

PZ系列可编程智能电测表

PZ series Programmable Intelligent Electric Parameter Meters

三相功率、三相电能部分
Three Phase Power, Three Phase Electrical Power
(P3/P4、E3/E4)

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安装使用说明书V1.3

Installation and Operation Instruction V1.3

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1 概述 General

PZ系列三相功率表、电能表，采用交流采样技术，可直接或间接测量三相电网中的电流和电压、功率、电能等电参量。既可用于本地显示，又能与工控设备连接，组成测控系统。

仪表具有RS-485通讯接口，采用兼容Modbus-RTU协议；可将电量信号转换成标准的模拟量输出；可带四路(两路)开关量输入/两路开关量输出。根据不同要求，通过仪表面板按键，对变比、报警、通讯等参数设置和控制。

PZ系列仪表具有极高的性价比，可以直接取代常规电力变送器和测量仪表。作为一种先进的智能化、数字化的前端采集元件，该电力仪表已广泛应用于各种控制系统、SCADA系统和能源管理系统中。

PZ Series three phase power meters, electric energy meters, adopting AC sampling technology, can measure many three phase grid electrical parameters such as current, voltage, power, electric energy etc. directly or indirectly. It may be used for local display, and connected with the control equipment to form measuring and controlling system.

Fitted with RS-485 communication port, adopting compatible Modbus-RTU protocol, meters can switch electric parameter signal into standard analog output, with four-channel (two-channel) switching input / two-channel switching output. Based on different requirements, by keys on the faceplate, electric parameters for transformation ratio, alarm, communication etc. can be set up and controlled.

PZ series meters have extra high price performance ratio, can simply replace traditional electric transducer and measuring meters. As an advanced intelligent, digital front end acquisition component, this electric meters have widely used in various control system, SCADA system and energy source management system.

2 产品型号规格 Type and specification of products

仪表型号	基本功能	外形	可选功能
LED数码显示 PZ72-P3/* PZ72-P4/*	测量有功功率、无功功率、功率因数； 测量三相电压、三相电流；	72方形	1、2路变送输出 + RS485 通讯 (/MC) 2、开关量 2DI2DO + RS485通讯 (/KC)
LED数码显示 PZ72-E3/* PZ72-E4/*	测量有功电能 (EPI/EPE) ； 测量有功功率、无功功率、功率因数； 测量三相电压、三相电流、频率；		1、2路变送输出 + 1路脉冲 + RS485通讯 (/MC) 2、2DI2DO + 1路脉冲 + RS485通讯 (/KC)

仪表型号	基本功能	外形	可选功能
LED数码显示 PZ80-P3/* PZ80-P4/*	测量有功功率、无功功率、功率因数； 测量三相电压、三相电流；	80 方形	1、1路变送输出 + RS485 通讯 (/MC) 2、开关量 2DI2DO + RS485通讯 (/KC) 3、开关量 4DI + RS485 通讯 (/KC)
LCD液晶显示 PZ80L-P3/* PZ80L-P4/*			1、开关量 4DI+ 1路脉冲 + RS485通讯 (/KC) 2、1 路变送输出 + 2路脉冲 + RS485通讯 (/MC)
LED数码显示 PZ80-E3/* PZ80-E4/*	测量有功功率、无功功率、功率因数； 测量三相电压、三相电流、频率；	96 方形	1、开关量 2DI2DO + RS485 通讯 (/KC) 2、开关量 4DI + RS485 通讯 (/KC) 3、2 路变送输出 + RS485 通讯 (/MC)
LCD液晶显示 PZ80L-E3/* PZ80L-E4/*			1、开关量 4DI2DO + RS485 通讯 (/KC) 2、开关量 4DI + RS485 通讯 (/KC) 3、2 路变送输出 + RS485 通讯 (/MC)
LED数码显示 PZ96-P3/* PZ96-P4/*	测量有功功率、无功功率、功率因数； 测量三相电压、三相电流；	96 方形	1、开关量 4DI+ 1路脉冲 + RS485通讯 (/KC) 2、开关量 2DI2DO + RS485 通讯 (/KC)
LCD液晶显示 PZ96L-P3/* PZ96L-P4/*			1、开关量 4DI+ 1路脉冲 + RS485通讯 (/KC) 2、开关量 4DI2DO + RS485 通讯 (/KC) 3、2 路变送输出 + 2 路脉冲 + RS485 通讯 (/MC)
LED数码显示 PZ42-P3/* PZ42-P4/*	测量有功功率、无功功率、功率因数； 测量三相电压、三相电流；	42 方形	1、开关量 4DI2DO + RS485 通讯 (/KC) 2、4路变送输出 + RS485 通讯 (/MC)
LCD液晶显示 PZ42L-P3/* PZ42L-P4/*			1、开关量 8DI2DO + RS485 通讯 (/KC) 2 开关量 8DI + 2路脉冲 + RS485 通讯 (/MC) 3、2 路变送输出 + 2 路脉冲 + RS485 通讯 (/MC)
LED数码显示 PZ42-E3/* PZ42-E4/*	测量有功功率、无功功率、功率因数； 测量三相电压、三相电流、频率；	42 方形	1、开关量 8DI2DO + RS485 通讯 (/KC) 2 开关量 8DI + 2路脉冲 + RS485 通讯 (/MC) 3、2 路变送输出 + 2 路脉冲 + RS485 通讯 (/MC)
LCD液晶显示 PZ42L-E3/* PZ42L-E4/*			1、开关量 8DI2DO + RS485 通讯 (/KC) 2 开关量 8DI + 2路脉冲 + RS485 通讯 (/MC) 3、2 路变送输出 + 2 路脉冲 + RS485 通讯 (/MC)

