

LCD Multiple Electric Meters Manual

Product Standard: GB/T22264.7-2008

I Overview

Multiple electric meters is an meter with functions such as programmable measurement, display, digital communication and electric energy impulse output. With the capability of performing electric parameter measurement, electric energy metering, data display, data acquisition and data transmission, it is extensively used for substation automation, distribution automation and the electric energy measurement, management and assessment in intelligent buildings and enterprises. The measurement accuracy class is 0.5. This meter adopts MODBUS-RTU communication protocol and can realize LCD status display and remote RS-485 digital interface communication.

Table 1:

Configuration Code	Overall Dimensions (mm)	Measurement	Display	Miscellaneous Functions
12 Square	120*120*80	Phase voltage, line voltage, current, total active power, total reactive power, total power factor, total apparent power, frequency, active electric energy, reactive electric energy	LCD paging display	Electric energy pulse output, D0 output, DI inPut, A0 output and digital communication
96 Square	96*96*80			
80 Square	80*80*80			
72 Square	72*72*80			Electric energy pulse output, DI input and digital communication

II Technical Parameters

Table 2:

Performance	Parameters		
Input, measurement and display	Net		Three-phase three-wire, three-phase four-wire
	Voltage	Rated value	AC100V, 400V (Please specify the model when ordering)
		Overload	Sustained: 1.2 times Transient: 10 times/10s
		Power dissipation	<1VA (per phase)
		Impedance	>500KΩ
		Accuracy	RMS measurement, accuracy class 0.5
	Current	Rated value	AC1A, 5A (Please specify the model when ordering)
		Overload	Sustained: 1.2 times Transient: 10 times/10s
		Power dissipation	<0.4VA (per phase)
		Impedance	<2mΩ
		Accuracy	RMS measurement, accuracy class 0.5
	Frequency		40~60Hz, accuracy of 0.1Hz
	Power		True power, reactive power, apparent power, accuracy class 0.5
	Electric energy		Four-quadrant measurement, accuracy class 0.5 for active power and accuracy class 1 for reactive power
	Display		Programmable, switchover and periodic (LCD) display
Power supply	Switching power	AC/DC 85~270V	
	Linear power	AC220V	
Output	Communication	RS-485, MODBUS-RTU protocol	
	Output	Two-way electric energy pulse output, electric energy pulse output, optically coupled relay	
Environment	Working temperature	-10~55℃	
	Storage temperature	-20~75℃	
Safety	Withstand voltage	Input/Power supply >2kV, Input/Output>2kV, Power supply/Output>1kV	
	Insulation	Input, output and power supply against the enclosure>5MΩ	

1) Auxiliary power supply:

The multiple electric meters is provided with universal (AC/DC) power input interface. When there is no special statement, the product provided is standard product with AC 220V power interface. It should be ensured that the power supply provided is suitable for the products to protect them from getting damaged.

Note: When AC is used, it is advised to install 1A fuse on the one side of the firing line.

When the electric is of relatively poor quality, it is advised to install a surge suppressor in the power circuit to avoid lightning stroke and an EFT suppressor.

2) Input signals:

The multiple electric meters adopts a calculation method in which data in each measurement channel are collected separately, which guarantees the complete consistency when used. It has several modes of connection, suitable for different forms of loads.

Note: For specific wiring and meter parameters (pulse constants, etc.), see the wiring diagram attached to the meter.

Explanation:

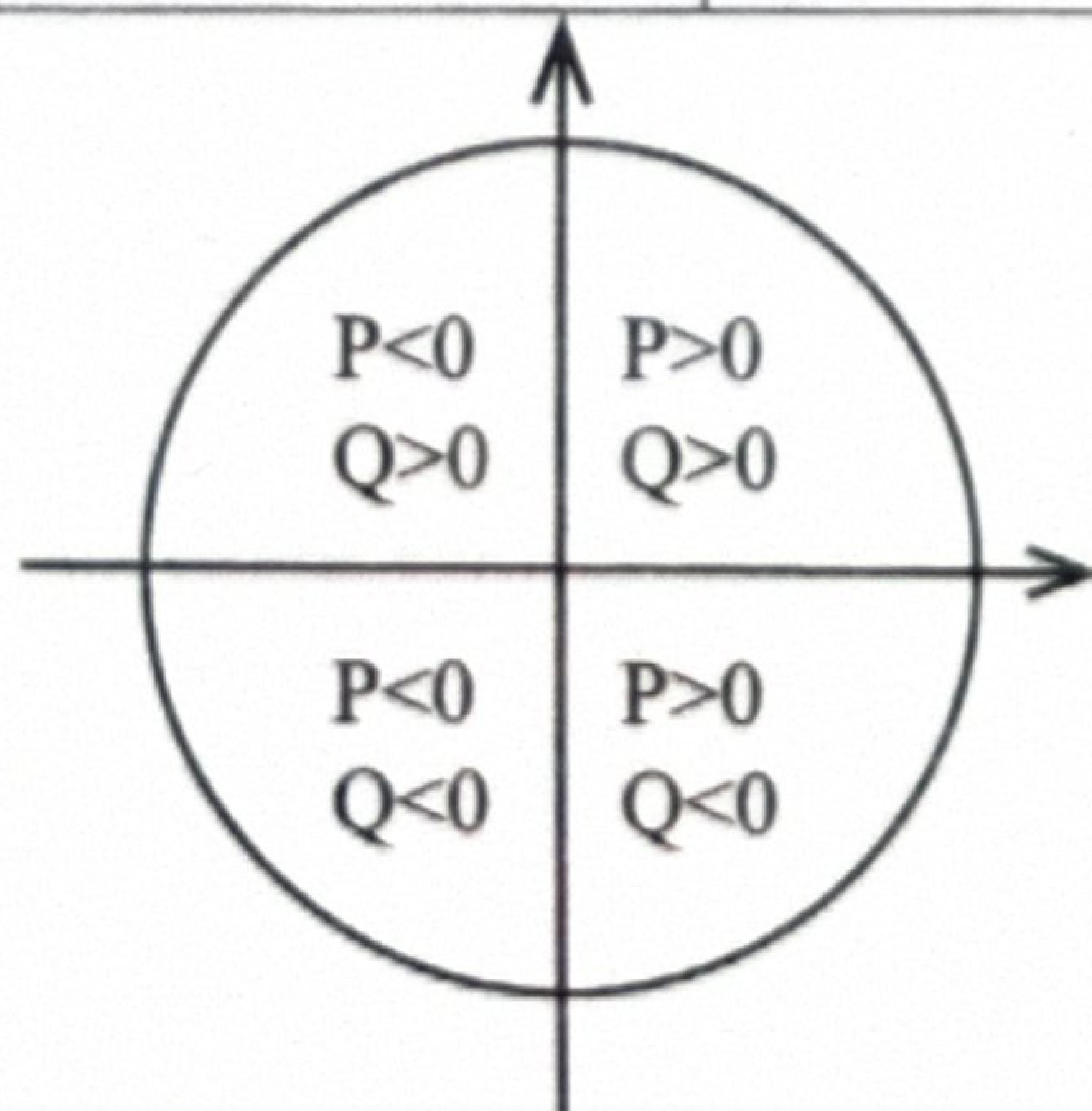
- A. Voltage input: The voltage input shall not be greater than the rated input voltage (100V or 400V). If there is no indication, the manufacturer voltage of the product is AC0~500V. When it exceeds 500V, you should consider using PT. And 1A fuse must be installed at the voltage input end.
- B. Current input: The standard rated current is 5A. When the current is greater than 5A, external CT should be used. If there are other meters connected to the CT, the wiring should be concatenation. Before removing the current input connection of the product, you must disconnect the primary circuit of CT or short out its secondary circuit first. Terminal strip is recommended. For the convenience of dismounting, do not connect it to CT directly.
- C. Input voltage and input current must be ensured to be corresponding and in the same sequence and direction, or there will be numeric-errors and symbol errors on the power and electric energy!!!
- D. The configuration of the fan-in network for meter depends on the number of CT in the system. When the number is 2, the three-phase three-wire two-element mode is chosen; when the number is 3, the three-phase four-wire three-element mode will be adopted. The fan-in network NET set up in the connection and programming of the meter should have the same mode of connection as the load to be measured has or this will cause incorrect measurement of voltage or power for the

meter. When the mode is three-phase four-wire, the voltage measured and displayed is the phase voltage of the electric grid.

III Programming and Use

1) Measurement and display: The multiple electric meters can measure the following electric parameters in the electric grid: U_a, U_b, U_c (phase voltage); U_{ab}, U_{bc}, U_{ca} (line voltage); I_a, I_b, I_c (current); P_s (total active power); Q_s (total reactive power); PF_s (total power factor); S_s (total apparent power); Hz (frequency) and active and reactive electric energy. All electric parameters measured are saved in the table of electric energy information within the meter, those data can be collected through the digital communication interface on the meter. The display content and display mode may vary from type to type. For details, please refer to the specific instruction. The computing methods for all electric parameters are digitalized discrete methods of the following formulas. Details are as follows:

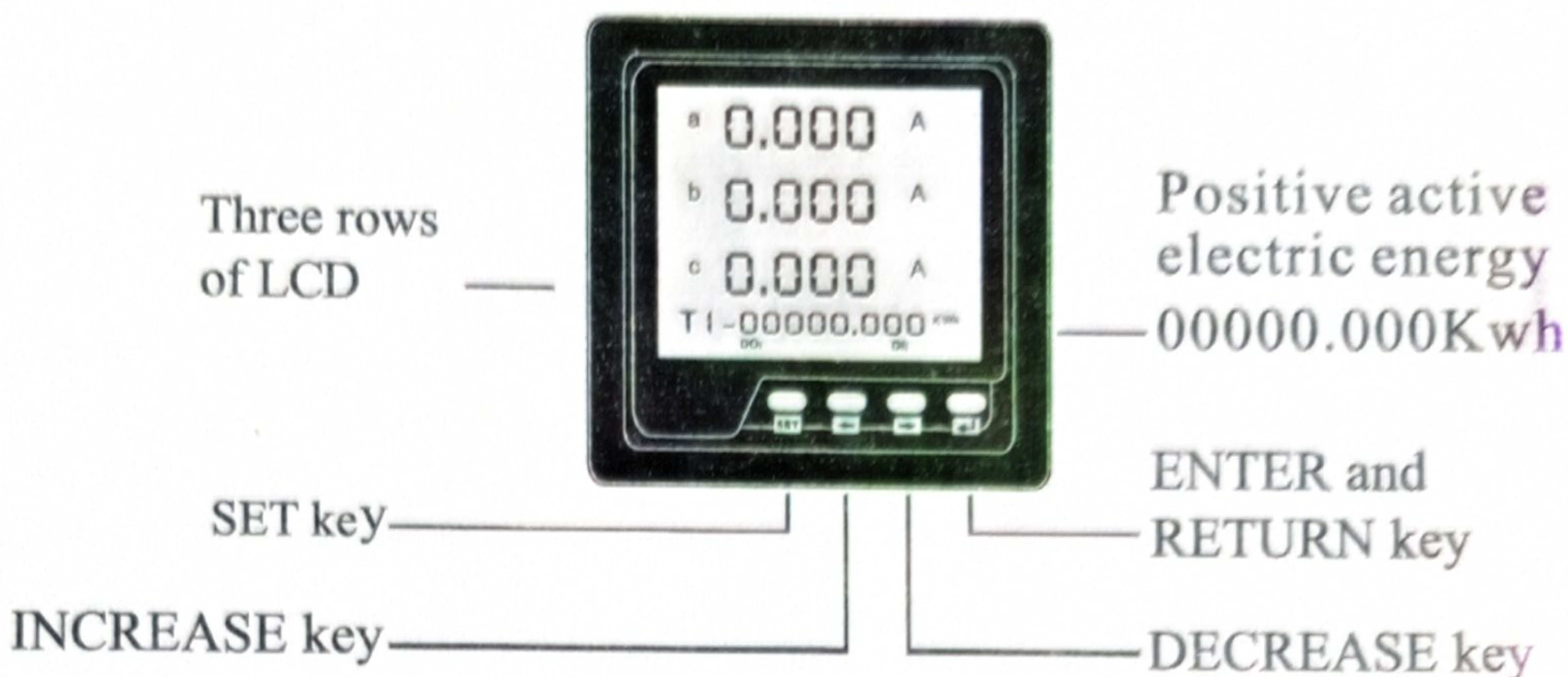
Formula	Remark	Formula	Remark
$U = \sqrt{\frac{1}{N} \sum_{n=1}^N U_n^2}$	Voltage effective value	$P_s = UI$	Average periodic single-phase apparent power
$I = \sqrt{\frac{1}{N} \sum_{n=1}^N I_n^2}$	Current effective value	$\cos \theta = P_p / P_s$	Power factor
$P_p = \frac{1}{N} \sum_{n=1}^N I_n U_n$	Average periodic single-phase active power	$P_q = \sqrt{P_s^2 - P_p^2}$	Reactive power
$P = \frac{1}{N} \sum_{n=1}^N (I_{an} U_{an} + I_{bn} U_{bn} + I_{cn} U_{cn})$	Average periodic total active power	$W = \int p \, dt$	Electric energy



Among that, when $P > 0$, the accumulated active electric energy is the absorption of active energy. When $P < 0$, the accumulated active electric energy is the active energy.

