User Manual of

Multifunctional Electric Power Meter

Applicable Model:

PD194Z-9HY Series / PD194Z-9HYX

Elecnova

Notices for use

Please read this manual carefully before using this device and be sure to observe the following notes while using it:

Note:

This device must be operated and maintained by a professional who has read this manual.

Before performing any internal or external operations on the device, disconnect all input signals and power supplies and make sure that the secondary terminals of the voltage transformer are not short-circuited and the secondary terminals of the current transformer are not open-circuited.

Be sure to use an appropriate voltage measuring device to confirm that there is no voltage present in any of the device's components.

The electric parameters supplied to the device must be within the rated range.

Please do not touch the terminals of the device while it is working.

To use the communication function of the device, please connect it to a secure communication network.

The following circumstances may result in the device being damaged or operating improperly:

The operating environment is out of range.

The voltage of the auxiliary power supply is out of range.

The frequency of the power distribution system is out of range.

The signal input exceeds the maximum rating.

The polarity of the current or voltage input is incorrect.

The wiring is not as required.

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Contents

1. Product Introduction

1.1 Overview

In line with the IEC 61557-12, this series of multifunctional electric power meters can measure the full electrical parameters, meter the electric energy, monitor the harmonics, trigger the over-limit alarm, and monitor the switching state, etc., to help users accurately monitor power operation data and satisfy their needs for power monitoring and energy management.

1.2 Functions

Functions		PD194Z-9HYX
Display mode	LCD Screen (Liquid Crystal Display)	•
Real-time measurement	Three-phase voltage (Va,Vb,Vc, Uab, Ubc, Uca)	•
	Three-phase current (Ia,Ib,Ic)	•
	Neutral current (Ia+Ib+Ic vector operation)	•
	Active power (P, Pa, Pb, Pc)	•
	Reactive power (Q, Qa, Qb, Qc)	•
	Apparent power (S, Sa, Sb, Sc)	•
	Power factor (Pf)	•
	Frequency (Hz)	•
	Demand	•
	Extreme value	•
Metering of electric energy	Bidirectional total active energy	•
	Bidirectional total reactive energy	•
	Bidirectional phase active energy	•

	Bidirectional phase reactive energy	•
	Four-quadrant reactive energy	•
	Apparent energy	•
	Bidirectional multi-rate energy	•
	Bidirectional total active fundamental energy	•
	Bidirectional total reactive fundamental energy	•
Power Quality	Voltage/current unbalance	•
	Voltage/current average	•
	Total harmonic distortion of voltage, current Harmonic content (2^{nd}…51^{st})	•
	Crest factor of voltage	•
	K-factor of current	•
	Phase angle	•
	Sequence component	•
	Current percentage	•
	Percentage of phase & total load	•
	Fundamental voltage/current	•
	Harmonic voltage/current	•
	Fundamental active power	•
	Fundamental reactive power	•
	Fundamental apparent power	•
Input/output	RS485 port	1
	Ethernet	1

	Digital input	6
	Relay output	2
Others	Over-limit alarm	•
	Event recording (32 pieces)	•
	8MB data memory	•
	Communication address mapping	•

2. Technical Specification

2.1 Technical Parameters

Environmental Characteristics	
Working Temperature	-25℃…+70℃
Relative Humidity	5%-95%RH, without condensation
Working Altitude	≤ 2000m CAT III
Pollution Level	2
Mechanical Characteristics	
External Dimension	96mm×96mm×83mm
Protection Level	Face frame: IP54; rear housing: IP20
Safety Characteristics	
Measurement Category	300V (CAT III)
Safety	IEC 61010-1, double insulation
Auxiliary Power Source	
Voltage	AC/DC 80V…270V
Power Consumption	≤ 5VA
Voltage Measurement Input	

Rated voltage	AC 3x230/400V
Measurement range	10 – 276VAC (L-N) 17 – 480VAC (L-L)
Resolution	0.1 V
Impedance	≥ 1.7 MΩ/phase
Consumption	≤ 0.1 VA /phase
Overload	Continuous: 1.2Vn; instantaneous: 2Vn/1min
Frequency	45Hz…65Hz
Current Measurement Input	
Rated Value	1A or 5A
Minimum operating current	10mA
Resolution	1mA
Impedance	≤ 20mΩ/phase
Consumption	≤ 0.2 VA/phase
Overload	Continuous: 2In; instantaneous: 20In/1s
Digital Input	
Quantity	6 Dry contact, built-in DC 24V
Relay Output	
Quantity	2 AC 250V/5A or DC30V/5A
Communication Interface	
RS485 port interface	1
Baud rate & communication Protocol	1.2kbps…115.2kbps - Modbus-RTU

Ethernet port interface and protocol	Ethernet, Modbus TCP/IP
Real-time Clock and Sampling cycle	
Clock Drifting	≤ 0.5s/day
Sampling cycle	128 samples/ cycle
Data update rate	1s
Terminals	
Tightening Torque	0.5Nm
Standards	
IEC 61557-12	Power metering and monitoring devices (PMD)
GB/T 22264.7	Special requirements for multi-function instruments
IEC 61326-1	Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements
IEC 61010-1	Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements
CE	Safety

2.2 Measurement Parameters

Measured Value	Accuracy Level	Unit
Va/Vb/Vc	Class 0.2 (IEC 61557-12)	[V, kV]
Uab/Ubc/Uca	Class 0.2 (IEC 61557-12)	[V, kV]
Ia/Ib/Ic	Class 0.2 (IEC 61557-12)	[A, kA]
In	Class 0.5 (IEC 61557-12)	[A, kA]
F	Class 0.1 (IEC 61557-12)	[Hz]

P/Pa/Pb/Pc	Class 0.5 (IEC 61557-12)	[kW, MW]
Q/Qa/Qb/Qc	Class 1 (IEC 61557-12)	[kvar, Mvar]
S/Sa/Sb/Sc	Class 0.5 (IEC 61557-12)	[kVA, MVA]
PF/PFa/PFb/PFc	Class 0.5 (IEC 61557-12)	—
EP+/EP-	Class 0.5S (IEC 61557-12)	[kWh, MWh]
EQ+/EQ-	Class 2 (IEC 61557-12)	[kvarh, Mvarh]
EQ1/EQ2/EQ3/EQ4	Class 2 (IEC 61557-12)	[kvarh, Mvarh]
ES	Class 0.5S (IEC 61557-12)	[kVAh, MVAh]
THDu	Class 1 (IEC 61557-12)	[%]
THDi	Class 1 (IEC 61557-12)	[%]
Harmonic content-U (2nd to 51st)	Class 1 (IEC 61557-12)	[%]
Harmonic content- I (2nd to 51st)	Class 1 (IEC 61557-12)	[%]
Unb/ Inb	Class 0.5 (IEC 61557-12)	[%]

3. Installation

3.1 Dimensions (Unit: mm)

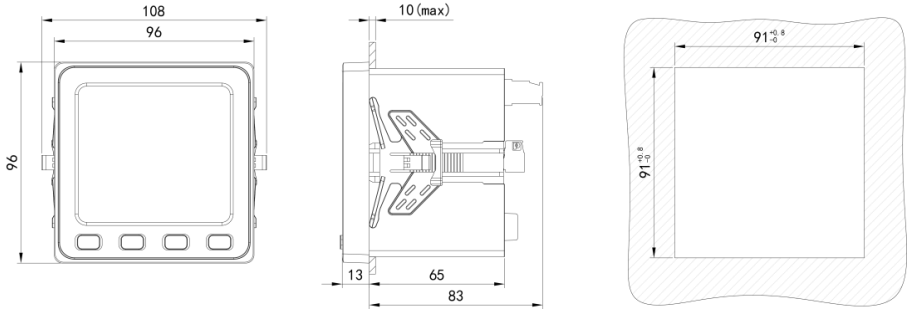


Figure 3.1.2 PD194Z-9HYX

3.2 Installation

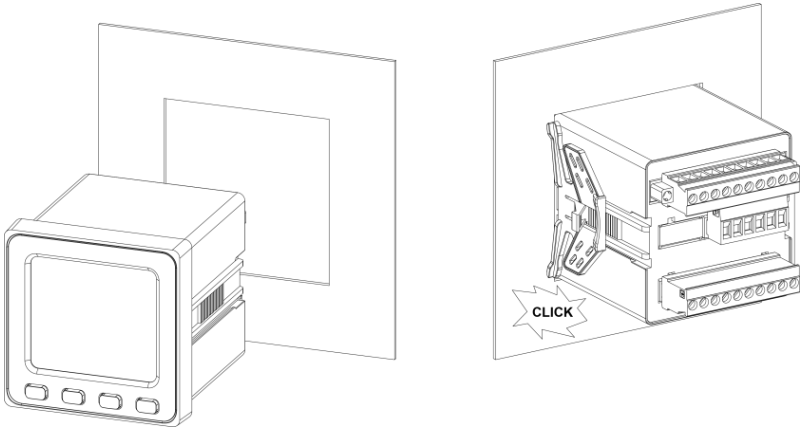
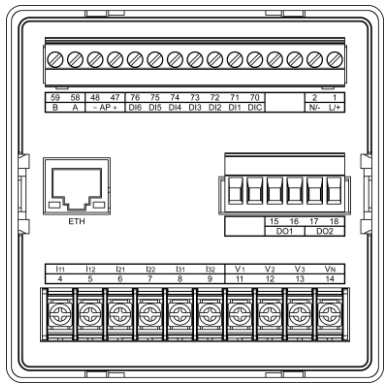


