

ALP220-PT 系列低压 PT 保护器
ALP220-PT Series Low Voltage PT Protector

安装使用说明书 V1.1
Installation Instructions V1.1

安科瑞电气股份有限公司

Acrel Co., Ltd

申 明

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目 录

Menu

1 概述 Overview.....	1
2 型号说明 Model description.....	2
3 技术参数 Technical parameters.....	2
4 外形及安装尺寸 Outline and installing dimension.....	4
5 安装接线 Installation and wiring.....	5
5.1 端子排列 Terminal arrangement.....	5
5.2 端子编号 Terminal number.....	6
6 操作指南 Operation instructions.....	7
6.1 显示操作说明 Display operation instructions.....	7
6.2 ALP220-PT 菜单概述 Overview of ALP220-PT menu.....	8
6.3 ALP220-PT 保护功能介绍 Functional introduction of ALP220-PT protection.....	19
6.4 子菜单详细描述 Detailed description of submenus.....	21
7 通讯指南 Communication instructions.....	27
7.1 Modbus RTU 通信协议概述 Overview of modbus communication protocol.....	27
7.2 ALP220-PT 系列通讯地址表 ALP220-PT communication address table.....	29
8 常见故障的诊断分析和排除 Diagnosis and Troubleshooting of Common Failures.....	43
8.1 电压显示值与实际电压值不对应 The voltage display value does not correspond to the actual voltage value.....	43
8.2 通讯无法正常连接 Communication cannot be connected normally.....	43
8.3 零序电压不能显示 Zero sequence voltage cannot be displayed.....	43
9 应用范例 Application examples.....	43
10 订货范例 Example of ordering goods.....	45

1 概述 Overview

ALP220-PT 系列智能型低压 PT 保护器（以下简称 ALP220-PT），适用于额定电压为 400V、额定频率为 50Hz 的低压系统。产品具备完善的保护、测量、控制与监视功能，为低压系统的保护与控制提供了完整的解决方案，同时还具有体积小，结构紧凑，安装方便等优势。

ALP220-PT series intelligent low-voltage PT protector apply to low-voltage system with rated voltage to AC 400V and rated frequency of 50Hz. ALP220-PT intelligent low-voltage PT protector, due to perfect protection, measurement, control and monitoring functions, not only provides a complete solution for low voltage system protection and control, but also has the advantages of small size, compact structure and easy installation.

ALP220-PT 系列产品集保护、测量、总线通讯为一体，提供面板指示、信号报警、故障/报警记录及开关量记录等功能。可以广泛使用于煤矿、石化、冶炼、电力、船舶、以及民用建筑等领域。

ALP220-PT series products have integrated protection, measurement, control and modbus communication into one and provided panel indication, signal alarm, trip alarm record and switch quantity record and other functions, applying to coal mine, petrification, smelting, electricity, ship and civil architecture and other fields.

ALP220-PT 系列产品具有以下特点：

ALP220-PT series products have the following characteristics:

- 辅助电源支持 AC 85V~265V/DC 110V~350V。
- The auxiliary power supply (APS) supports AC 85V~265V/DC 110V~350.
- 测量功能包括保护回路的电压测量和其他参数如接地电压的测量。
- The measurement function includes the voltage measurement of protection circuit and the measurement of other parameters such as grounding voltage.
- 具有低电压三段式保护、过电压保护、零序过电压保护、电压不平衡保护、PT 断线保护、小车位置保护、联动保护等功能。
- It has low voltage three-stage protection, overvoltage protection, zero-sequence overvoltage protection, voltage imbalance protection, PT disconnection protection, trolley position protection and other functions.
- 具有 5 路 DI 无源干接点输入，信号电源采用内置 DC24V 电源，另外可选配湿接点开关量输入。
- 5-circuit DI passive dry contact input and signal power adopts built-in DC24V power supply. Optional wet contact switching value input is also available.
- 具有 4 路 DO 输出，可用于保护控制。
- 4-circuit DO output is used to protection and control .
- 具有 2 路标准的 RS-485 通讯接口，采用 Modbus-RTU，保证了上位机通讯的快速可靠。
- It has 2-circuit standard RS-485 communication interface and ModbusRTU is adopted, which has guaranteed the rapid and reliable upper computer communication.
- 具有 1 路 DC 4~20mA 模拟量输出接口，可设定多项模拟量参数。

- It has 1-circuit DC4-20mA analog output interface and can set several analog parameters.
- 具有系统时钟和 8 次故障/报警记录功能，系统时钟记录当前时间（日、时、分、秒），故障记录功能记录故障原因。
- It has system clock and can record 8 failures. The system clock will record the current time (day, hour, minute, second) and the failure record function will record the failure cause.
- 具有 8 次 DI 动作记录功能，记录 DI 动作时间及状态。
- It has 8 times of DI operation recording functions to record the DI operation time and status.
- 采用全中文液晶显示界面。
- All-Chinese LCD interface is adopted

2 型号说明 Model description

表 1 ALP220-PT 型号说明表

Table 1 ALP220-PT model description

产品型号 Product model	开关量类型 Switching value type (K×)		选配功能 (M) Optional functions(M)
	型号 Model	说明 Description	
ALP220-PT-K×/M	K1	DI 为干结点 DI is dry contact	模拟量输出功能 Analog output (M)
	K2	DI 为湿结点，DC110V 输入 DI is wet contact, DC110V input.	
	K3	DI 为湿结点，DC220V 输入 DI is wet contact, DC220V input.	
	K4	DI 为湿结点，AC110V 输入 DI is wet contact, AC110V input.	

3 技术参数 Technical parameters

表 2 ALP220-PT 主要技术参数

Table 2 Main technical parameters

技术参数 Technical parameters	技术指标 technical indexes
精度等级 Accuracy class	电压 0.5 级 voltage: 0.5 grade
辅助电源 Auxiliary power supply	AC 85V~265V 或 DC 110V~350V 功耗 7VA AC 85V~265V or DC 110V~350V, power consumption: 7VA
额定输入电压 Rated operational voltage	AC 100V 50Hz

继电器输出触点容量 Relay output contact capacity	阻性负载 Resistance load	1 路 (95.96.97): AC250V 3A/DC30V 3A 3 路: AC250V 5A/DC30V 5A 1-circuit (95.96.97): AC 250V 3A/DC 30V 3A 3-circuit: AC 250V 5A/DC 30V 5A
开关量输入 Switch input	5 路无源干接点/有源湿接点 5-circuit passive dry contact/active wet contact	
通讯 Communication	Modbus-RTU 波特率: 2400-38400 Modbus-RTU baud rate: 2400-38400	
环境 Environment	工作温度 Operating temperature	-10°C~55°C
	贮存温度 Storage temperature	-25°C~70°C
	相对湿度 Relative humidity	≤95% 不结露, 无腐蚀性气体 ≤95% non-condensate, no corrosive gas
	海拔 Elevation	≤2000m
污染等级 Pollution degree	2 级 2-grade	
防护等级 IP grade	IP20	
安装类别 Installation category	III 级 III-grade	

产品功能配置如表 3 所示:

The product function configuration is shown in Table 3.

表 3 ALP220-PT 功能配置

Table 3 ALP220-PT functional configuration

配置 Configuration		标配功能 Standard configuration function	选配功能 Optional functions
功能 Function			
保护功能 Protection function	低电压三段式保护 Low voltage three-stage protection	√	
	过电压保护 Overvoltage protection	√	
	零序过电压保护 Zero-sequence overvoltage protection	√	
	电压不平衡保护 Voltage imbalance protection	√	
	PT 断线保护 PT disconnection protection	√	
	小车位置保护 Trolley position protection	√	

	联动保护 Linkage protection	√	
通讯功能 Communication function	Modbus-RTU	√	
开关量输入 Switch input	开关量输入 DI, 支持 5 路 DI Switch input DI, support 5-circuit DI	√	
继电器输出 Relay output	开关量输出 DO, 支持 4 路 DO Switch output DO, support 4-circuit DO	√	
模拟量输出 Analog output	DC4-20mA		√ (模拟量功能) (Analog function)
故障记录 Failure record	8 条记录, 记录线路发生故障、报警的原因、时间, 发生故障时的各参数以及线路的 DI 动作记录 8 failure records; the failure cause, time, Parameters of failure and DI action record of line are recorded.	√	
测量显示 Measurement display	三相线电压、三相电压最大值比值、零序电压、零序电压 (自产生)、电压不平衡度、频率 Three-phase line voltage, three-phase voltage maximum ratio, zero-sequence voltage, zero-sequence voltage (self-generating), voltage imbalance, frequency	√	
定值设定 Definite value setting	各种保护定值查询 Query of various protection definite values	√	
	各种保护定值设定 Setting of various protection definite values	√	

4 外形及安装尺寸 Appearance and installation dimension

ALP220-PT 外形尺寸及安装开孔尺寸如图 1 所示, ALP220-PT 采用嵌入式安装, 按照开孔尺寸在柜体表面开好安装孔, 通过锁紧件固定在柜体表面上。(单位: mm)

ALP220-PT appearance and installation hole opening dimension are shown in Figure 1. ALP220-PT shall adopt embedded installation: open the mounting hole on the cabinet surface according to hole size and fix on cabinet surface through retaining member. (Unit: mm)

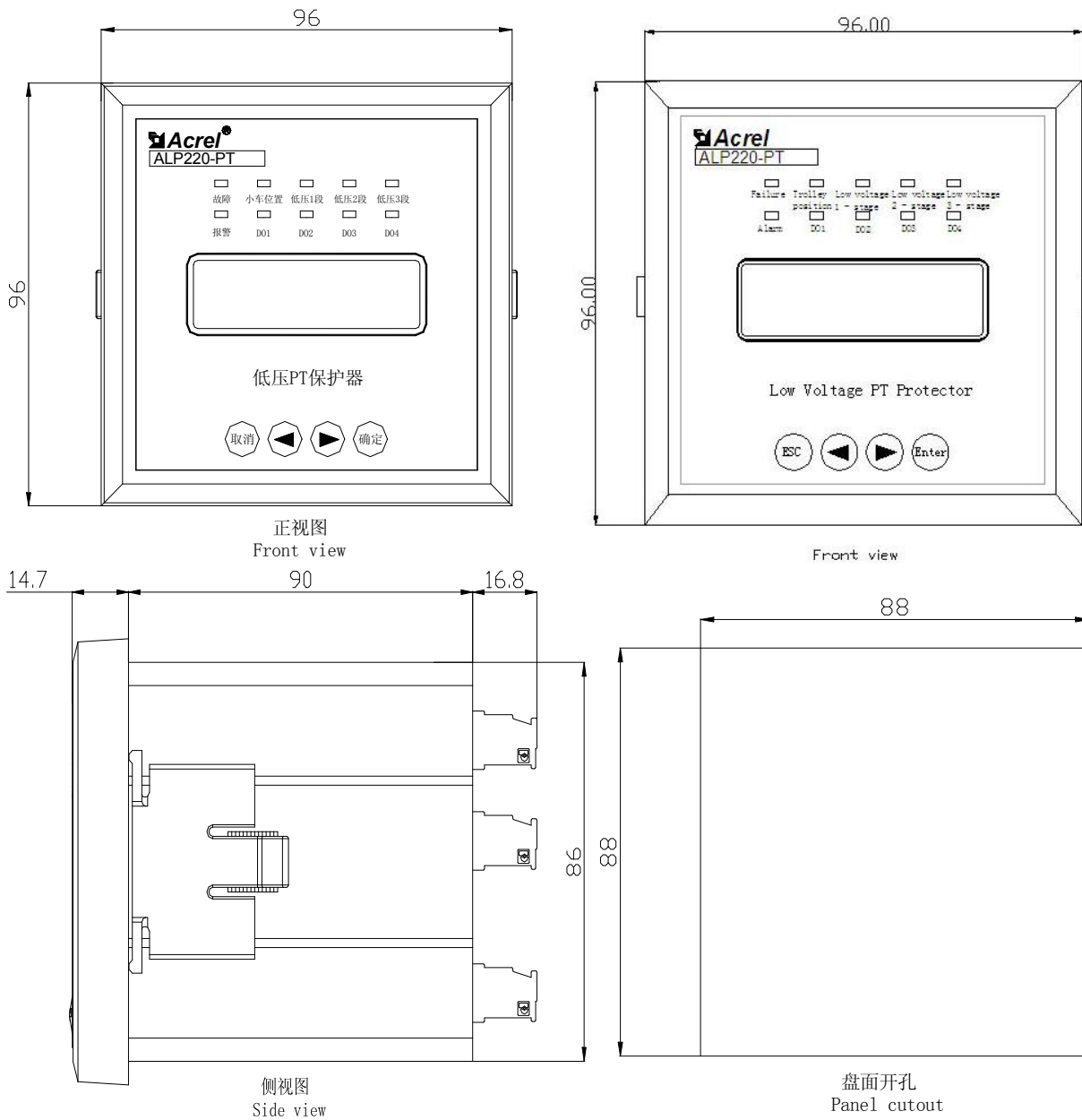


图 1 ALP220-PT 外形及安装开孔尺寸

Figure 1 Outline and installing dimension of ALP220-PT

5 安装接线 Installation and wiring

5.1 端子排列 Terminal arrangement

ALP220-PT 接线端子如图 2 所示。

ALP220-PT wiring terminal is shown in Figure 2:

4	5	6	3	40	41
Ua	Ub	Uc	Un	3U0*	3U0

14	15	16	17	18	23	35	36	25	26	28	29
DI1	DI2	DI3	DI4	DI5	COM1	IO+	IO-	A1	B1	A2	B2

L	N		D01	D02	D03	D04
1	2		95 96 97	7 8	9 10	11 12

图 2 ALP220-PT 接线端子图

Figure 2 ALP220-PT wiring terminal

5.2 端子编号 Terminal NO.

