

PZ系列可编程智能电测表

PZ series Programmable Intelligent Electric Parameter Meters

—直流表部分

Dc Meter

(DI、DU、DP、DE)

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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

PZ系列直流电测仪表是针对直流屏、太阳能供电、电信基站等应用场合而设计的，该系列仪表可测量直流系统中的电压、电流、功率、正向与反向电能。既可用于本地显示，又能与工控设备、计算机连接，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、开关量输出进行设置与控制。

2 产品型号与规格

仪表型号	基本功能	外形/显示方式	可选功能
PZ72-DU	直流电压测量	72方形 数码管显示	1、一路RS485通讯(/C) 2、一路变送输出(/M) (96方形可带3路变送输出/M3) 3、变送+RS485通讯(/MC) 4、RS485通讯+开关量2DI(/KC) 5、RS485通讯+开关量2DI2DO(/KC) 注：/J为一路继电器报警输出 (与第二路开关量复用)
PZ72-DI	直流电流测量		
PZ72-DUI	直流电压、电流测量		
PZ72-DP	直流电压、电流、功率测量		
PZ72-DE	直流电压、电流、功率、电能测量		
PZ72L-DU	直流电压测量	72方形 液晶显示	
PZ72L-DI	直流电流测量		
PZ72L-DUI	直流电压、电流测量		
PZ72L-DP	直流电压、电流、功率测量		
PZ72L-DE	直流电压、电流、功率、电能测量		
PZ80-DU	直流电压测量	80方形 数码管显示	
PZ80-DI	直流电流测量		
PZ80-DUI	直流电压、电流测量		
PZ80-DP	直流电压、电流、功率测量		
PZ80-DE	直流电压、电流、功率、电能测量		
PZ80L-DU	直流电压测量	80方形 液晶显示	
PZ80L-DI	直流电流测量		
PZ80L-DUI	直流电压、电流测量		
PZ80L-DP	直流电压、电流、功率测量		
PZ80L-DE	直流电压、电流、功率、电能测量		
PZ96-DU	直流电压测量	96方形 数码管显示	
PZ96-DI	直流电流测量		
PZ96-DUI	直流电压、电流测量		
PZ96-DP	直流电压、电流、功率测量		
PZ96-DE	直流电压、电流、功率、电能测量		
PZ96B-DU	直流电压测量	96槽形 数码管显示	
PZ96B-DI	直流电流测量		
PZ96B-DUI	直流电压、电流测量		
PZ96B-DP	直流电压、电流、功率测量		
PZ96B-DE	直流电压、电流、功率、电能测量		

3 技术参数

技术参数	指 标
输 入	直流电压 输入范围 0~48V, 0~110V, 0~220V, 0~1000V 输入阻抗 $\geq 2k\Omega/V$
	直流电流 输入范围 0~10A (直接输入, 启动电流: 5mA) 0~9999A (外置分流器或霍尔元件, 量程可编程设定)
	分流器 支持输出为75mV
	霍尔元件 支持输出为0~20mA、4~20mA、0~5V、0~10V等
	功耗 $\leq 1mW$
过载	1.2倍可持续正常工作, 2倍持续1秒
精度等级	0.5级

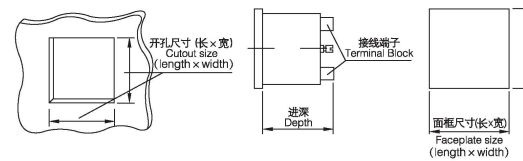
功 能	显示	LED或LCD (高亮蓝色背景光、背光延时时间可调)
	通讯	RS485接口, 半双工、光电隔离, Modbus-RTU协议, 波特率1200、2400、4800、9600、19200可选
	报警	1路继电器输出, 2A/30VDC或2A/250VAC
	模拟量	DC4~20mA、DC0~20mA (负载 $<500\Omega$), DC1~5V、DC0~5V (负载 $>1k\Omega$) 等可编程设置
开关量	输入 (DI)	干接点输入, 仪表内置电源, 光电隔离
	输出 (DO)	无源常开触点, 2A/30VDC或2A/250VAC
工作电源	电压范围	85~265VAC, 50/60Hz、110~350VDC、36~48VDC (订货时说明)
	功耗	$\leq 2W$
绝缘电阻		$\geq 100M\Omega$
工频耐压		电源端子组与信号输入、输出端子组之间2kV/1min (RMS) (当电压量程为1kV时, 为3kV/min)
平均无故障工作时间		$\geq 50000h$
环 境	温度	工作: $-10^{\circ}C \sim +55^{\circ}C$; 贮存: $-20^{\circ}C \sim +70^{\circ}C$
	湿度	$\leq 93\%RH$, 不结露, 不含腐蚀性气体
	海拔	$\leq 2500m$

4 安装指南

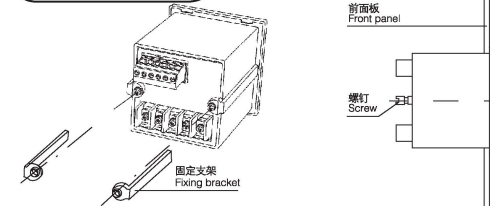
4.1 外形及安装开孔尺寸

仪表外形	面框尺寸			壳体尺寸			开孔尺寸	
	单位: mm	长	宽	宽	高	深	长	宽
72方形		75	75	66	66	98	67	67
80方形		84	84	75	75	98	76	76
96方形		96	96	86	86	85	88	88
96槽形		96	48	90	43	98	91	44

