

239



AMC 系列可编程智能电测表

AMC series Programmable Intelligent Electric Parameter Meters

——三相电流、电压部分

Three phase current, Three phase voltage Power

(AI3、AV3)

(A13. AV3)

安装使用说明书 V1.2

Installation and operation instruction V1.2

安科瑞电气股份有限公司

Acrel Co.,Ltd

申 明

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1. 概述 General

AMC 系列可编程智能三相电流、电压表，采用交流采样技术，可直接测量三相电网中的电流和电压。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，采用兼容 Modbus-RTU 协议；可将电量信号转换成标准的模拟量输出；或带一路继电器报警输出；或带四路（两路）开关量输入 / 两路开关量输出。根据不同要求，通过仪表面板按键，对变比、报警、通讯等参数设置和控制。

AMC Series programmable intelligent three phase current, voltage meter, adopting AC sampling technology, can directly measure current and voltage of 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 change electric parameter signal into standard analog output; or with 1 channel relay alarm output; or with 4 channel(2 channel) switching input/ 2 channel 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 Meter type	基本功能 Basic function	外形 Shape	可选功能 Optional function
AMC48-A13 AMC48-AV3	三相电流（或电压）测量； Three phase current (or voltage) measurement, LED 数码管显示 LED digital display	48 方形 Square	无
AMC 48L-A13 AMC 48L-AV3	三相电流（或电压）测量； Three phase current (or voltage) measurement, LCD 液晶显示； LCD liquid crystal display		
AMC 72-A13 AMC 72-AV3	三相电流（或电压）测量； Three phase current (or voltage) measurement., LED 数码管显示： LED digital display	72 方形 Square	1、一路 RS485 通讯(/C) 1 、 1 channel RS485 communication(/C) 2、一路变送输出(/M) 2 、 1 channel transmitting output (/M) 3、一路变送输出+一路 RS485 通讯(/MC) 3、 1 channel transmitting output+1 channel RS485 communication(/MC) 4、一路 RS485 通讯+开关量 2D12DO(/KC) 4 、 1 channel RS485 communication+ switching2D12DO (/KC)
AMC72L-A13 AMC72L-AV3	三相电流（或电压）测量； Three phase current (or voltage) measurement, LCD 液晶显示； LCD liquid crystal display		

AMC96-AI3 AMC96-AV3	三相电流(或电压)测量; Three phase current (or voltage) measurement, LED 数码管显示: LED digital display	96 方形 Square	1、一路 RS485 通讯 (/C) 1、1 channel RS485 communication (/C) 2、最多三路变送输出(/M 或/M3) 2、at most 3 channels transmitting output (/M or/M3)
AMC96L-AI3 AMC96L-AV3	三相电流(或电压)测量; Three phase current (or voltage) measurement, LCD 液晶显示; LCD liquid crystal display		3、变送输出+RS485 通讯 (/MC 或/M3C) 3、transmitting output+RS485 communication (/MC or/M3C) 4、RS485 通讯+开关量 4DI2DO (/KC) 4、RS485 communication+ switching 4DI2DO (/KC)
注: /J 为一路继电器报警输出 (与第二路开关量输出复用), 如有特殊需求请咨询本公司 Note: /J is 1 channel relay alarm output (multiplexing with second channel switching output), for special request, please consult our company			

3 技术参数 Technical parameters

技术参数 Technical parameter		指标 Value
输入 Input	标称值 Nominal value	交流电压: AC100V、220V、380V; 交流电流: AC1A、5A; AC voltage: AC100V、220V、380V; AC current: AC1A、5A; 特殊规格可事先咨询 Consult special specification in advance
	过载 Overload	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 Voltage: 1.2 times continuous, 2 times continuous 1 second; current: 1.2 times continuous, 10 times continuous 1 second
	频率 Frequency	45Hz~65Hz
	功耗 Power consumption	各电压、电流输入回路功耗均小于 0.5VA Power consumption of each voltage, current Input circuit is less than 0.5VA
精度等级 Accuracy class		0.5 级
功能 Fuction	显示 Display	LED 或 LCD 显示, 倍率可任意设置, 报警、开关量指示; LED or LCD display, can set multiplying power, alarm, switching indication —路模拟量时, 可程序设计设置对应显示; For 1 channel analog, display related programmable setting, AMC48 三相表的显示方式可编程设置: 三相数据轮回显示或手动切换 显示 (按左右键切换) 相应的指示灯会点亮。 The display mode of AMC48 three-phase meter can be set by programming. Three-phase data cycle display or manual switch display (press left/right key to switch). The corresponding indicator light will be on.

	通讯 Communication	RS485, Modbus-RTU 兼容协议; 1 个起始位, 8 个数据位, 1 个停止位, RS485, Modbus-RTU compatible protocol; 1 start bit, 8 data bit, 1 stop bit, 无奇偶校验;波特率: 2400/4800/9600/19200 bps no parity,Baud Rate 2400/4800/9600/19200 bps	
	报警 Alarm	1 路无源继电器, 触点容量 1A/30VDC, 1A/250VAC, 1 channel passive relay, contact capacity 1A/30VDC, 1A/250VAC, 高、低、不平衡报警等 Used for high、 low, unbalance alarm etc.	
	模拟量 Analog	DC4~20mA、DC0~20mA(负载 < 500 Ω), DC4~20mA, DC0~20mA(load < 500 Ω), DC0~5V(负载 > 1kΩ)等 DC0~5V(load >1kΩ) etc.	
	开关量 Switching	输入 Input	四路或两路干接点输入, 内置电源, 光耦隔离 4 channel or 2 channel dry contact Input, built in power supply, optoisolator
输出 Output		两路开关量输出, 常开继电器触点, 容量: 1A/30VDC, 1A/250VAC 2 channel switching output, NO relay contact, capacity: 1A/30VDC, 1A/250VAC	
电源 Power supply	电压范围 Voltage range	AC220V	
	功耗 Power consumption	<5VA	
绝缘电阻 Insulation resistance		≥100M Ω	
工频耐压 Power frequency withstand voltage		外壳与各端子组(除参比电压≤40V 的端子)之间 AC 4kV/1min(RMS) Between the shell and all set of terminals (except the set of terminals reference voltage less than 40V) AC 4kV/1min (RMS) 电源端子组与信号输入、输出端子组之间 2KV/1min(RMS) 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 Mean time between failures		≥50000h	
环境 Environment	温度 Temperature	工作: -10° C ~+55° C 贮存: -25° C ~+70° C Operation: -10° C ~+55° C Storage: -25° C ~+70° C	
	湿度 Humidity	≤93%RH,不结露, 不含腐蚀性气体 ≤93%RH, no condensation, without corrosive gas	

