

# PZ系列可编程智能电测表

PZ Series programmable intelligent meters

## ——单相表部分

Single phase meters

(AI、AV、F、P、E)

总部：安科瑞电气股份有限公司  
地址：上海市嘉定马东工业园区育绿路253号  
电话：021-69158300 69158301 69158302  
传真：021-69158303  
服务热线：800-8206632  
邮编：201801  
E-mail: [ACREL001@vip.163.com](mailto:ACREL001@vip.163.com)

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：0510-86179966 86179967 86179968  
传真：0510-86179975  
邮编：214405  
E-mail: [JY-ACREL001@vip.163.com](mailto:JY-ACREL001@vip.163.com)

## 安装使用说明书V1.3

Installation and Operation Instruction V1.3

安科瑞电气股份有限公司  
ACREL CO.,LTD

## 申明 DECLARATION

版权所有，未经本公司之书面许可，此手册中任何段落，章节内容均不得被摘抄、拷贝或以任何形式复制、传播，否则一切后果由违者自负。

本公司保留一切法律权利。

No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form by any means, electronic, mechanical photocopying, recording, or otherwise without prior permission of Acrel. All rights reserved.

本公司保留对本手册所描述之产品规格进行修改的权利，恕不另行通知。  
订货前，请垂询当地代理商以获悉本产品的最新规格。

This company reserve power of revision of product specification described in this manual, without notice. Before ordering, please consult local agent for the latest specification of product.

## 目录 CONTENTS

|                                                                                          |    |
|------------------------------------------------------------------------------------------|----|
| 1 概述 General                                                                             | 1  |
| 2 产品型号规格 Type and specification of products                                              | 1  |
| 3 技术参数 Technical parameter                                                               | 3  |
| 4 安装指南 Installation guide                                                                | 4  |
| 4.1 外形及安装开孔尺寸 Outline and mounting cut out size                                          | 4  |
| 4.2 仪表及开孔示意图 Schematic diagram of meter and its cut out                                  | 4  |
| 4.3 安装示意图 Schematic diagram of installation                                              | 4  |
| 4.4 安装说明 Installation instruction                                                        | 5  |
| 4.5 端子及接线 Terminal and connection                                                        | 5  |
| 4.6 注意事项 Notice                                                                          | 6  |
| 5 使用指南 Operating guide                                                                   | 8  |
| 5.1 按键 Press— key                                                                        | 8  |
| 5.2 菜单符号及意义 Menu symbol and its meaning                                                  | 8  |
| 5.3 编程流程 Program flow                                                                    | 11 |
| 5.4 功能设置与使用 Function setting and using                                                   | 16 |
| 5.5 测量数据查看 Look over measuring data                                                      | 20 |
| 6 通讯指南 Communication guide                                                               | 23 |
| 6.1 概述 General                                                                           | 23 |
| 6.2 协议 Protocol                                                                          | 23 |
| 6.3 错误校验码(CRC)的生成方法<br>Method to create error check code (CRC)                           | 25 |
| 6.4 单相表通讯参量地址表 (Word)<br>Single-phase meter communication parameter address table (Word) | 27 |
| 6.5 通讯应用 Communication application                                                       | 28 |

## 1 概述 General

PZ系列单相表，采用交流采样技术，可直接或间接测量单相电网或三相电网中某一相的电能、功率、电压、电流和频率等。既可用于本地显示，又能与工控设备连接，组成测控系统。

仪表可具有RS-485通讯接口，采用Modbus-RTU协议；可带模拟量输出、继电器报警输出、开关量输入/输出。根据不同要求，通过仪表面板按键，对变比、报警、通讯等参数进行设置和控制。

PZ Series programmable intelligent single phase meters, adopting AC sampling technology, can directly or indirectly measure electric energy, power, voltage, current and frequency of single phase or three phase grid. It can be used for local display, and connecting industrial control device to form measuring control system.

Meters have RS-485 communication interface, adopt compatible Modbus-RTU protocol; can fit analog output; relay alarm output; switching input/switching output. Based on different request, by pressing related keys on instrument panel, parameter setting and control of transformation ratio, alarm, communication etc. can be done.

## 2 产品型号规格 Type and specification of products

| 仪表型号<br>Meter type                                    | 基本功能<br>Basic function                                                                                                                        | 外形<br>Shape        | 可选功能<br>Optional function                                                                                                                                                                                                                                                                                                                                     |
|-------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PZ48-AI<br>PZ48-AV<br>PZ48-F                          | 单相电流、电压、频率测量；<br>Single phase current, voltage, frequency measurement;<br>LED数码管显示<br>LED digital display                                     | 48<br>方形<br>Square | 1、一路RS485通讯 ( /C )<br>1 channel RS485 communication ( /C )<br>2、一路变送输出 ( /M )<br>1 channel transmitting output ( /M )                                                                                                                                                                                                                                         |
| PZ48L-AI<br>PZ48L-AV<br>PZ48L-F                       | 单相电流、电压、频率测量；<br>Single phase current, voltage, frequency measurement;<br>LCD 液晶显示<br>LCD liquid crystal display                              |                    |                                                                                                                                                                                                                                                                                                                                                               |
| PZ72-AI<br>PZ72-AV<br>PZ72-F<br>PZ72-P<br>PZ72-E      | 单相电流、电压、频率、功率、电能测量；<br>Single phase current, voltage, frequency, power, electric energy measurement;<br>LED数码管显示<br>LED digital display       | 72<br>方形<br>Square | 1、一路RS485通讯 ( /C )<br>1 channel RS485 communication ( /C )<br>2、一路变送输出 ( /M )<br>1 channel transmitting output ( /M )<br>3、变送输出+RS485通讯 ( /MC )<br>Transmitting output+ RS485 communication ( /MC )<br>4、RS485通讯+开关量2DI ( /KC )<br>RS485 communication + switching2DI ( /KC )<br>5、RS485通讯+开关量2DI2DO ( /KC )<br>RS485 communication + switching2DI2DO ( /KC ) |
| PZ72L-AI<br>PZ72L-AV<br>PZ72L-F<br>PZ72L-P<br>PZ72L-E | 单相电流、电压、频率、功率、电能测量；<br>Single phase current, voltage, frequency, power, electric energy measurement;<br>LCD液晶显示<br>LCD liquid crystal display |                    |                                                                                                                                                                                                                                                                                                                                                               |

|                                                       |                                                                                                                                               |                    |                                                                                                                                                                                                                                                                                                                                                                |
|-------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PZ80-AI<br>PZ80-AV<br>PZ80-F<br>PZ80-P<br>PZ80-E      | 单相电流、电压、频率、功率、电能测量；<br>Single phase current, voltage, frequency, power, electric energy measurement;<br>LED数码管显示<br>LED digital display       | 80<br>方形<br>Square | 1、一路RS485通讯 ( /C )<br>1 channel RS485 communication ( /C )<br>2、一路变送输出 ( /M )<br>1 channel transmitting output ( /M )<br>3、变送输出+RS485通讯 ( /MC )<br>Transmitting output + RS485 communication ( /MC )<br>4、RS485通讯+开关量2DI ( /KC )<br>RS485 communication + switching2DI ( /KC )<br>5、RS485通讯+开关量2DI2DO ( /KC )<br>RS485 communication + switching2DI2DO ( /KC ) |
| PZ80L-AI<br>PZ80L-AV<br>PZ80L-F<br>PZ80L-P<br>PZ80L-E | 单相电流、电压、频率、功率、电能测量；<br>Single phase current, voltage, frequency, power, electric energy measurement;<br>LCD液晶显示<br>LCD liquid crystal display |                    |                                                                                                                                                                                                                                                                                                                                                                |
| PZ96-AI<br>PZ96-AV<br>PZ96-F                          | 单相电流、电压、频率测量；<br>Single phase current, voltage, frequency measurement;<br>LED数码管显示<br>LED digital display                                     | 96<br>方形<br>Square | 1、一路RS485通讯 ( /C )<br>1 channel RS485 communication ( /C )<br>2、最多三路变送输出 ( /M或/M3 )<br>most3 channel transmitting output ( /M/M3 )<br>3、变送输出+RS485通讯 ( /MC或/M3C )<br>Transmitting output + RS485 communication ( /MC /M3C )<br>4、RS485通讯+开关量4DI2DO ( /KC )<br>RS485 communication+ switching4DI2DO ( /KC )                                                     |
| PZ96L-AI<br>PZ96L-AV<br>PZ96L-F                       | 单相电流、电压、频率测量；<br>Single phase current, voltage, frequency, power, electric energy measurement;<br>LCD液晶显示<br>LCD liquid crystal display       |                    |                                                                                                                                                                                                                                                                                                                                                                |
| PZ42-AI<br>PZ42-AV<br>PZ42-F                          | 单相电流、电压、频率测量；<br>Single phase current, voltage, frequency measurement;<br>LED数码管显示<br>LED digital display                                     | 42<br>方形<br>Square | 1、一路RS485通讯 ( /C )<br>1 channel RS485 communication ( /C )<br>2、最多三路变送输出 ( /M或/M3 )<br>most3 channel transmitting output ( /M/M3 )<br>3、变送输出+RS485通讯 ( /MC或/M3C )<br>Transmitting output + RS485 communication ( /MC /M3C )<br>4、RS485通讯+开关量4DI2DO ( /KC )<br>RS485 communication+ switching4DI2DO ( /KC )                                                     |
| PZ42L-AI<br>PZ42L-AV<br>PZ42L-F                       | 单相电流、电压、频率测量；<br>Single phase current, voltage, frequency, power, electric energy measurement;<br>LCD液晶显示<br>LCD liquid crystal display       |                    |                                                                                                                                                                                                                                                                                                                                                                |

注：Note:

1. 电能表中，/KC(2DI&2DO)仪表无脉冲输出，其它类型有脉冲输出。  
In the meters, /KC(2DI&2DO)meter have no pulse output, other type have pulse output.
2. /J为一路继电器输出 ( 与第二路开关量输出复用 )，如有特殊需求请咨询本公司。  
/J is 1 channel relay output (multiplexing with second channel switching output), for special request, please consult our company.

