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METERS & ELECTRONICS

COIMBATORE

USER MANNUAL

3 PHASE MULTI-FUNCTIONAL INTELLIGENT PANEL METER

Dimensions : 72 x 72 (mm)

• Model No : TMCB025

1. Product Brief introduction

The three-phase multi-function meter is designed for the electric power intelligent monitoring and electric energy metering needs of electric power system, industrial and mining enterprises, public facilities, intelligent buildings and so on, high-precision measurement of all common power parameters in three-phase grid: three-phase voltage, three-phase current, active power, reactive power, apparent power, frequency, power factor, and with 485 communication functions。

2. Technical parameter

Item			Parameter
Signal input	Wiring		3 phase 4 lines/3 phase 3 lines
	Voltage	Measurement range	AC(20~500)V
		Over load	Continuous: 1.2 multiple, instantaneous: 2 multiple/1s
		Power consumption	＜1VA（per phase）
	Current	Measurement range	AC(10mA~5A)
		Over load	Continuous: 1.2 multiple, instantaneous: 10 multiple/5s
		Power consumption	＜0.4VA（per phase）
	Frequency		45~65Hz
Power supply			AC/DC 60~280V, ≤5VA
Communication			RS485 communication interface, physical layer isolation. Meet the international standard of MODBUS-RTU agreement Communication speed 1200~38400
Swithcing Input/Output			Passive dry contact
Measurement class			Power: 0. 5 Frequency: ±0. 2Hz Active power: 1. 0 Reactive power: 2. 0
Display mode			LED display, LCD display
Environment			Working temperature: -10~+45℃ Storage temperature: -25~+50℃ Relative humidity: ＜85%RH
Safety			Isolation:resistance of Signal input, power source and output terminal to cover＞100MΩ Withstand Voltage:Signal Input/power supply , Power Supply/Signal output :AC 2kV, Signal Input/Signal Output:1kV

3. Installation and Wiring

3.1 Size(mm)

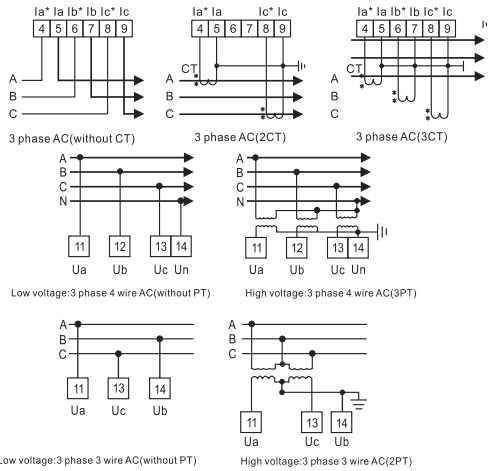
Panel Size(mm): 96×96 Hole Size(mm): 91×91

Depth(mm): 38

For TMCB025

3.2 Wiring terminal function

Power supply	1,2	AC/DC60～280V ≤5VA
Current signal	4,5,6,7,8,9	No.4,6,8 are the terminal of current signal input No.5,7,9 are the terminal of current signal output
Voltage signal	11,12,13,14	Three phase Voltage signal input is Ua, Ub,Uc,Un
RS485	58,59	A, B terminal
Switching input	70,71	1 loops of switching input, 70 is the common terminal



Note: The meter is provided with two kinds of wiring modes, please make sure the actual wiring is same to the set wiring in the meter. The wiring diagram and technical parameter printed on the product shall be prevailed.

4. Programme operation

Under programming status, digital interface adopts layered structure menu type ,meter supply three lines digital display.

No.1 line is first layer menu information.

No.2 line is second layer menu information,

No.3 line is third layer menu information.

For example: No.1 line: INPT means signal input.

No.2 line:CT current ratio No. 3 line: 5 means the CT value. CT value=25/5A=5.

