Three-phase multifunctional power quality analyzer

PEM5000 series

user's manual

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matismart
AIoT Electric

catalogue

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1 Product Overview

The PEM5000 three-phase multifunctional power quality analyzer is designed for real-time measurement, metering, and power quality analysis in single-phase or three-phase power systems. Featuring built-in calculation functions for various power parameters, it provides comprehensive measurement of voltage, current, power, energy, power factor, harmonics, and imbalance. The instrument supports four-channel current signal input (A/B/C/N) and is compatible with voltage-type current transformers (mV CT) and Rogowski coils.

The instrument features multi-rate metering, demand statistics, phase sequence detection, extreme value recording, event alarms, and digital input/output functions. It communicates with the host system via RS485 (Modbus-RTU) and RJ45 Ethernet (Modbus-TCP/IP), making it suitable for energy management systems, power monitoring systems, and integrated distribution cabinet equipment scenarios.

2 Function and Selection

2.1 function

model	**PEM5353-A**	**PEM5553-A**	**PEM5353-D**	**PEM5553-D**	**PEM5353-H**	**PEM5553-H**
CT type	5A CT	Compatibility of Voltage Transformer and Rogowski Coil	5A CT	Compatibility of Voltage Transformer and Rogowski Coil	5A CT	Compatibility of Voltage Transformer and Rogowski Coil
accessory power supply	95-265V AC 110~370VDC	95-265V AC 110~370VDC	18~36VDC	18~36VDC	90-528V AC	90-528V AC
instantaneous value						
phase voltage	U1, U2, U3, AVG, U0 (zero-sequence voltage)					

line voltage	U12,U23,U31,AVG
current	I1,I2,I3,AVG,In
frequency	F1, F2, F3, ∑ (Comprehensive)
power factor	PF PF1, PF2, PF3, ∑ (Comprehensive)
phasor power factor	DPF DPF1, DPF2, DPF3, ∑ (Comprehensive)
active power	P1, P2, P3, ∑ (total)
reactive power	Q1, Q2, Q3, ∑ (total)
apparent output	S1, S2, S3, ∑ (sum)
electric energy	
active power	EP1, EP2, EP3, ∑ (sum) When the total electricity reaches 1.0 x109 kWh, the power of each phase will automatically reset to zero.
active power	EP1, EP2, EP3, ∑ (sum) When the total electricity reaches 1.0 x109 kWh, the power of each phase will automatically reset to zero.
reactive power	EQ1, EQ2, EQ3, ∑ (sum) When the total power reaches 1.0 x10^9 kVarh, the power of each phase will automatically reset to zero.
negative reactive power	EQ1, EQ2, EQ3, ∑ (sum) When the total power reaches 1.0 x10^9 kVarh, the power of each phase will automatically reset to zero.
apparent electric energy	ES1, ES2, ES3, ∑ (total) When the total energy reaches 1.0×10^{9} kVah, the energy in each phase will automatically reset to zero.
tariff electricity	ET1,ET2, ET3,ET4, ET5,ET6 When the power reaches 1.0 x109 kWh, it will reset automatically.
demand	
demand	total active power, total reactive power, total apparent power

maximum demand of active power	Maximum demand and time
maximum demand of total reactive power	Maximum demand and time
maximum apparent power demand	Maximum demand and time
harmonic wave	
Voltage harmonic percentage	Total harmonics (U1, U2, U3), odd total harmonics (U1, U2, U3), even total harmonics (U1, U2, U3) Partial harmonics 1-50 (U1, U2, U3)
current harmonic percentage	Total harmonics (I1, I2, I3), odd total harmonics (I1, I2, I3), even total harmonics (I1, I2, I3), K coefficient (I1, I2, I3) Partial harmonics 1-50 (I1, I2, I3)
voltage harmonic value	Total harmonics (U1, U2, U3) Partial harmonics 1-50 (U1, U2, U3)
current harmonic value	Total harmonics (I1, I2, I3) Partial harmonics 1-50 (I1, I2, I3)
Maximum Minimum	
phase voltage	Each phase and the average
line voltage	Each phase and the average
current	Each phase and the average
active power	Each phase and the average
reactive power	Each phase and the average
apparent output	Each phase and the average
degree of unbalancedness	
voltage unbalance	Negative sequence, zero sequence
current imbalance	Negative sequence, zero sequence
Current K Factor and Wave Peak Factor	

Current K coefficient parameter	K coefficient calculation method: Parameters e and q for EU calculation method
current K factor	A/B/C phase current K coefficient
current wave peak factor	A/B/C phase current peak factor
voltage crest factor	A/B/C phase voltage peak factor
phase diagram	
phase diagram	Phase diagram between voltage and current
phase sequence	Voltage, Current
Voltage angle	U1,U2,U3
current angle	I1,I2,I3
voltage current angle	UI1,UI2,UI3
event argument	
jumping event	Voltage surge threshold, voltage drop threshold, voltage interruption threshold
phase sequence display	Phase sequence name/Phase sequence color
data logger	Instantaneous quantity\\Electric energy\\Demand\\Harmonic\\Unbalance degree
curve tracer	Sampling rate and time are adjustable
kWh overload alarm	■
DI/DO	■
Modbus RTU	■
Modbus TCP	■

1) Record and store functional data record types

project	state
Record start time	Settable
Record end time	Settable

Record period	Settable

2) Basic data record content

Data category	content
instantaneous recording	Voltage, Current, Zero Sequence, Frequency, Power, Power Factor, Fundamental Power Factor
electric energy record	Active/reactive power in both directions, apparent energy
demand record	Voltage, Current, Active/Reactive/Apparent Demand, Maximum Demand and Time
harmonic recording	Voltage/current THD, odd/even, 1−50th harmonic
imbalance record	Voltage/current negative sequence, zero sequence

3) harmonic data recording

type	content
voltage harmonic	THD (Total Harmonic Distortion), odd, even, and 1−50-order subharmonics
current harmonics	THD, odd, even, K factor, 1−50th harmonic

4) incident record

Event item	content
event type	System event type
Record content	Event time, recovery time, and corresponding value

5) Data save format

Data record format: CSV

Event record format: CSV

6) record declaration

Records are generated only when the recording feature is enabled.

Data can be exported for analysis or reports.

2. 2 technical parameter

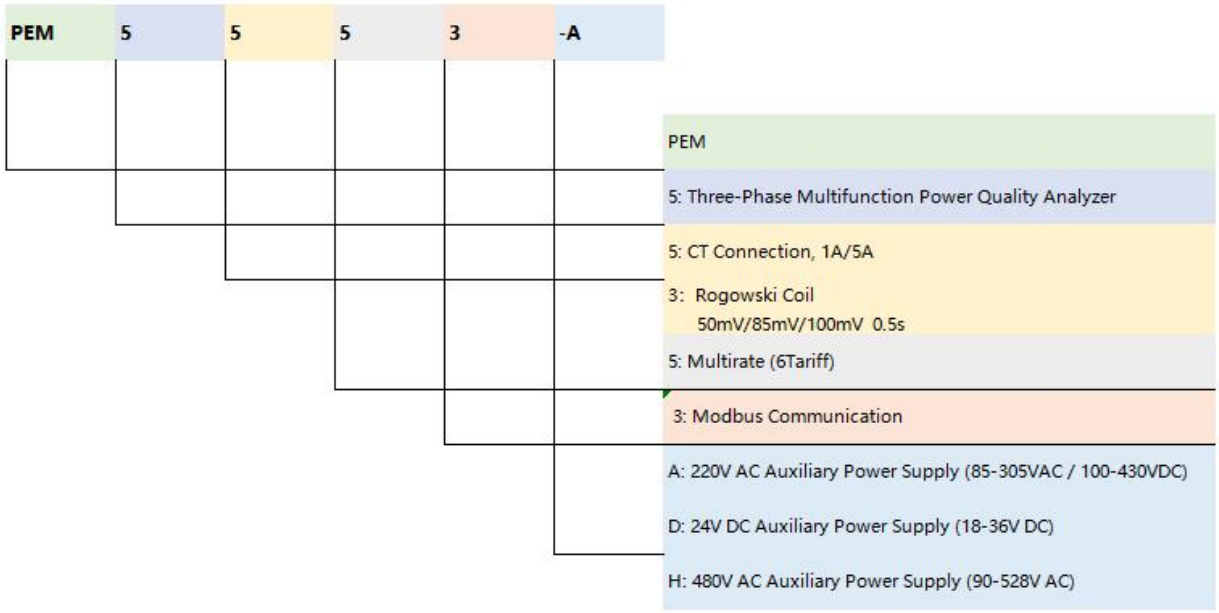
	PEM5353-A	PEM5553-A	PEM5353-D	PEM5553-D	PEM5353-H	PEM5553-H
CT linkage	Screw terminal current port	Rogowski Coil 0-900mVAC peak,636 mV RMS	Screw terminal current port	Rogowski Coil 0-900mVAC peak,636 mV RMS	Screw terminal current port	Rogowski Coil 0-900mVAC peak,636 mV RMS
Rogowski Coil	-	50mVkA@50Hz(0-12000A),@60Hz(0-10000A) 85mVkA@50Hz(0-7000A),@60Hz(0-6000A) 100mVkA@50Hz(0-6000A),@60Hz(0-5000A)	-	50mVkA@50Hz(0-12000A),@60Hz(0-10000A) 85mVkA@50Hz(0-7000A),@60Hz(0-6000A) 100mVkA@50Hz(0-6000A),@60Hz(0-5000A)	-	50mVkA@50Hz(0-12000A),@60Hz(0-10000A) 85mVkA@50Hz(0-7000A),@60Hz(0-6000A) 100mVkA@50Hz(0-6000A),@60Hz(0-5000A)
measuring voltage	L-N: 0 ~ 720VAC					
frequency range	45-65 Hz 1P+N, 3P,3P+N					
certainty of measurement						
current measurement accuracy	±(0.1% + current sensor accuracy)					
voltage measurement accuracy	±0.2%(0V~720V AC)					
grid frequency	±0.01% (45~65Hz) Power factor ±0.005					
active and apparent power	IEC62053-22 Class 0.5%					
reactive power	IEC62053-21 Class 1%					
active and apparent power	IEC62053-22 Class 0.5%					

reactive power	IEC62053-21 Class 1%
digit signal	
relay output	2-channel electromagnetic relay output, contact capacity: 3A 30V DC, 3A 250V AC
digital input	2-channel dry contact input with optocoupler isolation (5kVrms)
communication	Modbus; Communication rate: 2400bps to 38400bps; Protocol: Modbus-RTU
memory	
storage class	TF block
SC	32 GB
Export Data	Export via USB (the file system must be FAT32)
mechanical properties	
size	96 × 96 × 94 mm
weight	~850g
environmental aspect	
operating temperature range	-20℃ ~ +70℃
storage temperature range	-40℃ ~ +85℃
Humidity range	5~95% RH (no condensation)
class of pollution	Pollution Level 2 (compliant with IEC 60664-1)
overvoltage capacity	Overvoltage category III, suitable for distribution systems below 277/480VAC or 400/690VAC (compliant with IEC 60664-1)
insulation strength	Complies with IEC 61010-1, rated for 4kV AC for 1 minute
height	≤3000m (compliant with IEC 61010-1)
levels of protection	IP20 (compliant with IEC 60529)
metric	EN 62052-11，EN61557-12，EN 62053-21，EN 62053-22，EN 62053-23，EN 50470-1，EN 50470-3， EN 61010-1， EN

	61010-2， EN 61010-031

3 Product model and naming rules

3. 1 naming rule



3. 2 product model

model	**functional description**	**Current port category**	**accessory power supply**
PEM5353-A	Three-phase multifunction energy meter with complex tariff (6Tariff), multi-parameter measurement, Modbus communication, and DI/DO interface	screw type current terminal Screw-type Current Terminal	220V AC auxiliary power supply (85–305VAC/100–430VDC)
PEM5553-A	Three-phase multifunction energy meter with complex tariff (7Tariff), multi-parameter measurement, Modbus communication, and DI/DO interface	RJ12 current interface RJ12-type Current Input	220V AC auxiliary power supply (85–305VAC/100–430VDC)

PEM5353-D	Three-phase multifunction energy meter with energy metering, time-of-use tariff (8Tariff), multi-parameter measurement, Modbus communication, and DI/DO	screw type current terminal Screw-type Current Terminal	24V DC auxiliary power supply (18-36V DC)
PEM5553-D	Three-phase multifunction energy meter with complex tariff (9Tariff), multi-parameter measurement, Modbus communication, and DI/DO interface	RJ12 current interface RJ12-type Current Input	24V DC auxiliary power supply (18-36V DC)
PEM5353-H	Three-phase multifunction energy meter with time-of-use billing (10 Tariff), multi-parameter measurement, Modbus communication, and DI/DO interface	screw type current terminal Screw-type Current Terminal	480V AC auxiliary power supply (90-528V AC)
PEM5553-H	Three-phase multifunction energy meter with complex tariff (11Tariff), multi-parameter measurement, Modbus communication, and DI/DO interface	RJ12 current interface RJ12-type Current Input	480V AC auxiliary power supply (90-528V AC)

4 Installation and Wiring

4. 1 matters need attention

To ensure the safe, reliable, and accurate operation of the instrument, the following principles must be followed during wiring:

(1) External power must be disconnected prior to operation. All installation and wiring work

shall be performed by certified electrical personnel. The voltage input must be protected by a secondary fuse, and current signals must be obtained from the secondary side of the current transformer (CT). The CT must not be open-circuited before connection. Voltage-type transformers and Rogowski coils must be properly wired according to their output specifications. RS485 communication must use shielded twisted-pair cables with clear A/B polarity distinction.

(2) The external wiring of the instrument must exactly match its internal configuration. Voltage and current phases must be connected strictly according to the ABC standard phase sequence. If the wiring is incorrect, the instrument will display an abnormal voltage or current phase sequence.

(3) The polarity direction of the current transformer must be accurate, and the arrow on the CT must point to the load side. Otherwise, it may lead to incorrect power direction judgment or even reverse power metering.

4.2 Terminal Description

Interface number	Interface name	function definition	remarks
1	I1+	A-phase current input positive	input channel
2	I1−	A-phase current input negative	
3	I2+	B-phase current input positive	input channel
4	I2−	B-phase current input negative	
5	I3+	C-phase current input positive	input channel
6	I3−	C-phase current input negative	
7	In+	The N-phase (zero-sequence) current is input to the positive terminal.	zero sequence current input
8	NC	empty	NF
9	In−	The N-phase (zero-sequence) current input is negative.	zero sequence current input
10	N / −	Power supply (negative terminal)	Power supply range: 85−305VAC / 100−430VDC

11	NC	empty	NF
12	NC	empty	NF
13	L / +	Power supply (positive terminal)	
14	Vn	N-phase voltage input	measuring voltage channel
15	NC	empty	NF
16	V3	C-phase voltage input	measuring voltage channel
17	NC	empty	NF
18	V2	B-phase voltage input	measuring voltage channel
19	NC	empty	NF
20	V1	A-phase voltage input	measuring voltage channel
21	DIC	digital input common terminal	2-way digital input
22	DI1	Digital Input Channel 1	dry contact input
23	DI2	Digital Input Channel 2	dry contact input
24	RNC	Relay 2 normally closed contact	Output of Relay 2
25	RNO	Relay 2 normally open contact	
26	RCOM	Relay 2 Common Terminal	
27	RCOM	Relay 1 Common Terminal	Output of Relay 1
28	RNO	Relay 1 normally open contact	
29	RNC	Relay 1 normally closed contact	
30	B	RS485 Communication B End	RS485 interface
31	A	RS485 Communication A Port	
32	LAN	Ethernet communication port	RJ45（Modbus-TCP）
33	Flash Drive USB	USB drive port	Export data (USB storage)

4. 3 mode of connection

The wiring method supports the following standard power system connection methods. When

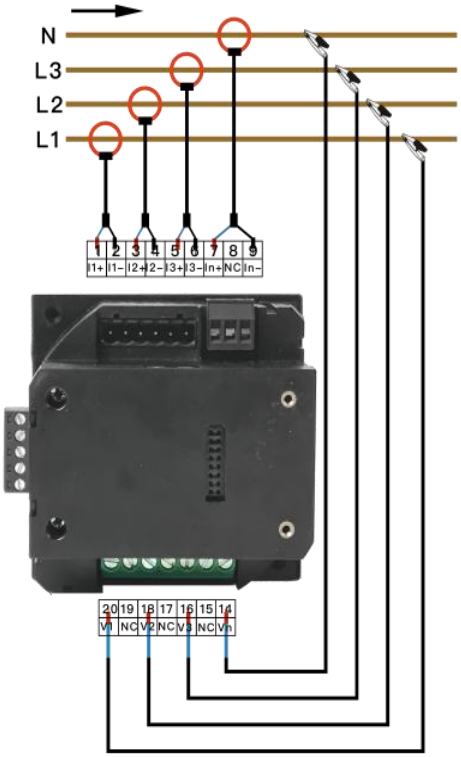
connecting, the external wiring must match the internal wiring mode of the instrument. Otherwise, it may cause measurement data deviation or phase sequence error.

4.3.1 Three-phase four-wire system 4CT (3P4W－4CT)

4 current sensors (A, B, C, N) are required.

The neutral current In is measured by N-phase CT.

Application scenario: For precise zero-sequence current measurement in four-wire systems.

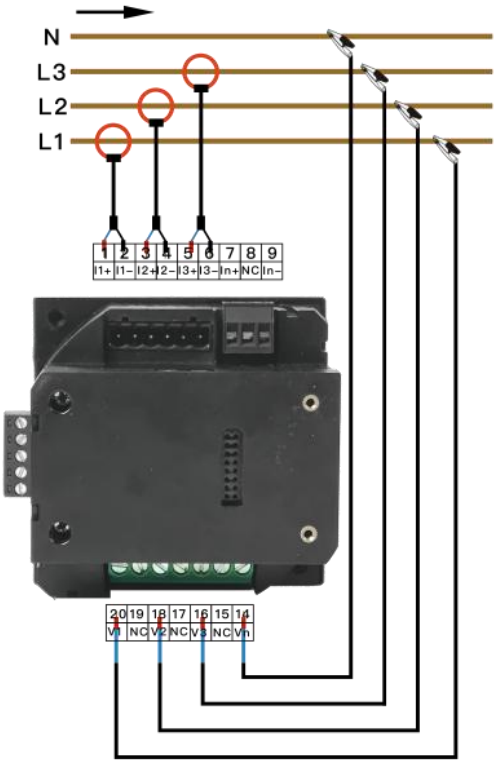


4.3.2 Three-phase four-wire system 3CT (3P4W－3CT)

3 current sensors (A, B, C) are required.

The neutral line current In is calculated by the instrument using vector analysis: In = －(IA + IB + IC)

Application scenario: distribution systems where zero-sequence current does not require independent measurement.

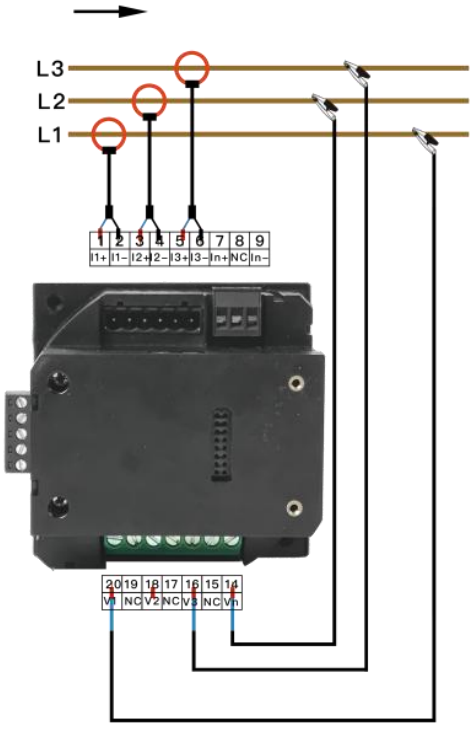


4.3.3 Three-phase three-wire system 3CT (3P3W－3CT)

3 current sensors (A, B, C) are required.

The B-phase current is directly measured by the sensor.

It is suitable for typical three-phase industrial distribution system.

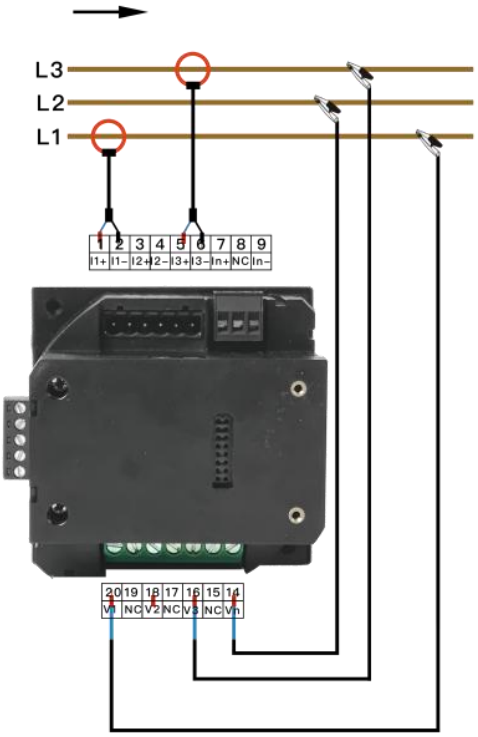


4.3.4 Three-phase three-wire system 2CT (3P3W－2CT)

2 current sensors (A, C) are required.