说明：

1、电能表若无附加功能，则配有两路电能脉冲输出，在选配开关量输入/输入的情况下，则无电能脉冲。

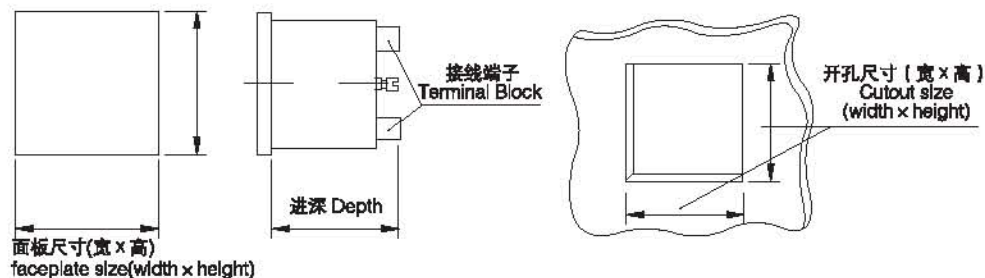
3 技术参数 Technical parameters

技术参数 Technical parameters		指标 Value
输入 Input	接线 Connection	三相三线、三相四线 3-phase-3-wire, 3-phase-4-wire
	频率 frequency	45~65Hz
	电压 voltage	额定值(rating): AC 100V、400V 过负荷: 1.2倍额定值(连续); 2倍额定值持续1秒 overload: 1.2 fold rating (continuous); 2 fold rating for 1 second 功耗: 小于0.2VA power consumption: < 0.2VA
	电流 current	额定值: AC 1A、5A rating: AC 1A, 5A 过负荷: 1.2倍额定值(连续); 10倍额定值持续1秒 overload: 1.2 fold rating (continuous); 10 fold rating for 1 second 功耗: 小于0.2VA power consumption: < 0.2VA
功能 function	电能 electric energy	输出方式: 2路集电极开路的光耦脉冲 Output mode: 2 channel open-collector photocoupler pulse 脉冲常数: 10000、40000、160000 Imp/kWh pulse constant: 10000, 40000, 160000 Imp/kWh
	通讯 communication	RS485接口、Modbus-RTU协议 RS485port, Modbus-RTU protocol
	显示 display	LED、LCD
	开关量输入 Switching input	2路或4路无源干接点输入方式 2channel/4channel passive dry contact input mode
	开关量输出 Switching output	输出方式: 2路继电器常开触点输出 Output mode: 2channel relay NO contact output 触点容量: 1A/30VDC或1A/250VAC contact capacity: 1A/30VDC 1A/250VAC
	模拟量输出 Analog output	输出方式: 1、2或4路输出, 0~20mA、4~20mA 可编程 Output mode: 1, 2 or 4 channel Output, 0~20mA, 4~20mA programmable 负载能力: ≤500Ω load capacity: ≤500Ω
精度等级 accuracy class	频率0.05Hz、无功电能1级、其它0.5级 frequency 0.05Hz, reactive electric energy 1 class, others 0.5 class	
电源 power supply	AC 85~265V ; (以仪表接线图为准) 功耗≤5VA DC 100~350V ; power consumption ≤5VA	
安全性 Security	工频耐压: 电源、电压输入回路 2kV/1min(RMS); Equipment withstand voltage: power supply, voltage input circuit 2kVAC; 电源、电流回路 2.5kV/1min(RMS); power supply, current circuit 2.5kVAC; 绝缘电阻: 输入、输出端对机壳>100MΩ Insulation resistance: input, output end to housing >100MΩ	
环境 Environment	温度 Temperature	工作(work): -10℃~+55℃ 储存(storage): -20℃~+70℃
	湿度 Humidity	≤93%RH 不结露(Non-condensing)
	海拔 Altitude	≤2500m

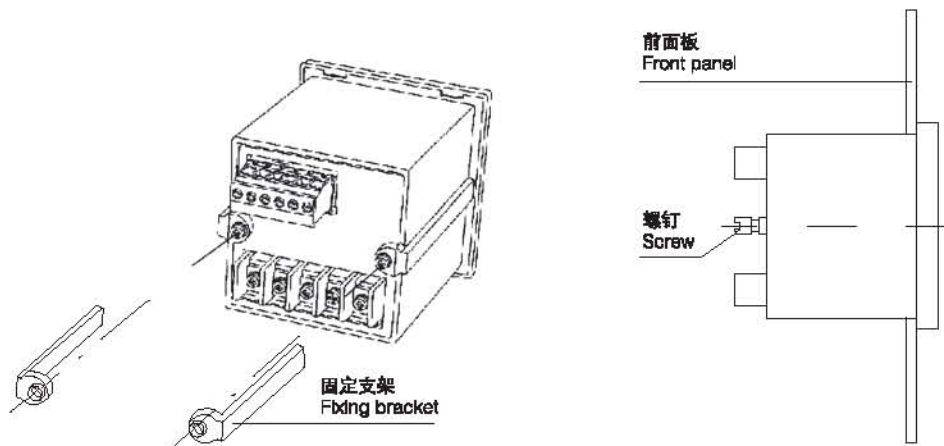
4 安装指南 Installation guide

4.1 外形及安装开孔尺寸 Outline and mounting cutout size

仪表外形 Outline 单位unit: mm	面板尺寸 faceplate size		壳体尺寸 housing size			开孔尺寸 cutout size	
	宽 width	高 height	宽 width	高 height	深 depth	宽 width	高 height
72方形 squareness	75	75	68	68	98	67	67
80方形 squareness	84	84	75	75	91	76	76
96方形 squareness	96	96	86	76	85	88	88
42方形 squareness	120	120	106	106	85	108	108



4.2 安装方法 Installation method

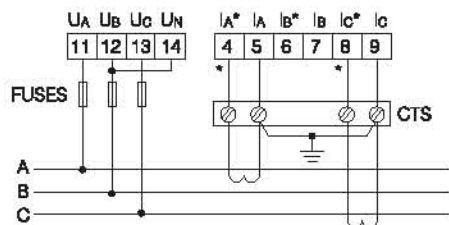


4.3 端子排列及接线

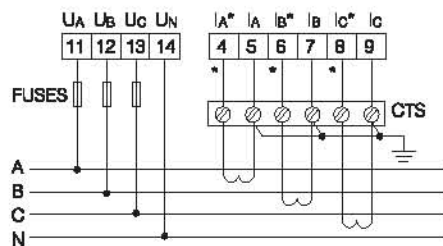
(注: 如与仪表壳体上接线图不一致, 以仪表壳体上接线图为准)

terminal arrangement and connection (Note: taking the diagram on the housing as standard)

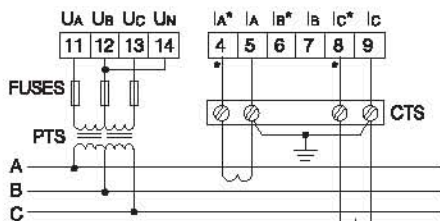
4.3.1 电压、电流信号端子 voltage, current signal terminal



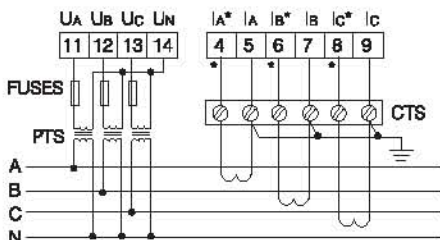
2CT (三相三线)
2CT (Three-phase-three-wire)



3CT (三相四线)
3CT (Three-phase-four-wire)



2PT, 2CT (三相三线)
2CT (Three-phase-three-wire)

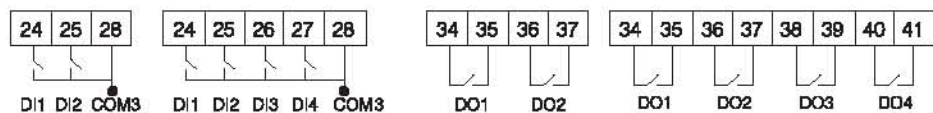


3PT, 3CT (三相四线)
3CT (Three-phase-four-wire)

注意: 三相三线接线时, 12号端子与14号端子外部需连接在一起。

Note: For Three-phase-three-wire, No.12 terminal must be connected with No.14 terminal

4.3.2 开关量输入/输出端子 Switching input/output terminal



开关量输入
Switching input

开关量输出
Switching output

开关输入是采用干接点开关信号输入方式, 仪表内部配备+5V的工作电源, 无须外部供电。当外部接通或断开的时候, 经过仪表开关输入模块采集其接通或断开信息并通过仪表本地显示, 同时可以通过仪表的RS485通讯接口实现远程传输功能, 即“遥信”功能。

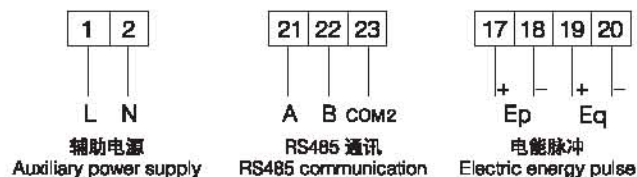
Switch input adopt wet contact switch signal input mode, with built-in +5V operational power supply, the meter need not external power supply. When the external is in ON or OFF, the ON or OFF information is collected by the input module of meter switch and is displaying locally, and implement remote transmission function, i.e. "remote signaling" function by meter digital port RS485.

开关量输出为继电器输出, 可通过上位机远程控制, 实现“遥控”功能, 也可以根据客户要求实现相应的报警功能。

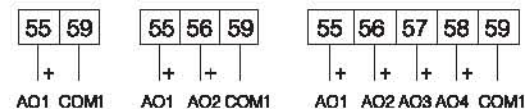
The switching output adopt relay output, Implement "telecontrol" function by remote control of the supervisory computer, and implement corresponding alarm function by user's request.

