139

PZ96B programmable digital display intelligent instrument

（AI、AV、DI、DV）

Installation instructions V1.4

ACREL Co.,Ltd

Declare

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Catalog

1 General

PZ96B series of single-phase meters, using AC sampling technology, can directly or indirectly measure the voltage and current in single-phase power grid. It can be used for local display and connected with industrial control equipment to form measurement and control system.

The instrument can have RS-485 communication interface and adopt Modbus-RTU protocol. It can bring analog output, relay alarm output, switch input / output. According to different requirements, through the instrument panel key, the variable ratio, alarm, communication and other parameters are set and controlled.

2 Technical parameter

Technical parameter			Feature
Input	Frequency		45～65Hz
	Voltage		Rating：AC 100V、380V；DC 300V、1000V
			Overload :1.2 times rating (continuous);2 times rating 1 second
			Power consumption： ＜ 0.5VA
	Current		Rating：AC 1A、5A；DC 75mV、10V、 0-20mA、4-20mA、5A
			Overload :1.2 times rating (continuous);10 times rating 1 second
			Power consumption： ＜ 0.5VA
Output	Communication		RS485 Interface、Modbus-RTU Protocol
	Display		LED
Function	Switching	Input	4 channel dry contact inputs
		Output	Output mode :2-Channel relay normally open contact output
			Contact capacity：AC capacity：1A/30VDC or1A/250VAC DC capacity：2A/30VD or 2A/250VAC
	Analog Output		Output mode :1 output ,0~20mA、4~20mA programmable
			Load capacity：≤500Ω
Accuracy			current/voltage class 0.5
Power			AC85～265V or DC100～350V；Power consumption＜5VA
Safety			Power frequency withstand voltage: AC2kV 1min; between power / switching output / current input / voltage input / communication / switching input; AC2kV 1min; between power supply, switch output, current input and voltage input; AC1kV 1min; between two inputs for communication and switching;

	Insulation resistance: input, output to housing & gt;100MΩ
Environment	working temperature：-10℃～+55℃；storage temperature：-25℃～+70℃ relative humidity：≤93%RH，no condensation; altitude：≤2500m

3 Figure and Size Schematic(Unit：mm)

Figure size

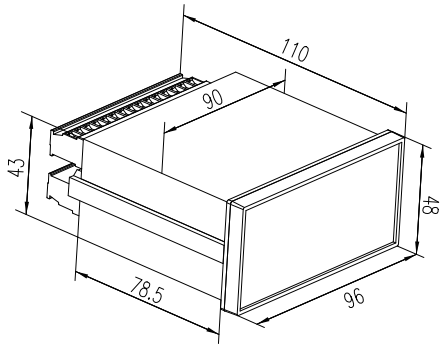


Figure 1

Panel Open hole in depth

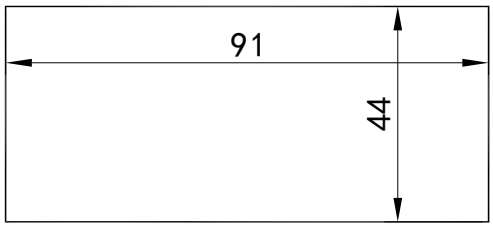
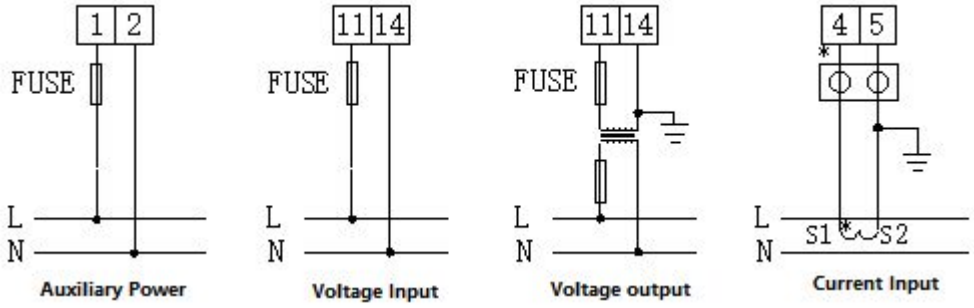