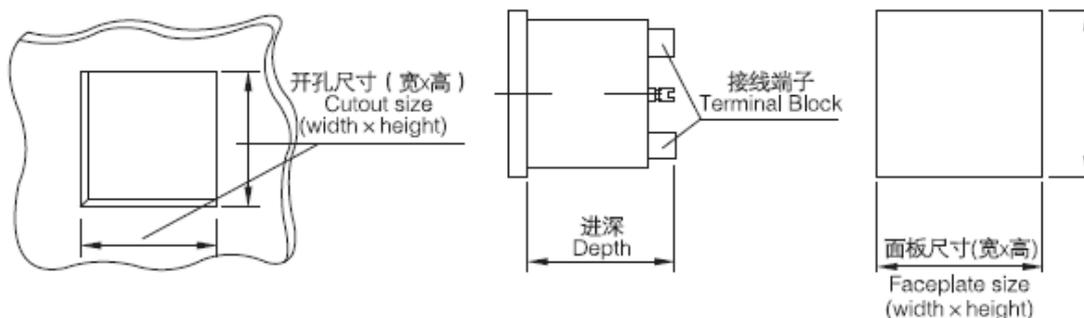
	海拔 Altitude	≤2500m
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4 安装指南

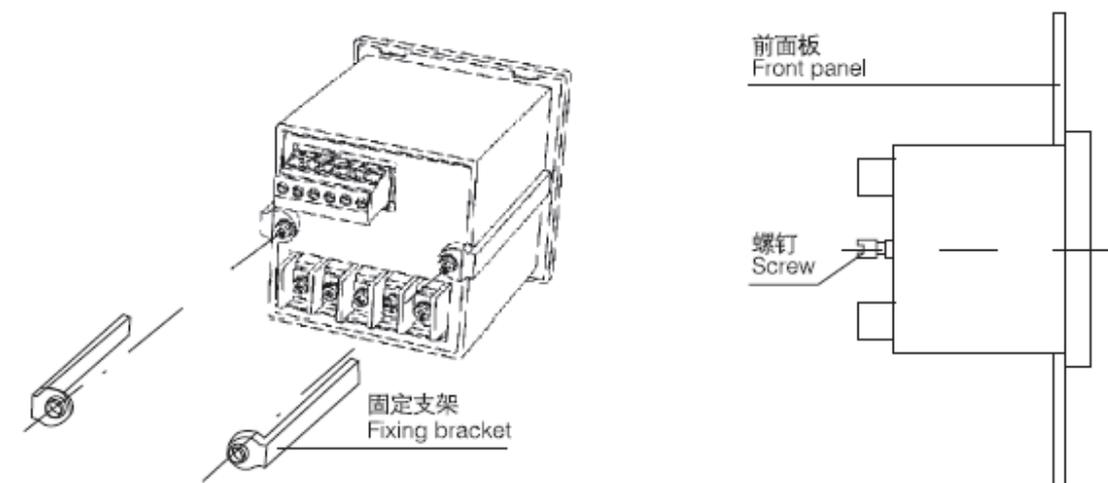
4.1 外形及安装开孔尺寸 Outline and mounting cut out size

仪表外形 Shape	面板尺寸 Panel		壳体尺寸 Housing			开孔尺寸 Cut out	
单位: mm Unit: mm	宽 Width	高 Height	宽 Width	高 Height	深 Depth	宽 Width	高 Height
48 方形 48 Square	48	48	44	44	100	45	45
72 方形 72 Square	75	75	66	66	98	67	67
96 方形 96 Square	96	96	86	86	92	88	88

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

安装时，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。

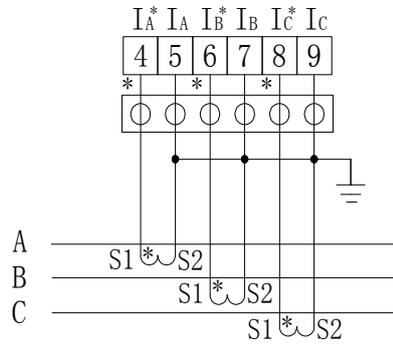
When meter is installing, embedded meter into mounting hole, restore fixed support, tighten screw, fix meter firmly. 48 shape is the card reed extrusion installion.

4.5 端子排列及接线

4.5.1 三相电流表电流信号端子

4.5 Terminal arrangement and connection

4.5.1 Current signal terminal of three phase current meter

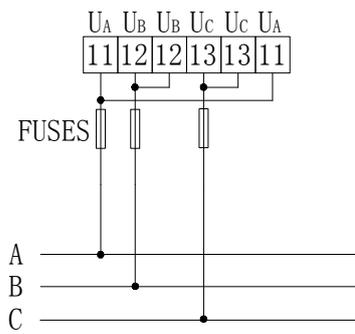


三相电流

three phase current

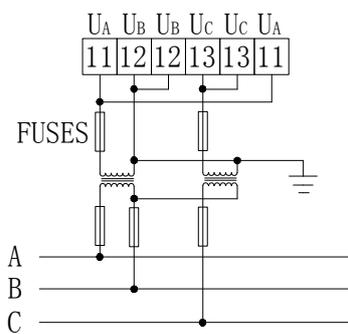
4.5.2 三相电压表电压信号端子

4.5.2 Voltage signal terminal of three phase voltage meter



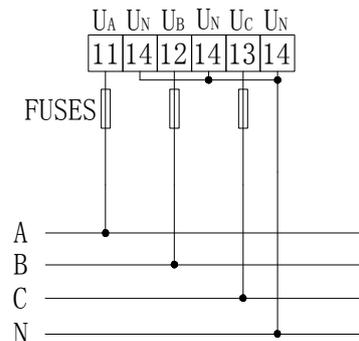
三相三线

Three-phase three-wire



三相三线

Three-phase three-wire

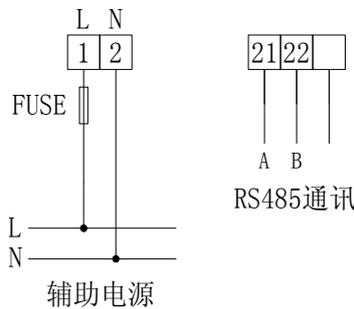


三相四线

Three-phase four-wire

4.5.3 电源端子、RS485 通讯端子

4.5.3 Power supply terminal, RS485 communication terminal



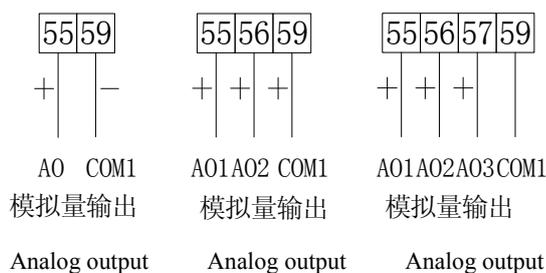
辅助电源

Auxiliary power supply

RS485 communication

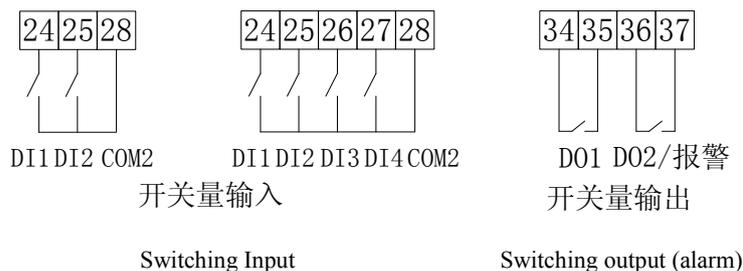
4.5.4 模拟量输出端子

4.5.4 Analog output terminal



4.5.5 开关量输入/输出（报警）端子

4.5.5 Switching Input / output (alarm) terminal



注：

- 1、符号表示电流进线端，该接线仅供参考，具体见实物；
- 2、/J 表示报警输出继电器，与开关量输出 D02 复用。

Note:

1. Symbol "*" represent the current inlet terminal, this connection is only for reference, the practice is decided by actual condition
2. /J represent the alarm output relay, multiplexing with switching output DO2.