4.2 仪表及开孔示意图



4.3 安装示意图



4.4 安装说明

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。

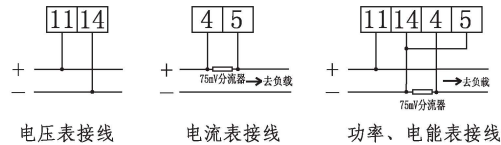
4.5 端子及接线

4.5.1 辅助电源端子



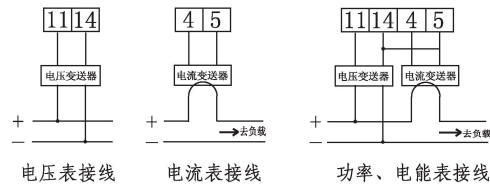
4.5.2 信号输入端子

- 信号直接输入



电压表接线 电流表接线 功率、电能表接线

- 采用带隔离功能的直流变送器

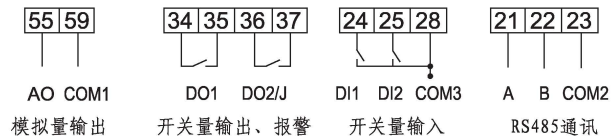


电压表接线 电流表接线 功率、电能表接线

注:

- 1、因电压信号端口与电流信号端口仪表内部未采取隔离措施。接线时，请注意电压信号负端与电流信号负端之间电压差不得大于5V。
- 2、在实际使用过程中，若电压或电流信号与接线方向相反，相对应的检测量将为负值，显示时，对应的显示项前将出现“-”号。当电压与电流信号全为正或负值时，功率将表示为正，电能用kWh表示；当电压与电流一正一负时，功率将表示为负，电能用kvarh表示。电能采用正负分开计量的方式，之间互不影响。
- 3、若采用直流变送器，请在订货前详细告知我司采用的变送器性能与规格！

4.5.3 附加功能端子



AO COM1 DO1 DO2/J DI1 DI2 COM3 A B COM2
模拟量输出 开关量输出、报警 开关量输入 RS485通讯

- 1、该接线仅供参考，具体以仪表上接线图为准；
- 2、继电器报警输出与开关量输出DO2复用。

4.6 注意事项

4.6.1 电压信号输入

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

4.6.2 电流信号输入

电流输入应使用外部分流器或直流变送器；

4.6.3 附加功能接线

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0.5mm²，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。

建议最末端仪表的A、B之间加匹配电阻，阻值范围为120Ω~10kΩ。

5 使用指南

5.1 按键



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）

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）

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）

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）

5.2 菜单符号及意义

类别	符号	含义	范围	
主菜单	rEAd	只读菜单	简写: rd	
	Prog	编程菜单	简写: Pg	
变比 (倍率)	Pt	电压(电流)变比	0001~9999	
	Ct			
通讯	Add	通讯地址	1~247	
	C	通讯波特率 (bps)	1200、2400、4800、9600等	
液晶背光	LCD	背光延时时间 (s)	1~250, 0 为常亮 LED 仪表此项无效	
	报警设置	U.H	电压高报警设置	0 ~ 150.0% 150.0%: 关闭)
		U.L	电压低报警设置	0 ~100.0% 0.0%: 关闭)
		A.H	电流高报警设置	0 ~150.0% (150.0%: 关闭)
		A.L	电流低报警设置	0 ~100.0% (0.0%: 关闭)
		AL.t	报警延时时间 (s)	1.0~20.0 (分辨率0.1s)
继电器 (DO输出)	do1.t	继电器1闭合持续时间 (s)	0~20 (分辨率1s)、 0: 继电器工作在保持状态	
	do2.t	继电器2闭合持续时间 (s)		
模拟量	do2.U	继电器2的用法	io: 作开关量 (K) ; AL: 作报警输出 (J)	
	o.L	模拟量下限设置	0~100.0%	
	o.H	模拟量上限设置	0~120.0%	
电能清零	o.U	模拟量输出选择	U、A、P	
	CLr E	电能清除	见注1	
密码	PS.	编程保护密码	0000~9999	
保存	SAvE	询问是否保存	按“回车”保存并退出 按“SET”放弃保存并退出	

注:

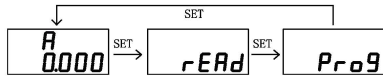
1、电能清零操作需在闪动的CLr E下，按动左或右键，使其变为CLr E，然后按动确认键。电能清零操作不需另行保存即可生效，且不能恢复，请谨慎操作；

2、百分量是指相对于额定量程计算。

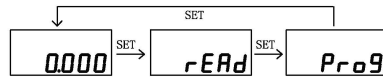
3、因仪表型号的不同，部分参数设定对仪表无意义。

5.3 编程流程 (此流程以LED显示为例, LCD显示与此类似)

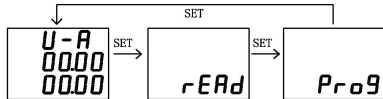
5.3.1 PZ72、PZ80系列仪表: 在正常显示画面时, 按SET键, 如下:



