

Ordering statement:

when Signing the contract, please declare such information as product model, input signal, wiring mode and so on. The series of products have a default prefatory setting and without standard function of four quadrant energy. Please specify in other item if user needs the function of four quadrant energy or have special requirement.

Examples of order

1、 product name: multifunction electric power meter

outline dimension: 120*120*90 (mm)

input: 10KV/AC100V、200A/AC5A

power grid: three-phase three-line

communication interface: RS485/MODBUS-RTU

2、 product name: multifunction electric power meter

outline dimension: 120*120*90 (mm)

outline dimension: 96*96*90 (mm)

input: AC 380V、200A/5A

power grid: three-phase four-line

communication interface: RS485/MODBUS-RTU

Multifunction Electric Power Meter (LCD type J)

USER' S MANUAL

(Version 2.0 May/2012)

VI Common problems and Solutions

1、 About communication

1) *The meter has not sent data back*

Reply: Make sure communication setting information of the meter such as subordinate machine address, baud rate, checking mode and so on correspond with the requirements of upper motion first; check whether the communication bus on spot is connected correctly and RS485 converter is in normal operation or not if many meters have not sent data back. Related communication bus shall also be checked if only signal or a few meters communicate abnormally. Modify subordinate machine address by exchanging that of abnormal and normal meter to exclude or confirm whether there is something wrong with the software of upper motion, or exchange installation site of abnormal & normal meter to exclude or confirm whether there is something wrong with the meter.

2) *The data sent back by the meter is not correct.*

Reply: The data of multifunction electric power meter opening to customers are primary power grids float type and secondary power grids int/long type. Please read the instruction about data storing address & format in communication address table carefully and make sure that transformation is carried out according to relative data format. It is suggested to download MODBUS-RTU protocol testing software MODSCAN which conforms to standard MODBUS-RTU protocol from the company homepage, and the data of the software can be display in int/long, float and hexadecimal, which can be compared with data displayed on meters directly.

2、 *Measurements about U, I and Pare not correct*

Reply: First make sure that the meter has been input right voltage and current, multi-meter is used for measuring voltage and clip-on ammeter for current if necessary. Then ensure signal line is connected correctly, for example, check whether the corresponding terminal (i.e. leading-in terminal) and each phase sequence is correct. Observe power interface display for multifunction electric power meter, its power symbol is displayed positive under normal condition and negative only when it is under reverse transmission which is caused by wrong connection of inlet-outlet lines or wrong phase sequence connection.

What is more, electric quantity displayed by the meter is the value of primary power grids; it may lead to wrong electric quantity display if the ratio of voltage and current transformer does not conform with that of transformer in-service. The default voltage and current range is not allowed to modify after delivery. Connection network is available to modify according to actual connection on spot, but the connection mode set in programming shall correspond with the actual, otherwise it may lead to wrong display.

3、 *Power running is not correct.*

Reply: Power accumulates on the basis of power measurement; check whether power value displayed is consistent with actual loading. As multi-function power meter supports bilateral power measurement, power will be accumulated to reverse active power instead of forward one if lines are not connected properly or total active power is negative. The most common problem on spot is inlet and outlet line of current transformer are in reverse connection. For multi-function power meter, it is available to observe active power in split phase with symbol, it may be negative because of wrong connection, and what is more, wrong phase sequence may lead to wrong running.

4、 *Meter does not work.*

Reply: Ensure proper auxiliary supply (AC/DC 80-270V) is linked to the auxiliary supply terminal, as the meter may be damaged by auxiliary supply voltage beyond regulation and can not recovery. Use multi-meter to measure the voltage of auxiliary supply, and non-display on the meter if it is all right, it is possible to electrify again; if the meter can not display normally, please contact with our technical service department.

catalogue

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multifunction electric power meter--user manual

I summary

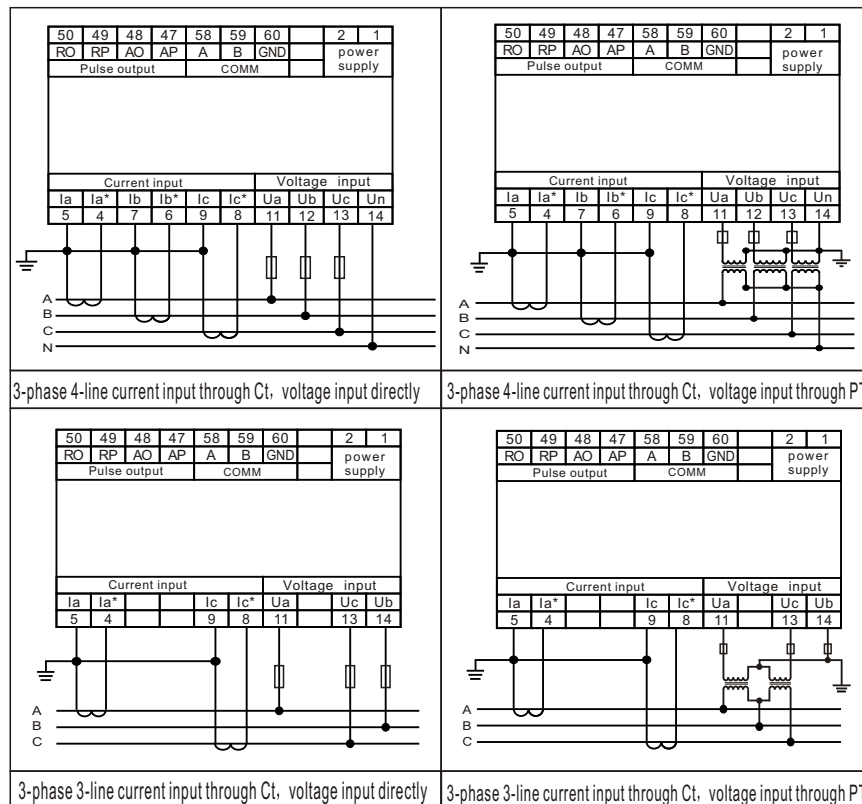
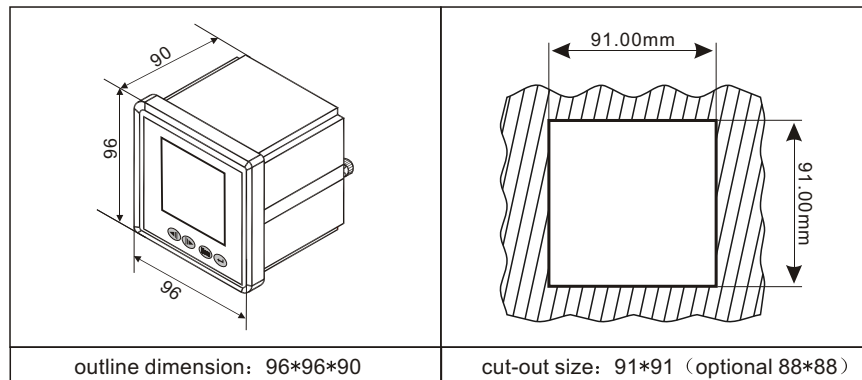
Multifunction electric power meter can complete electricity measuring, energy metering, data display, acquisition and transmission with functions of programmable measurement, display, digital communication, energy pulse output and transmission output and so on. They are widely used in substation automation system, distribution automation, intelligent building and enterprise for energy measuring, management and assessment, and can display on spot and remote Rs485 digital communication interface which used MODBUS-RTU protocol. Measuring precision is 0.5 magnitude.