4.6 注意事项

4.6 Notice

4.6.1 电压输入

输入电压应不高于产品的额定输入电压(100V、220V、380V)的 120% 否则应考虑使用 PT；
在电压输入端须安装 1A 保险丝；

4.6.1 Voltage Input

Input voltage shall not exceed 120% of product rated input voltage (100V、220V、380V), otherwise PT shall be used,
On the voltage input end, 1A fuse shall be fitted.

4.6.2 电流输入

电流输入应使用外部 CT；
如果使用的 CT 上连有其它仪表，接线应采用串接方式；
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联机之前，一定要先断开 CT 一次回路或短接二次回路；

4.6.2 Current Input

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

模拟量输出与开关量输入的 COM 表示公共端，并不是实际接地。

模拟量输出与开关量输入之间公共端不得相连；

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。

通讯连接建议使用两芯屏蔽线，每芯截面不小于 0.5mm²，分别接 A、B，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。

4.6.3 Adding function connection

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;

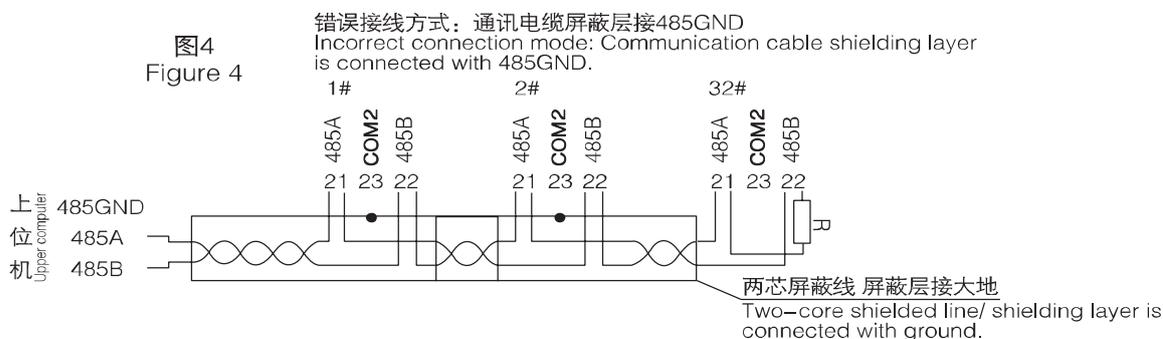
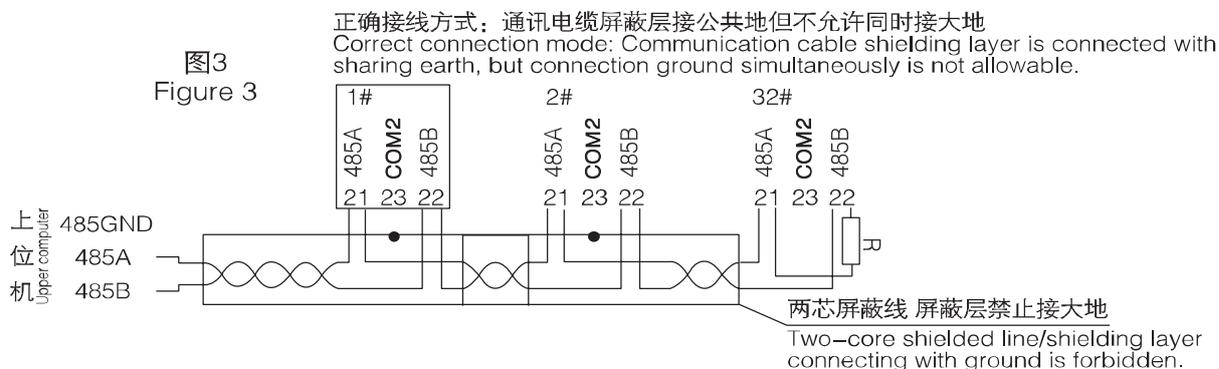
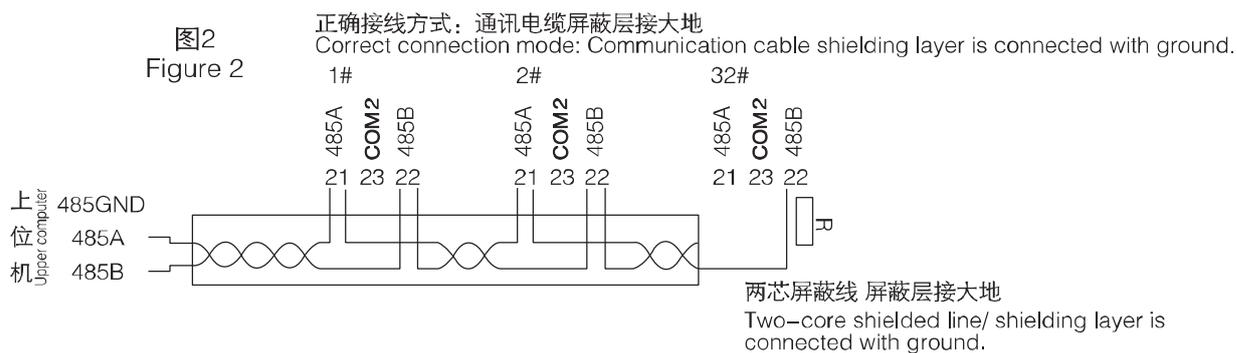
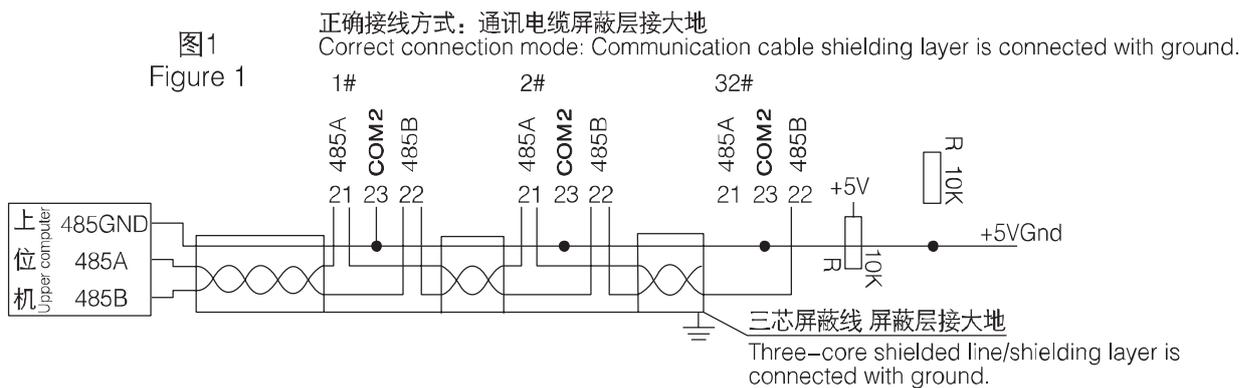
This meter provides asynchronism half duplex RS485 Communication interface, adopts MODBUS- RTU protocol, various data information may be transmitting on the Communication line .Theoretically, on the same line, meters up to 128 may be connected at the same time, each meter can set up its Communication address (Addr). Communication rate (baud) may be selected.