4.3.3 电源端子、RS485通讯端子、脉冲输出端子

Power supply terminal, RS485 communication terminal, pulse output terminal



4.3.4 模拟量输出端子 Analog output terminal



4.4 典型应用 Typical application

接线实例

可编程智能电表
PZ386 P4/C

序号	标号	名称	规格	数量	备注
12	10P2-004	熔断器	JRS-2 500/2A	3	
11	10T1	断路器	JRS-2 0.00/6A	1	
10	5S2	表箱	LS2-23 4L	1	
9	5S1	表箱	LS2-23 单	1	
8	10T	指示灯	JD1F-200/21 黄	1	A230V
7	10T	指示灯	JD1F-200/21 红	1	A230V
6	10T	指示灯	JD1F-200/21 绿	1	A230V
5	PZ	可编程智能电表	PZ386 P4/C	1	
4	P	电能表外壳	PZD 653 6/20*H	1	
3	CP	断路器	CSSE-CSM2P	1	
2	10L-704	安装底座	ADP-0.66 □/M	1	
1	10P1	熔断器	RT201-2 0.1-2000A 6/20*H	4	A230V

规格书 合格证 出厂日期 生产厂家 日期 数量 备注

上海安科瑞电气有限公司

电表接线图

电压测量回路

电流测量回路

控制回路

控制电源
熔断器
手动合闸
电动机锁
合闸指示
手动分闸
自动合闸
合闸指示
分闸指示
检修工作提醒

端子接线图

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

1 A1
2 A2
3 A3
4 A4
5 A5
6 A6
7 A7
8 A8
9 A9
10 A10
11 A11
12 A12
13 A13
14 A14
15 A15

5 编程与使用 Program and usage

5.1 测量项目及面板说明 Measuring items and faceplate

显示 Display

有功功率 active power
无功功率 reactive power
功率因数 power factor

显示 Display

A相电压 phase voltage
B相电压 phase voltage
C相电压 phase voltage

显示 Display

A相电流 phase current
B相电流 phase current
C相电流 phase current

显示电量
Display electric parameter
单位数量级
unit, magnitude

SET

PZ42

当右边指示灯只有k或M亮，且第一排数码显示EPI、EPE、E9L或E9C时，则第二、三排表示电能数据：第二排为高位，第三排为低位；例如第一排显示EPI，第二排显示0011，第三排显示01.58，k指示灯亮，其它指示灯不亮，则表示吸收有功电能(用电)：1101.58 kWh。

PZ系列电能表可以计量四象限电能数据：
EPI—吸收有功电能、EPE—释放有功电能、
E9L—感性无功电能、E9C—容性无功电能。

In the right indicators, if only k or M lights, and Level 1 number code display: EPI, EPE, E9L or E9C, then Level 2, Level 3 display :electric energy data; Level 2 is high bits, Level 3 is low bits; if Level 1 display EPI, Level 2 display 0011, Level 3 display 01.58, k indicator lights, other indicators never illuminate, then active electric energy is used (Power Consumption); 1101.58 kWh.

PZ Series electric energy meters may measure four-quadrant electric energy data:
EPI -- absorption active electric energy, EPE -- release active electric energy, E9L -- inductive reactive electric energy, E9C -- capacitive reactive electric energy.

数码管显示仪表，电能显示数据为一次侧数据；液晶显示为二次侧数据。

Digital display meter, electric energy display data as primary side data; liquid crystal display as secondary side data.

注：左边P、Q、λ等字符表示当右边指示灯亮时，此排数码管显示数据表示何种电量；左边“负号”一般不亮，当有接线错误时，分相有功功率P可能会显示为负值，因此可用于检查接线。

Note: Left P, Q, λ and other characters show. When the right indicator lights, this level digital displays electric parameter kind; left "minus sign" not ON commonly, if connection is improper, split-phase active power P may display as negative value, this may be used for connection checking.

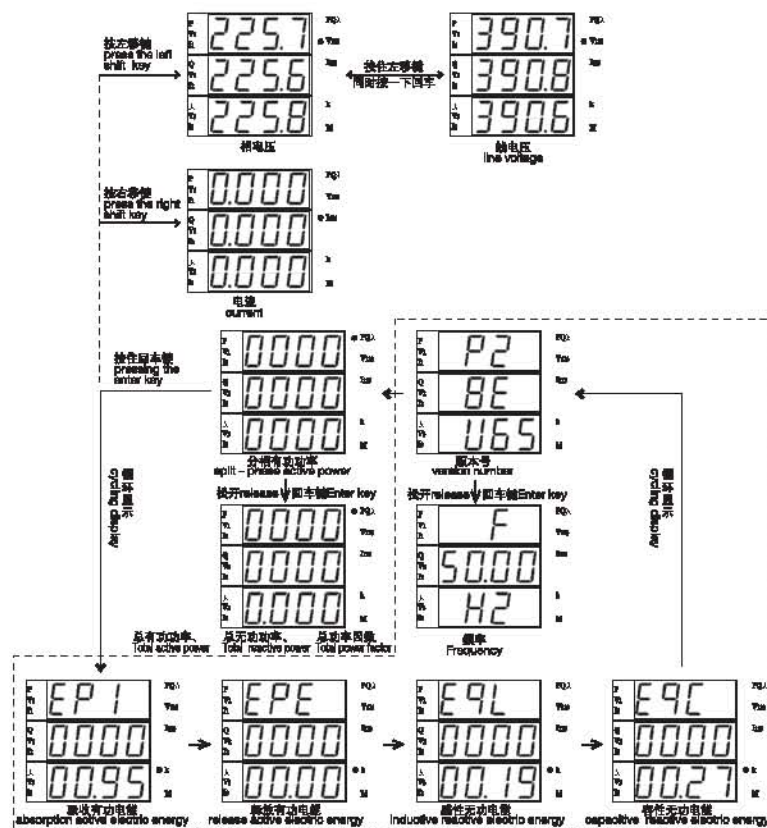
5.2 按键及功能说明 Key and specified function

SET键 Key 左移键left shift key 右移键Right shift key 回车键 Enter key

SET键 SET Key	测量模式下，按该键进入编程模式，仪表提示输入密码PASS，输入正确密码后，可对仪表进行编程设置；编程模式下，用于返回上一级菜单； measure mode DOWN, press SET Key enter program mode, meter Prompt input password PASS, after input correct password, put meter in programming; program mode DOWN, used for Return to previous menu.
左键 Left key	测量模式下，按该键显示三相电压； 编程模式下，用于同级菜单的向上翻页或个位数的减1 measure mode DOWN, press Left key display three phase voltage; program mode DOWN, used for page Up of same level menu or decrease 1 in ones place.
右键 Right key	测量模式下，按该键显示三相电流； 编程模式下，用于同级菜单的向下翻页或个位数的增1 measure mode DOWN, press Right key display three phase current; program mode DOWN, used for page Down of same level menu or Increase 1 in ones place.
回车键 Enter key	测量模式下， P3(P4)：按此键，LCD显示的仪表循环显示分相P、Q、λ(H)，LED数码管显示仪表只显示分相P，(Q、λ不显示) E3(E4)：按此键循环查看各象限电能等 编程模式下，用于确认菜单项目的选择和参数的修改 P3(P4)：press Enter key, cycling display split-phase P, Q, λ(H)； E3(E4)：press Enter key, cycling check each quadrant electric energy etc. program mode DOWN, affirming the selection of menu and revision of parameters.
左键+回车键 Left key +Enter key	编程模式下，用于百位数的减1 program mode DOWN, used for decrease 1 in hundreds place.
右键+回车键 Right key +Enter key	编程模式下，用于百位数的增1 program mode DOWN, used for increase 1 in hundreds place.