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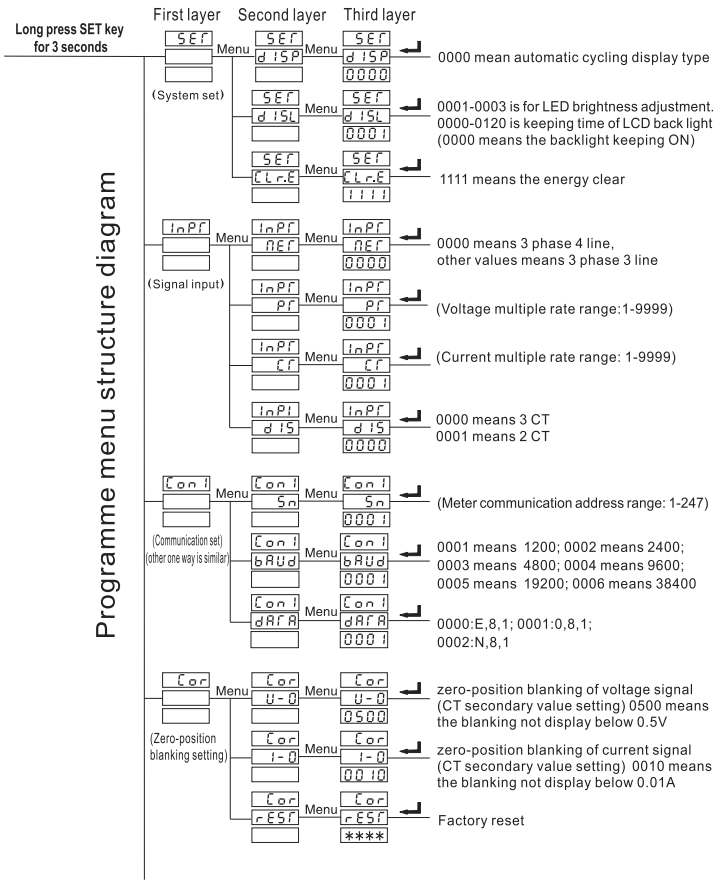
Parameter setting can be customized according to requirements.

No.1 layer	No.2 layer	No.3 layer	Description
System set "SET"	Display DISP	0000-0014	0000 means automatic cyclingdisplay
	DISL	0001-0003 or 0000-0120	0001-0003 is for LED brightness adjustment 0000-0120 is keeping time of LCD back light
	Energy clear CLr.E	1111	1111 means the energy clear, other values are invalid
Signal input INPT	Wiring mode NET	0000 or other values	0000 means 3 phase 4 line, other values means 3 phase 3 line
	Voltage transformation ratio PT	1 ~ 9999	PT value= PT primary value/ secondary value
	Current transformation ratio CT	1 ~ 9999	CT value= CT primary value/ secondary value
Communication set CONi (i is 1~2)	address SN	1 ~ 247	Meter address range: 1-247
	Communication speed BAUD	0001 ~ 0006	0001 means 1200; 0002 means 2400; 0003 means 4800; 0004 means 9600; 0005 means 19200; 0006 means 38400
	Data format DATA	0000 ~ 0002	0000:E,8,1; 0001:0,8,1; 0002:N,8,1;

Note: The above menu is applied to the product with complete function.If you find there is no such menu in the product or the menu is not working, It means the product not supporting the function.

Programming step



Operation instruction:

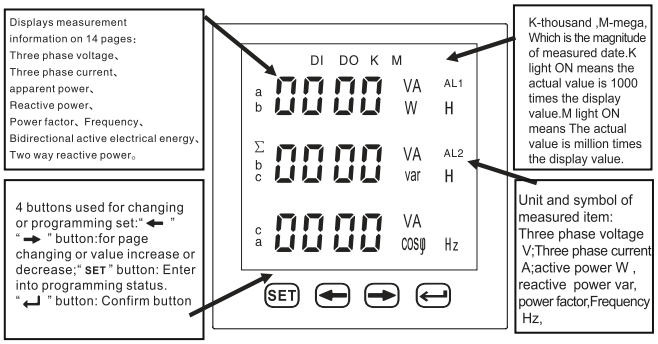
(a) After revised the data of third layer (or option), need press " ↵ " button to back the second menu then the setting take effect.

(b)The wiring method can be revised refer to the actual wiring mode.

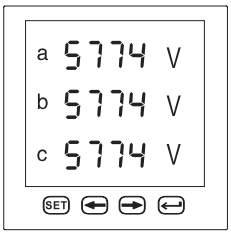
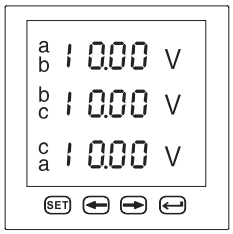
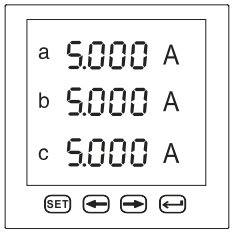
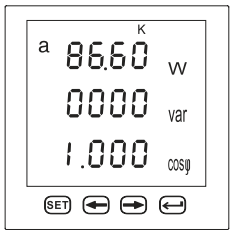
(c)Under normal condition, the label of product have remarked the model parameter and factory setting parameter. The user can reset the parameters according to the requirements.

