting, and F/T is the low cycle locking slip setting. In is the secondary rated current of the device.

4.9 低电压元件 Low voltage component

低电压保护，可设置经或不经电流闭锁。

低压元件的动作条件为：

1) 断路器合位；

2) 三个线电压均大于定值 2 秒以上，之后低于低电压定值；

3) 设置经电流闭锁时，三相电流必须小于“低压闭锁电流”定值；

4) 延时时间到；

5) 压板投入。

注：控制字 2 里的“低压电流闭锁”投入时，若任一相电流大于“低压闭锁电流”定值，则会闭锁低压保护元件。

Low voltage protection, can be set with or without current locking.

The action conditions of the low-voltage component are:

1) The circuit breaker is in position；

2) All three line voltages are above the set value for more than 2 seconds, and then below the low voltage set value；

3) When setting the current lock, the three-phase current must be less than the low voltage lock current setting value；

4) Delay time reached；

5) Soft linking piece input.

Note: When the "low voltage current lock" in code 2 is put in, if any phase current is greater than the "low voltage lock current" set value, the low voltage protection element will be locked.

4.10 过电压元件 Over voltage component

本装置可以反应母线电压的过压保护，过压元件的动作条件为：

1) 断路器合位；

2) 任一个线电压大于过电压定值；

3) 延时时间到；

4) 压板投入。

The device can reflect the over voltage protection of the busbar voltage, and the action conditions of the overvoltage component are:

1) The circuit breaker is in position；

2) Any line voltage is greater than the over voltage value；

3) Delay time reached；

4) Soft linking piece input.

4.11 零序过压元件 Zero sequence overcurrent component

适用于小电流接地系统的接地保护，本装置的零序电压无需取自三相五柱式电压互感器二次侧开口三角电压，而是取自三相电压的直接合成。

零序过压元件的逻辑为：

1) 断路器合位；

2) 零序电压大于定值；

3) 延时时间到；

4) 压板投入；

零序过压可投告警或跳闸。

The zero sequence overvoltage component is suitable for the grounding protection of the small current grounding system. The zero sequence voltage of the device does not need to be derived from the secondary opening triangle voltage of the three-phase five-column voltage transformer, but from the direct synthesis of the three-phase voltage.

The logic of a zero-sequence overvoltage component is:

1) The circuit breaker is in position；

2) The zero sequence voltage is greater than the fixed value；

3) Delay time reached；

4) Soft linking piece input.

Zero sequence voltage protection can alarm or trip.

4.12 失压元件 No voltage component

当系统电源消失时，经设定的延时时间Tset后，启动失压保护。系统电源消失判据结合了无压无流条件。失压元件的逻辑为：

1) 断路器合位；

2) 三相线电压均大于定值 2 秒以上，再小于定值；

3) 本线路无流(I<5%In 额定电流)；

4) 延时时间到；

5) 压板投入；

失压保护可投告警或跳闸。

When the system power supply disappears, after the set delay time Tset, start the voltage loss protection. System power loss criterion combined with no voltage and no current condition. The logic of the no voltage component is:

1) The circuit breaker is in position；

2) The three-phase line voltage is greater than the fixed value for more than 2 seconds, and then less than the fixed value；

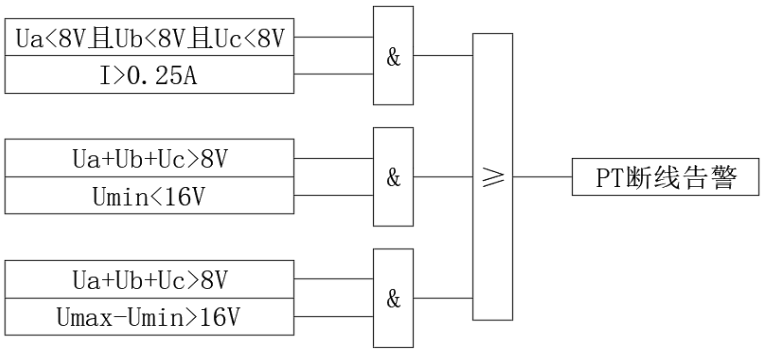
3) No current in this line (I<5%In rated current);

4) Delay time reached；

5) Soft linking piece input.