When $Q > 0$, the accumulated reactive electric energy is sensible reactive energy. When $Q < 0$, the accumulated reactive electric energy is capacitive reactive energy.

2) Panel illustration



3) Description of functions of keys

SET key: When it is the measurement display mode, pressing the SET key will start the programming mode. Then the meter will prompt you to enter the "code". After the correct password (0001) is entered, programming and setting can be done for the meter. In the programming mode, this key is used to confirm the selection of menu items and modify parameter values.

RETURN key: In the programming mode, this key is used to return to the parent menu in selecting the menu items. When the meter is displaying parameters in a cyclical manner, press the RETURN key, the parameters displayed will be fixed. Press the key one more time, it will go back to the cyclical display mode;

INCREASE key: In the programming mode, this key is used to page down menu items in selecting the menu items; in the modification of parameter values, it is used for the progressive increase of parameter values; and in the status of measurement display, pressing this key can page down the display interface.

DECREASE key: In the programming mode, this key is used to page up menu items in selecting the menu items; in the modification of parameter values, it is used for the progressive decrease of parameter values; and in the status of measurement display, pressing this key can page up the display interface.

4) Description of display modes

You can choose one of the following 11 display modes by programming of "diSP" parameters in the menu or you can manually switch the display mode by pressing the "INCREASE key" or the "Decrease Key". Five

seconds after the manual switch of display mode, there will be an automatic return to the display mode set.

Table 3:

DISP	Corresponding display interface	Description
9		Automatically loop through the following nine ways
0	Ln3V	Fixed display three-phase phase voltage, K light on for KV
1	3A	Fixed display three-phase current, K light on for KA
2	W var VA	Fixed display of the total active power, K light on for the KW, M light on for MW
3	W	Fixed display of split phase active power, K light on for the KW, M light on for MW
4	var	Fixed display of the total active power, K light on for the Kvar, M light on for the Mvar
5	VA	Fixed display phase separation apparent power, K light on for the KW, M light on for MW
6	PF Hz	Fixed display of total three-phase power factor and frequency
7	PF	Fixed display of total power factor
8	LL3V	Fixed display three-phase line voltage, K light on for KV

Display the main interface, press "↵" display the following parameters in order.

T1	Fixed display of positive active energy, K light on for Kwh, M light on for Mwh
T2	Fixed display of positive reactive energy, K light on for the Kvarh, M light on for the Mvarh
T3	Fixed display of positive reactive energy, K light on for the Kvarh, M light on for the Mvarh
T4	Fixed display of negative reactive energy, K light on for the Kvarh, M light on for the Mvarh

5) In the programming mode, the meter has 11 main classes of input setup menu items, namely setting(SET), input(inP), communication (Conn), alarm output1(D0-1), alarm output2(D0-2), alarm output3(D0-3), alarm output4(D0-3), transmission 1(A0-1), transmission 2(A0-2), transmission 3(A0-3) and transmission 4(A0-4) and adopts a hierarchical LED menu structure for management, with the first row displaying the first level of menu, the second row the second and third levels of menu and the third row showing the parameter values.

2. Programmable operation: During the programmable operation, the meter provides three input setup menu items setting (SET), input (INPT) and communication (CONN) and adopts a LCD menu structure with the first row displaying the first level of menu, the second row displaying the second level of menu and the third row displaying the third level of menu.

The organization structure of the menu is as below. Users can select appropriate set up parameters according to the actual situation

First level	Second level	Third level	Description
Password (CODE)		Password data (0~9999)	Only when the password input is correct can the programming be entered. Default password: 0001
System settings SET	Display disp	See Table 3	Selective display items are automatic and display item respectively.
	Clear the Electric Energy CLr. E	YES	When it is confirmed, the electric energy will be reset
	L-BL	ON and OFF	When ON is pressed, the meter will be normally on

First level	Second level	Third level	Description
Signal input INPT	Net NET	N.3.4 and N.3.3	Select the input network nEt 0: n3.3 stands for the three-phase three-wire 1: n3.4 stands for the three-phase four-wire
	Voltage range U.SCL	400V and 100V	Choose the range of voltage signal to be measured
	Current range I.SCL	5A and 1A	Choose the range of current signal to be measured
	Voltage turns ratio T. U	1~9999	Set the voltage turns ratio =Primary scale value/Secondary scale value e.g. 10KV/100V=100
	Current turns ratio T. I	1~9999	Set the current turns ratio=Primary scale value/ Secondary scale value e.g. 200A/5A=40
Commu- nication parameters CONN	Address SN	1~247	Meter's address range 1~247
	Communi- cation rate BAUD	1200~9600	Baud rate 1200, 4800 and 9600
Switched output setting D0-1	Alarm parameter address 0~54	Reference value 0~9999	Refer to the alarm output specification for details
Switched output setting D0-2	Alarm parameter address 0~54	Reference value 0~9999	Refer to the alarm output specification for details

First level	Second level	Third level	Description
Switched output setting D0-3	Alarm parameter address 0~54	Reference value 0~9999	Refer to the alarm output specification for details
Switched output setting D0-4	Alarm parameter address 0~54	Reference value 0~9999	Refer to the alarm output specification for details
Analog output setting A0-1	Transmission parameter address 0~54	Reference value 0~9999	Refer to the alarm output specification for details
Analog output setting A0-2	Transmission parameter address 0~54	Reference value 0~9999	Refer to the alarm output specification for details
Analog output setting A0-3	Transmission parameter address 0~54	Reference value 0~9999	Refer to the alarm output specification for details
Analog output setting A0-4	Transmission parameter address 0~54	Reference value 0~9999	Refer to the alarm output specification for details

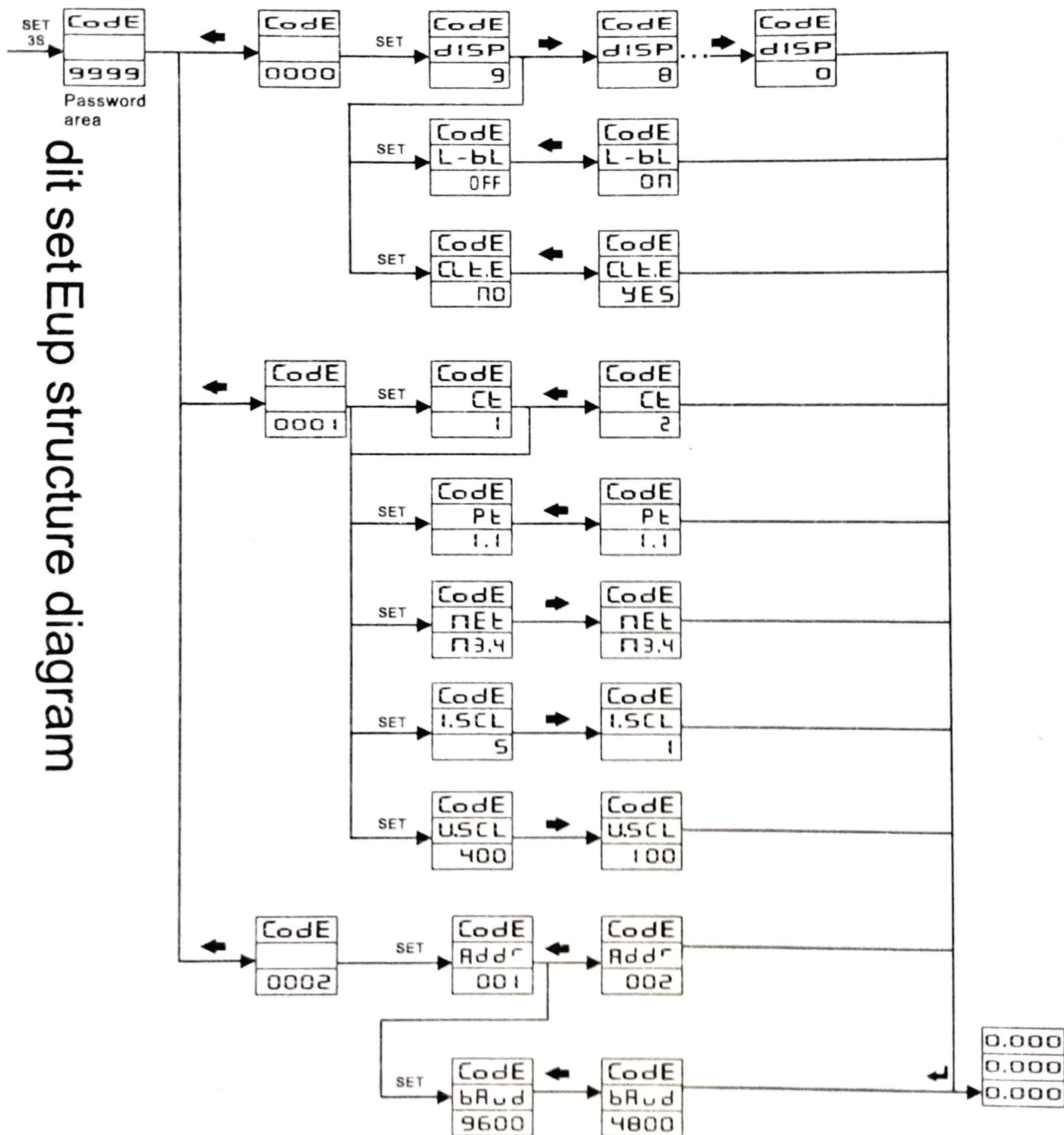
Operating requirements: When an meter is used for the first time, please check the consistency between the parameters of the meter and the parameters required by the electric distribution system. For example, an AC380V 200A/5A needs to be configured with an AC380V 200A/5A multiple electric meters. Users can also redo the programming setting to the meter according to actual needs.

For the same meter, when used in a 400A/5A circuit, you only need to alter T.I, the CT ratio of transformation into 80. As a general rule, the label on the back of the meter indicates the type parameters and set up parameters.

After the correct configuration of the meter, you need to do the wiring of the meter correctly according to actual requirements. Auxiliary electric supply, input signal and output signal are to be dealt with in accordance with the directions in the manual.

Example of programming: Make the signal input network of the meter three-phase four-wire and the voltage turns ratio 60. (Suppose the original

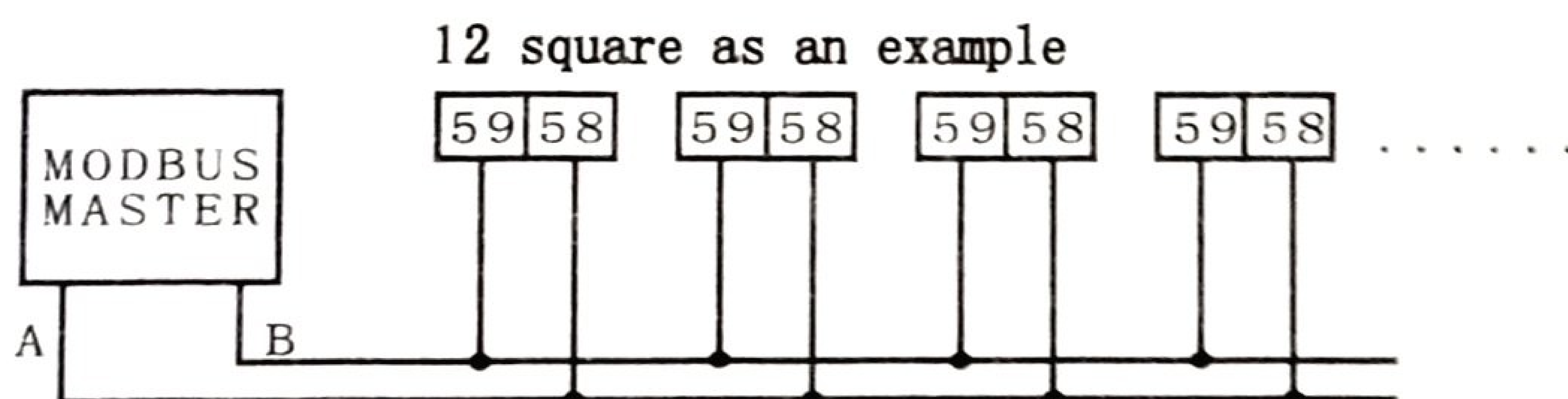
dit setEup structure diagram



Note: When any parameter value is modified, you can directly press "↵" the button to save and return to the measurement interface

IV Digital Communication

Multiple electric meters is provided with the asynchronous serial HDX RS485 communication interface, and adopts the MOD-BUS-RTU protocol, to transmit various data information on the communications lines. In a 485 bus, 32 network electric meters can be connected up at the same time, and each of which can be set with its Address NO.. The communication terminal number for different series of electric meters may be not the same, so the STP of diameter not less than 0.5mm² with copper mesh should be used in communication connection. Since the communication line should be away from the heavy current cable or other high field environment, T network connection is recommended for use, but not for the starlike or other connection mode.



MODBUS/RTU communication protocol: MODBUS protocol uses the master-slave response mode for communication mode. First of all, the signal of host computer addresses a terminal equipment (slave machine) of an unique address, and then, by which the response signal was transmitted to the host in the opposite direction, i.e., the signal transmits all communication data flow (HDX working mode) along opposite directions in a separate communication line.

MODBUS protocol only allows communication between the host (PC, PLC, etc.) and the terminal equipment, but not for independent data exchange between terminal equipment, so that each terminal equipment will not occupy the communication line during initialization, but only be limited to affect the native query signal.