ALP220-PT 端子标识见表 4 所示。

ALP220-PT wiring terminal No. is shown in Table 4.

表 4 ALP220-PT 端子标识及功能定义表

Table 4 Identification and function definition of ALP220-PT wiring terminal

端子号 Terminal No.	功能定义 Function definition	备注 Remarks
1	电源输入 L (直流时为+) Mains input L (It is + when it is DC)	辅助电源 Auxiliary power supply
2	电源输入 N (直流时为-) Mains input N (It is - when it is DC)	
95、96、97	D01 (默认电平输出, 低压 1 段故障) DO1 (Default level output, low voltage 1 - stage failure)	继电器输出 (DO) Relay output (DO)
7、8	D02 (默认电平输出, 低压 2 段故障) DO2 (Default level output, low voltage 2 - stage failure)	
9、10	D03 (默认电平输出, 低压 3 段故障) DO3 (Default level output, low voltage 3 - stage failure)	
11、12	D04 (默认电平输出, 总故障输出) DO4(Default level output,total failure output)	
14	DI1 (小车位置, 默认常闭) DI1(Trolley position, default normally closed)	开关量输入 (DI) Switch input (DI)
15	DI2 (普通 DI, 默认常开) DI2(Common DI, default normally open)	
16	DI3 (普通 DI, 默认常开) DI3(Common DI, default normally open)	
17	DI4 (普通 DI, 默认常开) DI4(Common DI, default normally open)	
18	DI5 (复位, 默认常开) DI5(Reset DI, default normally open)	
23	COM1 (DI 输入公共端) COM1 (DI input common terminal)	
25	A1	RS485 通讯接口 RS485 communication interface
26	B1	
28	A2	
29	B2	
35	模拟量输出 IO+ Analog output IO+	模拟量输出 Analog output
36	模拟量输出 IO- Analog output IO-	
40	零序电压输入 3U ₀ * Zero-sequence voltage input 3U ₀ *	零序电压输入 Zero-sequence voltage input
41	零序电压输入 3U ₀ Zero-sequence voltage input 3U ₀	
3	Un 输入 Un input	三相电压输入 Three-phase voltage

4	Ua A相电压输入 Ua A-phase voltage input	input
5	Ub B相电压输入 Ub B-phase voltage input	
6	Uc C相电压输入 Uc C-phase voltage input	

6 使用操作指南 Operation instructions

6.1 显示操作说明 Operation instructions for display

ALP220-PT 显示操作面板如图 3 所示。

The display panel of ALP220-PT is shown in Figure 3.



图 3 ALP220-PT 显示面板图

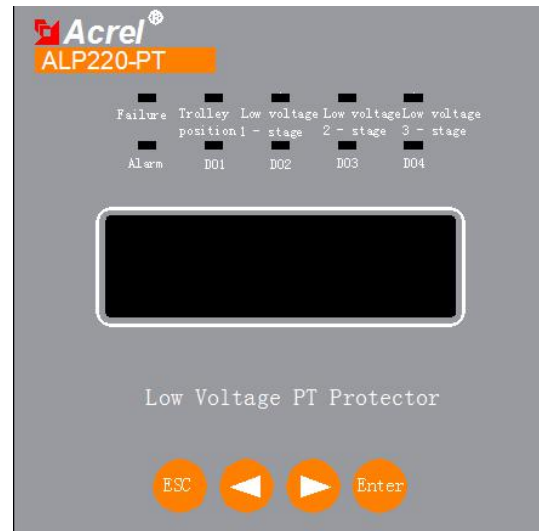


Figure 3 Display panel of ALP220-PT

ALP220-PT 显示状态说明、按键功能如表 5 所示。

The display status description and key function of ALP220-PT are shown in Table 5.

表 5 ALP220-PT 显示状态及按键功能说明表

Table 5 Display status description and key function of ALP220-PT

序号 NO.	名称 Name	状态 Status	功能说明 Function description
1	故障指示灯 Fault indicator light	亮/灭 On/off	常亮-脱扣, 灭-无脱扣 Normally on-tripping; off-no tripping
2	小车位置指示灯 Trolley position indicator light	亮/灭 On/off	亮-小车位置处于合位 灭-小车位置处于分位 On-trolley position is in detent position; Off-trolley position is in tripping-position.
3	低压 1 段指示灯 Low voltage 1 - stage indicator light	亮/灭 On/off	亮-低压 1 段故障, 灭-低压 1 段正常 On-low voltage 1 - stage failure, Off-low voltage 1 - stage normal.
4	低压 2 段指示灯 Low voltage 2 - stage indicator light	亮/灭 On/off	亮-低压 2 段故障, 灭-低压 2 段正常 On-low voltage 2 - stage failure, Off-low voltage 2 - stage normal.


5	低压 3 段指示灯 Low voltage 3- stage indicator light	亮/灭 On/off	亮-低压 3 段故障, 灭-低压 3 段正常 On-low voltage 3 - stage failure, Off-low voltage 3 - stage normal.
6	报警指示灯 Alarm indicator light	亮/灭 On/off	闪烁-报警, 灭-无报警 Flshing-alarm, Off-no alarm
7	D01-D04 指示灯 DO1-DO4 indicator light	亮/灭 On/off	亮-对应 DO 吸合, 灭-对应 DO 断开 On-corresponding DO pull-in, Off-corresponding DO disconnection.
8	“取消” 按键 “Cancel” key		无脱扣时: 单击: 退出菜单或取消修改操作。 常按: 不起作用 When there is no tripping: Click: exit the menu or cancel the modification operation. Press: doesn't work 有脱扣时: 单击: 退出菜单或取消修改操作。 常按: 复位 (上电初始界面有效) When there is tripping: Click: exit the menu or cancel the modification operation. Press: reset (The power-on initial interface is effective)
9	左右三角按键 Left and right triangle key		切换显示界面、切换菜单、修改参数 Switch the display interface, switch the menu and modify the parameters
10	“确定” 按键 “Confirm” key		进入菜单、保存修改参数 Enter the menu and save the modification parameters


6.2 ALP220-PT 菜单概述 Overview of ALP220-PT

上电后保护器显示屏处于数据显示界面, 主界面显示当前的日期、时间及线路最大电压。

After power on, the protector display screen will be on data display interface and the main interface will display the current date, time and maximum line voltage.

14-09-15	13:48:25
Umax:	0.0V
Umax:	0.0%

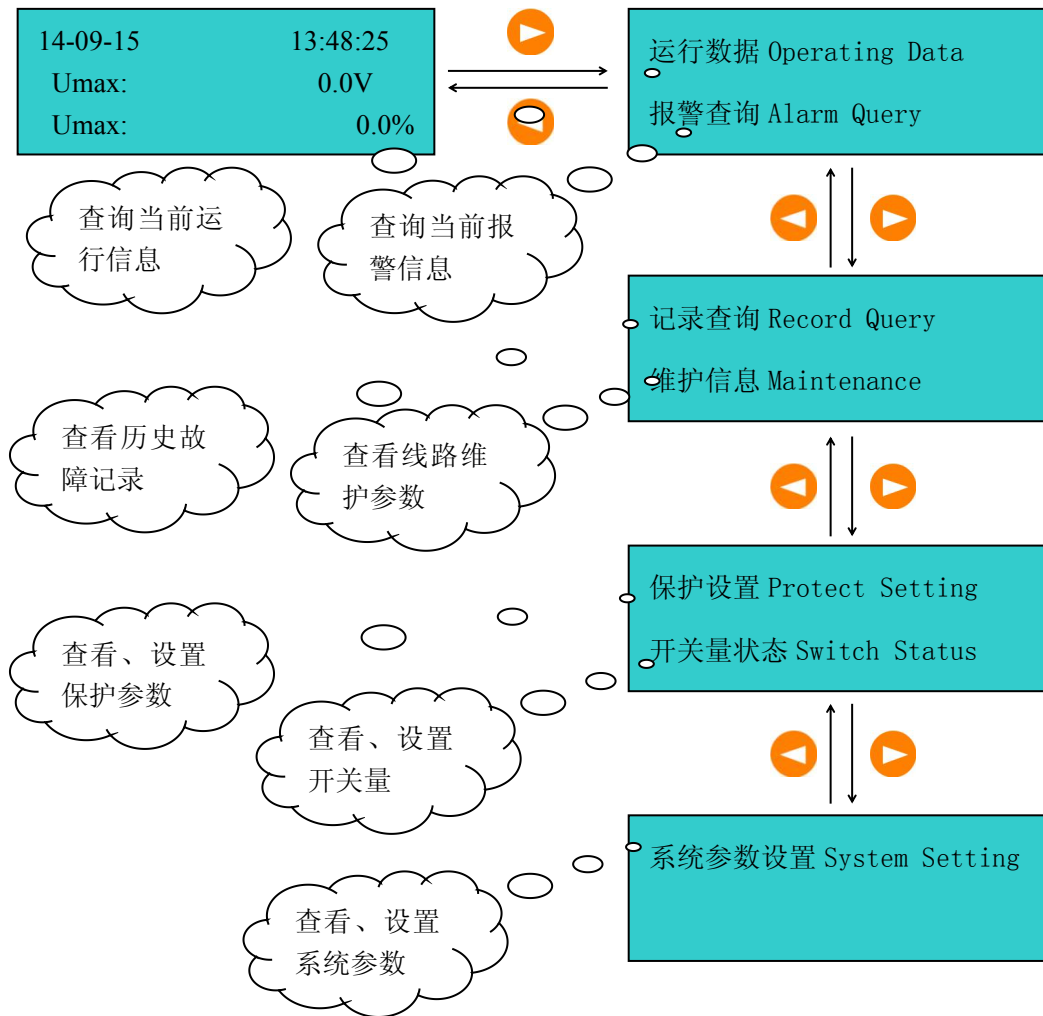
按  后进入主菜单。当有故障发生时, 主界面显示当前故障。

Press  to enter the main menu. In case of fault, the main interface will display the present fault.

6.2.1 ALP220-PT 主菜单概述 Overview of ALP220-PT main menu

ALP220-PT 液晶显示菜单为全中文显示。

The ALP220-PT LCD display menu is all-Chinese.

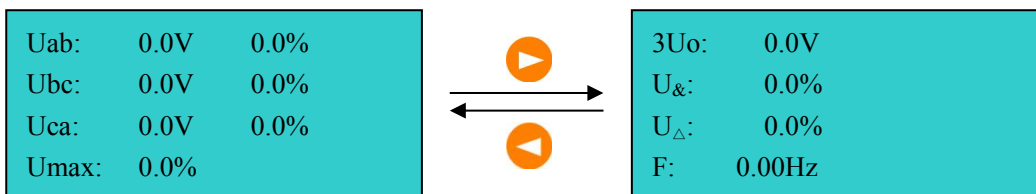


查询当前运行信息	Query the current operating information
查询当前报警信息	Query the current alarm information
查看历史故障记录	Check the historical failure record
查看线路维护参数	Check the line maintenance parameters
查看、设置保护参数	Check and set protection parameters
查看、设置开关量	Check and set analog
查看、设置系统参数	Check and set system parameters

可以操作 按键实现菜单选取和翻页，选中相应菜单后，按 进入对应菜单，按 退出相应菜单。

The menu selection and page turning can be realized by operating key. After selecting the corresponding menu, press to enter corresponding menu, press to exit corresponding menu.

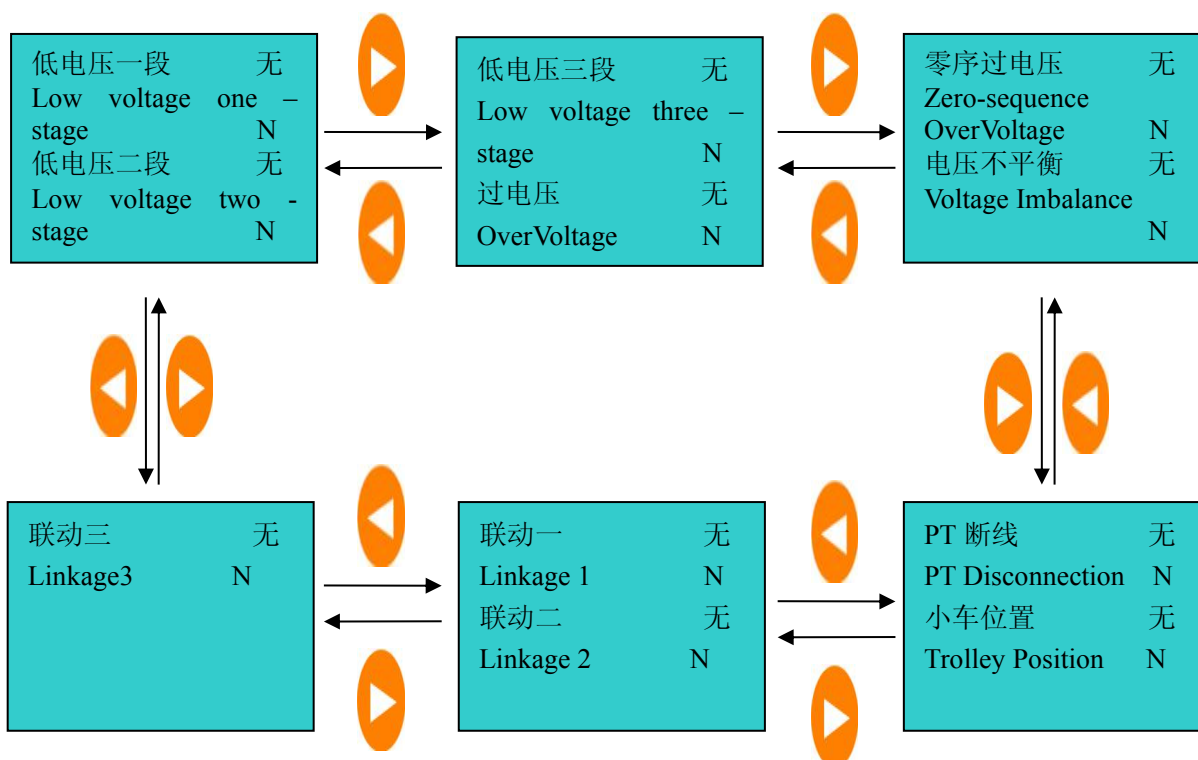
6.2.2 ALP220-PT 运行数据菜单 Operating data menu of ALP220-PT



可以操作 按键实现菜单选取和翻页，查看不同的参数显示。

The menu selection and page turning can be realized by operating key to check different parameter display.