Outline	Name	Measurement	Display	standard function
42square	multifunction electric power meter	Three-phase: U、I、P、Q、EP+、EP-、EQ+、EQ-、SP、F、PF or part of them	LCD pagination display	Rs485 communication、energy pulse output
96square				

II technical parameters

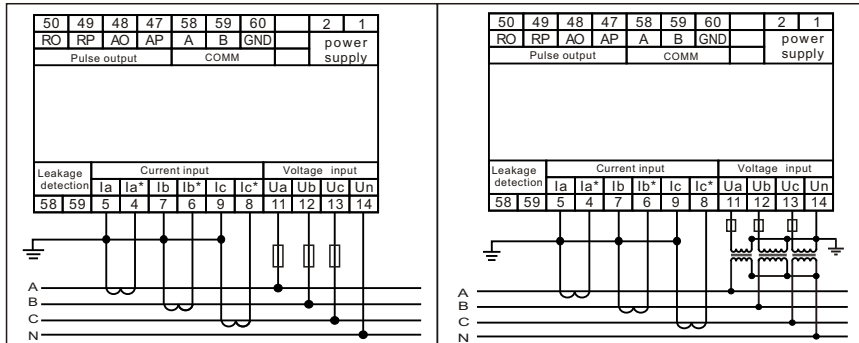
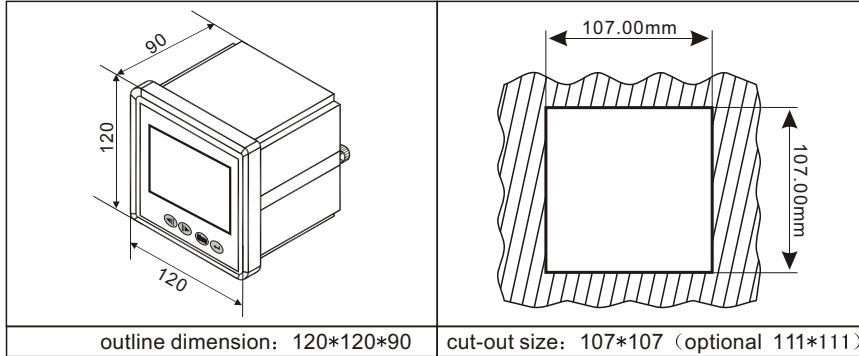
Performance		Parameters	
Input measurement display	Network	Three-phase three-line、three-phase four-line	
	Voltage	Rate value	AC25-500V
		Overload	continuous:1.2times instantaneous:10times/10s
		Power consumption	<1VA(each phase)
		Inpedance	>500k Ω
	Current	Accuracy	RMS measuring , accuracy class is 0.5
		Rate value	AC 1A、5A(specify when ordering)
		Overload	Continuous:1.2times instantaneous:10times/10s
		Power consumption	<0.4VA(each phase)
		Inpedance	<2m Ω
		Accuracy	RMS measuring , accuracy class is 0.5
Power supply	Frequency	45~55Hz	
	Power	Active power&apparent power is 0.5, reactive power is 1.0	
Output	Energy	Four quadrant metering active energy accuracy is 1.0,reactive energy is 1.5	
	Harmonic	Total harmonic content :2-31times	
Environment	Working scope	AC/DC 85~270V	
	Power consumption	\leq 5VA	
Security	Digital interface	RS-485、MODBUS-RTU protocol	
	Pulse output	2-way pulse output, pulse constant: 5000imp/h	
Energy measuring range	Working environment	-10~55 $^{\circ}$ C	
	Storage	-20~75 $^{\circ}$ C	
Security	Resist pressure	Input/power supply>2kV, input/output>2kV, power supply/output>1kV	
	Insulation	Input, output or power supply chassis>50M Ω	
Energy measuring range		Active or reactive energy measuring range is 0~99999999Mwh, energy data count from 0 when exceeding the data value	

■96 square (outline dimension: 96*96*90 mm cut-out size: 91.00*91.00mm)

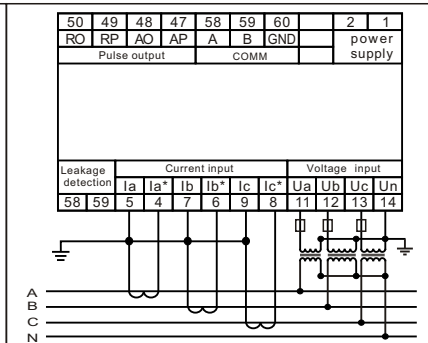


V wiring diagram (physical wiring prevail)

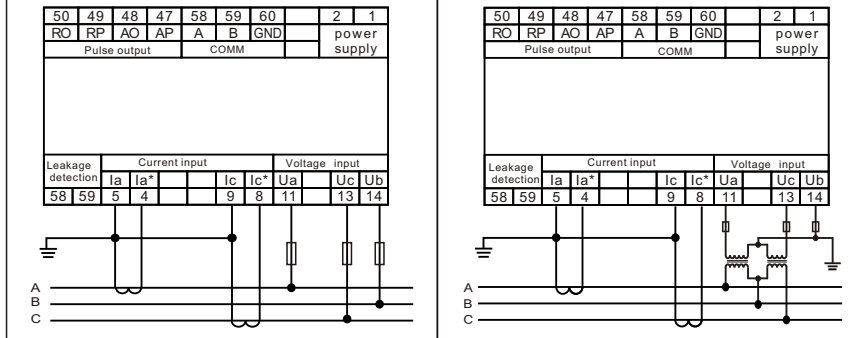
■42 square (outline dimension: 120*120*90 mm cut-out size: 107.00*107.00mm)



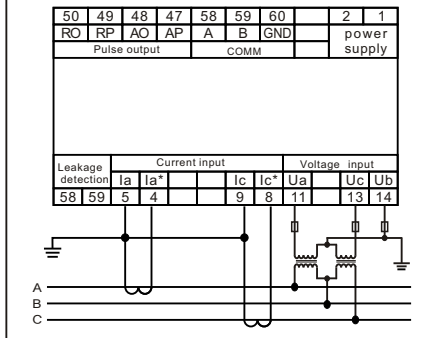
3-phase 4-line current input through Ct, voltage input directly



3-phase 4-line current input through Ct, voltage input through PT



3-phase 3-line current input through Ct, voltage input directly



3-phase 3-line current input through Ct, voltage input through PT

2.1 auxiliary power supply:

Multifunction electric power meter has common (AC/DC) power supply input interface, if no special statement, provide standard AC/DC85~270V power supply interface. Guarantee that the power is applied in the series of products to prevent damage.

note: when using AC power supply, it is recommended to install 1A fuse on the side of firewire.