### 3 技术参数 Technical parameter

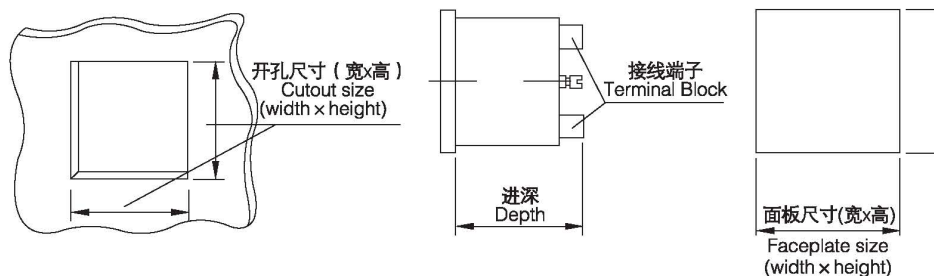
| 技术参数<br>Technical parameter               |                         | 指标<br>Value                                                                                                                                                                                                     |
|-------------------------------------------|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 输入<br>Input                               | 标称值<br>Nominal value    | 交流电压: AC100V、220V、380V; 交流电流: AC1A、5A;<br>AC voltage: AC100V, 220V, 380V; AC current: AC1A, 5A;<br>特殊规格可事先咨询<br>Consult special specification in advance                                                        |
|                                           | 过载<br>Over load         | 电压: 1.2倍持续, 2倍持续1秒; 电流: 1.2倍持续, 10倍持续1秒<br>Voltage: 1.2 times continuous, 2 times continuous 1 second;<br>current: 1.2 times continuous, 10 times continuous 1 second                                           |
|                                           | 频率<br>Frequency         | 45~65Hz                                                                                                                                                                                                         |
|                                           | 功耗<br>Power consumption | 各电压、电流输入回路功耗均小于0.5VA<br>Power consumption of each voltage, current input circuit is less than 0.5VA                                                                                                             |
| 精度等级<br>Accuracy class                    |                         | 0.5级<br>0.5class                                                                                                                                                                                                |
| 功能<br>Function                            | 显示<br>Display           | LED或LCD显示<br>LED or LCD display                                                                                                                                                                                 |
|                                           | 通讯<br>Communication     | RS485, Modbus-RTU协议<br>RS485, Modbus-RTU compatible protocol                                                                                                                                                    |
|                                           | 报警<br>Alarm             | 1路继电器输出, 1A/30VDC, 1A/250VAC<br>1 channel passive relay 1A/30VDC, 1A/250VDC,                                                                                                                                    |
|                                           | 模拟量<br>Analog           | DC4~20mA, DC0~20mA(负载<600Ω), DC0~5V(负载>1kΩ)等,<br>DC4~20mA, DC0~20mA( load<600Ω), DC0~5V(load>1kΩ) etc.                                                                                                          |
|                                           | 脉冲<br>Pulse             | 输出方式: 2路集电极开路的光耦脉冲<br>Output mode: photocoupler pulse with 2 channel collector open circuit<br>脉冲常数: 15000 imp/kWh, 15000 imp/kvarh<br>Pulse constant: 15000 imp/kWh, 15000 imp/kvarh                           |
|                                           | 开关量<br>Switching        | 输入: 干接点输入, 内置电源, 光耦隔离<br>Dry contact input, built-in power supply; optoisolator<br>输出: 两路开关量输出, 常开继电器触点, 容量: 1A/30VDC, 1A/250VAC<br>2 channel switching output, NO relay contact, capacity: 1A/30VDC, 1A/250VAC |
| 电源<br>Power supply                        | 电压范围<br>Voltage range   | AC85~265V 或 DC100~350V<br>AC85~265V or DC100~350V (以仪表接线图为准)                                                                                                                                                    |
|                                           | 功耗<br>Power consumption | < 5VA                                                                                                                                                                                                           |
| 绝缘电阻<br>Insulation resistance             |                         | ≥ 100MΩ                                                                                                                                                                                                         |
| 工频耐压<br>Power frequency withstand voltage |                         | 电源端子组与信号输入、输出端子组之间2kV/1min (RMS)<br>Between power supply set of terminals and signal input, output set of terminals 2kV/1min (RMS)                                                                              |
| 平均无故障工作时间<br>Mean time between failures   |                         | ≥ 50000h                                                                                                                                                                                                        |
| 环境<br>Environment                         | 温度<br>Temperature       | 工作: -10℃~+55℃<br>Operation: -10℃~+55℃<br>贮存: -20℃~+70℃<br>Storage: -20℃~+70℃                                                                                                                                    |
|                                           | 湿度<br>Humidity          | ≤ 93%RH, 不结露, 不含腐蚀性气体<br>≤ 93%RH, no condensation, without corrosive gas                                                                                                                                        |
|                                           | 海拔<br>Altitude          | ≤ 2500m                                                                                                                                                                                                         |

### 4 安装指南 Installation guide

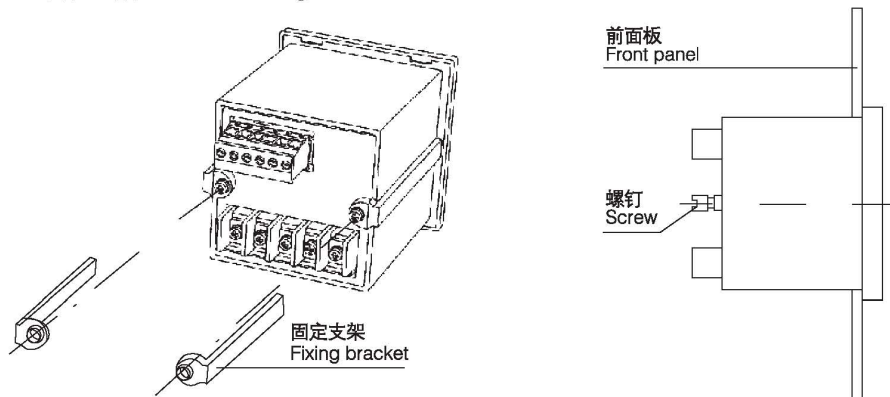
#### 4.1 外形及安装开孔尺寸 Outline and mounting cut out size

| 仪表外形<br>Shape      | 面板尺寸<br>Panel |             | 壳体尺寸<br>Housing |             |            | 开孔尺寸<br>Cut out |             |
|--------------------|---------------|-------------|-----------------|-------------|------------|-----------------|-------------|
| 单位: mm<br>Unit: mm | 宽<br>Width    | 高<br>Height | 宽<br>Width      | 高<br>Height | 深<br>Depth | 宽<br>Width      | 高<br>Height |
| 48方形<br>48 Square  | 48            | 48          | 42.5            | 42.5        | 100        | 44.5            | 44.5        |
| 72方形<br>72 Square  | 75            | 75          | 66              | 66          | 98         | 67              | 67          |
| 80方形<br>80 Square  | 84            | 84          | 75              | 75          | 98         | 76              | 76          |
| 96方形<br>96 Square  | 96            | 96          | 86              | 86          | 85         | 88              | 88          |
| 42方形<br>42 Square  | 120           | 120         | 106             | 106         | 85         | 108             | 108         |

#### 4.2 仪表及开孔示意图 Schematic diagram of meter and its cut out



#### 4.3 安装示意图 Schematic diagram of installation



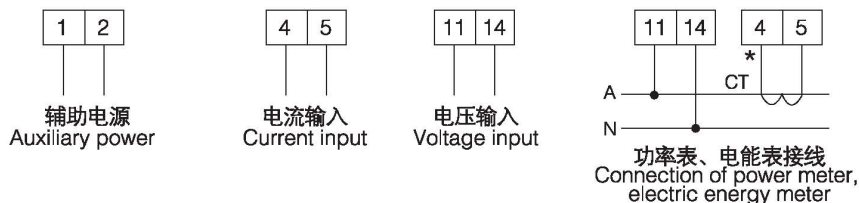
#### 4.4 安装说明 Installation instruction

仪表安装时，松开固定支架锁紧螺钉，取下固定支架，将仪表嵌入安装孔内，装上固定支架，拧紧螺钉，使仪表安装牢固，不松动即可。48外形为卡簧片挤压安装。

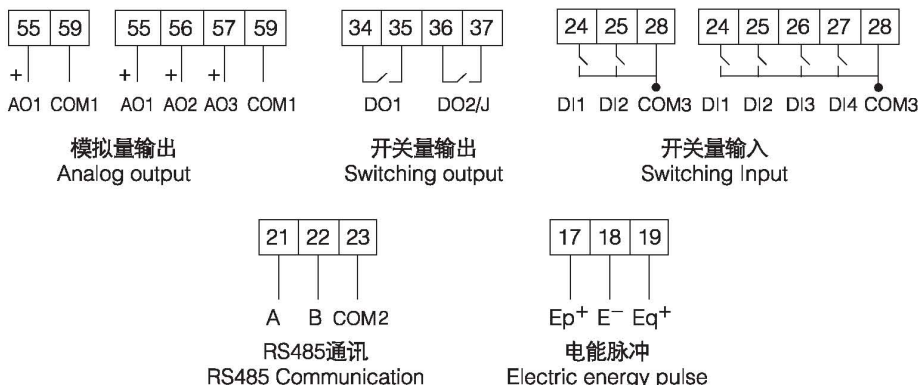
When meter is installing, loosen locking screw of fixed support, take down fixed support, embedded meter into mounting hole, restore fixed support, tighten screw, fix meter firmly.