5.2.1 数码管(LED)显示P3/P4/E3/E4电量查看流程

Digital (LED) display ; P3/P4/E3/E4 electric parameters checking flow chart



三相四线制 功率表、电能表电量查看流程 (LED)
3-phase-4-wire power meter, electric energy meter, electric parameter checking flow chart (LED)

说明:

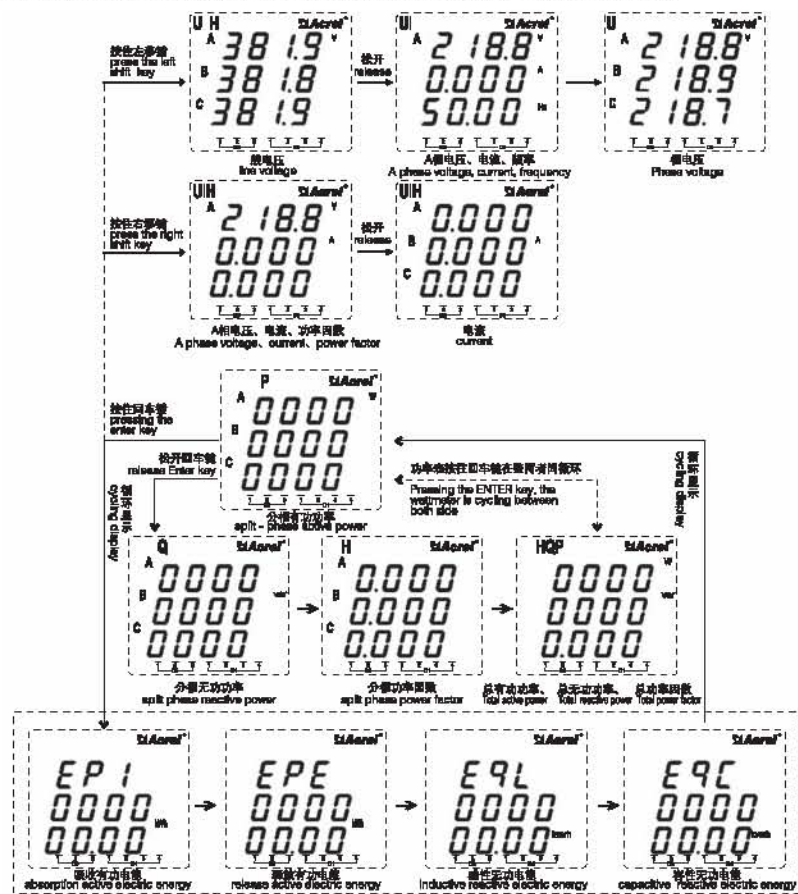
1. 虚线框内电量为电能表(E3/E4)所有，功率表(P3/P4)无；
2. 三相三线仪表，按左移键，只有线电压；其它电量查看流程与三相四线制同；
3. 功率表在查看其它电量时，约10s后，自动返回功率显示界面；
4. 电能表在查看其它电量后，将固定显示在最后查看的电量画面，按“回车键”可返回电能界面。

Explanation:

1. The electric parameter in the dotted line block is indicated in the electric energy meter (E3/E4), but not in the power meter(P3/P4);
2. 3-phase-3-wire meter, press the left shift key, only showing line voltage; other electric parameter checking flow chart is same as the 3-phase-4-wire case;
3. When the power meter check other electric parameters, after 10s or so, returning to power display interface;
4. After electric energy meter checked other electric parameter, fixing display the latest checked electric parameter picture,

5.2.2 液晶(LCD)显示P3/P4/E3/E4电量查看流程

Liquid crystal (LCD) display: P3/P4/E3/E4 electric parameters checking flow chart



三相四线制 功率表、电能表电量查看流程 (LCD)

3-phase-4-wire power meter, electric energy meter, electric parameter checking flow chart (LCD)

说明:

1. 虚线框内电量为电能表(E3/E4)所有, 功率表(P3/P4)无;
2. 三相三线制仪表, 电量查看流程与三相四线制同;
3. 功率表在查看其它电量时, 约10s后, 自动返回功率显示界面;
4. 电能表在查看其它电量后, 将固定显示在最后查看的电量画面, 按“回车键”可返回电能界面。

Explanation:

1. The electric parameter in the dotted line block is indicated in the electric energy meter (E3/E4), but not in the power meter(P3/P4);
2. 3-phase-3-wire meter, electric parameter checking flow chart is same as the 3-phase-4-wire case;
3. When the power meter check other electric parameters, after 10s or so, returning to power display interface;
4. After electric energy meter checked other electric parameter, fixing display the latest checked electric parameter picture.

5.3 编程菜单 Programming menu

5.3.1 仪表通用编程菜单 Meter general programming menu

第一级菜单 Level 1 menu	第二级菜单 Level 2 menu	第三级菜单 Level 3 menu	说明 Explanation
SyS	diSP	1~6	开机显示画面选择 Starting display menu selection
	CodE	0001~9999	密码设置(初始密码0001) Password setting(initial password 0001)
	Clr.E		按回车键, 电能清零 Press Enter key, electric energy zero clearing
In	LinE	3P3L, 3P4L	输入网络(三相三线、三相四线) Input network (3-phase-3-wire, 3-phase-4-wire)
	In.U	100, 400	输入电压范围 Input voltage range
	In.I	1, 5	输入电流范围 Input current range
	In.Pt	1~9999	输入电压变比 Input voltage transformation ratio
	In.Ct	1~9999	输入电流变比 Input current transformation ratio
buS	Addr	1~247	通讯地址 communication address
	bAUd	4800, 9600, 19200, 38400	通讯波特率 communication baud rate
tr.1 tr.4	001-026 101-126	0~9999	第一路变送(模拟量输出) First channel transmitting (analog output) 详见5.4.4 for detail, see 5.4.4 第四路变送(模拟量输出) Fourth channel transmitting (analog output)

5.3.2 LCD显示仪表增加的背光控制菜单 Added LCD display meter back light control menu

第一级菜单 Level 1 menu	第二级菜单 Level 2 menu	第三级菜单 Level 3 menu	说明 Explanation
SyS	b.Lcd	0~255	设置为0时, 背光常亮; Setting as 0, backlight lights; 设置为1~255时, 背光在1~255秒后熄灭。 Setting as 1~255, after 1~255 sec. backlight is extinguished.

5.3.3 带开关量输出增加菜单

PZ仪表开关量输出采用继电器输出，继电器触点有两种控制方式：

- 1、电平方式(继电器常开或常闭)；
- 2、脉冲方式(继电器闭合一段时间后断开，闭合时间由PL.do控制)。

5.3.3 Added menu with switching output

PZ meter 's switching output adopt relay output, there are two controlling modes for relay:

1. electrical level mode { relay NO or NC};
2. pulse mode(after closing specified time, the relay is breaking, the closing specified time is controlled by PL.do)。

第一级菜单 Level 1 menu	第二级菜单 Level 2 menu	第三级菜单 Level 3 menu	说明 Explanation
SyS	PL.do	0~255	设置为0时，继电器为电平控制方式； Setting as 0, relay as electrical level mode ; 设置为非0时，继电器为脉冲控制方式 (0.01s) 。 Setting as nonzero, relay as pulse mode { 0.01s } .

5.4 编程示例

编程示例以流程图的形式介绍改变编程菜单中的某些选项，如电流变比、变送设置等。

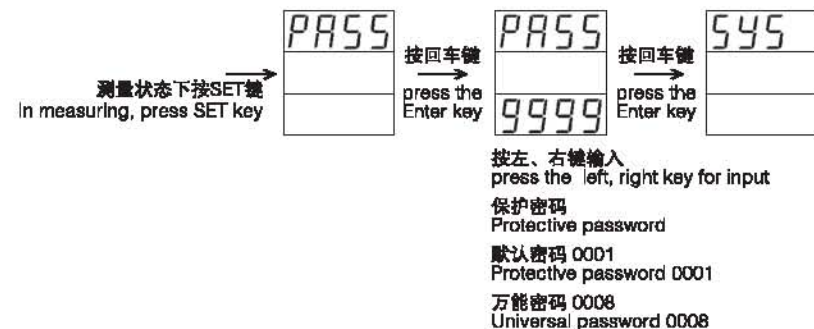
5.4 Programming Example

Programming Example take flow chart form to introduce changing some items in the Programming menu,such as current transformation ratio,transmitting setting etc..

注：在设置或选择完成后，需按回车键进行确认，确认完成后连接SET键直到出现SAVE/YES页面，按回车键确认，否则设置无效。

Note: After setting or selecting: press Enter key to affirm confirm,after affirming completion, continuously press SET KEY until SAVE/YES page appearing,press Enter key to affirm,otherwise, the setting is invalidation.