The B-phase current is calculated by the instrument using the two-CT algorithm, in accordance with Blondel's law.

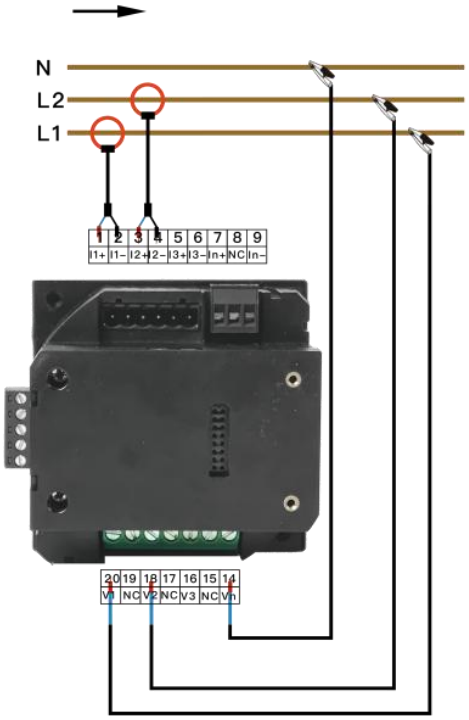
Application scenario: 2CT's three-wire system.



4.3.5 Single-phase three-wire (1P3W)

Use L1−N voltage input and 1 current sensor.

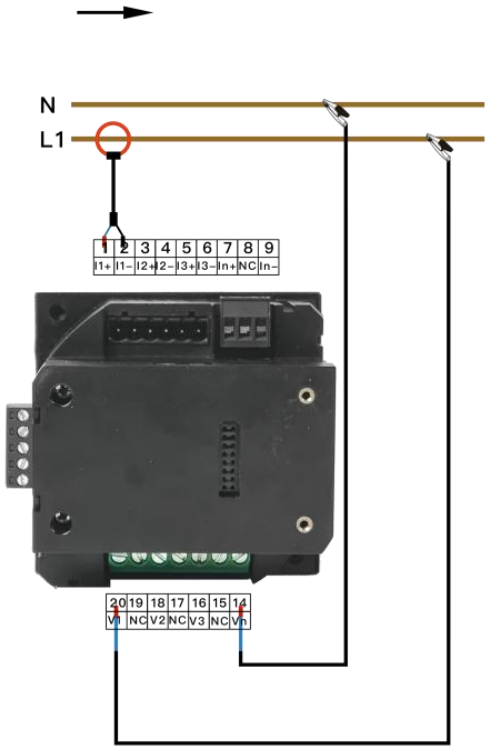
Applicable to single-phase three-wire load circuits in US standards.



4.3.6 Single-phase two-wire (1P2W)

The voltage input is L–N and the current sensor is 1.

It is suitable for ordinary single-phase power supply line.



4. 4 Product appearance and dimensions

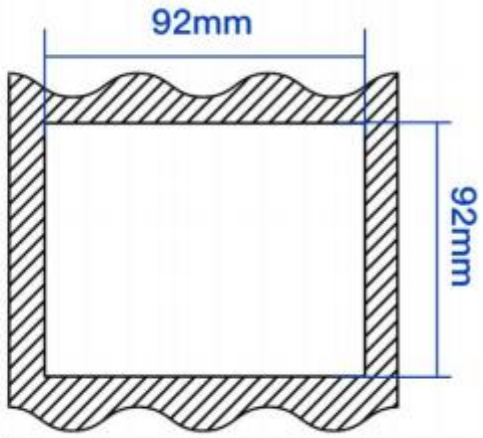


Figure 2-1 Product dimensions Figure 2-2 Hole dimensions

Figure 2-1 Product dimensions Figure 2-2 Hole dimensions

4. 5 Button functions

The front panel of the analyzer features 10 buttons, categorized into the following functions as shown:

Table 2-1 Key Functions

key	name	function
	directiion key	For page switching and parameter selection
	return key	Returns the previous interface
	Confirm key	Confirmation for selection and operation
	function key	Function extension for different pages

5 take notes

The instrument has built-in 32GB storage for data records, event logs, and waveform recordings. All records are in CSV format and can be exported via USB flash drive. They can also be deleted and managed in the interface.

5.1 data logger

The instrument supports multiple data recording types, including basic data, voltage harmonics, and current harmonics. Users can set the recording name, start time, duration, and interval. When the preset start time arrives, the instrument automatically initiates recording and stops once complete. All records are saved in CSV format for easy analysis and processing.

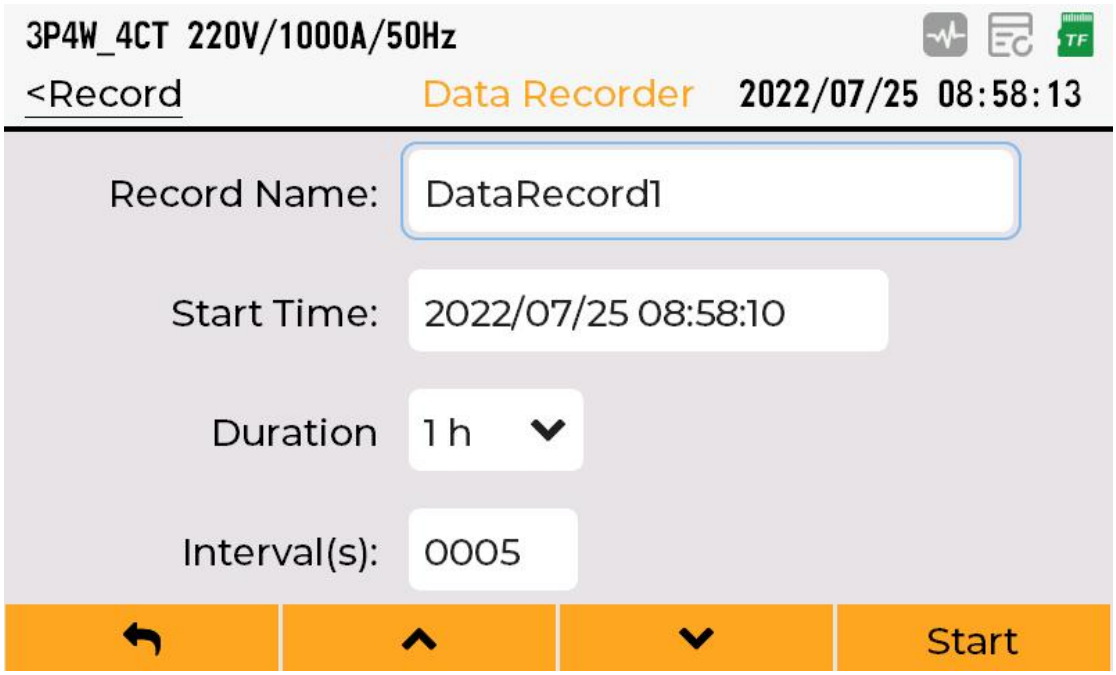


Figure 5-1 Data Recorder

5.2 incident record

> **warn**
>
> Event logging is only performed when data recording is enabled.

The instrument supports recording various power quality events, including voltage surges, voltage sags, voltage interruptions, frequency events, imbalance events, and harmonic events. The event records include the event type, start time, duration, and amplitude value, and are saved in CSV format.

Voltage surges and drops are rapid voltage changes within a short period, with amplitudes reaching several to hundreds of times the nominal voltage. Their duration can range from half a cycle to several seconds (per EN61000-4-30 standard). Users may set the nominal voltage as a

reference value.

Voltage surge (Swell): The event initiates when any phase voltage in a three-phase system exceeds the surge threshold, and terminates when all phase voltages drop to the threshold minus the hysteresis value. Key characteristics include duration, amplitude, and occurrence time.

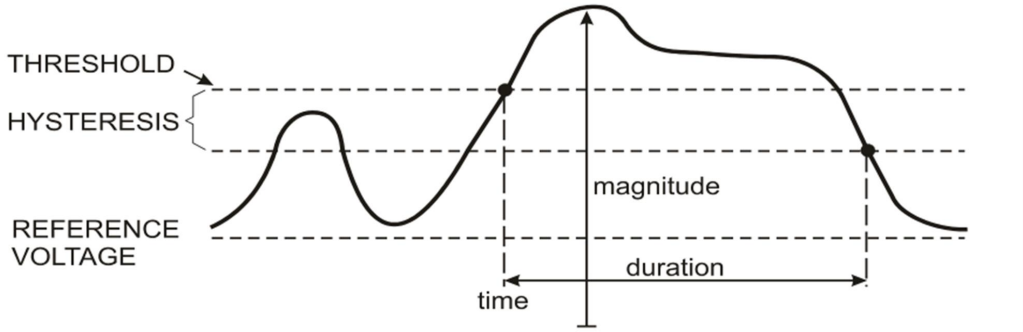


Figure 5-2 Voltage Surge

Voltage sag: The event begins when any phase voltage drops below the sag threshold and ends when all phase voltages rise to the threshold plus the lag value. Its main characteristics include duration, amplitude, and occurrence time.

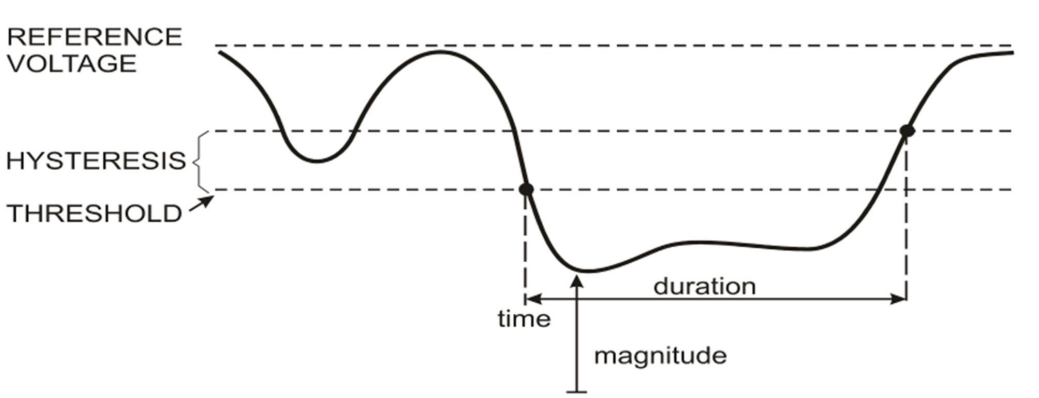


Figure 5-3 Voltage Drop

Voltage interruption: The event begins when any phase voltage drops far below the nominal value and reaches the interruption threshold, and ends when all phase voltages recover to the threshold plus the lag value. The event characteristics are described by duration, amplitude, and occurrence time.

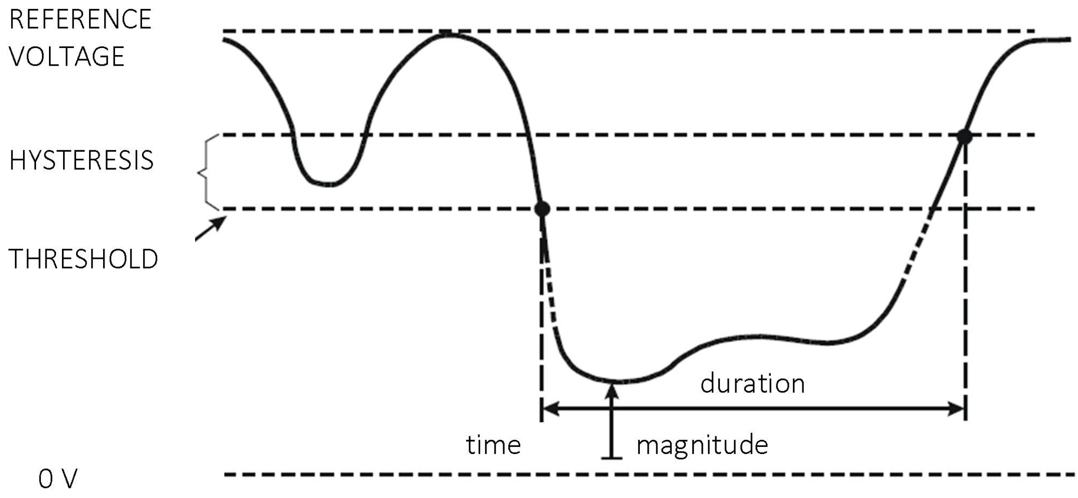


Figure 5-4 Voltage Interruption

= =

The typical event detection thresholds are as follows: the trigger threshold for voltage surge is 110% of the nominal voltage, for voltage drop it is 90%, and for voltage interruption it is 10% (where below 1% is considered complete interruption). All events use a ±2% hysteresis range to prevent repeated triggering.

= =

5.3 waveform recording

The instrument supports real-time waveform recording of three-phase voltage and current, with files saved in CSV format. Users can set the record name, start time, sampling rate, and duration. The recording starts automatically when the set time arrives and stops automatically when completed.

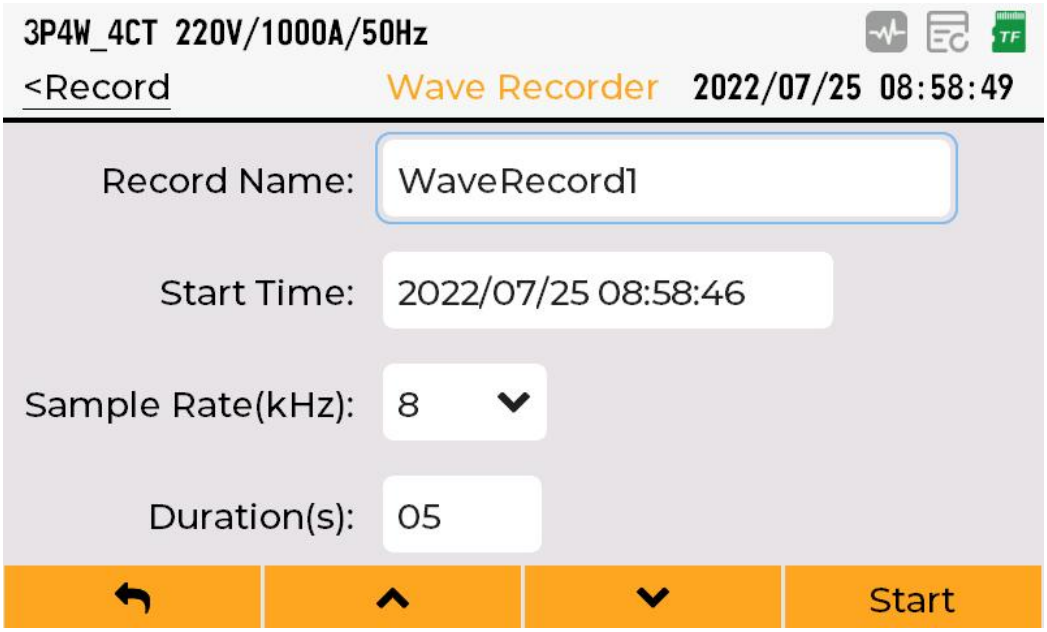


Figure 5-5 Waveform recorder

5. 4 record management

The instrument supports managing all record files, including deleting records and exporting them via a USB drive (the file system must be FAT32). All saved records can be viewed and maintained in the operation interface.

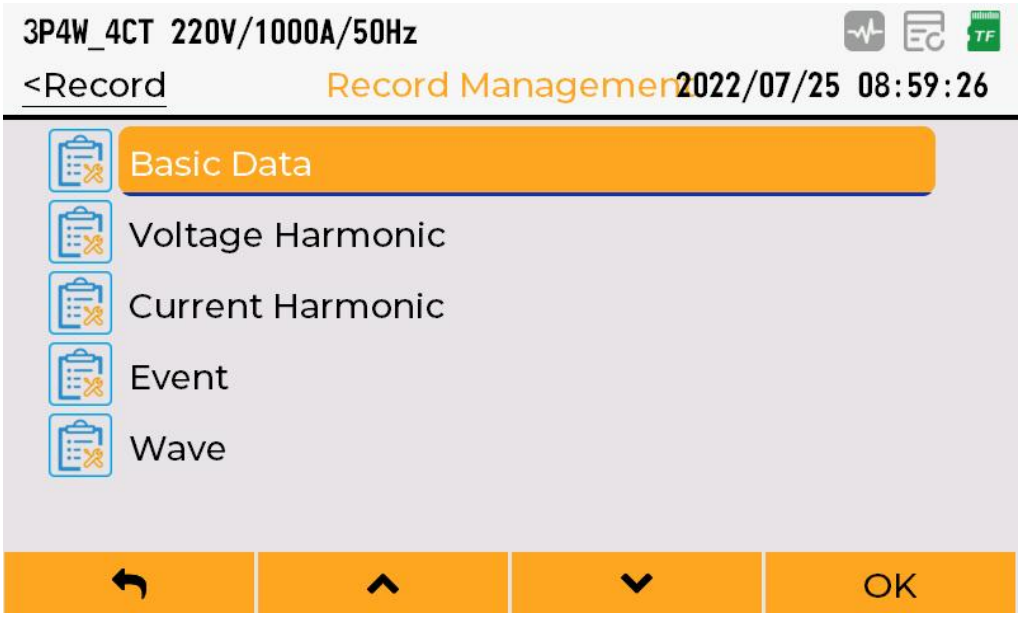


Figure 4-6 Record Management

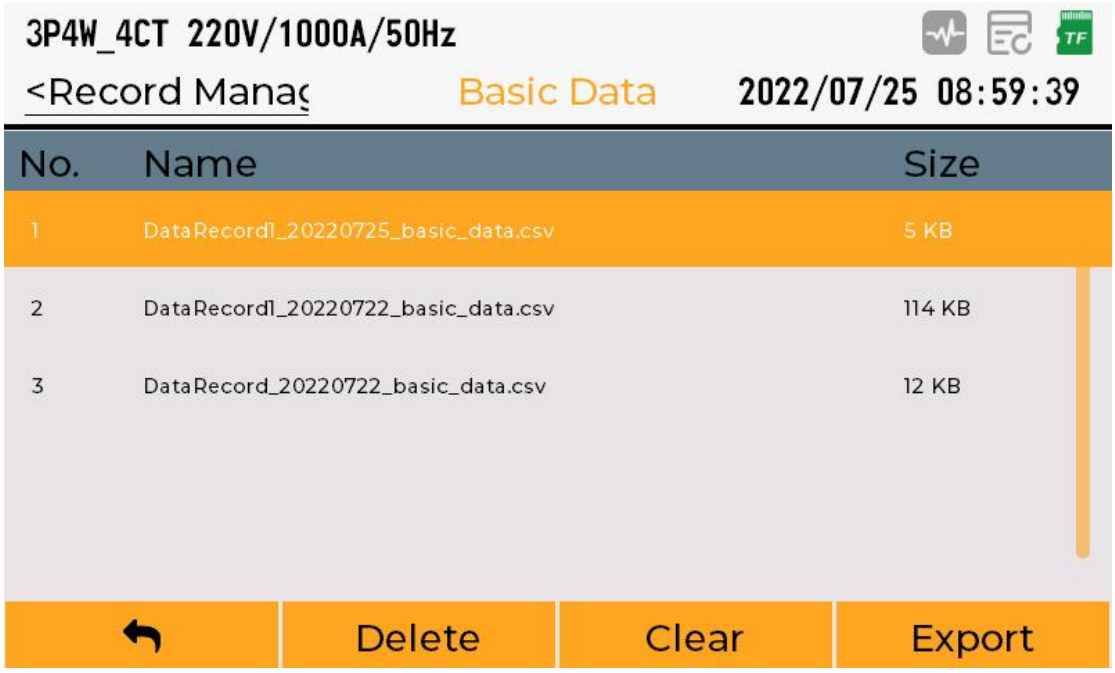


Figure 5-7 Data Recording

6 Parameter settings interface

6. 1 Feature Overview

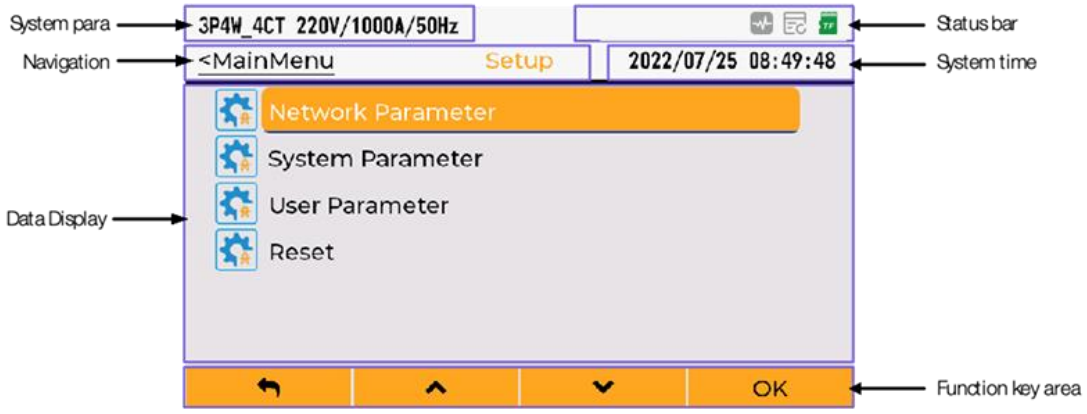
The operation interface of this instrument is divided into three main sections: the setting interface, the measurement interface, and the recording interface. The primary functions of each interface are illustrated in Table 6-1.