Poor power quality, it is recommended to install surge suppressor to prevent lightning, and install rapid burst suppressor in the power supply circuit.

2.2 input signal:

The product adopts numerical method of separate collection for each measurement channel to ensure consistent symmetry when using. Its connections with a variety of ways are for different load forms.

2.2.1 voltage input: input voltage should be below rated input voltage (100V or 400V), otherwise it is considered to use PT, and need to install fuse of 1A on the side of voltage input.

2.2.2 Current input: standard rated input current of 5A, should use the external CT when above 5A. If you use CT with other meters, wiring should be connected in series mode, be sure to disconnect CT of primary circuit or short secondary circuit before removing the current input connection. It is recommended to use terminal row, do not connect CT directly for easy disassembly.

2.2.3 Ensure that input voltage and current are in the same sequence, in-line and out-line are in the same direction, or there would be value and sign error!(power and energy)

2.2.4 The configuration of the meter input network is decided by the CT number of system, in the situation of 2 CT, select two components mode of 3-phase 3-line; in the situation of 3 CT, select three components mode of 3-phase 4-line. meter wiring and input net in program set should correspond to wiring mode of measured overload, or it can lead to measuring voltage or power incorrectly. Voltage measurement and display is line voltage in 3-phase 3 line; but voltage measurement and display is phase voltage in 3-phase 4-line.

III programming and usage

3.1 definition of press key

enter key confirming for password and numerical value modifying

menu key used for choosing menu interface, exiting function and returning last level menu

right key used for shifting function when measuring display, plus number when modifying data (from 0 to 9999 in circle)

left key used for shifting function when measuring display, minus number when modifying data (from 0 to 9999 in circle)

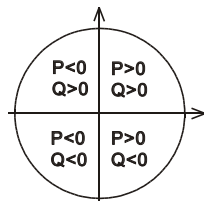
3.2 measuring display

can measure parameters in powergrid: Ua,Ub,Uc,(phase voltage); Uab,Ubc,Uca(line voltage);

Ia,Ib,Ic(current)), Ps(total active power), Qs(total reactive power). Pf(total power factor); Ss(total apparent power); FR(frequency), EP(active energy), and EQ(reactive energy). All measurement parameters are saved in internal power message table which can acquire through digital communication interface device.

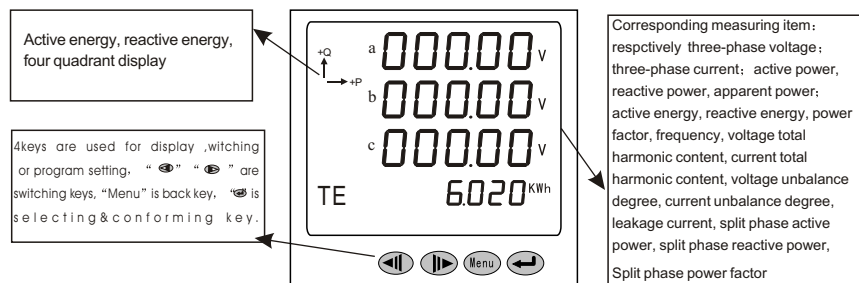
For different types of meters, its display content and type may be inconsistent, please refer to the specific details. The numerical method of all power parameters use following formula of digitized discrete method.

Formula	Notes	Formula	Notes
$U = \sqrt{\frac{1}{N} \sum_{n=1}^N U_n^2}$	Voltage effective value	$P = UI$	Single-phase apparent power Periodic average value
$I = \sqrt{\frac{1}{N} \sum_{n=1}^N I_n^2}$	Current effective value	$\cos \theta = P_p / P_s$	Power factor
$P_p = \frac{1}{N} \sum_{n=1}^N i_n u_n$	Single-phase active power Periodic average value	$P_q = \sqrt{P_s^2 - P_p^2}$	Reactive power
$P = \frac{1}{N} \sum_{n=1}^N (i_{an} u_{an} + i_{bn} u_{bn} + i_{cn} u_{cn})$	Total active power Periodic average value	$W = \int p dt$	Energy



P>0, cumulative active energy is active energy absorption, P<0, cumulative active energy is active energy release

Q>0, cumulative reactive energy is reactive energy inductive, Q<0, cumulative reactive energy is reactive energy capacitive.



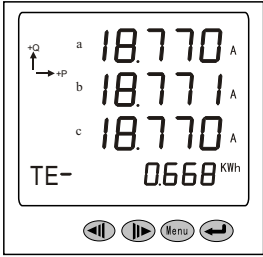
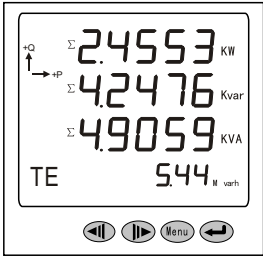
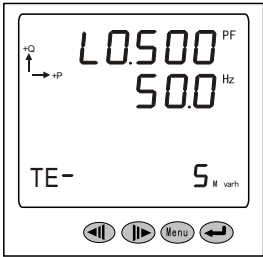
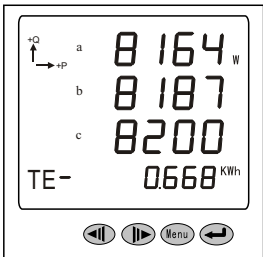
3.3 page display diagram:

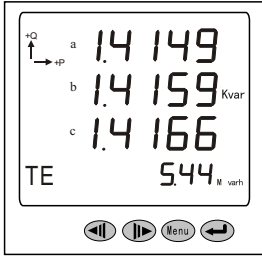
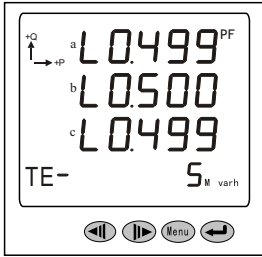
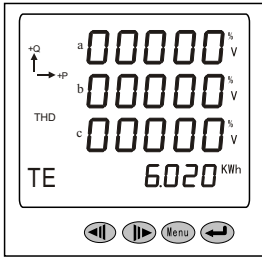
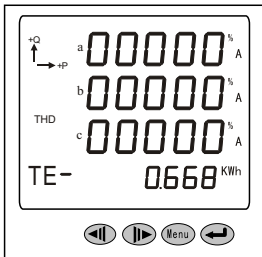
Multifunction electric power meter has 17 electrical parameters display pages, can be set for automatic switching display, also can be set for manual switching through Keys to complete page switching.