Figure 3.2.1 Installation instruction of Meter

3.3 Wiring

3.3.1 Terminal Diagram



3.3.2 Typical Wiring

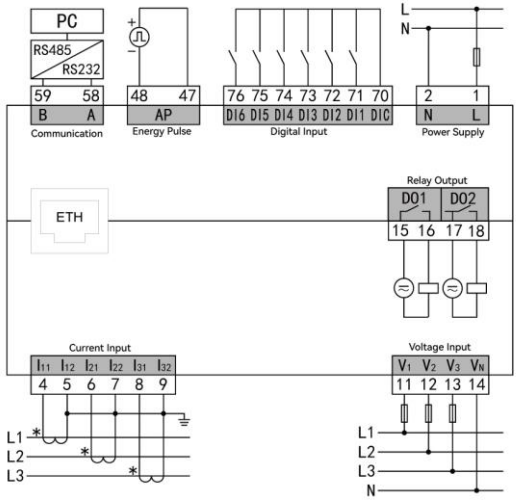
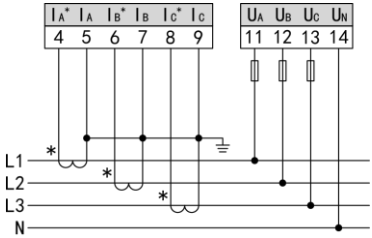


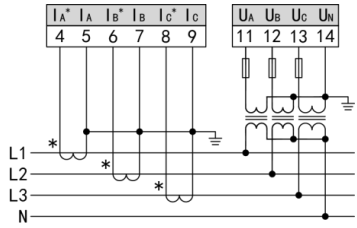
Figure 3.3.2

3.3.3 Wiring Mode of Input Signals



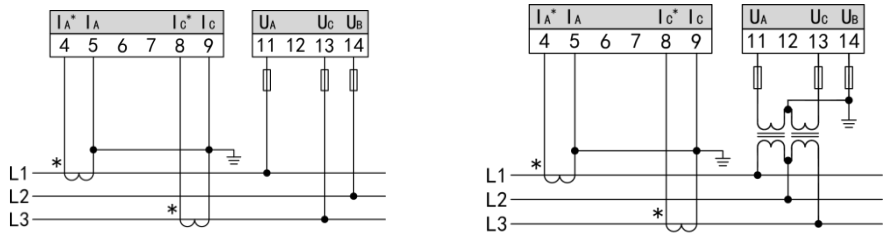
Three-phase four-wire,

with 3CT without PT



Three-phase four-wire,

with 3CT and 3PT



Three-phase three-wire, with 2CT without PT

Three-phase three-wire, with 2CT and 2PT

Figure 3.3.3 Wiring Diagram of Input Signals

Wiring Instructions:

1) The input voltage shall not be higher than the rated input voltage of the product; otherwise, PT shall be considered. It is recommended to use a terminal block for easy maintenance.

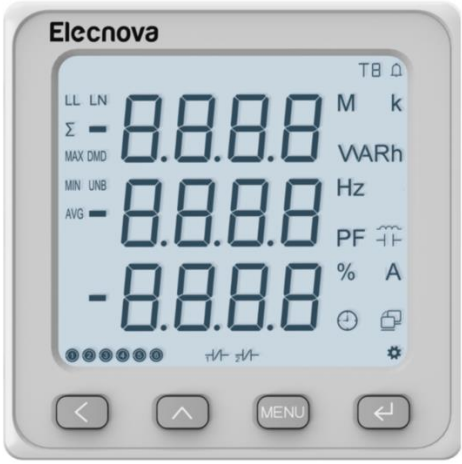
2) If the input current is more than 5A, an external CT shall be used. If there are other meters connected to the CT used, they shall be connected in series; before removing the current input connection of the device, always disconnect the primary circuit of the CT or short-circuit the secondary circuit. it is recommended to use the terminal block for easy maintenance.

3) It is necessary to ensure that the input voltage is corresponding to the current, and they are in the consistent phase sequence and direction; otherwise, there will be errors in the values and symbols of power and electric energy etc.

4) The meter can work in three-phase three-wire or three-phase four-wire mode, and the user shall select the corresponding wiring mode according to the service condition. It shall be noted that the wiring mode on site must be consistent with the wiring mode set in the meter; otherwise, the measurement data of the meter will be incorrect.

4. Operations

4.1 Panel



Instructions of Buttons

Buttons	Functions
<	Page down and cursor shift
^	Page up and number increment
MENU	Return to previous menu and enter/exit setting menu
↵	Enter next menu and confirm setting

Instructions of Symbols on Panel:

Symbols	Description
LL	L-L voltage
LN	L-N voltage
DMD	Demand
UNB	Unbalance
MAX	Maximum value
MIN	Minimum value
AVG	Average value
❷	Digital Input, if the lamp lights up, it indicates that the Digital Input is activated.
⊣⊢	Relay output, if the lamp lights up, it indicates that the relay is activated.
	Communication, it flashes when communication is in progress.
●	Pulse output; it flashes when the power is being metered.
	Alarm
	Setting; if the lamp lights up, it indicates that the meter is in parameter setting state.
	Time
T⊟	Rate number

4.2 Display

4.2.1 Display Operation

The display menu is designed with three cycles, i.e., skip cycle of categories, cycle of common data menus and cycle of small menus.

Skip Cycle of Categories (composed of content in Column 1 as shown in Figure 4.2.1): Press "MENU" to skip, where it consists of 6 categories, i.e., category of electric quantity (composed of "phase voltage" and "frequency" etc., skipping to "phase voltage" or "line voltage" interface), category of electric energy (composed of "forward active energy" and "energy of present reverse total multi-rate" etc., skipping to "forward active energy" interface), category of quality of electric energy (composed of "total harmonic distortion of phase A voltage" and "voltage unbalance" etc., skipping to "total harmonic distortion of phase A voltage" interface), category of temperature (skipping to "temperature T1-T2" interface) and category of time (skipping to "Y-M-D H-M-S" interface).

Cycle of Common Data Menus (composed of content in Column 2 as shown in Figure 4.2.1): Press the button "<" or "∧" to cycle through the common data menus, press the button "<" to cycle up and press the button "∧" to cycle down. In the "Phase Voltage" interface, press the button "<" to cycle to "Y-M-D H-M-S" interface; in the "Y-M-D H-M-S" interface, press the button "∧" to cycle to the "Phase Voltage" interface.

Cycle of Small Menus (composed of content in Column 3 as shown in Figure 4.2.1): Press the button "↵" to cycle through the small menus for checking the detailed data; in the last interface of the cycle of small menus, it will skip to the corresponding common data menu; if pressing the button "MENU", it will directly skip to the corresponding common data menu; in any interface of the cycle of small menus, it will be invalid to press the button "<" or "∧". For example, the Column 3 of the first row is "Small Cycle of Phase Voltage": Press the button "↵" to cycle through "Phase Voltage" -> "Maximum Phase Voltage" -> "Minimum Phase Voltage" -> "Average Phase Voltage" -> "Phase Voltage"; in the interface of "Maximum Phase Voltage", "Minimum Phase Voltage" and "Average Phase Voltage", it will be invalid to press the button "<" or "∧".