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

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

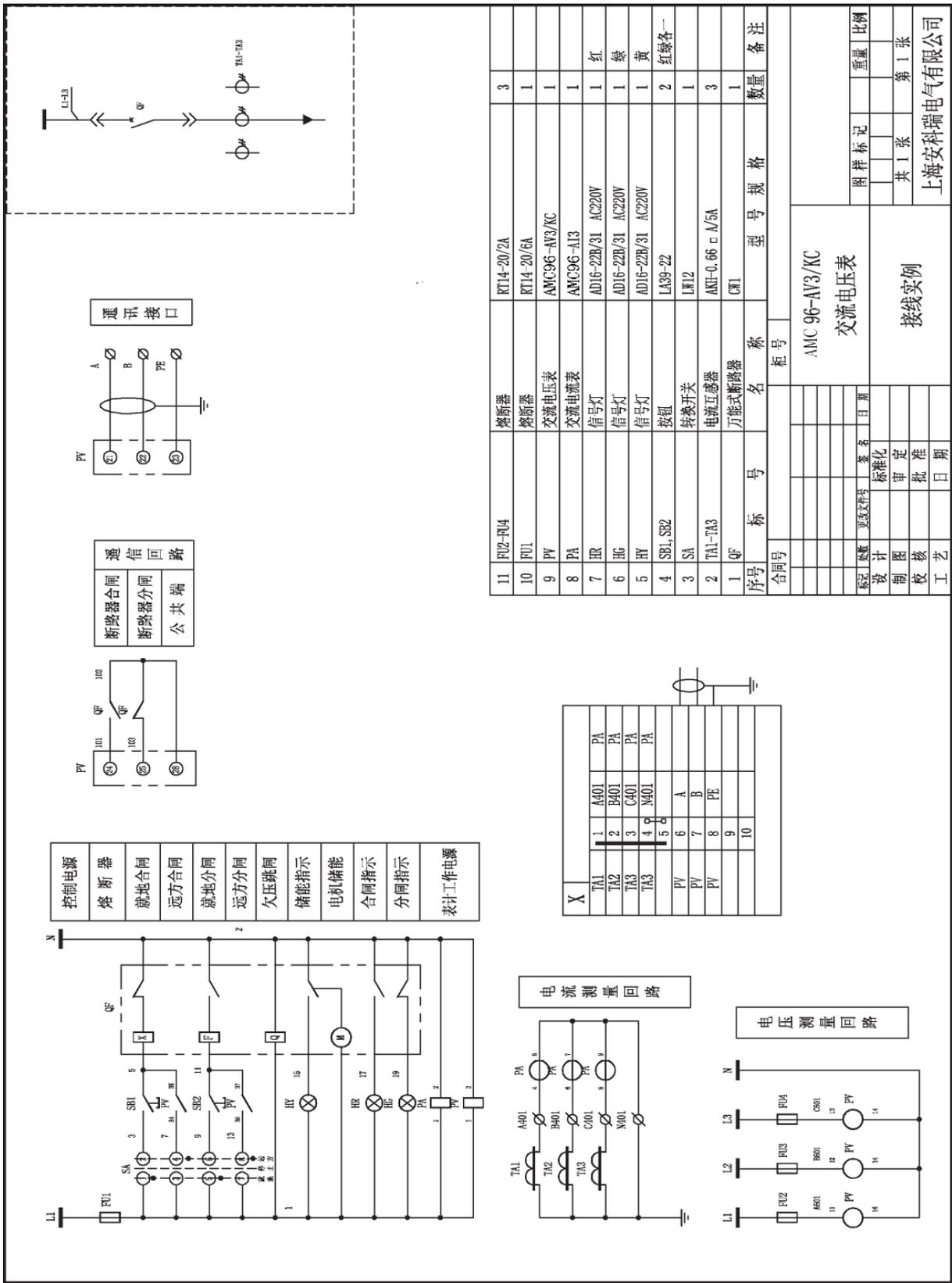
关于通讯部分的接线实例如下图所示：

Four connection mode in communication section are shown as following:

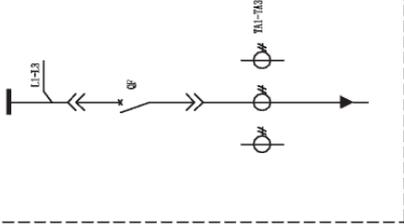
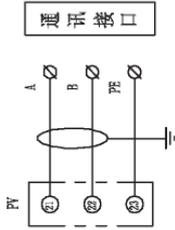
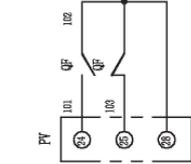


建议最末端仪表的 A、B 之间加匹配电阻，阻值范围为 120Ω-10kΩ

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

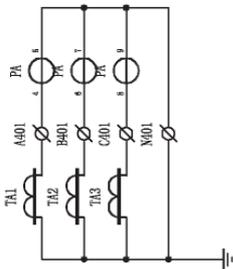


控制电源
熔断器
就地合闸
远方合闸
就地分闸
远方分闸
欠压跳闸
储能指示
电机储能
合闸指示
分闸指示
表计工作电源

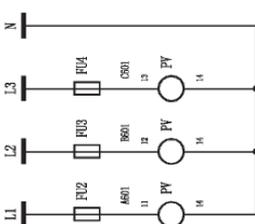


X	TA1	1	A401	PA
	TA2	2	B401	PA
	TA3	3	C401	PA
		4	M401	PA
		5		
	PV	6	A	
	PV	7	B	
	PV	8	PE	
		9		
		10		

电流测量回路



电压测量回路



11	FU2-FU4	熔断器	RT14-20/2A	3	
10	FU1	熔断器	RT14-20/6A	1	
9	PV	交流电压表	AMC96-AV3/KC	1	
8	PA	交流电流表	AMC96-AI3	1	
7	HR	信号灯	AD16-22B/31 AC220V	1	红
6	HG	信号灯	AD16-22B/31 AC220V	1	绿
5	HV	信号灯	AD16-22B/31 AC220V	1	黄
4	SBL, SBZ	按钮	LA99-22	2	红绿各一
3	SA	转换开关	LW12	1	
2	TA1-TA3	电流互感器	AKH-0.66 □ M/5A	3	
1	QF	万能式断路器	CW1	1	
序号	标号	名称	型号规格	数量	备注
合同号					
柜号					
AMC 96-AV3/KC					
交流电压表					
接线实例					
设计	数量	更改文件号	签名	日期	重量
制图	审核	批准	日期	共 1 张	第 1 张
校核	工艺				
上海安科瑞电气有限公司					