Page	Content	Instruction
Page 1		<p>Respectively display voltage U_a, U_b and U_c (three-phase four-line) and U_{ab}, U_{bc} and U_{ca} (three-phase three-line)</p> <p>As left picture, U_a=326.70V, U_b=326.71V, U_c=326.70V, , EP=6.020kWh The meter displays line voltage when Three-phase three-line wiring It displays phase voltage when Three-phase four-line wiring.</p>

MODBUS-RTU communication address information table					
Address HEX	Address Dec	Data content	Data format	Length word	instruction
0x00~0x09	0~9	retain			
Secondary power grid data (int/long integral data)					
	258~269	retain			
0x10E~0x1F	270~287	H-Ic	Int	1	C phase current 2-15 times harmonic total content
	288~299	retain			
Setting parameter					
0x12C	300	set password	Int	1	1-9999
0x12D	301	Meter com address	Int	1	1-247
0x12E	302	Voltage ratio	Int	1	PT=1-5000
0x12F	303	Current ratio	Int	1	CT=1-5000
0x130	304	Com baud rate	Int	1	0-1200; 1-2400; 2-4800; 3-9600
0x131	305	Com data format	Int	1	data format 0-N.8.1 1-O.8.1 2-E.8.1
0x132	306	Wiring mode	Int	1	0-three-phase four-line; 1-three-phase three-line
0x133	307	Voltage range	Int	1	0-100V; 1-220V; 2-380V
0x134	308	Current range	Int	1	0-5A; 1-1A
All parameters setting address (write)					
0x3E8	1000	set password	Int	1	1-9999
0x3E9	1001	Meter com. address	Int	1	1-247
0x3EA	1002	Voltage ratio	Int	1	PT=1-5000
0x3EB	1003	Current ratio	Int	1	CT=1-5000
0x3EC	1004	Com baud rate	Int	1	0-1200; 1-2400; 2-4800; 3-9600
0x3ED	1005	Com data format	Int	1	data format 0-N.8.1 1-O.8.1 2-E.8.1
0x3EE	1006	Wiring mode	Int	1	0-three-phase four-line; 1-three-phase three-line
0x3EF	1007	Voltage range	Int	1	0-100V; 1-220V; 2-380V
0x3F0	1008	Current range	Int	1	0-5A; 1-1A

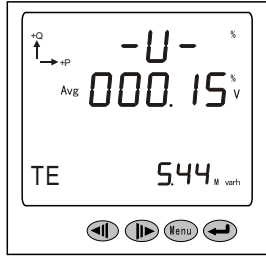
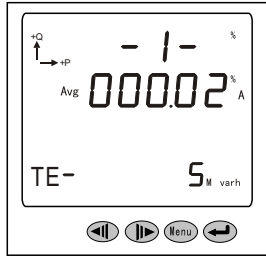
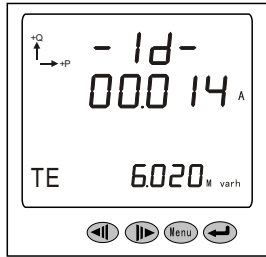
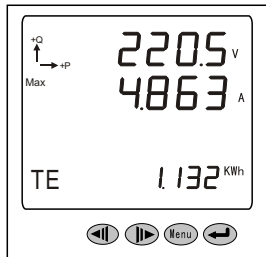
MODBUS-RTU communication address information table					
Address HEX	Address Dec	Data content	Data content	Length word	Instruction
0x00~0x09	0~9	retain			
Secondary power grid data(int/long integral data)					
0x61	97	Eq+	long	2	Inductive reactive energy, unit is varh
0x63	99	Eq-	long	2	Capacitive reactive energy, unit is varh
0x65	101	Umax	Int	1	Voltage maximum demand, 0.1V
0x66	102	Imax	Int	1	Current maximum demand, 0.001A
0x67	103	Pmax	Int	1	Active power maximum demand, W
0x68	104	Qmax	Int	1	reactive power maximum demand, Var
0x69	105	Id	Int	1	Zero sequence current or leakage current, 0.001A
	106~109	Retain			
0x6E	110	THD-Ua	Int	1	A phase voltage total harmonic content
0x6F	111	THD-Ub	Int	1	B phase voltage total harmonic content
0x70	112	THD-Uc	Int	1	C phase voltage total harmonic content
0x71	113	THD-Ia	Int	1	A phase current total harmonic content
0x72	114	THD-Ib	Int	1	B phase current total harmonic content
0x73	115	THD-Ic	Int	1	C phase current total harmonic content
0x74	116	Avg	Int	1	Three-phase voltage unbalance, 0.01%
0x75	117	Avg	Int	1	Three-phase current unbalance, 0.01%
	118~119	retain			
0x78~0x89	120~137	H-Ua	Int	1	A phase voltage 2-15 times harmonic content
	138~149	retain			
0x96~0xA7	150~167	H-Ub	Int	1	B phase voltage 2-15 times harmonic content
	168~179	retain			
0xB4~0xC5	180~197	H-Uc	Int	1	C phase voltage 2-15 times harmonic content
	198~209	retain			
0xD2~0xE3	210~227	H-Ia	Int	1	A phase current 2-15 times harmonic content
	228~239	retain			
0xF0~0x101	240~257	H-Ib	Int	1	B phase current 2-15 times harmonic content

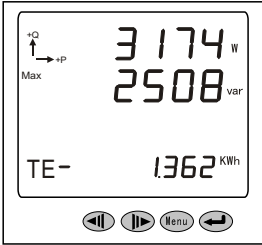
Page	Content	Instruction
Page 2		Display three-phase current Ia, Ib, Ic, with unit of A. As left picture, Ia=18.770A, Ib=18.771A, Ic=18.770A. EP=-0.668kWh
Page 3		Display active power (W), reactive power (var) and apparent power (VA). As left picture, PS=2.4553KW、 QS=4.2476KVar SS=4.9059KVA EQ=5.44MVarh
Page 4		Display apparent power factor (PF), frequency (F) As left picture, the 1st row: "PF" is 0.5; the 2nd row: frequency is 50.00Hz. EQ=-5MVarh
Page 5		Display A,B,C three-phase active power. As left picture Pa=8164W Pb=8187W Pc=8200W Ep=-0.668KWh

Page	Content	Instruction
Page 6		<p>Display A, B, C three-phase reactive power.</p> <p>As left picture, Qa=1.4149kvar Qb=1.4159kvar Qc=1.4166kvar EQ=5.44Mvarh</p>
Page 7		<p>Display A, B, C three-phase power factor.</p> <p>As left picture, PFa=0.449 PFb=0.5 PFc=0.499 EQ=-5Mvarh</p>
Page 8		<p>Display three-phase voltage total harmonic content(A,B and C respectively)</p> <p>Ep=6.02KWh</p>
page 9		<p>Display three-phase current total harmonic content(A,B and C respectively)</p> <p>EQ=-0.668KWh</p>