4.2.2 Display Menu

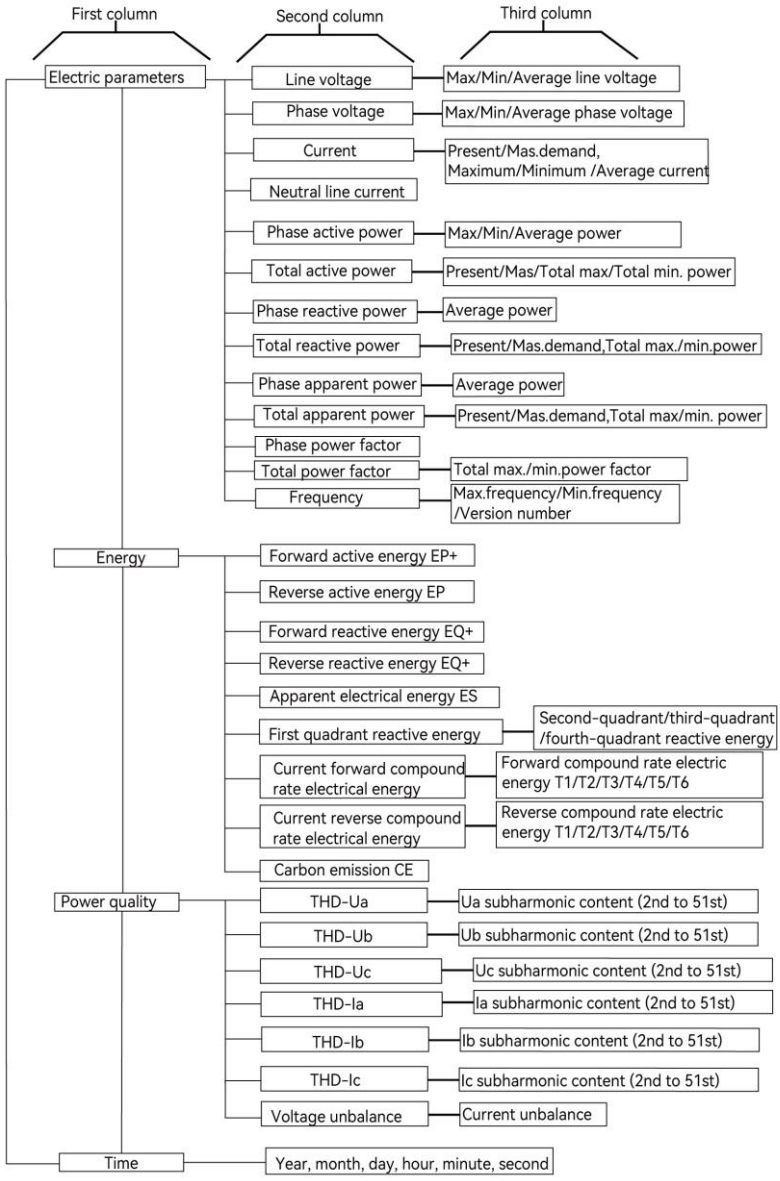


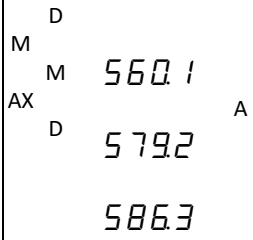
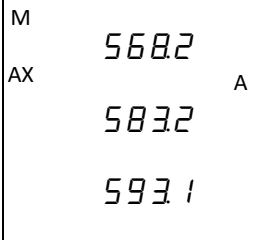
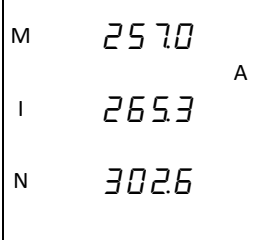
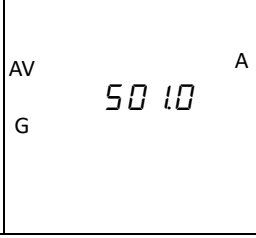
Figure 4.2.1 Display Menu

4.2.3 Example of Display Interface

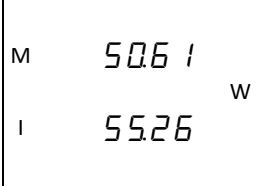
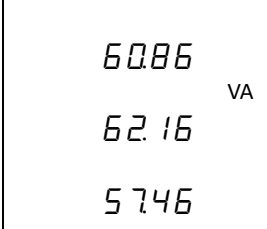
4.2.3.1 Electric Quantity

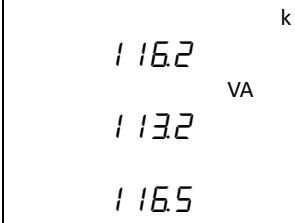
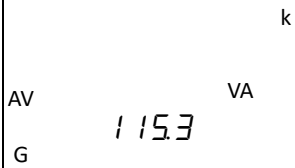
No.	Parameter	Display	Description
1	L-L voltage	LL 400.1 V 400.2 400.3	Uab: 400.1V Ubc: 400.2V Uca: 400.3V
2		LL M AX 410.3 V 410.4 410.5	Max Uab: 410.3V Max Ubc: 410.4V Max Uca: 410.5V
3		LL M I N 390.0 V 392.9 390.1	Min Uab: 380.0V Min Ubc: 392.9V Min Uca: 390.1V

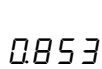
4		LL AV G 400.2 V	Average L-L voltage: 400.2V
5	L-N voltage	LN 230.1 V 230.2 230.3	Va: 230.1V Vb: 230.2V Vc: 230.3V
6	Current	505.1 A 491.9 506.0	Ia: 505.1A Ib: 491.9A Ic: 506.0A
7		D M 502.1 A D 499.9 500.0	Current demand of Ia: 502.1A Current demand of Ib:499.9A Current demand of Ic: 500.0A

8			Max demand of Ia: 560.1A Max demand of Ib: 579.2A Max demand of Ic: 586.3A
9			Max of Ia: 568.2A Max of Ib: 583.2A Max of Ic: 593.1A
10			Min of Ia: 257.0A Min of Ib: 265.3A Min of Ic: 302.6A
11			Average current 501.0A

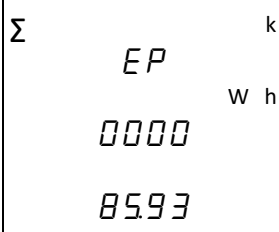
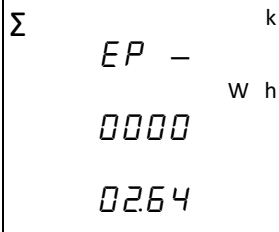
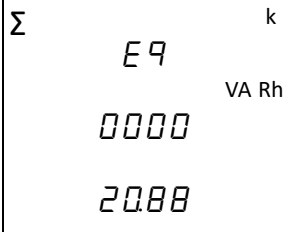
12	Neutral current	In A 013.9	Neutral current
13	Active power	k 99.03 W 95.02 101.5	Pa: 99.03kW Pb: 95.02kW Pc: 101.5kW
14		k AV W G 98.52	Average active power: 98.52kW
15		M k AX 111.3 W 112.2 118.7	Max of Pa: 111.3kW Max of Pb:112.2kW Max of Pc: 118.7kW

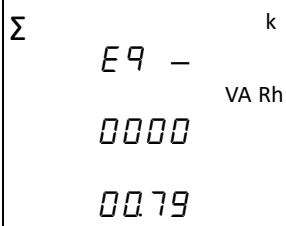
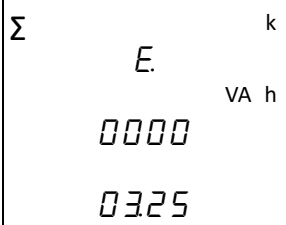
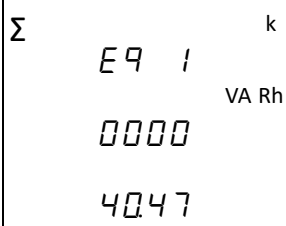
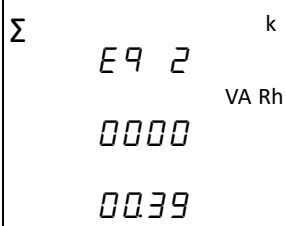
16			Min of Pa:50.61kW Min of Pb: 55.26kW Min of Pc: 61.80kW
17	Total active power		Σ P : 295.1kW
18	Reactive power		Qa: 60.86kvar Qb: 62.16kvar Qc: 57.46kvar
19			Average reactive power: 60.16kvar

