HT3050Three phase precision test power supply

Operating Instructions

Wuhan Huatian Electric Power Automation Co., Ltd.

Tel.: 027-87492243 87497907 4008855448

Email:wuhanhuatian@163.com www.whhuatian.com

Contents

I. Product Overview

Dear user, thanks for purchasing our HT3050Three phase precision test power supply,which can generate three-phase standard power frequency voltage and current signal with adjustable amplitude, phase, frequency and power.

The product is mainly used for testing and calibrating the electrical measuring digital instrument such as power meter, voltmeter, ammeter, phase meter, frequency meter, power meter and power factor meter, the energy sensor such as instrument voltage transformer, current transformer and pincerlike current transformer and the power transducer such as voltage transducer, current transducer, power transducer, power factor transducer and frequency transducer; and the instruments and equipment such as reactive compensation controller, power data collector, power meter field calibrator, power parameter tester, voltage monitor, distribution load monitor, multi-functional power instrument, load management terminal, voltage and current loss timer and distribution automation terminal.

The power supply is designed based on high-accuracy sampling technology and the latest digital signal processing method. The product has the advantages of being advanced in technology, good in performance, small in volume, light, convenient to carry and applicable to both laboratory and field using. We believe that you will be satisfied with the high-quality power supply.

Please carefully read the Operating Instructions before using the product. The following is the precaution for product using:

1. Please don't shut down or reset when voltage and current are outputting, especially when high voltage and large current are outputting. Please close the signal output by controlling keys before turning off the power supply of instrument.

2. The voltage output shall be short-circuited, and the current output shall not be

open-circuit; the operator shall ensure that the external connection is correct and not exposed before starting the output voltage and current signals. Please close the signal output when leaving temporarily.

3. Please ensure the good grounding of instrument when using the product.

4. Before measurement or calibration, preheat the instrument for 10min, or the indexes may be affected.

5. Please don't turn on the instrument arbitrarily without the permission of company so as to avoid electric shock caused by high voltage.

6. The company shall not be responsible for all consequences caused by violation of the above precautions.

II. Main Functions and Features

1. The product can output three-phase power frequency voltage, current, phase position, frequency, power and power factor signals with high stability and accuracy.

2. The product can output 2-31 harmonic signal. The harmonic frequency, harmonic content and phase position can be combined, superimposed and output freely.

3. The electrical parameters such as voltage, current, phase position and frequency can be set and adjusted freely in the span adjusting range.

4. The abundant voltage, current, phase position and power factor test point design realizes more convenient and efficient operation.

5. Accurate measurement of 32 electrical parameters, visual display of large screen color liquid crystal and more exquisite vector diagram lead to almost perfect experience.

6. With three-circuit electric energy pulse input/output interface, able to calibrate the

error of three single (three) phase power meter, used as the calibrating device of power meter.

7. With the counter test function of power meter. Countering of active energy, reactive energy and apparent energy.

8. The superior capacitive load driving capability can meet different loading requirements.

9. The instrument can be provided with tough screen, panel keys and adjusting knob. Multiple operation modes are applicable to different operation habits.

10. The instrument can realize complete machine operation through upper computer due to the RS485 and RS232 interface. The communication protocol is fully open, which helps the user for secondary development.

11. The instrument is provided with external control switch interface and external pedal switch to control the start and stop of signals, which is applicable to production department.

12. The standard output signal is beyond your imagination due to the hardware/software closed-loop technology.

13. The reliability and stability are greatly improved due to mature amplifier and scientific assembly process.

14. When the voltage is short-circuited, the current is open-circuit or the wiring is wrong, output can be stopped automatically, and there is alarm window and sound prompt. The user can use the product with an easy mind due to the perfect fault protection.

III. Major Technical Index

1. AC voltage output

Range RG: 380V, 220V, 100V, 57.7V

Adjusting range: (0-120)%RG Adjustment degree: 0.01%RG

Precision: 0.1%RG Stability: ≤0.02%/3min

Output power: 20VA per rated phase Full load adjustment rate: 0.05%RG

Distortion degree: ≤0.2% (non-capacitive load)

2. AC current output

Range RG: 20A, 5A, 1A, 0.2A

Adjusting range: (0-120)%RG Adjustment degree: 0.01%RG

Precision: 0.1% RG Stability: ≤0.02%/3min

Output power: 20VA per rated phase Full load adjustment rate: 0.05%RG

Distortion degree: ≤0.2% (non-capacitive load)

3. Phase

Adjusting range: 0°-359.99° Adjustment degree: 0.01°

Precision: 0.05°

4. Frequency

Adjusting range: 40Hz-70Hz; Adjustment degree: 0.001Hz

Precision: 0.005Hz

5. Active power

Precision: 0.1%RG

Stability: ≤0.05%/3min

6. Power factor

Adjusting range: -1.0-0-+1.0 Adjustment degree: 0.001

Precision: 0.005

7. Harmonic output

Harmonic frequency: 2-31 times Setting range of harmonic content: 0-40%

Setting accuracy of harmonic content: Set value ±0.1%

8. Environmental conditions

Working environment temperature: 0℃-40℃

Relative humidity: ≤85%

Working power: AC220V±15%, maximum power consumption 400VA

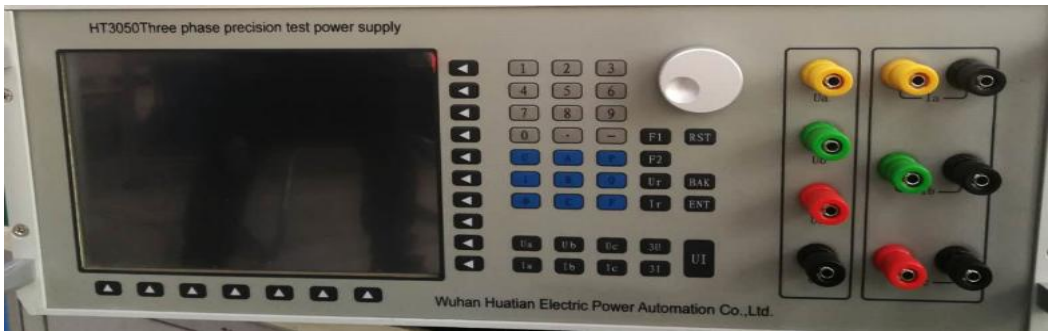
9. Appearance dimension and weight

External dimension: 449mm×455mm×177mm

Weight: 18Kg

IV. Panel Instruction

1. Front panel instructions



1.1. The display window is on the left of front panel, and the display screen is touch LCD and can be operated by finger touching. The operation key and adjusting knob are in the middle, and the voltage and current output terminals are on the right.

1.2. 17 Nameless keys are around the LCD, correspond to the buttons on LCD and have different definitions for different display interfaces. See the display interface for the details. The middle button area has 37 keys and is introduced as follows:

Figure keys (0-9): For inputting data in the input box.

Decimal point key: For inputting decimal data in the input box.

Minus key: For inputting negative data in the input box.

Letter key: There are 9 letter keys. The parameters can be set by figure keys and letter keys.

F1-F4 key: Function expansion key, not defined temporarily.

RST key: Complete machine reset key. When the instrument is crash due to strong interference, press RST to reset.

BAK key: Backspace key. For deleting the input data on the left of cursor in the input box.

ENT key: Confirm key. For confirming after inputting data in the input box.

Ua key: For starting and stopping Phase A voltage signal.

Ub key: For starting and stopping Phase B voltage signal.

Uc key: For starting and stopping Phase C voltage signal.

3U key: For starting and stopping three-phase voltage signal.

Ia key: For starting and stopping Phase A current signal.

Ib key: For starting and stopping Phase B current signal.

Ic key: For starting and stopping Phase C current signal.

3I key: For starting and stopping three-phase current signal.

UI key: For starting and stopping three-phase voltage and current signal.

1.3 The adjusting knob in the middle can rotate clockwise and anticlockwise. Confirm by pressing the adjusting knob directly. The key has different functions on different interfaces, it can choose different function menus on the main interface, quickly adjust and set electrical parameters in the input box on the standard source interface, quickly choose some setting parameters on the work mode interface, quickly choose harmonic channel and set harmonic parameters on the harmonic setting interface, quickly set and calibrate parameters on the parameter setting interface of error checking, quickly choose harmonic frequency on the harmonic analysis interface, quickly set the start energy, termination energy and countering time on the power test interface and quickly set system parameters on the instrument setting interface.

1.4 16 voltage and current output terminals are on the right of panel. I+, I-, U+, U-, R+ and R- terminals are DC current and voltage output terminals, and they only can be used by the instrument with DC module. Six terminals such as Ia, Ib and Ic are three-phase AC current output terminals, wherein the yellow, green and red are current out-flowing direction, black is the in-flowing direction, and the three black terminals can be used in direct short-circuit

mode. Ua, Ub, Uc and Un are three-phase AC voltage output terminals, wherein yellow, green and red are high terminal, and the black is common terminal.

2. Rear panel instructions

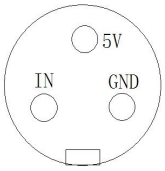
2.1 Cooling fan with two AC 220V power

2.2 There is a grounding terminal which is connected with the instrument shell and the grounding terminal in the AC220V power supply socket. To ensure the safety of instrument operator, the grounding terminal shall be grounded reliably.

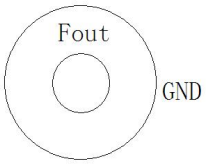
2.3 An AC 220V power supply socket (with 4A protective tube inside). Power supply voltage: AC220V±15%, maximum power consumption 400VA. To ensure the safety of instrument operator, the grounding terminal in the socket shall be grounded reliably.