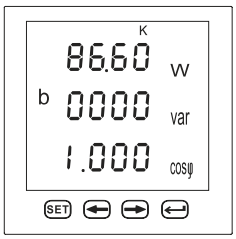
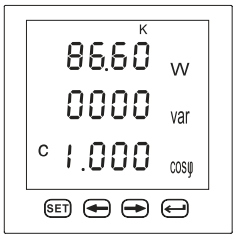
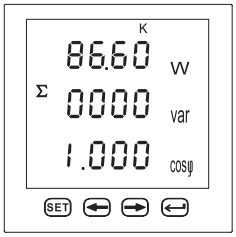
(d) After revise the value , through " ← " button and " → " button to increase or decrease , through" **SET** " button to move.

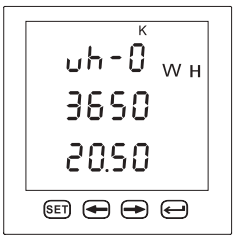
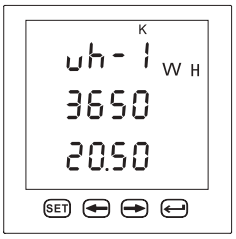
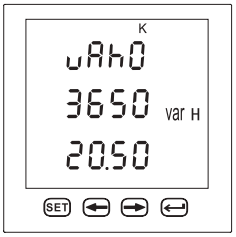
5. Panel explain and measurement information display (1) Panel instructions

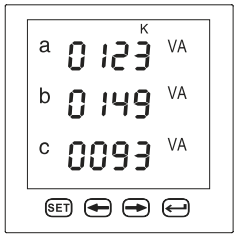
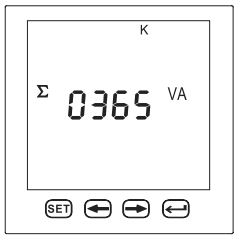
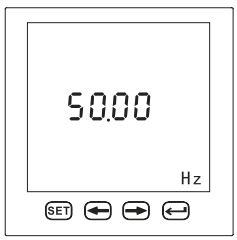


(2) The contents of displayed page

Page	Content	Explanation
DISP=1 three phase voltage		Separately display the voltage Ua, Ub, Uc (3 phase 4 line), positive active energy. In left Fig Ua=5774V Ub=5774V Uc=5774V
DISP=2 three phase voltage		Separately display the voltage Uab, Ubc, Uca (line voltage), In left Fig Uab=10kV Ubc=10kV Uca=10kV
DISP=3 three phase current		Display 3-phase current Ia, Ib, Ic, the unit is A. In left Fig Ia=5A Ib=5A Ic=5A
DISP=4 A phase separation Active Power Reactive power Power factor		Show a phase separation Active Power Pa Reactive power Qa Power factor PFa Left Pa=86.6kW Qa=Ovar PFa=1.0

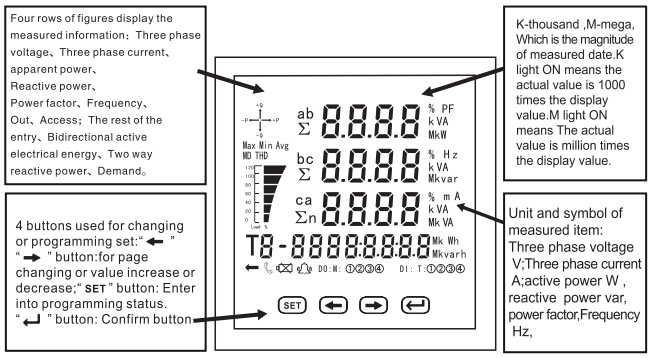
Page	Content	Explanation
DISP=5 B phase separation Active Power Reactive power Power factor		Show b phase separation Active Power Pb Reactive power Qb Power factor PFb Left Pb=86.6kW Qb=Ovar PFb=1.0
DISP=6 C phase separation Active Power Reactive power Power factor		Show c phase separation Active Power Pc Reactive power Qc Power factor PFc Left Pc=86.6kW Qc=Ovar PFc=1.0
DISP=7 Three phases total Active Power Reactive power Power factor		Display three phase total Active Power P Reactive power Q Power factor PF Left P=86.6kW Q=Ovar PF=1.0