#### 4.5 端子及接线 Terminal and connection

##### 4.5.1 辅助电源与信号输入端子 Auxiliary power and signal input terminal



##### 4.5.2 附加功能端子 Additional function terminal



注:

1. 符号 “\*” 表示电流进线端，该接线仅供参考，具体以仪表上接线图为准；
2. 报警输出继电器与开关量输出DO2复用。

Note:

1. Sign “\*” show current inlet, this connection is only for reference, take the wiring diagram on the meter as standard;
2. Alarm output relay duplex with switching output DO2.

#### 4.6 注意事项 Notice

##### 4.6.1 电压输入 Voltage Input

输入电压不得高于产品的额定输入电压的120%，否则应考虑使用PT；  
在电压输入端须安装1A保险丝；

Input voltage shall not exceed 120% of product rated input voltage, otherwise PT shall be used;  
On the voltage input end, 1A fuse shall be fitted;

##### 4.6.2 电流输入 Current Input

电流输入应使用外部CT；  
如果使用的CT上连有其它仪表，接线应采用串联方式；  
建议使用接线排，不要直接接CT，以便拆装；  
去除产品的电流输入连线之前，一定要先断开CT一次回路或短接二次回路。

Current input shall use external CT;  
If the used CT connected with other meters, the connection is adopting series connection mode;  
When wiring, using Connector bar is recommended, not connected with CT directly, to facilitate dismounting;  
Before removing product current input connection, firstly, cutoff CT primary circuit or short the secondary circuit.

##### 4.6.3 附加功能接线 Adding function connection

模拟量输出与开关量输入的COM表示各自公共端，并不是实际接地；  
该仪表提供异步半双工RS485通讯接口，采用MODBUS-RTU协议，各种数据信息均可在通讯线路上传送。理论上在一条线路上可以同时连接多达128个仪表，每个仪表均可设定其通讯地址 (Addr)、通讯速率 (baud) 也可通过设置选择。

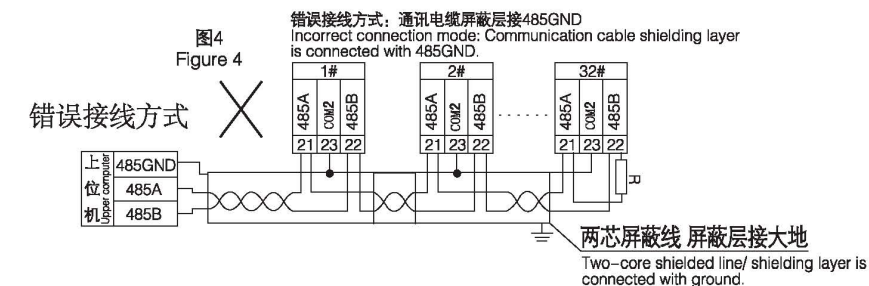
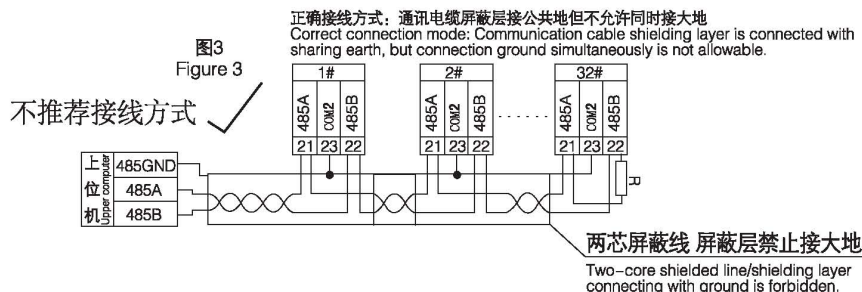
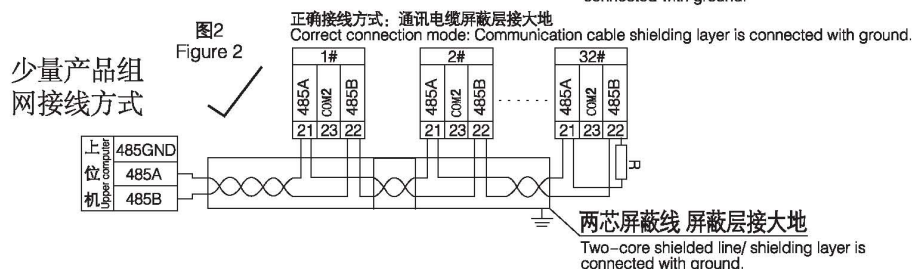
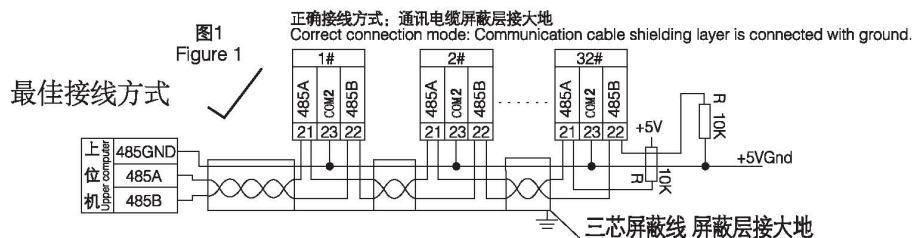
通讯连接建议使用三芯屏蔽线，每芯截面不小于0.5mm<sup>2</sup>，分别接A、B、COM2，屏蔽层接大地，布线时应使通讯线远离强电电缆或其他强电场环境。

COM of analog output and switching Input show that the common port is not earthing actually.  
Between analog output and switching input, common port is not connected;  
This meter provides asynchronism half duplex RS485 Communication interface, adopts MODBUS-RTU protocol, various data information may be transmitting on the Communication line. Theoretically, on the same line, meters up to 128 may be connected at the same time, each meter can set up its Communication address (Addr), Communication rate (baud) may be selected.

Communication connection recommendation of three-core shielded wire, its linear diameter is no less than 0.5mm<sup>2</sup>, separately connecting A, B, COM2, the shielded layer connecting earth, when wiring, the Communication line shall be far away from strong Current cable or other strong electric field environment.

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, 阻值范围为120Ω~10kΩ。

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

## 5 使用指南 Operating guide

### 5.1 按键 Press – key



SET键  
SET key



左移键  
Left shift key



右移键  
Right shift key



回车键  
ENTER key

SET 键 -- 功能切换或返回上一级菜单; ( 正常显示、只读菜单与编程菜单之间切换 )

SET key -- Function switching or Return to previous menu; normal display, switching between read only menu and programming menu.

左移键 -- 子菜单左移或减小数据; ( 功率表、电能表等正常状态下, 按左右键, 查看各项电量 )

Left shift key -- Same level menu shifting left or reducing data

右移键 -- 子菜单右移或增大数据; ( 普通电流电压表等正常状态下, 按住此键, 查看报警信息 )

Right shift key -- Same level menu shifting right or increasing data; in normal condition, pressing this key, display alarm information

回车键 -- 进入下一级菜单或确认; ( 正常状态, 按此键, 进入DI/DO指示与控制页面 )

ENTER key -- Enter Next level menu or Confirm; in normal condition, pressing this key, Enter DI/DO Indication and control page

### 5.2 菜单符号及意义

Menu symbol and its meaning

#### 5.2.1 PZ72(80)系列仪表

PZ72(80) Series meters

| 类别<br>Category                                           | 符号<br>Symbol | 含义<br>Meaning                                     | 范围<br>Range                                                       |
|----------------------------------------------------------|--------------|---------------------------------------------------|-------------------------------------------------------------------|
| 主菜单<br>Main mune                                         |              | 只读菜单<br>Read only mune                            | 简写: rd<br>Shortening: rd                                          |
|                                                          |              | 编程菜单<br>Programming mune                          | 简写: Pg<br>Shortening: Pg                                          |
| 变比 ( 倍率 )<br>Transformation ratio<br>(multiplying power) |              | 电压(电流)变比<br>Voltage(current) transformation ratio | 0001~9999                                                         |
| 通讯<br>Communcation                                       |              | 通讯地址<br>Communication address                     | 1~247                                                             |
|                                                          |              | 通讯波特率 ( bps )<br>Communication Baudrate (bps)     | 2400、4800、9600、19200                                              |
| 初始画面<br>Initial menu                                     |              | 上电显示的初始画面<br>Power on Initial menu                | Page的简写; 显示U、A、P等<br>Page shortening; display U,A,P etc.          |
| 液晶背光<br>LCD backlight                                    |              | 背光延时时间 ( s )<br>Backlight delay time (s)          | 1~250,0 为常亮LED 仪表此项无效<br>1~250, 0 is lighting LED This is invalid |