MODBUS-RTU communication address information table					
Address HEX	Address Dec	Data content	Data content	Length word	instruction
0x00~0x09	0~9	retain			
Secondary powergrid data(int/long integral data)					
0x46	70	Ua	Int	1	Three-phase phase-voltage data,unit 0.1V NOTE: it is valid only in three-phase four-line connection mode, and invalid in three-phase three-line connection mode.
0x47	71	Ub	Int	1	
0x48	72	Uc	Int	1	
0x49	73	Uab	Int	1	Three-phase phase-voltage data, with unit of 0.1V
0x4A	74	Ubc	Int	1	
0x4B	75	Uca	Int	1	
0x4C	76	Ia	Int	1	Three-phase current data, with unit of 0.001A
0x4D	77	Ib	Int	1	
0x4E	78	Ic	Int	1	
0x4F	79	Pa	Int	1	Split phase and total active power ,with unit of W NOTE: active power data marked with "+", means load electric energy, and "-" means load power generation. Generally, when the wiring is improper, the active power is "-".
0x50	80	Pb	Int	1	
0x51	81	Pc	Int	1	
0x52	82	ΣP	Int	1	Split phase and total reactive power, with unit of var NOTE: reactive power data marked with "+" means inductive load and "-" means capacitive load.
0x53	83	Qa	Int	1	
0x54	84	Qb	Int	1	
0x55	85	Qc	Int	1	Split phase and total apparent power, with unit of VA
0x56	86	ΣQ	Int	1	
0x57	87	Sa	Int	1	
0x58	88	Sb	Int	1	Power factor 0~1.000, fixed format 1000
0x59	89	Sc	Int	1	
0x5A	90	ΣS	Int	1	
0x5B	91	cosQ	Int	1	Frequency, with unit of 0.01Hz
0x5C	92	F	Int	1	
0x5D	93	Ep+	long	2	
0x5F	95	Ep-	long	2	Reverse active energy, unit is wh

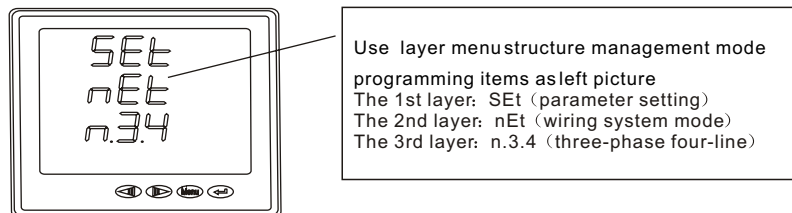
MODBUS-RTU communication address information table					
Address HEX	Address Dec	Data content	Data format	Length word	instruction
0x00~0x09	0~9	retain			
Primary power grid data(float)					
0x0A	10	Ua	Float	2	Three-phase phase-voltage data, unit 0.1V NOTE: it is valid only in three-phase four-line connection way, and invalid in three-phase three-line connection way.
0x0C	12	Ub	Float	2	
0x0E	14	Uc	Float	2	
0x10	16	Uab	Float	2	Three-phase phase-voltage data, with unit of 0.1V
0x12	18	Ubc	Float	2	
0x14	20	Uca	Float	2	
0x16	22	Ia	Float	2	Three-phase current data, with unit of 0.001A
0x18	24	Ib	Float	2	
0x1A	26	Ic	Float	2	
0x1C	28	Pa	Float	2	Split phase and total active power, with unit of k NOTE: active power data marked with "+", means load electric energy, and "-" means load power generation. Generally, when the wiring is improper, the active power is "-".
0x1E	30	Pb	Float	2	
0x20	32	Pc	Float	2	
0x22	34	PΣ	Float	2	Split phase and total reactive power, with unit of kvar NOTE: reactive power data marked with "+" means inductive load and "-" means capacitive load.
0x24	36	Qa	Float	2	
0x26	38	Qb	Float	2	
0x28	40	Qc	Float	2	Total apparent power KVA
0x2A	42	QΣ	Float	2	
0x2C	44	SΣ	Float	2	
0x2E	46	cosQ	Float	2	Power factor 0~1.00
0x30	48	FR	Float	2	Voltage frequency Hz
0x32	50	Ep+	Float	2	Positive active energy with unit of kWh
0x34	52	Ep-	Float	2	Reverse active energy (bi-directional metering)
0x36	54	Eq+	Float	2	Inductive active energy, with unit of kWh
0x38	56	Ep-	Float	2	Capacitive reactive energy
	58~69	Retain			





Page	Content	Instruction
page 10		Display three-phase voltage total unbalance degree. Left picture displays voltage unbalance degree : 0.15%. EQ=5.44Mvarh
page 11		Display three-phase current total unbalance degree. Left picture displays current unbalance degree: 0.02%. EQ=-5Mvarh
Page 12		Display leakage current or zero line current. Left picture displays leakage current: 0.014A. EQ=6.02Mvarh Only 96*96 outline has the function.
page 13		Display max voltage, current demand (acquisition data every 5 minutes) As left picture, Umax=220.5V Imax=4.863A Ep=1.132kWh


Page	Content	Instruction
Page 14		Display max active power , reactive power demand(acquisition data every 5 minutes) As left picture, Pmax=3174W Qmax=2508var Ep=-1.362kWh



3.4、program and operate


Under programming operation, the meter provides 4 basic menu items which are password verifying and changing(CODE), system setting (SET), display setting (DIS) and communication setting (CONN), and 8 expansive menu items which are 4-way analog setting (AO-1/2/3/4), 4-way switch output setting (Do-1/2/3/4); it uses layer menu structure management mode of LED display. the 1st row LED displays 1st layer menu information; the 2nd row LED displays 2nd layer menu information, the 3rd row LED displays 3rd layer menu information.





Using 4 keys to programming operation, left-right key “” “”、Backspace key “”、menu entering /confirming key “” to complete all above functional operation.

: If present normal display is voltage interface, press this key to enter programming mode. Press the key to return to last level menu in programming mode. if present display is the 1st layer menu, press the key to enter to parameter saving interface, repress it to cancel saving, and return to normal display interface.

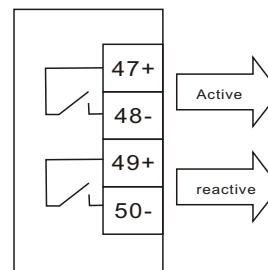
 : left right shifting key, to complete menu item shifting or number increasing or decreasing.

: selecting/confirming key, if present normal display is voltage interface, press this key, can shift “phase voltage/line voltage”; under programming mode, press the key to enter next level menu, control cursor move to next character or next layer selecting item.

Under the situation of programming mode returning to measuring mode, the meter will indicates “SAVE-YES”, select “” means no saving and exit, select “” save and exit.

4.2 energy pulse

Multifunction electric powermeter can supply bi-directional active and Bi-directional reactive electric energy metering, 2-channel electric energy pulse output and the digital interface of RS485 to complete display & remote transmission Of the electric energy data. Realize the active electric energy and reactive electric energy remote transmission through the electric energypulse of the optically coupled relay of the open collector as well as adopt the remote computer terminal and the pulse sum for the collection instrument of PLC, DI switch collection module to realize the electric energy cumulative metering. Adopt the pulse output mode to inspect the precision of the electric energy national Metro logical regulation: the comparative method for pulse error of the standard



Electric energy pulse output diagram

(1) Electrical Character: in the schematic diagram for the circuit of the pulse collection interface $VCC \leq 48V$, $I_z \leq 50mA$.