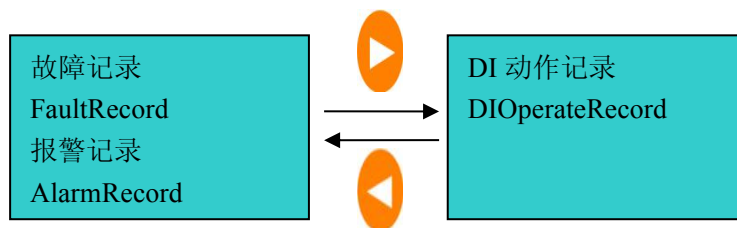
6.2.3 ALP220-PT 报警查询菜单 Alarm query menu of ALP220-PT



可以操作 按键实现报警信息菜单的选取和翻页，查看当前的报警状态显示。

The menu selection and page turning can be realized by operating key to check the current alarm status display.

6.2.4 ALP220-PT 记录查询菜单 Record query menu of ALP220-PT

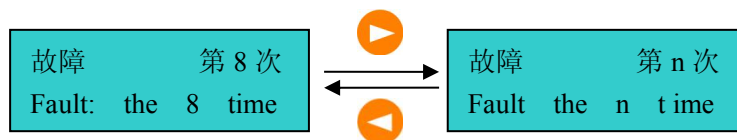


可以操作 按键实现维护信息菜单的翻页，选中相应菜单后，按 进入对应子菜单，按 退出相应子菜单。进入相应子菜单后，通过操作 按键实现子菜单的翻页，查看对应的故障信息。

The menu selection and page turning can be realized by operating key. After selecting the corresponding menu, press to enter corresponding submenu and press to exit corresponding submenu. After entering corresponding submenu, operate the key to realize the page turning of submenu and check corresponding fault and maintenance information.

- 故障记录子菜单:

Failure record submenu:

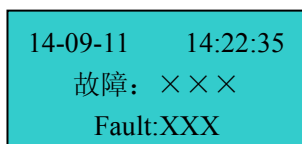


可以操作 按键实现对某次故障记录的选择，选中某次故障记录后，按 进入对应的故障详细信息。

Operating the button can be used to select a certain fault record. After selecting a fault record, press to enter the corresponding fault details.

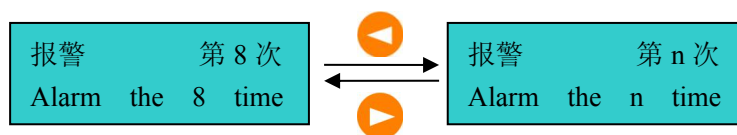
- 故障记录详情信息:




Detailed information of fault






- 报警记录子菜单:

Alarm record submenu:



可以操作   按键实现对某次报警记录的选择，选中某次报警记录后，按  进入对应的报警详细信息。

Operating the button   can be used to select a certain alarm record. After selecting an alarm record, press  to enter the corresponding alarm details.

报警信息详情信息：

Alarm information details:

14-09-11	14:22:35
报警：×××	
Alarm:XXX	

- DI 动作记录子菜单：
- DI operate record submenu:

DI1 断开	第 8 次
Xx Closed	The 8 time
14-09-04	16:59:33

可以操作   按键实现对某次 DI 记录的查询。





Operating the button   to inquire a DI record.

6.2.5 ALP220-PT 维护信息菜单 Maintenance information menu of ALP220-PT

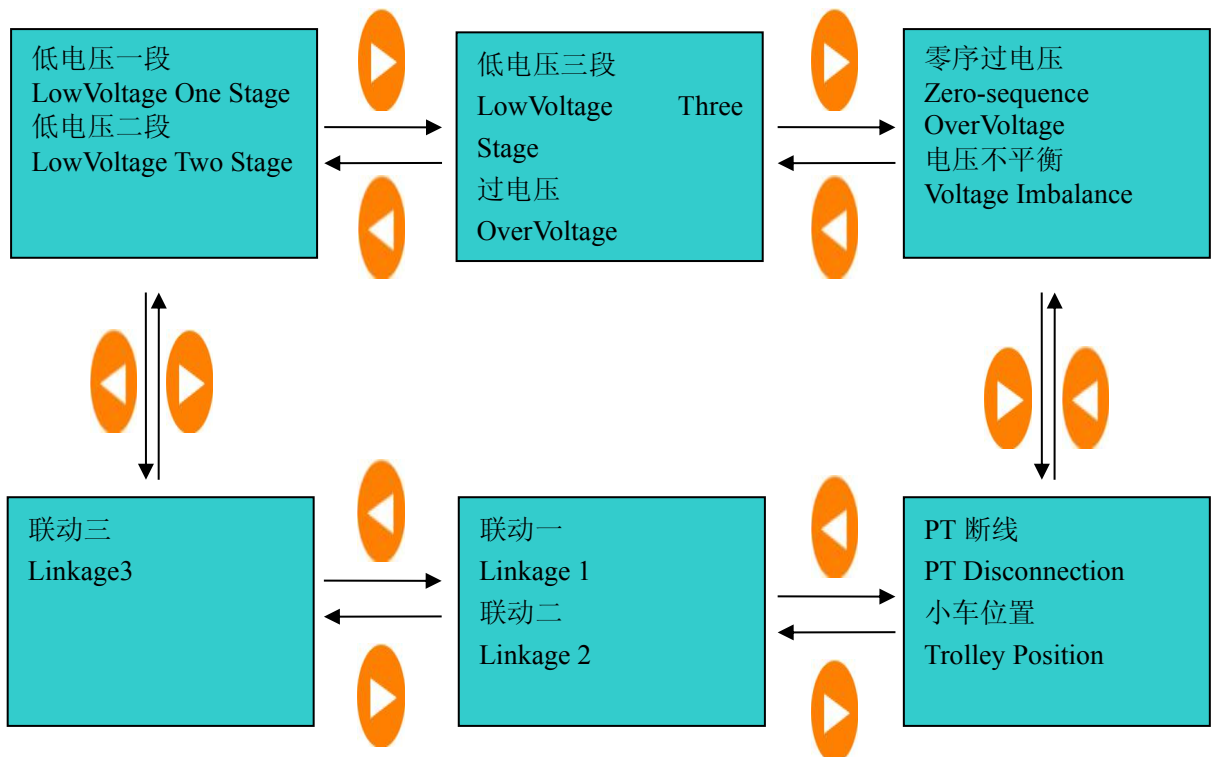
故障次数	××
TripTimes	××
报警次数	××
AlarmTimes	××

6.2.6 ALP220-PT 保护设置菜单 Protection setting menu of ALP220-PT

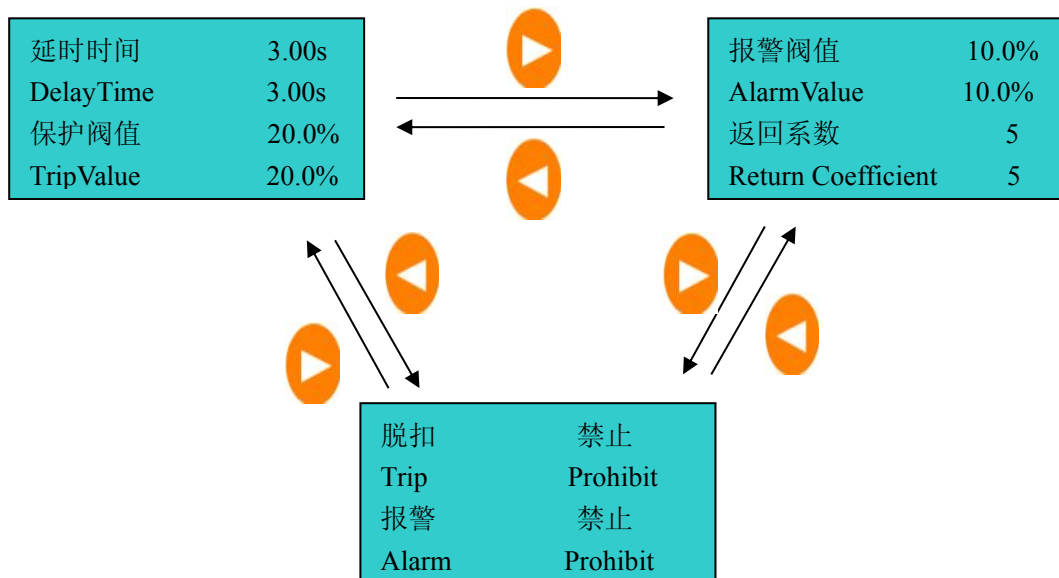
可以操作   按键实现保护设置菜单的翻页，选中相应菜单后，按  进入对应子菜单，按  退出相应子菜单。进入相应子菜单后，通过操作     按键实现子菜单的设置，保护设置菜单中详细设置参数见表 6。

The menu selection and page turning can be realized by operating   key. After selecting the corresponding menu, press  to enter corresponding submenu and press  to exit corresponding submenu.

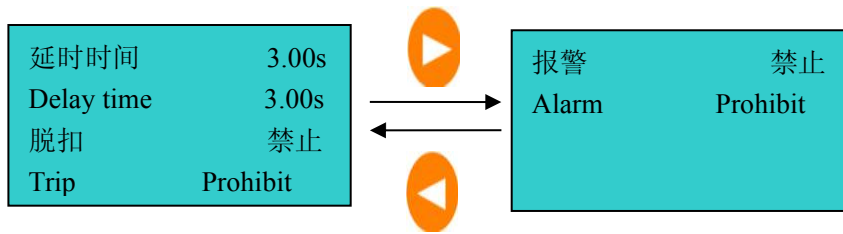
After entering corresponding submenu, operate the     key to realize the setting of submenu. See Table 6 for the detailed setting parameters in protection setting menu.



- 低压一段、低压二段、低压三段、过电压、零序过电压以及电压不平衡的子菜单：
- Sub menu of low voltage one stage, low voltage two stage, low voltage three stage, overvoltage, zero-sequence overvoltage and voltage imbalance:



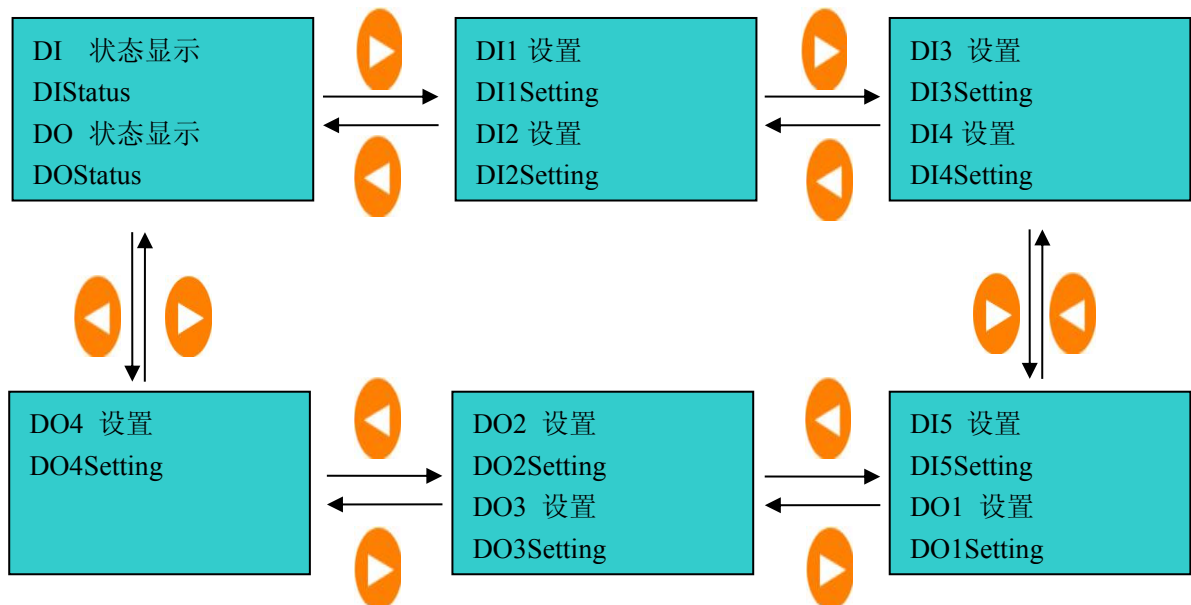
- PT 断线、小车位置、联动一、联动二以及联动三的子菜单：
- Sub menu of PT disconnection, trolley position and linkageI,II,III:



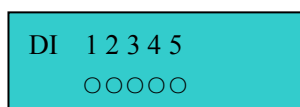
6.2.7 ALP220-PT 开关量状态菜单 Switch status menu of ALP220-PT

可以操作 按键实现开关量状态菜单的翻页，选中相应菜单后，按 进入对应子菜单，按 退出相应子菜单。进入相应子菜单后，通过操作 按键实现子菜单的设置，开关量状态菜单中详细设置参数见表 8。

The menu selection and page turning can be realized by operating key. After selecting the corresponding menu, press to enter corresponding submenu and press to exit corresponding submenu. After entering corresponding submenu, operate the key to realize the setting of submenu. See Table 8 for the detailed setting parameters in analog status menu.