(Figure 6-1 Main interface)

Table 6-1 Main Interface Description

Interface name	major function
Settings	Configure wiring method, voltage/current transformer parameters, event thresholds, communication parameters, and user parameters
interface measurement	Displays basic parameters such as voltage, current, power, and energy; shows harmonic percentage, bar chart, waveform, vector diagram, imbalance, and demand.
Record interface	Data recorder, waveform recorder; record export/deletion; storage formatting

6. 2 Interface Overview



(Figure 6-2 Interface Introduction)

This instrument interface is primarily composed of six functional areas:

1. System parameter panel: displays current wiring configuration, rated voltage, CT type and rated current, grid frequency, and other parameters.

2. Navigation bar: Shows the current interface location and parent path.

3. Status bar: Displays the system's operational status, with each icon's meaning as shown in Table 6-2.

4. System time bar: Displays the current system time.

5. Data display area: Shows corresponding measurement or setting information according to the menu.

6. Function key bar: Corresponding to F1−F4 function keys, each interface serves a distinct purpose.

Table 6-2 Status Bar Description

function	icon	explain
Ethernet status		No network cable is detected. The icon is not displayed. Network cable detected, no connection. The icon is gray.
		The network cable is detected and connected. The icon shows green.
USB status		The USB drive is not inserted or not recognized. The icon does not appear. The USB drive is inserted and initialized normally. The icon is displayed.
waveform recording status		Gray, waveform recording is not enabled
		Green, waveform recording is in progress
		Yellow, waveform recording completed
Data record status		Gray: Data recording is not enabled
		Green: Data recording is in progress
		Yellow, data recording completed
Memory card status		TF error. No TF card detected or TF card error.
		The TF card memory is full. You need to free up space.
		TF card is normal

6.3 Parameter settings interface

6.3.1 brief introduction

The parameter setting interface is used to configure the wiring mode, power grid parameters, transformer parameters, event threshold, communication settings and user parameters.

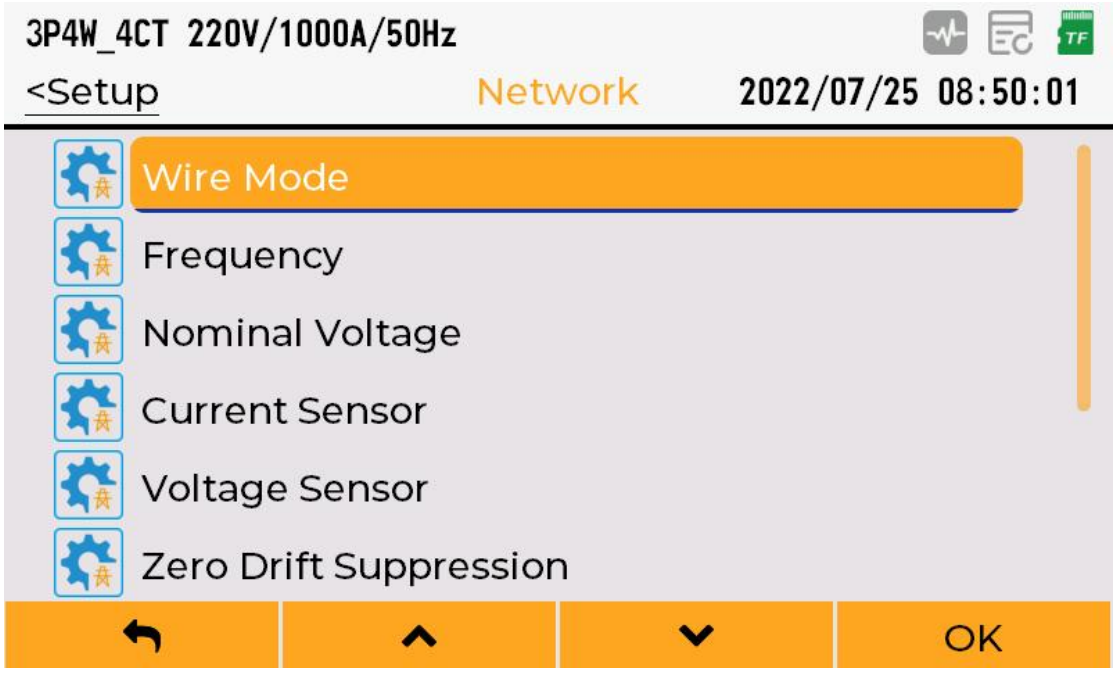
Figure 6-3: Settings interface

6.3.2 Button Operation Instructions

- Select parameter items with arrow keys
- Press [Confirm] to edit. The value will flash.
- Modify the value with the arrow keys
- Press [Confirm] to save
- Press [Back] to exit the current interface

6.4 power grid parameter setting

It is used to configure the wiring method, power grid frequency, nominal voltage, voltage/current transformer, zero drift suppression, harmonic threshold, event parameters, demand parameters, and CO2 emission factor.

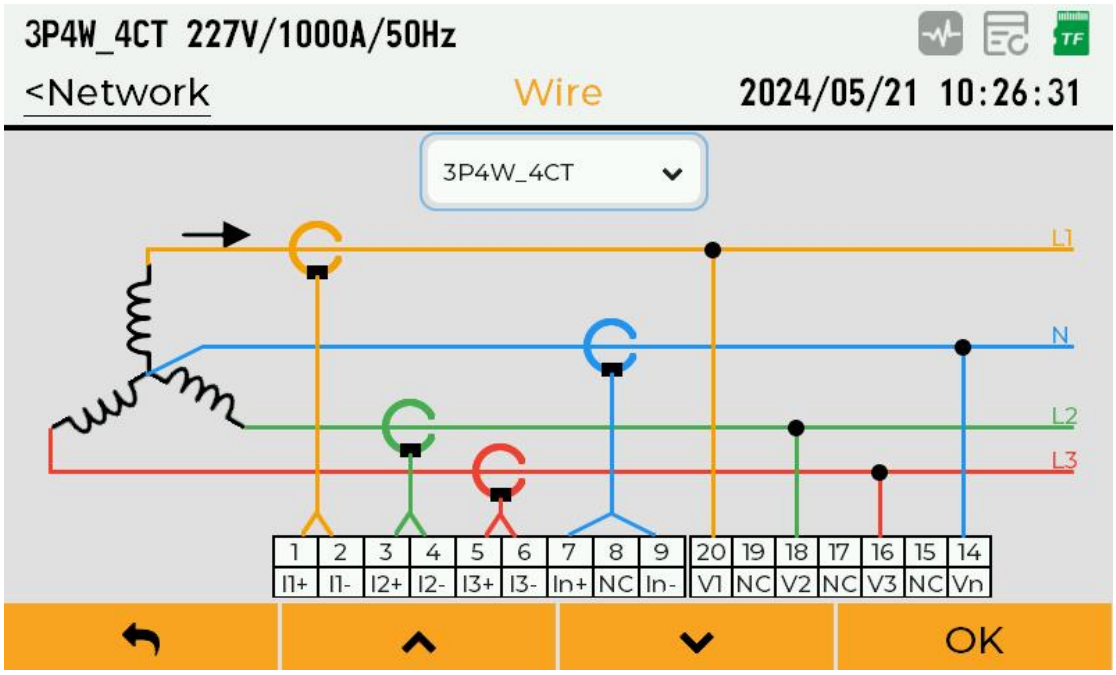


(Figure 6-4 Power Grid Parameters)

6.4.1 Wiring method settings

Supported wiring methods:

- 3P4W_4CT
- 3P4W_3CT
- 3P3W_3CT
- 3P3W_2CT
- 1P3W
- 1P2W



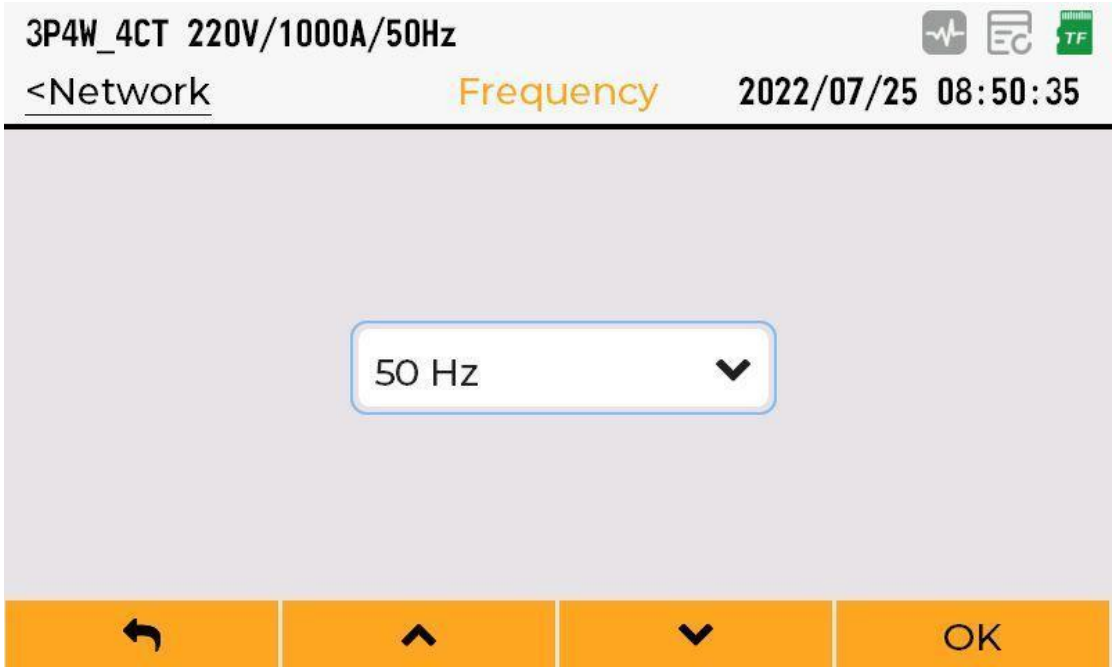
(Figure 6-5 Wiring Configuration)

6.4.2 power frequency setting

selectable ：

•50 Hz

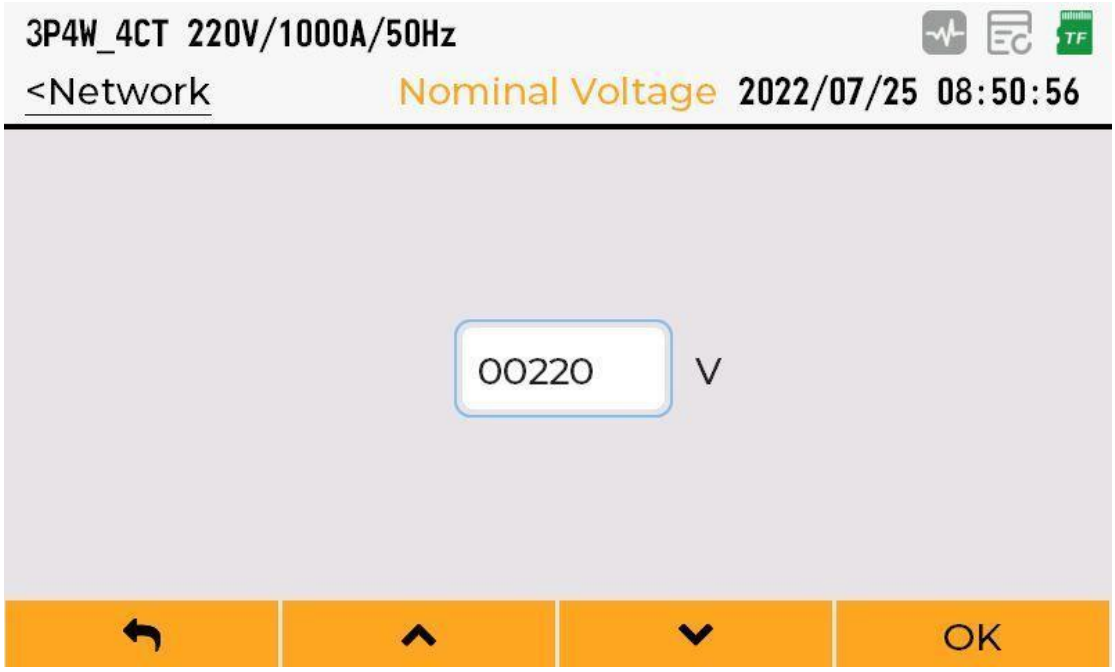
•60 Hz



(Figure 6-6 Frequency Configuration)

6.4.3 Nominal voltage setting

- Range: 1–99,999 V
- Used as a reference value for determining sudden rise/sudden fall/interrupted events

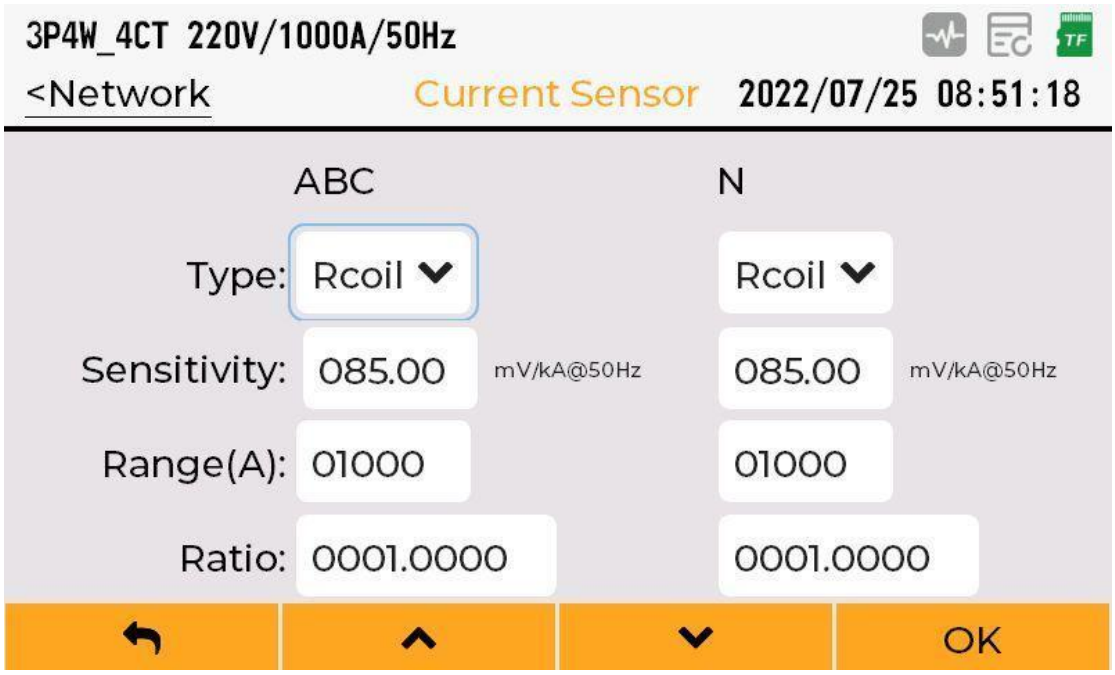


(Figures 6-7: Nominal Voltage Configuration)

6.4.4 Current transformer setting

It is used to configure the sensor type, sensitivity, nominal current and ratio.

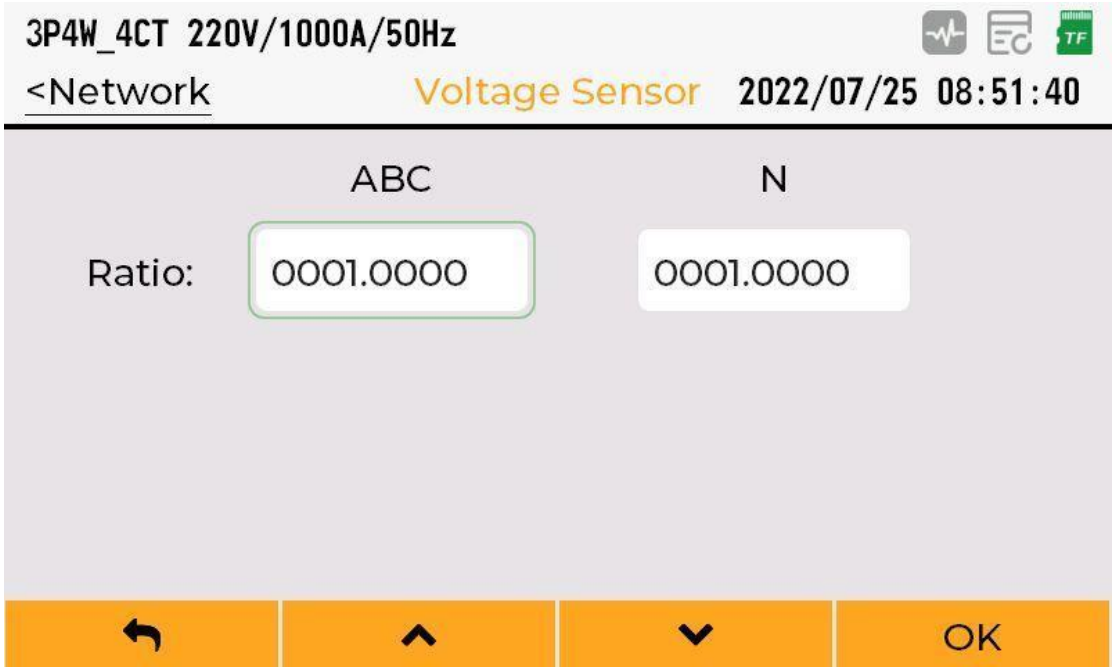
Parameter name	explain
Sensor type	Rcoil: Roche coil; CT: Voltage output CT
sensitivity	Rcoil unit: mV/kA; CT unit: mV/A
nominal current	Range 1–99999 A
no-load voltage ratio	0.0001–1000.0



(Figure 6-8 Current Transformer Configuration)

6.4.5 Setting of voltage transformer

Used to configure the voltage transformer ratio.

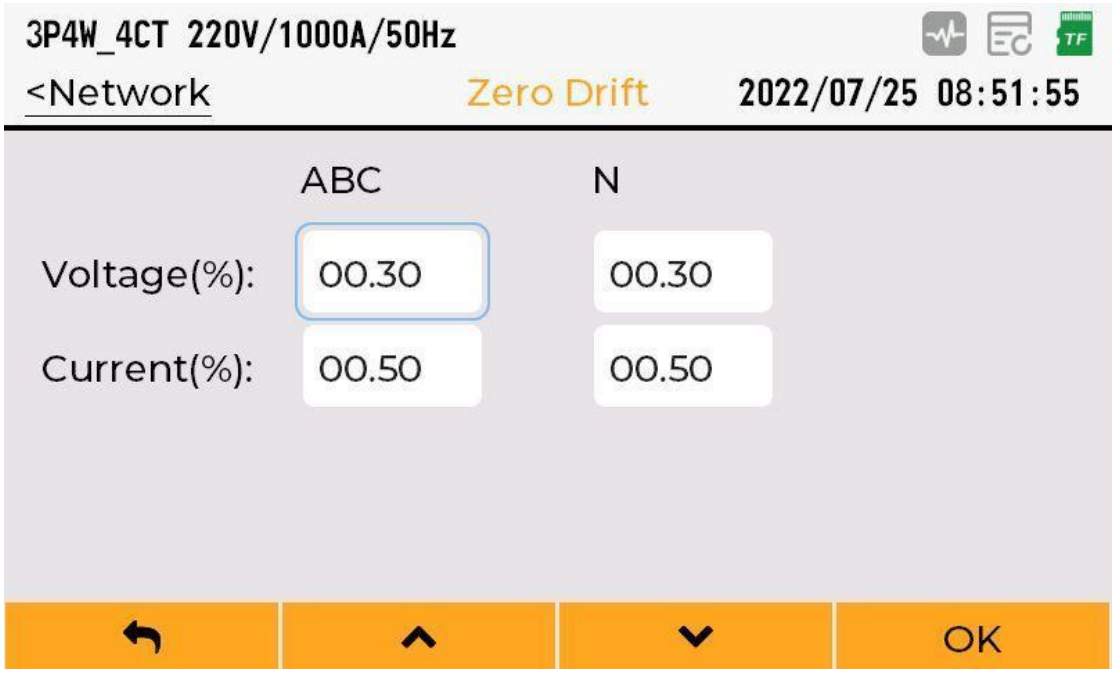


(Figure 6-9 Voltage Transformer Configuration)

6.4.6 zero drift suppression setting

Zero drift suppression sets minimum display thresholds for voltage and current to prevent noise-induced readings from fluctuating under no-load or low-signal conditions. Voltage zero drift is defined as 0-10% of the nominal voltage, and current zero drift as 0-10% of the nominal current. Readings below these thresholds are treated as zero.