5.4.1 如何进入编程菜单 How to entry into Programming menu

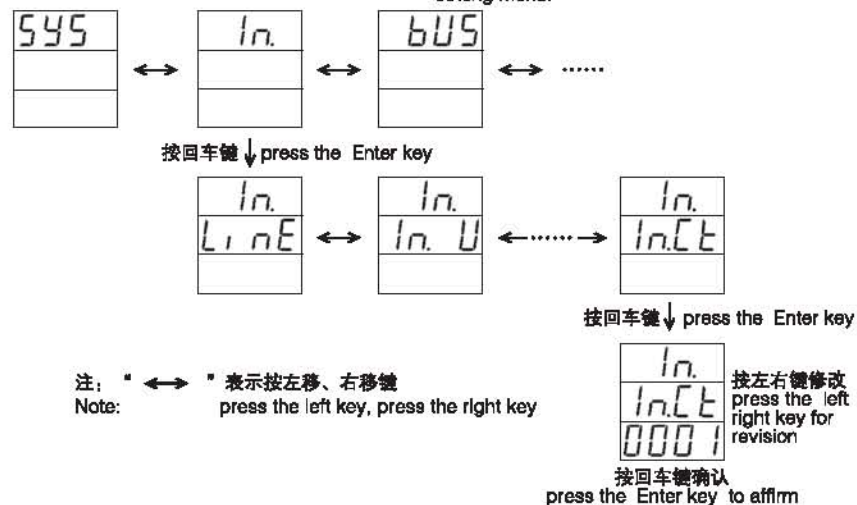


5.4.2 如何修改电流变比

进入编程菜单后，如下流程进入电流变比设置菜单：

5.4.2How to revise current transformation ratio

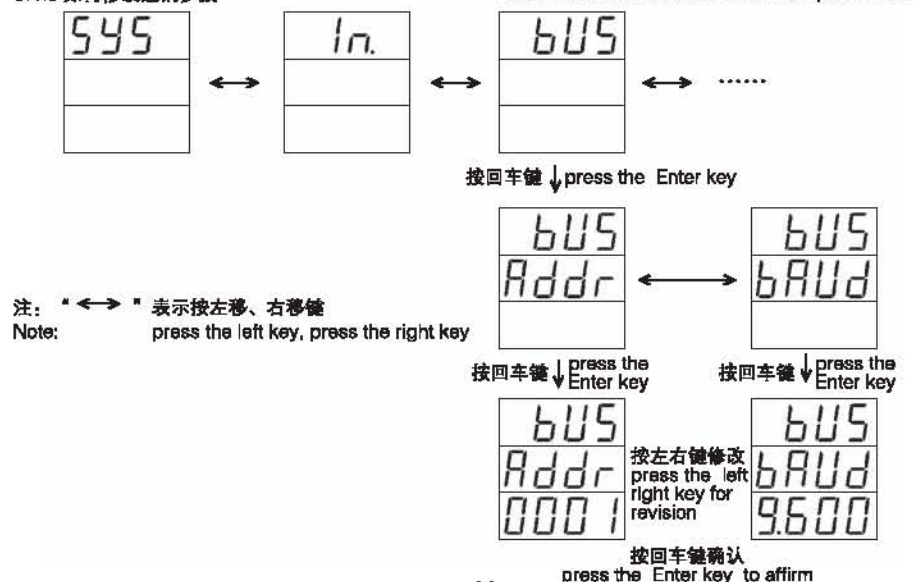
After entry into Programming menu, as per following flow chart, to entry into current transformation ratio setting menu:



注：电压变比(In.Pt)设置与此类似。此菜单中其它参数一般无需修改。

Note: The voltage transformation ratio (In.Pt) setting is similar. Other parameters in this menu need not revision usually.

5.4.3 如何修改通讯参数

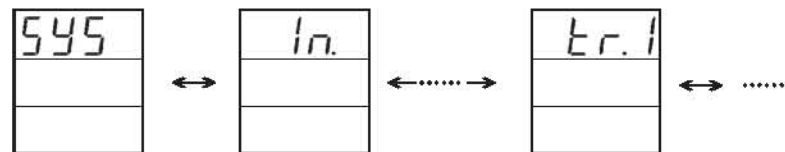


5.4.4 如何修改变送设置

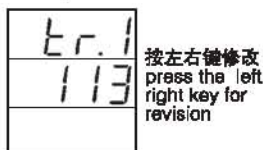
模拟量输出可将电网中常见的26个电量(Ua、Ub、Uc、Uab、Ubc、Uca、Ia、Ib、Ic、Pa、Pb、Pc、P总、Qa、Qb、Qc、Q总、PFa、PFb、PFc、PF、Sa、Sb、Sc、S总、F)中的两个量隔离变送输出为0~20mA或4~20mA的直流信号。

5.4.4 How to revise transmitting setting

Simulate transmitting output can be done by isolating two of 26 electric parameters commonly appearing in grid(Ua, Ub, Uc, Uab, Ubc, Uca, Ia, Ib, Ic, Pa, Pb, Pc, P total, Qa, Qb, Qc, Qtotal, PFa, PFb, PFc, PF, Sa, Sb, Sc, S total, F) and transmitting output of DC signal of 0~20mA or 4~20mA.



按回车键 ↓ press the Enter key



按回车键 ↓ press the Enter key



按回车键确认
press the Enter key to affirm

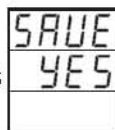
注：“←→”表示按左移、右移键
Note: press the left key, press the right key

说明:
Explanation:

113	左起第一位为变送选择, 如果是0~20mA输出, 则为0, 如果是4~20mA输出, 则为1; 第二、三位为变送量的选择, 01代表Ua, 02代表Ub……26代表频率(即将上面提到的26个电量按顺序1~26进行排序), 这里13表示有功功率P总 The Left first bit is the transmitting selection, if it is 0~20mA output, this value is 0, if it is 4~20mA output, this value is 1; the second, third bit is the transmitting parameter selection, 01 present Ua, 02 present Ub……26 present frequency(arranging above 26 electric parameters in sequence of 1~26) here, 13 present active power P total
6600	20mA输出与电量的显示值相对应; 如输入为220V, 100A/5A, 三相四线制, 则100% P总为220V × 100A × 3 = 66kW, 显示值为66.00kW, 则该值取6600(不计小数点), 若三相三线, 则220kV × 100A × √3 = 38.10kW, 该值取3810; 其它电量模拟量输出设置类似; 20mA output is corresponding with electric parameter display value; if input is 220V, 100A/5A, 3-phase-4-wire, then 100% P total is 220V × 100A × 3 = 66kW, display value is 66.00kW, and this value take 6600(decimal point is negligible), for 3-phase-3-wire, then 220kV × 100A × √3 = 38.10kW, take 3810; analog output setting of other electric parameters is similar;