No voltage protection can alarm or trip.

4.13 PT 断线检测 PT break detection



在下面三个条件之一得到满足的时候，装置报发“PT 断线”信息并点亮告警灯：

1. 三相电压均小于 8V，某相(a 或 c 相)电流大于 0.25A，判为三相失压。
2. 三相电压和大于 8V，最小线电压小于 16V，判为两相或单相 PT 断线。
3. 三相电压和大于 8V，最大线电压与最小线电压差大于 16V，判为两相或单相 PT 断线。

PT 断线检测功能可以通过“TV 断线自检”控制字投退。

装置在检测到 PT 断线后，可根据控制字选择，或者退出带方向元件、电压元件的各段保护，或者退出方向、电压元件。

The device reports a "PT break" message when one of the following three conditions is met:

1. The three-phase voltage is less than 8V, and the current of a phase (A or C phase) is greater than 0.25A, which is judged as three-phase voltage loss.
2. If the sum of the three-phase voltage is greater than 8V and the minimum line voltage is less than 16V, it is judged as a two-phase or single-phase PT break.

3. If the sum of the three-phase voltage is greater than 8V, and the difference between the maximum line voltage and the minimum line voltage is greater than 16V, it is judged as a two-phase or single-phase PT break.

The PT break detection function can be returned by the "TV break Self-check" (in code 1).

After detecting the PT break, the device can choose according to the control code, or exit the protection of each section with the direction element and voltage element, or exit the direction and voltage element.

4.14 CT 断线检测 CT break detection

Imin 无流(小于 0.05In)，Imax 有流且小于 1.2In，装置报 CT 断线。

If there is no current in Imin (less than 0.05In), and there is current in Imax (less than 1.2In), the device reports CT break.

4.15 控制回路断线检测 Control loop break detection

在跳位监和合位监均处于分位时，装置延时报控制回路断线。控制回路断线可设置退出或投入。

When the circuit breaker's opening position (TWJ) and closing position (HWJ) are both in the division signal, the device will delay to report the break of the control circuit. Control loop break can be set to exit or input.

五、装置整定 Device setting

5.1 整定值清单及说明 Setting list and description

序号 No.	定值名称 name	范围 range	单位 units	备注 note
1	控制字 1	0000～FFFF	/	参见控制字 1 说明
	Code 1		/	see Code 1 description
2	控制字 2	0000～FFFF	/	参见控制字 2 说明
	Code 2		/	see Code 2 description
3	电流I段定值	0.2～100.0	A	
	IOverI1			
4	电流II段定值	0.2～100.0	A	
	IOverI2			
5	电流III段定值	0.2～100.0	A	
	IOverI3			
6	电流I段时间	0.0～5.00	s	
	TOverI1			
7	电流II段时间	0.1～20.00	s	
	TOverI2			
8	电流III段时间	0.1～20.00	s	
	TOverI3			
9	零序I段定值	0.1～20.0	A	
	IOverI01			

序号 No.	定值名称 name	范围 range	单位 units	备注 note
10	零序II段定值 IOverI02	0.1～20.0	A	
11	零序III段定值 IOverI03	0.1～20.0	A	
12	零序I段时间 TOverI01	0.0～5.00	s	
13	零序II段时间 TOverI02	0.1～20.00	s	
14	零序III段时间 TOverI03	0.1～20.00	s	
15	电流加速定值 TOverI01	0.2～100.0	A	
16	电流加速时间 TAccelI	0.0～5.00	s	
17	零序加速定值 IAccelI0	0.1～20.0	A	
18	零序加速时间 TAccelI0	0.1～5.00	s	
19	电流闭锁电压 Vol Block	1.0～120.0	V	线电压 Line voltage
20	电流反时基准 InvI Base	0.2～100.0	A	
21	电流反时时间 InvI Time	0.005～127	s	
22	零序反时基准 InvI0 Base	0.1～20.0	A	
23	零序反时时间 InvI0 Time	0.005～127	s	
24	反时限指数 Inv Index	0.01～10.0	/	置 0.02，1，或 2 set as 0.02, 1, 2
25	过负荷电流 IOverLoad	0.5～10.0	A	
26	过荷告警时间 TAlarmOverL	0.1～9000	s	
27	过荷跳闸时间 TTripOverL	0.1～9000	s	
28	重合闸检同期定值 Reclose ANG	10～50	度 degree	
29	重合闸时间 TReclose	0.2～20.0	s	
30	低周元件频率	45.0～49.5	Hz	