- Voltage zero drift: 0%–10% (relative to nominal voltage)
- Current zero drift: 0%–10% (relative to nominal current)

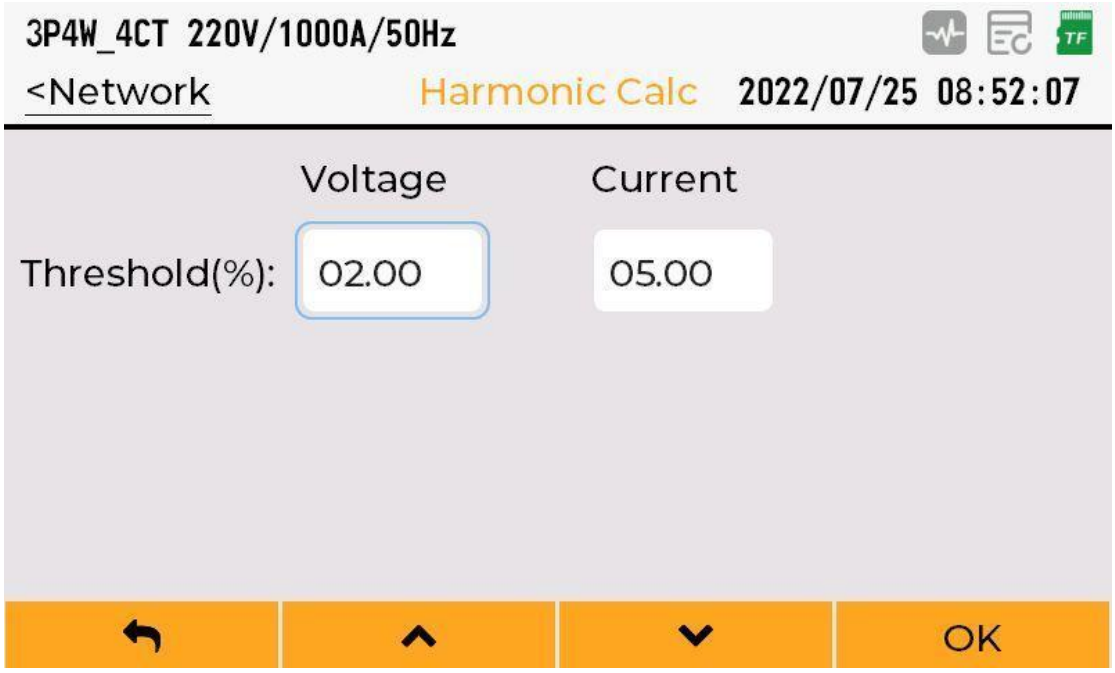


(Figure 6-10 Zero drift suppression settings)

6.4.7 harmonic calculation threshold setting

The harmonic calculation threshold sets the minimum voltage/current threshold for FFT operation. When voltage or current falls below the threshold, the instrument skips harmonic analysis to prevent abnormal fluctuations caused by no-load conditions, weak signals, or noise. This threshold is configured as a percentage of the nominal voltage/current, ranging from 0% to 10%. If the voltage or current is below the threshold, FFT harmonic calculation is not performed.

- Range: 0%–10%



(Figure 6-11 Harmonic Calculation Threshold Settings)

6.4.8 Event parameter settings

The configurable event thresholds are shown in Table 6-4.

Table 6-4 Event Parameter List

Parameter name	**Set range**	**Windows default**	**remarks**
Voltage surge threshold (%)	105.0~140.0	110	Use the nominal voltage as a reference
Voltage surge hysteresis value (%)	1.0~6.0	2	Use the nominal voltage as a reference
Voltage drop threshold (%)	75.0~95.0	90	Use the nominal voltage as a reference
Voltage drop hysteresis value (%)	1.0~6.0	2	Use the nominal voltage as a reference
Voltage interrupt threshold (%)	1.0~10.0	5	Use the nominal voltage as a reference
Voltage drop lag value (%)	1.0~6.0	2	Use the nominal voltage as a reference
Over-frequency threshold (%)	100.1~120.0	101	Use the nominal frequency as a reference
Low-frequency threshold (%)	50.0~99.9	99	Use the nominal frequency as a reference
Overvoltage threshold (%)	101.00~200.00	110	Use the nominal voltage as a reference

Low voltage threshold (%)	1.00~99.00	90	Use the nominal voltage as a reference
Overcurrent threshold (%)	101.00~200.00	110	Use the nominal current as a reference
Low current threshold (%)	1.00~99.00	90	Use the nominal current as a reference
Voltage unbalance threshold (%)	0.01~99.99	4	
Current imbalance threshold (%)	0.01~99.99	10	
Total voltage harmonic threshold (%)	0.01~99.99	5	
Voltage even harmonic threshold (%)	0.01~99.99	5	
Voltage odd harmonic threshold (%)	0.01~99.99	5	
Total current harmonic distortion threshold (%)	0.01~99.99	5	
Current even harmonic threshold (%)	0.01~99.99	5	
Current odd harmonic threshold (%)	0.01~99.99	5	

(Figure 6-12 Event Parameter Configuration)

6.4.9 Demand Settings

Table 6-5 Demand Parameters

Parameter name	explain
computational method	Fixed / Sliding
counting period	Duration: 1–60 minutes

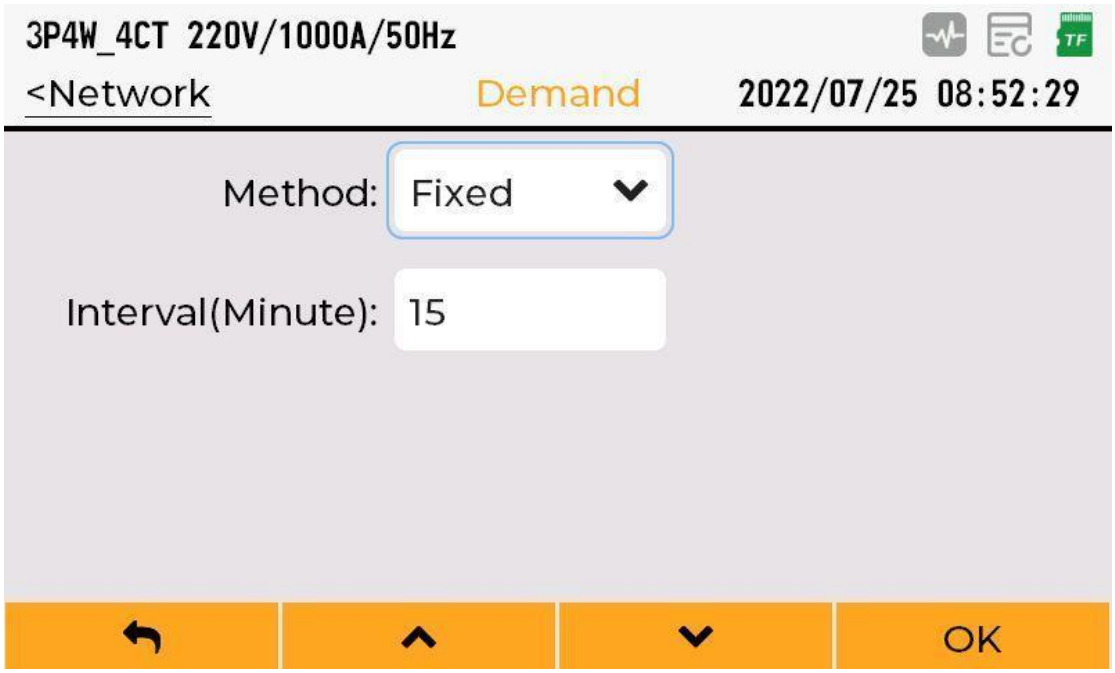
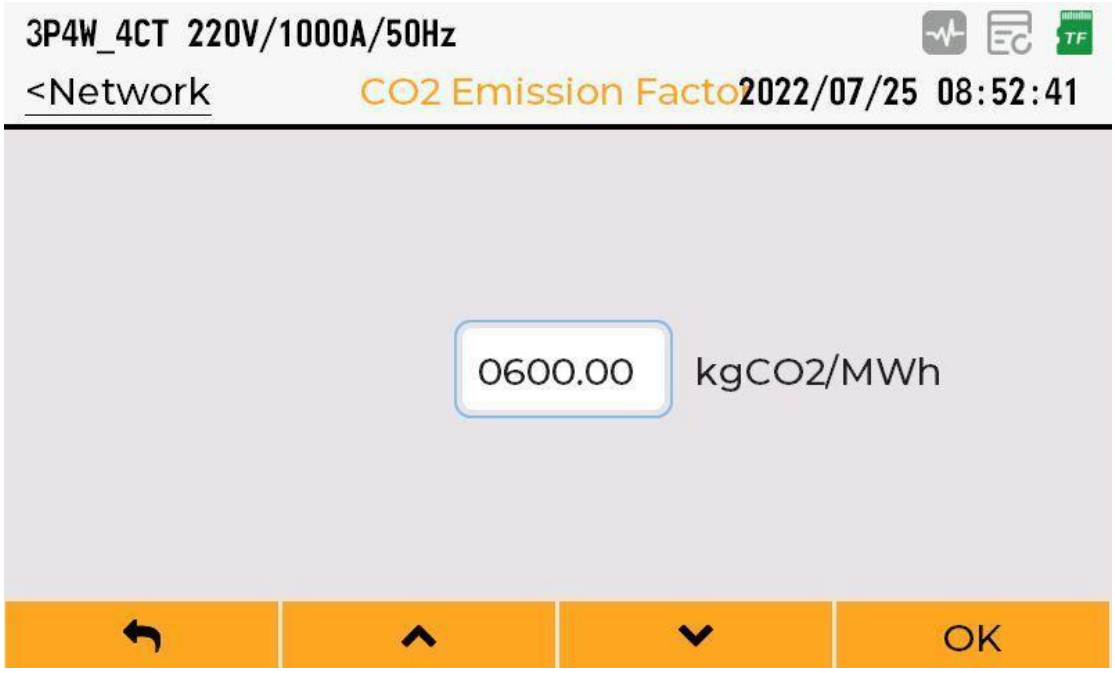


Figure 6-13 Demand Settings

6.4.10 CO_2 emission factor settings

Range: 0–9999.99

area	Common CO2 factor (kg/kWh)
Global average	0.997
China	~0.85
America	~0.45
EU average	~0.25
Japan	~0.47



(Figure 6-14 CO_2 Emission Factor Settings)

6.4.11 K coefficient parameter settings

The K coefficient quantifies the additional thermal losses caused by current harmonics in transformers, a key metric in power quality monitoring. Higher harmonic levels result in more severe transformer heating, leading to a greater K value.

This instrument supports two K-factor calculation methods: US (United States) and EU (European Union). The EU mode allows adjustment of parameters e (time smoothing coefficient, range 0－0.20s) and q (harmonic weighting index, range 1.00－2.00) to accommodate electrical environments with varying harmonic structures, ensuring K-factor calculations better reflect actual thermal effects.

Supports US and EU calculation methods.

EU mode parameters:

- e：0–0.20 s
- q：1.00–2.00

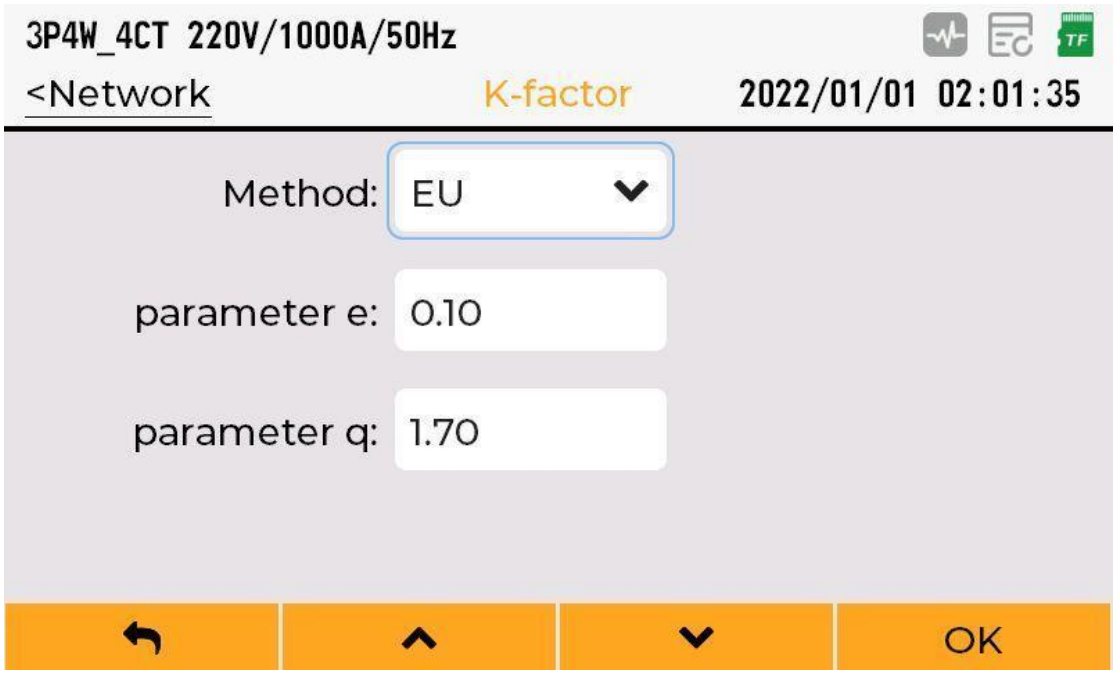
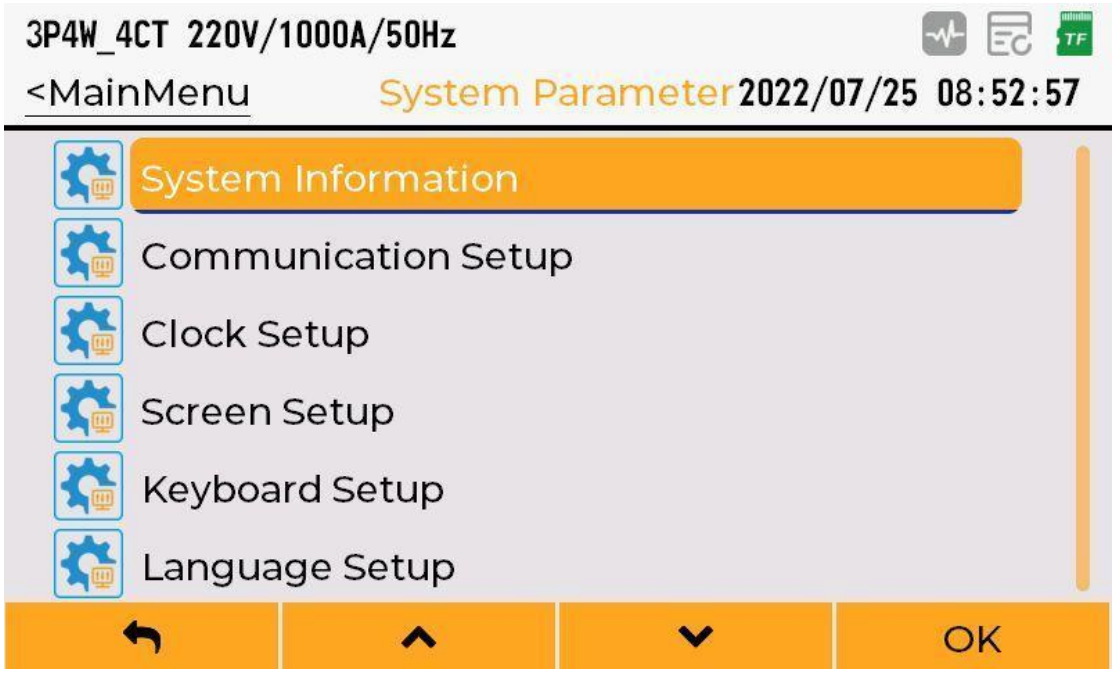


Figure 6-15 K coefficient parameter settings

6. 5 System parameter settings

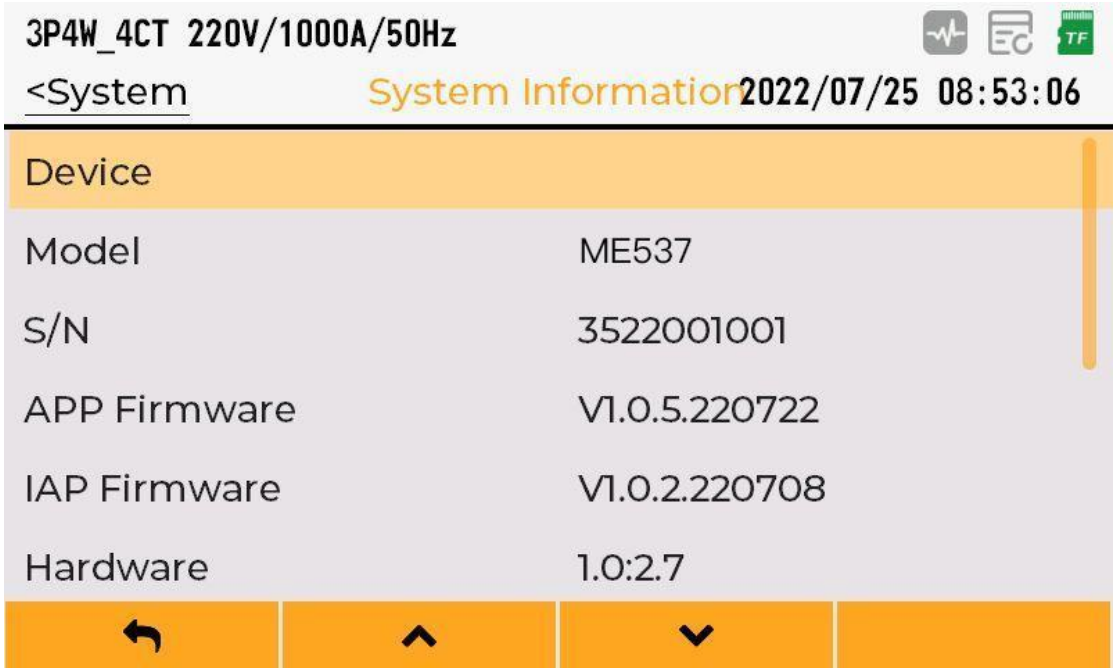
It is used for system information viewing, communication setting, clock setting, screen setting, keyboard setting and language setting.



(Figure 6-16 System Parameters)

6.5.1 system info

Display device model, serial number, firmware version, hardware version, and Ethernet parameters.



(Figure 6-17 System Information)

6.5.2 communications setting

Parameters for configuring Ethernet, Modbus-TCP, and RS485.