5.3.2 PZ96B系列仪表: 系列仪表在测量画面时, 按SET键, 如下:

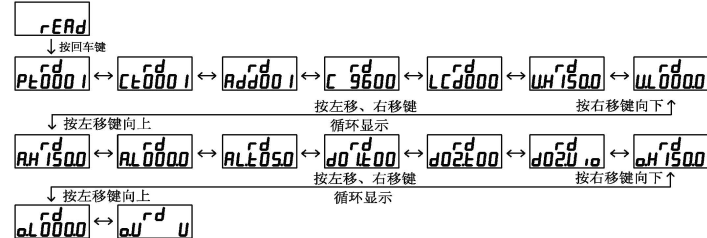


5.3.3 PZ96系列仪表: 系列仪表在测量画面时, 按SET键, 如下:

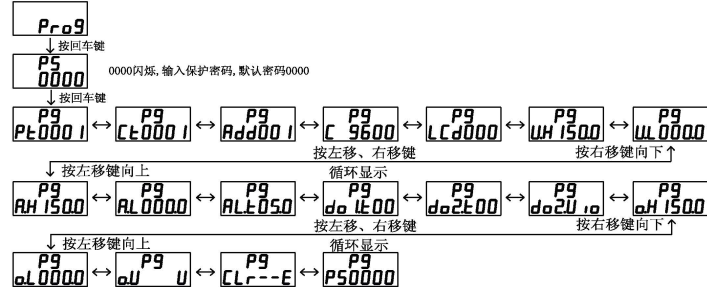


说明: rEAd — 只读菜单, 在此页面, 按回车键进入;
Prog — 编程菜单, 在此页面, 按回车键进入;

5.3.4 rEAd 菜单



5.3.5 Prog 菜单



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。

5.4 功能设置及使用

5.4.1 倍率更改设置

电压变比与电流变比都是以1V与1A为基准, 出厂时我们会根据用户的量程要求, 确定合适的仪表量程, 在外部输入此量程的信号, 若电压变比与电流变比都为“1”, 则仪表显示1V与1A, 在设定了对应的变比后, 仪表将显示对应的数据。用户不得自行改变信号的输入大小。如用户定了一100V/5V与100A/75mV仪表, 到了工作现场发现电压变送器为220V/5V与500A/75mV, 则可将电压变比由原来的100改为220, 电流变比由100改为500, 但需确定直流变送器的输出信号不得发生改变, 此例中为5V与75mV。

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5.3.4, 进入Prog菜单。

5.4.3 报警功能及参数设置

报警状态:

AL No-Err	AL U---Hi	AL U---Lo	AL A---Hi	AL A---Lo
正常	电压过高	电压过低	电流过高	电流过低

正常测量时, 有报警产生, 则对应的显示数据会闪烁。如果Prog菜单中的do2.U设置为AL, 则报警时会在继电器D02上产生一个输出(继电器常开结点闭合)。

报警状态可通讯读取, 参量地址见6.4 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。
当输入信号为零时, 仪表将关闭报警功能。

5.4.4 开关量功能及输出控制

仪表在正常测量状态时按下回车键, 可查看开关量状态, 如下:

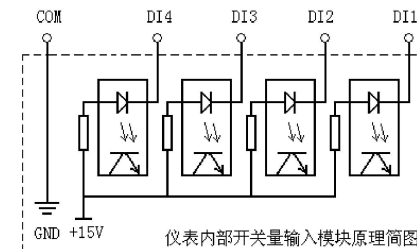


如图开关量输入指示在DI1、DI2, 开关量输出指示在D01、D02
另外, 液晶(LCD)显示方式仪表, 在正常测量状态下就有开关量输入/输出指示, 无需按快捷键查看。

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5.4.7), 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。

远程读取与控制见 6.5 通讯应用。
开关量输出为常开继电器; 开关量输入为光电隔离, 干接点输入, 简要原理如下:



5.4.5 模拟量输出及设置

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; 设置范围见5.2 菜单符号及意义
 例: DC500A/75mV, 对应输出一路4~20mA (即, DCOA对应4mA; DC500A对应20mA)
 设定: Ao.L(Ao.Lo):0.0 (%); Ao.H(Ao.Hi): 100.0 (%);
 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;

5.4.6 液晶背光控制

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。

5.4.7 编程密码设置

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

5.5 测量数据查看

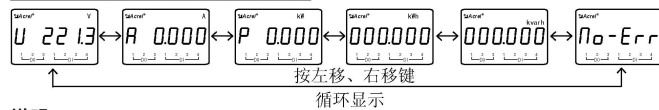
5.5.1 LED电能表测量数据查看流程

对于电流表、电压表, 其测量值显示在其初始画面; 而功率表、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。



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)
 P: 功率 (一次侧), 单位: 千瓦(kW) Ep: 正向电能 (一次侧), 单位: 千瓦时(kWh)
 Eq: 反向电能 (一次侧), 单位: 千乏时(kvarh) AL: 报警信息
 反向电能的单位实际上也为kWh, 但为了区别, 将其定义为kvarh
 其它类型仪表与电能表基本一致, 但没有无关联数据显示。