Figure 2

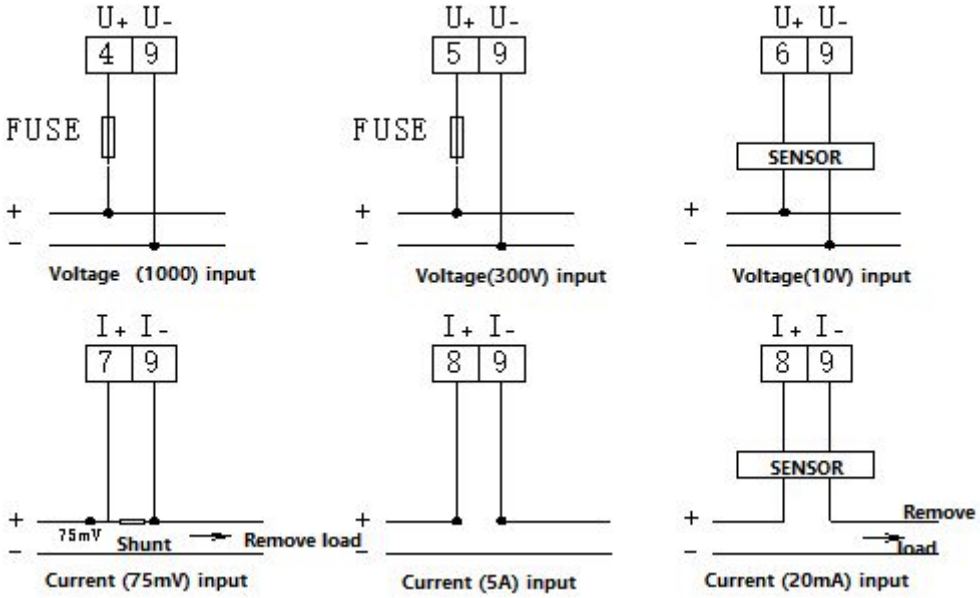
4 Wiring

（ Note: if the wiring diagram on the instrument housing is inconsistent, the wiring diagram on the instrument housing shall prevail）

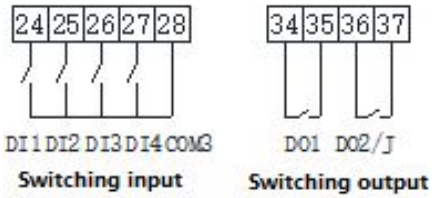
4.1 Single phase AC wiring



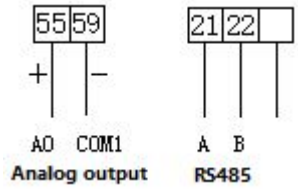
4.2 single phase DC wiring



4.3 Switching Input Output



4.4 Power、RS485、Analog Output



Note 1. The symbol "*" represents the current inlet end, which is for reference only, subject to the wiring diagram on the instrument.

5 Attention

5.1 Voltage input

Input voltage should not be higher than 120% of the rated input voltage of the product, otherwise PT; should be considered.

A fuse shall be installed at A voltage input;

5.2 Current input

Current input must use external CT access.

Ensure that the input current and voltage sequence is consistent, otherwise there will be a display value and symbol error; at the same time ensure that the current in and out line connection is correct (Note * terminal connection line);

If other instruments are attached to the CT used, the wiring shall be serialized;

Installation of wiring is recommended to use wiring row, do not directly connect CT, to facilitate disassembly;

Before removing the current input line of the product, the CT primary circuit or the short secondary circuit must be cut off.

DC current input shall use external shunt or DC transmitter.

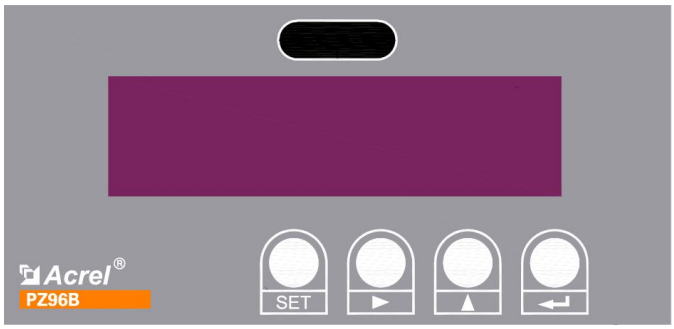
5.3 Communication wiring

The instrument provides asynchronous semi-dual RS485 communication interface, using MODBUS-RTU protocol, all kinds of data information can be transmitted on the communication line. Theoretically, up to 128 instruments can be connected at the same time on a line, each instrument can set its communication address (Addr), and the communication rate (buad) can also be selected by setting.

