SME1340

Multi-Channel Digital Power Meter

User Manual

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Catalogs

Chapter 1 Overview

1.1 Instrument Introduction

SME134X series multi-channel digital power analyzer (digital power meter) adopts high-speed 32-bit processor and professional DSP digital signal processor, equipped with embedded operating system, with fast speed, wide bandwidth, full-featured, compact structure, stable testing, simple operation and good human-machine interface, etc., it is a new generation of digital power analyzer. The main parameters that can be measured are voltage and current RMS, voltage and current AC component, voltage and current DC component, active power, reactive power, apparent power, power timing integral, power factor, frequency, voltage and current peak factor, voltage and current peak-to-peak value, and harmonic analysis and other electrical parameters.

The content of this manual covers a variety of instruments of SME134X series (the following SME134X indicates the common points of this series of instruments, with differences marked by specific models), all belonging to the multi-channel power analyzers, covering most of the electric power systems on the market with the advantage of a larger input frequency bandwidth (0.1Hz~100kHz), the series of instruments in addition to the basic measurement of electrical parameters, but also provide the In addition to the basic electrical parameter measurement, this series of instruments also provides the comparison function, intuitive input waveform display, and at the same time, the instrument provides the HANDLER interface, RS232C/RS485 interface and USB Device interface, USB Host, LAN interface, for the instrument used in the automatic sorting system and the remote operation of the computer to provide the conditions; the difference between the different models mainly lies in the current measurement range and the number of channels, the maximum test current of 20A, stable measurement accuracy, the specific difference can be seen in the following instrument model comparison table.

Key features of the instrument:

- Multi-channel combinations, providing 5 wire combinations can be set; for 4-channel instruments can be combined two by two.
- 7-inch 24-bit LCD liquid crystal display (resolution 800*480).
- Capacitive screen touch operation.
- Equipped with an embedded operating system, human-machine interaction is more friendly.
- Soft power switch.
- Input frequency range (0.1Hz~100kHz) covering most power systems.
- The range is automatically/manually controllable.
- Maximum test current 20A (model dependent), minimum current down to 0.1uA (model dependent);
- Controlled Synchronization Source.
- Provides a 500Hz line filter switch.
- Flexible integral control.
- Parameter comparison and Handler programmable 8-way output function.

- Harmonic analysis function.
- Waveform display function, power waveform display under integration state.
- Vector diagram display function.
- Support U disk file storage, can upgrade the instrument program through U disk.
- Serial interface: RS-232C/RS485, USB Host, USB Device, LAN port for the instrument and peripheral serial communication provides great convenience, peripheral can be set through the interface to the instrument for the functions and parameters, basically replacing the function of the panel keyboard; interface commands (SCPI) format and ModBus two protocols can be selected, greatly facilitating user programming. The interface commands are in (SCPI) format and ModBus protocols, which greatly facilitate user programming.
- Handler Interface: This interface is used for externally triggered tests and external control inputs.

1.2 Unpacking and Inspection

After opening the box, you should first check if the instrument is damaged due to transportation, we do not recommend you to power up the instrument in the case it is damaged.

The front panel of the instrument is labeled with the specific model of the instrument and the main measurement range, check whether it is consistent with the model you ordered, and please confirm according to the packing list, if there is any discrepancy, you can contact us or our distributor as soon as possible.

Comparison of instrument models and basic functions is shown in Table 1-1 below:

Model Classification	Differences and Functional Description		
	Number of channels	Measurement range	Others
SME1340	1	600V/2A	Harmonic, waveform and vector displays are standard.
SME1340-3	3		
SME1340-4	4		
SME1341	1	600V/20A	
SME1341-3	3		
SME1341-4	4		

Table 1-1 Comparison table of instrument models and basic functions

Note: It is better to keep the packing box of the instrument properly after opening the box, so as to avoid unnecessary damage to the instrument due to the mismatch of the packing box during transportation in the future.

Note: When the channel does not exist, some of the instrument's functions will be set invalid, such as no 4-channel instrument, involving CH4, P4, PS2, U4, I4 and other parameters are not applicable, here to make a special summary Description.

1.3 Conditions of Use

1.3.1 Power Connection

Power supply voltage: 200 to 240 VAC Power supply

frequency: 47 to 63 Hz

Power supply range: not less than 50 VA.

The power input phase line L, zero-line N and ground line E should be the same as the power plug of this instrument.

This instrument has been carefully designed to minimize spurious interference due to inputs from the AC power supply side, however, it should still be used in as low a noise environment as possible, and if this cannot be avoided, install a power supply filter.

WARNING: In order to prevent leakage of electricity from harming the instrument or people, the user must ensure that the ground wire of the power supply is reliably connected to earth.

1.3.2 Fuse

The instrument is equipped with a fuse from the factory, and the user should use the fuse provided by our company.

1.3.3 Environment

- Normal operating temperature: 0℃ ～40℃ , humidity: 20～80%RH
- Reference operating temperature: 20℃ ±8℃, humidity: < 80%RH
- Transportation ambient temperature: 0℃ to 55℃, humidity: · 93%RH
- Do not use under dusty, vibrating, direct sunlight or corrosive gases.
- To ensure good ventilation of the instrument, do not block the left vent hole to maintain the accuracy of the instrument.
- This instrument has been carefully designed to minimize spurious interference due to inputs from the AC power supply side, however, it should still be used in as low a noise environment as possible, and if this cannot be avoided, install a power supply filter.
- If the instrument is not used for a long time, please store it in the original packing box or similar box in a ventilated room with a temperature of 5℃ ~40℃ and relative humidity not more than 85% RH. The air should not contain harmful impurities that corrode the measuring instrument and should be protected from direct sunlight.

1.3.4 Preheating

To ensure accurate measurements, the instrument should be turned on and warmed up for no less than 30 minutes.

Do not switch the instrument on and off frequently as this may cause internal data confusion.

1.4 Instrument and Other Features

Power Consumption: Consumes about 50 VA.

Overall dimensions (W*H*D): 236mm*154mm*475.5mm;

Weight: About 8.1kg.

Chapter 2 Front and Rear Panel Descriptions and Basic Operation

This chapter describes the basic overview of the SME134X series instruments. Before using the SME134X series instruments, please read this chapter in detail so that you can quickly familiarize yourself with the operation structure of the SME134X series instruments.

2.1 Front Panel Description

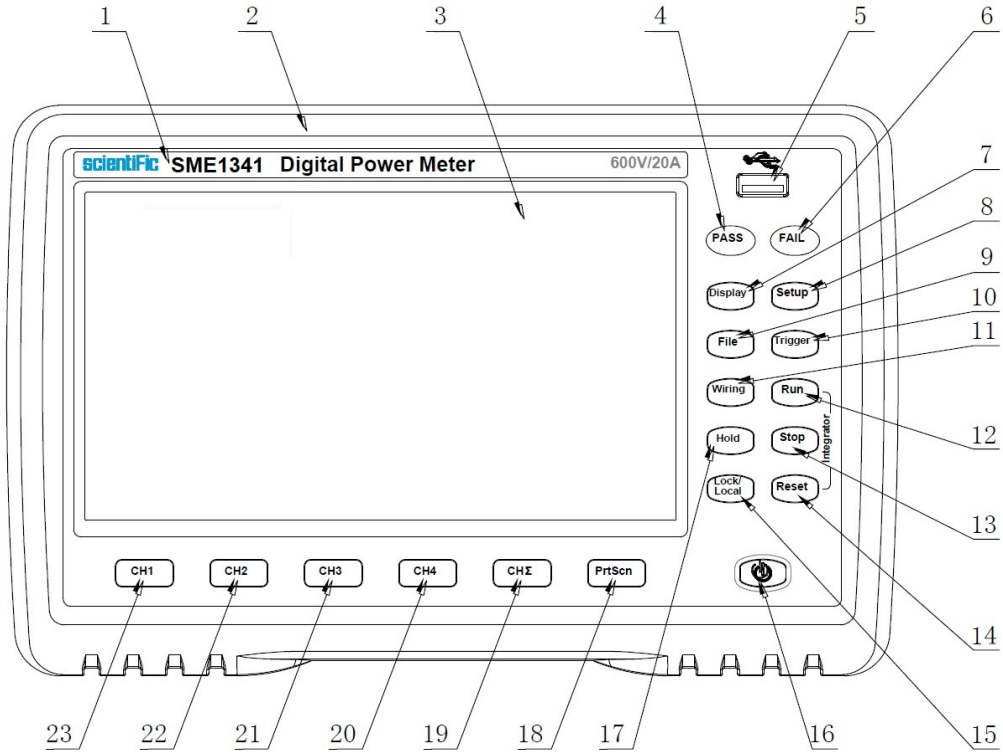


Figure 2-1 provides a brief Description of the SME134X Series front panel.

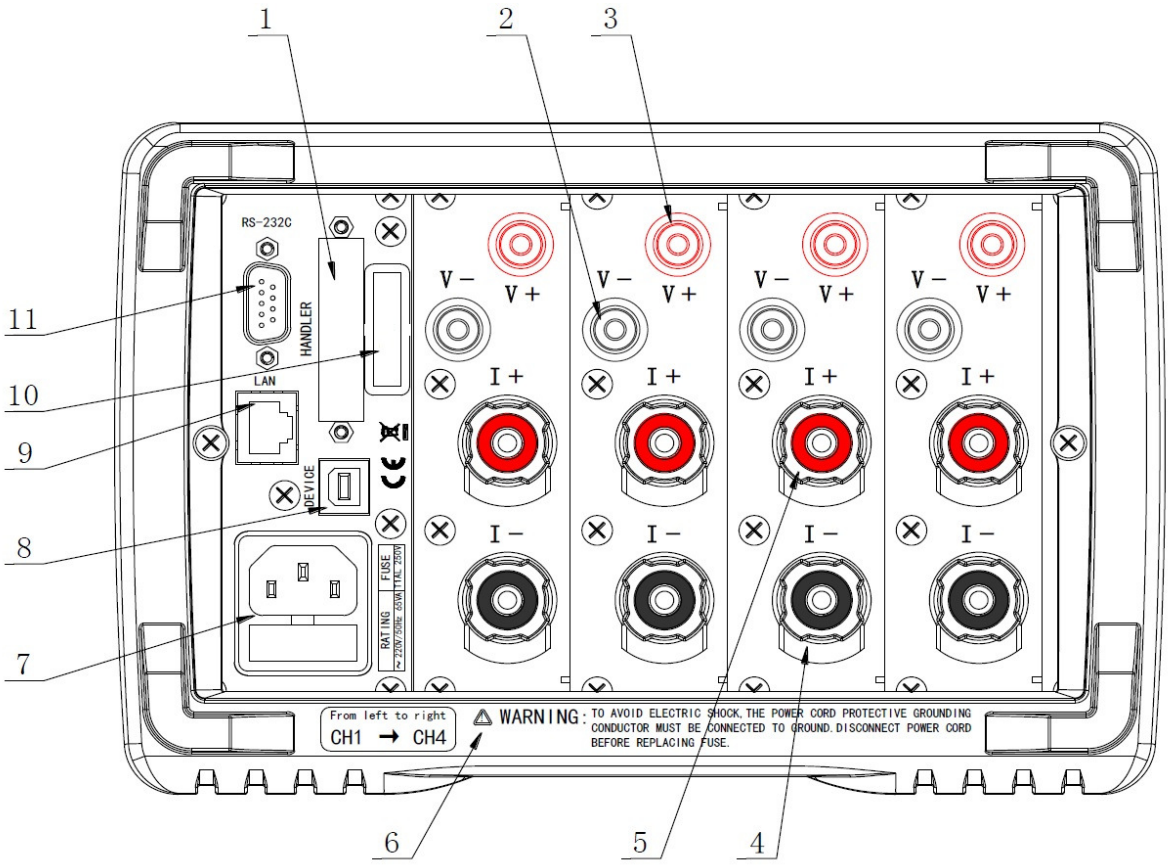
Label	Name	Purpose
1	Logo & Model Name	Indicate instrument model and test range
2	Front panel rubber cover	Aesthetically pleasing and resistant to knocks
3	LCD liquid crystal display	7-inch LCD touch screen for displaying test results and human-computer interaction operations
4	PASS light	Compare pass indicator, green
5	USB HOST	USB HOST port for USB flash drive storage and upgrades
6	FAIL light	Comparison fail indicator, red
7	Display key	Test module key for accessing the test module
8	Setup key	Setup module key for accessing the parameter setup

		module
9	File key	File module key for accessing the file management module
10	Trigger key	Manual trigger key, when the trigger mode is manual (MAN) mode, press this key once, a trigger measurement will be performed
11	Wiring key	Shortcut key for wire combination selection, pop-up dialog box to select wire
12	Run key	Energy integration start button, energy integration running in the red LED lights, integration stops the LED does not light up
13	Stop key	Energy integral stop key, in the stop state if you press Run again, then the last time and the results continue to run, if you reset the last time and the results need to press the Reset key in the stop state.
14	Reset key	Press this key after the integral timing stops, the energy accumulation will be reset to zero and the timing will be reset.
15	Lock/Local key	Used to lock or unlock the key function, the panel key is locked, LED light, the panel key is unlocked, LED light off
16	Power switch	Power switch, the key is green when the instrument is turned on and red when it is turned off.
17	Hold key	When pressed, the corresponding LED lights up and the test result is not refreshed; when pressed again, the LED goes out, releasing the measurement lock state
18	PrtScn key	Used to save a screenshot of the current interface, if external USB storage exists, it is preferentially stored in the external USB, otherwise it is stored in the instrument's internal files directory, both under the corresponding PIC folder;
19	CHΣ key	Used to switch between the wire combination test page and the normal test page.
20	CH4 key	Used to zoom in between the corresponding channel display page and the general test page.
21	CH3 key	
22	CH2 key	
23	CH1 key	

Table 2-1 Front Panel Description

2.2 Rear Panel Description

Figure 2-2 provides a brief Description of the SME134X Series rear panel.



(Figure2-2 Rear Panel Labeling)

1	HANDLER interface	Through the HANDLER interface, it is easy to form an automatic test system and realize automatic test. The instrument outputs the comparison result signal through this interface, and at the same time obtains the "external trigger" signal through this interface.
2	V- Input	Voltage measurement input terminal negative
3	V+ Input	Voltage measurement input terminal positive
4	I- Input	Negative side of the current measurement input terminal
5	I+ Input	Positive current measurement input terminal
6	Prompt label	Indicates the warning message of the instrument
7	Power sockets and fuses	For input AC 220V/50Hz power supply

8	USB Derive	USB DEVICE interface enables communication between PC and instrument.
9	LAN port	Wired LAN interface for LAN communication
10	S/N label	Used to indicate the specific S/N number of the instrument
11	RS232C/485 interface	Serial communication with host computer

Table 2-2 Rear Panel Description

2.3 Power on

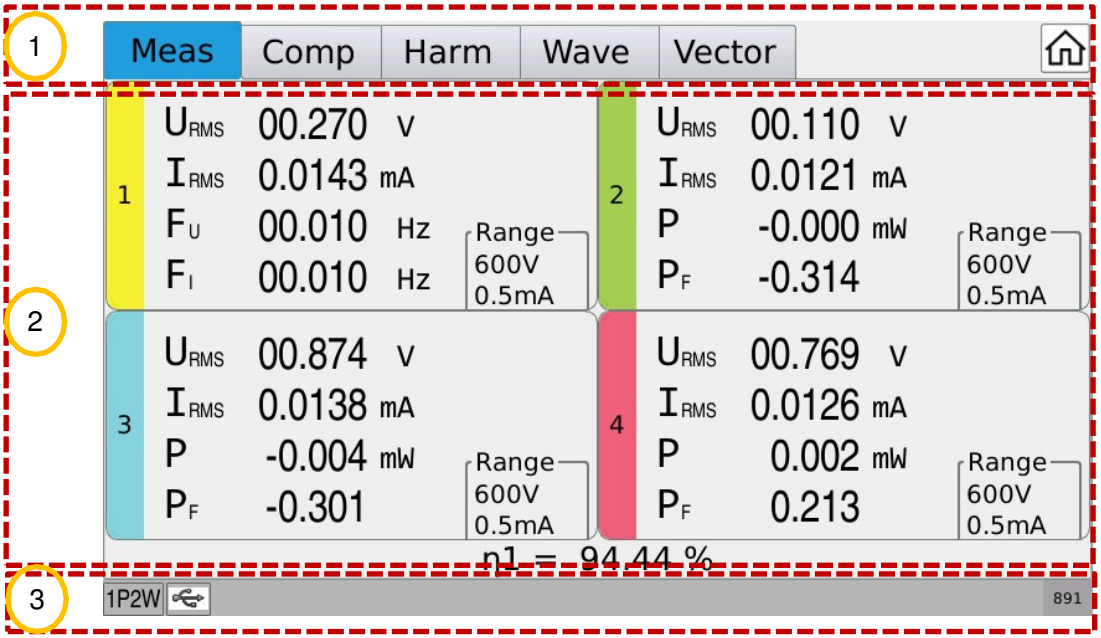
Plug in the AC 220V/50Hz 3-wire power plug to ensure that the power ground is reliably connected. The instrument will automatically power on and display the power-on screen. The power-on startup is mainly divided into 2 steps, the first step is the startup of the embedded operating system, and the second step is the startup of the application program, which makes the text information displayed on the power-on screen different.

(Figure 2-3 System startup screen)

2.4 On-screen Display

The SME134X series uses a 24-bit color 7-inch color LCD resistive touch screen with a resolution of 800*480. Two display styles are available on the main test page, which are selected for switching on the system setup page.

The screen display is divided into the display areas shown in Figure 2-5 below.



(Figure 2-5 Main display area divisions)

1	Header paging bar	Pagination display titles for each page function;
2	Measurement result display and parameter setting area	This area displays the test results as well as the measurement parameter settings on the Setup page;
3	Status line	Displays instrument status information, including range, line system, usb flash drive, etc. Status

Table 3-1 Description of the meaning of the regions

Chapter 3 Instrument Function Overview

This series of instruments on the input signal through the digital phase-locking and oversampling technology, accurate synchronization of the entire cycle of the input signal sampling, the test data of each measurement function are calculated from these sampling data, so as to get the numerical value of the data displayed on the screen and waveform data, etc.

For a Description of the symbols of the measured parameters and the related calculation formulas, see 8.1 Fundamentals.

The routine setup operation of this series of instruments is as follows:

Switch between the 3 main modules with the [Disp] key, [Setup] key and [File] key.

[Disp] Key -------- to switch to the test page.

[Setup] key ------- to switch to the setup page.

[File] Key---------- to switch to the file management page.

Then select the operating touch screen on each page according to the control name in order to adjust the parameter settings and display.

3.1 Independent Channel Measurement Function

The basic functions of each channel can be categorized into two groups: conventional measurement functions and integral measurement functions.

3.1.1 General Parameters

That is, after the instrument is powered up, the measurement functions that can be accomplished by each channel board under the normal triggering state. The measurable parameters are shown in Table 3-1 below:

Parameter symbol	Description of the meaning of the parameters	Unit		Parameter symbol	Description of the meaning of the parameters	Unit
U_{RMS}	Voltage True RMS	**V**		I_{RMS}	Current True RMS	A
U_{AC}	Voltage AC component RMS	**V**		I_{AC}	Current AC component RMS	A
U_{DC}	Voltage DC component	**V**		I_{DC}	Current DC component	A
U_{PK+}	Positive voltage peak	**V**		I_{PK+}	Positive peak current	A
U_{PK-}	Negative voltage peak	**V**		I_{PK-}	Negative peak current	A
U_{PP}	Peak-to-peak voltage	**V**		I_{PP}	Peak-to-peak current value	A
U_{CF}	Peak factor			I_{CF}	Peak factor of current	

P	Active power	**W**	**λ**(PF)	Power factor	
S	Total power (apparent power)	**VA**	**φ**(phase)	Voltage and current to phase difference	°
Q	Virtual power (reactive power)	var			
F_U	Voltage frequency	Hz	F_I	Current frequency	Hz

Table 3-1 Explanation of the Meaning of General Parameters

3.1.2 Integral Measurement Function

That is, after the instrument power supply, in the normal trigger state with the necessary integral control to complete the test function.

The measurable parameters are shown in Table 3-2 below:

Parameter symbol	Explanation of the meaning of the parameters	Unit
Time	Points time	s
W_P	Integration of active power, sum of positive and negative integrals	Wh
W_{P+}	Positive active power integral (consumption)	Wh
W_{P-}	Bearing power integration (feedback)	Wh
W_S	Total active power integral	VAh
W_Q	Reactive power integration	varh
q	Current integral, sum of positive and negative integrals	Ah
P_{AVG}	Average power over the integration time	W
P_{MAX}	Maximum power during integration time	W
P_{MIN}	Minimum power during integration time	W

Table 3-2 Meaning of Integral Parameters

3.2 Wiring Group ∑ Measurement Function

The instrument provides 5 wiring group modes to choose from.

The test parameters involved in the wiring group are shown in Table 3-3 below:

Parameter symbol	Explanation of the meaning of the parameters	Unit
$\sum U_{RMS}$, $\sum U_{AC}$, $\sum U_{DC}$	Average value of the corresponding voltage in the combination of line system	V
$\sum I_{RMS}$, $\sum I_{AC}$, $\sum I_{DC}$	Average value of the corresponding current in the combination of wire systems	A
$\sum P$	Active power within the line system portfolio	W
$\sum S$	Apparent power within the line system combination	VA
$\sum Q$	Reactive power within the line system portfolio	var
$\sum P_F$	Power factor within the wire system combination	
η	Energy efficiency within the wire system combination	
$\sum W_P$	Integration of active power within a combination of line systems	Wh

Table 3-3 Explanation of the Meaning of ∑ Parameter

3.3 Measurement Comparison and Output Functions

The number of comparison output paths relates to the number of external Handler ports. 8 external output ports and 1 external trigger signal are standard.

That is, up to 8 signals can be selected to participate in the comparison, and the result of the comparison will be output externally by means of a relay, and the specific mode of output is user-programmable:

Output methods programmable include:

Pass on output, fail on output, pass pulse output, fail pulse output, off output. Comparison of optional parameters is detailed in the Comparison Parameter Selection section:

3.4 Harmonic Analysis Function

Provides 50th harmonic analysis function, and the display form is available in list and bar graph.

The test results include analysis results of voltage and current signals:

Because of the different number of channels involved, the selectable parameters are limited, depending on the specific model, i.e. (U1, I1, U2, I2, U3, I3, U4, I4), and each signal can be

selected to be turned on or off.

RMS test results for each harmonic.

Percentage composition results for each harmonic.

Percentage component of total harmonics.

Harmonic calculation standards are optional: IEC and CSA.

The analysis of voltage and current parameters for each channel can be switched independently.

3.5 Waveform Display Function

There are two types of waveform displays, U&I (voltage and current waveforms) and Power (active power waveforms).

◆ Voltage and current waveforms (horizontal coordinates referenced to data cycle time)

Each signal that involves the channel can be enabled or disabled.

The waveform display is affected by the frequency, and it is planned not to display the waveform over 50kHz because the waveform plotting has no practical significance due to the limitation of the sampling principle.

The lock signal of the waveform display is selected in the order of priority (U1, I1, U2, I2, U3, I3, U4, I4) according to the state of the open signal, e.g., when only U1 and I2 are in the open state, the phase of the waveform lock is referenced to the U1 bit; when only I2 and I4 are in the open state, the phase of the waveform lock is referenced to the I2 bit.

Note: The purpose of this waveform display function is to help the user understand the signal's overall condition at the input port. Since the input signal frequencies of each channel are different based on the phase-locked reference waveforms, multiple-cycle waveforms may appear. Also, the waveform does not change the original phase difference of the signal.

◆ Power Waveform

The waveform display area will show the calculated average power. The calculation of average power is based on the data after the start of integration, while the power waveform only shows the nearest 256 data before the current moment, i.e., the data before 256 points are also involved in the calculation of average power, which may be reflected in the fact that there is a certain non-correspondence between the relative stable value of the waveform and the calculated average power, which is a normal phenomenon;

3.6 Vector Analysis Function

The vector diagram and test results visualize the phase relationship between the individual signals of the 3-phase input.

Understand the balanced condition of the three phases.

3.7 Basic Communication Functions

SME134X series are equipped with RS232/RS485, USBTMC and LAN as standard, among which RS232/RS485 is optional (one of the two options, RS232 is equipped as standard without special selection instructions).

The communication protocol of SME134X series adopts the standard SCPI command standard by default, which increases the readability and convenient practicality of the command; meanwhile, it also provides optional ModBus command protocol (this protocol resolution is only valid for RS232/RS485 interface), which facilitates the communication and control of PLC and other related electrical equipment.

Chapter 4 Measurement Parameter Settings and Descriptions

Step1: If you are not in the setup function page, press [Setup] to enter the setup related page.

Test setting, comparison setting, and system setting functions are available on the setting-related page.

The functions set are categorized as shown in Table 4-1 below:

Setting parameter classification	Description
Test settings	Mainly concerned with basic test-related parameters
Comparison settings	Mainly concerned with comparing the limits of parameters, functions and other relevant parameters
Harmonic settings	Parameters mainly related to harmonics (see Harmonic test page)
Waveform settings	Mainly concerned with waveform-related parameters (see waveform test page)
System settings	Mainly concerned with system-related parameters

Table 4-1 Setting Parameter Classification Description

The classification of the setting page mainly has test settings, comparison settings, and system settings optional. Other settings are not enough to open a separate page due to fewer setting items, so the corresponding settings are put into the corresponding test page to be realized.

Step2: According to the contents of the paging display, touch to select the corresponding page and enter the page to be set.

4.1 Measurement Settings

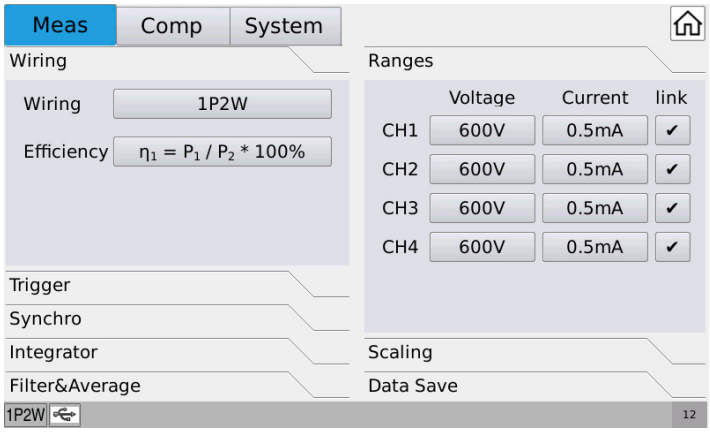
The settings under this subpage are mainly related to the adjustment and setting of the basic test-related setup parameters, and the main categories of the setup parameters are shown in Table 4-2 below:

Setting parameter classification	Description
Wiring Setting	Selection of wire systems and user programming of efficiency equations
Trigger settings	Trigger mode selection and trigger delay time setting

Synchronization Settings	Synchronization source settings for each channel
Integrator Setting	Control method of points and setting of time limit for points
Filter and average settings	Selection of hardware filters and the setting of test averaging times
Measurement range setting	Setting of voltage and current ranges for each channel
Scale factor setting	Setting the ratio coefficients for each channel voltage and current
Data saving settings	Used to control the opening and closing of data saving operations

Table 4-2 Measurement Setting Parameter Classification Description

The page display reference for measurement settings is shown in Figure 4-1 below



(Figure 4-1 Measurement Settings Page)

4.1.1 Wire System Setting

For details on the Description of the wiring system and its meaning, etc., see the Wiring System Wiring Methods section in Chapter 8.

4.1.1.1 Wire System Selection

SME134X offers a wire combination system with 5 types of external wiring:

One-phase two-wire (1P2W), one-phase three-wire (1P3W), three-phase three-wire (3P3W), three-phase four-wire (3P4W), three-voltage three-current (3V3A).

The setting of the line system determines how the external channels are wired and how the wiring group Σ is calculated (voltage, current, active power, apparent power, reactive power, power factor, conversion efficiency, etc.) For details, see Chapter 8, Σ Parameters section .

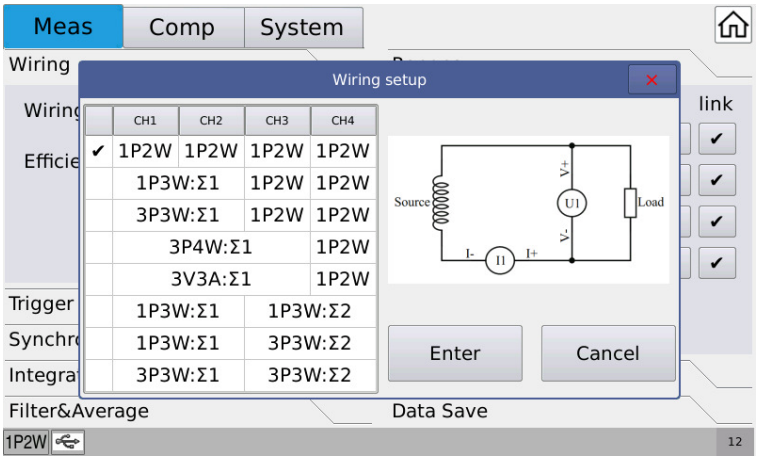
Setting method:

Press the [Setup] key on the panel, touch to enter the measurement setup page, expand the

Wiring tab and click the touch screen to select the desired line system combination setting.

In addition, you can see the [Wiring] button on the panel, which is a shortcut to access the wiring system selection.

The Wire System tab is shown in Figure 4-2:



(Figure 4-2 Wire System Options Window)

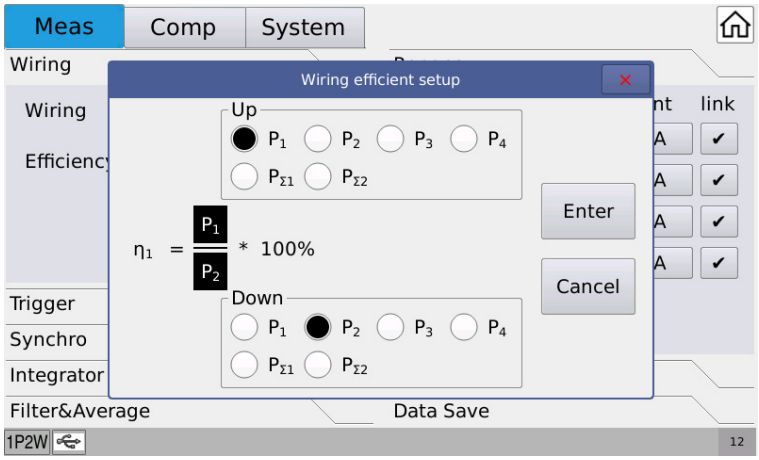
On the left side of the tab, each line represents a line system selection item, and the merging status of the cells indicates the current line system for channel use allocation, and on the right side of the recommended principal wiring circuit schematic diagrams, which is convenient for the user to use and check the connection status of the line system.

For the 4-channel instrument, considering that only 2 test channels are used in the wired system, while the remaining two channels are given the possibility to be combined again to be used in a second wired system, considering the adequacy of the use, as can be seen by seeing the layout of the tabs for the exact effect.

For different configurations with different numbers of channels, the actual options available will be limited.

4.1.1.2 Wiring Efficient Setup

In the non-1P2W line system, the efficiency formula of the line system is programmable, touch and click the corresponding button to edit the formula for efficiency calculation, the formula editing window is shown in Figure 4-3:



(Figure 4-3 Efficiency Formula Setup Window)

Select the numerator and denominator corresponding to the formula and press OK to complete the modification.

4.1.2 Trigger Settings

Trigger settings include trigger method settings and trigger delay settings.

Trigger mode refers to the triggering mechanism of the instrument test, i.e., the test execution of the instrument needs to be triggered by the trigger signal before executing a test job.

4.1.2.1 Trigger Method

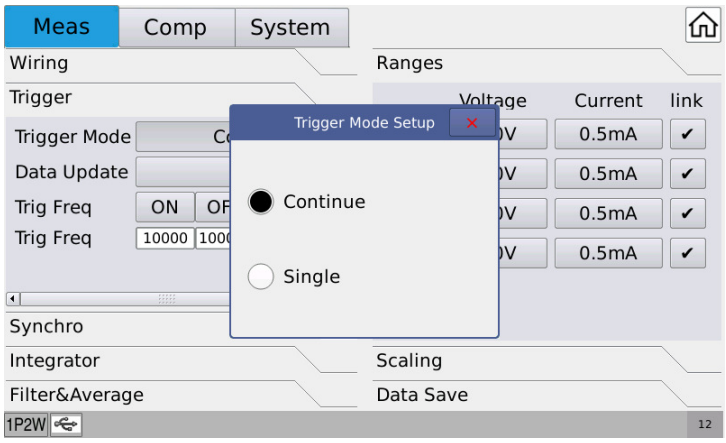
SME134X series has the following four trigger methods as shown in Table 4-3 below

Trigger method		Description
Continues trigger	Internal	Tests are performed automatically within the instrument
Single trigger	Manual trigger (Manual)	Press the front panel [Trigger] key to execute a test, the end of a test will enter the idle state, waiting for the next [Trigger] key trigger;
	External trigger (External)	Through the rear panel Handler port from the external reception of the "trigger" signal (generally for the falling edge, can not be modified), the execution of a test, a test will enter the end of the idle state, waiting for the next trigger;
	Bus trigger (Bus)	Trigger tests are performed via bus commands; see the relevant section on Command Descriptions for specific command Descriptions.
	Table 4-3 Explanation of the meaning of trigger mode	

Setting method:

Press the [Setup] key on the panel, touch to enter the measurement setup page, expand the **Trigger Setup** tab, and then touch the button corresponding to the **Trigger Mode** Setup item to bring up the Trigger Mode Setup window, and then click on the desired trigger mode in the Measurement Setup window.