Page	Content	Explanation
DISP=11 Positive active energy		The left image shows the value of positive active power, The 2nd row is the higher 4 bits, The 3rd row is the lower 4bits, to form a complete 8–bit value。 The left chart shows the value of positive active power :365020.50kW h.
DISP=12 Negative active energy		The left image shows Negative active energy values, The 2nd row is the higher 4 bits, The 3rd row is lower 4 bits, to form a complete 8 bit value。 The left chart shows the negative active power value is 365020.50kW h.
DISP=13 Positive reactive power		The left image shows the positive reactive energy values, The 2nd row is the higher 4 bits, The 3rd row is the lower 4 bits, to form a complete 8–bit value The left chart shows the value of positive reactive power 365020.50kvarh.

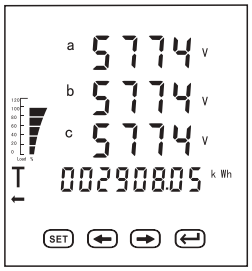
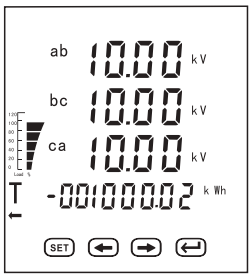
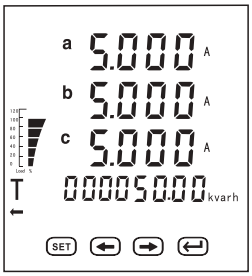
Page	Content	Explanation
DISP=8 A□B□C Three phase Apparent Power		Display the apparent power separately Sa、Sb、Sc Left Sa=123VA Sb=149VA Sc=93VA
DISP=9 Three phases total Apparent Power		Display three phase total Apparent Power S Left S=365VA
DISP=10 Frequency		The left diagram shows the present power grid frequency is 50.00Hz

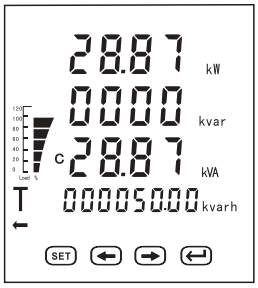
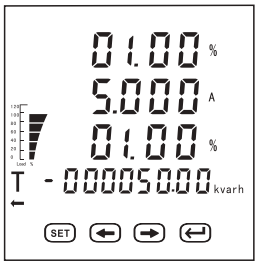
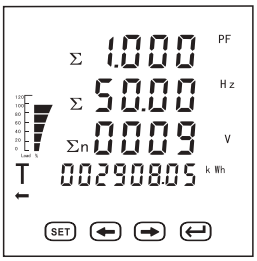
Page	Content	Explanation
DISP=14 Reverse reactive power		The left panel shows the reverse reactive power values,The 2nd row digital tube is 4 bits high, Row 3 is four places lower, Form an 8-bit value。 The left–hand chart shows the value of reverse reactive power 365020.50kvarh.

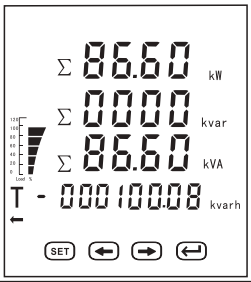
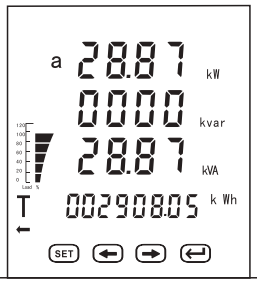
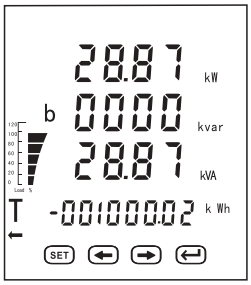
(2) Panel description(LCD liquid crystal display)