5.5.2 LCD电能表测量数据查看流程



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)
 P: 功率 (一次侧), 单位: 千瓦(kW) Ep: 正向电能 (一次侧), 单位: 千瓦时(kWh)
 Eq: 反向电能 (一次侧), 单位: 千乏时(kvarh) AL: 报警信息
 反向电能的单位实际上也为kWh, 但为了区别, 将其定义为kvarh
 其它类型仪表与电能表基本一致, 但没有无关联数据显示。

6 通讯指南

6.1 概述

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1200、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)

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

Address	Function	Data	Check
8-Bits	8-Bits	N×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。

6.2.3 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)	意义	行为
03H	读取保持寄存器	在一个或多个保持寄存器中取得当前的二进制值
10H	预置多寄存器	把具体的二进制值装入一串连续的保持寄存器

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。

6.3 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OFFFH（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。

6.4 通讯参量地址表（Word）：

地址	内容	简要说明
0000H	U有效值	电压（单位：V）
0001H	U指数位	-9999 ~ 9999
0002H	I有效值	电流（单位：A）
0003H	I指数位	-9999 ~ 9999
0004H	保留	
0005H	保留	
0006H	保留	
0007H	保留	
0008H	P有效值	功率（单位：W）
0009H	P指数位	-9999 ~ 9999
000aH	保留	
000bH	保留	
000cH	Ep高位	正向电能（单位：Wh）
000dH	Ep低位	0 ~ 999999999
000eH	Eq高位	反向电能（单位：varh）
000fH	Eq低位	0 ~ 999999999
0010H	Pt	电压变比
0011H	Ct	电流变比
0012H	报警及I/O	详细说明见下方
0013H	此后为保留字	

读写属性：R — 读；W — 写
除地址0012H为部分可写外，均为只读；
电能数据为一次侧数据；

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 × 10（指数位-3）
0012H:报警及开关量输入/输出状态字：

15	...	11	10	9	8	7	6	...	1	0
—		A.-H	A.-L	U.-H	U.-L	D11	D12	—	D01	D02
保留		电流高、低报警	电压高、低报警	电压高、低报警	电压高、低报警	开关量输入			开关量输出	

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。

6.5 通讯应用

本节所举实例尽可能采用下表格式（数据为16进制）

Addr	Fun	Data start		Data off		CRC16	
		reg Hi	reg Lo	reg Hi	reg Lo	Lo	Hi
01H	03H	00H	00H	00H	06H	C5H	C8H
地址	功能码	数据起始地址		数据读取个数		循环冗余校验码	

6.5.1 读数据

例1：读电流数据

查询数据帧	01 03 00 02 00 02 65 cb
返回数据帧	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)

单位：安培（A）

计算：946 × 100-3 = 0.946；

则仪表显示：

I=0.946

读电压表数据与读电表类似，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 通讯参量地址表。

例2：读正向电能数据

查询数据帧	01 03 00 0c 00 02 04 08
返回数据帧	01 03 04 00 00 30 26 f6 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)

因此该仪表一次测有功电能为：(0 × 65536 + 12326) / 1000 = 12.326 单位：kWh

6.5.2 写数据

例3：开关量输出远程控制（控制字：0012H）

写入数据帧	01 10 00 12 00 01 02 00 02 24 e3 (D01闭合)
	01 10 00 12 00 01 02 00 01 64 e2 (D02闭合)
	01 10 00 12 00 01 02 00 03 e5 23 (D01、D02闭合)
返回数据帧	01 10 00 12 00 01 A1 CC (不成功，无返回)

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。

DECLARATION

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1.General

PZ series DC analyzer is designed for application in GZDW, solar power supply, telecom station. It can measure voltage, current, power, forward and reverse energies of DC network. It may be used for local display and connected with the control equipment to regroup measuring and controlling system.

It can be equipped RS485 communication under Modbus-RTU protocol; and it has options of analog output, relay alarm, digital input/output. According to different request, meter's parameters can be set by 4 keys on its panel.

2.Specification

Type	Function	Outline/Display usage	Option
PZ72-DU	DC voltage measurement	72×72mm LED display	1. RS485 (/C) 2. One analog output (/M) (PZ96 with up to three outputs/M3) 3. Analog output+RS485 (/MC) 4. RS485+2DI (/KC) 5. RS485+2DI2DO (/KCC) Note: /J means one relay alarm output (multiplex with secondly switching value)
PZ72-DI	DC current measurement		
PZ72-DUI	DC voltage, current measurement		
PZ72-DP	DC voltage, current, power measurement		
PZ72-DE	DC voltage,current,power,energy measurement		
PZ72L-DU	DC voltage measurement	72×72mm LCD display	
PZ72L-DI	DC current measurement		
PZ72L-DUI	DC voltage, current measurement		
PZ72L-DP	DC voltage, current, power measurement		
PZ72L-DE	DC voltage,current,power,energy measurement		
PZ80-DU	DC voltage measurement	80×80mm LED display	
PZ80-DI	DC current measurement		
PZ80-DUI	DC voltage, current measurement		
PZ80-DP	DC voltage, current, power measurement		
PZ80-DE	DC voltage,current,power,energy measurement		
PZ80L-DU	DC voltage measurement	80×80mm LCD display	
PZ80L-DI	DC current measurement		
PZ80L-DUI	DC voltage, current measurement		
PZ80L-DP	DC voltage, current, power measurement		
PZ80L-DE	DC voltage,current,power,energy measurement		
PZ96-DU	DC voltage measurement	96×96mm LED display	
PZ96-DI	DC current measurement		
PZ96-DUI	DC voltage, current measurement		
PZ96-DP	DC voltage, current, power measurement		
PZ96-DE	DC voltage,current,power,energy measurement		
PZ96B-DU	DC voltage measurement	96×48mm LED display	
PZ96B-DI	DC current measurement		
PZ96B-DUI	DC voltage, current measurement		
PZ96B-DP	DC voltage, current, power measurement		
PZ96B-DE	DC voltage,current,power,energy measurement		