The Trigger Method Setup window is shown in Figure 4-4.



(Figure 4-4 Trigger Method Selection Window)

4.1.2.2 Data Update Rate

The data update rate, i.e. the data update interval, is a settable effective time interval for test data updates.

The data update rate determines the time interval for displaying, communicating, and outputting test results.

The data update rate that can be set is as follows: 0.1s,0.25s,0.5s,1s,2s,10s,20s or automatic

It is recommended to select a faster data update rate when measuring relatively high frequency input signals and a slower data refresh when measuring low frequency input signals.

If Auto is selected, one full cycle of the corresponding synchronization signal of the input signal will be used as the update cycle for one data analysis calculation.

4.1.2.3 Trigger Frequency (Trig Freq)

It is used to set the trigger frequency switch of each channel with the frequency value when it is turned on. (Off by default, generally used for non-sinusoidal irregular waveforms)

4.1.3 Synchronization Source Setting

Since the input signal of each channel consists of the corresponding voltage signal and current signal, a good signal source can be selected as the synchronous signal source for testing according to the actual signal distortion degree, which can improve the testing stability and accuracy of the instrument.

For each channel within a line system combination, the test synchronization signals of each

channel can only be synchronized on the same signal source, generally any input signal within the line system combination can be selected as the test synchronization signal source of this line system combination.

For one-phase two-wire (1P2W) channels, the test synchronization source of the channel can be selected as either the voltage signal synchronization or the current signal synchronization of the channel, and of course, in the case of other channels that have been formed into other wiring modes, the signal source of the wiring combination channel can also be selected as the synchronization source of the independent channel;

4.1.3.1 Functional Description

For all channels, the synchronization setting of each channel can theoretically select any input signal of voltage and current, and the main available options are shown in Table 4-4 below:

Synchronization source	Description
U1, I1	Voltage and current signals for channel 1
U2, I2	Voltage and current signals for channel 2
U3, I3	Voltage and current signals for channel 3
U4, I4	Voltage and current signals for channel 4

Table 4-4 Synchronization Source Optional Description

Note: The available options are directly related to the number of available channels for the machine, for example, for free 3-channel instruments, U4 and I4 are not available because the U4, I4 signal is not present.

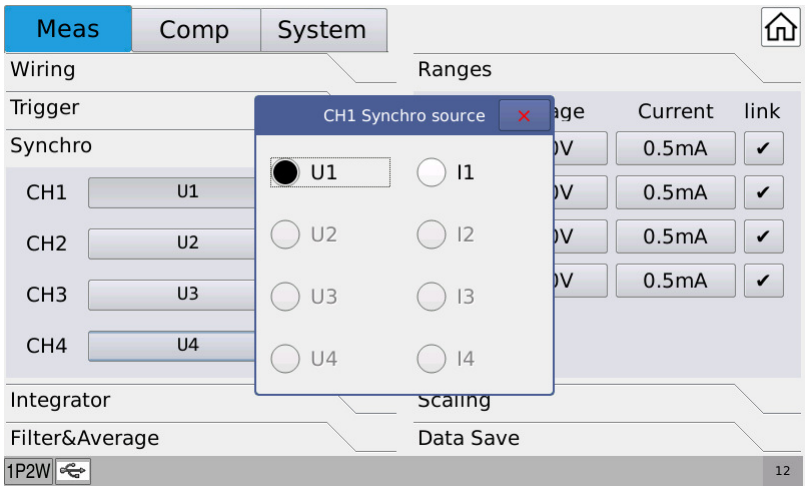
Note: If the system can't find a stable frequency for the synchronization signal, it will treat it as a DC signal test. To get accurate and stable test results for the input signal, you need to choose an appropriate synchronization source signal (i.e., the signal that most closely resembles a sine wave).

4.1.3.2 Setting Method

Press the [Setup] key on the panel, touch to enter the measurement setup page, expand the **Synchronization Setting** tab, the tab displays the settable items will be adjusted according to the wire system selection is not the same, mainly lies in the merger of the same wiring group within the channel synchronization settings, so that each channel within its combination can only be synchronized to the same selectable signals, but for the validity of synchronized signals considerations, it will mask some signals as optional (i.e. visible but not optional);

Note: If the test results show obvious unstable jumps, please check whether the corresponding synchronization source selection is reasonable, and switch to a suitable synchronization source before testing again.

The setup window is shown in Figure 4-5 below:



(Figure 4-5 Synchronization Signal Selection Window)

4.1.3.3 Setting Instructions and Recommendations

For special system testing, which may involve distortion of voltage or current signals and lead to abnormal signal testing, here we provide synchronization channel locking settings, such as testing part of the motor voltage signal will be distorted, while the current signal is relatively in line with the standard sinusoidal waveform, you can lock the synchronization in the current channel; such as testing inverter and other related equipment, the current will be distorted, while the voltage signal is relatively in line with the standard, you can lock the synchronization signal on the corresponding available voltage path. If the current is distorted when testing related equipment such as inverter, and the voltage signal is relatively standard, the synchronization signal can be locked on the corresponding available voltage path.

4.1.4 Integral Setting

It mainly involves setting up the relevant settings for energy integration, including the control mode of integration and the limited integration time.

4.1.4.1 Control Mode

The control mode mainly affects how the points are timed and how they are stopped.
The range of values is shown in Table 4-5 below:

Control mode	Description
Manual control (Manual)	In manual control mode, the integral time setting will be invalid, and there is full manual control of whether the integral starts or stops, and the timing is positive;

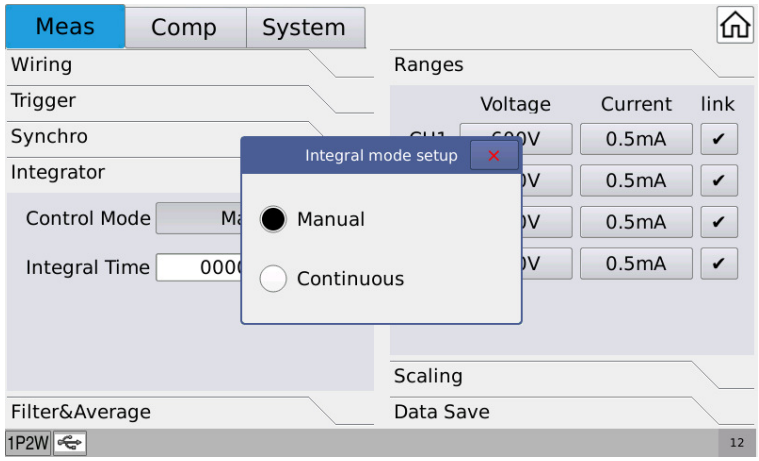
Continuous control (Continuous)	In the continuous control mode, after the integral runs, the timing is counted down according to the size of the set integral time, and the integral stop after the timing is finished;

Table 4-5 Description of Integral Control Mode

Feature Description:

- Manual control means manually pressing the [Run] key to start the energy credit function, while the dialog box position displays the credit timing clock (positive timing) and will not stop until the [Stop] key is manually pressed.
- Continuous control means that the [Run] key is pressed manually to start the energy point function, while the dialog box position displays the point timing clock (countdown), and the stop point function stops only when the set point time is up, or the [Stop] key is pressed.
- You can only press the [Reset] key to reset the integral result to the counting result after the integral control has stopped.

Setting method: Press the [Setup] key on the panel, touch to enter the measurement setting page, expand the Integrator tab, and touch the Control Mode button to display the Integral Control Mode Selection window, as shown in Figure 4-6:



(Figure 4-6 Integral Control Mode Selection Window)

4.1.4.2 Integral Time

When the integral mode is in the continuous control mode, the effective time of the integral is provided for the integral, which is used as the starting value of the countdown timer, and the end of the timer, i.e. the integral stops working.

Value range: 0~9999:59:59

Used to set the countdown time in the energy continuous integral control mode, the factory default setting is the maximum time, i.e. 0000 hours 00 minutes 00 seconds.

Setting method:

Press the [Setup] key on the panel, touch to enter the measurement setup page, expand the Integrator tab, and then double-click on the Integral Time Setup window to bring up the system keyboard, so that you can enter the specific value to be set in the system's numeric keypad.

4.1.5 Filter and Average

The instrument provides two internal filter settings, line filter and frequency filter.

4.1.5.1 Line Filter

An optional 500Hz filter is provided on the voltage and current sampling circuits and is turned off by default.

Turning on this filter effectively filters out high frequency signal components.

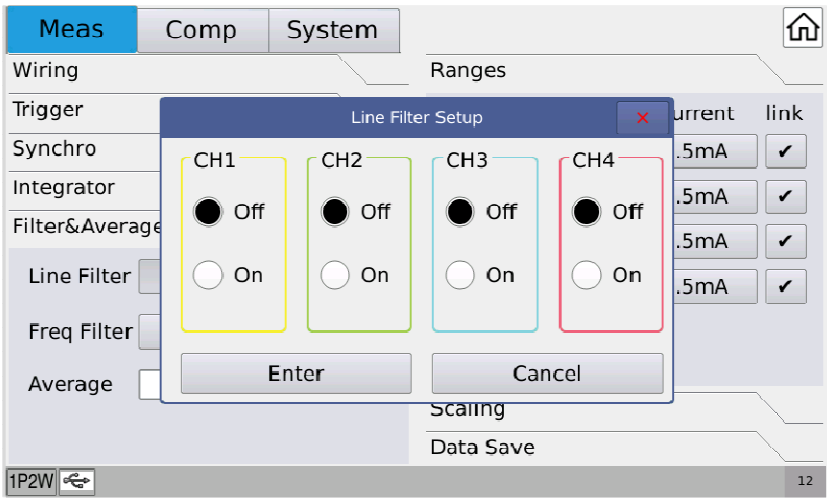
Setting method:

Press the [Setup] key on the panel, touch to enter the measurement setup page,

Expand the Filter & Average tab and touch the Line Filter button to display the Line Filtering selection window.

As shown in Figure 4-7:

Description of display meaning: "Off - Off - Off - On" indicates the switching status of the line filter function of the current 4 channels in turn.



(Figure 4-7 Line Filter Selection Screen)

4.1.5.2 Frequency Filter

The frequency filter setting is used for frequency testing only and turning it on or off will not affect the test results for voltage, current, harmonics, and other parameters.

For each channel, provide an independent frequency test optional 500Hz filter, in the input signal frequency is lower than 500Hz signal, in order to make the frequency measurement of the signal purer, you can consider the corresponding frequency filter open, the default setting is off.

Setting method:

Press the [Setup] key on the panel, touch to enter the measurement setup page, expand the Filter & Average tab, and touch the Frequency Filter button to display the Frequency Filter selection window.

As shown in Figure 4-8:

Description of display meaning: "Off - Off - Off - On" indicates the current switching status of the frequency filter function of the 4 channels in turn.

4.1.5.3 Average Number of Times

It is used to set the number of averages needed for sampling, i.e., sampling N times and then counting the averages as the result of one display.

Value range: 1~32.

The factory default setting is 1.

Setting method:

Press the [Setup] key on the panel, touch to enter the measurement setup page, expand the Filteri & Average tab, and then double-click Average setup window to bring up the system keyboard, so that you can enter the specific values to be set in the system's numeric keypad.

4.1.6 Test Range

Auto range and fixed range can be set for each channel.

Factory default setting:

Voltage at maximum voltage range (600V).

The current is in the maximum current range (20A/2A), corresponding to the instrument model.

Press the [Setup] key on the panel, touch to enter the measurement setup page, expand the **range setting** tab, expand the range settings tab as shown in Figure 4-1 right, and then touch and click the corresponding settings, you can pop up the corresponding channel voltage or current settings window touch and click to complete the corresponding selection.

Voltage range is used for voltage test range use.

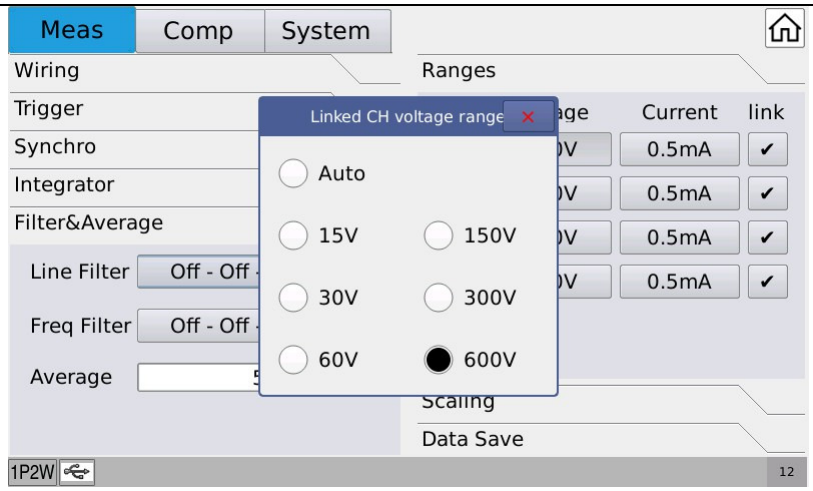
The current range is used for range use for current testing.

Power range is used to test active power, apparent power, reactive power test calculations, power range depends on the line system mode, voltage range, current range, and the detailed relationship is shown in the following table:

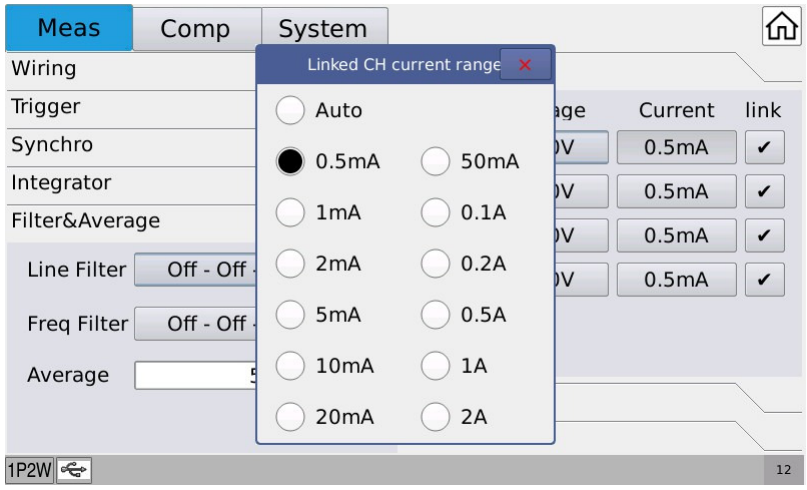
Wire mode	Power range
1P2W (one-phase, two-wire)	Voltage range * Current range
1P3W (one-phase three-wire) 3P3W (three-phase three-wire) 3V3A (triple voltage, triple current)	Voltage range * Current range* 2
3P4W (three-phase four-wire)	Voltage range * Current range* 3

The Voltage Settings window is shown in Figure 4-8.

The Current Settings window is shown in Figure 4-9:



(Figure 4-8 Voltage Range Selection Window)



(Figure 4-9 Current Range Selection Window)

Link option: when adjusting the voltage or current range of the checked channel, adjusting one of the channels, the values of all the selected channels will be adjusted to the same range option.

4.1.6.1 Fixed Range

That is, the set range is kept fixed.

The voltage range distribution is detailed in the table below:

SME134X series voltage range:						
Range number	0	1	2	3	4	5
Range size	15V	30V	60V	150V	300V	600V

The current range distribution is detailed in the table below:

range / number model number	0	1	2	3	4	5	6	7	8	9	10	11
SME134X(2A)	0.5 mA	1 mA	2 mA	5 mA	10 mA	20 mA	50 mA	100 mA	200 mA	500 mA	1A	2A

TH344x (20A)	5 mA	10 mA	20 mA	50 mA	100 mA	200 mA	500 mA	1A	2A	5A	10A	20A

Note: If you are measuring at a fixed range, be sure to pick the right range, otherwise the measurement accuracy and precision will be affected.

4.1.6.2 Auto Range

That is, according to the size of the input signal automatically do range switching, switchable range that is fixed two into the optional range listed.

Automatic range increase: The range is automatically increased when any of the following conditions are met:

Urms or Irms exceed 110% of the current range.

Upk or Ipk exceeds 160% of the current range.

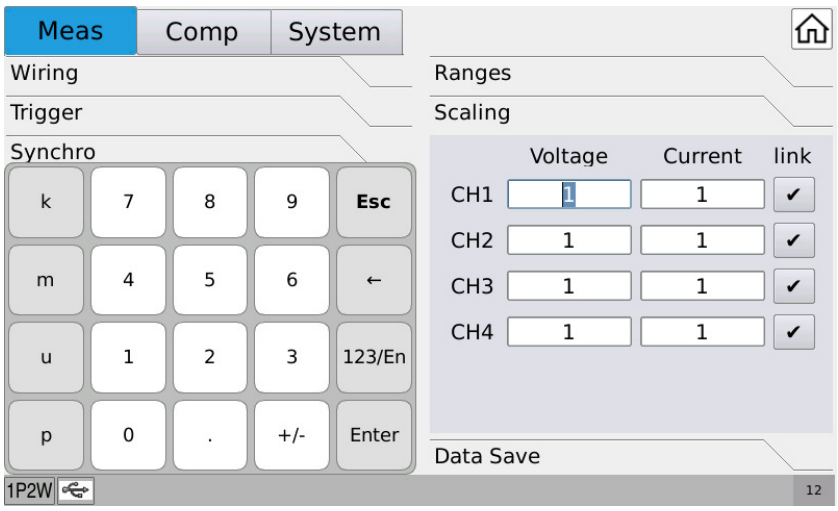
Automatic range reduction: The range is automatically reduced when all of the following conditions are met:

Urms or Irms is less than or equal to 90% of the next level of range.

Upk or Ipk is less than or equal to 160% of the range of the next level.

4.1.7 Scale Ratio

The settings are displayed as shown in Figure 4-10:



(Figure 4-10 Zoom Scale Setting Display)

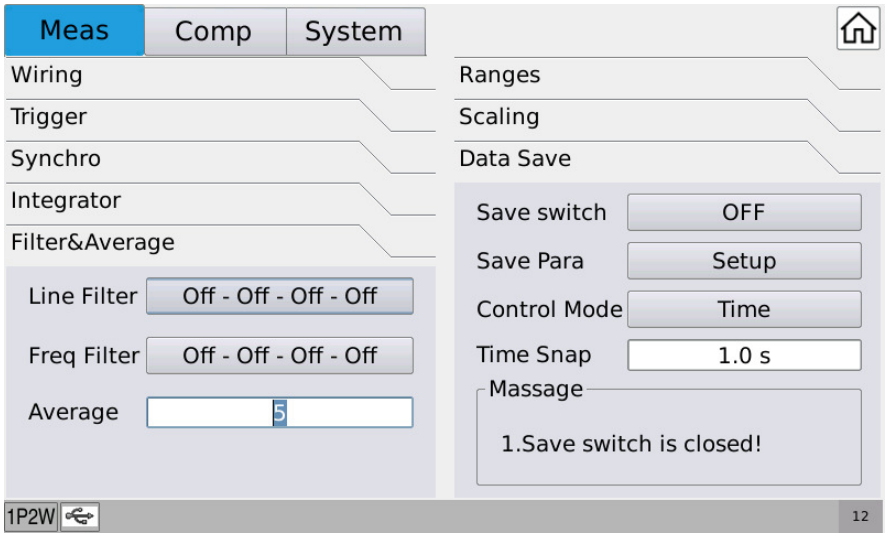
Adjust the scaling of the measurement result value on the display screen according to the scaling of the external circuit. link is the same as 4.1.6 link.

4.1.8 Data Saving Settings

It is used to set the relevant functions for test data saving, and the main parameters involved are as shown in the figure, i.e.

Settings item	Values and Descriptions
Save switch	Open ----is currently open. Close---- is currently closed. This setting is not saved after powering off the computer, and it is all off by default when powering on the computer;
Save parameters	After touching it, the parameter selection dialog box pops up, and you can tap the desired parameter to save it to the USB flash drive;
Control mode	Time-----controls the recording of data in time intervals. Times ----controls the recording of data with times prices;
Frequency interval	When the control mode is frequency control, according to the setting value here, it is decided to record the data once after every test, and the value range is 1~999 times;
Time interval	When the control mode is time control, according to the setting value here, it will decide how much time to record the data after every time, the value range is 0.2s~60.0s;
Parameter saving related settings	

The display settings are shown in Figure 4-11.



(Figure 4-11 Data Saving Off Status Display)

Setup method: Press the [Setup] key on the panel, touch to enter the measurement setup page, expand the data saving tab, and touch the corresponding button of the saving switch to toggle the switch operation of data saving, as shown in Figure 4-11:

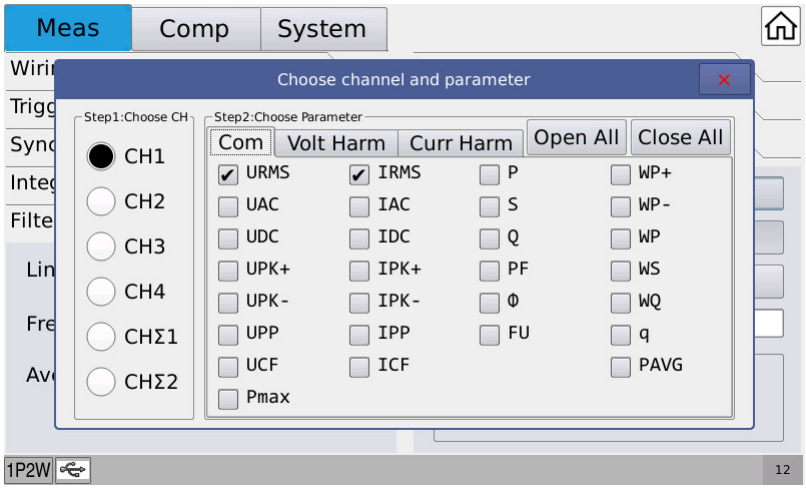
For most of the data that can be tested by the instrument, you can independently choose whether you want to save them to a USB flash drive, by touching the corresponding buttons behind the saving parameters, you can open the corresponding settings selection dialog box, as shown in Figure 4-11-a.

Note: If the setting needs to save more data or save the duration of a relatively long time, it may involve a larger file to save the data, so the instrument will be a certain size of the file to save the data is split into multiple files to record, in addition, open the data to save the function will inevitably affect the speed of the test more or less, please select the specific parameters to be saved in accordance with the needs;

When the corresponding state of the save switch is on, the test data starts to perform the save operation.

If you don't need to save the data, you need to go to this window to change the state of the saving switch to off, and the file name of the data saved is named in the format of "DATAx.csv", x is the file number added to avoid renaming.

Note: The default save path is the root directory of the external USB flash drive, i.e., if there is no USB flash drive plugged in, the file save operation cannot be performed.

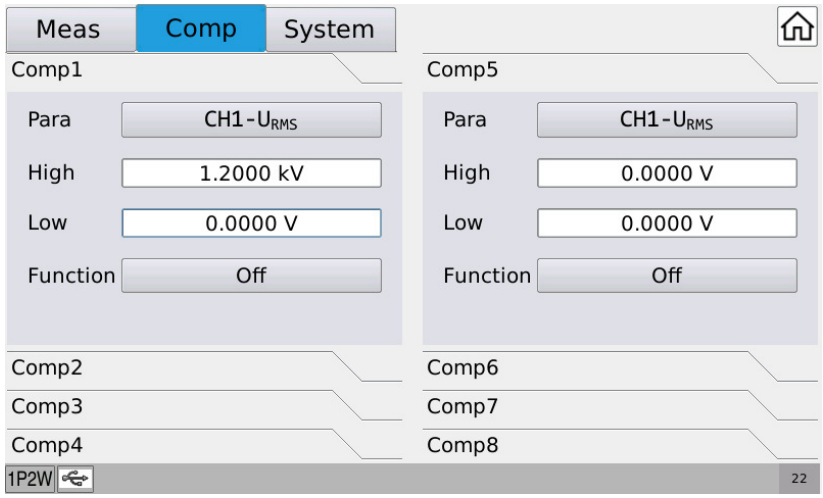


(Figure 4-11-a Save Parameter Settings dialog box display)

Note: Due to the data logging of the independent switch state involves more data items, so the related state written into the storage memory file will be written uniformly after this dialog box is closed, this is done to avoid the state of each parameter modification to be written once, to improve the service life of the memory, so in the exit of the dialog box due to the need to perform this data memory, it will be nearly several hundred milliseconds of stuttering feeling.

4.2 Comparison Settings

Press the [Setup] key on the panel and touch to enter the Comparison Setup page, as shown in Figure 4-12



(Figure 4-12 Comparison Settings Page)

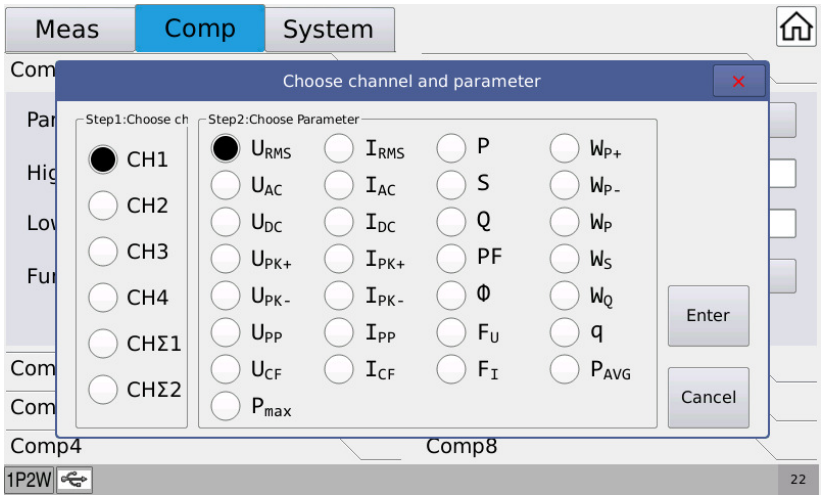
As shown in the above figure, the Comparison Settings page mainly involves the settings related to the comparison parameters of the 8 comparison channels, each comparison channel mainly includes the comparison parameters of the comparison channel, the high limit of the parameter comparison, the low limit of the parameter comparison and the selection of the comparison function.

Additionally, the acoustic output of the comparison results is integrated into the system setup page; see Chapter 6 System Setup section Comparison Acoustics for a Description of the section.

The 8 comparison channels correspond to the 8 outputs of the Handler board on the rear panel, and the function selection of the comparison parameters corresponds to the realization of its programmable outputs, which are described in detail in the Handler chapter later.

4.2.1 Comparison Parameter Selection

Press the [Setup] key on the panel, touch to enter the Comparison Setup page, expand the comparison channel paging card that needs to be set, and click the button behind the parameter to pop up the corresponding parameter selection window, as shown in Figure 4-13:



(Figure 4-13 Comparison Parameter Selection Screen)

Comparison parameter setting main parameter belongs to the channel selection as well as specific parameter selection within the specified channel; the optional parameters are shown in the figure above.

After selecting the specified channel and the parameters in the channel respectively, press the confirmation button in the window to complete the corresponding settings.

SME134X series instruments provide more comparison options, the user can freely select the required parameters to participate in the comparison and control the external output.

4.2.2 Compare High/Low Limits

It mainly provides a comparison condition for the comparison of comparison parameters, and the test results within the high and low limits are regarded as qualified, otherwise they are regarded as unqualified.

The factory default settings are all 0.

Setting method:

Press the [Setup] key on the panel, touch to enter the comparison setting page, expand the comparison channel paging card that needs to be set, double-click the input box behind the upper limit or lower limit to pop up the system keyboard, you can enter the specific value to be set in the system's numeric keypad.

Note: There are some basic setup requirements when setting upper and lower limits, considering that the setup values have usable values:

- The value of the low limit must not be greater than the value of the high limit.
- If the value of the low limit is greater than the value of the high limit, the system will automatically exchange the values of the high and low limits after the input is completed to ensure the validity of comparing the limits.

4.2.3 Comparison Function

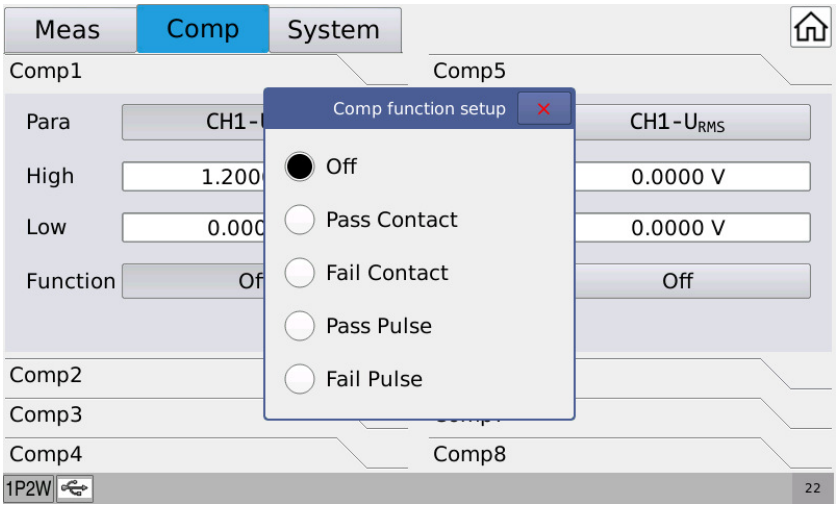
The comparison function mainly involves the output function of the Handler port corresponding to the comparison result at the back, and the optional functions are shown in Table 4-6 below:

Comparison function	Description
OFF	The comparison function of the current comparison channel is turned off, i.e., it does not participate in the comparison
Pass Contact	When the comparison result of the current comparison channel is qualified, the two output pins of the corresponding Handler port are controlled to be on.
Fail Contact	When the comparison result of the current comparison channel is not qualified, the two output pins of the corresponding Handler port are controlled to be in the on state.
Pass Pulse	When the comparison result of the current comparison channel is qualified, control the two output pins of the corresponding Handler port to conduct for 5ms and then disconnect, and the default is in the disconnected state.
Fail Pulse	When the comparison result of the current comparison channel is unqualified, control the two output pins of the corresponding Handler port to disconnect for 5ms and then turn on again, and the default is in the ON state.

Table 4-6 Handler Output Programming Description for Compare Function

Setting method:

Press the [Setup] key on the panel, touch to enter the Comparison Setup page, expand the comparison channel paging card that needs to be set, and click the button behind the function to pop up the corresponding parameter selection window, as shown in Figure 4-14:



(Figure 4-14 Compare Function Selection Screen)

4.2.4 Handler Interface Description

4.2.4.1 Circuit Principle

The Handler output post circuit uses relay isolated outputs, the principle of which is shown in Figure 4-15 below:

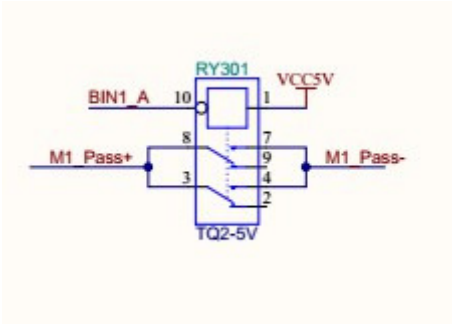


Figure 4-15 Handler Input Port Schematic Diagram

Comparison results control the action state of the relay coil, the two ends of the relay switch that corresponds to a pair of outputs of the rear panel Handler, this design not only plays a role in signal isolation, but also greatly increases the flexibility and diversity of the user, the user only needs to connect a simple external pull-up resistor or pull-down resistor, you can become a level signal or edge signal.