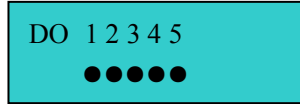
- DI 状态显示子菜单:
- DI status display sub menu:



其中空心圆圈表示无输出，实心圆圈表示有输出。

Hollow circles represent no output, solid circles represent output.

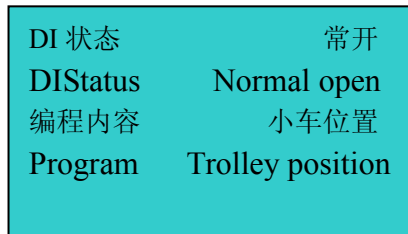
- DO 状态显示子菜单:
- DO status display sub menu:



其中空心圆圈表示无输入，实心圆圈表示有输入。

Hollow circles represent no output, solid circles represent output.

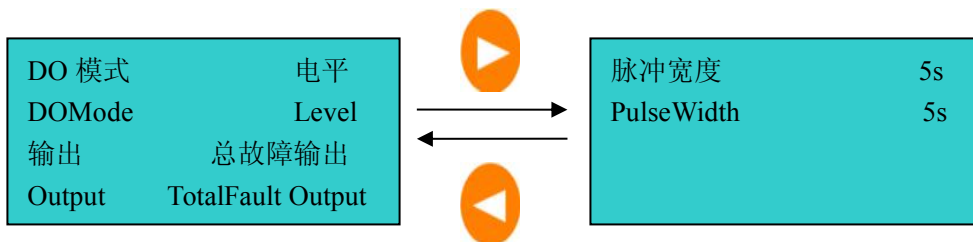
- DI 设置子菜单:
- DI setting sub menu:







按 进入对应子菜单，按 退出相应子菜单。进入相应子菜单后，通过操作 按键实现 DI 状态和编程内容的设置。

Press to enter the corresponding sub menu, press to exit the corresponding sub menu. After entering the corresponding sub menu, operating the button can be used to achieve DI status and programming content setting.

- DO 设置子菜单:
- DO setting sub menu:







可以操作 按键实现 DO 设置菜单的翻页，选中相应菜单后，按 进入对应子菜单，按 退出相应子菜单。进入相应子菜单后，通过操作 按键实现 DO 模式、输出以及脉冲宽度的设置。

The menu selection and page turning can be realized by operating   key. After selecting the corresponding menu, press  to enter corresponding submenu and press  to exit corresponding submenu.

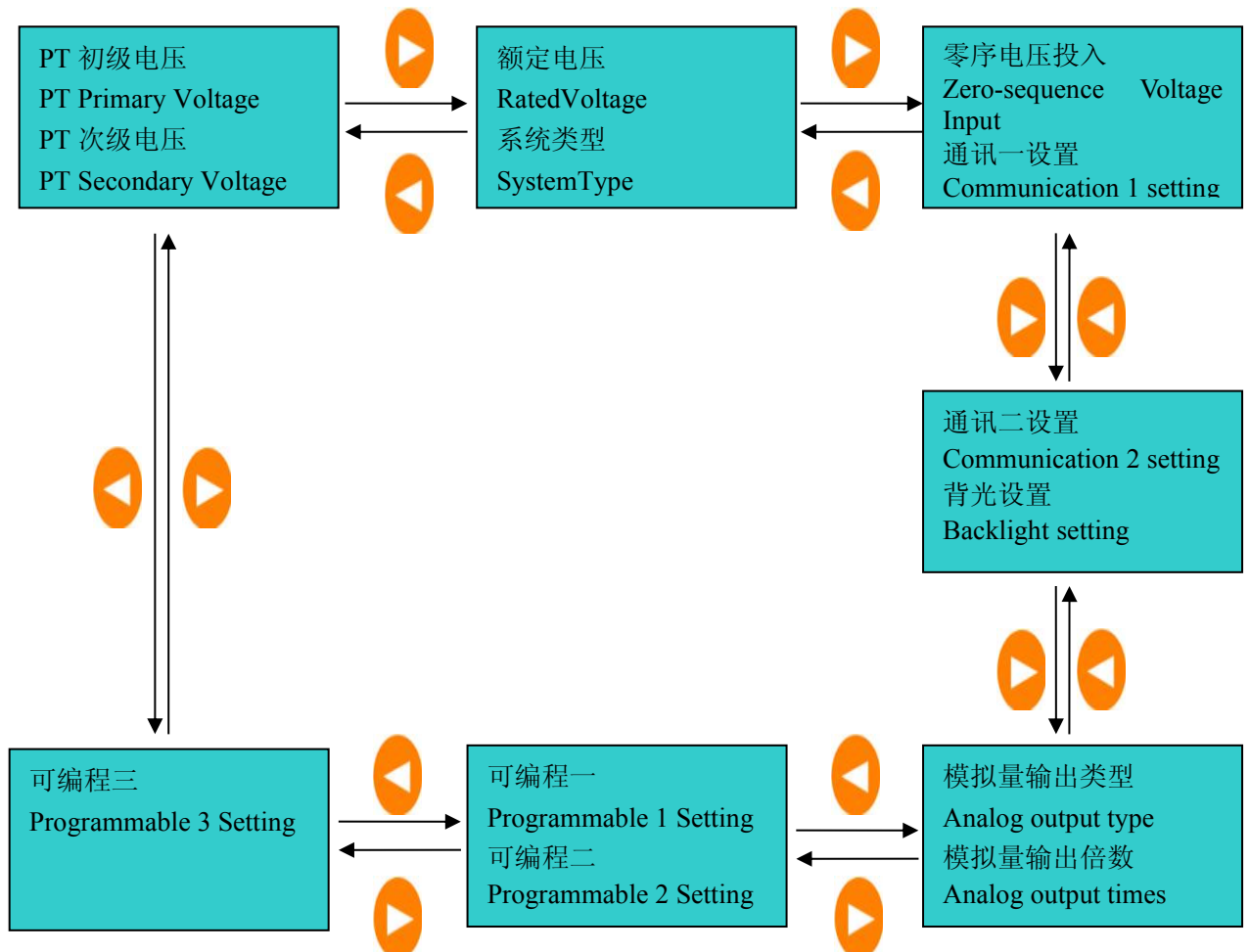
After entering corresponding submenu, operate the     key to realize the setting of DO mode, output and pulse width.

6.2.8 ALP220-PT 系统参数设置菜单 System parameter setting menu of ALP220-PT

可以操作   按键实现系统参数设置菜单的翻页，选中相应菜单后，按  进入对应子菜单，按  退出相应子菜单。进入相应子菜单后，通过操作     按键实现子菜单的设置，系统参数设置菜单中详细设置参数见表 9。

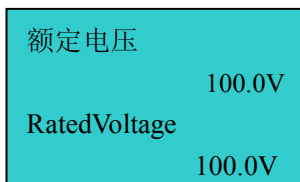
The menu selection and page turning can be realized by operating   key. After selecting the corresponding menu, press  to enter corresponding submenu and press  to exit corresponding submenu.

After entering corresponding submenu, operate the     key to realize the setting of submenu. See Table 9 for the detailed setting parameters in system parameter menu.







- PT 初级电压、PT 次级电压以及额定电压子菜单：

- PT primary voltage, PT secondary voltage and rated voltage sub menus:



可以通过操作     按键实现 PT 初级电压、PT 次级电压以及额定电压的设置。

Operating the button     can be used to achieve PT primary voltage, PT secondary voltage and rated voltage setting.

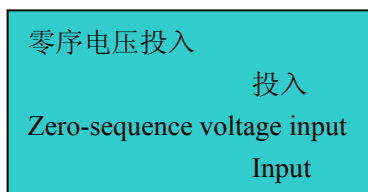
- 系统类型子菜单:
- System type sub menu:







可以通过操作     按键实现系统类型的设置。

Operating the button     can be used to achieve system type setting.

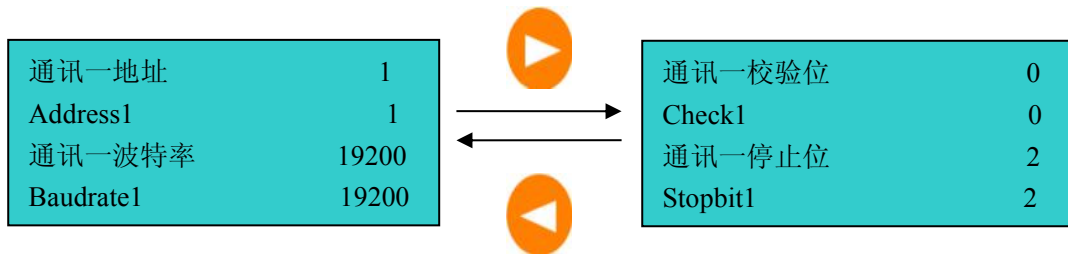
- 零序电压投入子菜单:
- Zero-sequence voltage input sub menu:



可以通过操作     按键实现零序电压投入的设置。

Operating the button     can be used to achieve zero-sequence voltage input setting.

- 通讯一、通讯二设置子菜单:
- Communication 1 and communication 2 setting sub menu:



可以通过操作 按键实现通讯一以及通讯二的设置。

Operating the button can be used to achieve communication 1 and communication 2 setting.

- 背光设置子菜单:
- Backlight setting sub menu:

背光设置	常亮
BacklightSetting	NormallyOn

可以通过操作 按键实现背光的设置。

Operating the button can be used to achieve system type backlight setting.

- 模拟量输出类型子菜单:
- Analog output type sub menu:

输出类型	Uab
Analog Output Type	Uab

可以通过操作 按键实现模拟量输出类型的设置。

Operating the button can be used to achieve analog output type setting.

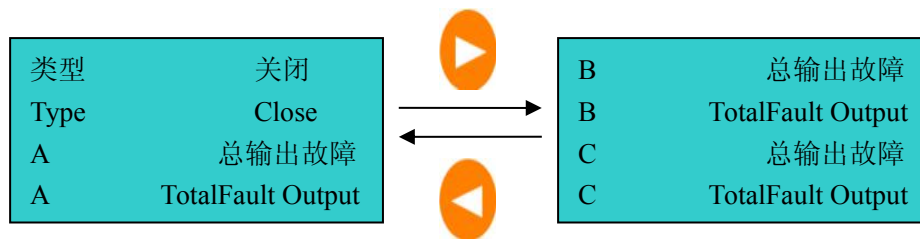
- 模拟量输出倍数子菜单:
- Analog output times sub menu:

输出倍数	2
Analog Output Times	2

可以通过操作 按键实现模拟量输出倍数的设置。

Operating the button can be used to achieve analog output times setting.

- 可编程设置子菜单:
- Programmable setting sub menu:



可以通过操作 按键实现编程的设置。

Operating the button can be used to achieve programming setting.

6.3 ALP220-PT 保护功能介绍 Introduction of ALP220-PT protection function

■ 低电压保护

■ Low voltage protection

低电压保护元件的判据为：根据测量的线电压值与低电压设定值比较，当三个线电压均持续低于定值并超过设定的延时时间，装置发出脱扣命令，低电压保护元件执行脱扣。

The criterion of the low voltage protection component is: according to the comparison between the measured line voltage value and the low voltage setting value, when the three line voltages are continuously lower than the fixed value and exceed the set delay time, the device issues a trip command, and the low voltage protection component performs the trip.

➤ 低电压保护动作条件：

➤ Low voltage protection action conditions:

- $\text{MAX}(U_{ab}, U_{cb}, U_{ca}) < \text{低压定值}$;
- $\text{MAX}(U_{ab}, U_{cb}, U_{ca}) < \text{low voltage setting value}$;
- $T > \text{低压延时时间}$;
- $T > \text{low voltage delay time}$;
- 小车位置闭合;
- Trolley position is closed;
- 低电压保护投入。
- Low voltage protection input.

■ 过电压保护 Overvoltage protection

➤ 过电压保护动作条件：

➤ Overvoltage protection action conditions:

- $\text{MAX}(U_{ab}, U_{bc}, U_{ca}) > \text{过电压定值}$;
- $\text{MAX} > \text{overvoltage setting value}$;

- T > 过电压延时时间;
- T > overvoltage delay time;
- 过压保护投入。
- Overvoltage protection input.

■ 零序过电压保护

■ Zero-sequence overvoltage protection

- 零序过电压保护动作条件:
- Zero-sequence overvoltage protection action conditions:
 - $U_0 >$ 零序过电压定值;
 - $U_0 >$ zero-sequence overvoltage setting value;
 - T > 零序过电压延时时间;
 - T > zero-sequence overvoltage delay time;
 - 零序过压保护投入。
 - Zero-sequence overvoltage protection input.

■ 电压不平衡保护

■ Voltage imbalance protection

计算三相电压不平衡率 U_{Δ} ，根据三相不平衡率和设定的不平衡保护动作设定值比较判断是否启动不平衡保护。

Calculate the three-phase voltage imbalance rate U^{Δ} , and judge whether to start the imbalance protection according to the three-phase imbalance ratio and the set imbalance protection action setting value.

$$U_{\Delta} = (\text{MAX}(U_{ab}, U_{bc}, U_{ca}) - \text{MIN}(U_{ab}, U_{bc}, U_{ca})) / \text{AVERAGE}(U_{ab}, U_{bc}, U_{ca})$$

- 电压不平衡保护动作条件:
- Voltage imbalance protection action conditions:
 - $U_{\Delta} \% >$ 不平衡保护百分比设定;
 - $U^{\Delta} \% >$ Imbalance protection percentage setting;
 - T > 不平衡延时时间;
 - T > Imbalance delay time;
 - 电压不平衡保护投入。
 - Voltage imbalance protection input.