3. Technical feature

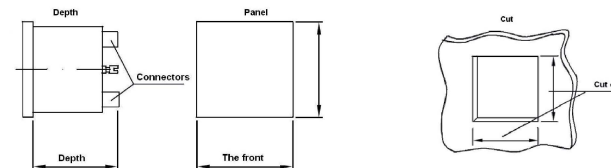
Technical feature		Value		
Input	DC voltage	Range	0-48V, 0-110V, 0-220V, 0-1000V	
		Impedance	≥2kΩ/V	
	DC current	Range	0~10A input directly (Start 5mA) 0~9999A(with Shunt or Hall component)	
		Shunt	Output 75mV	
		Hall Component	Output 0~20mA,4~20mA,0~5V,0~10V	
		Consumption	≤1mW	
	Overload	1.2 times (continuous),2 times during 1s		
Precision		0.5 class		
Function	Display	LED ,LCD		
	Communication	RS485,Modbus-RTU protocol		
	Alarm	1 channel relay output:2A/30VDC or 2A/250VAC		
	Analog	DC4:20mA,DC0~20mA(load< 600Ω), DC0~5V(load> 1kΩ)programmable		
Function	Switching value	input(DI)	Dry contact input, with insert power, optocoupler isolation	
		output(DO)	passive Opening contact,2A/30VDC or 2A/250VAC	
Power supply	Voltage	DC36~48V,DC110~350V,AC85~265V (Please indicate when order)		
	Consumption	≤2W		
Isolation resistance		≥100MΩ		
Isolation		2kV/1min(RMS) (inputs / power,outputs / power) (3kV/min when voltage range is 1kV)		
MTBN		≥50000h		
Environment	Temperature	LCD: -20C~+60C;LED: -10C~+55C Storage: -20C~+70C		
	Humidity	≤ 93%RH, no condensation,no corrosive gas		
	Altitude	≤ 2500m		

4. Installing and Wiring

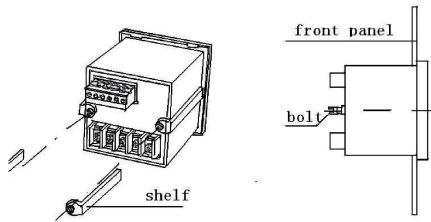
4.1 Installing dimension

Size	Panel			Housing			Cut hole	
	Unit:mm	W	L	W	L	H	W	L
72 Square	75	75	66	66	66	98	67	67
80 Square	84	84	75	75	75	98	76	76
96 Square	96	96	86	86	86	85	88	88
96 Trough	96	48	90	43	98	91	44	44

4.2 Outline (Unit: mm)



4.3 Installing

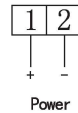


4.4 Installing explanation

Loosen the fixing bolt , put down the installing shelf; Insert the analyzer into the orifice and fit on the shelf and fixing bolt.

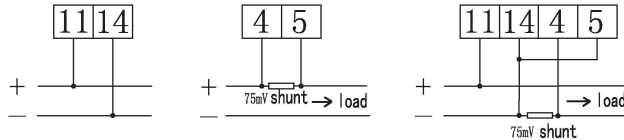
4.5 Wiring

4.5.1 power



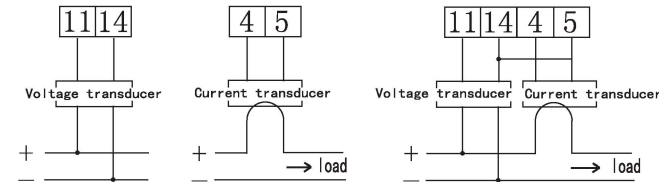
4.5.2 singal input

- Input directly



Voltage input Current input Voltage, current input

- Connected isolation DC shunt



Voltage input Current input Voltage, current input

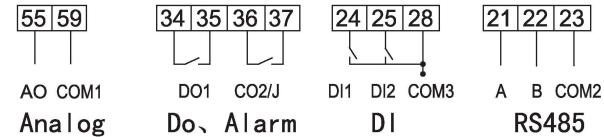
Note:

1. Because there is no isolation between current input and voltage input, the voltage range should blow 5V.
2. If voltage and current are reversed wired, the displayed values will be negative. The corresponding term appears“—”.The direction of voltage and current are same, the power is positive, and the energy is active energy (kWh); otherwise the power is

the power is positive, and the energy is active energy (kWh); otherwise the power is negative, and the energy is reactive energy (kvarh). (This function can be used in the DC system of recharge and discharge directly)

3. If connected DC transducer, please inform us the specification and capability before ordering.

4.5.3 additional function



Note:

- 1.This wiring is just for reference, please according to the wiring on the meter.
- 2.Alarm output and digital output DO2 are multiplex.