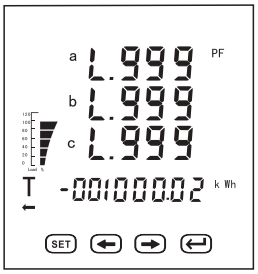


*** only for TMCB025**

Page	Content	Explanation
DISP=1 three phase voltage Positive active energy		Separately display the voltage Ua, Ub, Uc (3 phase 4 line), positive active energy. In left Fig Ua=5774V Ub=5774V Uc=5774V Positive active energy =2908,05kWh
DISP=2 three phase voltage Negative active energy		Separately display the voltage Uab, Ubc, Uca (line voltage), negative active energy. In left Fig Uab=10kV Ubc=10kV Uca=10kV Negative active energy =1000.02kWh
DISP=3 three phase current Positive reactive energy		Display 3-phase current Ia, Ib, Ic, the unit is A. Positive reactive energy In left Fig Ia=5A Ib=5A Ic=5A Positive reactive energy =50.00kvarh

Page	Content	Explanation
DISP=7 C phase active power C phase reactive power C phase apparent power Positive reactive power		C phase active power =28.87kW C phase reactive power =0000kvar C phase apparent power =28.87kVA Positive reactive power =50.00kvarh
DISP=8 Current Unbalance Average current Voltage Unbalance		Displayed in left Fig Current Unbalance:1% Average current=5A Voltage Unbalance:1% Negative Reactive Energy =50.00kvarh
DISP=9 Three phase total power factor, Frequency, Average Voltage		Displayed in left Fig Three phase total power factor =1.000 Frequency=50Hz Average Voltage=9V positive active energy =2908.05kWh

Page	Content	Explanation
DISP=4 Total active power Total reactive power Total apparent power Negative reactivepower		Total active power =86.60kW Total reactive power =0000kvar Total apparent power =86.60kVA Negative reactive power =100.08kvarh
DISP=5 A phase active power A phase reactive power A phase apparent power Positive active power		A phase active power =28.87kW A phase reactive power =0000kvar A phase apparent power =28.87kVA Positive active power =2908.05kWh
DISP=6 B phase active power B phase reactive power B phase apparent power Negative active power		B phase active power =28.87kW B phase reactive power =0000kvar B phase apparent power =28.87kVA Negative active power =1000.02kWh

Page	Content	Explanation
DISP=10 Power factor for each phase		Displayed in left Fig A phase power factor =0.999 B phase power factor =0.999 C phase power factor =0.999 Negative active energy =1000.02kWh

RS 485 Modbus Protocol

1. Protocol

1. 1 Physical layer

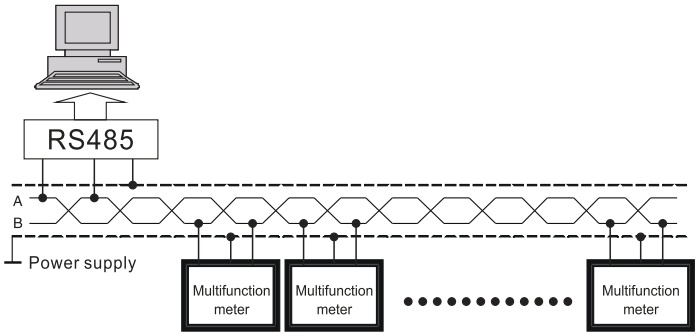
1.1.1 RS485 communication port, asynchronous half-duplex mode;

1.1.2 Communication speed 1200-38400bps can be set, factory default 9600dps;

1.1.3 Byte transfer format: 1 bit for initial bit, 8 bit for data bits, odd-even check (N81, E81, 081 can be selected), factory default N81.

1.2 Digital communication protocol

The meter is provided with serial asynchronism half-duplex RS485 communication port, adopt MODBUS-RTU protocol, various data can be transferred through communication line. One line can connect 32pcs meter at the same time, each meter can set different communication address. The communication terminal number of different series meters is different. communication should be connected by the shielded twisted-pair cable with copper network, and the diameter not less than 0.5mm^2.When wiring, keep the communication wire away from strong electric cables or other strong electric field, T type network Wiring is recommended (see Fig.1),Star-type or other wring is not recommended.



MODBUS-RTU communication protocol:

MODBUS protocol adopt host-slave response mode in one communication line. The signal of host computer addressing to the terminal device (Slave computer) with one address, then the terminal device send response signal back to host computer in the opposite direction. In one communication line, the communication data flow is transmitted in two opposite directions. (half-duplex working mode). MODUBUS protocol only allow the communication between Host computer (PC,PLC, etc) and terminal device(see Fig.11), not allow the data exchange between terminal devices, so each terminal device will not occupy the communication lines when initialized, but only response the query signal to the host computer.