■ PT 断线保护

■ PT disconnection protection

- PT 断线保护动作条件:

➤ PT disconnection protection action conditions

- 三相线电压均小于线电压额定值 8%，并且小车位置闭合，判为三相失压。
- If the three-phase line voltages are less than 8% of the line voltage rating, and the trolley position is closed, it is judged as three-phase voltage loss.
- 三相线电压大于线电压额定值 8%，最小线电压小于线电压额定值 16%，判为两相 PT 断线。
- If the three-phase line voltage is greater than 8% of the line voltage rating, and the minimum line voltage is less than 16% of the line voltage rating, it is judged as a two-phase PT disconnection.
- 三相线电压大于线电压额定值 8%，最大线电压与最小线电压差大于线电压额定值 16%，判为单相 PT 断线。
- If the three-phase line voltage is greater than 8% of the line voltage rating, and the maximum line voltage and the minimum line voltage difference are greater than 16% of the line voltage rating, it is judged as a single-phase PT disconnection.

以上条件有一条满足且时间超过设定时间，装置发出警告报文，报“PT 断线保护”。

If one of the above conditions is met and the time exceeds the set time, the device issues a warning message and reports “PT disconnection protection”.

■ 小车位置故障

■ Trolley position failure

设置为小车位置的开关量输入点作为 DI 输入点，无输入信号的时间长于延时时间，执行脱扣或报警

Set the switching value input point of the trolley position as the DI input point, if the time of non input signal is longer than the delay time, it will perform trip or alarm.

■ 联动保护

■ Linkage protection

设置为联动保护的开关量输入点作为联动输入点，联动信号长于延时时间，执行脱扣或报警。

Set the switching value input point of linkage protection as the DI input point, if the time of linkage signal is longer than the delay time, it will perform trip or alarm.

6.4 菜单详细描述

6.4 Detailed description of menu

保护设置子菜单内容详述见表 6。

See Table 11 for the detailed protection setting submenu content.

表 6 保护菜单各子菜单详述表

Table 6 Specification of all submenus of protection menu

菜单 Menu	功能介绍 Function introduction	设置范围 Setting scope	备注 Remarks
低电压三段式保护 Low voltage three-stage protection	低电压保护功能投退。 Low voltage protection function switching. 设置低电压 1 段、2 段、3 段的脱扣值、报警值、脱扣时间、返回系数。 Set the trip value, alarm value, trip time, and return coefficient of the low voltage 1 stage, 2 stage, and 3 stage.	延时时间： Delay time: 0.06s-600.00s 保护阈值： Protection threshold value: 10.0%-100.0% 报警阈值： Alarm threshold value: 10.0%-100.0% 返回系数： Drop-off to pick-up ratio: 5-50。 脱扣： 允许、禁止。 Tripping: allowed/prohibited 报警： 允许、禁止。 Alarm: allowed/prohibited	默认值： Default value: 详见表 7 保护参数默认设置表 See Table 7 Protection Parameter Default Setting Table for Details.
过电压 Overvoltage	过电压告警功能投退。 Overvoltage protection function switching. 设置过电压脱扣值、报警值、脱扣时间、返回系数。 Set the trip value, alarm value, trip time, and return coefficient of overvoltage protection		
零序过电压 Zero-sequence overvoltage	零序过电压告警功能投退。 Zero-sequence overvoltage alarm function switching. 设置零序过电压脱扣值、报警值、脱扣时间、返回系数。 Set the trip value, alarm value, trip time and return coefficient of the zero sequence overvoltage.		
电压不平衡 Voltage imbalance	电压不平衡投退。 Voltage imbalance switching. 设置零序过电压脱扣值、报警值、脱扣时间、返回系数。 Set the trip value, alarm value, trip time and return coefficient of the zero sequence overvoltage.		
PT 断线 PT disconnection	PT 断线告警和脱扣功能。设置 PT 断线脱扣时间。 PT disconnection alarm and trip function. Set the PT disconnection trip time.	延时时间： Delay time: 0.06s-600.00s 脱扣： 允许、禁止。	默认值： Default value: 详见表 7 保护参数默认设置表 See Table 7 Protection Parameter Default Setting Table for Details.
小车位置 Trolley position	小车位置报警和脱扣功能。设置小车脱扣时间。 Trolley position alarm and trip function. Set trolley	Tripping: allowed/prohibited 报警： 允许、禁止。	

	tripping time.	Alarm: allowed/prohibited	
联动保护 Linkage protection	联动报警和脱扣功能。设置联动一、二、三脱扣时间。 Linkage alarm and trip function. Set the linkage one, two and three trip time.		

表 7 保护参数默认设置表

保护类型 Protection type	脱扣值 (%) Trip value	报警值 (%) Alarm value	脱扣时间 (s) Trip time	返回系数 return coefficient	脱扣 Tripping	报警 Alarm
低电压一段 Low voltage one stage	60.0	70.0	0.5	5	允许 Allowed	允许 Allowed
低电压二段 Low voltage two stage	40.0	45.0	9	5	允许 Allowed	允许 Allowed
低电压三段 Low voltage three stage	40.0	45.0	9	5	允许 Allowed	允许 Allowed
过电压 Overvoltage	130.0	120.0	0.5	5	禁止 Prohibited	禁止 Prohibited
零序过电压 Zero-sequence overvoltage	20.0	15.0	1	5	禁止 Prohibited	禁止 Prohibited
电压不平衡 Voltage imbalance	30.0	20.0	5	5	禁止 Prohibited	禁止 Prohibited
PT 断线故障 PT disconnection failure	/	/	0.5	/	禁止 Prohibited	允许 Allowed
小车位置故障 Trolley position failure	/	/	5	/	禁止 Prohibited	允许 Allowed
联动一 Linkage I	/	/	5	/	禁止 Prohibited	禁止 Prohibited
联动二 Linkage II	/	/	5	/	禁止 Prohibited	禁止 Prohibited
联动三 Linkage III	/	/	5	/	禁止 Prohibited	禁止 Prohibited

开关量状态各子菜单内容详述见表 8。

表 8 开关量状态菜单详述表

菜单 Menu	功能介绍 Function introduction	设置范围 Setting scope	备注 Remarks
DI 状态显示	显示开关量输入状态	/	/

DI status display	Display switch input DI status		
DO 状态显示 DO status display	显示开关量输出状态 Display switch output DO status	/	/
DI1-DI5 设置 DI1-DI5 setting	DI1-DI5 参数设置 DI1-DI5 parameter setting	DI 状态设置： 常开、常闭。 DI status setting: normally open/closed 编程内容设置： DI programming content setting: 普通 DI、小车位置、联动 一、联动二、联动三、 复位。 Common DI, trolley position, linkage I, linkage II, linkage III	各 DI 的默认设置： DI status default setting: DI1 状态：常闭 DI1 status: normally closed DI1 编程内容：小车位置 DI1 programming content: trolley position DI2-DI4 状态：常开 DI2-DI4 status: normally open DI2-DI4 编程内容：普通 DI DI2-DI4 programming content: Common DI DI5 状态：常开 DI5 status: Normally open DI5 编程内容：复位 DI5 programming content: Reset
DO1-DO4 设置 DO1-DO4 setting	DO1-DO4 参数设置 DO1-DO4 parameter setting	DO 模式设置： 电平、脉冲。 DO mode setting: level/pulse DO 输出设置： DO output setting: 普通 DO、 Common DO; 总故障输出、 Total fault output; 低电压 1、2、3 段故障、 Low voltage 1, 2, 3 stage failure; 过电压故障、 Overvoltage failure; 零序过压故障、 Zero-sequence overvoltage failure; 不平衡故障、 Imbalance failure; PT 断线故障、 PT disconnection failure;	各 DO 的默认设置： DO1 输出模式：电平 DO1 输出编程：低压 1 段故障 DO1 脉冲宽度：5s DO2 输出模式：电平 DO2 输出编程：低压 2 段故障 DO2 脉冲宽度：5s DO3 输出模式：电平 DO3 输出编程：低压 3 段故障 DO3 脉冲宽度：5s DO4 输出模式：电平 DO4 输出编程：普通 DO DO4 脉冲宽度：5s

		小车位置故障、 Trolley position failure; 联动 1、2、3 故障、 Linkage 1, 2, 3 failure; 总报警输出、 Total fault output; 低电压 1、2、3 段报警 Low voltage 1, 2, 3 stage alarm; 过电压报警、 Overvoltage alarm 零序过压报警、 Zero-sequence overvoltage alarm; 不平衡报警、 Imbalance alarm; PT 断线报警、 PT disconnection alarm; 小车位置报警、 Trolley position alarm; 联动 1、2、3 报警、 Linkage 1, 2, 3 alarm; 自诊断输出、 Self-diagnostic output; 可编程一、二、三输出、 Programmable output1,2,3 脉冲宽度设置： Pulse width setting: 1-5s	
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系统参数设置子菜单内容详述见表 9。

See Table 9 for the detailed ALP220-PT parameter setting submenu content.

表 9 系统参数菜单各子菜单详述表

Table 12 Specification of all submenus of system parameter menu

菜单 Menu	功能介绍 Function introduction	设置范围 Setting scope	备注 Remarks
PT 初级电压 CT primary voltage	设置 PT 初级电压 Set PT primary voltage	57.7V~2000V	默认: 100 Default:100
PT 次级电压 CT secondary voltage	设置 PT 次级电压 Set PT secondary voltage	57.7V 或 100V 或 110V 57.7V or 100V or 110V	默认: 100 Default:100
额定电压 Rated voltage	设置 PT 额定电压 Set PT rated voltage	57.7V~2000V	默认: 100 Default:100

系统类型 System type	设置系统接线方式 Set the system wiring mode	1PT、2PT、3PT	默认：3PT Default:3PT
零序电压投入 Zero-sequence voltage input	设置 零序电压投入状态 Setting Zero-sequence voltage input status	投入、不投入 Input/no input	默认：不投入 Default:No input
通讯一、通讯二 设置 Communication 1,2setting	设置 保护器的通讯方式 Set the communication mode of protector	通讯地址： Communication address: 1-247 波特率： Baud rate: 2400、4800、9600、19200、38400。 奇偶校验： 0, 无校验、1, 奇校验、2, 偶校验。 Odd-even check: no parity check, odd parity check 停止位： 1 个停止位、2 个停止位。 Stop bit: 1 stop bit; 2 stop-bit	通讯地址默认值：1 Default value of communication address: 1 波特率默认值：19200 Default value of Baud rate: 19200 奇偶校验默认值：无校验 Default value of odd-even check: no parity check 停止位默认值：:1 个停止位 Default value of stop bit: 1 stop bit
背光设置 Backlight setting	设置保护器液晶 背光显示方式 Set the LCD backlight display mode of protector	常亮、自动 Normally on, automatic	默认：自动 Default: automatic
模拟量输出类型 Analog output type	设置保护器 模拟量输出的控制 类型 Set the control type of protector analog output	Uab、Ubc、Uca、Uav、Umax、F	默认：Uab Default:Uab
模拟量输出倍数 Analog output times	设置保护器 模拟量输出的控制 类型的倍数 Set the times of control type of protector analog output	1、2	默认：2 Default:2
可编程一、二、三 设置 Programmable I, II, III	设置可编程的参数 Set programmable parameters	类型： 关闭、A、A*B、A+B、A*B*C、(A+B)*C、 A*B+C、A+B+C、 Type: Closed、A、A*B、A+B、A*B*C、 (A+B)*C、A*B+C、A+B+C、 A、B、C： 无、总故障输出、低压 1 段故障	默认值： Default value: 可编程一类型：A programmable I type: A 可编程一 A、B、C 默认值：低压 1 段故障、 低压 2 段故障、低压 3 段故障

		<p>障、低压 2 段故障、低压 3 段故障、过压故障、零序过压故障、不平衡故障、PT 断线故障、小车位置故障、联动 1 故障、联动 2 故障、联动 3 故障、总报警输出、低压 1 段报警、低压 2 段报警、低压 3 段报警、过压报警、零序过压报警、不平衡报警、PT 断线报警、小车位置报警、联动 1 报警、联动 2 报警、联动 3 报警、DI1、DI2、DI3、DI4、DI5。 A、B、C: No output; Total fault output; Low voltage 1, 2, 3 stage failure; Zero-sequence overvoltage failure; Imbalance failure; PT disconnection failure; Trolley position failure; Linkage 1, 2, 3 failure; Total fault output; Low voltage 1, 2, 3 stage alarm; Overvoltage alarm; Zero-sequence overvoltage alarm; Imbalance alarm; PT disconnection alarm; Trolley position alarm; Linkage 1, 2, 3 alarm; DI1、DI2、DI3、DI4、DI5。</p>	<p>Default value of programmable I A, B, C: Low voltage 1 stage failure, low voltage 2 stage failure, low voltage 3 stage failure 可编程二类型: A*B programmable II type: A*B 可编程二 A、B、C 默认值: 过电压故障、零序过电压故障、电压不平衡故障 Default value of programmable II A, B, C: Overvoltage failure, zero-sequence overvoltage failure, voltage imbalance failure 可编程三类型: A+B programmable III type: A+B 可编程三 A、B、C 默认值: 低压 1 段报警、低压 2 段报警、低压 3 段报警 Default value of programmable III A, B, C: Low voltage 1 stage alarm, low voltage 2 stage alarm, low voltage 3 stage alarm</p>
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7 通讯指南 **Communication instructions**

7.1 Modbus RTU 通信协议概述 Overview of modbus communication protocol

电气接口: RS485 半双工

Electrical interface: RS485 half-duplex

波特率: 2400/4800/9600/19200/38400

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

地址: 由一个字节组成 (8 位二进制), 十进制为 0~255, 系统中只使用 1~247, 其它保留

Address: It is composed of one byte (8-digit binary) and decimal is 0-255. Only 1-247 is used in the system and

the others remain.