序号 No.	定值名称 name	范围 range	单位 units	备注 note
	FLowFreq			
31	低周元件时间	0.1～20.0	s	
	TLowFreq			
32	低周闭锁电压	10～120	V	线电压
	LowF Ublock			Line voltage
33	低周闭锁滑差	0.5～20.0	Hz/s	
	Df/dt Block			
34	过电压定值	20.0～120	V	线电压
	UOverU			Line voltage
35	过电压时间	0.1～20.0	s	
	TOverU			
36	零序过压定值	10.0～60.0	V	
	UOverU0			
37	零序过压时间	0.1～20.0	s	
	TOverU0			
38	低电压定值	20.0～120	V	线电压
	ULowU			Line voltage
39	低电压时间	0.1～20.0	s	
	TLowU			
40	低压闭锁电流	0.2～100.0	A	
	Block Cur			
41	失压定值	20.0～120	V	线电压
	ULostU			Line voltage
42	失压时间	0.1～20.0	s	
	TLostU			
43	PT 变比	1~9999	/	
	PT Ratio			
44	CT 变比	1~9999	/	
	CT Ratio			

控制字 1 定义： Code1 definition

序号 No.	内容 content	备注 note
1	电流 I 段带/不带方向	
	Direct / Non-Direct I1	
2	电流II段带/不带方向	
	Direct / Non-Direct I2	
3	电流III段带/不带方向	
	Direct / Non-Direct I3	
4	电流 I 段无压/电压闭锁	
	Non-UBlock / UBlock I1	
5	电流II段无压/电压闭锁	

	Non-UBlock / UBlock I2	
6	电流III段无压/电压闭锁	
	Non-UBlock / UBlock I3	
7	电流加速无压/电压闭锁	
	Non-UBlock / UBlock IAcc	
8	零序 I 段带/不带方向	
	Direct / Non-Direct I01	
9	零序II段带/不带方向	
	Direct / Non-Direct I02	
10	零序III段带/不带方向	
	Direct / Non-Direct I03	
11	电流反时限无/带方向	
	Non-Direct / Direct IInv	
12	零序反时限无/带方向	
	Non-Direct / Direct I0Inv	
13	选择前/后加速方式	
	Pre-IAcc / Post-IAcc	
14	PTDX 相关元件/段退出	PT 断线
	TV Fail Non-Dir / Non-Pro	PT break
15	开关偷跳不/启动重合	
	No SGACC / SGACC Reclose	Switch slip, initiate reclosing
16	PT 断线检测退出/投入	
	PT Fail Off / On	PT break detect

控制字 2 定义： Code2 definition

序号 No.	内容 content	备注 note
1	非同期方式/检同期方式/检无压方式 /检同期及无压方式	
	No Sync Reclose / Sync Reclose / No-Vol Reclose / Sync&No-Vol	
2	检同期选 UA/UB/UC/UAB/UBC/UCA	
	Synchronize UA/UB/UC/UAB/UBC/UCA	
3	零序过流用 I0 通道/自产	
	I0 USE CHANNEL / SELF	
4	CT 断线判别投入/退出	
	CT Fail On / Off	
5	零序过压投告警/跳闸	
	Zero Vol Alm / Trip	
6	低压电流闭锁退出/投入	
	Non-UBlock / UBlock LOWU	
7	失压投告警/跳闸	
	Lost Vol Alm / Trip	
8	零序 I 段投告警/跳闸	