(2) Pulse Constant: 5000 imp/kWh (all measuring range), The meaning is: when the meter cumulates 1 kWh, the number of the output pulse is 5000. It must be emphasized that 1 kWh is the secondary measured data of electric energy. Under the condition of PT and CT, the 5000 pulse data corresponding to primary measured electric energy is $1kWh \times \text{voltage transformation ratio } Pt \times \text{current transformation ratio } CT$.

(3) Application example: the pulse counting device is used for PLC terminal. Suppose during the period with the length of t, the number of collected pulse is N; the input of meter is: 10kV/100V 400A/5A, thus the electric energy accumulation Of meter during the time period is: $N/5000 \times 100 \times 80$ degrees electric energy.

4.1 message format command

1) read data register value (function code 0x03/0x04)

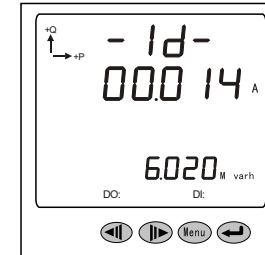
Host inquiry	Frame structure	Address code	Function code	Data code		check code
				Initial register address	Register number	
	Occupy bytes	1 byte	1 byte	2 bytes	2 bytes	2 bytes
	Data scope	1~247	0x03/ 0x04		Max 25	CRC
	Example of Message	<u>0x01</u>	<u>0x03</u>	<u>0x00 0x3D</u>	<u>0x00 0x03</u>	<u>0x79</u> <u>0xC9</u>
Slave response	Frame structure	Address code	Function code	Data code		check code
				Register byte number	Register value	
	Occupy bytes	1 byte	1 byte	1 byte	N bytes	2 bytes
	Example of Message	<u>0x01</u>	<u>0x03</u>	<u>0x06</u>	(6 bytes data)	(CRC)
Instruction: register address requested by host is inquiry initial address of primary power grid or secondary power grid inquiry, register number is inquiry data length, as above example, initial register address "0x00 0x3D" means the beginning address of three-phase phase-voltage float data, register number "0x00 0x03" means data length (3Word data). Please refer to appendix 1 for the detailed information of MODBUS-RTU communication address I.						

2) write seting register command (function 0x10)

Host inquiry	Frame structure	Address code	Function code	Data code				check code
				Initial relay address	Relay number	Data byte number	Relay action value	
	Occupy bytes	1 byte	1 byte	1 byte	1 byte	2 bytes	2 bytes	2 bytes
	Data scope	1~247	0x10		Max 25	Max 2*25		CRC
	Example of Message	<u>0x01</u>	<u>0x10</u>	<u>0x00</u> <u>0x07</u>	<u>0x00</u> <u>0x02</u>	<u>0x04</u>	<u>0x00</u> <u>0x64</u> <u>0x00</u> <u>0x0A</u>	<u>0x73</u> <u>0x91</u>
Slave response	Frame structure	Address code	Function code	Data code			check code	
				Start relay address		Number of relay		
	Occupy bytes	1 byte	1 byte	2 bytes		2 bytes	2 bytes	
	Example of Message	<u>0x01</u>	<u>0x10</u>	<u>0x00 0x07</u>		<u>0x00 0x02</u>	<u>0xF0</u> <u>0x09</u>	
Instruction: in order to ensure normal communication , carry on a host inquiry, register number is limit to 25.in above example, initial register address “0x00 0x07” means starting address of voltage ratio setting, register number “0x00 0x02” means total 2 Words data of voltage and current ratio setting, writing number “0x00 0x64 0x00 0x0A” means voltage ratio was set for 100, current ratio 10. Please refer to appendix 1 for the detailed information of MODBUS-RTU communication address .								

3.5. leakage current detecting instruction(only 120*120 outline has the function):

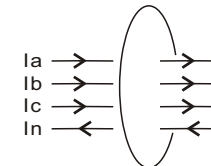
3.5.1、display interface as following:



3.5.2 function instruction:

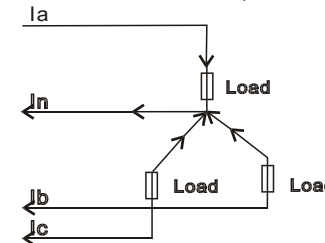
Residual current detecting part, including zero sequence current transformer(ZCT) and measuring circuit, zero sequence current inductance detecting. When ZCT detect s to exist over-limit residual current which can set between 3mA to 500mA in electricity lines, , displaying residual current of electric circuit through displaying interface, having passed 485 communication interface, using MODBUS protocol to upload leakage current data, power supply department can timely maintain the circuit breakdown. And also can control node through multi-channel for controlling alarm, tripout and so on.

3.5.3、internal zero sequence current transformer wiring diagram:



zero sequence current transformer

Under normal situation, vector sum of Ia, Ib and Ic current is equal to zero line Current In (Ia+Ib+Ic=In), but direction is opposite, thus they cancel out, zero sequence current transformer detects current, Id=0. Show as following



But if load or leakage current in wire, that is zero sequence current $In < Ia + Ib + Ic$, leakage current detecting current transformer can detect leakage current through away, leakage current magnitude: $Id = (Ia + Ib + Ic) - In$.

3.6 menu structure as following: user can set parameter according to actual situation.

First layer	Second layer	Third layer	Description
Password (CODE)	Verify Password Put	Password data (0~9999)	When input password is incorrect, can enter program default password:0001
	Change password Set	Password data(0~9999)	can change the password after It verify successfully
System setting Set	Net NET	N.3.4 and N.3.3	Select input network of measuring signal
	Voltage ratio PT.U	1~5000	Set voltage signal ratio=1st scale/ 2nd scale, eg.10KV/100V=100
	Current ratio CT.I	1~5000	Set current signal ratio=1st scale/ 2nd scale, eg.200A/5A=40
	Clear energy E.CLE	YES/no	If chose "YES", exit programmable menu, press enter key, energy clear, press back key, energy do not clear; chose "no", do not clear.
Display setting DIS	Display DISP.E	0000	Can set LCD sleep time at will
	Display page turning DIS.P	Auto/HAnd	Auto: turn page automatically, every 2S Hand: turn page by hand
	Bright degree B.LED	0~6	Adjust bright degree of digital tube "0" is the darkest, "6" is the brightest. (This item is meaningless.)
Com parameter CONN	Address Add	1~247	The meter address scope 1~247
	Com check bit dAtA	N.8.1/o.8.1/E.8.1	N.8.1: no check bit; o.8.1 odd check; E.8.1: even check
	Com speed rate BAUD	1200~9600	Baud rate 1200,2400,4800,9600

Data frame structure: the message format.