|                                          |              |                                                                |                                                                                                                     |
|------------------------------------------|--------------|----------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|
| 报警设置<br>Alarm setting                    | U-H          | 电压高报警设置<br>Voltage too high alarm setting                      | 0~150% ( 150%: 关闭 )<br>0~150% (150%: Closed)                                                                        |
|                                          | U-L          | 电压低报警设置<br>Voltage too low alarm setting                       | 0~100% ( 0%: 关闭 )<br>0~100% (0%: Closed)                                                                            |
|                                          | A-H          | 电流高报警设置<br>Current too high alarm setting                      | 0~150% ( 150%: 关闭 )<br>0~150% (150%: Closed)                                                                        |
|                                          | A-L          | 电流低报警设置<br>Current too low alarm setting                       | 0~100% ( 0%: 关闭 )<br>0~100% (0%: Closed)                                                                            |
|                                          | HL           | 功率因数低报警设置<br>Power factor too low Alarm setting                | 0.00~1.00 ( 0.00 关闭 )<br>0.00~1.00 (0.00 Closed)                                                                    |
|                                          | AL.t         | 报警延时时间 ( s )<br>Alarm delay time (s)                           | 1.0~20.0 ( 分辨率0.1s )<br>1.0~20.0 (resolution 0.1s)                                                                  |
| 继电器<br>( DO输出 )<br>Relay<br>(DO output)  | do1.t        | 继电器1闭合持续时间 ( s )<br>Relay 1 closing duration (s)               | 0~20 ( 分辨率1s )<br>0~20 (resolution 1s)                                                                              |
|                                          | do2.t        | 继电器2闭合持续时间 ( s )<br>Relay 2 closing duration (s)               | 0: 继电器工作在保持状态<br>0: Relay is working in keeping status                                                              |
|                                          | do2.U        | 继电器2的用法<br>Relay 2 use                                         | io: 作开关量 ( K ) ;<br>io: as switching (K);<br>AL: 作报警输出 ( J )<br>AL: as alarm output (J)                             |
| 模拟量<br>Analog                            | Al.L         | 模拟量下限设置<br>Analog lower limit setting                          | 0~100%                                                                                                              |
|                                          | Al.H         | 模拟量上限设置<br>Analog upper limit setting                          | 0~120%                                                                                                              |
|                                          | Al.U         | 模拟量输出选择<br>Analog lower output selection                       | U、A、P等<br>U, A, P etc.                                                                                              |
| 电能清零<br>Electric energy<br>zero clearing | CLr.E        | 电能清除<br>Electric energy clearing                               |                                                                                                                     |
| 量程<br>Range                              | SP.U<br>SP.A | 额定输入电压<br>Rated input voltage<br>额定输入电流<br>Rated input current | U:电压AC100V、220V、380V;<br>U:voltage AC100V, 220V, 380V;<br>A:电流AC1A、5A ( 不可修改 )<br>A: current AC1A, 5A (no revising) |
| 密码<br>Password                           | PS           | 编程保护密码<br>Program protection Password                          | 0000~9999                                                                                                           |
| 保存<br>Save                               | SAVE         | 询问是否保存<br>Save ?                                               | 保存按“回车”<br>Save press "Enter"                                                                                       |

注:

普通72、80单相电流、电压、频率表中的报警菜单与上稍有不同, 其不区分电流还是电压信号, 只表示数值的高低, 为: AL.H ( 高报警 )、AL.L ( 低报警 )、AL.t ( 报警延时 )

各参数设置流程见 5.3.4 Prog菜单; 百分数均相对于额定测量信号

CLr.E 菜单请小心使用, 电能一旦清除, 将不能恢复。

Note:

The alarm menu of common 72, 80 single-phase current, voltage, frequency meter is slightly different from above said, it does not identify current or voltage signal, only show size of value, as: AL.H (too high alarming), AL.L (too low alarming), AL.t (delay alarming)

Each parameter setting flow see 5.3.4 Prog menu; Percent relative to rated measuring signal

Using menu CLr.E carefully, once Electric energy is cleared, restoring is impossible.

## 5.2.2 PZ48 (96、42)系列仪表 PZ48 (96, 42) Series meters

| 类别<br>Category                                                 | 符号<br>Symbol | 含义<br>Meaning                                                  | 范围<br>Range                                                                                                          |
|----------------------------------------------------------------|--------------|----------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|
| 主菜单<br>Main menu                                               | READ         | 只读菜单<br>Read only menu                                         |                                                                                                                      |
|                                                                | PRG          | 编程菜单<br>Programming menu                                       |                                                                                                                      |
| 变比 ( 倍率 )<br>Transformation<br>ratio<br>(multiplying<br>power) | PT<br>CT     | 电压(电流)变比<br>Transformer multiplying power                      | 0001~9999                                                                                                            |
| 通讯<br>Communication                                            | Addr         | 通讯地址<br>Communication address                                  | 1~247                                                                                                                |
|                                                                | Baud         | 通讯波特率 ( kbps )<br>Communication Baudrate (kbps)                | 2.4、4.8、9.6、19.2等<br>2.4、4.8、9.6、19.2 etc                                                                            |
| 液晶背光<br>LCD<br>backlight                                       | LED          | 背光延时时间 ( s )<br>Backlight delay time (s)                       | 1~250, 0 为常亮LED 仪表此项无效<br>1~250, 0 is lighting<br>LED This is invalid                                                |
| 报警设置<br>Alarm<br>setting                                       | AL.H         | 高报警设置<br>HIGH alarm setting                                    | 0~150% ( 150%: 关闭 )<br>0~150% (150%: Closed)                                                                         |
|                                                                | AL.L         | 低报警设置<br>LOW alarm setting                                     | 0~100% ( 0%: 关闭 )<br>0~100% (0%: Closed)                                                                             |
|                                                                | AL.t         | 报警延时时间 ( s )<br>Alarm delay time (s)                           | 1.0~20.0 ( 分辨率0.1s )<br>1.0~20.0 (resolution 0.1s)                                                                   |
| 继电器<br>( DO输出 )<br>Relay<br>(DO output)                        | do1.t        | 继电器1闭合持续时间 ( s )<br>Relay 1 closing duration (s)               | 0~20 ( 分辨率1s )<br>0~20 (resolution 1s)                                                                               |
|                                                                | do2.t        | 继电器2闭合持续时间 ( s )<br>Relay 2 closing duration (s)               | 0: 继电器工作在保持状态<br>0: Relay is working in keeping status                                                               |
|                                                                | do2.U        | 继电器2的用法<br>Usage of relay 2                                    | io: 作开关量 ( K ) ;<br>io: as switching (K);<br>AL: 作报警输出 ( J )<br>AL: as alarm output (J)                              |
| 模拟量<br>Analog                                                  | Al.L         | 模拟量下限设置<br>Analog lower limit setting                          | 0~100%                                                                                                               |
|                                                                | Al.H         | 模拟量上限设置<br>Analog upper limit setting                          | 0~120%                                                                                                               |
| 量程<br>Range                                                    | SP.U<br>SP.A | 额定输入电压<br>Rated input voltage<br>额定输入电流<br>Rated input current | U:电压AC100V、220V、380V;<br>U: voltage AC100V, 220V, 380V;<br>A:电流AC1A、5A ( 不可修改 )<br>A: current AC1A, 5A (no revising) |
| 密码<br>Password                                                 | PASS         | 编程保护密码<br>Program protection Password                          | 0000~9999                                                                                                            |
| 保存<br>Save                                                     | SAVE         | 询问是否保存<br>Save ?                                               | 保存按“回车”<br>Save press "Enter"                                                                                        |

注:

各参数设置流程见 5.3.4 Prog菜单; 百分数均相对于额定输入信号

Note:

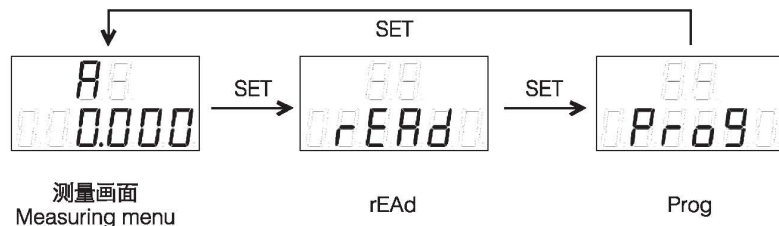
Each parameter setting flow see 5.3.4 Prog menu; Percent relative to rated input signal

5.3 编程流程 (此流程以LED显示为例, LCD显示与此类似)

5.3 Program flow (This flow take LED display as example, LCD display is similar)

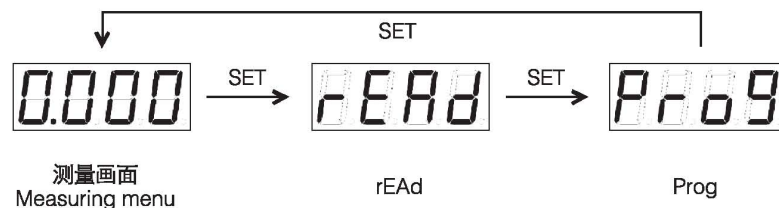
5.3.1 PZ72 (80) 系列仪表在正常显示画面时, 按SET键, 如下:

5.3.1 When PZ72 (80) Series mete is showing menu, press SET key, as follows:



5.3.2 PZ48 (96、42)系列仪表在测量画面时, 按SET键, 如下:

5.3.2 PZ48 (96, 42) Series mete is measuring menu, press SET key, as follows:



说明:

rEAd--只读菜单, 在此页面, 按回车键进入;

Prog--编程菜单, 在此页面, 按回车键进入;

Description:

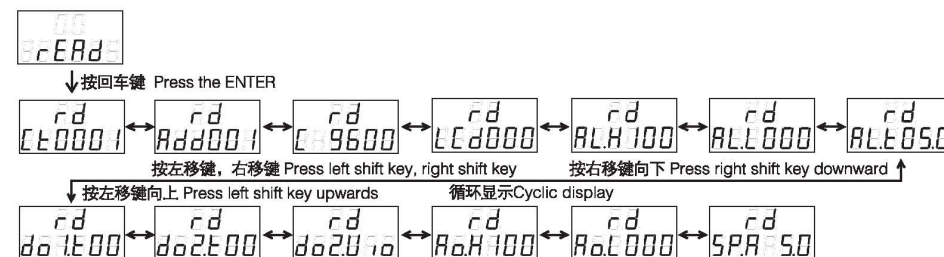
rEAd--Menu read only, at this page, press Enter key to enter;

Prog--Programming menu, at this page, press Enter key to enter;

5.3.3 rEAd菜单 (只读) rEAd Menu (read only)

PZ72 (80) 系列单相电流表 (PZ□□-AI/\*):

PZ72 (80) Series single phase current meter (PZ□□-AI/\*):



说明:

电压表菜单与此类似, 只有两处不同: 1.Pt 替代Ct; 2.SP.U替代SP.A;  
频率表无Pt(Ct)菜单

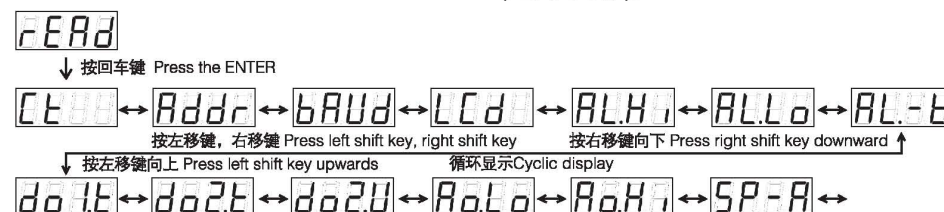
Description:

Voltage meter menu is similar, only 2 place is different: 1.Pt replace Ct; 2.SP.U replace SP.A;

No Pt (Ct) menu for frequency meter

PZ48 (96、42)系列单相电流表 (PZ□□-AI/\*):

PZ48 (96, 42) Series single phase current meter (PZ□□-AI/\*):



说明:

左右键选择需要查看的参数菜单, 按回车键进入查看具体设置值, 按SET键返回;

电压表、频率表菜单与此类似, 只有两处不同: 1.Pt替代Ct; 2.SP.U替代SP.A;

48型: 无 AL.Hi、AL.Lo、AL.-t、do1.t、do2.t 及do2.U菜单。

Description:

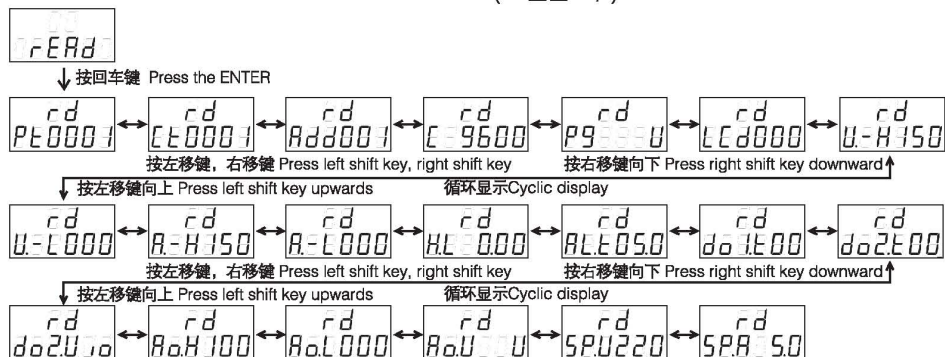
Left/right key select parameter menu to be look over, press Enter key to enter look over concrete setting, for returning to press SET key;

Voltage meter, frequency meter menu is similar, only 2 place is different: 1.Pt replace Ct; 2.SP.U replace SP.A;

48 Type: no AL.Hi, AL.Lo, AL.-t, do1.t, do2.t and do2.U menu.

PZ72(80)系列单相电能表 (PZ□□-E/\*):

PZ72 (80)Series single phase electricity meter  
(PZ□□-E/\*):



说明:

功率表与电能表的只读菜单相同

**Description:**

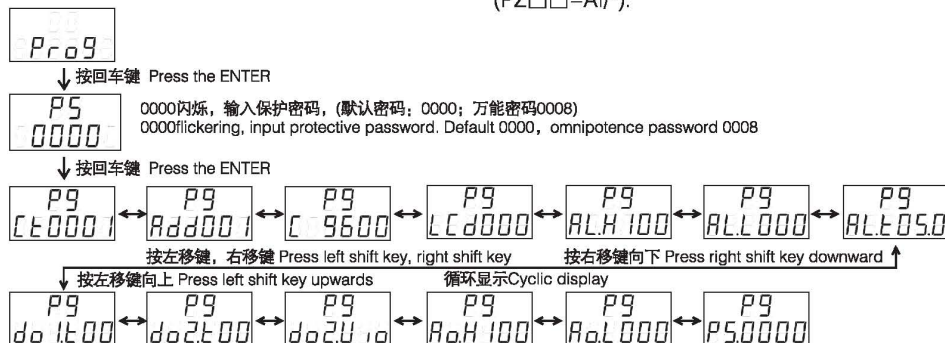
Menu read only of power meter and electricity meter is same

### 5.3.4 Prog菜单（可写）

PZ72 (80)系列单相电流表 (PZ□□-A1/\*):

#### 5.3.4 Prog menu (may be written)

PZ72 (80) Series single phase current meter (PZ□□-A/\*):



说明:

Prog菜单可按左移、右移键切换，按回车键则第二行数据闪烁，表示可修改；修改后按SET键放弃修改，按回车键确认修改。确认后再按SET键出现闪烁的SAVE，询问是否保存，保存按回车确认，不保存按SET键退出。

电压表菜单与此类似，只有一处不同：Pt替代Ct

代Ct

### 频率表无Pt(Ct)菜单

Explanation:

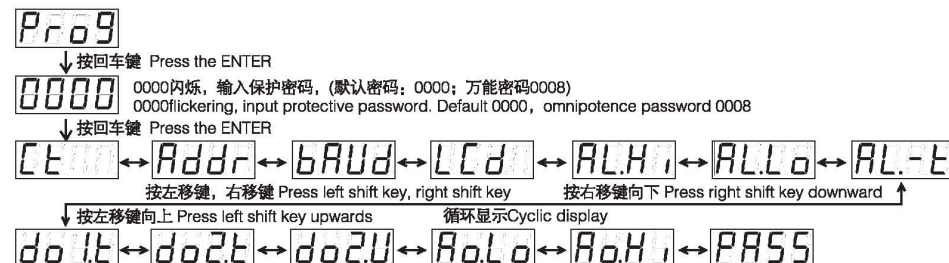
Prog menu can press Left shift key, Right shift key for switching, press ENTER key, then the third line digital flicker, indicate revising is allowable; after revising, press ENTER to Confirm. press SET key, the flicker SAVE to appear, ask save?, if need, press ENTER to Confirm, or press SET key to exit without saving.

Voltage meter menu is similar, only one difference: Pt replace Ct

No Pt (Ct) menu for frequency meter

PZ48(96、42)系列单相电流表 (PZ□□-A1/\*):

PZ48 (96, 42) Series single phase current meter  
(PZ□□-A/\*):



说明:

输入正确密码，按回车进入Prog菜单，按左、右键选择需要修改的参数，按回车键进入，数据闪烁，可修改；修改后按回车确认保存，按SET键放弃保存。

按SET键出现闪烁的SAVE，询问是否保存，如需保存按回车确认，否则按SET键退出不保存。

电压表菜单与此类似，只有一处不同：Pt替代Ct；频率表无Pt(Ct)菜单；

48型：无AL.Hi、AL.Lo、AL.-t、do1.t、do2.t及do2.U菜单。

**Description:**

Prog menu can press Left shift key, Right shift key for switching, press ENTER key, then the second line digital flicker, indicate revising is allowable; After revising, press SET key to quit revising, press ENTER to Confirm revising. After conforming.

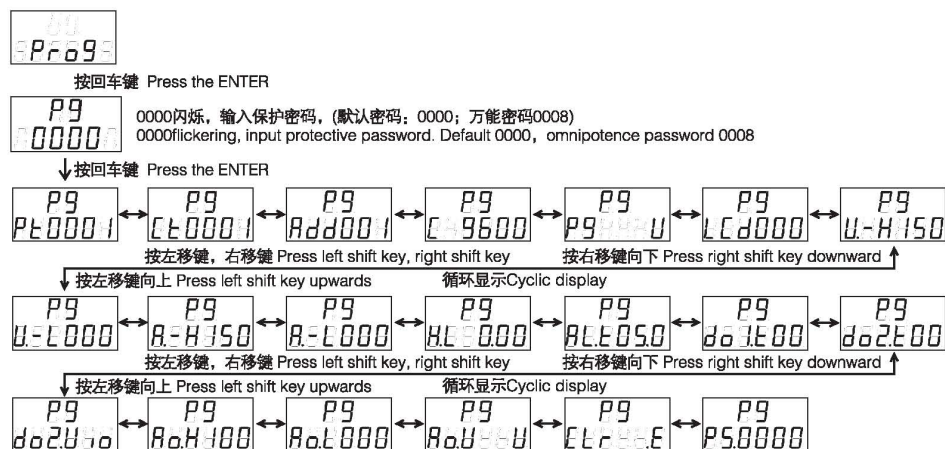
press SET key again, the flicker SAVE to appear, ask save?, if need, press ENTER to Confirm. or press SET key to exit without saving.

Voltage meter menu is similar, only one difference: Pt replace Ct; No Pt(Ct) menu for frequency meter;

48 Type: noAL.Hi, AL.Lo, AL.-t, do1.t, do2.t  
and do2.U menu.

PZ72(80)系列单相电能表 (PZ□□-E/\*):

PZ72 (80) Series single phase electricity meter  
(PZ□□-E/\*):



说明:

Prog菜单可按左移、右移键切换，按回车键则第二行数据闪烁，表示可修改；修改后按SET键放弃修改，按回车键确认修改。确认后再按SET键出现闪烁的SAVE，询问是否保存，保存按回车确认，不保存按SET键退出。

功率表菜单与此相同：但 CLr.E 菜单不起作用。

**Description:**

Prog menu can press Left shift key, Right shift key for switching, press ENTER key, then the second line digital flicker, indicate revising is allowable; After revising, press SET key to quit revising, press ENTER to Confirm revising. After conforming, press SET key again, the flicker SAVE to appear, ask save?, if need, press ENTER to Confirm, or press SET key to exit without saving.

Power meter menu is the same: but CLr.E menu is disable.