5.4.5 如何保存设置参数

需修改的参数修改后, 按回车键确认, 然后按SET返回, 直至出现右边界面; 在此界面按回车键保存, 按SET键则放弃。

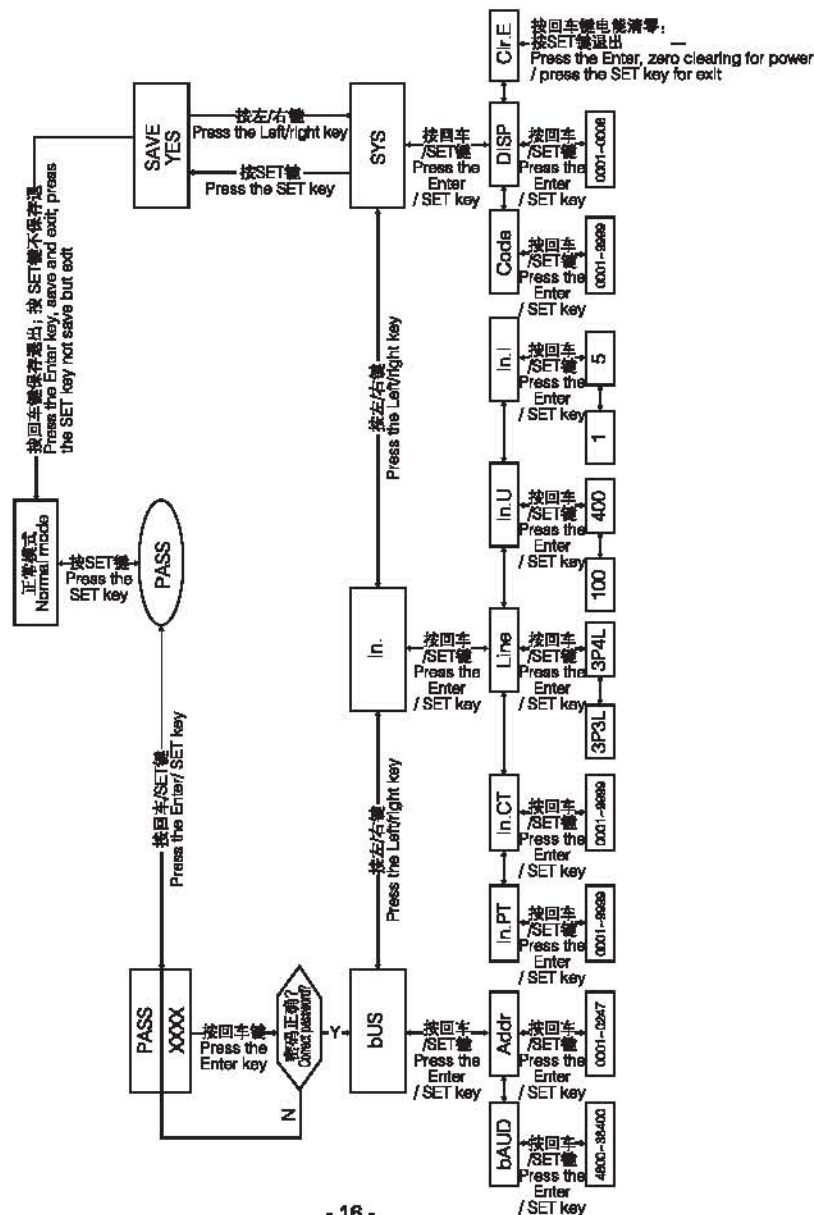


5.4.5 How to save setting parameters

After revising the specified parameters, press the Enter key to affirm, then press SET key to return, until the right interface is appearing; at this interface press the Enter key to save, press the SET KEY to quit.

5.5 编程流程(基本功能, 未含附加功能, 可参见5.4编程示例)

5.5 Programming flow chart(basic function, excluding the additional functions, refer to 5.4 programming example)



6 通讯指南 communication guide

6.1 概述

PZ系列仪表采用与Modbus-RTU相兼容的协议：“9600, 8, n, 1”，其中9600为缺省波特率，如果需要可通过编程修改为 4800、19200、38400 等，设置方法见本说明书5.4.3 通讯参数设置；8表示有8个数据位；n表示无奇偶校验位；1表示有1个停止位。
错误检测：CRC16（循环冗余校验）

6.2 协议

当数据帧到达终端设备时，它通过一个简单的“端口”进入被寻址到的设备，该设备去掉数据帧的“信封”（数据头），读取数据，如果没有错误，就执行数据所请求的任务，然后，它将自己生成的数据加入到取得的“信封”中，把数据帧返回给发送者。返回的响应数据中包含了以下内容：终端从机地址（Address）、被执行了的命令(Function)、执行命令生成的被请求数据（Data）和一个CRC校验码（Check）。发生任何错误都不会有成功的响应，或者返回一个错误指示帧。

6.2.1 数据帧格式 Data frame format

Address 地址	Function 功能	Data 数据	Check 检查
8-Bits	8-Bits	N x 8-Bits	16-Bits

6.2.2地址（Address）域

地址域在帧首，由一个字节（8-Bits，8位二进制码）组成，十进制为0~255，在我们的系统中只使用1~247，其它地址保留。这些位标明了用户指定的终端设备的地址，该设备将接收来自与之相连的主机数据。同一总线上每个终端设备的地址必须是唯一的，只有被寻址到的终端才会响应包含了该地址的查询。当终端发送回一个响应，响应中的从机地址数据便告诉了主机哪台终端正与之进行通信。

6.1 General

PZ Series meters adopt protocol compatible with Modbus-RTU: "9600,8,n,1", in it 9600 as default baud rate, it may be revised as 4800, 19200 38400 etc. via Programming, if needed, the setting method refer to this instruction 5.4.3 communication parameter setting; 8 indicate 8 data bit; n indicate non-parity check bit; 1 indicate 1 stop bit.
Error detection: CRC16 (cyclic redundancy check)

6.2 Protocol

When Data frame reach terminal unit, it through a simple "port" entry of the addressed unit, this unit take out Data frame "envelope" (data head), read data, If there is no error, execute job requested by data, then, adding self-produced data to the acquired "envelope", and return Data frame back to the sender. The returned responding data include following content: the terminal slave machine address (Address), the executed command(Function), the requested data resulting from command executing (Data) and one CRC check code (Check). Any error never lead to successful responding, or return one error indicating frame.

6.2.2 address (Address) domain

The address domain is at the front of the frame, composed of one byte (8-Bits, 8 bit binary code), decimal scale is 0~255, in our system, only 1~247 is used, other address is reserved these bits indicate the terminal unit address specified by users, this unit will accept host computer data connected with it. Every terminal unit address in the same FieldBus must be one and only, only the addressed terminal can respond the query including this address. When the terminal is sending one responding, the slave machine address data in this responding can tell host computer which terminal unit is communicating with it.

6.2.3 功能（Function）域

功能域代码告诉了被寻址到的终端执行何种功能。下表列出了该系列仪表用到的功能码，以及它们的意义和功能。

代码（十六进制） code(hexadecimal system)	意义 Meaning	行为 conduct
03H 03H	读取保持寄存器 Read register keeping	在一个或多个保持寄存器中取得当前的二进制值 Acquire current binary value from one or multiple register keeping
04H 04H	读取输入寄存器 Read Input register	在一个或多个输入寄存器中取得当前的二进制值 Acquire current binary value from one or multiple input register
10H 10H	预置多寄存器 Setting multiple register	把具体的二进制值装入一串连续的保持寄存器 Load concrete binary value into string continuous register keeping

6.2.4 数据（Data）域

数据域包含了终端执行特定功能所需的数据或终端响应查询时采集到的数据。这些数据可能是数值、参量地址或者设置值。
例如：功能域告诉终端读取一个寄存器，数据域则需要指明从哪个寄存器开始及读取多少个数据，内嵌的地址和数据依照类型和从机之间的不同而内容有所不同。

6.2.5 错误校验（Check）域

该域采用CRC16循环冗余校验，允许主机和终端检查传输过程中的错误。有时由于电噪声和其它干扰，一组数据从一个设备传输到另一个设备时，在线路上可能会发生一些改变，错误校验能够保证主机或从机不去响应那些发生改变的数据，这就提高了系统的安全性、可靠性和效率。

6.2.3 function (Function) domain

The function domain code tells the addressed terminal which function shall be executed. The function code and its meaning and function in this Series meters are listed below:

6.2.4 data (Data) domain

The data domain includes: the needed data for terminal to execute specified function or the collected data when terminal respond the query. These data may be value, parameter address or setting.
Example: function domain tell terminal unit to read one register, data domain must specify: The reading is starting from which register and how many data is needed. For the embedded address and data, the content depends on the different type and different slave machine.

6.2.5 Error check (Check) domain

This domain adopts CRC16 cyclic redundancy check, the data transmission checking function error of host computer and terminal is allowable. Because of electrical noise and other interfere, sometimes, when one group data is transmitting from one unit to another unit, in the data transmission process, there may be some changes, the error check can ensure master machine or slave machine not respond those changed data, so, the security, reliability and efficiency of system are upgraded.