The communication connection is recommended to use three-core shielding wire, the diameter of which is not less than 0.5 mm2, respectively connected to the earth A、B、COM, the shield layer, and the communication line should be kept away from the strong electric cable or other strong electric field environment.

The matching resistance between the A、B of the terminal instrument is recommended, with a resistance range of 120Ω~10 kΩ.

6 Panel Display



Single phase series（AI、AV、DI、DV) Front

图 三

7 Menu Function Setting

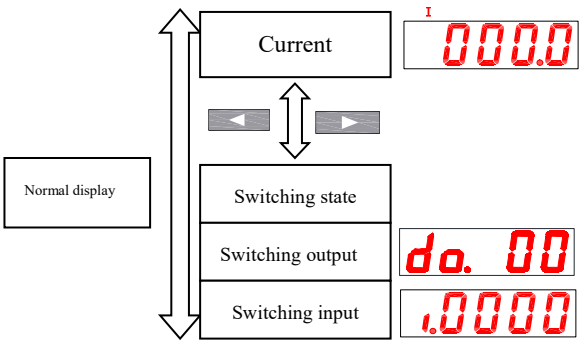
7.1 key function setting

PZ96B digital display intelligent instrument four keys from left to right are SET key, left key, right key, enter key.

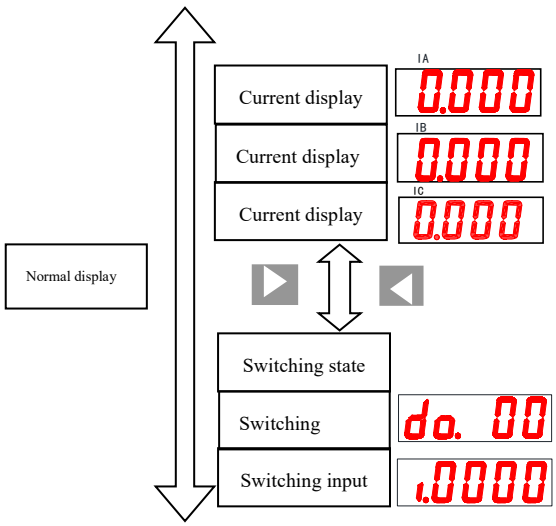
SET KEY	During the measurement mode, press the key to enter the programming mode, the instrument prompts to enter the password PASS, after entering the correct password, the instrument can be programmed and set; in the programming mode, it is used to return to the next level menu.
LEFT KEY	In measurement mode, for switching display items; Programming mode, used to switch the same level menu or single digit reduction.
RIGHT KEY	In measurement mode, for switching display items; Programming mode, used to switch the same level menu or single digit increase.
ENTER KEY	In measurement mode, for switching display items; Programming mode, for menu items selection confirmation and parameter modification confirmation.
LEFT+ENTER KEY	In programming mode, the key combination is used to reduce the number of digits
RIGHT+ENTER KEY	In programming mode, the key combination is used to increase the number of digits

7.2 Instrument menu structure

Instrument menu structure (AI)



Instrument menu structure (AI3)