2.4 A power switch.

2.5 The three electric energy pulse input terminals Fin1, Fin2 and Fin3 are used for receiving the electric energy pulse of calibrated power meter. There is pull-up resistor inside. The passive pulse and active pulse can be received. The terminal is defined as the figure below:



2.6 The three electric energy pulse output terminals Fout1, Fout2 and Fout3 are active pulse output without the need of external power supply. The terminal is mainly used for sending the instrument to legal metrology organization for electric energy calibration. The terminal is defined as the figure below:



2.7 A RS485 communication interface: maximum communication Baud rate: 115200; maximum communication distance: 500m.

2.8 A RS232 communication interface: maximum communication Baud rate: 115200; maximum communication distance: 10m. The terminal is defined as follows:

2----TXD

3----RXD

5----GND

2.9 A SWITCH interface. SWITCH is the interface of external pedal switch for the signal frequent start/stop occasion, the external switch shall be uncharged idle contact switch. The terminal is defined as follows:

Between 1 and 4: Correspond to the 3U key on front panel.

Between 2 and 4: Correspond to the 3I key on front panel.

Between 3 and 4: Correspond to the UI key on front panel.

V. Wiring Instructions

1. Wiring shall be conducted when the instrument stops outputting signal or is shut

down. Short circuit is strictly prohibited between voltage channels. The current channel cannot be open-circuit. The black terminal of three current channels can be in short circuit or connected with the black terminal of voltage channel without affecting the indexes of output signal.

2. Three-phase four-wire mode: The wiring mode is very simple. The three voltage channels and current channels can be connected with the terminals of tested equipment.

3. Three-phase three-wire mode: For the wiring mode, only Phase A and Phase C current and voltage channels have output, Phase B current and voltage channels have no output. The two-phase current and voltage channels are connected with the terminals of tested equipment, and the Un black terminal of voltage change and the Phase B voltage terminal of tested equipment are connected.

Note: Under the wiring mode, the phase position between Phase A and C voltage is output according to the phase relation of three-phase three-wire mode, and the common reference point is Un terminal.

4. Single-phase mode: It is allowed to choose any phase voltage and corresponding current channel for outputting.

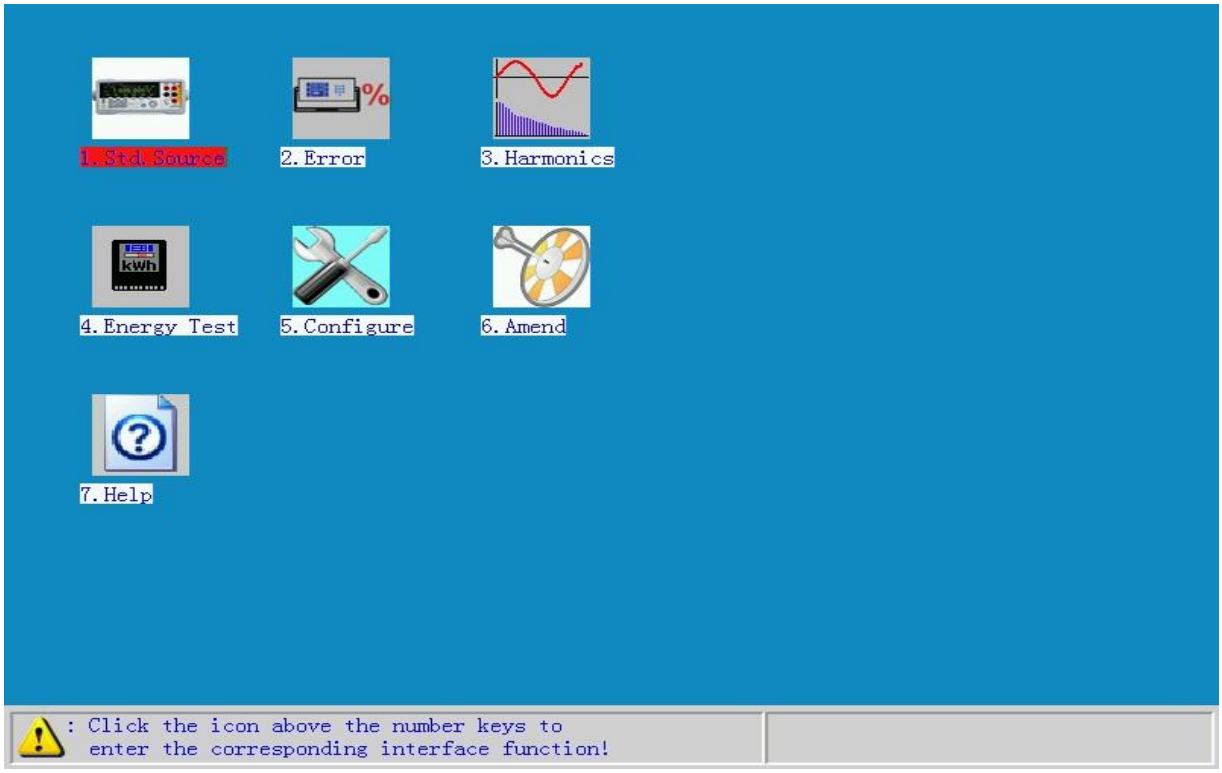
Note: Under single-phase mode, the voltage and current channels shall be the same phase, or no power will be output.

VI. Operation Instructions

1. Main menu interface

Turn on the power switch on the rear panel of instrument, or press the reset button on the front panel in the state of power-on for startup. After starting up for about 10s, the instrument will enter the working state, and the display interface of LCD is shown as the figure below.

The interface has 7 menu options, and there are 3 modes to enter the menu interface: Directly touch the icons of LCD, press the figure keys on front panel and operate the adjusting knob on the front panel.



(Main menu interface)

1.1. Standard source window:

The menu has the most basic standard source function or the most frequently-used function of user. The menu interface can output the three-phase power frequency sinusoidal voltage and current signals (the amplitude, phase position and frequency can be adjusted freely) and display 32 electrical parameters in real time.

1.2. Error checking:

The menu mainly calibrates the power meter. The menu interface can calibrate the power error of single-phase and three-phase power meter (the power errors of 3 power meters simultaneously at most).

1.3. Harmonic analysis:

The menu mainly outputs and measures harmonic and display the waveform. The menu interface can load or unload harmonic, display the harmonic content, amplitude, initial phase position and total harmonic distortion (THD) in real time.

1.4. Power test:

The menu mainly fulfills the counter test of the power meter. The menu interface can realize countering error test of active energy, reactive energy and apparent energy of power meter.

1.5. Instrument setting:

The menu mainly sets some system parameters of instrument. The menu interface can change the parameters such as Baud rate, vector diagram, Chinese/English interface and output power constant and display time.

1.6 Calibrating instrument:

The menu is mainly used for the commissioning and calibration during production and not open to the users.

1.7. System help:

The menu is reserved temporarily as an expansion function.

2. Standard source interface

There are 3 methods (directly touch the icons of LCD, press the figure keys on front panel and operate the adjusting knob on front panel) to enter from the main menu to the standard source interface.

(Standard source interface)

There are 5 functional areas on the interface, the details are as follows:

2.1. The black input box on the upper left corner is the set value inputting area where the user can input the required voltage or current or phase position, the instrument will identify whether the number in the inputting area exceeds the current range automatically, if so, it will limit it as the permitted maximum or minimum value. There are 2 setting methods.

The first method is to press the "Set value" on the bottom row of the interface, then 2 letter options that represent for the parameter typ will appear on the upper right corner; choose the required parameter type or operate the adjusting knob, input the required value in the back input box on the upper left corner directly, and press "ENT" to confirm input. Since

igh efficiency when the user changes a certain parameter frequently.

The second method is to set directly with the panel keys, but it is necessary to input the letter of parameter type and press "ENT" to confirm after setting. See the table below for the setting format.