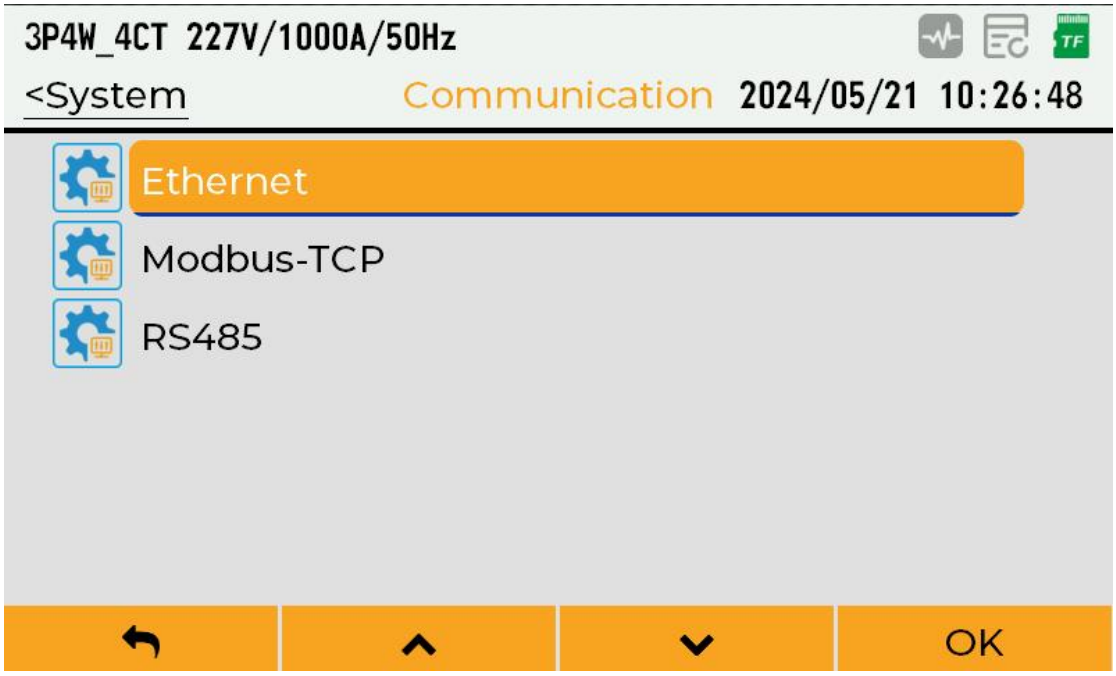
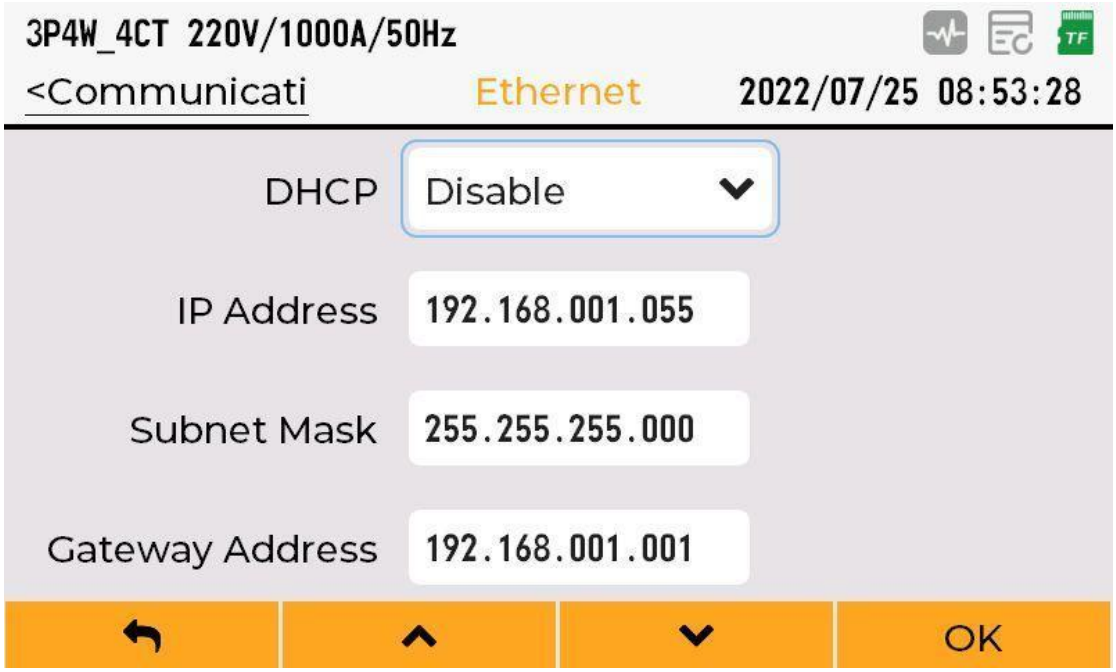


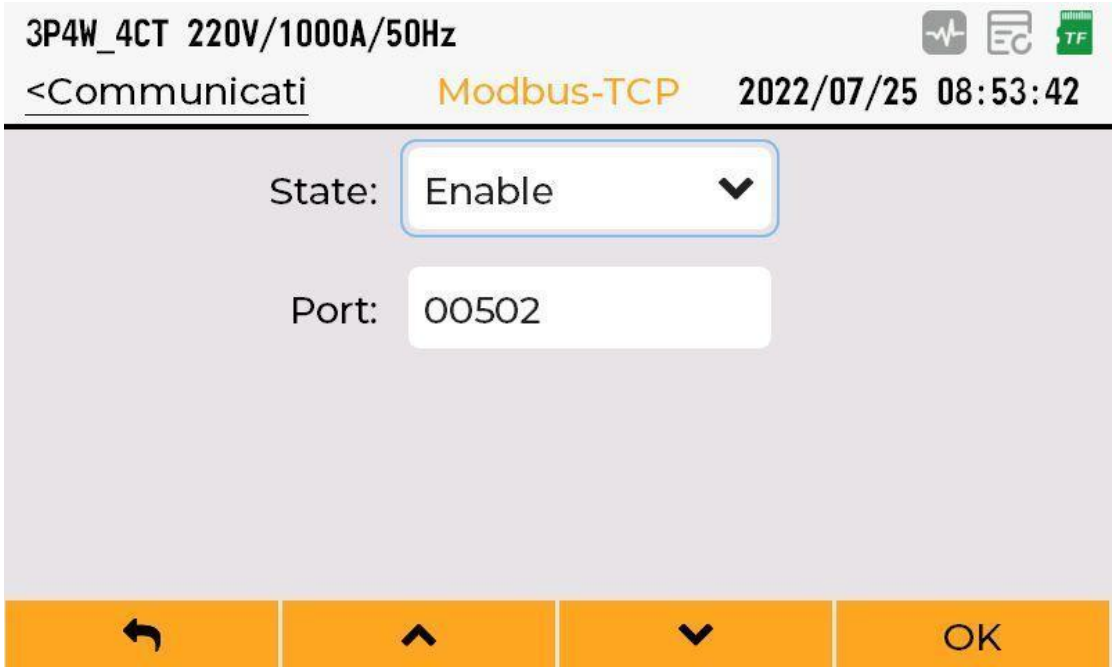
Figure 6-18 Communication Settings

• Ethernet: DHCP disabled by default, IP=192.168.1.55



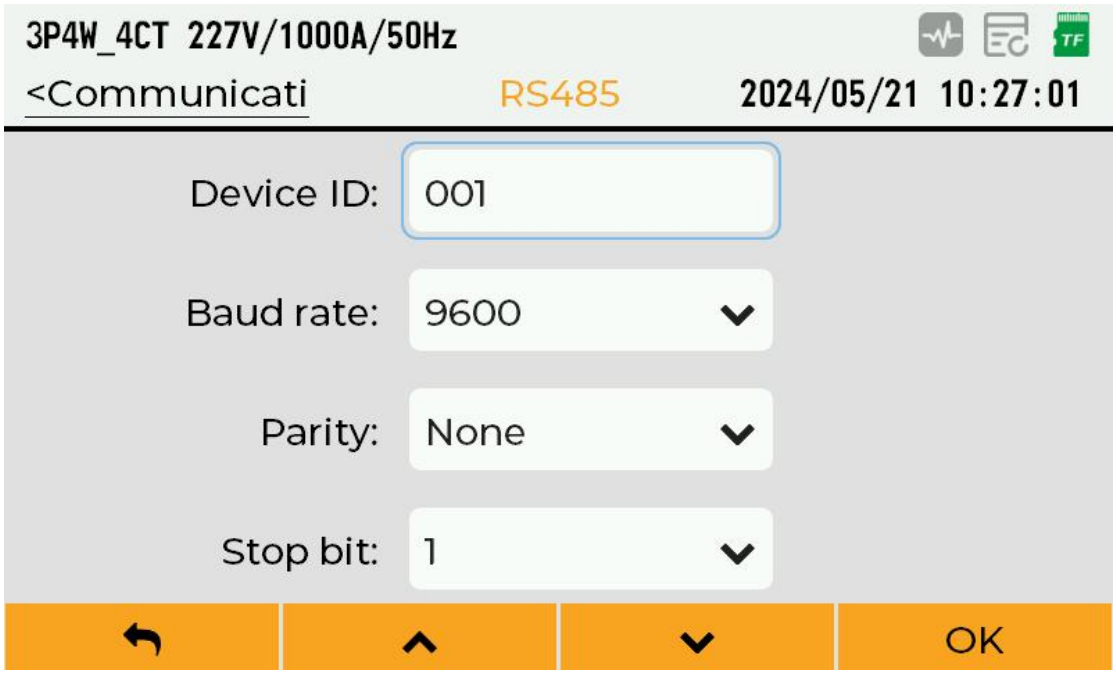
(Figure 6-19 Ethernet Settings)

• Modbus-TCP: Enable and port number configuration



(Figure 6-20 Modbus-TCP settings)

• RS485: Address, baud rate, parity, stop bit

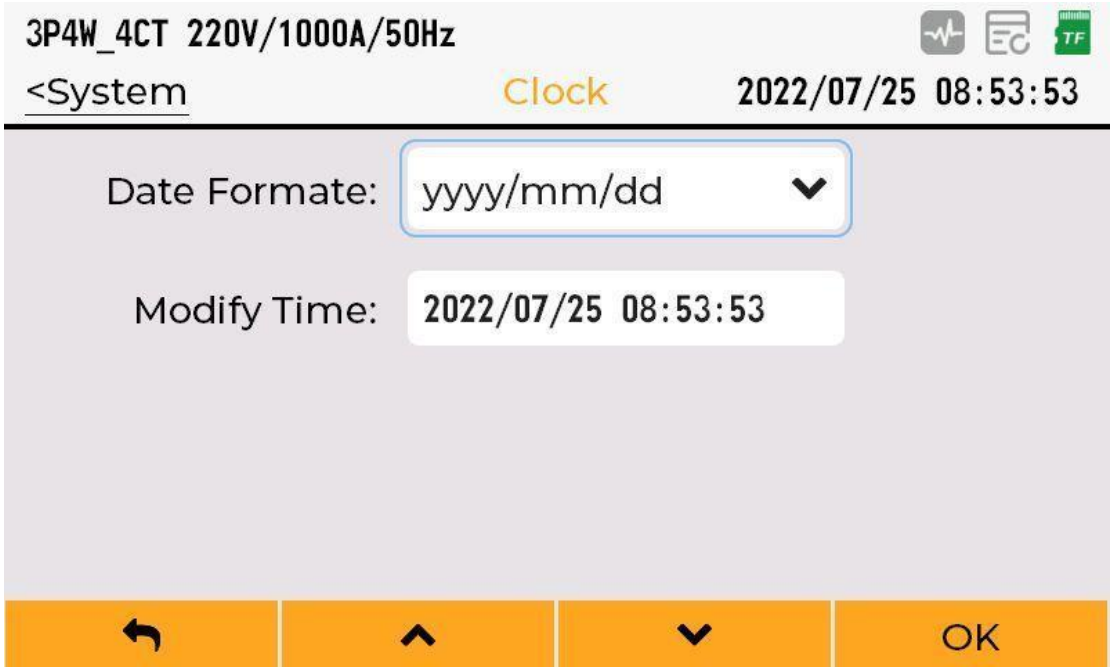


(Figure 6-21 RS485 Settings)

6.5.3 Clock settings

date format ：

- yyyy/mm/dd
- mm/dd/yyyy
- dd/mm/yyyy



(Figure 6-22 Clock Settings)

6.5.4 Screen settings

* Backlight brightness 1–5

* Auto Screen Off: Disabled, 1/5/10/30 minutes

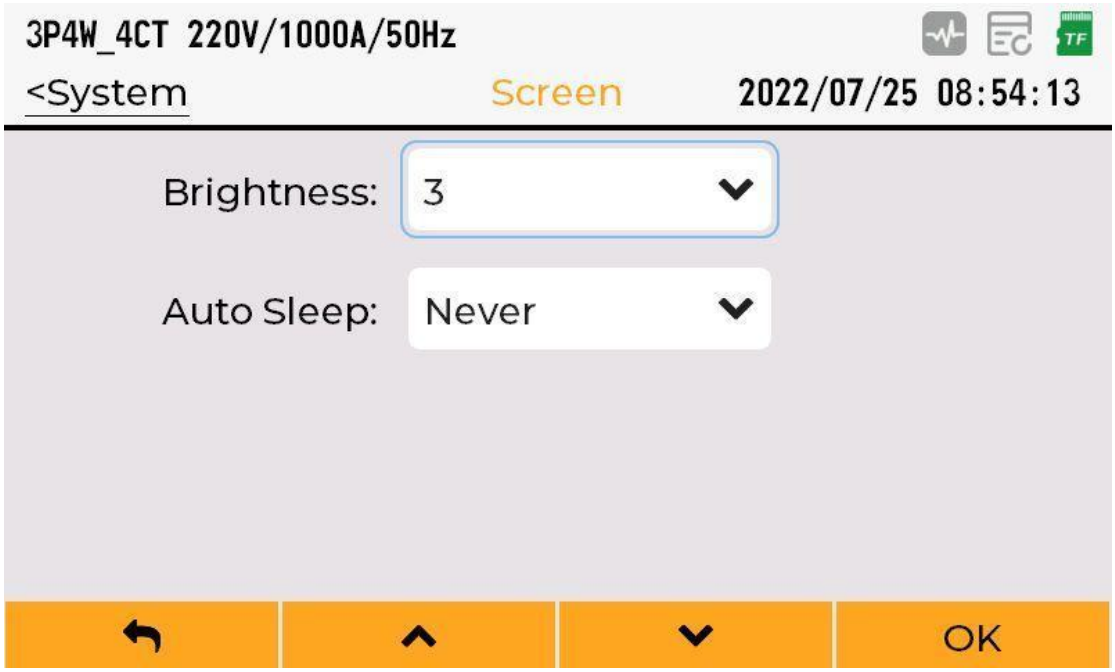


Figure 6-23 Screen Settings

6.5.5 Keyboard Settings

Configure keyboard sounds and auto-lock time.

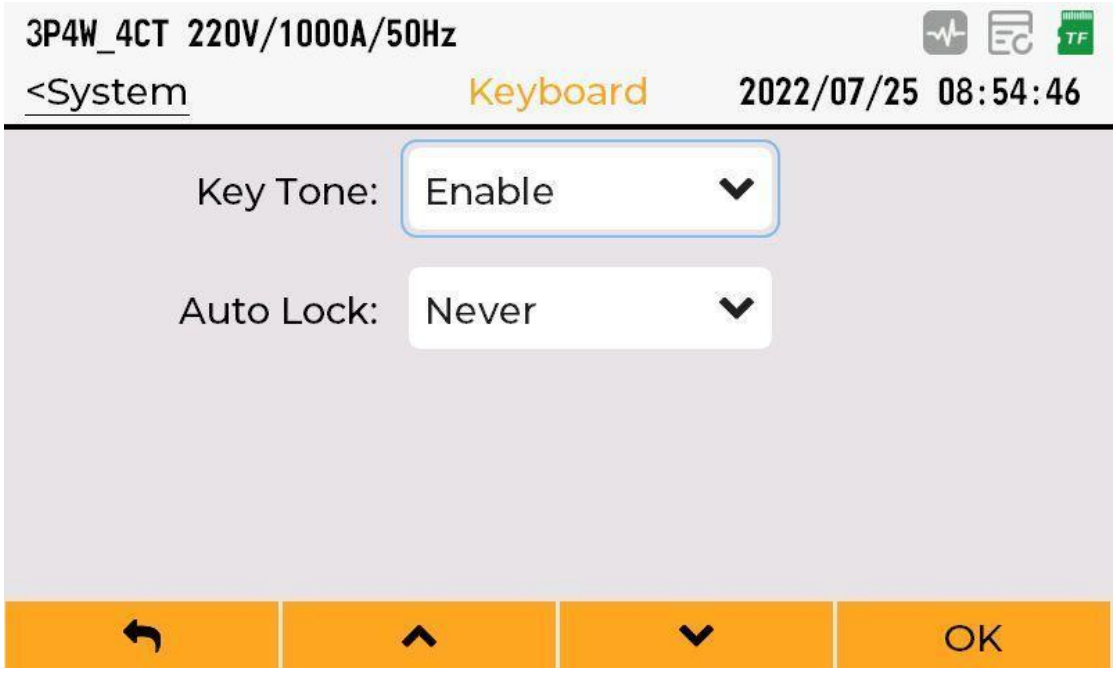


Figure 6-24 Keyboard Settings

6.5.6 Language Settings

Supported languages: Simplified Chinese, English, Traditional Chinese, French, Russian, Spanish, Portuguese

Figure 6-25 Language Settings

6. 6 User parameter settings

Used to set user information, phase sequence name, and phase sequence color.

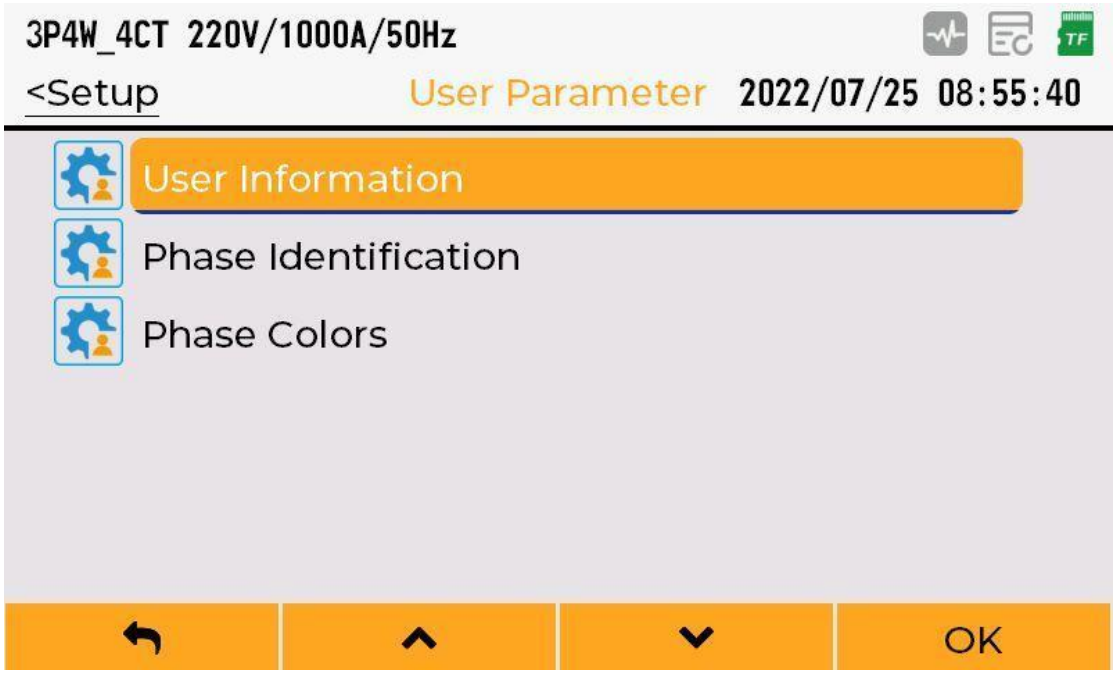


Figure 6-26 User Parameter Settings

6.6.1 userinfo

Used to set data such as username and location that are linked to records.

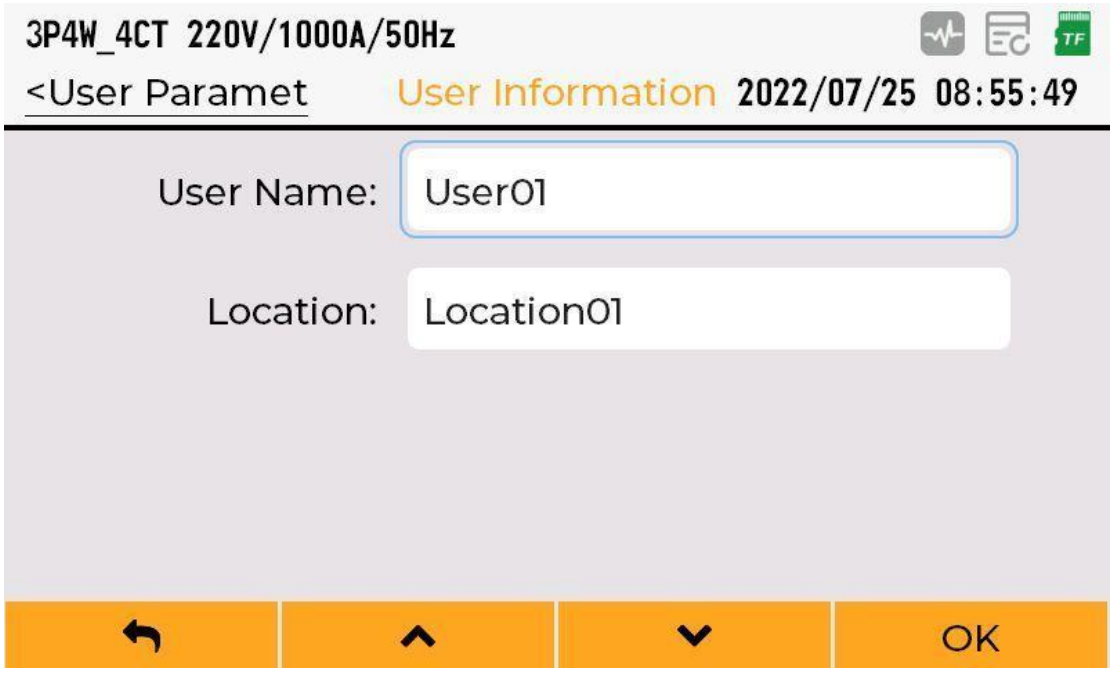
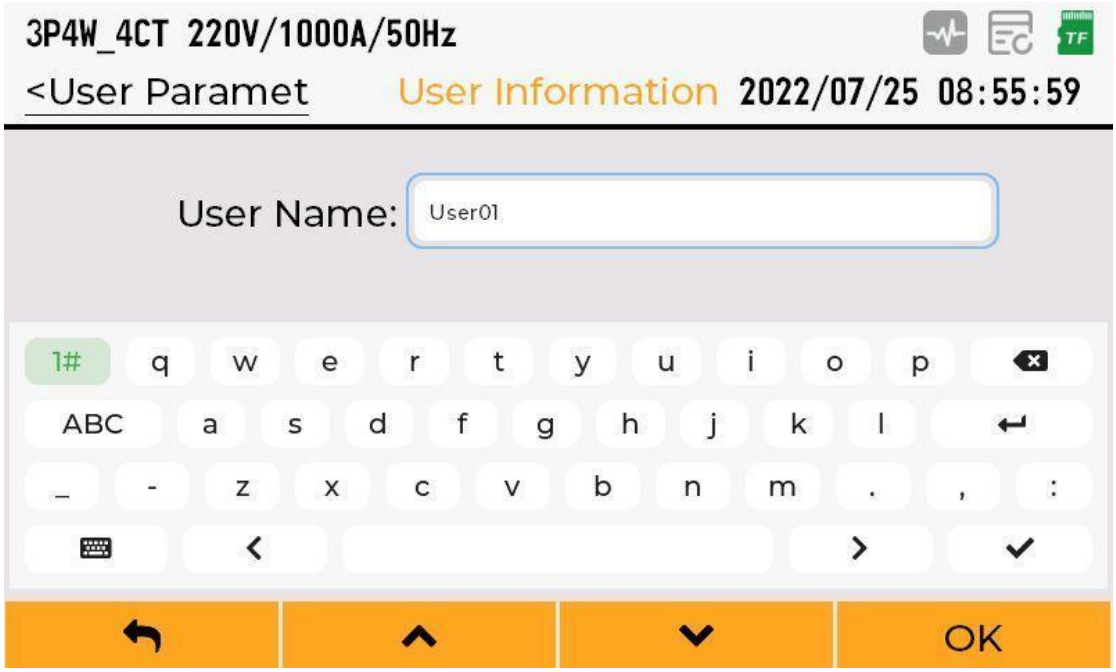


Figure 6-27 User Information Settings



6.6.2 Phase sequence name settings

You can set the phase sequence display format to ABC or L1L2L3.