Address code	Function code	Data code	Calibration code
One BYTE	One BYTE	N BYTE	Two BYTE

Address code : beginning part of the frame, a byte (8-bit binary code), with a decimal system from 0 to 255, but in our system 1 to 247 is used only with , other address remained. These bits indicate the terminal equipment address designated by the user, the equipment will receive the host data which has been connected with it. Address of each terminal unit must be unique, and the terminal only which is addressed will respond to the inquiry to this address. When the terminal sends back a response, the subordinate address data which is in response will tell the main machine which terminal is communicating with it..

Data Code includes the required data for the terminal to carry out the specific functions or the collected data when the terminal responds to the inquiry. The contents of these data may be the value, reference address or set value. For example: the function code tells the terminal to read a register, data field need to indicate that start from which register and read how much data, while the loop back content of slave data code includes data length and corresponding data.

Calibration Code The error check field occupies two bytes, which includes a 16-bit binary value. CRC value will be calculated by the transmission equipment and then added to the data frame, besides, the receiving equipment will recalculate CRC value when receiving the data and then compare the value with the received value in CRC field; if the two values are not equal, it shows that there is error.

The process of forming a CRC:

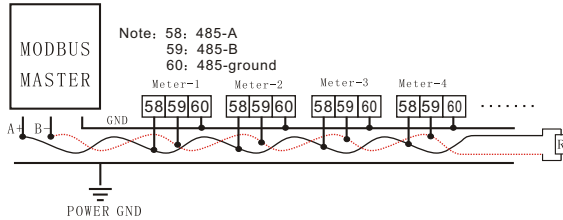
- (1) Preset a 16-bit register as OFFFH (full 1) and call it as CRC register.
- (2) Make the nonequivalence operation between the 8-bit of the first byte in the data frame with the low byte in CRC register, and store the results into CRC register.
- (3) Move CRC register rightward for one bit, and fill in the highest bit with 0, while the lowest bit shall be moved out and detected.
- (4) If the lowest-order bit is 0: repeat the third step (the next displacement); if the lowest-order bit is 1: make the nonequivalence operation between CRC register and a preset fixed value (0A001H).
- (5) Repeat the third step and the fourth step until there are eight times of displacement, thus it handles a complete eight-bit.
- (6) Repeat the second step and handle the next eight-bit in the fifth step until all the treatments for bytes are completed.
- (7) The CRC value is the final value of CRC register.

function code tells the selected slave equipment to operate what function. Supported function by the meter in the following table, and their meaning and function.

Code meanings	meaning
0x03/0x04	Read data register value
0x10	write setting register command

IV digital communication

Multifunction electric power meter provides asynchronous half-duplex mode of RS485 communication interface, using RS485 MOD-BUS-RTU protocol, all data are available on Communication transmission line. In a 485 bus can connect simultaneously up to 32 intelligent energy meter, each intelligent energy meter can set its communication address (Address NO.). Communication terminal numbers of different series meters may be different, Communication connection should be used with unshielded twisted-pair of copper network which diameter is not less than 0.5mm². When Wiring, you should use communication line away from the strong electrical cables or other strong electric field environment, recommend to use T-type network Connection, do not use star type or other connections.



MODBUS protocol is that a method to connect communications uses the method of principal and subordinate response on one communication line. First, signal of main computer address to a terminal unit with the unique address(subordinate computer), then the terminal unit sends a response signal is transformed to the main computer in the opposite direction, that is: signal on one independent communication line is transformed all communication data low along two opposite directions (semi-duplex working mode).

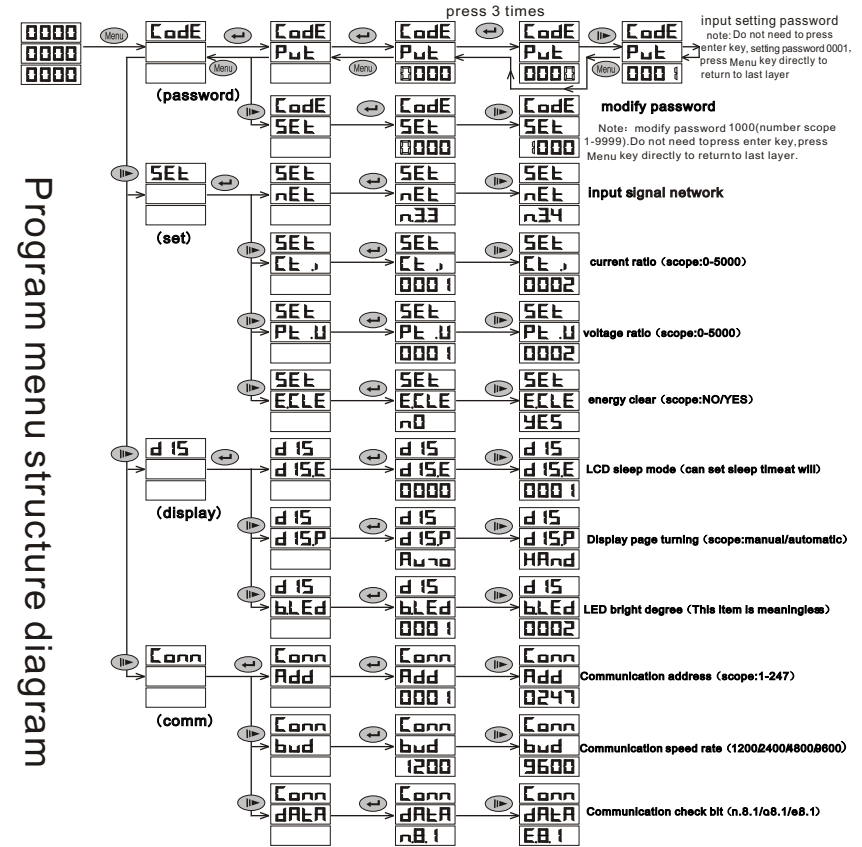
MODBUS protocol only allows the communication between the main (PC, PLC, etc.) and the terminal unit, do not allow to exchange data between independent terminal unit, so that all terminal units do not occupy communication line when they are initialized, but only limited to response to reach inquiry signal of its own computer.

Host inquiry: Inquiry message frame includes equipment address code, function code, data information code and check code. The address code indicates the slave equipment needed to select; function code tells the selected slave equipment to operate what function, for example, function code 03 or 04 requires slave equipment to read register and return their contents; data information code includes additional information of function executed by slave equipment. e.g. in the reading command, the additional information of data segments includes which register is the first to read and the numbers of the register to be read; the check code is used to test the correctness of a frame information and provide a way to check whether the message contents are correct. It adopts CRC16 calibration rules.

Slave response: If the slave equipment responses normally, the address code, function code, data code and CRC16 calibration code appear in response message. The data information code includes the data collected by slave equipment such as register value or state. If there is any error, we promise no response from slave.