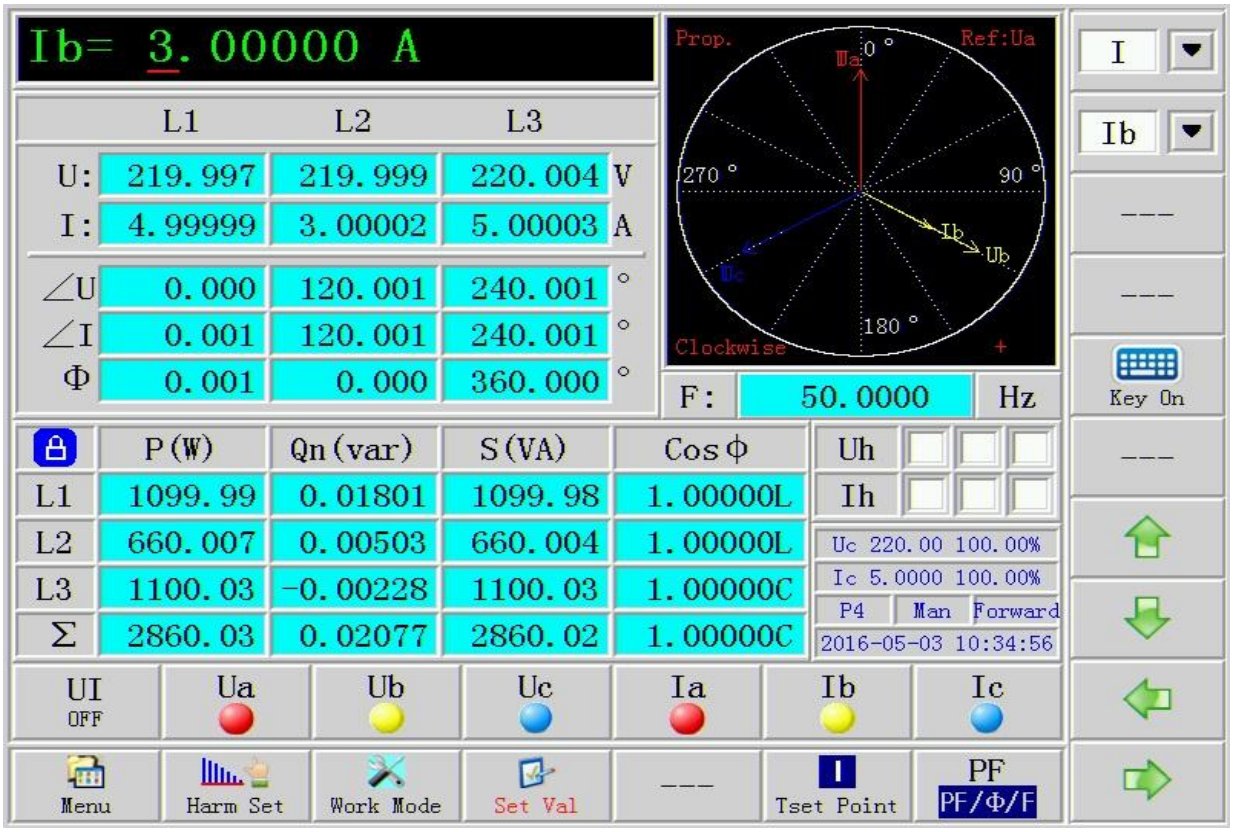
Set events	**Split-phase valid**			**Three-phase valid**
Voltage amplitude	**xxxxxxUA**	**xxxxxxUB**	**xxxxxxUC**	**xxxxxxU**
Current amplitude	**xxxxxxIA**	**xxxxxxIB**	**xxxxxxIC**	**xxxxxxI**
Active power	**xxxxxxPA**	**xxxxxxPB**	**xxxxxxPC**	**xxxxxxP**
Reactive power	**xxxxxxQA**	**xxxxxxQB**	**xxxxxxQC**	**xxxxxxQ**
Power factor	**xxxxxxPFA**	**xxxxxxPFB**	**xxxxxxPFC**	**xxxxxxPF**
Voltage phase	**-----**	**xxxxxxΦUB**	**xxxxxxΦUC**	**-----**
Current phase	**xxxxxxΦIA**	**xxxxxxΦIB**	**xxxxxxΦIC**	**xxxxxxΦI**
Power phase	**xxxxxxΦA**	**xxxxxxΦB**	**xxxxxxΦC**	**xxxxxxΦ**
Frequency	**xxxxxxF**			

For example: It is necessary to set Phase B current as 3A. The 2 setting methods are as follows:

Method 1: Press "Set value" in the bottom row, choose "I" and "Ib" on the upper right corner, input "3", press "ENT", then "Ib=3.00000A" will appear in the input box of the upper

left corner, and Phase B current channel will have 3A current output.

Method 2: Input "3IB" directly with the panel keys, press "ENT", then the input box will display "Ib=3.00000A", and Phase B current channel will have 3A current output.



(Input the set value interface in the input box)

2.2. The middle portion is the real-time display area of 32 electrical parameters and the vector diagram.

The 32 electrical parameters include the amplitude, phase position, frequency, three-phase active power, reactive power, apparent power and power factor of three-phase voltage and current.

The "" in the middle represent: Whether the current state is digital closed-loop output or open-lop output. Such symbols appeared on other interface are the same as the meaning here, so it is not described here.

It's important to note that there are 2 display modes of phase position: 0-360° and ±180°. Different display modes have different display effects. Specific setting shall be conducted in the instrument setting menu of main menu.

4 basic parameters of vector diagram display shall be set, and specific setting shall be conducted in the instrument setting menu of main menu interface. 4 parameters: Vector starting point (12:00 and 3:00), vector display (proportion display and fixed length display), vector rotation (clockwise and anticlockwise), vector criterion (U1 and I1). Any change of the four parameters may change the display effect of vector diagram.

2.3. The center right portion is the state indication area. The indication content is as follows:

Uh is the harmonic output indication of three-phase voltage channel: "√" indicates harmonic output, "blank" indicates that there is no harmonic output.

Ih is the harmonic output indication of three-phase current channel: "√" indicates harmonic output, "blank" indicates that there is no harmonic output.

The current voltage range and the percentage between the current actual output voltage and the voltage range. Alternate display of three-phase voltage channels.

The present current range and the percentage between the present actual output current and the current range. Alternate display of three-phase current channels.

Currently, there are 9 wiring modes: Three-phase four-wire P4, three-phase three-wire P3, single-phase P1, three-phase four-wire reactive Q4n, three-phase three-wire reactive Q3n, single-phase reactive Q1n, QX_3 reactive, QX_2 reactive and Q60 reactive.

Range mode: Automatic, manual.

Current direction: Forward, reverse.

Current time: YY/MM/DDDD, /hh/mm/ss.

2.4 Button area in the right column.

The button in the area mainly realizes step-by-step regulation of parameters such as voltage and current amplitude, phase position, frequency and power factor and display of common test points. The parameter type shall be determined according to the "**I test point**", "**PF/Φ/F**" and "**set value"** in the bottom row of screen.

During I test point, the button on the right top edge has 4 current options for alternate switching: Press Iabc, Ia, Ib or Ic to switch the state. It should be noted that the percentage test point or step-by-step regulation is only valid for the parameter of current state. The button also displays the user-defined 100% full-scale value. The percentage test point and step-by-step regulation can be switched by pressing "step-by-step regulation" and "percentage" in the lower right corner. There are 13 percentage test point buttons: 120%, 110%, 90%, 80%, 70%, 60%, 50%, 40%, 30%, 20%, 10%, 5% and 1%. The user can display all the 13 test points by pressing "Page Up" and "Page Down". The step-by-step regulation has 8 buttons in total: +10%, +1%, +0.1%, +0.01%, -10%, -1%, -0.1%, and -0.01%.

U test point is similar to I test point.

During PF test point, the right column has 14 power factor test point buttons, wherein 7 are positive power factors: 0.25L, 0.5L, 0.8L, 1.0, 0.8C, 0.5C and 0.25C. 7 are negative power factors: -0.25L, -0.5L, -0.8L, -1.0, -0.8C, -0.5C, -0.25C.

During Φ test point, the phase value and step-by-step regulation can be switched by pressing "phase value" and "step-by-step regulation" in the lower right corner. There are 14 phase position test point buttons, wherein 7 are positive phase positions: 0^0, 30^0, 60^0, 90^0, 120^0, 150^0 and 180^0. 7 are positive phase positions: 00, -300, -600, -900, -1200, -1500, and -1800. The step-by-step regulation has 10 buttons in total: +100, +10, +0.10, +0.010,

+0.0010, -100, -10, -0.10, -0.010, and -0.0010.

During F test point, the frequency value and step-by-step regulation can be switched by pressing "frequency value" and "step-by-step regulation" in the lower right corner. There are 6 frequency value test point buttons: 40Hz, 45Hz, 50Hz, 55Hz, 60Hz, and 70Hz. The step-by-step regulation has 8 buttons: +1Hz, +0.1Hz, +0.01Hz, +0.001Hz, -1Hz, -0.1Hz, -0.01Hz, and -0.001Hz.

When it is **"set value",** the required parameter type can be selected with the two buttons on the top of right column. There is a soft keyboard start button in the middle and four direction arrow buttons at bottom.

2.5. Two rows of button area at bottom.

"UI ON/OFF" can control the three-phase voltage and current signal start and stop. "Ua, Ub, Uc, Ia, Ib and Ic" can control the signal start and stop of channel. The button on the LCD can be operated here by finger touching or by pressing the keys on front panel.

Note: To protect the output sinusoidal wave signal from being shocked by the tested equipment, signal soft start and stop technology is used. When pressing the output start/stop key, the signal is not increased or decreased to the target value instantaneously, but in a slow process, which can be observed clearly by oscilloscope.

Return to the main menu interface by pressing **"main menu".**

Enter the harmonic setting interface by pressing **"harmonic setting"**, see Part 6 of operating instruction for the details.

Enter the basic work parameter setting interface of power supply by pressing **"work mode"**, see Part 3 for the operating instruction.

See Part 2.1 of operating instruction for the functions of **"set value".**

"----" is valid under the harmonic data setting state, and it will display "harmonic on" or "harmonic off". Press the button to start or stop harmonic output or stop.