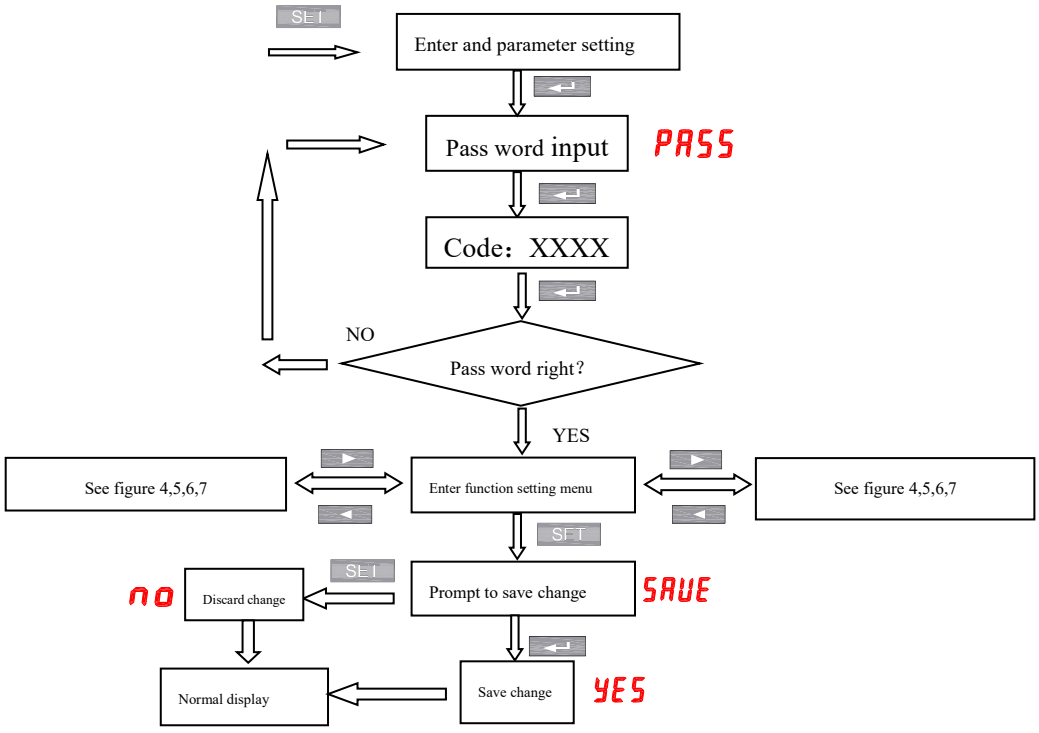


Note: Single-phase voltmeter is similar to AI menu structure, only one difference: voltage, frequency instead of current;

A three-phase voltmeter is similar to a AI3 menu, with only one difference: voltage instead of current;

DC meter switch quantity is not displayed in the menu, through the panel to display.