Table 1

Query info. of host device	Device address
Device address	Function code
Function code	Data segment
Data segment	Error checkout
Error checkout	Response info.of slave device

Host PC enquiry:

The query information frames include device address code, function code, data information code ,checkout code. The address code indicate the selected slave PC device; The function code indicate the executed function of selected slave device, for example, function code 03 or 04 means that the slave device will read the register and send back the content; The data segment include the other additional information of executed function, for example, in reading command, reading from which register? How many register to be read? The checkout code used for checking the correctness of one frame information, providing the information verification method for slave device, it adopts CRC 16 checkout rules.

Slave PC response:

If slave PC respond normally, the information include the slave address code, function code, data code and CRC 16 checkout code. Data code include the collected data from slave device, for example, register value or status. If the error occurs, the slave device will not respond. The transmission mode means one series independence data structure in one data frame and the rules for data transmission. The below defines the transmission mode compatible with MODBUS protocol RTU mode. Each bit of byte: 1 start bit, 8 data bit,(odd-even check bit),1 stop bit (w ith odd-even check bit) or 1 stop bit (without odd-even check bit).

Data frame structure (Message format) see Table 2

Table 2

Address code	Function code	Data code	Checkout code
1 BYTE	1 BYTE	N BYTE	2 BYTE

Slave PC response:

If slave PC respond normally, the information include the slave address code, function code, data code and CRC 16 checkout code. Data code include the collected data from slave device, for example, register value or status. If the error occurs, the slave device will not respond. The transmission mode means one series independence data structure in one data frame and the rules for data transmission. The below defines the transmission mode compatible with MODBUS protocol RTU mode. Each bit of byte: 1 start bit, 8 data bit,(odd-even check bit),1 stop bit (with odd-even check bit) or 1 stop bit (without odd-even check bit).

Function code: (see Table 3)

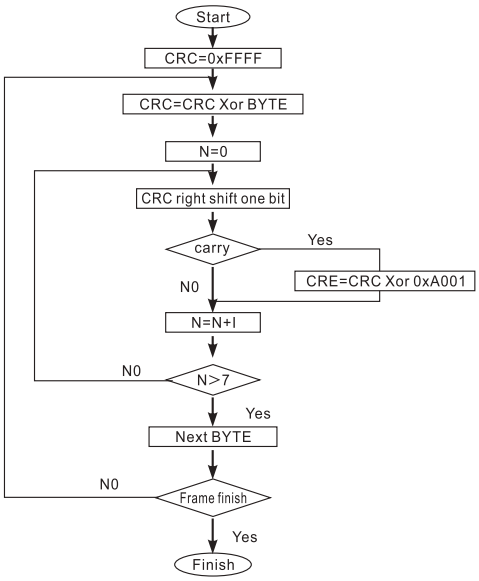
The code indicate which function should be operated by the terminal. Below Table shows the function code and their meaning and function.

Table 3

Code	Meaning	Action
01	Read switching output status	Get switching output status
02	Remote switch capacity input status	Get switching input status
03	Read the value of data register	
04	Read the value of data register	
05	Remotely control single switching output operation	
06	Write single register	Set the binary value to relative one register
0F	Remotely control more than one switching output operation	Get present binary value of one or more register
10H	Write preset register	Set the binary value to relative registers

Checkout code:

Error checkout (CRC) domain take 2 bytes, include one 16 bit binary value.CRC value is calculated by transmission device, then attached to data frame; When receiving device receive data, CRC value will be calculated again, then compare with the received value of CRC domain, if two values are not equal, the error occurs.



1.3 Input status command of remote-check switch 0 x 02 (see Table 4)

Table 4

Host PC query the command			Slave PC response	
Slave PC address	1 Byte	1 ~247	Slave PC address	1 Byte
Function code	1 Byte	0x02	Function code	1 Byte
Starting switch address	2 Bytes	0x0000(Fixed)	Byte number of register	1 Byte
Remote-check switch quantity	2 Bytes	0x000C(MAX.)	Register value	N Bytes
CRC checkout code	2 Bytes		CRC checkout code	2 Bytes

1.4 Example

Remote-check switching input status (Function code0 x 02)

Host PC request: 0x01 0x02 0x00 0x00 0x00 0x0A 0xF8 0x0D

- 0x00 0x0A: switching quantity (Max. 12 loops)
- 0x00 0x00: Starting address (fixed 0)
- 0x02: Function code of read relay status

Slave PC response: 0x01 0x02 0x02 0x08 0x01 0xBE 0x78

- 0x08 0x01: Switching input status value(No. 4 and 9 switching)
- 0x02: Register BYTE numbers

Description: The switching input status value corresponds to the status value of each switching input starting from the lowest bit of each byte according to the MODBUS protocol. 1 means the ON status and 0 means the OFF status.