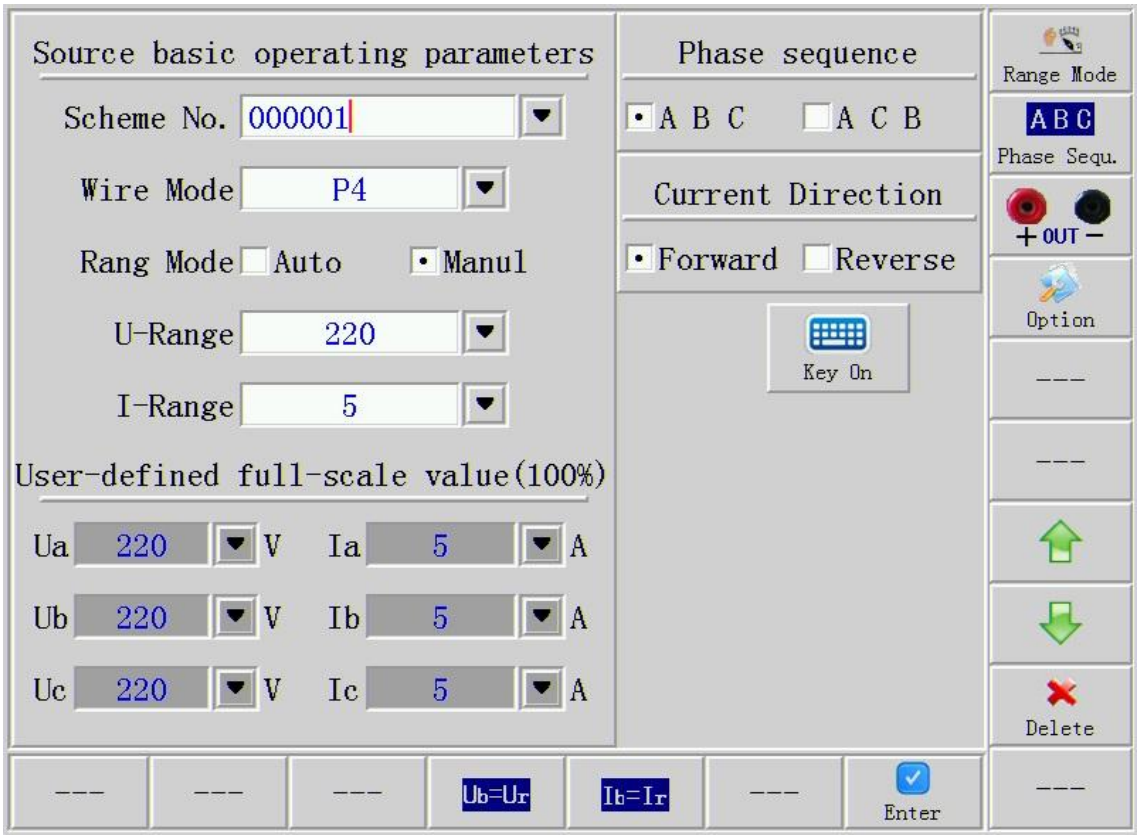
"I test point" can switch the righ column button on the screen into 13 common current percentage test points or step-by-step regulation button. "I test point" and "U test point" share the button, and alternate switching can be realized by pressing the button. See Part 2.4 of operating instruction for detailed functions.

"PF/Φ/F" can switch the button in the right column of screen to the common power factor test point, phase position test point and frequency test point alternatively**.** See Part 2.4 of operating instruction for detailed functions.

3. Work mode interface

Enter the work mode interface from "standard source window", "error checking", "harmonic analysis" or "power test", the operation method is the same, and it will not be described on other interfaces. The work mode interface can be operated with adjusting knob.

Press "work mode" in the bottom row of standard source interface to enter the work mode interface. The details are as follows:



(Work mode interface)

Scheme No.: Set scheme No. by inputting figures, or select the existing scheme No. by clicking dropdown arrow

Wiring mode: Choose the wiring mode by clicking dropdown arrow or with the "option" in right column and the up/down arrow. There are 9 wiring modes in total: Three-phase four-wire P4, three-phase three-wire P3, single-phase P1, three-phase four-wire reactive Q4n, three-phase three-wire reactive Q3n, single-phase reactive Q1n, QX_3, QX_2, and Q60.

Range mode: Automatic range and manual range.

Voltage range: The item is invalid under the automatic range mode. Under the manual range mode, the voltage range has 4 options (380V, 220V, 100V and 57.735V) which correspond to the 4 transformer tappings in the instrument. Choose the voltage range by clicking dropdown arrow or the "option" in right column and up/down arrow.

Current range: The item is invalid under the automatic range mode. Under the manual range mode, the current range has 4 options (20A, 5A, 1A and 0.2A) which correspond to the 4 transformer tappings in the instrument. Choose the current range by clicking dropdown arrow or the "option" in right column and up/down arrow.

User-defined full-scale value (100%): The user can define the 100% full-scale value of voltage and current by own regardless of automatic or manual range, and the voltage and current percentage test points on all interfaces are based on the 100% full-scale value defined here. It should be noted that there is no necessary correspondence between the 100% full-scale value and the currently introduced voltage and current range.

Under the automatic range mode, the setting range of 100% full-scale value of voltage is 11.547V (57.735V×20%)-456V (380V×120%), and the setting range of 100% full-scale value of current is 0.04A (0.2A×20%)-24A(20A×120%). If it's beyond the range, the instrument will prompt "the self-defined full-scale value is larger than 120% of the maximum range! Please set again!" or "the self-defined full-scale value is smaller than 20% of the minimum range! Please set again!". Different 100% full-scale values can be set for each channel by pressing "U1=U2=U3" and "I1=I2=I3" in the right column.

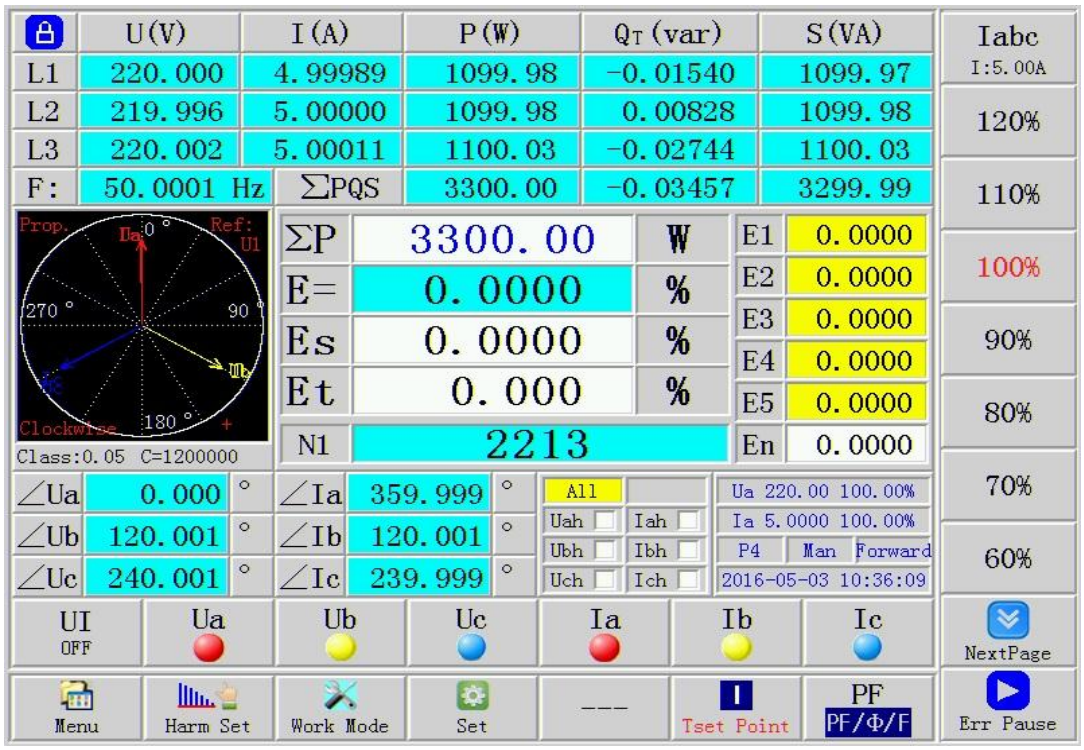
Under the manual range mode, the setting range of 100% full-scale value of voltage is 20%-120% of the current voltage range, and the setting range of 100% full-scale value of current is 20%-120% of the present current range. If it's beyond the range, the instrument will prompt "the self-defined full-scale value is larger than 120% of the maximum range! Please set again!" or "the self-defined full-scale value is smaller than 20% of the minimum range! Please set again!". Different 100% full-scale values can be set for each channel by pressing "U1=U2=U3" and "I1=I2=I3" in the right column.

Phase sequence: There are positive and negative sequences.

Current direction: There are forward and reverse directions. When choosing reverse direction, the current phase on the output terminal of instrument will output by 180° reversely, but the instrument itself will measure and display in the forward direction. It will be applicable to some special applications.

4. Error checking interface

The error checking interface is specially designed for the error checking of power meter. There are 3 methods (directly touch the icons of LCD, press the figure keys on front panel and operate the adjusting knob on front panel) to enter from the main menu to the error checking interface. There are two kinds of error checking interface: Check the checking interface of single power meter 1. Check the checking interface of 3 power meters 2. The display content is as follows.



(Error checking interface 1)

On the error checking interface 1, the middle position also displays the error data of calibrated power meter except the conventional electrical parameters.

∑P: Total active power:

E: The electric energy errors of current calibrated power meter.