6.3 错误校验的方法

错误校验 (CRC) 域占用两个字节, 包含了一个16位的二进制值。CRC值由传输设备计算出来, 然后附加到数据帧上, 接收设备在接受数据时重新计算CRC值, 然后与接收到的CRC域中的值进行比较, 如果这两个值不相等, 就发生了错误。

CRC运算时, 首先将一个16位的寄存器预置为全1, 然后连续把数据帧中的每个字节中的8位与该寄存器的当前值进行运算, 仅仅每个字节的8个数据位参与生成CRC, 起始位和停止位以及可能使用的奇偶位都不影响CRC。在生成CRC时, 每个字节的8位与寄存器中的内容进行异或, 然后将结果向低位移位, 高位则用“0”补充, 最低位 (LSB) 移出并检测, 如果是1, 该寄存器就与一个预设的固定值 (0A001H) 进行一次异或运算, 如果最低位为0, 不作任何处理。

CRC生成流程:

- 1 预置一个16位寄存器为0FFFFH (全1), 称之为CRC寄存器。
- 2 把数据帧中的第一个字节的8位与CRC寄存器中的低字节进行异或运算, 结果存回CRC寄存器。
- 3 将CRC寄存器向右移一位, 最高位填0, 最低位移出并检测。
- 4 如果最低位移出为0; 重复第3步 (下一次移位); 如果最低位移出为1; 将CRC寄存器与一个预设固定值 (0A001H) 进行异或运算。
- 5 重复第3步和第4步直到8次移位。这样就处理完了一个完整的8位。
- 6 重复第2步到第5步来处理下一个8位, 直到所有的字节处理结束。
- 7 最终CRC寄存器的值就是CRC的值。

此外还有一种利用查表计算CRC的方法, 它的主要特点是计算速度快, 但是表格需要较大的存储空间, 该方法此处不再赘述, 请查阅相关资料。

6.3 Error check method

The error check (CRC) domain occupy two bytes, including one 16 bit binary value. CRC value is calculated by the transmission unit, then adding to Data frame, during accepting data, the accept unit is recalculating the CRC value, then comparing with the accepted value in CRC domain, if these two values is not equal, the error occurs.

When calculating CRC, at first, setting one 16 bit register as whole-1, then continuously calculating the 8 bit of each byte in Data frame with current value of this register, only 8 data bit of each byte is taking part in producing CRC, the starting bit and the stop bit and the possible parity bit have no influence to CRC. When producing CRC, 8 bit of each byte with content of register to do exclusive or, then shift the result to the low bit, the high bit is complementarity with “0”, Least Significant Bit (LSB) is shifted and detected, if it is 1, this register carry out one exclusive or operation with one preset fixed value (0A001H), if the Least Significant Bit is 0, there is not any treatment.

CRC生成流程 Flow of CRC forming:

- 1 Preset one 16 bit register as 0FFFFH (whole-1), called as CRC register .
- 2 Carrying out exclusive or operation between 8 bit of the first byte in the Data frame and the lower byte in the CRC register, to save the result back to CRC register .
- 3 Right shift CRC register for one bit, the highest bit filling 0, the Least Significant Bit is shifted and detected.
- 4 If the Least Significant Bit is shifted and as 0: repeat the third step (next shift); if the Least Significant Bit is shifted and as 1: Carrying out exclusive or operation between CRC register with one preset fixed value (0A001H).
- 5 Repeat the third step and the fourth step, until 8 shift. So, one integrated 8 bit is treated.
6. Repeat the second step to the fifth step to treat next 8 bit, until all the byte treatment are completed.
- 7 The final CRC register value is the CRC value.

Another CRC calculation method is the look-up table technique with feature of fast calculating speed, but need larger save space, please refer to related data.

6.4 三相功率表、电能表通讯参量地址表 (word) :

Communication parameter address table (word) for three phase power meter, electric energy meter

地址 Address	参数 Parameter	读写 属性 R/W	数值范围 Value range	数据类型 Data type
0000H	保护密码	R/W	0001-9999	word
0001H 高字节 0001H High byte	通讯地址 Communication address	R/W	0001-0247	word
0001H 低字节 0001H Lower byte	通讯波特率 Communication baud rate	R/W	0-3; 38400、19200、9600、4800bps	
0002H	控制字 Control character	R/W	第8位-接线方式 8th bit-connection mode (0-三相四线, 1-三相三线) (0-3-phase-4-wire, 1-3-phase-3-wire) 第7位-输入电压范围 7th bit-input voltage range (0-400V, 1-100V) second bit-input current range 第2位-输入电流范围 (0-5A, 1-1A)	word
0003H	PT变比 PT transformation ratio	R/W	1-9999	word
0004H	CT变比 CT transformation ratio	R/W	1-9999	word
0005H - 000AH	tr.1-tr.4 四路变送参数 tr.1-tr.4 4-channel transmitting parameter	R/W	每一路占用三个字节 Each channel occupy 3 byte	word
000BH - 0021H	保留 Reserved			
0022H	开关量 输入输出状态 Switching input output state	R/W	详见 下一页附表 For detail, see next page attached table	word
0023H 高字节 0023H High byte	小数点U(DPT) Decimal point U(DPT)	R	3~7	word
0023H 低字节 0023H Lower byte	小数点I(DCT) Decimal point I(DCT)	R	1~5	
0024H 高字节 0024H High byte	小数点PQ(DPQ) Decimal point PQ(DPQ)	R	4~10	
0024H 低字节 0024H Lower byte	符号PQ Symbol PQ	R	高位-低位:Q、Qc、Qb、Qa、P、Pc、Pb、Pa; 0为正, 1为负 High bit-low bit:Q, Qc, Qb, Qa, P, Pc, Pb, Pa; 0= positive, 1= negative	word
0025H	相电压Ua Phase voltage Ua	R	0-9999	word
0026H	相电压Ub Phase voltage Ub	R	0-9999	word
0027H	相电压Uc Phase voltage Uc	R	0-9999	word
0028H	线电压Uab Line voltage Uab	R	0-9999	word
0029H	线电压Ubc Line voltage Ubc	R	0-9999	word
002AH	线电压Uca Line voltage Uca	R	0-9999	word
002BH	la	R	0-9999	word
002CH	lb	R	0-9999	word

002DH	lc	R	0-9999	word
002EH	Pa	R	0-9999	word
002FH	Pb	R	0-9999	word
0030H	Pc	R	0-9999	word
0031H	P总 P total	R	0-9999	word
0032H	Qa	R	0-9999	word
0033H	Qb	R	0-9999	word
0034H	Qc	R	0-9999	word
0035H	Q总 Q total	R	0-9999	word
0036H	PfA	R	0-1000	word
0037H	PfB	R	0-1000	word
0038H	PfC	R	0-1000	word
0039H	PF总 PF total	R	0-1000	word
003AH	Sa	R	0-9999	word
003BH	Sb	R	0-9999	word
003CH	Sc	R	0-9999	word
003DH	S总 S total	R	0-9999	word
003EH	频率FR Frequency FR	R	4500-6500	word
003FH - 0040H	吸收有功电度二次侧 absorptive active electric energy secondary side	R/W	0-999999999	Dword
0041H - 0042H	释放有功电度二次侧 Release active electric energy secondary side	R/W	0-999999999	Dword
0043H - 0044H	感性无功电度二次侧 Inductive reactive electric energy secondary side	R/W	0-999999999	Dword
0045H - 0046H	容性无功电度二次侧 Capacitive reactive electric energy secondary side	R/W	0-999999999	Dword
0047H - 0048H	吸收有功电度一次侧 absorptive active electric energy primary side	R		Fword
0049H - 004AH	释放有功电度一次侧 Release active electric energy primary side	R		Fword
004BH - 004CH	感性无功电度一次侧 Inductive reactive electric energy primary side	R		Fword
004DH - 004EH	容性无功电度一次侧 Capacitive reactive electric energy primary side	R		Fword