Hosts lookup: the query message frame includes device address codes, function codes, data information codes and check codes. Device address codes mean that the function code of selected slave machine informs the slave machine to perform what kind of functions, such as, the functional code 03 or 04 is to require the slave device to read the register and return to its content; the data segment contains other additional information for the

slave device to perform functions, such as in reading command, the additional information of data segments comprise the amount of registers for from which register to start reading; the check code is used to verify the correctness of a frame of information and adopts the calibration rule of CRC16, to provide a method for the slave device to verify whether the information is correct.

Slaves response: if there is a normal response from the slave device, the response message should contain the address code, function code, data information code and CRC16 check code of the slave device. The data information code includes data collected from the slave device, such as the register value or state. If there is an error, it's appointed that the response is not from the slave device.

The transmission mode refers to a series of independent data structure within a data frame and finite rules used for the transmission of data. The transmission mode compatible with MODBUS protocol - RTU mode is defined below. The digit of each byte: one start bit, eight data bits, (parity bits), one stop bit (when a parity bit is available) or 2 stop bits (no parity bits).

The structure of data frame: the message format

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

Address codes at the beginning of a frame are comprised by a byte (eight-bit binary code), 0-255 for the decimalism and only 1-247 used in our system, the others for reserve. These bits indicate the address of the user-specified terminal device, which will receive data from the host connected to it. Each address terminal device must be unique, and only the terminal was addressed will response the query contained the address, i.e., when the terminal sends back a response, the address data of slave device in the response inform the host that the terminal is communicating with it.

The function code informs the addressed terminal to perform what kind of functions. The following table lists the functional codes supported by multiple electric meters and their meanings and functions.

Address code	Meanings	Behaviors
03	Read data registers	Obtain the current binary value of one or more registers
08	Electric energy zero clearing	Electric energy zero clearing for operated meter
16	Write preset registers	Set the binary to the relevant registers

The data code contains the data needed by the terminal to perform specific functions, or gathered when the terminal responds to the query. The content of these data can be numeric, reference addresses or set values. For example, the functional domain code informs the terminal to read a register, and the data domain needs to reflect from which register to start and how many data to be read, and the loopback content of data codes from the slave device contains the data length and corresponding data.

The error check (CRC) domain of check code occupies two bytes, containing a 16-bit binary value. CRC value is calculated by the transmission equipment, and then attached to the data frame. The receiving device recalculates the CRC value when receiving data, and then compares with the received value in CRC domain. If these two values are not equal, there is a mistake.

The process of generating a CRC is:

- 1) A 16-bit register is preset to FFFFH (hexadecimal, complete 1), which is called the CRC register.

- 2) Take the 8-bit of the first byte in the data frame and the low byte in the CRC register for XOR, and the result is saved back to the CRC register.

- 3) Move the single bit for right shift of the CRC register, the highest bit is 0, and the minimum bit will be shifted out and detected.

- 4) If the one shifted out in the previous step is 0, repeats the third step (the next shift) : 1; Take the CRC register and a preset fixed value (0A001H) for XOR.

- 5) Repeat the step 3 and step 4 until 8 shifts. Then the complete 8-bit is disposed.

- 6) Repeat the step 2 to step 5 to process the next 8 bits until all the byte processing are ended.

- 7) The final value of the CRC register is the value of the CRC.

Illustration of communication messages: 1.reading data (functional code 03): this function enables users to obtain data gathered and recorded on terminal devices, and system parameters. There is no limit to the number of data collected by the host at a time, but not beyond the defined address scope. The examples below are from the slave device of terminal device address 12 (0CH) to read the three data Ia, Ib and Ic, (data in data frames occupy two words for each address, for Ia, the word address is 18 (12H), data length of 6 (06 H) words and words communication way.)

Query data frames (Host)

CRC16 high-order	D6
CRC16 low-order	F4
The number of registers (low-order)	06H
The number of registers (high-order)	00H
Starting register address (low-order)	0FH
Starting register address (high-order)	00H
Command	03H
Address	0CH

Response data frames(slave)

Address	Command	Data length	Data 1~12	CRC16 low-order	CRC16 high-order
0CH	03H	0CH	43556680H 43203040H 42DDCC80H	78H	DEH

Note: Ia=43556680H(213.4A), Ib=3203040H(160.1A), Ic=42DDCC80(110.8A)

Preset data (function code: 16): this function allows the user to change contents of multi- register (The data to be written in should be writable attribute parameters, and within the address range. The following example is the communication way for the write current ratio of 400A/5A=80.)

Preset data frames(Host)

CRC16 high-order	E9H
CRC16 low-order	70H
Write data (low-order)	50H
Write data (high-order)	00H
Starting register address (low-order)	07H
Starting register address (high-order)	00H
Command	10H
Address	0CH

Response data frames(slave), indicating that the data have been written

CRC16 high-order	E9H
CRC16 low-order	70H
Write data (low-order)	50H
Write data (high-order)	00H
Starting register address (low-order)	07H
Starting register address (high-order)	00H
Command	10H
Address	0CH

MODBUS address information table:

Address	Project	Description	Byte address	Illustrate
Setup information				
0	disp	Electric quantity display selection	0, 1	The display mode of electric quantity, 0-9 (low byte is effective)
1	Addr	Meter address	2, 3	1-247 (low byte is effective)
2	bAud	Band rate	4, 5	0 for 9600, 1 for 4800, 2 for 2400 (low byte is effective)
3	U.SCL	Voltage range	6, 7	0 for 400V, 1 for 100V, (low byte is effective)
4	I.scl	Current range	8, 9	0 for 5A, 1 for 1 A (low byte is effective)
5	net	Network type	10, 11	0 for N.3.3, 1 for N.34 (low byte is effective)
6	PT	Voltage ratio	12, 13	PT = Voltage input side/out put side(1-9999)
7	CT	Current ratio	14, 15	CT=Current input side/out put (1-9999)
8	STATUS	Status	16, 17	Reservation
Electric quantity information				
9, 10	Ua(Three-phase four-wire)	A Phase voltage	18, 19, 20, 21	In the data format of the floating number, all the data of standard IEEE -754 data format are measured by one time, containing the variable ratio parameter.
11, 12	Ub(Three-phase four-wire)	B Phase voltage	22, 23, 24, 25	
13, 14	Uc(Three-phase four-wire)	C Phase voltage	26, 27, 28, 29	
15, 16	Ia	A Phase current	30, 31, 32, 33	
17, 18	Ib	B phase current	34, 35, 36, 37	
19, 20	Ic	C phase current	38, 39, 40, 41	

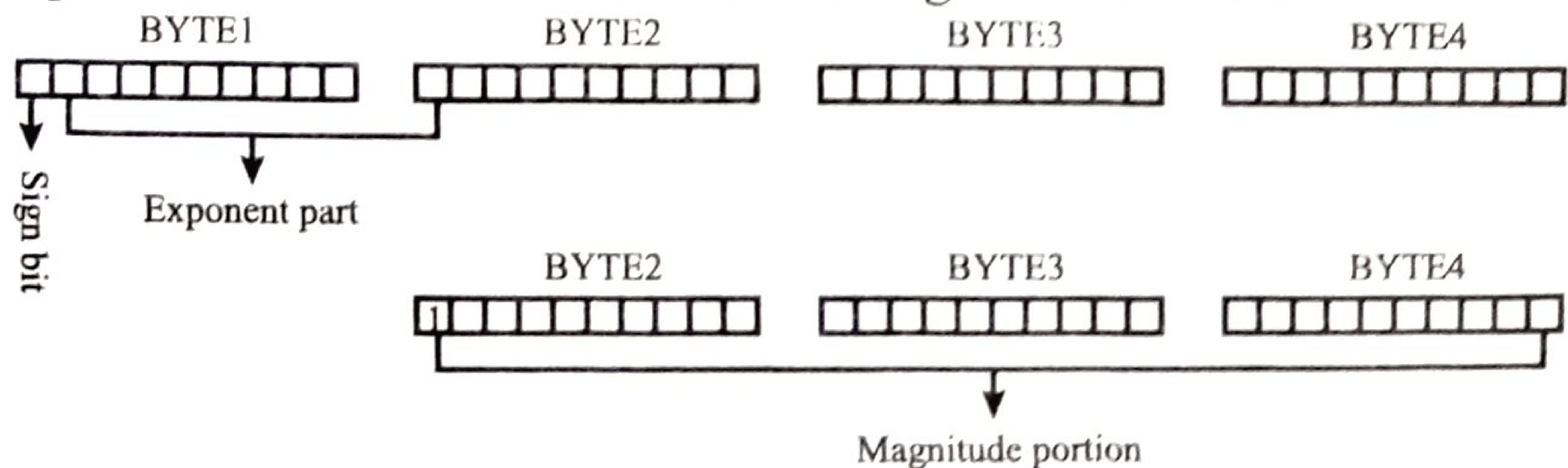
Address	Project	Description	Byte address	Illustrate
21, 22	Eabc	Average current	42, 43, 44, 45	In the data format of the floating number, all the data of standard IEEE -754 data format are measured by one time, containing the variable ratio parameter.
23, 24	PS	Total active power	46, 47, 48, 49	
25, 26	QS	Total reactive power	50, 51, 52, 53	
27, 28	PFS	Total power factor	54, 55, 56, 57	
29, 30	HZ	Frequency	58, 59, 60, 61	
31, 32	T1	Positive active energy	62, 63, 64, 65	
33, 34	T2	Negative active energy	66, 67, 68, 69	
35, 36	T3	Positive reactive energy	70, 71, 72, 73	
37, 38	T4	Negative reactive energy	74, 75, 76, 77	
39, 40	PA	A phase active power	78, 79, 80, 81	
41, 42	PB	B phase active power	82, 83, 84, 85	
43, 44	PC	C phase active power	86, 87, 88, 89	
45, 46	QA	A phase reactive power	90, 91, 92, 93	
47, 48	QB	B phase reactive power	94, 95, 96, 97	
49, 50	QC	C phase reactive power	98, 99, 100, 101	
51, 52	SA	A phase apparent power	102, 103, 104, 105	
53, 54	SB	B phase apparent power	106, 107, 108, 109	
55, 56	SC	C phase apparent power	110, 111, 112, 113	

Address	Project	Description	Byte address	Illustrate
57, 58	SS	Total apparent power	114, 115, 116, 117	
59, 60	PFA	A phase power factor	118, 119, 120, 121	
61, 62	PFB	B phase power factor	123, 124, 125, 126	
Electric energy information				
63, 64	PFC	C phase power factor	127, 128, 129, 130	
65, 66	Uab (Three-phase three-wire)	AB line voltage	131, 132, 133, 134	
67, 68	Ubc (Three-phase three-wire)	BC line voltage	135, 136, 137, 138	
69, 70	Uca (Three-phase three-wire)	CA line voltage	139, 140, 141, 142	
71, 72	T1	Forward direction active energy	143, 144, 145, 146	Secondary electric energy parameter measurement. Use the data description results of IEEE -754 floating number, with the unit of Wh. The X variable ratio of output side electric energy data under the function of the input signal should be considered.
73, 74	T2	Negative direction active energy	147, 148, 149, 150	
75, 76	T3	Forward direction active energy	151, 152, 153, 154	
77, 78	T4	Negative direction active energy	155, 156, 157, 158	
Switching value, analog quantity registers				

Address	Project	Description	Byte address	Illustrate
79	D1-DZ	Digital output 1 parameter address	159, 160	See the specification of output section of the switching value module
80	D1-VAL	Digital output 1 Reference value	161, 162	
81	D2-DZ	Digital output 2 parameter address	163, 164	
82	D2-VAL	Digital output 2 Reference value	165, 166	
83	D3-DZ	Digital output 3 parameter address	167, 168	
84	D3-VAL	Digital output 3 Reference value	169, 170	
85	D4-DZ	Digital output 4 parameter address	171, 172	
86	D4-VAL	Digital output 4 Reference value	173, 174	
87	A1-DZ	Analog output 1 parameter address	175, 176	See the specification of output section of the analog quantity module
88	A1-VAL	Analog output 1 Reference value	177, 178	
89	A2-DZ	Analog output 2 parameter address	179, 180	
90	A2-VAL	Analog output 2 Reference value	181, 182	
91	A3-DZ	Analog output 3 parameter address	183, 184	
92	A3-VAL	Analog output 3 Reference value	185, 186	
93	A4-DZ	Analog output 4 parameter address	187, 188	
94	A4-VAL	Analog output 4 Reference value	189, 190	
95	DIO	Switching value information	191, 192	See the switch module, and low byte is valid
Power, power factor information				

Address	Project	Description	Byte address	Illustrate
96	Pflag	Power sign bit	193	BBit0-3: respectively represent A, B, C, and the active power direction of phases, and 0 for positive, 1 for negative. BBit4-7: respectively represent A, B, C, and the reactive power direction of phases, and 0 for positive, 1 for negative.
	COSflag	Power factor sign bit	194	BBit0-3: respectively represent A, B, C, and the active power direction of phases, and 0 for positive, 1 for negative.
Setup information				
97	MM	Programming set password(only readable)	195, 196	2 respectively represent A, B, C, and the power factor direction of phases, and 0 for positive, 1 for negative, and B 2 bytes, 1-9999

Note: IEEE 754 adopts a four-byte binary floating-point to represent a data power, whose data format and meaning are as follows:



Sign bit: SIGN=0 is positive, and SIGN=1 is negative

Exponent part: E=exponent part -126.