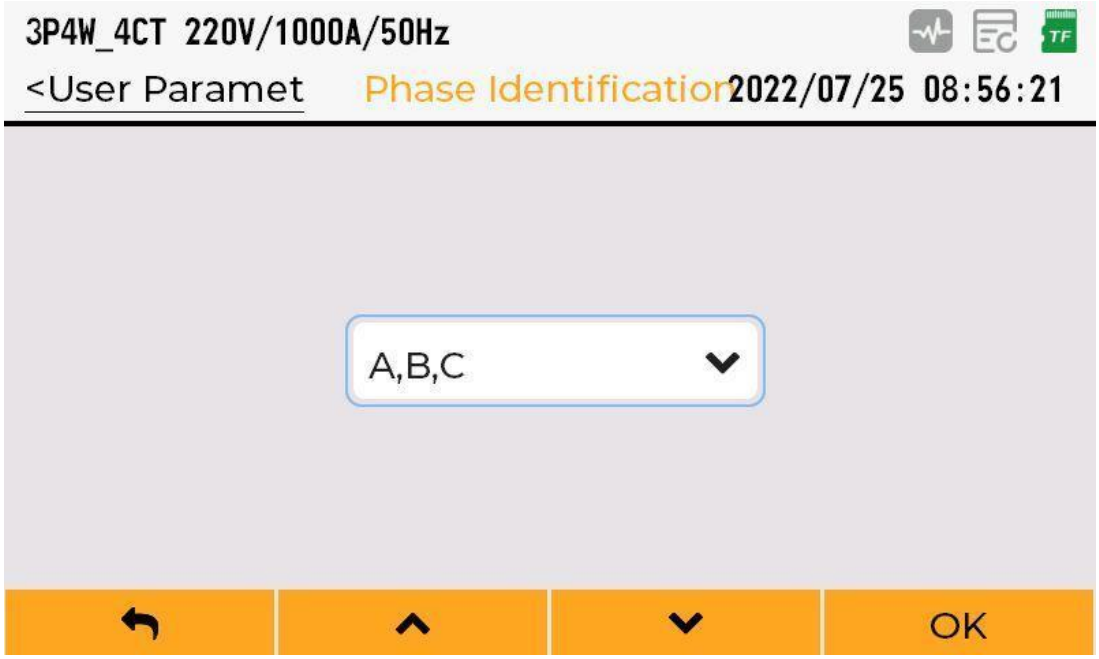
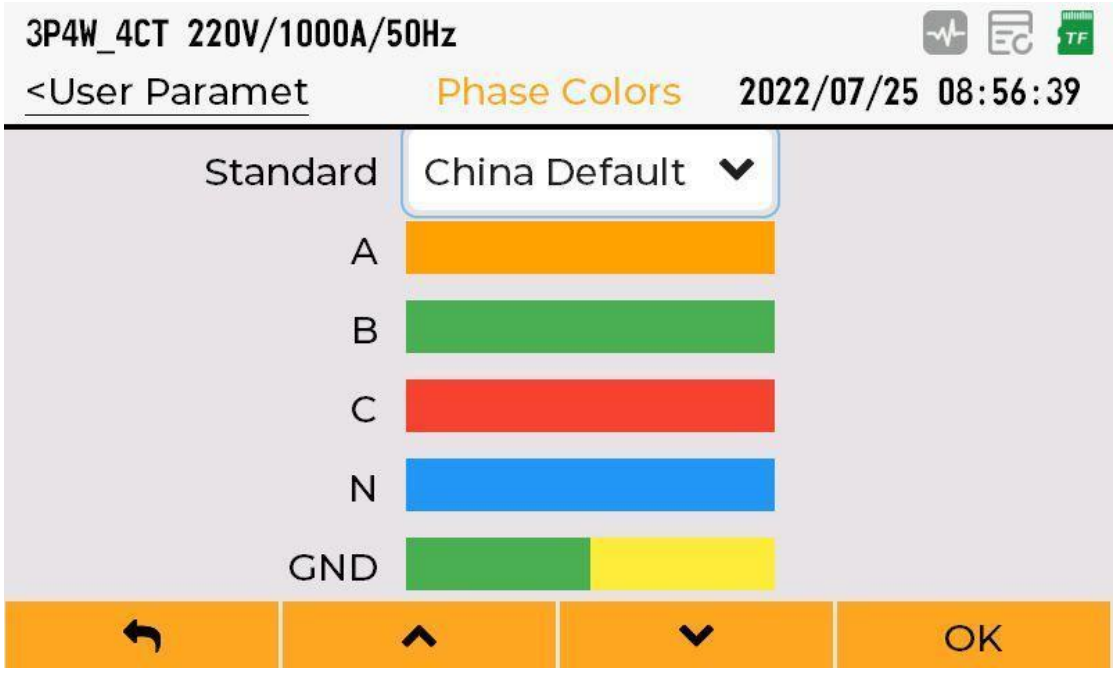


Figure 6-28 Phase Sequence Name Settings

6.6.3 Phase sequence color settings

support ：

- Chinese Industrial Standards
- USASI
- IEC standard
- user-defined



(Figure 6-29 Phase Sequence Color Settings)

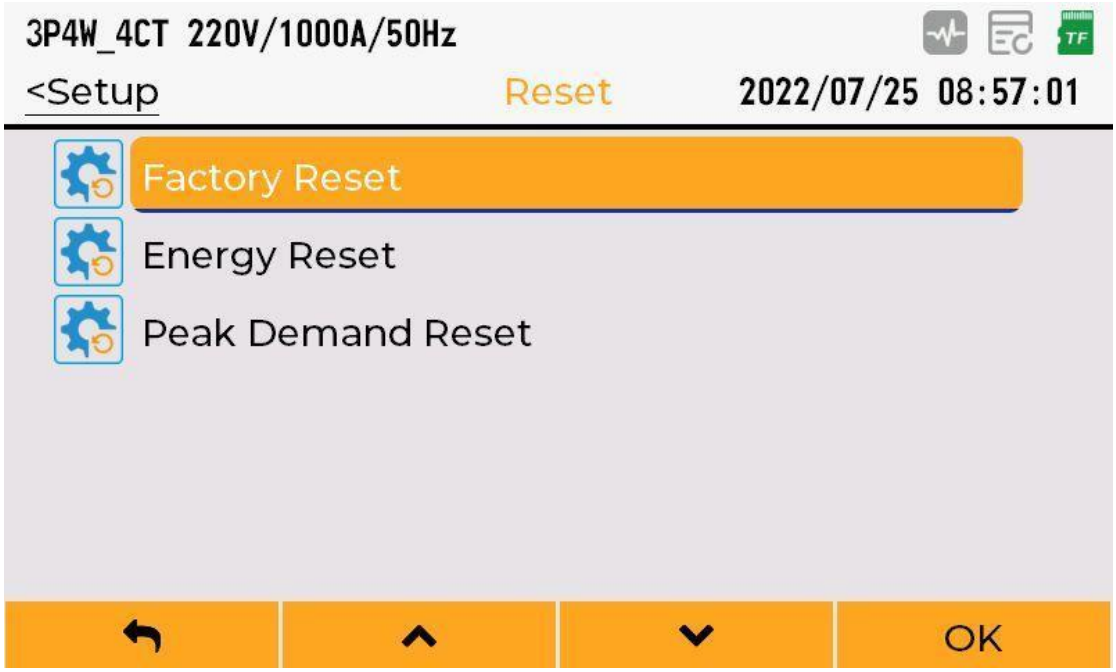
Custom color for sequence in Figure 6-29 and Figure 6-30

6. 7 resetting

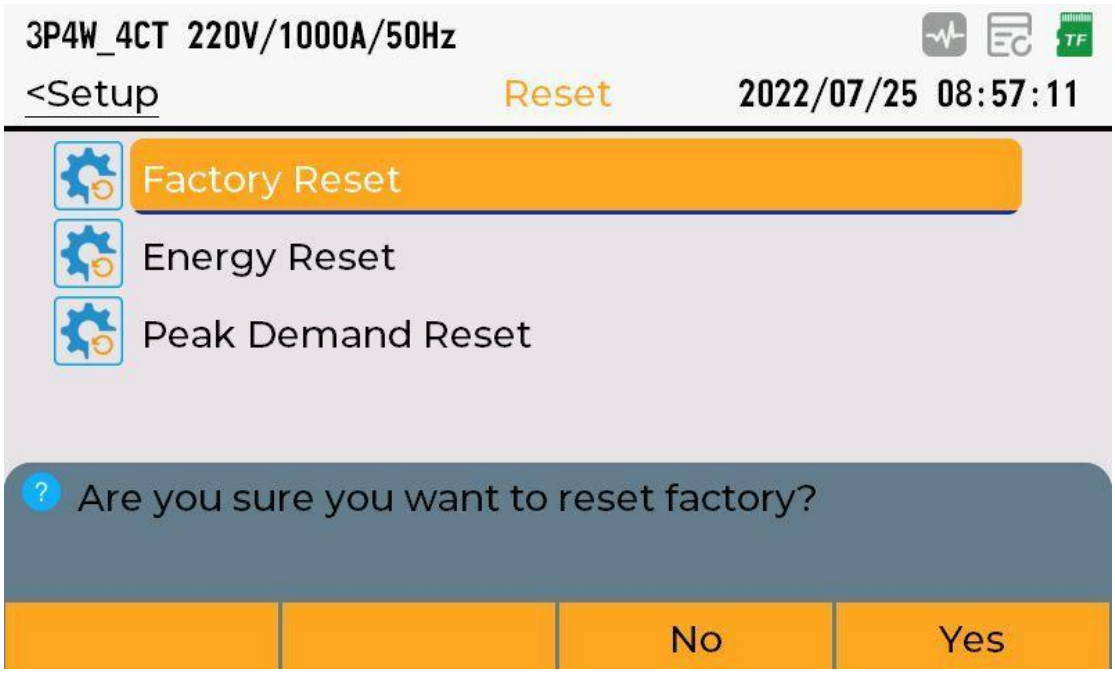
include ：

- factory data reset

- Clear power
- zero maximum demand



(Reset interface in Figure 6-31)

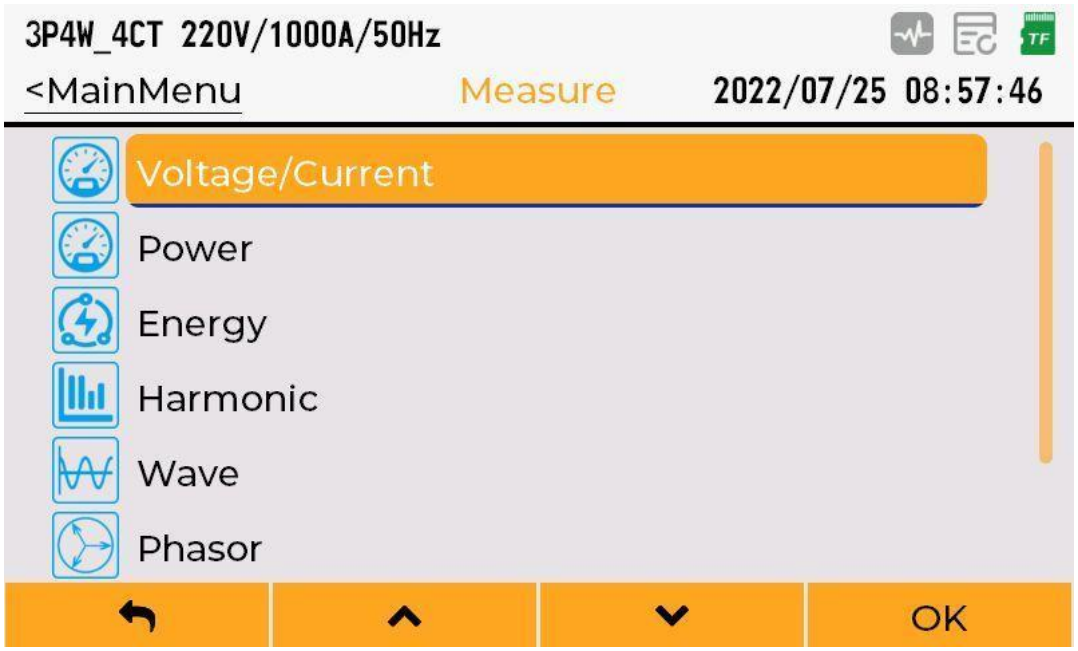


(Figure 6-32 Operation Confirmation Interface)

6.8 interface measurement

6.8.1 brief introduction

Display all electrical measurement data, including voltage, current, power, energy, harmonics, waveform, vector diagram, imbalance, and demand.

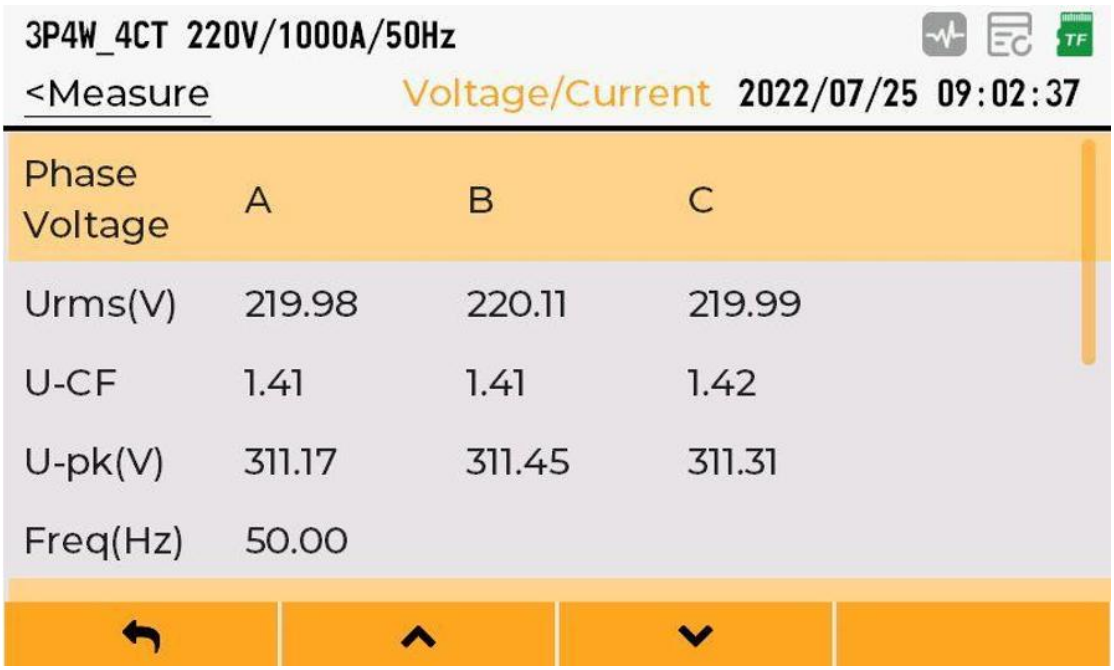


(Figure 6-33 Measurement Interface)

Use the arrow keys to navigate, press [Confirm] to enter, and [Return] to exit.

6.9 voltage current interface

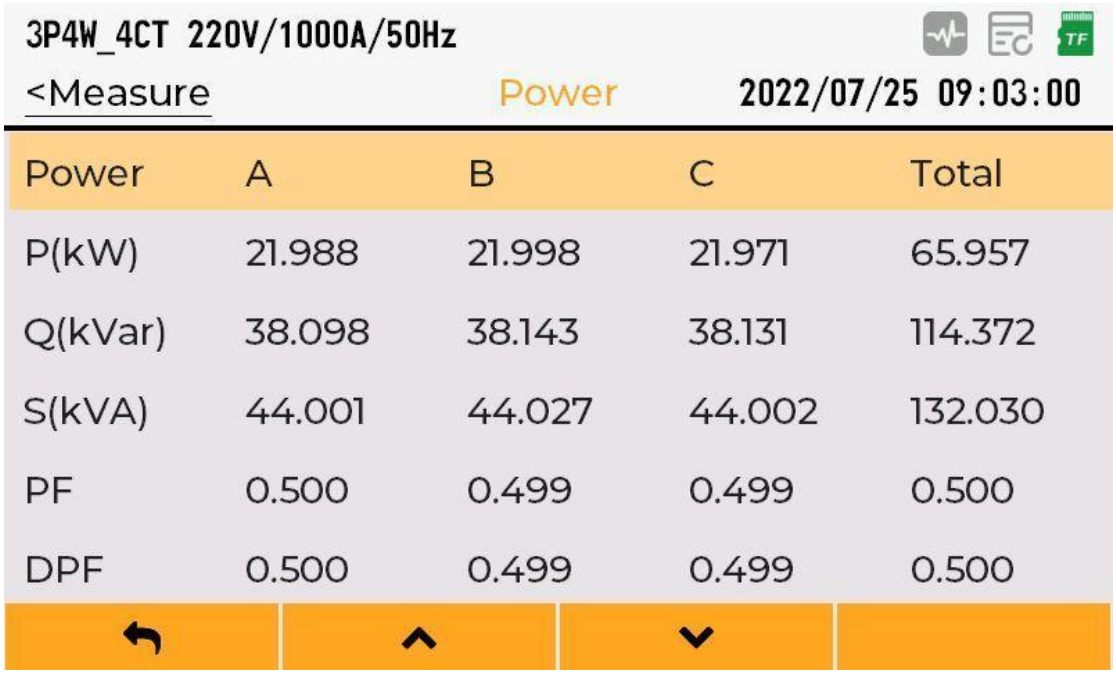
Display the phase voltage, line voltage, frequency, current, peak value, peak value coefficient, K coefficient.



(Figure 6-34 Voltage and Current)

6. 10 power interface

Display P, Q, S, power factor PF, and fundamental power factor DPF.