5. 使用指南

5.1 按键

5.1 Press-key



SET 键—功能切换或返回上一级菜单；正常显示、只读菜单、程序设计菜单之间切换；

左移键—同侧单左移或数据减小；

右移键—同级菜单右移或数据增大；正常状态下按住此键，显示报警信息；

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

5.2 Indication and control page

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

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

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

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

类别 Category	符号 Symbol	含义 Meaning	范围 Range
主菜单 Main menu.	rEAd	只读菜单 Read only menu	
	Prog	编程菜单 Programming menu	
变比（倍率） Transformation ratio (multiplying power)	Pt(Ct)	互感器倍数 Transformer multiples	0001-9999
通讯 Communication	Addr	通讯地址 Communication Address	1-247
	bAUd	通讯波特率(kbps) Communication baud rate (kbps)	2.4、4.8、9.6、19.2
液晶背光 LCD backlight	LCd	背光延时时间（s） Backlight delay time (s)	1-250, 0 为常亮 1-250, 0 lights LED 仪表此项无效 LED meter invalid
报警随 Alarm setting	AL.Hi	高报警设置 HIGH alarm setting	0-150% (150%: 关闭) 0-150% (150%: closed)

	AL.Lo	低报警设置 LOW alarm setting	0-100% (0%: 关闭) 0-100% (0%: closed)
	AL.-b	不平衡报警设置 Unbalance alarm setting	0-100% (0%: 关闭) 0-100% (0%: closed)
	AL.-t	报警延时时间 (s) Alarm delay time (s)	0.0-20.0 (分辨率 0.1s) 0.0-20.0 (resolution 0.1s)
继电器 (DO 输出) Relay (DO output)	do1.t	继电器 1 闭合持续时间 (S) Relay 1 closing duration (s)	0.0-20.0 (分辨率 0.1s) 0.0-20.0 (resolution 0.1s)
	do2.t	继电器 2 闭合持续时间 (s) Relay 2 closing duration (s)	0 表示电器工作在保持方式 0 indicate relay is in keeping mode
	do2.U	继电器 2 的用法 Usage of relay 2	io: 作开关量(K); io: used for switching (K); AL:作报警输出 (J) AL: used for alarm output (J)
模拟量 analog	Ao. Lo	模拟量下限设置 Analog lower limit setting	0-100%
	Ao.Hi	模拟量上限设置 Analog upper limit setting	0-120%
	Ao1.U	/M 时, M 对应输出哪一路; /M, M corresponding output channel; /M3 时 Ao1.U 必翻 1 /M3, Ao1.U must be 1	1(A)、2(B)、3(C)
量程 Measuring range	SP-U(A)	额定输入信号 Rated Input signal	电压: AC 100、220、380V 等; Voltage: AC100, 220, 380V etc.; 电流: AC1, 5A 等 Current: AC1, 5A etc.000
密码 Password	PASS	程序设计保护密码 Protective password programming	0000-9999

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

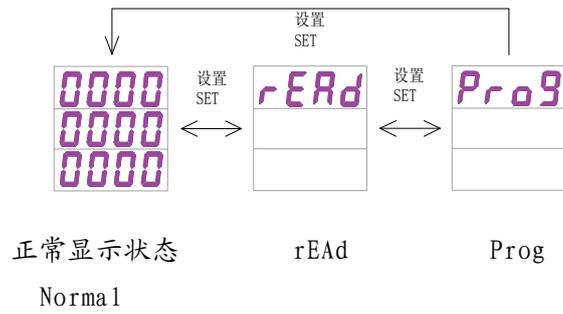
Note: Setting flow of each parameter see 5.3.4 Prog Menu; percentage is corresponding to the rated input signal

5.3 程序设计流程

5.3.1 在正常显示画面时, 按 SET 键, 如下

5.3 Programming flow chart

5.3.1 In normal display frame, press SET key, as follows:



说明:

rEAd-只读菜单, 在此页面, 按回车键进入

Prog-程序设计菜单, 在此页面, 按回车键进入;

Explanation:

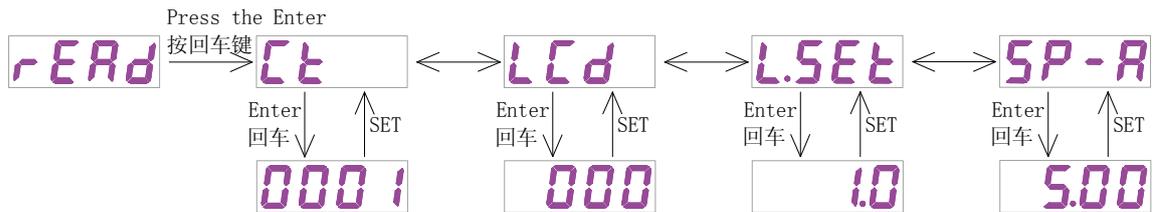
rEAd - read only menu, at this page, press ENTER key Enter.

Prog - Programming menu, at this page, press ENTER key Enter.