	OverI01 Trip / Alm	
9	零序II段投告警/跳闸	
	OverI02 Trip / Alm	
10	电流III段投告警/跳闸	
	OverI03 Trip / Alm	

5.2 保护压板说明 Soft linking piece definition

序号 No.	压板名称 name	对应功能 function
1	电流I段	退出/投入
	Over-Cur I	Off or on
2	电流II段	退出/投入
	Over-Cur II	Off or on
3	电流III段	退出/投入
	Over-Cur III	Off or on
4	零序I段	退出/投入
	Zero-Seq I	Off or on
5	零序II段	退出/投入
	Zero-Seq II	Off or on
6	零序III段	退出/投入
	Zero-Seq III	Off or on
7	电流加速段	退出/投入
	Cur Accel	Off or on
8	零序加速段	退出/投入
	Zero Accel	Off or on
9	电流反时限	退出/投入
	Cur Iverse	Off or on
10	零序反时限	退出/投入
	Zero Iverse	Off or on
11	过负荷告警	退出/投入
	OverLoad Alarm	Off or on
12	过负荷跳闸	退出/投入
	OverLoad Trip	Off or on
13	重合闸	退出/投入
	Reclose	Off or on
14	低周解列	退出/投入
	Low Freq	Off or on
15	低压保护	退出/投入
	Low Voltage	Off or on
16	过压保护	退出/投入
	Over Voltage	Off or on
17	零序过压保护	退出/投入
	Over Zero Vol	Off or on

序号 No.	压板名称 name	对应功能 function
18	失压保护	退出/投入
	Lost Vol	Off or on

5.3 内部控制字说明 Internal code definition

序号 No.	内容 content	备注 note
1	控制回路断线投入/退出	
	Contrl-Break On / Off	
2	PT 接线为 YY / VV	VV 接线时，短接电压采样端子 Ub 和 Un
	PT for YY / VV	If the connection mode is VV, short-circuit the voltage sampling terminals Ub and Un
3	开入 1 为远方位置/普通开入	
	DI1 Remote pos / for DI	
4	开入 12 为普通开入/检修压板	
	DI12 for DI / overhaul	
5	启动报文上送/不上送	
	StartUp Send / Not Send	
6	有/无以太网模块 2	
	Have /No Ethernet2	
7	不显示/显示主接线图	
	No View / View JXT	
8	远方位置为常开/常闭	
	Remote pos open / close	
9	弹簧未储能为常开/常闭	
	spr no energy open / close	
10	开入 13 为普通开入/复归	
	DI13 for DI / FG	FG means reset
11	B 码对时投入/退出	
	B Code On / Off	

六、装置信息一览表 List of device information

6.1 保护事件信息一览表 Protection Event Information List

序号 No.	事件名称	Event name	通信代码 Item No.	备注 note
1	保护启动	Startup	01H	
2	过流I段	Over-Cur I	02H	
3	过流II段	Over-Cur II	03H	