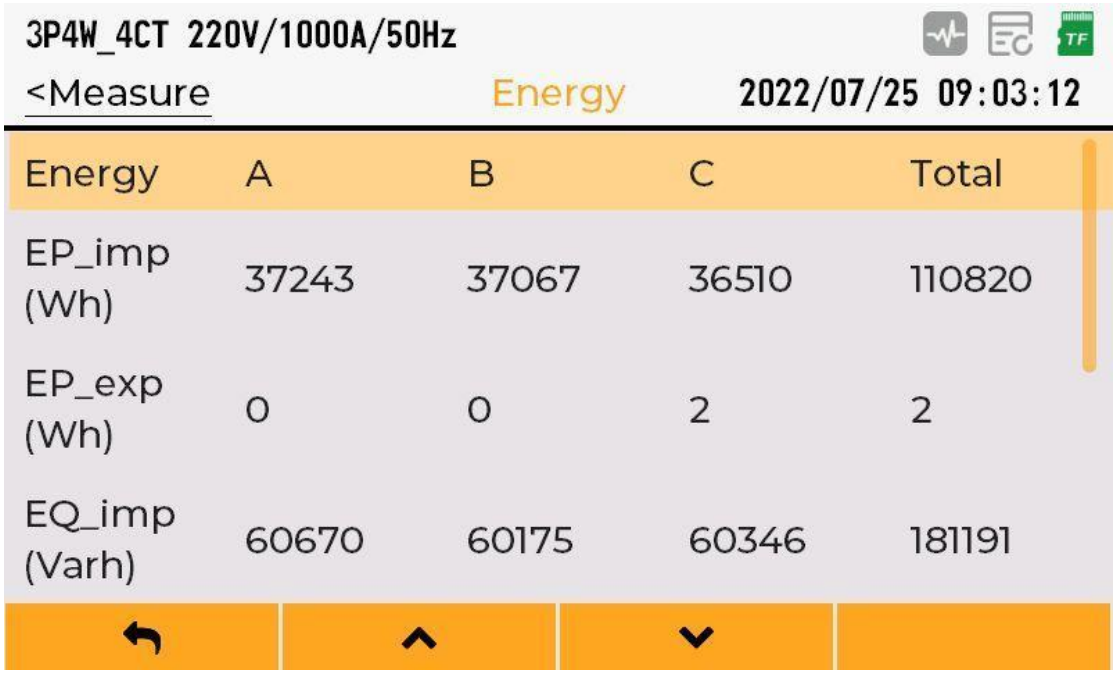


(Figure 6-35 Power)

6. 11 electric interface

show ：

- active positive electric energy EP_imp
- active reverse energy EP_exp
- Forward reactive power EQ_imp
- Reactive power reverse energy EQ_exp
- apparent electrical energy ES
- CO_2 discharge

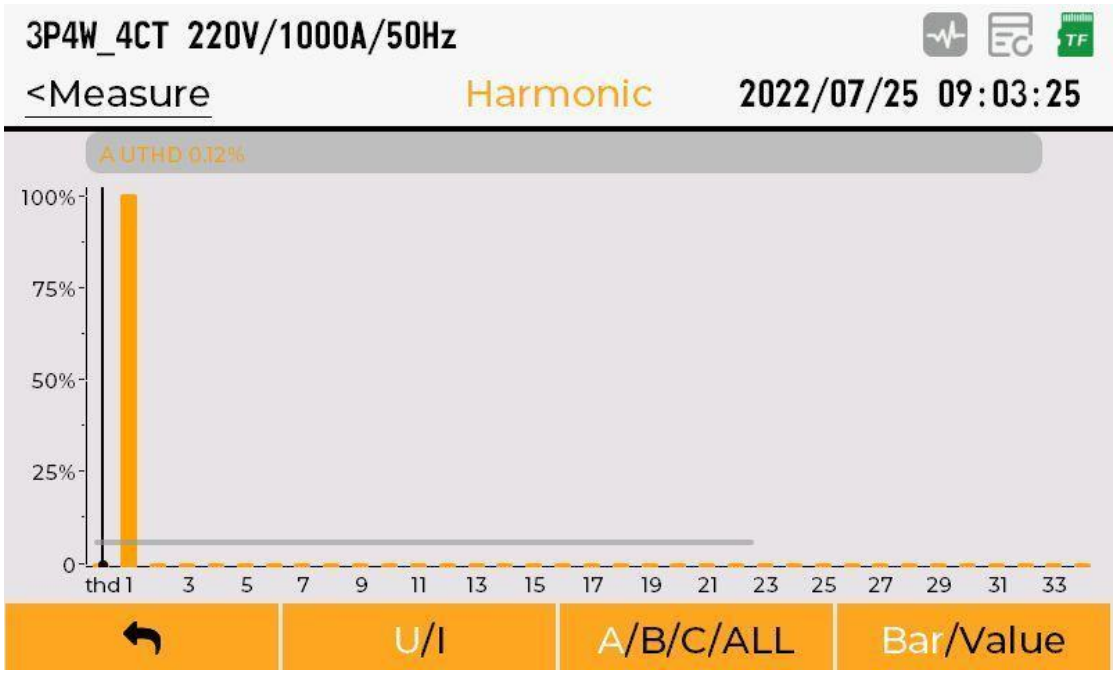


(Figure 6-36: Electrical Energy)

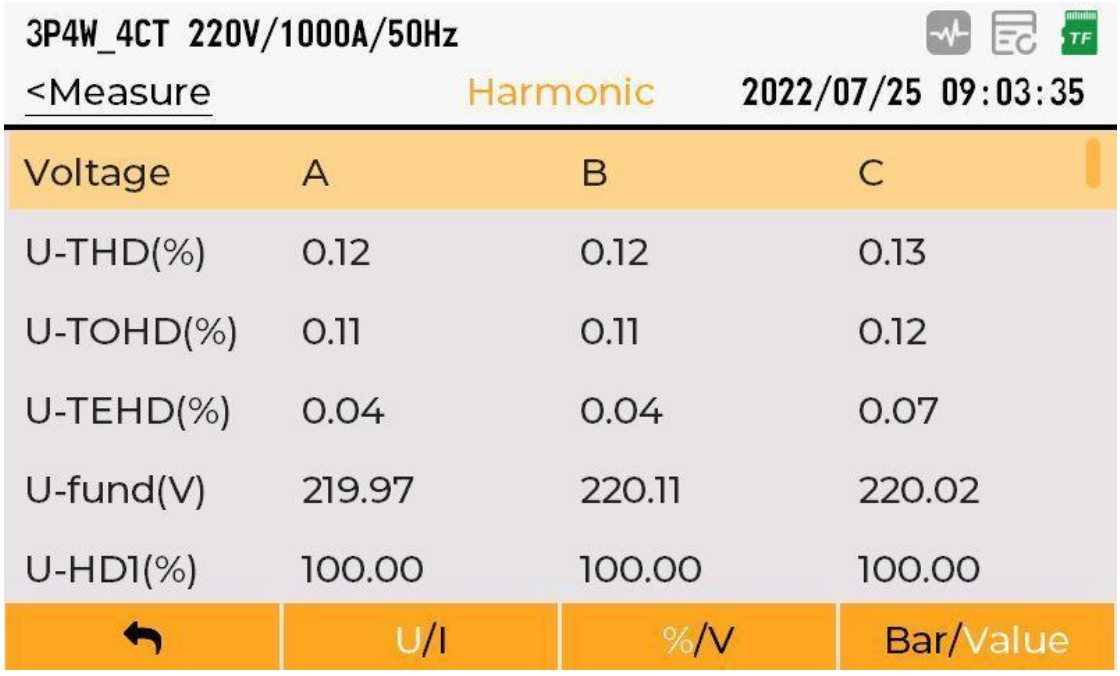
6. 12 harmonic interface

Display total harmonics and 1−50 harmonics:

- Column chart display
- Display values
- View cursor
- zoom



(As shown in Figure 6-37 harmonic histogram)



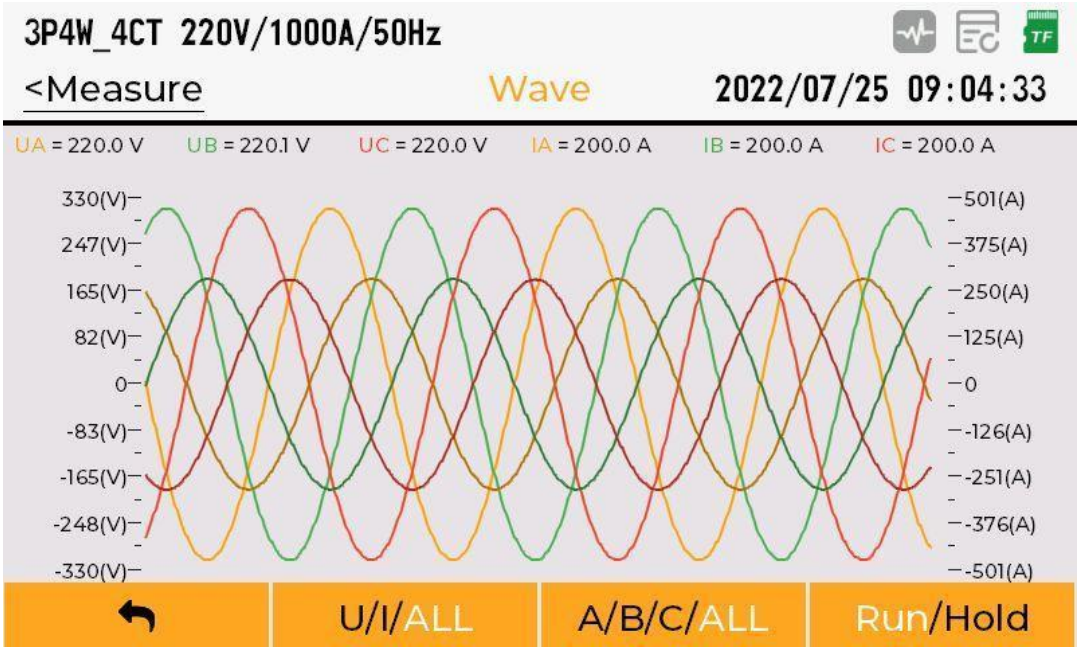
(Figure 6-38: Harmonic numerical display)

6. 13 wave interface

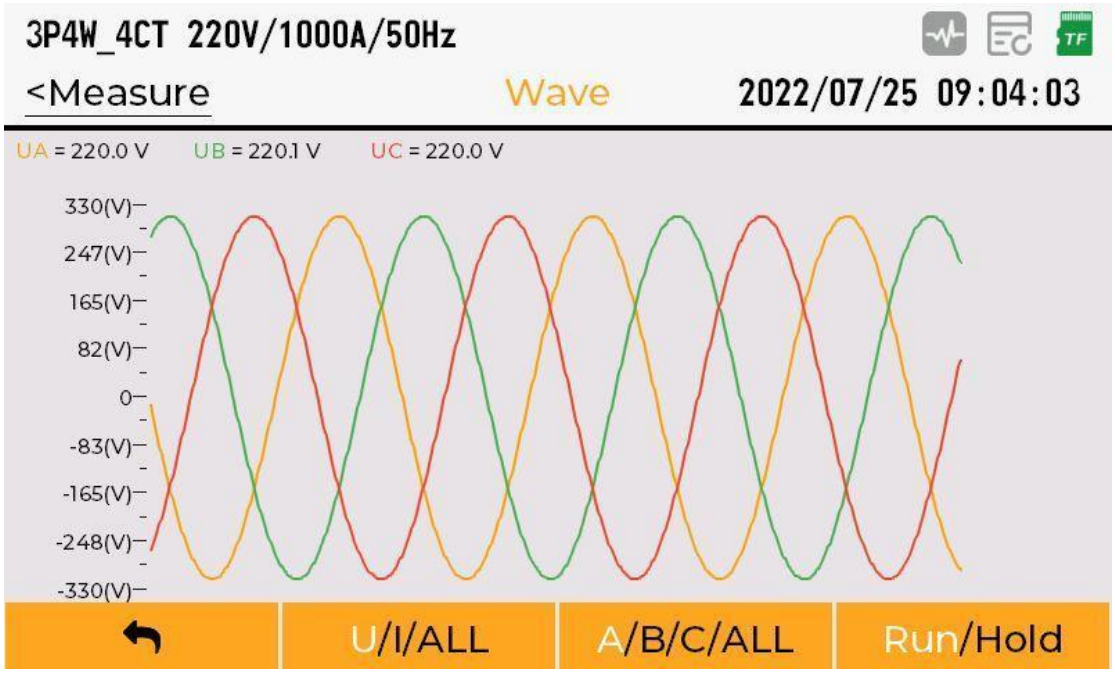
Display three-phase voltage and current waveforms. Options include:

- Refresh/Keep
- Voltage/Current/All

• zoom



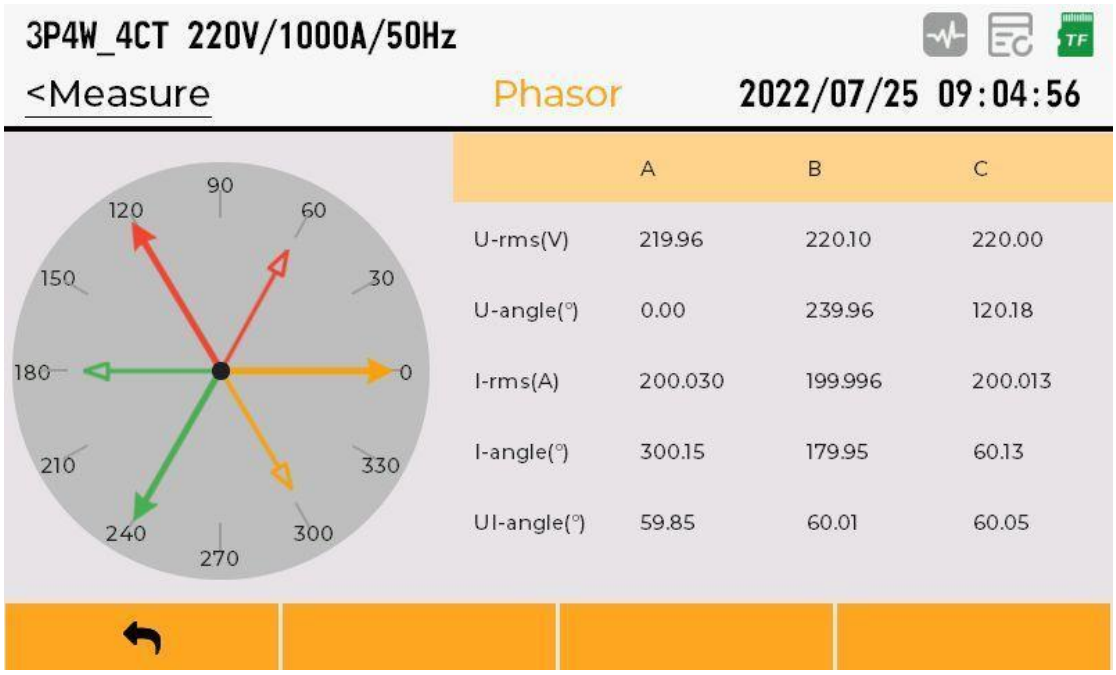
(Figure 6-39 Voltage and current waveform display)



(Figure 6-40 Voltage waveform display)

6. 14 Vector diagram interface

Displays the phase angle relationship between voltage and current, with phase A voltage as the reference.



(As shown in Figure 6-41 vector diagram)

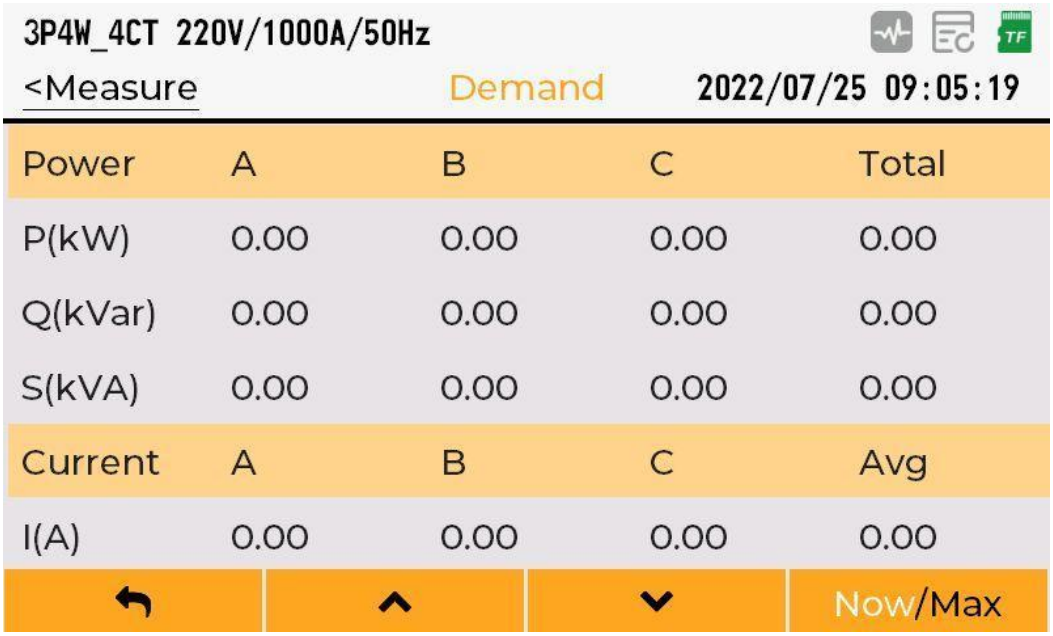
6. 15 unbalance interface

The negative sequence and zero sequence unbalance degree of voltage and current are displayed.

(See Figure 6-42 for the imbalance degree display)

6. 16 demand interface

Display current and peak demand with page navigation and switching.



(Figure 6-43 Current Demand)

(Figure 6-44 Maximum Demand)

6. 17 Record interface

Enter data recording, waveform recording, record management and storage management.

(Figure 6-45 recording interface)

The button operation is the same as the previous method.

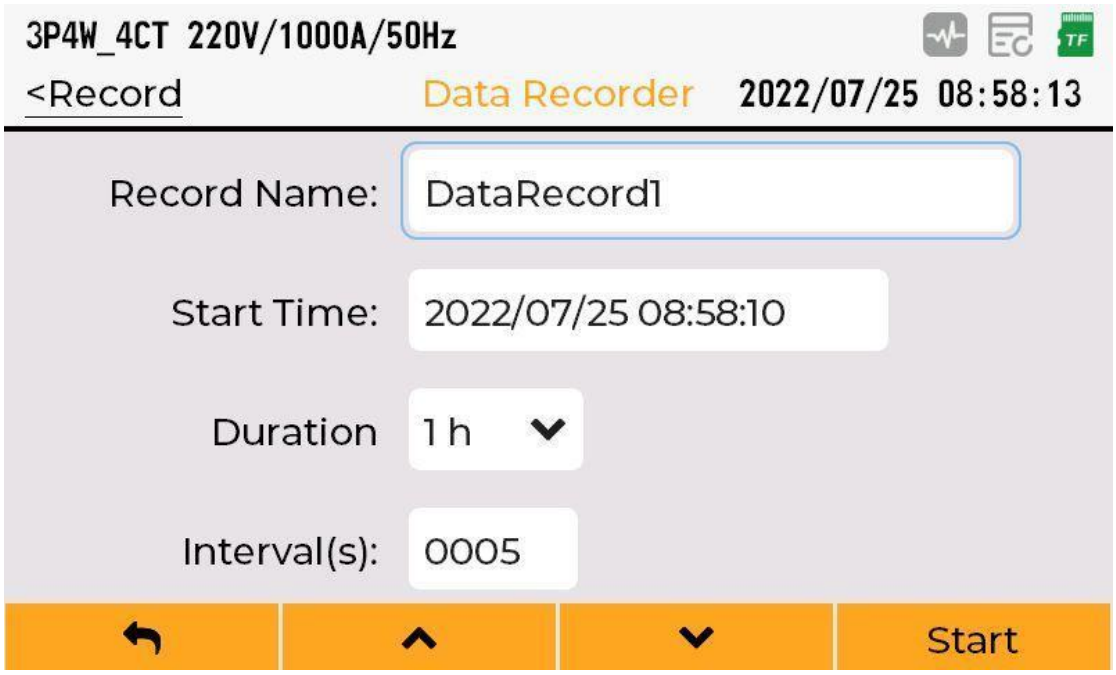
6. 18 data logger

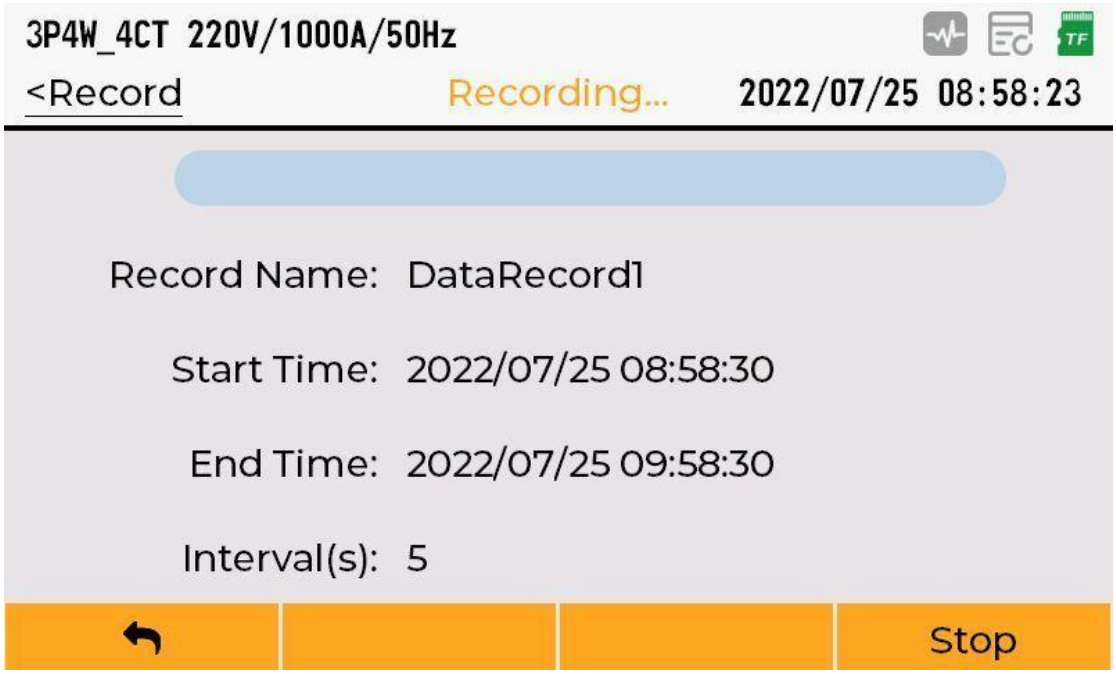
For recording: fundamental data, voltage harmonics, current harmonics For recording: fundamental data, voltage harmonics, current harmonics