The communication protocol of this meter follows the standard MODBUS-RTU protocol. And in the communication address Table, there are both floating-point primary power grid data and secondary power grid fixed-point integers. Customers can choose to read the corresponding data according to their own system requirements. MODBUS protocol communication address information table is shown in Table 17.

Communication message examples:

Read data(function code:03): this function makes the user get the data collected and recorded by terminal device and The system parameter. There is no quantity limit when the host PC collect the data in one time, but can't exceed the range of defined address. The below example is from terminal device addressing 12(0CH), read 3 data Ia, Ib, Ic (each address take 2 byte, the beginning address of Ia is 43 (2BH) , data length is 3(03H)byte.

Query the data frame (Host PC) (See Table 5)

Table 5

Address	Command	The beginning register address (high)	The beginning register address (low)	Register quantity (high)	Register quantity (low)	CRC16 (low)	CRC16 (High)
01H	03H	00H	58H	00H	02H	45H	D8H

Response data frame (slave PC) (see Table 6)

It means Ia=0000C317H(4.9943).

Table 6

Address	Command	Data length	Data 1234	CRC16 (low)	CRC16 (High)
01H	03H	04H	00H 00H C3H 17H	72H	E5H

Preset data (function code: 16): this function allows to change the contents of multiple registers (electrical measurement can be written with this function number, it should be emphasized that the written data is a writable attribute parameter, the number does not exceed the address Range), the following example is a communication method with a current transformation ratio of 400 / 5A = 80.

Query the data frame (Host PC) (See Table 7)

Table 7

Address	Command	The beginning register address (high)	The beginning register address (low)	Register quantity (high)	Register quantity (low)	Number of characters	Written data	CRC16 (low)	CRC16 (High)
01	10	00	2E	00	01	02	0050	A0	22

Query the data frame (Slave PC),indicates that the data has been written (See Table 8)

Table 8

Address	Command	The beginning register address (high)	The beginning register address (low)	Register quantity (high)	Register quantity (low)	CRC16 (low)	CRC16 (High)
01	10	00	2E	00	01	61	C0

MODBUS Address Data Table (see Table 9)