4.6 Attention

4.6.1 Voltage signal input

Input voltage can not be morn than 120% rating voltage, installed 1A fuse in the voltage input terminal.

4.6.2 Current signal input

Current input should use shunt outside or DC transducer.

4.6.3 Additional function

Analog output and digital input “COM”means commonality terminal, not earthing. With asynchronous half-duplex RS-485 communication interface and Modbus-RTU communication protocol, and all the data can be transmit by it. In theory, we can series 128 devices on a MODBUS circuit, and each meter has its address.

You’d better use 3-core shielded wire, and its diameter is less then 0.5mm². When wiring, please avoid in the strong electric interface environment; and between the analyzers at end of the Modbus network, we propose to use 120Ω ~ 10kΩ resistance between A and B.

5.Operation

5.1 Keys

- SET** Function change or return to previous menu; (Normal display:read menu and programming menu)
- Submenu leftward or minish value; (Press left and right key to check alarm information in power meter and energy meter)
- Submenu rightward or plus value; (In common current ,voltage state, press this key to check alarm information)
- Enter next menu or confirm; (In normal state, press this key to enter DI/ DO indicate and control menu)

5.2 Menu symbol and explanation

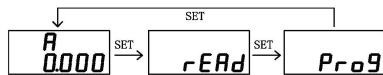
Type	Symbol	Explanation	Range
Main menu	rEAd	Read menu	Shortening:rd
	Prog	Program menu	Shortening:Pg
Ratio	Pt	Voltage(Current) ratio	0001~9999
	Ct		
Communication	Add	Address	1~247
	C	baud rate(bps)	1200,2400,4800,9600
LCD backlight	LCD	Backlight last time(s)	1-250,0 is constant ON LED is of no effect
Alarm set	U.H	Over voltage alarm set	0 ~150.0% :150.0%(close)
	U.L	Under voltage alarm set	0 ~100.0% :0.0%(close)
	A.H	Over current alarm set	0 ~150.0% :150.0%(close)
	A.L	Under current alarm set	0 ~100.0% :0.0%(close)
	AL.t	Alarm last time(s)	1.0-20.0(resolution ratio0.1s)
Relay (DO output)	do1.t	Relay 1 close last time(s)	0~20:resolution ratio
	do2.t	Relay 2 close last time(s)	1s;0:relay under working
	do2.U	Relay 2 usage	io:switching value (K); AL:alarm output(J)
Analog	o.L	Analog lower limit set	0~100.0%
	o.H	Analog upper limit set	0~120.0%
	o.U	Analog output choose	U,A,P
Energy clear	CLr E	Energy clear	Note 1
Code	PS.	Program protect code	0000~9999
Save	SAvE	Inquire if save	Press SET to save and exit; Press ESC to quit and exit

Note:
 1. Clear energy after flicker, press **◀** or **▶** to CLr E , then press **SET** .Energy clear needn't save and irreparability, please be care to operate.
 2. percentile scale is calculated relative to rating range.
 3. Because of different type of meters, parts parameters setting is of no effect. Such as :set AH in PZ72-DU.

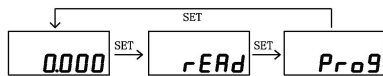
5.3 Program process

5.3.1 PZ72 series

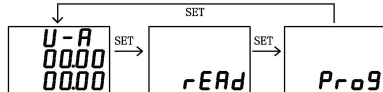
In normal menu, press **SET** , as following:



5.3.2 PZ96B series In metrical menu, press **SET** , as following:



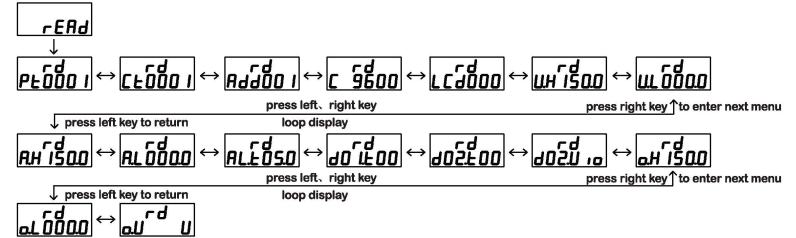
5.3.3 PZ96 series In metrical menu, pres **SET** , as following:



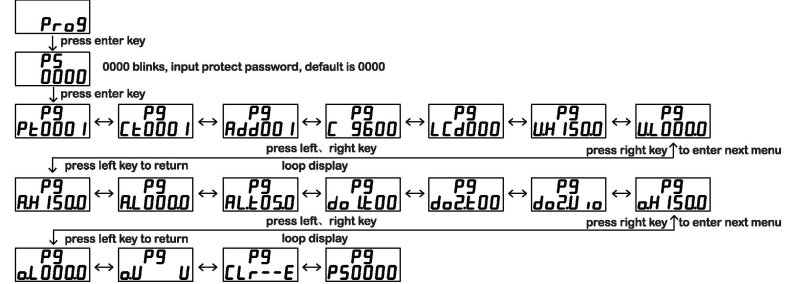
Explanation:

rEAd — read menu, in this menu press **↵** to enter;
 Prog — program menu, in this menu press **↵** to enter.