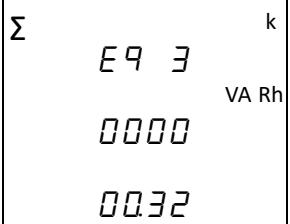
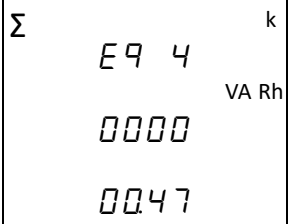
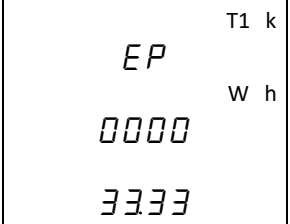
20	Total reactive power		Σ Q: 180.5kvar
21	Apparent power		Sa: 116.2kVA Sb: 113.2kVA Sc: 116.5kVA
22			Average apparent power: 115.3kVA
23	Total apparent power		Σ S: 346.1kVA

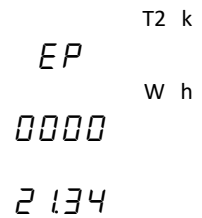
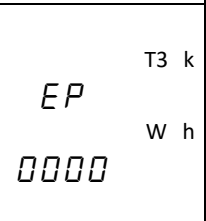
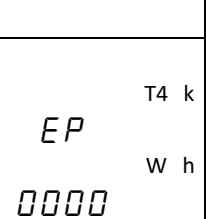
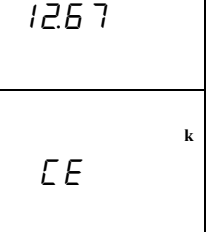
24	Power factor		PFa: 0.852 PFb:0.836 PFc: 0.870
25	Total power factor		PF: 0.853
26	Frequency		Frequency: 50Hz
27	Version number		Version number: 1000

4.2.3.2 Energy

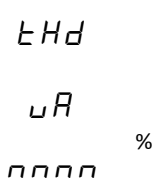
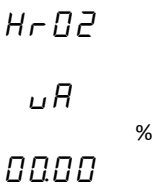
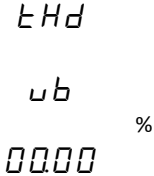
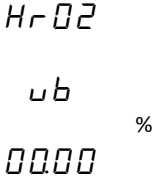
No.	Parameter	Display	Description
1	Forward active energy		Forward active energy: EP+ = 85.93kWh
2	Reverse active energy		Reverse active energy: EP- = 2.64kWh
3	Forward reactive energy		Forward reactive energy: EQ+ = 20.88kvarh

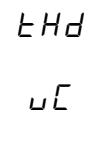
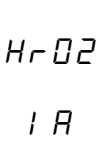
4	Reverse reactive energy		Reverse reactive energy: EQ- = 0.79kvarh
5	Apparent energy		Apparent energy: ES = 3.25 kVAh
6	Reactive energy of first quadrant		Reactive energy of first quadrant: EQ1 = 40.47kvarh
7	Reactive energy of second quadrant		Reactive energy of second quadrant: EQ2 = 0.36kvarh

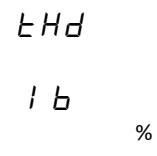
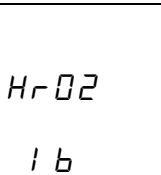
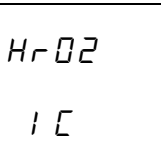
8	Reactive energy of third quadrant		Reactive energy of third quadrant: EQ3 = 0.32kvarh
9	Reactive energy of fourth quadrant		Reactive energy of fourth quadrant: EQ4 = 0.47kvarh
10	TOU active energy		Total active energy
11			Active Energy Tariff 1 : 33.33kWh

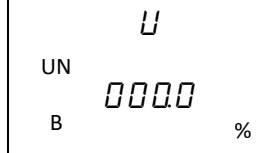
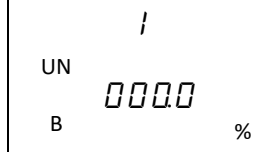
12			Active Energy Tariff 2: 21.34kWh
13			Active Energy Tariff 3: 18.59kWh
14			Active Energy Tariff 4: 12.67kWh
15	Generated CO2 emissions		Generated CO2 emissions CE = 4.556 kg

4.2.3.3 Power Quality

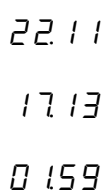
No.	Parameter	Display	Description
1	Total harmonic distortion & Individual harmonics		THD of Va
2			Individual harmonics of Va (2nd-51st)
3			THD of Vb
4			Individual harmonics of Vb (2nd-51st)

5			THD of Vc
6			Individual harmonics of Vc (2nd-51st)
7			THD of Ia
8			Individual harmonics of Ia (2nd-51st)

9			THD of Ib
10			Individual harmonics of Ib (2nd-51st)
11			THD of Ic
12			Individual harmonics of Ic (2nd-51st)

13	Voltage unbalance		Voltage unbalance
14	Current unbalance		Current unbalance

4.2.3.4 Time

No.	Parameter	Display	Description
1	Real time		The display time is 13:01:59 on November 17, 2022.

4.3 Setting

4.3.1 Setting Operations

In the display state of the meter, long press the button "MENU" to enter the code authentication interface, press the button "<" or "∧" to enter the code (the initial system code is 0001), and then press the button "↵" to enter the program setting interface. (Note: If there is no action in the interface after pressing the button "↵", it means the code is not correct.)

How to Use the Buttons during Programed Operation: The buttons "<" and "∧" are used for menu switching, cursor movement and number change, the button "MENU" is used as a return button, the "↵" is used to enter the next menu and confirm the changed value.

How to Modify the Numerical Digits: Press the button "<" to move the cursor to the numerical digit that needs to be modified, press the button "∧" to modify the corresponding numerical digit, and press the button "↵" to save the present setting.

How to Set the Decimal Point: After moving the cursor to the thousandth digit of the number, press the button "<", the decimal point in the digit will flash, and then by pressing the button "∧", you can modify the position of the decimal point, press the button "↵" to save the present setting.

After the data (or option) of the tertiary menu has been changed, it will become valid only after the button "↵" is pressed to return to the secondary menu; if the button "MENU" is pressed to return to the secondary menu, the change will not be saved (i.e., the change is not valid).

To exit the program setting interface, you can return to the primary menu of the program setting interface and then press the button "MENU" until the meter prompts "save-no". Now, you can select three types of operation:

(1) Save and Exit: Press the button "<" or "∧" to switch to "save-yes", and then press the button "↵" to save the setting parameters before exiting;

(2) Exit without Saving: Press the button "↵" to exit without saving the setting parameters;

(3) Keep in Program Setting State: Press the button "MENU" to keep in the program setting state.

4.3.2 Setting Menu

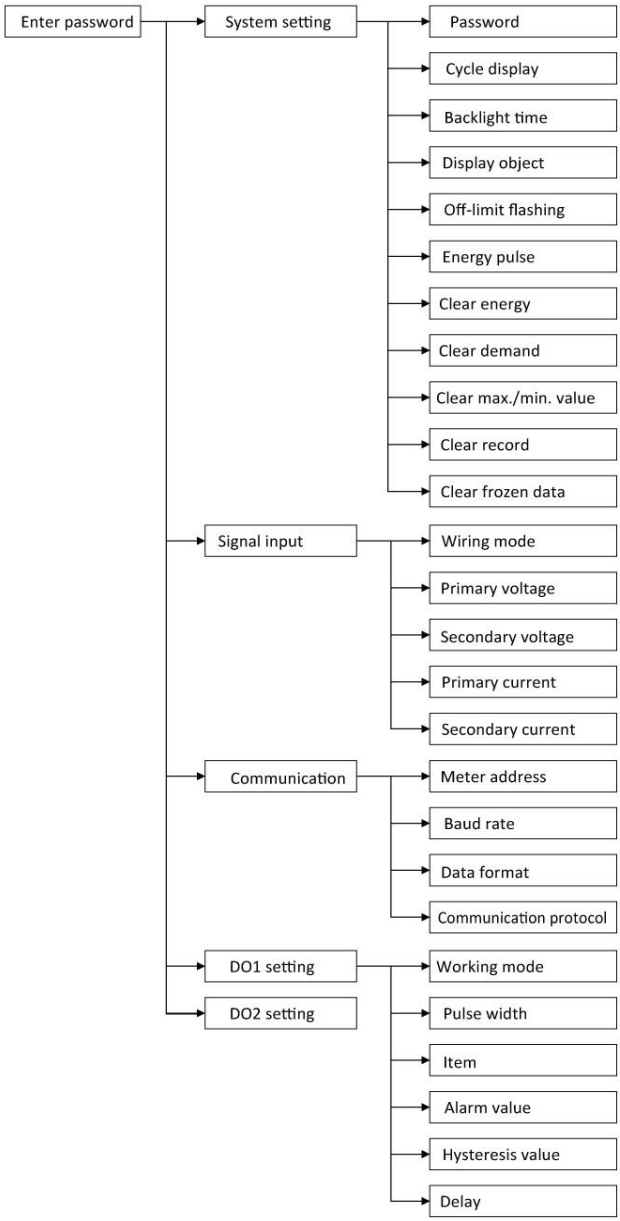


Figure 4.3.2 Overview of Setting Menus

Notes to Text on Setting Interface

Primary	Secondary	Tertiary	Instructions
System Settings	CodE	0000～9999	User code
	CYC	no or YES	Cycle through no: Not cycle through YES: Cycle through at an interval of 8s
	LIGH	0000～0240	Lighting time of backlight (s) 0: Normally on
	diSP	Voltage, current, etc.	Default display interface after powering on
	ALr	no or YES	Over-limit flashing no: Off YES: On
	PULS	AP or rP	Pulse of energy AP: Pulse of active energy rP: Pulse of reactive energy