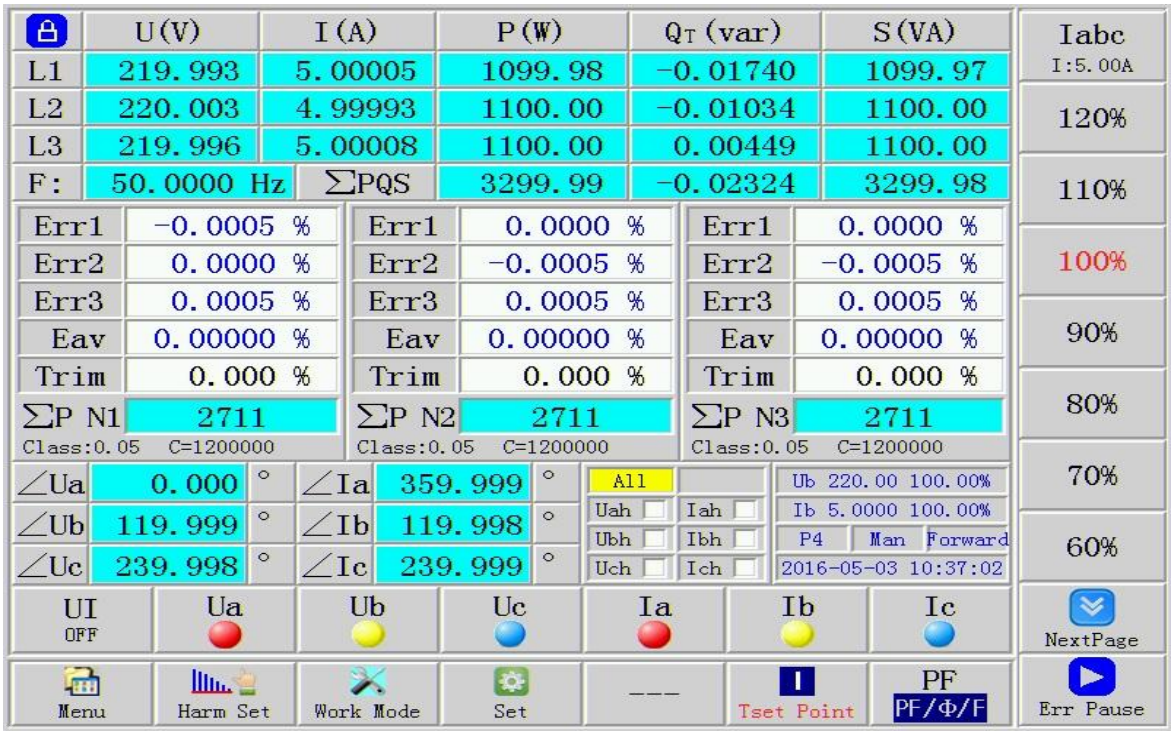
Es: The estimated value of standard deviation.

Et: The error rounding value, it is the result after rounding of error mean value "En" and the important parameters for judging whether the power meter is qualified.

N1: The pulse value cycling progressively-decreasing display frame input in the channel 1. When the pulse is decreased to 0 progressively, it will calculate the electric energy error.

E1---E5: The continuously-calculated 5 error values, and it will be refreshed progressively all the time as long as meter calibrating is not stopped.

En: The mean value of the five error values (E1-E5).

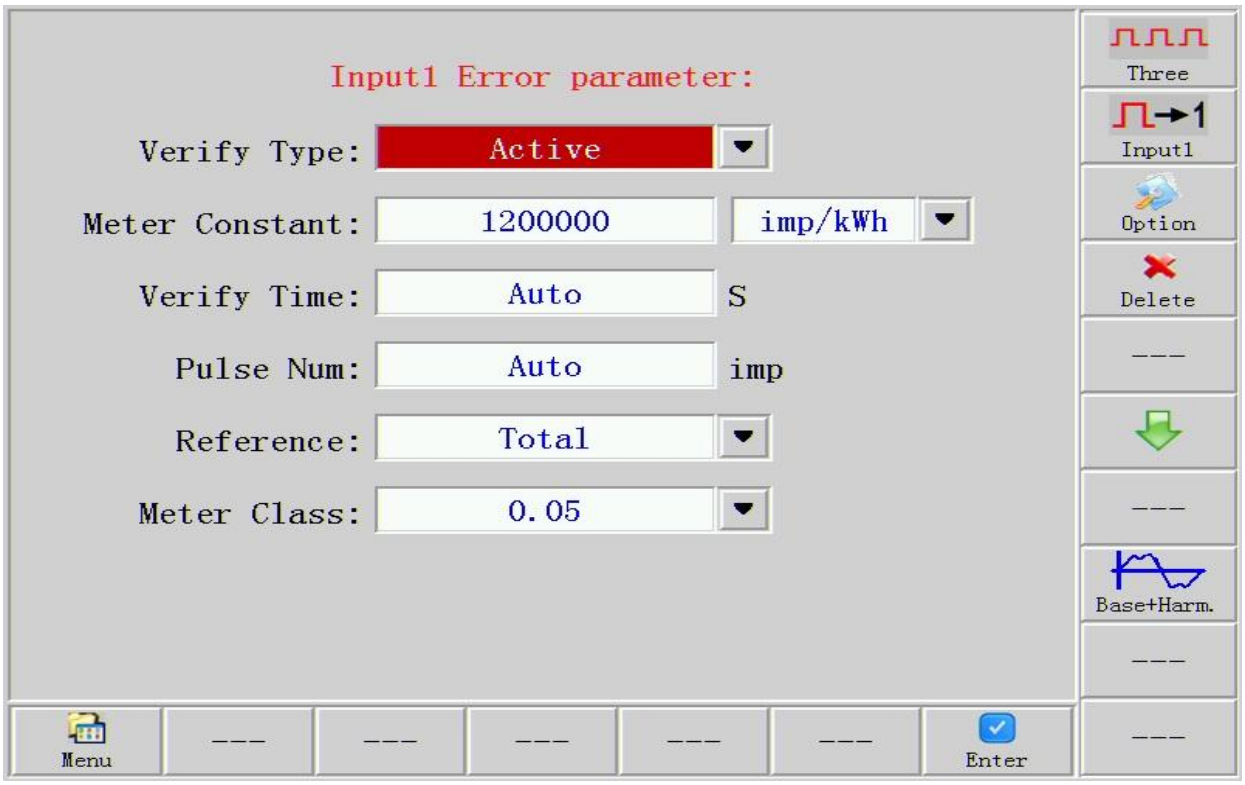


(Error checking interface 2)

On the error checking interface 2, the middle position also displays the error data of the

three calibrated power meters except the conventional electrical parameters simultaneously.

On the error checking interface, it should be specially noted that "parameter" shall set the meter calibrating parameters before meter calibrating, and enter the parameter setting interface of meter calibrating by pressing "parameter". The interface can be operated with adjusting knob.



(Meter calibrating parameter setting interface)

The middle position of the interface can set the parameters of 3 electric energy pulse input channels, the input channel can be switched (input 1, input 2 and input 3) with "input 1" in the right column, and the setting methods of the three channels are the same.

Calibration type: Active, reactive, apparent, voltage and current.

Meter calibrating constant: Set the power meter constant of calibrated power meter, and the unit of constant can also be selected. Different meter calibrating constants can be set for the three input channels of the instrument. The item can be input accurately according to the constant marked on the nameplate of calibrated meter. If the constant is set by mistake,

the calibration of power meter will be meaningless.

Calibration time: The error can be calculated based on time (0 or defaulted to be automatic mode). Under automatic mode, the instrument will set suitable time interval according to the current load, meter calibrating constant and the "error time" in the instrument setting menu. Either the item or the pulse can be set.

Pulse: The error can be calculated based on the number of pulses received (0 or defaulted to be automatic mode). Under automatic mode, the instrument will set suitable pulse according to the current load, meter calibrating constant and the "error time" in the instrument setting menu. Either the item or the pulse can be set.

Test function: Refer to the electric energy pulse input from the current channel representing the general power value of 3 phases or the energy value of a certain phase. There are 4 options in total: Total, Phase1, Phase2, and Phase3.

Accuracy grade: Choose the accuracy grade of the calibrated power meter. There are 8 options in total: 0.05, 0.1, 0.2, 0.5, 1.0, 2.0, 0.2S, and 0.5S. The item shall be selected according to the accuracy grade marked on the nameplate of calibrated meter. After selection, the instrument will conduct error value rounding automatically according to the setting when checking on the error checking interface.

Three-circuit: The button can choose whether the single-circuit or three-circuit electric energy pulse is input in the instrument. Chose single circuit when calibrating single meter; choose three circuits when calibrating three meters; choose three circuits when calibrating the active and reactive power of single meter.

Input 1: The button can choose which channel on the rear panel of instrument the electric energy pulse is input in, and set the parameters. There are three optional channels: Input 1 corresponds to Fin1 terminal on the rear panel, input 2 corresponds to Fin2 terminal

on the rear panel, and input 3 corresponds to Fin3 terminal on the rear panel.

Options: To display multiple options of current cursor.

Deletion: To delete the data of current cursor.

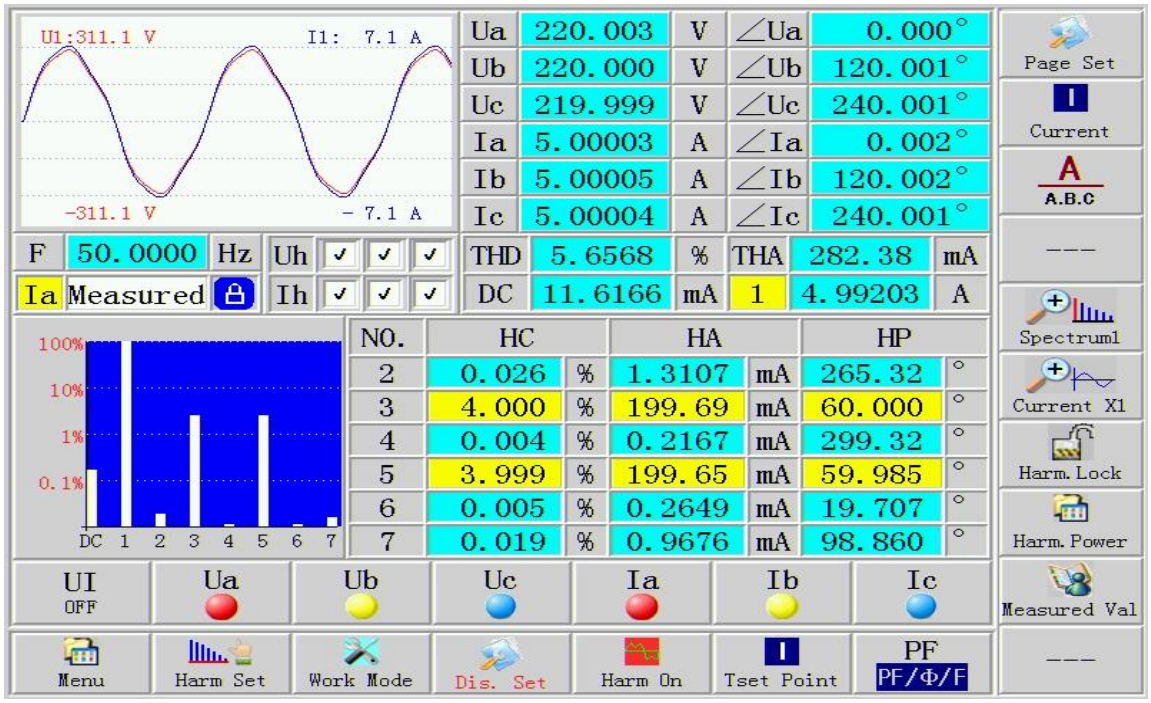
Keyboard on: Open or close the soft keyboard.