Instrument menu



Function Setting Menu

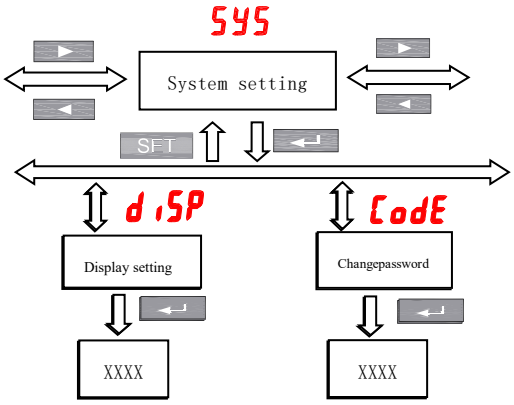


Figure 4

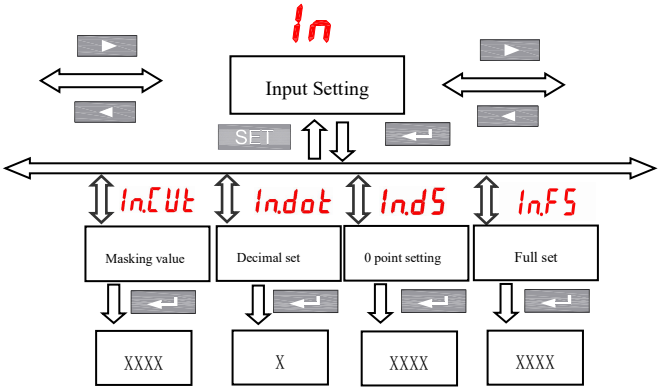


Figure 5

Function Setting Menu Structure

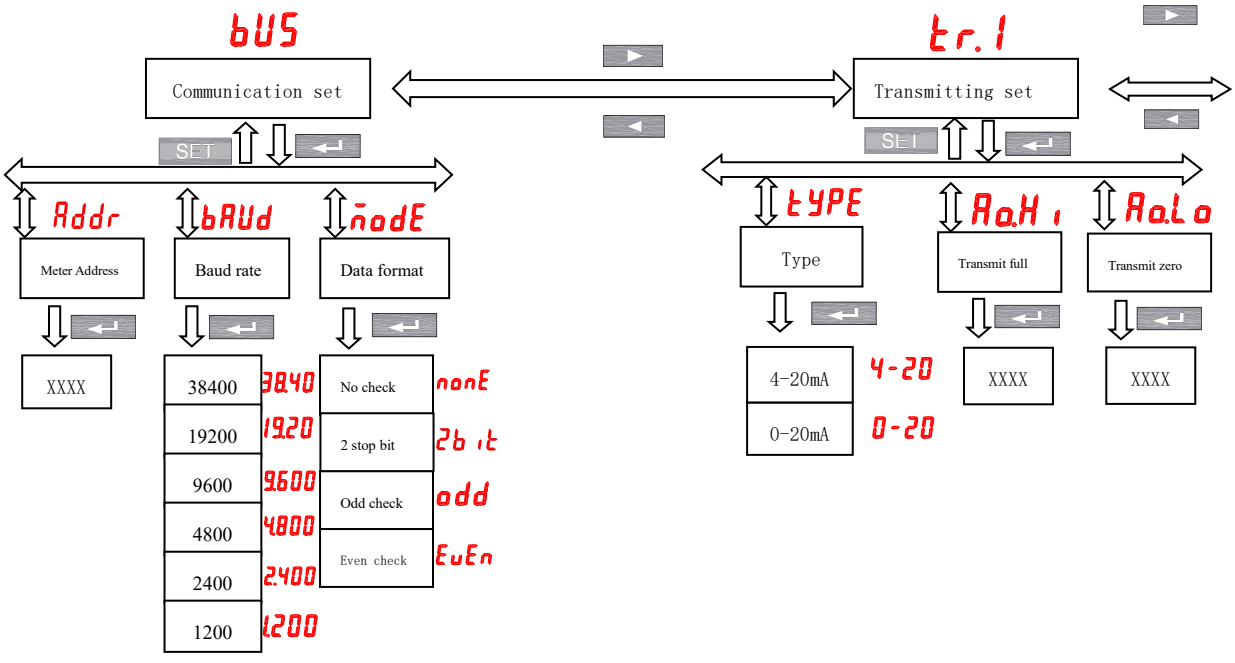


Figure 6

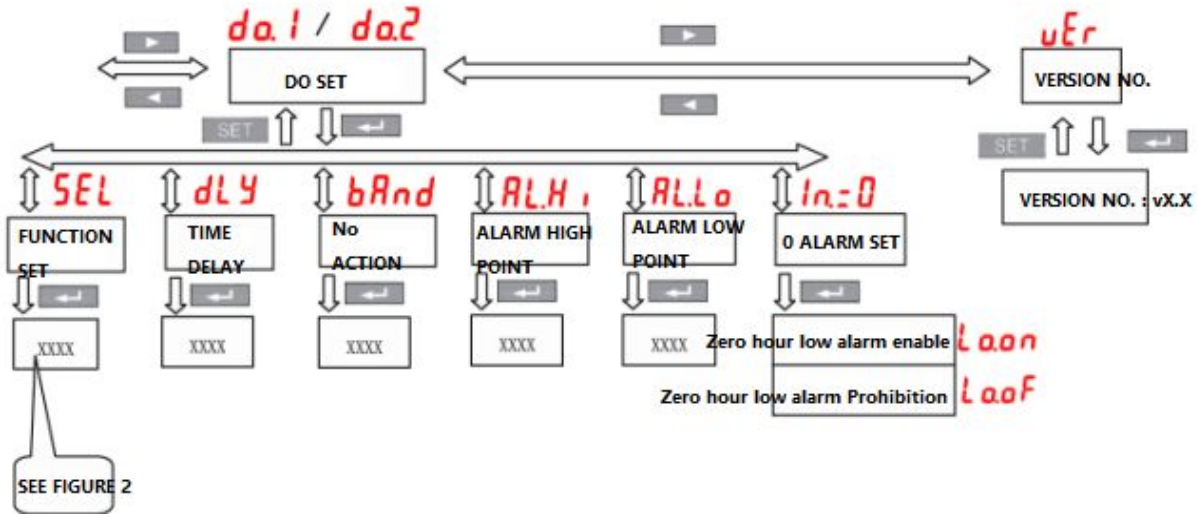


Figure 7

7.3 Transmitting Output settings

tr.1 corresponding settings

"type" Type Selection :4-20 mA Output and 0-20 mA(Customized) Output Selection

"Ao.Hi" set to 100% output value

"Ao.Lo" set to 0% output value

(The above two settings correspond to the power display value, Take the highest four-digit integer (decimal point ignored) less than 0, Example: Enter V 100A/5A,220 Three, four, Then 100% P total 220*100*3=66 kW, The value is 6600, "Ao.Hi" can set 6600, Set Ao.Lo"0 to 0 to 0-66 kW Output 4-20 mA,)

7.4 DO Output setting

do.1-do.2 corresponding settings

The output type DO set in the SEL ","0. do" is expressed as communication control (if the DLY is set to 0 output is level mode, otherwise it is pulse mode, if the DLY is set to 2, automatically disconnected 2 seconds after suction), others are alarm control.

0. do	Bus control
1. AL	Alarm function

Table 2

"dLy" is alarm delay (recommended when alarm time is not set to 0 to prevent interference misoperation, output type is DO for pulse or level output control)

"bAnd" setting for no action band

"AL.Hi" for high alarm values (no maximum 9999)

"AL.Lo" for low alarm values (no minimum-9999)

The maximum four-digit integer (the decimal point is ignored) is less than 0. Example: input 220 V 100A/5A, three-phase four-wire, then 100% P total input 220 V 100A/5A, three-phase four-wire ,100% P total 220*100*3=66 kW, this value takes 6600)

"In.=0" signal 0 whether to allow low alarm, Lo.on enable, Lo.of prohibited.

8 Communication

8.1 Communication protocol general

PZ96B digital display intelligent instrument uses MODBUS-RTU communication protocol, MODBUS protocol defines check code, data sequence and so on in detail, which are necessary contents of specific data exchange. MODBUS protocol uses a master-slave reply connection on a communication line (half duplex). When the signal of the main computer is addressed to a unique terminal device (slave), the terminal device sends a response signal to the host.