4.2.4.2 Port Definition

The rear panel of the SME134X series power meter provides users with a 25-pin D_type terminal for each external contact signaling and external switch interface, which is mainly used for the output of the instrument comparison results. The pin definition is as follows Table 4-7 shows:

Pin	Definition	Pin	Definition	Pin	Definition	Pin	Definition	Pin	Definition
1	+5V	6	M7-	11	M5-	16	M3+	21	M8-
2	M4+	7	M2+	12	M6+	17	/EXT.TRIG	22	M1-
3	reserve	8	M8+	13	+5V	18	M7+	23	M5+
4	M3-	9	M1+	14	EXTV	19	NULL	24	GND
5	GND	10	GND	15	M4-	20	M2-	25	M6-

(Table 4-7 Handler Pin Definitions)

4.2.4.3 Description of the specific meaning of the port

- +5V: Internal power supply, +5V.
- GND: Internal power supply, ground.
- EXTV: External power supply, if you don't use the internal power supply of the instrument but use the external power supply, you need to dismantle the case and change one of the jump caps on the Handler board to the other side, the voltage input range is +5V~+30V.

  Note: The external power supply does not have an external GND. When an external

power supply is selected, the high side of the external power supply and /EXT.TRIG form a loop to provide a trigger signal to the instrument.

- /TRIG: External trigger pin, edge trigger, default is high, falling edge trigger is valid, use this function to change the trigger mode to "external trigger (EXT)" mode in the measurement setting.
- Mx+ and Mx-: corresponding to the control output pin by the Handler port, is the Relay single gate output of the two contacts, when comparing the results of the control Relay on, the Relay output will be shorted, that is, Mx+ and Mx- on, the factory Relay specifications: 30VDC/2A MAX; the factory Relay specifications: 30VDC/2A MAX; the factory Relay specifications: 30VDC/2A MAX; the factory Relay output will be shorted, that is, Mx+ and Mx- on.
- Reserve: is the system reserve pin.
- NULL: Empty pin.

4.2.4.4 Handler Timing Sketch

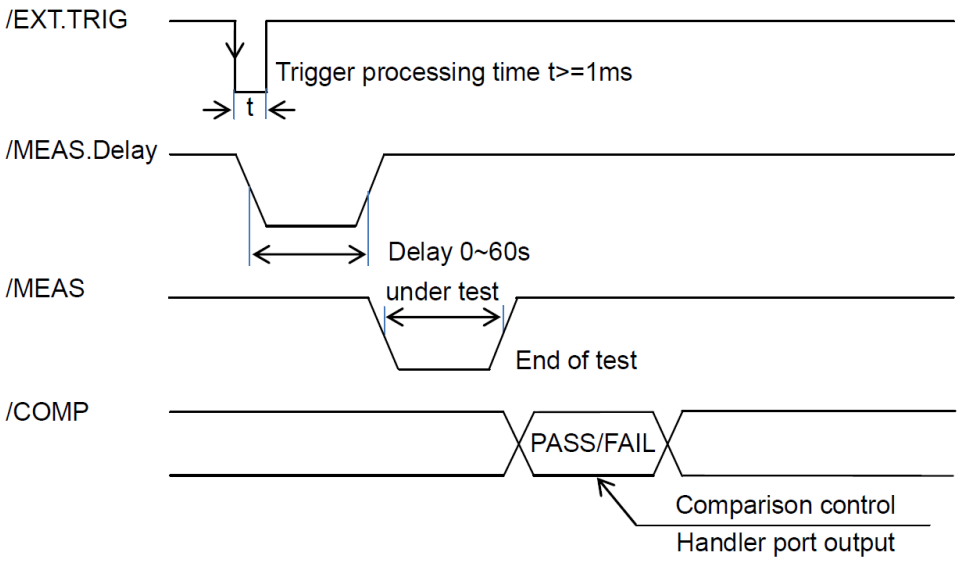


Figure 4-16 Handler Timing Diagram

Handler Timing Description:

- The external trigger pin only accepts falling edge triggering.
- The delay time after triggering is the user-settable trigger delay interval, which can be set from 0.000s to 60s.
- Start executing a test after the trigger delay is over, and get the relevant data of a test
- The comparison output has 8 channels available; each of the 8 channels has an independent output control condition i.e. the comparison result of the 8 comparison channels.

4.3 Harmonic Settings

Harmonic-related parameters are mainly related to the following aspects, as shown in Table 4-8:

Harmonic setting items	Description
Display form	For the form of displaying the harmonic results, you can choose between a list and a bar graph;
Data model	The format of the data content in the list displays, optionally % (percentage), Δ (absolute value);
Calculation criteria	Calculation standard for harmonic analysis results, optionally IEC, CSA;
Parameter selection	Multiple options are available for the specific signal parameters to be analyzed;
Table 4-8 Harmonics-related Parameters	

Note: Due to the relatively small number of harmonic related parameters, it is not enough to open a single harmonic setting page, so the related parameter settings can be found at harmonic test page , and the related parameters can be set directly in the harmonic test page.

4.3.1 Display Form

Used to set the display form of the harmonic analysis result display, the factory default setting is List display.

The optional functions are shown in Table 4-8 below:

Harmonic display form options	Description
List	The layout of the list display is related to the number of parameters selected, and the data displayed in the list is available in percentage mode and absolute value mode, depending on the data mode option;
Bar graph	The bar graphs show data sources that are all harmonically analyzed percentile value sizes, and the layout is adjusted depending on the number of parameters being selected;
Table 4-8 Description of Harmonic Display Forms	

Setting method:

Press the [Disp] key on the panel, touch to enter the Harmonics page, the display form option is visible on the right side of the display, touch to single select it.

4.3.2 Data Model

Used to set the data display format in the form of list display, the factory default setting is % (percentage mode).

The optional functions are shown in Table 4-9 below:

Harmonic data mode options	Description
% (percentage)	The calculation of the numerical results in % mode depends on the results of setting the calculation criteria, i.e. the results of the data in % mode will vary depending on the calculation criteria.
Δ (absolute)	

Table 4-9 Harmonic Data Pattern Description

Setting method:

Press the [Disp] key on the panel, touch to enter the harmonic page , the data mode option is visible on the right side of the display, touch to single select it.

4.3.3 Calculation Criteria

Used to provide different calculation criteria for total harmonics calculations and percentage harmonics numerical results calculations, factory default setting is IEC.

The optional functions are shown in Table 4-10 below:

Harmonic calculation standard option	Description
IEC	For detailed calculations and formulas, see Calculation formulas for fundamentals .
CSA	

Table 4-10 Description of Harmonic Calculation Criteria

Setting method:

Press the [Disp] key on the panel and touch to enter the Harmonics page, the Calculation Standard option is visible on the right side of the display, touch to single select it.

4.3.4 Parameter Selection

Used to set the channel and object targeted by harmonic analysis, the factory default setting is the voltage of channel 1 (U1).

The optional parameters are shown in Table 4-11 below:

Harmonic analysis parameter options	Description

U1, I1	Channel 1 voltage, current
U2, I2	Channel 2 voltage, current
U3, I3	Channel 3 voltage, current
U4, I4	Channel 4 voltage, current

Table 4-10 Description of Harmonic Analysis Parameters

Setting method:

Press the [Disp] key on the panel, touch to enter the harmonics page, the parameter selection options are visible on the right side of the display, touch to select it (multi-selectable).

4.4 Waveform Settings

The waveform-related parameters are mainly related to the following aspects, as shown in Table 4-11:

Waveform setup items	Description
Waveform type	Selectable voltage & current waveforms or power waveforms
Waveform parameter	Different options are available depending on the waveform type

Table 4-11 Harmonics-related Parameters

Note: Due to the relatively small number of waveform-related parameters, it is not enough to open a single waveform setting page, so the related parameter settings can be found at Waveform test page , and the related parameters can be set directly in the waveform test page.

4.4.1 Waveform Type

Used to set the type of parameter for waveform display, the factory default setting is Voltage Current (U&I).

The optional functions are shown in Table 4-12 below:

Waveform type options	Description
U&I	It indicates that the data source for waveform plotting is the voltage or current of each channel;
POWER	It indicates that the data source for waveform plotting is the power of each channel;

Table 4-12 Description of Waveform Types

Setting method:

Press the [Disp] key on the panel, touch to enter the waveform page, the waveform type option is visible on the right side of the display, touch to single select it.

4.4.2 Waveform Parameter

The optional parameters for the U&I waveform are shown in Table 4-13 below:

Waveform type	Optional parameters	Meaning
U&I waveforms	U1, I1	Voltage and current corresponding to channel 1
	U2, I2	Voltage and current corresponding to channel 2
	U3, I3	Voltage and current corresponding to channel 3
	U4, I4	Voltage and current corresponding to channel 4
Power waveform	P1, P2, P3, P4	Corresponding to the power of each channel

Table 4-13 Explanation of the Meanings of Optional Parameters for Waveforms

4.5 System Settings

See Chapter 6 System Setup section for details.

Chapter 5 Measurement Display and Description

This section describes the functional introduction of each display page of the test function.

Access to the test page is as follows:

Step1: If you are not in the test function page, press the [DISP] key to enter the test related page.

The measurement display pages are categorized as shown in Table 5-1 below:

Measurement display page classification	Description
Test	Mainly concerned with conventional measurement displays
Comparisons	Display of the status of results mainly related to parameter comparisons
Harmonic	Mainly concerned with the display of harmonic test results and related parameter settings
Waveform	Mainly concerned with the graphical display of waveform testing and related parameter settings
Vector graphics	Mainly suitable for vector diagram display of three-phase test systems

Table 5-1 Measurement Display Page Descriptions

Step2: According to the content of the paging title display, touch to select the corresponding page to enter different test pages.

5.1 Test Display Page

The Measurement Display screen is categorized by display effects, and the display contents can be set as described in Table 5-2 below:

Measurement display page classification	Description
Balanced display for each channel	All channels are equalized, and each channel displays 4 selectable parameters.
Specify the channel to highlight	Highlight the full-parameter test results of the specified channel, and other channels are displayed in a reduced size on the right side (only the RMS values of voltage and current are displayed).

Wire combination test display	Highlight the test results within a wire system combination and zoom in on the right to show all channels within the corresponding combination (only voltage and current RMS values are shown);

Table 5-2 Measurement Page Display Effect Classification Description

Switching mode:

Press the channel buttons at the bottom of the display to switch, and the power-on default is in the effect of balanced display of each channel.

Pressing [CH1] ~ [CH4] buttons, that is, the corresponding channel is specified to be highlighted, and the corresponding button light is on.

Press the [CHΣ] button, that is, select the line system combination measurement display, corresponding to the [CHΣ] button lights.

If the corresponding key lamp of [CH1] ~ [CHΣ] is lit, pressing the corresponding key again will return to the effect of balanced display of each channel.

Note: This display effect setting button will only respond if pressed from the measurement display page.

5.1.1 Balanced Display for Each Channel

The default display page after power on, due to the different number of channels involved, the layout of the balanced display of each channel is different, i.e., 1-channel using the main parameters and the full parameter display at the same time, as shown in Figure 5-1; 3-channel display using the "Chuan" distribution, as shown in Figure 5-2; 4-channel display using the "field" distribution, as shown in Figure 5-3; 4-channel display using the "field" distribution. field" distribution, as shown in Figure 5-3.

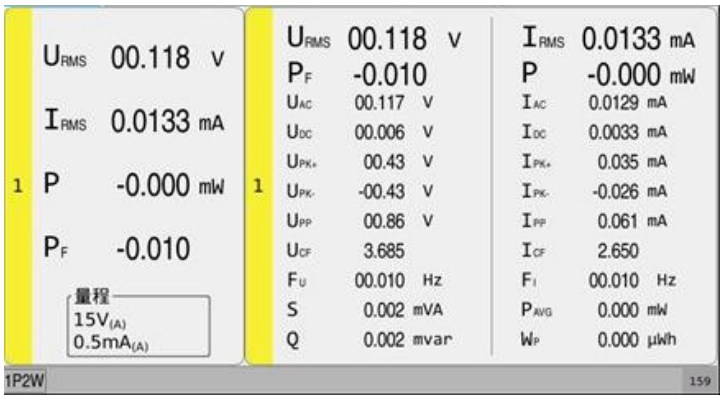


Figure 5-1 1-channel instrument display page effect

Figure 5-2 3-channel instrument equalization display page effect

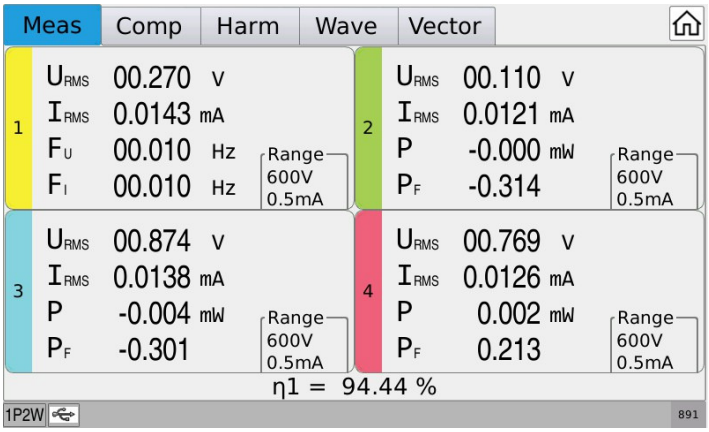


Figure 5-3 4-channel instrument equalization display page effect

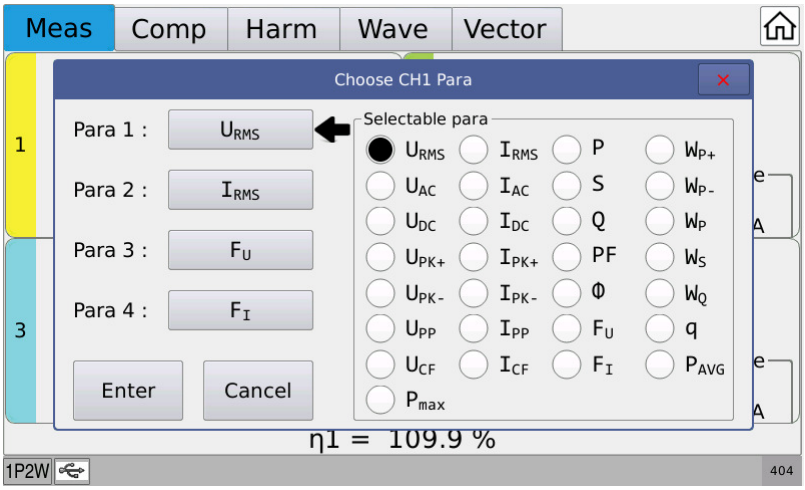
As shown above, the individual channel displays are described below:

The corner marker in the upper left corner indicates the channel number to which the current channel belongs.

The parameters displayed in the channel are the 4 common parameters displayed in the current channel test, and these 4 common parameters can be replaced by any settings, i.e., the setting methods for modifying the common parameters of the channel test are as follows:

Double-click any position in the corresponding area of the channel, the parameter selection window of the corresponding channel will be popped up, as shown in Figure 5-4, the title indicates the current setup of the channel, the four parameter buttons on the left side of the window corresponds to the four commonly used parameter setting buttons of the current channel, and the radio buttons on the right side correspond to the parameter selectable items;

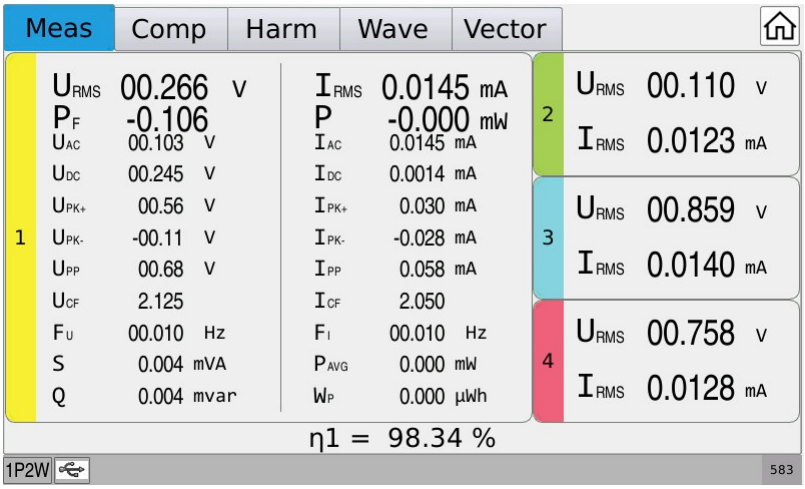
Click on the left side of the four parameters that need to modify the button, in the right side of the radio box to select the parameters to be needed, and finally click on the left side of the bottom of the confirmation button to complete the replacement of commonly used parameters.



(Figure 5-4 Channel common display parameter setting screen)

5.1.2 Specify the Channel to Highlight

The purpose of highlighting the specified channel is to enlarge the display window of the specified channel and reduce the display window of other channels, which is used to display more test parameter results in the window of the specified enlarged channel, and at the same time, you can also see the current basic test status of other channels in the small window on the right side, as shown in Figure 5-5:



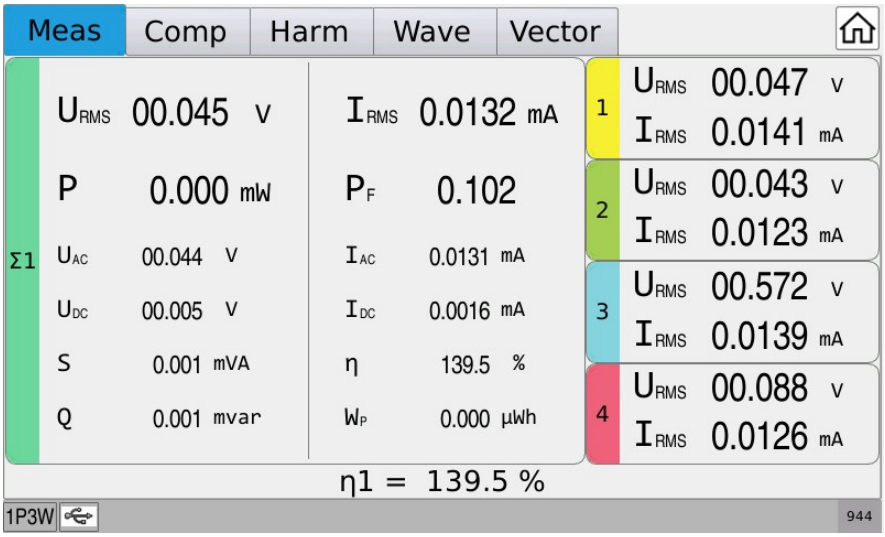
(Figure 5-5 Specifying channel 1 to highlight effects)

5.1.3 Wire Combination Test Display

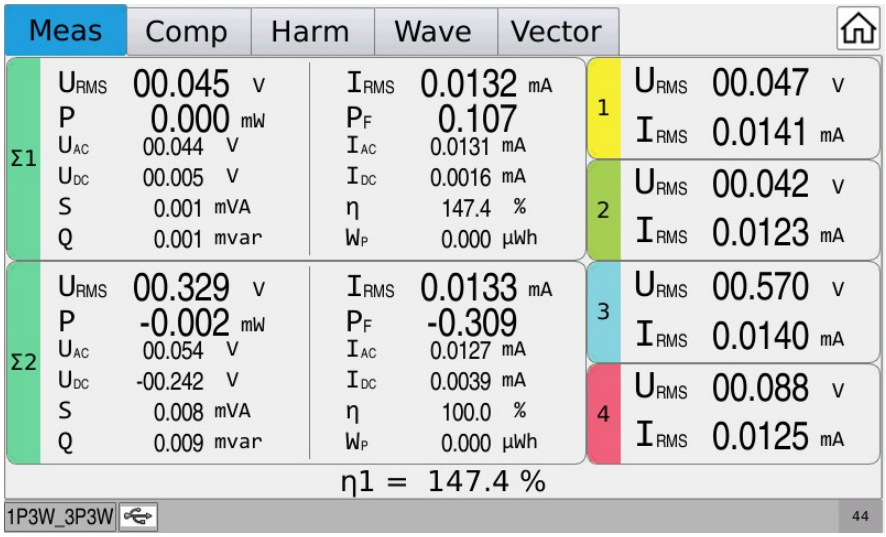
Among the optional line system combinations, although 1P2W is one of the line system optional, 1P2W does not do any line system operation, because 1P2W is using all channels as independent test channels, and there is no combination effect between channels, so in the case of 1P2W, there is no line system combination test display.

In the case of other wire system combinations, you can view the test results of relevant

parameters under the combination of wire systems through this display effect. For 4-channel instruments, due to the provision of two groups of wire system combinations of optional wire system options, when only one group of wire system combinations is selected, the display layout effect is the same as that of 3-channel instruments, as shown in Figure 5-6, if there are two groups of wire system combinations at the same time, the display layout of this page will be adjusted to display the test results of two groups of wire systems at the same time, as shown in Figure 5-7. If there are 2 groups of wire system combinations at the same time, the display layout of this page will be adjusted to display the test results of 2 groups of wire systems at the same time, as shown in Figure 5-7:



(Fig. 5-6 Display effect of only 1 group of wire system combinations)

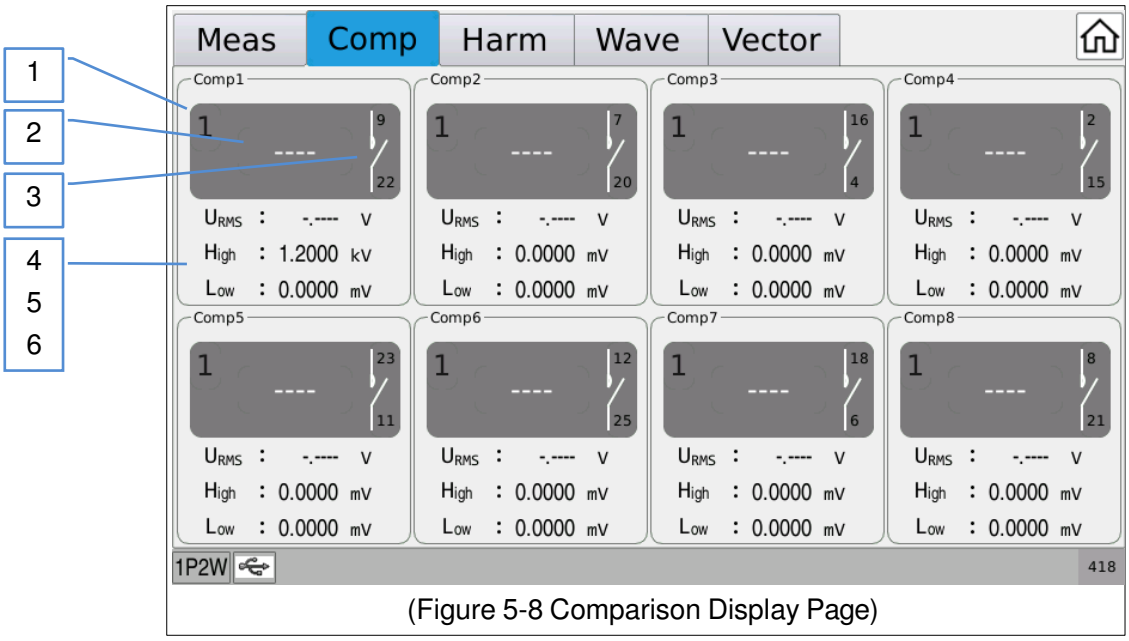


(Fig. 5-7 Display effect with 2 sets of wire system combinations at the same time)

Note: The corresponding small channel display on the right side of the display has a certain correspondence with the display on the left side, i.e., it indicates the channels used to compose the current front system.

5.2 Compare Display Interface

Press the [Disp] key on the panel and touch the paging title above the display to enter the comparison page, as shown in Figure 5-8



(Figure 5-8 Comparison Display Page)

The whole of the comparison page is neatly divided into 8 comparison windows for display according to the number of output channels to be compared, i.e., Comp1~Comp8, and the meanings of the individual components in the separate comparison windows are described as shown in Table 5-3 below:

1	Channel number	Indicates the channel to which the currently compared parameter belongs
2	Comparative results	PASS/FAIL----indicates that the result status of the comparison is Pass, Fail, or Not Compared
3	Relay symbols	Indicates the relay switching status of the output port corresponding to the current comparison channel
4	Comparison parameters	Indicates current comparison parameters and test results
5	High	Indicates the size of the upper limit setting for the current comparison parameter
6	Low	Indicates the size of the lower limit setting for the current comparison parameter

Table 5-3 Comparison Window Meaning Explanation

5.2.1 Compare Output Description

Explanation of pass/fail determination for comparison results:

- One or more of the comparison results of the parameters involved in the comparison fails, i.e., the overall comparison result fails, and the panel's red FAIL lamp lights.
- The comparison results in the parameters involved in the comparison are all qualified, i.e., the overall comparison result is qualified, and the green PASS lamp of the panel lights up.

Comparison Results Lighting Output Description:

- When all parameters involved in the comparison are qualified, the green PASS lamp on the panel lights up.
- Neither the PASS lamp nor the FAIL lamp on the panel lights up when no parameters are involved in the comparison.
- The red FAIL lamp on the panel lights when at least one of the parameters involved in the comparison fails.

Comparison result buzzer output Description:

- When all the parameters involved in the comparison are qualified, it is recorded as qualified, and if at least one parameter is unqualified, it is recorded as unqualified, and then according to this qualified and unqualified status together with the results of the setting of the comparative signal under the system setup page, the amount of the state of the control buzzer is obtained.
- Comparison results failed, if at this time the "signaling gear" is "qualified (PASS)", it means that all qualified will have the corresponding signaling output, this time for the unqualified state (buzzer does not ring); if at this time the "signaling gear" is "failed (FAIL)", it means that there is a failure will have the corresponding signaling output, this time for the unqualified state (buzzer does not ring); if at this time If the "sound level" is "failed (FAIL)", it means that there is a failure will have the corresponding sound output, this time for the unqualified state (buzzer sounded);
- The result of the comparison is qualified. If "Buzzer Level" is set to "Pass" at this time, it means that only if all are qualified will there be a corresponding buzzer output, and this is the qualified state (the buzzer sounds once); if "Buzzer Level" is set to "Fail" at this time, it means that only if there is a failure will there be a corresponding buzzer output, and this is the qualified state (the buzzer does not sound).

Note: If "OFF" is selected for the "Audible Mode", there will be no output response from the buzzer.

5.3 Harmonic Display Page

Press the [Disp] key on the panel and touch the paging title on the top of the display to enter the Harmonics page. The layout of the Harmonics display page is divided into left and right parts, with the harmonic result display area on the left and the harmonic-related parameter setting area on the right.

The harmonic results display area has 2 types of display forms, i.e. list display and bar graph display, and the factory default setting is list display.

The settings and Descriptions of the relevant parameters in the Harmonic Parameter Settings area are detailed in the Harmonic Settings section of Chapter 4.

Harmonic analysis function introduction: using a phase-locked loop circuit synchronized with the fundamental frequency, mainly analyzing the harmonic distortion condition of the voltage or current of industrial frequency signals (i.e., 50/60Hz), providing two commonly used standards for harmonic distortion calculation, i.e., IEC and CSA; the maximum number of analyses is up to the 50th harmonic. The maximum number of valid harmonics analyzed for high frequency signals decreases relatively.

5.3.1 Harmonic List Display

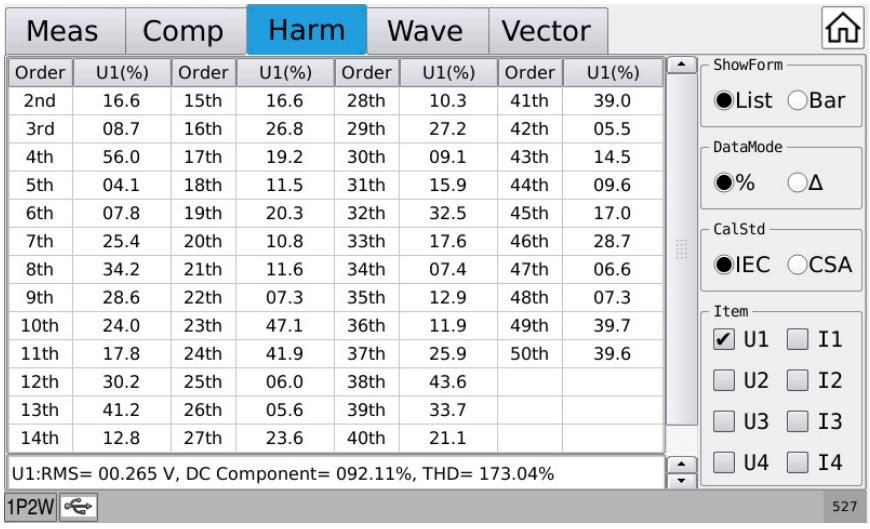


Figure 5-9 Harmonics list display effect

As shown in Figure 5-9, the harmonic list display effect, the left result display area is displayed in the form of a table, listing the 50th harmonic analysis results of the corresponding parameter, and the bottom row of the list cell displays the specified parameter corresponding to a specific result (including RMS value, DC component, total harmonic magnitude, etc.), and here the specific result belongs to the parameter designation mode:

After touching the list display area, the touch points recognized by the system correspond to the parameters of the list title.

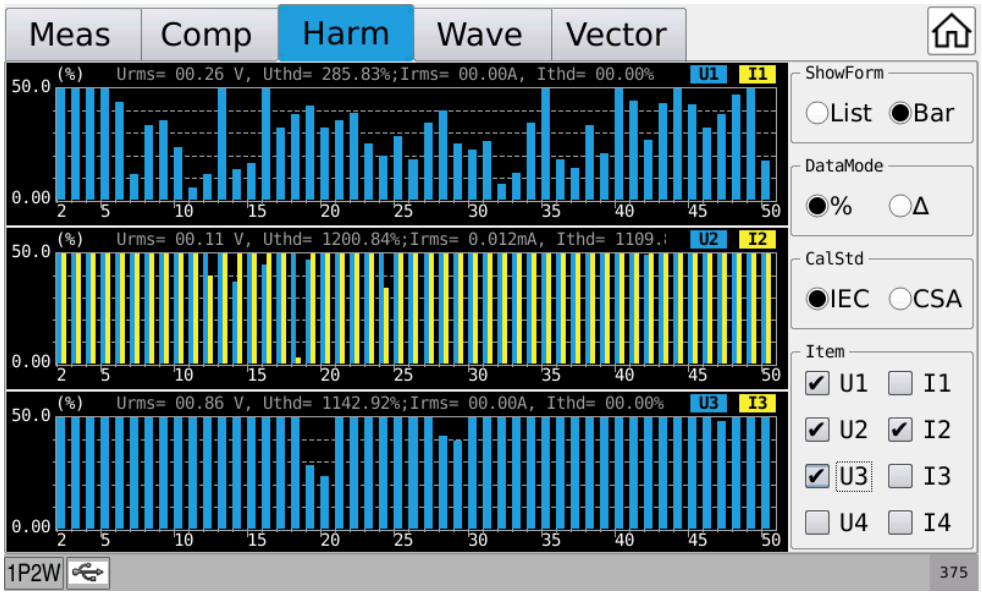
If the touch point is within the U1 area of the list, it indicates a need to look at a specific result for U1.

If the touch point is within the I1 area of the list, it indicates a need to look at a specific result for I1.

Also, if the data mode is a % (percentage) mode, the results displayed in the list will vary a bit depending on the calibration of the calculation.

The number of parameter selections varies, and the disaggregation of the list will be adjusted.

5.3.2 Harmonic Bar Graph Display



(Figure 5-10 Harmonic bar graph display effect)

As shown in Figure 5-10, the harmonic bar display effect, the left result display area is used for the bar graph display drawn according to the harmonic analysis of the size of the percentage of each harmonic, the horizontal coordinate is the number of enumerated harmonics, the range of values is 2~50, the vertical coordinate is the corresponding percentage size of each harmonic, the bar graph above the display of the voltage, the RMS value of the current and the size of the total harmonics of the specific test results;

The bar graph display effect supports zoom operation, i.e. single-touch bar graph area can be boxed.

The layout of the bar chart display is related to the number of parameters selected for analysis, i.e., appropriate layout adjustments are made based on the number of parameters that have been selected.

Voltage and current harmonic analysis bar graphs for the same channel will be displayed in the same coordinate system, differentiated by color, as shown in the upper right corner of the bar graph coordinates.

The parameter bar graphs for different channels will be displayed in different coordinate windows.

5.4 Waveform Display Page

Press the [Disp] key on the panel and touch the paging title on the top of the display to enter the waveform page. The layout of the waveform display page is divided into left and right parts, with the waveform plotting display area on the left and the waveform-related parameter setting area on the right.

Waveforms are categorized by waveform type as shown in Table 5-4 below:

Waveform Type	Description
U&I (Voltage & Current Waveforms)	Displays the input voltage and current waveforms with multiple selections of U1, I1, U2, I2, U3, I3, U4, I4;
Power (Power Waveform)	Display the power waveform with multiple selections of P1, P2, P3 and P4. Note: Points function is valid after running.

Table 5-4 Description of Waveform Parameter Classification

Note: The waveform display only provides the user with a basic source data information, and the waveform display details cannot be compared with those of an oscilloscope, so it is hereby declared.