Down arrow: Move up and down to choose parameters.

Full wave: To choose whether full wave power calibration or fundamental wave power calibration.

5. Harmonic analysis interface

The harmonic analysis interface is specially designed for harmonic output and measurement. There are 3 methods (directly touch the icons of LCD, press the figure keys on front panel and operate the adjusting knob on front panel) to enter from the main menu to the harmonic analysis interface.



(Harmonic analysis interface)

The interface can display not only conventional electrical parameters but also voltage

and current waveform, histogram of harmonic content, total harmonic distortion degree (THD), total harmonic amplitude (THA), DC amplitude (DC), fundamental wave amplitude and the harmonic content , amplitude and initial phase position.

Harmonic setting: The button can realize harmonic data setting and loading. See Part 6 of operating instruction for the details.

Work mode: The button can set the basic parameters of standard source. See Part 3 of operating instruction for the details.

Harmonic on When the harmonic data are set and loaded, press the button to start or stop the harmonic output.

"Display setting", "I test point" and "PF": The three buttons are the operation effect of one out of three, that is, only one of the three button is in the valid state in the same time. Here we mainly introduce the functions of buttons in the right column when "display setting" is valid (in red).

Frequency selection: The button is used for selecting the harmonic frequency range displayed on the current LCD. Due to the dimension limit of LCD, not all 31 harmonic parameters cannot be displayed but only displayed in batches. There are 9 selection ranges in total: 2-7 order, 8-13 order, 14-19 order, 20-25 order, 26-31 order, Meanwhile, the shortcut keys of the 9 selection ranges are defined on the panel key sequentially as follows: Figure keys (1-9): It can also select quickly with the adjusting knob.

I current button and ABC button: The two buttons are used for selecting the harmonic data of channel displayed on the current LCD. Meanwhile, the shortcut key is defined on the panel key: UA, UB, UC, IA, IB and IC. The required channel can be selected quickly with shortcut key.

Frequency spectrum X1: The histogram of harmonic content can be amplified. There are 3 amplification factors: X1, X5, and X10.

Harmonic open loop: Harmonic signal digital closed-loop switch can select closed-loop output or open-loop output. The function is expansion function and not configured temporarily.

Measured harmonic value: It can select the measured value or set value of harmonic parameter displayed on the current LCD. The button will be automatically hidden when there is no signal output.

6. Harmonic setting interface

Enter the harmonic setting interface from "standard source window", "error checking", "harmonic analysis" or "power test", the operation method is the same, and it will not be described on other interfaces. The harmonic setting interface can be operated with adjusting knob.

Before introducing the harmonic setting interface, let's first understand the harmonic output workflow.

①Select harmonic channel. First, select the channel that needs to stack harmonics, that is, which of the six channels of Ua, Ub, Uc, Ia, Ib and Ic needs to set harmonics.

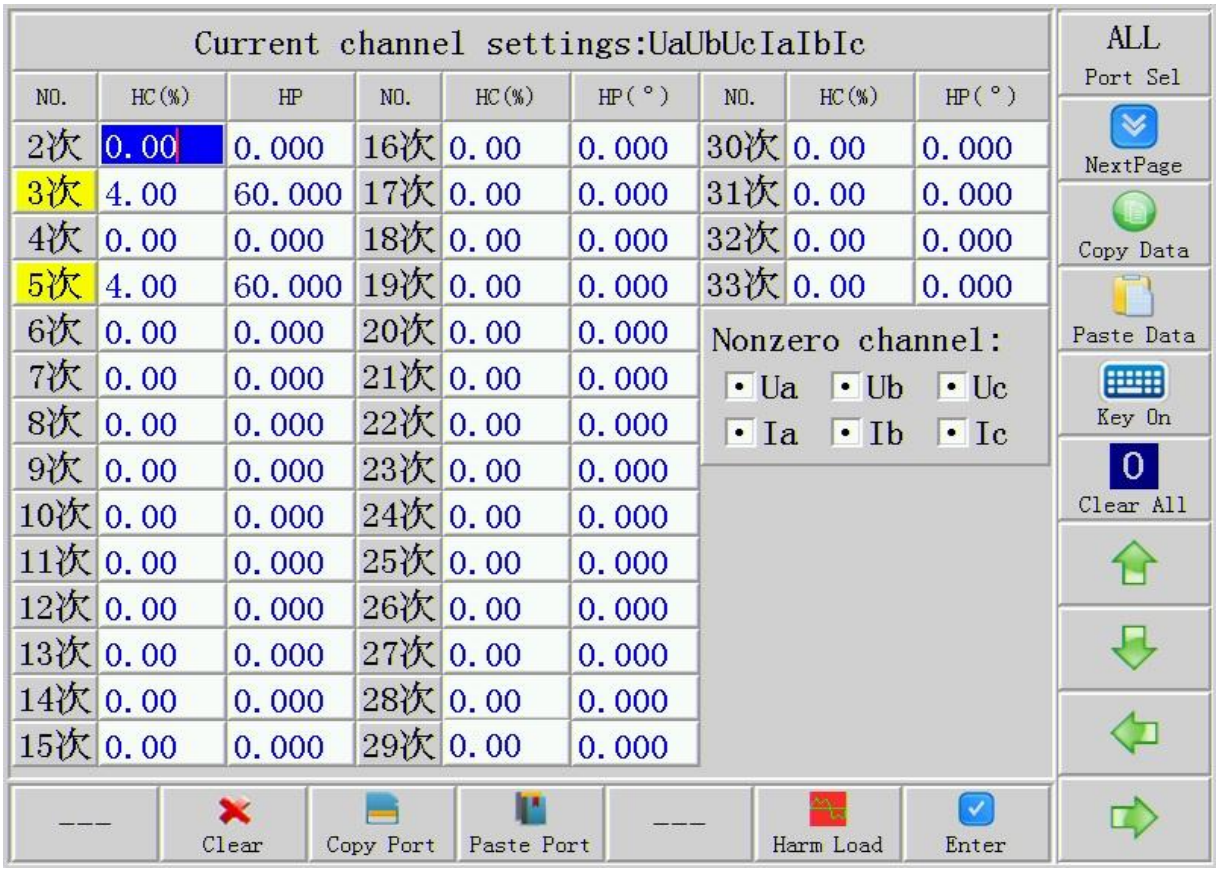
②Set harmonic data. Select the harmonic frequency on the selected channel and set the corresponding harmonic content and initial phase.

③ Load harmonic data. Load the harmonic data into the fundamental wave of the corresponding channel, and then press "OK" button to exit the harmonic setting interface.

④Output fundamental wave. Press "UI" button, and output fundamental wave.

⑤Output harmonic wave. Press "harmonic on" button, and output harmonic.

Next, the harmonic setting interface will be introduced in detail with harmonic workflow. In the harmonic analysis interface, press the "harmonic setting" button to enter the harmonic setting interface, which is as follows.



(Harmonic setting interface)

By pressing the channel selection button in the upper right corner of the interface, select the channel that needs to set harmonics, and there are 9 channels available (ALL, Uabc, Iabc, Ua, Ub, Uc, Ia, Ib, and Ic). After that, the top of the interface will display the corresponding text of "current settings channel XXXXX". Press the arrow button, and select the harmonic frequency needed to be set. The ratio and initial phase of the corresponding harmonic can be set by the figure key. All 31 harmonic frequencies can be displayed by pressing "Page Up" and "Page Down". After the harmonic data are set, there will be the corresponding "√" in the "harmonic non-zero channel" of the interface. If the sum of the harmonic content in a channel exceeds 40%, the instrument will prompt that "the total harmonic content should not

be greater than 40%", which will automatically disappear after 5s.