Transport mode refers to a series of independent data structure and limited regulation used for transporting data in a data frame, the following defines the compatible transmission mode with MODBUS protocol-RTU mode. Every byte bit: one start bit, eight data bits, (even-odd check bit), one stop bit (if even-odd check bit exists) or two stop bits (if no parity check bit).

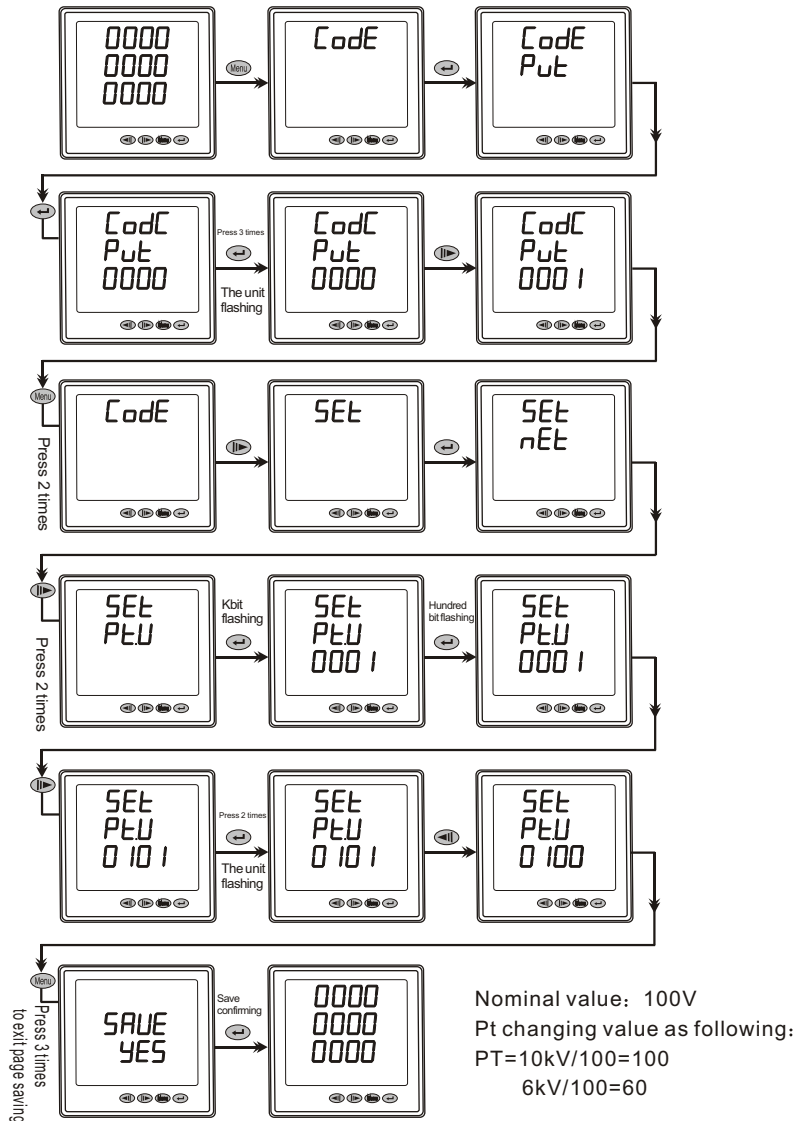
3. 7 programmable menu structure, user can set parameters according to actual situation



Note: exit menu setting, when appear SAVG YES, press key to save and exit, press key, exit ineffectively.

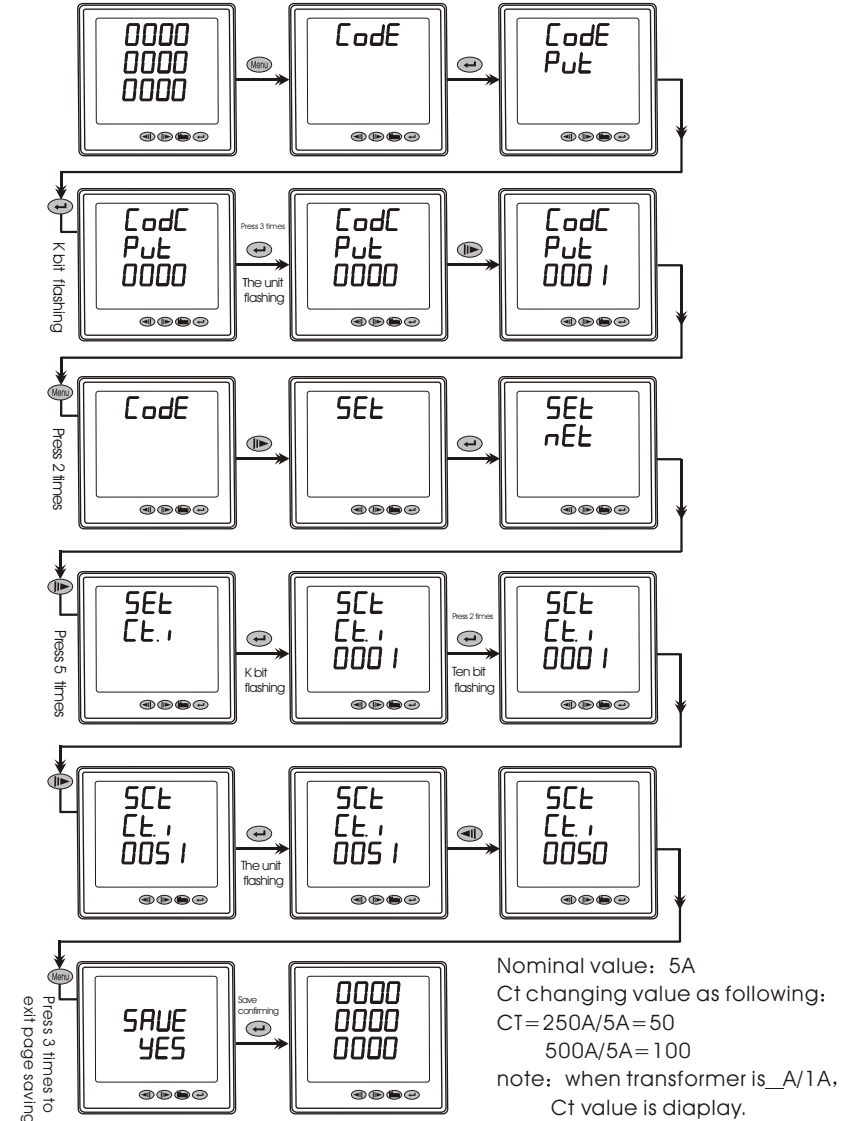
- Number displacement
- Number up
- Number down
- Return key

E.g1: voltage ratio modifying (e.g: 10KV/100V)



CodE	PuE	SEt	nEt	PtU	SAVE YES
Password	Input	Set	Phase-line network	Voltage ratio	Save

E.g 2: current ratio modifying (e.g: 250A/5A)



CodE	PuE	SEt	nEt	Ct.	SAVE YES
Password	Input	Set	Phase-line network	Current ratio	Save