	I.rvS	no or YES	Reverse current no: Off YES: On
	CLrE	no or YES	Clear energy no: Not clear YES: Clear all data of energy
	CLrd	no or YES	Clear demand no: Not clear YES: Clear all data of demand
	CLrn	no or YES	Clear extreme value no: Not clear YES: Clear all data of extreme value
	CLrr	no or YES	Clear record no: Not clear YES : 100 records were cleared

	CLrF	no or YES	Clear freezing data no: Not clear YES: Clear 4 sets of freezing data
Signal Input	nEt	n12, n33, n34	Wiring mode n12: Single-phase n33: There-phase three-wire n34: There-phase four-wire
	Pt .1	0000～9999 kV	Rated value of primary side of voltage transformer
	Pt .2	0000～0690 V	Rated value of secondary side of voltage transformer
	Ct .1	0000～9999 kA	Rated value of primary side of current transformer
	Ct .2	0000～0006 A	Rated value of secondary side of current transformer
Communi	Addr	0001～0247	Meter Address: 1-247

cation 1 Con1	bAUd	0012～1152 k	Baud rate: 1200、2400、4800、9600、19200、38400、57600、115200bps
	dAtA	n81 o81 E81 n82	Data format n81: No polarity check, 1 stop bit o81: Odd polarity check, 1 stop bit E81: Even polarity check, 1 stop bit n82: No polarity check, 2 stop bit
	Prot	rtU	Communication protocol rtU：Modbus-RTU
Communi cation 2 Con2	Addr	0001～0247	Meter Address:1～247
	IP.1～IP.4	0000～0255	IP：0～255
	nAS.1～nAS.4	0000～0255	Subnet Mask: 0-255
	GAt.1～GAt.4	0000～0255	Gateway: 0-255
	Prot	0000～9999	TCP Port: 0-9999, default 502

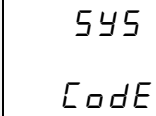
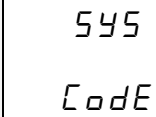
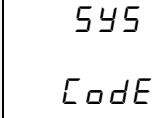
	dHCP	no or YES	no: Disable DHCP YES: Enable DHCP
DO Settings do-1 do-2 do-3	mode	oFF rEm ALr	Working modes oFF: Off rEm: Remote control ALr: Alarm
	tImE	0000～9999	Pulse width
	ItEm	LL .H…	Alarm item
	uAL	0000～9999	Alarm value
	HYS	0000～9999	Hysteresis
	dELY	0000～9999	Delay time

4.3.3 Examples of Parameter Settings

4.3.3.1 System Settings

To change the user code to 0112, enable the cycle through, and clear the extreme values, the operation steps for the menu are as follows:

No.	Display	Description
1	PrOG CodE 0000	Long press the button "MENU" to enter the code authentication interface.
2	PrOG CodE 0001	Press the button "<" or "∧" to enter the code (the initial system code is 0001).
3	SYS	Press the button "↵" to enter the primary setting menu (the first option is "System Setting") if the code is correct.

4		Press the button "↵" to enter the secondary setting menu (the first option is "Code").
5		Press the button "↵" to enter the tertiary setting menu, which shows that the present code is "0001".
6		Press the button "<" to move the cursor, press the button "^" to change the number at the position of cursor and enter the new code "0112".

7	SYS CodE	Press the button "↵" to confirm and return to the secondary setting menu.
8	SYS CYC	Press the button "∧" to select "cyc" (cycle through).
9	SYS CYC no	Press the button "↵" to enter the tertiary setting menu, which shows that the present cycle through enable "no" (not cycle through).
10	SYS CYC YES	Press the button "∧" to switch to "yes".

11	SYS CYC	Press the button "↵" to confirm and return to the secondary setting menu.
12	SYS CLr.n	Press the button "∧" to select "clr.m" (clear extreme value)
13	SYS CLr.n no	Press the button "↵" to enter the tertiary setting menu, which shows "no".
14	SYS CLr.n YES	Press the button "∧" to switch to "yes".

15	SYS CLr.n	Press the button "↵" to confirm and return to the secondary setting menu.
16	SYS	Press the button "MENU" to return to the primary setting menu.
17	SAuE no	Press the button "MENU" to the saving interface.
18	SAuE YES	Press the button "∧" to switch to "yes".

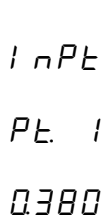
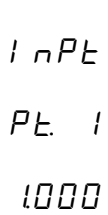
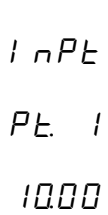
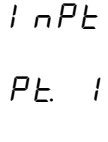
19	0000 V 0000 0000	Press the button "↵" to save and return to the electric quantity interface.

4.3.3.2 Signal Input Settings

If the signal of the meter is 10kV/100V, 500A/5A, the operation steps for the menu are as follows:

No.	Display	Description
1	PrOG CodE 0000	Long press the button "MENU" to enter the code authentication interface.
2	PrOG CodE 0001	Press the button "<" or "∧" to enter the correct code (the initial system code is 0001).

3	SYS	Press the button "↵" to enter the primary setting menu (the first option is "System Setting").
4	InPt	Press the button "∧" to select "inpt" (signal input).
5	InPt nEt	Press the button "↵" to enter the secondary setting menu (the first option is "Wiring Mode").
6	InPt Pt. 1	Press the button "∧" to select "pt.1" (primary voltage).

7		Press the button "↵" to enter the tertiary setting menu, which shows that the present primary voltage is "0.380k" (380V).
8		Press the button "<" or "^" to adjust the number to "1.000k".
9		Press the button "<" until the decimal point flashes, and then press the button "^" to change the decimal point to "10.00k" (10kV).
10		Press the button "↵" to confirm and return to the secondary setting menu.

11	InPt Pt. 2	Press the button "∧" to select "pt.2" (secondary voltage).
12	InPt V Pt. 2 0380	Press the button "↵" to enter the tertiary setting menu, which shows that the present secondary voltage is "0380" (380V).
13	InPt V Pt. 2 0100	Press the button "<" or "∧" to adjust the secondary voltage to "0100" (100V).
14	InPt Pt. 2	Press the button "↵" to confirm and return to the secondary setting menu.

15	SYS CT. 1	Press the button "∧" to select "ct.1" (primary current).
16	k InPt A CT. 1 0.005	Press the button "↵" to enter the tertiary setting menu, which shows that the present primary current is "0.005k" (5A).
17	k InPt A CT. 1 0.500	Press the button "<" or "∧" to adjust the primary current to "0.500k" (500A).
18	InPt CT. 1	Press the button "↵" to confirm and return to the secondary setting menu.

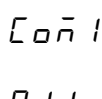
19	InPt	Press the button “MENU” to return to the primary setting menu.
20	SAvE no	Press the button “MENU” to the saving interface.
21	SAvE YES	Press the button “∧” to switch to “yes”.
22	0000 V 0000 0000	Press the button “↵” to save and return to the electric quantity interface.

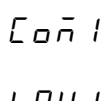
4.3.3.3 COM1 communication Settings

To set the communication address of meter to 12, the baud rate to 38,400, and the data format to even parity check for E81, the operation steps for the menu are as follows:

No.	Display	Description
1	ProG CodE 0000	Long press the button "MENU" to enter the code authentication interface.
2	ProG CodE 0001	Press the button "<" or "∧" to enter the correct code (the initial system code is 0001).
3	SYS	Press the button "↵" to enter the primary setting menu (the first option is "System Setting").