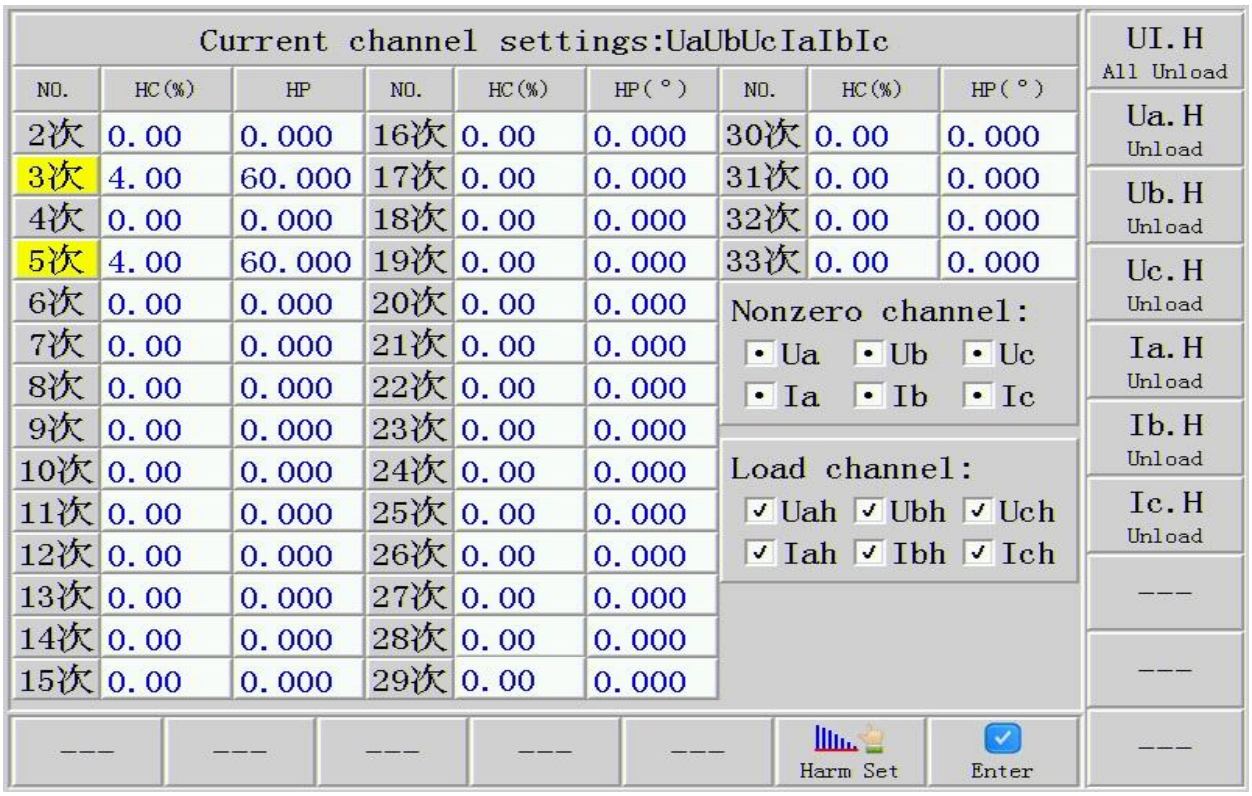
The "copy data" and "paste data" buttons in the right column can copy and paste the data of the current cursor position, which is very useful when the same harmonic data need to be set, and can greatly improve the efficiency of harmonic setting.

The "copy channel" and "paste channel" buttons at the bottom can completely copy and paste all harmonic data set on a channel to another channel, so that the harmonic data of the two channels are identical, which can also significantly improve the efficiency of harmonic setting.

The "zero clearing" button can clear harmonic data of the number of times of the current cursor.

The "all cleared" button can clear all the harmonic data of the current settings channel. After harmonic data are cleared, "√" at the "harmonic non-zero channel" of the interface will disappear.

Press the "harmonic loading" button, and enter the following interface.



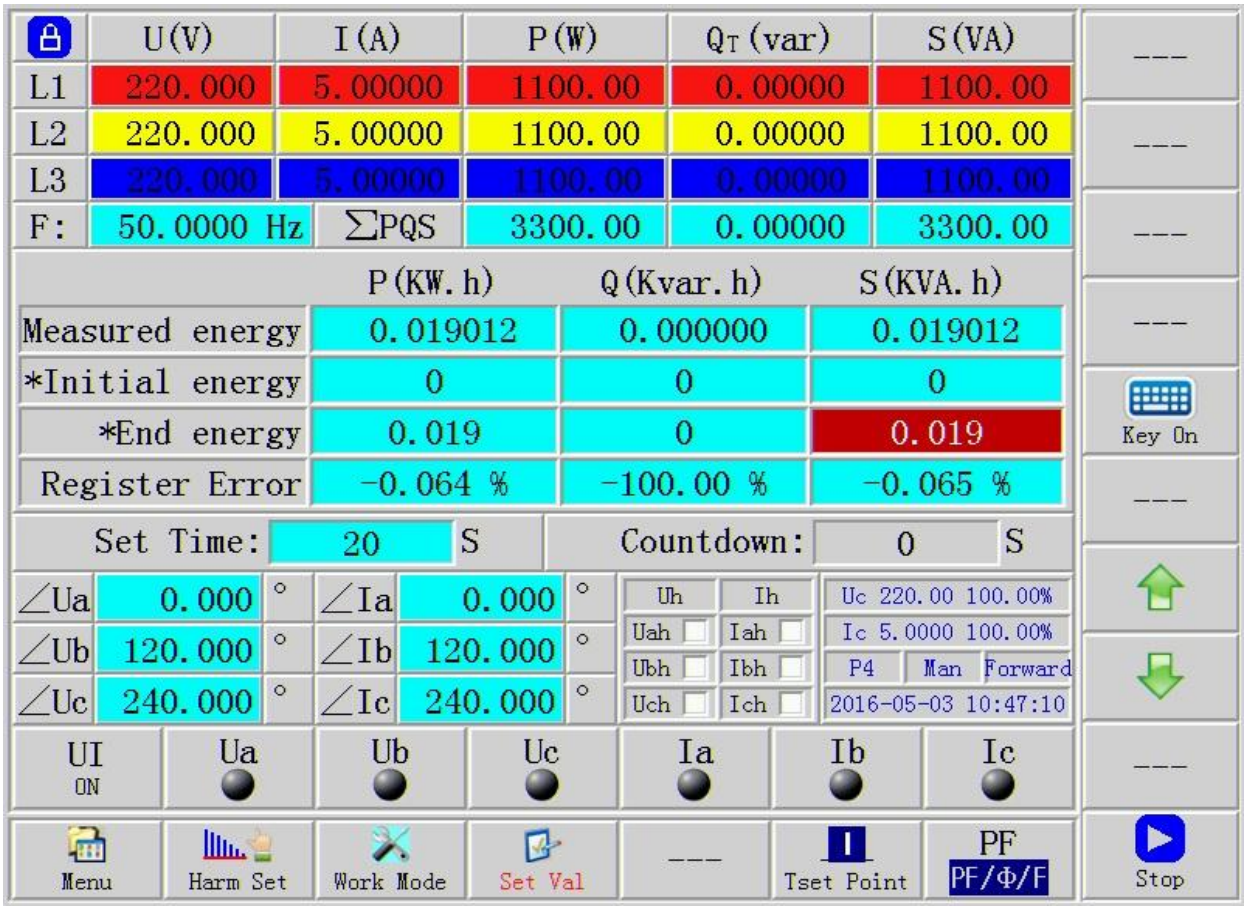
(Harmonic loading interface)

In this interface, the harmonic data can be loaded on the fundamental wave by pressing the corresponding button in the right column, or harmonics on the fundamental wave can be unloaded. It should be noted that only the harmonic data are set for the corresponding channel can harmonics be loaded for this channel in the interface. If harmonic data are not set for 6 channels, it will be prompted that "all the 6 channels do not have harmonic setting data! Loading failure!" when the "harmonic loading" button is pressed, so that it is impossible to enter the harmonic loading interface. The prompt will automatically disappear after 5s.

When harmonics are loaded or unloaded, the "OK" button must be pressed in order to return to the standard source interface, and then harmonics can be output in the standard source interface. Press the "harmonic on" and "harmonic off" buttons at the bottom in the standard source interface, and turn the harmonic output on or off at any time. If no harmonic data are set, this button will not be displayed.

7. Power test interface

The power test interface is specially designed for the counter test of power meter. There are 3 methods (directly touch the icons of LCD, press the figure keys on front panel and operate the adjusting knob on front panel) to enter from the main menu to the power test interface.



(Power test interface)

In this interface, the active energy, reactive energy and apparent energy displayed on the power meter under calibration are input into the corresponding "starting energy" position in the middle of the interface in the first place, and the countering time is set. Then turn on UI, the voltage and current signals rise, and press the "countering start" button in the lower right corner to start the counter test. When the set countering time countdown is completed, the instrument automatically stops signal output. The active, reactive and apparent energy shown

on the power meter under calibration will be input into the corresponding "electrical energy termination" position in the middle of the interface. The instrument will automatically display the corresponding countering error in the position of "countering error".

Functions of other buttons in this interface are the same as the button functions in the standard source, and reference is made to the operating instructions of the standard source.

8. Instrument setting interface

There are 3 methods (directly touch the icons of LCD, press the figure keys on front panel and operate the adjusting knob on front panel) to enter from the main menu to the instrument setting interface. There are 3 major settings in the instrument setting interface, which are system parameters, output constant, and time settings respectively.

8.1 The interface after system parameters are selected is as follows.

(System parameter setting interface)

Background color: A total of 5 options. The LCD background color is optional.

Buzzing: 2 options: Off, and On. This option can turn off or turn on the keypad tone,

and settings here do not affect the alarm of instrument failure.

Error time: While calibrating the power meter, set the error refresh interval, and there are 4 options of 3, 5, 8 and 10s.

Baud rate: When setting the baud rate for communicating with the upper computer, there are 8 options: 2400, 4800, 9600, 19200, 28800, 38400, 57600 and 115200.