5.4.1 U&I Waveforms

The U&I waveform (voltage & current waveform) is displayed as shown in Figure 5-12:

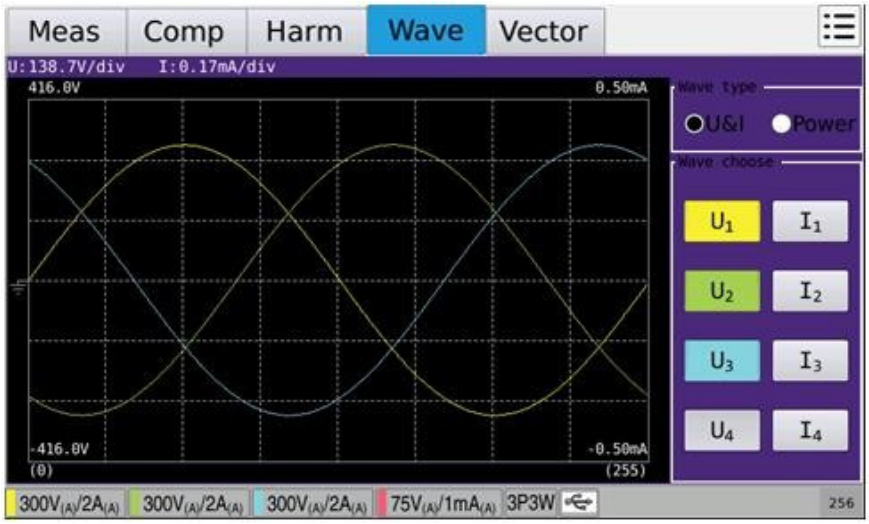


Figure 5-11 U&I waveform display effect

The optional waveform parameters on the right side are U1, I1, U2, I2, U3, I3, U4, I4; the selection method that is, touch to select can be selected, and the color of the selected button corresponds to the display color of the waveform.

The status above the waveform display indicates the resolution of the axis, i.e., the size of the value corresponding to each frame.

5.4.1.1 Waveform Display Description

- The waveform displays the results relative to the input curve of the response signal to aid in analytical use.
- Waveforms can be displayed with data sources of voltage or current of each channel, i.e. (U1, I1, U2, I2, U3, I3, U4, I4), which can be multi-selected.

  Special Note: The more data sources selected for waveform scanning; the refresh speed will be affected to a different degree.
- Multiple waveforms are designed to be displayed in a coordinate system, with the left side designated as the Y-axis and the right side as the Z-axis, defining the Y-axis and Z-axis as the voltage and current axes, respectively.
- If the waveform appears to be clipped, it means that the measurement data is out of range. If the voltage or current range is automatic, the corresponding labeling will be adjusted automatically with the change of the range, and this phenomenon will not occur in general.
- The waveform display is adjusted for zero synchronization but does not change the original phase difference between voltage and current.
- The trigger signal priority for waveform lock is (U1, I1, U2, I2, U3, I3, U4, I4).

5.4.1.2 Waveform Display with Harmonics

In the case where the input has harmonic components, turning on the waveform display will show the effect of waveforms with harmonic inputs, for reference only, as shown in Figure 5-12 above.

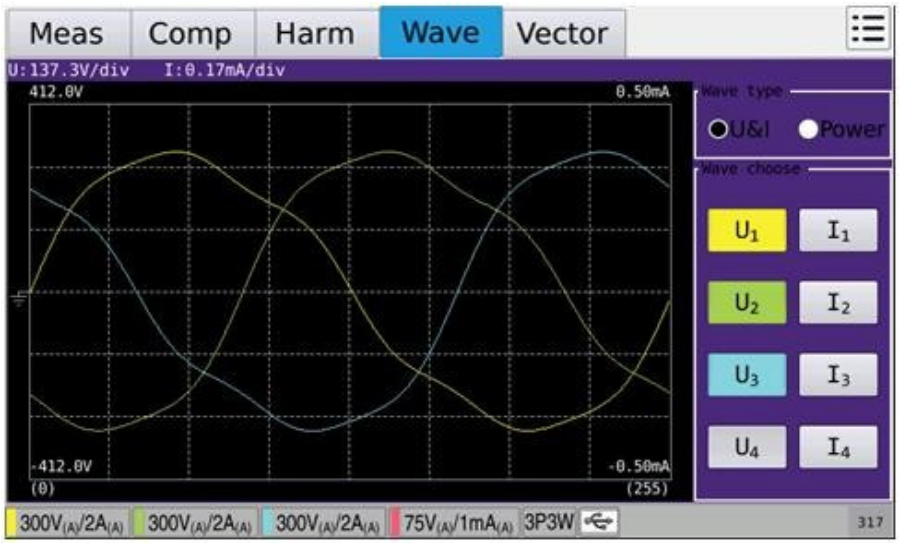


Figure 5-12 Waveform effect of U&I input with harmonics

Note: This kind of waveform is the input of the input source with harmonic components, and there is no necessary connection with whether the harmonic analysis function of this instrument is turned on or not.

5.4.2 Power Waveform

The Power waveform (power waveform) display effect is shown in Figure 5-13:

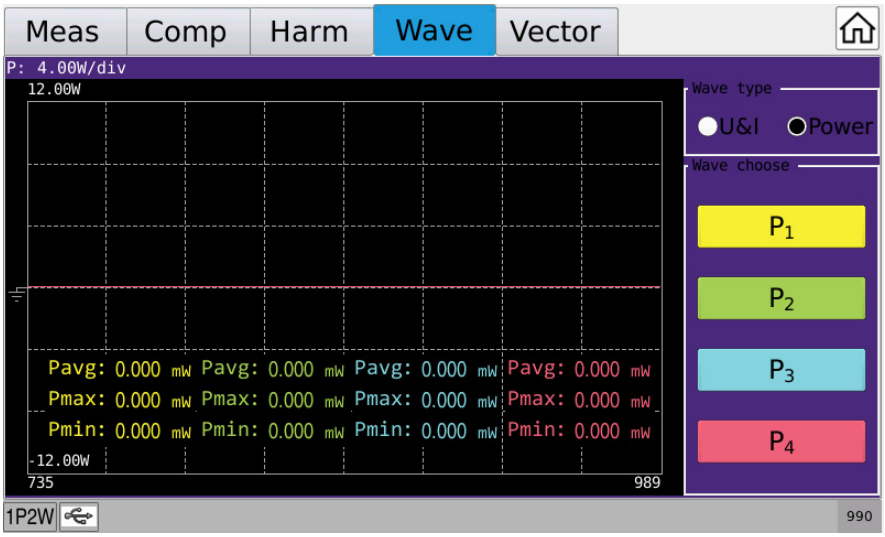


Figure 5-13 Power waveform display effect

Optional power waveform parameters are P1, P2, P3, P4, can be multi-selected, the selection method that is directly touch the button to select can be selected, selected button color that is the corresponding color of the waveform display.

The main purpose of the power waveform is to view the power change curve. The waveform hit points are displayed in a cyclic overlay, i.e., the most recent 256 power points are always displayed, and the previous data will be removed from the left side of the display.

Note: The power waveform is valid only after the integral function is running, otherwise the display is not refreshed.

5.5 Vector Image Display Page

Vector diagram display page mainly provides a vector display page for three-phase test, more intuitively shows the vector size of each signal within the three-phase combination, i.e., the phase angle relationship, as shown in Figure 5-14, the left side is used to display the vector of the polar coordinate system, the right side is to display the basic test results area; vector diagram as long as the display of each signal's voltage and current vector information diagram, the color and the right side of the parameters of the background color The color corresponds to the parameter background color on the right side, and the values on the top of the vector diagram indicate the size of the parameter values corresponding to the outer circle corresponding to the polar coordinates, respectively.

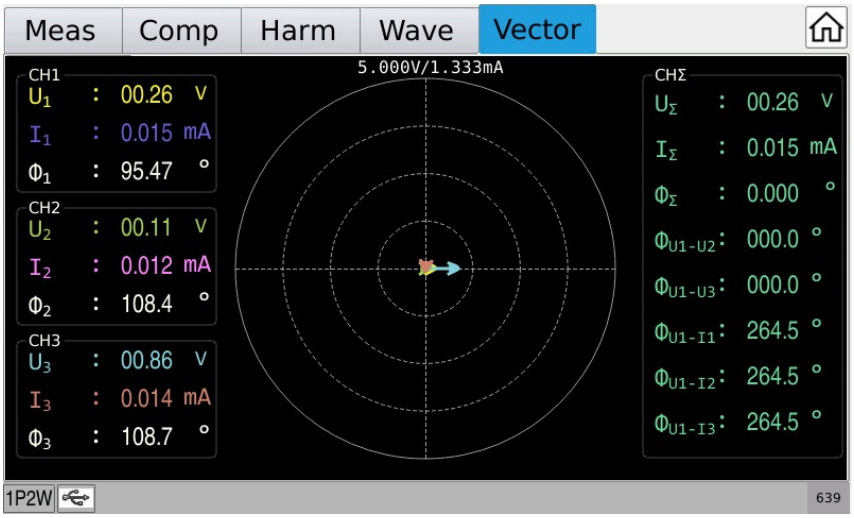


Figure 5-14 Vector Display Effect

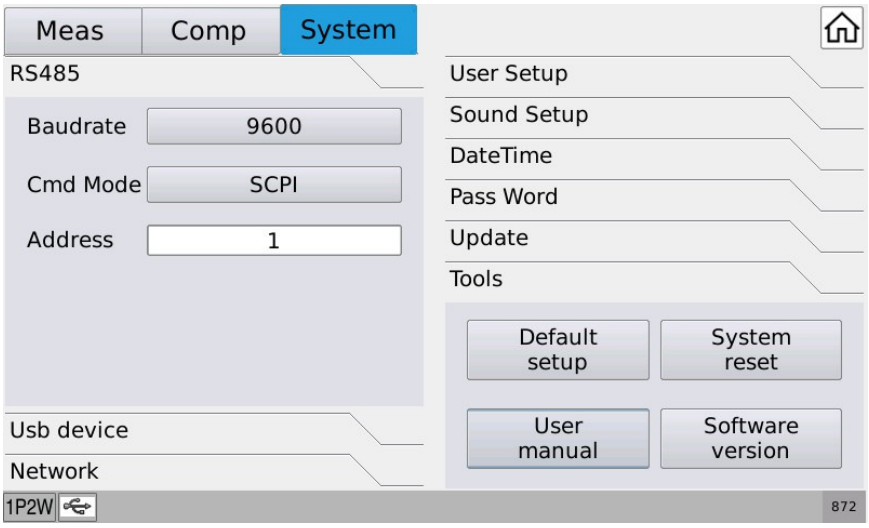
Chapter 6 System Settings

System settings are mainly concerned with instrument system-related settings. It generally does not affect measurements.

Access to the system settings is as follows:

Step1: If you are not in the setup function page, press [Setup] to enter the setup related page.

Step2: According to the contents of the pagination display, touch to select the system setting page to enter, as shown in Figure 6-1:



(Figure 6-1 System Setup Page)

The main settings included in the system settings are shown in Table 6-1 below:

System parameter classification	Description
RS232/RS485 Serial port settings	Includes serial port related settings
Usb devices	Includes USB port settings
LAN settings	Includes LAN-related settings
User settings	Includes user-related runtime environment settings
Date and time settings	Includes system date and time settings
Password	Password Changes Involving Instruments
Softkey upgrade	Operations related to instrument softkey upgrades
Tools	Includes common system tool options

Table 6-1 Description of System Parameter Classification

6.1 RS232/RS485 Serial Port Settings

Serial port settings are mainly related to the general settings of the serial port, including the communication speed of the serial port, command mode, bus address and other parameters, the interface and related specific principles are described in detail in Chapter 10 Remote Control chapter ;

The communication type of the serial port is divided into RS232 and RS485, this is the hardware selection (factory two choose one), factory default assembly RS232, if the user does not need RS232 and needs to use RS485 communication, need to confirm the installation in advance.

Communication speed is baud rate, providing 4800, 9600, 38400, 115200 optional; other default fixed configuration: 8 data bits, 1 stop bit, no parity, no data flow control.

Command Mode provides standard SCPI protocol and ModBus protocol options.

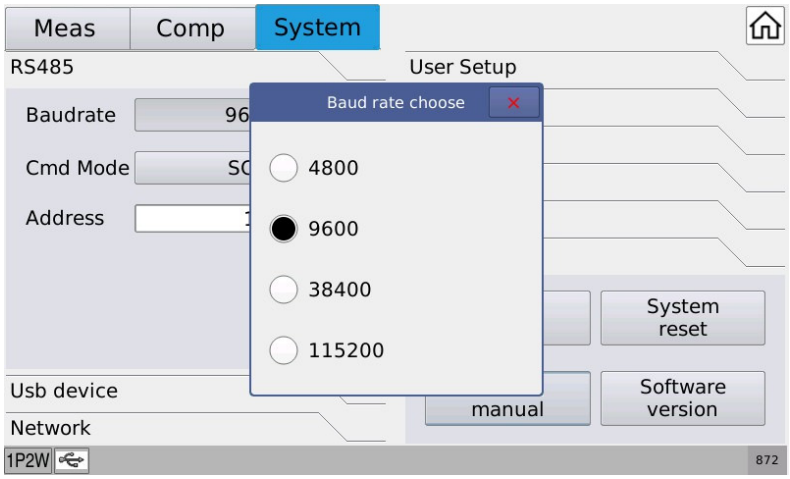
The bus address is used for communication local address under RS485 type instrument or ModBus protocol, which can be set up from 1 to 32.

6.1.1 Baud Rate Setting

Provides a choice of baud rate settings for serial communications.

Setting method:

Press the [Setup] button on the panel, touch to enter the system setup page, expand the RS232 or RS485 tab, and then touch the baud rate setting item corresponding to the button, you can pop up the baud rate setup window, in the window, click on the desired settings of the selection can be, the window is shown in Figure 6-2:



(Figure 6-2 Baud Rate Selection Screen)

6.1.2 Local Address Setting

Address application requirements: RS485 communication address and ModeBus protocol communication address

It is used to set the bus address for serial communication of this machine, i.e. the bus address for controlling and displaying the current instrument, setting range: 1 to 32.

Address 0 belongs to the broadcast address and cannot be set.

Setting method:

Press the [Setup] key on the panel, touch to enter the system setup page, expand the RS232 or RS485 tab and then then double-click the bus address setup window, you can pop up the system keyboard, you can enter the specific values to be set in the numeric keypad of the system, enter the values within the range of values can be.

Note: There is no bus address setting item in the SCPI command resolution mode for RS232 communication.

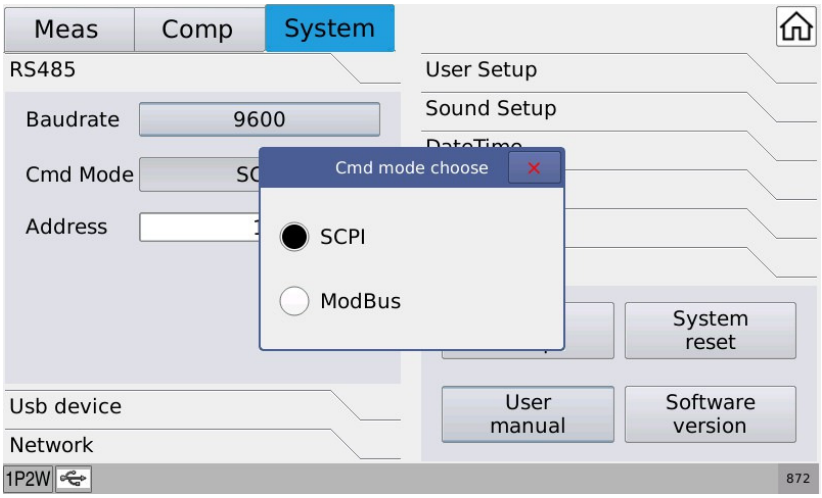
6.1.3 Command Mode Setting

Programmable command modes are SCPI command, ModeBus command protocol.

See Chapter 11 Communication Command Reference chapter for a detailed introduction.

Setting method:

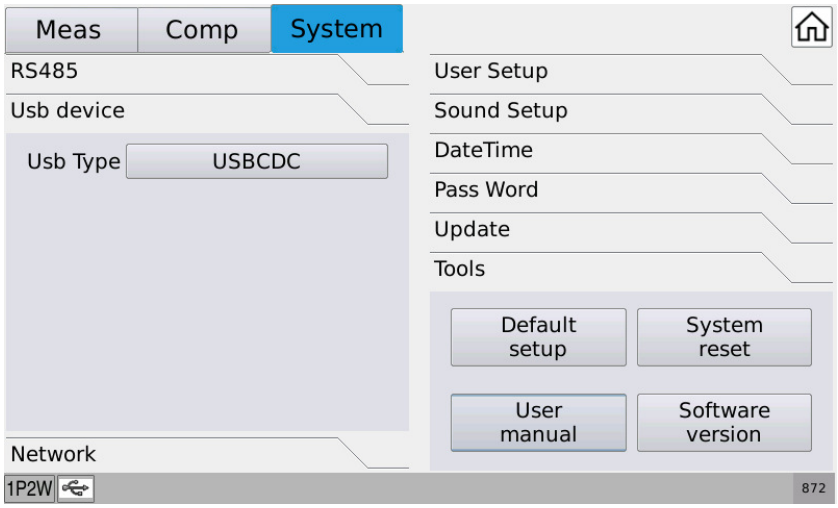
Press the [Setup] button on the panel, touch to enter the system setup page, expand the RS232 or RS485 tab, and then touch the button corresponding to the Command Mode Setup item to pop up the Command Mode Setup window, click on the required settings in the window can be set to the selection of the window, the window is shown in Figure 6-3:



(Figure 6-3 Command Mode Selection Window)

6.2 USB Devices

Switch USB device type: USB DCD or USB TMC



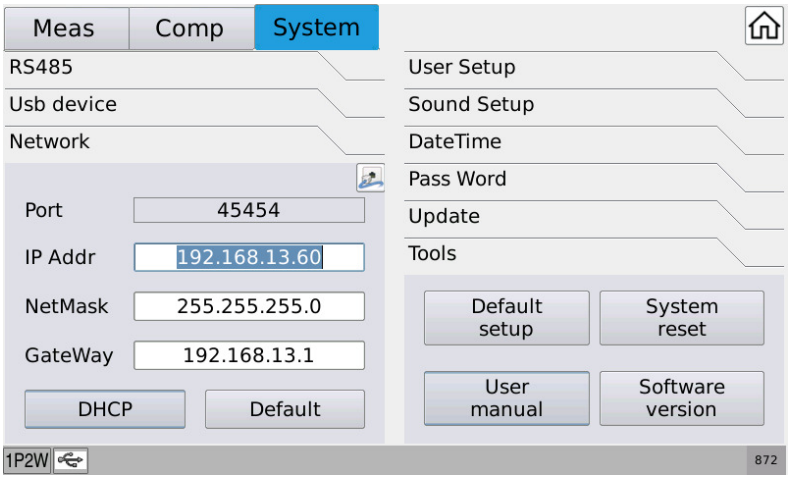
(Figure 6-4 USB Selection Window)

6.3 LAN Setting

The command parsing protocol used by the LAN is the standard SCPI command protocol.

The default network port numbers in the LAN settings are all 45454, and no changes are offered.

wired network connection, the Configuration Settings page is shown in Figure 6-5 below:



(Figure 6-5 Configuration Window for Wired LAN)

Configure the corresponding address parameters according to the specific attributes of the accessed LAN and plug in the Internet cable at the rear panel to use the network port to communicate.

If you need to modify the relevant address parameters, you can directly double-click the corresponding address display window to bring up the numeric keypad, enter the correct network configuration on the numeric keypad, and click Confirm to exit the keypad to complete the modification.

If the access to the network equipment (router or switch) supports the automatic allocation of IP functions, you can directly click on the display window in the automatic configuration button, try to automatically configure, configuration takes a few seconds, do not operate the machine during the configuration process; if not support, then you need to manually assign the setup address; if the automatic configuration fails to get the IP address of the local loopback, that is, 127.0.0.1 If the automatic configuration fails, you may get the local loopback IP address, i.e., 127.0.0.1; at this time, you can click on the default settings button in the display window to restore the default configuration, and then fine-tune the default configuration on the basis of the company's network technology engineers to obtain the address parameters of the network configuration.

6.4 User Settings

It involves general user settings, including display style, system language, backlight brightness, and other features.

6.4.1 System Language

The language mode of the operator interface is used to control the instrument.

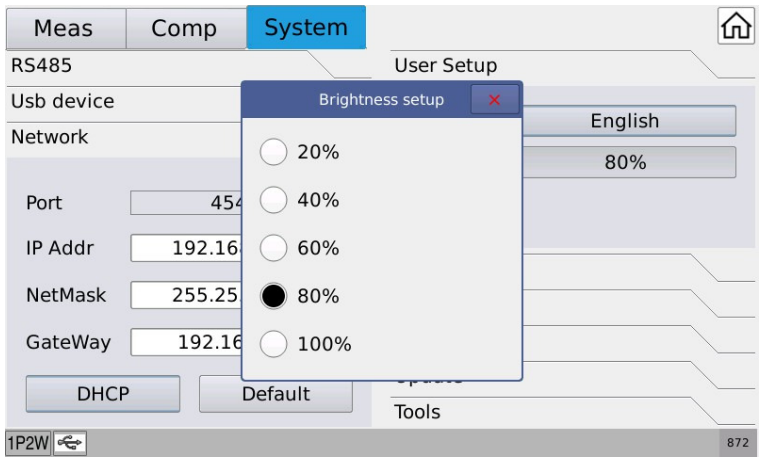
Parameter options: English

6.4.2 Backlight Adjustment

Backlight brightness adjustment of the LCD. Parameters available: 20%, 40%, 60%, 80%, 100%.

Setting method:

Press the [Setup] button on the panel, touch to enter the system setup page, expand the user settings tab, and then touch the backlight brightness settings item corresponding to the button, you can pop up the backlight brightness settings window, click on the window you need to set up the selection of items can be, the window is shown in Figure 6-7:



(Figure 6-7 Backlight Brightness Selection Window)

6.5 Signal Setting

Involves instrument-related buzzer settings, including key buzzer switch settings, comparison buzzer switch settings, and so on.

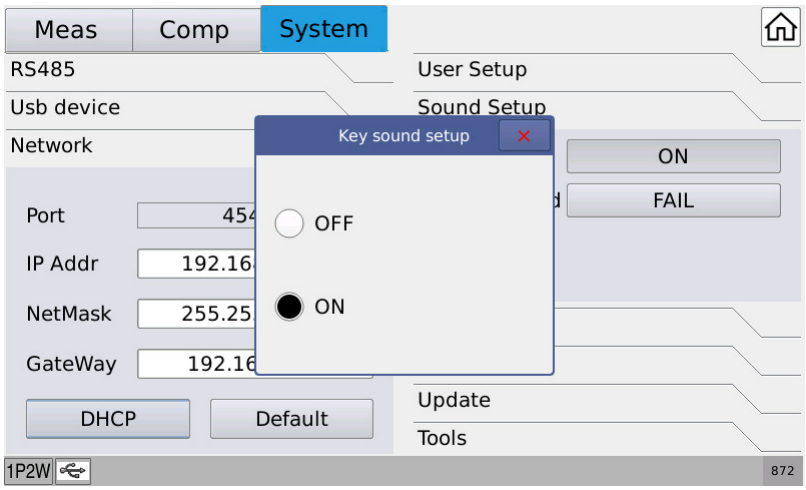
6.5.1 Key Sound

Used to control the key sound on and off, factory default setting is on. The parameter options are shown in the table below:

Pushbutton alarm status	Description
Open (ON)	Pushbutton buzzer opens
Close (OFF)	Pushbutton buzzer shutdown
Table 6-2 Descriptions of the key signaling status	

Setting method:

Press the [Setup] key on the panel, touch to enter the system setup page, expand the User Settings tab, and then touch the button corresponding to the key sound settings, you can pop up the key signaling settings window, click on the window you need to set up the selection of items can be, the window is shown in Figure 6-8:



(Fig. 6-8 Keysound Selection Window)

6.5.2 Comparator Sound

Sound signal output function for controlling the comparison function.

The parameter options are shown in the table below:

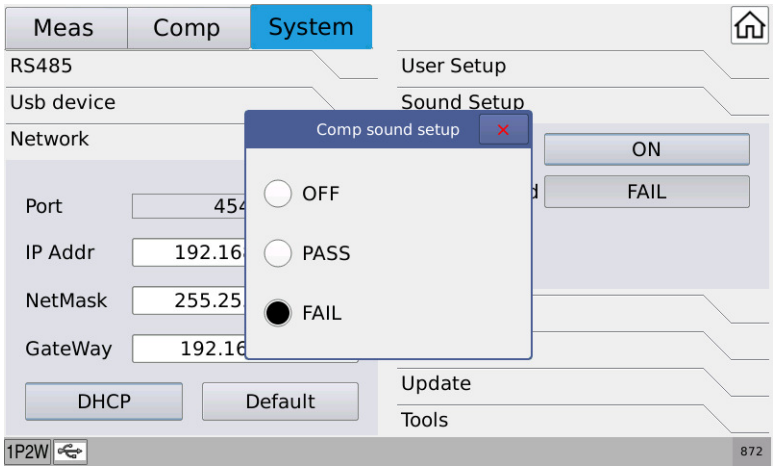
Comparison of signal states	Description
Pass (PASS)	The buzzer sounds when the comparison passes;
Failure (FAIL)	Comparison Failure Buzzer sounds;

OFF	Turns off the buzzer output function for comparison results.

Table 6-3 Description of Comparison Ring Status

Setting method:

Press the [Setup] button on the panel, touch to enter the system setup page, expand the user settings tab, and then touch the button corresponding to the comp sound audio settings, you can pop up the comparative audio settings window, click on the window you need to set up the selection of items can be, the window as shown in Figure 6-9:



(Figure 6-9 Compare Audible Selection Window)

6.6 Time and Date

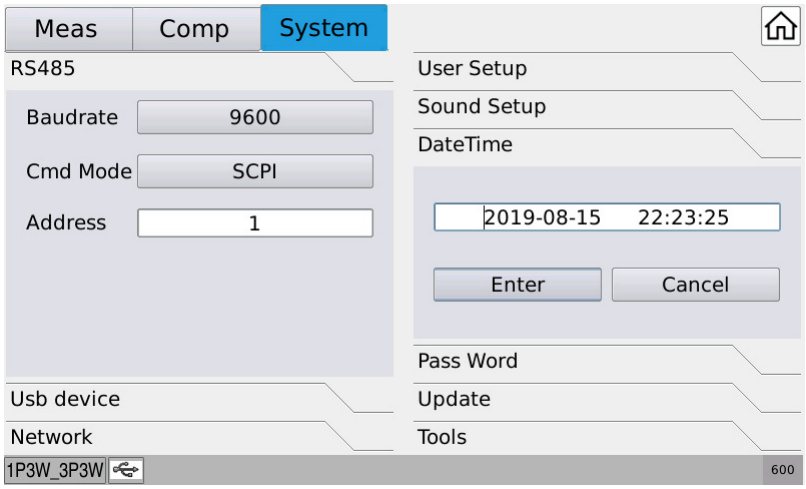
Press the Modify button to get the modification privilege, double-click the control to bring up the soft keyboard, and press the Confirm button after finishing the input.

Used to set the time in the local time zone.

For example, on August 15, 2018, at 9:13 am and 25 seconds

Displayed in format: 2018-08-15 09:13:25.

The window display after clicking the Modify button is shown in Figure 6-10 below:



(Figure 6-10 Date and Time Modification Window)

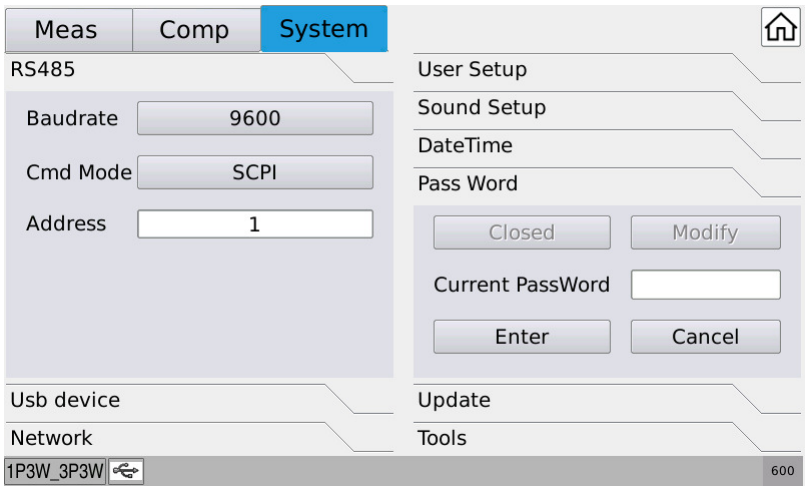
Then double-click the input window and enter the specific date and time in the soft keyboard that pops up and press the Confirm button to complete the modification.

6.7 Password

Password-protected mode for controlling the instrument.

Password protection is currently used as follows: when the unit needs to be unlocked, if password protection is enabled, the unit cannot be unlocked until the correct password is entered.

Press the panel of the [Setup] key, touch to enter the system settings page, expand the password password tab, you can pop-up password password settings window, in the window click on the desired settings of the selection can be, the window shown in Figure 6-11:



(Figure 6-11 Password Setting Window)

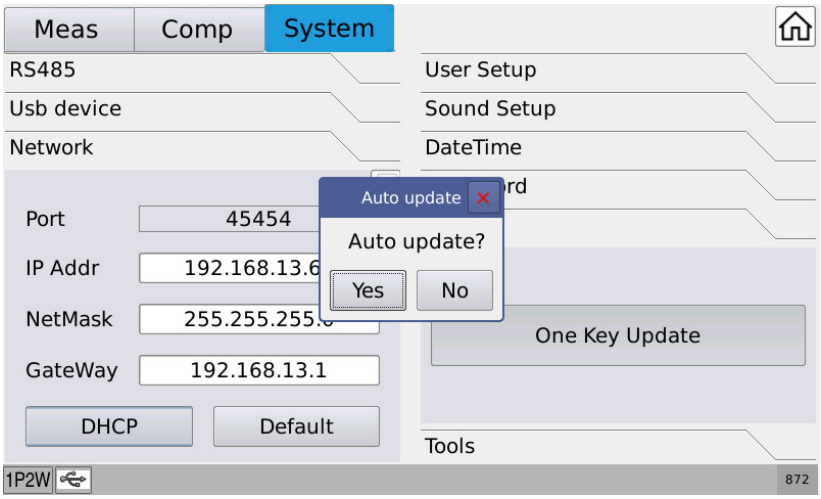
- Closed/Open: Indicates the current state of the password protection switch.
- Modify: Used to access the password change settings.

Note: The factory default password is instrument model (0000), default off

6.8 Software Upgrade

Software upgrade provides the software upgrade operation of the instrument, which mainly involves the application program (APP upgrade), channel board (DSP upgrade), front panel (key board upgrade) and other related operations, this series provides one-key upgrade, simple and fast.

The window is shown in Figure 6-12:

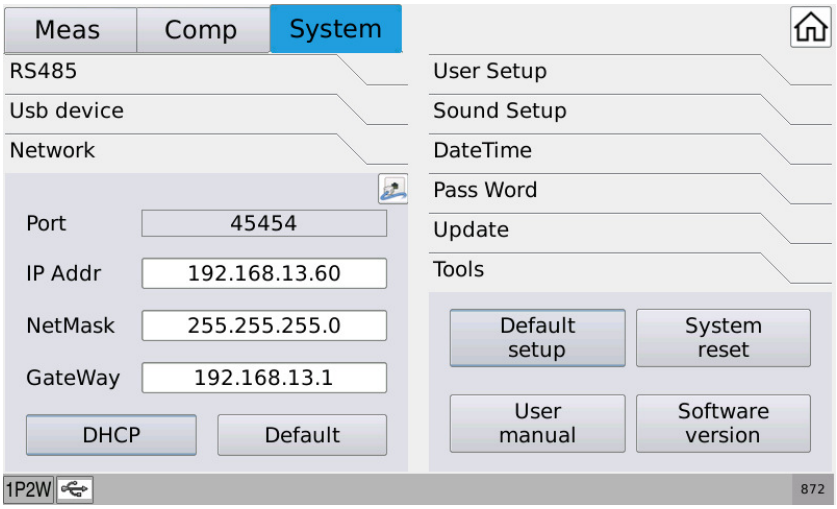


(Figure 6-12 Software Upgrade Settings Window)

Specify the storage path of the upgrade file: The upgrade files involved in this series of instruments need to be in the root directory of the USB flash disk, and make sure that the upgrade file name is update3431.sec, or else the required file cannot be found.