5.3.4 rEAd menu



5.3.5 Prog menu



Note:

You can press left . right key to switch, the display blinks when you press the Enter key, it means that you can set. After that, press SET key to quit, press Enter key to confirm. If you press the Enter key, then press the SET key, the display blinks with "SAVE", press Enter to save or press SET to exit.

5.4 Function set and usage

5.4.1 Ratio change set

Voltage ratio and current ratio is based on 1V and 1A. Before leaving factory according to user's request, we confirm suitable range and input the range signal outside. If the voltage and current ratio are "1", the meter displays 1V and 1A..After setting ratio, the meter displays corresponding data. The user cannot change the value of signal input. If the user orders 100V/5V and 100A/75mV meter, they can change PT from 100 to 220 and change CT from 100 to 500 when they find the transducer is 220V/5V and 500A/75mV in working scene. But to confirm that the signal output of DC transducer is unchanged, in this example is 5V and 75mV.

5.4.2 Communication and parameter set

Modbus-RTU protocol: "9600,8,n,1".
 Communication parameter follows 5.2 menu symbol and explanation, program process follows 5.3.4 to enter "Prog" menu.

5.4.3 Alarm function and parameter set

In alarm state:

AL No-Err	AL U---Hi	AL U---Lo	AL A---Hi	AL A---Lo
Normal	Over voltage	Under voltage	Over current	Under current

In normal measurement state, if alarming, the corresponding value glitters. If do2.U is set AL in Prog menu, one output will generate on relay DO2 when alarming.

Read alarm state via RS485,address refers to 6.4.

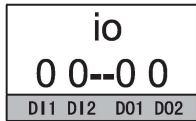
Alarm function set refers 5.2,program process refers to 5.3.4 Prog.

If alarm function is default close, except the clients need.

When the input signal is zero, the meter closes alarm function.

5.4.4 Switching values function and output control

Press \ominus to check DI/DO in normal state::



Digital input is DI1,DI2,digital output is DO1,DO2

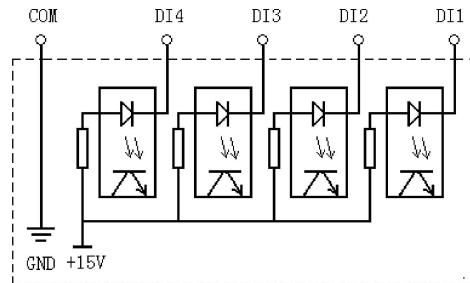
Besides ,LCD meter needn't use shortcut key to check DI/DO.

In switching value state page, press \ominus to enter local digital output control(similar to view menu, but digital output flicker bit is changeable);Press $\leftarrow \rightarrow$ to input code(default set:0000,code setting follows 5.4.7)

Number flicker figures changeable, press \leftarrow to choose items, press \rightarrow to change ,press \ominus to confirm, press SET to quit changing.

Remote reading and controlling follows 6.5

Digital output is opening relay; Digital input is optical isolation., dry contact input, brief theory as follow:



5.4.5 Analog output and set

Ao.L(Ao.Lo):analog lower limit setting; Ao.H(Ao.Hi):analog upper limit setting;Ao.U:analog output option of power and energy meter, corresponding to voltage,current,power; range setting refers to 5.2

E.g.:DC500A/75mV,corresponding to one channel 4-20mA,DC0A-4mA,DC500A-20mA;

Setting:Ao.L(Ao.Lo):0.0(%); Ao.H(Ao.Hi):100.0(%).

Explanation:Ao.L(Ao.Lo),Ao.H(Ao.Hi) setting value is the percentage of rating value.

5.4.6 LCD backlight control

Enter Prog menu, $\leftarrow \rightarrow$ choose PASS,press \ominus to enter change state; $\leftarrow \rightarrow$ to choose LCD backlight time:000~250s,LED meter is of no effect.

000:LCD constant ON

250:LCD backlight turns to decline light after 250s to delay the life.

5.4.7program code set

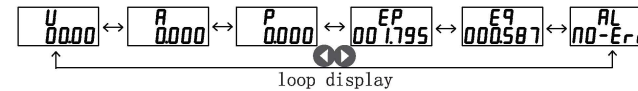
Enter Prog menu, press \leftarrow to display PASS ,press \ominus to enter change state; press \leftarrow

\rightarrow to change code:0000~9999,enter \ominus to confirm, press SET to quit. After changing, program protect code and digital output protect code are all new codes. Default code:0000, omnipotence code:0008

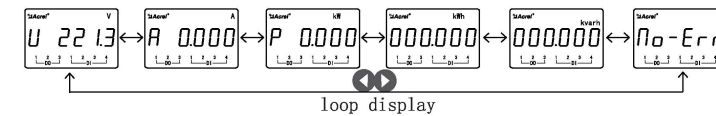
5.5 Measurement data

5.5.1 LED energy meter

For current,voltage meter, measurement value display on original menu; For power,energy, press SET to check each parameter.