Vector starting point: 2 options: 12:00 (UA or IA vector is always at 12 o'clock) and 3:00 (UA or IA vector is always at 3 o'clock).

Vector display: 2 options: Proportion display (length varies with amplitude), fixed length display (fixed length).

Vector rotation: 2 options: Clockwise/counterclockwise

Phase display: 2 options: 0-360°, ±180°

Vector benchmark: 2 options: Ua, and Ia.

Error progress indication: 2 options: Pulse, time progress bar. When calibrating the power meter, choose whether to carry out the error checking by decreasing the number of pulses or carry out the error checking by means of time progress bar.

Initial interface: There are two options for the interface after power-on or reset: Standard source interface, main menu interface.

Error unit: There are 2 options for selecting the unit of power meter error: %, ppm (parts per million).

Output constant dimension: There are 6 options for dimension selection of the electric energy constant output by this instrument: i/KWh, i/Wh, i/Ws, KWh/i, Wh/i, and Ws/i.

Date format: 2 options: Year/month/day, day/month/year.

Subscript type: 2 options: abc, and 123. If you choose abc, A-phase voltage mark is Ua, B-phase voltage is Ub, C-phase voltage mark is Uc, A-phase current mark is Ia, B-phase current mark is Ib and C-phase current mark is Ic; If you choose 123, A-phase voltage mark is U1, B-phase voltage is U2, C-phase voltage mark is U3, A-phase current mark is I1, B-phase current mark is I2 and C-phase current mark is I3;

Language selection: There are 2 options for selecting the instrument menu language: Chinese, and English

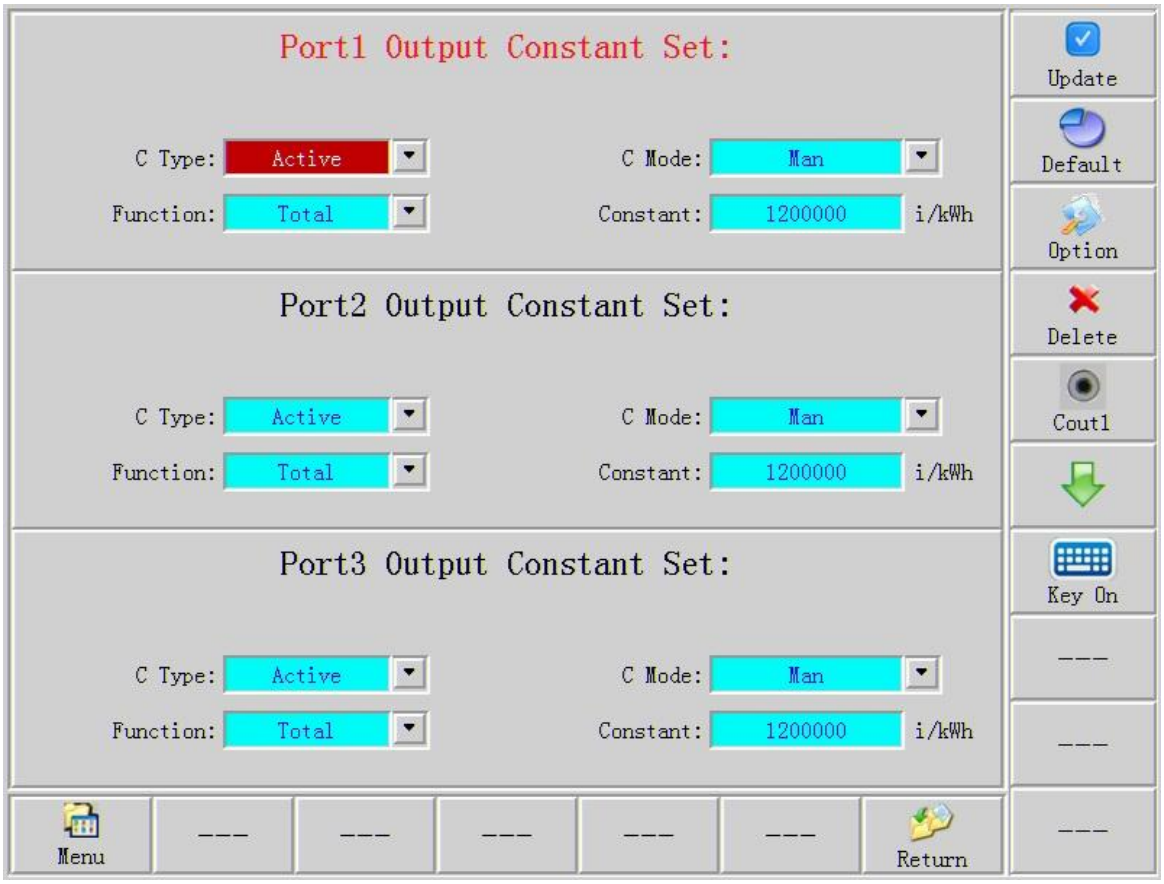
Voltage threshold: The numerical value needs to be input for voltage display zero threshold settings, and the unit is V. Users are advised not to set.

Current threshold: The numerical value needs to be input for current display zero threshold settings, and the unit is %. Users are advised not to set.

The settings of all items above can be selected by clicking the dropdown arrow of the corresponding item. Items can be set by pressing the option and arrow buttons in the right column or by using the adjustment knob on the panel.

When the above item settings are completed, you must press the "update" button in the upper right corner to save setting parameters.

8.2 The output constant setting interface is as follows.



(Output constant setting interface)

The output constant mainly refers to the electric energy pulse constant output by this instrument, which is mainly used to send the instrument to the statutory metering institution for electric energy calibration. This instrument is designed with 3 output channels, each of which can be set with the corresponding output electric energy pulse constant. The three channels are set in the same way.

Constant type: There are 5 options in total: Active, reactive, apparent, voltage and current. Only active and reactive options are valid now.

Constant mode: 2 options: Manual and automatic constants. A numerical value needs to be manually input for manual constant. Automatic constant, an electric energy constant will be set automatically based on the current power.

Channel function: Refer to the electric energy pulse input from the channel

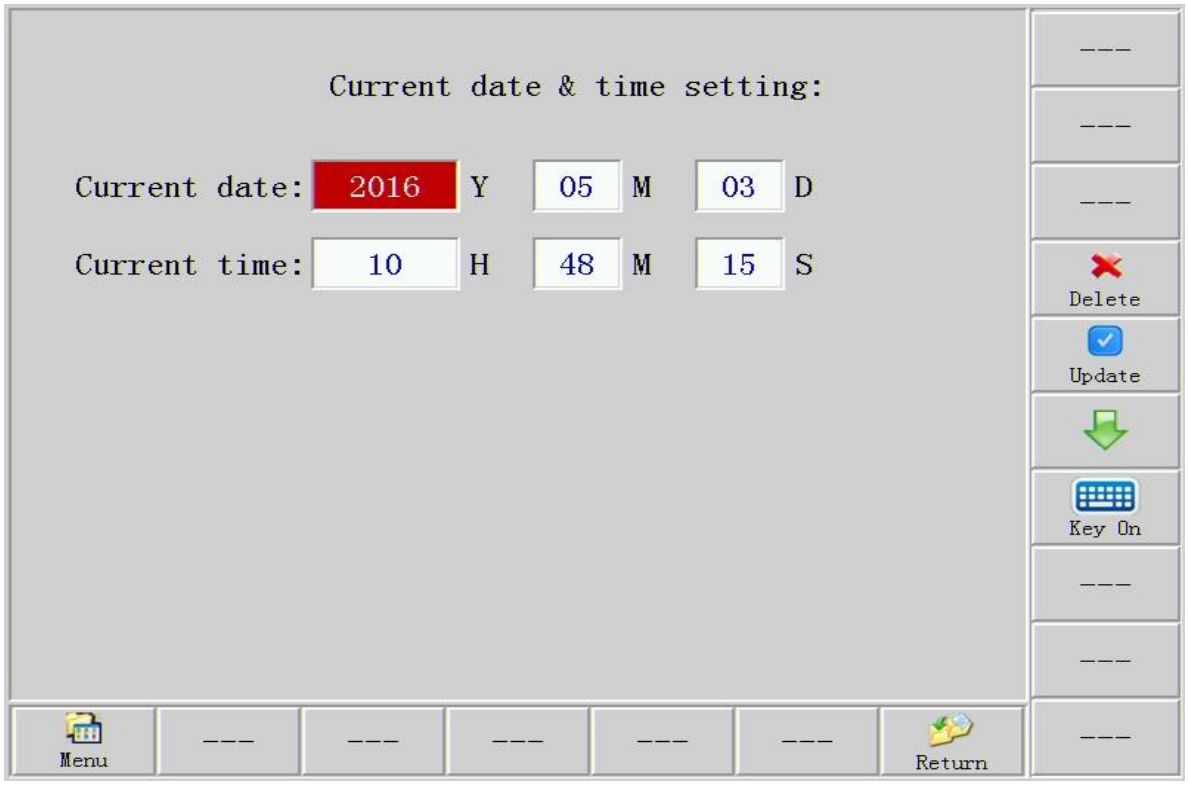
representing the general power value of 3 phases or the energy value of a certain phase. There are 4 options in total: Total, Phase1, Phase2, and Phase3.

Channel constant: Set the electric energy pulse constant output from this channel. Constant can only be input in the manual constant state.

When the above item settings are completed, you must finally press the "update" button in the upper right corner to save setting parameters.

8.3 The time setting interface is as follows.

The interface is mainly used to calibrate the clock of the instrument, and accurate date and time are input at the interface. Finally, the clock is calibrated by pressing the "update" button.



(Time setting interface)