6.9 Tools

It involves the auxiliary tool options that the system needs to use, including default settings, system reset, user manuals, software versions, and other functions. As shown in Figure 6-13:



(Figure 6-13 Tool Display Window)

6.9.1 Default Setting

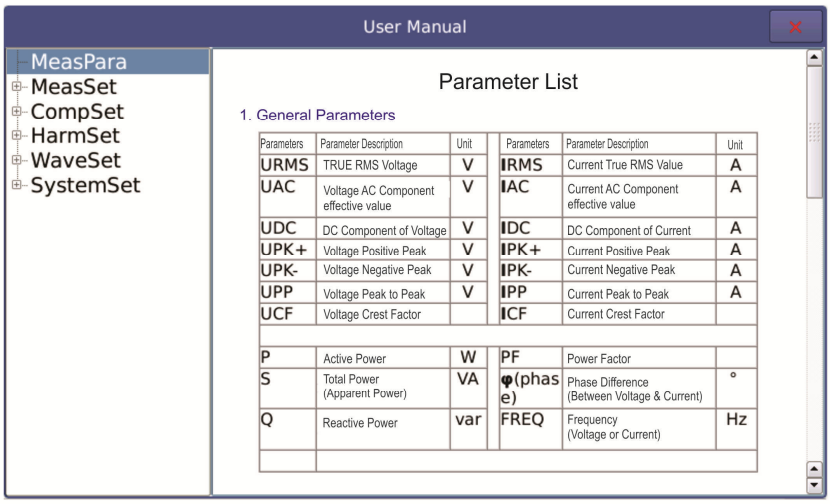
Restore Factory Settings restores all settable parameters to the factory default setting state.

6.9.2 System Reset

Reboot the system to allow the system to complete a reset reboot.

6.9.3 User Manual

Provide the necessary user help documents, you can directly open to view the corresponding function introduction, or long press some of the settings button will automatically open and jump to the specified chapter to view; display as shown in Figure 6-14:

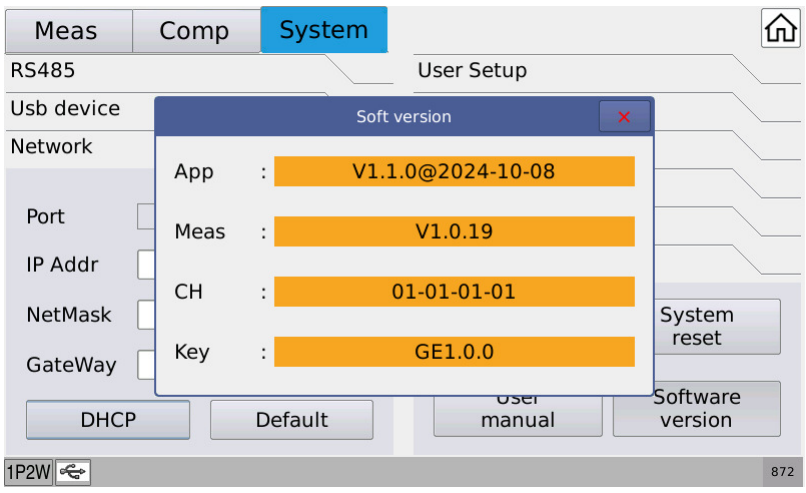


Parameters	Parameter Description	Unit	Parameters	Parameter Description	Unit
URMS	TRUE RMS Voltage	V	IRMS	Current True RMS Value	A
UAC	Voltage AC Component effective value	V	IAC	Current AC Component effective value	A
UDC	DC Component of Voltage	V	IDC	DC Component of Current	A
UPK+	Voltage Positive Peak	V	IPK+	Current Positive Peak	A
UPK-	Voltage Negative Peak	V	IPK-	Current Negative Peak	A
UPP	Voltage Peak to Peak	V	IPP	Current Peak to Peak	A
UCF	Voltage Crest Factor		ICF	Current Crest Factor	
P	Active Power	W	PF	Power Factor	
S	Total Power (Apparent Power)	VA	φ(phase)	Phase Difference (Between Voltage & Current)	°
Q	Reactive Power	var	FREQ	Frequency (Voltage or Current)	Hz

(Figure 6-14 User Manual Display Window)

6.9.4 Software Version

Used to view the current software version of the instrument; shown in Figure 6-15:



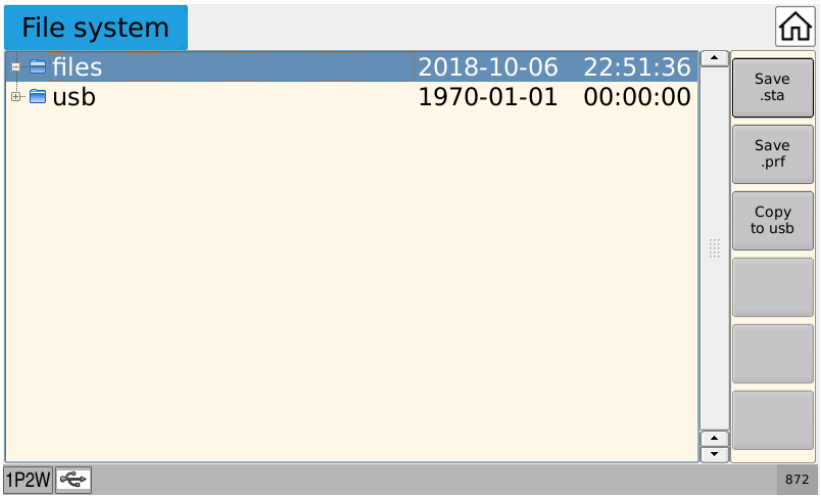
(Figure 6-15 Software Version Display Window)

Chapter 7 File Management

SME134X series instruments can store the parameters set by the user into the internal memory of the instrument in the form of a file. When you want to use the same settings next time, the user does not need to reset these parameters, just load the corresponding file; you can get the last set parameters.

7.1 File Management Function Interface

If you are not in the file management page, press the [File] key on the front panel to enter the file management page. As shown in Figure 7-1:



(Figure 7-1 Effect of displaying the document management page)

7.2 Introduction to Store/Recall Functions

This section provides information about the Store/Recall function. With the Store/Recall function, the user can save the instrument configuration information to and retrieve it from the instrument's internal Flash or external USB flash drive, and the test results and screenshots can only be saved in the external USB flash drive.

Symbol Description:

- files: internal files.
- usb: external files.

Preservation Methods and Uses Introduction, Table 7-1 below describes the available preservation methods and their uses:

Preservation methods		whether it can be called	Purpose
Type	File format		
System configurations saving	*.prf	Yes	Save the system configuration status of the instrument
Measurement configuration saving	*.sta	Yes	Save the instrument's test configuration status
Save screenshot	*.png	No	Save a screenshot of the instrument.
Test data	*.csv	No	Save test data

Table 7-1 Preservation Methods and Uses

7.3 Folder/File Structure

File system for the SME134X series:

For configuration file saving, it will automatically choose whether to save in the root directory of the internal file or the root directory of the USB flash drive based on the current location of the file cursor index.

For screenshot files, when a USB flash drive exists, it will automatically be saved in the root directory of the USB flash drive under the PIC file plus, if the USB flash drive is unavailable, this will automatically be saved in the PIC directory of the internal files.

For the saving of test data, the data saving function can only be used when the USB flash disk is available, and several test data can only be saved in the root directory of the USB flash disk.

The following points should be noted when using a USB flash drive on the SME134X series:

- Before connecting a USB memory stick to the SME134X series, it is recommended that the user back up the data saved on the USB memory stick. Scientific is not responsible for the loss of data in the USB memory device when the USB memory device is used with this instrument.
- In order for you to efficiently save instrument data to the USB flash drive, it is recommended that there are not too many files or folders on the USB flash drive.
- Due to the limited internal storage space, it is recommended to copy the files stored inside the instrument to a USB flash drive and clean up and delete the internal files accordingly.

7.4 File Management Procedure

You can perform various operations on the file as follows:

Click to select the file name to be operated, according to the toolbar on the right side of the screen can be operated as follows:

- Saving measurement settings

  When the focus of the file list is under the files path, it will save the measurement settings file in the root directory with the files file after entering the file name.

- Saving system settings

  When the focus of the file list is under the files path, it will save the system setup file in the root directory with the files file after entering the file name.

- Copy to usb

  When the cursor is under the path corresponding to files, copy the file or folder corresponding to the cursor to the usb root directory.

  Note: If the file to be copied is a file, it will overwrite the file in the usb path if the file with the same name exists in the usb; if the file to be copied is a folder, please make sure that there is no folder with the same name in the usb root directory, or else it will lead to the failure of copying;

- Delete

  The instrument will delete the file where the cursor is located.

- Load

  Load the settings file specified by the file index to reconfigure the instrument's parameter settings.

7.5 Data Saving Operation

Please perform the data saving operation when the USB flash disk is available!

Press the [Setup] key on the panel, touch to enter the measurement setup page, expand the data saving tab, and click the touch screen to complete the corresponding state switch settings; for detailed settings, see Measurement Setup Data Saving Settings section.

The data save switch is closed by default at power on, manually open it when needed, after opening it a few data will start to record and save, while recording, the status bar will have the status picture of the write operation displayed, indicating that the test data is being recorded.

The data logging stop needs to be turned off manually. To ensure the read/write speed of the USB flash disk, please master the time interval of data logging by yourself.

Chapter 8 Correct Measurement

8.1 Wire Wiring Methods

SME134X provides 1-channel, 3-channel and 4-channel instruments to choose from. 1-channel only 1P2W is available, 3-channel and 4-channel instruments all support the basic wiring system combination method, the combination method has a direct relationship with the wiring method; the combination method is as follows:

One-phase two-wire (1P2W), one-phase three-wire (1P3W), three-phase three-wire (3P3W), three-phase four-wire (3P4W), three-voltage three-current (3V3A).

Note: In theory, 3V3A is also 3P3W. Because of the difference between using two channels and three channels, the industry has uniformly referred to 3P3W using three channels as 3V3A.

The relationship between the number of configurations of the wire system combination Σ and the wiring use channel is as follows:

The correspondence between the number of instruments used and the channel numbers used in the line system combination Σ is shown in Table 8-1 below:

Linear (3-channel instrument)	Channel utilization		
	CH1	CH2	CH3
1P2W	1P2W	1P2W	1P2W
1P3W or 3P3W	Σ (1P3W or 3P3W)		1P2W
3P4W or 3V3A	Σ (3P4W or 3V3A)		

Table 8-1 3-Channel Instrument Line System Combined Use of Channels

Considering that 1P3W and 3P3W need to use only 2 channels, for 4-channel instruments, in order to make full use of the remaining CH3 and CH4 channels under these two line system combinations, the 4-channel instrument also provides 2-channel combination options for the latter two channels, namely 1P3W_1P3W, 1P3W_3P3W, and 3P3W_3P3W, and the channel combinations are shown in Table 8-2 below:

Linear (4-channel instrument)	Channel utilization			
	CH1	CH2	CH3	CH4
1P2W	1P2W	1P2W	1P2W	1P2W
1P3W_1P2W or 3P3W_1P2W	Σ1 (1P3W or 3P3W)		1P2W	1P2W

3P4W_1P2W or 3V3A_1P2W	Σ1 (3P4W or 3V3A)	1P2W
1P3W_1P3W	Σ1 (1P3W)	Σ2 (1P3W)
1P3W_3P3W	Σ1 (1P3W)	Σ2 (3P3W)
3P3W_3P3W	Σ1 (3P3W)	Σ2 (3P3W)

Table 8-2 4-Channel Instrument Line System Combined Use of Channels

8.1.1 1P2W Wiring

Whether it is a single-phase system or a multi-phase system, the wiring of each channel can be referred to the basic wiring of sub-1P2W, which can be combined to become a multi-phase test system.

1P2W as a choice of line system, but because of the line system mode, all channels are working independently, can be seen as a single-channel digital power meter to use, so the line system mode does not do the combination of line system operation, that is, by pressing the panel on the [CHΣ] button will not display the results of the line system test.

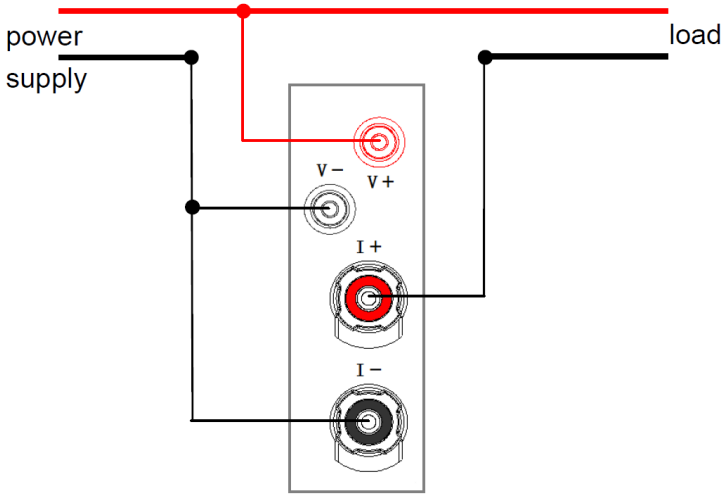
The SME134X series instruments provide four test wiring inputs for each channel, i.e., voltage high side, voltage low side, current high side, and current low side.

Since the voltage and current are floating inputs, there can be various combinations of test wiring, and different applications can be reconnected to the corresponding test circuits. Two typical wiring methods for the recommended measurement circuits are given here, i.e., the ammeter-internal method and the ammeter-external method.

Tip: Considering that the presence of distributed capacitance may affect the test, in order to minimize the effect of distributed capacitance on the test circuit, it is recommended to try to make the current test terminal as close as possible to the ground of the input source, i.e., connecting the current terminal at the low end of the test circuit.

8.1.1.1 Ammeter internal connection

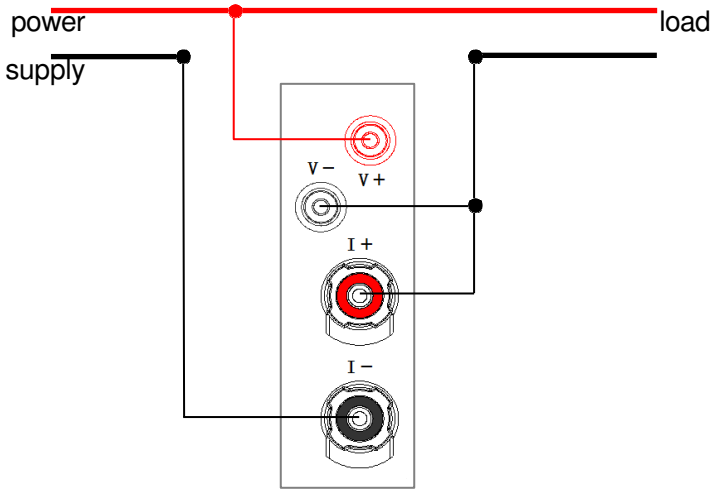
This method is recommended for low-power testing, i.e., where the testing current is relatively small, making the current test more accurate, while the voltage measurement will have a small error due to the voltage drop generated by the current flowing on the ammeter (this error can be disregarded). Wiring as shown in Figure 8-1:



(Figure 8-1 Ammeter Internal Connection - for small current connections)

8.1.1.2 Ammeter external

This method is suitable for high-power load test, that is, the testing current is relatively large recommended for use, making the voltage test more accurate, while the current measurement will be due to the voltmeter shunt and produce a small error (this error can be disregarded). The wiring method and brief principle are shown in Figure 8-2:



(Figure 8-2 Ammeter External Connection Method - for high current connection)

8.1.1.3 Ammeter Internal/External Selection Principal Basis

The ammeter internal and external connection principle is introduced, and the schematic Description is shown in Figure 8-3:

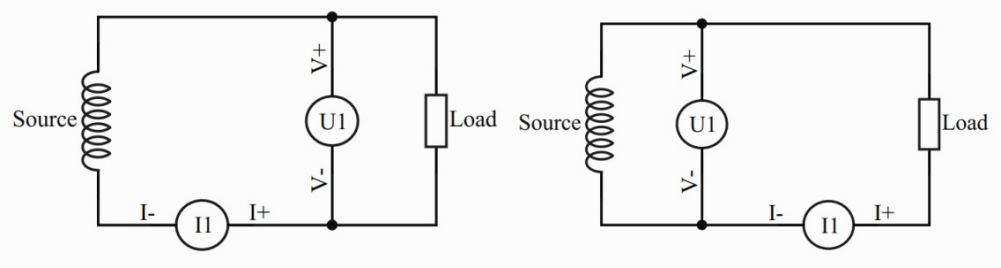


Figure 8-3 Ammeter external (left), Ammeter internal (right) - Schematic diagram of principle

Ammeter internally connected: the ammeter is connected in series with the load and then in parallel with the voltmeter, i.e. the ammeter is internally connected within the test range of the voltmeter.

Ammeter external: The voltmeter is connected in parallel with the load and then in series with the ammeter, i.e., the current is connected outside the test range of the voltmeter.

Since both voltmeters and ammeters have internal resistance, for SME134X series instruments, the input impedance of the voltage side is 3MΩ, and the input impedance of the current side is related to the specific range switching, see Performance Parameters section Description ;

When the load impedance is relatively small (assuming that the impedance of the load and the impedance of the ammeter is similar), if the ammeter is connected internally, the result measured by the voltmeter is the sum of the voltage drop of the ammeter itself and the voltage drop of the load, and at this time, due to the impedance of the load and the ammeter's impedance is similar to that of the ammeter, i.e., the result of the voltmeter test has nearly half of the components of the voltage divider, and the internal arithmetic of the instrument at this time still treats the result of the voltmeter test as the voltage of the load, thus the error is quite large. At this time, the internal operation of the instrument is still the result of the voltmeter as the voltage on the load, which can be seen that the error is quite large, in this case it shows that the ammeter is not suitable for internal connection, the need to use the external method of the ammeter, so that because the impedance of the load is much smaller than the impedance of the voltmeter, the current is basically in the load, so the ammeter test is basically on the current on the load, at this time, the error can be reduced to a minimum.

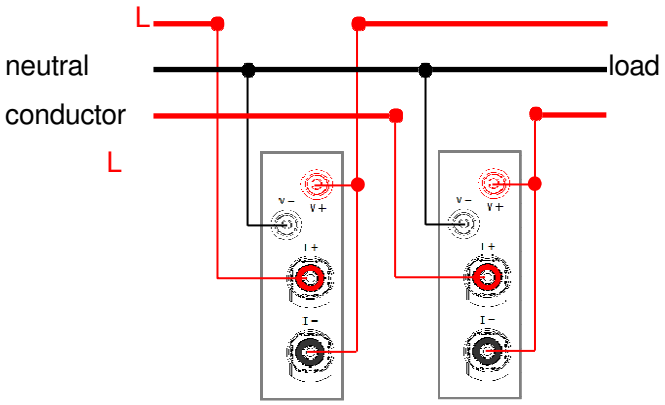
On the contrary, when the load impedance is relatively large (assuming that the load impedance and voltmeter impedance is similar), that is, the impedance of the load is much larger than the impedance of the current, that is, when using an ammeter external, the ammeter test results are only nearly half of the current flowing through the load, so the error is larger, it is necessary to change to an ammeter internal connection is more appropriate, so that the results of the ammeter test and the load current flow is the same as that of the voltmeter. The test results can basically ignore the ammeter's voltage division, so the overall error is minimized.

8.1.1.4 The recommended Process for Coaxing Test Wires:

1) Start by connecting the current terminal in series with the load (connected to a loop, with the negative current terminal connected to the zero wire).
2) Then connect the voltage terminals to **the load terminals** or **to the terminals of the input source**, as required.
   i.e., the positive voltage terminal is connected to the firewire.
   The negative voltage terminal is connected to the positive current terminal (external ammeter method) or the negative current terminal (internal ammeter method).
3) Wiring confirmation check
   That is, just make sure that the fire wire of the input source is connected to the positive voltage terminal and the zero wire of the input source is connected to the negative current terminal.

8.1.2 1P3W Wiring

For instruments with only 3 channels, 1P3W is composed of channel 1 and channel 2, while for 4-channel instruments, depending on the wiring options, channel 3 and channel 4 can be used instead to form a 1P3W test system. 1P3W test recommended wiring diagram and schematic Description are shown below:



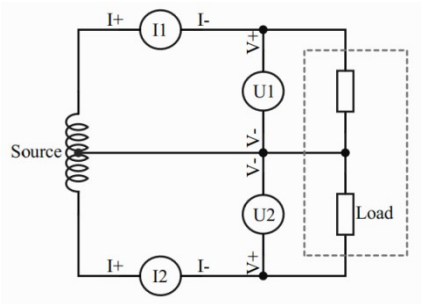
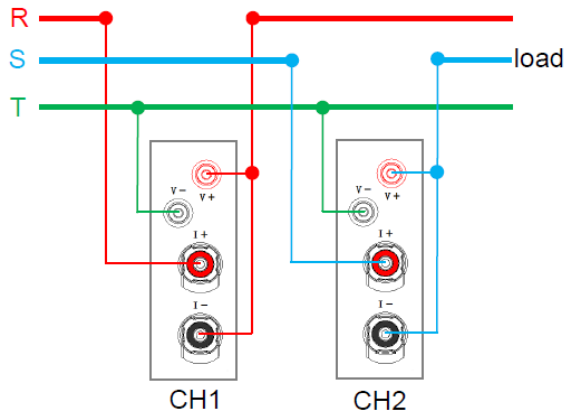


Figure 8-4 Schematic diagram of 1P3W

8.1.3 3P3W Wiring

For instruments with only 3 channels, the 3P3W is composed of channel 1 and channel 2, while for 4-channel instruments, depending on the wiring options, channel 3 and channel 4 can be used instead to form a 3P3W test system, 3P3W test recommended wiring diagram and schematic Description is shown in the figure below:



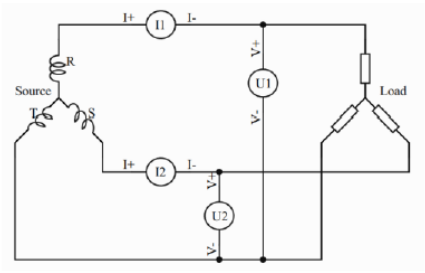
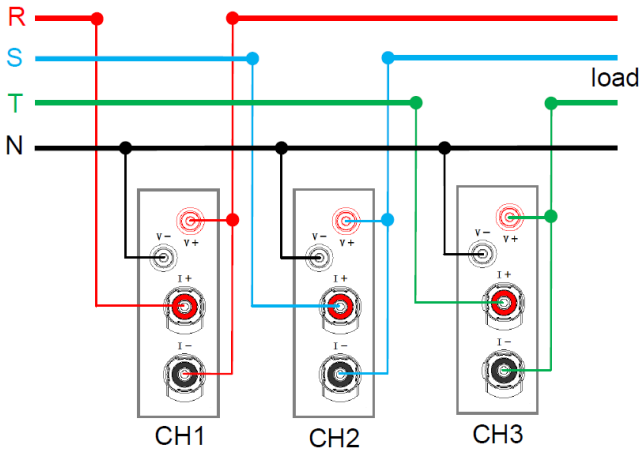


Figure 8-5 Schematic diagram of 3P3W

8.1.4 3P4W Wiring

Three channels are required for 3P4W, so for 3- and 4-channel instruments, channels 1, 2, and 3 are used to form 3P4W. The recommended wiring diagram and principal Description for the 3P4W test is shown in the figure below:



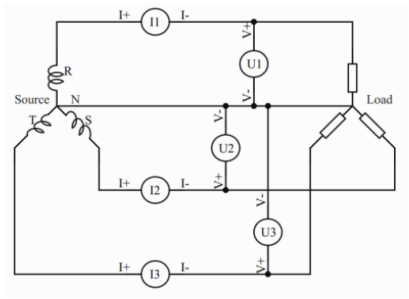
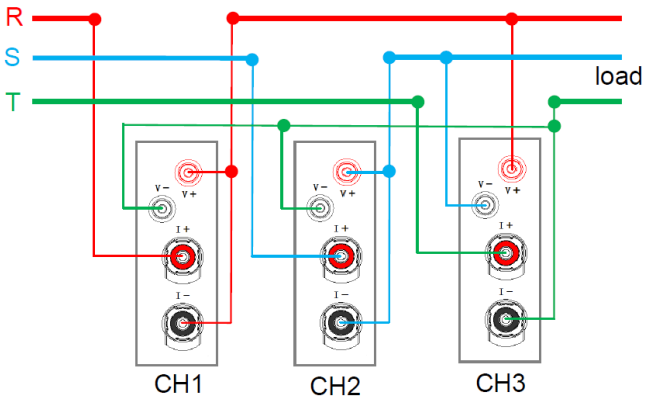


Figure8-6 Schematic diagram of 3P4W

8.1.5 3V3A Wiring

For 3V3A, three channels are required, so for 3- and 4-channel instruments, channels 1, 2, and 3 are all used to form 3V3A. The recommended wiring diagram and principal Description for the 3V3A test is shown in the figure below:



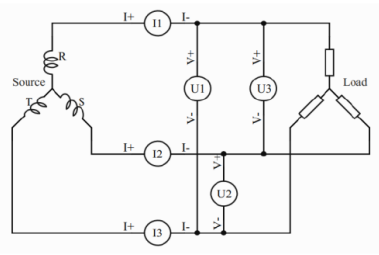


Figure8-7 Schematic diagram of 3V3A

8.2 Test Condition

8.2.1 General Test Conditions

Confirm the range (Auto can be selected).

Confirm the trigger method (continuous trigger is selected by default).

Verify that the line system settings and the wiring of the line system are correct.

Verify that the synchronization source for each channel is appropriate.

The factory default settings are generally sufficient to complete the setup of basic test conditions.

8.2.2 Comparison of Test Conditions

Set the parameters to be compared in the comparison settings, as well as the corresponding upper and lower limits, and finally select the corresponding function options.

8.2.3 Harmonic Test Conditions

Harmonic analysis is mainly for low-frequency signals, i.e. (industrial frequency signals), turn on Filter in the Measurement Settings page, go back to the Harmonic Display page, and set up the corresponding harmonic analysis options on the right side.

8.2.4 Waveform Test Conditions

Since the waveform test is divided into voltage & current waveform test and power waveform test, for the U&I waveform test, you only need to select the waveform to be displayed; for the power waveform, it depends on the start time and end time of the integration function, i.e., if the integration function is not turned on, the function waveform will not be displayed; if the integration function is turned on, you can select the power parameter to be displayed accordingly. If the integration function is turned on, the power parameter to be displayed can be selected accordingly.

8.2.5 Vector Test Conditions

Vector diagram display does not require special condition settings, it is worth reminding that: vector diagram is mainly designed for 3-phase test system, and mainly for 3P4W and 3V3A wire system to have relative significance.

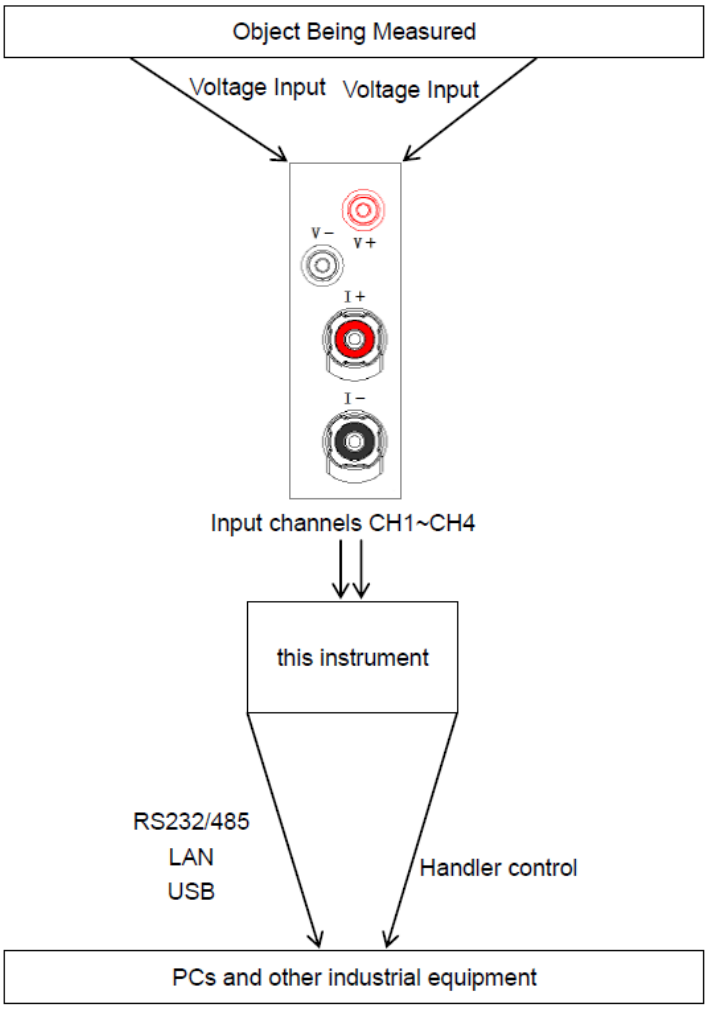
Chapter 9 Basic Principle and Technical Index

9.1 Fundamentals

9.1.1 System Configuration

The main structure of this series of multi-channel digital power meter is to connect the multi-channel voltage and current of the equipment system to be tested to the corresponding multi-channel inputs of this instrument, and then, after the calculation of the different line system combinations provided, the corresponding electrical parameters of each channel and the line system test results of the channel combinations can be effectively derived, and in addition to the display of the results of the instrument itself, the instrument provides a wide range of external communication interfaces for the convenience of the user. The instrument provides a variety of external communication interfaces, which are convenient for users to use the upper computer programming control.

system components, as shown in Figure 9-1:



(Figure 9-1 System Configuration)

9.1.2 Schematic Block Diagram

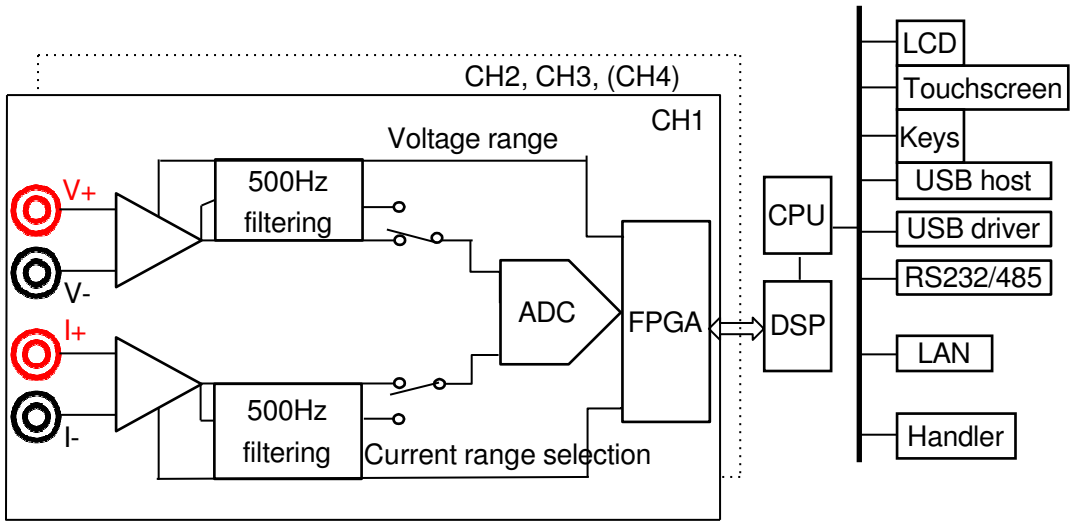
SME134X series of multi-channel digital power meter is the main principle of the structure of the multi-channel joint composition of the test system, the equipment to be tested system of multi-channel voltage, current access to the instrument corresponding to the multi-channel inputs, after differential amplification, digital filtering, phase-locked frequency sampling, synchronous AD conversion, that is, the voltage, the current of the analog signal is converted into a digital quantity after synchronous sampling Ui, Ii, and then by the CPU through the discrete integration method to derive the voltage RMS value, current RMS value, active power and power factor parameters sent to the LCD display. CPU through the discrete integral method to derive the voltage RMS, current RMS, active power and power factors and other parameters sent to the liquid crystal display.

The plus and minus signs of the power calculation results represent the direction of power flow (whether the power supply provides energy to the load, or the load gives energy back to the power supply, respectively).

Power factor is the ratio of active power to apparent power (total power), theoretically there is no positive or negative sign of power factor, but in the application of the power meter with a positive or negative sign to determine the phase relationship of the voltage and current, taking the value of -1 to +1 between the positive value on behalf of the voltage leading the current, and the negative sign on behalf of the voltage lagging behind the current.

Multi-channel test results according to the wiring of the wire system combination state, integrated processing to obtain multi-phase electrical parameter test results, for the display and storage of test results, the instrument provides a variety of communication interfaces and U disk storage function, which is convenient for the user to control and read the results of the instrument on the PC terminal directly, the instrument itself to deal with the display of the basic test parameters, it also provides a waveform display, vector diagram display, and the FFT calculation of the harmonic list display and bar graph display and other rich human-computer interaction. In addition to the basic test parameters display, the instrument also provides waveform display, vector diagram display, harmonic list display after FFT calculation and histogram display, and other rich human-computer interaction.