The MODBUS protocol only allows communication between the host (PC,PLC, etc.) and the terminal device, and does not allow data exchange between independent terminal devices, so that each terminal device does not occupy the communication line when they are initialized. It is limited to responding to the query signal arriving at the local machine.

Transmission mode

the information is transmitted asynchronously and in bytes. the communication information passed between the host and slave is in 10-bit word format, containing 1 start bit ,8 data bits (minimum valid bit first sent), no parity bit ,1 stop bit (setable).

Information frame format

Address code	Function code	Data area	CRC checking code
1 bytes	1 bytes	N bytes	2 bytes

Address code: address code in the beginning of the frame, consisting of a byte (8-bit binary code), decimal 0~255, in the ACR instrument only 1~247, other addresses reserved. These bits indicate the address of the user-specified terminal device that will receive data from the connected host. The address of each terminal device must be unique, and only the addressed terminal responds to a query containing that address. When the terminal sends back a response, the slave address data in the response tells the host which terminal is communicating with it.

Function code: the function code tells what function the addressable terminal performs. The following table lists the functional codes used in this series of instruments, as well as their significance and functions.

Function	Definition	Operation
03H/04H	Read data register	Gets the current binary value of one or more registers
10H	Preset Multiple Registers	Set binary values to a series of multiple registers

Data area: the data area contains the data required by the terminal to perform a specific function or the data collected when the terminal responds to the query. The data may be numeric, reference address, or set value. For

example, the function code tells the terminal to read a register, and the data area needs to indicate which register to start and how many data to read. The embedded address and data vary according to the type and slave.

CRC validity code: the error check (CRC) domain takes up two bytes and contains a 16-bit binary value. the CRC value is calculated by the transmission device and then attached to the data frame. the receiving device recalculates the CRC value when receiving the data, and then compares it with the value in the received CRC domain. if the two values are not equal, an error occurs.