错误检测: CRC

Error detection: CRC

数据格式: Data format:	地址码 Address code	功能码 Function code	数据区 Data area	CRC 校验 CRCcheck
数据长度: Data length	1 个字节 1 byte	1 个字节 1 byte	N 字节 N byte	2 个字节 2 bytes

每字节位: 1 位起始位、8 位数据位 (最小有效位先发送)、无奇偶校验、1 位停止位

Each byte bit: 1 start bit, 8 data bits (the least significant bit will be sent firstly), no odd-even check, 1 stop bit.

ALP220-PT 系列支持的 modbus 功能码:

Modbus function code supported by ALP220-PT:

03 (0x03) 功能码: 读保持寄存器

03 (0x03) function code: read holding registers

06 (0x06) 功能码: 写单个保持寄存器

06 (0x06) function code: write single holding register

16 (0x10) 功能码: 写多个保持寄存器

16 (0x10) function code: write several holding registers

通讯应用

Communication application

本节所举实例尽可能采用下表格式 (数据为 16 进制)

The examples taken in the section shall adopt the format of following table as much as possible (the data is hex system).

Addr	Fun	Data start		Data		CRC16	
		reg Hi	reg Lo	reg Hi	reg Lo	Lo	Hi
01H	03H	00H	00H	00H	06H	C5H	C8H
地址 Address	功能码 Function code	数据起始地址 Data initial address		数据读取个数 Data read number		循环冗余校验码 CRC code	

读数据 Read data

例 1: 使用 03 功能读寄存器: 读取 247 号 ALP220-PT, 从地址 00 开始读 3 个数据

Example 1: use 03 function read register to read No.247 ALP220-PT and start reading 3 data from address 00.

查询数据帧 Query data frame	F7 03 00 00 00 03 11 5D
返回数据帧 Return data frame	F7 03 06 00 00 00 00 00 0E D1

说明: Description:

F7: 从机地址

F7: Slave address

03: 功能码

03: Function code

06: 十六进制, 十进制为 6, 表示后面有 6 个字节的数据

06: hexadecimal, decimal is 6, meaning that it has 6-byte data behind.

0E D1: 循环冗余校验码

0E D1: CRC code

7.2 ALP220-PT 系列通讯地址表 ALP220-PT communication address table

ALP220-PT 系列详细 Modbus 通讯地址见表 10 所示。

See Table 16 for the detailed MODBUS communication address of ALP220-PT.

表 10 ALP220-PT 系列通讯地址表

Table 10 ALP220-PT communication address table

地址 Address	名称 Name	参数范围 Scope	属性 Attribute	默认值 Default value	备注 Remarks
0000	A 相电压 A-phase voltage	0-9999	R		
0001	B 相电压 B-phase voltage	0-9999	R		
0002	C 相电压 C-phase voltage	0-9999	R		
0003	AB 线电压 AB line voltage	0-9999	R		
0004	BC 线电压 BC line voltage	0-9999	R		
0005	CA 线电压 CA line voltage	0-9999	R		
0006	平均线电压 Average line voltage	0-9999	R		
0007	最大线电压 Maximum line voltage	0-9999	R		
0008	AB 线电压百分比 AB voltage percentage	0-9999	R		
0009	BC 线电压百分比 BC voltage percentage	0-9999	R		
000A	CA 线电压百分比 CA voltage percentage	0-9999	R		
000B	平均线电压百分比 Average line voltage percentage	0-9999	R		
000C	最大线电压百分比 Maximum line voltage percentage	0-9999	R		
000D	零序电压 Zero-sequence voltage	0-9999	R		

000E	接地电压 Grounding voltage	0-9999	R		
000F	电压不平衡率 Voltage imbalance rate	0-9999	R		
0010	频率 Frequency	4500-6500	R		
0011	自诊断输出 Self-diagnosis output	0-3	R		Bit0=1: 内部 3.3V 低于 2.8V; Internal 3.3V, lower than 2.8V; Bit1=1: 主频错误 Main frequency error
0012	输入输出状态 Input and output status	/	R		Bit0-Bit4:DI(输入 input)1~5; Bit9-Bit12:D0(输出 output)1~4。 (输入: 0-断, 1-通; 输出: 1-吸合, 0-断开) (Input: 0-disconnected, 1-breakover; Output: 1-closed, 0-disconnected)
0013	故障状态 Failure state	0-2047	R		Bit0: 低电压一段 Low voltage 1 stage failure Bit1: 低电压二段 Low voltage 2 stage failure Bit2: 低电压三段 Low voltage 3 stage failure Bit3: 过电压 Overvoltage Bit4: 零序过电压 Zero-sequence overvoltage Bit5: 电压不平衡 Voltage unbalance Bit6: PT 断线 PT disconnection Bit7: 小车位置脱扣 Trolley position trip Bit8: 联动一 Linkage 1 Bit9: 联动二 Linkage 2 Bit10: 联动三 Linkage 3
0014	报警状态 Alarm state	0-2047	R		同上 Ibid
0015	可编程输出结果 Programmable output result	0-7	R		bit0: 可编程 1; bit1: 可编程 2; bit3: 可编程 3。 (1-有输出, 0-无输出) bit0- programmable 1; bit1-programmable 2; bit3 programmable 3.

					(1-output, 0-no output)
0016	复位 Reset	/	W		复位命令: 0x03 Reset command:0x03
0017-001A 保留 Reserved					
001B	实时时钟年月 Real-time clock, year, month		R/W		
001C	实时时钟日时 Real-time clock, day, hour		R/W		
001D	实时时钟分秒 Real-time clock, minute, second		R/W		
001E-0021 保留 Reserved					
0022	脱扣保护使能 Tripping protection enabling	0-2047	R/W		Bit0: 低电压一段 Low voltage 1 stage failure Bit1: 低电压二段 Low voltage 2 stage failure Bit2: 低电压三段 Low voltage 3 stage failure Bit3: 过电压 Overvoltage Bit4: 零序过电压 Zero-sequence overvoltage Bit5: 电压不平衡 Voltage unbalance Bit6: PT 断线 PT disconnection Bit7: 小车位置脱扣 Trolley position trip Bit8: 联动一 Linkage 1 Bit9: 联动二 Linkage 2 Bit10: 联动三 Linkage 3
0023	报警保护使能 Alarm protection enabling	0-2047	R/W		同上 Ibid
0024	低电压一段动作值 Low voltage 1 stage action value	10%-100%	R/W	60%	
0025	低电压一段报警值 Low voltage 1 stage	10%-100%	R/W	70%	

	alarm value				
0026	低电压一段动作时间 Low voltage 1 stage action time	0.1s-100s	R/W	0.5s	
0027	返回系数 Drop-off to pick-up ratio	5%-50%	R/W	5	
0028	低电压二段动作值 Low voltage 2 stage action value	10%-100%	R/W	40%	
0029	低电压二段报警值 Low voltage 1 stage alarm value	10%-100%	R/W	45%	
002A	低电压二段动作时间 Low voltage 1 stage action time	0.1s-100s	R/W	9s	
002B	返回系数 Drop-off to pick-up ratio	5%-50%	R/W	5	
002C	低电压三段动作值 Low voltage 3 stage action value	10%-100%	R/W	40%	
002D	低电压三段报警值 Low voltage 1 stage alarm value	10%-100%	R/W	45%	
002E	低电压三段动作时间 Low voltage 1 stage action time	0.1s-100s	R/W	9s	
002F	返回系数 Drop-off to pick-up ratio	5%-50%	R/W	5	
0030	过电压动作值 Overvoltage action value	100%-150%	R/W	130%	
0031	过电压报警值 Overvoltage alarm value	100%-150%	R/W	120%	
0032	过电压动作时间 Overvoltage action time	0.1s-100s	R/W	5s	
0033	返回系数 Drop-off to pick-up ratio	5%-50%	R/W	5	
0034	零序电压动作值 Zero-sequence voltage action value	2V-80V	R/W	20V	
0035	零序电压报警值 Zero-sequence voltage alarm value	2V-80V	R/W	15V	
0036	零序电压动作时间 Zero-sequence voltage action time	0.1s-100s	R/W	1s	
0037	返回系数	5%-50%	R/W	5	

	Drop-off to pick-up ratio				
0038	电压不平衡动作值 Voltage imbalance action value	5%-100%	R/W	30%	
0039	电压不平衡报警值 Voltage imbalance alarm value	5%-100%	R/W	20%	
003A	电压不平衡动作时间 Voltage imbalance action time	0.1s-100s	R/W	5s	
003B	返回系数 Drop-off to pick-up ratio	5%-50%	R/W	5	
003C	PT 断线动作时间 PT disconnection action time	0.1s-100s	R/W	0.5s	
003D	小车位置动作时间 Trolley position action time	0.1s-100s	R/W	5s	
003E	联动一动作时间 Linkage1 action time	0.1s-100s		5s	
003F	联动二动作时间 Linkage2 action time	0.1s-100s		5s	
0040	联动三动作时间 Linkage3 action time	0.1s-100s		5s	
0041 保留 Reserved					
0042	接线方式 Wiring mode	0-2	R/W	3PT	0: 1PT; 1: 2PT; 2: 3PT
0043	额定电压 Rated voltage	57.7-2000V	R/W	100V	
0044	PT 初级电压 CT primary voltage	57.7-2000V	R/W	100V	
0045	PT 次级电压 CT secondary voltage	57.7 或 100 或 110	R/W	100V	
0046	零序电压投入 Setting Zero-sequence voltage input	0-1	R/W	不投入 No input	0: 不投入; 1: 投入 0: No input; 1: input
0047	通讯地址 1 Communication address1	1-247	R/W	1	
0048	波特率 1 Baud rate1	2400-38400	R/W	19200	
0049	奇偶校验 1 Odd-even check:1	0-2	R/W	none	0: 无校验; 1: 奇校验; 2: 偶校验 0: no parity check; 1: odd parity check; 2: even check
004A	停止位 1 Stop bit1	1-2	R/W	1	1: 1 个停止位; 2: 2 个停止位 1: 1 stop bit; 2: 2 stop bits
004B	通讯地址 2	1-247	R/W	1	

	Communication address2				
004C	波特率 2 Baud rate2	2400-38400	R/W	19200	
004D	奇偶校验 2 Odd-even check:2	0-2	R/W	none	0: 无校验; 1: 奇校验; 2: 偶校验 0: no parity check; 1: odd parity check; 2: even check
004E	停止位 2 Stop bit2	1-2	R/W	1	1: 1 个停止位; 2: 2 个停止位 1: 1 stop bit; 2: 2 stop bits
004F	背光 Backlight	0-1	R/W	自动	0: 自动, 1: 常亮 0: Automatic, 1: Normally on
0050	模拟量输出类型 Analog output type	0-5	R/W	Uv	0-Uab; 1-Ubc; 2-Uca; 3-Uav; 4-Umax; 5-F
0051	模拟量输出倍数 Analog output times	1-2	R/W	2	
0052-0056 保留 Reserved					
0057	DI1 设置状态 DI1 setting status	0-1	R/W	1-常闭 Normally closed	0-常开; 1-常闭; 0-Normally open;1-Normally closed
0058	DI1 编程内容 DI1 setting contents	0-5	R/W	1-小车位置 1-Trolley position	0-普通 DI; 1-小车位置; 2-联动 1; 3-联动 2; 4-联动 3; 5-复位 0-Common DI;1-Trolley position; 2-Linkage1; 3-Linkage2;4-Linkage3; 5-Reset
0059	DI2 设置状态 DI2 setting status	0-1	R/W	0-常开	同 DI1 设置状态 Same as DI1 setting status
005A	DI2 编程内容 DI2 setting contents	0-5	R/W	0-普通 DI	同 DI1 编程内容 Same as DI1 setting contents
005B	DI3 设置状态 DI3 setting status	0-1	R/W	0-常开	同 DI1 设置状态 Same as DI1 setting status
005C	DI3 编程内容 DI3 setting contents	0-5	R/W	0-普通 DI	同 DI1 编程内容 Same as DI1 setting contents
005D	DI4 设置状态 DI4 setting status	0-1	R/W	0-常开	同 DI1 设置状态 Same as DI1 setting status
005E	DI4 编程内容 DI4 setting contents	0-5	R/W	0-普通 DI	同 DI1 编程内容 Same as DI1 setting contents
005F	DI5 设置状态 DI5 setting status	0-1	R/W	0-常开	同 DI1 设置状态 Same as DI1 setting status
0060	DI5 编程内容 DI5 setting contents	0-5	R/W	5-复位	同 DI1 编程内容 Same as DI1 setting contents
0061-0067 保留 Reserved					
0068	DO 通讯使能 DO communication enabling	/	W	/	普通 DO 状态: D01: Bit0-Bit1: 3 为闭合, 0 为断开; D02: Bit2-Bit3: 3 为闭合, 0 为断开; D03: Bit4-Bit5: 3 为闭合, 0 为断开; D04: Bit6-Bit7: 3 为闭合, 0 为断开;

0069	D01 输出模式 DO1 output mode	1-2	R/W	电平 Level	1: 电平; 2: 脉冲 1: Level; 2: Pulse
006A	D01 输出编程 DO1 output programming	0-28	R/W	2: 低电压 1 段 故障输出 2: low voltage 1 stage failure	0-普通 DO; Common DO; 1-总故障输出; Total fault output; 2-低电压 1 段故障输出; Low voltage 1 stage failure output; 3-低电压 2 段故障输出; Low voltage 2 stage failure output; 4-低电压 3 段故障输出; Low voltage 3 stage failure output; 5-过电压故障输出; Overvoltage failure output; 6-零序过电压故障输出; Zero-sequence overvoltage failure output; 7-电压不平衡故障输出; Imbalance failure output; 8-PT 断线故障输出; PT disconnection failure output; 9-小车位置故障输出; Trolley position failure output; 10-联动 1 故障输出; Linkage 1 failure output; 11-联动 2 故障输出; Linkage 2 failure output; 12-联动 3 故障输出; Linkage 3 failure output; 13-总报警输出; Total fault output output; 14-低电压 1 段报警输出; Low voltage 1 stage alarm output; 15-低电压 2 段报警输出; Low voltage 2 stage alarm output; 16-低电压 3 端报警输出; Low voltage 3 stage alarm output; 17-过电压报警输出; Overvoltage alarm output; 18-零序过电压报警输出; Zero-sequence overvoltage alarm output; 19-电压不平衡报警输出; Voltage imbalance alarm output; 20-PT 断线报警输出; PT disconnection alarm output; 21-小车位置报警输出; Trolley position alarm output; 22-联动 1 报警输出;