4		Press the button "∧" to select "com.1" (communication).
5		Press the button "↵" to enter the secondary setting menu (the first option is "Address").
6		Press the button "↵" to enter the tertiary setting menu, which shows that the present address is "0001".
7		Press the button " <" or "∧" to enter the new address "0012".

8		Press the button "↵" to confirm and return to the secondary setting menu.
9		Press the button "∧" to select "baud" (baud rate).
10		Press the button "↵" to enter the tertiary setting menu, which shows that the present baud rate is "9,600".
11	k 	Press the button "∧" to select "38.4k" (38,400).

12		Press the button "↵" to confirm and return to the secondary setting menu.
13		Press the button "∧" to select "data" (check mode).
14		Press the button "↵" to enter the tertiary setting menu, which shows "n.8.1" (no parity check for N81).
15		Press the button "∧" to switch to "e.8.1" (even parity check for E81).

16	Con 1 dAtA	Press the button "↵" to confirm and return to the secondary setting menu.
17	Con 1	Press the button "MENU" to return to the primary setting menu.
18	SAvE no	Press the button "MENU" to the saving interface.
19	SAvE YES	Press the button "∧" to switch to "yes".

20	0000 V 0000 0000	Press the button "↵" to save and return to the electric quantity interface.

4.3.3.4 Relay Output Setting

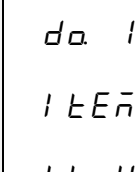
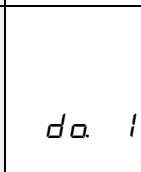
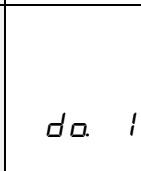
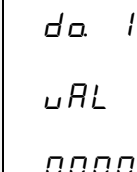
To set the high alarm output of phase B line current to realize the first switching alarm output when the phase B current is more than 3A, i.e., the first switching circuit is on, the operation steps for the menu are as follows:

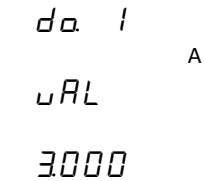
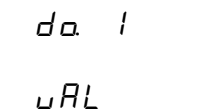
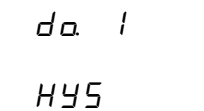
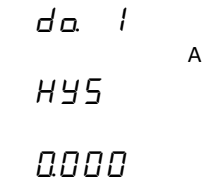
No.	Display	Description
1	PrOG CodE 0000	Long press the button "MENU" to enter the code authentication interface.
2	PrOG CodE 0001	Press the button "<" or "∧" to enter the code (the initial system code is 0001).

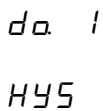
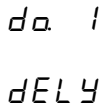
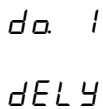
3	SYS	Press the button "↵" to enter the primary setting menu (the first option is "System Setting").
4	do. 1	Press the button "∧" to select "do.1" (relay output 1)
5	do. 1 mode	Press the button "↵" to enter the secondary setting menu (the first option is "Working Mode").
6	do. 1 mode oFF	Press the button "↵" to enter the tertiary setting menu, which shows that the present working mode is "off" (turned off).

7	do. 1 mode ALr	Press the button "<" or "∧" to select the working mode as "alr" (alarm mode).
8	do. 1 mode	Press the button "↵" to confirm and return to the secondary setting menu.
9	do. 1 tIme	Press the button "∧" to select "time" (pulse width).
10	do. 1 tIme 000.0	Press the button "↵" to enter the tertiary setting menu, which shows that the present pulse width is "000.0" (level mode).

11	do. 1 tI nE 0 10.0	Press the button "<" or "∧" to adjust the pulse width to "010.0" (10s).
12	do. 1 tI nE	Press the button "↵" to confirm and return to the secondary setting menu.
13	do. 1 I tEn	Press the button "∧" to select "item" (alarm item).
14	do. 1 I tEn uA H	Press the button "↵" to enter the tertiary setting menu, which shows that the present alarm item is "va.h" (high alarm of phase A voltage).

15		Press the button "∧" to select the alarm item "ib.h" (high alarm of phase B current).
16		Press the button "↵" to confirm and return to the secondary setting menu.
17		Press the button "∧" to select "val" (alarm threshold).
18	 A	Press the button "↵" to enter the tertiary setting menu, which shows that the present alarm threshold is "0000" (0A).

19		Press the button "<" or "^" to adjust the alarm threshold to "3.000" (3A).
20		Press the button "↵" to confirm and return to the secondary setting menu.
21		Press the button "^" to select "hys" (hysteresis).
22		Press the button "↵" to enter the tertiary setting menu, which shows that the present hysteresis is "0.000" (0A).

23	 A	Press the button "<" or "^" to adjust the hysteresis to "1.000" (1A).
24		Press the button "↵" to confirm and return to the secondary setting menu.
25		Press the button "^" to select "dely" (delay time).
26		Press the button "↵" to enter the tertiary setting menu, which shows that the present delay time is "000.0" (0s).

27	do. 1 dELY 0 10.0	Press the button "<" or "^" to adjust the delay time to "010.0" (10s).
28	do. 1 dELY	Press the button "↵" to confirm and return to the secondary setting menu.
29	do. 1	Press the button "MENU" to return to the primary setting menu.
30	SAuE no	Press the button "MENU" to the saving interface.

31	SAvE YES	Press the button "∧" to switch to "yes".
32	0000 V 0000 0000	Press the button "↵" to save and return to the electric quantity interface.

5. Functions

5.1 Real-time measuring

Types	Parameter	Phases	Total	Average
Voltage	L-N voltage	•	–	•
	L-L voltage	•	–	•
	Voltage unbalance	–	•	–
	Phase angle	•	–	–
	Fundamental voltage	•	–	–
	Crest factor of voltage	•	–	–
Current	Current	•	–	•
	Neutral current	•	–	–

	Current unbalance	–	•	–
	Phase angle	•	-	–
	Fundamental current	•	-	–
	K-factor of current	•	-	–
	Current percentage	•	-	–
Power	Active power	•	•	•
	Reactive power	•	•	•
	Apparent power	•	•	•
	Power factor	•	•	–
	Load percentage	•	•	–
	Fundamental active power	•	•	–
	Fundamental reactive power	•	•	–
	Fundamental apparent power	–	•	–
	Displacement power factor	•	•	–
Frequency	Frequency (phase A voltage)	–	•	–
Harmonics	Total harmonic distortion of voltage	•	–	–
	Total harmonic distortion of current	•	–	–
	2nd-51st harmonic distortion of voltage	•	–	–
	2nd-51st harmonic distortion of current	•	–	–

5.2 Demand

The meter can provide present demand, demand of last cycle, maximum demand, maximum demand of current month, maximum demand of last month and maximum demand of month before last month, and two calculation methods slip type and fixed type, and the relevant settings can be made through communication.

The meter provides the following demand data:

- Three-phase current demand
- Total active power demand
- Total reactive power demand
- Total apparent power demand

5.2.1 Slip Demand

The settings related to slip calculation are as follows:

- ✧ Working Mode of Demand: set to “Slip Block”.
- ✧ Slip Time (t) of Demand: Set to “1” minute.
- ✧ Cycle Factor (n) of Demand: Set to “15”.

The calculation method is shown in Figure 5.2.1:

- ➢ Demand of Previous Cycle = $(dmd_{t1}+dmd_{t2}+ \dots + dmd_{t14}+ dmd_{t15})/15$
- ➢ Demand of Present Cycle = $(dmd_{t2}+ dmd_{t3}+ \dots + dmd_{t15}+dmd_{t16})/15$

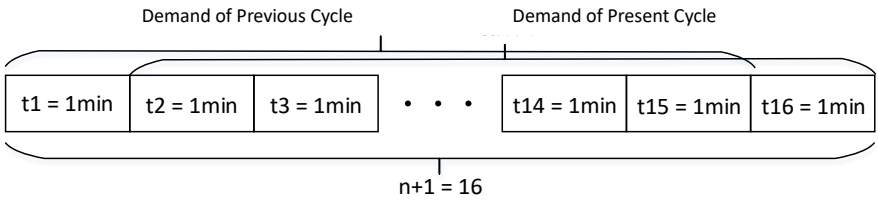


Figure 5.2.1 Schematic Diagram of Slip Demand Calculation

5.2.2 Fixed Demand

The settings related to fixed calculation are as follows:

- ✧ Working Mode of Demand: Set to “Fixed block”.
- ✧ Slip Time (t) of Demand: Set to “1” minute.
- ✧ Cycle Factor (n) of Demand: Set to “15”.