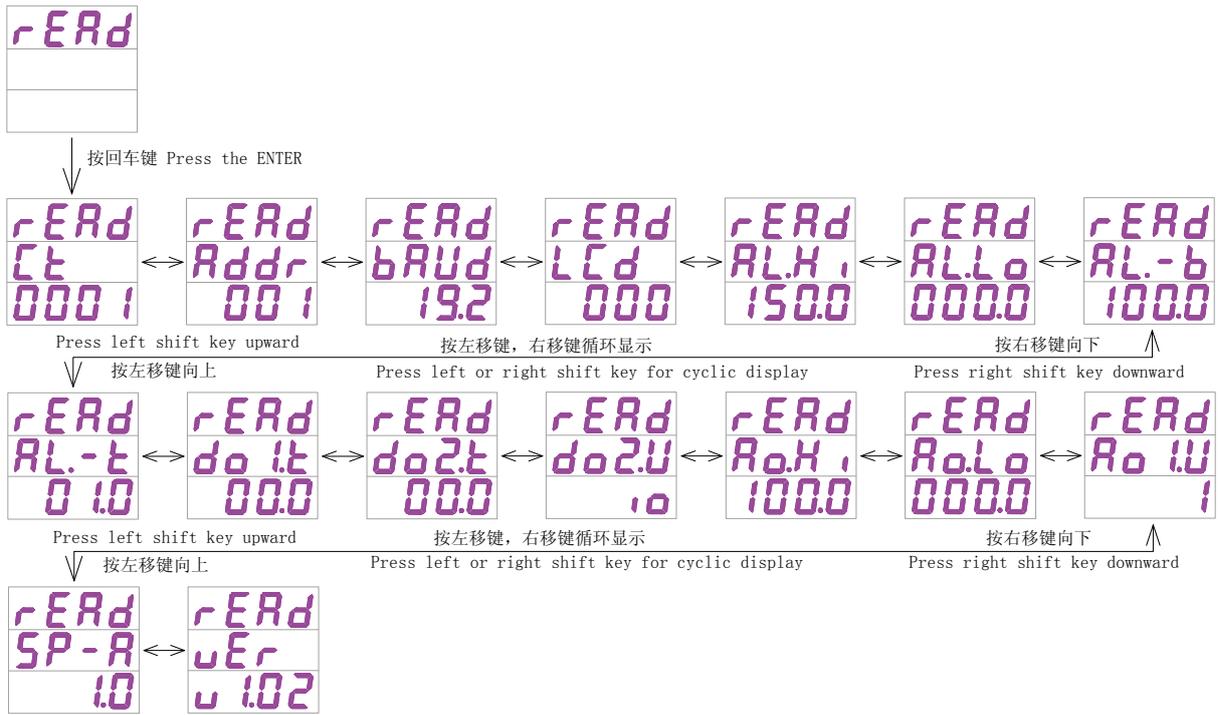
5.3.2 rEAd 菜单

5.3.2 rEAd menu

AMC48 三相电流 (AMC48-AI3)



AMC72(96)三相电流表 (AMC□□-AI3/*):



说明：此 rEAd 菜单可按左移、右移键查看设置的各种参数，按 SET 键返回上一级菜单。

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

Description:

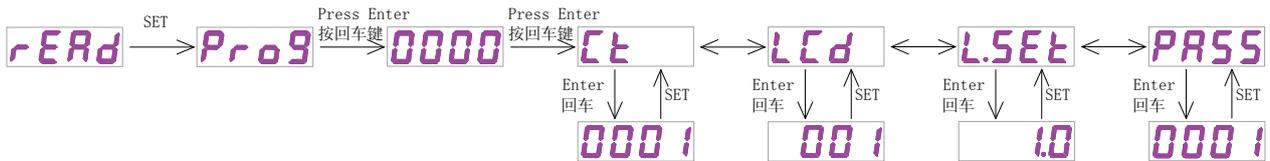
Left/right key select parameter menu to be look over, press Enter key to enter look over concrete setting, for returning to press SET key.

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

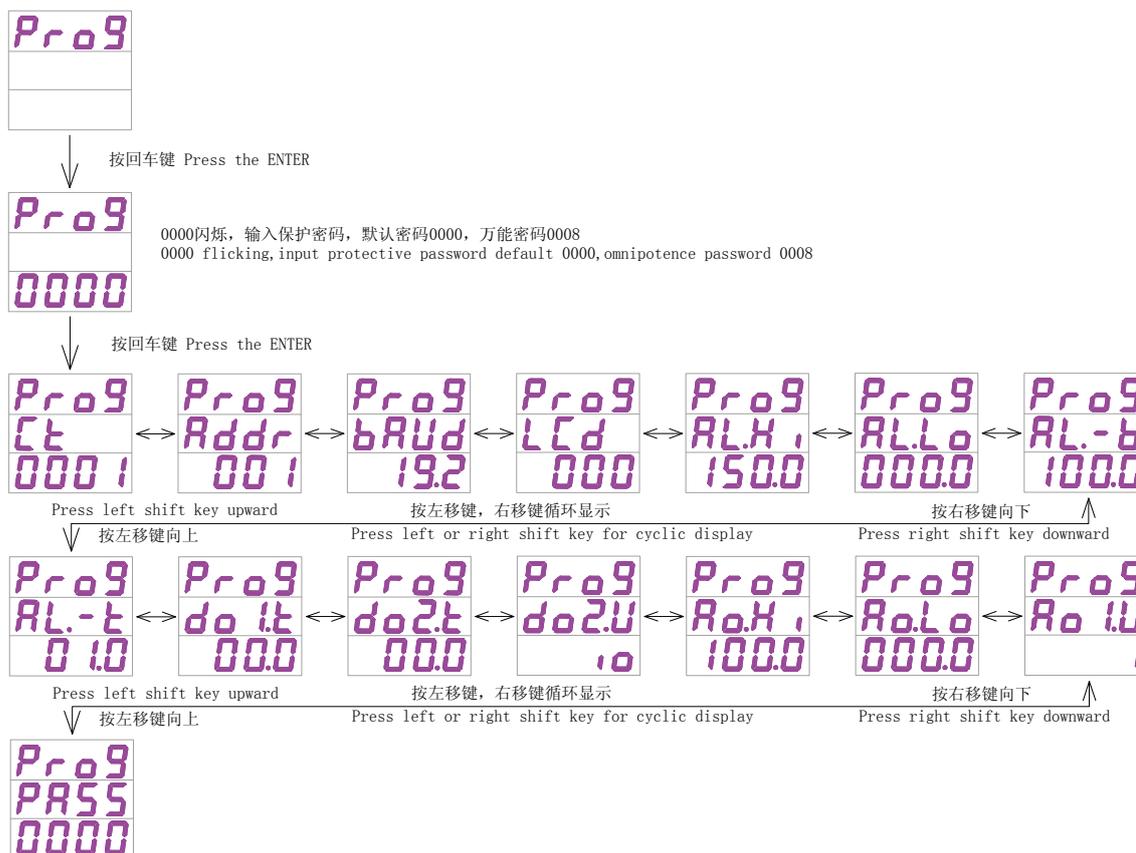
5.3.3 Prog 菜单

5.3.3 Prog menu

AMC48 三相电流 (AMC48-AI3)



AMC72(96)三相电流表 (AMC□□-AI3/*) :



说明:

Prog 菜单可按左移、右移键切换，按回车键则第三行数码闪烁，表示可修改；修改后按回车键确认。

按 SET 键出现闪烁的 SAVE，询问是否保存，如需保存按回车键确认，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。

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 2 place is different: 1.Pt replace Ct; 2.SP.U replace SP.A.

5.4 功能设置与使用

5.4 Function setting and using

5.4.1 倍率更改设置

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

计算方法：10000V ÷ 100V = 100

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

一般当测量数据大于或等于 10kV 或 10kA 时，面板上的单位指示 k 灯会亮。

5.4.1 Multiplying power revise setting

Example 1: AC10kV/100V voltage meter: Enter Prog menu, revise Pt as 100,

Computing Method: 10000V ÷ 100V = 100

Example2: AC500A/5A current meter: Enter Prog menu, revise Ct as 100. Generally, if measured data ≥ kV or 10kA, faceplate's

Unit Indication k lamp lights .