4	过流III段	Over-Cur III	04H	
5	零序I段	Ze-Seq I Trip	05H	
6	零序II段	Ze-Seq II Trip	06H	
7	零序III段	Ze-Seq III Trip	07H	
8	重合闸	Reclose	08H	
9	低周	Low Freq	09H	
10	过负荷动作	OverLoad Trip	0AH	
11	电流加速段	Cur Accel	0BH	
12	零序加速段	Zero Accel	0CH	
13	电流反时限	Cur Inverse	0DH	
14	零序反时限	Zero Inverse	0EH	
15	过压	Over Voltage	0FH	
16	欠压	Low Voltage	10H	
17	零序过压动作	Zer Vol Trip	11H	
18	失压	Lost Voltage	12H	
19	CT 断线	CT Failure	13H	
20	PT 断线	PT Failure	14H	
21	控制回路断线	Control Fail	15H	
22	跳闸失败	Trip Failure	16H	
23	合闸失败	Close Fail	17H	
24	过负荷告警	OverLoad Alm	18H	
25	零序过压告警	Zer Vol Alm	19H	
26	失压告警	Lost Vol Alm	1AH	
27	零序I段告警	Ze-Seq I Alm	1BH	
28	零序II段告警	Ze-Seq II Alm	1CH	
29	零序III段告警	Ze-Seq III Alm	1DH	
30	遥控跳闸出口	Protec Trip	1EH	
31	遥控合闸出口	Protec Close	1FH	
32	遥控备用出口 1	Protec BACK1	20H	
33	遥控备用出口 2	Protec BACK2	21H	
34	遥控备用出口 3	Protec BACK3	22H	
35	遥控备用出口 4	Protec BACK4	23H	
36	遥控备用出口 5	Protec BACK5	24H	
37	遥控备用出口 6	Protec BACK6	25H	
38	定值设置成功	Set Success	26H	
39	定值设置失败	Set Fail	27H	
40	参数设置成功	Para Success	28H	
41	参数设置失败	Para Fail	29H	
42	一次图设置 OK	JXT Success	2AH	
43	一次图设置 FA	JXT Fail	2BH	
44	未知事件	Unknown Eve	2CH	

6.2 告警事件信息一览表 Alarm Event Information List

序号 No.	事件名称	Event name	通信代码 Item No.	备注 note
1	装置上电	Device On	01H	
2	RAM 错误	Ram Err	02H	
3	ROM 错误	Rom Err	03H	
4	AD 错误	AD Err	04H	
5	定值无效	Set Err	05H	
6	参数无效	Para Err	06H	
7	开出异常	Do Err	07H	
8	网络 1 异常	Net1 Err	08H	
9	网络 2 异常	Net2 Err	09H	

6.3 保护遥信量信息一览表 Remote Signal Information List

序号 No.	遥信量名称	name	通信代码 Item No.	备注 note
1	远方/就地/开入 1	DI1	01H	
2	弹簧未储能	Spring no energy	02H	
3	闭锁重合闸	Block Reclose	03H	
4	开入 4	DI4	04H	
5	开入 5	DI5	05H	
6	开入 6	DI6	06H	
7	开入 7	DI7	07H	
8	开入 8	DI8	08H	
9	开入 9	DI9	09H	
10	开入 10	DI10	0AH	
11	开入 11	DI11	0BH	
12	开入 12/检修	DI12	0CH	
13	开入 13/复归	DI13	0DH	
14	TWJ	TWJ	0EH	Tripping position
15	HWJ	HWJ	0FH	Closing position
16	STJ	STJ	10H	
17	事故总	General Fault	11H	
18	告警总	General Alarm	12H	
19	GPS	GPS	13H	