Magnitude portion: M=the magnitude portion supplements the high-order to be 1

Data result: $REAL = SIGN \times 2E \times M / (256 \times 65536)$

For example: The host reads the electric energy data, and knows from the address table that the address of electric energy is (the byte mode, and old standards compatible) 92 (005CH) and the length of 4 (0004H).

Host: 01H 04H 00 5CH 00 04H 31 DBH

Slave: 01 04H 04H 50 80 00 00H EBH 6CH

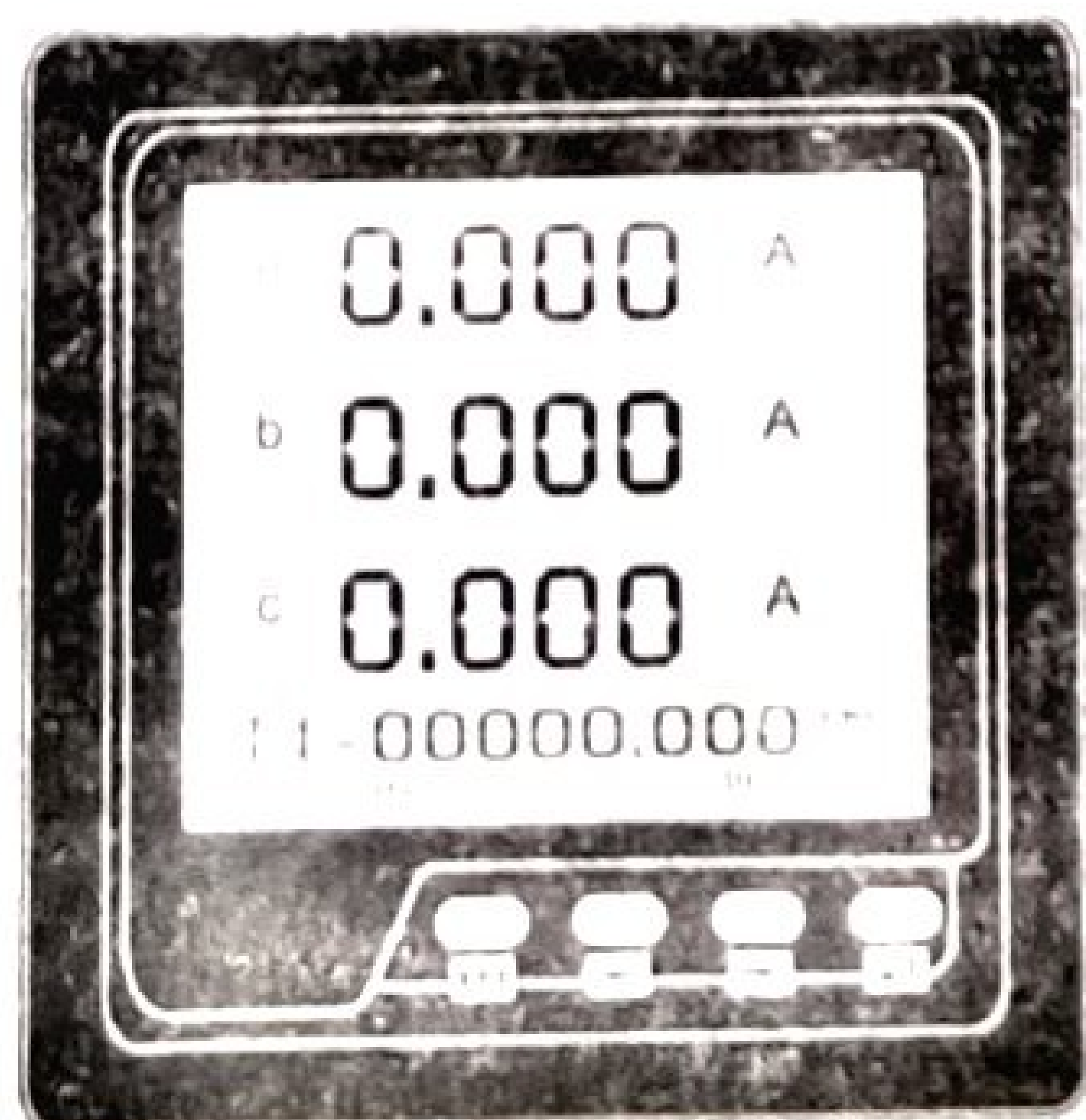
Thereinto, 50 80 00 00 is active energy(absorbing)data, EBH, the low-order and high-order 6CHCR16.

Size: SIGN (sign bit = 0, positive), index EX = A1H-126 = 35, mantissa: 08 00 00H

Result: $235 \times 80.00 \text{ 00H} / 100 \text{ 00 00H} = 17179869184 \text{ Wh} = 17179869 \text{ kWh}$.

V Function output

1. The electric energy measuring and pulse output: provide the active/reactive electric energy measuring, two-way electric energy pulse output function and RS485 digital interface to complete the display and remote transmission of electric energy data. The electric energy pulse(resistance signal) of collector open-circuit optical couple relay realizes active electric



energy (positive) and reactive electric energy (reverse) teletransmission, and uses the remote computer terminals, PLC and DI switches to collect the total amount of impulses of meters to achieve cumulative measurement of electrical energy. The output adopted with the output method is also the way for accuracy check of electrical energy (National metrological regulation = pulse error comparison method for standard scales).

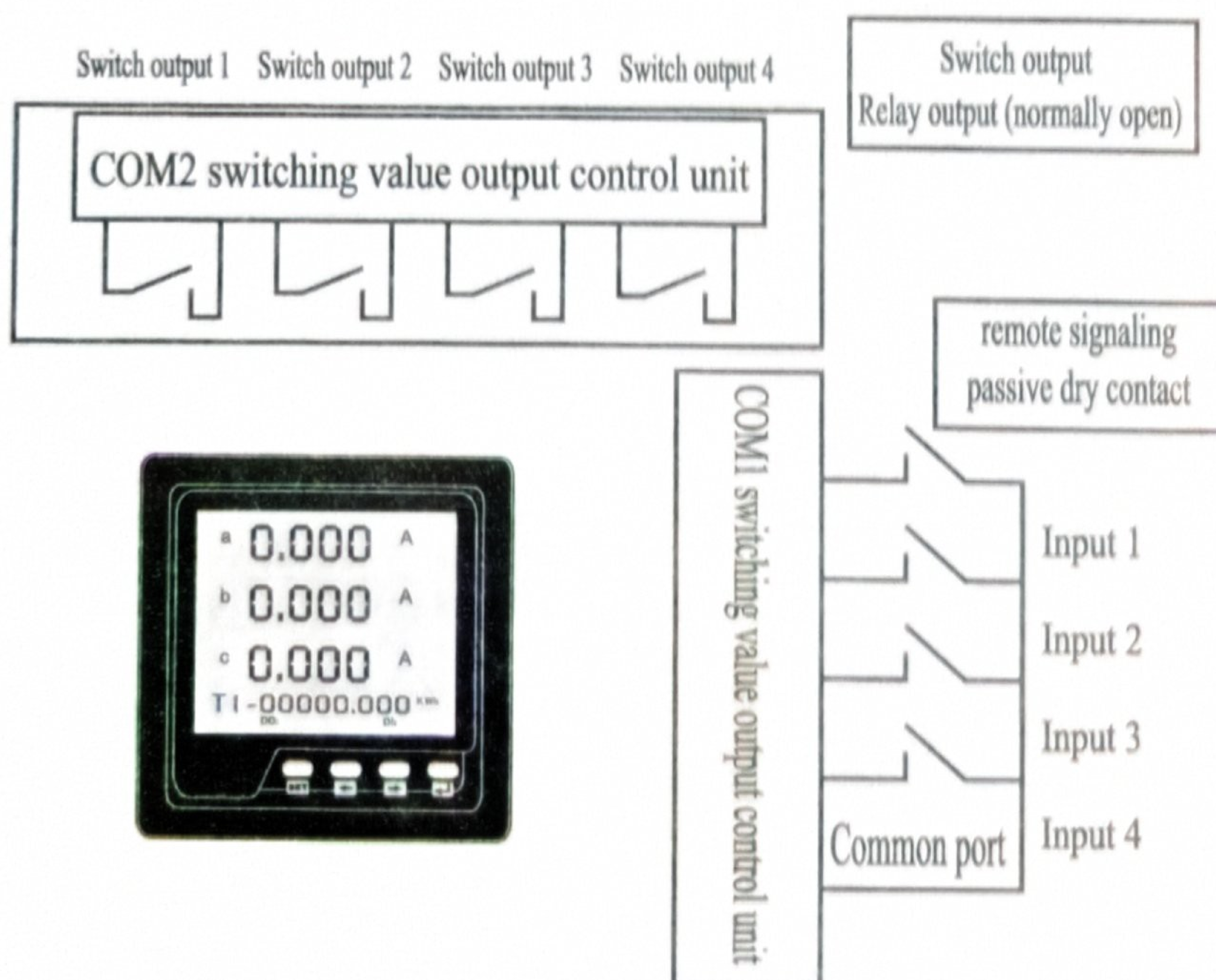
1) Electrical characteristics: collector switching voltage VCC is no more than 48V and the current Iz is no more than 50mA.

2) Pulse constant: the fastest pulse speed of 3200 imp/kWh is not more than 200ms, which means: the number of pulse output is N (5000, 20000, 80000) at the meter accumulation of 1kWh. It must be emphasized that 1kWh is secondary energy data of electric energy, and in the case of PT and CT, relative N pulse data correspond to one time of lateral electrical energy for 1kWh X voltage ratio PT X current ratio CT.

3) Application and examples: PLC terminal uses the pulse counting device, which is supposed to collect N pulses in a period of t time, with meter input of 10 kV/ 100V and 400A/5A, then the accumulation of meter electric energy in this period is $N/20000 \times 100 \times 80$ degree of electricity energy.

2. The module section of switching value: provides the 4-way

switching value input function and the switching value output function of 4-path photocoupled relay. The four-way input adopts the signal input method of the dry contact resistance switch, with meters equipped with a +12V power supply, and no need for external power supply. When the external connection is connected, the meter switched input module DI collects it as the cut-in information and displays as 1; When the external is disconnected, the meter switched input module DI collects it as disconnecting information and displays as 0. Switching value input module can not only collect and display the local switch information, at the same time can realize the remote transmission function through the digital interface RS485 of meter, namely “the remote communication function”; the switching value output function of 4-path photocoupled relay can be used for the output function of alarm indication and protection control in various places. When the switched output is valid, the relay output is conducted; and at the time of the switched output is closed, the relay output is shut off.



1) Electric parameters:

Digital input DI: switch on resistance $R < 500\Omega$; switch off resistance $R > 100K\Omega$

Digital output D0: AC250V 0.1A

2) Registers:

The DI0 information register (address 95) : the low byte of this register means the status information of the four-way switching value input and the 4-way switching value output.

DI0 register	BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
Corresponding switch ports	Di4	Di3	Di2	Di1	Do4	Do3	Do2	Do1
Reset	0	0	0	0	0	0	0	0

The high 4 bits (BIT7, BIT6, BIT5, BIT4) of the DI0 information register are the switch input status information.

If the contents of the register are 0101 0000, it indicates that the switch input ports are on for 3 and 1 ways, and closed for 4 and 2 ways.

The low 4 bits (BIT3, BIT2, BIT1, BIT0) for DI0 information register is the switch output state information. If the contents of the register are 0000 1101, it indicates the port way 1, 3, 4 are on and 2 is off, and all DI0 information can be displayed on the LCD in meter.