5.4.2 通讯功能及录设置

兼容 Modbus-RTU 协议：“9600, 8, n, 1”，尔 LED 仪表接收到通讯数据时，仪表面板上的通讯指示灯(COM)会亮；液晶显示无通讯指示。

通讯参数见 5.2 菜单符号及意义，程序设计流程见 5.3.3，进入 Prog 菜单。

5.4.2 Communication function and parameter setting

Compatible Modbus-RTU protocol: "9600, 8, n, 1", when LED meter receive communication data, communication Indication lamp (COM) on the meter faceplate lights; liquid crystal display have no communication Indication.

Communication parameter see 5.2 menu symbol and meaning, programming flow see 5.3.3, Enter Prog menu.

5.4.3 报警功能及设置

报警状态（正常测量时，按住右移键，可查看报警信息）

1 ---	1 - H i	1 ---	E r r	三相数据全为 0 时不报警
2 ---	2 ---	2 ---		
3 ---	3 ---	3 - L o	L i n E	
正常	U1(I1)过高	U3(I3)过低	不平衡或缺相	

正常测量时，哪一路有报警产生，则哪一路显示数据会闪烁，不平衡报警时，三路全闪烁。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（继电器常开接点闭合），且面板上 DO2 指示灯亮。

报警状态可通讯读取，参量地址见 6.4 三相表通讯 参量验表

报警功能设置，参观 5.2 菜单符号及意义，设置流程见 5.3.3Prog 菜单。

报警功能默认为关闭状态，除非客户要求。

5.4.3 Alarm function and parameter setting

Alarm condition (in normal measuring, pressing Right shift key, can look over alarm information)

In normal measuring, for alarming channel, this channel display data is flickering, for unbalance alarming, all three channels are flickering. In Prog menu, if do2.U setting as AL, when alarming, one output comes from relay D02 (relay NO contact is closing), D02 Indicator on the faceplate lights.

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

Alarm function setting, parameter see 5.2 menu symbol and meaning, setting flow see 5.3.3 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

正常测量时，按下回车键，可查看开关量状态，如下：

5.4.4 Switching function and output control

In normal measuring, press down ENTER key, can look over switching condition, as follows:



DI1 DI2 DI3 DI4 （开关量输入 Switching input）

DO1 DO2 （开关量输出 Switching output）

如图表示：开关量 DI3 有输入，开关量 D02 有输出（即继电器闭合）

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，单击回车键，进入本地开关量输出(继电器)控制页面(St, io)，左右键输入保炉密码（出厂设置：0000，密码设定见 5.4.7),回车确认进入：

As diagram shown: switching DI3 have input, switching D02 have output (i.e. relay closed)

Moreover, liquid crystal (LCD) display meter, under normal measuring condition have switching input / output indicate, press shortcut key to look over is unnecessary.

When look over switching condition web page, press down ENTER, Enter local switching output (relay) control web page (St. io), press left/right key to enter protective password (Default Value; 0000, password setting see 5.4.7), press ENTER to confirm enter:



DO1 控制 (1: 闭合继电器; 0: 分开继电器)

DO1 Control(1:closing relay,O:opening relay)

DO2 控制 DO2 Control

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, 回车确认修改; 如果需要同时控制两路继电器, 应先全部修改后, 再按回车键确认。

Digital flicker indicate revisability, press left key to select revising item, press right key to do revising, press ENTER to confirm revising; If Control two channel relay is needed, firstly, finishing all the revising, then press ENTER to confirm.

远程读取与控制见 6.5 通讯应用。

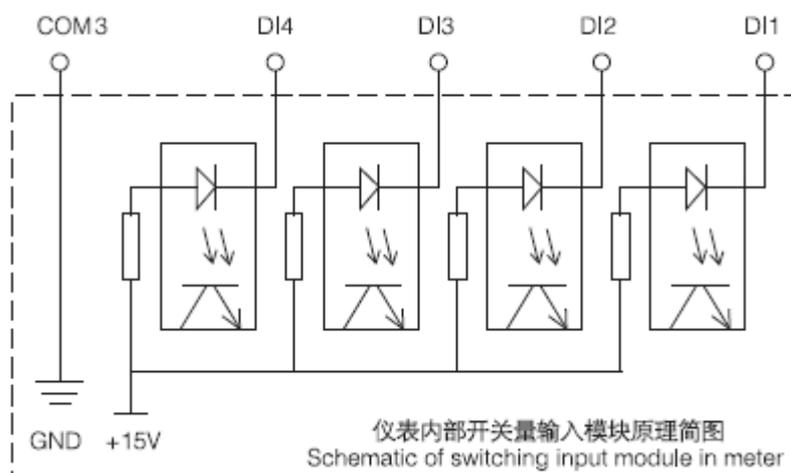
当 D01、D02 的继电器动作时, 面板上对应的指示灯会亮。

开关量输出为继电器常开触点; 开关量输入为光耦检测干接点输入, 简要原理如下:

Remote read and Control see 6.5 Communication application.

When DO1, DO2 relay is acting ,the corresponding indicator on the faceplate will light.

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



5.4.5 仿真量功能及输出设置

Ao.Lo: 模拟量下限设置; Ao.Hi:模拟量上限设置; Ao1.U: 单路模拟量输出选择设置; 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, ACOA 对应 4mA; AC500A 对应 20mA)

设定 Ao.Lo:000 (%); Ao.Hi: 100 (%); Ao1.U: 1 (默认输出 A 相)

说明: Ao.Lo、Ao.Hi 的设定值均为额定输入的百分数

Ao1.U : 1 表示 A 相; 2 表示 B 相; 3 表示 C4;

注意: 当仪表附加功能为/M3 时, A01.U 必须设为 1: 三路模拟量对应三相。

5.4.5 Rnalog function and output setting

Ao.Lo: Analog lower limit setting; Ao.Hi: Analog upper limit setting; Ao1.U: single channel Analog output selective setting; setting range see 5.2 menu symbol and meaning.

Example: AC500/5A, corresponding output one channel 4-20mA (i.e., ACOA corresponding 4mA; AC500A corresponding 20mA)

Setting Ao.Lo:000 (%); Ao.Hi: 100(%); Ao1.U:1 (Default output A phase)

Explanation: Ao.Lo, Ao.Hi setting is a percentage of rated input.

Ao1. U: 1 Indicate A phase; 2 Indicate B phase; 3 Indicate C phase;

Note: When adding meter function is / M3, Ao1.U must be 1 ;three Analog corresponding to three phase.

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。

5.4.6 Liquid crystal backlight control

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.

5.4.7 程序设计密码设置

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，回车确认修改。修改后，程序设计保护密码及 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

5.4.7 Program password setting

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.