Table 9

Address		Description	Data format	Data length	Read/write	Explanation
0001						
0002		Corresponding item of output 1	uchar	1	R/W	Corresponding item of switching output
		Level delay of output 1	uchar	1	R/W	Unit: Second
0003		Corresponding value of output 1	uint	2	R/W	Alarm value
0004		Return difference value of output 1	uint	2	R/W	Returned value
0005		Limit alarm of output 1	uint	2	R/W	Min. value of lower alarm
0006-0019		Output 2-6 loops				
001A		Corresponding item of analog output 1	uchar	1	R/W	Corresponding item of analog output
		Corresponding mode of analog output 1	uchar	1	R/W	0,4-20mA 1,0-20mA
001B		Corresponding value of analog output 1	uint	2	R/W	Analog corresponding value
001C-0021		2-4 loops of analog output				
0022-0027		Backup				
0028		Power display setting	uchar	1	R/W	Reserve
		Wiring mode selection	uchar	1	R/W	see the address explanation
0029		Power-on display	uchar	1	R/W	displayed contents
		Back-light delay time	uchar	1	R/W	Back-light delay time
002A		Luminance	uchar	1	R/W	LED Luminance
		CT quantity	uchar	1	R/W	0,3CT 1,2CT
002B		Time setting of scrolling display				
002C		Voltage multiplying power	uint	2	R/W	1-9999
002D		PT divisor	uint	2		1-9999
002E		Current multiplying	uint	2	R/W	1-9999
002F		Backup				
0030		Voltage null	uint	2	R/W	0.001-9.999
0031		Current null	uint	2	R/W	0.001-.500
0032		Power null	uint	2	R/W	0.001-9.999
0033		Communication protocol	uint	2	R/W	0-RS485Modbus
0034		Communication address	uint	2	R/W	0-247
0035		Baud rate	uint	2	R/W	1-6,1:1200,2:2400, 3:4800,4:9600(default), 5:19200,6:38400
0036		checking	uint	2	R/W	0-2,0:even checking, 1:odd checking, 2:no checking(default)
0037		Backup				
0038-003B		645 communication address	uchar	8	R/W	BCD code
003C		Baud rate of No.2 loop	uint	2	R/W	1-6,1:1200,2:2400, 3:4800,4:9600(default), 5:19200,6:38400
003D		No.2 loop checking	uint	2	R/W	0-2,0:even checking, 1:odd checking, 2:no checking(default)
003E-003F		Backup				
0040		Switching output information	uint	2	R	High 8 bit backup, low 8 bit valid 0: OFF 1: ON
0041		Switching input information	uint	2	R	0: OFF 1: ON
0042		A phase voltage	ulong	4	R	4 decimal point (0.0001V)
0043						
0044		B phase voltage	ulong	4	R	4 decimal point (0.0001V)
0045						
0046		C phase voltage	ulong	4	R	4 decimal point (0.0001V)
0047						
0048		Average phase voltage	ulong	4	R	4 decimal point (0.0001V)
0049						
004A		Phase voltage unbalance	ulong	4	R	0.01-99.99 2 decimal point (%)
004B						
004C		AB line voltage	ulong	4	R	4 decimal point (0.0001V)
004D						
004E		BC line voltage	ulong	4	R	4 decimal point (0.0001V)
004F						
0050		CA line voltage	ulong	4	R	4 decimal point (0.0001V)
0051						
0052		Average line voltage	ulong	4	R	4 decimal point (0.0001V)
0053						
0054		Zero-sequence voltage	ulong	4	R	4 decimal point (0.0001V)
0055						
0056		Line voltage unbalance	ulong	4	R	0.01-99.99 2 decimal point (%)
0057						
0058		A phase current	ulong	4	R	4 decimal point (0.0001A)
0059						
005A		B phase current	ulong	4	R	4 decimal point (0.0001A)
005B						
005C		C phase current	ulong	4	R	4 decimal point (0.0001A)
005D						
005E		Average current	ulong	4	R	4 decimal point (0.0001A)
005F						
0060		Zero-sequence current	ulong	4	R	4 decimal point (0.0001A)
0061						
0062		Current unbalance	ulong	4	R	0.01-99.99 2 decimal point (%)
0063						
0064		A phase active power	long	4	R	4 decimal point (0. 0001kW)
0065						
0066		B phase active power	long	4	R	4 decimal point (0. 0001kW)
0067						
0068		C phase active power	long	4	R	4 decimal point (0. 0001kW)
0069						
006A		Total active power	long	4	R	4 decimal point (0. 0001kW)
006B						
006C		A phase reactive power	long	4	R	4 decimal point (0. 0001kvar)
006D						
006E		B phase reactive power	long	4	R	4 decimal point (0. 0001kvar)
006F						
0070		C phase reactive power	long	4	R	4 decimal point (0. 0001kvar)
0071						
0072		Total reactive power	long	4	R	4 decimal point (0. 0001kvar)
0073						
0074		A phase apparent power	long	4	R	4 decimal point (0. 0001kVA)
0075						
0076		B phase apparent power	long	4	R	4 decimal point (0. 0001kVA)
0077						
0078		B phase apparent power	long	4	R	4 decimal point (0. 0001kVA)
0079						
007A		Total apparent power	long	4	R	4 decimal point (0. 0001kVA)
007B						
007C		A phase power factor	int	2	R	3 decimal point
007D		B phase power factor	int	2	R	3 decimal point
007E		C phase power factor	int	2	R	3 decimal point
007F		Total power factor	int	2	R	3 decimal point
0080		Frequency	uint	2	R	Frequency 2 decimal point
0081		Backup				
0082		Total positive active energy	ulong	3	R	Secondary side (0.001kWH)
0083						
0084		Total negative active energy	ulong	3	R	Secondary side (0.001kWH)
0085						
0086		Total positive reactive energy	ulong	3	R	Secondary side (0.001kvarH)
0087						
0088		Total negative reactive energy	ulong	3	R	Secondary side (0.001kvarH)
0089						
008A		Total positive active energy	float		R	Primary side
008B						
008C		Total negative active energy	float		R	Primary side
008D						
008E		Total positive reactive energy	float		R	Primary side
008F						
0090		Total negative reactive energy	float		R	Primary side
0091						