5.5.2 LCD energy meter



Explanation:

U:Voltage value(PRI), unit:V

A:Current value(PRI) unit:A

P:Power(PRI) unit:KW

Ep:positive energy(PRI) unit :kWh

Eq:reverse energy(PRI) unit:kvarh

AL:alarm

In fact, the reverse energy's unit is kWh,defined kvarh is to distinguish.

Other types are similar to energy meter, without associated data display.

6. Communication protocol

6.1 general

PZ series meters adopt Modbus-RTU protocol:“9600,8,n,1”,9600 is default baud rate, it can be revised as 1200,2400,4800,19200,setting method refers to 5.4.3;8 figures 8 data bit;n figures non-parity check bit;1 figures 1 stop bit.

Error check:CRC16

6.2 protocol

When data frame reaches terminal unit, it enters the addressed unit through a simple “port”, this unit take out data frame “envelope”(data head) to 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.

6.2.1 Data frame format

Address	Function	Data	Check
8-Bits	8-Bits	N×8-Bits	16-Bits

6.2.2 Address (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 this meters, just1~247 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 address,

only the addressing terminal is responding enquiry including this address. When terminal is transmits one responding, the responding slave address data tell host computer that which terminal is communicating with it.

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:

Order (hexadecimal)	Function	Explanation
03H	Read order	To read the measurement data from device
10H	Write order	To write the parameters into the device

6.2.4 Data (Data) domain

Data field includes 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 specify the starting register and how many data to read. The built-in address and data have different content depending on type and slave computer.

6.2.5 Error check (Check) domain

This domain adopts 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.

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6.3 Method to create error check code (CRC)

Error check (CRC) domain occupies 2 byte, including one 16 bit binary system value. CRC value is calculated by transmission device, and 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.

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 Code list (Word) :

Code	Item	Explanation	R/W: R — read; W — write 0012H are W; others are R.
0000H	Voltage RMS	Voltage(unit:V)	
0001H	Voltage index	-9999 ~ 9999	
0002H	Current RMS	Current(unit:A)	
0003H	Current index	-9999 ~9999	
0004H	-		
0005H	-		
0006H	-		
0007H	-		
0008H	Power RMS	Power(unit:W)	
0009H	Power index	-9999 ~ 9999	
000aH	-		
000bH	-		
000cH	Ep high	Posive energy (unit:Wh)	
000dH	Ep low	0~999999999	
000eH	Eq high	Negative energy (unit:varh)	
000fH	Eq low	0~999999999	
0010H	Pt	Voltage ratio	
0011H	Ct	Current ratio	
0012H	Alarm and I/O	Detail as below	
0013H	-		

Explanation:

① Voltage,current,power calculate method:(Eg:6.5.1)

Read value=RMS *10 (index-3)

0012H:Alarm and DI/DO bits.

15	...	11	10	9	8	7	6	...	1	0
—		A.-H	A.-L	U.-H	U.-L	DI1	DI2	—	DO1	DO2
-		Over current, low alarm	Over voltage, low alarm	Digital input			Digital output			

Explanation:

① “—” figures reserved bit or byte.

② alarm symbol bit:1 is on alarm,0 is no alarm.

6.5 Communication application

Addr	Fun	Data start		Data off		CRC16	
		reg Hi	reg Lo	reg Hi	reg Lo	Lo	Hi
01H	03H	00H	00H	00H	06H	C5H	C8H
Address	Order	Start data		Read data number		CRC check	

6.5.1 read data

E.g.: read current data

Check data frames	01 03 00 02 00 02 65 cb
Return data frames	01 03 04 03 b2 00 00 5a 50

Explanation:

01:Slave Address 03:Function code
04:04:hex;decimal is 4;figures 4 bytes data behind
5a 50:CRC

Data processing method refers to:6.4

Process as follow: 03 b2(hex) = 946 (decimal)

00 00(hex) = 0 (decimal)

Calculate:946*100-3 = 0.946; unit:A

So the meter displays:

I	0.946
---	-------

The voltage meter is similar to current meter, but the incept address is 00H,query data frame: 01 03 00 00 00 02 c4 0b Each address refers to:6.4

E.g. 2:read positive energy data

Check data frames	01 03 00 0c 00 02 04 08
Return data frames	01 03 04 00 00 30 26 f e9

Data process:

High bit: 00 00(hex) = 0 (decimal)

Low bit:30 26(hex) = 12326 (decimal)

So this meter has measurement secondary active energy:

(0*65536 + 12326)/1000 = 12.326 Unit:kWh

Reactive energy is sameness;if need primary energy data, multiply voltage,current ratio self.

6.5.2 write data

E.g. 3:digital output remote control(control byte:0012H)

Write data frames	01 10 00 12 00 01 02 00 02 24 e3 (DO1 close)
	01 10 00 12 00 01 02 00 01 64 e2 (DO2 close)
	01 10 00 12 00 01 02 00 03 e5 23 (DO1,DO2 close)
Return data frames	01 10 00 12 00 01 A1 CC(unsuccesful, no return)

Explanation:

Write 1 into digital output byte ,then close; Write 0,then break.

When the relay close constant time is not 0(0 figures long closing),it acts setting value.