Schematic block diagram, shown in Figure 9-2:



(Figure 9-2 Schematic Block Diagram)

9.1.3 Symbols of Measured Parameters and Calculation Formulas

9.1.3.1 General Parameters

Parameter symbol	Explanation of the meaning of the parameters	Unit		Parameter symbol	Explanation of the meaning of the parameters	Unit
U_{RMS}	Voltage True RMS	V		I_{RMS}	Current True RMS	A
U_{AC}	Voltage AC component RMS	V		I_{AC}	Current AC component RMS	A
U_{DC}	Voltage DC component	V		I_{AC}	Current DC component	A
U_{PK+}	Positive voltage peak	V		I_{PK+}	Positive peak current (physics)	A
U_{PK-}	Negative voltage peak	V		I_{PK-}	Negative peak current (physics)	A
U_{PP}	Peak-to-peak voltage	V		I_{PP}	Peak-to-peak current value	A
U_{CF}	Peak factor			I_{CF}	Peak factor of current (physics)	
P	Active power	W		P_F	Power factor	
S	Total power (apparent power)	VA		φ(phase)	Voltage and current to phase difference	°
Q	Virtual power (reactive power)	var		F_U, F_I	Frequency of voltage and current	Hz

Table 9-1 Explanation of the meaning of general parameters

Calculation formula:

Measured parameter	Calculation formula/calculation method	Measured parameter	Calculation formula/calculation method
U_{RMS}	$\sqrt{\frac{1}{T}\int_0^T u^2(t)dt}$	I_{RMS}	$\sqrt{\frac{1}{T}\int_0^T i^2(t)dt}$
U_{DC}	$\frac{1}{T}\int_0^T u(t)dt$	I_{DC}	$\frac{1}{T}\int_0^T i(t)dt$
U_{AC}	$\sqrt{U_{RMS}^2 - U_{DC}^2}$	I_{AC}	$\sqrt{I_{RMS}^2 - I_{DC}^2}$
U_{PK+}	Maximum value in one sample period $u(t)$	I_{PK+}	Maximum value in one sample period $i(t)$
U_{PK-}	Minimum value in one sample period $u(t)$	I_{PK-}	Minimum value in one sample period $i(t)$
U_{PP}	U_{PK+} - U_{PK-}	I_{PP}	I_{PK+} - I_{PK-}
U_{CF}	$\max(\lvert U_{PK+}\rvert, \lvert U_{PK-}\rvert) / U_{RMS}$	I_{CF}	$\max(\lvert I_{PK+}\rvert, \lvert I_{PK-}\rvert) / I_{RMS}$
P	$\frac{1}{T}\int_0^T u(t)i(t)dt$	λ(PF)	$\frac{P}{S}$
S	$U_{RMS} * I_{RMS}$	φ(phase)	$\cos^{-1}(\frac{P}{S})$
Q	$\sqrt{S^2 - P^2}$	FU, FI	Zero crossing detection

Table 9-2 Calculation formula for conventional parameters

9.1.3.2 Integral Parameters

Parameter symbol Description:

Parameter symbol	Explanation of the meaning of the parameters	Unit
W_{P+}	Positive active power integral (consumption)	Wh
W_{P-}	Bearing power integration (feedback)	Wh
W_P	Integration of active power	Wh

W_S	Total active power integral	VAh
W_Q	Reactive Power Integration	varh
q	current integral	Ah
P_{AVG}	Average power over the integration time	W
P_{MAX}	Maximum power during integration time	W
P_{MIN}	Minimum power during integration time	W

Table 9-3 Meaning of Integral Parameters

Calculation formula:

Measured parameter	Calculation formula/calculation method	Measured parameter	Calculation formula/calculation method
W_{P+}	$\int_{t1}^{t2} Pdt,(P \geq 0)$	W_S	$\int_{t1}^{t2} Sdt$
W_{P-}	$\int_{t1}^{t2} Pdt,(P < 0)$	W_Q	$\int_{t1}^{t2} Qdt$
W_P	$\int_{t1}^{t2} Pdt$	q	$\int_{t1}^{t2} I_{RMS}dt$
P_{AVG}	$\frac{1}{t2-t1}\int_{t1}^{t2} I_{RMS}dt$	Note: t1 indicates the start time of the integral and t2 indicates the end time of the integral, as determined by the control of the user integral function.	

Table 9-4 Calculation formula for integral-related parameters

9.1.3.3 ∑ Parameters

Parameter symbol	Explanation of the meaning of the parameters	Unit
∑URMS, ∑UAC, ∑UDC	Average value of the corresponding voltage in the combination of line system	V
∑IRMS, ∑IAC, ∑IDC	Average value of the corresponding current in the combination of line systems	A
∑P	Active power within the line system portfolio	W
∑S	Apparent power within the line system combination	VA
∑Q	Reactive power within the line system portfolio	var

∑PF	Power factor within the line system combination	
η	Energy efficiency within the line system combination	
$\sum W_P$	Integration of active power within a combination of line systems	Wh

Table 9-5 Explanation of the meaning of ∑ parameter

Calculation formula:

Measured parameter	Calculation formula/calculation method			
	1P3W	3P3W	3V3A	3P4W
URMS∑, UAC∑, UDC∑	$(U_1+U_2)/2$		$(U_1+U_2+U3)/3$	
IRMS∑, IAC∑, IDC∑	$(I_1+I_2)/2$		$(I_1+I_2+I3)/3$	
P∑	P_1+P_2			$P_1+P_2+P_3$
S∑	S_1+S_2	$\frac{\sqrt{3}}{2}(S_1+S_2)$	$\frac{\sqrt{3}}{3}(S_1+S_2+S3)$	S_1+S_2+S3
Q∑	Q_1+Q_2			Q_1+Q_2+Q3
λ∑	$\frac{P\sum}{S\sum}$			
η	The calculation formula is user programmable, e.g. $\frac{P\sum}{S\sum}$			
$W_P\sum$	$\int_{t1}^{t2} P_\Sigma dt$			

Table 9-6 Calculation formula for ∑ related parameters

9.1.3.4 Harmonic Parameter

It is mainly concerned with the total harmonics of voltage and current in terms of the magnitude of each harmonic.

The total harmonics are represented by the symbol THD, and the magnitude of each harmonic is represented in a table or bar graph. The symbol identification is not reflected in the instrument, but for the convenience of the Description of the following calculation formula, the harmonics-related symbols are illustrated as shown in the table below:

Parameter symbol	Explanation of the meaning of the parameters
THD_u	Voltage total harmonic magnitude (%)
THD_i	Current total harmonic magnitude (%)
U_{h_n}	Each harmonic of the voltage, n takes the value 2~50
I_{h_n}	Each harmonic of the current, n takes the value 2~50

Table 9-7 Explanation of the meaning of harmonic-related parameters

Harmonic calculations are based on the International Electrotechnical Commission (IEC standards) and Canadian Standards Association (CSA standards), and two calculation methods are given accordingly (optional on the Harmonic Settings page), as described below:

IEC standard: Calculate the ratio (%) of the root mean square of the RMS value of the 2nd to 50th harmonic components to the RMS value of the fundamental (i.e., the first harmonic) using the following formula:

Total Harmonics: $THD= \sqrt{\sum_{k=2}^{n}(C_k)^2} \Big/ C_1$

Percentage composition of each harmonic $C_{h\_k} = C_k / C_1 * 100\%$

CSA Standard: Calculate the ratio of the root mean square of the RMS value of the 2nd to 50th harmonic components to the root mean square of the 1st to 50th RMS values (%) using the following formula:

$$THD= \sqrt{\sum_{k=2}^{n}(C_k)^2} \Big/ \sqrt{\sum_{k=1}^{n}(C_k)^2}$$

Percentage composition of each harmonic $C_{h\_k} = C_k \Big/ \sqrt{\sum_{k=1}^{n}(C_k)^2} * 100\%$

Explanation of the meaning of the characters used in the above formula:

C_1 : The RMS value of the fundamental (i.e., the first harmonic) of U (voltage) or I (current).

C_k : RMS value of the kth harmonic of U (voltage) or I (current), obtained by FFT calculation.

C_{h_k} : Percentage component of the kth harmonic of the voltage or current

k : Harmonic number index, 2~50

n : Maximum harmonic factor, i.e. 50.

9.1.3.5 Vector Parameter

Parameter symbol	Explanation of the meaning of the parameters
Φ_{U1-U2}	U2 phase angle with respect to U1
Φ_{U1-U3}	U3 phase angle with respect to U1
Φ_{U1-I1}	I1 phase angle with respect to U1
Φ_{U1-I2}	I2 phase angle with respect to U1
Φ_{U1-I3}	I3 phase angle with respect to U1

Table 9-8 Explanation of the meaning of vector-related parameters

9.2 Performance Parameters

9.2.1 Overview of Overall Parameters

Overview of Overall Parameters		
Model/name	Multi-Channel Digital Power Meter	
	SME1340/SME1340-3/SME1340-4	SME1340/SME1341-3/SME1341-4
Fundamental characteristic	600V/2A	600V/20A
	AC/DC, 1/3/4 channels, harmonic analysis, waveform display, vector analysis, power testing,	
Monitor	7-inch (800*480) color TFT capacitive touch screen monitor	
Measured parameter	Basic Data, Integral Data, Waveform, Bar Graph, Vector Graph	
Basic measurement accuracy	0.1% reading + 0.1% range	
Voltage range	1V~600V, minimum resolution 0.001V	
Current range	0.01mA~2A Minimum resolution 0.	0.1mA~20A Minimum resolution 1uA
Power range	0.01mW~ 1.	0.1mW~ 12kW
Frequency range	Base frequency range: DC/0.1Hz-100kHz, Filter 500Hz Harmonic analysis fundamental frequency range: 10Hz~1.2kHz	
Power factor range	-1.000~1.000	
Electrical energy integration range	0~99999kWh	
Lockout function	Data lock	

Measurement range	Auto/Manual
Refresh rate	Optional 0.1s/0.25s/0.5s/1s/2s/10s/20s
Input impedance	Voltage input 2MΩ
Comparator output	Sound and light alarm, relay 8 programmable outputs
Communication method	RS232C/RS485, USB, LAN, Setup File Storage
Power supply	AC220V±10%, 50/60Hz±5%, soft power switch
Volume and weight	215mm*132mm*441mm (W*H*D); Shelf size 236mm*154mm*475.5mm (W*H*D); (about 8.1kg).

9.2.2 Specific Input Indicators

Input Metrics					
Items	Input voltage	Amps			
	All models	SME1340/SME1340-3/SME1340-4		SME1340/SME1341-3/SME1341-4	
Measurement range	15v/30v/60v/150v/300v/600v	0.5mA/1mA/2mA/5mA/10mA/20mA	0.05A/0.1A/0.2A/0.5A/1A/2A	5mA/10mA/20mA/50mA/100mA/200mA	0.5A/1A/2A/5A/10A/20A
Input impedance	2MΩ	4Ω	40mΩ	400mΩ	4mΩ
1s instantaneous maximum allowable input	1000V	3A		30A	
Continuous maximum allowable input	700V	2A		20A	

9.3 Precision Indicators

9.3.1 Voltage and Current Accuracy

Environmental requirements for accuracy metrics:

Ambient temperature: 23±5 ℃

Ambient humidity: 30~ 75%RH

Input waveform: sine wave

Peak factor: 3

Display digits: 5 digits

Signal filtering: 500Hz filtering off

Note: The accuracy is valid for 12 months, and the detailed accuracy indicators are as follows:

Frequency segmentation	TH3431/TH3433/TH3434 (VOLTAGE/CURRENT)	TH3441/TH3443/TH3444 (VOLTAGE/CURRENT)
DC	±(0.1% of reading + 0.2% of range)	
0.1Hz ≤ Freq < 45Hz	±(0.1% of reading + 0.2% of range)	
45Hz ≤ Freq < 66Hz	±(0.1% of reading + 0.1% of range)	
66Hz ≤ Freq < 1kHz	±(0.1% of reading + 0.2% of range)	
1kHz ≤ Freq < 10kHz	±((0.07*Freq) % reading + 0.3% range)	
10kHz ≤ Freq < 20kHz		
10kHz ≤ Freq ≤ 100kHz	±(0.5% reading + 0.5% range) ±[0.04*(Freq-10k)] % reading	

9.3.2 Active Power Accuracy

Frequency segmentation	TH3431/TH3432/TH3433/TH3434 (VOLTAGE/CURRENT)	TH3441/TH3442/TH3443/TH3444 (VOLTAGE/CURRENT)
DC	±(0.1% of reading + 0.2% of range)	
0.1Hz ≤ Freq < 45Hz	±(0.3% of reading + 0.2% of range)	
45Hz ≤ Freq < 66Hz	±(0.1% of reading + 0.1% of range)	
66Hz ≤ Freq < 1kHz	±(0.2% of reading + 0.2% of range)	
1kHz ≤ Freq < 10kHz	±((0.1) % reading + 0.3% of range) ±[0.067*(Freq-1k)] % reading	
10kHz ≤ Freq < 20kHz		
10kHz ≤ Freq ≤ 100kHz	±(0.5% reading + 0.5% range) ±[0.09*(Freq-10k)] % reading	

9.3.3 Other Parameter Test Accuracy

Remarks: Voltage and current overload limit 1.1 times of full scale; power factor measurement accuracy requires voltage amplitude higher than 10% range and current amplitude higher than 1% range; frequency test requires voltage amplitude higher than 10% range or current amplitude higher than 1% range.

Chapter 10 Remote Control

10.1 RS232C Interface Description

Currently widely used serial communication standard is the RS-232 standard, can also be called asynchronous serial communication standard, RS for the "Recommended Standard" (Recommended Standard) of the acronym, 232 is the standard number, the standard is the U.S. Electronic Industries Association (IEA) in 1969 officially announced the standard, it provides for one bit at a time through a data line transmission. The standard is the American Electronic Industries Association (IEA) in 1969 officially announced the standard, which provides for one bit at a time by a data line transmission.

As with most serial ports in the world, the instrument's serial interface is not strictly based on the RS-232 standard, but only a minimal subset is provided. This is shown in Table 10-1 below:

Code	Abridge	Connector pin number
Send data	TXD	2
Receive data	RXD	3
Grounding	GND	5

Table 10-1 Instrument RS232 Signal and Pin Comparison

The reason is that the operation of three lines is easier and more convenient than the operation of five or six lines and has a strong compatibility, the use of a fairly wide range, which is the biggest advantage of using serial port communication.

The instrument is connected to the computer as shown in Figure 10-2:

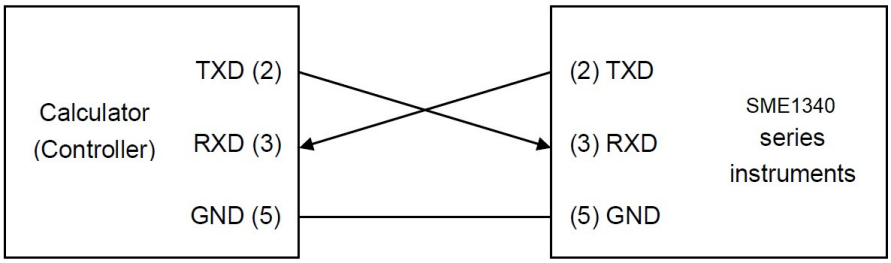


Figure 10-2 Schematic diagram of the connection between the computer and the instrument.

As can be seen from Figure 8-1, the pin definitions of the instrument are different from those of the 9-pole connector serial interface pin definitions used by IMB AT-compatible machines. Users can purchase the serial interface cable line between the computer and the instrument from Scientific.

RS232 interface baud rate can be selected from 9600~115200, no parity, 8 data bits, 1 stop bit.

Instrument commands are compliant with the SCPI standard. When the command string is sent to the instrument, LF (hexadecimal: 0x0A, escape character '\n') is required to be sent as the end character. The maximum number of bytes of SPCI command string that the instrument can receive at one time is 128 Byte.

For the format of the result data sent from the instrument to the computer, see the Command Reference section for instructions.

10.1.1 Command Standard for Programmable Instruments (SCPI)

SCPI is a new common command based on the IEEE 488.2-1987 standard. (SCPI is equivalent to TMSL, the Test and Measurement Instrument System Language adopted by Hewlett-Packard in the United States.)

10.2 RS485 Interface Description

RS485 interface using a combination of balanced driver and differential receiver, the ability to enhance the resistance to common mode interference, that is, good resistance to noise interference, in addition, RS485 signal transmission distance (about 1219m) than the RS232 far, and a bus generally supports a maximum of 32 nodes, if the use of a special 485 chip, the number of nodes that can be mounted will also increase.

The interface comparison is shown in Table 10-2.

Code	Abridge	Connector pin number
Data +	485+	1
Data-	485-	4

Table 10-2 Instrument RS485 Signal and Pin Comparison

RS485 and then use the two-wire connection, and RS232 share an external interface, so that it is easy to use and does not interfere with each other.

SME134X series instruments have internal 485 to 232 hardware decoder, the default configuration of RS232 decoding, if the user customized instrument with 485 communication protocol, before the specific communication also needs to configure the communication required baud rate, parity bit, data bit, stop bit and other related configurations.

10.3 USBTMC Remote Control System

The USB (Universal Serial Bus) remote control system controls devices via a USB interface. The connection is compliant with the USBTMC-USB488 and USB 2.0 protocols.

10.3.1 System Configuration

Connect the USB port on the rear panel of the SME134X series instrument to the USB port on the host computer via the USB cable.

10.3.2 Installation of Drivers

The first time you connect the SME134X to the computer with a USB cable, the computer will prompt "New Hardware Found" in the lower right corner of the desktop, followed by a pop-up dialog box requesting the installation of a driver. This is shown in Figure 10-3 below:

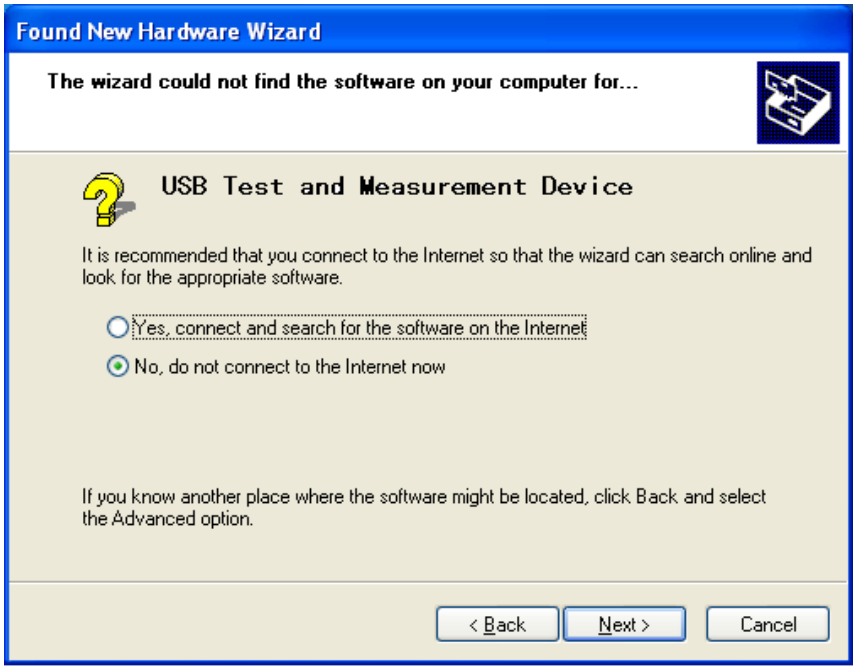


Figure 10-3 Installing the USB Driver Step 1

Click "Next", the dialog box shown in Figure 10-4 will pop up, select "Automatically install software (recommended)".

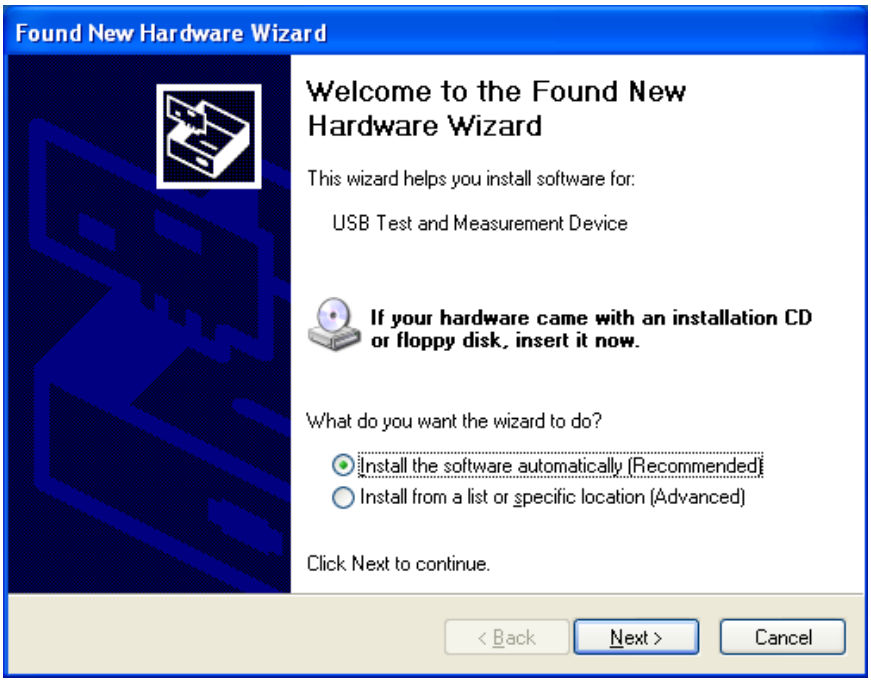


Figure 10-4 Installing the USB Driver Step 2

After the driver is installed, users can see "usb test and measurement device" in the device manager of the computer. As shown in Figure 10-5 below:

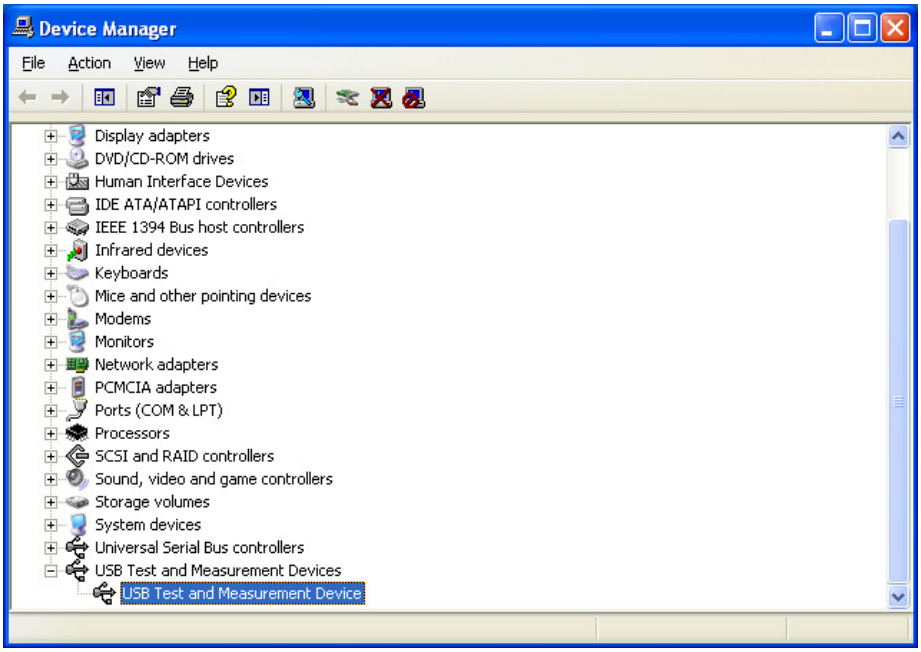


Figure 10-5 PC Device Manager Displaying USBTMC

Users can access the instrument through labview software programming when using the USBTMC interface.

Chapter 11 Communication Command Reference

The communication commands of this series of instruments are available in SCPI command standard and ModBus command standard, in which ModBus command protocol is only applicable to RS232C/RS485 communication interfaces, and other communication interfaces only parse the standard SCPI command.

11.1 SCPI Command

SCPI (Standard Commands for Programmable Instruments) is an ASCII-based instrument command language for test and measurement instruments. SCPI commands are based on a hierarchical structure (also known as a tree system). In this system, related commands are grouped under a common node or root so that subsystems are formed.

According to the command syntax, most commands (and some arguments) are represented by a mixture of upper- and lower-case letters. Upper case letters indicate abbreviated commands. For shorter program lines, you can send commands in abbreviated format. For better program readability, you can send commands in a longer format.

Note: In order to avoid misunderstanding of the instruction abbreviation, this series tries to avoid too much abbreviation optionality in the instruction Description, most of the instruction Description will use the abbreviation form to describe directly.

Grammatical conventions: [SOURce[1|2]:]VOLTage:UNIT {VPP|VRMS|DBM}

[SOURce[1|2]:]FREQuency:CENTer {<frequency>|MINimum|MAXimum|DEFault}

Note: Command syntax conventions:

- The curly brackets ({ }) contain the parameter options for the given command string. The curly brackets are not sent with the command string.
- The vertical bar (|) separates multiple parameter selections for a given command string. For example, in the above command, {VPP|VRMS|DBM} means you can specify "VPP", "VRMS" or "DBM". The vertical bar is not sent with the command string.
- The pointed brackets (< >) in the second example indicate that a value must be specified for the bracketed argument. For example, in the above syntax statement, the argument in pointed brackets is <frequency>. The pointed brackets are not sent with the command string. You must specify the value for the parameter (e.g., "FREQ:CENT 1000") unless you select one of the other options shown in the syntax (e.g., "FREQ:CENT MIN").
- Some syntax elements (such as nodes and arguments) are enclosed in square brackets ([ ]). This means that the element is optional and can be omitted. The pointed brackets are not sent with the command string. If no value is specified for an optional parameter, the instrument will select the default value. In the above example, "SOURce[1|2]" means that you can pass "SOURce" or "SOURce1", or "SOUR1" or "SOUR" to refer to source channel 1. In addition, since the entire SOURce node is optional (in square brackets), you can refer to channel 1 by omitting the SOURce node altogether, since channel 1 is the default

channel for the SOURce language node. This is because channel 1 is the default channel for the SOURce language node. On the other hand, to refer to channel 2, you must use "SOURce2" or "SOUR2" in the program line.

- ^END: The EOI (end-of-instance) signal for the IEEE-488 bus.

11.1.1 IEEE488.2 Common Commands

Standard SCPI commands:

●*IDN ●*TRG ●*RST

Note: This machine mainly uses 3 common commands.

11.1.1.1 *IDN?

- Description: Read out product information.

Syntax: *IDN?

Return result: {string1},{string2},{string3}<^END>

Return data information as follows: "Product Model", "Software Version", "Product Serial Number".

{string1} Model No. (SME1340).

{string3} Software version number (Ver 1.0.0).

{string2} The product serial number, i.e., SN number.

Example:

*IDN?---returns: e.g. SME1340, Ver 1.0.0,1234567890

11.1.1.2 *TRG

- Description:

When the trigger mode of the instrument is set to BUS mode trigger, this command triggers the instrument to perform a measurement. And the instrument actively returns the measurement data after this measurement.

Syntax: *TRG

Return data:

The format refers to the ":FETCh?" command, which returns the voltage and current RMS test results for all channels.

11.1.1.3 *RST

- Description: Reset the machine to the factory initial state, including the value of the parameter setting. Automatic reboot after reset is completed

Syntax: *RST

Example:

*RST

11.1.2 DISPlay Subsystem Command Set

It mainly involves commands for switching between individual display pages.

11.1.2.1 Page Switching

◆ Description: control page switching

Syntax:

:DISP:PAGE?

:DISP:PAGE< PageName>

The meaning of the parameter: PageName is described in Table 10-1 below:

PageName value	Meaning
MEAS	Measurement page
COMP	Comparison page
HARM	Harmonics page
WAVE	Waveform page
VECTOR	Vector page
MEASSET	Measurement settings page
COMPSET	Compare settings page
SYSTEM	System settings page
FILE	File management page
Table 10-1 Meaning of PageName	

Example:

:DISP:PAGE MEAS ---- to access the measurement display page;

:DISP:PAGE MEASSET ---- to enter the Measurement Setup page;

:DISP:PAGE? ---- returns the currently displayed page. Refer to PageName for values.

11.1.2.2 Main Display Channel Switching

◆ Description：Control test page main display channel switching

Syntax: :DISP:PAGE:MEAS?

:DISP:PAGE:MEAS <CH1|CH2|CH3|CH4|CHS>

Parameter: See Table 10-2 below for a Description of the meaning of the values:

CH1	Zoom in or out on display channel 1
CH2	Zoom in or out on display channel 2
CH3	Zoom in or out on display channel 3
CH4	Zoom in or out to show channel 4, some models without CH4

CHS	Zoom in or out on display channel ∑
Table 10-2 Explanation of Channel Meanings	

Example:

:DISP:PAGE:MEAS? ---- returns to the main test page displaying channel information.

:DISP:PAGE:MEAS CH1 ---- Zoom in or out to show channel 1

:DISP:PAGE:MEAS CH2 ---- Zoom in or out to show channel 2

:DISP:PAGE:MEAS CH3 ---- Zoom in or out to show channel 3

:DISP:PAGE:MEAS CH4 ---- Zoom in or out to show channel 4

:DISP:PAGE:MEAS CHS ---- Zoom in or out to show channel ∑

11.1.2.3 Data Update Display Function Switch

◆ Description: Test data update display function switch

Syntax: :DISP:SWIT?

:DISP:SWIT< ON | OFF>

Parameter: ON ------ i.e. synchronized update display of measurement results

OFF ----- i.e. not refreshing the measurement results after the end of the test, equivalent to the panel's [Hold] key

Example:

:DISP:SWIT? ---- returns to the measured data display function status.

:DISP:SWIT ON---- turns on the measurement data display function;

:DISP:SWIT OFF---- turns off the measurement data display function;

11.1.3 FUNCtion Subsystem Command Set

It mainly involves querying and setting the relevant parameters on the measurement display screen and the measurement setting screen.

11.1.3.1 Wired Combination State

◆ Description：Query and setup of wire combination status

Syntax: :FUNC:WIRING?

:FUNC:WIRING <para_list>

Parameter: para_list See Table 10-3 below for a Description of values and meanings:

para_list value	Meaning
1P2W	Setting up all channels to be used as independent 1P2W tables
1P3W	Setting up the first 2 channel combinations for line system 1P3W use
3P3W	Setting up the first 2 channel combinations for line system 3P3W use
3P4W	Setting up the first 3 channel combinations for line system 3P4W use
3V3A	Setting up the first 3 channel combinations for line system 3V3A use
The following parameters are for 4-channel instruments only	
1P3W_1P3W	Setting up the first 2 channel combinations for line system 1P3W use After setting up, the 2 channels are combined to be used in line system 1P3W.
1P3W_3P3W	Setting up the first 2 channel combinations for line system 1P3W use After setting up, the 2 channels are combined to be used as a line system 3P3W.
3P3W_3P3W	Setting up the first 2 channel combinations for line system 3P3W use After setting up, the 2 channels are combined to be used as a line system 3P3W.
Table 10-3 Explanation of the meaning of wire system parameters	

Example:

:FUNC:WIRING ---- returns the current state of the wiring combination;

:FUNC:WIRING ---- sets the current 3P3W system;

:FUNC:WIRING ---- sets the current 1P3W_3P3W system;

◆ Description：Efficiency calculation formula query and setting within the wire system combination

Syntax: :FUNC:WIRING:EFFI?

:FUNC:WIRING:EFFI {<group_num>,<up_para>,<down_para>}

Parameter: group_num: value 1|2, indicates that the efficiency formula under the first wire system combination is being set.

The 3-channel instrument has the most one-wire combination state, so it can only take a value of 1.

A 4-channel instrument may have 2 wire states, so take the value 1 or 2.

up_para denotes the molecular part of the

down_para indicates the denominator part.

The values and meanings of up_para and down_para are described in Table 10-4 below:

up_para and down_para value	Meaning
P1, P2, P3, P4	Active power for channels 1/2/3/4
PS	Active power of combination 1
PS1	
PS2	Active power of combination 2
Note: P4 and PS2 are optional parameters for 4-channel instruments, and are not applicable to 3-channel instruments; where PS and PS1 have the same meaning, and both indicate the active power under the first wire system combination;	

Table 10-4 Explanation of the meaning of the efficiency formula under the combination of line system

Example:

:FUNC:WIRING:EFFI---- returns the efficiency formula for all wire systems;

:FUNC:WIRING:EFFI 1,P1,PS ---- setη1 = $P_1/P_{\sum}$ * 100%;

:FUNC:WIRING:EFFI 2,P1,PS2 ---- setη2 = $P_1/P_{\sum 2}$ * 100%;

11.1.3.2 Line Filter Function Switch

- DESCRIPTION: Test Line 500Hz Filter Function Switch Settings and Queries Syntax:

:FUNC:linefilt?