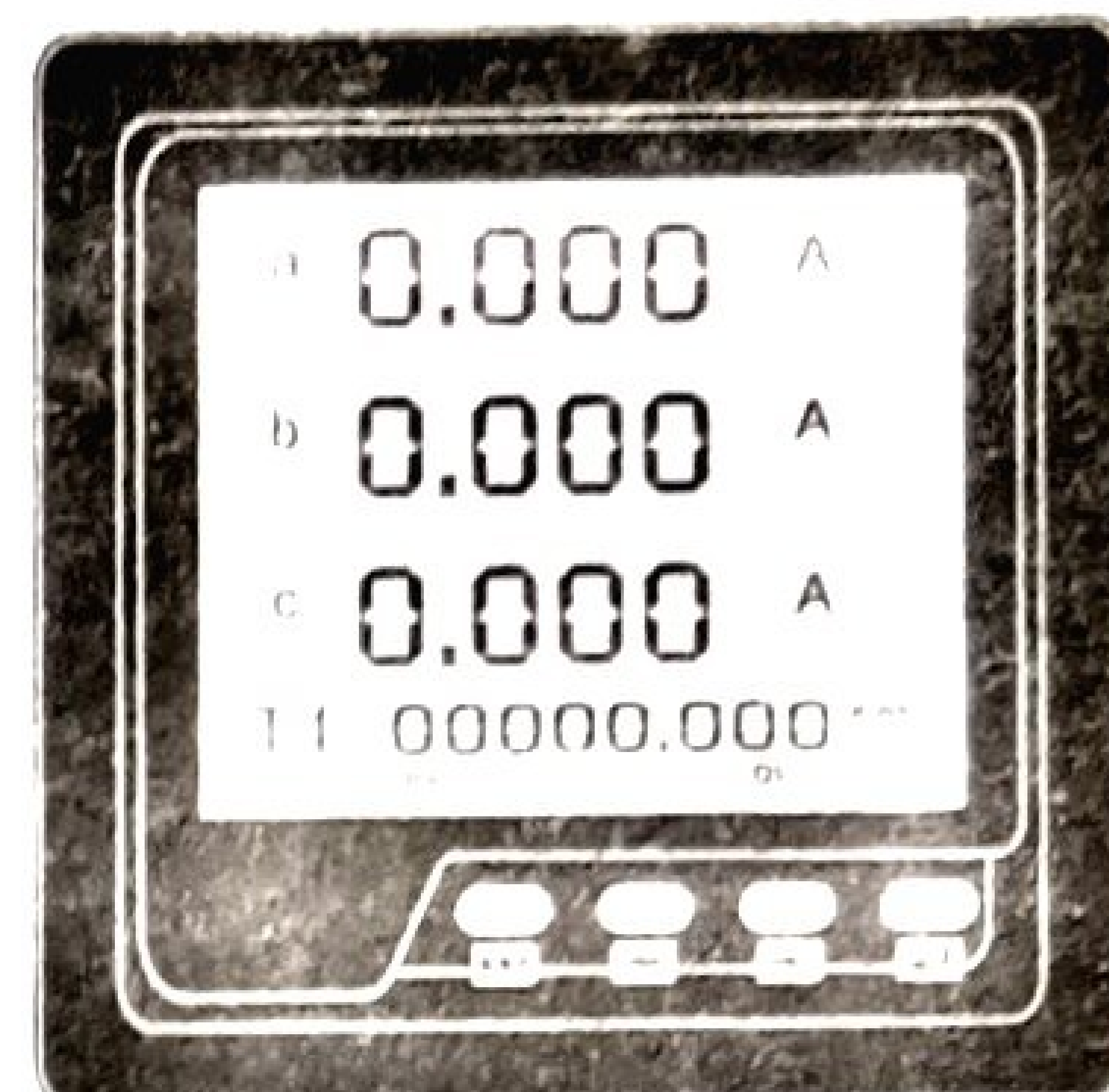
The parameters of switch alarm output quantity for each way are stored by using Dx-DZ and Dx-VAL two consecutive addresses. For example, the low byte of two bytes of the first D1-DZ address is to store the alarm threshold-crossing address; the two bytes of the D1- VAL address store the parameters for the alarm output object, such as 8 for the Ua low alarm parameter, and the high alarm of 7; 0 indicates the remote control mode, and two bytes of D1-VAL are the alarm threshold-crossing parameter. The other three ways are similar. The corresponding address space can be referred to the addresses list.

Project	Variable	Meaning	Variable	Meaning
Switched output 1	D1-DZ	(1 ~ 255), the project of alarms, and the singular numbers in 1-54 correspond to relevant low alarms of measured electric quantity in the electric quantity address list; meanwhile the even numbers correspond to high alarms, and 0 means the remote control way. Refer to the parameter comparison table of electric quantity for the switching value output and transmitting output.	D1-VAL	Alarm limit parameter (1~999)
Switched output 2	D2-DZ		D2-VAL	
Switched output 3	D3-DZ		D3-VAL	
Switched output 4	D4-DZ		D4-VAL	

3) Application and examples:

A.Switches input functions:

The switch module has the acquisition function of 4-way switching value input, and after the collection of input signal, the LCD of meter panel displays “on - 1” or “off - 0” information, for local monitoring of switch signals. The meter should be switched to the display state of switch information.



Through the RS485 digital interface of the meter, the information of switch information register (DI0) can be transferred to the remote computer terminal.

B.Switches output functions:

Remote control function: write in control information by the upper computer to the DI0 information register, to control the on and off of 4-way switching value output port, such as, writing in 1 for corresponding to be on, 0 for off, the binary number 00001011 for to be on of switching value output port of 1, 2 and 4 ways, and be off of the way 3. The function can not be used together with the other off-limit alarm output function of switch output module at the same time. It should be instead by the remote control function, and the parameter of electric quantity object must be set to 0, i.e., close the alarm output function, and the line two parameter of meter at setting switching value output function is 0. The upper right figure shows in the remote control state, the fourth and first circuit are closed, and the third and second are on.

Another function of the switch output module is the off-limit alarm output. Set the scope of electrical parameter, if which exceeds the set range, the corresponding switch output port should be on, and the corresponding position of panel displays 1; when the signal comes back to the parameters range, the display will be 0, and D0Si (3 bytes) inside the meter can set register for switches, and realize alarm set through writing in parameters by the communication interface of meter; also can be operated directly through the panel key, to set the alarm object and alarm value.

Programming examples: for settings of the meter 10KV/100V and 400A/5A, D0-1 for $U_a > 11$ kV alarm, D0-2 for $I_a > 400$ A alarm, D03 for $PFS < 0.9$ alarm, D0-4 for $F > 51.00$ Hz alarm, and the control word should be written as:

Category	Warning conditions	Dx-DZ		Dx-VAL	
		BYTE1	BYTE0	BYTE1	BYTE0
Switched output 1	$U_a > 11.00$ kV	007(00H 07H)		1100 (04H 4CH)	

Switched output 2	Ia>400.0A	013(00H 0DH)	1000 (03H E8H)
Switched output 3	PFS<0.900	052(00H 34H)	900 (03H 84H)
Switched output 4	F>51.00Hz	053(00H 35H)	1020 (03H FCH)

The set parameter of switching value D0-x can be set up by keyboard programming. In the programming operation, the D0-x relevant parameter. In the right figure: LCD1: D0-1 indicates that the project set is the first way of switching value output; LCD2:0014 for the selected alarm electric quantity project, 14: Ia for the low warning whistle. 2000 is the section of alarms, and when Ia < 2000, D01 outputs the alarm signal, that is: the relay is on.

The comparison table of electric parameters for switching value output and transmitting output

Project	Digital output		Transmitting output	
	Corresponding parameters (High alarm)	Corresponding parameters (Low alarm)	Corresponding parameters (4~20mA)	Corresponding parameters (0~20mA)
Uab (AB phase voltage)	1	2	1	2
Ubc (BC phase voltage)	3	4	3	4
Uca (CA phase voltage)	5	6	5	6
Ua (A line voltage)	7	8	7	8
Ub (B line voltage)	9	10	9	10
Uc (C line voltage)	11	12	11	12
Ia (A phase current)	13	14	13	14
Ib (B phase current)	15	16	15	16
Ic (C phase current)	17	18	17	18
Eabc (average current)	19	20	19	20
Pa (A phase active power)	21	22	21	22

Pb (B phase active power)	23	24	23	24
Pc (C phase active power)	25	26	25	26
Ps (Total active power)	27	28	27	28
Qa (A phase reactive power)	29	30	29	30
Qb (B phase reactive power)	31	32	31	32
Qc (C phase reactive power)	33	34	33	34
Qs (Total reactive power)	35	36	35	36
Sa (A phase apparent power)	37	38	37	38
Sb (B phase apparent power)	39	40	39	40
Sc (C phase apparent power)	41	42	41	42
Ss (Total apparent power)	43	44	43	44
PFa (A phase power factor)	45	46	45	46
PFb (B phase power factor)	47	48	47	48
PFc (C phase power factor)	49	50	49	50
PFS (Total power factor)	51	52	51	52
F (Frequency)	53	54	53	54

Alarm parameters calculation method:

The calculation of the absolute maximum rating of the electrical parameter alarm: bring the maximum four digits of significant of the range value, and the parameter ratio of a four-digit integer is obtained. The ratio of the alarm value to the range value is equal to the ratio of the set value.

Alarm value

$$\text{Set value} = \frac{\text{Alarm value}}{\text{Range value}} \times 1000$$

If the meter is for 400V, 800A/5A.

Set requirements	Alarm conditions	Programming setting parameter		Range
		Corresponding parameters to electrical parameters	Set value	Range value
Voltage alarm	Ua>400V	7	1000	400
	Ua>430V	7	1075	
	Uc<80V	12	200	
Current alarm	Ia>800A	13	1000	800
	Ib<400A	16	500	
	Ic<70A	18	87	
Power alarm	Pa>320kW	21	1000	320K
	Ps>980kW	27	3062	320K
	Ps<560kW	28	1750	
Power factor alarm	PFs>0.9	51	900	1
	PFa>0.866	45	866	
	PFs<0.5	52	500	

3. Analog quantity transmitting output module: provides 4-way analog quantity transmitting output function, and each way can choose any one of the 26 electrical parameters to set. Can transmit functions of module through the analog quantity of the meter itself, to achieve the simulation transmitting output function (0~20mA/4~20mA) of electric parameter, and the quantitative correspondence can be set arbitrarily.

1) Electrical parameters: output 0~20mA, 0~20mA accuracy grade 0.5%

Overload: 120% effective output, maximum current 24mA, voltage 12V.

Load: $R_{max}=400\Omega$

2) Register:

The transmitting output parameters for each way are stored by using the Ax-DZ and Ax-VAL two continuous addresses.

The parameters of switch alarm output quantity for each way are stored by using Dx-DZ and Dx-VAL two consecutive addresses. For example, the low byte of two bytes of the first A1-DZ address is to store the alarm threshold-crossing address; the two bytes of the A1- VAL address store the parameters for the alarm output object, such as 8 for 0~20 mA transmitting parameters of the Ua, and the 4~20 mA transmitting parameters of 7; A1-VAL is the parameter when transmit the parameter of 20 mA. The other three ways are similar. The corresponding address space can be referred to

the addresses list.

Can set up the control word of AO-X by the computer and meter programming keyboard, to realize settings of 4-way simulation transmitting output, including to select the electric quantity project to be transmitted and the corresponding electric quantity parameters for the full range of 20mA output.

Project	Variable	Meaning	Variable	Meaning
Variable output 1	A1-DZ	(1~255), the project of alarms, and the singular numbers in 1~54 correspond to corresponding 4~20mA transmission measured in the electric quantity address list; meanwhile the even numbers correspond to corresponding 4-20mA transmission. Refer to the parameter comparison table of electric quantity for the switching value output and transmitting output.	A1-VAL	(1~9999), 20mA output, and the corresponding parameter values.
Variable output 2	A2-DZ		A2-VAL	
Variable output 3	A3-DZ		A3-VAL	
Variable output 4	A4-DZ		A4-VAL	

3) Application and examples: Set in the meter of 10KV/100V, 400A/5A as follows: A01-Ua:0-10kV/4-20mA:A02-Ia:0-400A/4-20mA;A03-P:0-12MV/0-20 mA:A04-Q:0-12Mvar/0-20 mA.

Category	Transmitting output	Ax-DZ		Ax-VAL	
		BYTE1	BYTE0	BYTE1	BYTE0
Transmitting output 1	Ua:4-20mA	007(00H 07H)		1100 (04H 4CH)	
Transmitting output 2	Ia:4-20mA	013(00H 0DH)		1000 (03H E8H)	
Transmitting output 3	PS:0-20mA	028(00H 1CH)		3000 (0BH B8H)	
Transmitting output 4	QS:0-20mA	036(00H 24H)		3000 (0BH B8H)	

Calculation of the parameter value of electric parameters transmitting output: the top digit significance is obtained from the range value, to get an integer parameter ratio. The ratio between the transmitting value and range value is equal to the ratio of the set value to the parameter ratio. (the transmitting value should not be less than % of the range value.)

Transmitting value

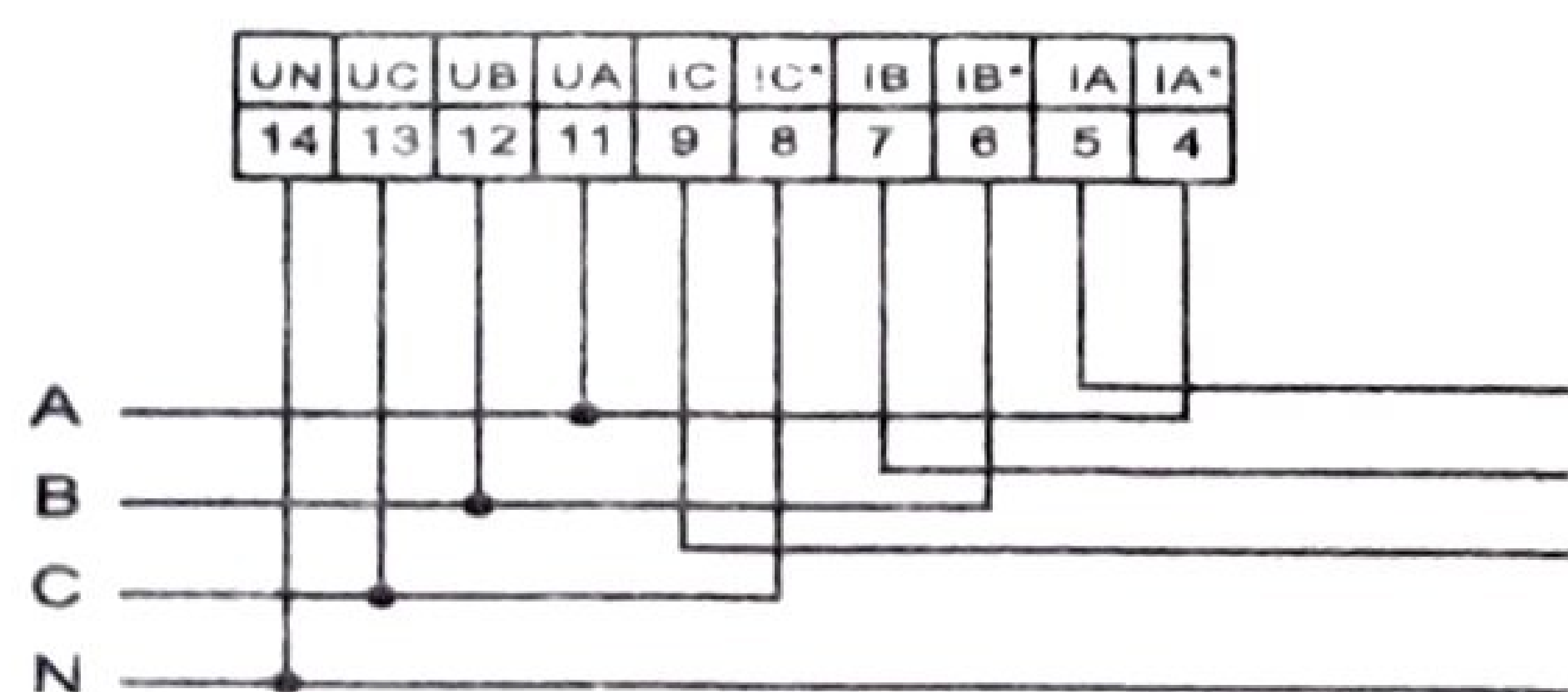
Set value =-----x 1000 et value g value

Range value
If the meter is for 400V, 800A/5A.