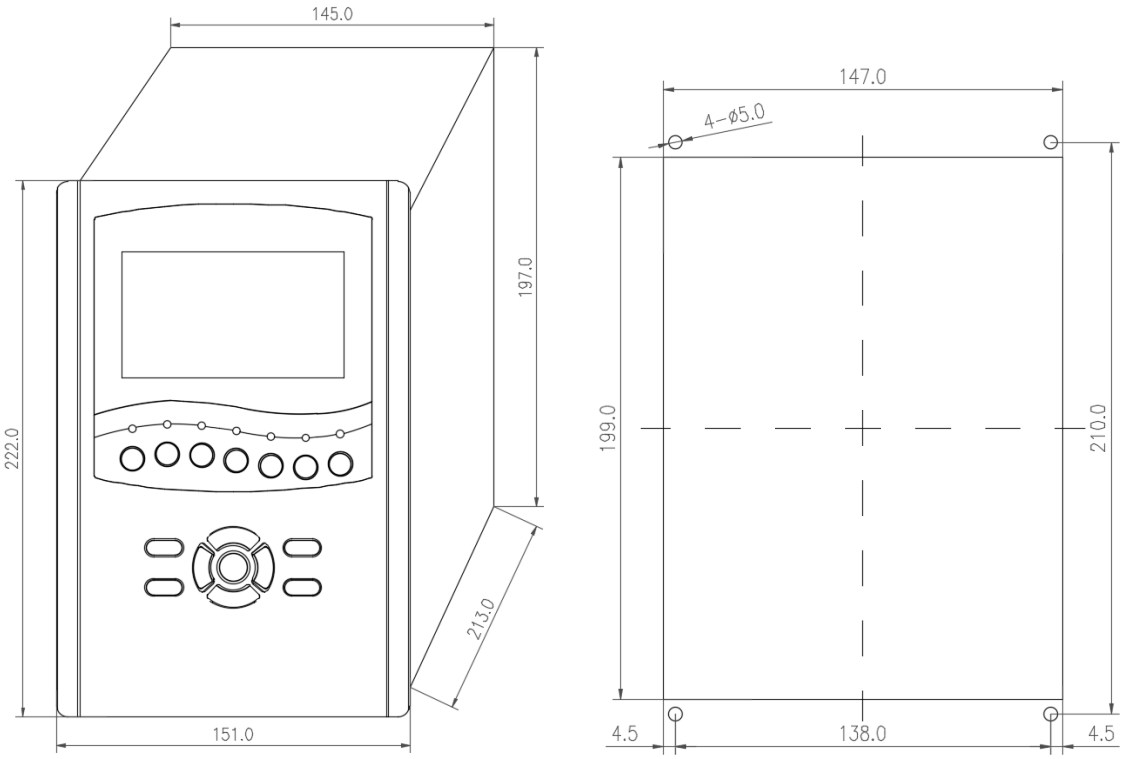
6.4 保护遥测量信息一览表 Remote Measurement Information List

序号 No.	遥测量名称 name	通信代码	备注
1	Ua	01H	
2	Ub	02H	
3	Uc	03H	
4	Uab	04H	

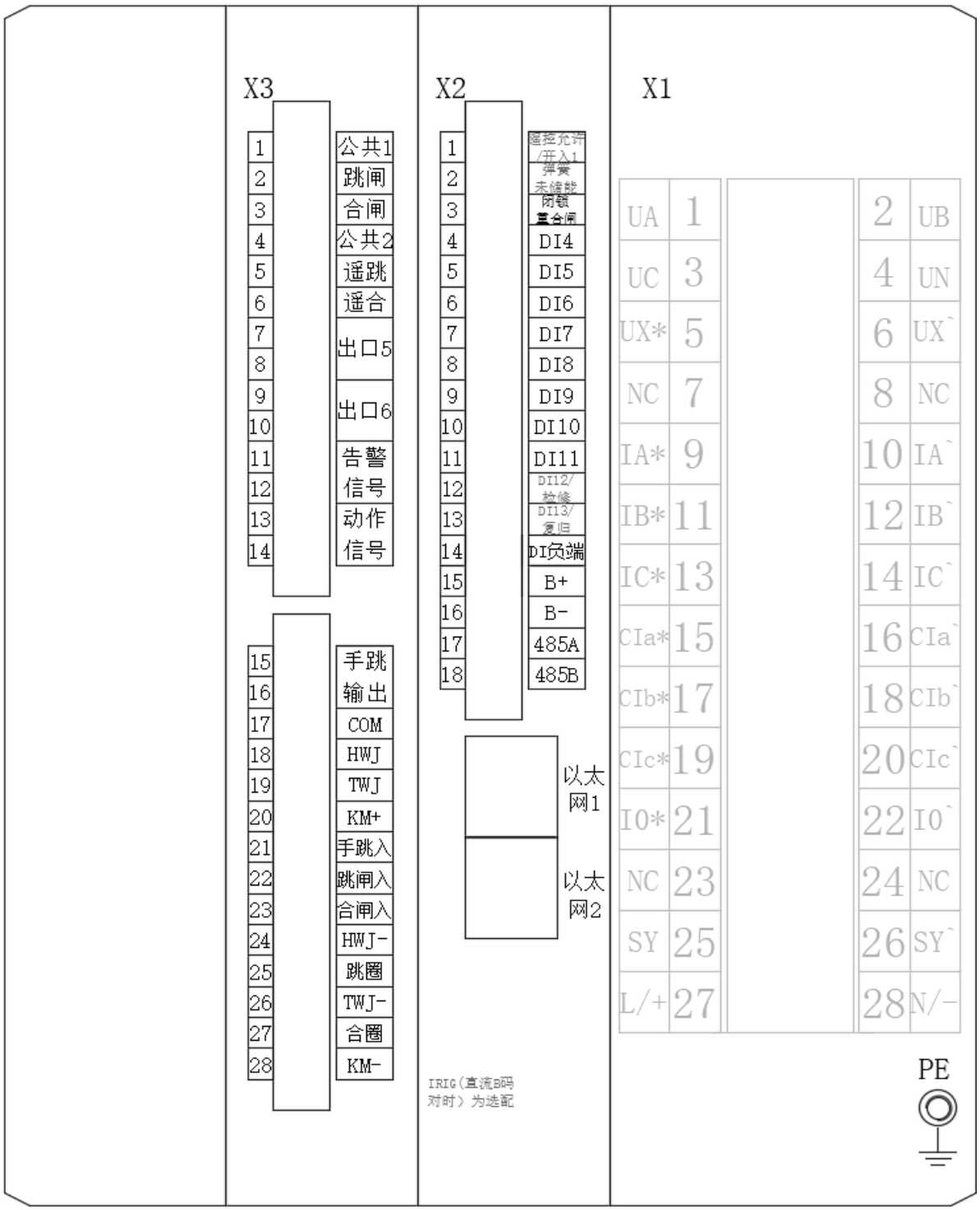
5	Ubc	05H	
6	Uca	06H	
7	3U0	07H	Zero sequence voltage
8	Ia	08H	
9	Ib	09H	
10	Ic	0AH	
11	P	0BH	Active power
12	Q	0CH	Reactive power
13	COSΦ	0DH	Power factor
14	F	0EH	Frequency