开关量输入/输出状态 (0022H) Switching input/output state (0022H)

1、PZ80(L)、PZ96(L):

	16	15	14	13	12	11	10	9	8-1
0022H			DO2	DO1	DI4	DI3	DI2	DI1	保留 Reserved

2、PZ42(L):

	16	15	14	13	12	11	10	9	8-1
0022H	DI1	DI2	DI3	DI4	DO1	DO2	DO3	DO4	保留 Reserved

6.5 通讯应用

6.5.1 读数据

该系列测量值用Modbus-RTU 通讯规约的03H命令读出, 通讯值与实际值之间的对应关系如下表: (约定 Val_t为通讯读出值, Val_s为实际值)

6.5 Communication application

6.5.1 Reading data

The measuring value of this series is read out by 03H Command of Modbus-RTU communication protocol, the relation between the communication value and the actual value is shown as following: (Default Val_t= communication reading, Val_s= actual value)

适用参量 Applied parameter	对应关系 Relation	单位 Unit
电压值 Voltage value UA、UB、UC	$Val_s = (Val_t / 10000) * (10^4 DPT)$	伏 V
电流值 Current value IA、IB、IC	$Val_s = (Val_t / 10000) * (10^4 DCT)$	安培 A
功率值 value PA、PB、PC、P总、QA、 QB、QC、Q总 PA, PB, PC, Ptotal, QA, QB, QC, Q total	$Val_s = (Val_t / 10000) * (10^4 DPQ)$	瓦 W 乏 var
功率因数 Power factor value PFA、PFB、PFC、PFS	$Val_s = Val_t / 1000$	无单位 nondimensional
频率 Frequency FR	$Val_s = Val_t / 100$	赫兹 Hz
电度量二次侧值 Secondary side value	$Val_s = Val_t$	瓦时 Wh 乏时 varh

一次侧电度的值采用浮点变量数据类型。它用符号位表示数的符号，用阶码和尾数表示数的大小。仪表采用的数据格式为IEEE754数据格式具有24位精度，尾数的高位始终为“1”，因而不保存，位的分布如下：1位符号位、8位指数位、23位尾数，符号位是最高位，尾数为最低的23位。

具体举例如下：

读出数：0 10001110 100 1011 1010 1100 0000 0000b

符号位S=0，（“1”为负，“0”为正）；

计算指数E=10001110，化为10进制数142；

计算尾数M=100 1011 1010 1100 0000 0000，化为10进制数4959232。

计算公式：一次侧电度

Electric energy primary side measuring value adopts the floating point variable data mode. It use Symbol bit to indicate symbol of number, use biased exponent and mantissa to indicate size of number. The data format of meter is IEEE754 data format with 24 bit precision, the high bit of mantissa is always “1”, Non-Save, distribution of bits is shown as following: 1 bit= symbol bit, 8 bit= exponent bit, 23 bit= mantissa, the symbol bit is the highest bit, the mantissa is the lowest 23 bit.

The actual example is shown below:
Reading number: 0 10001110 100 1011 1010 1100 0000 0000b
Symbol bit S=0, (“1” = negative, “0” = positive);
Computing exponent E=10001110, changing into decimal number 142;

Computing mantissa M=100 1011 1010 1100 0000 0000, changing into decimal number 4959232.

Computing formula:
: Primary side electric power consumption

$$= (-1)^S \times 2^{(E-127)} \times \left(1 + \frac{M}{2^{23}} \right)$$

上例计算结果为：
Calculated result:

$$(-1)^0 \times 2^{(142-127)} \times \left(1 + \frac{4959232}{2^{23}} \right) = 52140 \text{ Wh}$$

6.5.2 写数据 Write (data)

该系列写入用Modbus-RTU 通讯规约的10H命令，如开关量输出控制；For this series, using 10H command of Modbus-RTU communication protocol to write, such as switching output control:

查询数据帧 Query Data frame	01 10 00 22 00 01 02 10 00 ad 12 (DO1 输出output) 01 10 00 22 00 01 02 20 00 b9 12 (DO2 输出output) 01 10 00 22 00 01 02 30 00 b4 d2 (DO1、DO2 输出output)
返回数据帧 Return Data frame	01 10 00 22 00 01 a1 c3

说明 Explanation:

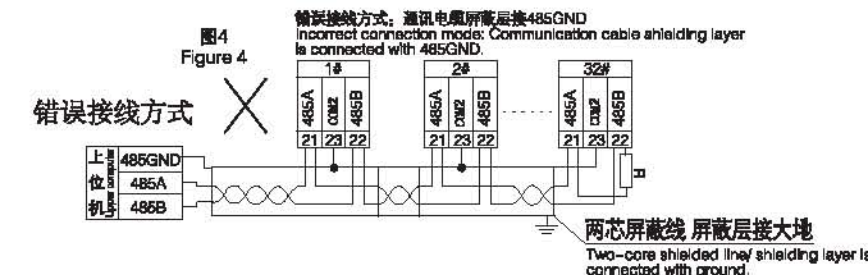
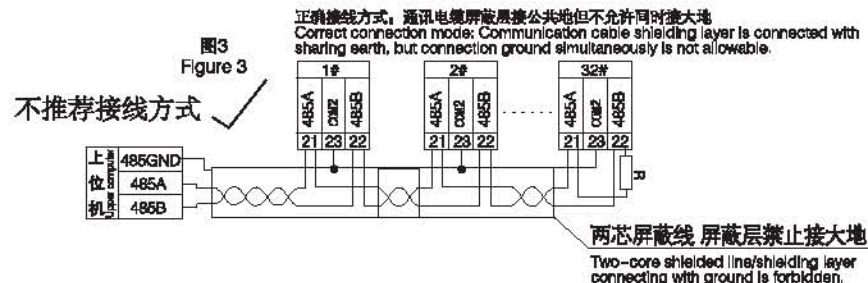
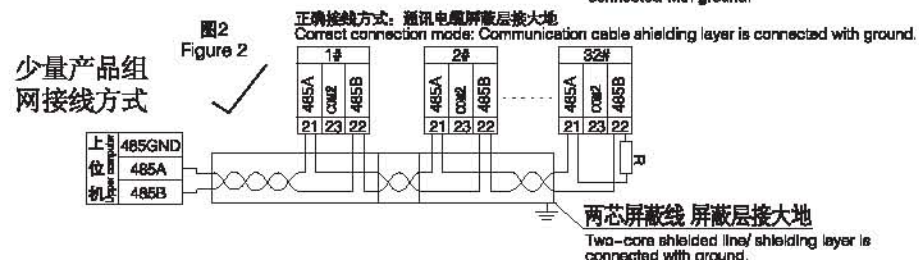
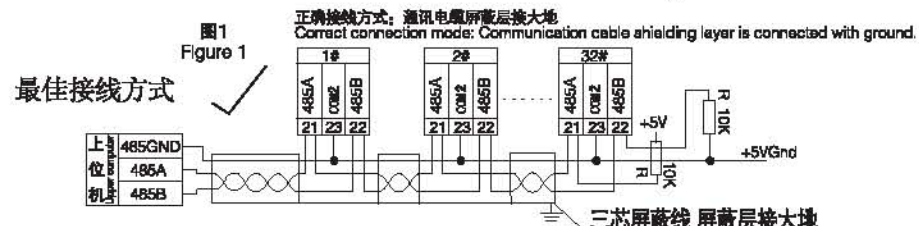
向开关量输出状态位远程写入1，则闭合；写入0，则分开。

For switching output status bit, remote write 1, then closing; write 0, then breaking.

6.6 通讯接线实例 Connection mode in communication

关于通讯部分的接线实例如下图所示：

Four connection mode in communication section are shown as following:



建议最末端仪表的A、B之间加匹配电阻，阻值范围120Ω~10kΩ。

Recommendation of adding matched resistance between A, B of the last meter, the rated resistance range is 120Ω~10kΩ.