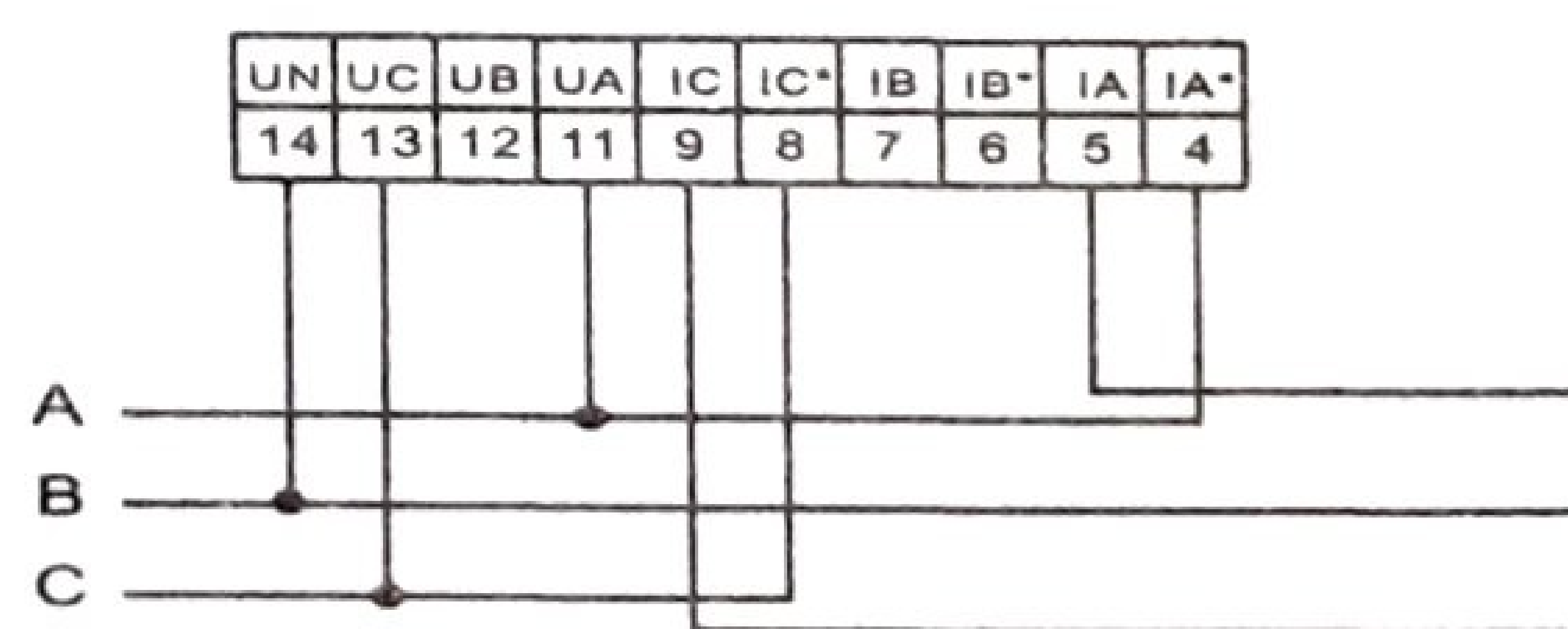
Set requirements	Transmitting conditions	Program setting parameter		Range values
		Corresponding parameters of electric parameter	Set value	
Voltage transmission	Ua:0-400V/4-20mA	7	1000	400
	Ub:0-420V/4-20mA	9	1050	
	Uc:0-350V/0-20mA	12	875	
Current transmission	Ia:0-800A/0-20mA	14	1000	800
	Ia:0-800A/4-20mA	13	1000	
	Ib:0-900A/4-20mA	15	1125	
Power transmission	Pa:0-320kW/0-20mA	22	1000	320K
	Ps:0-960kW/4-20mA	27	3000	
Power factor transmission	Pfa:0-1/0-20mA	28	1000	1
	PFs:0-0.9/4-20mA	51	900	

The transmitting output setting parameter AOSi (3BYTE) can be set by the keyboard programming. In programming, setting parameters of transmitting module parameter are in the AO-x menu item. And in the setting parameter figure below, programming projects AO-1 is for transmitting output of the first way; 007: select electric quantity Ua as the 4-20 mA transmitting output, and 20mA corresponds to the voltage of 1000, for example, in the network of 10kV/100V, namely complete the output function of transmitting output circuit I:Ua:0-10kV/4-20mA.

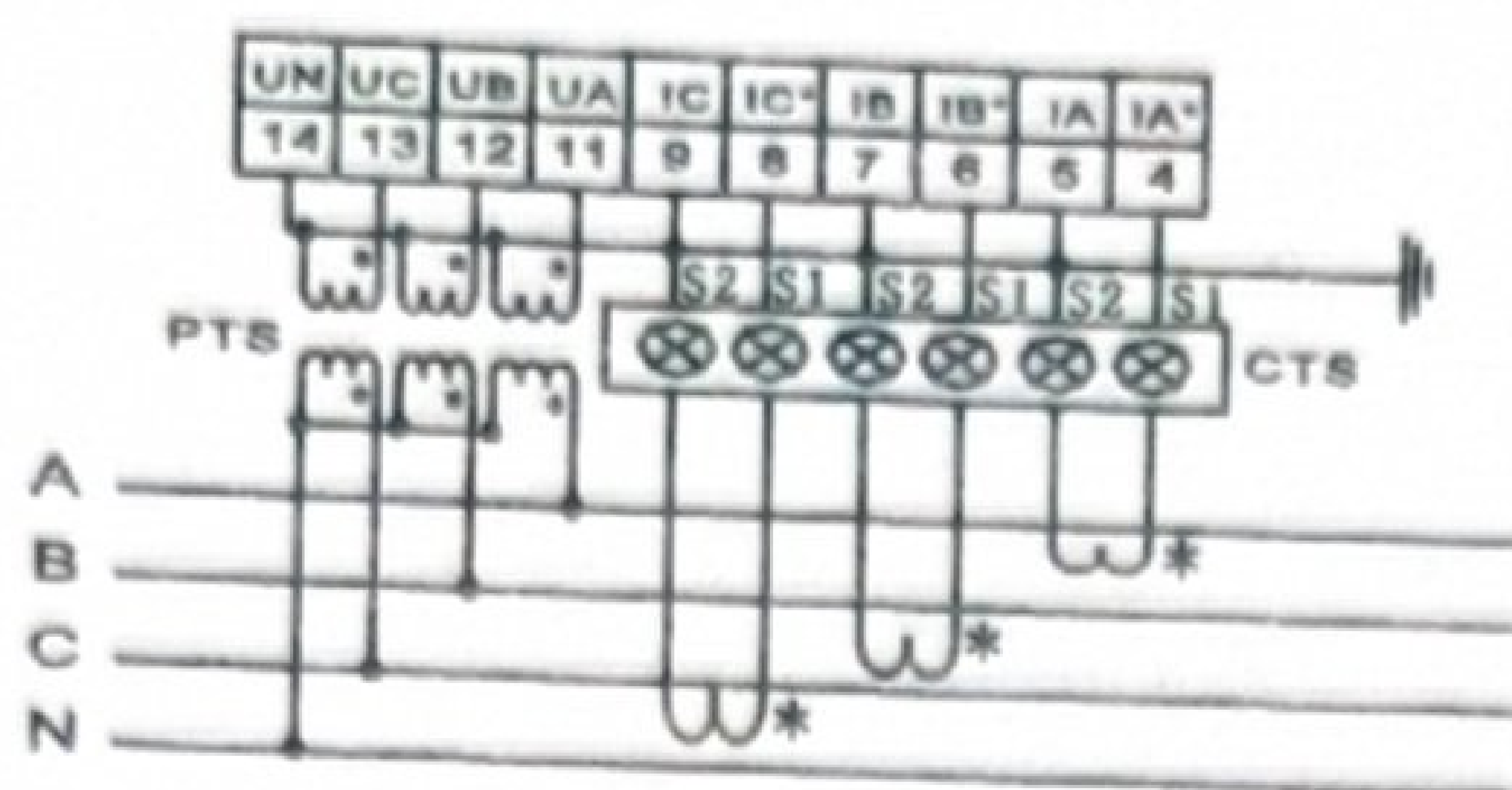
VI Connection Modes of Meters



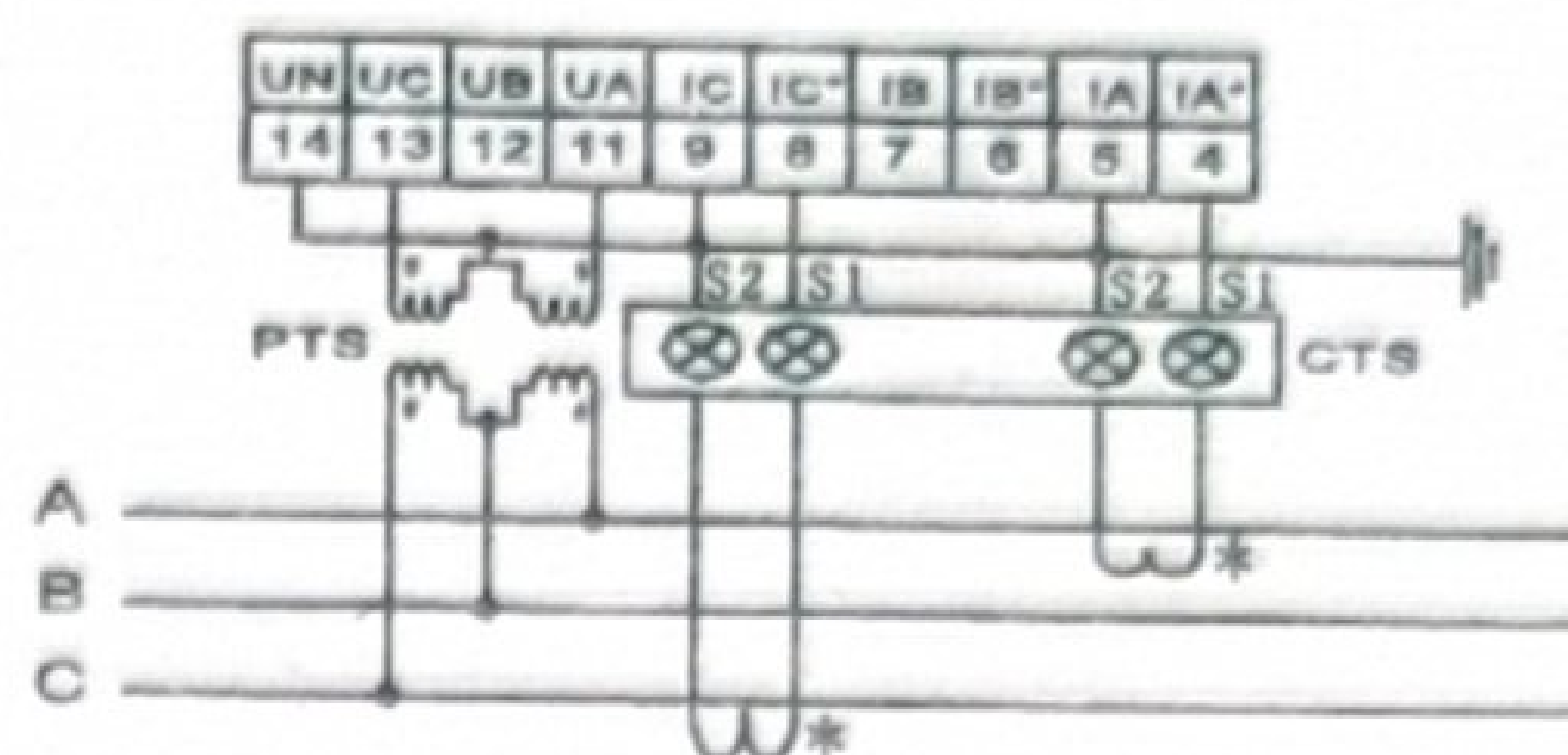
A voltage source is connected directly;
a current source is connected directly