A process to generate a CRC is:
1. preset a 16-bit register of 0 FFFFH(all 1), called a CRC register.
2. the 8 bits of the first byte in the data frame are different from the low byte in the CRC register, and the result is saved back to the CRC register.
3. move the CRC register to the right, fill the highest bit with 0, move out the lowest bit and detect.
4. if the lowest bit is 0, repeat the third step (next shift); if the lowest bit is 1, the CRC register is XOR with a preset fixed value (0 A001H).
5.repeat the third and fourth steps until 8 shifts. This is done with a complete eight.
6. repeat steps 2 through 5 to handle the next eight bits until all byte processing is over.
7. value of the final CRC register is the value of the CRC.

Master sends		Data sends		Slave return		Data return
Address code		01H		Address code		01H
Function code		03H		Function code		03H
start address	High byte	00H		Number of bytes		02H
	Low byte	25H		Register data	High byte	Uncertain value
Number of registers	High byte	00H			Low byte	Uncertain value
	Low byte	01H		CRC Check code	Low byte	Uncertain value
CRC Check code	Low byte	95H			High byte	Uncertain value
	High byte	C1H				

Besides, there is a method to calculate CRC by using preset tables. Its main characteristic is that the calculation speed is fast, but the tables need large storage space. This method is not repeated here, please refer to the relevant information.

8.2 Function Code Brief Introduction

Function code 03H or 04H： read register

This function allows users to obtain data and system parameters collected and recorded by the device. There is no limit to the number of data requested by the host at a time, but not beyond the defined address range.

The following example is a basic data (2 bytes per address in per address in the data frame) read from the machine U, where the U address is 0025 H.

Function Code 10H： Write Register

Function code 10 H allows the user to change the contents of multiple registers, in which system parameters, switch output status and so on can be written by this function number. The host can write up to 16(32 bytes) data at a time.

Here is an example of a meter output switch DO1. with a preset address of 01 Switch input / output status indicator register address 0022 H,9-12 bits corresponding DI1-DI4,13-14 bits corresponding to DO1-DO2. respectively

Master sends		Data sends		Slave return		Data return
Address code		01H		Address code		01H
Function code		10H		Function code		10H
start address	High byte	00H		start address	High byte	00H
	Low byte	22H			Low byte	22H
Number of registers	High byte	00H		Number of registers	High byte	00H
	Low byte	01H			Low byte	01H
Number of bytes		02H		CRC Check code	Low byte	A1H
0022H Data to be written	High byte	10H			High byte	C3H
	Low byte	00H				
CRC Check code	Low byte	ADH				
	High byte	12H				

8.3 Communications application details

PZ96B digital display intelligent instrument in the design of the communication address table unified planning, users according to the following introduction can easily achieve telemetry, remote communication, remote control and other functions.

8.4 Switching Input Output

PZ96B digital display intelligent instrument switch input is a dry contact switch signal input mode, the instrument is equipped with ±5V of working power supply, no external power supply. When the external contact is closed or disconnected, the instrument displays the switch state locally, and the remote transmission function can be realized through the communication port of the instrument, that is, the "remote communication" function.

PZ96B digital display intelligent instrument switch output is relay output, can be remote control through the

upper computer (remote control has two ways :1, level trigger ;2, pulse trigger), to achieve the "remote control" function, but also according to customer requirements to achieve the corresponding alarm function (such as overcurrent, undervoltage).

The communication address of PZ96B digital display intelligent instrument and switch input and output is 0022H, and its corresponding relation with switch input and output is as follows:

0022H	16	15	14	13	12	11	10	9	8～1
			DO2	DO1	DI4	DI3	DI2	DI1	SAVE

8.5 Power parameter

The series of measurements are read out by command 03 of the Modbus-RTU communication protocol. The corresponding relationship between the communication value and the actual value is as follows :(the agreed Val_t is the communication read value, the Val_s is the actual value)

1、 Voltage U：

Val_s=Val_t×10＾（DPT-4）， Unit Volt V, DPT read from 0023 H high byte.

2、 Current I：

Val_s=Val_t×10＾（DCT-4）， Unit Ampere A, DCT read from 0023 H low byte.