					Linkage 1 alarm output; 23-联动 2 报警输出; Linkage 2 alarm output; 24-联动 3 报警输出; Linkage 3 alarm output; 25-装置故障/失电; Device failure/power loss output; 26-可编程一输出; Programmable 1 output; 27-可编程二输出; Programmable 2 output ; 28-可编程三输出; Programmable 3 output ;
006B	D01 脉冲宽度 DO1 pulse width	1-5	R/W	5s	
006C	D02 输出模式 DO2 output mode	1-2	R/W	电平 Level	
006D	D02 输出编程 DO2 output programming	0-28	R/W	3-电压 2 段故障输出 3: low voltage 2 stage failure	同 D01 输出编程 Same as DO1 output programming
006E	D02 脉冲宽度 DO2 pulse width	1-5	R/W	5s	
006F	D03 输出模式 DO3 output mode	1-2	R/W	电平 Level	
0070	D03 输出编程 DO3 output programming	0-28	R/W	4-低电压 3 段故障输出 4: low voltage 3 stage failure	同 D01 输出编程 Same as DO1 output programming
0071	D03 脉冲宽度 DO3 pulse width	1-5	R/W	5s	
0072	D04 输出模式 DO4 output mode	1-2	R/W	电平 Level	
0073	D04 输出编程 DO4 output programming	0-28	R/W	0-总故障输出 0-Total fault output	同 D01 输出编程 Same as DO1 output programming
0074	D04 脉冲宽度 DO4 pulse width	1-5	R/W	5s	
0075-0077 保留 Reserved					
0078	可编程输出 1 编程类型 Programmable type of programmable output	0-7	R/W	A	0-关闭; 1-A; 2-A*B; 3-A+B; 4-A*B*C; 5-(A+B)*C; 6-A*B+C; 7-A+B+C 0-closed; 1-A; 2-A*B; 3-A+B; 4-A*B*C; 5-(A

	1				+B)*C;6-A*B+C;7-A+B+C
0079	可编程 1 输入条件 A Programmable 1 input condition A	0-29	R/W	2-低电压 1 段 故障输出 2-Low voltage 1 stage failure output	0-无输入; No input; 1-总故障输出; Total fault output; 2-低电压 1 段故障输出; Low voltage 1 stage failure output; 3-低电压 2 段故障输出; Low voltage 2 stage failure output; 4-低电压 3 段故障输出; Low voltage 3 stage failure output; 5-过电压故障输出; Overvoltage failure output; 6-零序过电压故障输出; Zero-sequence overvoltage failure output; 7-电压不平衡故障输出; Imbalance failure output; 8-PT 断线故障输出; PT disconnection failure output; 9-小车位置故障输出; Trolley position failure output; 10-联动 1 故障输出; Linkage 1 failure output; 11-联动 2 故障输出; Linkage 2 failure output; 12-联动 3 故障输出; Linkage 3 failure output; 13-总报警输出; Total fault output output; 14-低电压 1 段报警输出; Low voltage 1 stage alarm output; 15-低电压 2 段报警输出; Low voltage 2 stage alarm output; 16-低电压 3 端报警输出; Low voltage 3 stage alarm output; 17-过电压报警输出; Overvoltage alarm output; 18-零序过电压报警输出; Zero-sequence overvoltage alarm output; 19-电压不平衡报警输出; Voltage imbalance alarm output; 20-PT 断线报警输出; PT disconnection alarm output; 21-小车位置报警输出; Trolley position alarm output; 22-联动 1 报警输出;

					Linkage 1 alarm output; 23-联动 2 报警输出; Linkage 2 alarm output; 24-联动 3 报警输出; Linkage 3 alarm output; 25-DI1; 26-DI2; 27-DI3; 28-DI4; 29-DI5;
007A	可编程 1 输入条件 B Programmable 1 input condition B		R/W	3-低电压 2 段故障输出 3-Low voltage 2 stage failure output	同可编程 1 输入条件 A Same as Programmable 1 input condition A
007B	可编程 1 输入条件 C Programmable 1 input condition C		R/W	4-低电压 3 段故障输出 4-Low voltage 3 stage failure output	同可编程 1 输入条件 A Same as Programmable 1 input condition A
007C	可编程输出 2 编程类型 Programming type of programmable output 2		R/W	A*B	同可编程输出 1 编程类型 Same as Programming type of programmable output 1
007D	可编程 2 输入条件 A Programmable 2 input condition A		R/W	5-过电压故障输出	同可编程 1 输入条件 A Same as Programmable 1 input condition A
007E	可编程 2 输入条件 B Programmable 2 input condition B		R/W	6-零序过压故障输出	同可编程 1 输入条件 A Same as Programmable 1 input condition A
007F	可编程 2 输入条件 C Programmable 2 input condition C		R/W	7-电压不平衡故障	同可编程 1 输入条件 A Same as Programmable 1 input condition A
0080	可编程输出 3 编程类型 Programming type of programmable output 3		R/W	A+B	同可编程输出 1 编程类型 Same as Programming type of programmable output 1
0081	可编程 3 输入条件 A Programmable 3 input condition A		R/W	14-低电压 1 段报警	同可编程 1 输入条件 A Same as Programmable 1 input condition A
0082	可编程 3 输入条件 B Programmable 3 input		R/W	15-低电压 2 段报警	同可编程 1 输入条件 A Same as Programmable 1 input condition A

	condition B				
0083	可编程 3 输入条件 C Programmable 3 input condition C		R/W	16-低电压 3 端报警	同可编程 1 输入条件 A Same as Programmable 1 input condition A
0084-00C6 保留 Reserved					
200-359	故障记录, 见表 11 See Table 11 for the failure record				
360-439	DI 动作记录, 见表 12 See Table 12 for the DI action record				
440-459	预留 Reserved				
460-620	报警记录, 见表 13 See Table 13 for the alarm record				

ALP220-PT 系列故障记录通讯地址见表 11 所示。

See Table 11 for ALP220-PT series failure record communication address.

表 11 ALP220-PT 系列故障记录通讯地址表

Table 11 ALP220-PT series failure record communication address table

地址 Address	名称 Name	属性 Attribute	数据格式 Data format	备注 Remarks
00C7	最新故障 记录通讯地址 Latest failure record communication address	R	Word	201、221、241、261、281、301、321、341
00C8	故障年月 Failure year/month	R	BCD 码 BCD code	
00C9	故障日时 Failure day/hour	R	BCD 码 BCD code	
00CA	故障分秒 Failure minute/second	R	BCD 码 BCD code	
00CB	故障指示 Fault indicator	R	Word	Bit0: 低电压一段 Low voltage 1 stage Bit1: 低电压二段 Low voltage 2 stage Bit2: 低电压三段 Low voltage 3 stage Bit3: 过电压 Overvoltage Bit4: 零序过电压 Zero-sequence overvoltage Bit5: 电压不平衡

				Voltage imbanlace Bit6: PT 断线 PT disconnection Bit7: 小车位置脱扣 Trolley position trip Bit8: 可编程一 Programmable 1 Bit9: 可编程二 Programmable 2 Bit10: 可编程三 Programmable 3
00CC	报警指示 Alarm indicator	R	Word	同故障指示 Same as Fault indicator
00CD	AB 相电压 A-phase voltage	R	Word	
00CE	BC 相电压 B-phase voltage	R	Word	
00CF	CA 相电压 C-phase voltage	R	Word	
00D0	零序电压 Zero-sequence voltage	R	Word	
00D1	模拟零序电压 Analog Zero-sequence voltage	R	Word	
00D2	电压不平衡 Voltage imbanlace	R	Word	
00D3	频率 Frequency	R	Word	

注意：剩余故障记录地址起始地址分别为 221、241、261、281、301、321、341，数据格式与表 11 相同。

Note: The initial addresses of residual failure record address are respectively 221、241、261、281、301、321、341. The data format is the same as Table 11.

表 12 ALP220-PT 系列 DI 动作记录通讯地址表

Table 12 ALP220-PT Series DI Action Record Communication Address Table

地址	名称	属性	数据格式	备注
0167	DI 记录最新通讯地址 Latest DI record communication address	R	Word	361、371、381、391、401、411、421、431
0168	DI 记录年月 DI record	R	BCD 码 BCD CODE	

	year/month			
0169	DI 记录日時 DI record day/hour	R	BCD 码 BCD CODE	
016A	DI 记录分秒 DI record minute/second	R	BCD 码 BCD CODE	
016B	DI 状态 DI status	R	Word	高 8 位判断 DIX: 1-5 对应 DI1-DI5; 低 8 位判断原因: 1=断开, 2=闭合。 High 8-digit judgment DIX: 1-5 corresponds DI1-DI5; low 8-digit judgment cause: 1=disconnected; 2-closed.
016C-0170: 保留 Reserved				

注意：剩余的 DI 动作记录地址起始地址分别为 371、381、391、401、411、421、431，数据格式与表 12 相同。

Note: The initial addresses of residual failure record address are respectively 371、381、391、401、411、421、431. The data format is the same as Table 12.

ALP220-PT 系列报警记录通讯地址见表 13 所示。

See Table 13 for the alarm record communication address of ALP220-PT series

表 13 ALP220-PT 系列报警记录通讯地址表

Table 13 ALP220-PT Series DI Alarm Record Communication Address Table

地址 Address	名称 Name	属性 Attribute	数据格式 Data format	备注 Remarks
01CB	最新报警记录 通讯地址 Latest alarm record communication address	R	Word	461、481、501、521、541、561、581、601
01CC	报警年月 Alarm year/month	R	BCD 码 BCD CODE	
01CD	报警日時 Alarm day/hour	R	BCD 码 BCD CODE	
01CE	报警分秒 Alarm minute/second	R	BCD 码 BCD CODE	

01CF	基本故障脱扣位 Basic trip fault bit	R	Word	Bit0: 低电压一段 Low voltage 1 stage Bit1: 低电压二段 Low voltage 2 stage Bit2: 低电压三段 Low voltage 3 stage Bit3: 过电压 Overvoltage Bit4: 零序过电压 Zero-sequence overvoltage Bit5: 电压不平衡 Voltage imbanlace Bit6: PT 断线 PT disconnection Bit7: 小车位置脱扣 Trolley position trip Bit8: 可编程一 Programmable 1 Bit9: 可编程二 Programmable 2 Bit10: 可编程三 Programmable 3
01D0	基本报警脱扣位 Basic alarm fault bit	R	Word	同故障指示 Same as the fault indicator
01D1	AB 相电压 A-phase voltage	R	Word	
01D2	BC 相电压 B-phase voltage	R	Word	
01D3	CA 相电压 C-phase voltage	R	Word	
01D4	零序电压 Zero-sequence voltage	R	Word	
01D5	模拟零序电压 Analog Zero-sequence voltage	R	Word	
01D6	电压不平衡 Voltage imbanlace	R	Word	
01D7	频率 Frequency	R	Word	

注意：剩余故障报警地址起始地址分别为 461、481、501、521、541、561、581、601，数据格式与表 13 相同。

Note: The initial addresses of residual failure record address are respectively 461、481、501、521、541、561、581、601. The data format is the same as Table 13.

8 常见故障的诊断分析和排除 **Diagnosis and Troubleshooting of Common Failures**

8.1 电压显示值与实际电压值不对应 The voltage display value does not correspond to the actual voltage value.

- 查看电压的初级电压是否和外部接入的 PT 一致，进入方法：“系统参数设置->PT 初级电压”；
- Check whether the primary voltage of the voltage is consistent with the externally connected PT. Entering method: "System Setting -> PT Primary Voltage";
- 查看设置接线方式是否和外部接入的 PT 一致，进入方法：“系统参数设置->系统类型”。
- Check whether the wiring setting mode is consistent with the externally connected PT. Entering method: "System Setting -> PT Primary Voltage";

8.2 通讯无法正常连接 Communication cannot be connected normally

- 查看通讯接线是否正确，包括 A/B 线正确性，是否存在短路、断线的情况；
- Check whether the communication wiring is correct, including the correctness of the A/B line, and whether a short circuit or disconnection occurs;
- 查看产品通讯地址是否正确，进入方法：“系统参数设置->通讯一设置->通讯一地址”，“系统参数设置->通讯二设置->通讯二地址”；
- Check whether the product communication address is correct. Entering method: "System Setting -> Communication 1 Setting -> Address1", "System Setting -> Communication 2 Setting -> Address2";
- 查看产品通讯波特率是否正确，进入方法：“系统参数设置->通讯一设置->通讯一波特率”，“系统参数设置->通讯二设置->通讯二波特率”；
- Check whether the product communication baud rate is correct. Entering method: "System Setting -> Communication 1 Setting -> BaudRate1", "System Setting -> Communication 2 Setting -> BaudRate2";
- 注意：本产品为双通讯产品，如果通讯一、通讯二处于同一回路，请设置不同的通讯地址。
- Note: This product is a dual communication product. If communication 1 and communication 2 are in the same circuit, please set different communication address.

8.3 零序电压不能显示 Zero sequence voltage cannot be displayed

- 查看零序电压投入设置是否打开，进入方法：“系统参数设置->零序电压投入”。
- Check whether the zero-sequence voltage input setting is turned on. Entering method: "System Setting -> Zero-Sequence Voltage Input".