:FUNC:linefilt {ON|OFF}

Parameters: ON/OFF ---- for "on/off" test filtering function respectively

Example:

:FUNC:linefilt? ---- returns the current 500Hz filter status (ON or OFF).

:FUNC:linefilt ON ---- turns on 500Hz filtering for tests

:FUNC:linefilt OFF ---- disables 500Hz filtering for tests

11.1.3.3 Average Number of Times

- Description: Setting and querying the average number of measurements

Syntax: :FUNC:AVG?

:FUNC:AVG {NUM}

Parameter: NUM Values 1~32 Example:

:FUNC:AVG? ---- returns the average number of current measurements (1~32)

:FUNC:AVG 1 ---- sets the number of measurement averages to 1,
i.e. no averaging;
:FUNC:AVG 8 ---- sets the number of measurement averages to 8;

11.1.3.4 Synchronization Source

◆ Description：Synchronization source setting and query for channel test

Syntax: :FUNC:SYNC?
:FUNC:SYNC:CH1?
:FUNC:SYNC:CH2?
:FUNC:SYNC:CH3?
:FUNC:SYNC:CH4?
:FUNC:SYNC:CH1 {U1|I1|U2|I2|U3|I3|U4|I4}
:FUNC:SYNC:CH2 {U1|I1|U2|I2|U3|I3|U4|I4}
:FUNC:SYNC:CH3 {U1|I1|U2|I2|U3|I3|U4|I4}
:FUNC:SYNC:CH4 {U1|I1|U2|I2|U3|I3|U4|I4}

Parameters: CH1, CH2, CH3, CH4 indicate the channel markers to be set.

The meanings of U1, I1, U2, I2, U3, I3, U4, and I4 are shown in Table 10-5 below:

U1, I1	Voltage and current signals for channel 1
U2, I2	Voltage and current signals for channel 2
U3, I3	Voltage and current signals for channel 3
U4, I4	Voltage and current signals for channel 4, some models without CH4

Table 10-5 Explanation of Channel Meanings

Example:

:FUNC:SYNC? ----- returns the synchronization status of all channels.
:FUNC:SYNC:CH1? ---- returns the synchronization status of channel 1.
:FUNC:SYNC:CH1 U1 ---- sets the synchronization of channel 1 on the U1 signal;
:FUNC:SYNC:CH1 I2 ---- sets the synchronization of channel 1 on the I2 signal
Other parameters for other channels and so on can be used.
Note: Since this setting is related to the current state of the wire system combination, some settings may not take effect, which indicates that this setting is limited by the current wire system situation, i.e. setting conflict.

11.1.3.5 Energy Integral Control

◆ Description：Set the energy integral control method

Syntax: :FUNC:ECMODE?
:FUNC:ECMODE {MAN|CONT}

Parameter: MAN|CONT stands for "manual/continuous" control respectively.

Example:

:FUNC:ECMODE?

---- returns to energy integral control mode;

:FUNC:ECMODE MAN

---- sets the energy integral control mode to manual control;

:FUNC:ECMODE CONT

---- sets the energy integral control mode to automatic control;

◆ Description: Setting the energy integration time

Syntax: :FUNC:ETIME?

:FUNC:ETIME {< ehour,emin,esec>}

Parameters: ehour, emin, esec for "hour, minute, second" control respectively.

ehour	Value range 0~9999
emin,esec	Value range 0~59

Example:

:FUNC:ETIME?

---- returns the current energy credit limit time.

:FUNC:ETIME 1,22,33

---- sets the energy credit time to 1 hour, 22 minutes and 33 seconds;

◆ Description: control energy integral operating state

Syntax: :FUNC:ENERGY?

:FUNC:ENERGY {RUN | STOP | RESET}

Parameter: RUN ---- startup run

STOP ---- stops running

RESET ---- Accumulated results and accumulated time reset

Example:

:FUNC:ENERGY? ---- returns the current energy credit operating status

:FUNC:ENERgy RUN ---- startup run energy credit

:FUNC:ENERgy STOP ---- Stop Running Energy Integration

:FUNC:ENERgy RESET ---- Reset Energy Integration Results and Timing Status

11.1.3.6 Voltage Range

◆ Description: Simultaneous query and control of voltage ranges for all channels

Syntax: :FUNC:VOLT:RANG? ---- returns the voltage range for all channels.

:FUNC:VOLT:RANG {0|1|2|3|4|5} ---- controls the voltage range for all channels;

Parameter: {0|1|2|3|4|5} corresponds to the voltage range of the instrument, see section 4.1.6.1 for the Description of the meaning ;

Example:

:FUNC:VOLT:RANG

---- returns the voltage range for all channels;

:FUNC:VOLT:RANG 0

---- sets the voltage range for all channels to the number 0;

:FUNC:VOLT:RANG 1

---- sets the voltage range for all channels to #1;

:FUNC:VOLT:RANG 2

---- sets the voltage range for all channels to #2;

:FUNC:VOLT:RANG 3

---- sets the voltage range for all channels to #3;

:FUNC:VOLT:RANG 4

---- sets the voltage range for all channels to number 4;

:FUNC:VOLT:RANG 5

---- sets the voltage range for all channels to #5;

◆ Description：Setting and querying the voltage range of the specified channel.

Syntax: :FUNC:VOLT:RANG:CH<1|2|3|4>?

--- Returns the voltage range for the specified channel.

:FUNC:VOLT:RANG:CH<1|2|3|4> {0|1|2|3|4|5}

---- sets the voltage range for the specified channel.

Parameter: CH<1|2|3|4> indicates the first channel of the instrument.

{0|1|2|3|4|5} corresponds to the voltage range of the instrument, see section 4.1.6.1 for the Description of the meaning :

Example:

:FUNC:VOLT:RANG:CH1

---- returns the current voltage range of channel 1;

:FUNC:VOLT:RANG:CH2

---- returns the current voltage range of channel 2;

:FUNC:VOLT:RANG:CH3

---- returns the current voltage range of channel 3;

:FUNC:VOLT:RANG:CH4?

---- returns the current voltage range of channel 4;

:FUNC:VOLT:RANG:CH1 0

---- sets the channel 1 voltage range to switch to number 0;

:FUNC:VOLT:RANG:CH1 1

---- sets the channel 1 voltage range to switch to number 1;

:FUNC:VOLT:RANG:CH1 2

---- sets channel 1 voltage range switch to #2;

:FUNC:VOLT:RANG:CH1 3

---- sets the channel 1 voltage range to switch to number 3;

:FUNC:VOLT:RANG:CH1 4

---- sets the channel 1 voltage range to switch to number 4;

:FUNC:VOLT:RANG:CH1 5

---- sets the channel 1 voltage range to switch to number 5;

Note: The settings for the other channels can be set up in a similar manner.

◆ Description: Voltage auto-ranging setting and query for all channels

Syntax: :FUNC:VOLT:RANG:AUTO?

--- Returns the voltage range auto state for all channels.

:FUNC:VOLT:RANG:AUTO {ON|OFF}

---- sets the voltage range auto state for all channels.

Parameter: {ON|OFF} Switch corresponding to auto range.

Example:

:FUNC:VOLT:RANG:AUTO?

---- Returns all channels to the voltage range auto state;

:FUNC:VOLT:RANG:AUTO ON

---- Sets all channel voltage ranges automatically;

:FUNC:VOLT:RANG:AUTO OFF

---- Set all channel voltage ranges not automatic

◆ Description：Auto-range setting and querying of voltage for specified channels Syntax:

:FUNC:VOLT:RANG:CH<1|2|3|4>:AUTO?

--- Returns the voltage range auto state for the specified channel.

:FUNC:VOLT:RANG:CH<1|2|3|4>:AUTO {ON|OFF}

---- sets the voltage range auto state for the specified channel.

Parameter: CH<1|2|3|4> indicates the first channel of the instrument.

{ON|OFF} The switch corresponding to the auto range.

Example:

:FUNC:VOLT:RANG:CH1:AUTO?

---- Returns to channel 1 voltage range auto status.

:FUNC:VOLT:RANG:CH2:AUTO?

---- Returns to channel 2 voltage range auto status.

:FUNC:VOLT:RANG:CH3:AUTO?

---- Returns to Channel 3 Voltage Ranging Auto status.

:FUNC:VOLT:RANG:CH4:AUTO?

---- Returns to Channel 4 Voltage Ranging Auto status.

:FUNC:VOLT:RANG:CH1:AUTO ON

---- Sets channel 1 voltage range automatically;

:FUNC:VOLT:RANG:CH1:AUTO OFF

---Set channel 1 voltage range not automatic

Note: The settings for the other channels can be set up in a similar manner.

11.1.3.7 Current Range

- Description: Simultaneous query and control of current ranges for all channels Syntax:

  :FUNC:CURR:RANG?

  ---- returns the current range for all channels.

  :FUNC:CURR:RANG {0~11}

  ---- controls the current range of all channels;

  Parameter: {0~11} corresponds to the current range of the instrument, see section 4.1.6.1 for the meaning Description:

  Example:

  :FUNC:CURR:RANG

  ---- returns the current range for all channels;

  :FUNC:CURR:RANG 0

  ---- sets the current range for all channels to the number 0;

  :FUNC:CURR:RANG 1

  ---- sets the current range for all channels to #1

  :FUNC:CURR:RANG 2

  ---- sets the current range for all channels to #2;

  :FUNC:CURR:RANG 3

  ---- sets the current range for all channels to #3;

  :FUNC:CURR:RANG 4

  ---- sets the current range for all channels to number 4;

  :FUNC:CURR:RANG 10

  ---- sets the current range for all channels to number 10;

  :FUNC:CURR:RANG 11

  ---- sets the current range for all channels to number 11;

- Description：Current range setting and query for specified channel

  Syntax: :FUNC:CURR:RANG:CH<1|2|3|4>?

  --- Returns the current range for the specified channel.

  :FUNC:CURR:RANG:CH<1|2|3|4> {0~11}

  ---- sets the current range for the specified channel.

  Parameter: CH<1|2|3|4> indicates the first channel of the instrument.

  {0~11} corresponds to the current range of the instrument, see Section 4.1.6.1 for the Description of the meaning:

  Example:

  :FUNC:CURR:RANG:CH1

  ---- returns the current current range of channel 1;

  :FUNC:CURR:RANG:CH2

  ---- returns the current current range of channel 2;

  :FUNC:CURR:RANG:CH3

---- returns the current current range of channel 3;

:FUNC:CURR:RANG:CH4?

---- returns the current current range of channel 4;

:FUNC:CURR:RANG:CH1 0

---- sets channel 1 current range switching to number 0;

:FUNC:CURR:RANG:CH1 1

---- sets channel 1 current range switching to #1;

:FUNC:CURR:RANG:CH1 2

---- sets channel 1 current range switching to #2;

:FUNC:CURR:RANG:CH1 11

---- sets the channel 1 current range to switch to number 11;

Note: The settings for the other channels can be set similarly.

◆ Description: Automatic current range setting and query for all channels

Syntax: :FUNC:CURR:RANG:AUTO?

---- returns the current range auto status for all channels.

:FUNC:CURR:RANG:AUTO {ON|OFF}

---- sets the current range auto state for all channels.

Parameter: {ON|OFF} Switch corresponding to auto range.

Example:

:FUNC:CURR:RANG:AUTO?

---- Returns all channels to current range auto status.

:FUNC:CURR:RANG: AUTO ON

---- Sets all channel current ranges automatically;

:FUNC:CURR:RANG:AUTO OFF

---- Sets all channel current ranges not to be automatic

◆ Description：Auto-range setting and query for current of specified channel

Syntax: :FUNC:CURR:RANG:CH<1|2|3|4>:AUTO?

--- Returns the current range auto state for the specified channel.

:FUNC:CURR:RANG:CH<1|2|3|4>:AUTO {ON|OFF}

---- sets the current range auto state for the specified channel.

Parameter: CH<1|2|3|4> indicates the first channel of the instrument.

{ON|OFF} The switch corresponding to the auto range.

Example:

:FUNC:CURR:RANG:CH1:AUTO?

---- Returns to channel 1 current range auto state.

:FUNC:CURR:RANG:CH2:AUTO?

---- Returns to channel 2 current range auto status;

:FUNC:CURR:RANG:CH3:AUTO?

---- returns to channel 3 current range auto status;

:FUNC:CURR:RANG:CH4:AUTO?

---- returns to channel 4 current range auto status;

:FUNC:CURR:RANG:CH1:AUTO ON

---- Sets channel 1 current range auto;

:FUNC:CURR:RANG:CH1:AUTO OFF

---- Sets channel 1 current range not to be automatic

Note: The settings for the other channels can be set similarly.

11.1.3.8 Basic Measurement Parameters (4)

◆ Description: Basic measurement page to set and query 4 measurement parameters for each channel

Syntax: :FUNC:PARA:CH<1|2|3|4>?

:FUNC:PARA:CH<1|2|3|4> {< S1>,<S2>,<S3>,<S4>}

Parameter: CH<1|2|3|4> denotes the specified channel number

S1~S4 indicates the names corresponding to the 4 parameters in the channel, and the values are shown in Table 10-8 below:

For a detailed Description of the meaning, see the parameter Description section

S1~S4 values	
FU, FI, URMS, UAC, UDC, UPK+, UPK-, UPP, UCF, IRMS, IAC, IDC, IPK+, IPK-, IPP, ICF, P, S-VA, Q-VAR, PF, PHASE, WP+, WP-, WP, PAVG, q, WS, WQ, PMIN, PMAX	
Table 10-8 Optional names for basic parameters	

Example:

:FUNC:PARA:CH1? ---- returns the names of the 4 basic parameters corresponding to channel 1.

:FUNC:PARA:CH2? ---- returns the names of the 4 basic parameters corresponding to channel 2.

:FUNC:PARA:CH3? ---- returns the names of the 4 basic parameters corresponding to channel 3.

:FUNC:PARA:CH4? ---- returns the names of the 4 basic parameters corresponding to channel 4.

:FUNC:PARA:CH1 URMS,IRMS,P,PF

---- sets the 4 basic parameters of channel 1.

:FUNC:PARA:CH2 URMS,IRMS,P,PF

---- sets the 4 basic parameters for channel 2.

Note: The settings for the other channels can be set up in a similar manner.

11.1.3.9 Data Update Time

- Description: Set the refresh interval for test data update

  Syntax: :FUNC:dataupdate<0.1/0.25/0.5/1/2/10/20>

  :FUNC:dataupdate?

  Parameters: 0.1/0.25/0.5/1/2/10/20 (default unit is s) Indicates the data refresh interval

  Example:

  :FUNC:dataupdate 0.5 ---- sets the test data to be refreshed every 0.5s;

  :FUNC:dataupdate? ---- returns the current test data refresh interval

- Description: Set the switch of automatic test data update function.

  Syntax: :FUNC:dataupdate:auto<ON/OFF>

  :FUNC:dataupdate:auto?

  Parameters: ON/OFF indicates whether to enable the data auto refresh function or not

  Example:

  :FUNC:dataupdate:auto ---- ON sets the test data auto refresh;

  :FUNC:dataupdate:auto? ---- returns the current status of data auto refresh.

11.1.4 COMPare Subsystem Command Set

It mainly involves the query and modification of parameters related to the comparison function.

11.1.4.1 Comparison Parameters

- Description：Set query comparison parameters

  Syntax: :COMP:COMP<1|2|3|4|5|6|7|8>:PARA?

  :COMP:COMP<1|2|3|4|5|6|7|8>:PARA {CH<1,2,3,4>,STR}

  :COMP:COMP<1|2|3|4|5|6|7|8>:PARA {CHS<1,2>,STR2}

  Parameters: COMP<1|2|3|4|5|6|7|8> corresponds to 8 comparison terms in order.

  CH<1,2,3,4> denotes 4 optional channels

  CHS<1,2> indicates an optional 2-wire combination grouping

  STR is the name of the parameter corresponding to each channel, and the values are shown in Table 10-9 below:

  STR2 is the name of the parameter in the line system grouping, and the values are shown in Table 10-9 below:

STR value	FU, FI, URMS, UAC, UDC, UPK+, UPK-, UPP, UCF, IRMS, IAC, IDC, IPK+, IPK-, IPP, ICF, P, S-VA, Q-VAR, PF, PHASE, WP+, WP-, WP, PAVG, q, WS, WQ, PMAX
STR2 value	URMS, UAC, UDC, IRMS, IAC, IDC, P, S, Q, PF, WP, EFFiciency

Table 10-9 Optional names for basic parameters

Example:

:COMP:COMP1:PARA

---- returns the parameters set by Compare 1;

:COMP:COMP1:PARA CH1,URMS

---- sets the parameter for Compare 1 to the URMS of channel 1;

:COMP:COMP1:PARA CHS,URMS

---- sets the parameter of Compare 1 to the URMS of line system combination 1;

:COMP:COMP1:PARA **CHS1**,URMS

---- has the same meaning as above;

:COMP:COMP1:PARA CHS2,URMS

---- sets the parameter of Compare 1 to the URMS of line system combination 2;

Note: The settings of other items can be set by analogy.

11.1.4.2 Lower Limit of Comparison

◆ Description：Set the lower limit size of the current parameter of the query comparison channel

Syntax: :COMP:COMP<1|2|3|4|5|6|7|8>:LOW?

:COMP:COMP<1|2|3|4|5|6|7|8>:LOW {float}

Parameters: COMP<1|2|3|4|5|6|7|8> corresponds to 8 comparison terms in order.

Float represents the size of floating-point data.

Example: :COMP:COMP1:LOW?

---- returns the lower data size for comparison 1;

:COMP:COMP1:LOW 200.2

----sets the lower data limit for Compare 1 to 200.2;

Note: The settings of other items can be set by analogy.

11.1.4.3 Upper Limit of Comparison

◆ Description：Set the upper limit size of the current parameter of the query comparison channel

Syntax: :COMP:COMP<1|2|3|4|5|6|7|8>:HIGH?

:COMP:COMP<1|2|3|4|5|6|7|8>:HIGH {float}

Parameters: COMP<1|2|3|4|5|6|7|8> corresponds to 8 comparison terms in order.

Float represents the size of floating-point data.

Example: :COMP:COMP1:HIGH?

---- returns the upper limit data size for comparison 1;

:COMP:COMP1:HIGH 200.2

---- sets the upper limit data for Compare 1 to 200.2;

Note: The settings of other items can be set by analogy.

11.1.4.4 Compare Function Status

◆ Description：Set the function status of querying the current parameters of the comparison channel.

Syntax: :COMP:COMP<1|2|3|4|5|6|7|8>:FUNC?

:COMP:COMP<1|2|3|4|5|6|7|8>:FUNC {STR}

Parameters: COMP<1|2|3|4|5|6|7|8> corresponds to 8 comparison terms in order.

STR is the name of the parameter corresponding to each channel, and the values are shown in Table 10-10 below:

STR value	Meaning
OFF	Disables the comparison function of the corresponding comparison channel
FAILCOUNT	Unqualified conduction output
PASSCOUNT	Qualified On Output
FAILPULSE	Failure pulse output
PASSPULSE	Qualified Pulse Output

Table 10-10 Comparison Function Meaning Explanation

Example: :COMP:COMP1:FUNC?

---- returns the functional status of Compare 1.

:COMP:COMP1:FUNC failcont

---- sets the Compare 1 fail conduction output;

:COMP:COMP1:FUNC passcont

---- Sets the Compare 1 qualified conduction output;

:COMP:COMP1:FUNC failpulse

---- Sets the Compare 1 fail pulse output;

:COMP:COMP1:FUNC passpulse

---- Sets the Compare 1 qualified conduction output;

Note: The settings of other items can be set by analogy.

11.1.5 HARMonic Subsystem Command Set

11.1.5.1 Calculation Criteria

◆ Description: Setting calculation criteria for harmonic analysis data

Syntax: :HARM:calstd ?

:HARM:calstd {IEC| CSA}

Parameter: IEC|CSA stands for "International Electrotechnical Commission/Canadian Standards Association" calculation standards, respectively.

Example:

:HARM:calstd?

---- Return to Calculation Criteria for Harmonic Analysis Data

:HARM:calstd IEC

---- sets the calculation standard for harmonic analysis to the IEC standard

:HARM:calstd CSA

---- sets the calculation standard for harmonic analysis to the CSA standard

11.1.5.2 Display Form

◆ Description：Set the display form of harmonic analysis results

Syntax: :HARM:form?

:HARM:form {LIST| BAR}

Parameter: LIST| BAR means "list/bar chart" respectively.

Example:

:HARM:form?

---- returns the form in which the current harmonic analysis results are displayed

:HARM:form LIST

---- sets the display of harmonic analysis results as a list.

:HARM:form BAR

---- sets the display of harmonic analysis results as a bar chart.

11.1.5.3 Data Model

◆ Description：Set the data mode corresponding to the harmonic analysis data Syntax:

:HARM:DATAmode?

:HARM:DATAmode {ABS| PER}

Description：Set the data mode corresponding to the harmonic analysis data Parameter:

ABS| PER for "real mode/percentage mode" respectively.

Example:

:HARM:DATAmode ? ---- returns the data mode for harmonic analysis

:HARM:DATAmode PER ---- sets harmonic data mode to percent

:HARM:DATAmode ABS ---- sets the harmonic data mode to real mode

11.1.5.4 Analyzing Parameter Terms

- Description：Set up to query the status of all channel harmonic analysis parameter items

Syntax: :HARM:ITEM?

:HARM:ITEM {ON| OFF}

Parameter: {ON| OFF} Indicates the state of the switch. Example:

:HARM:item? ---- returns an enumeration of the parameters that are turned on by the switching state of the harmonic analysis.

:HARM:item ON ---- sets the harmonic calculation on for all channels;

:HARM:item OFF ---- sets the harmonic calculation off for all channels;

Note: If all parameters are turned on, the query result should be "U1,I1,U2,I2,U3,I3" or "U1,I1,U2,I2,U3,I3,U4,I4"; if all parameters are turned on, then partial enumeration is returned; if all parameters are turned off, then no return or "null" is returned; if all parameters are turned off, then no return or "null" is returned; if all parameters are turned on, then no return or "null" is returned; if all parameters are turned off, then no return or "null" is returned; if all parameters are turned on, then no return or "null" is returned. If the enumeration is partially opened, it returns the partial enumeration, if it is completely closed, it returns nothing or "null";

- Description：Set the status of query harmonic analysis parameter item

Syntax: :HARM:ITEM:<STR>?

:HARM:ITEM:<STR> {ON| OFF}

Parameter: <STR> indicates the corresponding name of the analyzable item, see Table 10-11 below for values:

{ON| OFF} indicates the state of the switch.

STR value	Meaning
U1, I1	Voltage and current corresponding to channel 1
U2, I2	Voltage and current corresponding to channel 2
U3, I3	Voltage and current corresponding to channel 3

U4, I4	Voltage and current corresponding to channel 4

Table 10-11 Explanation of the meaning of harmonic analyzable parameters

Example:

:HARM:item:U1?

---- returns the switching state of the U1 harmonic analysis.

:HARM:item:I1?

---- returns the switching state of the I1 harmonic analysis.

:HARM:item:U1 ON----------sets the harmonic calculation of U1 on;

:HARM:item:U1 OFF ----------sets the harmonic calculation of U1 off;

Note: The settings of other items can be set by analogy.

11.1.6 WAVE Subsystem Command Set

- Description：Set the query waveform type

Syntax: :WAVE:TYPE?

:WAVE:TYPE {UI| POWER}

Parameter: UI indicates voltage and current waveform POWER indicates the power waveform

Example:

:WAVE:TYPE?----------returns the wave type.

:WAVE:TYPE UI ----------sets the wave type to UI wave;

:WAVE:TYPE POWER ----------sets the wave type to power waveform;

- Description：Set the status of query waveform display parameter items

Syntax: :WAVE:ITEM:<STR>?

:WAVE:ITEM:<STR> {ON| OFF}

Parameter: <STR> indicates the corresponding name of the analyzable item, see Table 10-12 below for the values:

{ON| OFF} indicates the state of the switch.

STR value	Meaning
U1, I1	Voltage and current corresponding to channel 1
U2, I2	Voltage and current corresponding to channel 2
U3, I3	Voltage and current corresponding to channel 3
U4, I4	Voltage and current corresponding to channel 4
P1, P2, P3, P4	Power for each channel

Table 10-12 Explanation of the meanings of optional parameters for waveforms

Example: :WAVE:item:U1?

---- returns the switch state of the U1 waveform display.

:WAVE:item:I1?

---- returns the switch state of the I1 waveform display.

:WAVE:item:P1?

---- returns the switch state of the P1 waveform display.

:WAVE:item:U1 ON ---- sets the display state of U1 on;

:WAVE:item:U1 OFF ---- sets the display state of U1 off;

:WAVE:item:P1 ON ---- sets the display state of P1 on;

Note: The settings of other items can be set by analogy.

11.1.7 SYSTem Subsystem Command Set

11.1.7.1 Keypad Signal

- Description: Setting the keypad audible switch

Syntax: :SYSTEM:BEEP?

:SYSTEM:BEEP {ON|OFF}

Parameter: ON|OFF stands for "On/Off" respectively. Example:

:SYSTEM: BEEP? ---- to return to the status of the keypad audible switch;

:SYSTEM: BEEP ON ---- sets the key beep switch on;

:SYSTEM: BEEP OFF ---- sets the key beep switch off;

11.1.7.2 Comparative Signal

- Description: Setting the Compare Audible Switch

Syntax: :SYSTEM:BEEP:COMP?

:SYSTEM:BEEP:COMP {PASS| FAIL | OFF}

Parameters: {PASS| FAIL | OFF} stands for "Pass/Fail/Off" respectively.

Example:

:SYSTEM:BEEP:COMP?

---- returns to the status of the compare alarm switch.

:SYSTEM:BEEP:COMP PASS ---- sets the comparison signal to pass;

:SYSTEM:BEEP:COMP FAIL ---- sets the compare signal to fail;

:SYSTEM:BEEP:COMP OFF ---- sets the Comparison Audible Switch off;

11.1.7.3 System Language

- Description: Setting the system language

Syntax: :SYSTEM:LANG?

:SYSTEM:LANG {EN}

Parameters: EN stands for "English".

Example:

:SYSTEM:LANG? ---- returns the current system language

:SYSTEM:LANG EN ---- sets the system language to English

11.1.7.4 Liquid Crystal Backlight Brightness

- Description：Set the brightness of LCD backlight

Syntax: :SYSTEM:LIGHT?

:SYSTEM:LIGHT {20 | 40 | 60 | 80 | 100}

Parameter: {20 | 40 | 60 | 80 | 100} denotes the percentage value of brightness desirable

Example:

:SYSTEM:LIGHT?

---- returns the percentage size of the LCD backlight brightness

:SYSTEM:LIGHT 20 ---- sets the LCD backlight brightness to 20%.

:SYSTEM:LIGHT 40 ---- sets the LCD backlight brightness to 40%.

:SYSTEM:LIGHT 60 ---- sets the LCD backlight brightness to 60%.

:SYSTEM:LIGHT 80 ---- sets the LCD backlight brightness to 80%.

:SYSTEM:LIGHT 100 ---- sets the LCD backlight brightness to 100%.

11.1.7.5 System Date and Time

- Description: Set the system date and time at the same time

Syntax: :SYSTEM:DATETIME?

:SYSTEM:DATETIME {year,month,date,hour,minute,sec}

Parameters: see separate instructions above for range of values Example:

:SYSTEM:DATETIME?

---- return datetime, e.g. 2019-12-18 08:30:20

:SYSTEM:DATETIME 2019,12,12,8,30,20

---- set date time to 2019-12-18 08:30:20

- Description: Set the system date ---- year

Syntax: :SYSTEM:year?

:SYSTEM:year NUM}

Parameter: NUM value range 2018~ 2999 Example:

:SYSTEM:year? ---- returns the year, e.g. 2019

:SYSTEM:year 2019 ---- sets the date to 2019

- Description: Set the system date ---- month

Syntax: :SYSTEM:MONTH?

:SYSTEM:MONTH {NUM}

Parameter: NUM value range 1~12

Example:

:SYSTEM:MONTH? ---- returns the month

:SYSTem:MONth 1 ---- modify the setup date to January

- Description: Set the system date ---- day

Syntax: :SYSTEM:DATE?

:SYSTEM:DATE {NUM}

Parameter: NUM value range 1~31

Example:

:SYSTEM:DATE? ---- returns day information

:SYSTEM:DATE 1 ---- modify set date to 1

- Description：Set the system time at ----

Syntax: :SYSTEM:HOUR?

:SYSTEM:HOUR {NUM}

Parameter: NUM value range 0~23

Example:

:SYSTEM:HOUR? ---- returns hours

:SYSTEM:HOUR 12 ---- modify the set date to 12 o'clock

- Description：Set the system time minutes

Syntax: :SYSTEM:MINUTE?

:SYSTEM:MINUTE {NUM}

Parameter: NUM value range 0~59

Example:

:SYSTEM:MINUTE? ---- returns minutes

:SYSTEM:MINUTE 12 ---- modify set date to 12 minutes

- Description: Set the system time ---- seconds

Syntax: :SYSTEM:SEC?

:SYSTEM:SEC {NUM}

Parameter: NUM value range 0~59

Example:

:SYSTEM:SEC? ---- returns seconds

:SYSTEM:SEC 12 ---- modify set date to 12 seconds

11.1.7.6 Serial Port Settings

- Description：Set serial port baud rate

Syntax: :SYSTEM:RS232:BAUD?

:SYSTEM:RS232:BAUD {4800 | 9600 | 38400 | 115200}

Parameters: Provides 4 settable baud rates

Example:

:SYSTEM:RS232:BAUD? ---- returns the baud rate size

:SYSTEM:RS232:BAUD 4800 ---- sets the baud rate to 4800

:SYSTEM:RS232:BAUD 9600 ---- sets the baud rate to 9600

:SYSTEM:RS232:BAUD 38400 ---- sets the baud rate to 38400

:SYSTEM:RS232:BAUD 115200 ---- sets the baud rate to 115200

Note: The other configurations of the serial port use the regular configuration, i.e., data bits (8), stop bits (1), no parity, and no data flow control.

- Description：Set the local address for serial communication

Syntax: :SYSTEM:RS232:ADDR?

:SYSTEM:RS232:ADDR {NUM}

Parameter: {NUM}, value 1~32

Example:

:SYSTEM:RS232:ADDR? ---- returns the local serial port communication address

:SYSTEM:RS232:ADDR 1 ---- sets the local serial port communication address to 1

:SYSTEM:RS232:ADDR 32 ---- sets the local serial port communication address to 32.

Note: The settings of other items can be set by analogy.

- Description：Set the command mode (i.e. parsing protocol) for serial port communication

Syntax: :SYSTEM:RS232:CMDMODE?

:SYSTEM:RS232:CMDMODE {SCPI | MODBUS}

Parameter: {SCPI | MODBUS}, provides two commonly used command parsing protocols for selection.

Example:

:SYSTEM:RS232:CMDMODE? ---- return to command mode

:SYSTEM:RS232:CMDMODE SCPI

---- sets the command parsing protocol to the SCPI protocol

:SYSTEM:RS232:CMDMODE MODBUS

---- sets the command parsing protocol to the ModBus protocol

11.1.7.7 Wired LAN Setting

- Description：Set the IP address of LAN

Syntax: :SYSTEM:LAN:IPAD?

:SYSTEM:LAN:IPAD {X.X.X.X}

Parameter: {X.X.X.X}, regular format of network address, X takes value 0~255

Example:

:SYSTEM:LAN:IPAD? ---- returns the local IP address

:SYSTEM:LAN:IPAD 192.168.1.242 ---- set the IP address to 192.168.1.242

- Description: Set the LAN port number

Syntax: :SYSTEM:LAN:PORT?

:SYSTEM:LAN:PORT {NUM}

Parameter: {NUM}, the value range of port number is 0~65535 in theory, factory default 45454.

Example:

:SYSTEM:LAN:PORT? ---- returns the port number

:SYSTEM:LAN:PORT 45454 ---- sets the port number to 45454

Note: The setting of network port number needs to avoid the recognized ports (0~1023), after modifying the communication abnormality, please contact the network administrator to confirm whether the set port number is occupied or not.

- Description: Set the LAN subnet mask

Syntax: :SYSTEM:LAN:SMASk?

:SYSTEM:LAN:SMASk {X.X.X.X}

Parameter: {X.X.X.X}, regular format of network address, X takes value 0~255

Example:

:SYSTEM:LAN:SMASk? ---- returns the subnet mask

:SYSTEM:LAN:SMASk 255.255.255.0

---- set the subnet mask to 255.255.255.0

- Description: Set the LAN gateway address

Syntax: :SYSTEM:LAN:GATeway?