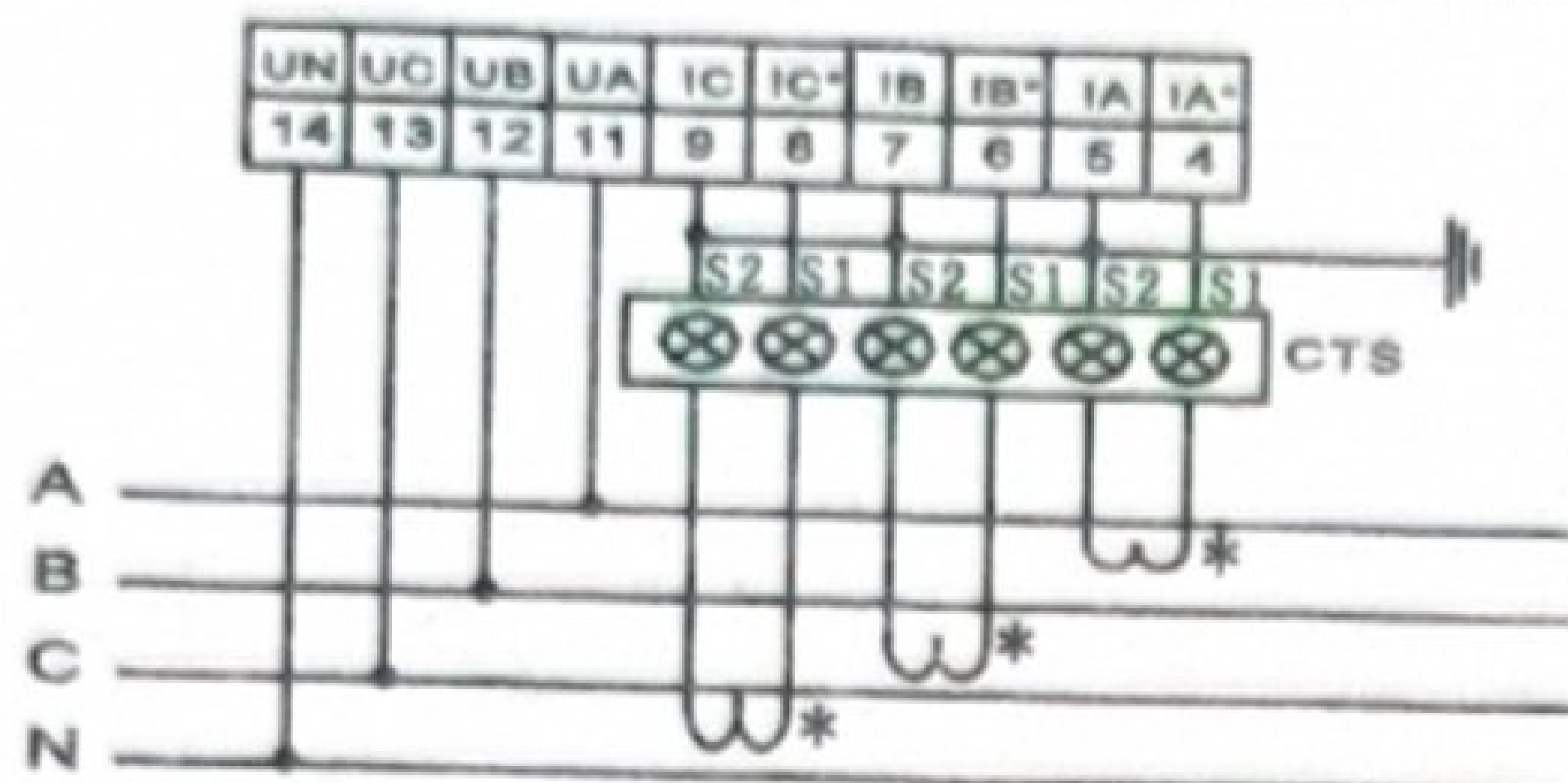
A voltage source is connected directly;
a current source is connected directly



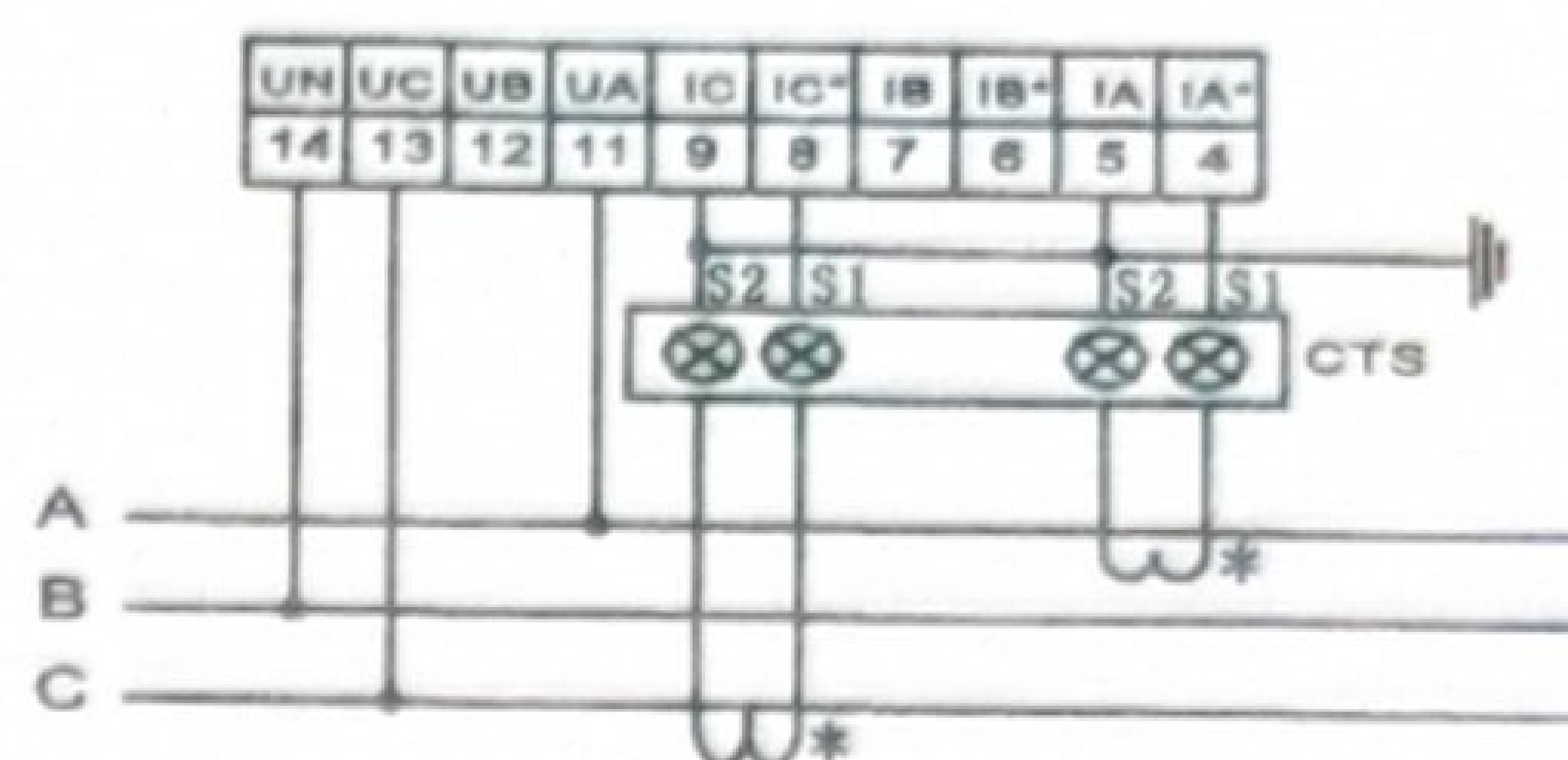
A voltage source is connected across a mutual inductor;
a current source is connected across a mutual inductor



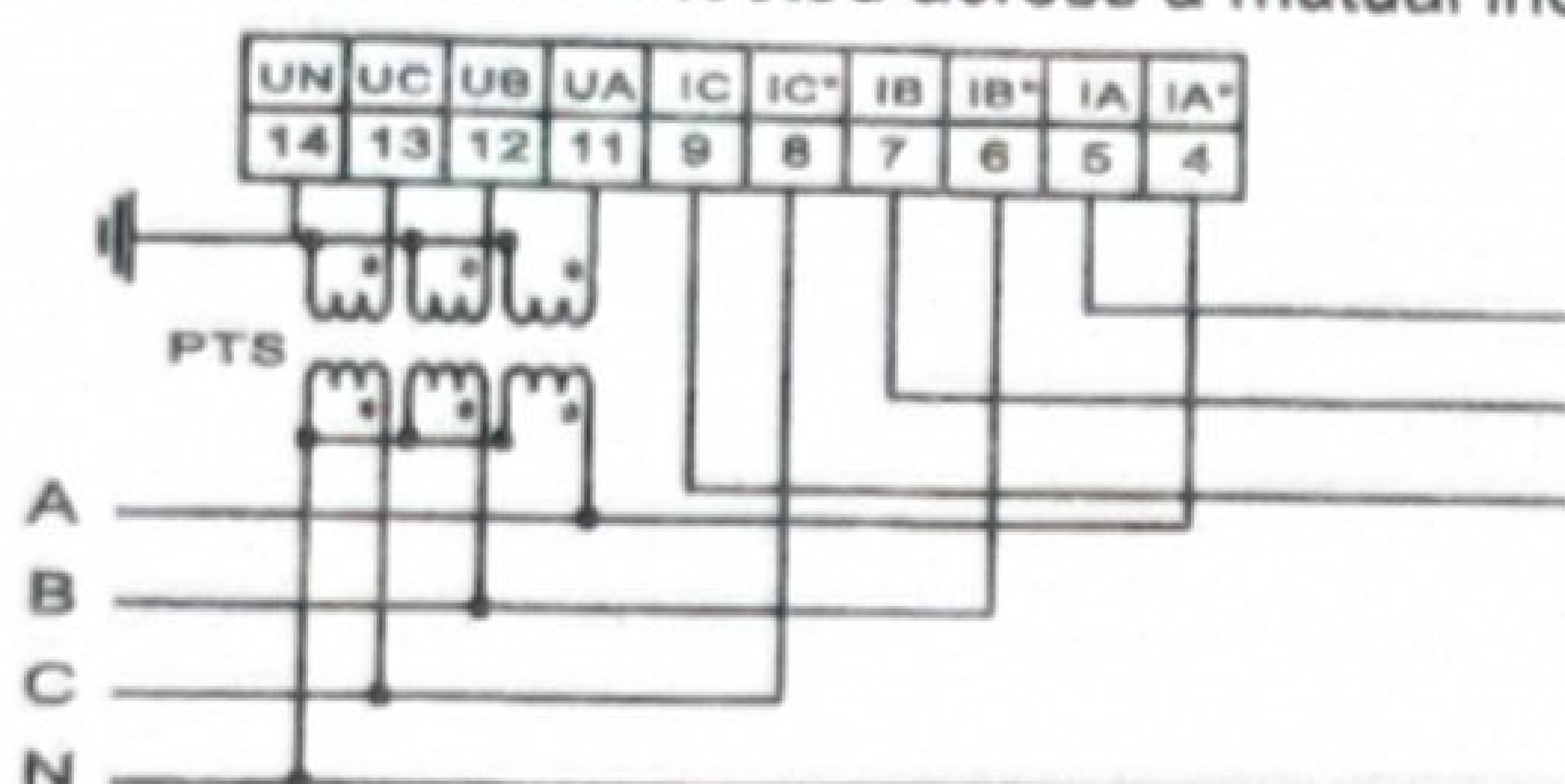
A voltage source is connected across a mutual inductor;
a current source is connected across a mutual inductor