- Record name: Set the name of the record file, up to 20 characters. The system automatically includes the start time in the file name to distinguish different record files.
- Start time: Sets the recording start time. When the user presses the [Start] key to begin recording, if the set start time is earlier than "current time + 10 seconds", the system will automatically adjust it to "current time + 10 seconds" to ensure the recording starts correctly.
- Duration: Sets the total recording time. Options include: 1h / 2h / 4h / 8h / 16h / 24h / 2d / 7d / 30d / 3mo / 6mo / 12mo / Max. Max means recording continues until the user stops manually or storage space runs out.
- Record interval (seconds): Sets the data collection cycle. The default is 60 seconds, with a minimum of 5 seconds and a maximum of 9999 seconds.

set up ：

- Name (up to 20 characters)
- start time
- Duration (1h to 12mo or Max)
- Record interval (5–9999s)





(Figure 6-46 Data Recorder

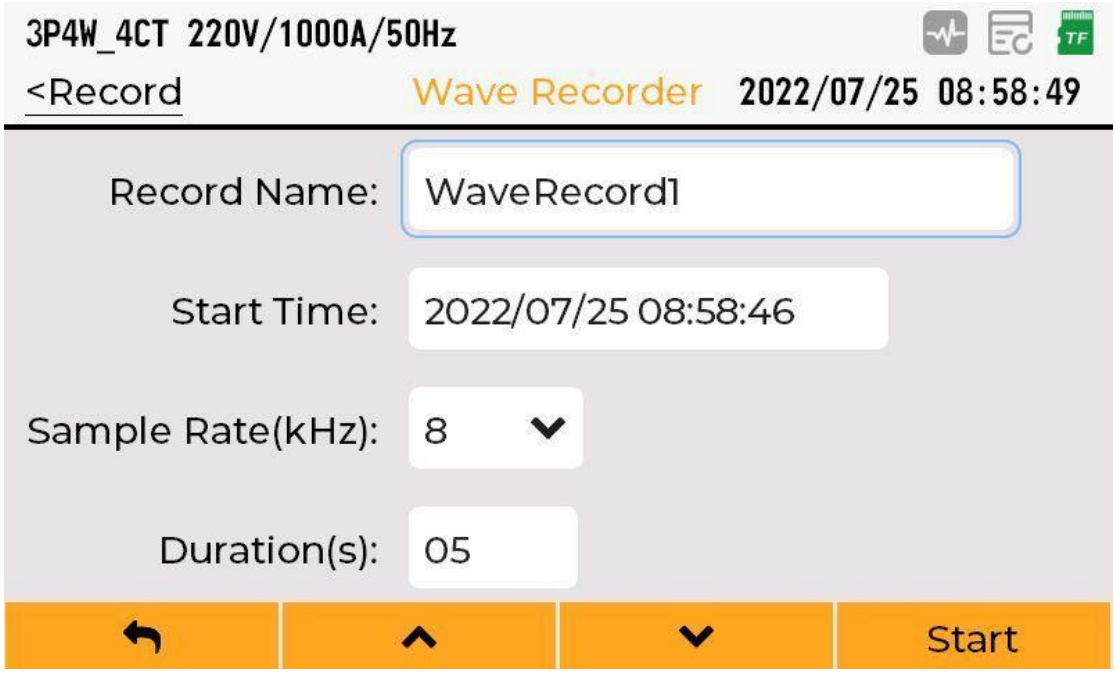
6. 19 curve tracer

The waveform recorder is used to collect the real-time waveform data of three-phase voltage

and three-phase current.

- Record name: Set the file name for the record, with a maximum length of 20 characters. The system automatically includes the record start time in the file name to distinguish different waveform records.
- Start time: Sets the start time for waveform acquisition. When the user presses the [Start] key, if the set start time is earlier than "current time + 10 seconds", the system will automatically adjust to "current time + 10 seconds" to ensure the recording process runs smoothly.
- Sampling rate (kHz): Sets the waveform sampling speed. Available values: 1/2/4/8 kHz, with maximum recording durations of:
  - kHz → 40 seconds
  - kHz → 20 seconds
  - kHz → 10 seconds
  - kHz → 5 seconds

- The higher the sampling frequency, the shorter the recording time.

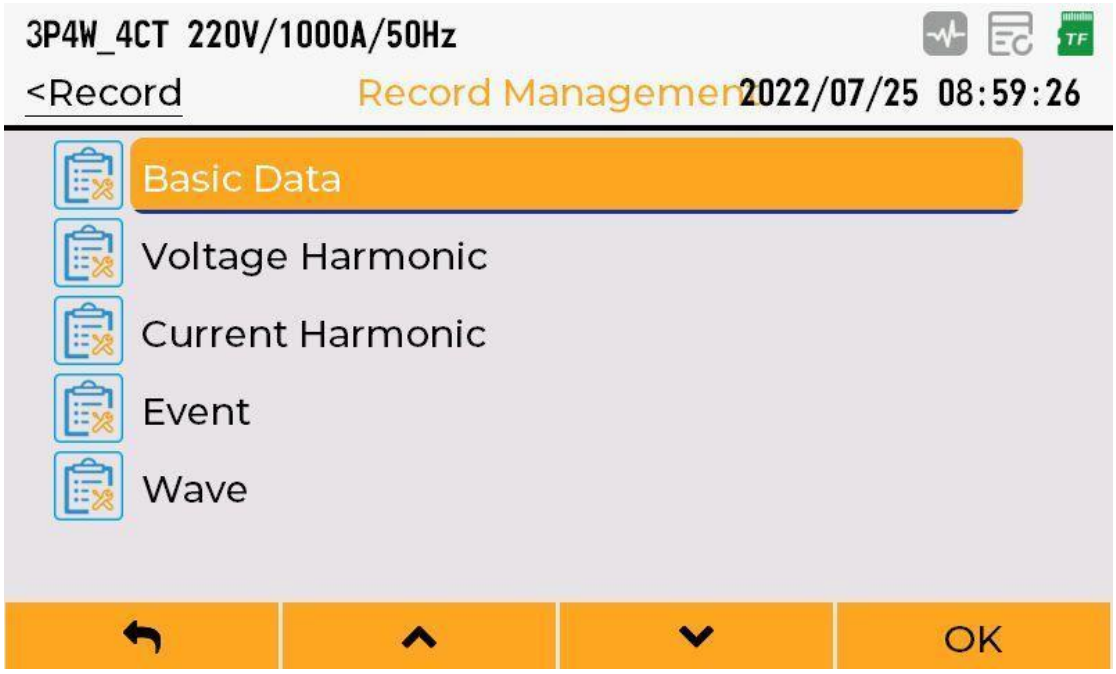


(Figure 6-47 Waveform recorder)

6. 20 record management

Includes export, delete, and delete all.

Insert a FAT32 USB drive to export.



(Figure 6-48 Record Management)

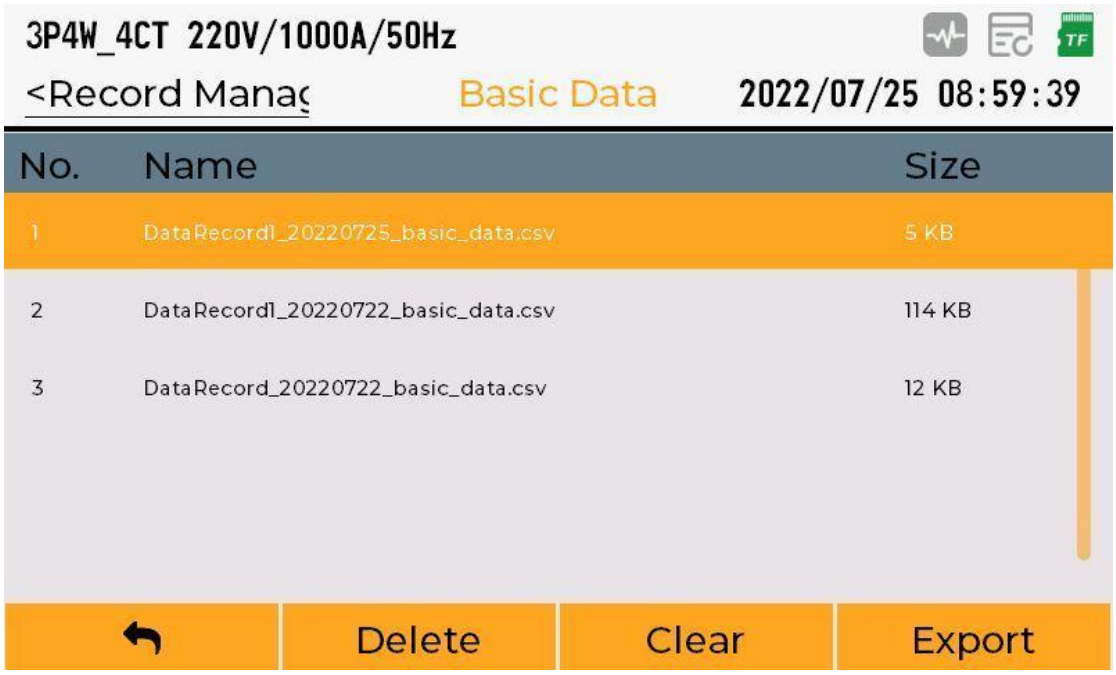
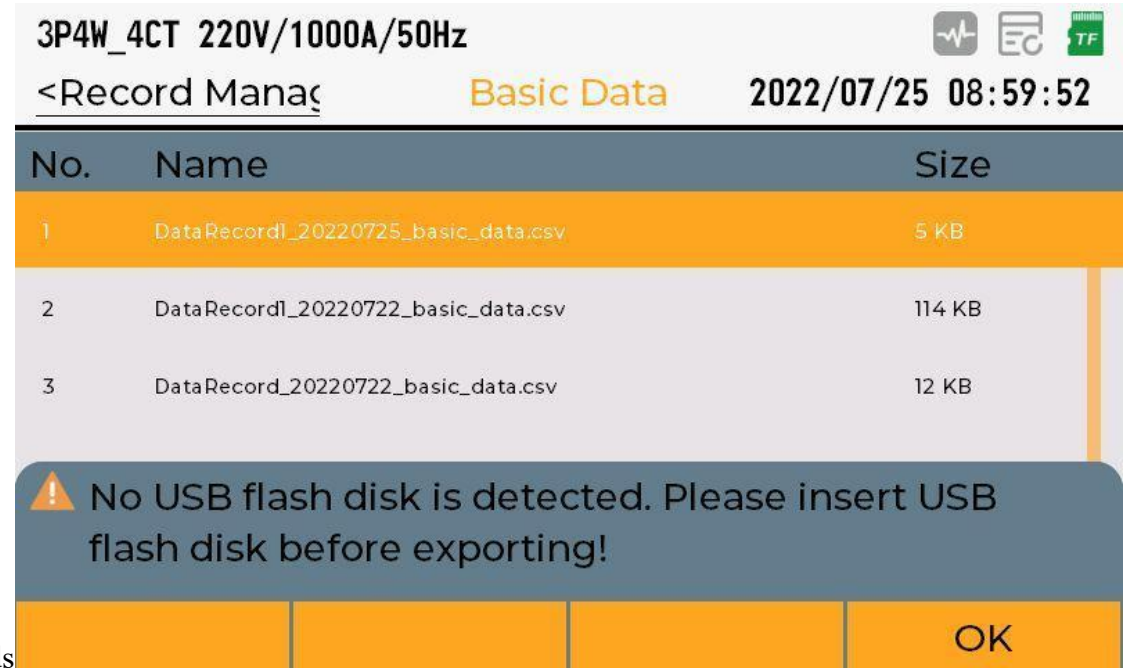


Figure 6-49 Export of Basic Data



Records

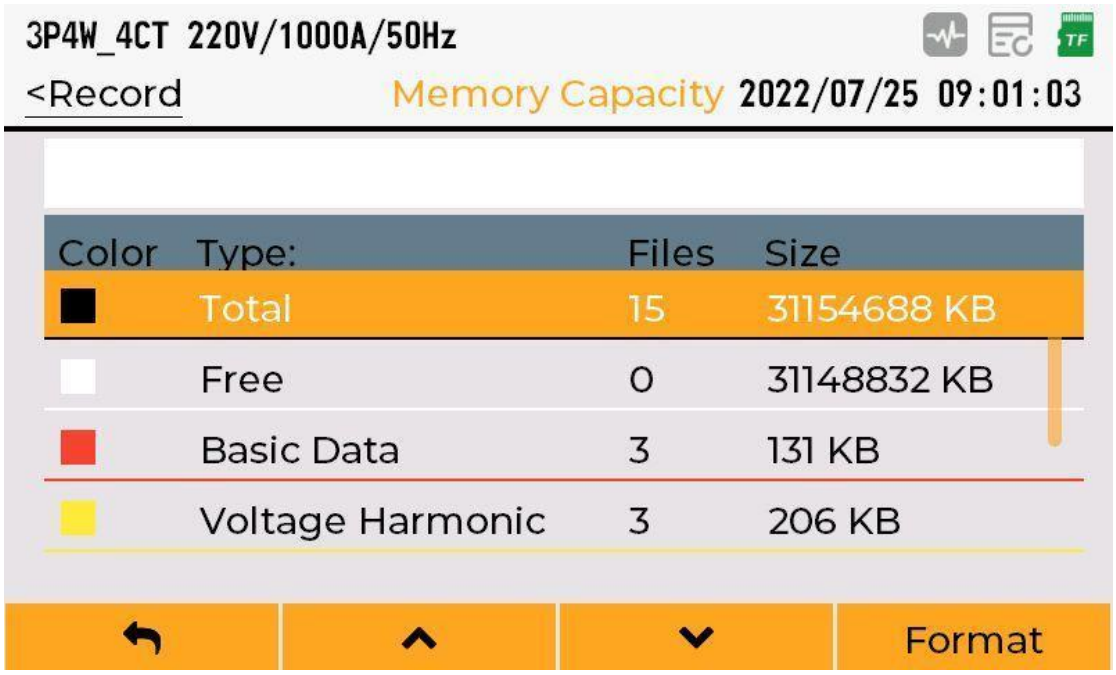
Figure 6-50 USB Drive Detection

Delete the current record in Figure 6-51

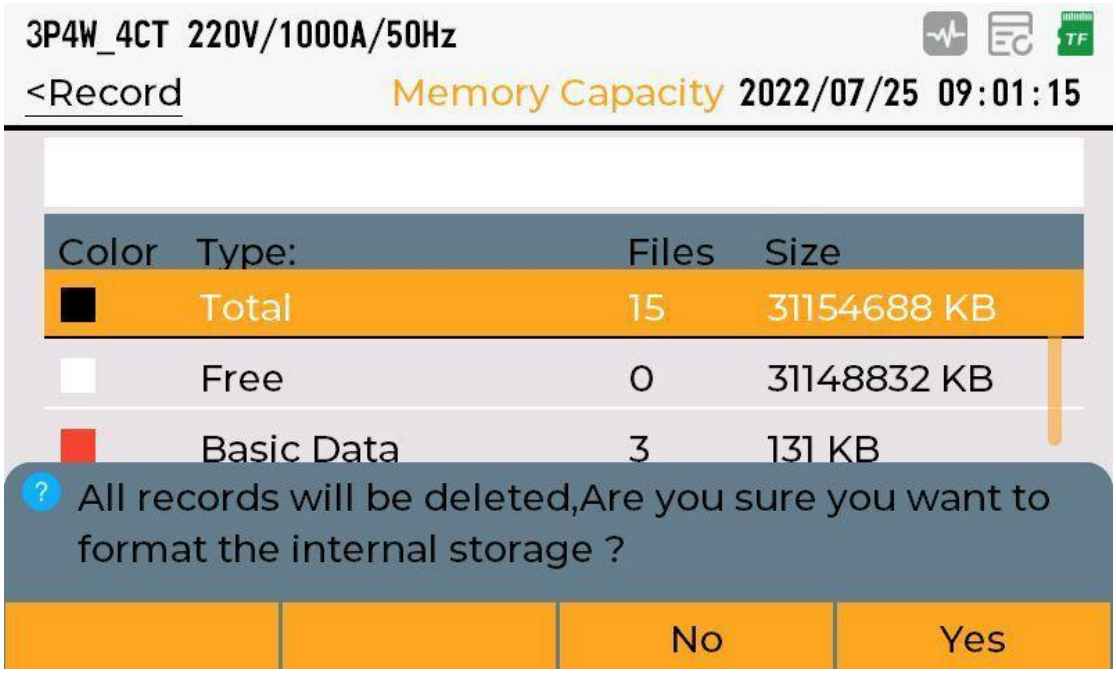
Delete all records

6. 21 SC

Show internal storage usage and format it.



(Figure 6-53 Storage Capacity)



Format as Figure 6-54

7 Operation and interface directory structure

Instrument navigation directory

7. 1 Measurement module

module	classify	Feature	explain

Measurement module	Voltage/Current	phase voltage U	effective value （V）
		Peak Voltage Factor CF	Crest Factor
		peak voltage pk	Voltage Peak
		Line voltage U12/U23/U31	three-phase line voltage
		grid frequency F	50/60Hz
		current effective value I	RMS current
		Current Peak Factor I-CF	peak current ratio
		Current K coefficient KF	Harmonic heating factor
	power	active power P	kW
		reactive power Q	kVar
		apparent output S	kVA
		power factor PF	total power factor
		fundamental power factor DPF	Fundamental PF
	electric energy	Active power EP_imp	kWh
		Active reverse power EP_exp	kWh
		Reactive power EQ_imp	kVarh
		Reactive Reverse EQ_exp	kVarh
		apparent electrical energy ES	VAh
		CO_2 discharge	calculated by emission factor
	harmonic wave	Total Harmonic Distortion (THD) (V/I)	Voltage/Current THD%
		odd/even harmonic	automatic calculation
		1−50 voltage harmonics	Amplitude/Percentage

		1−50 current harmonics	Amplitude/Percentage
	wave form	three-phase voltage waveform	real-time display
		three-phase current waveform	real-time display
		voltage/current superposition waveform	Zoom and pause
	vector	vector diagram of voltage	phase angle display
		current vector diagram	phase angle display
	degree of unbalancedness	voltage unbalance	Negative sequence, zero sequence
		current imbalance	Negative sequence, zero sequence
	demand	current demand	Current/Maximum
		power demand	Current/Maximum

7. 2 logging module

module	classify	Feature	explain
logging module	data logger	Record name	Maximum 20 characters
		start time	Auto-adjust to current +10s
		duration	1 hour to 12 months or Max
		interrecord gap	5−9999 seconds
	curve tracer	Record name	ditto
		start time	ditto
		sampling rate	1/2/4/8 kHz
		Maximum sampling duration	40/20/10/5 seconds
	record management	Basic Data Record	Browse/Export/Delete
		voltage harmonic recording	ditto
		current harmonic recording	ditto
		incident record	ditto
		waveform recording	ditto
	SC	gross capacity	Internal Flash/TF
		residual capacity	Visualization
		Basic data usage	Display by category
		voltage harmonic occupancy	Display by category

		current harmonic occupancy	Display by category
		waveform occupancy	Display by category
		formatting	Clear all records

7.3 Settings module

7.3.1 grid parameters

classify	Feature	explain
mode of connection	3P4W_4CT / 3P4W_3CT / 3P3W_3CT / 3P3W_2CT / 1P3W / 1P2W	Must match the actual wiring
grid frequency	50Hz / 60Hz	System operating frequency
nominal voltage	1–99999V	For event threshold reference
current transformer	type	Rcoil / CT
	sensitivity	mV/kA or mV/A
	nominal current	1–99999 A
	no-load voltage ratio	0.0001–1000
potential transformer	ratio setting	Enter the PT ratio
zero drift suppression	voltage/current zero drift	0–10%
harmonic threshold	FFT threshold	0–10%

event argument	Rise threshold, fall threshold, interrupt threshold, frequency, harmonics, imbalance degree, etc.	All adjustable
demand parameter	Method (fixed/sliding), interval	1–60 min
CO2 emission factor	0–9999.99	The default is approximately 1.00 kg/kWh
K coefficient	US/EU, parameter e/q	e:0–0.20s； q:1.0–2.0

7.3.2 system parameter

classify	Feature	explain
system info	Model, serial number, version, and MAC address	plant parameter
Ethernet Settings	IP, subnet mask, gateway, automatic acquisition	DHCP/ static state
Modbus-TCP	Status, port number	Default port 502
RS485	Address, baud rate, parity, stop bit	Modbus-RTU
clock	Date format and time calibration	yyyy/mm/dd
screen	Backlight brightness, screen off time	1–5, disabled for ~30 minutes
fingerboard	Key sound, auto lock key	Disable/1–5 minutes
language	7 languages	Chinese/English/French/Russian/Spanish/Portuguese

7.3.3 User parameters

classify	Feature	explain
userinfo	Username and location	Write to the record file
Phase sequence name	ABC / L1L2L3	Optional display format
Phase sequence color	China/United States/IEC/Custom	Customizable adjustable color

7.3.4 resetting

Feature	explain
factory data reset	Restore to default
Clear power	Clear power only
zero maximum demand	Clear maximum demand