The calculation method is shown in Figure 5.2.2:

- ➢ Demand of Previous Cycle = $(dmd_{t1}+ dmd_{t2}+ \dots + dmd_{t14}+ dmd_{t15})/15$
- ➢ Demand of Present Cycle = $(dmd_{t16}+ dmd_{t17}+ \dots + dmd_{t29}+ dmd_{t30})/15$

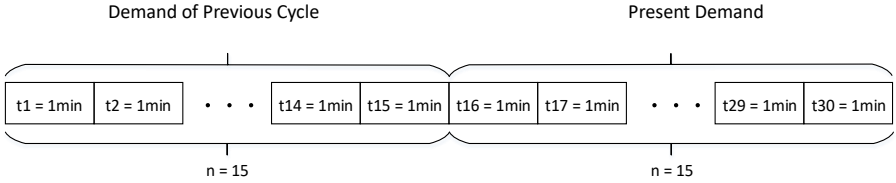


Figure 5.2.2 Schematic Diagram of Fixed Demand Calculation

[Note] The maximum demand value can be configured as an interval extreme value or a historical extreme value according to the method as specified in 5.3 “Extreme Values”

5.3 Extreme Values

The meter provides two types of extreme values i.e., interval extreme values or historical extreme values. When the interval time is set to “0”, it is the historical extreme value; when it is not set to “0”, it is the interval extreme value. When the interval time is set to 15min and the current time is 12:20, the extreme values displayed by the meter with multi-rate type are the extreme values within 12:15-12:30, and the extreme values displayed by the meter without multi-rate type are the extreme values at an interval of 15min.

Record the following extreme value data:

- Maximum /minimum of L-N voltage and occurrence time
- Maximum /minimum of L-L voltage and occurrence time
- Maximum /minimum of current and occurrence time
- Maximum /minimum of neutral current and occurrence time
- Maximum /minimum of active power and occurrence time
- Maximum /minimum of reactive power and occurrence time
- Maximum /minimum of apparent power and occurrence time
- Maximum /minimum of power factor and occurrence time
- Maximum /minimum of frequency and occurrence time
- Maximum /minimum of total harmonic distortion of voltage and occurrence time
- Maximum /minimum of total harmonic distortion of current and occurrence time

5.4 Power Quality

5.4.1 Fundamental Analysis

The meter can provide the following fundamental data:

- Three-phase fundamental voltage
- Three-phase fundamental current
- Three-phase fundamental power

5.4.2 Harmonic Analysis

The meter can provide the maximum 51 orders of phase harmonics data, and the harmonics data are as follows:

- Total harmonic distortion of phase voltage (THD-Va, THD-Vb, THD-Vc)
- Total harmonic distortion of phase current（THD-Ia, THD-Ib, THD-Ic）
- Sub-harmonic distortion of phase voltage (HR2-Va... HR51-Va, HR2-Vb... HR51-Vb, HR2-Vc... HR51-Vc)
- Sub-harmonic distortion of phase current （HR2-Ia… HR51-Ia, HR2-Ib… HR51-Ib, HR2-Ic… HR51-Ic）

5.4.3 Crest Factor

The meter calculates the crest factor by analyzing a complete voltage cycle and provides the crest factor of three-phase voltage:

- Crest factor of voltage = Crest value of circumferential wave/Effective value of circumferential wave

5.4.4 K-factor

The meter calculates the K-factor from the harmonic data of the calculated current. The K-factor for three-phase currents is available as follows:

$$k = \frac{\sum_{h=2}^{h=h_{max}} I_h{}^2 h^2}{I_{th}{}^2}$$

In which, h refers to the number of harmonics, Ih refers to the value of the harmonic distortion of the h^{th} current harmonic and Ith refers to the value of the total harmonic distortion. Since the meter can measure 2nd-51st harmonics, the max is 51.

5.4.5 Unbalance

The calculation method for the voltage and current unbalance of the meter will be adjusted according to the wiring mode:

- Three-phase Four-wire System:

  Unbalance = Negative sequence component/Positive sequence component

- Three-phase Three-wire System:

  Unbalance = MAX (phase value - average value)/Average value

5.5 Energy

The meter can provide the following energy data:

- Bidirectional active energy
- Bidirectional reactive energy
- Apparent energy
- Four-quadrant reactive energy
- Bidirectional fundamental active energy
- Bidirectional fundamental reactive energy

5.6 Time of Use (TOU)

Time of Use (TOU) is a billing method that adjusts electricity pricing based on time of day, day of the week, and seasonal variations. The TOU system allows users to configure

electricity price schedules and categorize energy consumption into different TOU tariff tiers according to usage time.

The TOU feature supports two TOU schedules, which can automatically switch at predefined times. Each schedule includes the following configuration capabilities:

- 6 tariffs (corresponding to different time-of-use rate levels)
- 12 seasonal cycles (e.g., summer/winter pricing strategies)
- 22 fixed holidays and 60 floating holidays (customizable non-standard billing dates)
- 6 daily profiles, each with 12 Periods in 15-minute interval

Multi-tariff forward active energy recording

- Current: Total / Tariff1-Tariff6
- Current Month: Total / Tariff1-Tariff6
- Historical (Previous Month 1 to 12): Total / Tariff1-Tariff6
- Multi-tariff Reverse Active Energy Recording
- Current Reverse: Total / Tariff1-Tariff6

5.7 Alarm

The meter can provide independent over-limit alarms with enable, threshold, hysteresis, and delay time. When an alarm is triggered, the corresponding value on the meter panel will flash (the flashing function for alarm needs to be activated, and when the wiring mode is “1P2W”, please set the total alarm of the electric quantity; otherwise, this function will be invalid), and the register value of the alarm state of the communication address table will be updated accordingly.

The electric quantity of alarm is shown in the following table:

Type	Item	Phase	Total	Upper Limit	Lower Limit
Voltage	L-N voltage	•	–	•	•
	L-L voltage	•	–	•	•
	Phase loss	–	–	–	•
Current	Current	•	–	•	•
Power	Active power	–	•	•	•
	Reactive power	–	•	•	•
	Apparent power	–	•	•	•
	Power factor	–	•	–	•
Frequency	Frequency (phase A voltage)	–	•	•	•

Triggering Conditions of Alarm:

1) The corresponding alarm enable bit is enabled (bit position 1)

2) The electric quantity of alarm is more than the threshold in case of upper limit alarms; the electric quantity of alarm is less than the threshold in case of lower limit alarms.

3) The duration exceeds the delay time

Release Conditions of Alarm:

4) The electric quantity of alarm is less than the value of threshold - hysteresis in case of upper limit alarms; the electric quantity of alarm is more than the value of threshold + hysteresis in case of lower limit alarms

5.8 Event Recording

5.8.1 Event recording

The meter provides 32 data records for querying, where each record can be divided into two parts i.e., event + occurrence time. The event is divided into a high byte (event classification) and a low byte (specific event), as shown in the following table:

High	Event Classification	Low	Specific Events
0x00	No event	—	—
0x01	Power on/off event	0x00	Power off
		0x01	Power on
0x02 0x03	Alarm start event Alarm end event	Voltage alarm event	
		0x00	Va. H
		0x01	Va. L
		0x02	Vb. H
		0x03	Vb. L
		0x04	Vc. H
		0x05	Vc. L
		0x06	Uab. H
		0x07	Uab. L
		0x08	Ubc. H
		0x09	Ubc. L
		0x0A	Uca. H
		0x0B	Uca. L

		Current alarm event	
		0x10	Ia. H
		0x11	Ia. L
		0x12	Ib. H
		0x13	Ib.L
		0x14	Ic.H
		0x15	Ic.L
		Power alarm event	
		0x20	P.H
		0x21	P.L
		0x22	Q.H
		0x23	Q.L
		0x24	S.H
		0x25	S.L
		Frequency and other alarm events	
		0x40	F.H
		0x41	F.L
		0x42	PF.L
		0x43	Phase loss
		0x44	Voltage phase sequence
		Temperature alarm event	
		0x60	T1.H
		0x61	T1.L
		0x62	T2.H

		0x63	T2.L
		0x64	T3.H
		0x65	T3.L
		0x66	T4.H
		0x67	T4.L
		0x68	T5.H
		0x69	T5.L
		0x6A	T6.H
		0x6B	T6.L
0x04	DI event	0x00	DI1 on
		0x01	DI1 off
		0x02	DI2 on
		0x03	DI2 off
		0x04	DI3 on
		0x05	DI3 off
		0x06	DI4 on
		0x07	DI4 off
		0x08	DI5 on
		0x09	DI5 off
		0x0A	DI6 on
		0x0B	DI6 off
		0x0C	DI7 on
		0x0D	DI7 off
		0x0E	DI8 on

		0x0F	DI8 off
0x05	DO event	0x00	DO1 on
		0x01	DO1 off
		0x02	DO2 on
		0x03	DO2 off
0x06	Meter operation event	0x00	Programmed operation
		0x01	Clearing of all data
		0x02	Clearing of electric energy
		0x03	Clearing of demand
		0x04	Clearing of extreme values
		0x05	Clearing of data records
		0x06	Clearing of freezing data
		0x07	Clearing of DI pulse count
		0x08	Clearing of DI shift count

5.8.2 real time data

Meter supports timed recording of real-time data (e.g., voltage, current, power, etc.), with a maximum capacity of 105,200 data groups. Each group includes 38 registers, where:

The first three registers store the timestamp (year, month, day, hour, minute, second).