6. 通讯指南

6.1 概述

AMC 系列仪表采用与 Modbus-RTU 相兼容的协议：“9600, 8, n, 1”，其中 9600 为默认波特率，如果需要可通过程序设计修改为 2400、4800s 19200 等，设置方法见本说明书 5.4.2 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）

6.1 General

AMC Series meter adopt compatible 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

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)₀ 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 Protocol

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

6.2.1 Data frame format

地址 Address	功能 Function	数据 Data	校验 Check
8-Bits	8-Bits	N × 8-Bit	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，在本仪表中只使用 1~247，其它地址保留。这些位(Adress)标明了使用者指定的终端 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。

6.2.2 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 the ACR meters, 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

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。

6.2.3 Function (Function) domain

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(十六制) Code(hex)	意义 Meaning	行 Operation
03H	读取保持寄存器 Read holding register	在一个或多个保持寄存器中取得当前的二进制值 Obtain current binary system value of one or multiple holding register
10H	预置多寄存器 Present multiple register	把具体的二进制值装入一串连续的保持寄存器 Set actual binary system value into a series of continuous holding register

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。

6.2.4 Data (Data) fields

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

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

6.2.5 Error check (Check) domain

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.

6.3 错误校验码(CRC)的生成方法

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。

6.3 Method to create error check code (CRC)

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.

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

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 OFFFHH (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 三相表通讯参量地址表 (word)

6.4 Three phase meter communication parameter address meter (word):

地址 Address	内容 Content	简要说明 Brief Explanation	简要说明 Brief Explanation
0000H	Ua 有效值 Ua Effective value	三相电压 Three phase voltage	读写属性: R-读; W-写 除 002aH 为部分可写外, 均为只读。 Read/Write: R-read;W-write The 002aH is partial writable,the rest is read-only.
0001H	Ua 指数 Ua Exponential	三相三线时: Three phase three wire:	
0002H	Ub 有效值 Ub Effective value	线电压 Line Voltage	
0003H	Ub 指数位 Ub Exponential	三相四线时: Three phase four wire:	
0004H	Uc 有效值 Uc Effective value	相电压 Phase voltage	
0005H	Uc 指数位 Uc Exponential		
0006H	Ia 有效值 Ia Effective value	三相电流 Three phase current	
0007H	Ia 指数位 Ia Exponential		
0008H	Ib 有效值 Ib Effective value		
0009H	Ib 指数 Ib Exponential		

	Ib Exponential		说明： ① “—” 表示保留字或保留位。 ②电压、电流等数据数值计算方法： 读数=有效值×10E(指数位-3) Explanation: ① “—” indicate Reserved word or Reserved bit. ② voltage, current etc. data numerical value Computing Method: Reading = Effective value ×10E (Exponential-3)
000aH	Ic 有效值 Ic Effective value		
000bH	Ic 指数位 Ic Exponential		
000cH	— 保留字 — reserved		
...			
0029H			
002aH	报警及 I/O Alarm and I/O	详细说明见下方 Detail explanation see below	
002bH	Pt	电压变比 Voltage transformation ratio	
002cH	Ct	电流变比 Current transformation ratio	
002dH	—保留字 — Reserved word		
...			

002aH: 报警及开关量输入输出状态字(控制字)

002aH: alarm and switching Input / output condition word (control word):

15	14	13	12	11	10	9	8
-	AL.-b	AL.Lo1	AL.Hi1	AL.Lo2	AL.Hi2	AL.Lo3	AL.Hi3
(R)不平衡报警指示 (R) unbalance alarm Indication				(R)高、低报替指示 (R)HIGH,LOWalarmIndication			
7	6	5	4	3	2	1	0
DI1	DI2	DI3	DI4	-		DO1	DO2
开关量输入指示(R) 1 表示闭合, 0 断开 Switching Input Indication(R) 1 indicate closing, 0 opening.				开关量输出指示(R/W)1 闭合, 0 断开 switching output Indication (R/W) 1 closing, 0 opening			

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)

6.5	U1	221.9	Communication this section adopt
application	U2	222.0	
Example in	U3	222.0	

below format (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 Address	功能码 Function code	数据起始地址 Data start address		数据读取位数 Data read number		循环冗余校验码 Cyclic redundancy check code	

6.5.1 读数据

例 1:读三相电压表数据

6.5.1 Read data

Example 1: Read Three phase voltage meter data

查询数据帧 Inquiry Data frame	01 03 00 00 00 06 c5 c8
返回数据帧 Return Data frame	01 03 0c 08 ab 00 02 08 ac 00 02 08 ac 00 02 1b 05

说明:

01: 从机地址 03: 功能码

0c:十六进制, 十进制为 12, 表示后面有 12 个字节的数据

1b 05: 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: 08 ab(16 进制)=2219(10 进制)

08ac(16 进制)=2220(10 进制)

0002(16 进制)=2 (10 进制)

计算: $2219 \times 10^{-3} = 221.9$;

$2220 \times 10^{-3} = 222.0$ 单位: 伏特(V)

Explanation:

01: Slave address 03: function code

0c: hex, decimal as 12, indicate: 12 byte data rearwards

1b 05: cyclic redundancy check code Data processing method see: 6.4 communication parameter address meter

Processing as follows: 08 ab(hex)=2219(decimal)

08ac (hex)=2220 (decimal)

0002 (hex)=2 (decimal)

Calculation: $2219 \times 10^{-3} = 221.9$;

$2220 \times 10^{-3} = 222.0$ Unit: Volt (V)

仪表显示

Meter display:

读电流表数据与读电压表类似，但起始地址为 06H,查询帧: 01 03 00 06 00 06 25 c9

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。

Read current meter data is similar to reading voltage meter, but start address as 06H, Query frame: 01 03 00 06 00 06 25 c9

Read other information Query frame is identical with this format, each information address see: 6.4 communication parameter address meter.

6.5.2 写数据

例 2:开关量输出远程控制（控制字：002aH）

6.5.2 Write data

Example 2: switching output remote control (control word: 002aH)

设置数据帧	01 10 00 2a 00 01 02 00 02 20 5b (DO1 输出)
Setting Data frame	01 10 00 2a 00 01 02 00 02 20 5b (DO1 output) 01 10 00 2a 00 01 02 00 01 60 5a (DO2 输出) 01 10 00 2a 00 01 02 00 01 60 5a (DO2 output)
返回数据帧	01 10 00 2a 00 01 20 01 (若无数据返回表示设置不成功)
Return Data frame	01 10 00 2a 00 01 20 01 (If no data returning indicate setting is unsuccessful)

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，表示继电器工作在脉)中方式，继电器闭合持续时间为所设值；若持续时间设置为 0，则表示继电器工作在保持方式。

Explanation:

Remote write in 1 to switching output condition bit, then closing; write in 0, then breaking.

When relay closing duration is Nonzero, indicate: relay adopt pulse mode, relay closing duration as setting value; if duration setting as 0, then indicate: relay adopt holding mode.

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