8.6 Modbus protocol correspondence address list

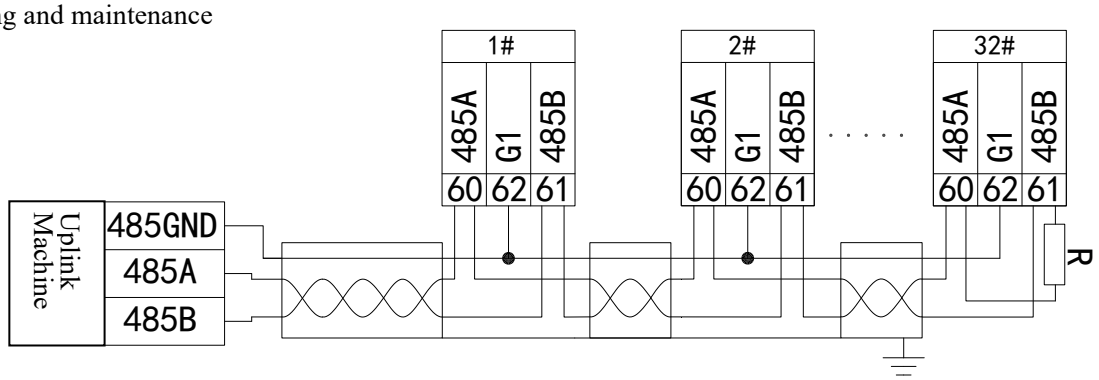
Address	Parameter	Read / write attributes	Data range	Data type
0000H	Protect password	R/W	0001-9999	word
0001H High byte	Communication address	R/W	0001-0247	word
0001H Low byte	Communication Baud rate	R/W	0-3：38400、19200、 9600、4800bps	
0002H	SAVE	R/W	Manufacturer parameters, user is forbidden to write commands	word
0003H	PT Ratio	R/W	1-9999	word
0004H	CT Ratio	R/W	1-9999	word
0005H～0021H	Save	R/W	Manufacturer parameters, user is forbidden to write commands	word
0022H	Input and output state of switch	R/W	See 7.3.1	word
0023H High byte	Decimal point U(DPT)	R	3～7	word

0023H Low byre	Decimal point I(DCT)	R	1～5	
0024H High byte	decimal point PQ(DPQ)	R	4～10	word
0024H Low byte	symbol PQ	R	No .8：P No .4：Q 0 is positive,1 is negative	
0025H	U	R	AC：0-9999 DC：-9999-9999	word
0026H～002AH	SAVE	R		word
002BH	I	R	AC：0-9999 DC：-9999-9999	word
002CH～0030H	SAVE	R		word
0031H	P	R	0-9999	word
0032H～0034H	SAVE	R		word
0035H	Q	R	0-9999	word
0036H～0038H	SAVE	R		word
0039H	PF	R	0-1000	word
003AH～003CH	SAVE	R		word
003DH	S	R	0-9999	word
003EH	Frequency F	R	4500-6500	word

8.7 Communication Wiring Example

When multiple devices are used in networking, the A of the last RS485 and the B terminal should be connected with a terminal matching resistance to ensure the communication impedance matching. The terminal matching resistance is generally between 120Ω-10kΩ. Wiring different terminal matching resistors may be different. Above is a schematic diagram of using three-core shielding wire, shielding layer connected to the earth, each equipment G1 terminal and connected.

Debugging and maintenance



Operation Instruction

1) Check that the power cord is properly connected before electrified.

2) Establishment of communications

a) access the RS485 bus correctly and connect to the upper computer.

b) host computer according to the module station number and baud rate, according to the protocol format issued orders. At this time, the communication indicator lamp of the module flashes, indicating that the module has received the command of the upper computer and replied, that is, the communication has been established.

Debugging

Check that the power supply is connected correctly before the

1) Check that the power supply is connected correctly before electrified.

2) only when the communication indicator flashes does it indicate that the communication is established.

Set the upper computer query time interval. Because the bus is a half-duplex mode, the upper computer should set the appropriate time interval, the time interval should be determined according to the length and baud rate of the module response command, and the improper setting of the time interval will lead to the communication failure.

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