9 应用范例 **Application examples**

ALP220-PT 低压 PT 保护装置二次接线图

ALP220-PT low voltage PT protection device secondary wiring diagram

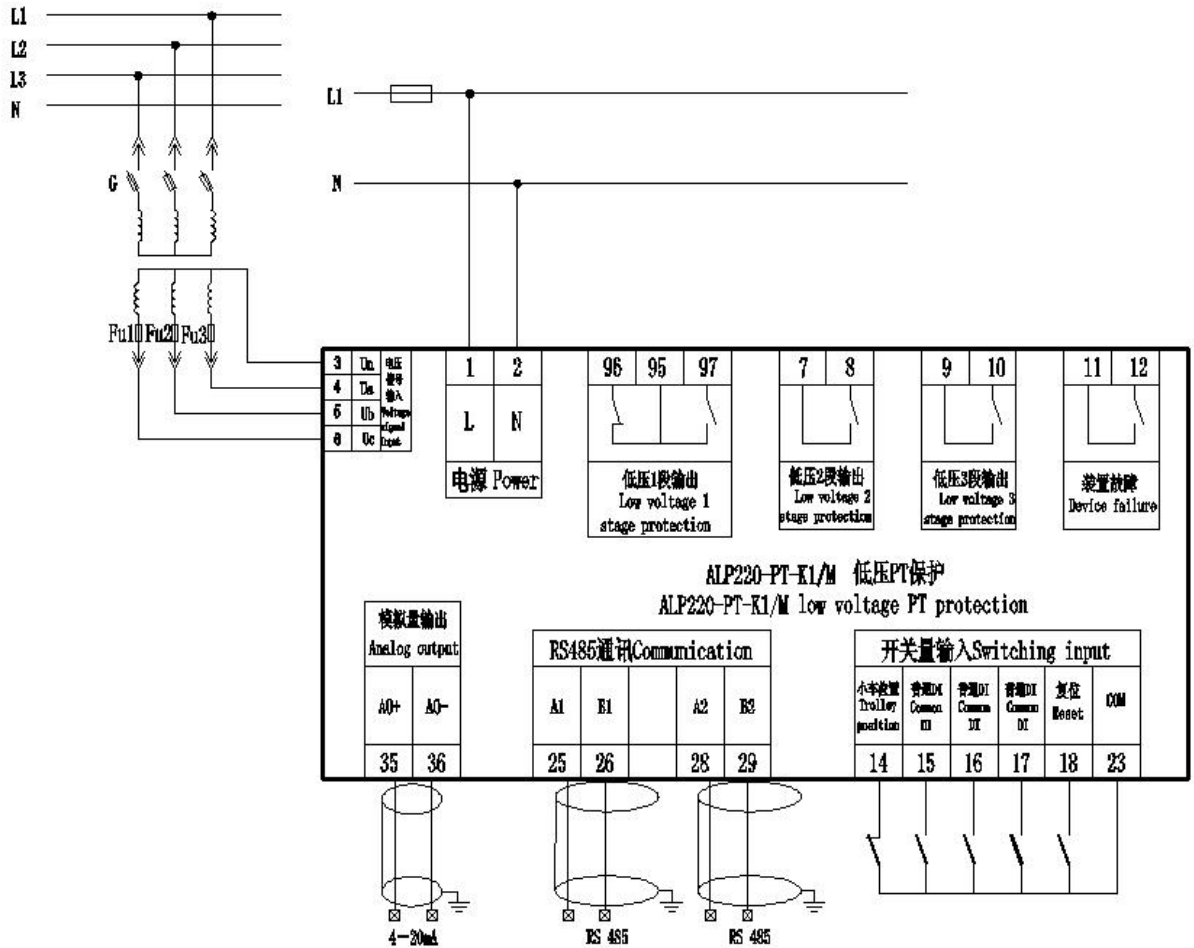


图 4 三相四线、弱电开入

Figure4 Three-phase four-wire, weak current switching input

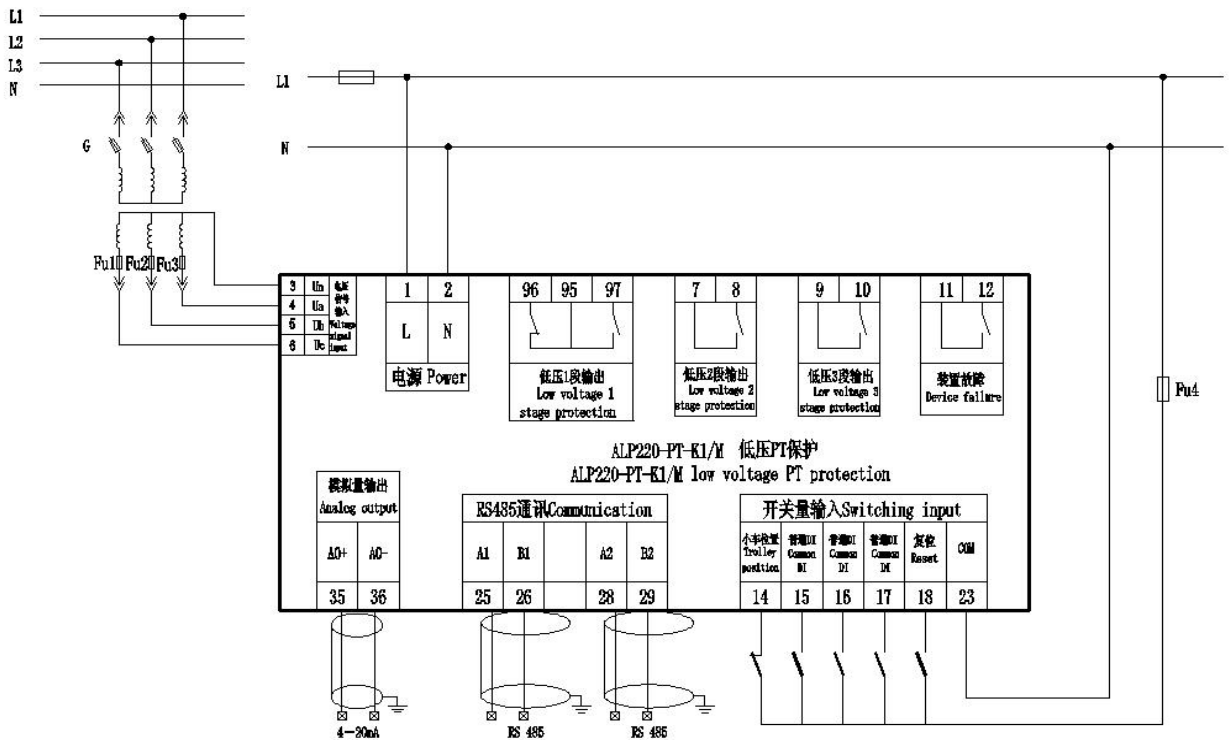


图 5 三相四线、强电开入

Figure5 Three-phase three-wire, strong current switching input

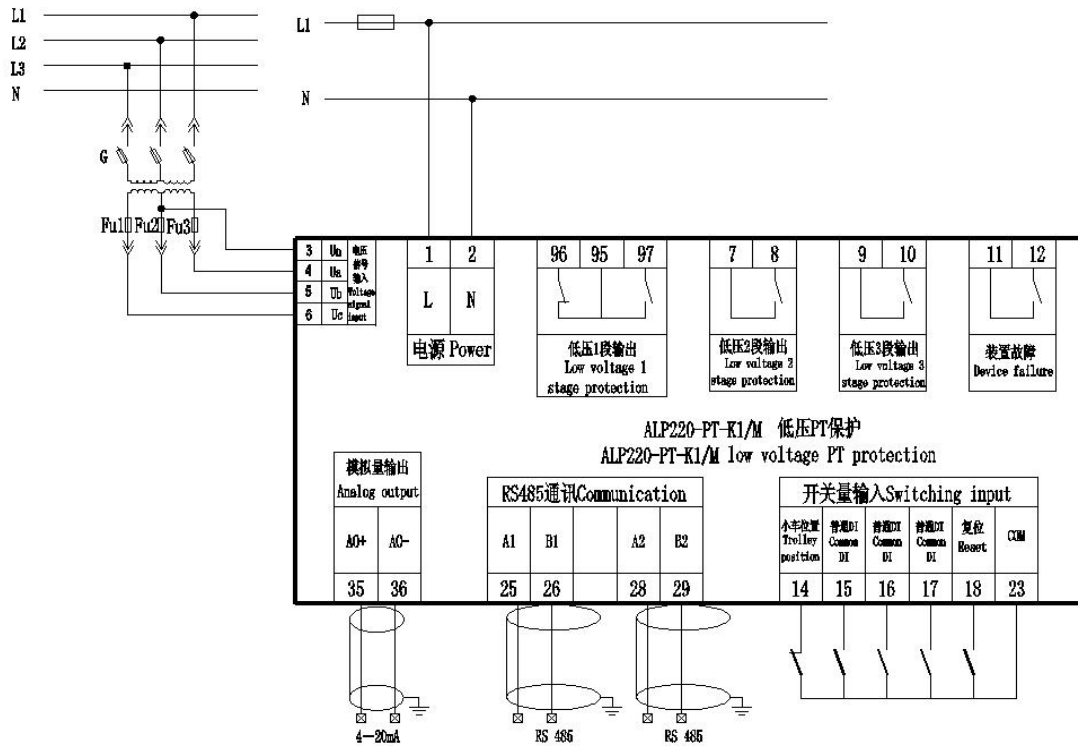


图 6 三相三线、弱电开入

Figure6 Three-phase four-wire, weak current switching input

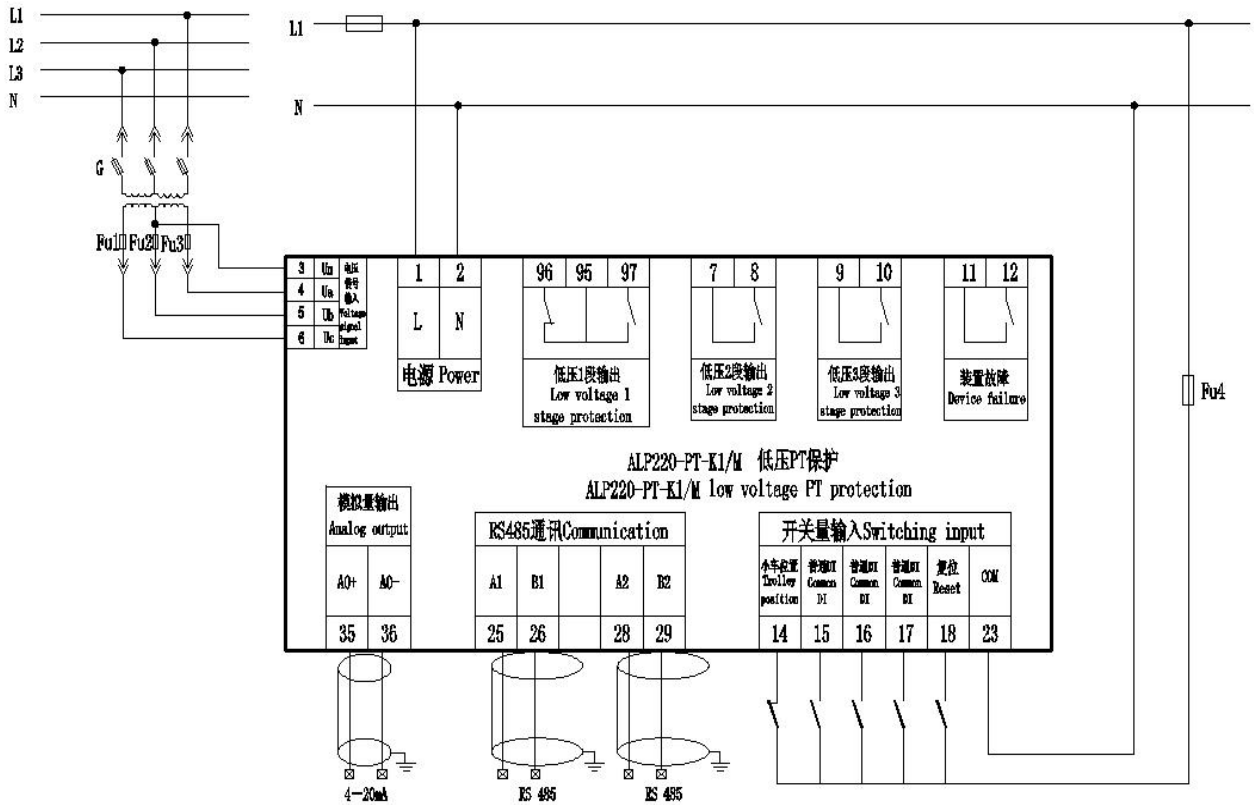


图 7 三相三线、强电开入

Figure7 Three-phase four-wire, weak current switching input

10 订货范例 Ordering examples

例：型号：ALP220-PT-K1/M

For example:Model: ALP220-PT-K1/M

辅助电源：AC220V

Auxiliary power supply: AC220V

应用场合：低压 PT 柜

Application: Low voltage PT cabinet

测量参数：三相电压、接地电压

Measurement parameters: three-phase voltage, ground voltage

附加功能：模拟量输出

Additional functions: Analog output

总部：安科瑞电气股份有限公司
地址：上海市嘉定区马东工业园育绿路 253 号
电话：021-69158300 69158301 69158302
传真：021-69158303
服务热线：800-820-6632
网址：www.acrel.cn
邮箱：ACREL001@vip.163.com
邮编：201801

生产基地：江苏安科瑞电器制造有限公司
地址：江阴市南闸镇东盟工业园区东盟路 5 号
电话：(86) 0510-86179966 86179967 86179968
传真：(86) 0510-86179975
邮编：214405
邮箱：JY-ACREL001@vip.163.com