:SYSTEM:LAN:GATeway {X.X.X.X}

Parameter: {X.X.X.X}, regular format of network address, X takes value 0~255

Example:

:SYSTEM:LAN:GATeway? ---- returns the gateway address

:SYSTEM:LAN:GATeway 192.168.1.0

---- set the gateway address to 192.168.1.0

- Description: Set the LAN host name

Syntax: :SYSTEM:LAN:HOSTname?

:SYSTEM:LAN:HOSTname <str>

Parameters: <str>, regular string

Example:

:SYSTEM:LAN:HOSTname? ---- returns the hostname

:SYSTEM:LAN:HOSTname VIC ---- sets the hostname to VIC

- Description：Query LAN MAC address

Syntax: :SYSTEM:LAN:MAC?

Parameters: None

Example:

:SYSTEM:LAN:MAC? ---- returns the LAN MAC address

11.1.7.8 USB Address Query

- Description：Query the ID of USBTMC

  Syntax: :SYSTEM:USB:ID?

  Parameters: None

  Example:

  :SYSTEM:USB:ID? ---- returns the ID of the USBTMC

11.1.8 TRIGger Subsystem Command Set

- Description: Perform a bus trigger test

  Syntax: :TRIG

  Parameters:

  Example: :TRIG ---- performs a bus trigger test in the bus touch state

- Description：Set the trigger method

  Syntax: :TRIG:SOUR?

  :TRIG:SOUR {CONTinue | SINGle}

  Parameters: COUTinue | SINGle means "continuous/single" respectively.

  Example:

  :TRIG:SOUR? ---- returns the trigger method for system measurements

  :TRIG:SOUR CONTinue ---- sets the measurement trigger mode to continuous trigger

  :TRIG:SOUR SINGle ---- sets the measurement trigger mode to single trigger

11.1.9 FETCh Subsystem Command Set

11.1.9.1 Query Basic Test Data

- Description: query and return all channels 4 basic results

  Syntax: :FETCH?

  Parameters:

  Example:

  :FETCH? ---- returns the 4 basic data for each channel Return data order: channel 1 ~ channel 4 (3) data, each channel fixed 4 data

- Description：Query the test results of all channels with specified parameters Syntax: :FETCH <para>

  Parameter: <para> See Table 10-8 for values.

  Return: Returns test results

  Example:

  :FETCH URMS ---- returns the voltage RMS values for all channels

  :FETCH IRMS ---- returns all channel current RMS values

:FETCH FREQ ---- returns all channel signal frequencies

:FETCH PF ---- returns all channel power factors

Note: Other parameters can be used by analogy, multiple return values are spaced by ",".

◆ Description: Measurement data automatically returned to the setting

Syntax: :FETCH:auto?

:FETCH:auto {ON | OFF}

Parameter: ON ---- means that the data will be returned to the host computer automatically after each test, return the same as above ":FETCH?"

OFF ---- is set to turn off the automatic return of measured data.

Example:

:FETCH:auto? ---- returns the current state of the automatic data return function switch.

:FETCH:auto ON ---- Set the data to be returned to the host computer automatically after each test.

:FETCH:auto OFF---- Setting to disable the automatic return of measured data

11.1.9.2 Querying Test Results for In-channel Parameters

◆ Description：Query the test results of the specified parameter for the specified channel.

Syntax: :FETCH:CH<1|2|3|4> <para>

Parameter: CH<1|2|3|4> corresponds to the specified channel number

See Table 10-8 for <para> values.

Return: Returns test results

Example:

:FETCH:CH1 URMS ---- returns channel 1 voltage RMS

:FETCH:CH1 IRMS ---- returns channel 1 current RMS

:FETCH:CH1 FREQ ---- returns channel 1 signal frequency

:FETCH:CH1 PF ---- returns channel 1 power factor

:FETCH:CH1 ALL ---- returns all parameters for channel 1

Note: Other parameters and so on will suffice.

◆ Description：Query the test results of all parameters of the specified channel Syntax: :FETCH:CH<1|2|3|4> ALL

Parameter: CH<1|2|3|4> corresponds to the specified channel number Return: Returns test results

Example:

:FETCH:CH1 ALL ---- returns all parameters for channel 1

:FETCH:CH2 ALL ---- returns all parameters for channel 2

:FETCH:CH3 ALL ---- returns all parameters for channel 3

:FETCH:CH4 ALL ---- returns all parameters for channel 4

Note: The order of parameters corresponding to the returned results is as follows (29):

FREQ, URMS, UAC, UDC, UPK+, UPK-, UPP, UCF. IRMS, AC, IDC, IPK+, IPK-, IPP, ICF.

P, S, Q, PF, PHASE.

WP+, WP-, WP, PAVG.

Q+, Q-, Q, WS, WQ, PMAX, PMIN

11.1.9.3 Querying the Test Results of the Specified Parameter Within a Wire System Combination

◆ Description：Query the test result of the specified parameter within the combination of wire system

Syntax: :FETCH:CHS[1|2] <para>

:FETCH:CHS[1|2] ALL

Parameter: CHS[1|2] corresponds to the specified channel combination number 10-13 See Table 10-14 for <para> values.

CHS[1|2] value	Meaning
CHS	Refers to 3-channel instruments
CHS1	First wired combination of 4-channel instruments, same as CHS
CHS2	Second wire combination for 4-channel instruments

Table 10-13 Explanation of the Meaning of CHS[1|2] Parameters

The value of STR	
URMS, UAC, UDC, IRMS, IAC, IDC, P, S-VA, Q-VAR, PF, WP, EFFiciency	

Table 10-14 Optional Names of Parameters within the Wire System Combination

Return: Returns test results

Example:

3-channel instrument:

:FETCH:CHS URMS ---- returns the RMS value of the voltage within the line

system combination

:FETCH:CHS IRMS ---- returns the RMS value of the current within the wiring harness combination

:FETCH:CHS P---- return to active power within the wire system portfolio

:FETCH:CHS S-VA---- return to total power within the wire system combination

:FETCH:CHS Q-VAR ---- return to imaginary (reactive) power within the line system portfolio

:FETCH:CHS PF ---- Return to Power Factor within Wireline Combination

:FETCH:CHS WP ---- Return to Integration of Line Combined Active Power

:FETCH:CHS EFF---- returns efficiency results within the wire system combination channel instrument:

:FETCH:CHS URMS ---- returns the RMS value of the voltage within the wiring harness combination 1

:FETCH:CHS IRMS ---- return current rms value within wiring combination 1

:FETCH:CHS1 P ---- return to active power within wiring combination 1

:FETCH:CHS1 S-VA ---- return line system combination 1 within total power

:FETCH:CHS2 Q-VAR ---- return line system combination 2 within the virtual power (reactive power)

:FETCH:CHS2 PF ---- Return to Power Factor within Wire Combination 2

:FETCH:CHS2 WP---- Return to Integration of Active Power within Wired Combination 2

:FETCH:CHS2 EFF---- returns the efficiency results within the wire system combination 2

Note: Other parameters and so on will suffice.

:FETCH:CHS ALL---- returns all results within the line system combination 1

:FETCH:CHS1 ALL---- returns all results within the line system combination 1

:FETCH:CHS2 ALL--- returns all results within the line system combination 2

Note: The order of the parameters of the returned ALL is as follows (12):

URMS, UAC, UDC.

IRMS, IAC, IDC".

P, S, Q.

PF, WP, η

11.1.9.4 Query Harmonic Analysis Data

- Description：Query the harmonic analysis data for the specified number of times Syntax:

  :FETCH:HARM:<para>:RANGE {low,high}

  Parameter: <para>Take the value "U1,I1,U2,I2,U3,I3,U4,I4", i.e. voltage and current signal of each channel;

  {low,high} Harmonic data for the specified number of intervals.

low<=high and ranges from 2 to 50.

Example:

:FETCH:HARM:U1:RANGE 2,50

---- returns U1 harmonic data from the 2nd to the 50th harmonic.

:FETCH:HARM:U1:RANGE 6,10 ---- returns 6~10th U1 harmonics data

:FETCH:HARM:U1:RANGE 2,2 ---- returns 2nd U1 harmonic data

:FETCH:HARM:I1:RANGE 2,50 ---- returns I1 harmonic data from the 2nd to the 50th harmonic.

:FETCH:HARM:I1:RANGE 6,10 ---- returns 6~10th I1 harmonics data

:FETCH:HARM:I1:RANGE 2,2 ---- returns 2nd I1 harmonic data

Note: Other parameters and so on will suffice.

◆ Description: Query the magnitude of the components of the total harmonics of voltage and current

Syntax: :FETCH:HARM:THD {U1 | I1 | U2 | I2 | U3 | I3 | U4 | I4}

Parameter: {U1 | I1 | U2 | I2 | U3 | I3 | U4 | I4} refers to the voltage and current signal of each channel.

Example:

:FETCH:HARM:THD U1 ---- returns the total harmonic size of U1

:FETCH:HARM:THD I1 ---- returns the total harmonic size of I1

:FETCH:HARM:THD U2 ---- returns the total harmonic size of U2

:FETCH:HARM:THD I2 ---- returns the total harmonic size of I2

:FETCH:HARM:THD U3 ---- returns the total harmonic size of U3

:FETCH:HARM:THD I3 ---- returns the total harmonic size of I3

:FETCH:HARM:THD U4 ---- returns the total harmonic size of U4

:FETCH:HARM:THD I4 ---- returns the total harmonic size of I4

11.1.9.5 Query Waveform Data

◆ Description：Query waveform data

Syntax: :FETCH:wave { U1 | I1 | U2 | I2 | U3 | I3 | U4 | I4 }

Parameter: {U1 | I1 | U2 | I2 | U3 | I3 | U4 | I4} refers to the voltage-current signal of each channel

Example:

:FETCH:wave U1 ----returns the wave data of U1

:FETCH:wave I1 ---- returns the wave data of I1

:FETCH:wave U2 ---- returns the wave data of U2

:FETCH:wave I2 ---- returns the wave data of I2

:FETCH:wave U3 ----returns the wave data of U3

:FETCH:wave I3 ---- returns the wave data of I3

:FETCH:wave U4 ----returns the wave data of U4

:FETCH:wave I4 ---- returns the wave data of I4

Note: Since the waveform data is relatively more, only 128 points of waveform data are returned here. The source of the 128 points of data is the point data of the even numbered point positions obtained by sampling in one cycle, which is sufficient to depict the waveform.

11.1.9.6 Query Comparison Results

- Description：Query the comparison result of 8 comparison parameters Syntax: :FETCH:COMP?

  Parameters:

  Example:

  :FETCH:COMP ?----returns 8 comma-separated comparison results

  Returns

  e.g. "PASS,PASS.FAIL,NULL.NULL.NULL,NULL.NULL".

  Where PASS means qualified, FAIL means unqualified, and NULL means not compared.

11.1.9.7 Query Vector Angle Results

- Description：Query the relatively angular size of the displayed parameters in the vector drawing

  Syntax: :FETCH:VECTOR:DEG?

  Parameters:

  Example:

  :FETCH:VECTOR:DEG? ---returns 6 comma-separated angle results

  Note: The order in which the results are returned is as follows: the reference angle 0 of U1 and the angle of I1 relative to U1.

  the angle of U2 with respect to U1 and the angle of I2 with respect to U1. the angle of U3 with respect to U1, the angle of I3 with respect to U1.

11.2 ModBus Commands

11.2.1 Command Format

The command format is the internal version 2.0 standard, see the following Description for details:

11.2.1.1 Write Instructions

- Send Format:

Instrument address	Function code	Address high	Address low	**Register number** high	**Register number** low	**Byte count**	Data byte 1	. . .	Data byte n	CRC low	CRC high

- Return Format:

Instrument address	Function code	Address high	Address low	**Register number** high	**Register number** low	CRC low	CRC high

a) Instrument Address

It is the local address of the instrument, which can be set in the bus address of the system setting interface of the instrument, and the range of value is 1~31.

b) Function code: 0x10

This instruction can write one data or multiple data, so its code is: 0x10

c) Address High and Address Low

It is the address where the data is stored in the instrument, which can be a real storage address or a mapped address.

d) **Register Number** High and **Register Number** Low

Indicates the number of registers written in this operation, each register is 2 bytes in size

e) Byte count

Indicates the total number of bytes written in this operation

f) Data byte 1~Data byte n

It is to write these data contents to the instrument.

g) CRC high and CRC low

CRC 16-bit checksum, we use the lookup table method for CRC checksums

- Example Note: For details of specific commands and function setting relationships, see the appendix table ModeBus Command Function Comparison Table (Section 11.2.3).

  I set the voltage range, set to range 2, the voltage range parameter is stored in the instrument at address 0x3000, and the instrument bus address is 8

  Then the instructions are:

0x08	0x10	0x30	0x00	0x00	0x00	0x01	0x02	D5	CD

where the penultimate bit corresponds to the voltage of two into the index value, type char, accounting for 1 byte

The return information is as follows:

0x08	0x10	0x30	0x00	0x00	0x00	0XCF	0x90

11.2.1.2 Read Command

- Send Format:

Instrument address	Function code	Address high	Address low	**Register number** high	**Register number** low	CRC low	CRC high

➢ Returns the format:

Instrument address	function code	**byte count**	Data byte 1	.....	Data byte n	CRC low	CRC high

a) The function code is: 0x03

➢ Example: For details of specific commands and function setting relationships, see the appendix table ModeBus Command Function Comparison Table (Section 9.3.3).

To read the current range of the voltage, its memory address is 0x3000 and the instrument number is 8 Then send the command as:

0x08	0x03	0x30	0x00	0x00	0x00	0x4A	0x53

The return message is:

0x08	0x03	0x04	0x02	0x02	0x02	0x02	0x43	0xEA

11.2.2 CRC16 Calculation Method - Table Lookup Method

a) First define two 256-byte checksum tables

// CRC Higher Byte Value Table

```
const BYTE chCRCHTalbe[] =                    // CRC high byte value table
 {
 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41,
 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40,
 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41.
 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41.
 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41,
 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40.
 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40.
 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40.
 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41,
 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40.
 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41.
 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41.
 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41,
 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41.
 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41.
 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41.
 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41,
 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40.
 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41.
 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41.
 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41,
 0x00, 0xC1, 0x81, 0x40
 };
```

```
// CRC low byte value table

const BYTE chCRCLTalbe[]
 {
 0x00, 0xC0, 0xC1, 0x01, 0xC3, 0x03, 0x02, 0xC2, 0xC6, 0x06, 0x07, 0xC7,
 0x05, 0xC5, 0xC4, 0x04, 0xCC, 0x0C, 0x0D, 0xCD, 0x0F, 0xCF, 0xCE, 0x0E.
 0x0a, 0xca, 0xcb, 0x0b, 0xc9, 0x09, 0x08, 0xc8, 0xd8, 0x18, 0x19, 0xd9,
 0x1B, 0xDB, 0xDA, 0x1A, 0x1E, 0xDE, 0xDF, 0x1F, 0xDD, 0x1D, 0x1C, 0xDC.
 0x14, 0xD4, 0xD5, 0x15, 0xD7, 0x17, 0x16, 0xD6, 0xD2, 0x12, 0x13, 0xD3,
 0x11, 0xD1, 0xD0, 0x10, 0xF0, 0x30, 0x31, 0xF1, 0x33, 0xF3, 0xF2, 0x32,
 0x36, 0xF6, 0xF7, 0x37, 0xF5, 0x35, 0x34, 0xF4, 0x3C, 0xFC, 0xFD, 0x3D,
 0xFF, 0x3F, 0x3E, 0xFE, 0xFA, 0x3A, 0x3B, 0xFB, 0x39, 0xF9, 0xF8, 0x38.
 0x28, 0xE8, 0xE9, 0x29, 0xEB, 0x2B, 0x2A, 0xEA, 0xEE, 0x2E, 0x2F, 0xEF.
 0x2d, 0xed, 0xec, 0x2c, 0xe4, 0x24, 0x25, 0xe5, 0x27, 0xe7, 0xe6, 0x26.
 0x22, 0xE2, 0xE3, 0x23, 0xE1, 0x21, 0x20, 0xE0, 0xA0, 0x60, 0x61, 0xA1.
 0x63, 0xA3, 0xA2, 0x62, 0x66, 0xA6, 0xA7, 0x67, 0xA5, 0x65, 0x64, 0xA4.
 0x6C, 0xAC, 0xAD, 0x6D, 0xAF, 0x6F, 0x6E, 0xAE, 0xAA, 0x6A, 0x6B, 0xAB.
 0x69, 0xA9, 0xA8, 0x68, 0x78, 0xB8, 0xB9, 0x79, 0xBB, 0x7B, 0x7A, 0xBA.
 0xBE, 0x7E, 0x7F, 0xBF, 0x7D, 0xBD, 0xBC, 0x7C, 0xB4, 0x74, 0x75, 0xB5.
 0x77, 0xB7, 0xB6, 0x76, 0x72, 0xB2, 0xB3, 0x73, 0xB1, 0x71, 0x70, 0xB0.
 0x50, 0x90, 0x91, 0x51, 0x93, 0x53, 0x52, 0x92, 0x96, 0x56, 0x57, 0x97.
 0x55, 0x95, 0x94, 0x54, 0x9c, 0x5c, 0x5d, 0x9d, 0x5f, 0x9f, 0x9e, 0x5e.
 0x5a, 0x9a, 0x9b, 0x5b, 0x99, 0x59, 0x58, 0x98, 0x88, 0x48, 0x49, 0x89.
 0x4b, 0x8b, 0x8a, 0x4a, 0x4e, 0x8e, 0x8f, 0x4f, 0x8d, 0x4d, 0x4c, 0x8c.
 0x44, 0x84, 0x85, 0x45, 0x87, 0x47, 0x46, 0x86, 0x82, 0x42, 0x43, 0x83.
 0x41, 0x81, 0x80, 0x40
 };
```

a) Then do the math.

```
WORD CRC16(BYTE* pchMsg, WORD wDataLen)
 {
      BYTE chCRCHi = 0xFF; // High CRC byte initialization
      BYTE chCRCLo = 0xFF; // low CRC byte initialization
      WORD wIndex;          // index in CRC loop
```

```
       while (wDataLen--)
      {
            // Calculate the CRC
            wIndex = chCRCLo ^ *pchMsg++ ;
            chCRCLo = chCRCHi ^ chCRCHTalbe[wIndex] ;
            chCRCHi = chCRCLTalbe[wIndex] ;
      }
```

```
        return ((chCRCHi << 8) | chCRCLo) ;)
 }
```

11.2.3 Command Function Comparison Table

Instrument bus address	**Function code**	**Command address**	**Number of data bytes**	**Data item**	**Data content**	
Instrument address	Read/ Write	High + Low	High + Low	Data item	Setting value corresponding to the address	Command function meaning
1~31	R	0x0000				Queries the instrument IDN and returns the instrument model number
	R/W	0x1000	0x0001	1	0x00	Measurement display
					0x01	Comparative display
					0x02	Harmonic display
					0x03	Waveform display
					0x04	Vector graphics display
					0x05	Measurement settings
					0x06	Comparison settings
					0x07	System settings
					0x08	Document management
	R/W	0x1001	0x0001	1	0x00	Turning off display refresh is equivalent to turning off Hold.
					0x01	Turning on display refresh is equivalent to turning on Hold.
	R/W	0x1002	0x0001	1	0x00	Turns highlighting of channel 1 on or off
					0x01	Turns highlighting of channel 2 on or off
					0x02	Turns highlighting of channel 3 on or off
					0x03	Turns highlighting of channel 4 on or off
					0x04	Turn on or off highlighting of line tests
	R/W	0x2000	0x0001	1	num	Wire system setting
						For 3-channel instruments, NUM takes the values 0x00~0x04, indicating 1P2W,1P3W,3P3W,3P4W,3V3A respectively. For 4-channel instruments, NUM takes the value 0x00~0x07, which means 1P2W, 1P3W, 3P3W, 3P4W, 3V3A, 1P3W_1P3W, 1P3W_3P3W, 3P3W_3P3W, respectively.
	R/W	0x2001	0x0002 0x0003	2 3	Up down Σn up down	Line system related efficiency settings

						Σn takes the value 0 or 1, indicating the first group of line combinations The range of values for up and down are as follows: For 3-channel instruments: 0x00~0x04 (no 0x03) For 4-channel instruments: 0x00~0x05 Where 0x00~0x03 correspond to P1~P4. 0x04,0x05 correspond to P_{Σ} ($P_{\Sigma 1}$), $P_{\Sigma 2}$
	R/W	0x2002	0x0001	1	0x00	Turn on the line 500 Hz filter
					0x01	Turn off the line 500Hz filter
	R/W	0x2003	0x0001	1	0x01~0x20	Average number of tests
	R/W	0x2004	0x0001	1	0x00~0x08	The test synchronization signals of channel
						1, 0x00~0x07, indicate U1, I1, U2, I2, U3, I3, U4, I4, respectively
	R/W	0x2005	0x0001	1	0x00~0x08	The test synchronization signals of channel 2, 0x00~0x07, indicate U1, I1, U2, I2, U3, I3, U4, I4 respectively
	R/W	0x2006	0x0001	1	0x00~0x08	The test synchronization signals of channel 3, 0x00~0x07, indicate U1, I1, U2, I2, U3, I3, U4, I4 respectively
	R/W	0x2007	0x0001	1	0x00~0x08	The test synchronization signals of channel 4, 0x00~0x07, indicate U1, I1, U2, I2, U3, I3, U4, I4 respectively
	R/W	0x2008	0x0001	1	0x00	Setting up manual control of energy credits
					0x01	Setting the energy integral continuous control
	R/W	0x2009	0x0004	3	int+char+char	Setting the energy integration interval (int hours, char minutes, char seconds)
	R/W	0x200A	0x0001	1	0x00	Operational energy integral
					0x01	Stopping energy credits
					0x02	Reset energy integral

	R/W	0x200B	0x0004	4	a+b+c+d	Setting the 4 basic display parameters of channel 1 The parameter value range is 0~31, corresponding to the parameter respectively: FU, FI, URMS, UAC, UDC, UPK+, UPK-, UPP, UCF, IRMS, IAC, IDC, IPK+, IPK-, IPP, ICF, P, S-VA, Q-VAR, PF, PHASE, WP+, WP-, WP, PAVG, Reservation, reservation, q, WS, WQ, PMIN, PMAX
	R/W	0x200C	0x0004	4	a+b+c+d	Setting the 4 basic display parameters for channel 2 Parameter value range Description as above
	R/W	0x200D	0x0004	4	a+b+c+d	Setting the 4 basic display parameters for channel 3 Parameter value range Description as above
	R/W	0x200E	0x0004	4	a+b+c+d	Setting the 4 basic displ3ay parameters for channel 4 Parameter value range Description as above
	R/W	0x200F	0x0001	1	0~6	Setting the data refresh interval
						0~6 corresponds to 0.1s,0.25s,0.5s,1s,2s,10s,20s
	R/W	0x2010	0x001	1	0/1	Setting the data auto refresh function status 0 - Auto 1 - not Auto
	R/W	0x3000	0x0001	1	num	Set the voltage range of all channels at the same time, and the value of the num is 0x00~0x05.
	R/W	0x3001	0x0001	1		Setting the voltage range of channel 1 individually
	R/W	0x3002	0x0001	1		Setting the voltage range of channel 2 individually
	R/W	0x3003	0x0001	1		Individually set voltage range for channel 3

	R/W	0x3004	0x0001	1		Individually set voltage range for channel 4
	R/W	0x3005	0x0001	1	auto	Set the voltage range of channel 1 to auto, and the value of auto is 0x00 for no auto. 0x01 means automatic
	R/W	0x3006	0x0001	1		Set the voltage range of channel 2 to auto, with the same value as above.
	R/W	0x3007	0x0001	1		Set the voltage range of channel 3 to auto, with the same value as above.
	R/W	0x3008	0x0001	1		Set the voltage range of channel 4 to auto, with the same value as above.
	R/W	0x4000	0x0001	1	num	Set the current range of all channels at the same time, the value of num is: 0x00~0x0b means the current range from small to large, see 4.1.6 Test range
	R/W	0x4001	0x0001	1		Setting the current range of channel 1 individually
	R/W	0x4002	0x0001	1		Individually set current range for channel 2
	R/W	0x4003	0x0001	1		Individually set current range for channel 3
	R/W	0x4004	0x0001	1		Individually set current range for channel 4
	R/W	0x4005	0x0001	1	auto	Set the current range of channel 1 to auto, and the value of auto is 0x00 for no auto. 0x01 means automatic
	R/W	0x4006	0x0001	1		Set current range auto for channel 2, same value as above.
	R/W	0x4007	0x0001	1		Set current range auto for channel 3, same value as above.
	R/W	0x4008	0x0001	1		Set current range auto for channel 4, same value as above.
	W	0x5000	0x0001	1	0x00	Perform a bus trigger test
	R/W	0x5001	0x0001	1	0x00	Continues trigger
					0x01	Single trigger

	R/W	0x8000	0x0001	1	0x00	Turning off the key ringer
					0x01	Turn on the keypad alarm
	R/W	0x8001	0x0001	1	0x00	Turn off the comparison signal.
					0x01	Comparison signal is qualified
					0x02	Comparison signal is not qualified
	R/W	0x8002	0x0001	1	0x00	Setting the system language to English
					0x01	Setting the system language to Chinese
	R/W	0x8003	0x0001	1	0x14	Setting the display backlight brightness to 20%
					0x28	Setting the display backlight brightness to 40%
					0x3C	Setting the display backlight brightness to 60%
					0x50	Setting the display backlight brightness to 80%
					0x64	Setting the display backlight brightness to 100%
	R/W	0xC000	0x0001	1	0x00	Setting the standard for harmonic calculations to IEC
					0x01	Setting the standard for harmonic calculation as CSA
	R/W	0xC001	0x0001	1	0x00	Setting the harmonic display as a list
					0x01	Setting the harmonic display as a bar graph (histogram)
	R/W	0xC002	0x0001	1	0x00	Setting the harmonic data format as a percentage
					0x01	Setting the harmonic data format to absolute
	R/W	0xC003	0x0002	2	P,S	Set the state of harmonic analysis parameters, P is the parameter, S is the state; P takes the value 0~7 corresponding to U1, I1, U2, I2, U3, I3, U4, I4. The S value 0,1 corresponds to close and open.
	R/W	0xD000	0x0001	1	0x00	Set the waveform type to UI waveform
					0x01	Set the waveform type to Power

						waveform
	R/W	0xD001	0x0002	2	P, S	Set UI waveform parameter state, P is parameter, S is state; P takes value 0~7 corresponding to U1, I1, U2, I2, U3, I3, U4, I4. The S value 0,1 corresponds to close and open.
	R/W	0xEx00	0x0002	2	Ch, para	Setting the parameters under the comparison channel.
						The parameter address can be changed to values 0~7 corresponding to 8 comparison channels, such as 0xe100, etc. Ch is the test channel, and para is the corresponding parameter item under the test channel. Ch takes values from 0 to 3, corresponding to CH1, CH2, CH, CH4. Para takes values from 0 to 31 and corresponds to FU, FI, URMS, UAC, UDC, UPK+, UPK-, UPP, UCF, IRMS, IAC, IDC, IPK+, IPK-, IPP, ICF, P, s-va, q-var, pf, phase, WP+, WP-, WP, PAVG, Reservation, reservation, q, WS, WQ, PMIN, PMAX
	R/W	0xEx01	0x0004	4	float	Set the upper limit size corresponding to the compare parameter under the current compare channel, address Description as above
	R/W	0xEx02	0x0004	4	float	Set the size of the lower limit corresponding to the compare parameter under the current compare channel, address Description as above

	R/W	0xEx03	0x0001	1	Func	Sets the compare function corresponding to the compare parameter under the current compare channel, with the same address Description as above. Func takes the following values: 0x00 corresponds to shut down. 0x01 corresponds to qualified conduction. 0x02 corresponds to failed conduction. 0x03 corresponds to the pass pulse. 0x04 corresponds to the failure pulse;
	R	0xF020~ 0xF03F	Number of channels*4			Read the test results of the corresponding parameters of all channels, the lower 8 bits of the address take the value 0x20~ 0x3f (32 in total), corresponding to the FU, FI, URMS, UAC, UDC, UPK+, UPK-, UPP, UCF, IRMS, IAC, IDC, IPK+, IPK-, IPP, ICF, P, S-VA, Q-VAR, PF, PHASE,
						WP+, WP-, WP, PAVG, Reservation, reservation, q, WS, WQ, PMIN, PMAX The return data length is the number of channels * 4;
	R	0xF000~ 0xF01F	0x0004			Read the test parameter result of channel 1, the lower 8 bits of the address take the value 0x20~ 0x1f (32 in total), corresponding to the FU, FI, URMS, UAC, UDC, UPK+, UPK-, UPP, UCF, IRMS, IAC, IDC, IPK+, IPK-, IPP, ICF, P, S-VA, Q-VAR, PF, PHASE, WP+, WP-, WP, PAVG, Reservation, reservation, q, WS, WQ, PMIN, PMAX
	R	0xF100~ 0xF11F	0x0004			Read test parameter results for channel 2, address low 8 Description as above
	R	0xF200~ 0xF21F	0x0004			Read test parameter results for channel 3,

						address low 8 Description as above
	R	0xF300~ 0xF31F	0x0004			Read test parameter results for channel 4, address low 8 Description as above
	R	0xF400~ 0xF40B	0x0004			Read the results of the test parameters under the first wire system combination, address low 8 takes the value 0~ 11 corresponds to 12 calculations, i.e., U_{RMS}, U_{AC}, U_{DC}, I_{RMS}, I_{AC}, I_{DC}, P, S, Q, PF, W_P, η
	R	0xF500~ 0xF50B	0x0004			Read the results of the test parameters under the second wire system combination, address low 8 takes the value 0~ 11 corresponds to 12 calculations, i.e., U_{RMS}, U_{AC}, U_{DC}, I_{RMS}, I_{AC}, I_{DC}, P, S, Q, PF, W_P, η
	R	0xFx01~ 0xFx01	0x0004			Reading the total harmonics corresponding to the parameter. Address bit8~bit11 bits take the value 6~ 13 corresponding to parameters u1, i1, u2, i2, u3, i3, u4, i4;
	R	0xFx02~ 0xFx32	0x0004			Read the harmonic results corresponding to the specified number of times that the parameter Address bit8~bit11 bits take the value 6~13 corresponding to parameters U1, I1, U2, I2, U3, I3, U4, I4. The address bit0~bit7 is the 2~50th harmonic result of the corresponding parameter.
	R	0xFE00~ 0xFE07	0x0200			Read waveform data 128 points of data Address bit0~bit7 bits take the value 0~7 corresponds to parameters U1, I1, U2, I2, U3, I3, U4, I4;
	R	0xFF00	0x0008			Reads all the comparison results of the comparison parameter, i.e., the 8-byte number returned. Returns 0 corresponding to pass. Return 1 corresponds to failure. Returning 2 corresponds to no

						comparison;

Chapter 12 Dispatch procedure for service, E-Waste Management and Warranty

12.1 Dispatch procedure for service

No user serviceable parts are inside the instrument, should it become necessary to send back the instrument to factory for service, please observe the following procedure:

Before dispatching the instrument please write to us at following link giving full details of the fault noticed. https://www.scientificindia.com/services-support/service-request

1. After receipt of your communication, our service department will advise you whether it is necessary to send the instrument back to us for repairs or the adjustment is possible in your premises.
2. Dispatch the instrument (only on the receipt of our advice) securely packed in original packing duly insured and freight paid along with accessories and a copy of the fault details noticed at our Service Center or factory.

12.2 E-Waste

We support environmentally sustainable measures and solicit your cooperation in this endeavor by way of sending the equipment to us at the end of the life of the product. The equipment will be sent for recycling through authorised recyclers as per E-Waste Management Rules. Please write to us at support@scientificindia.com for this purpose. Your support will go a long way as each and everybody's action can lead to improve global environment.

12.3 Warranty

Scientific warrants all its Instruments to be free from defects in material and workmanship when used under normal operating conditions in accordance with the instructions given in the manual for a period of 12 (Twelve) months from date of purchase from Scientific or its authorized dealers. The service during the warranty period will be rendered on return to factory / service center basis.

1. Its obligation under this warranty is limited to repairing or replacing at its own discretion. This warranty shall not apply to any defect, failure or damage caused by accident, negligence, misapplication, alteration or attempt to repair, service or modify in any way.
2. This warranty does not include display, fuses, batteries or accessories. This warranty is only valid with the original purchaser who must have properly registered the product within 15 days from date of purchase. No other warranty is expressed or implied.
3. When it becomes necessary to return the instrument to our Factory facility, kindly pack it carefully in the original carton or equivalent and ship it duly insured, transportation charges prepaid.
4. Your Scientific instrument is a complex electronic device and deserves the best service available by technicians thoroughly familiar with its service and calibration procedures.