## 5.4 功能设置与使用 Function setting and using

#### 5.4.1 倍率更改設置

例1: AC10kV/100V的电压表: 进入Prog菜单, 修改Pt为100:

计算方法:  $10000V \div 100V = 100$

例2: AC500A/5A的电流表: 进入Prog菜单, 修改Ct为100;

计算方法:  $500A \div 5A = 100$

功率表、电能表的Pt、Ct都可更改。

#### 5.4.1 Multiplying power revise setting

Example1: AC10kV/100V voltage meter:

Enter Prog menu, revise Pt as 100;

Computing Method:  $10000V \div 100V = 100$

Example2: AC500A/5A current meter: Enter  
Prog menu, revise Ct as 100;

Computing Method:  $500A \div 5A = 100$

Power meter, electricity meter Pt, Ct can be revised

### 5.4.2 通讯功能及参数设置

Modbus-RTU协议：“9600, 8, n, 1”。

通讯参数见5.2菜单符号及意义，编程流程见

### 5.4.2 Communication function and parameter setting

Modbus-RTU Protocol: "9600, 8, n, 1".

Communication parameter see 5.2 menu  
symbol and meaning, programming flow see  
5.3.4, Enter Prog menu.

### 5.4.3 报警功能及参数设置

PZ72(80)系列仪表报警状态:

|                                                                                     |                                                                                     |                                                                                     |                                                      |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|------------------------------------------------------|
|  |  |  | 测量值为0时<br>不报警<br>No alarming for<br>0 measured value |
| 正常<br>Normal                                                                        | 过高<br>Too high                                                                      | 过低<br>Too low                                                                       |                                                      |

PZ96 (42)系列仪表报警状态(正常测量时,按右移键,可查看报警信息)

### 5.4.3 Alarm function and parameter setting

PZ72(80) Series meter alarm status:

|                                                                                       |                                                                                       |                                                                                       |                                                       |
|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|-------------------------------------------------------|
|  |  |  | 测量值为0值时<br>不报警<br>No alarming for<br>0 measured value |
| 正常<br>Normal                                                                          | 过高<br>  Too high                                                                      | 过低<br>  Too low                                                                       |                                                       |

pz 96(42) Series meter alarm status (In normal measuring, press right shift key, to look over alarm information)

正常测量时，有报警产生，则显示数据会闪烁。如果Prog菜单中的do2.U设置为AL，则报警时会在继电器DO2上产生一个输出（继电器常开接点闭合）。

报警状态可通讯读取，参量地址见6.4 单相表通讯参量地址表

报警功能设置，参数见5.2 菜单符号及意义，设置流程见5.3.4 Prog菜单。

报警功能默认为关闭状态，除非客户要求。

In normal measurement, if alarming occur, the displaying data will be flickering. If Prog menu do2.U setting is AL, during alarming, relay do2 produce one output(relay NO node is closed).

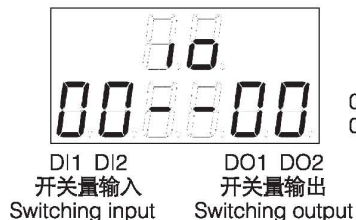
Alarm condition can communication read, parameter address see 6.4 Single phase meter communication parameter address meter.

Alarm function setting, parameter see 5.2 menu symbol and meaning, setting flow see 5.3.4 Prog menu.

Alarm function default as closed condition, unless customer request changing.

#### 5.4.4 开关量功能及输出控制 Switching function and output control

5.4.4.1 PZ72(80)系列仪表，正常测量时，按下回车键，可查看开关量状态，如下：



5.4.4.1 PZ72 (80) series meters, in normal measuring, press down ENTER key, can look over switching condition, as follows:

0表示断开；1表示闭合  
0 for opening; 1 for closing

如图开关量输入指示在DI1、DI2，开关量输出指示在DO1、DO2

另外，液晶(LCD)显示方式仪表，在正常测量状态下就有开关量输入/输出指示，无需按快捷键查看。

在查看开关量状态页面，再次按下回车键，将进入本地开关量输出(继电器)控制页面(与查看页面相同，但开关量输出位闪烁可修改)，左右键输入保护密码（出厂设置：0000，密码设定见5.4.8），回车确认进入：

数字闪烁表示可修改，按左键选择需修改项，按右键进行修改，按回车确认修改，按SET键放弃修改。

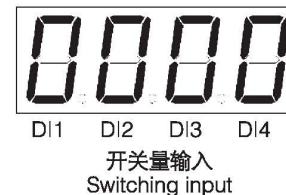
As figure show: Switching input is indicating DI1, DI2, Switching output is indicating DO1, DO2

In addition, Liquid Crystal Display (LCD)display meter, in normal measuring status have Switching input/output indication, look over shortcut key is unnecessary.

When look over Switching status page, press Enter key again, will enter local Switching output (relay) control page (the same as look over the page, but Switching output bit flicker indicate revisable), press left/right key to input protective password (Shipping setting: 0000, password setting see 5.4.8), press ENTER to confirm enter:

Digital flicker indicate its revisable, press left key to select revising item, press right key to do revising, press ENTER to confirm revising; press SET key to quit revising.

5.4.4.2 PZ96 (42)系列仪表，正常测量时，按下回车键，可查看开关量输入状态，如下：



5.4.4.2 pZ 96(42) Series meter, in normal measuring, press Enter key, can look over Switching input status, as follows:

0表示断开；1表示闭合  
0 for opening; 1 for closing

如图开关量输入指示DI1-DI4，数码管(LED)显示方式仪表，其开关量输出指示在面板上，字符DO1、DO2

另外，液晶(LCD)显示方式仪表，在正常测量状态下就有开关量输入/输出指示，无需按快捷键查看。

在查看开关量输入状态页面，再次按下回车键，将进入本地开关量输出(继电器)控制页面，左右键输入保护密码（出厂设置：0000，密码设定见5.4.7），回车确认进入：

As figure show: Switching input indication DI1-DI4, light-emitting diode display meter, its Switching output is indicating on the faceplate, character DO1, DO2

In addition, Liquid Crystal Display (LCD)display meter, in normal measuring status have Switching input/output indication, look over shortcut key is unnecessary.

When look over Switching input status page, press Enter key again, will enter local Switching output (relay) control page, press left/right key to input protective password (Shipping setting: 0000, password setting see 5.4.7), press ENTER to confirm enter:



开关量输出控制页面中，数字闪烁表示可修改，左键选择需修改项，右键进行修改（0表示断开，1表示闭合），回车确认修改，按SET键放弃修改。

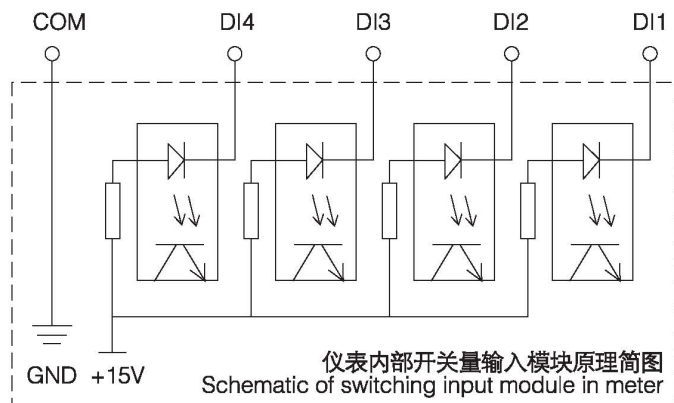
In Switching output control page, digital flicker indicate its revisable, press left key to select revising item, press right key to do revising, (0 for opening, 1 for closing) press ENTER to confirm revising; press SET key to quit revising.

远程读取与控制见 6.5 通讯应用。

开关量输出为继电器常开触点；开关量输入为光电隔离，干接点输入，简要原理如下：

Remote read and Control see 6.5 Communication application.

Switching output adopt NO relay; switching input adopt photocoupler detection, the briefing principle is shown as following:



#### 5.4.5 模拟量输出及设置 Analog output and setting

Ao.L(Ao.Lo): 模拟量下限设置；  
Ao.H(Ao.Hi): 模拟量上限设置；Ao.U: 功率表及电能表中此菜单表示模拟量输出选择，可对应所测电网电压、电流、功率等；设置范围见5.2菜单符号及意义

例：AC500/5A，对应输出一路4~20mA（即，AC0A对应4mA；AC500A对应20mA）

设定：Ao.L(Ao.Lo):000（%）；  
Ao.H(Ao.Hi): 100（%）；

说明：Ao.L(Ao.Lo)、Ao.H(Ao.Hi)的设定值均为额定输入信号的百分数；

频率表变送以50Hz为额定输入信号；

Ao.L(Ao.Lo): Setting for analog lower limit;  
Ao.H(Ao.Hi): Setting for analog upper limit;  
Ao.U: In power meter and electricity meter, this menu show analog output selection, can correspond to voltage, current, power etc. of measured grid; Setting range see 5.2 menu sign and meaning.

Example: AC500/5A, correspond to output 1-channel 4~20mA (i.e., AC0A correspond to 4mA; AC500A correspond to 20mA)

Set: Ao.L(Ao.Lo):000（%）; Ao.H(Ao.Hi): 100（%）;

Description: Rating of Ao.L(Ao.Lo), Ao.H(Ao.Hi) is percentage of rated input signal;

Frequency meter transmitting take 50Hz as rated input signal;

#### 5.4.6 脉冲输出功能 Pulse output function

单相电能表一般具有两路脉冲输出功能，一路有功脉冲，一路无功脉冲；输出接口为无源光耦接点，脉冲常数为：15000imp/kWh、15000imp/kvarh

Single-phase electricity meter usually have 2-channel Pulse output function, one is the active Pulse, another is the reactive Pulse; output interface is the passive photo-coupling contact, Pulse constant is: 15000imp/kWh, 15000imp/kvarh

#### 5.4.7 液晶背光控制 Liquid crystal backlight control

进入Prog菜单，左右键选择LCd页面，按回车键进入修改状态；左右键进行液晶背光时间修改000~250s，此项对LED显示仪表无效。

000：表示液晶背光常亮；

250：表示液晶背光在按键250秒无操作后，转入微亮状态，以延长背光使用寿命。

Enter Prog menu, left/right key select LCD web page, press ENTER to enter revising condition; press left/right key to revise Liquid crystal backlight time 000~250s, to LED display meter, this item is invalid.