七、装置外观及开孔尺寸图 Device appearance and hole size drawing

产品外观及尺寸：151mm(W)/ 222mm(H)/ 213mm(D) (厚度不含面板，不含接线端子)。
Device appearance and size: 151mm(W)/ 222mm(H)/ 213mm(D)
(Thickness does not include panel, does not include terminal).



八、装置背板端子图 Device backplane terminal definition diagram

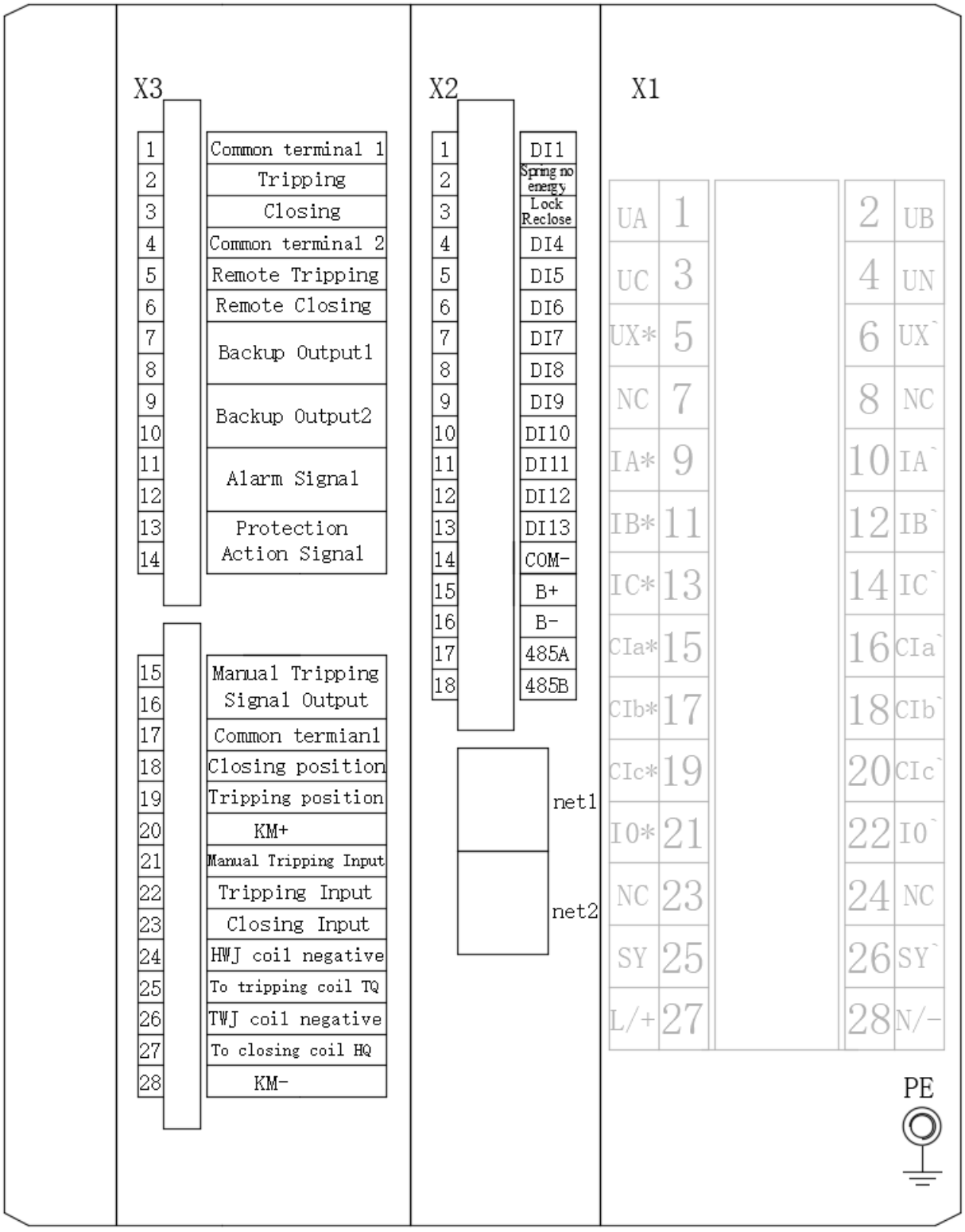


说明：

1、VV 接线时，短接 X1 板的 UB 和 UN。

2、X1 板的 IA、IB、IC 为保护电流，带*为输入，带’为输出。

3、X1 板的 CIa、CIb、CIc 为测量电流，带*为输入，带’为输出。



Note:

1、When connecting VV cables, short-circuit UB and UN of the X1 board.

2、The IA, IB and IC of the X1 board are protection currents, with * as input and ' as output.

3、The CIa, CIb and CIc of the X1 board are measurement currents, with * as input and ' as output.

Note:

序号 No.	端子序号 Terminal No.	定义	definition	功能描述 descripition
1	X2-14	DI 负端	COM-	Binary signal value input COM (DC220V- or DC110V-)
2	X3-20	KM+	KM+	Control power supply input positive terminal
3	X3-21	手跳入	Manual tripping input	Manual tripping, remote control tripping or external protection tripping input (block the reclosing) input terminal.
4	X3-22	跳闸入	Tripping input	Protection tripping input (not block the reclosing)
5	X3-23	合闸入	Closing input	Reclosing, manual or remote control closing input termianl
6	X3-24	HWJ-	HWJ coil negative	breaker tripping coil, whose connection termianl should not be blocked via the pressure contact.
7	X3-25	跳圈	To tripping coil TQ	Connect with the circuit breaker tripping coil
8	X3-26	TWJ-	TWJ coil negative	Connect TWJ coil negative terminal to HQ (To circuit breaker closing coil, whose connection end should not be blocked via the pressure or spring with stored energy contact)
9	X3-27	合圈	To closing coil HQ	Connect with the circuit breaker closing coil
10	X3-28	KM-	KM-	Control power supply input negative terminal