The remaining 35 registers are user-definable.

Data recording is performed via communication using Function Code 0x14 (Hex). The recording interval is configured by setting the 0x0800 register via communication. For details, refer to the communication register table.

5.9 Freezing Data

The meter provides ability to query and set 3 sets of freezing data. In each set, 18 pieces of data can be selected for freezing, and the freezing mode is selectable (timed freezing or communication freezing). Sets 1-2 are for general glectric quantities, and set 3 is for freezing of 64-digit electric energy data.

5.9.1 Timed Freezing

When the timed freezing is selected, the setting of freezing interval will be valid.

The settings are as follows:

The 1st set of freezing data 1 is set as “1” (phase voltage-Vb).

The 1st set of freezing mode is set as “0x00” (timed freezing).

The 1st set of freezing intervals “15” (15min).

In the 1st set of freezing data 1, the phase voltage-Vb will be frozen at 0, 15, 30 and 45min of every hour.

[Note] When setting the freezing interval, it is necessary to set it as the common divisor of 60, where the setting range is 1-60min.

5.9.2 Communication Freezing

When the communication freezing mode is selected, the freezing refresh register will be valid.

The settings are as follows:

The 3rd set of freezing data 1 is set as “0” (forward active electric energy-Ep+).

The 3rd set of freezing mode is set as “0x01” (communication freezing).

When “1” is written into the 3rd set of freezing refresh register, it will freeze the forward active electric energy-Ep+ once.

5.10 Address Mapping

The meter provides 60 addresses starting from 0x1000 to map any address before 0x1000 for the convenience of the user to read the data that they want but is not contiguous in one frame.

For example, if the host computer wants to read “Va”, “Vb”, “Vc”, and “average voltage” in one frame, you can set as follows:

- ✧ Custom data setting 1/2 set to “0x0006”/ “0x0007” (address of voltage-Va)
- ✧ Custom data setting 3/4 set to “0x0008”/ “0x0009” (address of voltage-Vb)
- ✧ Custom data setting 5/6 set to “0x000A”/ “0x000B” (address of voltage-Vc)
- ✧ Custom data setting 7/8 set to “0x0310”/ “0x0311” (Address of average voltage)

After the setting is completed, the host computer can read 8 addresses directly from the 0x1000 to complete a frame reading the above data.

5.11 Digital Input

The Digital Input module adopts the dry contact input mode. Since it is equipped with an internal working power source, the meter can be used to monitor the opening/closing state of the circuit breaker, count the number of shifts, and accumulate the pulses of electric energy without external power source.

5.12 Relay Output

The relay output has two working modes, alarm mode and remote-control mode.

5.12.1 Alarm Mode

Alarm threshold is set based on primary value. When the measured value meets the alarm condition, an alarm will be triggered; when the measured value returns to the normal range, the alarm will be released. The alarm can be associated with a relay output to control the relay output.

Triggering and Release Flow of Alarm:

- High Alarm Mode:

Triggering Condition: When the measured value is more than the threshold value and the hold time is more than the set delay time.

Release Condition: When the measured value is less than (threshold value - hysteresis).

- Low Alarm Mode:

Triggering Condition: When the measured value is less than the threshold value and the hold time is more than the set delay time.

Release Condition: When the measured value is more than (threshold value - hysteresis).

The working mode, action pulse width, alarm item, alarm range, alarm hysteresis and alarm delay of each relay can be flexibly set during the programed operation.

Alarm Items:

No.	Items	Range	Description
00	Va. H	0.001V-999.9kV	High alarm of Va
01	Va. L	0.001V-999.9kV	Low alarm of Va
02	Vb. H	0.001V-999.9kV	High alarm of Vb
03	Vb. L	0.001V-999.9kV	Low alarm of Vb
04	Vc. H	0.001V-999.9kV	High alarm of Vc
05	Vc. L	0.001V-999.9kV	Low alarm of Vc

06	VLn. H	0.001V-999.9kV	High alarm of L-N voltage
07	VLn. L	0.001V-999.9kV	Low alarm of L-N voltage
08	Uab. H	0.001V-999.9kV	High alarm of Uab
09	Uab. L	0.001V-999.9kV	Low alarm of Uab
10	Ubc. H	0.001V-999.9kV	High alarm of Ubc
11	Ubc. L	0.001V-999.9kV	Low alarm of Ubc
12	Uca. H	0.001V-999.9kV	High alarm of Uca
13	Uca. L	0.001V-999.9kV	Low alarm of Uca
14	ULL.H	0.001V-999.9kV	High alarm of L-L voltage
15	ULL.L	0.001V-999.9kV	Low alarm of L-L voltage
16	Ia. H	0.001A-999.9kA	High alarm of phase A current
17	Ia. L	0.001A-999.9kA	Low alarm of phase A current
18	Ib. H	0.001A-999.9kA	High alarm of phase B current
19	Ib. L	0.001A-999.9kA	Low alarm of phase B current
20	Ic. H	0.001A-999.9kA	High alarm of phase C current
21	Ic. L	0.001A-999.9kA	Low alarm of phase C current
22	I. H	0.001A-999.9kA	High alarm of any phase current
23	I. L	0.001A-999.9kA	Low alarm of any phase current
24	In. H	0.001A-999.9kA	High alarm of neutral current
25	In. L	0.001A-999.9kA	Low alarm of neutral current
26	P. H	0.001W-999.9kW	High alarm of total active power
27	P. L	0.001W-999.9kW	Low alarm of total active power
28	Q. H	0.001var-999.9kvar	High alarm of total reactive power

29	Q. L	0.001var-999.9kvar	Low alarm of total reactive power
30	S. H	0.001VA-999.9kVA	High alarm of total apparent power
31	S. L	0.001VA-999.9kVA	Low alarm of total apparent power
32	PF. H	0.001-999.9	High alarm of total power factor
33	PF. L	0.001-999.9	Low alarm of total power factor
34	F. H	45.00Hz-65.00Hz	High alarm of grid frequency
35	F. L	45.00Hz-65.00Hz	Low alarm of grid frequency
36	UTH.H	0.001%-999.9%	High alarm of total harmonic distortion of voltage
37	UTH.L	0.001%-999.9%	Low alarm of total harmonic distortion of voltage
38	ITH.H	0.001%-999.9%	High alarm of total harmonic distortion of current
39	ITH.L	0.001%-999.9%	Low alarm of total harmonic distortion of current
40	ALM.H	--	With over-limit alarm action
41	ALM.L	--	Without over-limit alarm action
42	D1. 1	--	Action when Digital Input 1 is 1
43	D1. 0	--	Action when Digital Input 1 is 0
44	D2. 1	--	Action when Digital Input 2 is 1
45	D2. 0	--	Action when Digital Input 2 is 0
46	D3. 1	--	Action when Digital Input 3 is 1
47	D3. 0	--	Action when Digital Input 3 is 0

48	D4. 1	--	Action when Digital Input 4 is 1
49	D4. 0	--	Action when Digital Input 4 is 0
50	D5. 1	--	Action when Digital Input 5 is 1
51	D5. 0	--	Action when Digital Input 5 is 0
52	D6. 1	--	Action when Digital Input 6 is 1
53	D6. 0	--	Action when Digital Input 6 is 0

5.12.2 Remote Control Mode

The relay is controlled to open or close by communication command 0x05/0x0F.

Revision History

Version Number	Content	Revision Date
V2.0	EN Updated	April, 2024
V3.0	EN Finalized	March, 2025

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