000: Indicate Liquid crystal backlight lights;

250: Indicate Liquid crystal backlight after pressing for 250 seconds without operation, switch to glimmer light condition, to prolong backlight service life.

#### 5.4.8 编程密码设置 Program password setting

进入Prog菜单，左键选择PASS页面，按回车键进入修改状态；左右键进行密码修改，密码范围0000\_9999，按回车确认修改，按SET键放弃修改。修改后，编程保护密码及开关量输出控制保护密码均为新密码。

默认密码：0000；万能密码：0008

Enter Prog menu, left key select PASS web page, press ENTER to enter revising condition; press left/right key to carry out password revising, password range 0000~9999, press ENTER to confirm revising. After revising, programming protective password and switching output Control protective password are new password.

Default password: 0000; omnipotence password: 0008

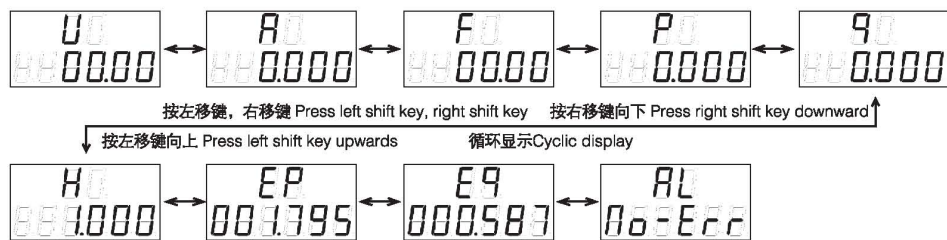
#### 5.5 测量数据查看 Look over measuring data

对于单相电流表、电压表、频率表，其测量值显示在其初始画面；而72、80外形单相功率表、电能表，因测量数据较多，不能同时显示多种数据，在正常测量状态下，可以按左、右键进行查看所测各电量参数。

For single-phase current meter, voltage meter, frequency meter, its measured value display on its initial menu; for 72, 80 single-phase power meter, electricity meter, because of excessive measuring data, display every value at the time is impossible, in normal measuring status, can press left key, right key to look over each measured parameter respectively.

### 5.5.1 PZ72(80)系列LED显示功率表、电能表测量数据查看

### 5.5.1 Look over measuring data of PZ72 (80) Series LED display power meter, electricity meter



LED电能表测量数据查看流程

Measuring data look over flow of LCD electricity meter

#### 说明:

- U: 电压值(一次侧), 单位: 伏特(V)
- A: 电流值(一次侧), 单位: 安培(A)
- F: 频率值, 单位: 赫兹(Hz)
- P: 有功功率(一次侧), 单位: 千瓦(kW)
- Q: 无功功率(一次侧), 单位: 千乏(kvar)
- H: 功率因数
- Ep: 有功电能(二次侧), 单位: 千瓦时(kWh)
- Eq: 无功电能(二次侧), 单位: 千乏时(kvarh)
- AL: 报警信息

功率表电量查看流程与电能表基本一致, 但无电能数据显示。

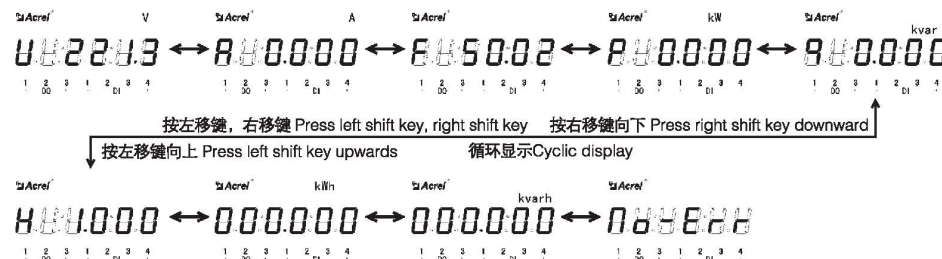
#### Description:

- U: voltage value (primary side), Unit: V
- A: current value(primary side), Unit: A
- F: Frequency value, Unit: Hz
- P: Active power (primary side), Unit: kW
- Q: Reactive power (primary side), Unit: kvar
- H: Power factor
- Ep: Active electric energy (secondary side), Unit: kWh
- Eq: Reactive electric energy (secondary side), Unit: kvarh
- AL: Alarm information

Power meter electric energy look over flow is basic same as electricity meter, but have no electric energy data display.

### 5.5.2 PZ72(80)系列LCD显示功率表、电能表测量数据查看

### 5.5.2 Measuring data look over flow of PZ72(80) Series LCD display power meter, electricity meter



LCD电能表测量数据查看流程

Measuring data look over flow of LCD electricity meter

#### 说明:

液晶表测量数据查看流程基本与数码管显示仪表一致, 因显示方式的不同, 两者略有不同。  
功率表电量查看流程与电能表基本一致, 但无电能数据显示。

#### Description:

Measuring data look over flow of LCD meter is basic same as LED meter, but has slight difference.

Measuring data look over flow of power meter is basic same as electricity meter, but have no electric energy data display.

## 6 通讯指南 Communication guide

### 6.1 概述 General

PZ系列仪表采用Modbus-RTU协议：“9600, 8, n, 1”，其中9600为默认波特率，可通过编程修改为2400、4800、19200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）

PZ Series meter adopt Modbus-RTU protocol: "9600, 8, n, 1", in it 9600 is default baud rate, based on request, it can be revised as 2400, 4800, 19200 etc., for the setting method, see this instruction 5.4.3 communication parameter setting; 8 indicate have 8 data bit; n indicate no parity bit; 1 indicate have one stop bit.

Error detecting: CRC16 (cyclic redundancy check)

### 6.2 协议 Protocol

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。

When Data frame reach terminal device, it enter addressed device by a simple "port", this device remove Data frame "envelope"(data head), read data, if there is no error, executing task requested by data, then, add the new produced data in the obtained "envelope", return the data frame to the transmitter. Returned responding data include following content: slave terminal address (Address), executed command (Function), requested data produced by executing command (Data) and one CRC check code (Check). If any error occur, no successful responding or returning one error indication frame.

#### 6.2.1 数据帧格式 Data frame format

| 地址<br>Address | 功能<br>Function | 数据<br>Data | 校验<br>Check |
|---------------|----------------|------------|-------------|
| 8-Bits        | 8-Bits         | N × 8-Bit  | 16-Bits     |

#### 6.2.2 地址（Address）域 Address domain

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（Address）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。

Address domain: address domain is located at beginning of frame, composed of one byte (8 bit binary system domain), decimal system is 0~255, in our system, just 1~247 is used, other address is Reserved. these bits indicate terminal device address specified by users, this device will receive the connecting host computer data. Every terminal device has its only one address, only the addressing terminal is responding enquiry including this address. When terminal is Transmitting one responding, the responding slave address data tell host computer that which terminal is communicating with it.

#### 6.2.3 功能（Function）域 Function domain

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。

Function domain: function domain tell the addressed terminal to execute what function. Below table list: function domain used in this Series meters, and their meaning and function.

| 代码(十六进制)<br>Code(hex) | 意义<br>Meaning                      | 行<br>Operation                                                                                      |
|-----------------------|------------------------------------|-----------------------------------------------------------------------------------------------------|
| 03H                   | 读取保持寄存器<br>Read holding register   | 在一个或多个保持寄存器中取得当前的二进制值<br>Obtain current binary system value of one or multiple holding register     |
| 10H                   | 预置多寄存器<br>Preset multiple register | 把具体的二进制值装入一串连续的保持寄存器<br>Set actual binary system value into a series of continuous holding register |

#### 6.2.4 数据（Data）域 Data（Data）fields

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。

Data field: data field is including the data needed by terminal for executing specific function, or the collected data when terminal is responding enquiry. Content of these data may be value, reference address or setting value. For example: The function domain tell terminal to Read one register, the data field need to specify the starting register and Read how many data, the built-in address and data have different content depending on type and slave computer.

### 6.2.5 错误校验 (Check) 域 Error check (Check) domain

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。

### 6.3 错误校验码(CRC)的生成方法

Method to create error check code (CRC)

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。

This domain adopt CRC16 cyclic redundancy check, for host computer and terminal, the error in checking and transmitting is allowable. Due to electric noise and other interfere, when one group of data is transmitting from one device to another device, on the transmitting line, some change may be produced. The error check can enable the host computer or slave computer not responding those changed data, so, safety, reliability and efficiency of system are upgraded.

Error check (CRC) domain occupy 2 byte, including one 16 bit binary system value. CRC value is calculated by transmission device, then attached to the data frame, the receiving device, while receiving, it calculates the CRC value again, then comparing it with the receiving CRC domain value, if these two values is not equal, it shows a error occurs.

When operating, firstly, preset one 16-bit register as All-1, then continuously operating each byte 8 bit of Data frame and current value of this register, only every 8 data bit of each byte to participate in forming CRC the start bit and stop bit and usable parity bit have no affect on the CRC. When forming CRC, every 8 data bit of each byte and content of register carry out exclusive or operation, then shift the result to the low bit the high bit is filled with 0, shift out the least significant bit (LSB) is shifted out and tested, if it is 1, this register and one preset fixed value (0A001H) carry out one exclusive or operation, if the least significant bit is 0, no treating is needed.

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。

Flow for forming one CRC:

- 1, Preset one 16 bit register as 0FFFFH (All-1), called as CRC register.
  - 2, 8 bit of data frame first byte and low byte of CRC register carry out exclusive or operation, then save its result back to CRC register.
  - 3, Right shift CRC register for one bit, the most significant bit is filled with 0, the least significant bit is shifted out and tested.
  - 4, If the least significant bit is 0, Repeat the third step (next shift); If the least significant bit is 1, CRC register and preset fixed value specified (0A001H) carry out exclusive or operation.
  - 5, Repeat the third step and the fourth step until shift for 8 times, the complete 8 bit is done.
  - 6, Repeat the second step to the fifth step to treat next 8 bit until all the byte is treated.
  - 7, The CRC register final value is CRC value.
- Besides, there is another CRC calculation method by preset table, its main feature is fast calculating speed, but large saving space is needed, please refer to related data.