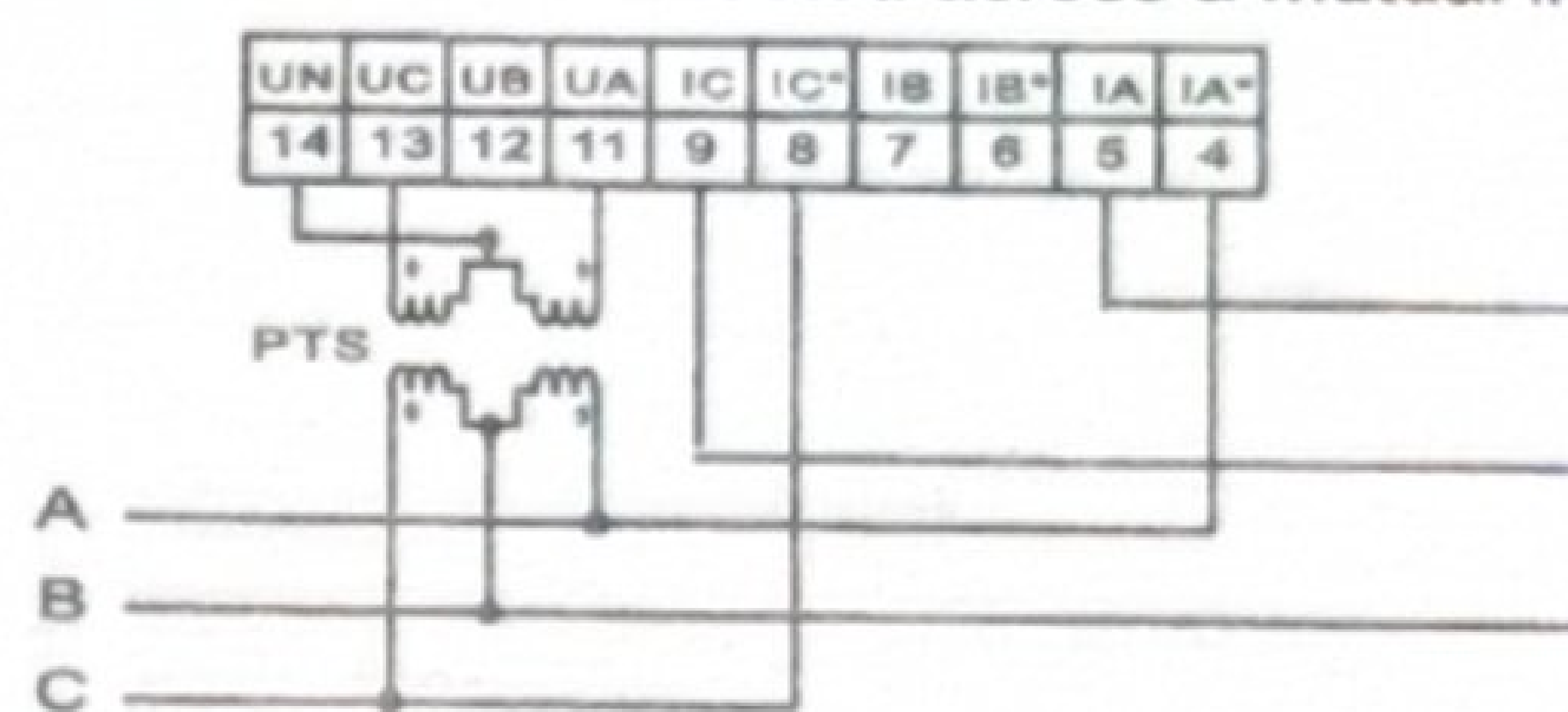
A voltage source is connected directly;
a current source is connected across a mutual inductor



A voltage source is connected directly;
a current source is connected across a mutual inductor



A voltage source is connected across a mutual inducer;
a current source is connected directly



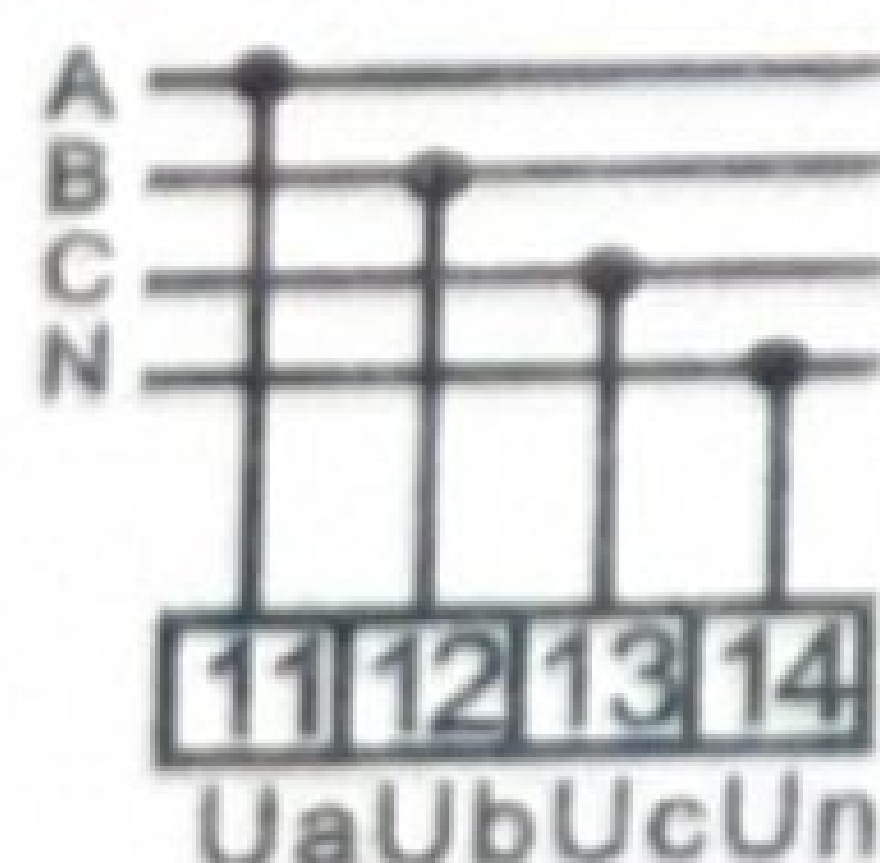
A voltage source is connected across a mutual inducer;
a current source is connected directly

Meters in dimensions 120*120, 96*96, 80*80 and 72*72 have no output wiring diagrams

1 2
N L
Power

Operated by staff only, Please check the power supply carefully before power on!

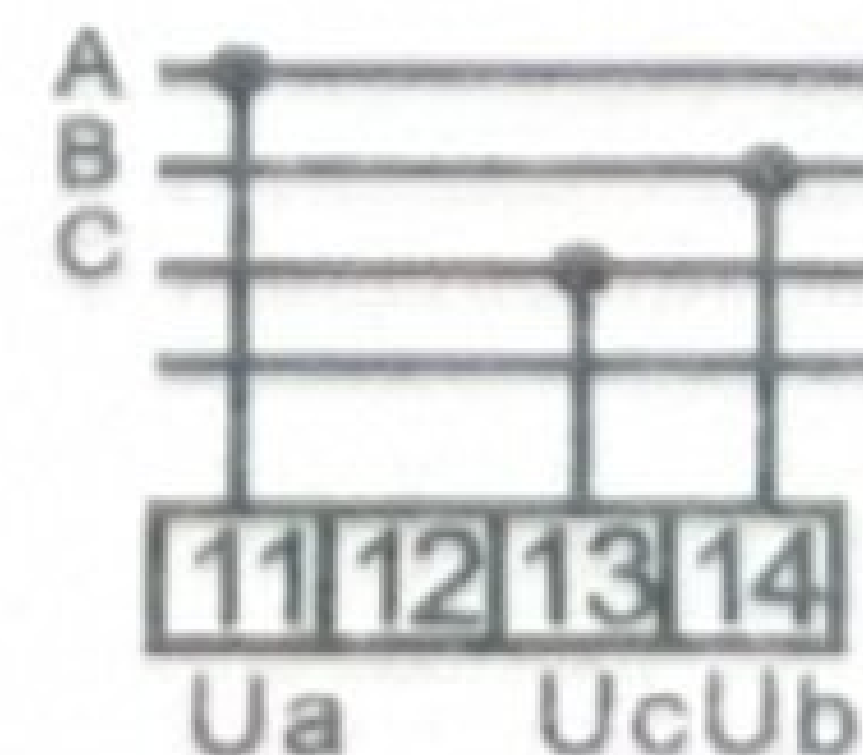
3PHASE 4WIRE



VOLTAGE DIRECTLY

CONNECT VOLTAGE FROM TRANSFORMER

3PHASE 3WIRE



VOLTAGE DIRECTLY

CONNECT VOLTAGE FROM TRANSFORMER

Note: Current with "*" symbol is input end.

Voltage

Un	Uc	Ub	Ua
14	13	12	11

Current Signal

Ic	Ic*	Ib	Ib*	Ia	Ia*
9	8	7	6	5	4

1 2

N L

Power

47	48	49	35	36	30	59	58
AP+	R-A-	RP+	IN1	IN2	COM	B	A
Active Pulse	COM	Reactive Pulse	On-Off Input			RS485	

Operated by staff only, Please check the power supply carefully before power on!

Note: Current with “*” symbol is input end.

Voltage				Current Signal					
Un	Uc	Ub	Ua	Ic	Ic*	Ib	Ib*	Ia	Ia*
14	13	12	11	9	8	7	6	5	4

1 2

N L

Power

	46	47	49	48	30	35	36	59	58
	AP+	AP-	RP+	RP-	COM	IN1	IN2	B	A
	Active Pulse		Reactive Pulse		On-Off Input			RS485	

Operated by staff only, Please check the power supply carefully before power on!

34	33	32	31	29		30	28	27	26	25	24	23
D0	D4	D3	D2	D1		COM	IN4	IN3	A04-	A03-	A02-	A01-

Note: Current with “*” symbol is input end.

Voltage			
Un	Uc	Ub	Ua
14	13	12	11

Current Signal					
Ic	Ic*	Ib	Ib*	Ia	Ia*
9	8	7	6	5	4

Meters in dimensions 120*120 and 96*96 have output wiring diagrams

VII FAQs and Solutions

1. About communication

1) The meter fails to return data

A: First, make sure that the location information such as slave address, Baud rate and verification mode in the communication setting of the meter is consistent with the requirements of the host computer:

If several meters on site fail to return data for communication, check whether the connection of communication bus on site is accurate and

reliable or not and whether RS 485 convertor is normal or not. If only one meter or very few meters are normal for communication, corresponding communication cables also needs to be checked. Test can be made by altering the slave addresses of the abnormal and normal meters to troubleshoot or identify the problems of upper computer software or by changing the installation sites of abnormal and normal meters to troubleshoot or identify the meter faults.

2) The data returned by the meter are inaccurate

Answer: The multiple electric meters makes two types of communication data accessible to customers: float-type primary electric system data and int/long-type secondary electric system data. Please read carefully the instruction on address and format for data storage in the mailing address table and make sure the data are converted into corresponding format.

Customers are recommended to ask for testing software MODSCAN in the MODBUS-RTU communication protocol from the dealer. This software follows the standard MODBUS-RTU communication protocol and data can displayed in formats such as integer, floats and hexadecimal and can be compared with the data displayed on the meter directly.

2. About inaccurate measurement of U, I and P

Answer: First, make sure that correct voltage and current signals have been connected to the meter. A multimeter can be used to measure the voltage signal. And use a clamp meter to measure the current signal when necessary. Second, ensure that the signal lines are correctly connected. For instance, to make sure whether the dotted terminal (i.e. the inlet terminal) of the current signal and the phase sequence of each phase are correct or not. This can be observed from the display on the electric interface of the multiple electric meters . Only when the electric transmission is reversed, the active electric is negative. As a general rule, the active electric is positive. If the value is negative, it may be caused by the misconnection of the incoming and outgoing lines for current. Besides, the misconnection of phase sequence also leads to the electric display anomaly. Moreover, it should be noted that the electric quantity displayed on the meter is the primary electric grid value. If the multiplying electric of the built-in voltage and current transformers is not consistent with that of an actually used mutual inducer, the electric quantity display on the meter may be inaccurate. The ranges of built-in volt-ammeter is not allowed to be altered after leaving the factory. The connection network can be altered according to the actual mode of connection on the site but mode of connection in the programming menu should be set in agreement with the actual one or false

display information will be caused.

3. About inaccurate energy display and that the electric energy data cannot be saved

Answer: 1) The accumulation of electric energy on the meter is based on the measurement of power. First, observe the electric value on the meter and see whether it is consistent with the actual load. The multiple electric meters supports bidirectional electric energy measuring. When the connection is false and the total active electric is negative, the electric energy will be added to the reverse active electric energy and not to the forward active electric energy. The most common problem in field uses is the converse connection of the incoming and outgoing lines of a current transformer. Signed split-phase active electric can be observed on the multiple electric meters. If the electric value is negative, it may be caused by the wrong connection. Besides, the mistaken phase sequence may also lead to the energy display abnormality of the meter.

2) If the electric energy data cannot be saved, check whether there is load in the meter. The meter is expected to add up the electric energy when loaded.

4. The meter does not light

Answer: Ensure that appropriate auxiliary electric supply (AC/DC80-270V) has been connected to the auxiliary electric supply terminals of the meter. When the auxiliary electric supply provided exceeds the prescribed range, irreparable damage may be made to the meter. A multimeter can be used to measure the voltage value of the auxiliary electric supply. If the supply voltage is normal and nothing is displayed, consider cutting off the electric and switching on the electric again. If the meter still cannot display the data properly, please contact the technical services department of our company.

VIII Ordering Information

When signing a contract, please specify the product model, input signal, mode of connection and other information. Products of this series all have a default factory setting. If the customer has any special requirements, please specify the requirements in other items as below:

e.g.1 Name:120*120*80 (Multiple electric meters)

Input:10KV/AC100V, 200A/AC5A

Electric network: three-phase three-wire

Communication interface:RS485/MODBUS-RTU

e.g.2 Name:96*96*80 (Multiple electric meters)

Input:AC380V, 200A/5A

Electric network: three-phase four-wire

Communication interface: RS485/MODBUS-RTU

e.g.3 Name:80*80*80 (Multiple electric meters)

Input:AC450V, 100A/5A

Electric network: three-phase four-wire

Communication interface:RS485/MODBUS-RTU

e.g.4 Name:72*72*80 (Multiple electric meters)

Input:AC10KV/100V 3000A/5A

Electric network: three-phase three-wire

Communication interface:RS485/MODBUS-RTU