#### 6.4 单相表通讯参量地址表 (Word) :

Single-phase meter communication parameter address table (Word):

| 地址<br>Addr | 内容<br>Content                          | 简要说明<br>Briefing Description                                                                                                                                                     |
|------------|----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0000H      | U有效值<br>U virtual value                | 读写属性: R – 读; W – 写<br>除地址0012H为部分可写外, 均为只读;<br>Belong to R/W: R-read; W-write<br>Address 0012H may be written partly, the rest is read only;                                     |
| 0001H      | U指数位<br>U exponent bit                 |                                                                                                                                                                                  |
| 0002H      | I有效值<br>I virtual value                |                                                                                                                                                                                  |
| 0003H      | I指数位<br>I exponent bit                 |                                                                                                                                                                                  |
| 0004H      | F有效值<br>Fvirtual value                 |                                                                                                                                                                                  |
| 0005H      | F指数位<br>Fexponent bit                  |                                                                                                                                                                                  |
| 0006H      | H有效值<br>Hvirtual value                 |                                                                                                                                                                                  |
| 0007H      | H指数位<br>Hexponent bit                  |                                                                                                                                                                                  |
| 0008H      | P有效值<br>Pvirtual value                 |                                                                                                                                                                                  |
| 0009H      | P指数位<br>Pexponent bit                  |                                                                                                                                                                                  |
| 000aH      | Q有效值<br>Qvirtual value                 | 电能数据为二次侧数据;<br>如需要一次侧数据请自行乘电压及电流倍率;<br>The electric energy data is the secondary side data; If the primary side data is needed, please multiply the rate of voltage and current; |
| 000bH      | Q指数位<br>Qexponent bit                  |                                                                                                                                                                                  |
| 000cH      | Ep高位<br>Ep High bit                    |                                                                                                                                                                                  |
| 000dH      | Ep低位<br>Ep Low bit                     |                                                                                                                                                                                  |
| 000eH      | Eq高位<br>Eq High bit                    |                                                                                                                                                                                  |
| 000fH      | Eq低位<br>Eq Low bit                     |                                                                                                                                                                                  |
| 0010H      | Pt                                     |                                                                                                                                                                                  |
| 0011H      | Ct                                     |                                                                                                                                                                                  |
| 0012H      | 报警及I/O<br>Alarm and I/O                |                                                                                                                                                                                  |
| 0013H      | 此后为保留字<br>Reserved character hereafter |                                                                                                                                                                                  |

说明:

① 电压、电流、功率等数据数值计算方法: (例见: 6.5.1 读数据) 读数 = 有效值 × 10E(指数位-3)

Description:

① Voltage, current, power etc. calculating method: (example see: 6.5.1 reading data) Reading = virtual value × 10E(exponent bit-3)

0012H: 报警及开关量输入/输出状态字:

0012H: Alarm Switching input / output status Character:

|                                                                                     |     |    |                                      |      |                                            |      |                                            |      |                                              |     |     |     |
|-------------------------------------------------------------------------------------|-----|----|--------------------------------------|------|--------------------------------------------|------|--------------------------------------------|------|----------------------------------------------|-----|-----|-----|
| 15                                                                                  | ... | 10 | 9                                    | 8    | 7                                          | 6    | 5                                          | 4    | 3                                            | 2   | 1   | 0   |
| —                                                                                   |     |    | AL.L                                 | AL.H | DI1                                        | DI2  | —                                          |      | —                                            |     | DO1 | DO2 |
| (R) 高、低报警指示<br>(R) H,L alarm indication                                             |     |    |                                      |      | (R) 1闭合, 0断开<br>(R) 1 closing, 0 openin    |      |                                            |      | (R/W) 1闭合, 0断开<br>(R/W) 1 closing, 0 opening |     |     |     |
| 72、80功率表、电能表报警状态字:<br>72, 80 power meter, electricity meter alarm status character: |     |    |                                      |      |                                            |      |                                            |      |                                              |     |     |     |
| 15                                                                                  | ... | 13 | 12                                   |      | 11                                         | 10   | 9                                          | 8    | 7                                            | ... | 0   |     |
| —                                                                                   |     |    | H.L                                  |      | A.-H                                       | A.-L | U.-H                                       | U.-L | 开关量输入/输出状态<br>Switching input/output status  |     |     |     |
|                                                                                     |     |    | 功率因数低报警<br>Low power factor alarming |      | 电流高、低报警<br>High, Low. alarming for current |      | 电压高、低报警<br>High, Low. alarming for voltage |      | 与上表同<br>Ditto                                |     |     |     |

说明:

① – 表示保留字或保留位。

② 报警标志位: 1为有报警, 0为无报警。

Description:

①-showing Reserved character or Reserved bit.

② Alarming mark bit: 1 for alarming, 0 for no alarming.

#### 6.5 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)

Actual example, the whole way adopt format of below table (data as Hex)

| Addr          | Fun                  | Data start                   |        | Data # of                  |        | CRC16                                   |     |
|---------------|----------------------|------------------------------|--------|----------------------------|--------|-----------------------------------------|-----|
|               |                      | reg Hi                       | reg Lo | reg Hi                     | reg Lo | Lo                                      | Hi  |
| 01H           | 03H                  | 00H                          | 00H    | 00H                        | 06H    | C5H                                     | C8H |
| 地址<br>Address | 功能码<br>Function code | 数据起始地址<br>Data start address |        | 数据读取个数<br>Data read number |        | 循环冗余校验码<br>Cyclic redundancy check code |     |

## 6.5.1 读数据 Read data

## 例1: 读单相电流数据

Example1: Read single-phase current data

|                             |                            |
|-----------------------------|----------------------------|
| 查询数据帧<br>Inquiry Data frame | 01 03 00 02 00 02 65 cb    |
| 返回数据帧<br>Return Data frame  | 01 03 04 03 b2 00 00 5a 50 |

## 说明:

01: 从机地址

03: 功能码

04: 十六进制, 十进制为4, 表示后面有4个字节的数据

5a 50: 循环冗余校验码

数据处理方法见: 6.4 通讯参量地址表

处理如下: 03 b2(16进制) = 946 (10进制)

00 00(16进制) = 0 (10进制)

计算:  $946 \times 10^{0-3} = 0.946$ ;

单位: 安培 (A)

## Description:

01: Slave address

03: Function code

04: Hex, decimal system is 4, show follow by 4 byte data

5a 50: Cyclic redundancy check code

Data processing method see: 6.4 communication parameter address table

Data processing:

03 b2 (Hex) = 946 ( decimal system)

00 00( Hex) = 0 ( decimal system)

Calculation:  $946 \times 10^{0-3} = 0.946$ ;

Unit: A

则仪表显示 Meter display:

|  |       |
|--|-------|
|  | 0.946 |
|--|-------|

读电压表数据与读电流表类似, 但起始地址为00H, 查询帧: 01 03 00 00 00 02 c4 0b

读其它信息的查询帧与此格式相同, 各信息地址见: 6.4 单相表通讯参量地址表。

Read voltage meter data is similar with that of read current meter, but starting address is 00H, inquiry frames: 01 03 00 00 00 02 c4 0b

Read inquiry frames of other information is same as this format, each information address see: 6.4 Single-phase meter communication parameter address table.

## 例2: 读有功电能数据

Example2: Read active electric energy data

|                             |                            |
|-----------------------------|----------------------------|
| 查询数据帧<br>Inquiry Data frame | 01 03 00 0c 00 02 04 08    |
| 返回数据帧<br>Return Data frame  | 01 03 04 00 00 30 26 6f e9 |

## 数据处理:

高位: 00 00(16进制) = 0 (10进制)

低位: 30 26(16进制) = 12326 (10进制)

因此该仪表二次测有功电能为:  $(0 \times 65536 + 12326)/1000 = 12.326$  单位: kWh

无功电能作相同处理; 如需一次测电能数据, 请自行乘以电压、电流变比。

## Data processing:

High bit: 00 00 (Hex) = 0 (decimal system)

Low bit: 30 26 (Hex)=12326 (decimal system)

Secondary side active electric energy of this meter is:  $(0 \times 65536 + 12326)/1000 = 12.326$  Unit: kWh

Reactive electric energy is doing same processing; if electric energy data of primary is needed, please multiply transformation ratio of voltage, current.

## 6.5.2 写数据 Read in data

## 例3: 开关量输出远程控制 (控制字: 0012H)

Example3: Switching output remote control (control character: 0012H)

|                              |                                                                    |
|------------------------------|--------------------------------------------------------------------|
| 写入数据帧<br>Read in data frames | 01 10 00 12 00 01 02 00 02 24 e3 (DO1闭合)<br>(DO1 closing)          |
|                              | 01 10 00 12 00 01 02 00 01 64 e2 (DO2闭合)<br>(DO2 closing)          |
|                              | 01 10 00 12 00 01 02 00 03 e5 23 (DO1、DO2闭合)<br>(DO1, DO2 closing) |
| 返回数据帧<br>Return Data frame   | 01 10 00 12 00 01 A1 CC (不成功, 无返回)<br>(no success, no returning)   |

## 说明:

向开关量输出状态位远程写入1, 则闭合; 写入0, 则断开。

当继电器闭合持续时间为非0时 (0为长闭), 继电器闭合持续时间为所设值。

## Description:

To Switching output status bit, remote read in 1, then closing; read in 0, then opening.

When relay closed duration is nonzero (0 is long closed), relay closed duration is the setting value.